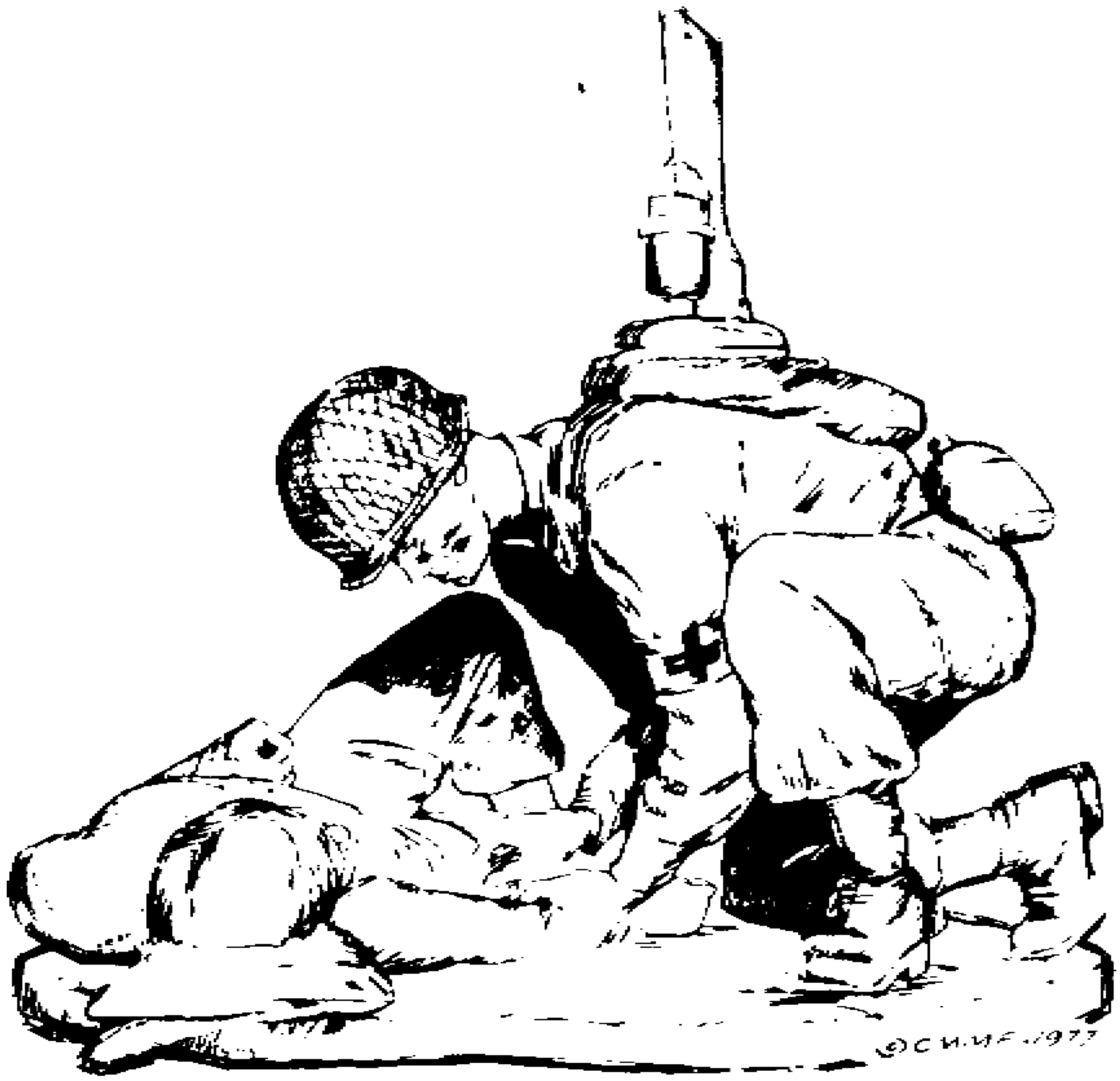
FM 8-230

FIELD MANUAL

MEDICAL SPECIALIST



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FIELD MANUAL
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MEDICAL SPECIALIST

Preface

This manual is for use in training the Medical Specialist, MOS 91B10, in field medical activities, patient care procedures, and general nursing care duties involved in patient care and treatment. It also serves as a ready reference for use by other Army Medical Department units and activities. The material in this manual is applicable to peacetime, nuclear war, and nonnuclear war.

Use of trade names in this manual is for clarity only and does not constitute endorsement by the Department of Defense.

Users of this manual are encouraged to submit recommendations to improve the publication. Comments should be keyed to the page, paragraph, and line(s) of the text where a change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be submitted on DA Form(s) 2028 (Recommended Changes to Publications and Blank Forms) and forwarded to the **Commandant, Academy of Health Sciences, US Army, ATTN: HSHA-TLD, Fort Sam Houston, Texas 78234.**

When used in this publication, the terms "he," "him," "his," "man," and "men" represent both masculine and feminine genders unless otherwise stated. The terms "patient" and "patients" are considered synonymous with the terms "casualty" and "casualties."

The contents of this manual are subject to and in consonance with the following Standardization Agreements:

TITLE	NATO STANAG
Documentation Relative to Medical Evacuation, Treatment, and Cause of Death of Patients	2132
Basic Military Hospital (Clinical) Records	2348

When amendment, revision, or cancellation of this publication is proposed which will affect or violate the international agreements concerned, the preparing agency will take appropriate reconciliatory action through international standardization channels.

*This manual supersedes TM 8-230, 2 November 1970, and FM 8-36, 15 March 1973.

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CHAPTER 1

INTRODUCTION

Section I. THE ARMY MEDICAL DEPARTMENT

1-1. General

As a medical soldier, you are a member of a branch of the Army with a long and proud history of service and achievement. The Army Medical Department (AMEDD) was established by the Continental Congress on 27 July 1775. Since that time the AMEDD has cared for American soldiers and has played a vital role in the growth and advancement of medicine around the world. Breakthroughs in military medicine have had a significant impact on the course of civilian medical practice, just as progress in civilian medicine has affected the military.

1-2. Mission

The AMEDD is responsible for maintaining the health of the Army to conserve its fighting strength. It is responsible for all medical services provided within the Department of the Army (DA) and for other agencies and organizations as prescribed in AR 10-5.

Section II. THE COMBAT MEDIC

1-3. General

a. This section is designed for you, the combat medic—whether you serve in an infantry platoon, an artillery battery, a cavalry troop, an engineer battalion, an isolated detachment, or a temporary task force. Although addressed to you, the section is also designed for your leaders (platoon sergeants, physicians' assistants, and the leaders of medical elements) so they will know your capabilities.

b. Your responsibility is heavy, but you can handle it. You have not been sent out to do an impossible job, just an important one. When it comes to taking care of the men who are seriously wounded in battle, you are the key man. The entire medical treatment system behind you—from the most forward combat zone hospital all the way back to CONUS—depends on you. Consider this: Every patient of yours who is admitted to a medical treatment facility represents a success on your part. If you had not kept the man alive, he would not be admitted to the facility. Medical treatment facilities save about 98 percent of your patients, but they could not do it unless you saved the patients first.

1-4. Your Main Job

In addition to lifesaving and first aid measures, your job includes the disposition of patients. When a soldier is wounded, or when you are faced with a medical problem, ask yourself, "Should I evacuate this man or treat him here?" Often, the tactical situation and the nature of the man's illness or injuries require *you* to treat him. This manual tells you *how* to treat him.

1-5. Your Resources

In the field, you can give emergency medical treatment but you do so with limited resources. Your physical resources are limited by two things: the tactical situation and how much you can carry. You are trained to improvise in many situations, and to request assistance in others.

1-6. What a Good Combat Medic Does

a. Most of your time is spent, not in combat and treating patients, but in waiting. While you are waiting, you care for your equipment and replenish your supplies; equally important you talk with the troops and advise the battalion surgeon, the physicians' assistant, and the platoon sergeant on *minor medical problems.*

b. You must do your share of the hard work. You are expected to defend yourself and your patients when necessary. You are not supposed to carry a radio or parts of crew-served weapons, but do not hesitate to help a fellow soldier carry a heavy load when you are not in contact with the enemy.

c. Besides doing your share of the work, you will always look out for the welfare of your troops. Before the unit goes on a mission, check out each individual. If you find a soldier with a medical problem, advise the platoon sergeant of the man's condition, capabilities, and limitations. During the mission, observe each man. If you get to know the men well, you can quickly tell when one is getting sick and anticipate many medical problems. Make sure you explain the danger of not using proper personal hygiene; take every opportunity to encourage preventive measures.

d. At the end of the mission, check each soldier again to see if anyone is sick or injured. Some will get minor wounds but not complain about them.

e. During rest periods and between missions, you should make sure all minor medical problems are settled. You may want to go with a trooper on sick call and learn from the medical officer the best way to continue treating him. If medication is prescribed, you should be certain it is taken correctly.

1-7. Preoperational Briefings

Commanders usually include medical personnel in briefings of tactical situations before a mission. The more you know about the mission and its likely medical hazards, the better you can do your work. When alerted for a mission, go to the platoon sergeant or the platoon leader and ask about it. Find out how far the men are going, how many are going, how long they will be away, and how much enemy action is expected. This information will help you decide what supplies to take.

1-8. Your Aid Bag

The surgical instrument and supply set, individual, is a general use aid bag issued by the medical depot with a standard packing list of supplies. This standard aid bag is a starting point for you. You are responsible for packing and maintaining your aid bag. The aid bag and basic items carried by an aidman are shown in Figure 1-1. What you will need to carry in the aid bag depends upon the nature of the mission. For example, if the mission is to be a walk to and a look around a village, lasting about 2 hours and taking 15 men,

with no enemy action expected, you would take a light bag of supplies. If the mission is to go several miles away, taking 40 men and setting up a night ambush, with enemy action expected, you would take a different bag of supplies. If the company is going on an extended mission, you would take still another aid bag.



CLOSED BAG



OPEN BAG WITH CONTENTS

Figure 1-1. Medical aid bag.

1-9. Steps in Solving Medical Problems

a. Get a history and do a rapid physical examination of the patient. For example, determine whether the wound was caused by a bullet, a mortar round, a booby trap, or a fall from a vehicle. If it is a perforating wound, see if it has both entrance and exit sites. Determine the number of wounds and find out if there is severe hemorrhage, internal bleeding, or a broken bone(s). Quickly assess the vital signs (pulse, blood pressure, respiration) to determine whether the patient's life is in danger.

b. Make a judgment or a tentative diagnosis. For example, if the wound is serious, will the patient die soon without definitive medical treatment? If the wound is not serious, can he continue his mission with some treatment? What is the tactical situation? How much time do you have? How much help can you get?

c. Take positive action.

(1) Get yourself and the patient in the safest position consistent with his injuries and the tactical situation.

(2) Clear the airway and give artificial respiration if necessary. Control hemorrhage as quickly as possible. Treat for shock, if necessary.

(3) Ask for assistance. Move the patient to a safer location and request evacuation if indicated.

(4) Reassure the patient. Positive action will reassure him more than anything you can say to him.

d. For guidance in handling a medical problem beyond your capability, you may be able to use radio communications if the tactical situation permits. The operator can connect you with other medical personnel who can assist you in handling the problem. They can also dispatch personnel and equipment to help you.

Section III. INTERPERSONAL RELATIONSHIPS

1-10. General

There are two kinds of interactions that take place between individuals and individuals and groups: actions and reactions, or cause and effect. When these interactions unite individuals and groups into teams whose members mutually support one another to accomplish their goals, good interpersonal relationships are developed. Since the goal of the AMEDD is to restore a patient to physical and mental health, you must be aware of the importance of good interpersonal relations among the health care team and between the team and the patients/casualties.

1-11. Developing Good Interpersonal Relationships

Development of good interpersonal relationships is not always easy. The number of people involved in providing patient care creates problems of communication and understanding. Good relations are easier to describe than

they are to achieve, and there are few successful formulas that apply in all situations. Some guidance can be given, however, as a means of developing good interpersonal relations.

a. Understanding Oneself. The foundation for good relations with others is a state of good relations with oneself. Self-understanding and self-acceptance (based on a realistic picture of oneself and a genuine feeling of self-worth), justified by performance, are ingredients of effective relationships with others. Just as each individual is a unique person, each must accept the right of another to differ within socially accepted limits. Thus, in any situation where relationships are less than the best, each person must examine himself to see if he has contributed to the faulty relations.

b. Understanding the Patient's Need for Privacy.

(1) You must not divulge information concerning the patient except to those individuals having an official reason to know. Discussions regarding diagnosis, care, and treatment of patients should be held in private to prevent their being overheard by individuals who are not concerned with the medical care being given. Improperly releasing information from a patient's medical records can result in criminal prosecution or disciplinary action for violation of the Privacy Act (see AR 340-21). Release of such information should ordinarily be made only in response to a written request and only after coordination of the request with the Patient Administration Office.

(2) Special attention must be given to the release of information obtained under the provisions of the Army Drug and Alcohol Abuse Program (AR 600-85). Notification of the discovery of potential drug/alcohol abuse is required in certain cases by that program. Notification is also required in certain cases where child or spouse abuse is suspected as the result of providing medical care. These matters must be communicated to medical superiors to determine if reporting is appropriate.

Section IV. LEGAL ASPECTS OF MEDICAL CARE AND TREATMENT

1-12. General

a. Those legal aspects of medical care and treatment of importance to you are covered in this section. This is to alert you to the law as it pertains to your rendering of medical care and treatment.

b. This discussion includes:

(1) Your legal status as a medical service patient care team member.

(2) Some medical-legal problems that could arise when you are assisting with medical care and treatment and when something is done that interferes with the rights and privileges of a patient.

(3) The application of professional practices acts to your duties.

(4) Certain Federal laws, such as the Federal Torts Claims Act (FTCA) and the Gonzalez Act, which apply to your performance of medical duties.

c. The public has special trust in medical and allied professions and in the institutions that provide medical care and treatment. To help insure that this trust is deserved, there are statutes and legal principles which provide patients with legal remedies when they do not receive proper medical care. These remedies are available not only in those rare cases where the patient is harmed intentionally, but also in those cases where the patient is harmed as a result of negligence (carelessness) on the part of medical personnel.

d. Negligent or intentional failure on your part to provide proper medical care to your patients may result in court-martial or administrative actions. Those actions could include MOS reclassification, bar to reenlistment, or administrative discharge from active duty with less than an Honorable Discharge.

e. Negligent actions on your part in the performance of your medical duties may also result in the Army's liability for payment of damages to the patient.

1-13. Law and the Medical Soldier

a. The medical soldier is authorized to perform his assigned military-medical duties within the conditions established for their performance. His legal protection and legal status are established when he works:

(1) Within the scope of his duties (as defined by AR 611-201).

(2) Within the limits of his training.

(3) According to the policies established by his local medical commander. Army regulations that pertain to providing medical services in AMEDD treatment facilities are found in the 40-series.

b. Field Manual (FM) 21-13 contains detailed information regarding the legal status of enlisted personnel as soldiers, subject to and protected by both civil and military law.

1-14. Negligence as a Medical-Legal Problem

a. There is no one uniform code of medical law, but there are laws that have special significance in medical care and treatment areas. A basic rule that applies in providing all medical services is the *rule of negligence.* Everyone—military and civilian, professional and medical specialist—has an absolute duty to conduct himself and operate his property to avoid injury to the person or the property of others. Although the spirit of service to others is a key principle in providing all medical duties, there are responsibilities that extend beyond being kind and thoughtful. When services are rendered, there is *an obligation to use due care* to insure that the patient is not injured because of negligence, which can be defined simply as failure to exercise due care with respect to one to whom care is due. A more complicated legal definition of negligence is doing or failing to do the act (in carrying out a duty) that a

reasonable person in the same or similar circumstances would or would not do where the acting or nonacting in carrying out the duty is the proximate cause of injury to another person or to his property.

b. Although negligence results in an unintentional injury, once injury results, it matters little to the injured patient that it was not intended. Negligence is one of the most common grounds for lawsuits against medical facilities and medical personnel. Examples of negligence include the injuries caused by the use of faulty equipment, burns from applications of hot water bottles and other heating devices, medication errors, falling out of bed, and careless handling of sponges and instruments in operating rooms.

c. In AMEDD treatment facilities, when a patient is the victim of negligent treatment or an accident that may or may not have caused injury, reporting will be accomplished according to the local standing operating procedure (SOP) and the local Risk Management Plan.

1-15. The Federal Torts Claim Act (FTCA)

a. This act permits legal action against the Federal government on damage claims "for injury or loss of property, or personal injury or death caused by the negligent or wrongful act or omission of any employee of the government while acting within the scope of his office or employment, under circumstances where the United States, if a private person, would be liable to the claimant in accordance with the law of the place where the act or omission occurred." The phrase "employee of the government" includes members of the military forces, while "scope of his office or employment" for military forces is defined to mean "acting in the line of duty."

b. As the result of a U.S. Supreme Court decision *(Feres v. U.S.)*, an Active Duty service member is not permitted to sue the Army if his injury was received incident to his service. This decision prohibits Active Duty personnel from recovering for injuries they incur while receiving medical care as receiving such care is incident to their service. However, dependents of service personnel and retired service members can sue for their own injuries received in such cases.

c. Under terms of the Gonzales Act, 18 USC 1089, the United States is the only defendant that may be required to pay damages in a lawsuit arising out of the provision of military medical care, so long as the health care provider was acting within the scope of his military duties. These lawsuits are defended in Federal courts by the Department of Justice. While this statute protects the health care provider from tort liability (paying money damages), it does not prevent appropriate disciplinary action being taken (para 1-12d). This statute does not protect a military health care provider who is engaged in outside employment or is otherwise acting outside the scope of his military duties.

d. Various states have so-called "Good Samaritan" laws which protect certain individuals who stop at the scene of an accident or other emergency and render medical attention. These laws vary from state to state in terms of who is protected (in some states only physicians are protected) and under what circumstances. In a very few states, you may be required to render such

emergency assistance, but as a rule, there is no such requirement. Your local Staff Judge Advocate Office can provide information concerning such laws in your state.

Section V. MEDICAL TERMINOLOGY

1-16. General

a. Every specialized field has its own vocabulary to communicate special concepts and concerns--medicine is no exception. It is important for you to become familiar with the language of medicine for several reasons. First, an understanding of medical terminology will enable you to think more precisely in terms of medical problems. Also, a knowledge of the terminology will help you communicate effectively with the other health professionals with whom you will be dealing; to communicate, you must speak the same language.

b. Medical terms are often derived from Greek and Latin roots. These root words or key words are the foundation of a word. An example of a root word is "aden," which means pertaining to a gland. A root word, followed by a vowel to facilitate pronunciation (as in "adeno"), is known as a combining form; however, this is not a complete word. Adenocarcinoma (a malignant growth of gland-like cells) or adenoma (a tumor, usually benign, with a gland-like structure) are complete words.

c. When using two or more root words, a root word and a combining form, or a combining form and a whole word put together, the result is called a compound word. Examples of the first two combinations include chicken pox and erythrocyte (red blood cell), respectively. Thermometer, speedometer, and microscope are 2 examples of the latter, whereby "thermo," "speedo," and "micro" are the combining forms and "scope" and "meter" are the words.

1-17. Prefixes

A prefix is a part of a word that precedes the root word and changes its meaning. It is usually a preposition or an adverb. The final vowel of the preposition is dropped when the word to which it is affixed begins with a vowel. "Dys" is a prefix meaning disordered, painful, or difficult. Dysrhythmia implies a disordered heart rhythm. "Neuro" (denoting nerve), another example of a prefix, combines with the term "algia" (pain) to form neuralgia, which refers to an aching along the course of nerve. Tables 1-1 and 1-2 list some of the more common prefix roots with which you should become familiar.

Table 1-1. Common Prefixes Pertaining to the Body

Prefix	Meaning
arthro-	joint
brach-	arm
capit-	head
cardi-	heart
cephalo-	head
cerebro-	brain
cholecyst-	gallbladder
choli-	bile
cyst-	bladder
derma-	skin
entero-	intestines
gastro-	stomach
glosso-	tongue
hemo-	blood
hepato-	liver
hystero-	uterus
laparo-	abdomen
myo-	muscle
nephro-	kidney
neuro-	nerve
ophthalmo-	eye
oral-	mouth
osteo-	bone
oto-	ear
pharyn-	throat
phlebo-	vein
pneumo-	air, lung
procto-	rectum
pyelo-	pelvis
rhino-	nose
thoracic-	chest

Table 1-2. Common Prefixes Pertaining to Conditions

Prefix	Meaning
a-, an-	lacking, absence of
ante-	before
anti-	against
auto-	self
brady-	slow
contra-	against, opposed to
dys-	difficult, painful
endo-	within
hemi-	half
hydro-	water
hyper-	above, increase
hypo-	below, under
mal-	ill, poor, bad, disorder
neo-	new, recent
oligi-	scanty, few
poly-	too many, too much
pyo-	pus
pyro-	heat, temperature
tachy-	fast

1-18. Suffixes

a. A suffix, or word ending, is a part that follows the root word and adds to or changes its meaning. It follows the root word without insertion of a connective "o."

b. The suffix "pnea" means breathing. Dyspnea is interpreted as difficulty in breathing. "Itis" refers to inflammation, as in neuritis, which means inflammation of a nerve. Another common suffix is "ology," or the science of cardiology, which is the science of the heart. Neurology is the science of the nerves and of the nervous system. Tables 1-3 and 1-4 list some of the more common suffix roots with which you should be familiar.

Table 1-3. Common Suffixes Pertaining to Conditions of the Body

Suffix	Meaning
-algia	pain
-cele	tumor, swelling
-clysis	slow injection of a large amount of fluid
-cyte	cell
-emia	blood
-esthesia	sensation
-itis	inflammation
-lith	stone
-mania	insanity
-oma	tumor
-opia	vision
-pathy	disease
-phobia	fear or dread
-plegia	paralysis
-pnea	breathing
-ptosis	falling
-rrhea	flow or discharge
-scopy	looking into
-therapy	treatment
-thermy	heat
-trophic	growth
-uric or uria	urine

Table 1-4. Common Suffixes Pertaining to Surgical Operations

Suffix	Meaning
-ectomy	removal of
-manometer	used to measure pressure
-meter	used to measure
-(o)rrhaphy	repair of
-(o)stomy	creation of an opening
-(o)tomy	cutting into
-pely	to fasten
-plasty	to form or build up
-scope	used to examine by looking into, or by hearing

CHAPTER 2

INTRODUCTION TO THE HUMAN SYSTEM

2-1. General

a. The science of anatomy is the study of the structure of the body. Considering the body as a complex machine, anatomy is the study of how that machine is put together. It deals with the structure of the parts, ranging from the molecular components of the tiniest cell, to the whole individual, and the relationship of these parts to one another.

b. Physiology is concerned with the functions, or mechanics of the body; how it works and what regulates, limits, and protects it. Functions include digestion, respiration, circulation, and reproduction. Structure and function are so closely related that it is impossible to understand one without the other, since the effectiveness with which a function can be carried out depends largely upon the structure of the part.

c. Pathology is the study of changes in the structure or function of the body caused by disease or trauma. In this chapter, we will be concerned with normal structures and functions of the various subsystems of the human body.

2-2. Anatomical Terminology

Terms of position, direction, and location that are used in reference to the body and its parts include the following:

a. Terms of Position. Anatomical position—an artificial posture of the human body. See Figure 2-1. This position is used as a standard reference throughout the medical profession:

(1) The body stands erect with heels together.

(2) Upper extremities are along the sides with the palms of the hand forward.

(3) The head faces forward.

b. Anatomical Postures. The anatomical postures are:

(1) *Erect.* The normal posture of the body in a standing position.

(2) *Supine.* The horizontal position of the body lying flat on the back.

(3) *Prone.* The horizontal position of the body lying face down.

(4) *Lateral recumbent (Sims position).* The horizontal position of the body lying on the left or right side.

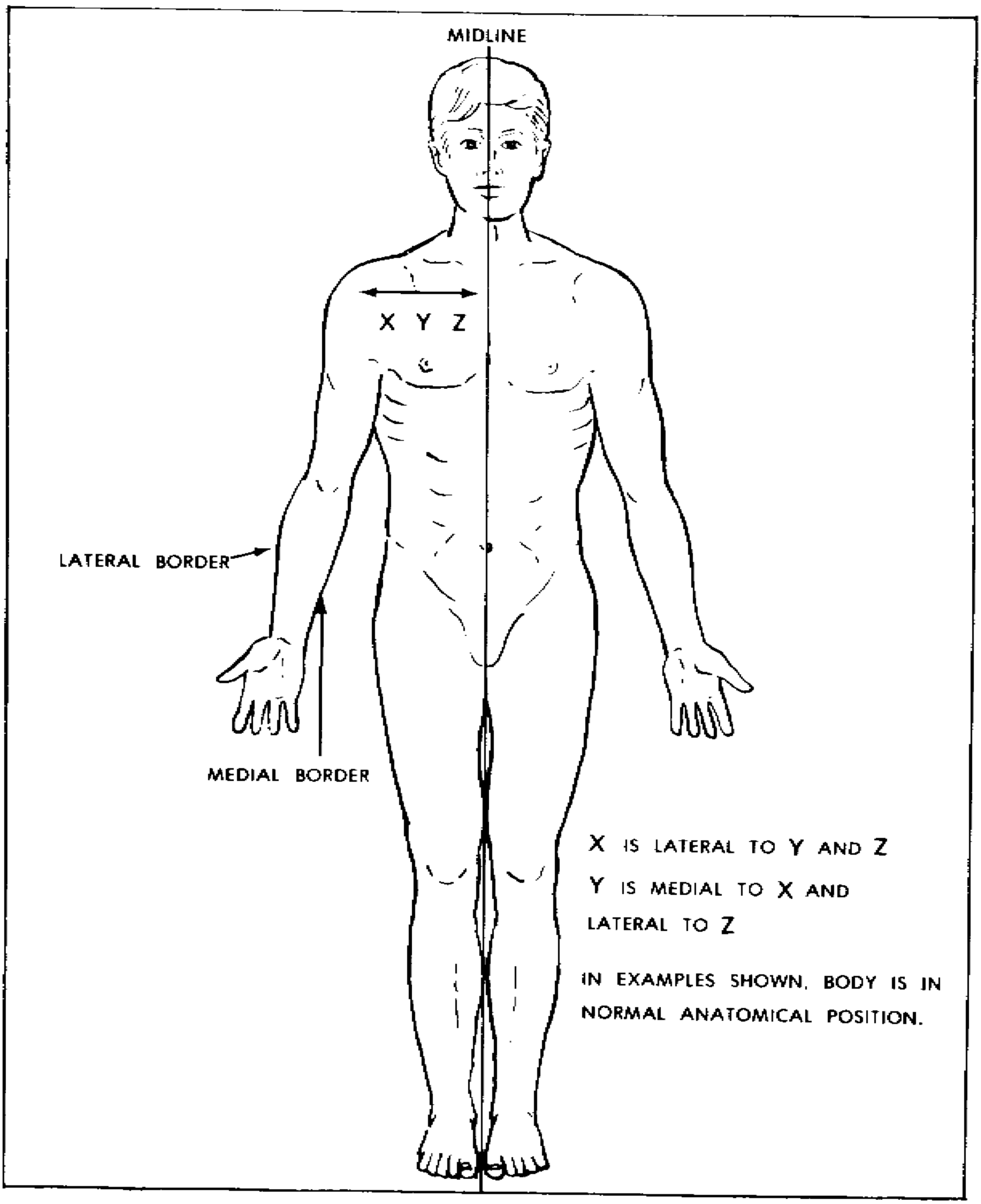


Figure 2-1. The anatomical position.

c. Terms for Anatomical Planes. Imaginary straight line divisions of the body are called planes. Figure 2-2 illustrates the imaginary planes used to describe the body.

(1) *Sagittal planes.* Vertical planes that pass through the body from front to back. The median or midsagittal plane is the vertical plane that divides the body into right and left halves.

(2) *Horizontal (transverse).* Planes that divide the body into two segments. They are perpendicular to both the sagittal and frontal planes.

(3) *Frontal (coronal).* Vertical planes that pass through the body from side to side. They are perpendicular to the sagittal plane.

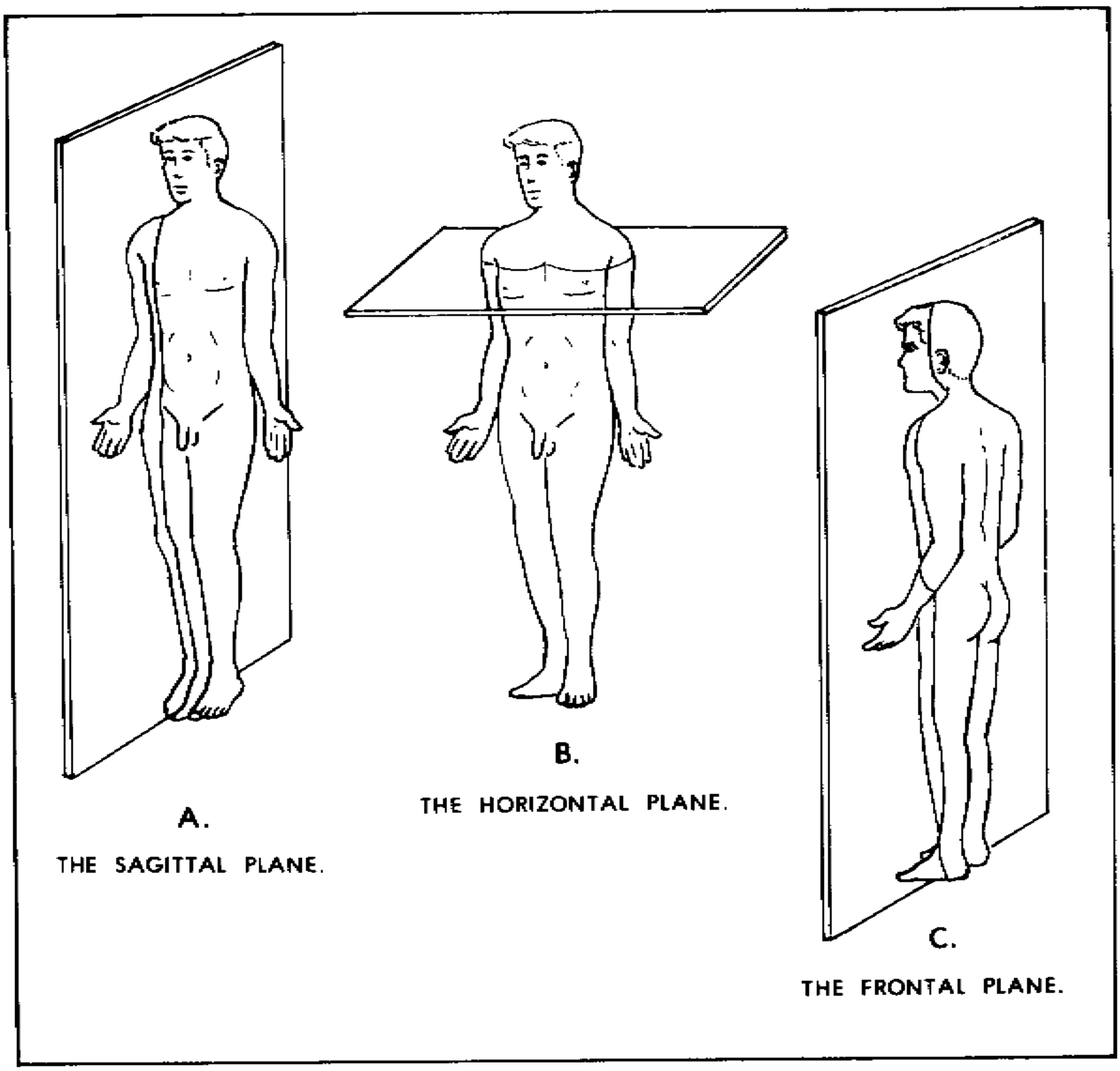


Figure 2-2. Anatomical planes.

d. Terms of Direction and Location.

(1) *Anterior (or ventral)*—at or near the front side of the body.

(2) *Posterior (or dorsal)*—at or near the back side of the body.

(3) *Medial*—toward or near the midline of the body.

(4) *Lateral*—away from the midline or toward the left or right of the midline.

(5) *Proximal*—nearest the point of origin or attachment. Used most in describing the limbs.

(6) *Distal*—away from the point of origin or attachment.

(7) *Superior (cranial)*—above or toward the head.

(8) *Inferior (caudal)*—below or toward the feet.

e. Terms of Body Regions. The body is a single, total composite system. Everything works together. Each part acts in association with all other parts. It is also a series of regions (Figure 2-3). Each region is responsible for certain body activities. These regions are:

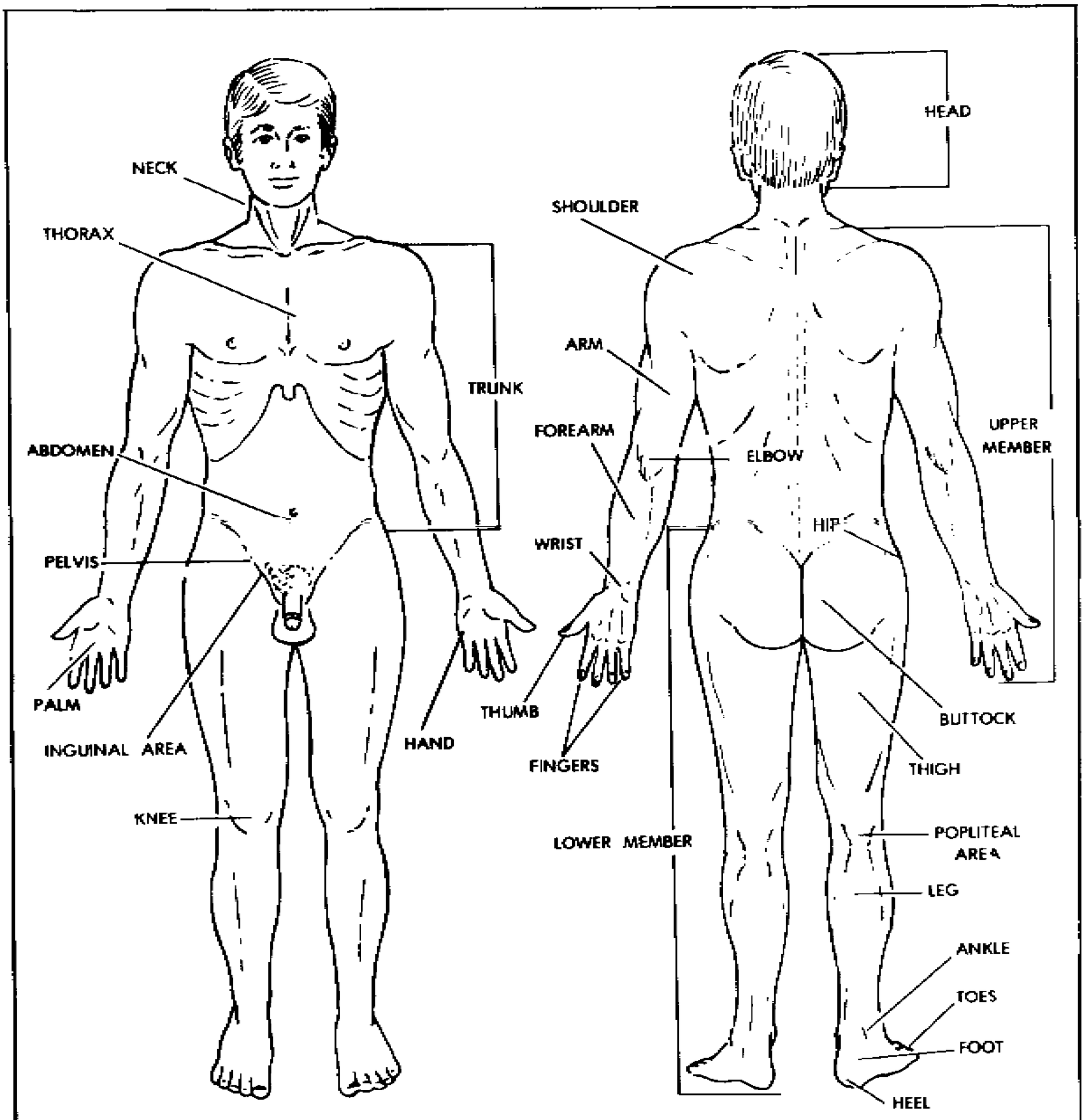
(1) *Back and trunk.* The torso includes the back and the trunk. The trunk includes the thorax (chest) and abdomen. At the lower end of the trunk is the pelvis. The perineum is the portion of the body forming the floor of the pelvis. The lungs, heart, and digestive system are found in the trunk.

(2) *Head and neck.* The brain, eyes, ears, mouth, pharynx, and larynx are found in this region.

(3) *Extremities.*

(a) Each upper extremity includes a shoulder, arm, forearm, wrist, and hand.

(b) Each lower extremity includes a hip, thigh, leg, ankle and foot.



NOTE: The perineal region (perineum) is on the underside of the trunk, between the beginnings of the thighs.

Figure 2-3. Regions of the body.

f. Terms for Directions of Movement.

(1) *Abduction*—movement away from the midline of the body.

(2) *Adduction*—movement toward the midline of the body.

(3) *Lateral rotation*—to rotate outward, or away from the body's midline.

(4) *Medial rotation*—to rotate inward or toward the body's midline.

(5) *Flexion*—is the act of bending.

(6) *Extension*—is the act of straightening.

2-3. Cells

The cell is the basic structural and functional unit of all living things. It may be defined as the minimal structural unit of protoplasm that can carry on all of the vital functions characteristic of living things. The human body is composed of trillions of cells which vary in shape and size. Cells are microscopic in size with the largest being only about 1/1,000 of an inch. Because of this, a special unit of measurement, the micron, is used to determine cell dimensions. (One micron equals 1/1,000 millimeter or about 1/25,000 of an inch.) Each of these cells is a living organism in itself, capable of existing, performing chemical reactions, and contributing its part to the overall function of the body. Although all living matter is composed of cells, animal cells are significantly different from each other. Not only do plant cells contain chlorophyll, a green coloring matter, but also have a cell wall around them which is made up of a very complex carbohydrate known as cellulose. Neither chlorophyll nor cell walls are present in animal cells. A typical animal cell includes a cell membrane, protoplasm, and a nucleus. A typical animal cell is illustrated in Figure 2-4.

a. Cell Membrane. The cell or plasma membrane surrounds and separates the cell from its environment. This membrane allows certain materials to pass through it as they enter or leave the cell. It is through the cell membrane that all materials essential to metabolism are received, and all products of metabolism are disposed of.

b. Protoplasm. The major substance of the cell is known as protoplasm. It is a combination of water and a variety of materials dissolved in water. Outside the cell nucleus, protoplasm is called cytoplasm; inside the cell nucleus, it is called nucleoplasm.

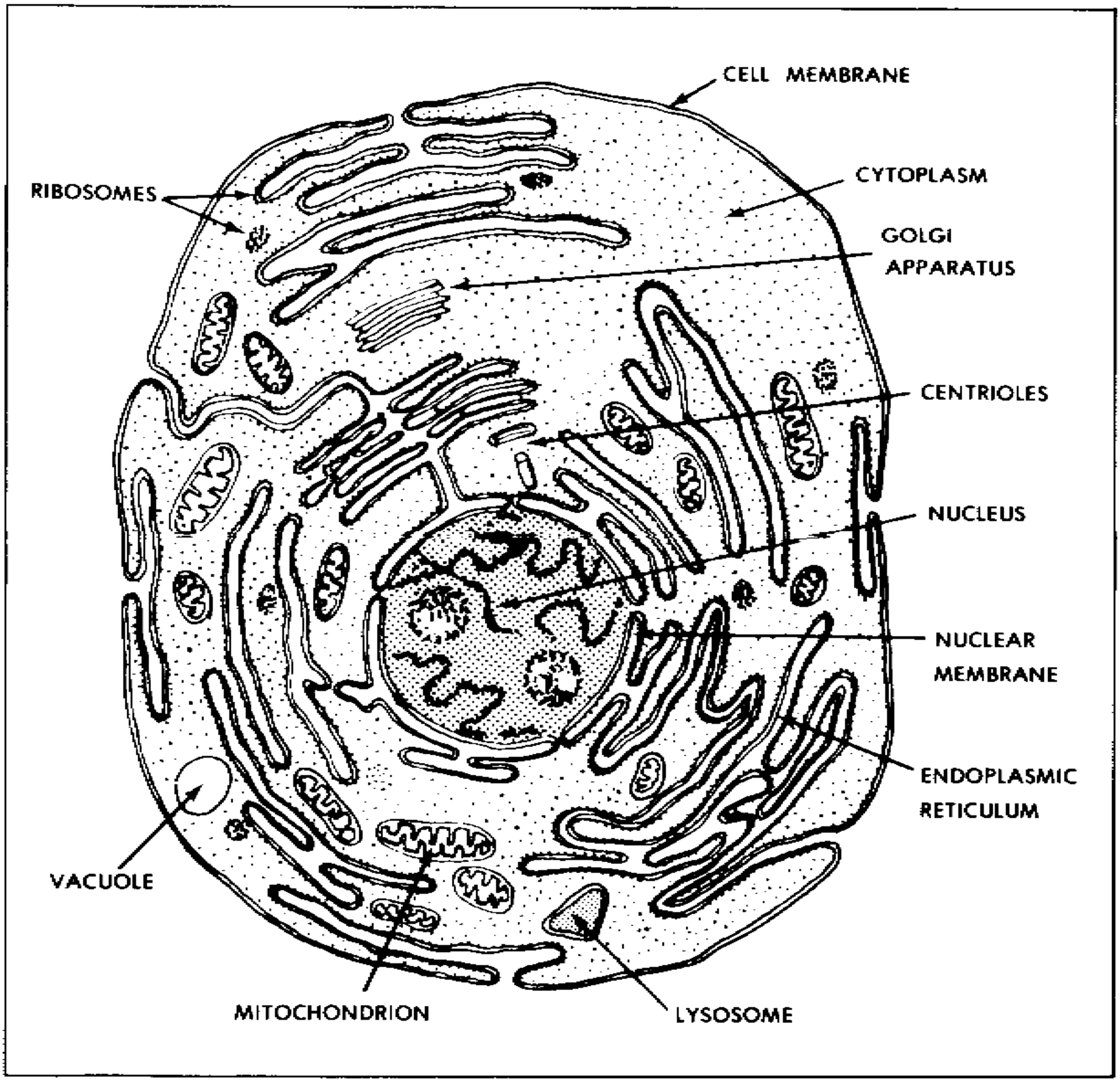


Figure 2-4. Simple animal cell.

c. Nucleus. The nucleus plays a central role in the cell. It controls all activities of the cell including growth and reproduction. Information is stored in the nucleus and distributed to guide the life process of the cell. This information is in a chemical form called nucleic acids. Two types of structures found in the nucleus are chromosomes and nucleoli. Chromosomes can be seen clearly only during cell division. Chromosomes are composed of both nucleic acids and proteins, and contain genes. Genes are the basic units of heredity which are passed from parents to their children. Genes guide the activities of each individual cell.

d. Vital Functions. Reduced to the simplest terms, the so-called vital functions may be identified by four properties: metabolism, growth, irritability and adaptability, and reproduction.

(1) Metabolism is the ability to carry on all the chemical activities required for cell function. The processes are involved in energy exchange. It includes using food and oxygen, producing and eliminating waste, and manufacturing new materials for growth, repair, and use by other cells. Growth and metabolism involve many of the same functions, but they are two different things.

(2) Growth occurs when the metabolic balance is tipped slightly in favor of building processes over breakdown processes. It is because of the metabolic processes that cells grow larger and more numerous. The metabolism of special cells allows them to form structures such as bones and fibrous tissues, enlarging the entire body. Thus metabolism is the basic function not only for energy needed by the body, but also for growth itself.

(3) Irritability and adaptability denote the ability to respond to a change in the environment, that is, to a stimulus. Adaptation is a long-range response to environmental change, as observed in evolutionary changes over many generations. The nature of the responses varies with the structure or cell stimulated, as well as the nature of the stimulus.

(4) Reproduction is the ability to perpetuate an individual's own kind. Reproduction also insures the continuity of the species. Cell growth and reproduction usually go together, with both occurring simultaneously. We know that certain cells, such as blood cells, bone marrow, and layers of the skin, grow and reproduce all the time. However, many other cells, such as muscle cells do not reproduce for many years. A few cells, such as neurons, do not reproduce during the entire life cycle of the human body. Most cells of the body reproduce continually, though that rate of reproduction usually remains greatly surpressed. Yet, if there is an insufficiency of a given type of cell in the body, this type of cell will usually grow and reproduce very rapidly until appropriate numbers are again available.

2-4. Tissue

Tissue is a cohesive group of similar cells. For example, liver cells are bound together to form liver tissue, and bone cells are bound together with lime salts to form bony tissue. The tissues of the body have different characteristics because the cells which compose them are different both in structure and function. There are four primary types of body tissue:

a. Epithelial tissue which makes up all covering and lining membranes of the body and all glands.

b. Connective tissue which supports and connects other tissues.

c. Nervous tissue which is specialized to receive stimuli and conduct messages over long distances.

d. Muscle tissue which is specialized to contract (shorten) in response to stimuli from nerves.

2-5. Connective Tissues

Connective tissues are the tissues that support or hold other tissues together, or fill spaces. Among and outside the cells of the connective tissue is a material called matrix. The matrix is manufactured by the connective tissue cells. Each type of connective tissue has its own particular type of matrix. Several major types of connective tissue (CT) include fibrous CT (FCT), cartilage CT, bone CT, and fat CT.

2-6. Muscle Tissue

There are muscle tissues and there are organs called muscle tissues. Muscle tissue and the muscles they make up are specialized to contract. Because of their ability to shorten (contract), muscles are able to produce motion. Figure 2-5 illustrates the three types of muscle tissue: smooth, striated, and cardiac.

a. Smooth Muscle Tissue. Cells of smooth muscle are long, but remain as individual cells. Smooth muscle tissue is found generally in the walls of hollow organs, such as the digestive system, the respiratory system, the blood vessels, and the urinary bladder.

b. Striated Muscle Tissue. The cells of striated muscle tissue have united to form fibers. Striated muscle tissues are found making up the skeletal muscles that assist in activities such as pushing, pulling, running, walking, or swimming.

c. Cardiac Muscle Tissue. In the myocardium (the muscle layer of the heart), the cells have also united to form cardiac fibers. These fibers are cross-striated, but branched. The heart and its component parts will be discussed in a later chapter.

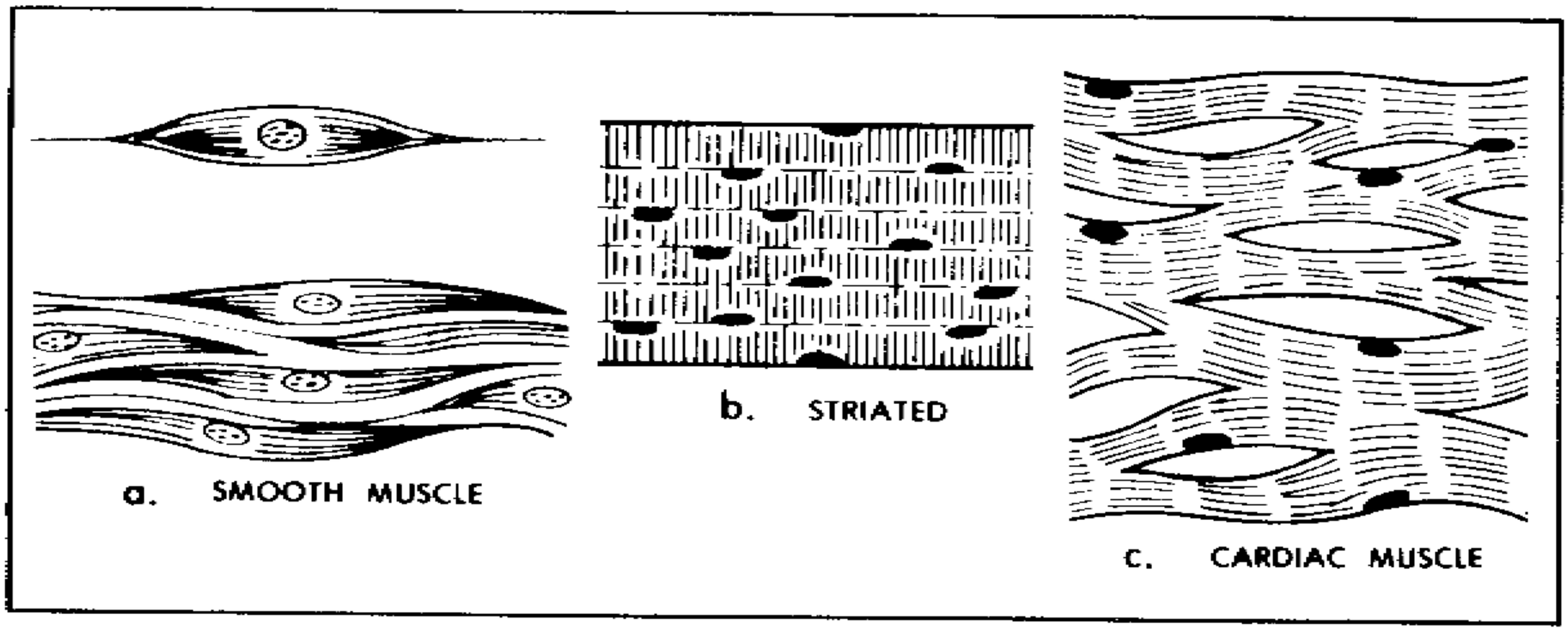


Figure 2-5. Types of muscle tissue.

2-7. Nervous Tissue

Nervous tissue is a collection of cells that respond to stimuli and transmit information.

a. A neuron (Figure 2-6), or nerve cell, is the cell of the nervous tissue that actually picks up and transmits a signal from one part of the body to another. A synapse (Figure 2-7) is the point at which a signal passes from one neuron to the next.

b. The neuroglia (also known as glia) is made up of the supporting cells of the nervous system. The nervous tissues will be discussed in a later chapter.

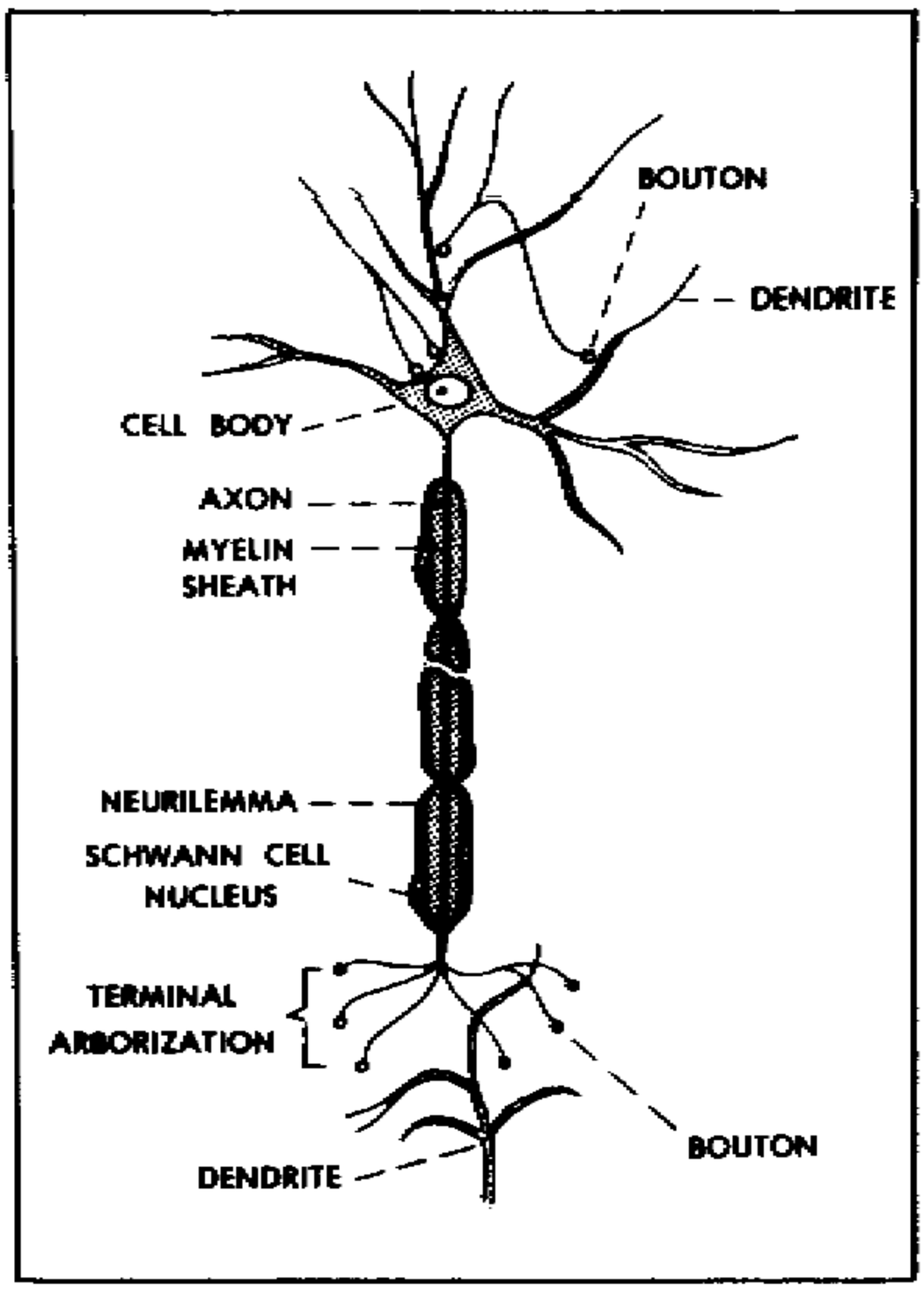


Figure 2-6. A neuron.

Figure 2-7. A synapse.

CHAPTER 3

THE INTEGUMENTARY SYSTEM

3-1. General

The integumentary system includes the integument proper and the integumentary derivatives. The integument proper is commonly known as the skin and is the outermost covering of the entire body. The integumentary derivatives include the hairs, nails, and various glands of the skin. The skin, as the largest organ of the body, serves the body in many important ways:

a. Protection as a mechanical barrier to the entrance of bacteria and foreign objects and against minor injury.

b. Regulation of body temperature through control of heat and loss or retention of water.

c. Sensory perception through neuron endings that transmit sensations of heat, cold, touch, pain, and pressure.

d. Limited excretion of body wastes through sweat. The skin also protects inner tissues from drying. Although this is not one of its normal functions, the skin can absorb water and other substances. This function is used to advantage in the local application of certain drugs. It can also be harmful when toxins and chemical agents are absorbed through the skin.

3-2. The Integument Proper

The integument proper (skin) is the outermost layer of the body. The skin consists of two layers: the outer layer and the inner layer. The outer layer is called the epidermis and the inner layer is called the dermis.

a. The Epidermis. The epidermis is a stratified squamous epithelium. This means that it is made up of several layers of cells. There are no blood vessels or neuron endings in the epidermis. The outermost cells are flat and resemble scales. These dead cells are constantly flaking off the surface. As this happens, growing inner epidermal cells are pushing up toward the surface to replace the outer cells. Skin pigment called melanin is produced in cells located below the epidermis and injected into the epidermal cells. It determines the darkness or lightness of skin color. However, the skin color is also due to the quantity and state of the blood circulating in the dermis. Pinkness, blueness (cyanosis), or paleness (pallor) of the skin surface is due to the amount of blood circulation.

b. The Dermis (Dermal Layer). The dermis is the layer of the skin lying just beneath the epidermis. It is dense fibrous connective tissue consisting of white and yellow fibers. The dermis has fingerlike projections called papillae. These papillae extend into the epidermis and keep the dermis and epidermis from sliding on each other. The dermal layer includes blood vessels, lymph vessels, nerve endings, hair follicles, and glands.

3-3. Integumentary Derivatives (Skin Accessory Organs)

The integumentary derivatives include the glands, hairs, and nails associated with the skin. All integumentary derivatives are formed from the tissues of the integument proper (dermis and epidermis). They are appended (attached) to the integument proper and are often known as the appendages of the skin. (See Figure 3-1.)

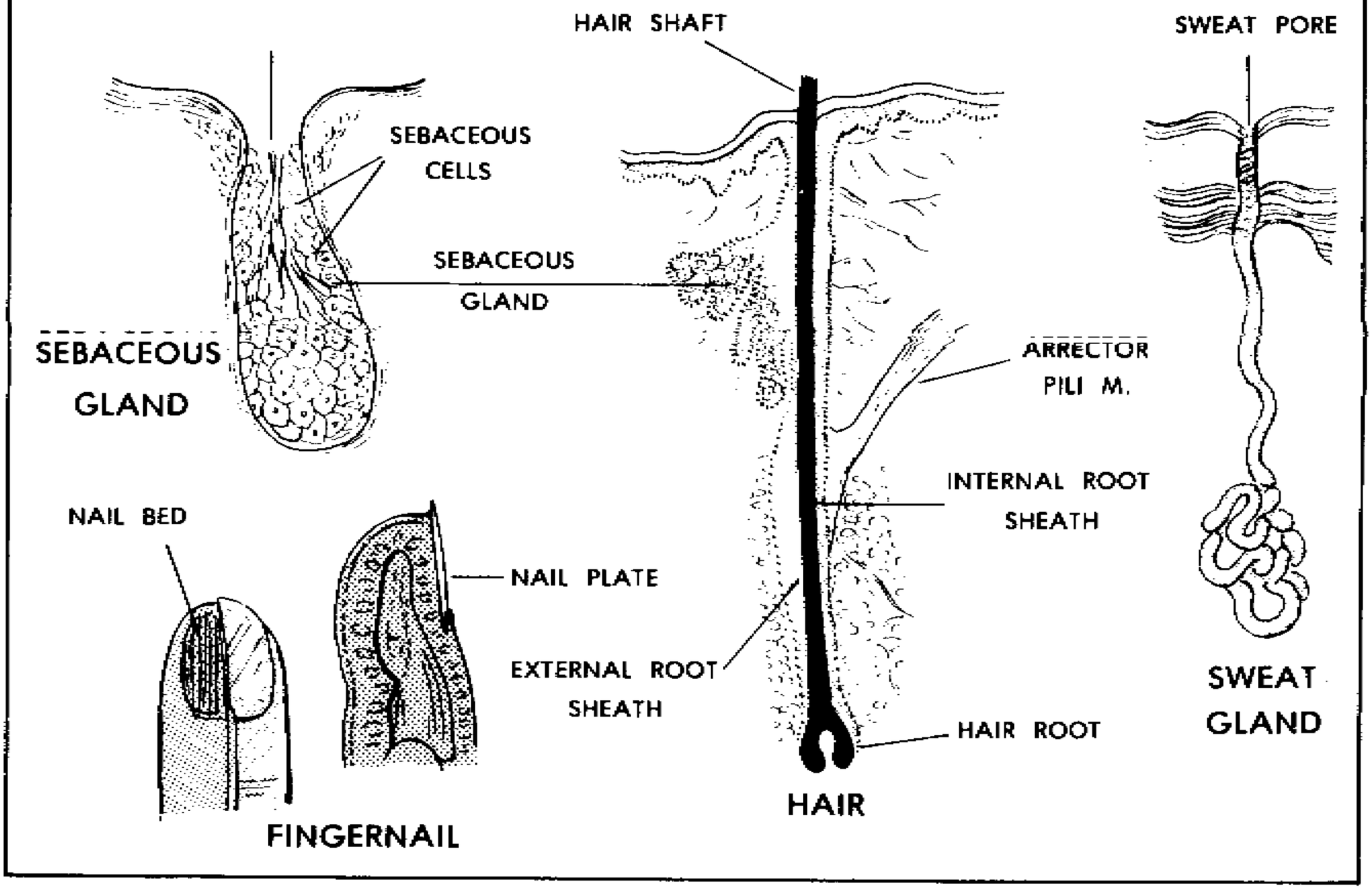


Figure 3-1. The integumentary derivatives.

a. Hairs.

(1) A hair follicle is formed by the extension of the skin (dermis and epidermis) deeper into the surface of the body. Follicles may extend into the subcutaneous layer. At the base of the hair follicle is the hair root. The hair shaft grows out from the root and is made up of cells from the outermost layers of the epidermis.

(2) Scalp and facial hairs grow continuously. Other hairs of the body grow to fixed lengths. The types and patterns of hairs are determined for each individual by genetics.

(3) Friction against the integument is reduced by hairs and outer dead cells.

b. Glands. The types of glands include the sweat glands, the sebaceous (fat/oil) glands, and the mammary glands (breasts). The ducts and secretory parts of these glands are made of epithelial tissues. Backup or supporting tissue is of fibrous connective tissue.

(1) *Sweat glands.* Sweat glands consist of a coiled secretory portion and a duct leading to the surface of the skin. The coiled secretory portion is located in the dermis or deeper. Sweat glands are found everywhere on the body in association with the skin. Sweat glands manufacture sweat, or perspiration, from fluid drawn from blood. Sweat contains salts and organic wastes and is about 99 percent water. It is discharged through skin openings called pores. As sweat evaporates, the body is cooled. Sweat formation and excretion are important mechanisms for reducing body heat.

(2) *Sebaceous glands.* Sebaceous glands produce an oily substance called sebum, which lubricates the skin and hairs. The oil keeps the skin and hairs pliable and helps keep the skin waterproof. The sebaceous glands are usually found as a part of the walls of hair follicles and their oil flows into the follicle. In a few places without hairs, they open directly to the skin surface. When the openings of the sebaceous glands become plugged with dirt, they form blackheads.

(3) *Mammary glands.* In the adult human female, the mammary glands lie in the subcutaneous layer anterior to the chest muscle (pectoralis major). Their function is to nourish the newborn. A nipple is located near the center of each breast. Around each nipple is a darkened area known as the areola. The tip of the nipple has many small openings to allow the passage of the milk from the milk ducts. These ducts are connected to lobes of glandular tissue located throughout the breast. Fat and fibrous connective tissue fill in the spaces among the lobes.

c. Nails. Nails are located in the ends of the digits (thumbs, fingers, and toes). Nails help to protect the ends of these digits and aid in picking up objects. Each nail bed is attached to the top of the terminal phalanx (bone of each digit). The nail itself is made up of cornified (hardened) outer cell layers of the epidermis. The nails grow continuously from their roots.

3-4. Fascial Tissue

A fascia is a sheet or collection of fibrous connective tissue. The superficial fascia is the connective tissue which lies immediately beneath the skin and is often known as the subcutaneous layer. Deep fasciae (plural) form envelopes for muscles and other organs. Portions of the integumentary system and fascial tissue are shown in Figure 3-2.

a. Superficial Fascia.

(1) The superficial fascia is the second envelope of the body. It is the connective tissue that lies immediately between the skin (integument proper) and the deep fascial envelope. It is often called the subcutaneous layer, but it is technically not a part of the integumentary system. Fat deposits located here store reserve energy for the body and form an insulating layer. Fat and other fibrous connective tissues in the subcutaneous layer round out body surfaces and cushion bony parts.

(2) The superficial fascia is made up primarily of loose areolar fibrous connective tissue with the spaces filled by fatty tissue and tissue fluid. It contains the superficial or cutaneous branches of nerves, arteries, veins, and lymphatics (NAVL) of the skin.

b. Deep Fasciae.

(1) The deep fasciae include various membranes made of consolidated or dense fibrous connective tissue. A deep fascia envelops the entire body as the third envelope. This third envelope is known as the investing deep fascia. It is beneath the skin and subcutaneous layers.

(2) Deep fasciae also include the envelopes of the muscles and other organs. Around individual organs (for example, the kidney) it is called a capsule.

(3) Another form of deep fascia is found in the collections of loose areolar fibrous connective tissue and fat that are found as filling among the organs. Similar deep fasciae attach organs to the body wall.

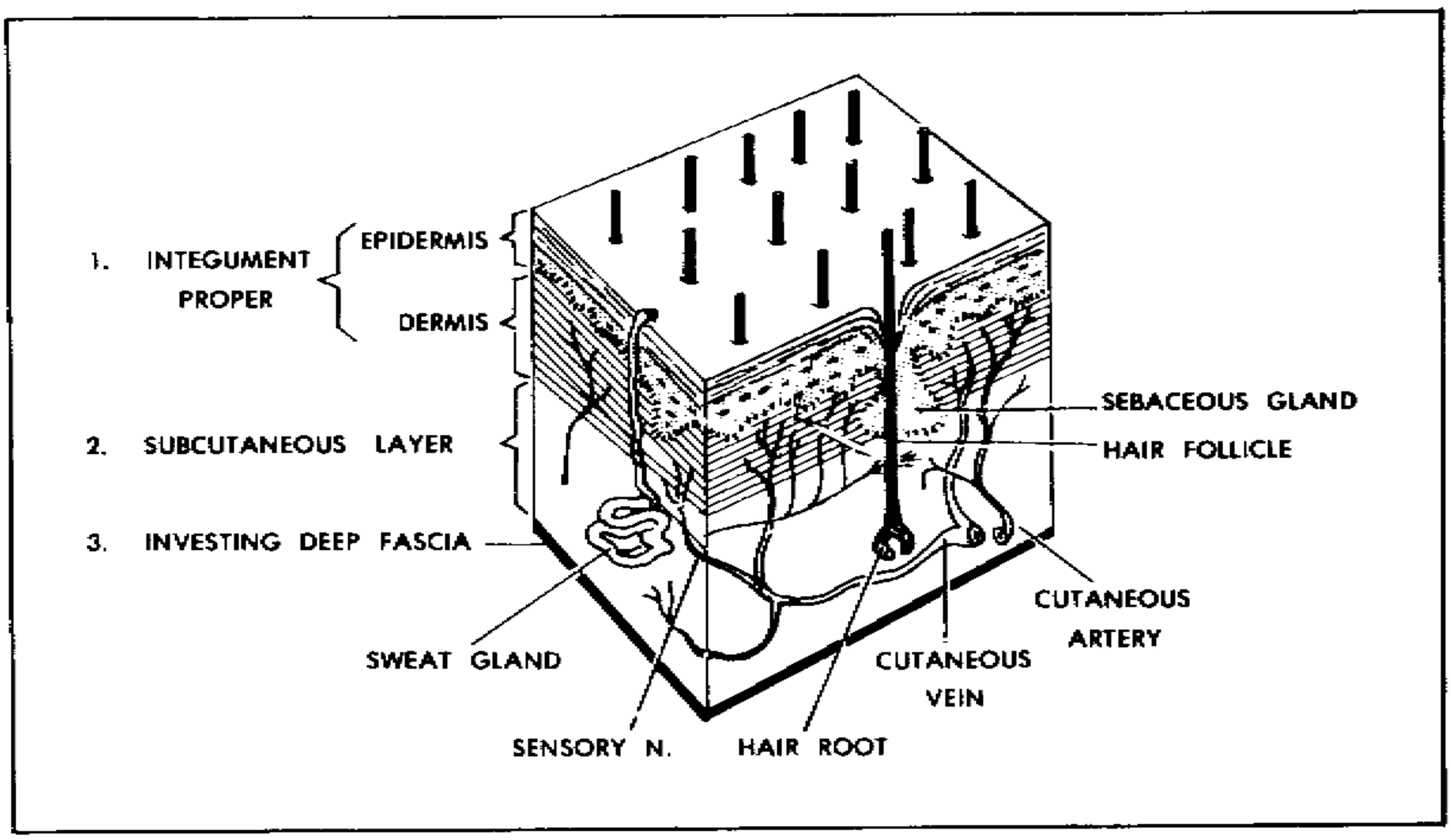


Figure 3-2. The integument and related structures.

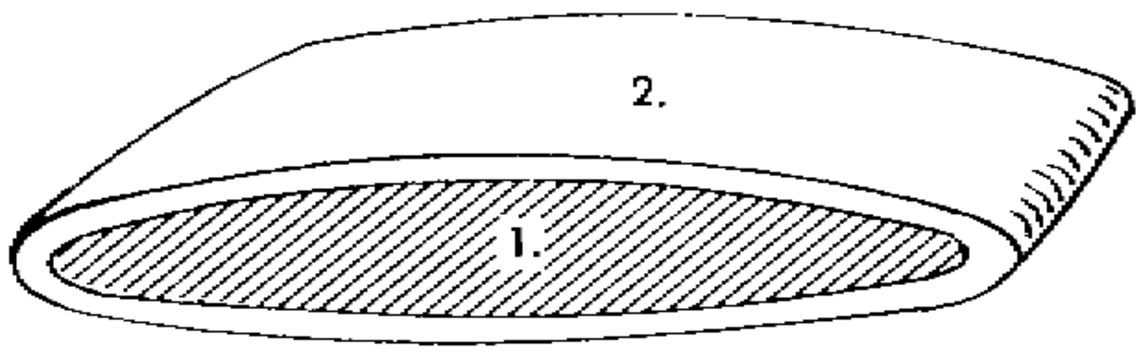
3-5. Serous Cavities of the Body

The term serous refers to a watery-type fluid. Serous cavities are sacs lined with serous membranes. These cavities serve as lubricating devices. They reduce the friction during the motion between organs.

a. Bursa.

(1) A bursa (Figure 3-3) is the simplest of serous cavities. Each bursa is a small sac located between two moving structures, usually a muscle moving over a bony surface. The bursa reduces the friction between the two structures. For example, a bursa prevents excessive friction between the skin and patella (kneecap). This bursa, called the prepatellarbursa, allows the skin to move freely over the patella.

(2) As a fibrous sac, each bursa has a central cavity that is lined with a serous membrane. This membrane is a simple epithelium. The serous membrane secretes a serous fluid into the serous cavity. The serous fluid is the lubricant, minimizing friction.



1. SEROUS (BURSAL) CAVITY:
   a. SPACE CONTAINING JUST ENOUGH SEROUS FLUID TO MOISTEN INNER SURFACE
   b. SPACE ARTIFICIALLY WIDENED FOR DIAGRAMMATIC PURPOSES.
2. (BURSAL) CAPSULE
   a. "BAG-LIKE" -- SURROUNDING THE SEROUS CAVITY.
   b. FCT MEMBRANE MAIN STRUCTURAL ELEMENT.
   c. A SEROUS MEMBRANE (SIMPLE SQUAMOUS EPITHELIAL TISSUE) AS AN INNER LINING OF THE CAPSULE. THE SEROUS MEMBRANE INCLOSES THE SEROUS CAVITY AND SECRETES THE SEROUS FLUID.

Figure 3-3. A bursa—the simplest serous cavity.

b. Other Serous Cavities of the Body.

(1) Other important serous cavities are associated with the major hollow organs, referred to as visceral organs. Each lung is encased in a serous cavity called the pleural cavity. The heart lies in a serous cavity called the pericardial cavity. The intestines are allowed to move freely during the digestive processes within the peritoneal cavity.

(2) Each serous cavity has an inner and an outer membrane. The inner membrane is intimately associated with the surface of the visceral organ. The outer membrane forms the outer wall of the cavity. The serous lining of the cavity secretes the serous fluid into the cavity to act as a lubricant between the membranes, allowing freer motion for the organs.

CHAPTER 4

THE SKELETAL/MUSCLE SYSTEM

Section I. THE SKELETAL SYSTEM

4-1. General

The skeletal system (Figures 4-1A and 4-1B) provides a framework for the body, giving it form and protection, and enclosing the vital organs, such as the brain, heart, and lungs. The skeletal system is composed of:

a. *Bones,* 206 in number, which form the hard framework of the body.

b. *Cartilage,* which provides connecting and supporting structures.

c. *Ligaments,* which bind bones together.

4-2. Basic Structure of a Bone

Bones are formed of a protein matrix, which provides growth, and salts (basically calcium phosphate salts), which give bones their characteristic hard texture. Living cells within the matrix constantly repair the structure of bones and play an important role in the healing of fractures. Other cells (the marrow) occupy the cavities within the bones and produce blood cells. Bones are living tissue like muscle, skin, and other tissues; a rich blood supply constantly provides the oxygen (O_2) and nutrients required by the bones. Each bone also has an extensive nerve supply. This is why the fracture of a bone will produce severe pain from irritation of nerves as well as significant bleeding from damage to its blood vessels. Figure 4-2 represents the basic structure of an individual bone.

4-3. Bone Marrow

Two kinds of marrow, yellow and red, are found in the marrow cavities of bones. Red bone marrow is active blood cell manufacturing material, producing red blood cells and many of the white blood cells. Deposits of red bone marrow in an adult are in cancellous portions of some bones—the skull, ribs, and sternum, for example. Yellow bone marrow is mostly fat and is found in marrow cavities of mature long bones. The examination of red marrow deposits is important for diagnostic tests when the condition of developing blood cells must be determined. For microscopic examination, the doctor obtains a small amount of marrow through a special needle puncture, usually in the sternum.

4-4. Shapes of Bones

Bones are classified according to their shape (long, short, flat, or irregular) or according to their embryonic origin (membranous or cartilaginous), and their structure (compact or spongy). Long bones are found in the extremities and include the humerus, radius, ulna, femur, tibia, fibula, and the phalanges. Short bones are found in the wrist and ankles and include carpal and tarsal bones. Flat bones include the ribs, scapula, and some skull bones. Irregular bones include the vertebrae, coccyx, and mandible.

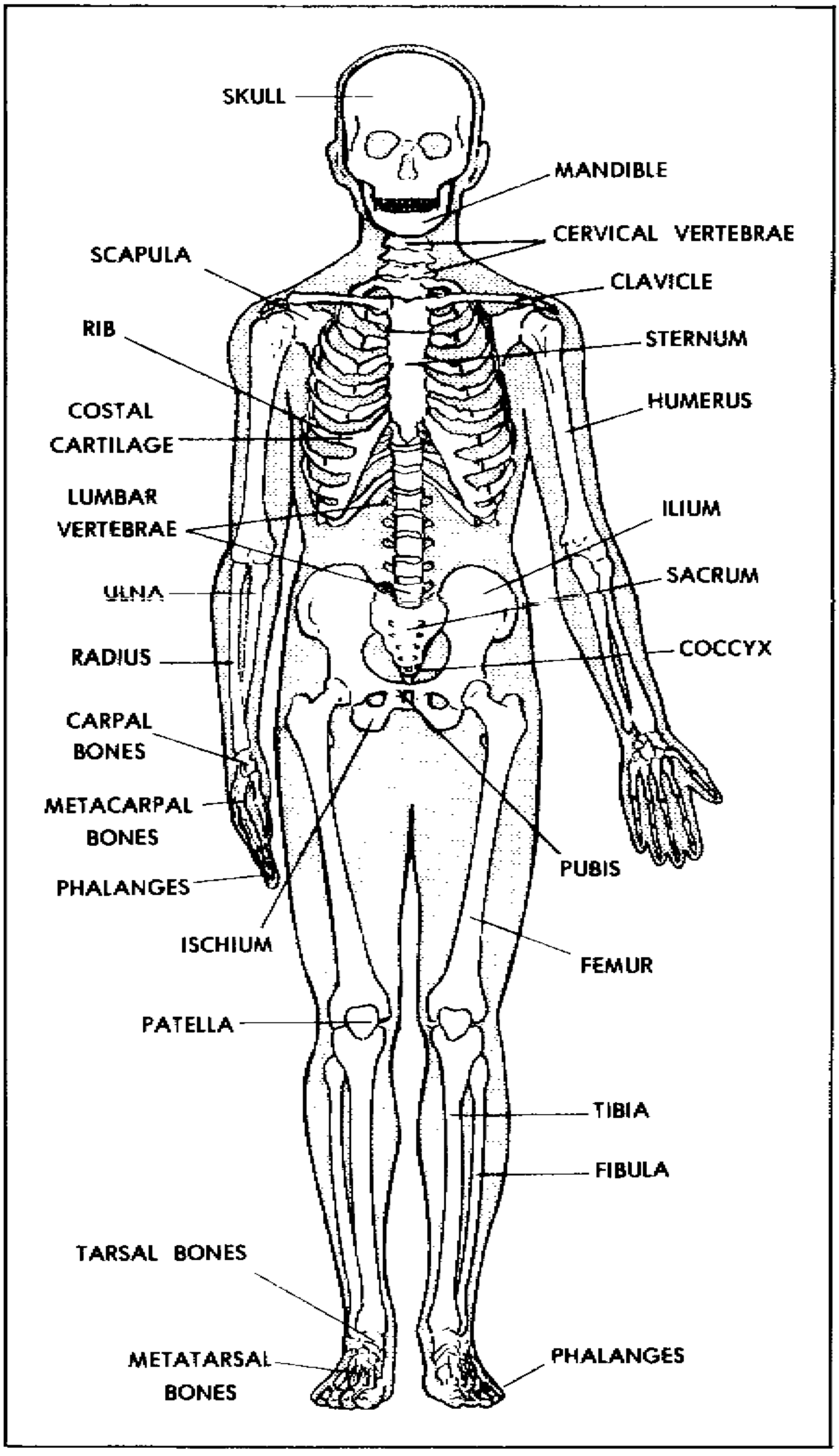


Figure 4-1A. The skeleton (anterior).

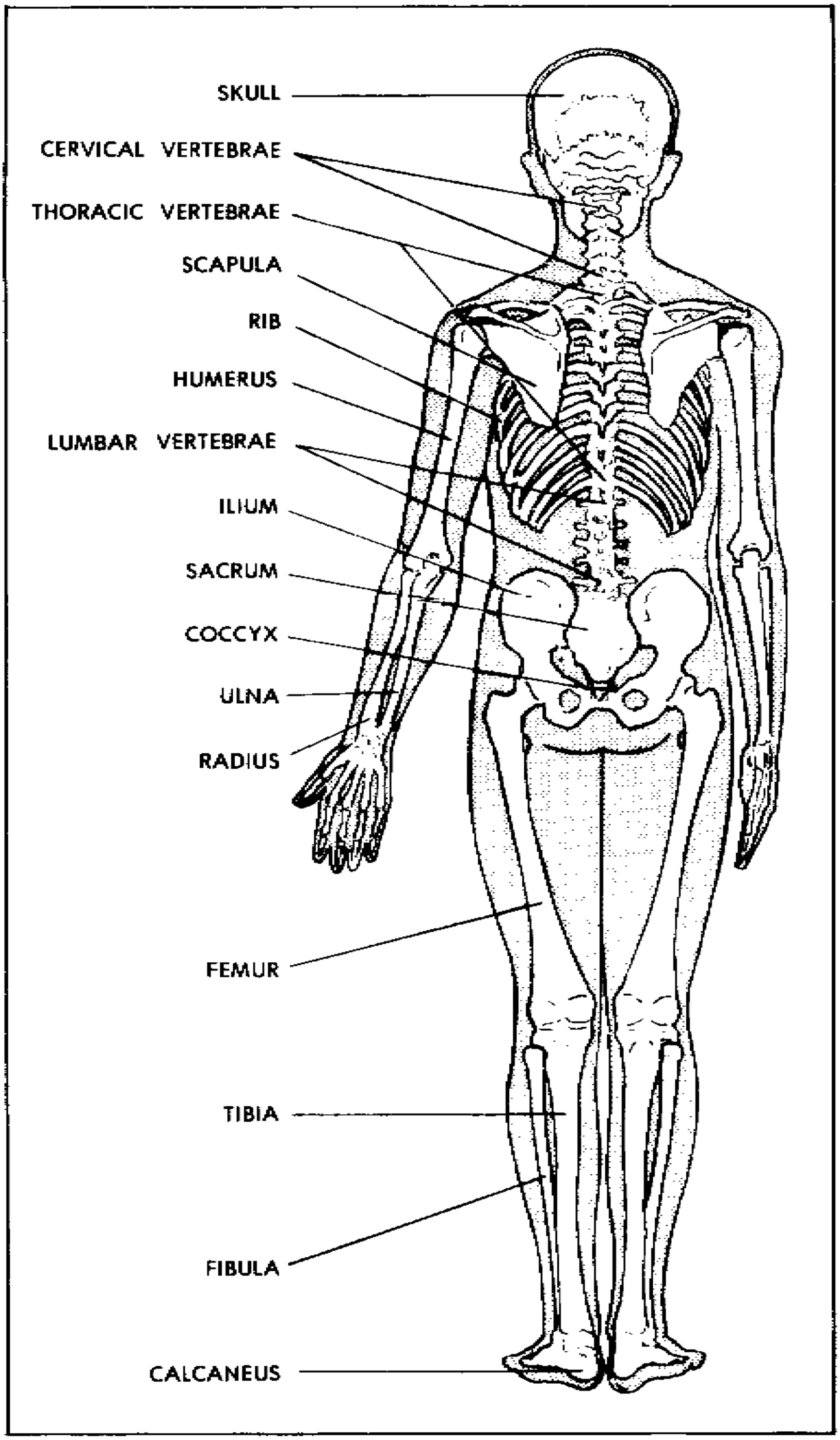


Figure 4-1B. The skeleton (posterior).

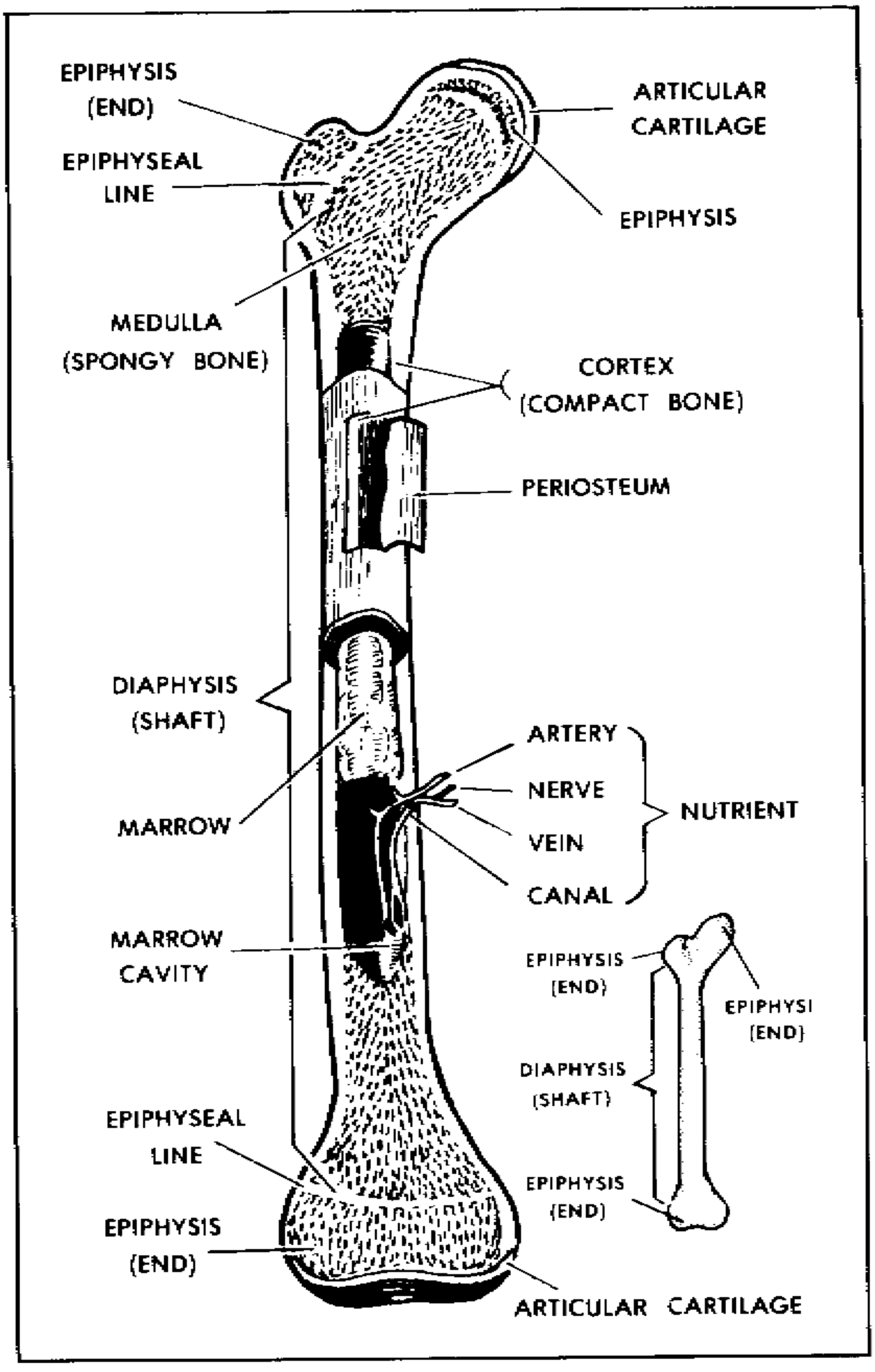


Figure 4-2. A mature long bone (femur).

4-5. Skeletal System

The framework provided by the skeleton permits an erect posture and gives the body its characteristic form (Figure 4-3).

a. The Skull (Figure 4-3). The skull is a bony framework. It has two major subdivisions: the cranium and the facial skeleton. The most important are the cranial bones, including the frontal, occipital, temporal, and parietal, which enclose and protect the brain and the upper jaw, or maxilla, the lower jaw or mandible, and the cheek bones, or zygomatic bones. The mandible is attached to the skull by modified joints that permit the lower jaw to move.

(1) The cranial bones are fused at joints called the *coronal suture.* The bones of the cranium are not fully fused and the sutures are soft at birth. As the baby grows, the bones of the skull fuse firmly, making the skull a rigid box that does not permit expansion. When bleeding occurs within the adult skull, or if brain tissue swells, the increase in intracranial volume will increase pressure and damaged brain tissue can occur.

(2) The facial skeleton consists of bones which surround the nose and mouth and are mainly flat and irregular in shape. The face is composed of bones fused together to provide protection for important structures. For example, the orbit (eye socket) is composed of two facial bones, the maxilla and the zygoma, as well as the frontal bone of the cranium, to form a solid bony rim that protrudes around the eye to protect it. The maxilla contains the upper teeth and forms the hard palate, or the roof of the mouth. The mandible, or lower jaw, is the only movable facial bone that has a joint (the temporomandibular) with the cranium just in front of the ear. The nasal bone is very short and the majority of the nose is composed of flexible cartilage.

(3) Certain bones of the skull have air-filled spaces called the paranasal sinuses.

NOTE

The skull includes the flat bones of the cranium, which are fused, and the facial bones. The mandible (lower jaw) is freely movable.

(4) The upper jaw (maxilla) and the lower jaw (mandible) are parts of the facial skeleton that surround the mouth.

(5) The hyoid bone is located at the junction between the head and the neck. It is held in place—and moved around—by groups of muscles above and below. The root of the tongue is attached to its upper anterior surface. The larynx is suspended from its inferior surface. These three structures, together, form the hyoid complex. This complex is a functional unit for swallowing.

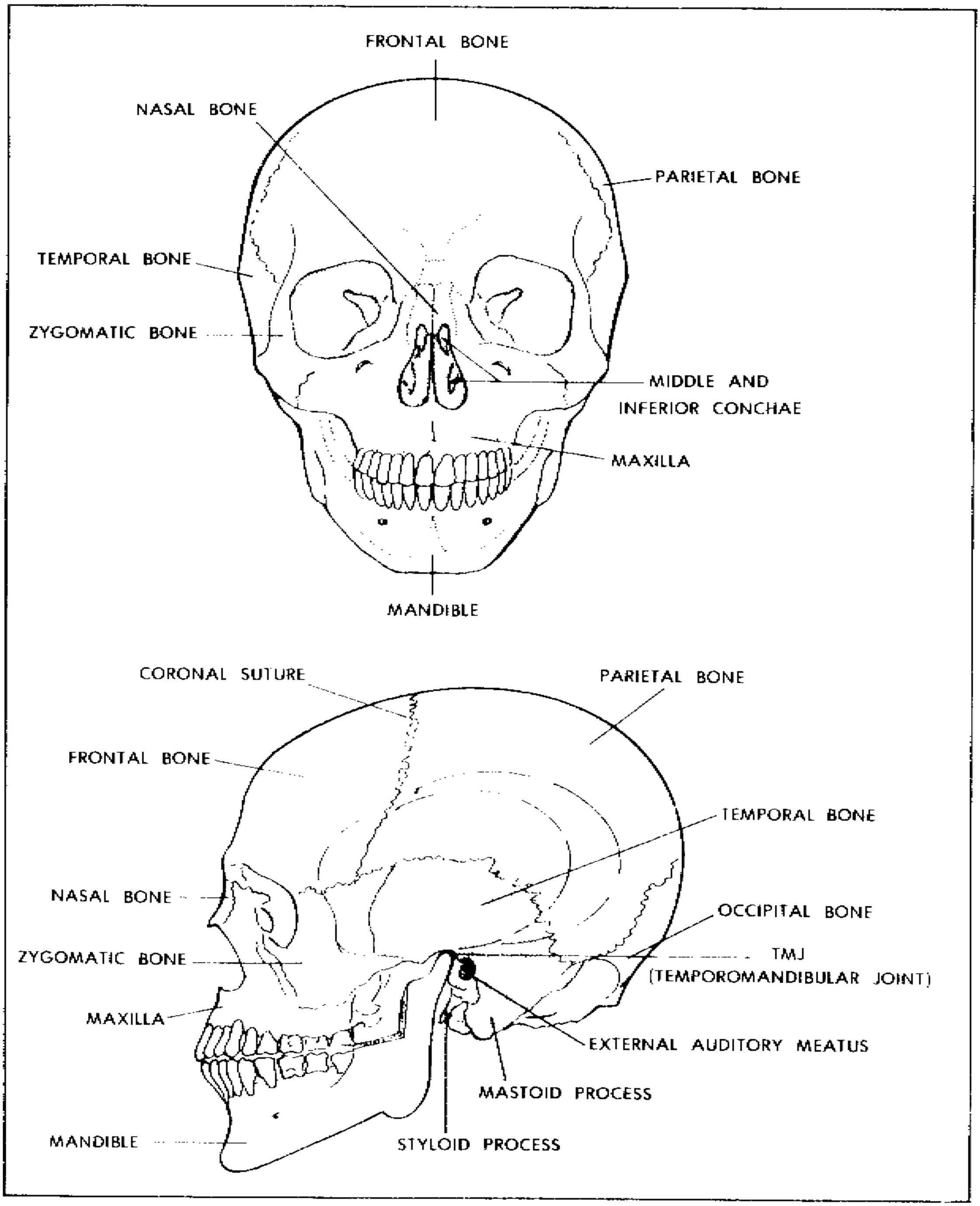


Figure 4-3. The skull (front and side views).

b. The Spinal Column (Figure 4-4).

(1) The spinal column serves as the main axis of the body, providing rigidity but permitting some degree of movement. It also serves as a protective case, inclosing the spinal cord and the roots of the spinal nerves. The spinal column is composed of 33 bones called the vertebrae. The skull rests at the top of the spinal column. From the brain extends the long nerve tracts that form the spinal cord. This cord is an extension of the brain composed of virtually all the nerves carrying messages between the brain and the rest of the body.

(2) The ribs join with the upper vertebrae to form the thorax. The pelvis, with the lower part of the spinal column, or sacrum, form the pelvic girdle. The spinal column is divided into five sections (Figure 4-4)—

- Section 1—Cervical Spine: comprising the first seven vertebrae in the neck region.

- Section 2—Thoracic Spine: consisting of 12 vertebrae in the upper back with which the 12 pairs of ribs join.

- Section 3—Lumbar Spine: made up of five vertebrae in the lower back.

- Section 4—Sacrum: joins with the pelvis at the sacroiliac joint, forming part of the pelvic girdle.

- Section 5—Coccyx (tail bone): consists of the last four vertebrae which are fused together.

(3) The vertebrae are named according to the section of the spine in which they lie and are numbered from top to bottom. The first seven vertebrae form the cervical spine (C_1-C_7). The next twelve vertebrae make up the thoracic or dorsal spine; one pair of ribs articulates (joins) with each of these vertebrae. The next five vertebrae form the lumbar spine, or the lower back.

(4) The five sacral vertebrae are fused together to form the sacrum. The sacrum is joined to the iliac bones of the pelvis with strong ligaments to form the pelvic girdle. The last four vertebrae form the coccyx, or tailbone.

(5) The front part of each vertebrae is a round solid block of bone called the body. The back part of each vertebrae forms a bony arch (Figure 4-5). These series of arches, from one vertebrae to the next, form a tunnel that runs the length of the spine and is called the spinal canal. The spinal canal incloses and protects the spinal cord. Nerves branch off from the spinal cord between each two vertebrae to form the motor and sensory nerves of the body (Figure 4-5).

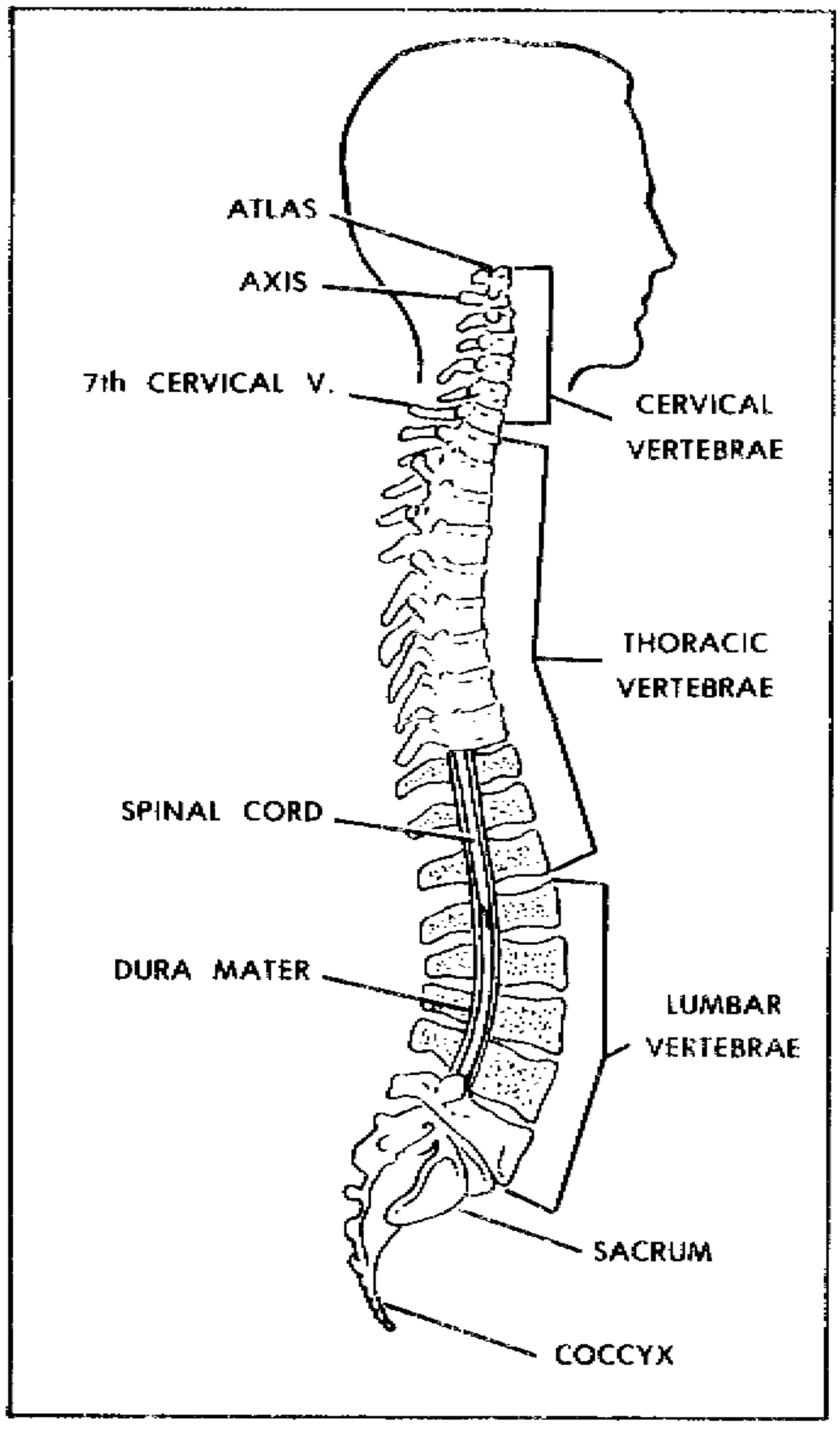


Figure 4-4. The spinal column.

(6) The vertebrae are connected by ligaments, and between each two vertebral bodies is a cushion, the intervertebral disc. These ligaments and discs allow some motion, such as turning the head or bending the trunk forward or backward, but they also act to limit motion of the vertebrae so that the spinal cord will not be injured. When a fracture of the spine occurs, protection for the spinal cord and its nerves may be lost. Until the fracture is made stable, the medical specialist, must guard against further injury to the spinal cord. The spinal column itself is virtually surrounded by muscles; however, the posterior spinous process of each vertebrae can be felt as it lies just under the skin in the midline of the back.

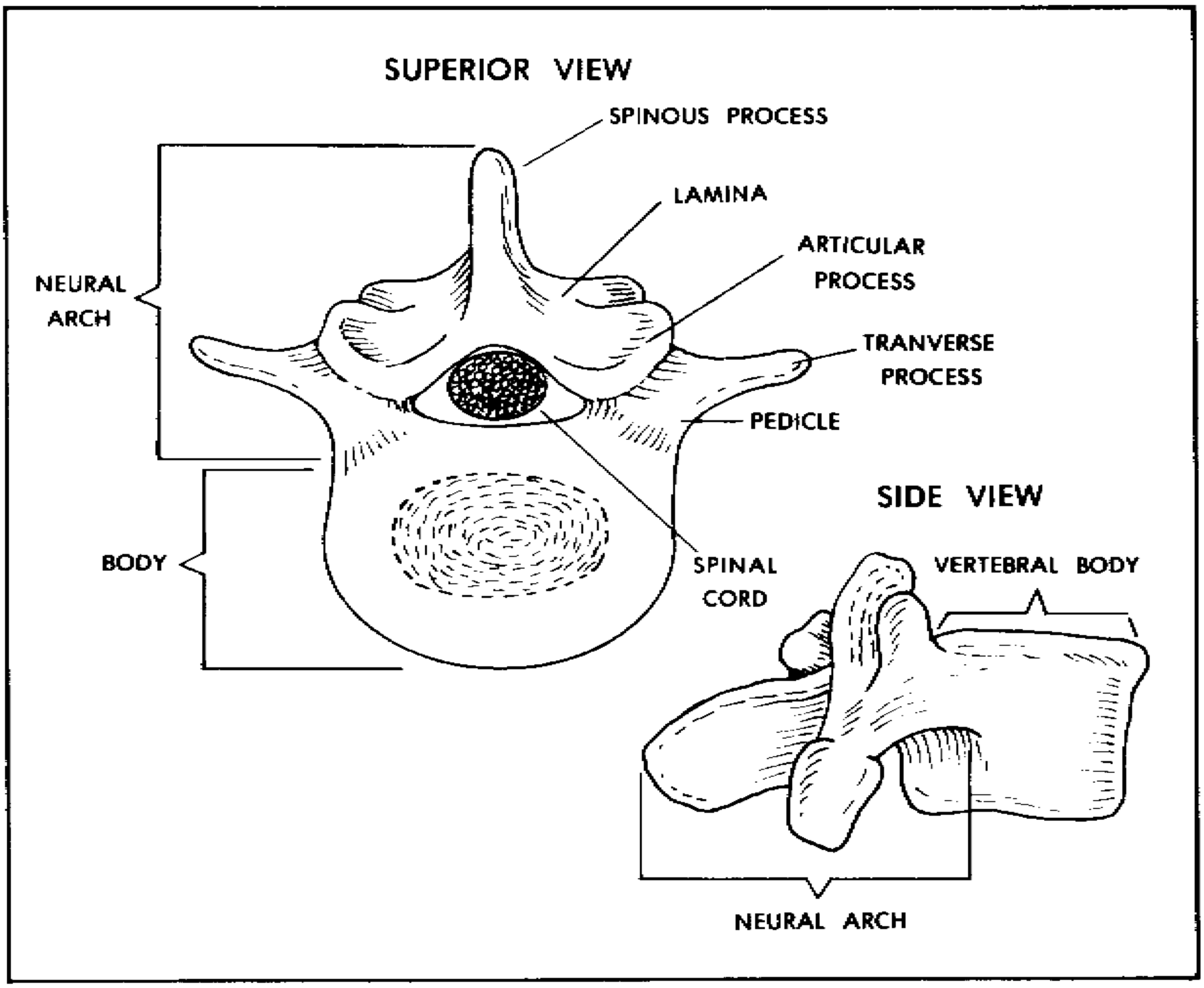


Figure 4-5. Top view of a thoracic vertebrae showing the spinal canal protecting the spinal cord.

c. The Thorax

(1) The rib cage, or thorax, is made up of the ribs, the 12 thoracic vertebrae, and the sternum (breastbone) (Figure 4-6). There are 12 pairs of ribs. Each rib forms a joint with its respective thoracic vertebrae and curves around to form the rib cage. At the front of the rib cage, ribs one through ten connect with the sternum. For the lower five ribs, cartilaginous bridge is formed. The sternum forms the middle part of the front of the thoracic cage. The xiphoid process of the sternum is cartilaginous, pointed, and very tender to palpation.

(2) Moderate pivoting of the ribs at their joints with the vertebrae allows expansion of the thorax when one inspires (breathes in). As the ribs pivot upward, the thoracic cavity becomes larger, and air is drawn into the lungs.

(3) The primary function of the rib cage is to protect the vital chest contents from injury.

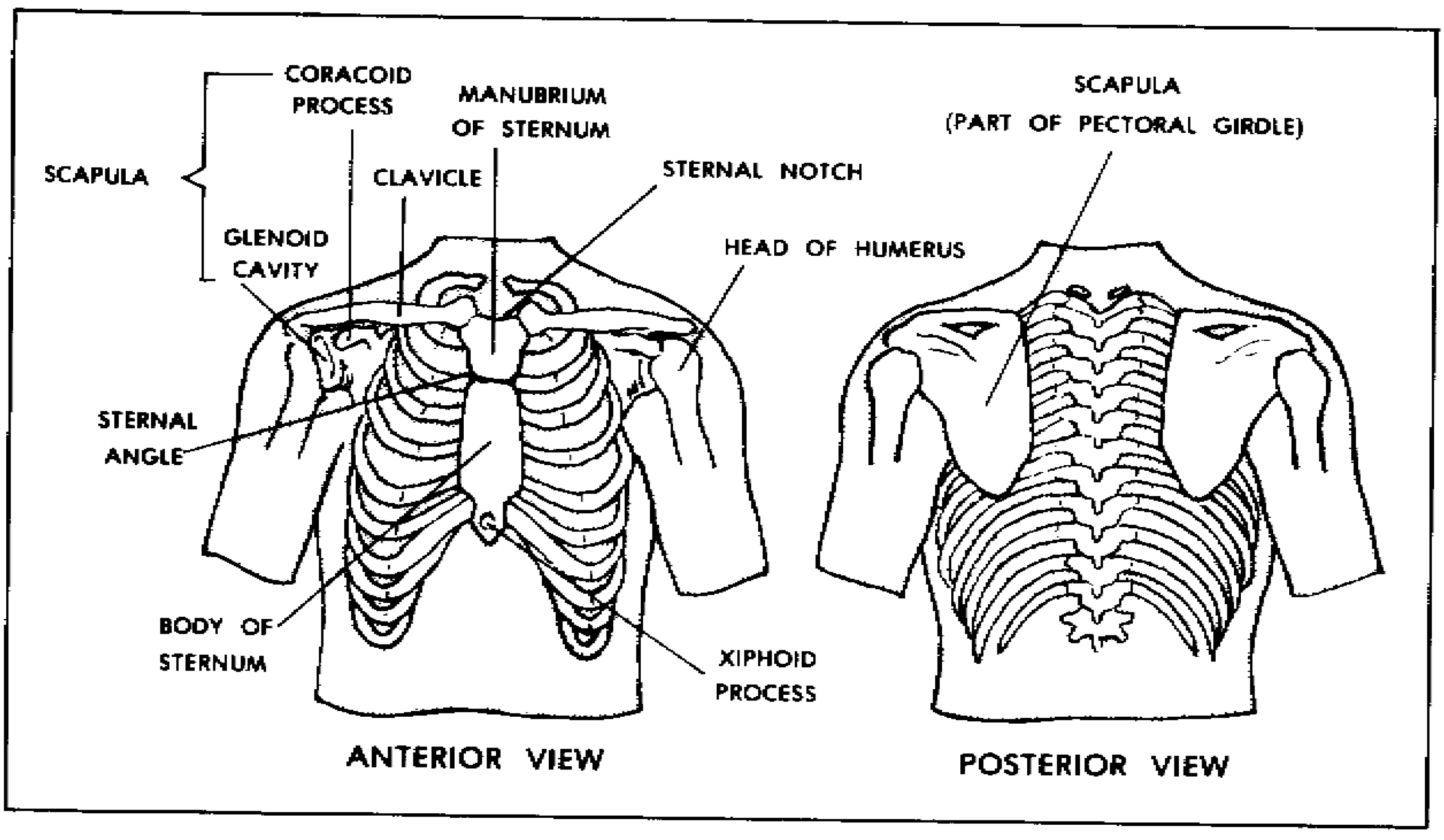


Figure 4-6. The thoracic cage.

d. The Upper Extremities. The upper extremities are composed of the bones of the shoulder girdle (Figure 4-7), arms, forearms, and hands.

(1) The shoulder girdle consists of the scapula (shoulder blade), clavicle (collar bone), and humerus (Figure 4-7).

(a) The shoulder blade, or scapula (Figure 4-7), is a large flat, triangular bone held to the rib cage posteriorly by powerful muscles. The scapula floats freely on the upper posterior ribs, because it is not attached to the ribs beneath it. The upper outer portion of the scapula forms the socket of the joint, where motion is very free in all planes.

(b) The collar bone (clavicle) (Figure 4-7) is a long, slender bone that lies just under the skin and serves as a support or prop for the upper extremity. The collar bone is a somewhat f-shaped bone attached by strong ligaments to the sternum at one end and to the scapula at the other.

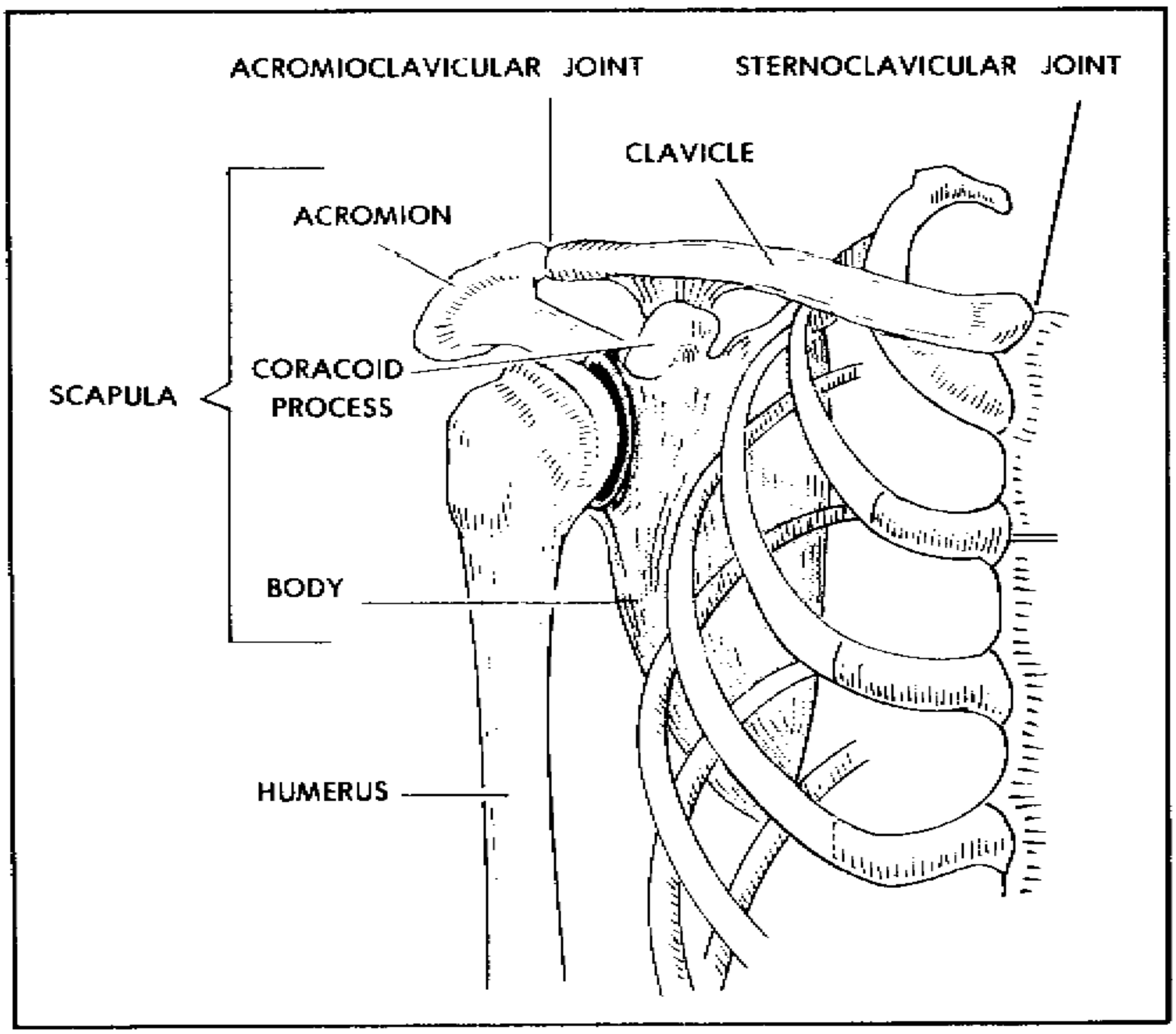


Figure 4-7. The shoulder girdle.

(c) The upper arm, or humerus (Figure 4-8) joins proximally with the scapula and distally with the bones of the forearm—the radius and ulna—to form the (hinged joint) elbow joint.

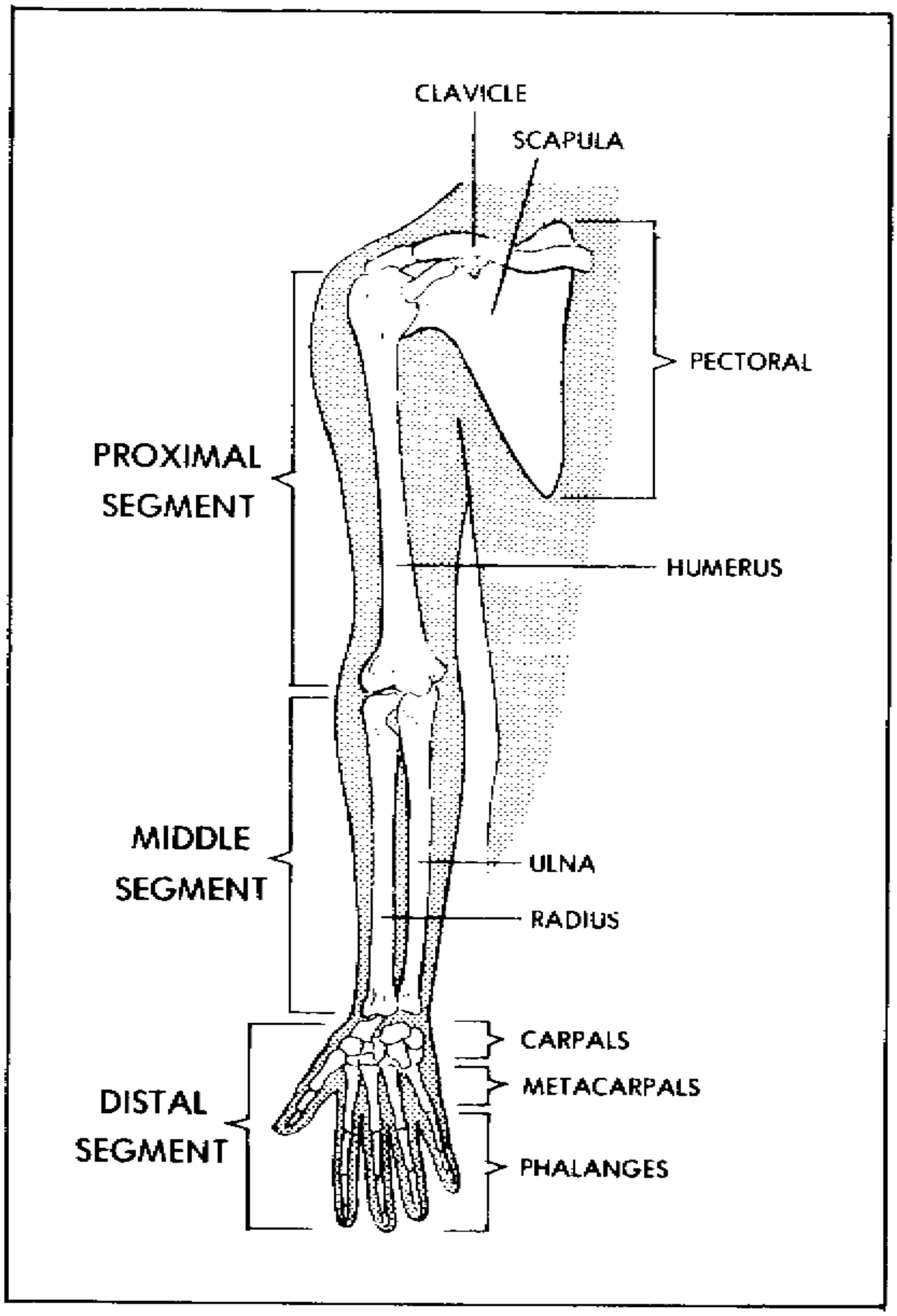


Figure 4-8. The upper and lower arm.

(d) The radius and ulna form the forearm. An extension of the ulna, called the olecranon process ("funny bone"), forms part of the elbow joint. The ulna is narrow and is on the same side of the forearm (the ulnar side) as the little finger. The ulna serves as a pivot around which the radius turns to rotate the palm upward (supination) or downward (pronation). At the elbow, the ulna is larger than the radius, but at the wrist the radius is the larger of the two.

(2) The hand (Figure 4-9) includes three groups of bones: the wrist bones (carpals), the hand bones (metacarpals), and the finger bones (phalanges). The back of the hand is referred to as the dorsum and the front, the palm. The thumb side of the hand and wrist is called the radial side (after the radius), and the little finger side is called the ulnar side (after the ulna).

(a) The wrist joint (Figure 4-9) is a modified ball-and-socket joint formed by the radius, ulna, and several small wrist bones (the carpal bones). The wrist can be flexed and extended and also bent to each side and rotated to some degree.

(b) Extending from the carpal bones are five metacarpals,which serve as the base for each of the fingers (Figure 4-9). In the thumb there are two bones beyond the metacarpal, the proximal and distal phalanges. The remaining four fingers of the hand are named in order: the index, the long, the ring, and the little finger. The phalanges join with the metacarpal and with themselves through simple hinge joints (Figure 4-9). The many subtle motions permitted by the joints of the hands and wrist enable us to perform highly skilled tasks.

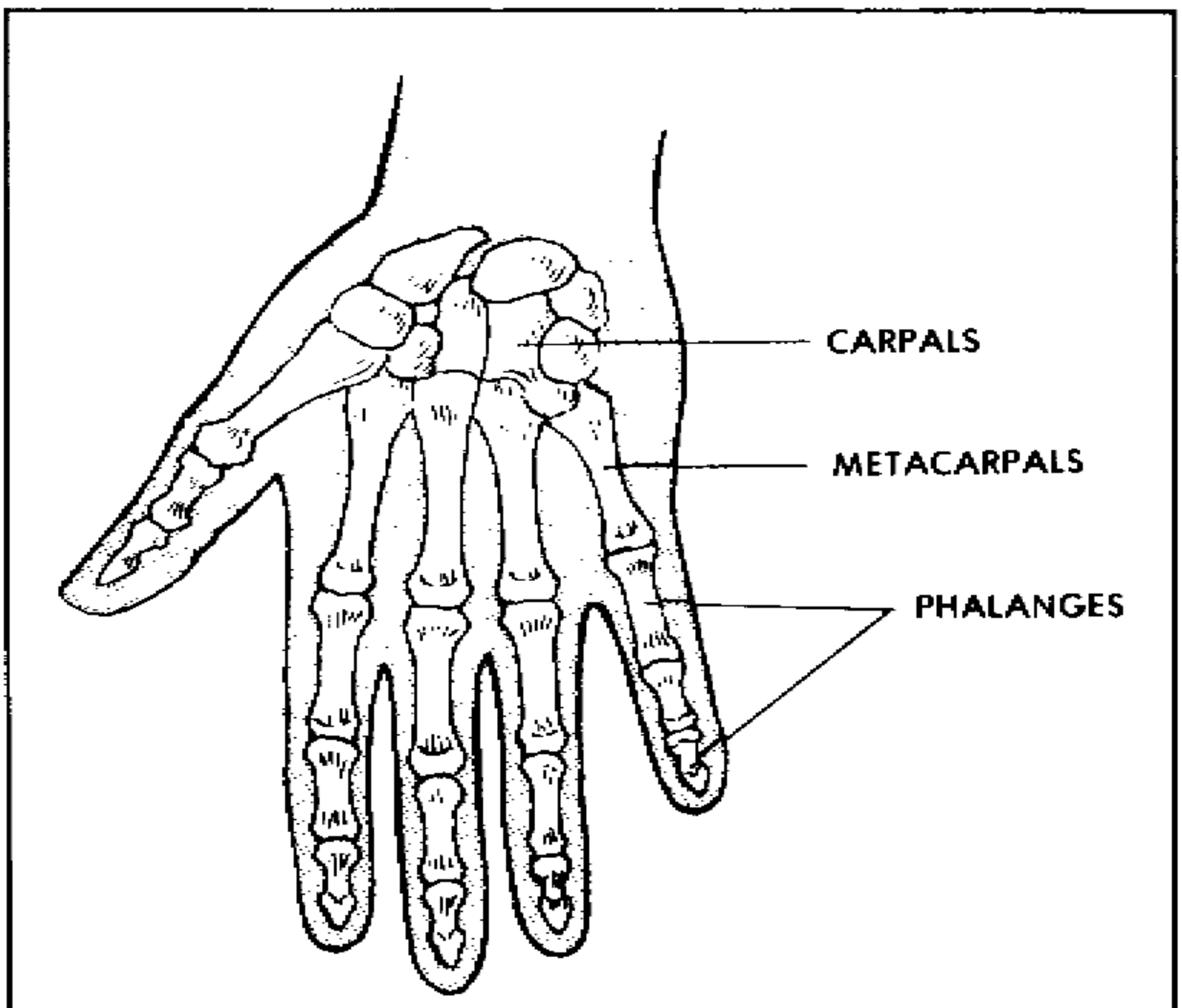


Figure 4-9. The hand.

e. The Lower Extremities. The lower extremities consist of bones of the pelvis, upper legs, lower legs, and feet. The hip bone, or pelvic girdle (Figure 4-10), is in reality three bones—the ischium, ilium, and pubis—fused together to form a bony ring. The two ilial bones join posteriorly with the sacrum. Anteriorly, the three bones unite at a socket-like depression, the acetabulum, which receives the head of the long leg bone, the femur. All three joints allow little motion, because they are firmly held together by strong ligaments. The pelvic ring is strong and stable, designed to support the body weight and protect the structures within the pelvic cavity (the bladder, the rectum, and the female reproductive organs).

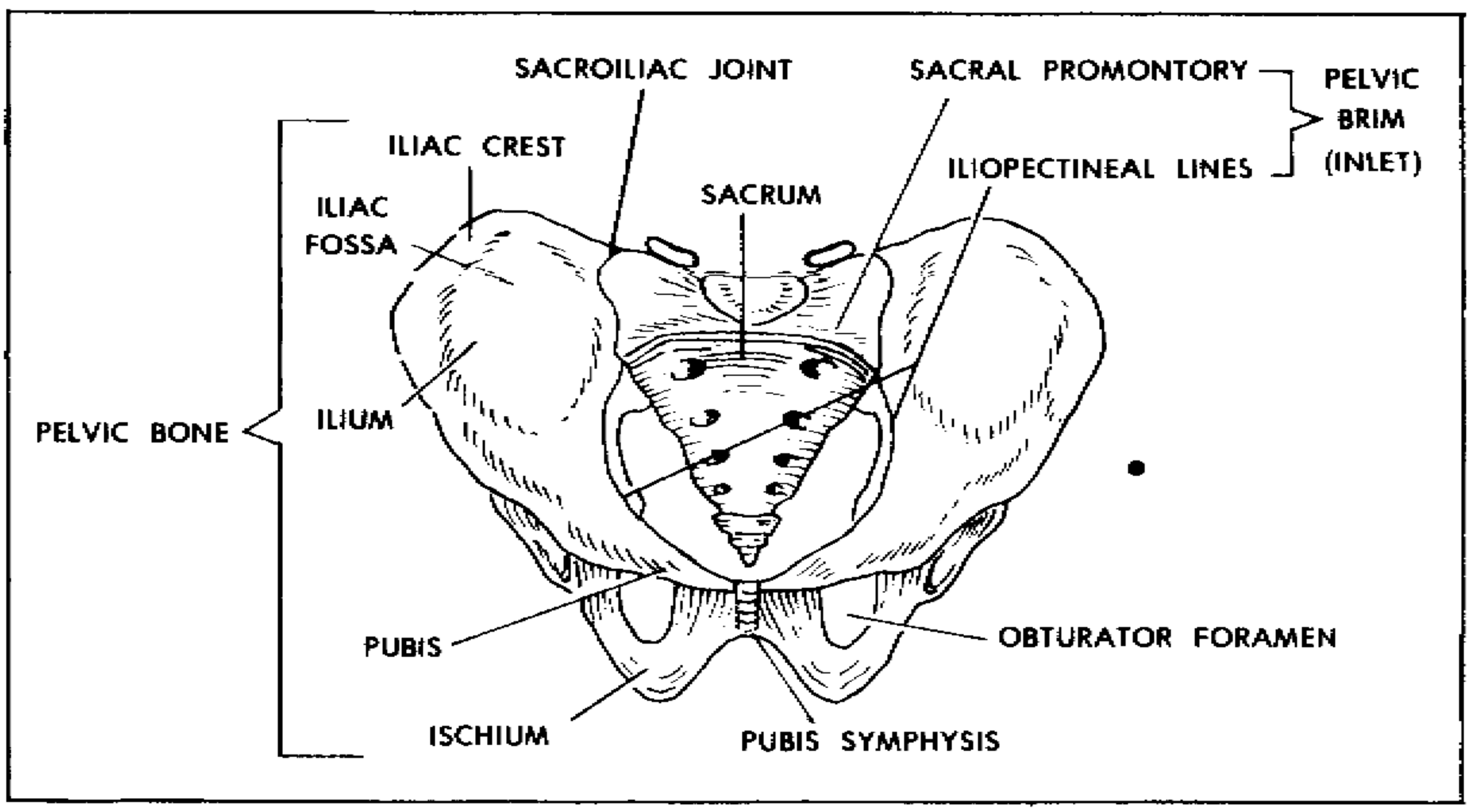


Figure 4-10. The hip bone or pelvic girdle.

(1) The upper leg, or femur (thigh bone) (Figure 4-11) is the longest and one of the strongest bones in the body. The femoral head joins with the acetabulum of the pelvis. This ball-and-socket joint allows flexion, extension, adduction (motion of the limb toward the midline), abduction (motion of the limb away from the midline), as well as internal and external rotation of the lower extremity.

(2) The femur consists of a head, the ball-shaped part that fits into the acetabulum; a neck, which is about 3 inches (7.6 cm) long and is set at an angle; and a shaft. The femoral neck is a common site for fractures, especially in the elderly (Figure 4-11).

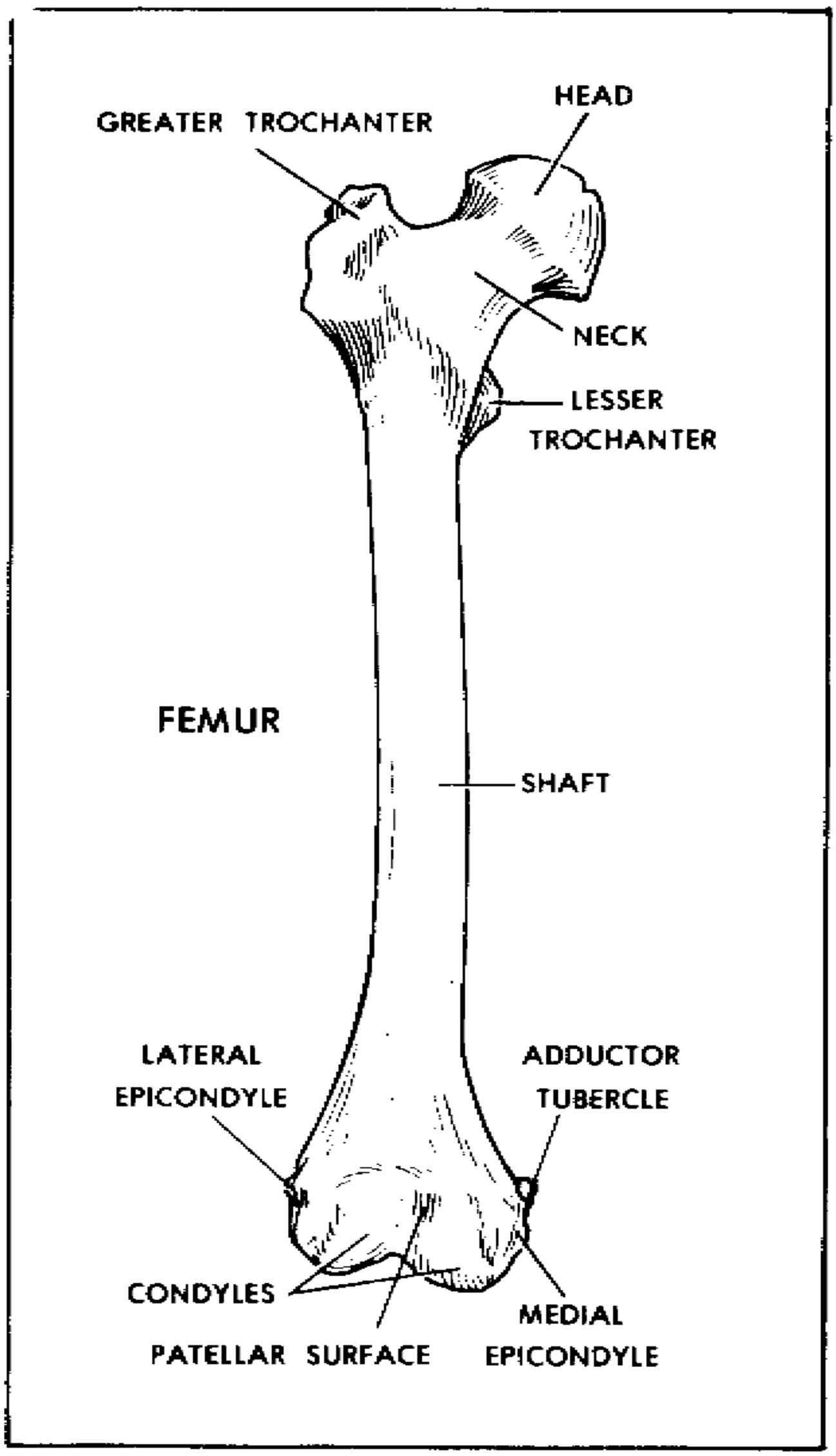


Figure 4-11. The upper leg or femur.

(3) In the proximal thigh, the prominence of the greater trochanter of the femur can be easily palpated. This is sometimes called the "hip bone." The shaft of the femur is surrounded by muscle (the quadriceps anteriorly and the hamstrings posteriorly) and is not easily palpated. Just above the knee, however, the medial and lateral femoral condyles can be felt.

(4) Between the thigh and the lower leg is the knee joint, which is the joint (Figure 4-12) between the femur and the tibia. The knee is the largest joint in the body and is essentially a hinge joint, allowing only flexion and extension. Adduction, abduction, and rotation are resisted by complex ligaments that are quite susceptible to injury.

(5) In front of the knee joint is the patella (kneecap). It lies within the tendon of the quadriceps muscle and acts to protect the front of the knee joint from injury (Figure 4-12).

(6) The leg (Figure 4-12) is the portion of the lower extremity between the knee and the ankle joints. The lower leg consists of two bones, the tibia and the fibula. The tibia (shin bone) is the larger bone. It lies anterior in the leg with its front edge just under the skin and is easily palpable. The fibula is not a component of the knee joint but does make up the lateral aspect of the ankle joint (lateral malleolus). The medial malleolus or body knob on the inner side of the ankle, is the end of the tibia.

(7) The ankle is a hinge joint that allows flexion and extension of the foot and leg. The distal end of the tibia provides a smooth articular surface for the ankle bone (talus).

(8) In the foot, beneath the ankle bone (talus), sits the heel bone (calcaneus or os calcis). The talus and calcaneus (as well as five other bones of the mid-foot) are called tarsal bones. Five metatarsals join with the tarsal bones, and each gives rise to its respective toe (Figure 4-13).

f. Joints (Articulations).

(1) Wherever two bones come into contact, a joint articulation is formed. Some joints allow motion; for example, the hip, knee, or elbow. Other bones fuse with one another at joints so that a solid, immobile bony structure results. The skull is composed of several different bones that fuse as the person grows into adulthood. The infant, whose bones are not yet fused, has soft spots called fontanelles between the bones. Many joints of the body are named by combining the names of the bones forming that joint; for example, the sternoclavicular joint is the articulation between the sternum and the clavicle.

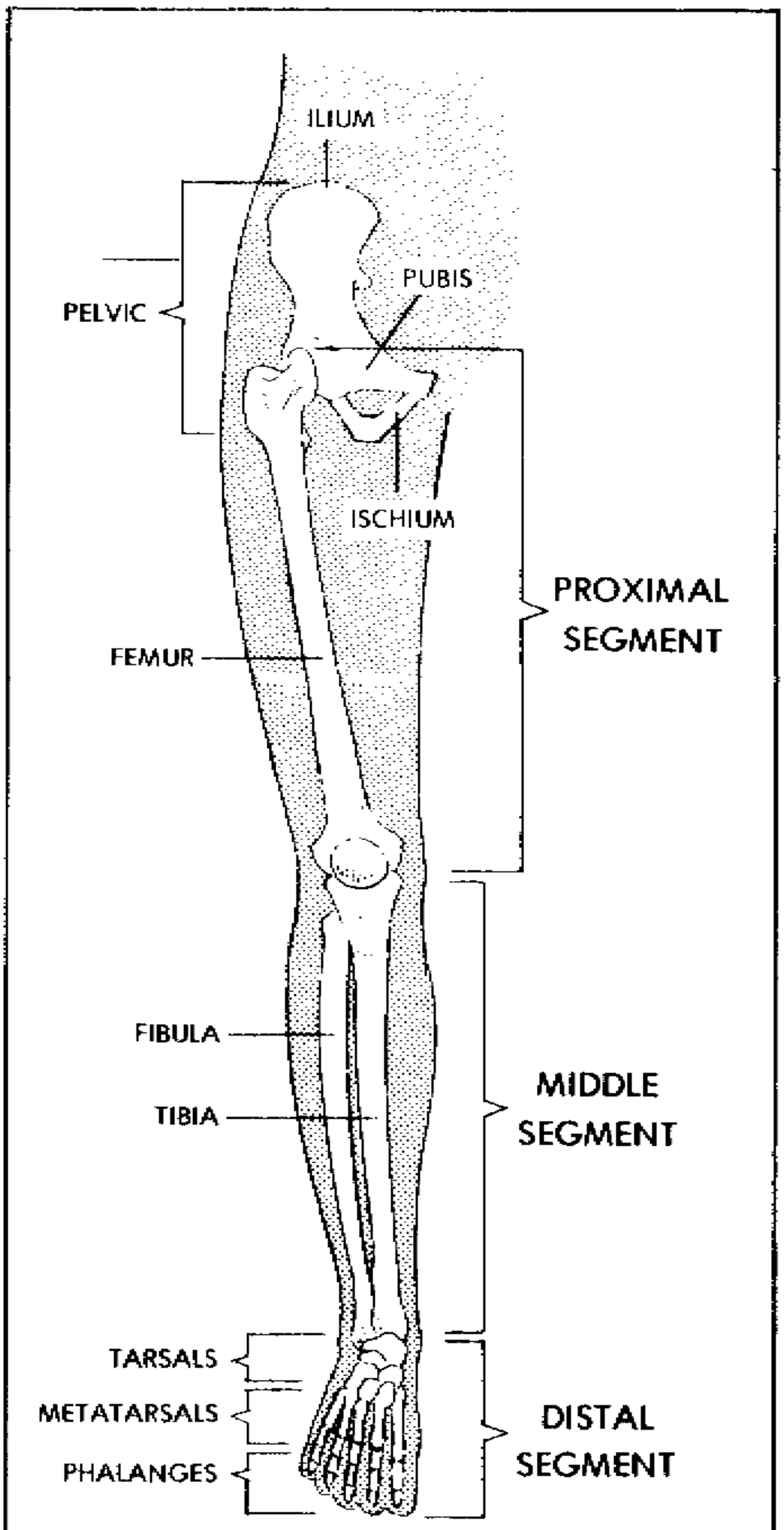


Figure 4-12. The lower extremity.

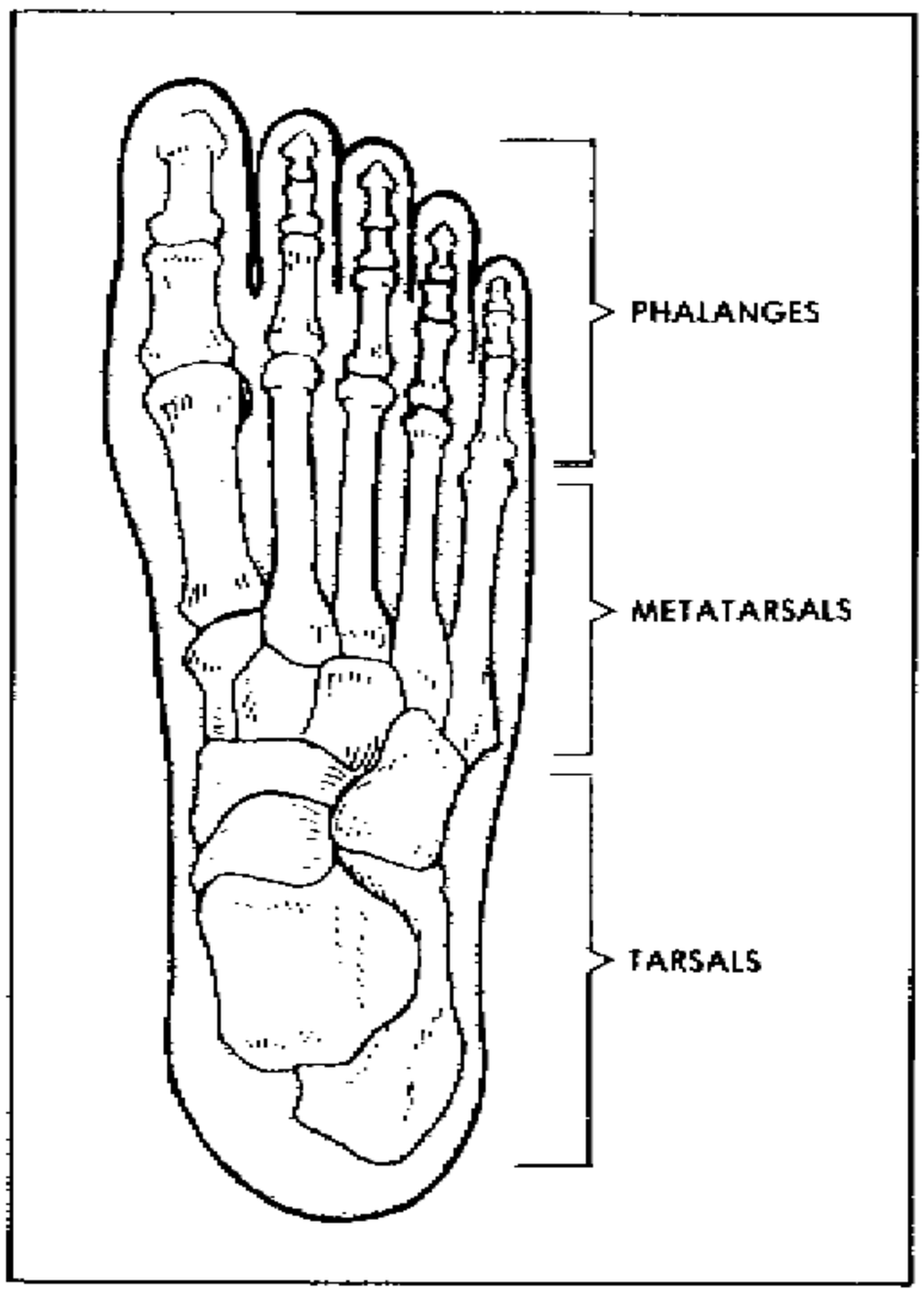


Figure 4-13. The foot.

(2) A joint consists of the ends of the bones that make up the joint and the surrounding connecting and supporting tissues (Figure 4-14). The ends of bones that articulate with each other are covered with a smooth, shiny surface called articular cartilage. Inside some joints, most notably the knee, there are cartilaginous cushions that fill up spaces between the bones and aid in the gliding motion of that joint. Such a cushion is called a meniscus or sometimes simply a cartilage. When injured and torn from its attachments, the meniscus can produce symptoms of locking or catching in the joint.

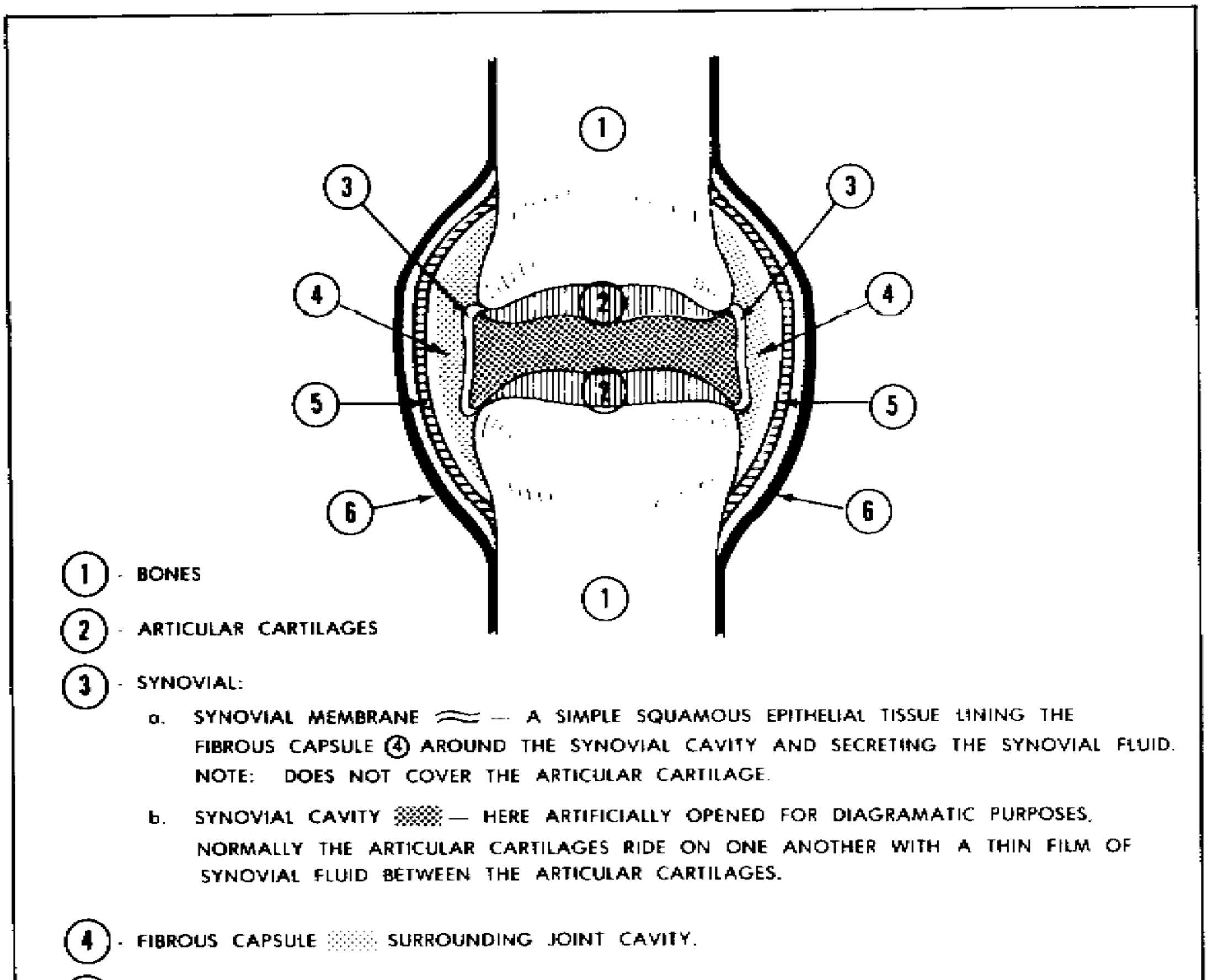


Figure 4-14. The typical joint.

(3) In joints that allow motion, the bone ends are held together by a fibrous tissue capsule. At certain points around the joint, the capsule is lax and thin to allow motion in a certain plane, while in other areas it is quite thick and resists stretching or bending. These bands of tough, thick capsule are called ligaments.

(4) A joint that is virtually surrounded by tough, thick ligaments (such as the sacroiliac joint) will have little motion. However, a joint with few ligaments (such as the shoulder) will be free to move in almost any direction (these are more prone to dislocation).

(5) The degree of freedom of motion of a joint is determined by the extent to which the ligaments hold the bone ends together and by the configuration of the bone ends themselves. While the amount of motion varies from joint to joint, all joints have a definite limit of motion. When a joint is forced beyond this limit, damage to some structure will occur such as:

(a) The bones forming the joint may fracture (break).

(b) The supporting capsule and ligaments may be torn. The inner surface of the joint capsule (the synovium) produces a fluid that nourishes and lubricates the articular cartilage. This is called synovial fluid. It is thick—almost oily—and clear yellow in color. Normally, only a few cubic centimeters of synovial fluid are produced to protect the joint. Injury or disease may result in increased production of synovial fluid and swelling inside the capsule; for example, the so-called "water on the knee."

(6) Motion of a joint is produced by the action of muscles. All muscles of the extremities pass through tendons to two bones (Figure 4-15). The muscle originates from one bone, and its other end inserts into the second bone. When the muscle contracts (shortens) (Figure 4-15), the ends of the bones will be brought closer together, with motion occurring at the intervening joint. Muscle on the opposite side of the limb will lengthen (relax) to allow this motion to occur. When motion in the opposite direction is desired, the second group of muscles will contract and the first will relax, pulling the joint back to its original position (Figure 4-15).

g. Synovial Joints. Joints are of several types. They may be fibrous (like those between the skull bones, allowing little motion) or cartilaginous (like the discs between vertebrae, allowing slight motion). Joints may also permit free motion. In a synovial joint, the articulating surfaces are covered with cartilage and surrounded by a fibrous capsule lined with the smooth, slippery synovial membrane. Synovial joints include:

(1) The gliding joint, which allows only short slipping or gliding motion. The joint between the carpal and tarsal bones of the wrist and ankle is a gliding joint.

(2) The hinge joint, which allows only flexion and extension. The finger joints and the knees are typical hinge joints, with motion restricted to one plane.

(3) The ball-and-socket joint, which allows movement in many directions (the hip and shoulder joints).

(4) The pivot joint, which allows only rotation around a long axis. An example of a pivot joint is the joint between the proximal radius and the ulna. As the hand is turned from palm up to palm down (pronated), the head of the radius rotates on the pivot formed by the ulna.

(5) The condylar joint, which allows mainly flexion and extension. The condylar joint has two articulating surfaces. In this joint, flexion and extension movements are combined with gliding and rolling movements with rotation around a vertical axis (the knee joint). Joint motion occurs through the contraction and relaxation of skeletal muscles, which cross joints and attach to bones. The bones serve as levers that enable skeletal muscle to move body parts.

h. Joints and Bursae. At some joint locations, the tendon connecting muscle to bone passes over a joint; *for example*, at the shoulder, elbow, knee, and heel. To reduce pressure, small sacs containing fluid are formed over and around the tendon. The sac is a bursa, an irritated bursa is bursitis. Bursitis can be very painful, and normal movement may be impossible.

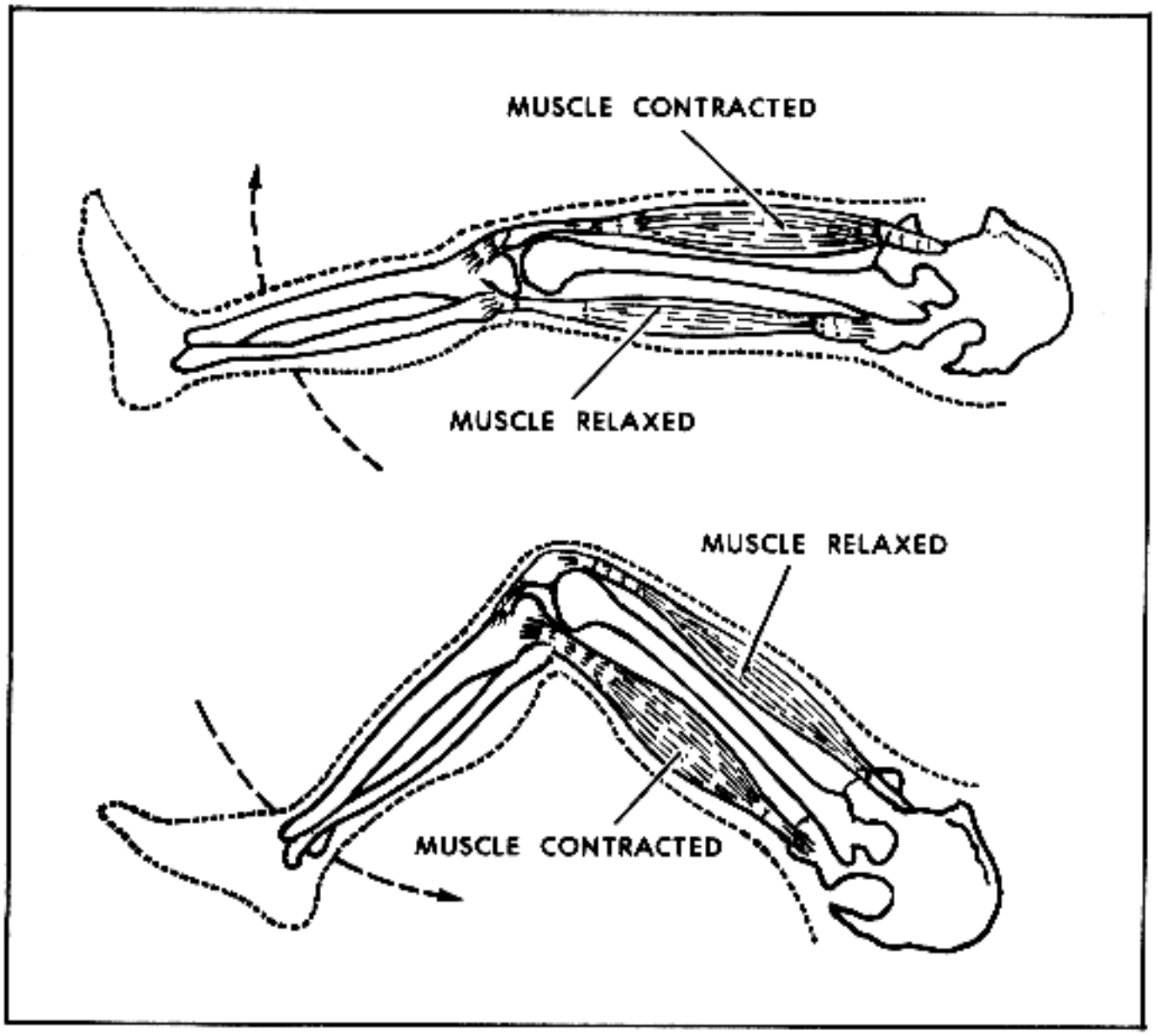


Figure 4-15. The mechanism of joint motion.

Section II. THE MUSCULAR SYSTEM

4-6. General

Muscle is characterized by the ability to contract, or to shorten. The power of contraction enables a muscle to move parts of the body. All movements of the body, whether conscious or unconscious, are due to the action of muscles. Muscle makes up much of the fleshy portions of the body. Muscles vary in shape and structure according to the work they have to do. There are three main types of muscle: voluntary, involuntary (smooth), and cardiac (heart).

4-7. Types of Muscles

a. Voluntary Muscle. Voluntary muscle is so-called because it is controlled by will through the central nervous system. All the skeletal muscles (those attached to the skeleton) are of the voluntary type. Besides the skeletal muscles, those which move the eye, tongue, and pharynx are voluntary.

(1) *Functions.* Voluntary muscles cause movement of the body as a whole and the movements of its parts. They maintain posture, carry on the rhythmic movements of respiration, produce most of the heat generated by the body, and serve to protect certain organs.

(2) *Structure.* Voluntary muscle is made of long, slender fibers held together by connective tissue to form muscle bundles. Groups of muscle bundles, enclosed in a fibrous sheath called fascia, form the individual muscles.

(3) *Parts.* A skeletal muscle has three main parts: belly, origin, and insertion. The belly is the body of the muscles. Tendons extend from each end of the belly and attach to bones. A tendon is a band of tough, nonelastic fibrous tissue. Tendons unite with the periosteum of bones to form secure attachments for the muscles. The origin of the muscle is that portion which accomplishes least movement when the muscle is contracted. The insertion is the most movable end of the muscle.

(4) *Names.* Each muscle has a name. Some muscles are given names derived from their location. Other muscles are named according to function, shape, size, and/or points of attachment.

b. Involuntary (Smooth Muscle). The involuntary muscles are called that because the nerve supply is from the autonomic nervous system, which is not under the control of the will. It is also called smooth muscle. Smooth muscle is found in the walls of the blood vessels, respiratory passages, gastrointestinal tract, ureters and urinary bladder, and certain other organs.

(1) *Functions.* Smooth muscle performs many varied functions. It regulates the size of blood vessels, which is essential to the maintenance of blood pressure. It moves food through the intestinal tract. It regulates the bronchioles (small air passages) in the lungs. Still another function of smooth muscles is the movement of urine from the kidneys to the urinary bladder.

(2) *Structure.* Smooth muscle is made of spindle-shaped fibers of cells. The fibers are arranged in bundles or sheets to form a layer in the walls of blood vessels and other viscera.

c. Cardiac Muscle. Cardiac, or heart, muscle is involuntary muscle, but is found only in the heart. The structure of cardiac muscle is different from that of other muscles. Cardiac muscle forms the walls of the heart. The whole heart works together because all parts are connected with special bands of cardiac muscle.

d. Action of Voluntary Muscles.

(1) A muscle seldom works alone in carrying out movement. Usually the performance of a movement, even a simple motion, requires the combined action of a group of muscles. Many skeletal muscles are arranged in pairs; for each muscle producing one motion, there is another muscle which produces the opposite motion. One muscle must relax in part while the other contracts.

(2) At all times, muscle is in a state of partial contraction called tone or tonus. Because of this, when a muscle is cut, the two ends pull apart like the cut ends of a stretched rubber band. Tone in skeletal muscle is maintained by a reflex and therefore depends on nerve connections to a functioning spinal cord.

(3) Muscle contraction uses food and oxygen and produces acids and heat. Muscle activity is the major source of the body's heat. Acids accumulating as a result of continued activity cause fatigue. Muscle fatigue occurs most rapidly when contractions are frequent; it occurs slowly if rest periods are taken between contractions. Exercise causes muscles to become larger, stronger, and better developed. This increase in size is called hypertrophy. Inactivity results in wasting away of muscles called atrophy.

(4) Voluntary muscle activity results from impulses which arise in the cortex of the brain and are transmitted to the muscle by the spinal cord and the motor nerves. Interruption of any part of this pathway will cause paralysis.

e. Principal Groups of Skeletal Muscles. A description of each of the skeletal muscles of the body can be found in any of the standard anatomy books. This manual gives a general discussion of the principal groups of skeletal muscles and describes individually some of the more important muscles of the extremities (Figures 4-16A and 4-16B).

(1) *Head and face.* The muscles of the head and face are small and numerous. They are involved in the movement of the eye and face, making possible facial expression, talking, chewing, and swallowing.

(2) *Neck.* The muscles of the neck move the head from side to side, forward and backward, and rotate it. Some of them also assist in respiration, speaking, and swallowing.

(3) *Arm.* Among the muscles which cause movement of the arms are the deltoid, biceps, and triceps.

(a) The deltoid is a triangular-shaped muscle located on the shoulder and upper arm. This muscle lifts the arm forward, sideways, and to the rear.

(b) The biceps muscle is a long muscle located on the front of the arm. Its action bends the arm at the elbow.

(c) The triceps muscle is located on the back of the upper arm. This muscle works against the biceps muscle to extend the lower arm at the elbow.

(4) *Back.* The muscles of the back are large and some are broad. Attached to vertebrae, they keep the trunk in erect posture and aid it in bending and rotating. In the thoracic region, these muscles assist in respiration and in the movements of the neck, arm, and trunk.

(5) *Abdominal.* The abdominal muscles form broad thin layers which support the internal organs, assist in respiration, and help in flexion and rotation of the spine. The diaphragm separates the thoracic and abdominal cavities. It is an important muscle used in breathing.

(6) *Perineal.* The muscles of the perineum form the floor of the pelvic cavity.

(7) *Thigh.* The muscles located on the front and rear of the thigh cross two joints, the thigh and knee. When they contract, they extend one joint and flex the other.

(a) The quadriceps femoris, a group of muscles located on the front of the thigh, extends the leg.

(b) Muscles located to the rear and above the thigh extend, rotate, or abduct the thigh. Among them are the gluteal muscles: the gluteus maximus, gluteus medius, and gluteus minimus.

(8) *Leg.* The most important muscles of the leg are the anterior and posterior groups. An important member of the anterior group is the anterior tibiales, which flexes the foot. The most superficial, and largest, muscle of the back of the leg is the gastrocnemius. The gastrocnemius is commonly called the calf muscle.

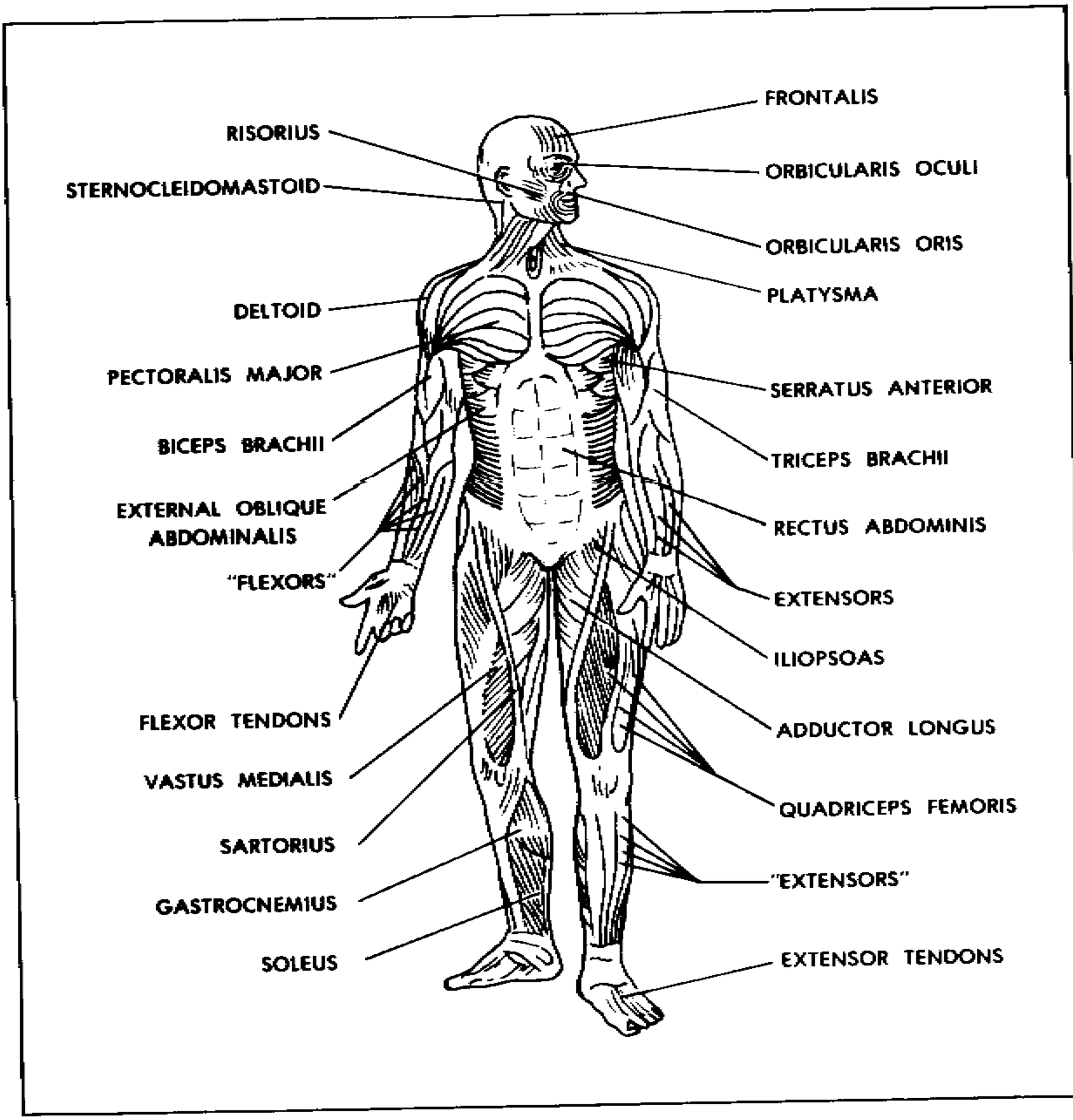


Figure 4-16A. Superficial muscles of the body (anterior).

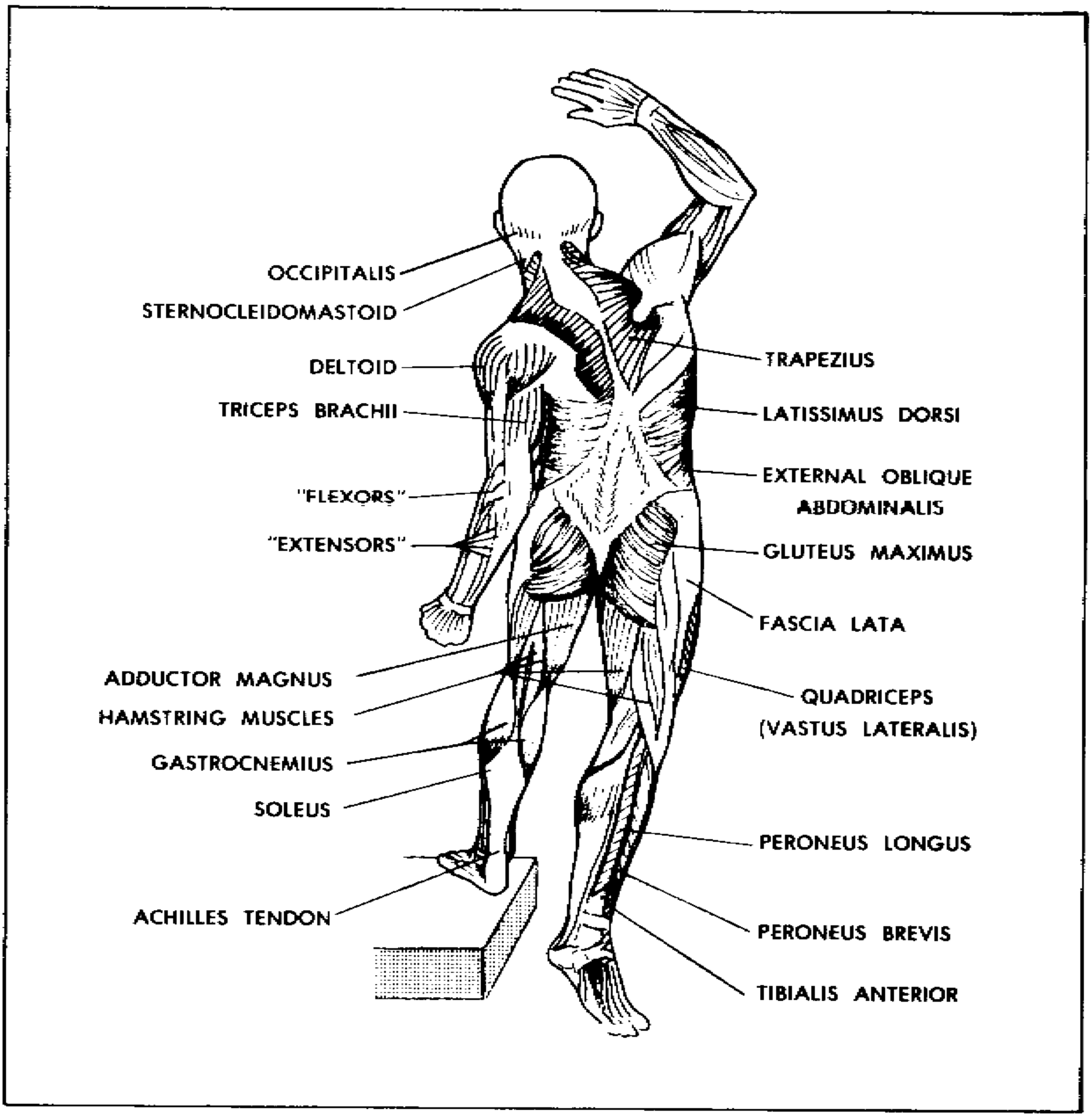


Figure 4-16B. Superficial muscles of the body (posterior).

CHAPTER 5

THE CIRCULATORY SYSTEM

5-1. General

The circulatory system has two major fluid transportation systems: the cardiovascular and the lymphatic.

a. Cardiovascular System. This system, which contains the heart and blood vessels, is a closed system, transporting blood to all parts of the body. Blood flowing through the circuit formed by the heart and blood vessels (Figure 5-1) brings oxygen, food, and other chemical elements to tissue cells and removes carbon dioxide and other waste products from the cell.

b. Lymphatic System. This system, which provides drainage for tissue fluid, is an auxiliary part of the circulatory system, returning an important amount of tissue fluid to the bloodstream through its own system of lymphatic vessels.

5-2. The Heart

The heart, a highly efficient pump, is a four-chambered muscular organ, lying within the chest, with about 2/3 of its mass to the left of the midline (Figure 5-2). It lies in the pericardial space in the thoracic cavity between the two lungs. In size and shape, it resembles a man's closed fist. Its lower point, the apex, lies just above the left diaphragm.

a. Heart Covering. The pericardium is a double-walled sac inclosing the heart. The outer fibrous surface gives support, and the inner lining prevents friction as the heart moves within its protective jacket. The inner surface of the pericardial sac produces a small amount of pericardial lubricating fluid that aids in the normal movements of the heart.

b. Heart Wall. This muscular wall is made up of cardiac muscle called myocardium.

c. Heart Chambers. There are four chambers in the heart. These chambers are essentially the same size. The upper chambers, the atria, are seemingly smaller than the lower chambers, the ventricles. The apparent difference in total size is due to the thickness of the myocardial (muscle) layer. The right atrium communicates with the right ventricle; the left atrium communicates with the left ventricle. The septum (partition), dividing the interior of the heart into right and left sides, prevents direct blood flow from right to left chambers or left to right chambers. This is important, because the right side of the heart receives unoxygenated blood returning from the systemic (body) circulation. The left side of the heart receives oxygenated blood returning from the pulmonary (lung) circulation. The special structure of the heart keeps the blood flowing in its proper direction to and from the heart chambers.

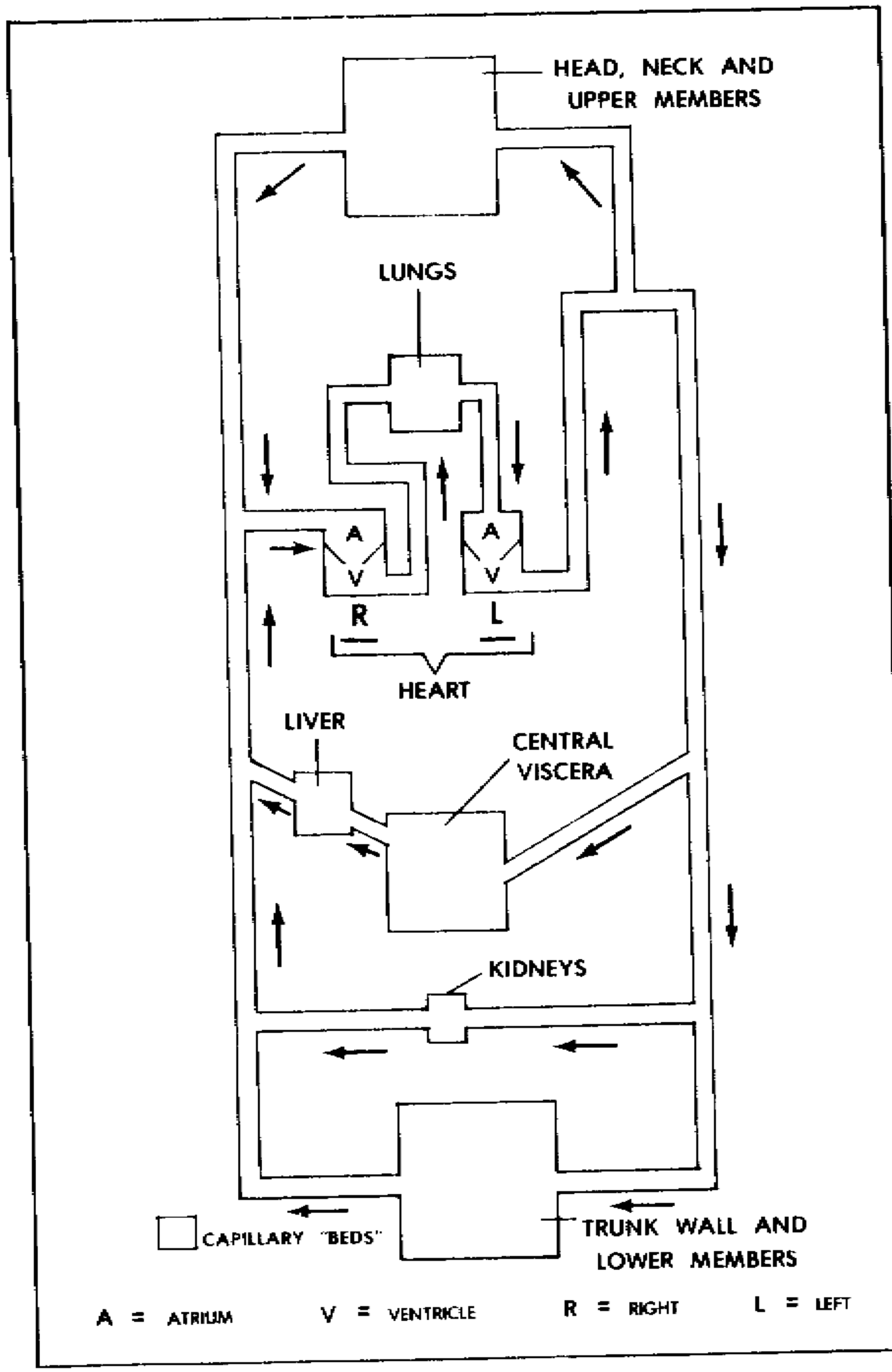


Figure 5-1. Circulation of the blood (diagrammatic).

d. Heart Valves. The four chambers of the heart are lined with endocardium (membrane tissue). This lining folds on itself and extends into the chamber opening to form valves. These valves allow the blood to pass from a chamber but prevents backflow. The atrioventricular valves, between the upper and lower chambers, are within the heart itself. The semilunar valves are within arteries attached to the right and left ventricles.

(1) *Atrioventricular valves.* The tricuspid valve is located between the right atrium and right ventricle. It has three flaps or cusps. The bicuspid (mitral) valve is located between the left atrium and left ventricle. It has two flaps or cusps.

(2) *Semilunar valves.* The pulmonary semilunar (half-moon shaped) valve is located at the opening into the pulmonary artery that is attached to the right ventricle. The aortic semilunar valve is located at the opening into the aorta that is attached to the left ventricle.

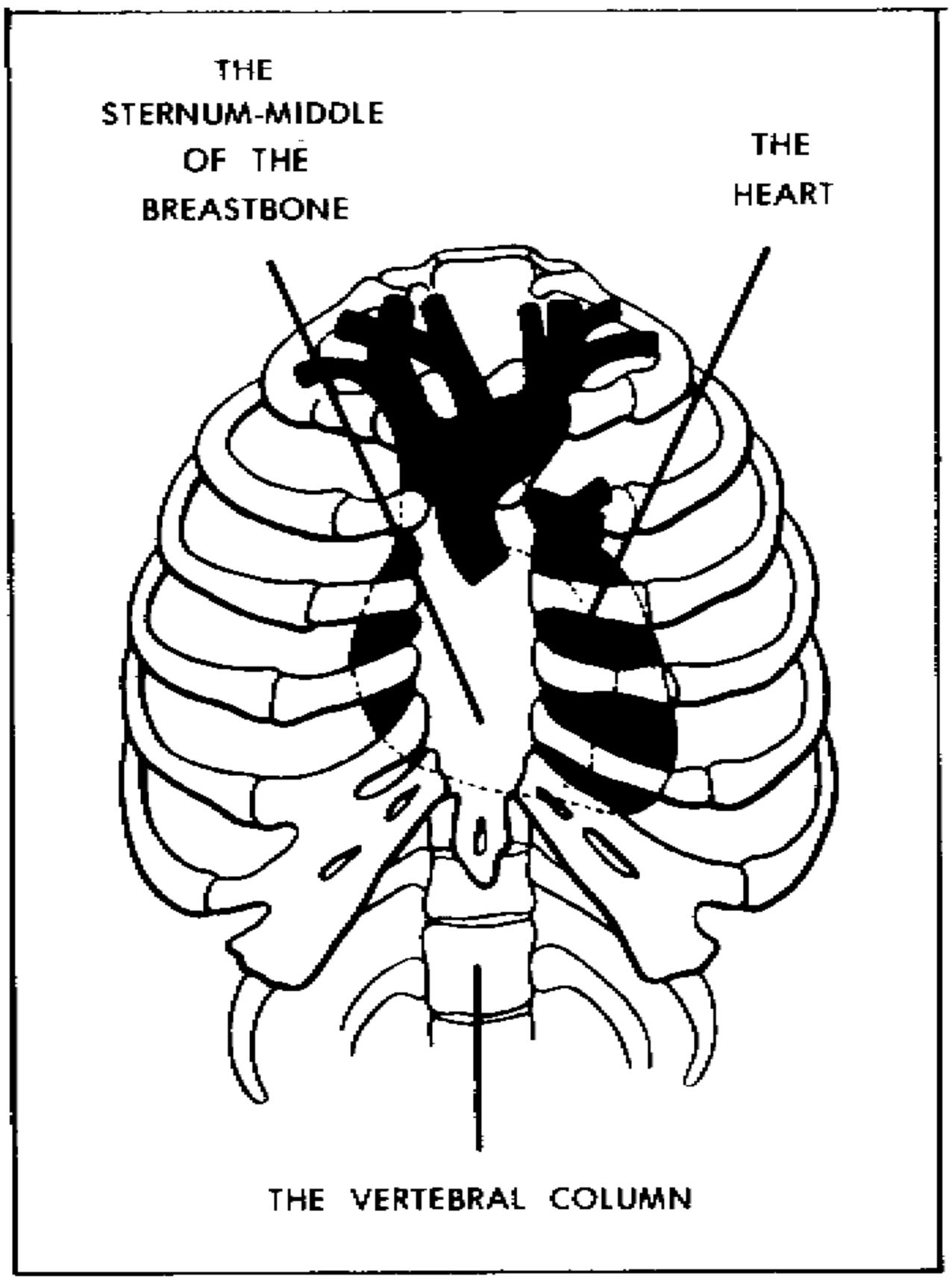


Figure 5-2. Heart and thoracic cage.

5-3. Flow of Blood Through the Heart

It is helpful to follow the flow of blood through the heart, to understand the relationship of the heart structures. Remember, the heart is the pump and is also the connection between the systemic circulation and pulmonary circulation. Blood returning from the systemic circulation must flow through the pulmonary circulation for the exchange of carbon dioxide and oxygen to take place. Blood from the upper part of the body enters the heart through the superior vena cava, and from the lower part of the body through the inferior vena cava (Figure 5-3).

a. Blood from the superior vena cava and inferior vena cava enters the heart at the right atrium. The right atrium contracts, and blood is forced through the open tricuspid valve into the relaxed right ventricle.

b. As the right ventricle contracts, the tricuspid valve is closed, preventing back flow into the atrium. The pulmonary semilunar valve opens as the blood is forced through it and is pumped into the pulmonary artery.

c. The blood is carried through the lung tissues, exchanging its carbon dioxide for oxygen in the alveoli. This oxygenated blood is collected from the main pulmonary veins and delivered to the left atrium.

d. As the left atrium contracts, the oxygenated blood flows through the open bicuspid (mitral) valve into the left ventricle.

e. As the left ventricle contracts, the bicuspid valve is closed. The aortic semilunar valve opens as the oxygenated blood is forced through it into the aorta, the main artery of the body. The oxygenated blood now starts its flow to all body cells and tissues. The systemic circulation starts from the left ventricle, the pulmonary circulation from the right ventricle.

NOTE

Veins carry unoxygenated blood and arteries carry oxygenated blood. The only exception to this is the pulmonary vein which carries oxygenated blood from the lungs to the heart and the pulmonary artery which carries unoxygenated blood from the heart to the lungs.

5-4. Blood and Nerve Supply of the Heart

a. Coronary Arteries. The heart gets its blood supply from the right and left coronary arteries. These arteries branch off the aorta just above the heart, then subdivide into many smaller branches within the heart muscle. If any part of the heart muscle is deprived of its blood supply, the muscle tissue cannot function properly and will die. This is called a myocardial infarction. Blood from the heart tissue is returned by coronary veins to the right atrium.

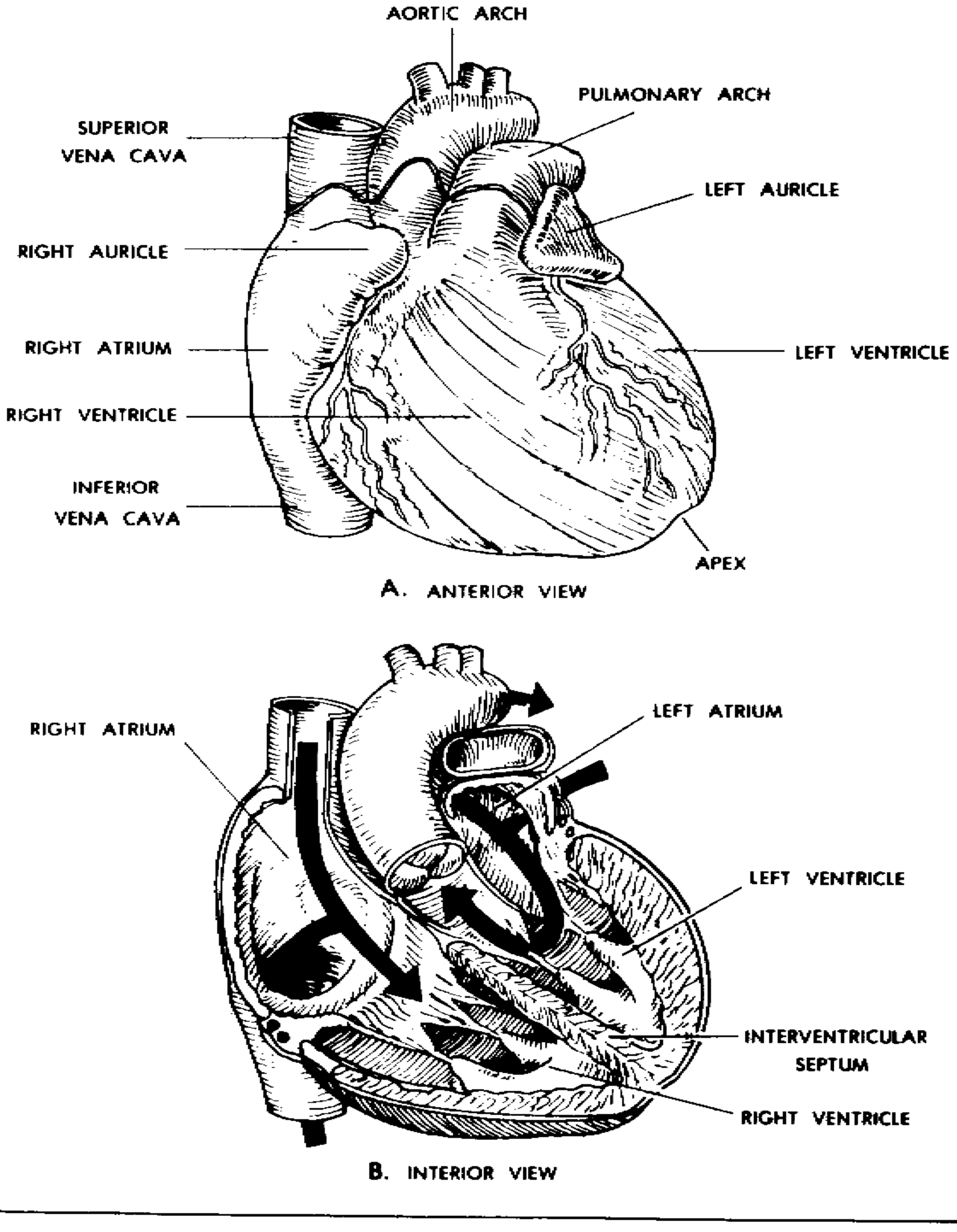


Figure 5-3. The heart chambers and flow of blood.

b. Nerve Supply. The nerve supply to the heart is from two sets of nerves originating in the medulla of the brain. The nerves are part of the involuntary (autonomic) nervous system. One set branches from the vagus nerve and keeps the heart beating at a slow, regular rate. The other set, the cardiac accelerator nerves, speeds up the heart. The heart muscle has a special ability; it contracts automatically, but the nerve supply is needed to control the contractions for blood circulation. Within the heart muscle itself are special groups of nerve fibers that conduct impulses. These groups make up the conduction system of the heart. When the conduction system does not operate properly, the heart muscle contractions are uncoordinated and ineffective. The impulses within the heart muscle are minute electric currents, which can be picked up and recorded by the electrocardiogram (ECG).

5-5. The Heartbeat and Heart Sounds

a. Heartbeat. This is a complete cycle of heart action—contraction (systole) and relaxation (diastole). During systole, blood is forced from the chambers. During diastole, blood refills the chambers. The term *cardiac cycle* means the complete heartbeat. The cardiac cycle, repeated continuously at a regular rhythm, usually 70-80 times per minute. Each complete cycle takes less than one second—in this brief time, all of the heart action needed to move blood must take place, and the heart must be ready to repeat its cycle.

b. Heart Sounds. When heard through a stethoscope, heart sounds are described as "lubb-dup." The first sound, "lubb," is interpreted as the sound, or vibration, of the ventricles contracting and atrioventricular valves closing. The second, higher-pitched sound, "dup," is interpreted as the sound of the semilunar valves closing. The doctor listening to the heart sounds can detect alterations of normal sounds; the interpretation of these heart sounds is part of the diagnosis of heart disease.

5-6. Blood Vessels

The blood vessels are the closed system of tubes through which the blood flows. The arteries and arterioles are distributors. The capillaries are the vessels through which the exchange of fluid, oxygen, and carbon dioxide takes place between the blood and tissue cells. The venules and veins are collectors, carrying blood back to the heart. The capillaries are the smallest of these vessels but are of the greatest importance in the circulatory system.

a. The Arteries and Arterioles. The system of arteries (Figure 5-4) and arterioles is like a tree, with the large trunk, the aorta, giving off branches which repeatedly divide and subdivide. Arterioles are very small arteries, about the diameter of a hair. In comparison, the aorta is more than 1 inch (2.5 cm) in diameter. An artery wall has a layer of elastic, muscular tissue which allows it to expand and recoil. When an artery is cut, the artery wall does not collapse; bright red blood escapes from the artery in spurts. Arterial bleeding must often be controlled by clamping and tying off (ligating) the vessel. Some of the principal arteries and the area they supply with blood are—

(1) Carotid arteries, external and internal, supply the neck, head, and brain through their branches.

(2) Subclavian arteries supply the upper extremities.

(3) Femoral arteries supply the lower extremities.

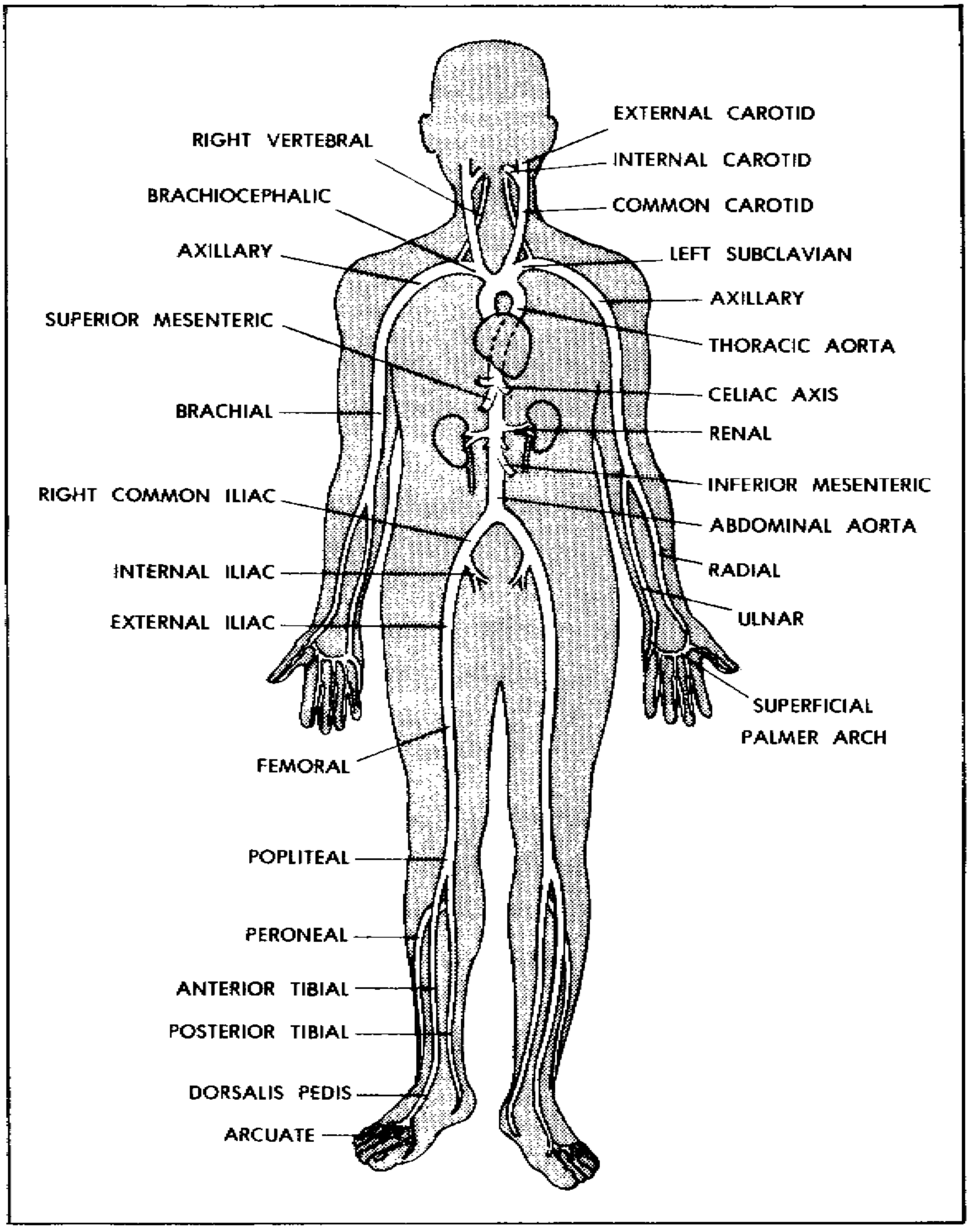


Figure 5-4. Arterial system (diagrammatic).

b. Capillaries. Microscopic in size, capillaries are so numerous that there is at least one or more near every living cell. A single layer of endothelial cells forms the walls of a capillary. Capillaries are the essential link between arterial and venous circulation. The vital exchange of substances from the blood in the capillary with tissue cells takes place through the capillary wall. Blood starts its route back to the heart as it leaves the capillaries.

c. Veins. Veins (Figure 5-5) have thin walls and valves. Formed from the inner vein lining, these valves prevent blood from flowing back toward the capillaries. Venules, the smallest veins, unite into veins of larger and larger size as the blood is collected in its return to the heart. The superior vena cava, collecting blood from all regions above the diaphragm, and the inferior vena cava, collecting blood from all regions below the diaphragm, return the venous blood to the right atrium of the heart. Superficial veins lie close to the surface of the body and can be seen through the skin.

(1) The median basilic vein at the antecubital fossa (in the bend of the elbow) is commonly used for venipuncture to obtain blood specimens or to inject solutions of drugs or fluid intravenously.

(2) The great saphenous vein is the longest vein in the body, extending from the foot to the groin. The saphenous vein has a long distance to lift blood against the force of gravity when an individual is in a standing position. It is therefore very susceptible to becoming dilated and stretched with the valves no longer functioning properly. When this occurs, the vein is said to be varicosed.

5-7. Pulse and Blood Pressure

a. Pulse. Pulse is the alternate expansion and recoil of an artery. With each heartbeat, blood is forced into the arteries causing them to dilate (expand). Then the arteries contract (recoil) as the blood moves further along in the circulatory system. The pulse can be felt at certain points in the body where an artery lies close to the surface. The most common location for feeling the pulse is at the wrist, proximal to the thumb (radial artery), on the palm side of the hand. Alternate locations are in front of the ear (temporal artery), at the side of the neck (carotid artery), and on the top (dorsum) of the foot (dorsalis pedis).

b. Blood Pressure. The force that blood exerts on the walls of vessels through which it flows is called blood pressure. All parts of the vascular system are under pressure, but the term blood pressure usually refers to arterial pressure. Pressure in the arteries is highest when the ventricles contract during systole. Pressure is lowest when the ventricles relax during diastole. The brachial artery, in the upper arm, is the artery usually used for blood pressure measurement.

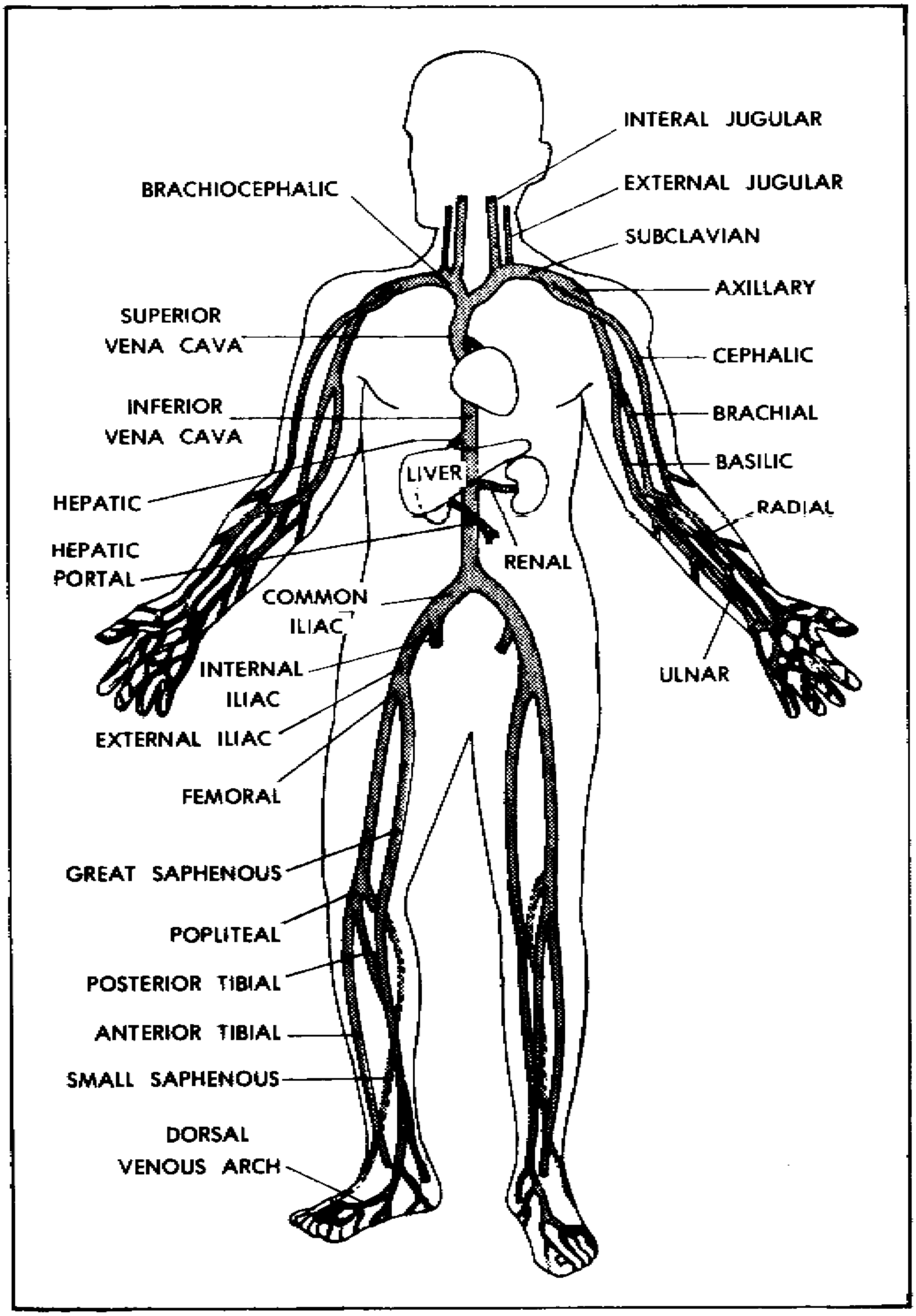


Figure 5-5. Venous system (diagrammatic).

5-8. Lymphatic System

The lymphatic system consists of lymph, lymph vessels, and lymph nodes (Figure 5-6). The spleen belongs, in part, to the lymphatic system. Unlike the cardiovascular system, the lymphatic system has no pump to move the fluid which it collects, but muscular contractions and breathing movements aid in the movement of lymph through its channels and its return to the bloodstream.

a. Lymph and Tissue Fluid. Lymph, fluid found in the lymph vessels, is clear and watery and is similar to tissue fluid, which is the colorless fluid that fills the spaces between tissues, between the cells of organs, and between cells and connective tissues. Tissue fluid serves as the "middleman" for the exchange between blood and body cells. Formed from plasma, it seeps out of capillary walls. The lymphatic system collects tissue fluid, and as lymph, it is started on its way back into the circulating blood.

b. Lymph Vessels. Starting as small ducts within the tissues, the lymphatic vessels enlarge to form lymphatic capillaries. These capillaries unite to form larger lymphatic vessels, which resemble veins in structure and arrangement. Valves in lymph vessels prevent backflow. Superficial lymph vessels collect lymph from the skin and subcutaneous tissue; deep vessels collect lymph from all other parts of the body.

c. Lymph Nodes. Occurring in groups of up to a dozen or more, lymph nodes lie along the course of the lymph vessels. Although variable in size, they are usually small oval bodies which are composed of lymphoid tissue. Lymph nodes act as filters for removal of infectious organisms from the lymph stream. Important groups of these nodes are located in the axilla (armpit), the cervical region, the submaxillary region, the inguinal (groin) region, and the mesenteric (abdominal) region.

d. Infection and the Lymphatic System. Lymph vessels and lymph nodes often become inflamed as the result of infection. An infection in the hand may cause inflammation of the lymph vessels as high as the axilla. Sore throat may cause inflammation and swelling of lymph nodes in the neck (submandibular nodes below the jaw and cervical nodes).

e. Spleen. The largest collection of lymphoid tissue in the body, the spleen is located high in the abdominal cavity on the left side (LUQ), below the diaphragm and behind the stomach. It is somewhat long and ovoid (egg-shaped). Although it can be removed (splenectomy) without noticeable harmful effects, the spleen has useful functions, such as serving as a reservoir for blood and red blood cells.

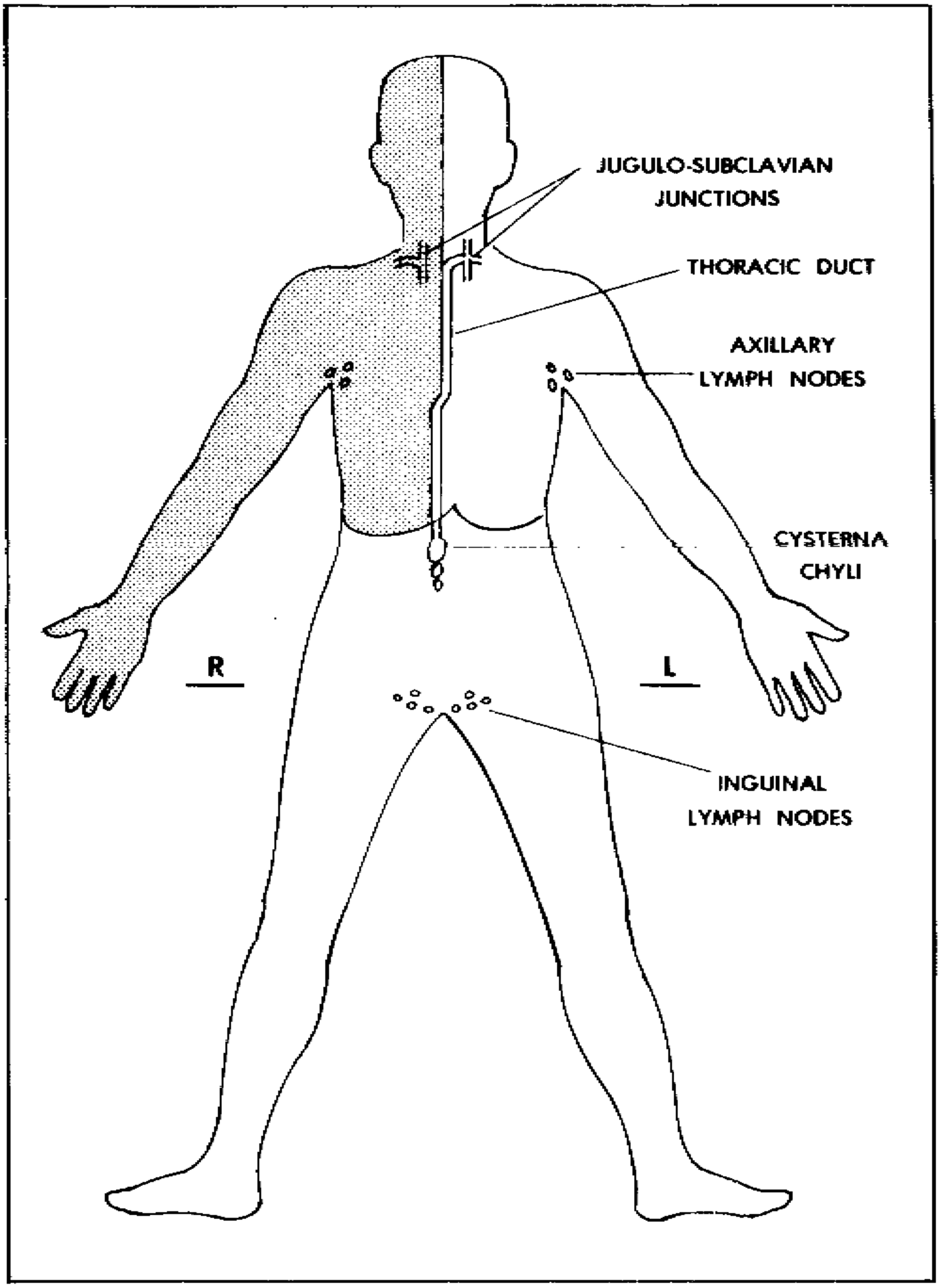


Figure 5-6. Lymphatic system.

5-9. The Blood

Blood is the red body fluid flowing through the arteries, capillaries, and veins. It varies in color from bright red (oxygenated blood) when it flows from arteries, to dark red (deoxygenated blood) when it flows from veins. The average man has about 6000 ml of blood.

a. Functions of Blood. The six major functions of blood are all carried out as the blood circulates through the vessels. These functions are—

(1) To carry oxygen from the lungs to tissue cells and carbon dioxide from the cells to the lungs.

(2) To carry food materials absorbed from the digestive tract to the tissue cells and to remove waste products for elimination by excretory organs (the kidneys, intestines, and skin).

(3) To carry hormones, which help regulate body functions, from ductless (endocrine) glands to the tissues of the body.

(4) To help regulate and equalize body temperature. Body cells generate large amounts of heat, and the circulating blood absorbs this heat.

(5) To protect the body against infection.

(6) To maintain the fluid balance in the body.

b. Composition of Blood. Blood is made up of a liquid portion (plasma) and formed elements (blood cells) suspended in the plasma.

(1) *Plasma.* Making up more than one-half of the total volume of blood, plasma is the carrier for blood cells, carbon dioxide, and other dissolved wastes. It brings hormones and antibodies (protective substances) to the tissues. Other components of plasma are water, oxygen, nitrogen, fat, carbohydrates, and proteins. Fibrinogen, one of the plasma proteins, helps blood clotting. When blood clots, the liquid portion that remains is serum. Blood serum contains no blood cells.

(2) *Blood cells.* The cellular elements in the blood are red cells (erythrocytes, or rbc), white cells (leukocytes, or wbc) and blood platelets (thrombocytes).

5-10. Red Blood Cells (Erythrocytes)

There are about 5,000,000 red blood cells in 1 cubic millimeter (cmm) of blood. Individual red blood cells are disc-shaped. Red cells are formed in the red bone marrow. Millions of red cells are destroyed daily, in the liver, the spleen, the lymph nodes, or in the vascular system itself. In a healthy person, the destruction rate is equaled by the production rate, maintaining a count of about 5,000,000 per cubic millimeter. Red blood cells have an average life span of about 90 to 120 days before becoming worn out.

a. Hemoglobin. Hemoglobin (Hgb) gives red cells their color. Hemoglobin has the power to combine with oxygen, carrying it from the lungs to the tissue cells. Hemoglobin assists in transporting carbon dioxide from the cells to the lungs. This transportation of gases is the principal function of the

red cells. In order to carry oxygen, hemoglobin needs iron which is ordinarily available in a nutritionally adequate diet.

b. Anemia. Anemia is due to a reduction in the number of red cells or a reduction in the hemoglobin content of red cells.

5-11. White Blood Cells (Leukocytes)

White blood cells vary in size and shape, and are larger and much fewer in number than red cells. The average number in an adult is 5,000 to 10,000 in 1 cmm of blood. Their function is primarily one of protection. They can ingest and destroy foreign particles, such as bacteria, in the blood and tissues. White cells can pass through the walls of capillaries into surrounding tissues. This ability to enter tissue makes them very useful in fighting infection—an area of infection is characterized by a great increase of white cells which gather about the site to destroy bacteria. An example of this is seen in an ordinary boil (furuncle). The pus contained in the boil is made up largely of white cells plus bacteria and dissolved tissue. Many of the white cells are killed in their struggle with invading bacteria.

5-12. Blood Platelets (Thrombocytes)

Blood platelets, which are smaller than red blood cells, are thought to be fragments of cells formed in the bone marrow. Platelets number about 300,000 per cmm of blood. Their main function is to aid in the coagulation of blood at the site of a wound. Platelets release a substance to hasten formation of a blood clot.

5-13. Coagulation of Blood

a. Blood coagulation (clotting) is the body's major method of preventing excessive loss of blood when the walls of a blood vessel are broken or cut open. When undisturbed, blood circulates in its vascular system without showing a tendency to clot. Physical and chemical factors are changed when blood leaves its natural environment and it begins to clot almost at once. At first the clot is soft and jellylike, but soon becomes firm and acts as a plug, preventing further escape of blood.

b. It takes 3 to 5 minutes for blood to clot, but sometimes it is necessary to hold back the clotting process. This is done with anticoagulant drugs.

5-14. Blood Types

All human blood is divided into four main types or groups—O, A, B, AB. This system of typing is used to prevent incompatible blood transfusion, which causes serious reactions and sometimes death. Certain types of blood are incompatible (not suited) to each other if combined. Two bloods are said to be incompatible when the plasma or serum of one blood causes clumping of the cells of the other. Two bloods are said to be compatible and safe for transfusion if the cells of each can be suspended in the plasma or serum of the other without clumping. Blood typing and cross-matching is done by highly trained laboratory technicians.

a. Importance of Blood Types. Table 5-1 shows that if the donor's blood is type "O" it is compatible with all types of recipient blood; or, in other words, type "O" is the universal donor. If the recipient's blood is type "AB," it is compatible with all types of donor blood, or, in other words, type "AB" is the universal recipient. When a blood transfusion is given, the blood type of both donor and recipient should be identical, and their compatibility must be proven by a cross-matching test. However, when blood of the same type is not available and death may result if transfusion is delayed, a type "O" donor (universal donor) may be used if the cross-matching is satisfactory.

b. Rh Factor. In addition to blood grouping and cross-matching for compatibility, the Rh factor must be considered. The Rh factor is carried in red cells, and about 85 percent of all individuals have this factor and are, therefore, Rh positive. Individuals who do not have the Rh factor are Rh negative. As a general rule, Rh negative blood can be given to anyone, provided it is compatible in the ABO typing system, but Rh positive blood should not be given to an Rh negative individual.

Table 5-1. Blood Types

Donor	Recipient O	Recipient A	Recipient B	Recipient AB
O -------	Compatible	Compatible	Compatible	Compatible
A -------	Incompatible	Compatible	Incompatible	Compatible
B -------	Incompatible	Incompatible	Compatible	Compatible
AB -----	Incompatible	Incompatible	Incompatible	Compatible

5-15. Coronary Artery Disease and Angina Pectoris

a. As mentioned before, coronary arteries are blood vessels whose primary function is to transport blood to the heart muscles and at the same time remove carbon dioxide and waste products. Sometimes the coronary arteries become blocked depriving the heart muscles of oxygen and nutrients and slowing down or stopping the removal of waste products. If this condition continues without proper treatment, the artery will eventually close off, resulting in death of the affected tissue.

b. Certain factors contribute to coronary artery disease. Some of these factors are controllable while others are not. These factors are—

- Hypertension (hign blood pressure)
- Cigarette smoking.
- Diabetes.
- Elevated serum cholesterol.

- Dietary habits (excessive intake of calories, carbohydrates, and/or saturated fats).
- Obesity.
- Sex (male).
- Hereditary (family history).
- Stress.

c. Early stages of coronary artery disease are asymptomatic. In the late stages of the disease, the blood flow no longer meets the demands of the myocardium for oxygen and the patient begins to experience chest pain. This pain is referred to as *angina pectoris* (choking of the heart). The patient with advanced coronary artery disease may have adequate oxygen at rest, however, during any form of stress or exercise, blood flow to the heart is inadequate. This results in angina pectoris. A patient can also experience angina pectoris while at rest. If this occurs, that patient has much more severe coronary artery disease than the one who only experiences pain with exercise and stress. The pain (angina) is characterized as a crushing chest pain which usually radiates to the neck, jaw, shoulders, and upper extremities. The duration of the pain is usually 2 to 3 minutes. Treatment for this condition is either stopping the stress or administering nitroglycerin. The drug, nitroglycerin, is a vasodilator. It causes the coronary arteries to dilate and provides improved blood flow to the myocardium.

5-16. Myocardial Infarction

a. Myocardial infarction (MI) (heart attack) is a blockage in a coronary artery with resulting death to the affected tissue.

b. Signs and symptoms of an MI.

(1) Chest pain similar to angina, however, more severe and longer lasting. The pain may not be relieved with nitroglycerin. The patient usually complains of severe crushing pain or tightness in the chest. A clenched fist is usually used to describe the pain. In approximately 25 percent of the patients, the pain will radiate down the left arm and into the fingers. Usually the pain radiates to the jaw, neck, upper back, and epigastrium. An MI is sometimes mistaken for indigestion.

(2) Along with chest pain, the patient complains of nausea.

(3) Diaphoresis (profuse perspiration) usually accompanies an MI.

(4) The patient may also experience a fear of impending doom.

(5) Shortness of breath.

(6) Hypotension or hypertension.

(7) Cyanosis.

c. Treating an MI. The physical findings of an MI may not always be obvious. They vary with the site and extent of cardiac muscle damage. Therefore, diagnosis in the field will depend primarily on the history of the current complaint. Treatment and stabilization should be started immediately with a detailed history. Early treatment can mean the difference between life and death. The patient should be immediately transported to a medical facility where definitive treatment can be initiated. Early treatment should include—

(1) Attaching a cardiac monitor (if available).

(2) Administrating oxygen by mask or nasal prongs at a flow rate of 4 to 6 liters per minute.

(3) Starting an IV infusion (D_5W at Tko rate).

(4) Monitoring vital signs.

(5) Positioning the patient in a semi-Fowlers or high-Fowlers (sitting) position to reduce respiratory distress.

5-17. Congestive Heart Failure

a. Congestive heart failure (CHF) is the inability of the heart to pump blood efficiently. There are several contributing factors to CHF. Some of these include—

(1) Secondary to an MI.

(2) Pulmonary embolism.

(3) Administration of too much IV fluids.

(4) Excessive sodium intake.

b. There are two types of heart failure: acute pulmonary edema and chronic congestive heart failure.

c. Signs and symptoms of pulmonary edema.

(1) Congestion of the lungs.

(2) Fatigue.

(3) Dyspnea.

(4) Cough.

(5) Insomnia—often due to increased respiratory effort.

(6) Hemoptysis.

(7) Restlessness.

d. Signs and symptoms of congestive heart failure.

(1) Unexplained weight gain.

(2) Abdominal pain—usually in the upper region of the abdomen.

(3) Mild to moderate respiratory distress.

(4) Diaphoresis.

(5) Weakness.

(6) Anorexia.

(7) Pitting edema.

e. Treatment of heart failure is aimed at improving oxygenation, increasing myocardial contractability, and reducing venous return. Certain specific treatments are recommended for the medical specialist and include:

(1) Placing the patient in a sitting position, with the feet dangling. This position decreases venous return, making breathing easier.

(2) Administering oxygen by mask at a flow rate of 4-6 liters per minute.

(3) Starting an IV of D_5W at 10 drops per minute (Tko) rate.

(4) Attaching a cardiac monitor, if available.

(5) Using several types of drugs to improve cardiac function and assist respiration (if ordered by a physican).

(6) Using rotating tourniquets to slow the venous blood flow.

(7) Monitoring the patient's vital signs.

The primary aim when treating a patient who has CHF is to improve the cardiac function and correct hypoxia. This is accomplished to some extent by placing the patient in a sitting position and administering oxygen.

CHAPTER 6

THE RESPIRATORY SYSTEM

6-1. General

a. The cells of the body require a constant supply of oxygen to carry on the chemical processes necessary to life. As a result of these processes, carbon dioxide (a waste product) is formed and must be removed from the body. Oxygen and carbon dioxide are continuously being exchanged, both within the body and between the body and the atmosphere, by the process known as respiration.

b. Respiration is the exchange of gases between the atmosphere and the cells of the body. It is a physiological process. There are two types of respiration: external and internal. External respiration is the exchange of gases between the air in the lungs and blood. Internal respiration is the exchange of gases between the blood and the individual cells of the body.

c. Breathing is the process that moves air into and out of the lungs. It is a mechanical process. There are two types of breathing: costal (thoracic) and diaphragmatic (abdominal). In costal breathing, the major structure causing movement of the air is the rib cage. In diaphragmatic breathing, interaction between the diaphragm and the abdominal wall causes the air to move into and out of the lungs.

6-2. Components and Subdivisions of the Respiratory System

See Figure 6-1 for an illustration of the respiratory system.

a. Components. The components of the respiratory system consist of air passageways and two lungs. Air moves from the outside of the body into tiny sacs in the lungs called alveoli.

b. Main Subdivisions. The main subdivisions of the respiratory system may be identified by their relationship to the voice box (larynx).

SUBDIVISIONS	FUNCTION
(1) *Supralaryngeal Structures* (above the larynx) (external nose, nasal chambers, and pharynx)	Cleanse, warm, moisten, and test inflowing air.
(2) *Larynx* (voice box)	Controls the volume of inflowing air; produces selected pitch (vibration frequency) in the moving column of air.
(3) *Infralaryngeal Structures* (below the larynx) (trachea and bronchi, alveoli, lungs, and pleural cavities)	Distribute air to the alveoli of the lung where the actual external respiration takes place.

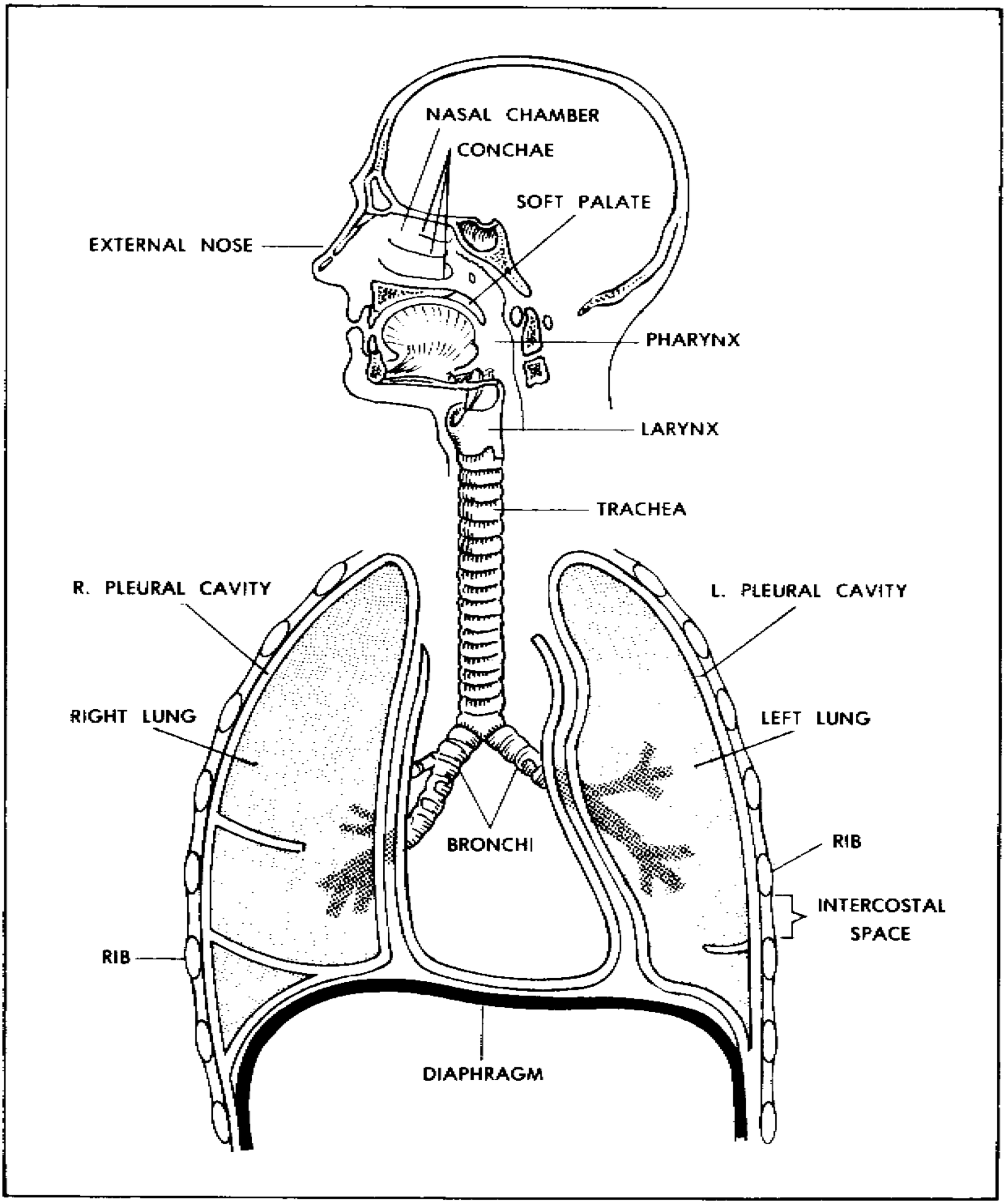


Figure 6-1. The respiratory system.

6-3. Supralaryngeal Structures

Figure 6-2 (cross-section) indicates the supralaryngeal structures.

a. External Nose. The external nose is the portion projecting from the face. It is supported primarily by nasal cartilages. It has a midline divider called the nasal septum, which extends from the internal nose. Paired openings (nostrils) lead to paired spaces (vestibules). Guard hairs in the nostrils filter incoming air.

b. Nasal Chambers (Internal Nose). Behind each vestibule of the external nose is a nasal chamber. Together the two nasal chambers form the internal nose. These chambers also are separated by the nasal septum.

(1) The walls of the nasal chambers are lined with a thick mucous-type membrane known as the mucoperiosteum. They have a ciliated (provided with hairlike projections that move fluids to the rear) epithelial surface. They also have a rich blood supply, which provides warmth and moisture. At times, they may become quite swollen.

(2) The sense of smell is the result of special nerve endings located in the upper areas of the nasal chambers.

(3) There are air "cells" or cavities in the skull known as paranasal sinuses. The paranasal sinuses are connected with the nasal chambers and are lined with the same ciliated mucoperiosteum. These sinuses are extensions of the nasal chambers into the skull bones. For this reason, they are known as paranasal sinuses.

c. Pharynx. The pharynx is the common space in the back of the throat for the respiratory and digestive systems.

(1) The portion of the pharynx specifically related to the respiratory system is the nasopharynx located above the soft palate. The two posterior openings (nares) of the nasal chambers lead into the single space of the nasopharynx. The auditory (eustachian) tubes also open into the nasopharynx. The auditory tubes connect the nasopharynx with the middle ears (to equalize the pressure between the outside and inside of the eardrum). Lying in the upper posterior wall of the nasopharynx are the pharyngeal tonsils (adenoids). The soft palate floor of the nasopharynx is a trapdoor that closes off the upper respiratory passageways during swallowing.

(2) The portion of the pharynx closely related to the digestive system is the oropharynx. It is the portion of the pharynx below the soft palate and above the upper edge of the epiglottis. (The epiglottis is the flap that prevents food from entering the larynx during swallowing.)

(3) The portion of the pharynx that is common to the respiratory and digestive systems is the laryngopharynx. It is the portion of the pharynx below the upper edge of the epiglottis. The digestive and respiratory systems lead into it from above and lead off from it below.

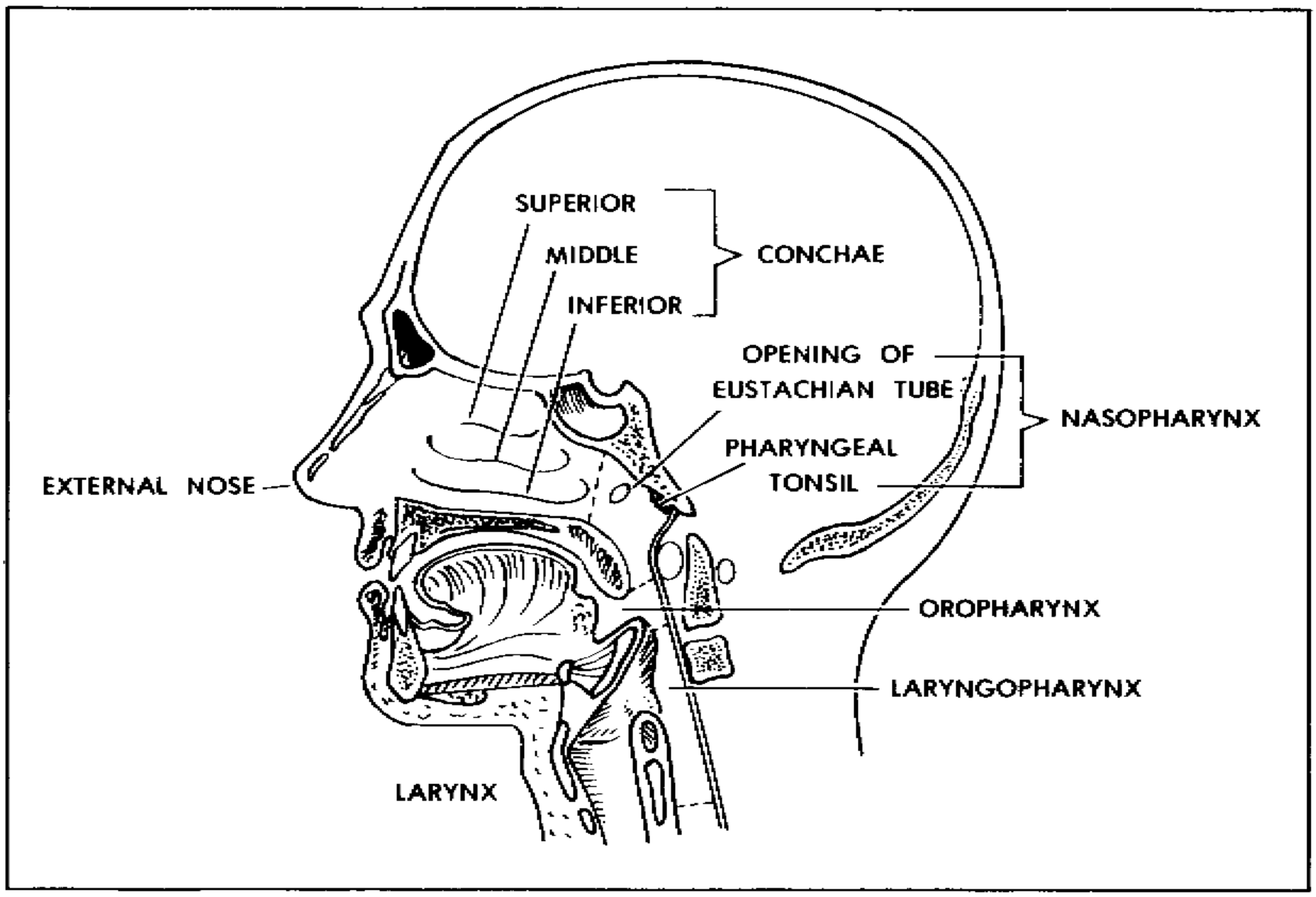


Figure 6-2. Supralaryngeal structures.

6-4. Larynx

The larynx, also called the Adam's apple or voice box, connects the pharynx with the trachea. The larynx, located in the anterior neck region, has a box-like shape (Figure 6-3). The voice box of the male becomes larger and heavier during puberty and the voice deepens. The adult male's voice box tends to be located lower in the neck; in the female, the larynx remains higher and smaller and the voice is of a higher pitch.

a. The larynx has a vestibule (entrance hallway) that can be covered over by the epiglottis. The glottis itself is the hole between the vocal cords. Through the glottis, air passes from the vestibule into the main chamber of the larynx (below the cords) and then into the trachea. The skeleton of the larynx is made up of a series of cartilages.

b. The larynx serves two functions and has two sets of muscles—one for each function.

(1) One set controls the size of the glottis. Thus, it regulates the volume of air passing through the trachea.

(2) The other set controls the tension of the vocal cords. Thus, it produces vibrations of selected frequencies (variations in pitch) of the moving air to be used in the process of speaking.

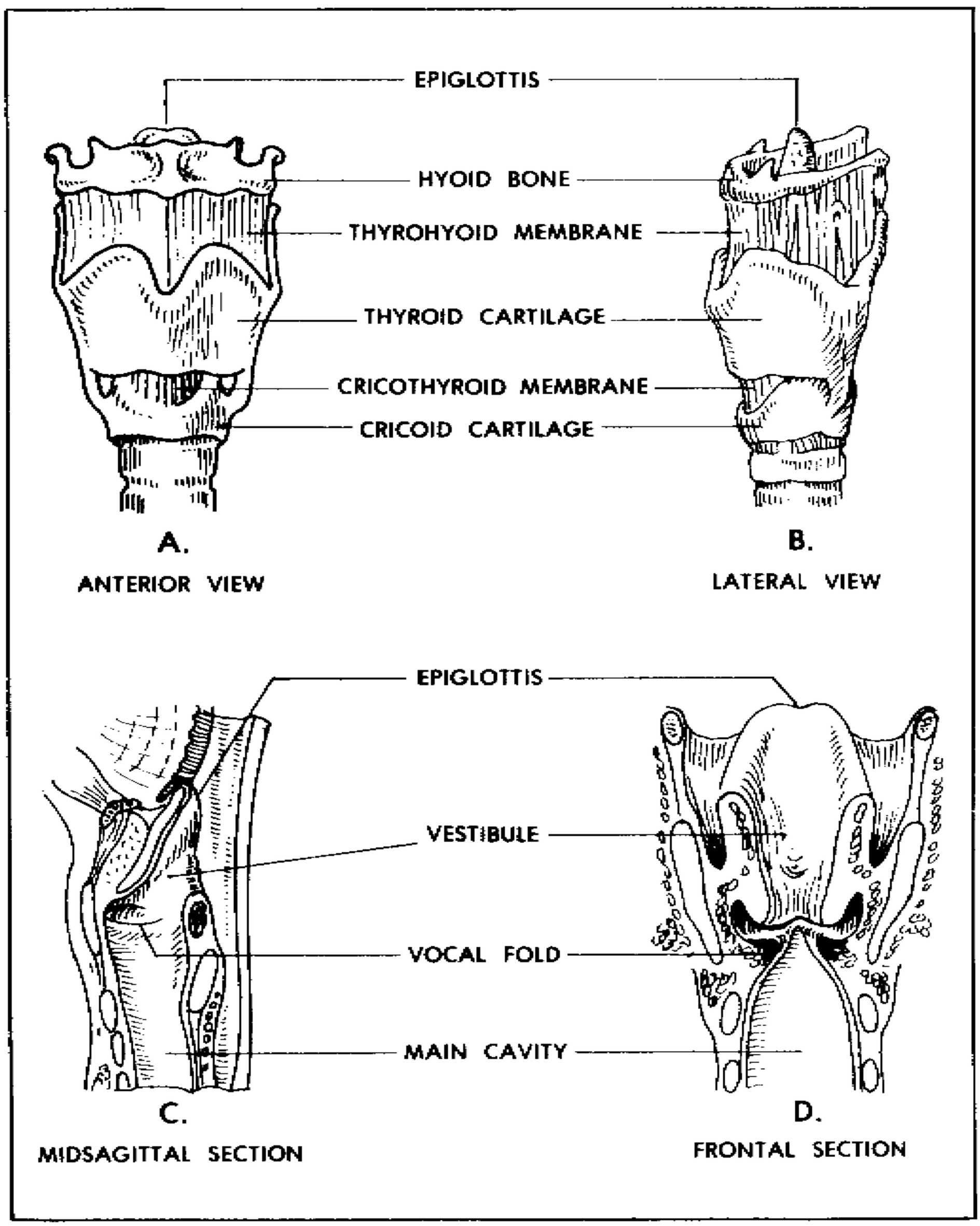


Figure 6-3. The larynx.

6-5. Infralaryngeal Structures

See Figure 6-4 for an illustration of the infralaryngeal structures.

a. Trachea and Bronchi. The respiratory tree is the set of tube-like structures that carry air from the larynx to the alveoli of the lungs. The respiratory tree is so named because it has the appearance of an inverted tree with its trunk and branches. These tubular parts are held open (made *patent*) by rings of cartilage. Their lining is ciliated to remove mucus and other materials that get into the passageway.

b. Alveoli. The alveoli (alveolus, singular) are tiny spherical (balloon-like) sacs that are connected to the larger tubes of the lungs by tiny tubes as alveolar ducts and bronchioles. The alveoli are so small that there are billions in the adult lungs. This produces a maximum surface area through which external respiration takes place. External respiration is the actual exchange of gases between the air in the alveolar spaces and the adjacent blood capillaries through their air walls.

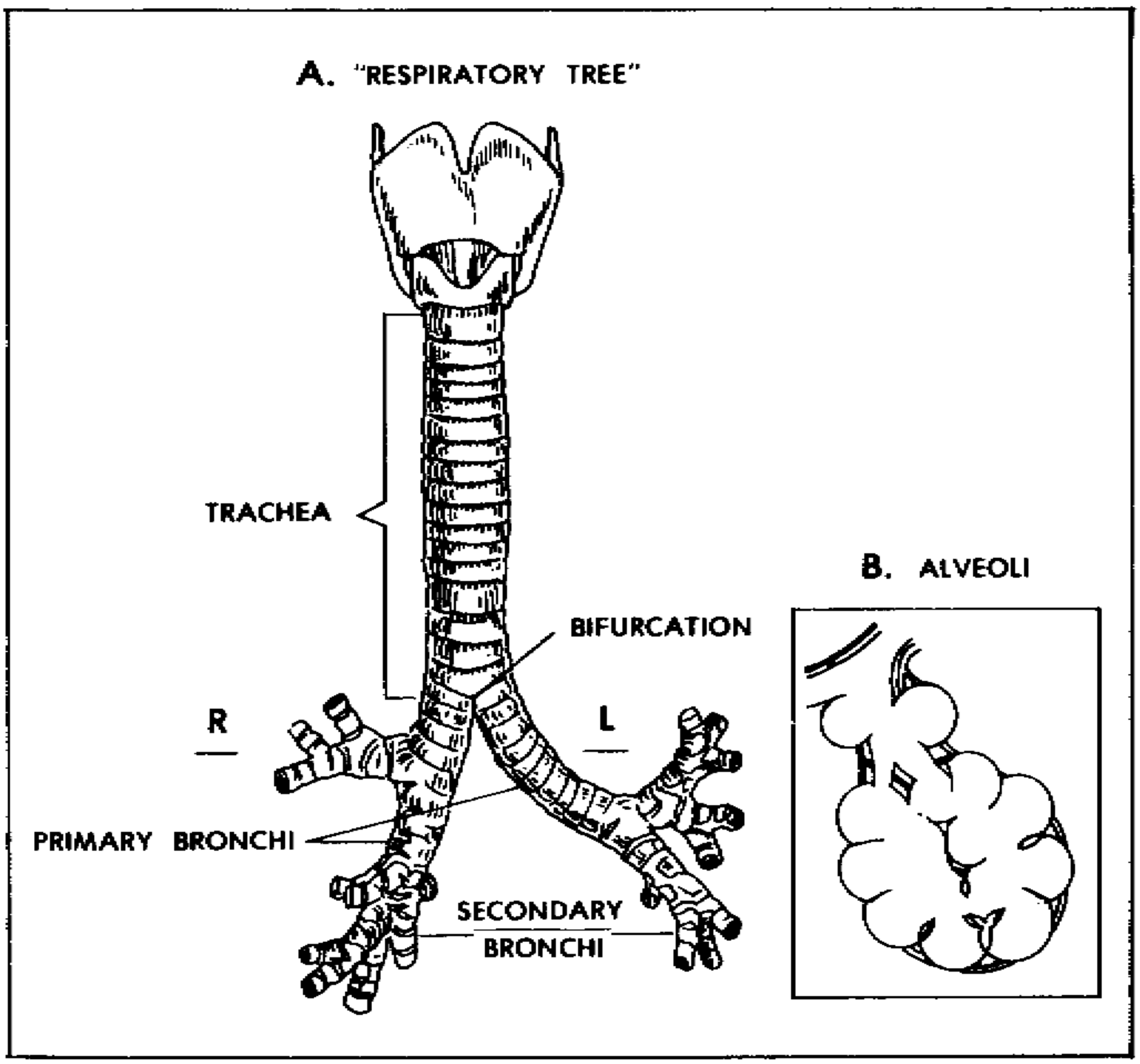


Figure 6-4. Infralaryngeal structures.

c. Lungs. A lung is an individual organ composed of tubular structures and alveoli, bound together by fibrous connective tissue. There are two lungs, right and left. Each lung is supplied by a primary or mainstream bronchus leading off of the trachea. The right lung is larger in volume than the left lung because the left lung must leave room for the heart. The right lung is divided into three pulmonary lobes (upper, middle, and lower). The left lung is divided into two pulmonary lobes (upper and lower). A pulmonary lobe is a major subdivision of the lung and is marked by deep folds.

d. Pleural Cavities. The pleural cavity is a serous cavity with inner and outer membranes. In the case of the lungs, the inner membrane is known as the visceral pleura which very closely covers the surface of the lungs. The outer membrane is known as the parietal pleura, forming the outer wall of the cavity. The pleural cavities are the potential spaces between the inner and outer membranes. The pleural cavities allow the lungs to move freely with a minimum of friction during the expansion and contraction of breathing. Located in the middle of the thorax, between the two pleural cavities, is the mediastinum (meaning "I stand between"). The mediastinum is filled with tissues and organs. Within it, the heart (of the blood circulatory system) is located at the same level as the lungs.

6-6. Breathing and Its Mechanisms

a. Boyle's law tells us that as the volume (V) of a gas-filled container increases, the pressure (P) inside decreases; as the volume of a closed container decreases, the pressure inside increases. When two connected spaces of air have different pressures, the air moves from the space with greater pressure to the one with lesser pressure. In regard to breathing, we can consider the air pressure around the body to be constant. The pressure inside the lungs may be greater or less than the pressure outside the body. Thus, a greater internal pressure causes air to flow out; a greater external pressure causes air to flow in.

b. The upper portion of the body can be compared to a cylinder. This cylinder is divided into upper and lower cavities by the diaphragm. The upper is the thoracic cavity and is essentially gas-filled. The lower is the abdominopelvic cavity and is essentially water-filled.

6-7. Costal (Thoracic) Breathing

a. Inhalation. Muscles attached to the thoracic cage raise the rib cage. A typical rib might be compared to a handle, attached at one end to the sternum (breastbone) and at the other end to the vertebral column. This handle is lifted by the overall movement upward and outward of the rib cage. These movements increase the thoracic diameters from right to left (transverse) and from front to back. Thus, the intrathoracic volume increases. Recalling Boyle's law, the increase in volume leads to a decrease in pressure. The air pressure outside the body then forces air into the lungs and inflates them.

b. Exhalation. The rib cage movements and pressure relationships are reversed for exhalation. Thus, intrathoracic volume decreases. The intrathoracic pressure increases and forces air outside the body.

6-8. Diaphragmatic (Abdominal) Breathing

The diaphragm is a thin, but strong, dome-shaped muscular membrane that separates the abdominal and thoracic cavities. The abdominal wall is elastic in nature. The abdominal cavity is filled with soft, watery tissues.

a. Inhalation. As the diaphragm contracts, the dome flattens and the diaphragm descends. This increases the depth (vertical diameter) of the thoracic cavity and increases its volume. This decreases air pressure within the thoracic cavity. The greater air pressure outside the body then forces air into the lungs.

b. Exhalation. As the diaphragm relaxes, the elastic abdominal wall forces the diaphragm back up by pushing the watery tissues of the abdomen against the underside of the relaxed diaphragm. The dome extends upward. The process of inhalation is thus reversed.

6-9. Nervous Control of Breathing

As we have seen, breathing is a combination of many factors. These factors are integrated and controlled by the nervous system.

a. Respiratory reflexes are controlled by the respiratory center found in the medullary portion of the posterior brainstem. The level of carbon dioxide ($C0_2$) in the circulating blood is one of the major influences upon the respiratory reflex.

b. The individual intercostal nerves innervate the intercostal muscles.

c. The muscles attached to and moving the rib cage are innervated by their appropriate nerves. (Ultimately, almost every muscle in the torso may be mobilized to assist in breathing.)

d. The diaphragm is innervated by its own individual pair of nerves.

6-10. Functional Blood Supply

There are essentially two blood supplies for the lungs—nutrient blood and functional blood. Nutrient blood is carried by the bronchial arteries from the thoracic aorta and provides nourishment and oxygen to the tissues of the lung. Functional blood is involved in the respiratory exchange of gases between the alveoli and the capillaries. It is brought to and from the lungs by the pulmonary cycle of the cardiovascular system.

a. The pulmonary cycle originates in the right ventricle of the heart. Contraction of the right ventricle forces the blood into the pulmonary arch, which divides into the right and left pulmonary arteries and paralleling the branching of the respiratory tree, the arteries divide and subdivide within the lungs. These arteries lead to capillaries in the vicinity of the alveoli. The walls of these capillaries are thin enough to accommodate the passage of gases to and from the alveoli.

b. The blood, now saturated with oxygen, is collected by the pulmonary venous system and is deposited into the left atrium of the heart.

6-11. Exchange and Transportation of Gases

Oxygen and carbon dioxide are the primary gases involved in respiration. At the alveoli, gases are exchanged between the air inside and the blood in the adjacent capillaries. Within the body, gases are exchanged between the blood of the capillaries and the individual cells of the body. The gases are transported between the alveoli and the individual cells by the cardiovascular system.

a. Some of the gases are dissolved directly in the plasma of the blood.

b. However, the greater percentages of the gases are carried within the substance of the RBCs (red blood cells/erythrocytes). The RBCs, found in large numbers in the blood, are specially constructed for transporting the gases. Hemoglobin, a substance found within RBCs, has a great affinity for oxygen. Yet, the hemoglobin can readily give up the oxygen wherever it is needed.

CHAPTER 7

THE NERVOUS SYSTEM

7-1. General

a. The nervous system is composed of the brain, spinal cord, and branches from the spinal cord and brain called nerves. The system is divided anatomically into two parts: the central nervous system and the peripheral nervous system.

b. The central nervous system includes the brain and the spinal cord. The peripheral nervous system includes the nerves, which are either sensory or motor or a combination of both. Sensory nerves are adapted to carry sensations of touch, taste, heat, cold, and pain. Motor nerves are adapted to transmit impulses to muscles, causing them to move.

c. That part of the nervous system that regulates functions over which there is voluntary control is often called the sympathetic nervous system.

d. There is also a subdivision called the autonomic, or involuntary, nervous system. Automatic functions (such as digestion, control of vessel dilation, the ability to sweat, and all sensations and responses that cannot be controlled by a voluntary act of conscious will) are under the direction of this system.

7-2. The Central Nervous System (CNS)

a. Nerve Cells.

(1) The nerve cell, or neuron, is the basic unit of the nervous system. Each neuron is composed of a cell body, which contains the nucleus of the nerve cell; dendrites, which carry impulses to the cell body; and axons, which carry impulses away from the cell body. Collections of cell bodies appear gray, and therefore are referred to as "gray matter."

(2) Impulses are transmitted along nerves through a process that is part chemical and part electrical. It may be helpful to think of the nerves as "wires," surrounded by myelin "insulation." Nerve cells can receive impulses (excitability), conduct them (conductivity), and transmit them to a second cell (transmission). Impulses travel from the dendrites to the cell body and then from the cell body down the axon. When an impulse reaches the end of the axon, it is transmitted to a second cell across a junction. This junction is called a synapse (Figure 7-1). The second cell may be another nerve cell or a gland cell.

(3) Unlike excitability and conductivity (which are electrical in nature), transmission of impulses from one nerve cell to another is chemical. A chemical released by the axons crosses the synapse to excite the second cell.

(4) Some drugs and poisons can block this transmission and prevent excitability of the second cell. Others can lead to a buildup of the chemical transmitter and excess excitation of the second cell.

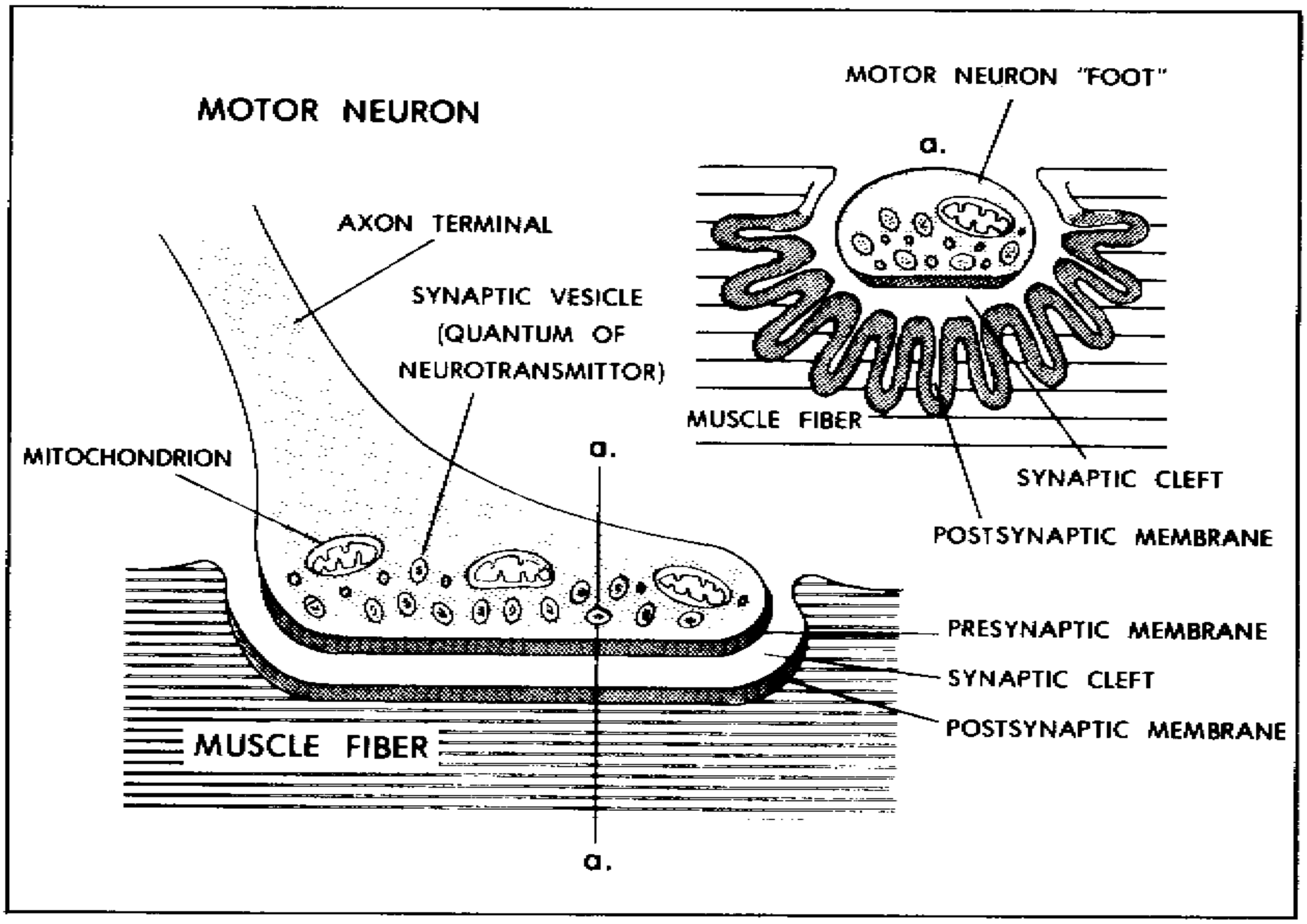


Figure 7-1. A synapse.

b. The Brain.

(1) The brain is the controlling organ of the body and occupies the entire space within the cranium (skull). It is made up of many different types of cells. Each type of cell has a specific function: some cells in the brain receive sensory impulses or messages; other cells are responsible for signaling muscles and organs to act. Still other cells are responsible for transmitting impulses to other areas of the brain and to the spinal cord.

(2) The brain is a very soft tissued organ and is richly supplied with blood vessels. This makes the brain very susceptible to injury. The skull can protect the brain from external injury because of its rigidity and hardness, but the same qualities can, in some cases, injure the brain. In some ways, the brain behaves like a sponge inside a steel case—it cannot expand inside the rigid skull. Therefore, a swelling of the brain or accumulation of blood inside the skull compresses the brain and increases the pressure inside the skull. This pressure (increased intracranial pressure) causes changes that interfere with brain functioning. Furthermore, because the skull is hard, both the brain and

the blood vessels on the brain's surface may be damaged if they strike the skull's inner surface. This condition can occur when the head is struck directly or when it is rapidly accelerated or decelerated. When struck on the back of the head, the phenomenon of "seeing stars" is due to the occipital lobe of the brain (the part that controls vision) striking against the back of the skull.

(3) The brain is divided into three main parts: the cerebrum, cerebellum, and brain stem (Figure 7-2). The first main portion, or cerebrum is the largest part of the brain, occupying the top and front of the skull. The cerebrum is divided from the front to the back of the skull into left and right cerebral hemispheres. The cerebral cortex is the gray, outer surface layer of the cerebral hemispheres. This thin layer, 2 to 5 millimeters (mm) thick, contains nerve cell bodies. Each cerebral hemisphere is further divided into four lobes: frontal, temporal, parietal, and occipital, named according to the overlying skull bones. These lobes are separated from each other by fissures, as shown in Figure 7-2.

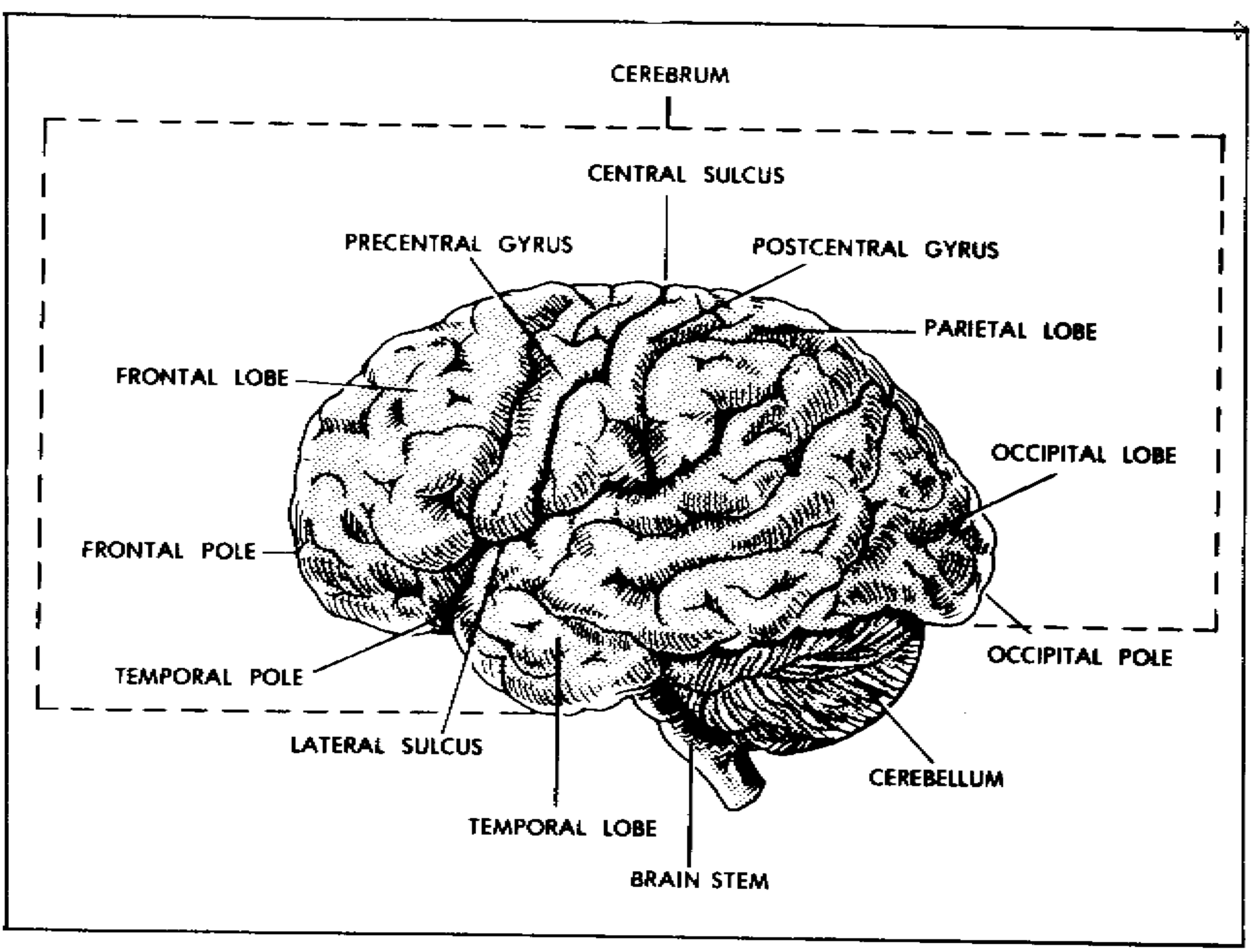


Figure 7-2. The brain.

(4) Each nerve cell in the cerebral cortex (cortical nerve cell) has a specific function, and groups of these cells that perform related functions are located in different areas of the brain. The eight major functions of the brain are:

(a) Sensation. The brain receives sensory input from all sense organs, including the eyes, ears, nose, and taste buds, and from all receptors of pain, pressure, and temperature. This sensory input is then interpreted by the cerebral cortex.

(b) Voluntary movement. The cerebral cortex directs and assists voluntary movement by coordinating muscle actions and maintaining posture and equilibrium.

(c) Mental functions. Mental functions include memory, foresight, personality, speech, and intelligence, and are functions of the cerebral cortex.

(d) Emotions. Happiness, sadness, rage, and other emotions are functions of the thalamus and the cerebral cortex.

(e) Control of autonomic functions. The hypothalamus directs the autonomic nervous system which innervates smooth muscle, cardiac muscle, and glands.

(f) Control of endocrine function. The hypothalamus triggers anterior pituitary secretion which regulates the hormone production of target endocrine glands.

(g) Consciousness. The reticular activating system, which originates in the brain stem and travels to the cerebral cortex, maintains wakefulness. Injuries or drugs that affect the reticular activating system produce unconsciousness.

(h) Control of vegetative functions. The medulla, which is part of the brain stem, controls respiration, heart rate, and blood pressure. Therefore, injury to the medulla can produce cardiorespiratory arrest.

(5) The areas are given functional names but also may be referred to by their anatomic location. It is important to be familiar with these areas because damage to each area (such as that caused by trauma (injury) and stroke) causes specific clinical signs and symptoms. The cerebrum is more subject to injury than are other parts of the central nervous system.

(6) Injury to the motor cortex, which is located in the frontal lobe, causes weakness or paralysis on the opposite side of the body because many nerve fibers from the cortex are crossed in the brain stem and spinal cord. The left side of the brain controls the right side of the body.

(7) The rest of the frontal lobe is involved in the higher mental processes of judgment, foresight, and perserverance. People with damage (injury) to this area often have difficulty making appropriate judgments.

(8) Speech is controlled by a small area of the left temporal lobe. Damage (injury) to this area causes a variety of difficulties with speech, ranging from inability to find the correct words to not being able to speak. In the superior temporal lobes, hearing is controlled by the auditory cortex. The occipital cortex, located in the posterior part of the cerebrum, is responsible for sight (visual sensation). The sensory area, located in the parietal lobe, receives and processes other types of sensory information (such as touch, temperature, vibration, position sense, and pain). The crossover relationship between the brain and the body also applies to the transmission of sensory information. For example, the sensation of a pain caused from a burn on the right hand is received by the left side of the brain. Damage to the left sensory cortex causes a loss of perception of the right side of the body.

(9) The second major area of the brain is the cerebellum. The cerebellum is located in the lower back, or inferoposterior, part of the skull (Figure 7-2). The cerebellum is divided into two hemispheres. It has a thin covering of gray matter over a core of white matter. The functions of the cerebellum are not as well localized to specific areas as the cerebral functions. Coordination of skilled voluntary muscle movement, posture, and balance are maintained by the cerebellum. Difficulties in balancing and coordination are caused by damage to the cerebellum. The difficulties are most noticeable when the injured person tries to walk. Because of its location in the back of the skull, the cerebellum rarely is injured except by direct trauma (injury) to this area.

c. The Brain Stem.

(1) The brain stem is the third major portion of the brain (Figure 7-2). It is located at the base of the brain, between the spinal cord and the cerebrum and surrounded by the cerebellum. The brain stem contains nerve tracts, which are functional units formed by groups of axons that carry impulses to and from the brain and the spinal cord. These structures also contain groups of nerve cell bodies (nuclei) that control various body functions. The medulla oblongata, the lowest area of the stem, located just above the spinal cord, has centers critical to the maintenance of vital body functions such as heart rate, respiration, and blood pressure. Damage to these centers, or interference with their functioning by certain drugs, causes various cardiorespiratory disturbances, from a slowing of the heart rate (bradycardia) to cardiopulmonary arrest.

(2) Other centers in the brain stem control the muscles of the eyes, throat, and face and receive sensory information from these areas. From these centers (nuclei), nerves run through different bony passages to the facial structures. Damage to the facial nerve (which can be caused by a skull fracture) will paralyze some of the facial muscles. Similar damage to the oculomotor (eyeball) nerve will prevent the pupil on the damaged side of the body from responding to different light levels.

d. The Spinal Cord.

(1) The second major part of the central nervous system is the spinal cord. All of the important centers of the brain are connected by long tracts of nerves directly with the organs or muscles they control. These tracts join to form the spinal cord, a continuation of the brain (Figure 7-2). Like the brain, the spinal cord is protected by a bony structure, the spine. Each section

(vertebrae) of the spine contains an anterior bony vertebral body to support the body's weight and a posterior bony ring (neural arch) to protect the spinal cord (Figure 7-3).

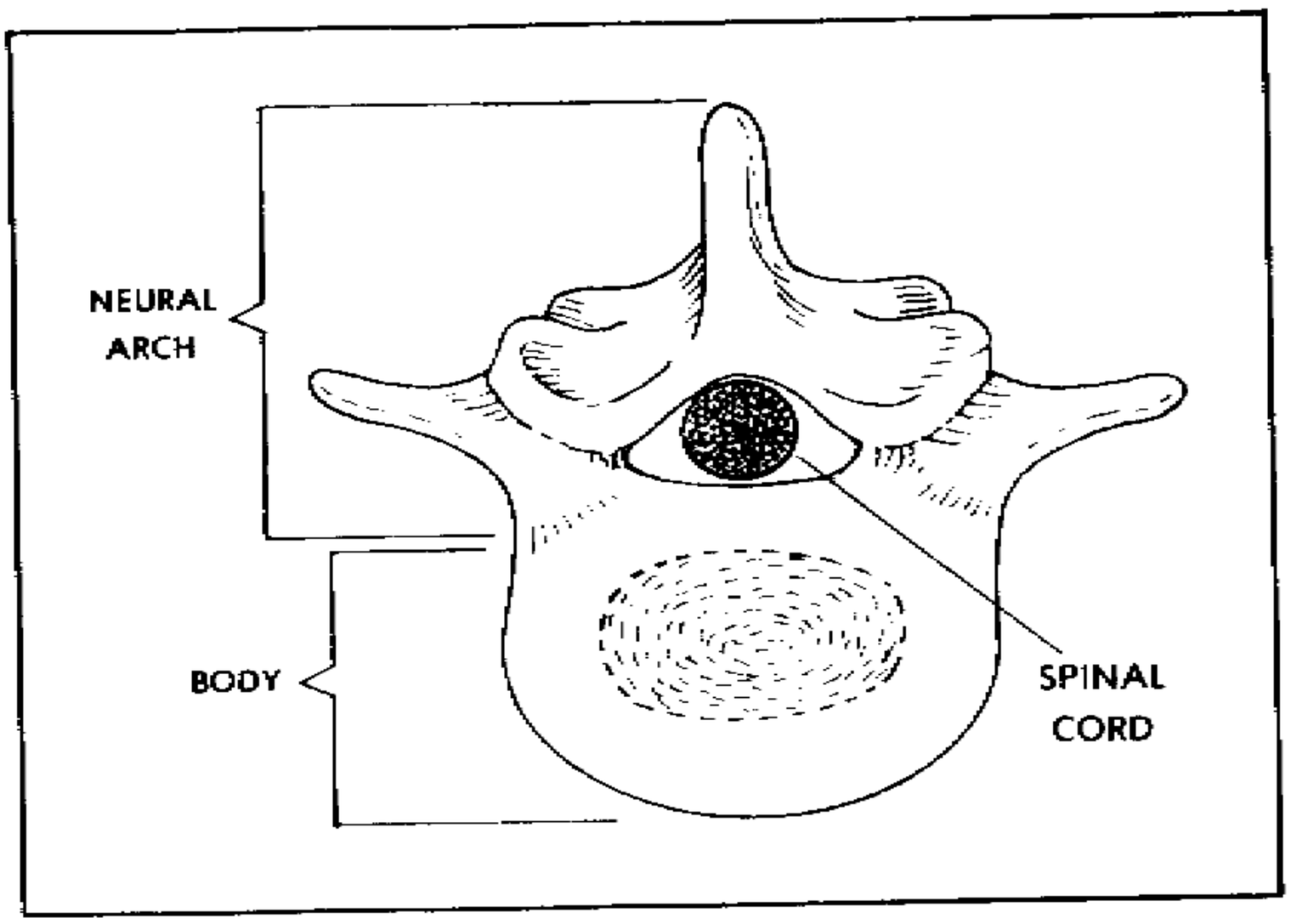


Figure 7-3. Spinal vertebra in cross-section.

(2) The spinal cord has a gray matter core surrounded by a layer of white matter. The gray matter contains cell bodies. The white matter contains nerve tracts which connect the brain with the rest of the body. There are three important nerve tracts.

(a) The posterior column, which separates position and vibratory senses.

(b) The lateral spinal thoracic tract, which separates pain and temperature sensation.

(c) The cortical spinal tract, which controls muscle movement. The spinal cord transmits messages between the brain and the peripheral nervous sytem. These messages are passed along a nerve as electrical impulses, much as messages are passed in a telephone cable.

(3) There are five main areas in which the spinal cord can be divided: cervical, thoracic, lumbar, sacral, and coccygeal (tailbone) (Figure 7-4). In each section of the spinal cord, nerve cells control motor function and sensation for specific parts of the body. At each level of the cord, bundles of nerve fibers join to form nerve roots that leave the front and back sides of the spinal cord and then join to form peripheral nerves (Figure 7-5). Nerve roots in different areas control specific functions. For example, inability to move the shoulder indicates injury to the fifth cervical nerve root (C5). The following list gives other important relationships between nerve roots and the function of various body structures.

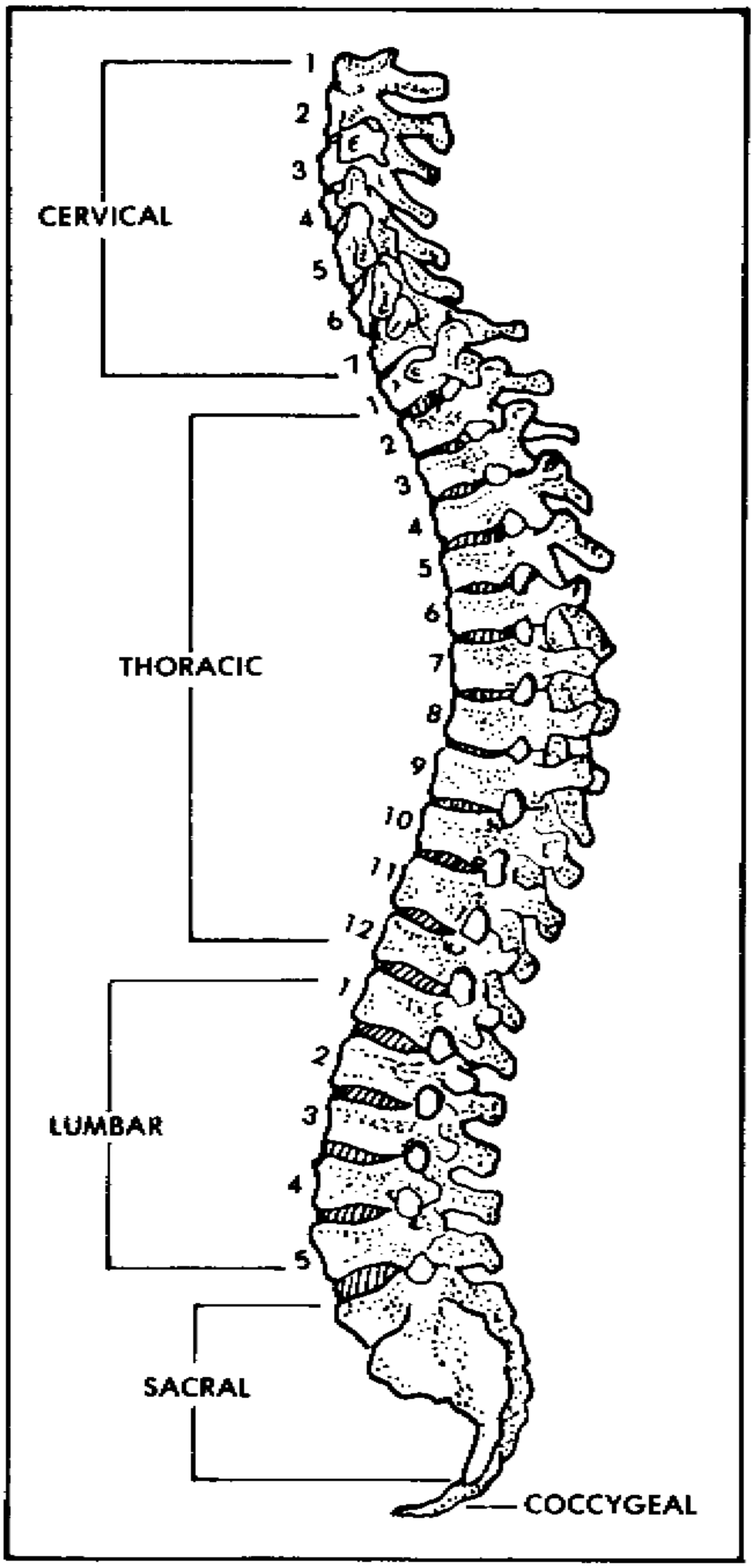


Figure 7-4. The five divisions of the spine.

- *Cervical.*
  - o Shoulder girdle (C5).
  - o Elbow flexion (C5, C6).
  - o Elbow extension (C6, C8).
  - o Wrist movement (C6, C7).
- *Thoracic.*
  - o Thoracic region movement and sensation (T4 through T10).
  - o Sensation at the nipple level (T4).
  - o Sensation at the umbilicus (navel) level (T10).
- *Lumbar.*
  - o Hip flexion (L2, L3).
  - o Hip extension (L4, L5).
  - o Knee extension (L3, L4).
- *Sacral.*
  - o Knee flexion (L5, S1).
  - o Ankle movement (S1, S2).
  - o Toe movement (L5, S1, S2).

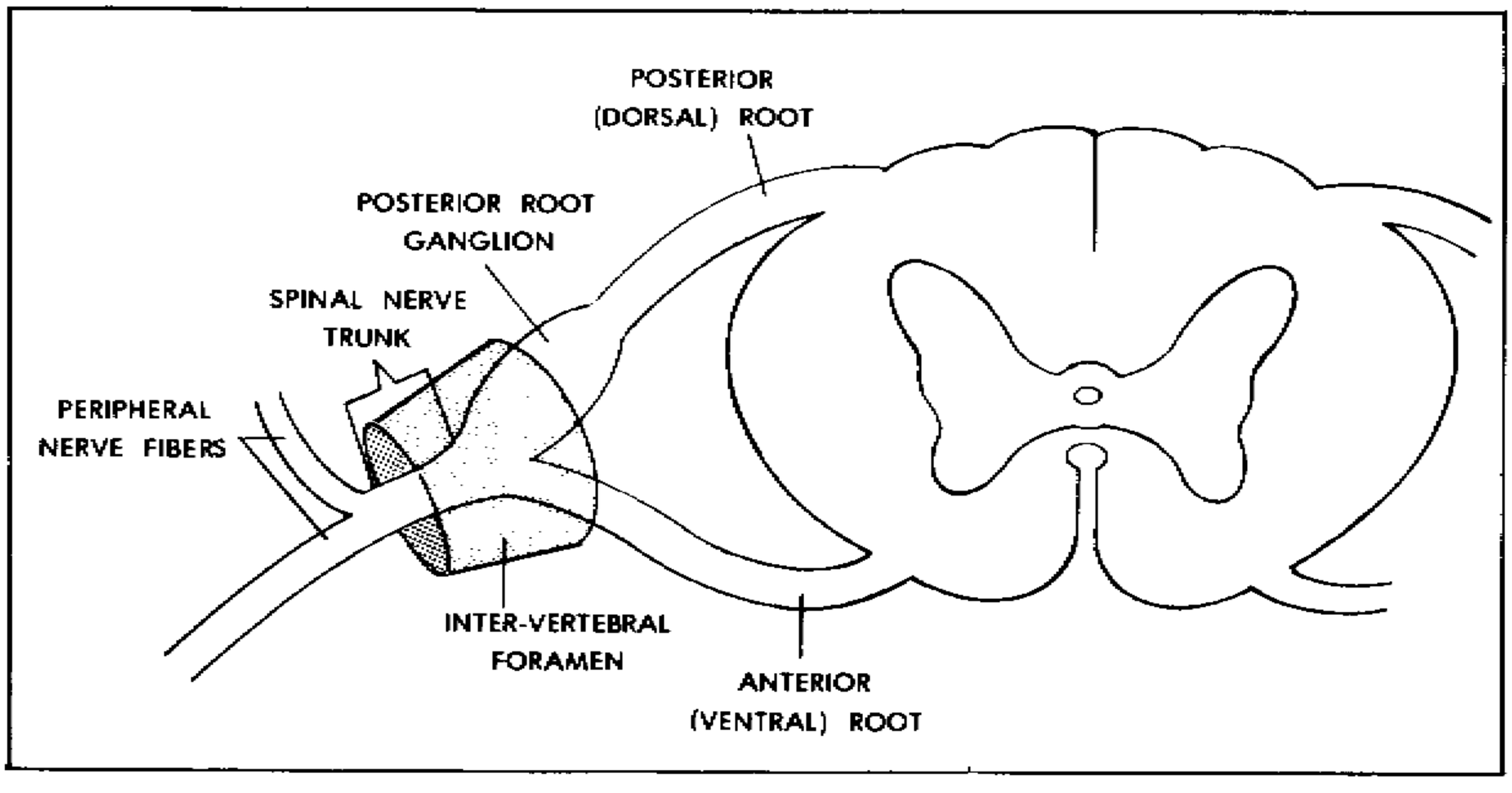


Figure 7-5. Bundles of nerve fibers joining nerve roots.

Another way of assessing possible damage to specific nerve roots is to test skin sensation in different areas. Each nerve root has cutaneous (skin) nerves which supply a given area. The area supplied by cutaneous nerves from a single nerve root is called a dermatome (Figure 7-6). These cutaneous nerves are part of the peripheral nervous system (paragraph 7-3).

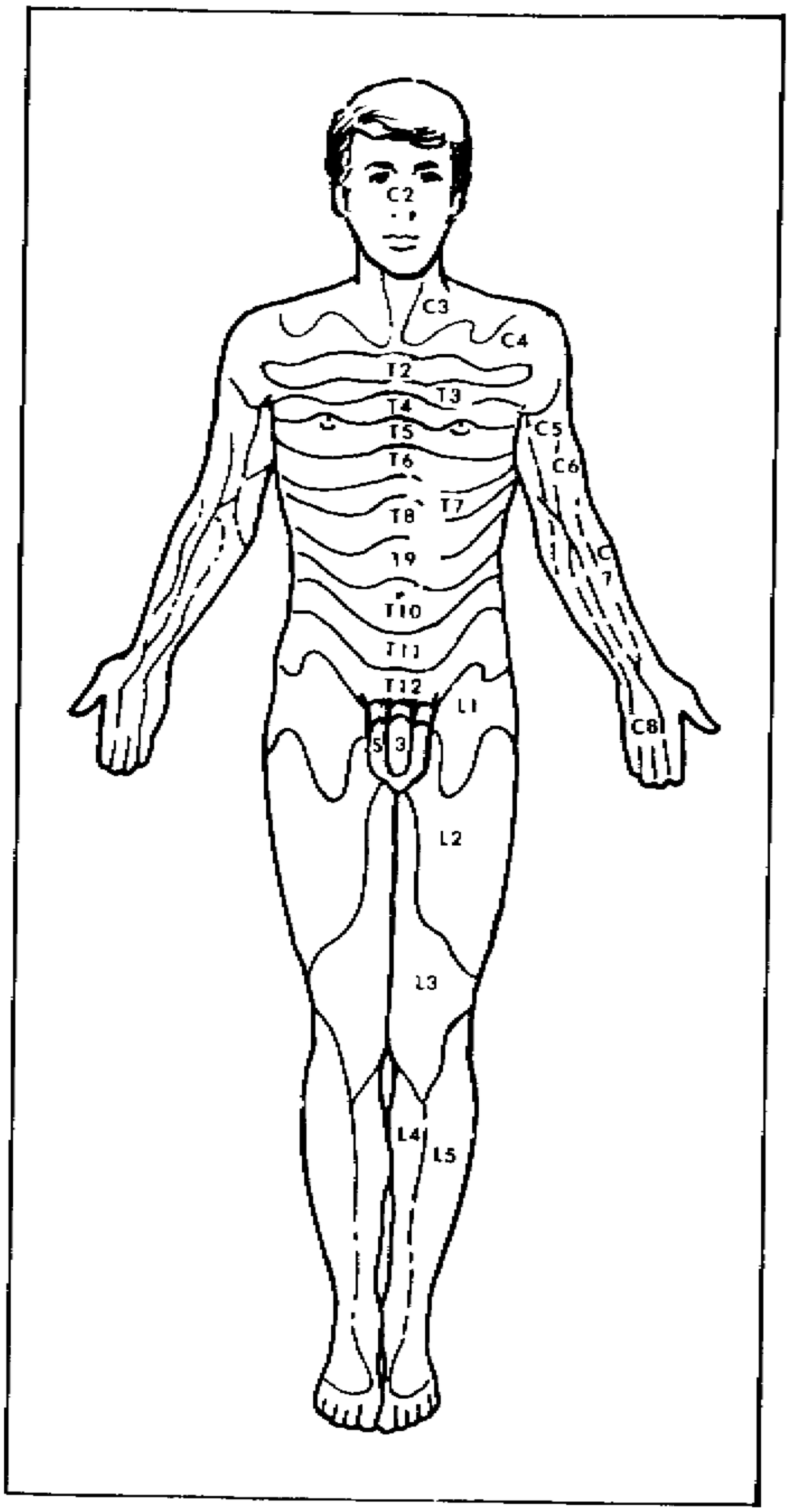


Figure 7-6. Dermatome in cross-section.

7-3. Peripheral Nervous System

a. The peripheral nervous system is complex. Branches from the spinal nerves join together with branches from other spinal cord segments to form large bundles or plexuses. These plexuses divide further to form the peripheral nerves that run to the muscles, skin, and other structures in the extremities. The peripheral nerves may be injured by fractures or lacerations of the extremities, which may cause local muscular paralysis and loss of sensation.

b. A group of large nerves in the base of the neck and armpit is the brachial plexus. Branches of the brachial plexus innervate the arm and the shoulder. Six major nerves branch from the brachial plexus:

(1) *Axillary nerve.* The axillary nerve supplies the deltoid muscle and skin of the shoulder.

(2) *Musculocutaneous nerve.* The musculocutaneous nerve descends laterally to supply the biceps muscle and ends in a cutaneous sensory nerve in the forearm.

(3) *Radial nerve.* The radial nerve branches off to the arm and forearm muscles, to the skin of the posterior arm, and to the posterior forearm. When the radial nerve is damaged, motion of and sensation in the thumb are lost.

(4) *Superficial radial nerve.* The superficial radial nerve is a cutaneous nerve that innervates the skin of the lateral posterior forearm and lateral posterior hand.

(5) *Deep radial nerve.* The deep radial nerve innervates the skin and the muscles of the ulna (the long bone in the forearm) and the hand. Because the ulnar nerve crosses the outer part of the elbow, it can be damaged in injuries to this joint. Such injuries cause sensorimotor loss in the little finger.

(6) *Median nerve.* The median nerve innervates muscles of the forearm and hand, the skin of the thumb, the first three fingers, and the radial side of the palm.

c. The lumbosacral plexus innervates the legs. Its major branches include:

(1) *Femoral nerve.* The femoral nerve innervates the muscles in the front of the thigh, including the quadriceps group. It also gives off cutaneous branches to the skin of the anterior and medial distal thigh and the medial leg and foot.

(2) *Obturator nerve.* The obturator nerve innervates muscles of the medial thigh and the skin of the distal medial thigh.

(3) *Sciatic nerve.* The sciatic nerve is the largest nerve in the body and is found in the posterior thigh. It innervates the muscles of the calf and the back of the thigh and the skin of the lower calf and the upper surface of the foot.

(4) *Superficial peroneal nerve.* The superficial peroneal nerve innervates the lateral leg muscles and the skin on the back (dorsum) of the foot.

(5) *Deep peroneal nerve.* The deep peroneal nerve innervates the anterior and lateral leg muscles and the muscles that move the toes.

(6) *Tibial nerve.* The tibial nerve innervates the skin and muscles of the posterior leg and the sole of the foot. Damage to the tibial nerve results in "footdrop," the inability to dorsiflex the foot (to bend it backward by flexing the ankle).

7-4. Autonomic Nervous System

a. The autonomic nervous system stimulates the smooth muscle of the blood vessels and the bowel, the heart muscle, and some endocrine glands. This system maintains the various bodily functions over which the individual has no conscious control, including blood pressure, temperature regulation, sweating, and peristaltic activity of the bowel. In stressful situations, the autonomic nervous system also helps the body produce the appropriate "fight or flight" response, characterized by changes in blood flow and metabolism.

b. The autonomic nervous system is divided into the parasympathetic nervous system (which controls the involuntary functions mentioned above) and the sympathetic nervous system (which prepares the body for stress). The parasympathetic nerves release acetylcholine when stimulated. This chemical transmitter crosses the synapse (neuromuscular junction) to stimulate the end organ, or muscle. Effects of acetylcholine (cholinergic effects) include salivation, pupillary constriction in the eye, slowing of the heart, constriction of bronchial smooth muscle, and increased intestinal motility.

c. Because atropine inhibits the breakdown of acetylcholine at the neuromuscular junction (increasing cholinergic activity), it is used clinically to increase the heart rate. Some insecticides, notably those of the organophosphate type, block cholinergic activity and can lead to fatal paralysis and cardiac arrest unless their effects are countered by treatment with atropine.

d. The sympathetic nervous system has more widespread effects than the parasympathetic system. Chemical transmitters in the sympathetic nervous system include norepinephrine, which is released from sympathetic nerve endings, and epinephrine (Adrenalin), which is released from the adrenal gland when it is stimulated by the sympathetic nerves. Sympathetic nervous stimulation increases the heart rate (pulse) and the force of cardiac contraction. In the blood vessels, sympathetic stimulation of specialized receptors (called beta-1 and beta-2 adrenergic receptors) can both increase and decrease the muscular tone of the vessel wall and influences blood pressure and blood flow to different parts of the body.

e. Damage to the thoracic and lumbar segments of the spinal cord can cause derangement of the sympathetic nervous system, which originates in those areas. Such damage can lead to heat loss and shock; as vascular tone diminishes, blood collects in the extremities.

7-5. Protective Mechanisms for the Central Nervous System

a. The brain and the spinal cord do not have the ability to regenerate if cells are permanently damaged. Although some brain cells can take over the functions of other damaged cells, the amount of function regained cannot be predicted and is usually limited. To prevent additional damage, any patient with possible neurological injury must be handled very carefully in the emergency treatment situation.

b. There are several protective mechanisms for the structures of the central nervous system (Figure 7-7). The skull provides a rigid container for the brain, and the spine protects the spinal cord. Within these bony structures, three layers of tissue (called meninges) provide additional protection.

(1) The first of these layers is the dura mater, the thick fibrous outer covering of the brain. It is attached to the skull except at the falx cerebri, which separates the two halves of the cerebrum, and the tentorium cerebelli, which separates the occipital lobe of the cerebrum from the cerebellum. These dural infoldings provide a suspension system for the brain and help prevent excessive motion within the skull. The dura mater also forms the outer covering of the spinal cord.

(2) The second layer of tissue is called the arachnoid membrane. Between the arachnoid membrane and the dura mater is the subdural space in which blood vessels and nerves pass to and from the brain.

(3) The third layer is the pia mater, which is closely attached to the surface of the brain and spinal cord and dips into every fold of their surfaces. Between the arachnoid membrane and the pia mater is the subarachnoid space, which is filled with cerebrospinal fluid (CSF). The cerebrospinal fluid protects the brain and spinal cord by providing a cushion between them and their adjacent bony structures. Clear and colorless, this fluid circulates through and around the brain and spinal cord before being resorbed. When tears in the dura mater occur (usually after skull fractures), the cerebrospinal fluid may leak out through the nose or the ears. Leakage of this fluid indicates a critical situation because it signals serious injury to the central nervous system and possible infection (meningitis).

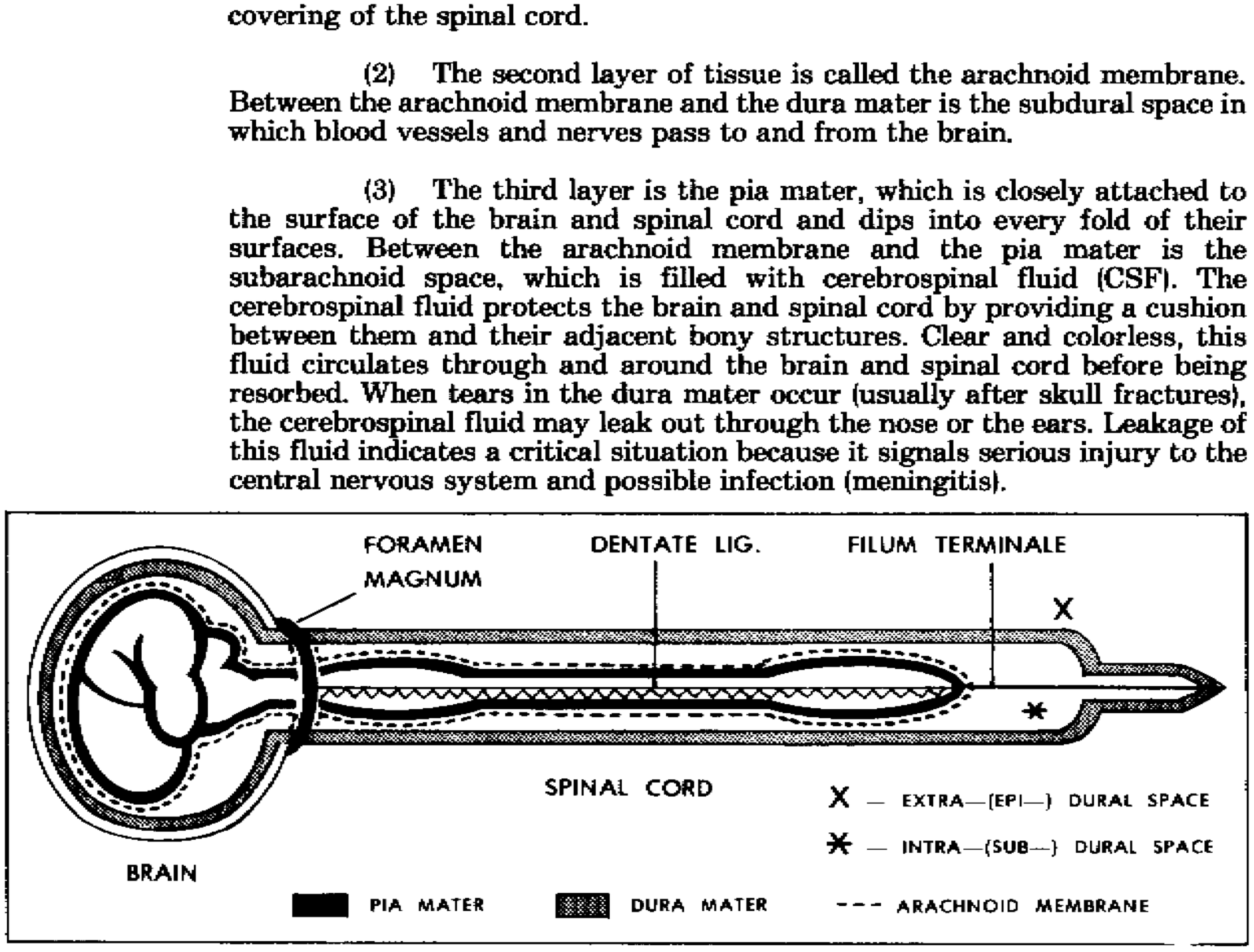


Figure 7-7. The covering membranes (meninges) suspend and protect the skull and spinal canal.

CHAPTER 8

THE DIGESTIVE SYSTEM

8-1. General

a. The digestive system is made up of the alimentary tract (food passage) and the accessory organs of digestion. Part of this system is also known as the gastrointestinal (GI) tract. Its main functions are to take in foods, initially process foods, digest the foods, and eliminate waste material. The products of the accessory organs help to prepare food for digestion and its absorption.

b. Digestion consists of two processes: one mechanical and the other chemical. The mechanical part of digestion includes chewing, swallowing, peristalsis (movement for propelling the stomach contents), and defecation. The chemical part of digestion consists of breaking food into simple components that can be absorbed and used by the body cells. In this process, foods are broken down by enzymes in the digestive juices formed by the digestive glands. Carbohydrates are changed into glucose (simple sugar), while fats are changed into fatty acids and proteins are converted into amino acids. These materials are used by the cells—

- As energy for life processes.
- For growth and repair of body tissues.

8-2. Structure of the Digestive System

The digestive system (Figure 8-1) consists of the following:

a. The alimentary canal is about 28 feet long (8.52 m), extending from the mouth (where food is taken in) to the anus (where solid waste products of digestion are expelled from the body). This passageway is divided into: the mouth, pharynx, esophagus, stomach, small intestine and associated glands, large intestine (colon), rectum, and anal canal and anus.

b. The accessory organs that aid the process of digestion are the salivary glands, pancreas, liver, gallbladder, and other intestinal glands.

8-3. Oral Complex

The oral cavity contains structures which together are commonly known as the mouth. The cavity takes in and initially prepares foods prior to the digestive process. See Figure 8-2.

a. Lips and Cheeks. The structure of the oral cavity is covered with fleshy tissues known as cheeks. The margins of the cheeks around the oral opening are the lips. Muscles in the lips control the opening and closing of the mouth.

b. Jaws. There are two jaws: the upper jaw, which is called the maxilla and the lower jaw, which is called the mandible.

(1) In each jaw, there are sockets for the teeth. These sockets are known as alveoli. The bony parts of the jaws holding the teeth are known as alveolar ridges.

(2) The upper jaw is fixed to the base of the cranium while the lower jaw is movable. There is a special articulation (temporomandibular joint) with muscles to bring the upper and the lower teeth together to perform their functions.

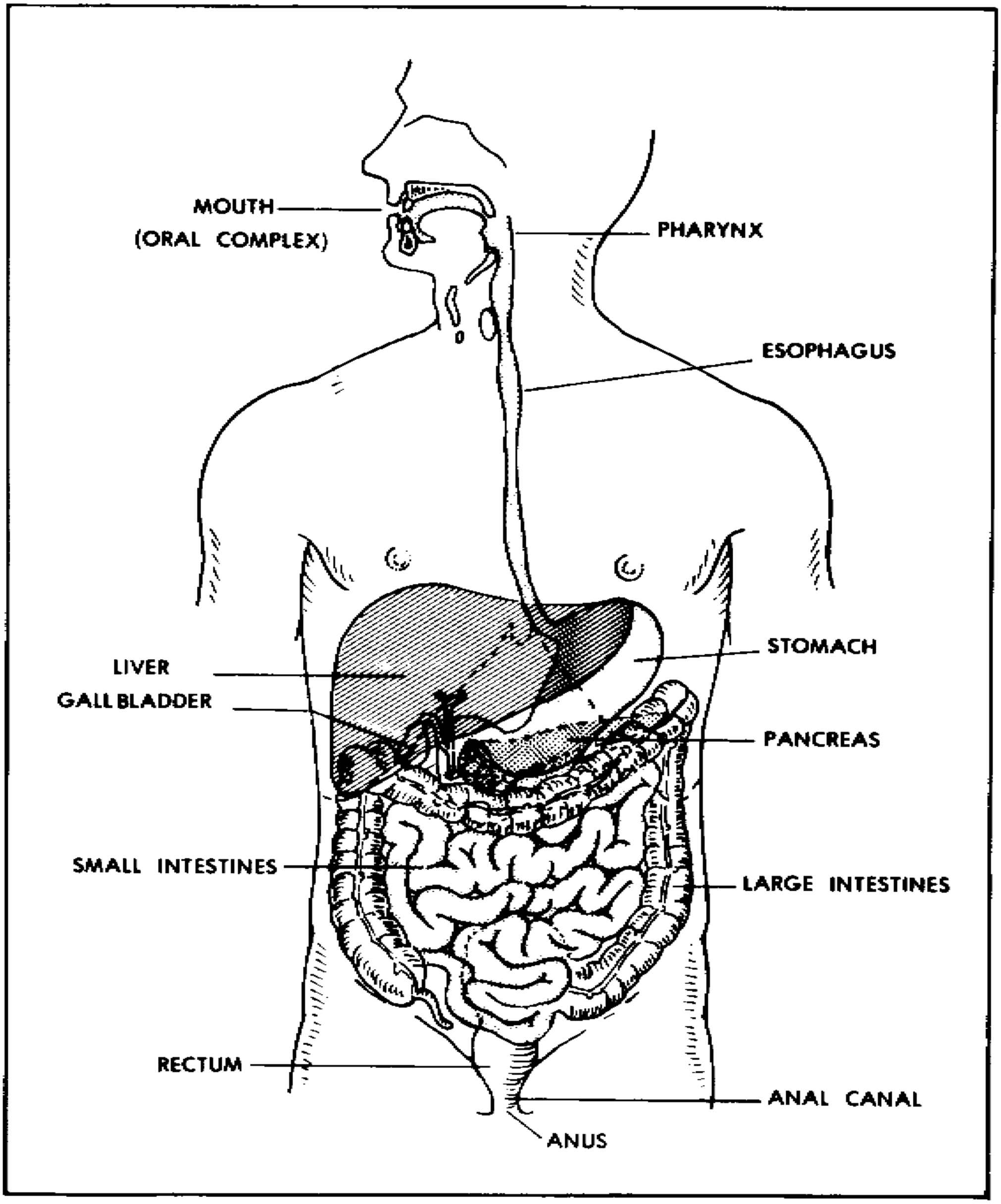


Figure 8-1. The digestive system.

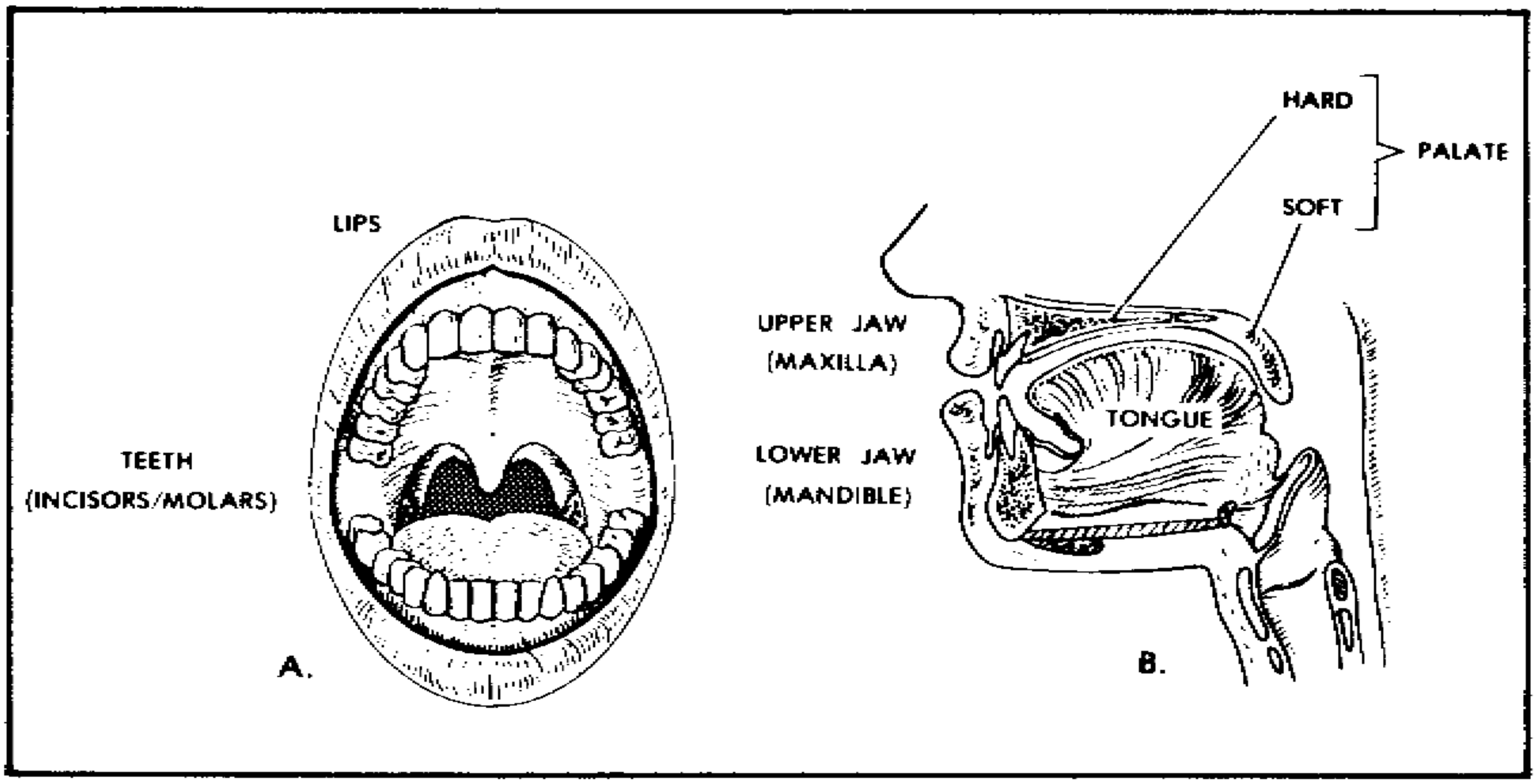


Figure 8-2. Anatomy of the oral cavity.

c. Teeth.

(1) A tooth (Figure 8-3) has two main parts: the crown and the root. A root canal passes up through the central part of the tooth. The root is suspended within a socket (called the alveolus) of one of the jaws of the mouth. The crown extends up above the surface of the jaw. The root and inner part of the crown are made of a substance called dentin. The outer portion of the crown is covered with a substance known as enamel. Enamel is the hardest substance of the body. The nerves and blood vessels of the tooth pass up into the root canal from the jaw substance.

(2) There are two kinds of teeth: anterior and posterior. The anterior teeth are also known as incisors and canine teeth and serve as choppers. They chop off mouth-sized bites of food items. The posterior teeth are called molars and are grinders. They increase the surface area of food materials by breaking them into smaller and smaller particles.

(3) There are two sets of teeth: deciduous and permanent. Initially, the deciduous set includes 20 baby teeth. These are eventually replaced by a permanent set of 32 teeth.

d. Palate. The palate serves as the roof of the mouth and the floor of the nasal chamber above. Since the anterior two-thirds is bony, it is called the hard palate. The posterior one-third is musculomembranous and is called the soft palate. The soft palate serves as a trap door to close off the upper respiratory passageway during swallowing.

e. Tongue. The tongue is a muscular organ that is capable of internal movement to shape its body. The tongue is moved as a whole by muscles outside of it. Interaction between the tongue and the cheeks keeps food between the molar teeth during the chewing process. When the food is properly processed, the tongue also initiates the swallowing process.

f. Taste Buds. Associated with the tongue and the back of the mouth are special clumps of cells known as taste buds. These taste buds literally taste the food; that is, they check its quality and acceptability.

g. Salivary Glands. Digestion is the process that converts food into chemical substances that can be absorbed and assimilated by the body. The chewing process greatly increases the surface area available. The surfaces are wetted by saliva produced by the salivary glands in the oral complex.

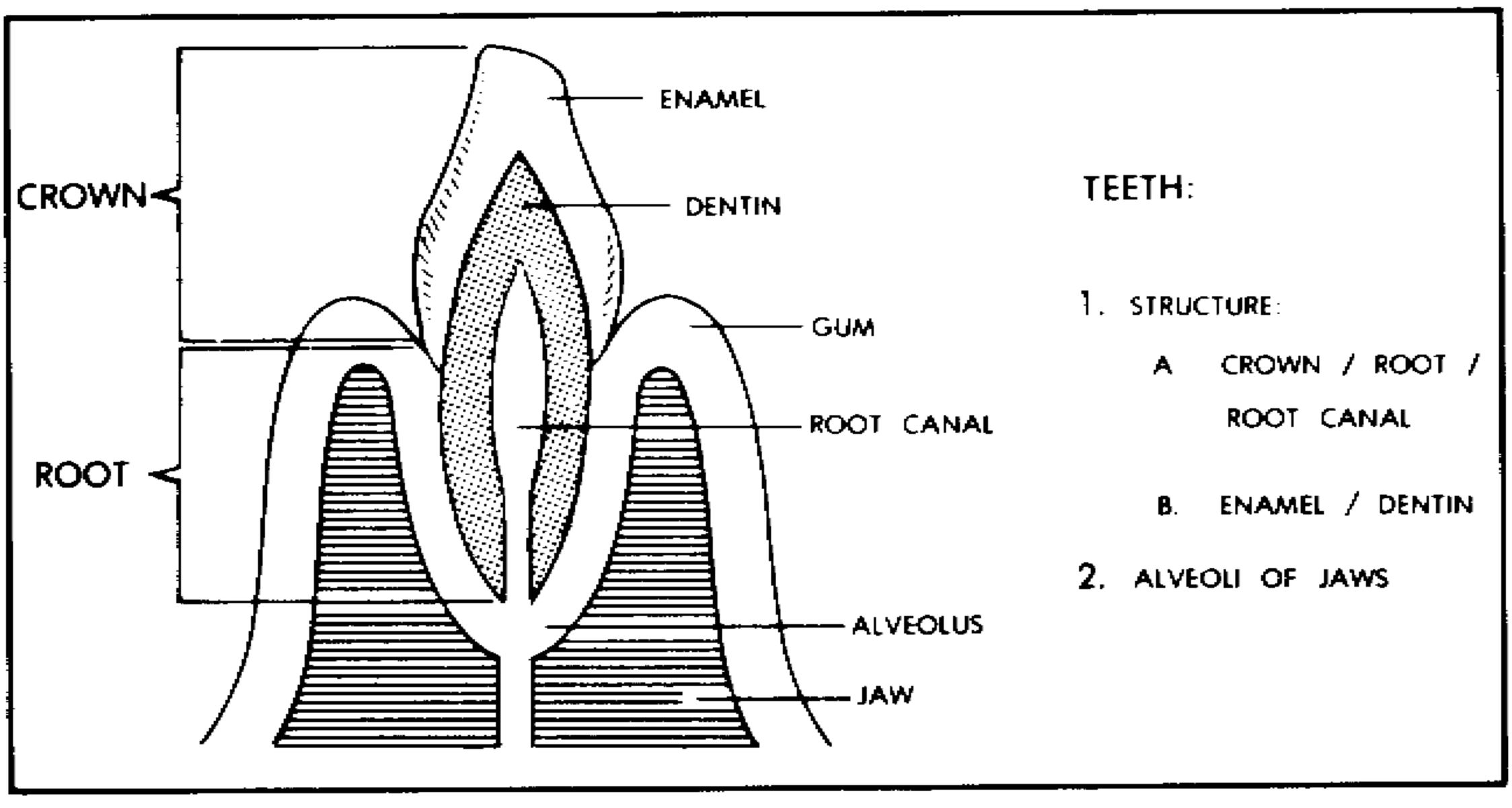


Figure 8-3. Section of a tooth and jaw.

8-4. Pharynx

The pharynx is a continuation of the back of the mouth region, just in front of the vertebral column (spine). It is a common passageway for both the respiratory and digestive systems.

8-5. Esophagus

The esophagus is a tube with muscular walls. It extends from the pharynx, down through the neck and the thorax (chest), to the stomach. During swallowing, the esophagus serves as a passageway for the food from the pharynx to the stomach.

8-6. Stomach

a. The stomach is a sac-like enlargement of the digestive tract specialized for the storage of food. The presence of valves at each end prevents the stored food from leaving the stomach before it is ready. The pyloric valve prevents the food from going further. The inner lining of the stomach is in folds to allow expansion.

b. While the food is in the stomach, the digestive processes are initiated by juices from the wall of the stomach. The musculature of the walls thoroughly mixes the food and juices while the food is being held in the stomach. The stomach has an extra layer of muscle fibers for this purpose.

c. When the pyloric valve of the stomach opens, a portion of the stomach contents moves into the small intestine.

8-7. Small Intestine and Associated Glands

The chemical process of digestion is facilitated by special chemicals called digestive enzymes. The end products of digestion are absorbed through the wall of the intestine into the blood vessels. These end products are then distributed to body parts that need them for growth, repair, or energy. There are associated glands—the liver and the pancreas—which produce additional enzymes to further the process. Most digestion and absorption takes place in the small intestine.

a. Anatomy of the Small Intestine.

(1) The small intestine is divided into three areas: the duodenum, jejunum and ileum. The duodenum is C-shaped, about 10 inches (25.40 cm) long in the adult. It is looped around the pancreas. The jejunum is approximately 8 feet (2.4 m) long and connects the duodenum and the ileum. The ileum is about 12 feet (3.6 m) long. The jejunum and the ileum are attached to the posterior wall of the abdomen with a membrane called the mesentery. This membrane allows mobility and serves as a passageway for nerves and vessels to the small intestine.

(2) The small intestine is tubular. It has muscular walls that produce a wave-like motion (called peristalsis) which moves the contents along. The small intestine is just the right length to allow the processes of digestion and absorption to take place completely.

(3) The inner surface of the small intestine in NOT smooth; it has folds known as plicae. On the surface of these plicae are fingerlike projections called villi. These folds and the presence of villi increase the surface area available for absorption.

b. Liver. The liver is a large and complex organ. Most of its mass is on the right side of the body and within the lower portion of the rib cage. Its upper surface is in contact with the diaphragm. The liver is a complex chemical factory with many functions. These include aspects of carbohydrate, protein, lipid, and vitamin metabolism and processes related to blood clotting and red blood cell destruction. Its digestive function is to produce a fluid called bile or gall.

c. Gallbladder. Until needed, the bile is stored and concentrated in the gallbladder, a sac on the inferior surface of the liver. Fluid from the gallbladder flows through the cystic duct, which joins the common hepatic duct from the liver to form the common bile duct. The common bile duct then usually joins with the duct of the pancreas as the fluid enters the duodenum.

d. Pancreas. The pancreas is a soft, pliable organ stretched across the posterior wall of the abdomen. When needed, it secretes its powerful digestive fluid, known as pancreatic juice, into the duodenum. The pancreatic duct joins the common bile duct.

8-8. Large Intestine

a. The primary function of the large intestine is salvaging water and electrolytes (salts). (Most of the end products of digestion have already been absorbed in the small intestine by the time they reach the large intestine.) Within the large intestine, the contents are first a watery fluid. Thus, the large intestine is important in the conservation of water for use by the body. The large intestine removes water until a nearly solid mass is formed before defecation (the evacuation of feces). Vitamin K, which is very important in blood clotting, is produced by microorganisms located in the large intestine. Antibiotics potentially may decrease production of vitamin K, but this is rarely of any practical significance.

b. The major subdivisions of the large intestine are the cecum (with the vermiform or "worm-shaped" appendix), ascending colon, transverse colon, descending colon, and sigmoid colon. The colon extends along the right side of the abdomen from the cecum up to the region of the liver (ascending colon). There the colon bends (hepatic flexure) and continues across the upper portion of the abdomen (transverse colon) to the spleen. The colon bends again (splenic flexure) and goes down the left side of the abdomen (descending colon). The last portion makes an S curve (sigmoid colon) toward the center and posterior of the abdomen and ends in the rectum of the pelvic cavity. The fecal mass is stored in the sigmoid colon until it is passed into the rectum.

8-9. Rectum, Anal Canal, and Anus

The rectum is a tubular structure about 6 inches (15.24 cm) long and follows the curve of the sacrum and coccyx until it bends back into the short anal canal. The anal canal is the last 1 1/2 inches (3.81 cm) beyond the rectum. It has an external opening (anus) to the exterior at the lower end of the digestive system. The anus is kept closed by strong sphincter muscles. By the action of peristalsis, the rectum receives feces and periodically expels this material through the anus. This elimination of waste is called defecation.

8-10. Time Required for Digestion

The time required for digestion varies greatly depending (among other things) on the type of meal consumed. In general, though, within a few minutes after a meal reaches the stomach, it begins to pass through the lower valve of the stomach. After the first hour the stomach is half empty, and at the end of the sixth hour none of the meal is present in the stomach. The meal goes through the small intestine, and the first part of it reaches the cecum in 20 minutes to 2 hours. At the end of the sixth hour, most of it should have passed into the

colon; in 12 hours all should be in the colon. Within 24 hours from the time food is eaten, the meal should reach the rectum. However, part of a meal may be defecated (eliminated) at one time and the rest at another time.

8-11. Special Protective Mechanisms

a. The digestive system is essentially a continuous tube open at both ends. Therefore, the cavity connects directly with the surrounding environment. Along with the ingested food, toxic materials, microorganisms, and even foreign bodies can pass through the mouth into the digestive system.

b. Within the body, there are many substances that aid in protection from bacteria, viruses, and other foreign substances. These structures include cells that can phagocytize (engulf) foreign particles or manufacture antibodies (which help to inactivate foreign substances). Collectively, such cells make up the reticuloendothelial system (RES). Such cells are found in bone marrow, the spleen, the liver, and the lymph nodes.

c. Lymphoid structures make up the largest part of the reticuloendothelial system. Lymphoid structures are collections of cells associated with the circulatory system.

(1) Tonsils are masses of lymphoid tissue. Tonsils are found in the region of the pharynx. Three pairs of tonsils (lingual, pharyngeal, and faucial) are found at the beginning of the pharynx. Together they form a ring of lymphoid tissue. This ring, called Waldeyer's ring, completely surrounds the entrance to the pharynx from both the mouth (digestive entrance) and the nose and nasal chambers (respiratory entrance).

(a) In the upper recess of the pharynx is the pair of pharyngeal tonsils (commonly known as adenoids).

(b) On either side, below the soft palate, are the palatine (faucial) tonsils. These are the tonsils that one sees most frequently in small children.

(c) On the back of the root of the tongue are the lingual tonsils.

(2) Lymphoid aggregates of varying sizes are found in the walls of the small intestine. In the ileum portion, in particular, these aggregates are large enough to be observed and are called Peyer's patches. These might be considered "tonsils" of the small intestine.

(3) At the beginning of the large intestine, at the inferior end of the cecum, is a structure known as the vermiform appendix. Since the vermiform appendix is actually a collection of lymphoid tissue, it should be considered the "tonsil" of the large intestine.

CHAPTER 9

THE UROGENITAL SYSTEM

9-1. General

The urinary and genital systems are discussed together because their various organs and passages develop from the same embryologic beginnings, and they share many structures. The urinary system is made up of the organs which control the discharge of certain waste materials filtered from the blood. The genital system controls the reproductive processes from which life is created.

9-2. The Urinary System

The major parts of the urinary system include two kidneys, two ureters (one connecting each kidney to the urinary bladder), the urinary bladder, and the urethra (Figure 9-1). The urinary system helps the body maintain its delicate balance of water and various chemicals in the proportions needed for good health. During the process of urine formation, waste products are removed from circulating blood for elimination, and useful products are returned to the blood.

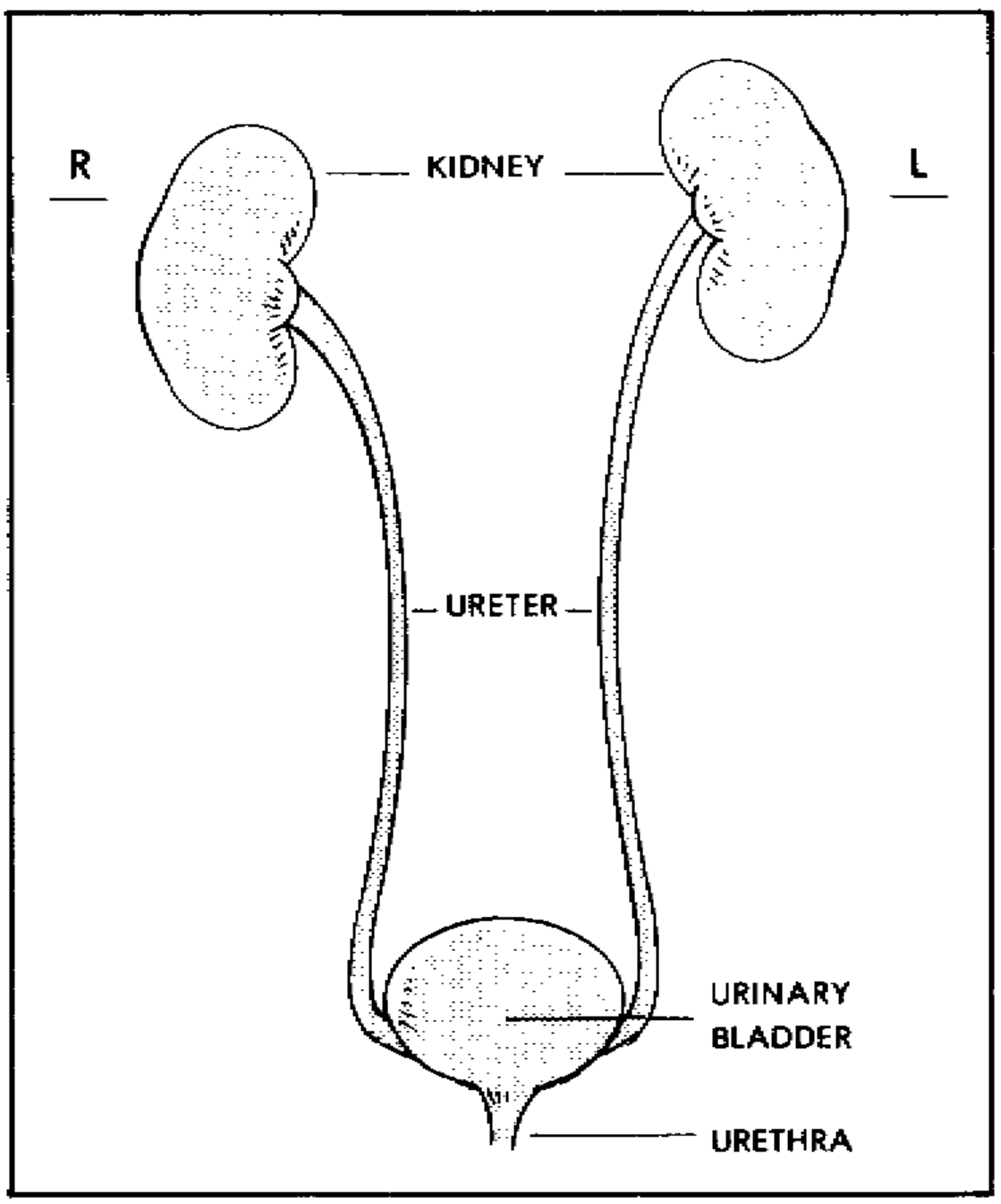


Figure 9-1. The urinary system.

9-3. Kidneys

a. The kidneys are a pair of reddish-brown organs lying against the posterior muscular wall of the abdominal cavity, near the level of the last thoracic vertebrae and the first lumbar vertebrae. The right kidney is usually slightly lower than the left. Each kidney is a bean-shaped organ 4 to 5 inches (10.2 to 12.7 cm) long.

b. The kidney (Figure 9-2) is composed of an outer shell (or cortex) and an inner layer (the medulla). The cortex is made of firm, reddish-brown tissue containing millions of microscopic filtration plants called nephrons. Nephrons are urine-forming units that receive and filter all of the body's blood approximately once every 12 minutes. During this period, they draw off and filter the liquid portion of the blood, remove liquid wastes (urine), and return the usable portion to the circulatory system to maintain the body's fluid balance.

c. Nephrons are complex structures which perform every aspect of urine formation. Each nephron has a capsule (Bowman's capsule) containing a cluster of filtering capillaries called glomerulus. Leading from the capsule is a continuous looped tubule. The water, salts, waste products, and usable products pass from the capsule to the tubules; usable products and water are then reabsorbed. The final waste product (urine) drains from the last loop of the tubule. The glomerulus, the capsule, and the loops of the tubule together form a nephron. Each part is essential for the coordination, filtration, reabsorption, and excretion processes.

d. Channels called collecting tubules form larger tubes and deliver the urine to the pelvis of the kidney.

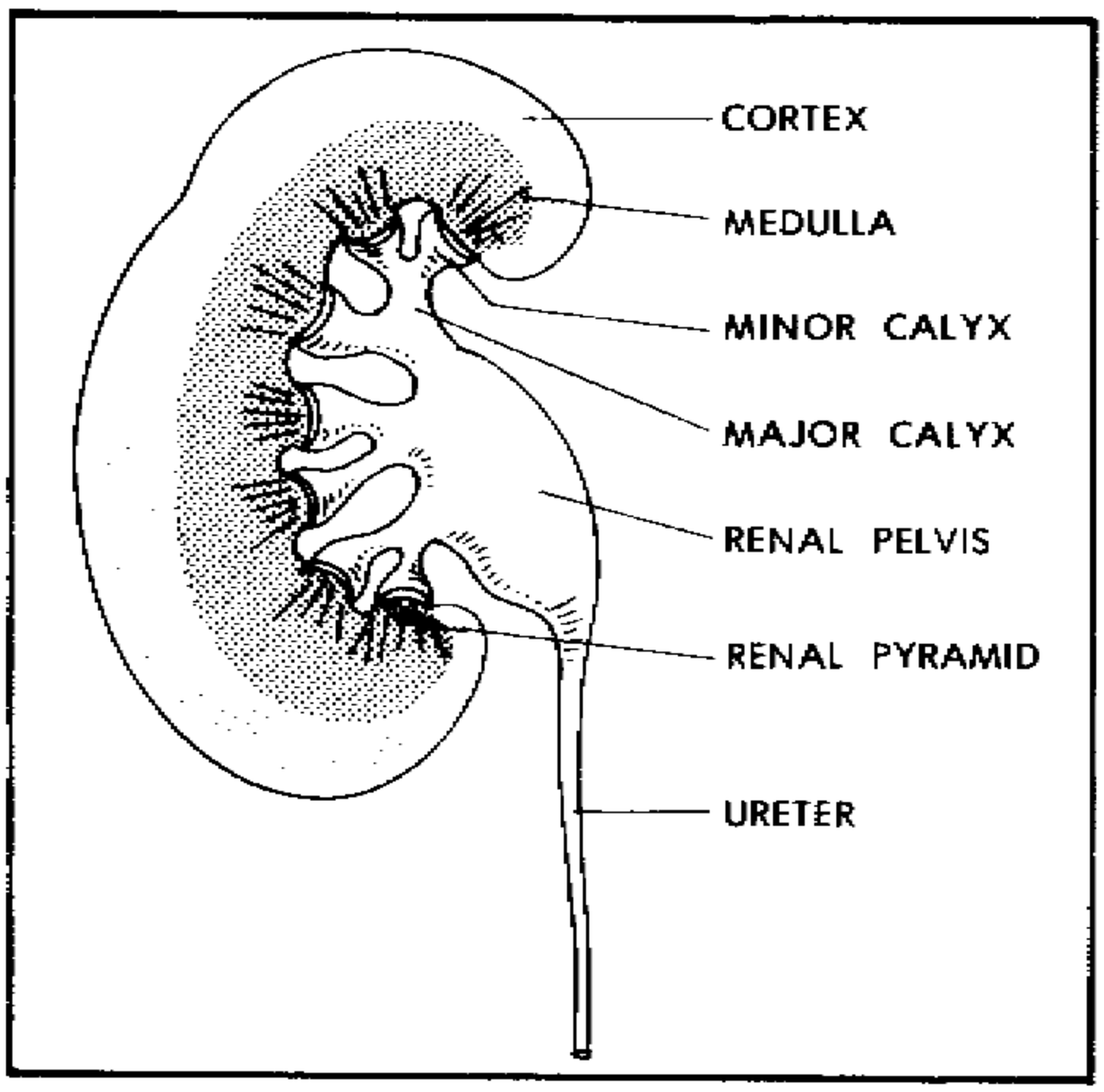


Figure 9-2. Cross section of kidney.

9-4. Ureters

The pelvis of each kidney is drained by a ureter, a muscular tube extending from the kidney to the posterior portion of the urinary bladder. Ureters are smooth muscle structures, and urine is passed through each ureter by peristalsis into the bladder. Ureters are about 15 to 18 inches (38 to 45.7 cm) in length and about 1/5 inch (.5 cm) in diameter.

9-5. Urinary Bladder

The urinary bladder is a muscle sac formed of smooth muscle with a specialized lining membrane. It is located in the lowest part of the abdominal cavity and its purpose is to store urine. Normally it holds 300 to 500 ml of urine. The bladder is emptied by contraction of muscles in its walls, which force urine out through the urethra.

9-6. Urethra

The urethra is the tube that carries urine from the urinary bladder to the external opening, the urinary meatus. In the male, the urethra varies in length. Including the portion within the body, it is about 6 to 7 1/2 inches (15 to 19 cm) long. It is divided into three areas: the prostatic, which passes through the prostate gland; the membranous area, beneath the prostate; and the penile area (anterior), which passes through the penis. The female urethra, about 1 1/2 inches (3.8 cm) long, extends from the bladder to the urinary meatus, which is located above the vaginal opening.

9-7. Urine

Normal urine is a transparent (clear) fluid varying in color from amber or pale yellow to a brownish hue. Freshly voided urine has a characteristic aromatic odor, while stale urine has a strong ammonia odor. The average quantity of urine excreted by a normal adult in 24 hours ranges from 1,500 to 2,000 ml, depending upon the fluid intake, amount of perspiration, and other factors. Urine contains protein wastes (urea), salts in solution, hormones, and pigments. (Normal urine should not contain blood, albumin, sugar, or pus cells.)

9-8. Urination

Urination (micturition) is the discharge or voiding of urine. It is accomplished by a contraction of the bladder and relaxation of the sphincters. In the adult, urination is largely an autonomic (involuntary) function, which can, however, be controlled voluntarily. Voluntary contraction of abdominal muscles can aid in urination.

9-9. The Genital System

The male and female genital (reproductive) systems have their own specialized internal and external organs, passageways, and supportive structures. The parts and functions of these systems are designed to make the process of fertilization possible. The female cell, the ovum, must be fertilized by the male cell, spermatozoa. The normal result of fertilization is reproduction.

9-10. The Male Reproductive System

The male reproductive system includes the scrotum, testicles, vas deferens (seminal duct), seminal vesicles, ejaculatory ducts, prostate gland, urethra, and penis. The penis, testicles, and scrotum are referred to as the external genitalia (see Figure 9-3).

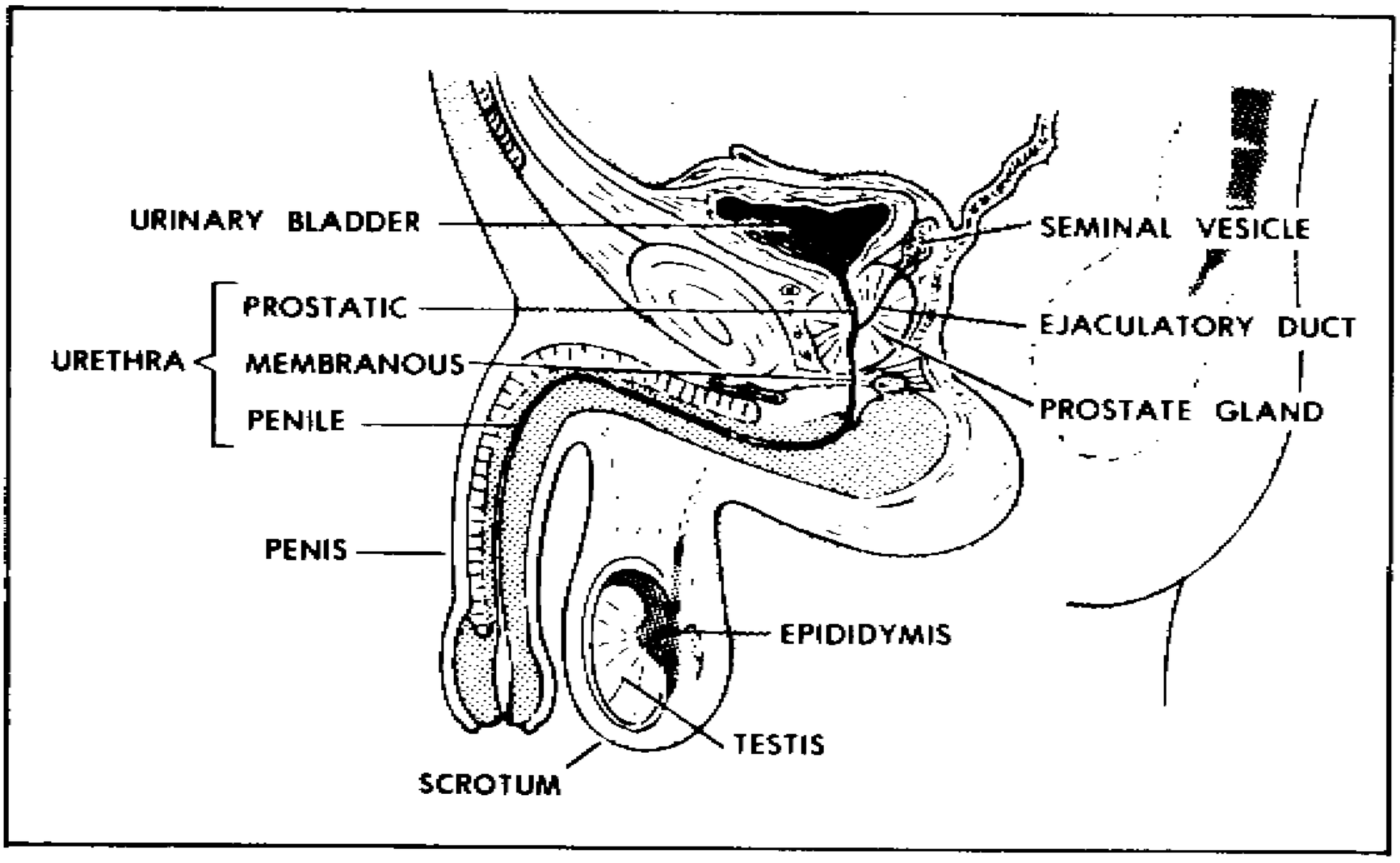


Figure 9-3. Male urogenital system.

a. The Scrotum, Testicles (Testes), and Epididymis. There are two testicles (testes), one on each side of the septum of the scrotum. A testicle (testis) is an oval-shaped gland, about 1 1/2 to 2 inches (3.8 to 5 cm) in length. Each testicle contains specialized cells that produce germ cells called spermatozoa (or sperm), and the male hormone, testosterone. The hormone is absorbed directly into the blood from the testicles. Sperm are produced in great numbers, starting at the age of puberty. Although microscopic in size, each sperm has a head, which contains a cell nucleus, and an elongated tail for movement. Sperm travels from the testicles to a tightly coiled tube, the epididymis. The vas deferens is a continuation of the epididymis.

b. The Vas Deferens. This duct carries sperm from the scrotum to the pelvic cavity. As the duct leaves the scrotum, it passes through the inguinal canal into the pelvic cavity as part of the spermatic cord. Spermatic cords, in the groin, are supporting structures. Each vas deferens curves around the bladder and delivers the sperm to one of two storage pouches, called the seminal vesicles.

c. The Seminal Vesicles and the Ejaculatory Ducts. The seminal vesicles are located behind the bladder. These vesicles constitute small storage sacs for sperm and seminal fluid. During the storage of sperm in these vesicles,

secretions are added to the sperm to keep them alive and motile. These secretions and the sperm form the seminal fluid (or semen). Ejaculatory ducts carry this seminal fluid from the seminal vesicles, through the prostate gland, and empty into the urethra.

d. The Prostate Gland. The prostate gland is a small gland that surrounds the urethra at the neck of the bladder. Prostatic secretions are added to the seminal fluid to protect it from urethral secretions and female vaginal secretions. During the act of intercourse, special mechanisms in the nervous system prevent the passage of urine into the urethra. Only seminal fluid, prostatic fluid, and sperm pass from the penis into the vagina during ejaculation. When the prostate gland becomes enlarged (hypertrophied), it can seriously constrict the urethra. The size and consistency of the prostate gland is determined by the physician by means of a rectal examination.

e. The Urethra and the Penis. The urethra, a passageway for seminal fluid and for urine, has its longest segment in the penis. Several glands add secretions to the urethra, the largest being two bulbo-urethral (or Cowper's) glands. The terminal opening of the urethra is in the glans penis, which is surrounded by a retractable fold of skin called the foreskin, or prepuce. Surgical removal of this foreskin is called a circumcision, which is performed to reduce the possibility of an abnormal constriction of the glans, called phimosis, or to reduce the possibility of irritation from secretions that accumulate under the foreskin. The penis has a special type of tissue called erectile tissue. When filled with blood, this special tissue causes the penis to distend into a state of erection. Thus, the penis becomes a rigid organ that can enter the vagina.

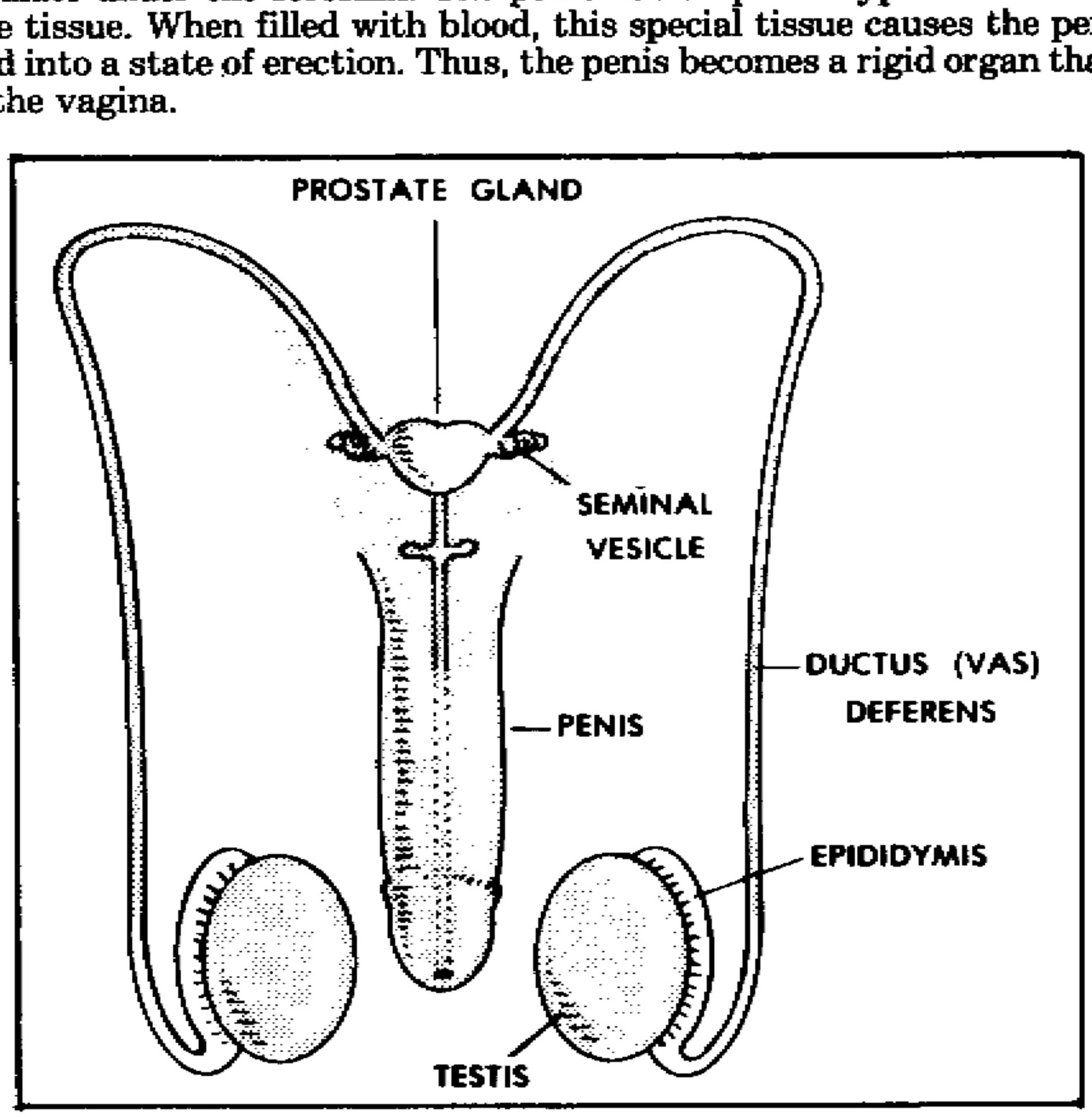


Figure 9-4. Diagram of the male reproductive system.

9-11. The Female Reproductive System

The female reproductive organs include the ovaries, fallopian tubes, uterus, vagina, and external genitalia (the vulva). The supportive structures for the internal reproductive organs are a complicated arrangement of pelvic ligaments, which are formed in part from folds of peritoneum that line the abdomino-pelvic cavity. A detailed discussion of the female reproductive system is contained in Section I, Chapter 15.

a. The Ovaries. These are two almond-shaped glands, one on either side of the abdomino-pelvic cavity. The ovaries, like the testicles, produce sex hormones (estrogen and progesterone) and specialized germ cells, ova, for reproduction. The female sex hormones are absorbed directly into the blood and aid in maintaining the normal menstrual cycle. A specialized cell, called an ovum, is expelled from the surface of an ovary in a process called ovulation, which occurs about halfway between each menstrual period. An expelled ovum is picked up by the free end of a fallopian tube for movement to the uterus.

b. Fallopian Tubes. The fallopian tubes are connected to the uterus and carry the ovum to the cavity of the uterus. There are two fallopian tubes (oviducts) each curving outward from the upper part of the uterus. Each tube is approximately 4 inches in length and has a free end which curves around, but is not attached to, an ovary. The fringed surface of the free end of the fallopian tube carries an expelled ovum into the tube, and the ovum moves slowly on its way to the uterus. If fertilization takes place, it normally occurs as the ovum moves through this tube. The male germ cell, the sperm, must therefore travel up the female reproductive tract in order to unite with the female germ cell, the ovum. Of the millions of sperm produced, only one must unite with one ovum for fertilization to occur.

c. The Uterus. The uterus, shaped somewhat like a pear, is suspended in the pelvic cavity, supported between the bladder and the rectum by its system of eight ligaments. The normal position of the body of the uterus is anteflexion (bent forward over the bladder) (Figure 9-5). The uterus is about 3 inches (7.6 cm) long and 3 inches (7.6 cm) thick at its widest part. It has a thick wall of smooth muscle and a relatively small inner cavity. During pregnancy, it can increase about 20 times in size. The upper dome-shaped portion of the uterus is the fundus, the main part is the body, and the lower neck portion is the cervix (Figure 9-6). The cervix is a canal that opens into the vagina. The inner lining of the uterus, the endometrium, undergoes periodic changes during the regular menstrual cycle, to make the uterus ready to receive a fertilized ovum. If the ovum is not fertilized, the endometrium gets a message from hormone influences and sheds its surface cells and built-up secretions. Some of the extra blood supply, the surface cells, and uterine secretions are eliminated as menstrual flow.

d. The Vagina. This muscular canal extends from the cervix portion of the uterus to the vaginal opening in the vestibule of the vulva. The vaginal canal is capable of stretching widely and serves as the birth canal. Part of the cervix protrudes into the uppermost portion of the vagina. An important part of a female pelvic examination is the physical examination of the visible surface of the cervix and vagina, plus a laboratory examination of cervical and vaginal secretions. A Pap (Papanicolaou) smear is made by obtaining these secretions for laboratory examination.

e. The Vulva. The several structures that make up the female external genitalia form the vulva. These are the mons pubis, the labia, the clitoris, and the vestibule. The labia, two parallel sets of liplike tissues, are the labia majora (the larger outer folds of tissue) and the labia minora (the small inner folds). The clitoris is located at the upper meeting point of the labia majora and the labia minora. Between the labia minora is the vestibule, a shallow depression into which the urethra and the vagina open. The urethral opening is above the vaginal opening. A series of glands which can become infected open into the vestibule, the largest being the Bartholin glands at the vaginal opening.

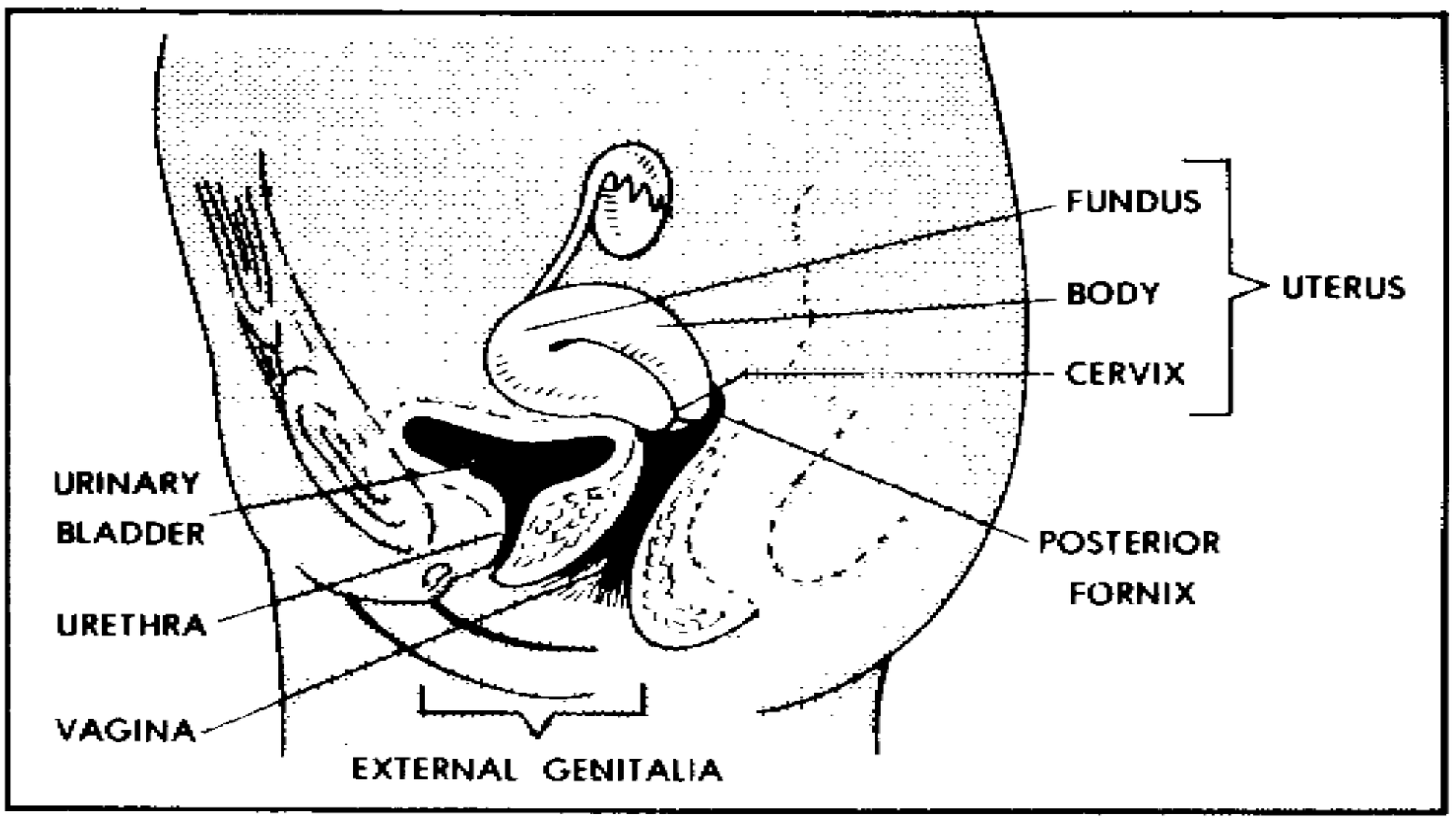


Figure 9-5. Female urogenital system.

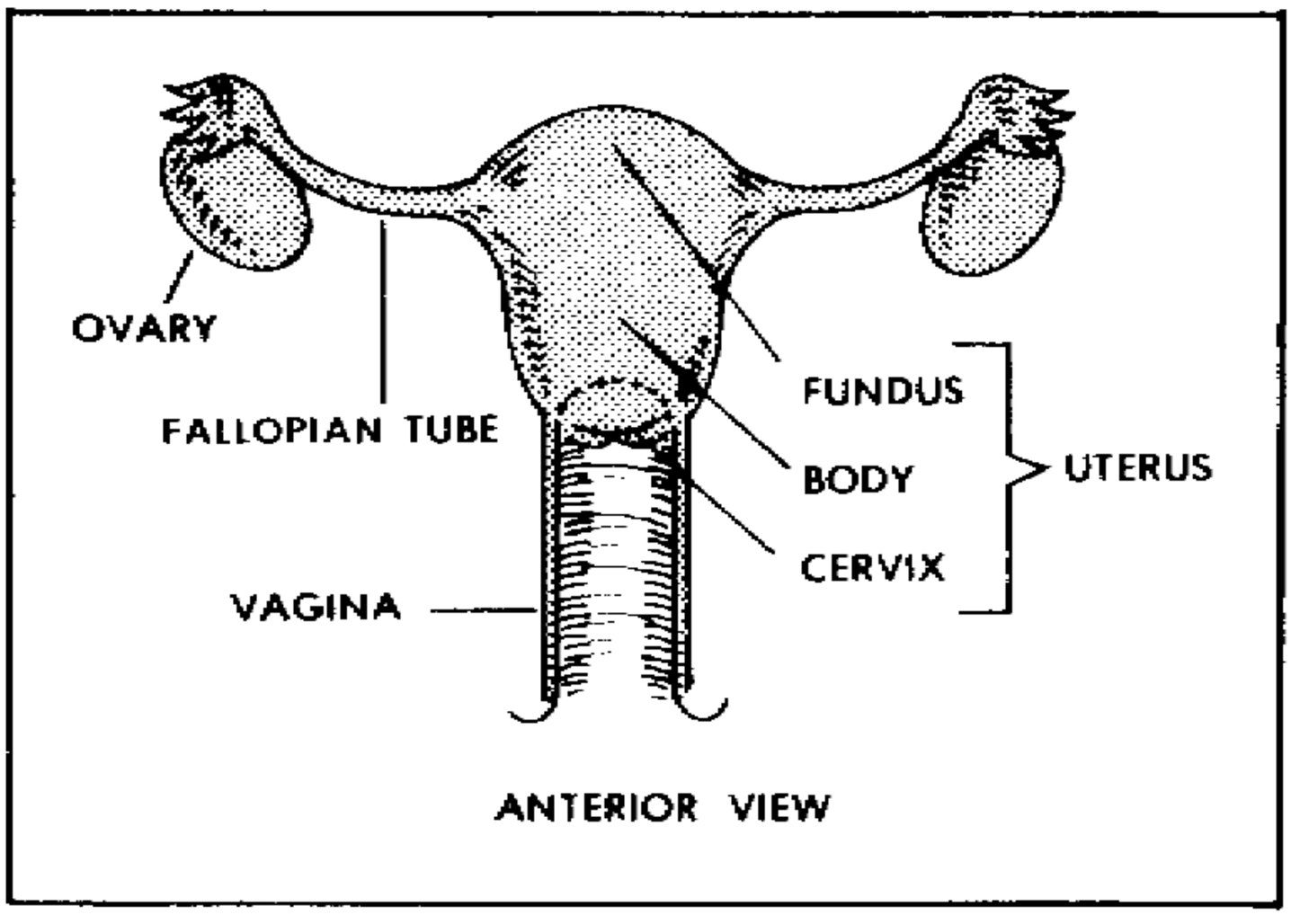


Figure 9-6. Female reproductive organs (frontal section).

9-12. Menstruation

a. The menstrual period is the end of the monthly female reproductive cycle. This process begins at puberty and is repeated, except when interrupted by disease or pregnancy, approximately every 28 days until a female passes through menopause at about 40 to 50 years of age.

b. Each month the endometrium (lining of the uterus) is stimulated by the female sex hormones to form a special bed. This bed (which is a very thin layer of cells and blood) is prepared so that if a sperm and an ovum unite, making a fertilized egg, the uterus will be able to receive it and provide a place for it to grow.

c. If the ovum is not fertilized, there will be a menstrual period. During this period, the uterus will shed its recently formed special lining. The lining, in the form of menstrual flow, will be expelled from the uterus through the vagina and out of the body. The flow will last about 5 days.

CHAPTER 10

THE ENDOCRINE SYSTEM

10-1. General

The endocrine system is made up of glands of internal secretion (ductless glands) located in different parts of the body (Figure 10-1). Hormones produced by endocrine glands are secreted directly into the circulating blood and reach every part of the body. These hormones influence the activities of specific organs and tissues, as well as the activities of the body as a whole. Small in quantity, but powerful in action, hormones are part of the body's chemical coordinating and regulating system. There are six recognized endocrine glands:

- Pituitary body.
- Thyroid gland.
- Parathyroid gland.
- Pancreatic islets (islets of Langerhans).
- Suprarenal (adrenal) glands.
- Gonads (female—ovaries; male—testes).

10-2. The Pituitary Body

The pituitary body is a small and pea-shaped structure attached to the base of the brain in the region of the hypothalamus (Figure 10-1). It is housed within a hollow of the bony floor of the cranial cavity called the sella turcica (Turk's saddle). The pituitary body consists of two glands: the posterior pituitary gland and the anterior pituitary gland. These glands are initially separate but join together during development of the embryo.

a. Posterior Pituitary Gland. The posterior pituitary gland is the portion that comes from and retains a direct connection with the base of the brain. The hormones of the posterior pituitary gland are actually produced in the hypothalamus of the brain. From the hypothalamus, the hormones are delivered to the posterior pituitary gland where they are released into the bloodstream. There are two recognized hormones of the posterior pituitary gland:

(1) Antidiuretic hormone (ADH) is involved with the resorption or salvaging of water within the kidneys. This hormone is produced under thirst conditions.

(2) Oxytocin is involved with contractions of smooth muscle in the uterus and with milk secretion.

b. Anterior Pituitary Gland. The anterior pituitary gland originates from the roof of the embryo's mouth. It then "attaches" itself to the posterior pituitary gland. The anterior pituitary gland is indirectly connected to the hypothalamus by means of a venous portal system. Portals are the veins that carry substances from the capillaries of one point to the capillaries of another point. In the hypothalamus, certain chemicals known as releasing factors are produced. These are carried by the portal system to the anterior pituitary

gland where they stimulate the cells of that gland to secrete their specific hormones. The anterior pituitary gland produces many hormones. In general, these hormones stimulate the target organs to develop or produce their own products. This stimulating effect is referred to as trophic. Of the many hormones produced by the anterior pituitary gland, two are of particular importance:

(1) Somatotrophic hormone (growth hormone), whose target organs are the growing structures of the body. This hormone influences such structures to grow as the body matures.

(2) Adrenocorticotrophic hormone (ACTH), which stimulates the cortex of the suprarenal (adrenal) gland to produce its hormones. The hormones of the suprarenal cortex are involved with anti-inflammatory reactions of the body.

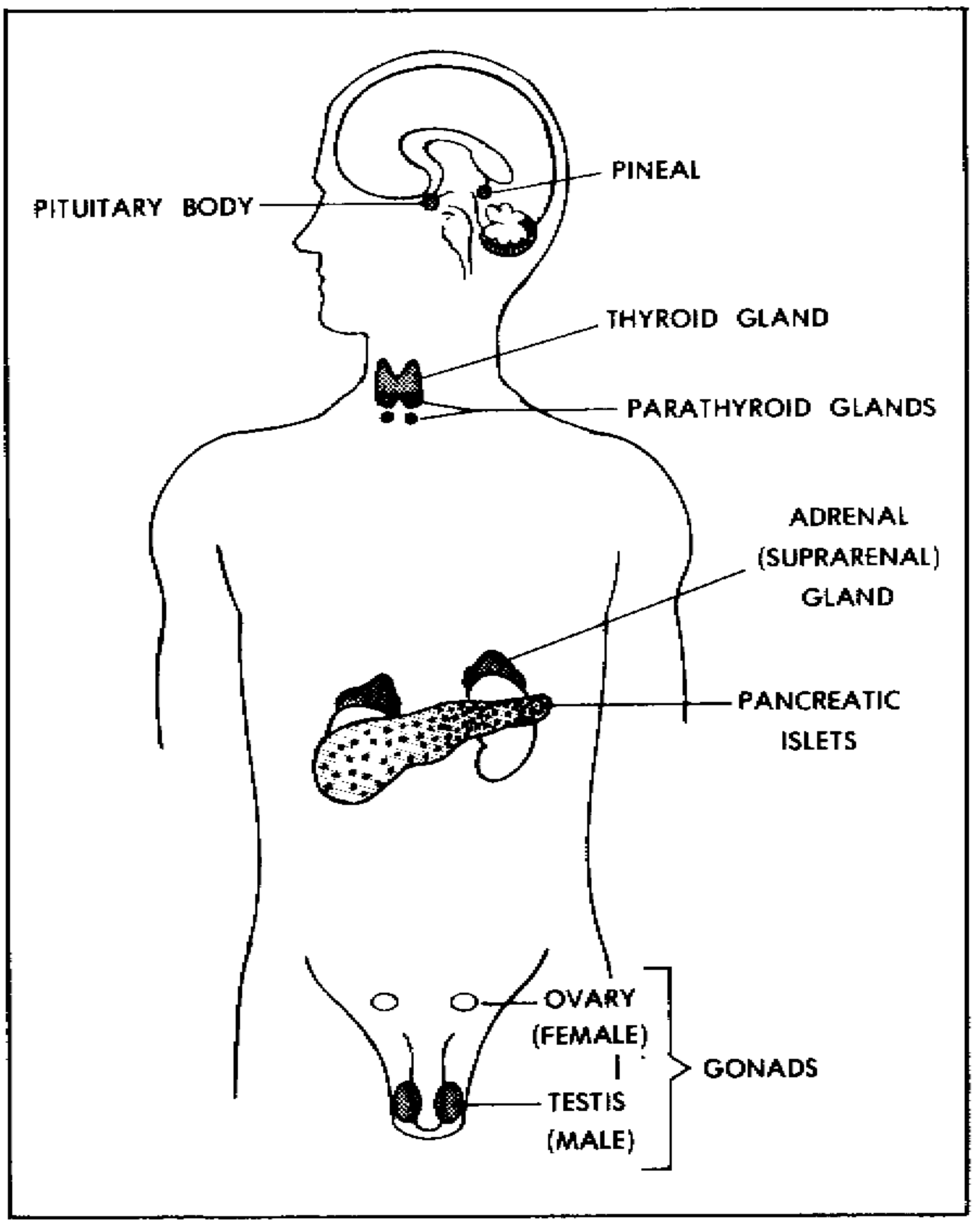


Figure 10-1. The endocrine glands and their locations.

10-3. The Thyroid Gland

This gland is in the neck region just below the larynx and surrounds the trachea. The right and left thyroid lobes are the masses on either side of the trachea. The isthmus is found across the front of the trachea and connects the two lobes. Each lobe is supplied by arteries from above and below (superior and inferior thyroid arteries). The thyroid produces two hormones:

a. Thyroxin, which affects the basal metabolic rate (BMR), or level of activity of the body. Since iodine is a necessary element in the production of thyroxin, malformations of the thyroid gland (called goiters) can be observed where there is little or no iodine available.

b. Calcitonin, which is produced by the thyroid gland, is involved with calcium metabolism in the body.

10-4. The Parathyroid Glands

The parathyroid glands are two pairs of small, round tissue masses. These glands are located on the posterior aspects of both thyroid lobes. The hormone produced by these glands is called parathyroid hormone, or parathormone. It is involved with the body's calcium metabolism.

10-5. The Pancreatic Islets (Islets of Langerhans)

Within the pancreas are distributed small groups of cells known as islets. Although the pancreas is a ducted gland of the digestive system, these isolated islets are, in fact, ductless glands. Insulin and glucagon are the two most commonly recognized hormones of the islets. These hormones are involved with glucose metabolism.

10-6. The Suprarenal (Adrenal) Glands

Embedded in the fatty layer above each kidney is a suprarenal gland. Both suprarenal glands have an internal medulla and an external cortex.

a. Hormones of the Suprarenal Medulla. The medullary portion of each suprarenal gland produces a pair of hormones: epinephrine (adrenaline) and norepinephrine (noradrenaline). These hormones are involved in the mobilization of energy during stress reactions.

b. Hormones of the Suprarenal Cortex. Each suprarenal cortex produces a variety of hormones that can be grouped into three categories:

(1) Mineralocorticoids, which are involved with the electrolytes of the body.

(2) Glucocorticoids, which are involved with many metabolic functions and are anti-inflammatory in nature.

(3) Sex hormones.

10-7. The Gonads

The primary sex organs are known as gonads. The gonads produce sex cells (gametes) and sex hormones. These sex hormones are in addition to those produced by the suprarenal cortex (see paragraph 10-6*b*).

a. Female Sex Hormones. In the female, the ovaries produce two types of sex hormones during the menstrual cycle. During the first half of the cycle (days 1 to 14), the estrogens are produced. During the last half of the cycle (days 15 to 28), progesterone is produced. These hormones are involved with female sexuality and the preparation of female sex organs for reproduction.

b. Male Sex Hormones. In the male, certain cells of the testes produce the male sex hormones known as androgens (for example, testosterone). Androgens are involved with male sexuality.

CHAPTER 11

THE SENSORY SYSTEM

11-1. General

Sensations of smell, taste, sight, hearing, and equilibrium are usually referred to as special senses. These sensations are received through specialized sense organs or receptors which are sensitive to specific stimuli. Other sensations such as touch, pressure, pain, heat, and cold are received through receptors in the skin, underlying tissue, and viscera. Impulses for both special and other senses are carried by sensory nerve pathways to the cerebrum. There the impulses are converted into sensation and perception (awareness or consciousness of sensation). The parts of the sensory mechanism are (1) the sense organ or receptor, (2) the pathway by which the impulse is conducted into the central nervous system, and (3) the sensory center in the cerebrum. The sensory mechanisms of the special senses are summarized as follows:

a. Smell. Cells located in the olfactory membrane of the nose are stimulated by odors. The olfactory membrane is located in the uppermost part of the nose. Impulses from receptors for odors are transmitted by the olfactory nerve. Although olfactory receptor cells are quite sensitive, they can also become fatigued. Smell is considered a primitive sense and the detection of odor is more highly developed in animals than in man.

b. Taste. Sense organs for taste are the taste buds, located on the surface of the tongue. The primary taste sensations are sweet, sour, salty, and bitter. The actual sensation of taste is influenced by the sense of smell. Taste sensation is usually dulled when nasal membranes are congested. Impulses from taste receptors are transmitted by the facial and glossopharyngeal nerves.

c. Sight. Cells in the retina of the eye are stimulated by light rays entering the eye. These stimuli create impulses that are carried by the optic nerve.

d. Hearing. Cells in the cochlea of the inner ear are stimulated by vibration of sound waves. These stimuli create impulses that are carried by the acoustic (auditory) nerve.

e. Equilibrium. In addition to receptors for hearing, the internal ear contains three semicircular canals which regulate the sense of equilibrium. Change in position of the head causes movement of fluid within the canals. The fluid movement stimulates nerve endings in the walls of the canals which send impulses to the brain by the vestibular branch of the auditory nerve.

11-2. The Ear

The ear, the organ of hearing, consists of three parts: the external ear, the middle ear (tympanic cavity), and the internal ear (the labyrinth) (Figure 11-1). These divisions are commonly referred to as the outer ear, the middle ear, and the inner ear. They provide for the reception and conduction of sound and contain one of the principal mechanisms of equilibrium. The structures of the ear, except the part protruding from the head, are situated within the temporal bone of the skull.

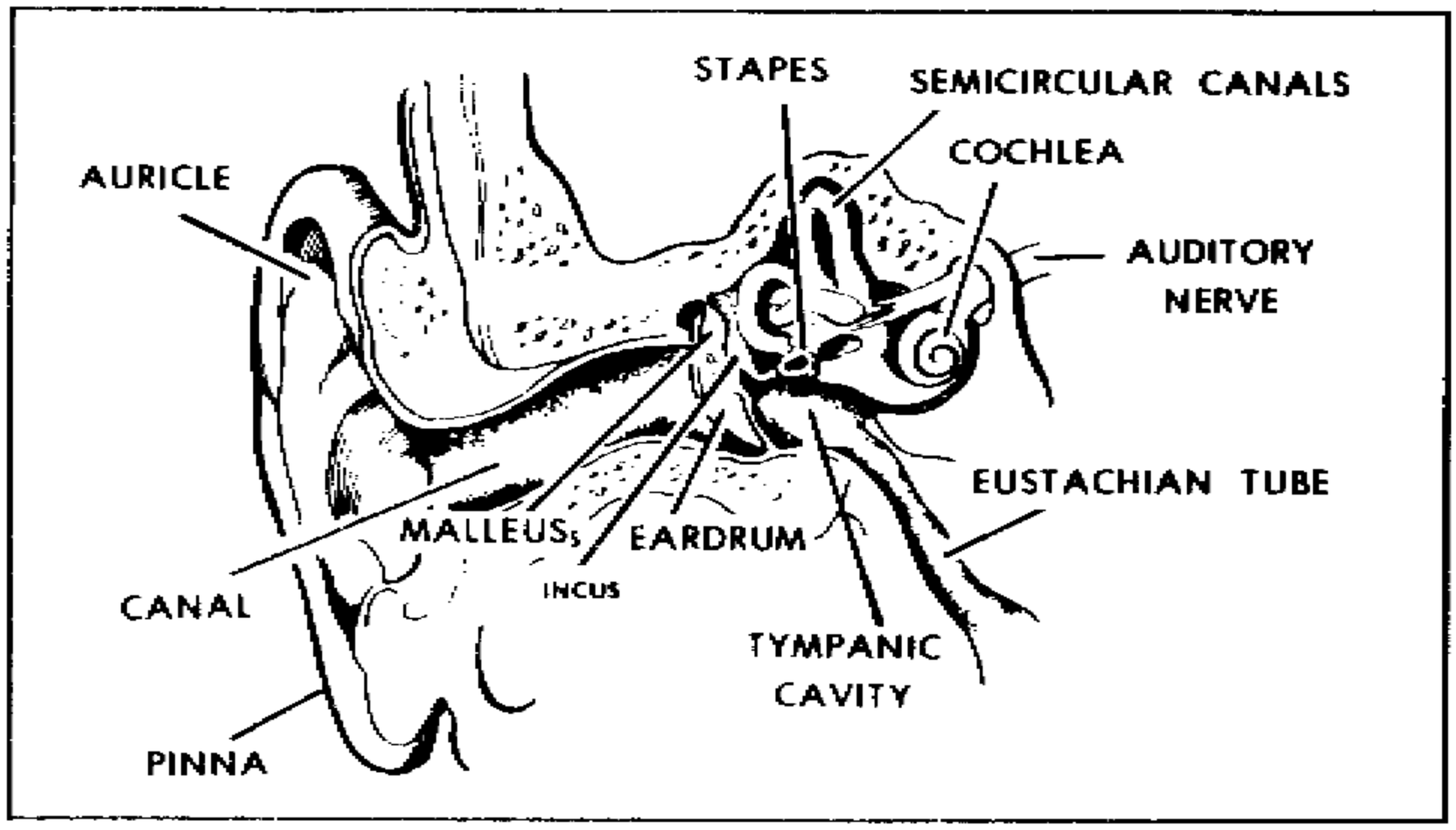


Figure 11-1. The external, middle, and internal ear, frontal view.

a. The external ear (Figure 11-2) consists of the shell-shaped portion of the ear, called the auricle (pinna), which projects from the side of the head, and the external auditory canal leading toward the middle ear. The principal function of the external ear is the collection and conduction of sound waves to the middle and inner ear. The auricle is composed of cartilage covered with membrane and the skin.

(1) The prominent folded rim of the ear is the helix.

(2) A deep cavity, the concha, leads into the external auditory canal.

(3) In front of the concha and projecting backward over the entrance to the external auditory canal is a small, triangular piece of cartilage called the tragus. The undersurface of the tragus is covered with soft hairs which help prevent foreign bodies from entering the ear.

(4) The lobe is the lowest point of the helix. The lobe is composed of fatty tissue and connective tissue, but does not have any cartilage.

b. The external auditory canal extends from its entrance to the tympanic membrane (eardrum) which closes its inner end. The canal is formed of two parts: (1) its outer (cartilaginous) part which is formed of cartilage and membrane; and (2) its inner (bony) portion which is formed by a passage in the temporal bone.

(1) If the auricle (helix area) is pulled up and back, the outer canal straightens and may be examined or treated more easily. Near the entrance of the canal, the skin contains wax-producing glands and hair follicles. This wax, called cerumen, helps prevent the entry of foreign objects into the ear.

(2) The tympanic membrane (eardrum) separates the inner end of the canal from the middle ear. The normal eardrum is partly translucent and shiny gray (pearl-like). When inflamed, it appears pink or dull red.

c. The middle ear (tympanic cavity) is an irregular space in the temporal bone filled with air and containing the three ossicles of the ear: malleus (hammer), incus (anvil), and stapes (stirrup). These bones conduct vibrations from the eardrum to the internal ear. The eustachian tube connects the middle ear with the nasopharynx. Its principal function is to keep the air pressure equal on either side of the eardrum. This is also an avenue of infection by which disease spreads from the throat to the middle ear.

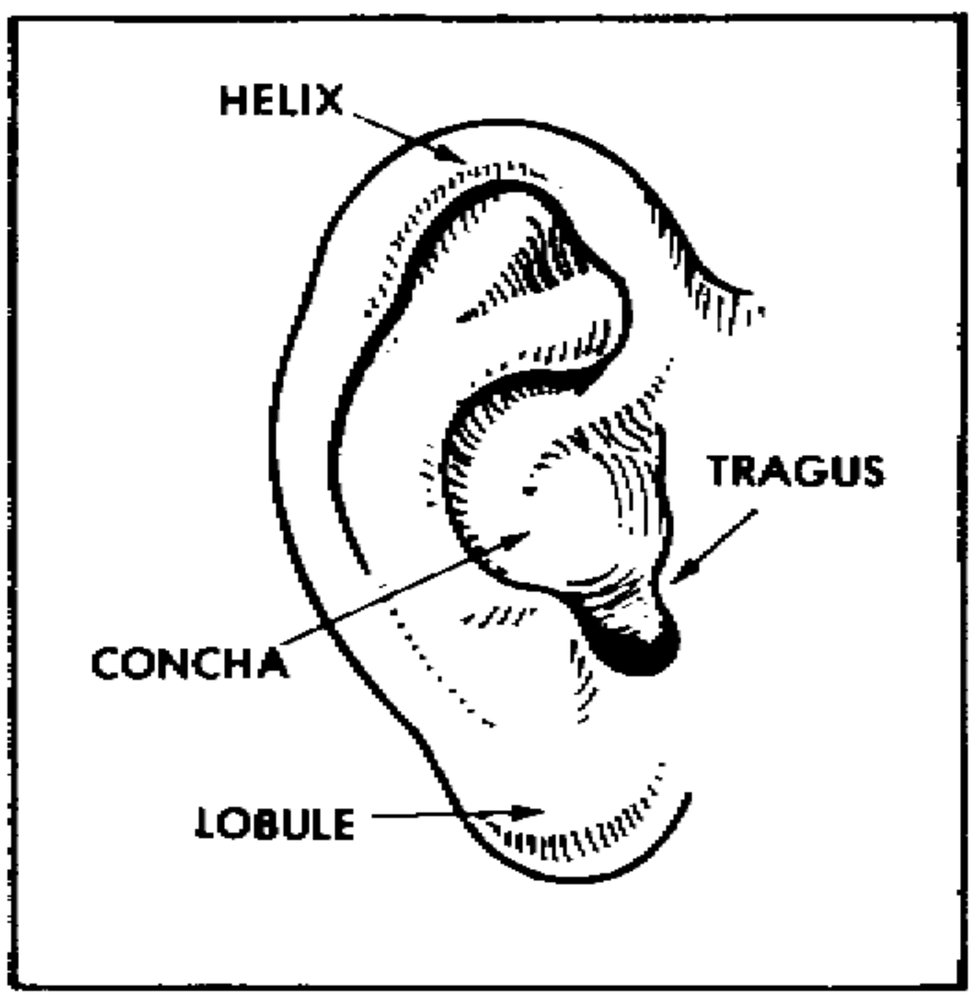


Figure 11-2. The auricle.

d. The internal ear (labyrinth) contains receptors for hearing and equilibrium. The receptor for hearing lies within the cochlea which is coiled and resembles a snail shell.

(1) Sound waves, which pass through the external auditory canal, vibrate the eardrum and ossicles and are transmitted through the fluid of the inner ear. Nerve impulses travel through the acoustic (auditory) nerve to the auditory center of the cerebral cortex.

(2) The internal ear also contains three semicircular canals which control equilibrium. Change in the position of the head causes movement of the fluid within the canals and this fluid movement stimulates nerve endings in the wall of the canal. These nerve endings serve as receptors and transmit impulses along the acoustic nerve to the cerebellum.

11-3. The Eye

The eye is specialized for the reception of light. Each eye is located in a bony socket or cavity called the orbit, which is formed by several bones in the skull. The orbit provides protection, support, and attachment for the eye and its muscles, nerves, and blood vessels.

a. The Eyeball. The interior of the eye (Figure 11-3) is divided into an anterior cavity (anterior to the lens) and a posterior cavity (posterior to the lens). A clear watery solution (aqueous fluid) is formed and circulated in the anterior cavity. A transparent semifluid material (vitreous fluid) is contained in the posterior cavity. The globular form and firmness of the eyeball is maintained by its fluid contents which also functions in the transmission of light.

(1) *Eye tissue coats.* The eyeball has an outer coat, a middle coat, and an inner coat.

(a) Outer coat. The outer coat consists of a normally transparent anterior portion, the cornea, and a fibrous white portion, the sclera. The cornea focuses and transmits light to the interior of the eye. The sclera helps maintain the shape of the eyeball and protects the delicate structures within.

(b) Middle coat. The middle coat consists of the choroid, iris, and ciliary body. The choroid, the vascular middle layer of the eyeball, lines the posterior portion of the eye from the ciliary body to the optic nerve. The iris is a circular, colored, muscular membrane which is suspended between the cornea and the lens. The pigment in the iris gives the eye its characteristic color. The round opening in its center is the pupil. The muscle structure of the iris adjusts the size of the pupil to adapt the eye to the brightness of light. The ciliary body lies between the iris and choroid; it has a muscular function, changing the focus of the lens, and a secretory function, producing aqueous fluid.

(c) Inner coat. The inner coat is the retina which lines the interior of the eye except toward its anterior inner surface. The visual nerve cells (rods and cones) are arranged closest together at the central portion of the retina, the macula lutea. A slight depression in the macula lutea is the fovea centralis. Medial to the fovea centralis is the area called the optic disk, the site of exit of the optic nerve. The inner surface of the retina is in contact with the vitreous and the outer surface with the choroid. The condition known as "detached retina" means that some portion of the retina has become separated from the supporting choroid.

(2) *The lens.* The lens is a small, disk-shaped, transparent structure about 1/3 inch in diameter. It is situated behind the iris and in front of the vitreous cavity. The lens is suspended by the suspensory ligament. This ligament is attached to the ciliary body. Muscular movements of the ciliary body affect the suspensory ligament and focus the lens. The condition of "cataract" means that some portion of the lens has become cloudy (opaque).

(3) *Aqueous fluid.* The aqueous fluid is formed by the ciliary body and fills the two divisions of the anterior cavity of the eye, called the anterior and the posterior chamber. Aqueous fluid is crystal clear for transmission of light rays. Its formation and flow help maintain the normal intraocular pressure. The aqueous fluid flows from the posterior chamber to the anterior

chamber and drains by means of a series of channels into the venous blood. Interference with the normal formation and flow of aqueous fluid can lead to development of excessively high intraocular pressure, a condition called glaucoma.

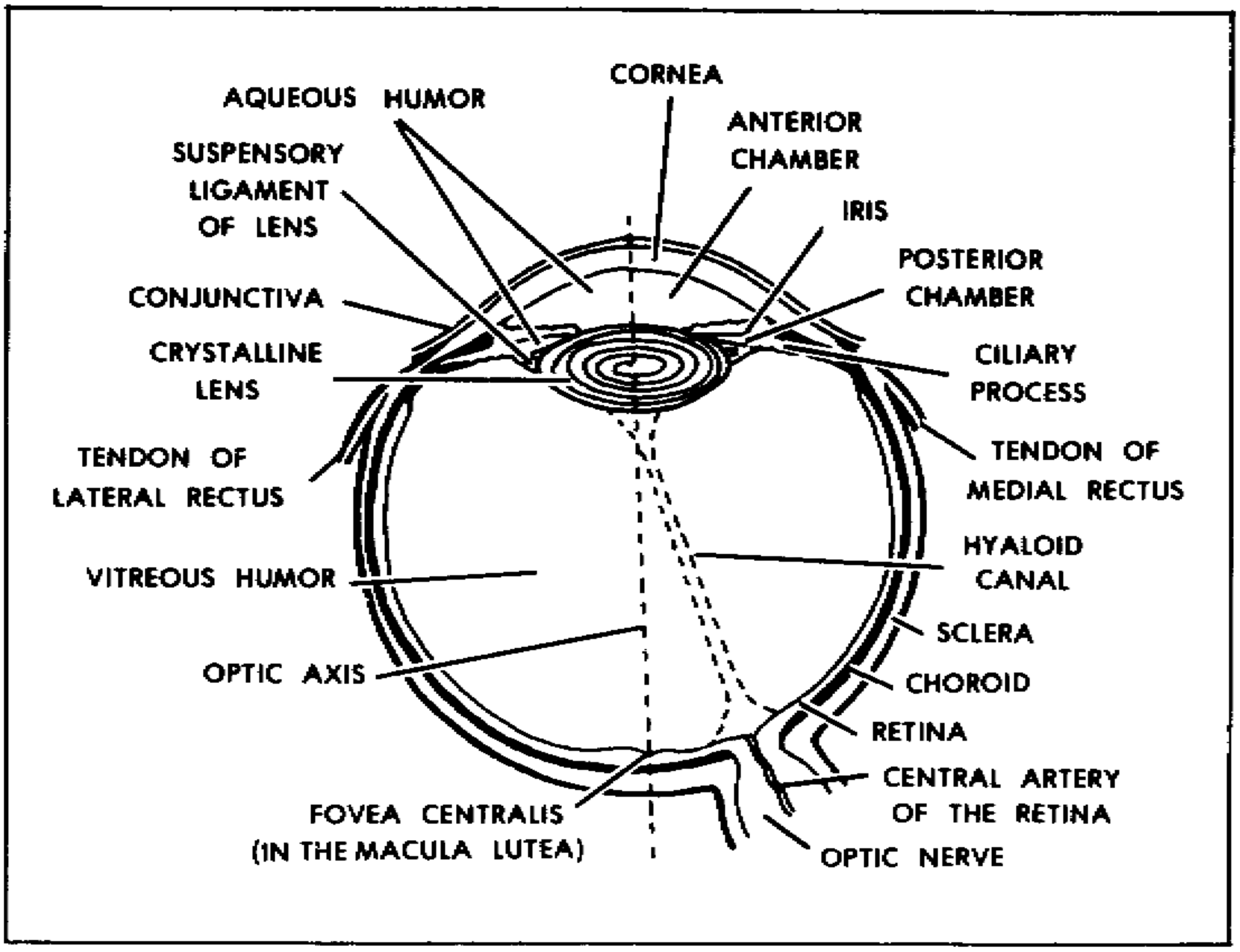


Figure 11-3. The eye.

b. The External Eye and Accessory Structures. Viewed from the surface of the body, the anterior surface of the eye and some of its accessory structures (such as eyebrows, lids, lashes, and conjunctiva) are readily visible. An additional essential accessory structure is the lacrimal (tear) apparatus (Figure 11-4).

(1) *Eyebrows and eyelashes.* The eyebrow and lashes are usually considered to have a cosmetic (decorative) function, but the eyelashes protect against the entrance of foreign objects. On the margin of the eyelids near the attachment of the eyelashes are the openings of a number of glands. Infection in these glands is commonly called a sty.

(2) *Eyelids.* The eyelids are thin, moveable, protective coverings for the eyes. The junctions of the upper and lower eyelids of each eye are canthi. The inner canthus (Figure 11-4) is at the nasal junction and the outer canthus is at the temporal junction.

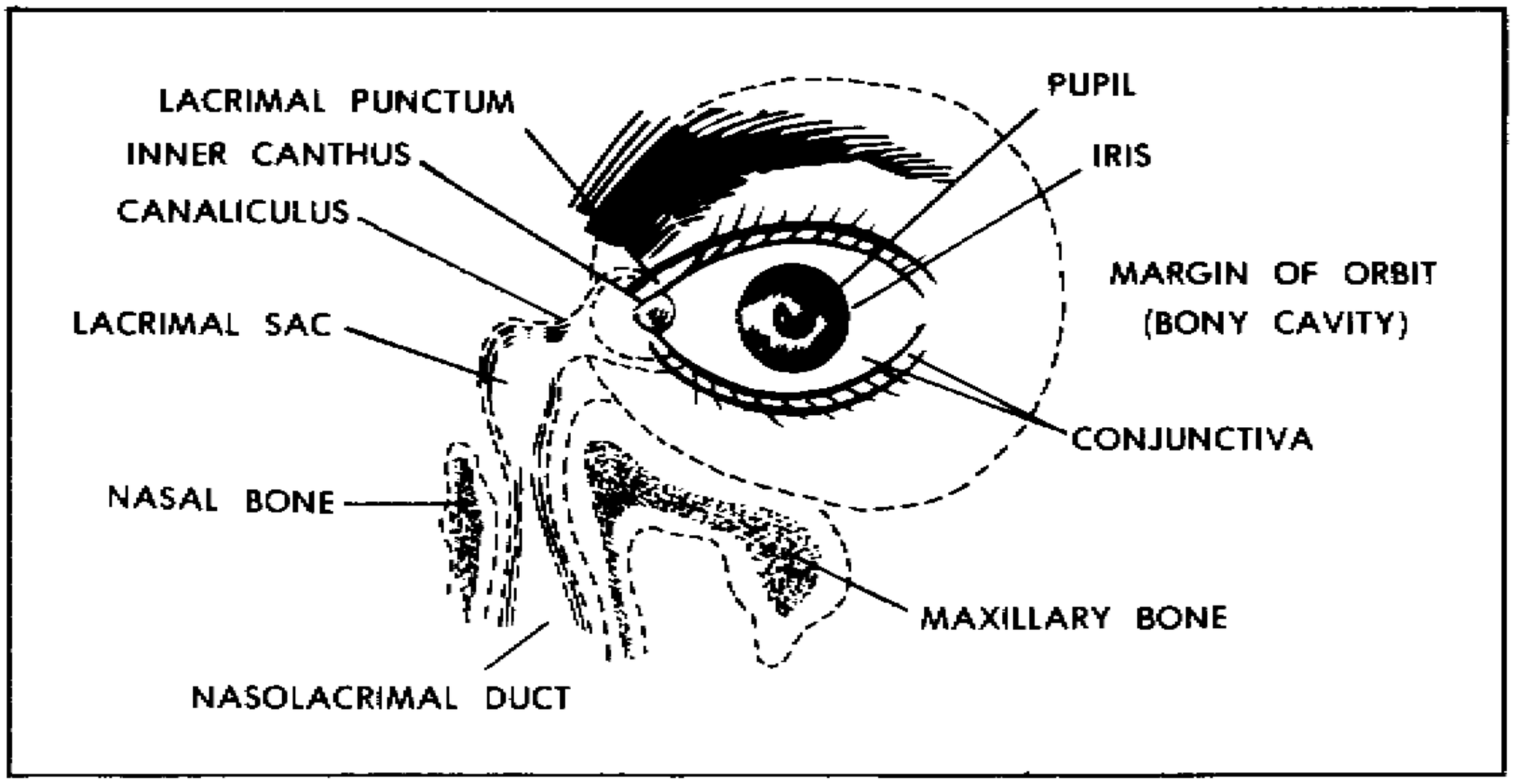


Figure 11-4. The external eye and accessory structure.

(3) *Conjunctiva.* The conjunctiva (Figure 11-4) is a delicate mucous membrane which lines the inside of the eyelids and covers the front surface of the eyeball. The semitransparent conjunctiva appears white on the front surface of the eyeball where it covers the sclera and pink where it overlies lid tissue. Should the conjunctiva itself become inflamed or infected, it appears red and swollen. (One type of acute bacterial infection of the conjunctiva is commonly called "pinkeye.")

(4) *The lacrimal apparatus.* The lacrimal apparatus consists of the lacrimal gland, lacrimal ducts, lacrimal sac, and nasolacrimal duct (Figure 11-4). Its function is the secretion and drainage of tears. The lacrimal gland is about the size and shape of a small almond and is located in a small depression on the lateral side of the frontal bone of the orbit. Many small ducts drain tears secreted by the gland to the conjunctival surface; the tears drain downward and toward the inner angle of the eye. The normal blinking of the eyelids helps spread the tears evenly to provide a lubricating, protective, moist film over the exposed surface of the cornea. The tears drain into openings near the nasal portion of each eyelid (lacrimal puncti) and then into the tear ducts, the sac, and finally into the nose through the nasolacrimal duct. This normal function and drainage of tears is the natural way in which the eye surface is kept clean and moist.

(5) *Extraocular muscles.* There are six sets of muscles located outside the eyeball. These muscles raise, lower, or rotate the eyeball within its socket. The muscles of the two eyes normally function in a coordinated manner so that both eyes move simultaneously and are aimed in the same direction.

CHAPTER 12

TRIAGE AND PATIENT ASSESSMENT

Section I. TRIAGE

12-1. General

Triage (pronounced tree-ahzh) is the French word for "sorting." In medicine, it refers to the sorting of casualties to establish priorities of treatment and evacuation. Triage is generally applied to situations in which there are several casualties; however, the word can also refer to the assessment of one patient with multiple injuries in order to decide which injury should be treated first. In this chapter, we will examine triage and the techniques used when dealing with mass casualty situations.

12-2. Principles of Triage

Whether you are dealing with one patient who has multiple injuries or many injured people, the fundamental principles of triage are the same:

a. Asphyxia and hemorrhage are the two immediate threats to life.

b. Salvage of life takes priority over salvage of the limb.

NOTE

These two principles should guide all of your work with critically injured patients and dictate the priorities of treatment.

12-3. Triage of the Multiple Injured Patient

You may not have used the word "triage" before, but every time you have performed the proper sequence of treatment, you were performing triage: sorting out the patient's problems according to priorities. Triage of the multiple injured patient begins with the primary survey, with emphasis on airway, breathing, and circulation (ABC's).

a. Airway. The airway remains the first consideration. The trauma victim, if unconscious, will have his airway obstructed by the base of his tongue. The usual solution of tilting the head back is not adequate because every severely injured, unconscious victim is considered to have a cervical spine injury until proven otherwise. The approach is modified by using the jaw thrust method of opening the airway. By using this method, any motion of the head and/or neck is avoided. The tongue, blood, vomitus, avulsed teeth, or broken dentures may obstruct the airway of a trauma victim. To insure that the airway of the trauma victim is open you must:

(1) Open the airway, avoiding any movement of the head or neck.

(2) Clear foreign material manually or with suction. Remember to always anticipate vomiting.

(3) Keep the unconscious patient turned on one side (after the spine is properly stabilized) so that foreign materials can drain from the patient's mouth.

(4) Facial fractures around the mouth and trachea are extreme emergencies and the patient should be evacuated immediately.

b. Breathing. Insure the patient is breathing adequately. If the victim is not breathing, artificial ventilation must be started promptly and supplemented as soon as possible with high concentrations of oxygen. Even if the patient is making respiratory efforts, there are a number of injuries that can decrease the effectiveness of the respirations. For instance, sucking chest wounds will prevent adequate expansion of the lung; these wounds must be closed without delay. To insure respiration in the trauma victim, you must—

(1) Start artificial ventilation for apnea.

(2) Close sucking chest wounds.

(3) Decompress the chest at once or evacuate the victim without delay if tension pneumothorax is evident.

(4) Note presence of flail chest (stabilize later).

(5) Give oxygen to every severely injured patient.

c. Circulation. When we discuss circulation in the context of trauma, we are talking principally about control of bleeding and treatment of shock. Both actions must be accomplished as rapidly as possible once the airway and breathing have been insured. To insure circulation in a trauma victim, you must—

(1) Start external cardiac compressions if there is no pulse.

(2) Control bleeding with direct pressure.

(3) Anticipate shock in every severely injured patient and treat accordingly.

12-4. The Secondary Survey

Having dealt with the ABC's, you have now taken care of the conditions that pose an immediate threat to life. Recall, however, the second principle of triage: salvage of life takes priority over salvage of limb. This means that a patient may have to be moved before treatment is completed. For instance, a patient with pericardial tamponade must be evacuated with all possible speed, even if splinting of fractures has not been completed.

12-5. Multiple Casualties

Situations involving several casualties may be the most difficult and challenging you will face. Not only does the multiple casualty situation require you to employ the skills of judgment and emergency care, but it also demands that these skills be exercised under frequently difficult conditions.

12-6. Sorting of Casualties

The goal of this process is to accomplish the greatest good for the greatest number, remembering that the highest priority is keeping the patient alive. Sorting of casualties (triage) is conducted in several rounds. On the first round, you should identify those patients who require immediate attention according to the familiar priorities of airway, breathing, and circulation.

12-7. Categories of Triage

a. Immediate—to Save Life or Limb.

(1) Airway obstruction.

(2) Respiratory and cardiorespiratory failure (cardiorespiratory failure is not considered an "immediate" condition on the battlefield; it would be classified as expectant).

(3) Massive external bleeding.

(4) Shock.

(5) Sucking chest wound, if respiratory distress is evident.

(6) Second or third degree burns of the face and neck, or perineum (causing shock or respiratory distress).

(7) After casualty with life/limb threatening conditions has been initially treated, no further treatment will be given until other "immediate" casualties have been treated.

b. Delayed—Less Risk by Treatment Being Delayed.

(1) Open chest wound.

(2) Penetrating abdomen wound.

(3) Severe eye injury.

(4) Avascular limb without apparent blood supply.

(5) Other open wounds.

(6) Fractures.

(7) Second and third degree burns not involving the face and neck or perineum.

c. Minimal—Can Be Self Aid or Buddy Aid.

(1) Minor lacerations.

(2) Contusions.

(3) Sprains.

(4) Minor combat stress problems.

(5) Partial thickness burns (under 20 percent).

(6) Patients in this category are not evacuated to a medical treatment facility.

d. Expectant—Little Hope of Recovery. This category should be used only if resources are limited.

(1) Massive head injury with signs of impending death.

(2) Burns—more than 85 percent of the body surface area.

NOTE

Casualties with minor injuries can assist with (1) recording treatment, (2) emergency care, and (3) defense of the area.

Section II. PATIENT ASSESSMENT

12-8. General

At any level of medical treatment, evaluation of the patient must come before treatment. A good evaluation should be used to discover a condition rather than confirm it. Therefore, you must perform a thorough, advanced examination that proceeds in a logical pattern, uncovering all important findings needed to make good prehospital treatment decisions. The first in the sequence of examining the patient is the triage examination or initial patient assessment.

12-9. Assessment Tools

To perform a complete patient assessment, you need a penlight, wristwatch, stethoscope, blood pressure cuff, your eyes for inspection, your ears for hearing, and your hands for palpation.

12-10. Techniques for Patient Assessment

a. Inspection. Look for colors, contours, masses, bleeding, and any changes in the physical appearance of the part being examined.

b. Auscultation. Listen for breath sounds and apical (heartbeat) pulse.

c. Palpation. Feel for textures, consistency, depressions, moisture, and temperature.

12-11. Triage Examination

The triage examination determines if any life-threatening conditions exist; it allows for simple treatment steps to protect vital functions.

a. Airway. Check for open airway. If the airway is closed, you should open it with manual maneuvers.

(1) *Head tilt-chin lift.* This technique provides a consistently more effective method of opening the airway in the unconscious victim and is less tiring than other methods.

(2) *Head tilt-neck lift.* This technique should never be used if victim has a suspected cervical spinal injury.

(3) *Jaw thrust.* This technique is the safest first approach to opening the airway of a victim who has a suspected neck injury because, in most cases, it can be accomplished without extending the neck.

NOTE

It should be noted that if the victim is making respiratory efforts, the airway may still be obstructed. Many times opening the airway is all that is needed.

b. Breathing. Check for breathing by using the *Look, Listen,* and *Feel* technique. If patient is not breathing, give four quick ventilations.

c. Circulation.

(1) *Pulse.* Check for a carotid pulse. It is important to check the carotid pulse because it is most accessible, most reliable, and most easily learned and remembered. If the carotid pulse is absent, begin cardiac compressions. In triage, under combat conditions, you should move on to other injured patients.

(2) *Bleeding.* Check for persistent external bleeding. If there is profuse bleeding, apply direct pressure and elevate. In some instances, a tourniquet may be required.

(3) *Level of consciousness.* Check the casualty's level of consciousness (for example, can he talk, does he understand what you are saying to him). If traumatic injury is present, apply a cervical collar, if available, or stabilize the neck with sand bags, or a wire ladder splint made into a cervical collar.

NOTE

See Chapter 13 for specific instructions concerning the application of the ABC's.

12-12. Vital Signs (Pulse, Blood Pressure, Respiration, and Temperature)

a. Pulse. Normal pulse for adults is 60-80 heartbeats per minute, for children 80-100, and for infants 120-160. Also observe its regularity and strength.

b. Blood Pressure. Normal blood pressure for an adult is 110-146 mm/Hg systolic and 60-90 mm/Hg diastolic. Infant readings are 50-80 mm/Hg systolic and 40-58 mm/Hg diastolic.

c. Respiration. Normal respiratory rate for adult is 12-20 per minute; for children, a higher rate is normal. Also, observe the rhythm and depth.

d. Temperature. Normal temperature is 98.6^{0}F (37.0^{0}C). If patient shows symptoms of shock (weak, rapid pulse; pale skin; skin that is cool and moist to the touch), control of the shock should be achieved before continuing with the assessment.

12-13. Head-to-Toe Examination

a. General appearance would include the patient's general skin color, obvious wounds or eviscerations, presence of the odor of alcohol, dress, social condition, and presence of cigarettes. Skin color may be red (fever, allergic reactions, carbon monoxide poisoning), white (excessive blood loss, fright), blue (hypoxemia, peripheral vasoconstriction from cold or shock), yellow (indicative of liver disease, especially hepatitis; may also be seen in sclera), or mottled (cardiovascular shock).

b. Degree of distress is the patient's response to his illness or injury and normally varies among individuals. This is usually classified as mild, moderate, or severe.

c. State of consciousness is based on the Glascow Coma Scale, which is explained below. (Pain is elicited by rubbing the sternum while examining the ribs.)

(1) Eye opening response:

(a) 4—Spontaneous.

(b) 3—Responds to verbal stimuli.

(c) 2—Responds to painful stimuli.

(d) 1—No response.

(2) Verbal response:

(a) 5—Oriented to person, place, and time.

(b) 4—Confused.

(c) 3—Inappropriate words.

(d) 2—Incomprehensible words.

(e) 1—No response.

(3) Motor response:

(a) 6—Follows commands.

(b) 5—Localizes pain.

(c) 4—Withdraws from painful stimuli.

(d) 3—Exhibits flexion to painful stimuli.

(e) 2—Extension to painful stimuli.

(f) 1—No response.

d. The patient is scored by adding the numbers the patient receives in each category of the examination. This score is placed over a maximum score of 15 (the score becomes a fraction; 15/15 would be the score received by a fully alert patient).

e. Examine:

(1) *Scalp.* The scalp is examined for the presence of bleeding or contusions and palpated for tenderness or depression. Do not move the neck!

(2) *Forehead.* Touch the forehead with the back of your hand to ascertain both temperature and moisture.

(3) *Eye.*

(a) Eyelids—check for raccoon eyes (bilateral discoloration without swelling).

(b) Pupils—check for dilation or constriction, equality or inequality, roundness, eye movement, and gross acuity (by following finger).

(c) Conjunctiva—pull one of the lower eyelids down to check color on the inside of the lid.

(4) *Nose.* Check for deformity, bleeding, or discharge.

(5) *Ears.* Inspect for drainage or bleeding without turning patient's head.

(6) *Mastoids.* Check for bruising or defined discoloration (Figure 12-1) or Battle's sign (bruising behind the ear), which may indicate a skull fracture.

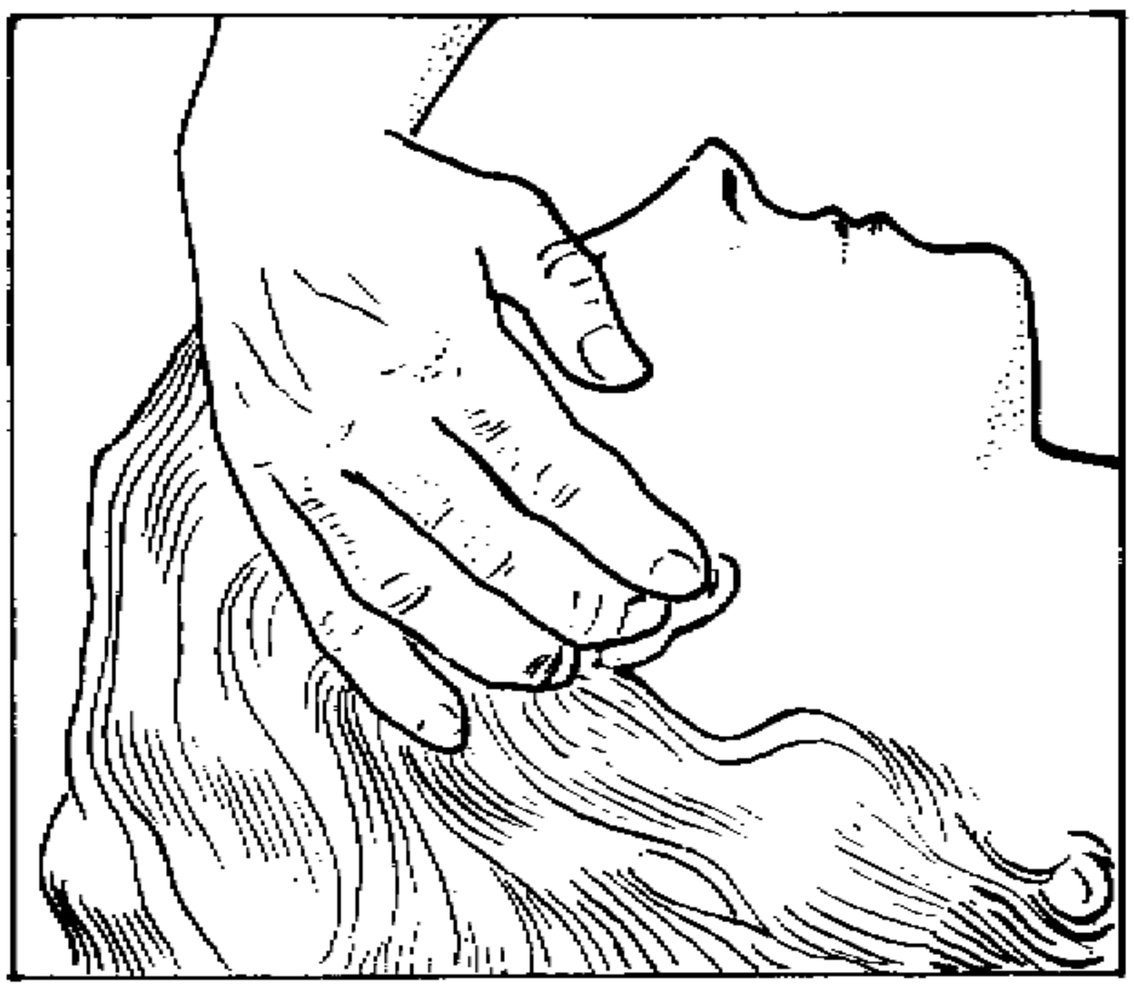


Figure 12-1. Looking for discoloration.

(7) *Facial bones.* Examine the face for lacerations or contusions; palpate zygomatic arches, maxilla, and mandible for tenderness (Figures 12-2 and 12-3).

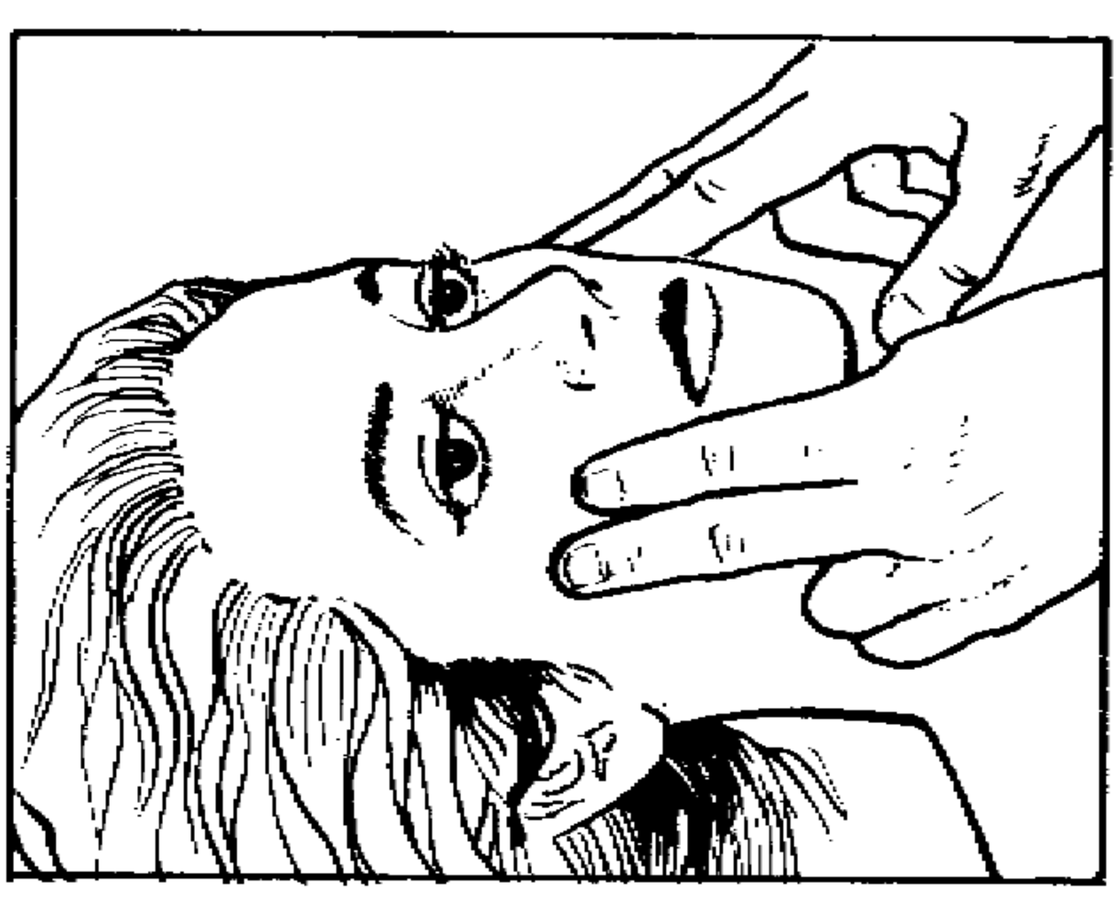


Figure 12-2. Palpating zygoma for fractures.

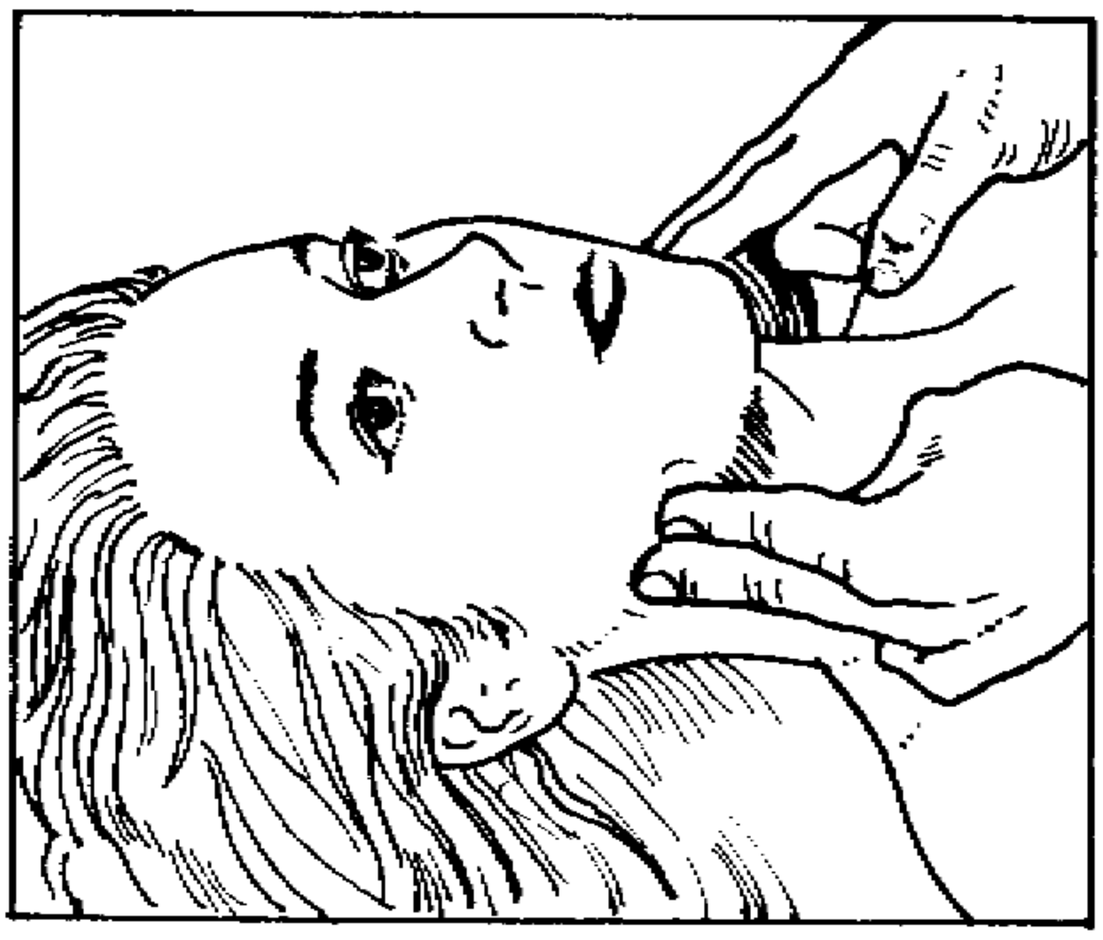


Figure 12-3. Palpating mandible for fractures.

(8) *Mouth.* Examine the mouth for loose teeth, abnormal alignment, oral hydration, and visibly check for perioral cyanosis.

(9) *Tracha.* Check for midline position, presence of stoma, and medicalert necklace.

(10) *Suprasternal area.* Check for retractions, accessory muscle usage, and subcutaneous emphysema.

(11) *Neck veins.* Check for distension (Figure 12-4); if distension is present, see if the veins fill from above (the head) or below (the heart).

(12) *Cervical spine.* Check for deformity or midline point tenderness without moving patient (Figure 12-5).

(13) *Chest wall.* Examine for paradoxical breathing (flail chest—when a portion of chest wall goes in on inspiration, out on expiration), splinting, or retractions (Figure 12-6).

(14) *Ribs.* Examine for bruising or tenderness during chest compression. Do not push over any abrasive bruise (Figure 12-7).

(15) *Thoracic spine.* Palpate for deformity or tenderness without moving the patient.

(16) *Breath sounds.* Check in the four quadrants, anterior and posterior. Bilateral equality is noted, as in the presence of rales (fine crackling sounds indicating fluid), Rhonchi (coarser sounds indicating fluid in larger airways; "bubbling"), or wheezes (whistling sounds).

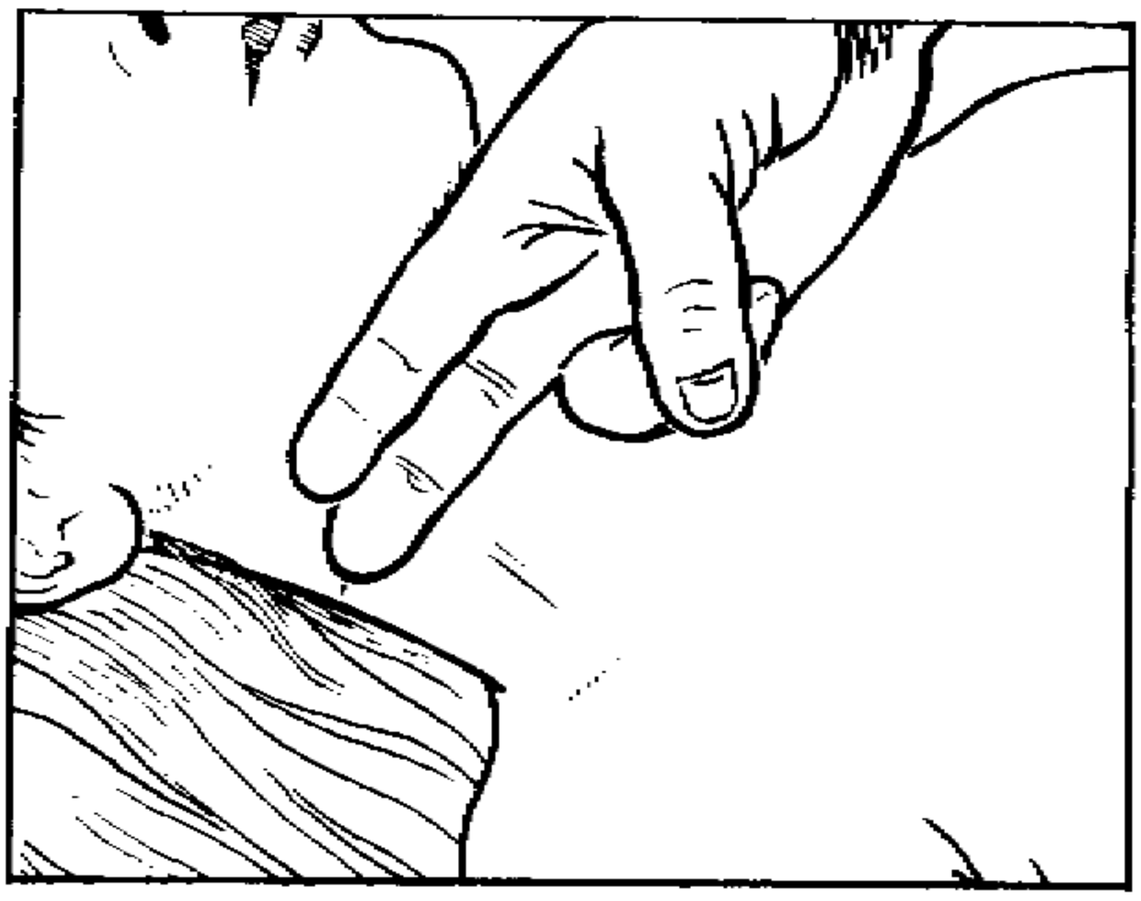


Figure 12-4. Check neck veins for distension.



Figure 12-5. Palpating the cervical spine.

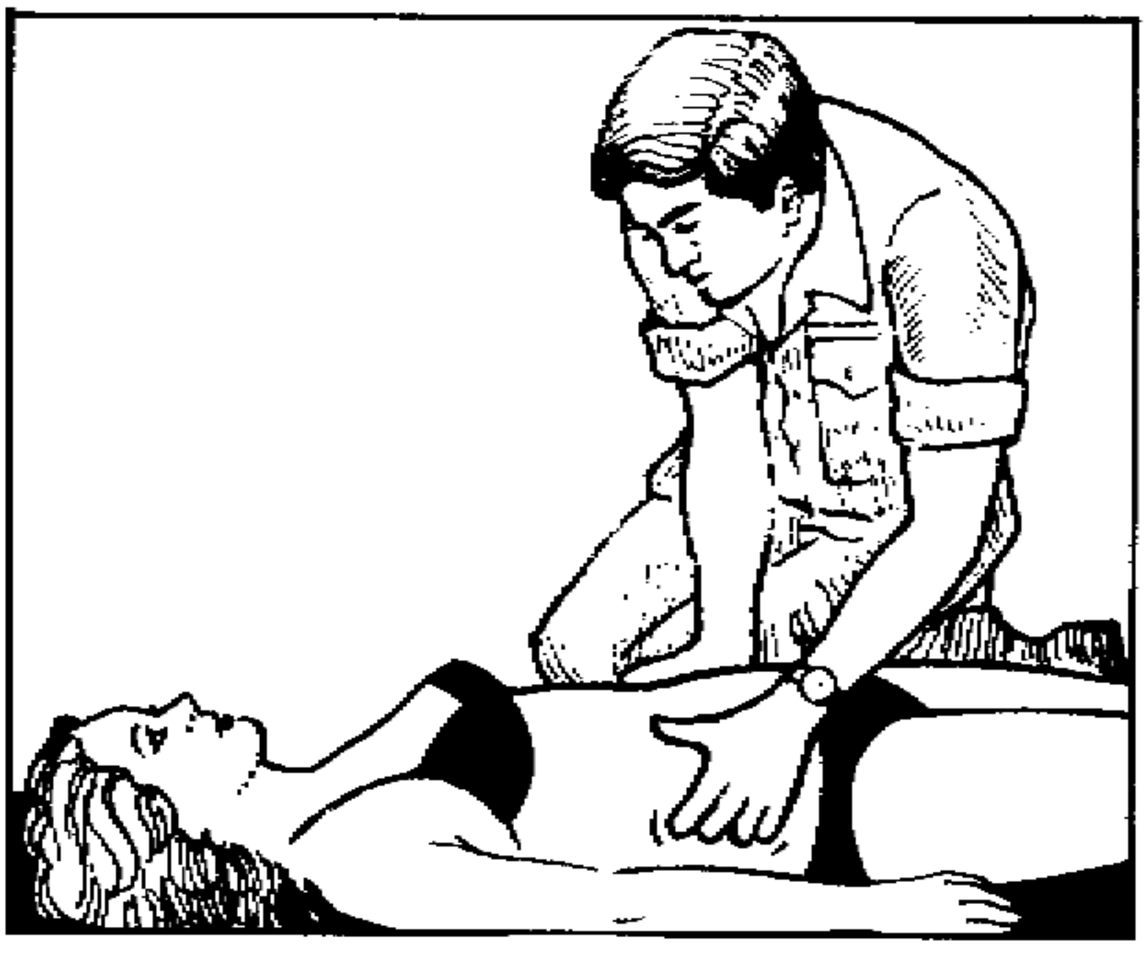


Figure 12-6. Checking for flail chest.

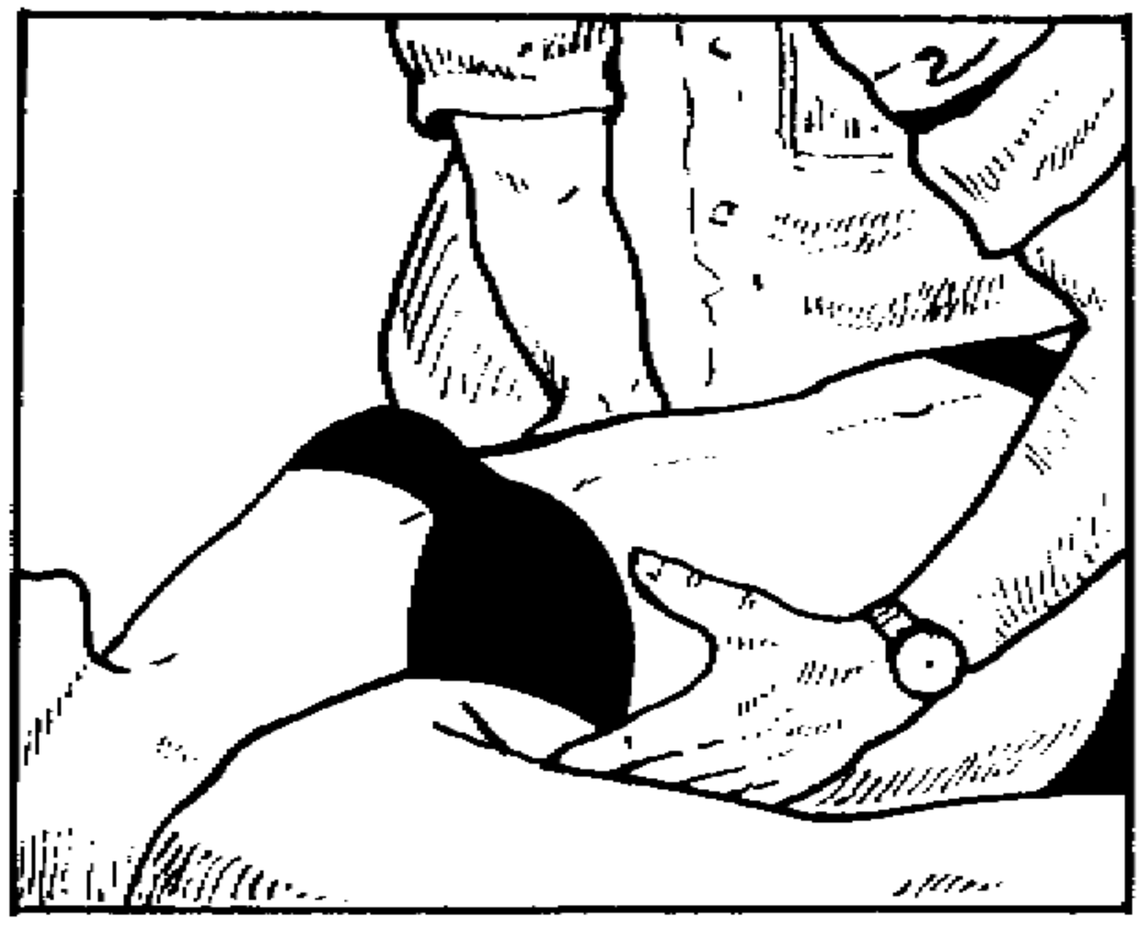


Figure 12-7. Examining for rib tenderness.

(17) *Apical pulse.* Auscultate the heart for apical rate and possibility of muffled heart tones.

(18) *Abdomen.*

(a) External—observe for wounds, distension, or evisceration of bowel.

(b) Bowel sounds—auscultate for bowel sounds; if absent, mention the amount of time listening.

(c) Abdominal tenderness—palpate lightly for tenderness; note presence of rigidity.

(19) *Lumbar spine.* Palpate for deformity or tenderness without risking spinal injury.

(20) *Pelvis.* Compress the pelvis with hands covering the hip joint and iliac crest. Note any pubic tenderness or incontinence (Figure 12-8).

(21) *Femoral pulses.* Check for presence and bilateral equality.

(22) *Lower extremities.*

(a) Legs—inspect and palpate both legs for bleeding, tenderness, and deformity.

(b) Calves and tibias—check the calves for pain on squeezing and the tibias for pitting edema.

(c) Pedal pulses—palpate both feet for either the dorsalis pedis pulse or posterior tibial pulse (Figures 12-9, 12-10, and 12-11).

(d) Foot movement—examine feet for strength and sensation by having patient demonstrate ability to wave both feet and then check strength of extension.

(e) Foot sensation—ask patient to determine which toe is touched.

(f) Painful withdrawal—test withdrawal to pressure on the toe nail beds bilaterally.

(g) Reflexes—test knee jerk and ankle jerk reflexes (Figure 12-12); also check for Babinski reflexes (Figure 12-13).

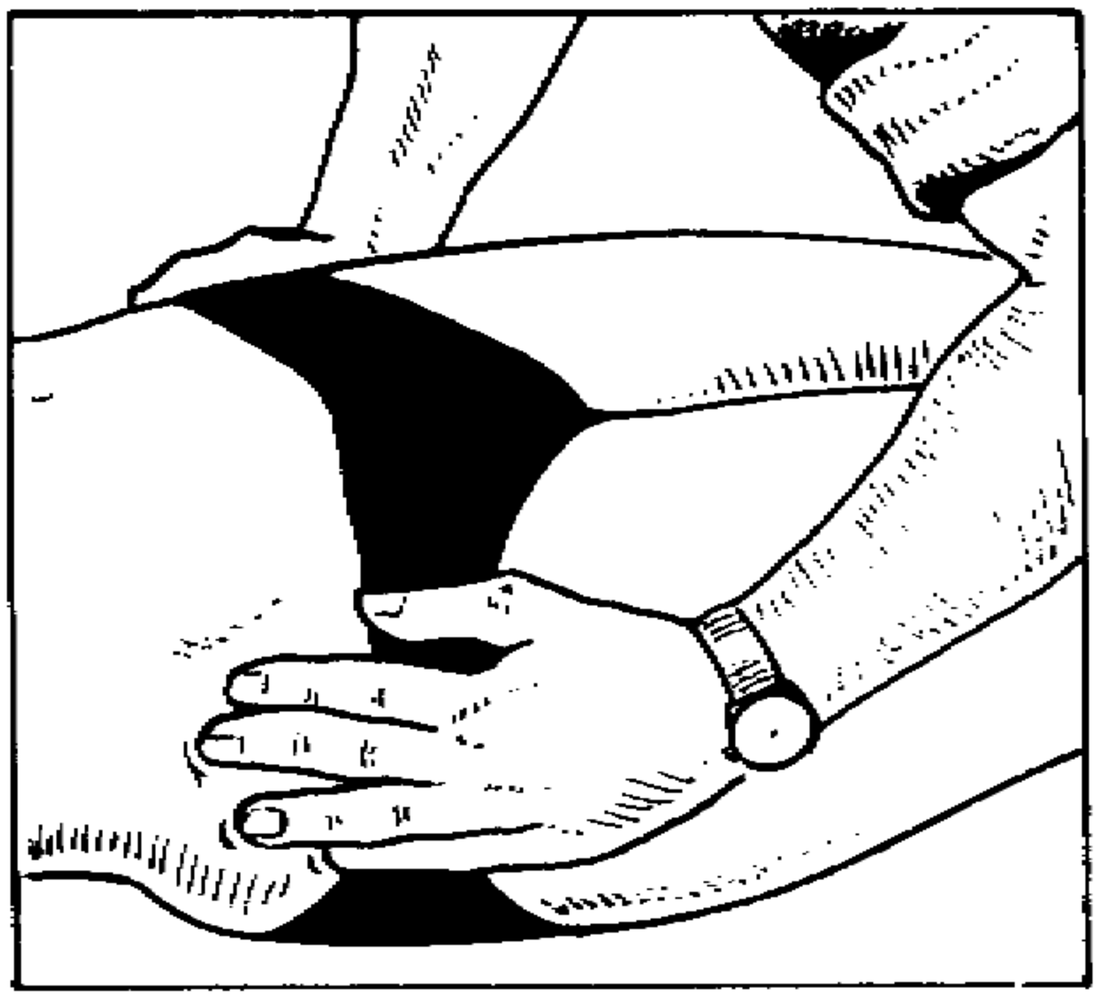


Figure 12-8. Testing pelvis for compression pain.

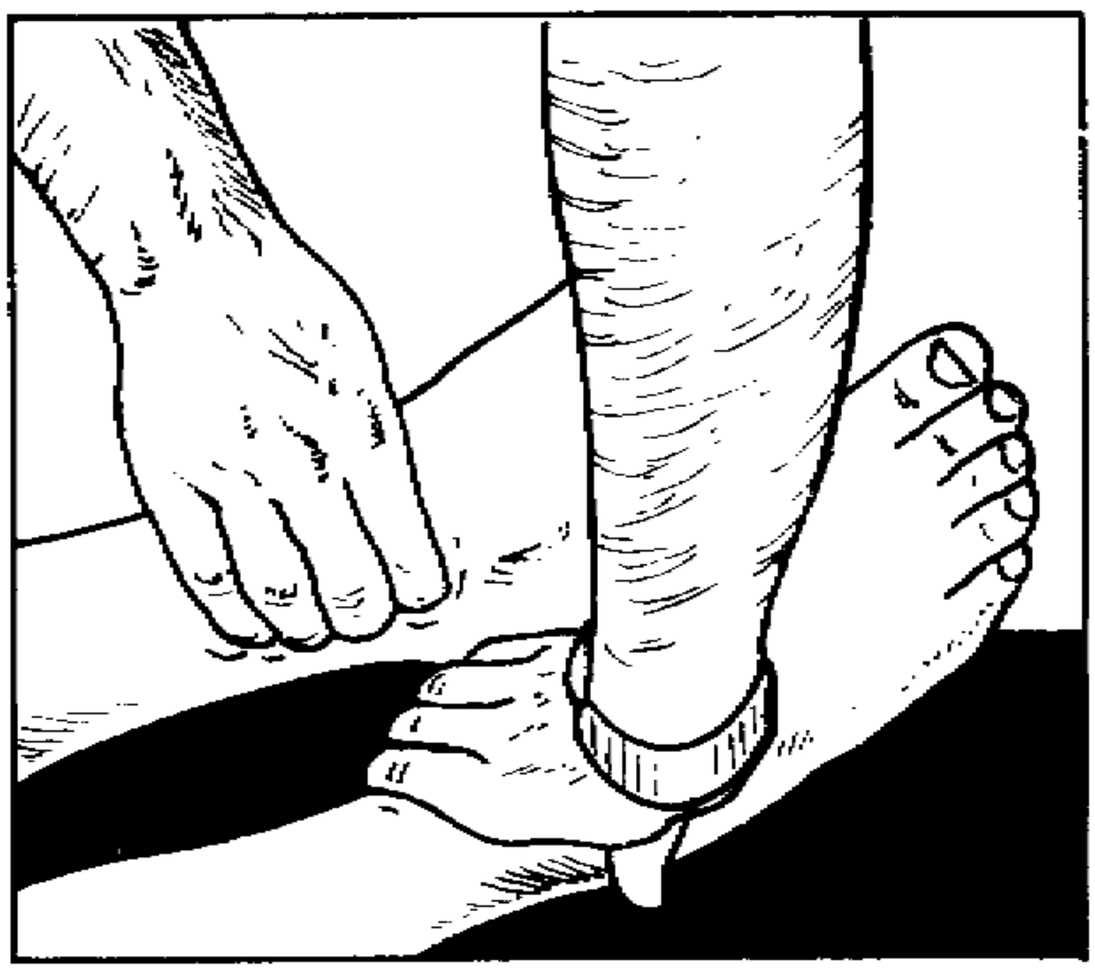


Figure 12-9. Palpating for pedal pulses.



Figure 12-10. Palpating for dorsalis pedis pulse.

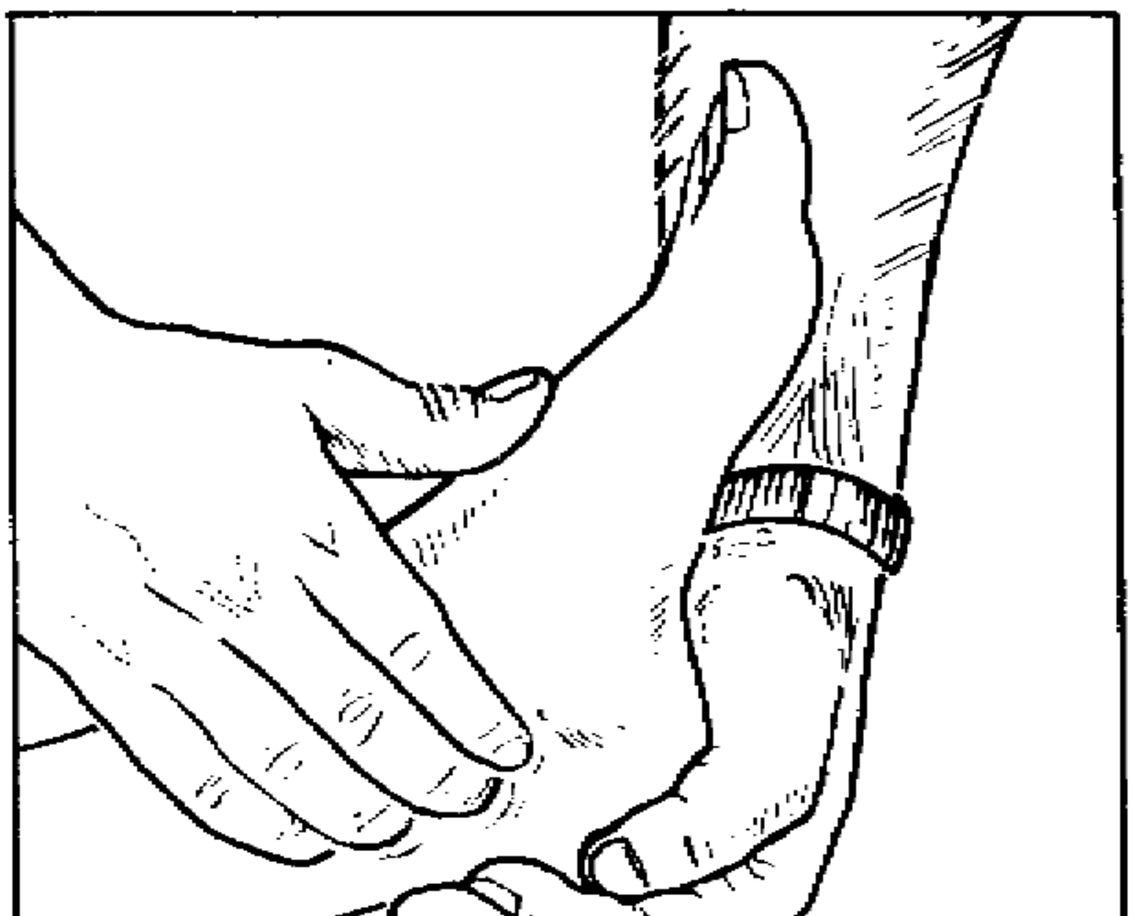


Figure 12-11. Palpating for posterior tibial pulse.

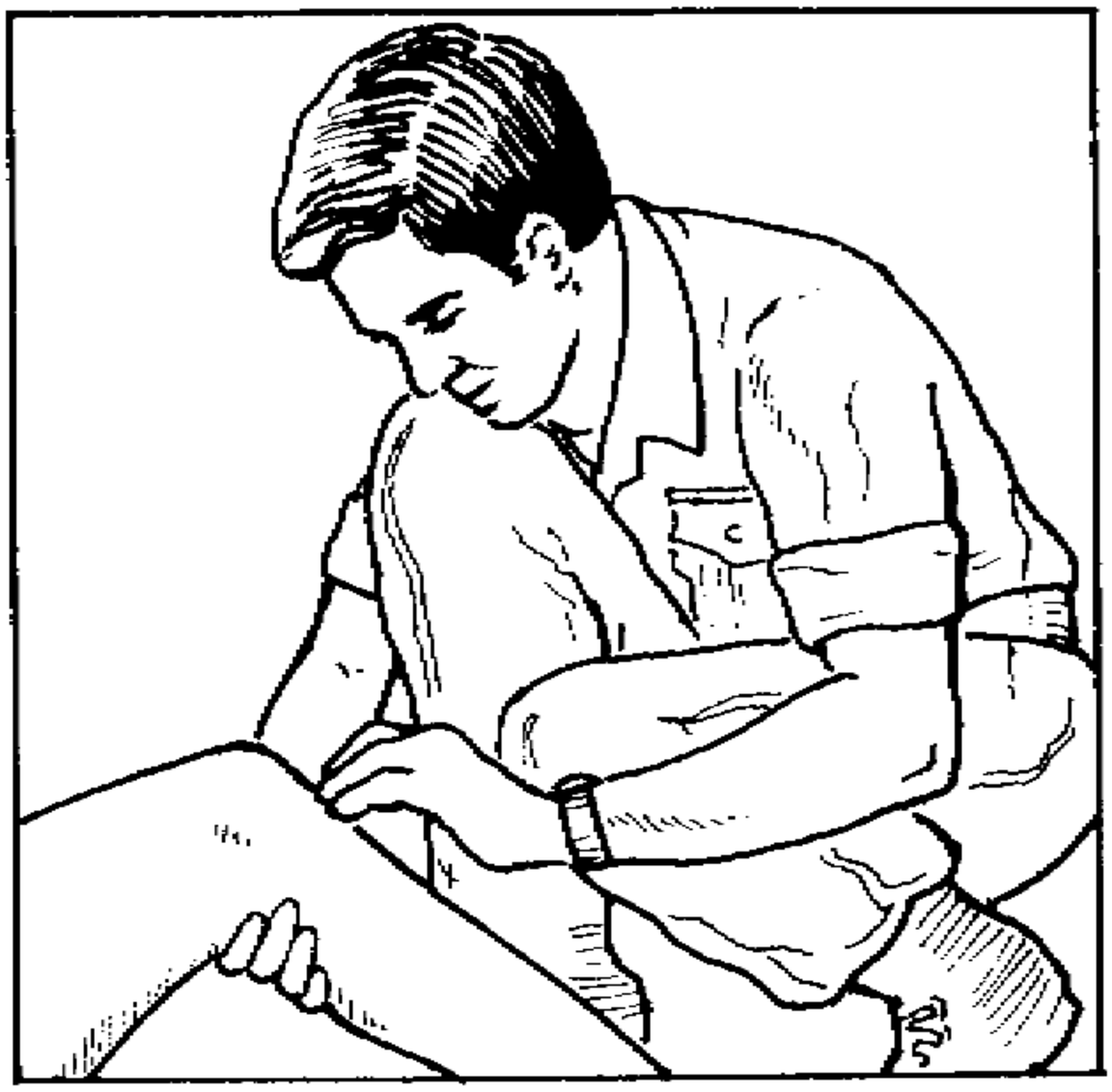


Figure 12-12. Testing knee jerk reflexes.

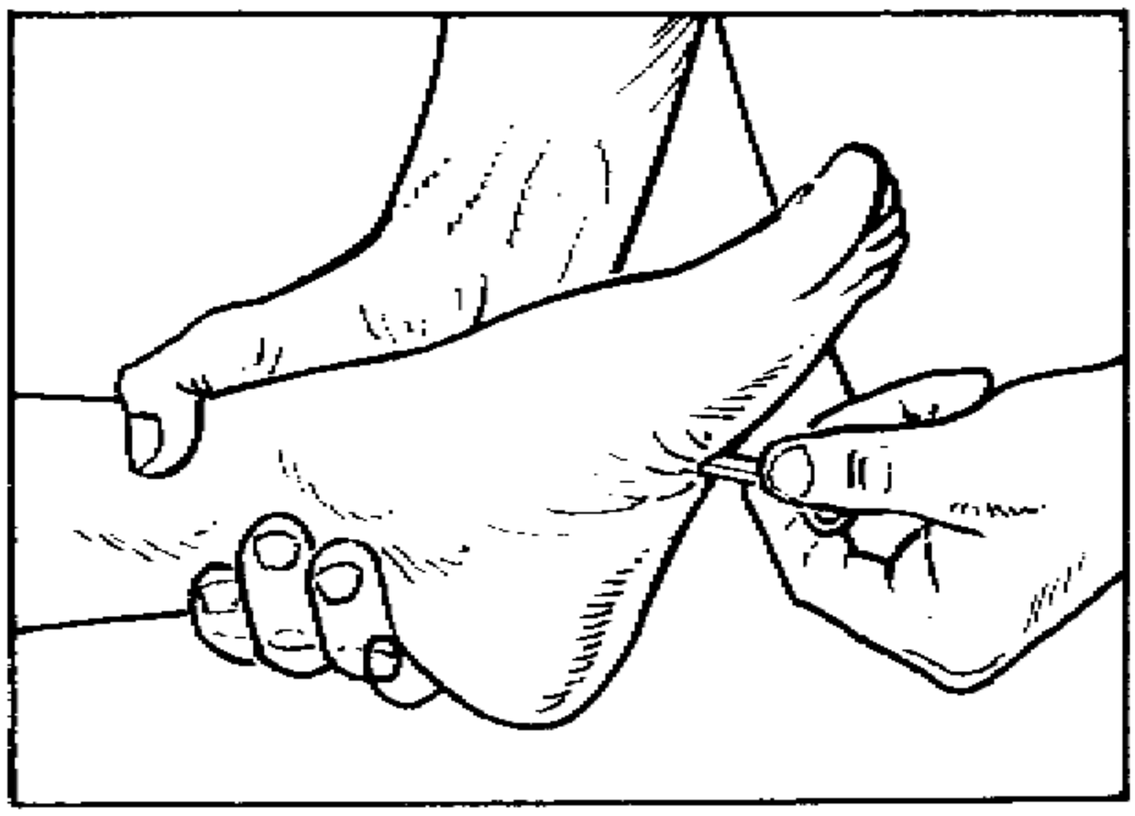


Figure 12-13. Testing Babinski reflexes.

(23) *Upper extremities.*

(a) Clavicles—palpate both clavicles from the sternum towards the shoulder for tenderness or deformity.

(b) Arms and forearms—inspect and palpate both arms for bleeding, tenderness, and deformity.

(c) Radial pulses—compare radial pulses for presence and equality (if unequal, compare blood pressures bilaterally).

(d) Hand movement—instruct patient to wave both hands to confirm flexion and extension. Check grip strength.

(e) Hand sensation—ask patient to determine which finger is touched.

(f) Painful withdrawal—test withdrawal to pressure on thumb nail beds bilaterally.

(g) Reflexes—test biceps reflexes (Figure 12-14).

(24) *Back.* Log roll and observe—log roll the patient unless spine injury is suspected, and observe for any posterior wounds.

(25) *Rhythm strip.* If possible, check the heart rhythm on a cardiac monitor.



Figure 12-14. Testing biceps reflexes.

Section III. PRIORITIES FOR MEDICAL EVACUATION

12-14. General

Assignment of medical evacuation priorities is necessary because it provides the supporting medical unit and controlling headquarters with information that is used in determining the commitment of available evacuation assets. It is for this reason that correct assignment of evacuation priority is essential. Overclassification of casualties has been, and continues to be, a problem. They will be picked up by evacuation resources as soon as possible, consistent with available transportation means and pending missions.

12-15. Evacuation Priorities

One of three different priorities can be assigned to a casualty, depending on the severity of their wound(s)/illness:

a. Urgent—this precedence is assigned to emergency cases that should be evacuated as soon as possible and within a maximum of 2 hours in order to save life, limb, or eyesight. Casualty's stabilization cannot be controlled.

(1) Shock—does not respond to IV therapy.

(2) Head injury—increase in intracranial pressure.

(3) Avascular limbs.

(4) Open chest/abdominal wounds.

(5) Uncontrollable bleeding.

(6) Severe burns—20 to 85 percent of the body surface area, or involving the face and neck.

b. Priority—this precedence is assigned to sick and wounded personnel needing prompt medical care. It is used when stabilization is difficult and the patient should be evacuated within the next 4 hours to prevent his condition from deteriorating to urgent precedence.

(1) Chest injury with pericardial tamponade, pneumothorax, hemothorax, or multiple risk fractures.

(2) Injuries which interfere with respiration.

(3) Abdominal injuries.

(4) Eye injuries.

(5) Spine injuries.

(6) Burns of hands, feet, genitalia, perineum, even if *less than 20 percent of the body surface is involved.*

c. Routine—this precedence is assigned to sick and wounded personnel requiring evacuation but whose condition is not expected to worsen significantly. Individuals in this category should be evacuated within 24 hours. Stabilization is under control.

(1) Closed fracture.

(2) Other open wounds.

(3) Psychiatric cases.

(4) Terminal cases.

12-16. Factors Affecting Medical Evacuation Decisions

a. Weather—single biggest factor in determining whether ground or air transportation can be employed.

b. Resources available—inadequate availability can sometimes delay evacuation for several hours. This means that careful consideration must be given before assigning evacuation priority.

c. Medical expertise available.

d. Tactical situation.

Section IV. TROOP MEDICAL CLINIC/ CONDUCT OF SICK CALL

12-17. General

a. A troop medical clinic (TMC) is a medical treatment facility designed primarily to provide outpatient examination and care for ambulatory patients, to treat emergency cases, and to arrange for admission to a hospital of a patient requiring inpatient care. The TMC also performs various administrative and preventive medicine activities related to the health of the personnel served. In general, the term "troop medical clinic" designates a facility situated away from the immediate vicinity of a hospital; the term "outpatient clinic" is used for a unit of the hospital that provides medical service primarily for nonhospitalized patients; and the term "aid station" designates a unit TMC providing primary medical care for troops in the field.

b. TMCs are the first level of medical service for all military personnel except those troops actually engaged in combat operations. Under combat or simulated combat conditions, first level medical service for troops is provided in aid posts and aid stations. TMCs are not merely first aid or sorting stations; they provide proper diagnosis and treatment for patients or transfer them to a hospital facility for inpatient care. The majority of patients seeking medical care do so because of minor sickness or injury. If these individuals are returned to duty from the TMC level without adequate examination and treatment, they can become less effective in their assignments.

c. The importance of professional medical care and good interpersonal patient relationships in TMC-level facilities cannot be overemphasized or exaggerated; a well-organized and efficiently-operated TMC is one of the most effective means of providing and extending medical service to the military community.

d. Some of the more important activities carried on by a TMC are:

- Emergency treatment.
- Sick call.
- Continuing routine treatment for patients who do not require hospitalization.
- Immunizations.
- Physical examinations.
- Sanitary inspections.
- Maintenance of individual health records.
- In some TMCs, provisions of medical and nursing care and observations of quarters-status patients who are admitted to the patient care bed unit of the TMC.

12-18. Routine Duties

The TMC must be kept ready so that patients can be received and treated in a clean and orderly environment. A common and workable method is to establish standing operating procedures (SOP) for daily and periodic routine duties that will not interfere with a smooth, uninterrupted flow of patients and that will take advantage of periods when the unit is free of patients. Each individual should have an assigned area of responsibility, to include treatment rooms, examining rooms, and rooms in common use such as waiting room, latrines, and corridors.

a. Daily Measures.

(1) At the beginning of the day and before treatment of patients begins, thoroughly air out the TMC; check emergency equipment, sterilizers, and treatment area supply levels (drugs, linen, instruments, utensils); check handwashing facilities for soap and paper towels; make a final check for dust and for orderly arrangement of equipment.

(2) As a concurrent measure throughout the day, check examining and treatment rooms after each use, to include removing all soiled linen, instruments, and gloves; replace supplies as required; and wipe up spills on floor and furniture immediately.

(3) During the noon period, air the waiting room and treatment area. Restore order for the afternoon's operations.

(4) At the end of the day, carry out general cleanup measures in order to have the TMC in readiness for the next day's operation. As each area is cleaned, restock and arrange all equipment in its proper place. Daily cleanup measures include damp dusting all furniture and damp mopping all floors, to include corners and behind doors.

b. Periodic Measures. Although these measures are not necessarily a part of the daily routine, observe them continually and accomplish the following at periodic intervals: cleaning windows; cleaning and replacing bulbs in ceiling lights; washing walls and woodwork; cleaning radiators and baseboards; caring for floors, such as removing wax, rewaxing, and polishing; and cleaning and rearranging cabinets and storage shelves.

12-19. Patient Receiving and Records Activities

a. General. The medical specialist works closely with and may perform part of the duties in the receiving and records section of the TMC. This section usually includes the reception and appointment desk and the records file. Organization of procedures at this station is essential to assure that—

(1) All individuals are received in a courteous, friendly, and professional manner.

(2) All patients are seen by a doctor with minimum delay.

(3) Emergency cases are seen first. Regardless of his reason for coming to the TMC, each individual who requests to see a doctor must be permitted to do so.

b. Routine Procedures. Routine procedures established for the receiving and records stations should include an SOP for—

(1) Handling records.

(2) Recording examination and treatments.

(3) Obtaining X-ray, laboratory studies, and other diagnostic measures such as consultations.

(4) Making appointments.

(5) Referring patients.

(6) Filing diagnostic reports returned to the TMC as the referring activity.

(7) Making necessary entries on the daily worksheet, in a ledger, or on machine records cards to facilitate preparation of the monthly Outpatients Report, DA Form 3537.

c. Ethical Aspects.

(1) *Privileged information.* Information given by the patient to the doctor and all medical and health records are privileged information in connection with professional medical care. The individual authorized access to information which is privileged or to information which would cause embarrassment to the patient will not reveal this information to those not officially concerned with the patient's medical treatment.

(2) *Female patients.* When medical examination or procedures are performed on adult or child female patients, a female nurse or attendant must be present. When female personnel are not assigned to the TMC, it is important to request that the husband, the parent, or a responsible female adult remain in the waiting room on call as needed as a chaperon. The male medical specialist assisting with patient care must make certain that an appropriate chaperon is present before preparing the patient for examination, before advising the doctor that the patient is ready for examination or treatment, or before performing any procedure himself.

d. Interpersonal Relations. The manner in which an individual is received when he comes to the reception desk and the things he observes while in the receiving area or waiting room create a lasting impression. The family member or friend who accompanies the patient is also concerned for the care and attention received. Four factors which foster good interpersonal relations under all circumstances are courtesy, concern for the individual, sympathetic understanding, and helpfulness.

12-20. Sick Call

Sick call (AR 40-2) is a daily assembly of sick and injured military duty personnel. Sick call is held each day at a designated place and time to provide routine medical examination and treatment for persons on duty status. Military personnel not reporting for medical treatment at sick call are seen on an appointment basis except that in an emergency they are seen at any time. After examination, patients medically unfit for duty are admitted to a hospital or confined to quarters. Patients not admitted will be given any necessary treatment. When excused from duty for medical reasons which do not indicate a need for hospitalization, military personnel may be authorized to occupy a bed in a TMC or to remain in quarters.

a. Individual Sick Slip. Each person who comes to the TMC on sick call should present an Individual Sick Slip (DD Form 689). The sick slip is prepared in the individual's unit orderly room. It is used to inform the unit commander of the status of an individual in his command who has reported on sick call. After examination and treatment of the patient, the attending medical officer indicates the disposition of the patient on the sick slip, which is returned to the unit commander. In exceptional cases, the treatment facility initiates the sick slip; for example, when an individual reports directly to the treatment facility in an emergency. Although the sick slip is not a part of the health record, it is an important means of communication in regard to the individual's duty status.

b. Dental Sick Call. Local policy may prescribe use of an Individual Sick Slip in connection with routine requests for dental attention. Provisions are made in each dental clinic to hold dental sick call. A definite period is set aside and personnel report directly to the dental clinic, not to medical sick call.

In a dental emergency, as in a medical emergency, patients are seen at any time. A dental officer of the day is available during other than normal dental clinic hours. After duty hours, personnel usually report to their regular TMC or clinic, and TMC personnel call the dental officer of the day.

12-21. Conducting Sick Call

NOTE

This is a typical sick call procedure which is subject to local modification.

a. Military Personnel, Usual Procedure.

(1) On arrival at the TMC, the individual reports to the TMC clerk and gives him the Individual Sick Slip. The clerk checks each slip to see that it contains the necessary information (individual's name, service number, grade, and organization).

(2) The clerk takes each patient's health record from the file for use by the attending doctor. The date of the patient's appearance on sick call is entered in the patient's Chronological Record of Medical Care (SF 600).

(3) A medical specialist receives the health record from the clerk; observes the patient; questions him about his complaint or condition; and takes his temperature, pulse, and respiration (TPR) for entry on the record.

(a) The TPR is taken and recorded as part of the routine examination procedure, since the significance of almost any symptom will change if accompanied by an elevated temperature.

(b) The specialist should talk to the patient, listen to his complaints, and observe signs and symptoms of distress or discomfort. Signs and symptoms that are readily observable during the initial contact with the patient include—

- Skin (observe lips and nail beds also, when applicable):
  - o Temperature—hot or cold to the touch.
  - o Color—flushed or pale.
  - o Rash—location.
  - o Wounds—location, condition of dressing if one is in place.
- Eyes and eyelids:
  - o Pupils—enlarged or pinpoint.
  - o Sclera—white, yellow, or red.
  - o Lids—swollen, encrusted, or clear at lid margins.

- Complaint of pain:
  - o Location.
  - o Start of pain—how and when.
  - o Type—sharp or dull, mild or severe, constant or intermittent.
- State of consciousness:
  - o Alert.
  - o Drowsy.
  - o Orientation to surroundings—knows where he is or seems confused.
- Nausea or vomiting:
  - o Time when started.
  - o If vomited, presence or absence of blood.
  - o Time, content, and source of last meal that was eaten.
- Temperature, pulse, respiration:
  - o Any marked deviation from normal, which is: temperature, 98.6^{o} (oral); pulse, 60 to 80; respiration, 14 to 20.
  - o Abnormalities of pulse rate and rhythm.
  - o Difficulty in breathing.
- General posture and gait:
  - o Sits and stands with or without difficulty.
  - o Walks with or without difficulty.

(c) Any patient with an obvious rash, an elevated temperature, a complaint of sore throat, or other upper respiratory symptoms that might indicate a communicable disease should not be left in a common waiting room in proximity with other patients. A separate waiting area should be provided. The SOP may specify that the doctor see the patient in the segregated area before requesting him to come to the examining room.

(4) The health record is taken to the doctor, who is informed immediately of any patient who appears to be acutely ill. The doctor calls in the patients one at a time, questions them, examines them, and determines what treatment they are to have.

(5) If the treatment procedure is one that can be carried out in the TMC, it will be given either by the doctor or by a designated assistant.

(6) If further diagnostic study is needed and it can be done while the patient is on a duty status, the doctor directs the clerk to prepare appropriate forms requesting a laboratory, clinic, hospital, or other suitable installation to do this work.

(7) If the doctor wants medicine dispensed to a patient, he writes a prescription and gives it to the patient, directing him to the TMC pharmacist. If the medicine is not available in the TMC, the patient may be instructed to take the prescription to a hospital pharmacy or he may have to return to the TMC after the pharmacist has obtained it.

(8) The doctor makes his entry on the patient's SF 600 and includes his determination of the patient's duty status: return to full duty; return to duty with limitations specified; or relieved of duty for "sick in quarters" or hospitalization.

(9) The doctor makes his entry on the Individual Sick Slip, indicating his disposition of the patient. (Local policy may include indicating the time that the patient was dismissed from Sick Call.)

(10) If it is necessary to hospitalize a patient, the doctor will direct the transfer procedure in accordance with local policy. An individual medical record is prepared for the patient transferred to the hospital. In some instances the clerk in the TMC will prepare this record; in other instances the A and D branch of the hospital registrar division prepares it.

(11) Patients requiring relief from duty but not hospitalization are carried as "sick in quarters." An individual medical record is prepared by the TMC clerk for each such case.

b. Nonmilitary Personnel Seen on Sick Call. When nonmilitary personnel are seen as sick call patients (that is, on a nonappointment basis), the procedures are usually the same as for military patients except that Individual Sick Slips are not used and a decision concerning duty status is not necessary.

c. Screening Patients on Sick Call. During normal sick call hours, the medical specialist may screen patients according to an SOP prescribed by the attending doctor. The screening procedure is done to designate priorities for examination by the doctor. As part of the screening procedure, the medical officer may permit a qualified nonprofessional assistant to evaluate and treat certain minor injuries and ailments, such as a scratch or minor abrasion, a cold with no cough or temperature elevation, or a slight headache. When this type of screening is permitted, the patient must be permitted to see a medical officer if he so requests.

d. Post Treatment Care on Sick Call. Following prescribed treatment in the TMC, the patient should not be dismissed until he has received any necessary instruction, medications, and future appointments. The medical specialist can do much to insure a better quality of patient care when he is able to reinforce the doctor's instructions by making sure the patient understands

what he must do as a self-care measure. It is essential that the medical specialist check the doctor's order on SF 600 and also check with the doctor so that all instructions he gives are in accordance with the doctor's instructions to the patient. If the patient on sick call has had medications administered which may produce drowsiness, any loss of coordination, or a delayed reaction, the medical specialist may often find it necessary to—

(1) Detain the patient in the TMC for a period of observation. The patient should not be seated in the common waiting room during this time unless no other suitable area is available. A cot or recovery bed is often provided adjacent to the treatment room for this purpose.

(2) Provide an escort if there is any question of the patient's ability to return alone to his orderly room or quarters.

12-22. Continuing Treatment in the Troop Medical Clinic

The doctor may order the patient to return to the TMC for a series of treatments over a period of days. (It may not be necessary for the patient to see the doctor each time he comes to the TMC for continuing treatments such as soaks, dressing changes, irrigations, repeated injections, or other treatment measures for which a written order has been entered on the patient's SF 600.) This general procedure should be followed:

a. The patient reports to the TMC or clinic at the specified hour.

NOTE

The original Individual Sick Slip may be used or the patient may have received DA Form 8-97 (Medical and Dental Appointment) at the time the follow-up appointment was made in the TMC.

b. The clerk obtains the patient's health record from the file, enters the date, and gives the record to the medical specialist.

c. The medical specialist is responsible for—

(1) Checking the doctor's order on SF 600 before any treatment is given. The order usually includes—

- Type of treatment.
- Number and duration of treatments.
- Dosage of medication.
- The time that the doctor desires to see the patient.

(2) Carrying out the treatment order. He notifies the doctor if there is an apparent change in the patient's condition. He must not hesitate to ask the doctor if further explanation is needed. He also must make certain that he understands the order and knows how to carry it out.

(3) Instructing the patient regarding any self-care measures and the time when the patient is to return to the TMC.

(4) Recording the treatment given on SF 600.

(5) Consulting the doctor immediately if:

- The treatment produces unsatisfactory results.
- The patient reacts unfavorably to the treatment.
- The patient desires to see the doctor.

12-23. Emergency Treatment in the Troop Medical Clinic—General Instructions

Emergency medical treatment is the early care given to the wounded, injured, or sick by trained medical personnel. Only some of the general procedures governing initial management of a patient brought to a TMC for emergency care will be discussed. In the TMC situation, a medical specialist will function primarily as the doctor's assistant. If he is the first person to see the patient who has come or been brought to the TMC for emergency treatment, he must know how to do first things first.

a. Preparation for Emergency Care. The specialist should be prepared to receive emergency patients. He should make certain that:

(1) He maintains proficiency in applying the basic ABCD measures of first aid—

- A—Clear the AIRWAY and restore breathing and heartbeat.
- B—Stop the BLEEDING by application of digital pressure to compression points, direct pressure, or pressure dressing to the wound.
- C—Start shock CONTROL measures by maintaining aeration and blood circulation.
- D—Apply a wound DRESSING to protect it from further contamination and control bleeding.

(2) Emergency equipment is ready for use, in its proper location, and immediately available—not locked up.

(3) He knows how to operate all emergency apparatus and how to use all items on an emergency tray. In an emergency, there is no time to look up a technique in a procedure manual, to review an instruction booklet, or to review an SOP.

b. Initial Patient Care Measures. The medical specialist should remember the following instructions:

(1) Do not get excited. Do one thing at a time quickly and efficiently.

(2) Take the patient to an examining or treatment area. Assist the patient to lie down with his head level. If he has been carried on a stretcher or litter, do not move him from the stretcher. Unless he is having difficulty in breathing, keep him lying down with his head level until the doctor gives other instructions. If he is having breathing difficulty, he may be more comfortable with the head of the stretcher elevated to support him in a semisitting position.

(3) Find out what is wrong. Observe the patient. Ask him if he is in pain and, if so, where he hurts. This brief questioning will help to determine his state of consciousness.

(4) Look for signs of breathing difficulty, bleeding, shock, or poisoning. Treatment of these conditions takes precedence over everything else because they are life-endangering.

(5) Notify the doctor immediately, giving a brief, accurate description of the nature of the emergency and the patient's condition.

(6) Take and record vital signs.

(7) Loosen and remove enough of the patient's clothing to enable the doctor to examine the patient, back and front. Handle the patient gently to avoid injury. If it is necessary to cut his clothing, ask for his permission or for that of an accompanying relative, if possible. Cut clothing along seams, if practicable, so that it can be repaired.

(8) Assist the doctor as needed, obtaining any equipment and carrying out all orders quickly and accurately.

c. Follow-up Measures.

(1) Assure the patient's relatives or other concerned individuals who have brought the patient to the TMC that care is being given. Request them to remain in a designated area in the TMC waiting room until the doctor can see them. Make them as comfortable as possible.

(2) Handle the patient's personal possessions as carefully as possible. Safeguard money, identification papers, and other valuables, following the SOP. If eyeglasses, dentures, a hearing aid, or other prosthetic appliances are removed from the patient, handle as if they were valuables.

(3) If other patients are waiting for care, explain briefly why their care is delayed.

(4) Plan to review and discuss the emergency situation with the doctor and other TMC personnel afterward—how it was handled, what deficiencies were noted, and what must be done to improve the handling of future emergencies.

12-24. Accident Reporting

a. Installation commanders are authorized to use a duplicate copy of the sick slip in lieu of DA Form 1051 (Record of Injury) (see AR 385-10) in cases of nonbattle injury of Army active duty military personnel for whom sick slips are ordinarily prepared. The individual initiating the sick slip will check the "Injury" box at the top of the form. Two copies of the form will be initiated for all injury cases, including suspected poisoning cases. After the medical officer's section of the form has been completed, the second copy of the slip will be forwarded to the safety officer concerned by means of a Memo Routing Slip (OF 41).

b. DA Form 1051 is initiated in three copies by the supervisor of the individual concerned, and delivered by the patient, if possible, to the TMC or first aid station. After the medical officer or medical attendant has completed his section of the form, distribution is made as follows: first copy returned to supervisor; second copy retained by medical treatment facility; third copy forwarded to safety officer concerned.

CHAPTER 13

FIELD MEDICAL CARE/ MEDICAL EMERGENCIES

Section I. INTRODUCTION

13-1. General

Field medical care is best defined as the provision of helpful and needful things to a sick or injured person to restore him to the best possible state of physical and mental health in a field environment. Whether assigned to a field unit, TMC, or hospital facility, the medical specialist must perform many aspects of field medical care to the sick and wounded. This chapter outlines and discusses various field medical procedures that the medical specialist will be expected to perform. Some of these procedures will have to be modified due to special circumstances such as equipment shortage, the tactical situation, or the personnel available.

13-2. Qualities of the Medical Specialist

In order to provide effective field medical care to sick and wounded personnel, the medical specialist must possess certain personal qualities. Many of them are inherent while others must be cultivated and improved upon.

a. Aptitude is the ability to anticipate the needs of patients, make appropriate decisions, and to adapt to various working conditions. Intelligence and a reasonable degree of manual dexterity indicate an aptitude for field medical care procedures.

b. Attitude is the manner of acting, feeling, or thinking that shows an individual's disposition or opinion. A desirable opinion is one that generates—

- Cooperation and understanding with fellow workers.
- Concern and consideration for the patients' welfare.
- A sense of individual job satisfaction.

c. Interest is a strong motivating force to provide satisfactory duty performance. Interest in a duty assignment can lead an individual to improve upon abilities and job knowledge.

d. Personal hygiene is the quality that includes both physical cleanliness and mental hygiene.

Section II. MANAGEMENT OF BURNS

13-3. General

a. Causes. Burns are commonly caused by direct contact with flames, hot liquids, chemicals, hot metals, hot air, steam, or electric current. Burns can cause a substantial loss of body fluids which results in shock. There is danger

of infection in all burns, especially if there are blisters or a loss of skin. Hot gas and flame burns of the neck, nose, and mouth are associated with airway swelling. Even minor burns, incurred in enclosed areas, may cause respiratory damage.

b. Severity. The severity of burns is measured by the degree or depth to which tissues are injured and by the extent or percent of body surface burned.

(1) *Degree of burns.*

(a) First degree. A first degree burn is superficial and involves only the outer layers of the epidermis. An example is minor sunburn in which the skin is red and painful, but with no blisters or fluid loss. It is not an open wound and does not become infected.

(b) Second degree. The second degree (partial thickness) burn extends into, but not completely through, the dermis. This type of burn destroys or damages skin cells, glands, and blood vessels. It is characterized by redness, pain, blisters, and "weeping" of serum. Body fluids are lost through the damaged skin. The second degree burn is an open wound and is susceptible to infection.

(c) Third degree. A third degree (full thickness) burn destroys all layers of the dermis and may extend through the subcutaneous tissues into the muscle layer and underlying bone. There may be amputation of parts. This burn is characterized by *insensitivity* to pain (nerve branches in the area are destroyed) and a hard dry surface which is either charred or pearly white. The surface is usually depressed below that of the surrounding second degree burn. Large amounts of body fluids are lost into the damaged tissues and through the destroyed skin layer. A third degree burn is an open wound highly susceptible to infection.

(2) Percent of body surface area burned.

(a) An early estimate of the percent of body surface area (BSA) burned is of great importance in determining the amount of fluid replacement necessary to prevent shock and in the management of mass casualties. Usually, first degree burns are not included in this estimate. For practical purposes (especially in an emergency situation), second and third degree burns are considered to have the same effect when estimating the percent of body surface burned (for fluid replacement purposes).

(b) The percent of BSA is estimated by using the "Rule of Nines" shown in Figure 13-1. The total body surface is divided into the major anatomic parts, each part representing approximately 9 percent or multiples of 9 except for the perineal area. The head and neck represent 9 percent; each arm including the hand, 9 percent; the anterior trunk, 18 percent; the posterior trunk, 18 percent; each leg including the foot, 18 percent; and the perineum and external genitalia, 1 percent. Proportionate areas of these parts may be estimated.

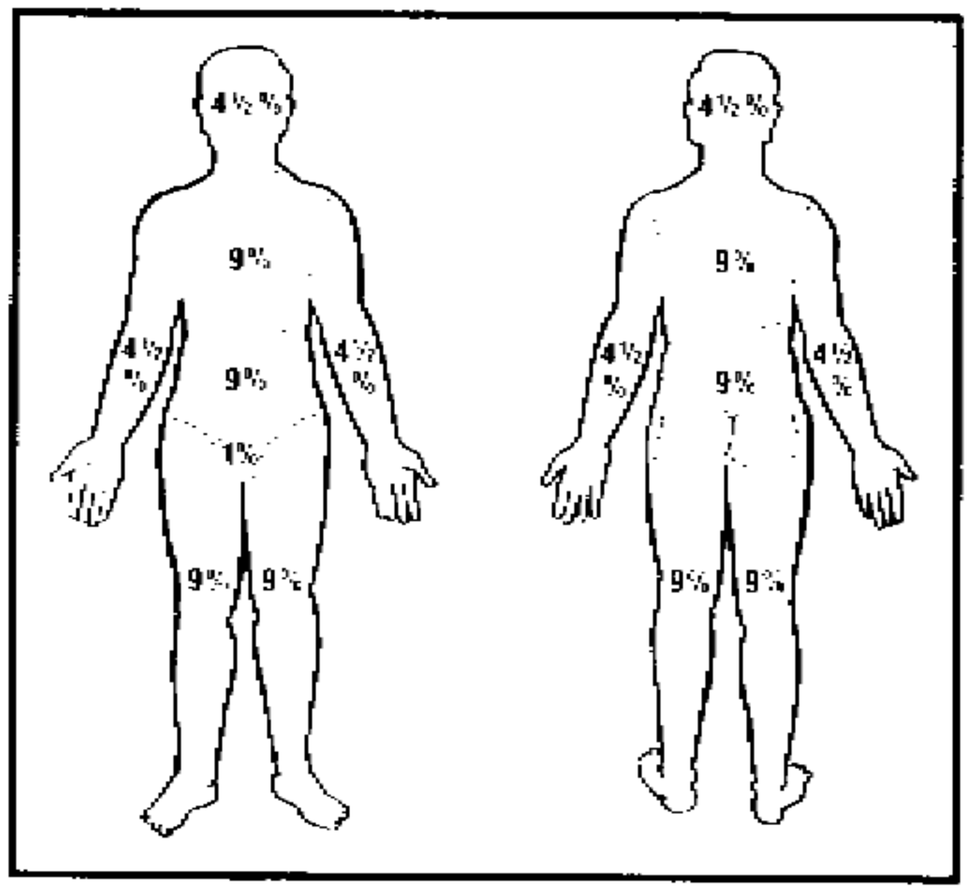


Figure 13-1. "Rule of Nines" BSA estimate.

13-4. Pathology of Second and Third Degree Burns

The pathologic process involved in second and third degree burns consists of three phases:

a. Phase 1. In the first phase there is always some destruction of the skin, which results in a loss of plasma. In second degree burns, there is a temporary loss of plasma in the form of edema fluid and a permanent loss through blister fluid or through "weeping" burned surfaces. Plasma rapidly seeps into burned tissues and produces widespread edema (swelling). Edema begins to develop at the time of burning and is evident within a few hours; it continues for 2 or 3 days. In second and third degree burns (particularly in third degree), there is destruction of red blood cells.

b. Phase 2. The second phase generally begins on the third day after injury. The coagulum which forms on the surface of second degree burns and eschar (scab) on third degree burns reduces fluid losses from the surface of the burn.

c. Phase 3. In the third phase, infection develops. Second and third degree burns are open wounds and are subject to contamination from the time they occur.

13-5. Classification of Burns

For emergency treatment purposes, second and third degree burns are classified by severity as minimal, moderate, or extensive, depending upon the percent of body surface burned.

- Minimal burn
  1. Third degree burns of less than 2 percent and no critical areas burned.
  2. Second degree burns of less than 15 percent BSA.
- Moderate burn
  1. Third degree burns of 2-10 percent BSA not involving face, hands, feet, or perineum.
  2. Second degree burns involving 15-25 percent BSA.
  3. First degree burns involving 50-75 percent BSA.
- Extensive burn — Burns of any degree that are complicated by respiratory injury or other major injury or fracture, or that involve hands, feet, face, or perineum.

13-6. Mortality Among Burned Patients

a. As a practical matter, *a second or third degree burn of more than 20 percent of the body surface endangers life.* In addition, the patient's age influences the outcome of a burn; the old and the very young do not withstand burn injuries well. *Without adequate treatment, a second or third degree burn of more than 30 percent is generally fatal to adults.* The outlook also varies according to the location of the injury.

b. Facial burns are often accompanied by complications involving the eyes or the respiratory passages; a serious risk of infection accompanies burns of the perineum. Most deaths among burn patients during the first few hours or days after injury can be attributed to shock. Some form of respiratory obstruction accounts for most other deaths during this early period. Pulmonary edema from burns about the face and neck or from inhalation of noxious agents, superheated air, or superheated vapor are prominent forms of respiratory obstruction. Gastrointestinal bleeding from a stress ulcer may account for some early deaths. Later mortality is almost always due to infection.

13-7. Procedure for Administering Initial Treatment for Burns

a. Survey the Patient.

(1) Respiratory functions of burn patients must be assessed frequently due to swelling and reduced respiratory function.

(2) Examine for singed nasal hairs, carbon-like material in the nose or mouth, or black or carbon-flecked sputum. These signs indicate inhalation burns.

CAUTION

Administer narcotics cautiously to burn patients because they may compromise respiration.

b. Determine the Cause of the Burn. If the cause is not evident, ask the patient or any bystanders for information.

c. Prevent Further Injury to the Patient.

(1) *Thermal burns.*

(a) Move patient away from any contact with the burn source.

(b) Remove all clothing and any metal items, such as jewelry. Do not remove clothing that is stuck to the burn, cut around the stuck clothing.

(c) Do not immerse the patient's whole body in water for more than 2 minutes.

NOTE

Ice or cold compresses may be applied locally to minor (first and second degree) burns. This will have a local anesthetic effect and relieve some pain. It causes vasoconstriction in the area, helping decrease edema. Ice should not be applied directly to the burn. Prepare a container of iced water and immerse the affected part for 10-15 minutes every 30-60 minutes for the first 6 hours. Care must be taken to avoid causing cold injury to the casualty.

(2) *Electrical burns.*

(a) Turn off the source of electrical current.

(b) If unable to do so, remove the patient by—

- Standing on a dry surface.
- Using a dry, nonconductive material such as a wooden pole or rope to physically move him from the source of the current.

NOTE

Electrical burns may cause deep, severe tissue destruction with only small skin burns at the point of current entry and exit.

CAUTION

1. Patients exposed to electrical currents may suffer cardiac arrest due to disturbances in their cardiac rhythm. Apply the ABC's of treatment and administer CPR if indicated.

2. Do not directly touch a patient receiving an electical shock. Such contact will extend the current to you.

3. Examine the patient for exit as well as entrance burns (exit burns may be on soles of feet).

(3) *Chemical burns.*

(a) Remove and dispose of contaminated clothing.

(b) Brush off solid chemical particles.

CAUTION

Do not touch the chemicals or get them on your clothing.

(c) Flush the skin with large amounts of water for 20-30 minutes if possible. If the chemical is white phosphorus, flush the burn area thoroughly and cover it with a wet dressing.

d. Expose the Burn Injury. Expose the entire burned area by removing the clothing surrounding the affected area. Do not remove any clothing that is stuck to the burn to avoid increasing tissue damage.

e. Determine the Percent of Body Area Burned. Calculate the percent of BSA burned (using the "Rule of Nines") by adding the percentages of the affected areas (Figure 13-1).

NOTE

The actual percentage of body surface area burned is used to calculate fluid requirements. Incorrect estimates will distort the fluid requirements.

f. Assess and Determine the Depth of the Burns.

(1) **FIRST DEGREE**—First layer of skin is red and painful (sunburn).

(2) **SECOND DEGREE**—Skin reddened and blistered.

(3) **THIRD DEGREE**—Full thickness of skin destroyed (burns down to the fat, muscles, and/or bones).

g. Treat for Shock.

(1) All patients with second and third degree burns of 20 percent or more body surface area must be treated for shock.

NOTES

1. Burn patients are extremely susceptible to shock due to loss of large amounts of fluids through the burned area.

2. The head and neck should be elevated if those areas are burned.

3. Place the patient in a high semi-Fowler position to assist in respiration. Monitor closely for respiratory difficulty.

4. Elevate burned extremities above the level of the heart. Assess for the presence of peripheral pulses and record presence or absence on FMC. Excessive edema can impede circulation.

(2) Start an IV with lactated Ringer's solution through a large bore needle (14-16 ga).

NOTE

Start the IV in an unburned area, if possible. Starting it in a burned area increases the chances of infections.

(a) Calculate the patient's body weight in kilograms by dividing his weight in pounds by 2.2 (see Table 13-1). This will yield the patient's approximate kilogram weight.

(b) A simple method of fluid replacement for field management involves patients who have sustained *greater* than 20 percent BSA second or third degree burns. A large bore IV is started and the patient receives 1 liter of lactated Ringer's solution per hour for the first 2 hours. If the patient cannot be evacuated during that time and must remain in the field environment, the following calculations will be utilized for fluid replacement:

1. Multiply 1 milliliter of fluid (1.00 cc) times the percentage of body surface area burned times the kilograms of the body weight. This will give the total amount of fluids (in cc's) to be administered during the first 8 hours. **EXAMPLE.** The patient weighs 165 pounds (75 kgs) and 30 percent of his body surface area is burned. This equals to 1.00 cc x 30 x 75 = 2250 cc's for the first 8 hours. In the first 24 hours the patient will require 1-4 cc's of electrolytes times the percentage of burns times the body weight in kilograms. This is required to maintain an adequate urine output (30-50 cc's/hr). (This fluid requirement may be as much as 9000 cc's in the first 24 hours in the above example.)

2. Measure the urine output as small, medium, or large volume and record it on the FMC (indicate the times(s) of output if possible).

3. Patients with extensive burns should have a Foley catheter inserted to monitor urine output (See Chapter 14). Urine output should be maintained at 30-50 cc/hr. If the patient is vomiting, distended, nauseated, or has burns over 25 percent BSA, a nasogastric tube should be inserted.

Table 13-1. Pounds/Kilograms and Conversion Table.

Kgs	5	10	15	20	25	30	35	40	45
Lbs	11	22	33	44	55	66	77	88	99
Kgs	50	55	60	65	70	75	80	85	90
Lbs	110	121	132	143	154	165	176	187	198
Kgs	95	100	105	110	115	120	125	130	135
Lbs	209	220	231	242	253	264	275	286	297
Kgs	140	145	150	155	160	165	170		
Lbs	308	319	330	341	352	363	375		

NOTES

1. The percentage of body surface area burned is used as a whole number, not as a decimal.

2. In the first 24 hours the patient may need fluids up to, or in excess of 4 ml/kilogram/percentage of burns. This fluid requirement could actually be in excess of 20,000 cc's for a large person (200 pounds) with extensive burns (75 percent BSA).

3. Fluid rates adjusted to maintain a drop rate of approximately 94 per minute insures the administration of 2250 cc's in 8 hours.

h. Dress the Burns. Do not apply dressings to the patient's face, hands, feet, or perineum.

CAUTION

Do not apply ointment or grease because they cause retention of heat in burns. If available, Silvadene or Sulfamylon cream can be applied.

Give the patient nothing by mouth unless an IV cannot be started; then only give *small* sips of water to a patient who will not reach the MTF within 3 hours. Do not give excessive amounts of water because kidney function may be impaired due to severe burns.

NOTE

Dressings will reduce fluid loss and aid in preventing the progress of shock. If sterile dressings are not available, apply the cleanest cover possible (a clean blanket or sheet).

13-8. Treatment of the Patient with Extensive Burns

With the best of care and treatment conditions, only about 50 percent of patients with extensive burns survive more than a few days. With the limited medical capability envisioned during the first 72 hours after onset of a mass burn situation, survival rate among these patients is expected to be much lower. Diversion of medical resources to these individuals when their chance for survival is so limited adds tragedy to disaster because it deprives other patients less gravely injured of the treatment, care, and supplies which, if applied early and correctly, can help them back to health. The extensively burned patient, therefore, has no priority for replacement fluid, dressings, antibiotics, or time of personnel except for those few moments needed to give analgestics or other medications available for the relief of pain. Those who survive the emergency phase are then given treatment and care to the extent possible that is not detrimental to the welfare of patients in higher priority treatment categories.

Section III. IMPALEMENT INJURIES

13-9. General

When treating an impalement injury, immediate and positive action is required by the medical specialist. An understanding of the principles of emergency care combined with proper application of these principles will greatly reduce the possibility of post-injury complications including hemorrhage and shock.

13-10. Initial Treatment for Impalement Injuries

a. Always treat for life threatening conditions first. Check the patient for consciousness. If he is unconscious, the cardiac and/or respiratory functions may be impaired.

(1) If respiration is impaired, check the airway for obstruction and ventilate the patient, if necessary.

(2) Check the patient for presence of a pulse. If none can be detected, follow established procedure for performing cardiopulmonary resuscitation.

b. DO NOT remove the object. Its removal may cause severe hemorrhage or damage of nerves or muscles lying close to the object. Try to stop any bleeding from the entrance wound by direct pressure on the surrounding tissue; avoid exerting any force on the impaled object itself.

c. Remove clothing covering the wound. Use a bulky dressing to stabilize the object. The impaled foreign body should be incorporated within the dressing so that its motion is reduced after the bandage is applied.

d. Transport patient to more definitive care with the object still in place.

13-11. Impalement Injuries of the Head

a. When evaluating a patient with an impalement head wound, you should—

(1) Assess the level of consciousness—conscious, confused, semiconscious, unconscious.

(2) Evaluate eye movements and pupil response—dilated, constricted, responsive to light, equal or unequal pupil size.

(3) Assess posture and movement (motor system) including reflexes.

b. Treatment.

(1) Check for life threatening conditions.

(2) Cut through sterile dressings to the halfway point and place them around the impaled object. The number and placement of the dressing will depend upon the size and position of the object.

(3) Use additional bulky materials/dressings to build up the area around the object.

(4) Apply supporting bandage over bulky materials to hold them in place. Gauze with adhesive tape, cravats, and strips of clothing may be used as bandaging material. Exercise caution when using elastic bandages since they can be difficult to apply by one person and may be applied too tightly.

(5) Record the treatment given on the FMC.

(6) Evacuate the patient immediately to the nearest medical treatment facility.

c. Treatment of impalement injury to the eye.

(1) Place padding around the protruding object, but do not touch or remove the object (Figure 13-2).

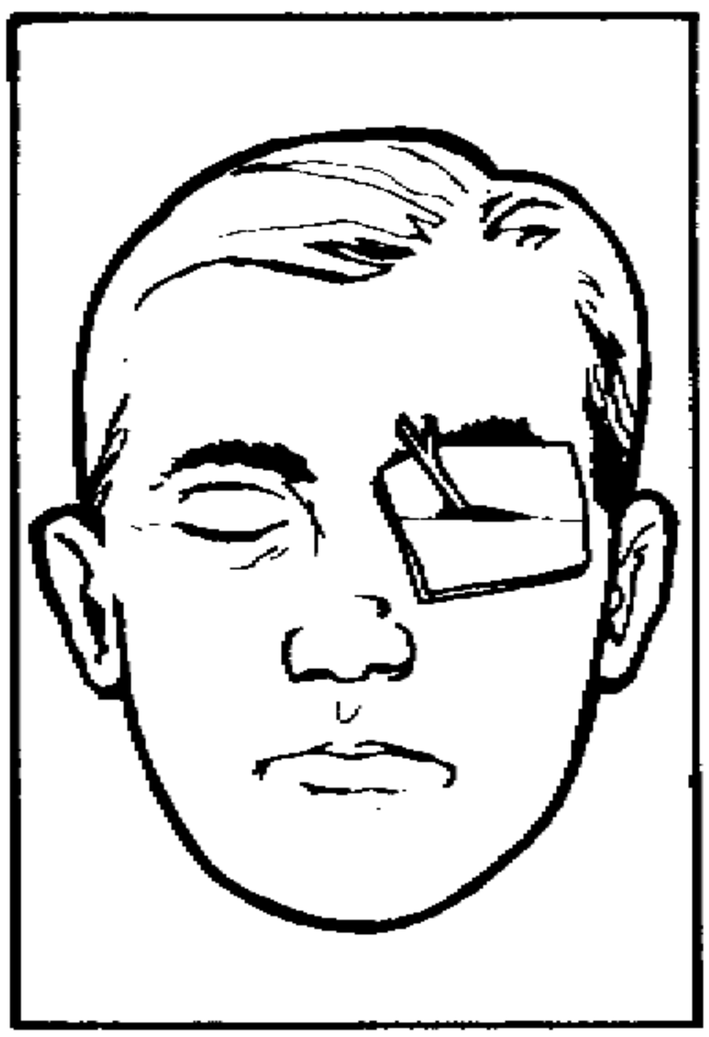


Figure 13-2. Padding placed around protruding object.

(2) Caution the patient not to squeeze his eyelids together.

(3) Cut partially through a first aid dressing so that it will fit around the object (Figure 13-3). This will keep the object from being pushed further into the eye.

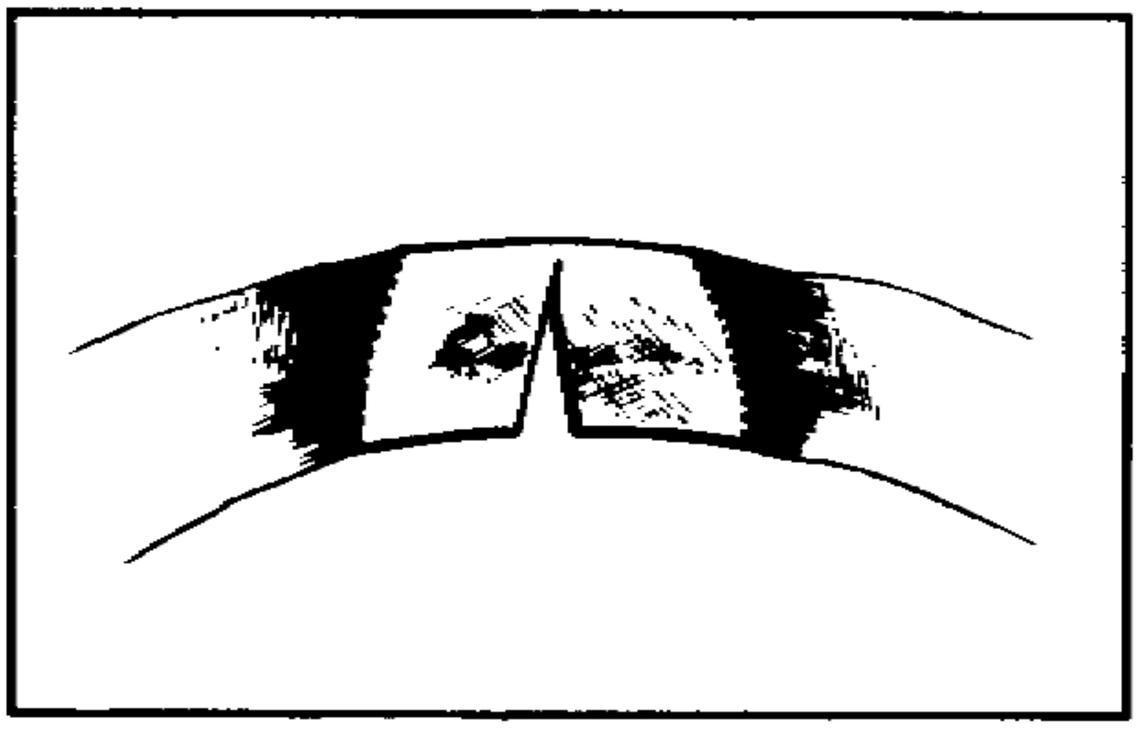


Figure 13-3. Cut first aid dressing.

NOTE

Padding must not put pressure on the object. It should also be built up so that it prevents the object from moving. The padding may be cloth material folded to fit the eye area. Tape may be used to hold the padding in place.

(4) Place the first aid dressing over the injured eye. If necessary, apply a second dressing so that both eyes are covered.

13-12. Impalement Injuries of the Chest

a. An object that has penetrated the chest wall may also penetrate and sever or come near a large blood vessel. This can cause a pneumothorax, tension pneumothorax, or hemothorax. In these conditions, normal lung expansion cannot occur and the lung is compressed so that volume of air is lost. Less air can be inhaled and there may be significantly less blood to carry the reduced amount of oxygen available to the patient.

b. Treatment. Use the same treatment procedures as outlined for treatment of an impalement head wound.

13-13. Treatment of Impalement Injuries of the Extremities

a. Check patient for immediate life threatening conditions first. Caution patient to remain still and not remove the impaled object. Expose the injury by cutting away clothing, shoes, or equipment (Figure 13-4). Check the pulse in the extremity involved, distal to the injury site.

b. Immobilize the impaled object by cutting through sterile dressings to the halfway point and placing them around the impaled object. This will help control bleeding and stabilize the object (Figure 13-5).

c. Use additional dressings or bulky materials to build up the area around the object. Two persons should be used to perform this procedure. One to immobilize the object and prevent any motion and the second to apply the bulky dressing (Figure 13-6) and bandaging (Figure 13-7).

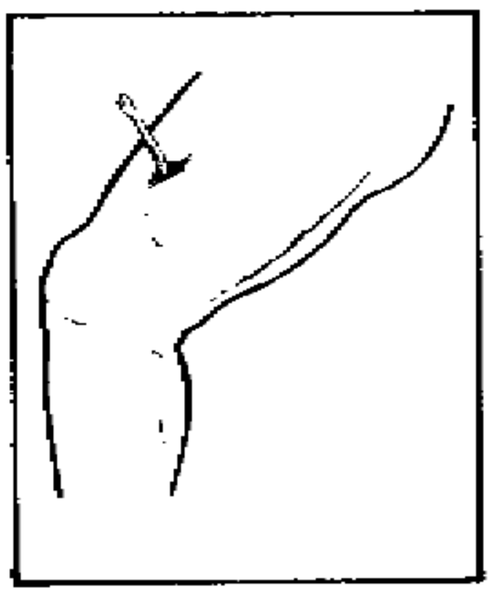


Figure 13-4. Exposed impalement.

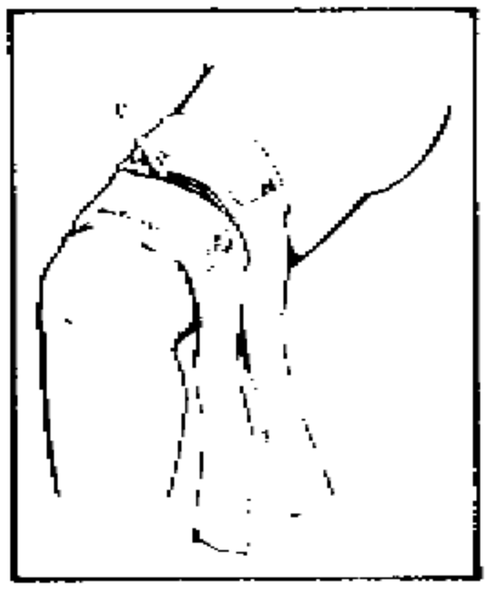


Figure 13-5. Dressing around impalement.



Figure 13-6. Bulky materials used.

d. Apply the bandage as tightly as possible to stabilize the object, *but not to the point where it will interfere with circulation.* Gauze with adhesive tape, cravats, and strips of clothing may be used as bandaging material.

e. Secure support bandage with adhesive strips or safety pins (Figure 13-8).

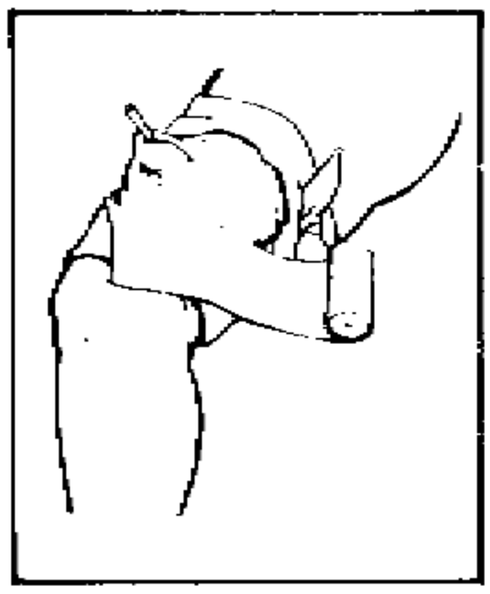


Figure 13-7. Applying bandage over bulky support materials.

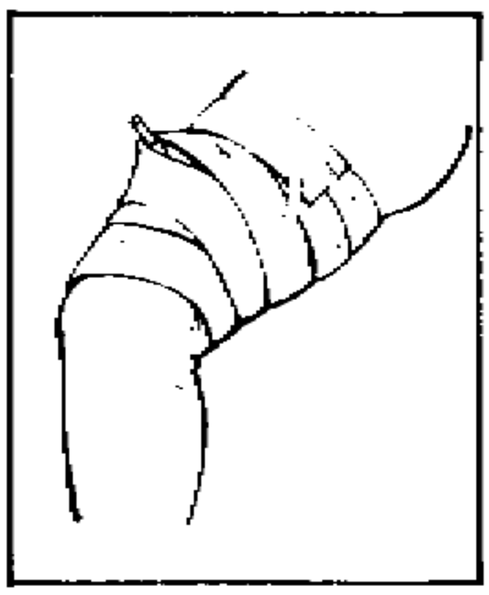


Figure 13-8. Securing bandage.

13-14. Immobilize the Affected Area

Immobilize the injured area by a—

a. Splint. Objects impaled in limbs require that the limb be splinted in the same manner as a fracture to prevent movement.

b. Sling. When an object is impaled in the upper chest and an arm is affected, the arm should be placed in a sling and swathe (see paragraph 13-52) to prevent movement and further damage.

CAUTION

1. The splint or sling should not be anchored to the impaled object.

2. Avoid undue motion of the impaled object when applying splints.

NOTE

In some instances, it may be necessary to shorten the length of the impaling object prior to evacuating the patient. Due to possible damage to underlying tissues, any manipulation of the object should be done with minimal movement.

13-15. Evacuate the Patient.

a. Check the patient's pulse distal to the injury site.

NOTE

If indications of shock are noted, follow the procedure for treating hypovolemic shock. This procedure may be used for all impalement injuries.

b. Record the treatment given.

c. Evacuate the patient immediately.

Section IV. HEAD, FACE, NECK, AND SPINE INJURIES

13-16. General

a. With the exception of fractures of the arms or legs, injuries to the head, face, neck,and spine are among the most common you will see. There is a wide range of injuries that can occur in these areas, from minor maxillofacial abrasions to massive trauma injuries. This section describes these injuries in detail and provides definitive treatment procedures.

b. The head consists of two major structures: the skull and the brain.

(1) *Skull.* The skull is essentially a hollow structure. On the outside are the musculature (muscle structures), skin, and appendages of the face and scalp. The scalp and facial structures are attached to the bones of the skull by means of a thin, tough, fibrous sheath, the periosteum. Within the face are the structures of the mouth, nose, and pharynx. The largest hollow of the skull, the cranium, contains the brain. The cranium completely envelops the brain except for a hole at the base of the skull through which the spinal cord connects with the brain. Cranial nerves and blood vessels pass through small holes in the cranium that are sealed by the cranial lining.

(2) *Brain.* The brain is the primary organ of life and the chief component of the central nervous system (CNS) (see Chapter 7). It is protected from injury by three separate mechanisms: the skull, the meninges, and the cerebrospinal fluid (CSF). The CNS consists of the brain, the spinal cord, and peripheral nerves that control all activities of the body. The brain directly controls the functions of the eyes, ears, face, heart, and respiratory apparatus by means of electrical charges that pass between these structures and the control centers in the brain by the cranial nerves. Interference with these control centers results in erratic behavior or cessation of function in the organs and structures they control. Brain cells do not regenerate. Once a brain cell is destroyed, it cannot be replaced by a new brain cell. Scar tissue takes its place, but not its function, which is lost forever. The brain lies very close to but not directly against the bones of the cranium. It is separated from the cranium by the meninges and fluid. The outer surface of the brain is intimately covered by one of the meningeal membranes, the pia mater, which contains many small blood vessels. The cranium is lined intimately with the dura mater (a tough, fibrous, relatively thick meningeal membrane). Between the dura and the pia is a thin subdural space, which contains a little fluid, the delicate net-like arachnoid membrane, and the subarachnoid space filled with cerebrospinal fluid. This fluid, which is clear, salty, and very watery, bathes the outer and certain inner surfaces of the brain and the spinal cord.

13-17. Classification of Head Injuries

Head injuries discussed in this section are limited to those involving the scalp, cranium, and its contents. Head injuries are divided into two main classes, open and closed. (Facial and pharyngeal injuries are discussed in paragraphs 13-22 through 13-25).

a. Closed Injuries. No obvious external damage except for a possible bruise or contusion is present. Injury may be to the brain itself, the pia, or the arachnoid meninges (Figure 13-9). Ruptured blood vessels of the pia are particularly important in closed injuries. Blood spilled onto brain cells is a foreign substance and disturbs the functions of these tissues. Blood collecting within the cranium exerts pressure against the brain when there is no fracture to the skull, or the skull fracture is such that the integrity of the dura is not disturbed. If the skull is depressed (displaced inwardly), it may exert direct pressure on the brain even without formation of a hematoma (blood pool).

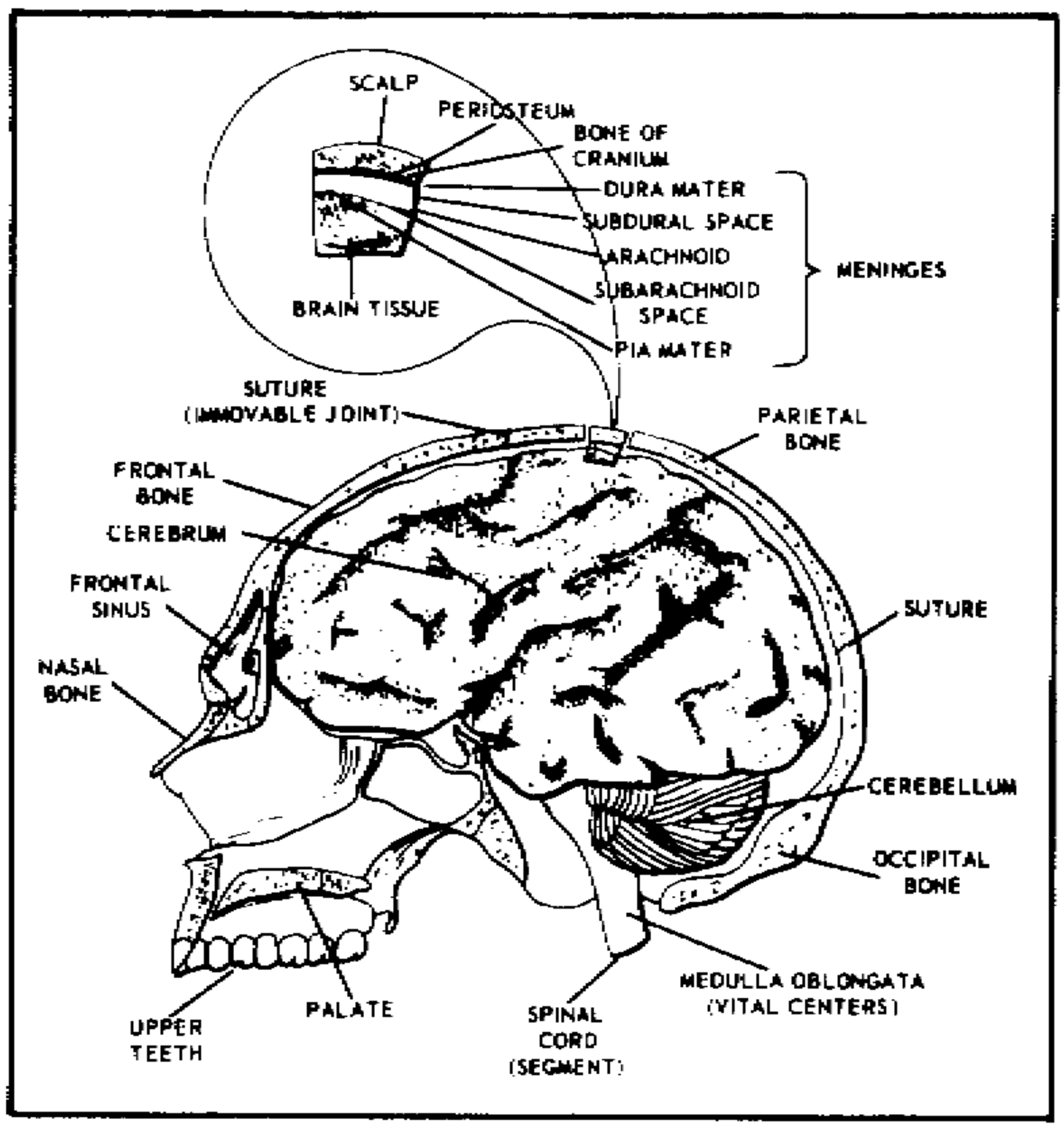


Figure 13-9. View of left side of brain with left side of skull and the mandible removed.

b. Open Wound. In an open wound there is obvious external damage. Open wounds of the head are subclassified according to whether or not the integrity of the dura is disturbed.

(1) *Nonperforated dura mater.* The wound may only be a laceration of the scalp which, although not to be taken lightly, may not be serious. Also, there may be one or more fractures of the skull without the dura being perforated. In either case, internal damage is likely to be or become more serious than that of the scalp and skull. If the skull is fractured, it will hold in the same manner as a closed injury against pressure of any hemorrhage that occurs within the cranium.

(2) *Perforated dura mater.* The skull is fractured in such a way that it is no longer a closed vault (part of it may be torn away) and the dura is open with the meninges exposed to the open air. In some cases, the delicate meninges are opened with the brain itself exposed or extruding through the opening.

13-18. Assessment of Head Injuries

All head injuries are potentially dangerous, not only because of the immediate tissue damage and increased susceptibility to infection, but also because of the probability that some vital area or special sense is or will become involved. For these reasons, all signs and symptoms referable to the nervous system must be carefully noted including the time of their occurrence or observation.

a. State of Consciousness. A notation of the state or states of consciousness observed in the patient will greatly assist the physician who treats the patient later. The following descriptive terms should be used, as appropriate, to define the state of consciousness observed.

- *Conscious.* Patient is alert and oriented in time and space.

- *Confused.* Patient is alert but disoriented and excited; he can take fluids by mouth. The disorientation and excitement may be temporary and have a psychological basis in addition to, or instead of, brain injury.

- *Semicomatose (semiconscious).* Patient responds to any applied stimulus; he cannot be given fluids by mouth. The patient displays unnatural drowsiness (somnolence)

- *Comatose (unconscious).* Patient does not respond to any applied stimulus; he cannot be given fluids by mouth.

b. Pupil Size. Normally, pupils of the eyes become very small in the presence of strong light and dilate (become larger) as the light fades. Dilation in the presence of strong light indicates central nervous system impairment. Normally, the pupils are also matched in size. When neither eye is obviously injured and the pupils are of unequal size, brain impairment is assumed.

c. Muscles. The musculature on one or both sides of the face may droop due to a lack of brain stimulation. There may be a loss of speech or an impairment to speech. Paralysis and a lack of firmness in the muscle mass of any part of the body without damage in that part, or no evidence of spinal cord damage, is an indication of impairment in the brain area that controls those muscles.

d. Vital Signs. The vital signs (temperature, pulse, blood pressure, and respiration) are important when treating head injuries. Changes in the vital signs frequently indicate the onset of complications. It is important to recheck and record vital signs frequently. Be especially alert for changes in pulse and blood pressure. Rising blood pressure with a slow pulse indicates increased intracranial pressure. Falling blood pressure with a rapid pulse indicates shock.

13-19. Symptoms of Closed Head Injuries

a. Headache, nausea, dizziness, and loss of consciousness (which may be brief, intermittent, or extended) may accompany a closed head injury. If the injury is from an impact with a blunt surface, an elevated contusion (bruise) forms when blood and other fluids collect in the subcutaneous tissue between the dermis and the skull; there may be a fracture of the skull if the skull is displaced inwardly. Many skull fractures can only be diagnosed by x-ray. However, there are several important signs to look for if a skull fracture is suspected. These signs are—

- Deformity, a depression or instability in a part of the skull.
- CSF leakage from the nose, an ear, or a scalp wound.
- Blood oozing from the nose or an ear.
- Ecchymosis (bruising) behind the ear(s) (Battle's sign).
- Ecchymosis in the soft tissue under the eyes ("Raccoon" or black eyes).

b. In more severe injuries, vomiting and paralysis of muscle groups may occur. The patient may bleed from the nose, mouth, or ears in the absence of obvious injury to these parts. CSF coming from the nose or ears indicates a serious injury. The CSF becomes cloudy when mixed with blood. Signs of increasing intracranial pressure include—

- Elevated blood pressure.
- Elevated pulse pressure (distance between diastolic and systolic blood pressure).
- Slow pulse.
- Restlessness.
- Dilation of one or both pupils.
- Decreased respiration.
- Cyanosis.
- Delirium or irritability.
- Paralysis.

13-20. Symptoms of Open Head Wounds

The patient may be either conscious or unconscious. Signs of intracranial pressure and internal damage, if any, are the same as for a closed injury.

a. Lacerations. Lacerations of the scalp bleed profusely because the blood vessels, which are quite numerous, do not constrict and retract as do those of other body areas. Scalp lacerations tend to remain open because the scalp, when intact, envelops the skull very tightly.

b. Skull Fracture. The skull may be misshapen, yielding, or minus parts or pieces. The most severe open head wound is a skull fracture in which the brain tissue is exposed through the skull or extruded through the bone fragments and lacerated scalp. Another type of skull fracture is caused by penetrating objects. If the object is protruding, no attempt should be made to remove it. The protruding end of an impaled object may have to be cut off to transport the casualty.

13-21. Treatment for Head Wounds

a. Open the Airway. Clear the air passage of any vomitus, mucus, or debris as necessary; place the patient in the coma position (Figure 13-10); turn the semicomatose or comatose patient from one side to the other every 20 minutes. As the patient's condition stabilizes, turning him every hour may be sufficient. Always protect the cervical spine. Patients with injuries above the clavicle are considered to have a cervical spine injury until proven otherwise.

NOTE

Maintaining an open airway is usually not a problem for patients who have only scalp lacerations; the first consideration with these patients is to control the profuse bleeding.

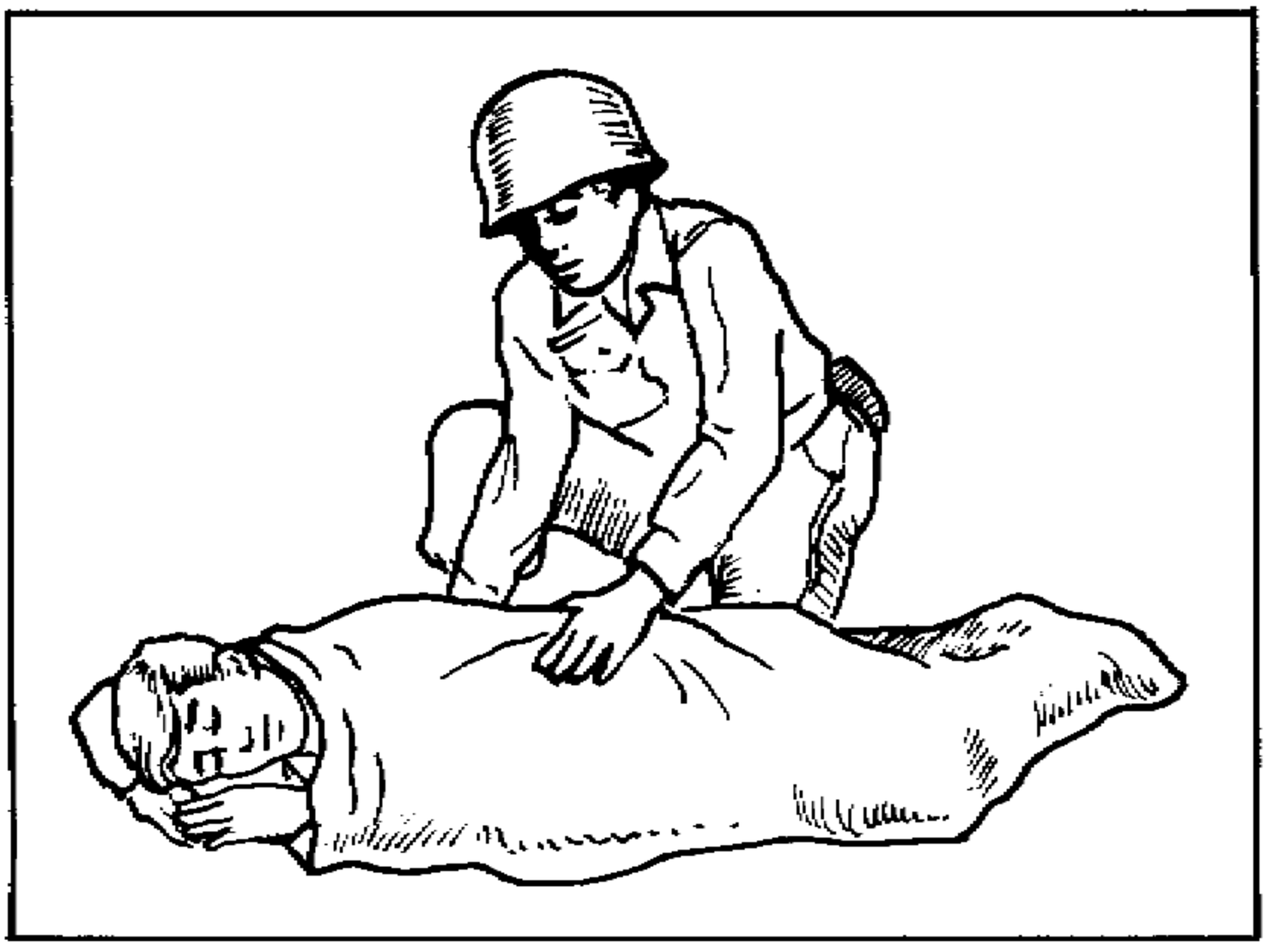


Figure 13-10. Coma position.

b. Control Bleeding and Protect the Wound. Do not remove or disturb any foreign material which may be in the wound; leave any protruding brain tissue as it is. Apply the dressing over this tissue.

(1) *Use a sterile pressure dressing.*

- Place the dressing over the wound (Figure 13-11), allowing the tails to fully unfold and hang along the side of the patient's cheeks.

- Grasp one tail, wrap it under the chin, up over the head covering the dressing, and down the opposite side of the head to the level of the patient's eyes (Figure 13-12).

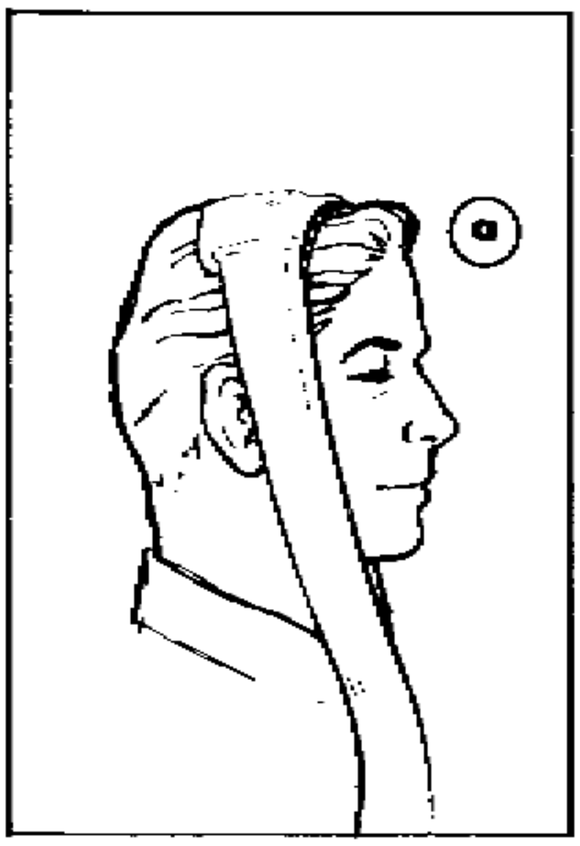


Figure 13-11. Sterile dressing over the wound.

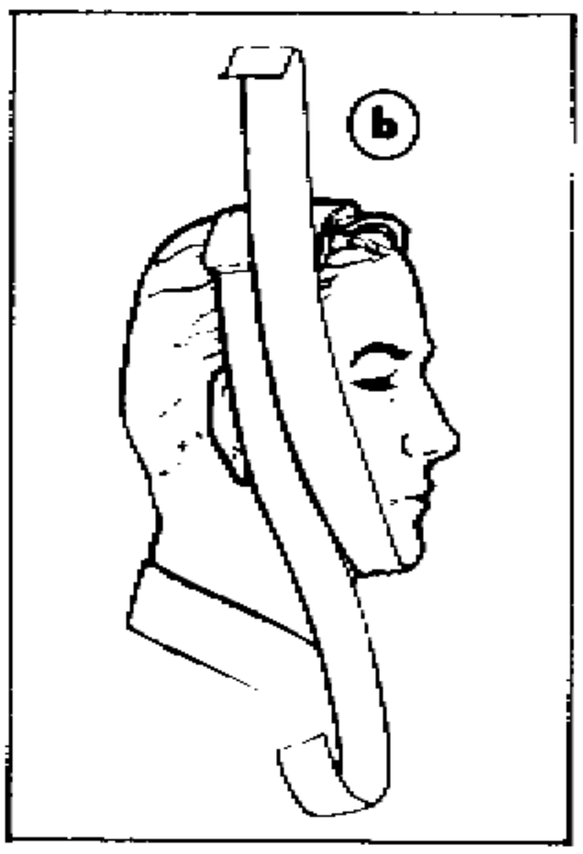


Figure 13-12. Tails wrapped around chin and head.

- Grasp the other tail, wrap it under the chin in the opposite direction and bring it up the side of the head, meeting the first tail at the level of the patient's eye.

- Cross the tails, wrap one tail around the back of the patient's head to the opposite ear. Wrap the other tail around the patient's forehead until it meets the first tail (Figure 13-13).

- Tie the tails over the crossings of the two directional wrappings (Figure 13-14).

NOTE

If blood seeps through the initial dressing, do not disturb the dressing. Apply a second dressing over it. This will help reinforce the primary dressing as well as aid in the clotting process for controlling the bleeding.

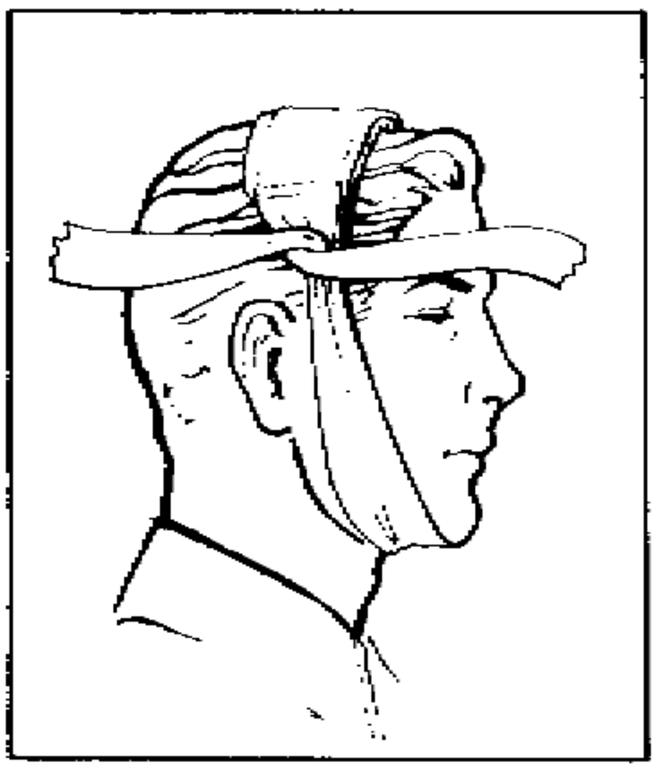


Figure 13-13. Tails crossed around the patient's head.

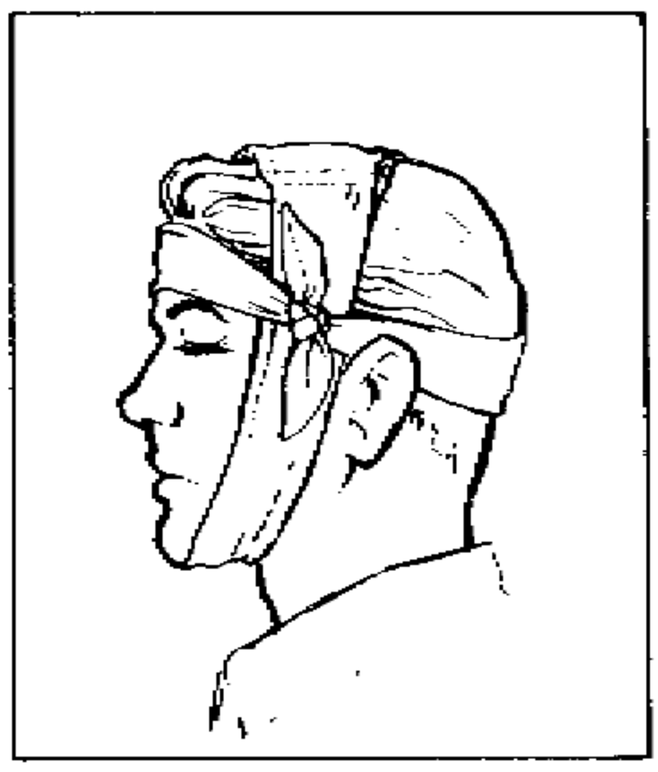


Figure 13-14. Tied dressing.

(2) *Use a cravat and 4 by 4 inch gauze pads.*

- If a field dressing is not available, place several 4 by 4 inch gauze pads over the wound site.

- Unfold one cravat (triangular bandage) completely.

- Place the cravat over the patient's head with the base (longest side) hanging over his eyes, and the tips hanging over the back of the neck (Figure 13-15).

- Fold the base upward along the creases by grasping both ends of the base and turning them upward until the patient's eyes and ears are uncovered.

- Wrap both tails around the head in opposite directions (Figure 13-16).

- Tie the tails at the side of the head (Figure 13-17).

- Tuck the third tip of the cravat under the band formed by the long tails at the back of the head. This is to hold the cravat snugly over the top of the head (Figure 13-18).

NOTE

If there is an injury or suspected injury to the cervical spine, the head must be immobilized before the patient is turned. The head must be maintained in a stable position.

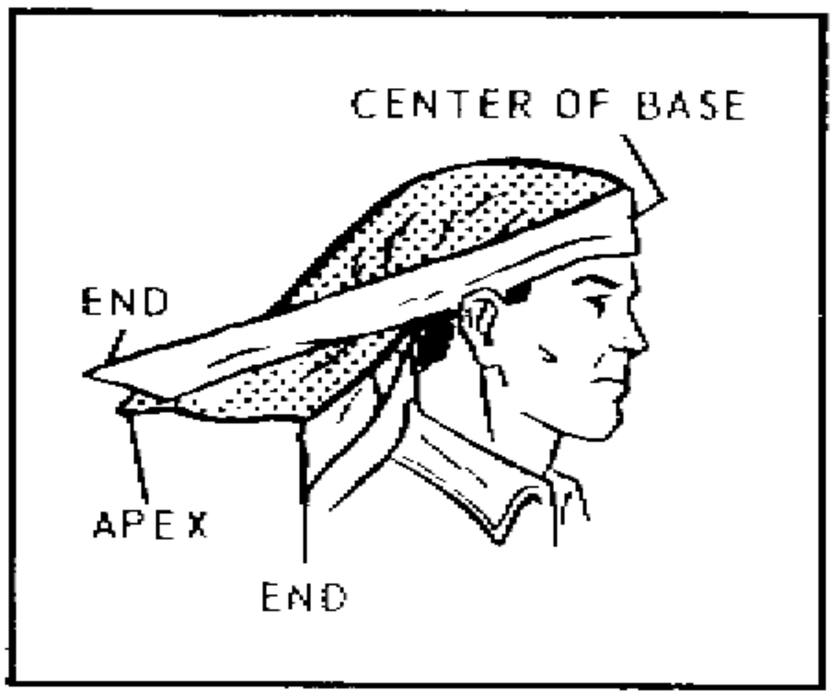


Figure 13-15. Cravat placed over head.

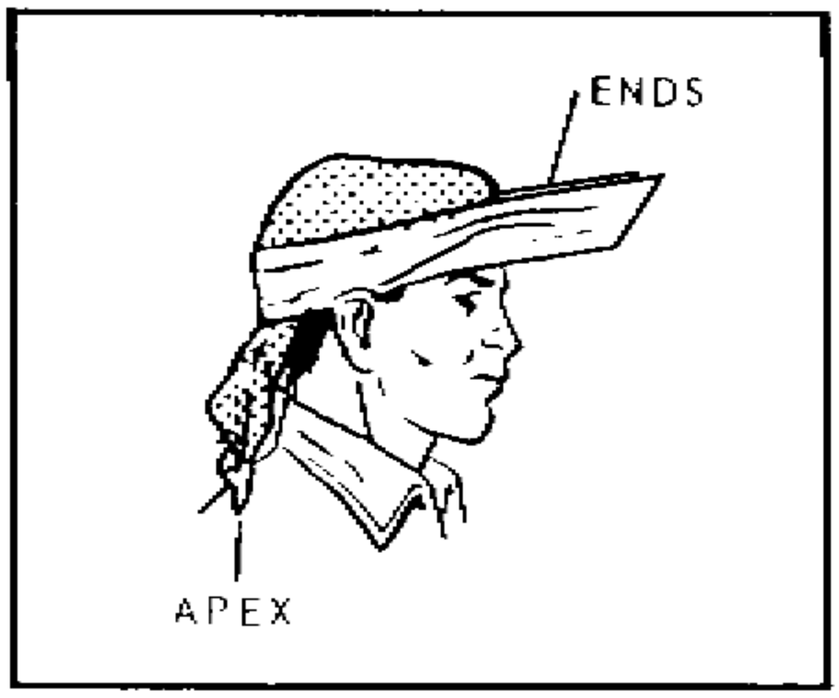


Figure 13-16. Cravat wrapped around the head.

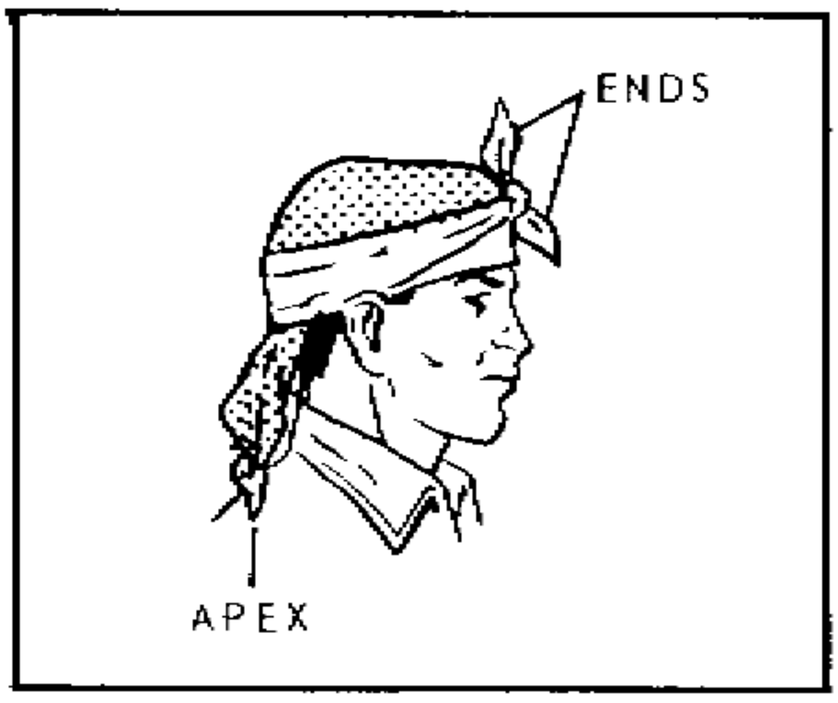


Figure 13-17. Cravat tied around the head.

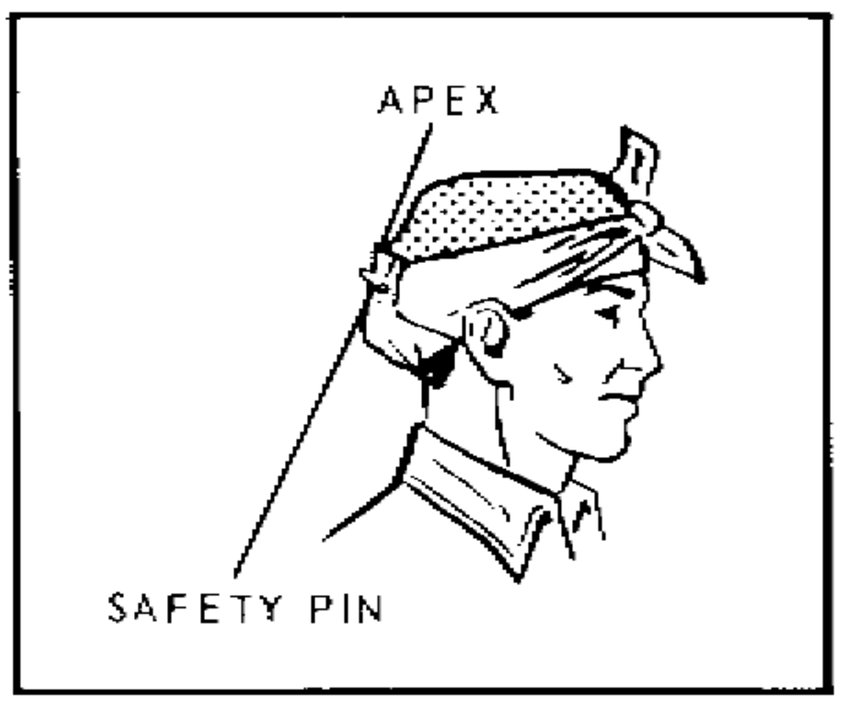


Figure 13-18. Cravat tucked in on back of head.

c. Prevent or Treat for Shock. Apply measures for prevention or treatment of shock with the following exceptions:

(1) Do not use the head-down position.

(2) **DO NOT GIVE MORPHINE.** Morphine (a depressant) affects respiration, increases intracranial pressure, and decreases the patient's level of consciousness.

(3) Do not give fluids by mouth. Initiate a large bore IV at a "keep open" rate, using dextrose, 5 percent, in water (D5W).

CAUTION

Administering an IV at faster than keep open rate risks over-hydration that increases intracranial pressure.

d. Record Treatment Given.

e. Evacuate the Patient.

13-22. Face Wounds

The face is very richly supplied with blood vessels. Therefore, injuries to the face are likely to have profuse bleeding or bruising. Hemorrhage is difficult to control. Because facial injuries may tend to be quite disfiguring, the medical specialist may apply dressings to these wounds first, forgetting the priorities of treatment. Facial wounds are life-threatening only when the airway is obstructed or there is massive bleeding.

13-23. Treatment for Facial Wounds

a. The most immediate concern in treating a person with facial wounds is to insure an adequate airway. Clear the mouth of blood, mucous, broken teeth, detached bone fragments, removable dentures, and other foreign material. If the patient is unconscious, the base of the tongue may rest against the back of the throat and block off the pharynx. This type of obstruction is easily relieved by using manual maneuvers to open the airway. Any force strong enough to produce severe facial injuries may have produced cervical spine injuries as well. Thus, when opening the airway, avoid hyperextension of the neck. The jaw thrust is the preferred technique when there is any suspicion of a cervical spine injury. If necessary, apply digital pressure to control bleeding while clearing the airway.

b. Place the patient in a comfortable sitting position. Tilt his head slightly forward to drain blood or mucous out of the mouth. Do not use the sitting position if—

- It would be harmful to the patient because of other injuries.
- The patient is unconscious, in which case, place him in the coma position. If there is a suspected injury to the cervical spine, immobilize the head before turning the patient on his side.

c. Apply a sterile dressing to the wound.

(1) Apply a sterile dressing using local pressure to help control the bleeding (Figure 13-19). The conscious patient or an assistant can hold the dressing in place.

NOTE

A laceration may extend through the cheek into the mouth with an object protruding from the injury. Remove the object before attempting to control the bleeding. This is the only time that an impaled object can be removed outside an MTF.

(2) If the patient or an assistant cannot hold the dressing in place, use one hand to maintain pressure on the dressing over the wound. Wrap the upper tail over the head and under the chin and hold in place over the wound.

(3) Wrap the other tail under the chin and over the head in the opposite direction from the first tail (Figure 13-20).



Figure 13-19. Dressing over the face injury.

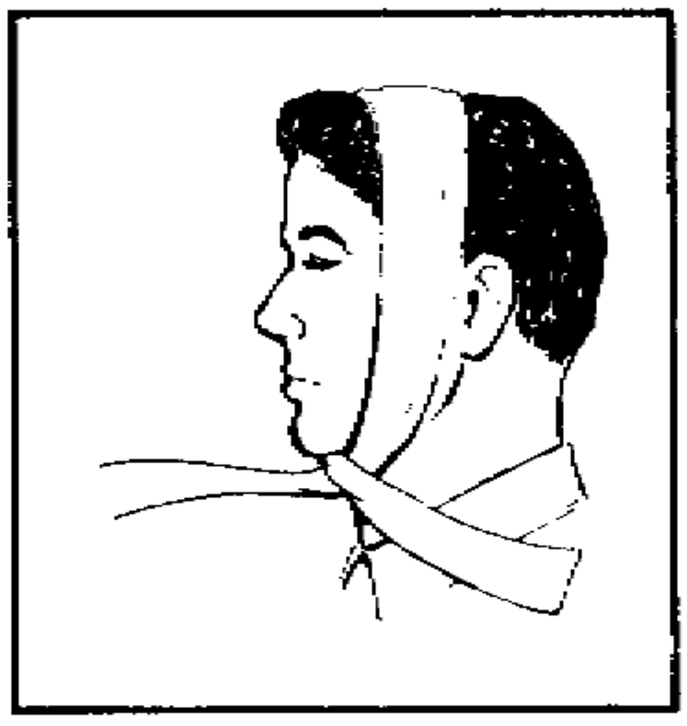


Figure 13-20. Wrapping the tails.

(4) Cross the tails over the ear on the dressing side of the head (Figure 13-21).

(5) Wrap the tails in opposite directions around the forehead and the back of the head.

(6) Tie the tails over the temple area above the ear on the uninjured side (Figure 13-22).



Figure 13-21. Crossing the tails.



Figure 13-22. Tails tied opposite the injury.

CAUTION

Do not tie the dressing so tight that it prevents drainage from the mouth.

d. Secure the dressing with a cravat bandage.

(1) Fold the cravat to 3 inches in width.

(2) Place the cravat over the dressing. Wrap one end over the head and the other end under the chin.

(3) Cross the end above the ear on the opposite side from the wound.

(4) Wrap one end around the back of the head and the other end around the forehead.

(5) Tie the ends above the ear on the injured side.

13-24. Neck Injuries

The neck is the most vital and vulnerable part of the body anatomy. The airway, the blood supply to the brain, and the nerve supply to the whole body below the head passes through the neck. Injuries to the neck have enormous potential for lasting damage. Hemorrhage from a neck wound, unless attended to immediately, can rapidly become fatal. Major concern in emergency treatment of patients with neck wounds, other than those involving the spinal column, is keeping the airway open. The airway may be obstructed by blood, mucous, edema fluid, plasma (if the throat is burned), and broken parts of the trachea and larynx. Clearing the mouth (not the pharynx) with the fingers, together with postural drainage in the coma position may be successful. If not, an emergency surgical airway must be performed promptly by the most experienced medical person available.

13-25. Treatment for Neck Injuries

a. Place a sterile dressing over the injury.

- Pass the tails upward over the head on opposite sides and tie the knot on top of the head, OR

- Pass the tails around the chest and back downward under the opposite armpit and tie the tails under the arm.

- NEVER pass the tails around the neck, to avoid pressure on the trachea.

b. Prevent or treat for shock with the following exceptions:

- DO NOT use the head-down position.

- DO NOT give morphine.

c. Check for signs of closed head injuries.

d. Record treatment given.

e. Evacuate the patient.

13-26. Neck Fractures

a. The cervical vertebrae (skeleton) of the neck consists of the upper seven vertebrae of the spine. The greatest danger in a neck fracture is damage to the spinal cord, which can cause permanent paralysis. The nerves that control the diaphragm are located in the cervical spine. Injury to this area can cause respiratory difficulty and/or arrest.

b. Extreme care must be taken when moving an individual with a neck fracture. The injured vertebrae must be immobilized and maintained in its normal alignment parallel to the spine. Movement of the injured vertebrae can cause spinal cord damage (compression of the spinal cord) or the spinal cord may be severed by the movement, causing disastrous results.

13-27. Signs and Symptoms of Neck Fractures

a. Ask the patient about his injury:

- Does he have tingling or numbness in his upper extremities?

- How did he receive the injury (auto accident, fall from a high place, dive into shallow water)?

- If the patient is unconscious, question others that may have witnessed the accident.

- Palpate for tenderness or deformities by inserting your hand under the patient's neck without moving his head. Gently feel the area of the back of the neck.

- If the patient has pain or increased pain when pressure is applied to the back of his neck, treat him as having a neck injury. If he has pain in the shoulder region without signs of shoulder injury accompanied by pain in the neck, treat him as a neck injury patient.

b. Caution the patient not to move. Explain to the patient that movement may increase the severity of his injury. Do not frighten him, but insure that he understands the seriousness of his injury.

13-28. Treatment for Neck Fractures

a. Immobilize the injury.

(1) If the patient is lying on his back, leave him in this position. If he is face down and has other injuries, or cannot breathe, request assistance in turning him over.

(2) To move the patient before splinting, grasp his head with your hands and apply gentle traction to maintain the head in alignment while others move or turn him (Figure 13-23).

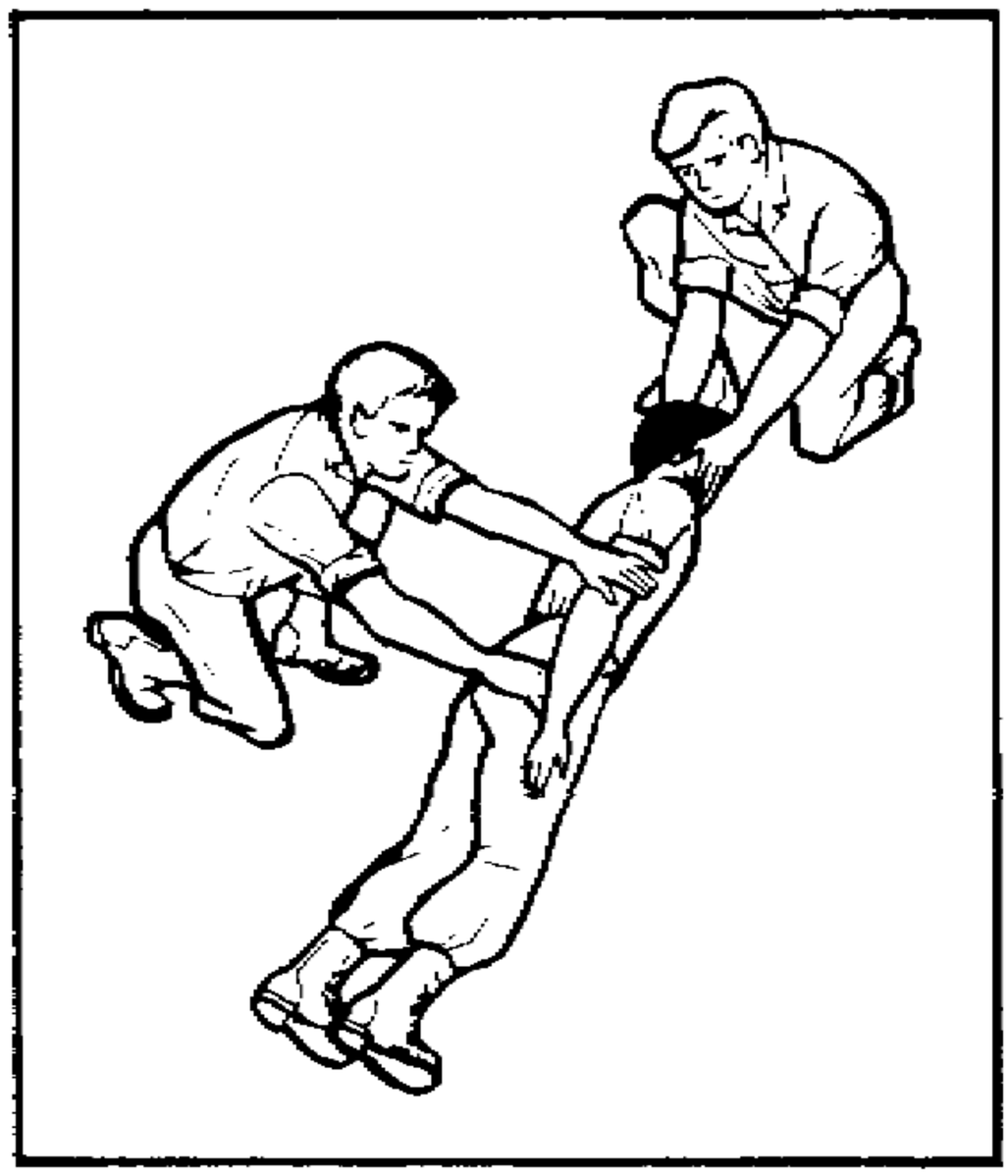


Figure 13-23. Turning patient on his back.

b. Apply a cervical collar to the neck.

NOTE

An improvised "collar" can be made from various materials (folded towel, T-shirt, field jacket, or other flexible material that will provide support).

(1) Gently slide one end of the collar under the neck (Figure 13-24).

(2) Wrap the collar around the neck. Be careful not to move the head or neck.

(3) Fasten the collar in place with tape, safety pins, or a cravat (Figure 13-25).

(4) Check the collar for tightness. If the skin at the temples shows signs of swelling, or if breathing is impaired, you must adjust the collar so that it is snug but does not fit too tightly.

c. With assistance, move the patient onto a spine board or another board that is at least 4 inches longer than the patient's height (Figure 13-26).

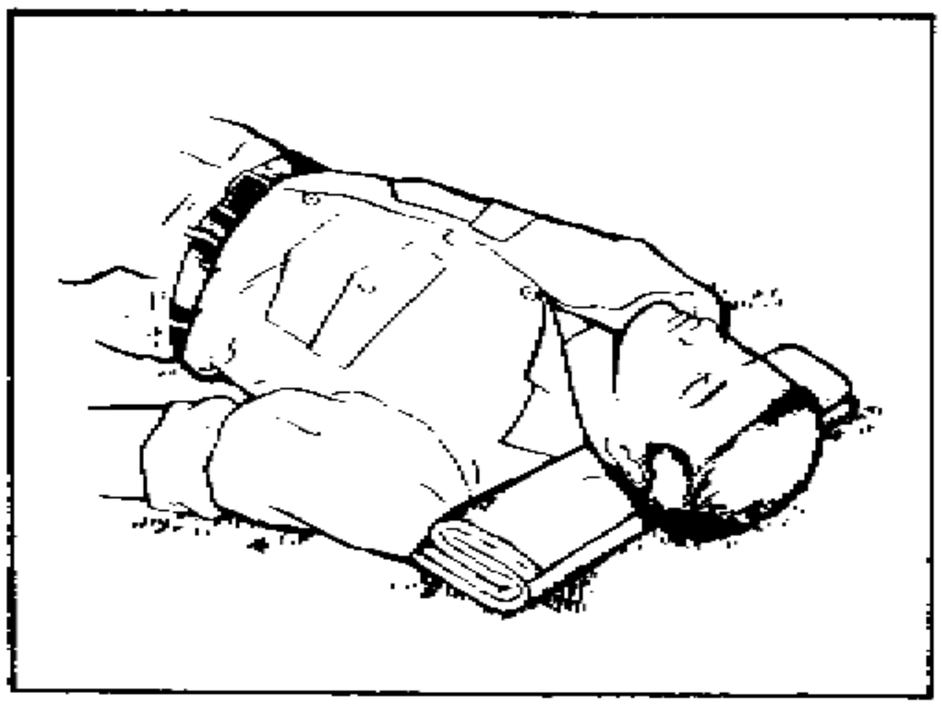


Figure 13-24. Collar under the patient's neck.

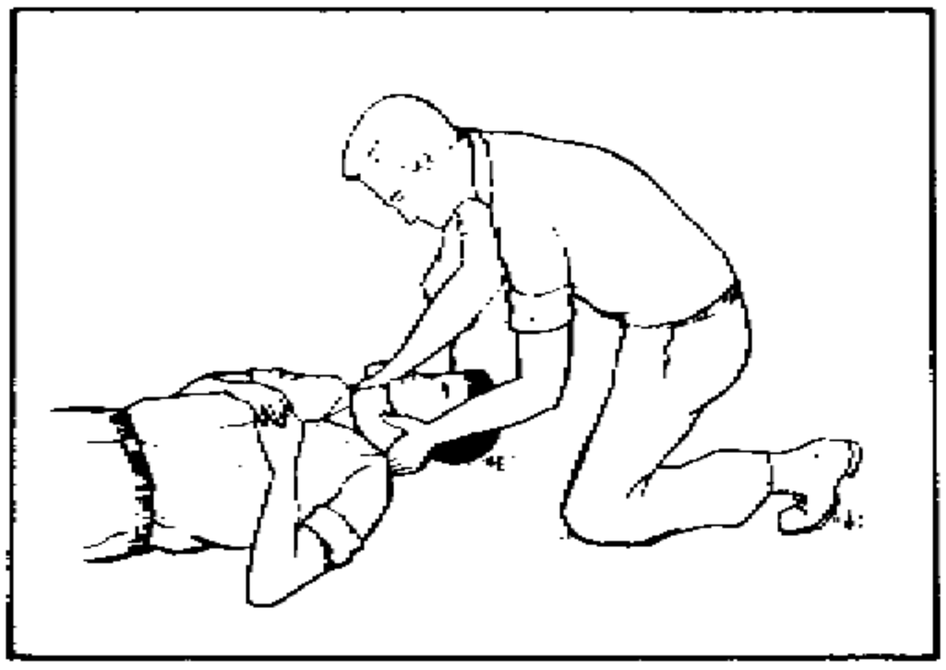


Figure 13-25. Collar fastened in place.

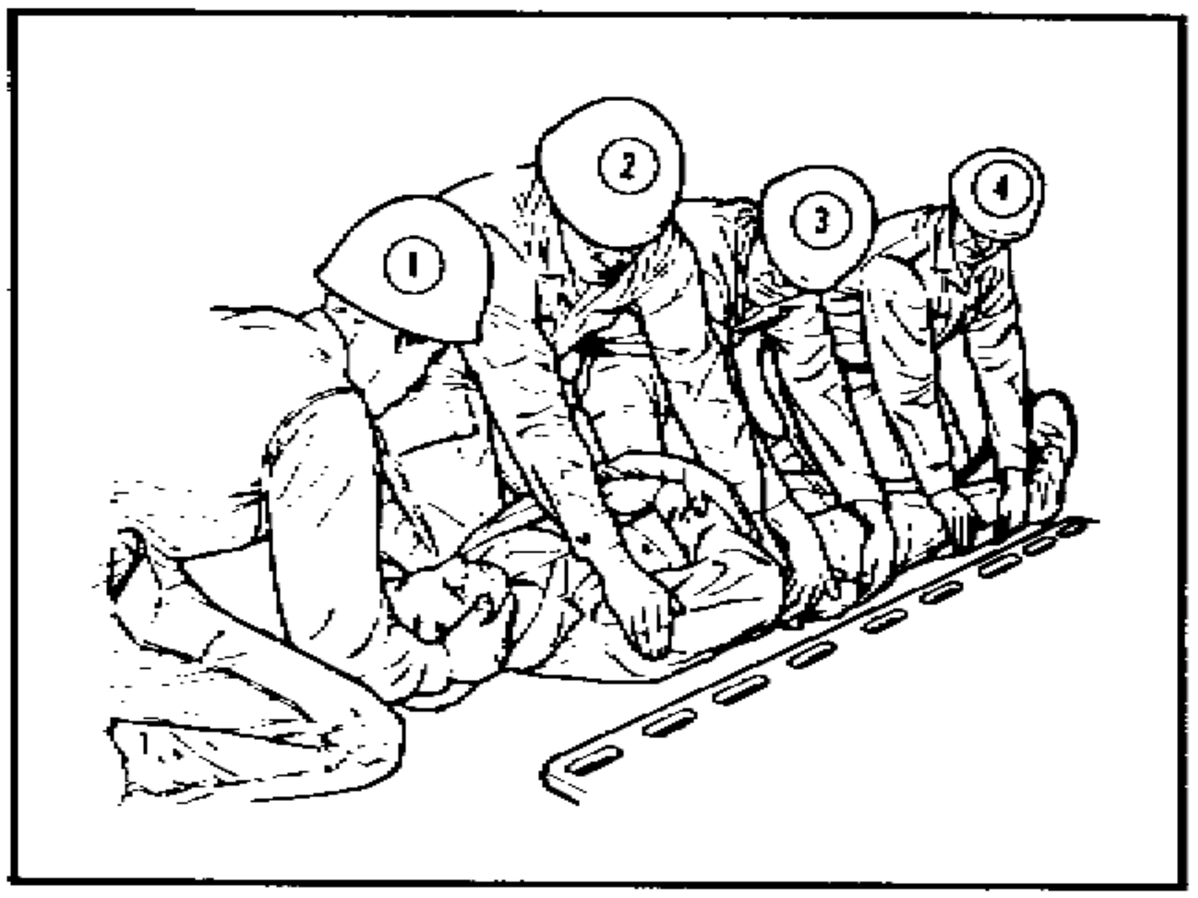


Figure 13-26. Placing patient on board.

CAUTION

Do not attempt to move the patient onto the board without assistance.

d. Place a padded object on each side of the patient's head. To prevent movement, tie his head and the padding to the board.

e. Place the patient and the board on a litter (Figure 13-27).

NOTE

If a board is not available, the patient's head can be immobilized by using padded material and tying his head to the litter.

f. Record the treatment given.

g. Evacuate the patient.

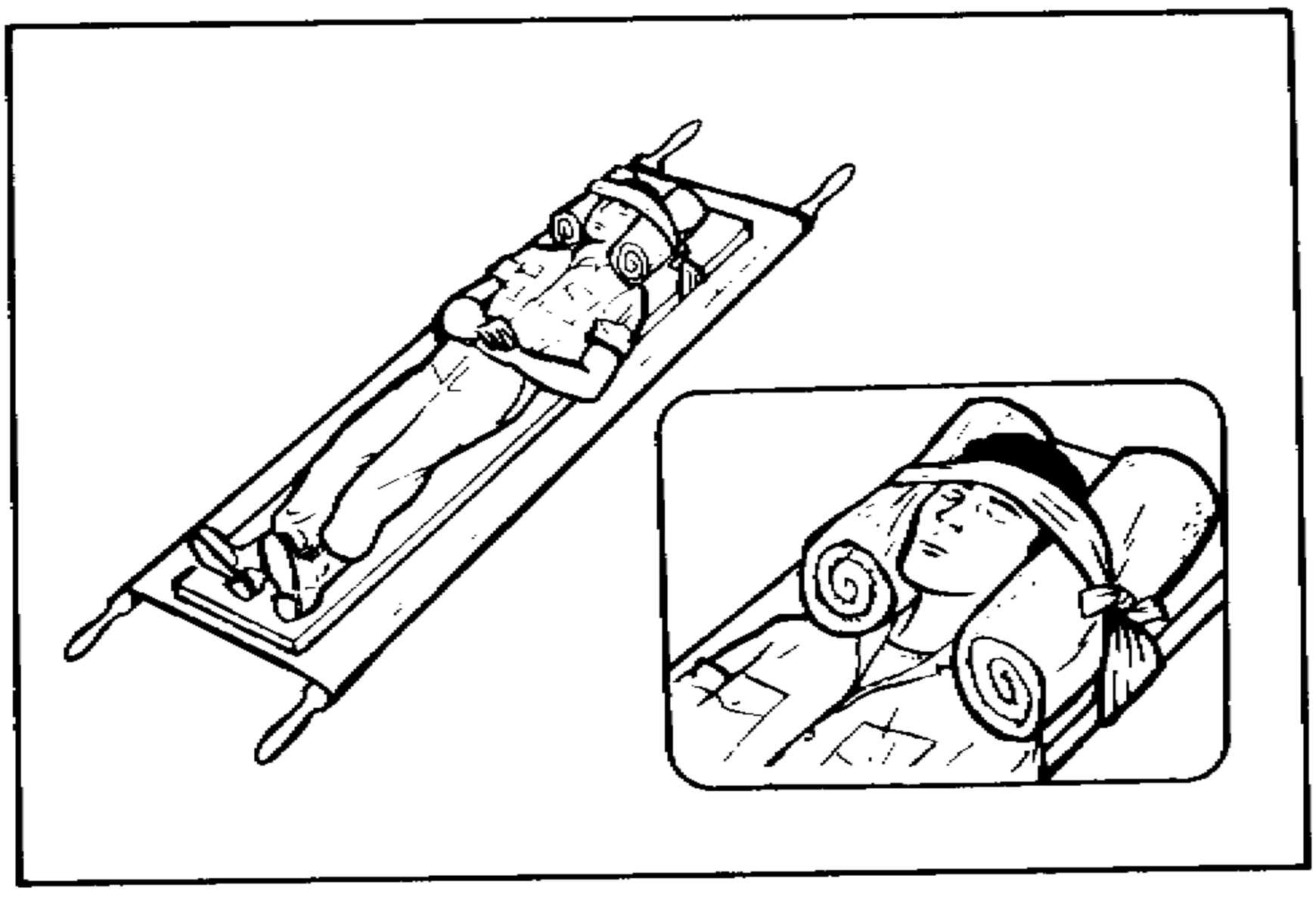


Figure 13-27. Patient with padded head on board and litter.

13-29. Spinal Injuries

a. The spinal column is composed of 33 bones or vertebrae. The upper 24 bones are separated by cartilage disks,the 5 bones of the sacrum form part of the pelvis, and the remaining 4 bones comprise the coccyx.

b. The spinal column encases the spinal cord. If a vertebrae or disk is fractured or dislocated, the spinal cord may be injured. Injuries to the spinal cord can cause paralysis below the point of injury. All patients with known or suspected spinal injuries must be immobilized before movement.

13-30. Signs and Symptoms of a Spinal Injury

a. Ask the patient if he has any pain, numbness, or tingling. Ask bystanders about the cause of the injury if the patient is unconscious. Determine numbness by gently pinching or pricking the injured area. The patient may not be able to move or may not experience sensation in parts of the body below the injury.

NOTE

An unconscious patient involved in a situation in which a spinal injury is suspected should be treated as if he has a spinal injury.

CAUTION

Do NOT permit any motion of the spine if a spinal injury is suspected.

b. Gently palpate along the spine for tenderness or deformity. Watch the patient's reaction for signs of tenderness. Local tenderness over a portion of the spine may indicate a spinal injury and the patient should be treated accordingly.

13-31. Treatment for Spinal Injuries

a. Caution the patient not to move. The patient must not move until the injury has been immobilized. The spinal cord must be protected from damage when the patient is moved. The head and neck must be maintained in a stable, neutral position; extension or flexion may cause the spinal cord to be compressed disastrously and paralysis can result. If the neck is hyperextended (the head falls backward), posterior compression of the spinal cord by fractured vertebrae can occur. If the neck is flexed (the head falls forward), anterior compression of the spinal cord by fractured vertebrae can occur.

NOTE

A patient with pain in his shoulder without any sign of injury and accompanied by pain of the neck indicates a spinal injury.

(1) If the patient is lying face up, immobilize him in that position.

(2) If he is face down and has no other serious injuries or cannot breathe properly, request assistance to turn him onto his back.

(3) If the patient must be moved before splinting, you must maintain gentle traction of the head while moving him. To maintain traction, kneel at the patient's head, place your hands on each side of his head and jaws, and pull back slightly to immobilize his head and neck (Figure 13-28). Keep the direction of pull in a direct line with his spinal column.

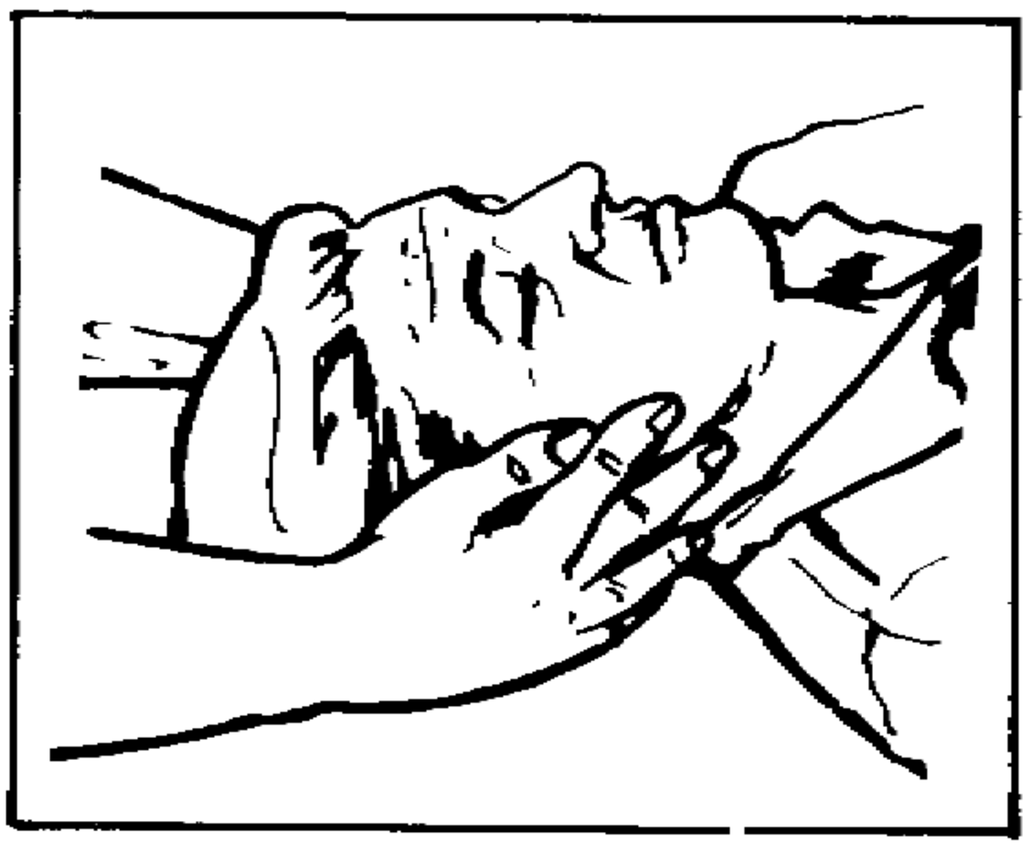


Figure 13-28. Maintaining traction.

(4) Gently slide the cervical collar under the neck. Wrap the collar around the neck and secure it in place.

(5) Place the patient on a spine board.

(6) Place the patient and spine board on a litter.

(7) Record treatment.

(8) Evacuate the patient.

b. Apply a short spine board before extracting a patient from a vehicle.

(1) Two rescuers are required. No. 2 man pushes the board as far down into the seat as possible behind the patient while No. 1 man maintains traction on the patient's head (Figure 13-29). It may be necessary to move the patient slightly forward if the back of the seat has a pronounced curve.

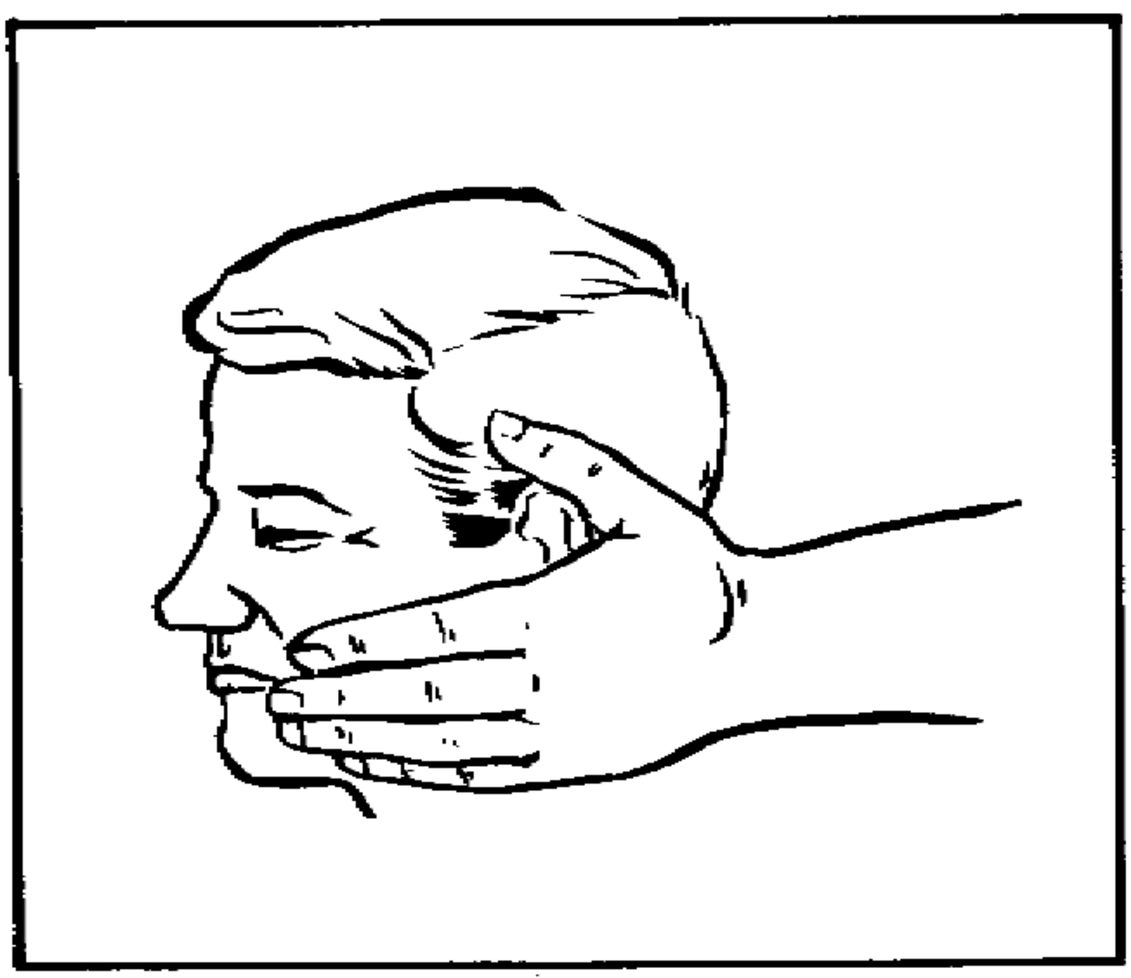


Figure 13-29. Maintaining traction on a sitting patient's cervical spine.

NOTE

It may be easier to insert the head end of the board into the vehicle first, especially if the vehicle has a low roof. This way, there will not be a need to maneuver the board around the patient.

(2) No. 2 man places a cervical collar or a neck roll in the hollow space between the patient's neck and the board. The collar or neck roll serves to fill the gap between the patient's neck and the board. The neck roll should only be large enough to fill the gap; not to exert pressure on the neck.

(3) No. 1 man maintains traction on the patient's head. No. 2 man secures the patient's head to the board by using a cravat, head straps, or other cloth strips. Pass the cravat downward diagonally across the patient's forehead, and tie it securely to the head portion of the board.

CAUTION

The patient's head must be firmly secured in place before the No. 1 man releases the traction.

(4) Secure the patient to the spine board (Figure 13-30) by—

- Placing the buckle of the first strap on the patient's lap.
- Passing the other end through the lower hole in the board; up the back of the board; through the top hole; under the armpit; over the shoulder; and across the back of the board at the neck.
- Buckling the second strap to the first one.
- Placing the buckle on the side of the spine board at the neck.
- Passing the other end of the strap across the shoulder; under the opposite armpit; through the top hole in the board; down the back of the board; through the lower hole; and across the lap.
- Securing the end to the first strap by buckling.



Figure 13-30. Patient secured to short spine board.

(5) Tie the patient's hands together and place them on his lap to keep the arms from moving.

(6) No. 1 man pivots the patient in the seat with his back facing the opened vehicle door, by grasping his upper body. No. 2 man remains in the vehicle, grasping the patient's legs, lifting them onto the seat and pivoting the patient in unison with the No. 1 man.

CAUTION

Do not grasp the short board to move the patient. Pressure of lifting should be applied under the patient's arms and legs. Using the short board to lift the patient will cause excessive pressure on his neck and spine.

(7) No. 1 man slides a long board in perpendicular to the patient's back, with the end against his buttocks.

(8) No. 2 man exits the vehicle and positions himself opposite the No. 1 man. Together, they lay the patient down horizontally on the long spine board.

(9) Move the patient from the vehicle by grasping the sides of the long board.

(10) Line up the holes of the short board with the holes of the long board and tie the boards together.

c. Place a patient that is not in a vehicle on a long spine board.

(1) Obtain a long board; seek the assistance of at least three other individuals and explain the procedure to them.

(2) Prepare the spine board.

- Place the spine board in position near the patient.
- Insure that all necessary equipment is ready.
- Have pads available for padding the spine board in the areas of the natural curve of the neck and small area of the back (Figure 13-31).

NOTE

If a spine board is not available, use a standard litter or improvise one from a board or door. A hard surface is more suitable than one that does not support the patient's weight. If the injured patient is in a face-down position, transport him in that position.

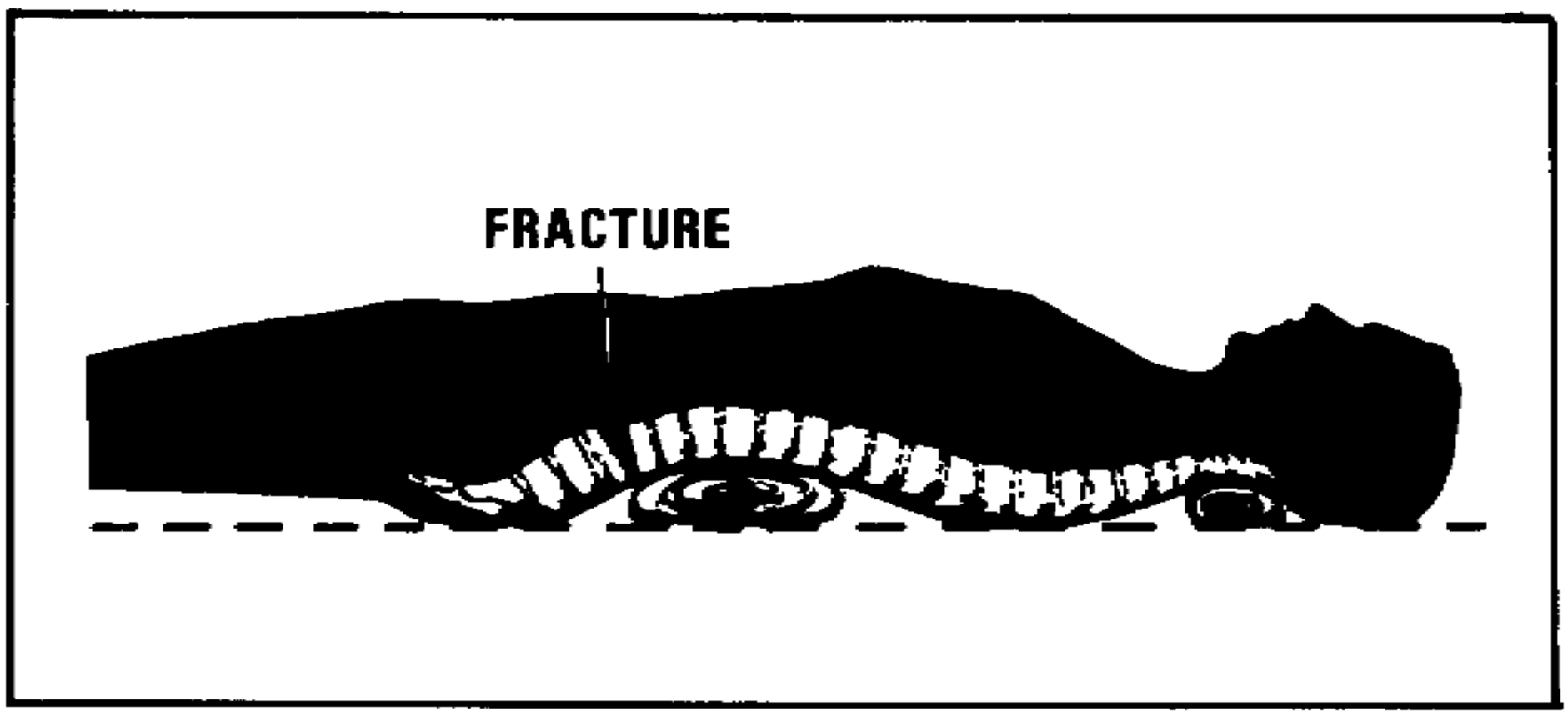


Figure 13-31. Padding of neck and small of back.

(3) Instruct the patient not to move or attempt to assist in placing his body on the spine board.

(4) Loosely tie the patient's wrists together at his waist. This prevents the arms from moving while he is being placed on the spine board.

(5) Use the log-roll technique to place the patient on the spine board.

(a) Place the spine board parallel to the patient's body.

(b) Kneel at the patient's head, place your hands on each side of his head and jaws, and pull back slightly to immobilize the head and neck.

(c) Instruct the three assistants to kneel on either side of the patient and place their hands on the opposite side at his shoulder and waist, hip and thigh, knee and ankle.

(d) On your command, have the assistants, in unison, roll the patient's body slightly toward them while you turn his head, keeping it parallel with the spine.

(e) Instruct assistant #3 to reach across the patient's body with one hand, grasp the board at the closest edge, and slide the board against the patient. With the same hand, assistant #3 then reaches across the board to the far edge and holds the board in place.

(f) Instruct all assistants to slowly roll the patient backwards onto the board, keeping his head and spine in a straight line.

NOTE

All assistants should kneel on the same knee and utilize their own thighs to help support the patient.

(g) If the patient is in the face-down position, the spine board is still placed on the opposite side of the patient away from the assistants. Roll the patient away from the assistants (toward the board) using the same technique as above.

OR

(6) Use the straddle-slide technique to place a patient on the spine board.

(a) Place the spine board at the patient's head in alignment (parallel) with his body.

(b) Stand at the patient's head with your feet on each side of the spine board. Place your hands on each side of his head and jaws. Apply slight traction to immobilize the head and neck.

(c) Instruct one assistant to straddle the patient while facing you and gently elevate the patient's shoulders just enough to permit the spine board to slide under them.

CAUTION

Do NOT bend or flex the spine or neck.

(d) Instruct assistant #2 to straddle the patient while facing you and carefully elevate his hips.

(e) Instruct assistant #3 to stand behind the spine board and gently slide it under the patient.

(f) Instruct assistant #3 to move the patient's feet and straddle his legs. Carefully elevate the legs and ankles while sliding the board completely under the patient.

(7) Secure the patient to the spine board.

(a) Secure the patient's forehead with a cravat.

(b) Secure the patient with straps across his chest (include the arms if the strap is long enough), hips, thighs, and lower legs (Figure 13-32).

d. Record the treatment given.

e. Evacuate the patient.

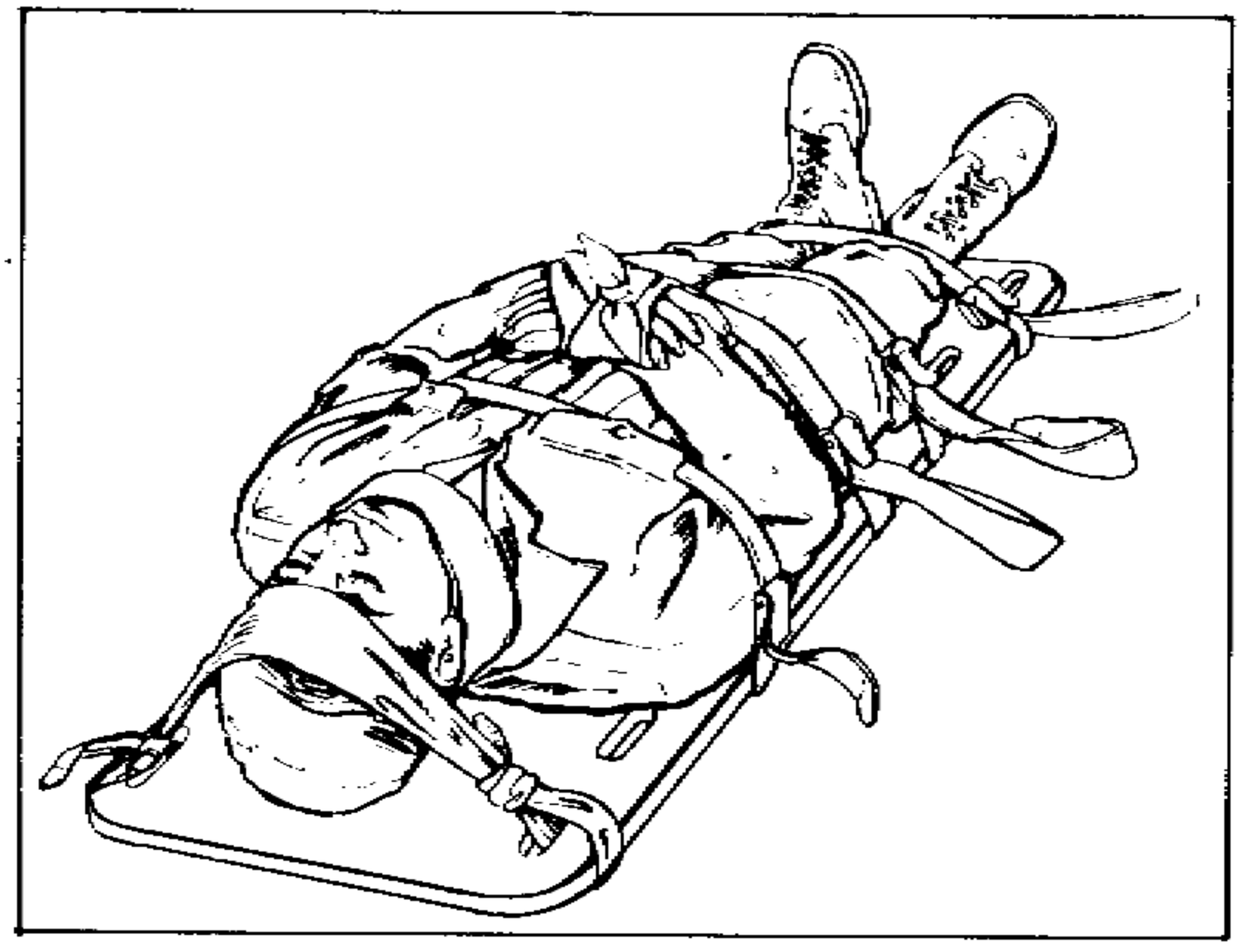


Figure 13-32. Patient secured to a spine board.

Section V. ORTHOPEDIC INJURIES

13-32. General

The evaluation of a patient with possible musculoskeletal damage requires determining the cause of the injury; obtaining an accurate patient history; and giving a thorough examination. Take note of the patient in relation to the environment (possible mechanisms of injury). Ask the patient to identify the areas of pain and to move each extremity.

a. Types and Causes of Injuries. Orthopedic injuries are the result of a variety of causes. Types of injuries and causes include—

- Direct injuries (a broken bone at the point of impact with a solid object, such as a jeep bumper).

- Indirect injuries (a fracture or a dislocation at some distance along the bone from the point of impact, such as a hip fracture caused by the knees slamming into a solid object).

- Twisting injuries (fractures, sprains, and dislocations that occur when there is torsion of the joint while the end of the limb remains fixed).

- Powerful muscle contractions (muscle torn from the bone or muscle breaking away a piece of the bone; occurs in seizures or tetanus).

- Fatigue fractures (caused by repeated stress). These most commonly occur in the feet after prolonged marching (stress fractures).

● Pathologic fractures (occur in patients with diseases such as cancer that weaken areas of bones). A fracture may occur with minimal force. The elderly have more brittle bones and are more prone to pathologic fractures.

b. Patient History. Most patients with musculoskeletal injuries will complain of pain. Usually the pain is well localized to the area of injury. Sometimes the patient with a fracture will report having felt something snap. Try to determine how the injury occurred. For example, for a twisted ankle, did the injury occur with the ankle bent outward (everted) or bent inward (inverted)? Does the patient have any serious illnesses, such as cancer, that might account for an otherwise unexplained fracture.

c. Examination. With rare exceptions, orthopedic injuries are not life threatening. In the patient with multiple injuries, fractures may be the most obvious and dramatic, but may not be the most serious. Therefore, you should do a primary survey and treat any life-threatening conditions first. Management of orthopedic injuries fit well in the secondary survey.

● *Look.* Swelling and black-and-blue marks indicate the escape of blood into the tissues (extravasation). Shortening or angulation between the joints, deformity or angulation in unusual direction around the joints, and internal or external rotation when compared with the opposite extremity indicate a bone defect. *Lacerations or puncture wounds near the site of a bone fracture are open fractures.*

● *Listen.* Crackling sounds (crepitation) can be heard with a stethoscope or felt with palpating fingers. The sounds are produced when the broken bone ends rub together. Do NOT attempt to move the injured area to evaluate this sign. Percussion over a bony protuberance while listening with a stethoscope on another bony prominence distal to a fracture will produce a sound different from the sound produced on an uninjured bone.

● *Feel.* Palpation along the length of the bone can help detect deformities, bony protuberances, or angulation that is not seen.

● *Check.* Pulse and neurological sensation should always be evaluated distal to the fracture before and after application of splints. In the arm, you should test the radial and ulnar arteries; in the leg, the dorsalis pedis and posterior tibial arteries (Figure 13-33). If there is not a distal pulse, two or three gentle manipulations of the extremity should be carried out to try to restore the blood flow. Do not make prolonged attempts; the loss of blood may be due to actual vascular injury or to preexisting hardening of the arteries (arteriosclerosis) rather than simple compressions.

● *Evaluate.* A neurological evaluation of both motor and sensory functions should be made. For example, when checking an arm, are the nerves intact and can the hand demonstrate intact sensory nerves by both sensation and finger movements?

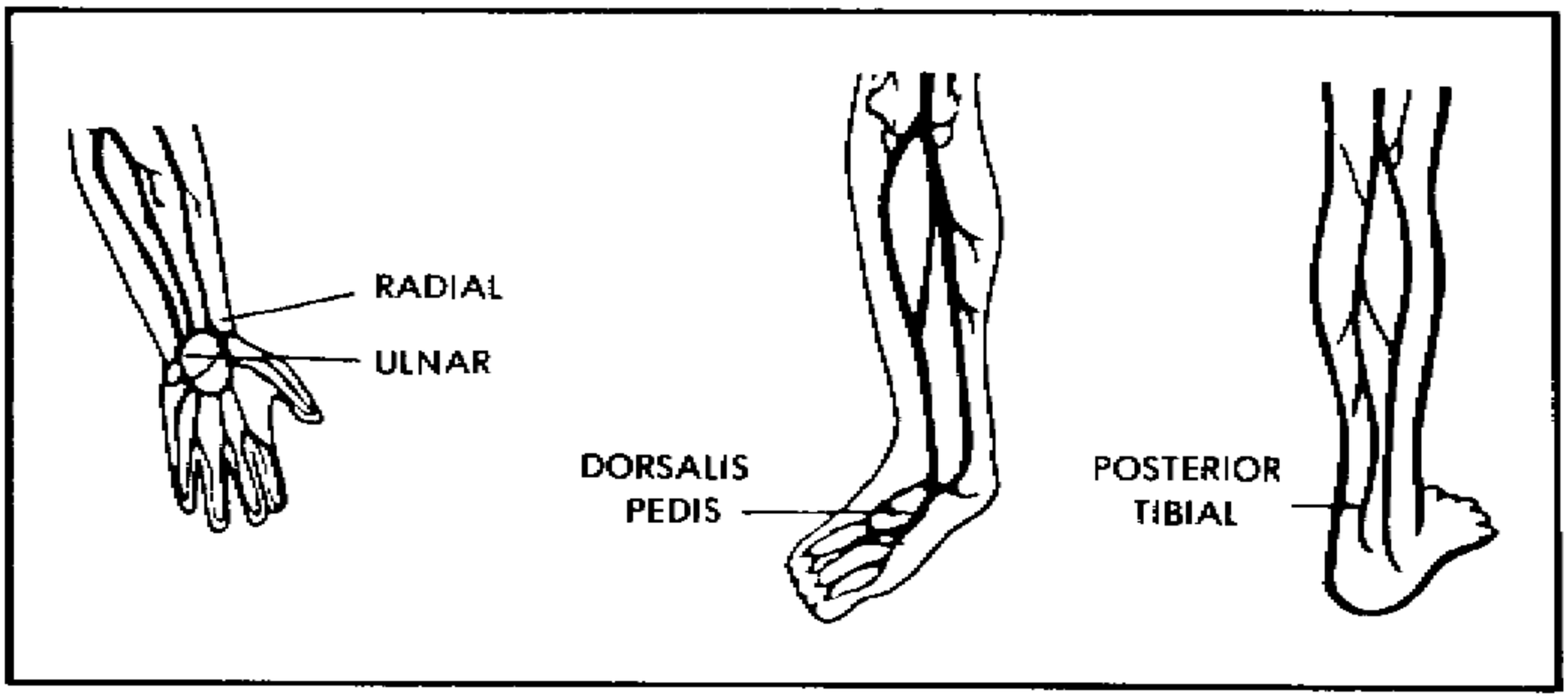


Figure 13-33. Distal pulses locations.

● *Palpate all bones.* When doing the secondary survey, palpate and manipulate every bone in the body to determine the extent of the injury. The only exception to the manipulation is with possible spinal column injuries. Some bones, such as the ribs and the pelvis, can be palpated by applying direct pressure. EXAMPLE: For pelvis injuries, apply bilateral pressure on the anterior iliac spines to elicit pain. Pressure over the symphysis pubis will also flex the pelvic ring to detect any existing fractures.

● *Treat as fracture.* It is difficult to distinguish between fractures and sprains without x-ray. If there is a question, immobilize and treat the injury as if it were a fracture. The pain produced by a fracture will cause muscle spasms. The patient will guard or not move the fractured bone at all. Fractures do not produce paralysis. Only nerve damage produces paralysis. The pain may be so great, however, that the patient does not voluntarily move the bone or its muscular attachment.

13-33. Management of Orthopedic Injuries

a. The signs and symptoms of orthopedic injuries—fractures, dislocations, and sprains are given in Table 13-2.

Table 13-2. Orthopedic Injuries: Signs and Symptoms.

Fracture	Dislocation	Sprain
Pain, tenderness.	Pain.	Pain, tenderness.
Deformity or shortening.	Deformity.	No deformity.
Loss of use.	Loss of movement.	Painful movement.
Swelling.	Swelling.	Swelling.
Ecchymosis.	Ecchymosis.	Redness.
Grating.	Located at joint.	
Guarding.		
Exposed bone ends.		

- *Fractures.*

  o A fracture is a break in a bone. It may either be closed (skin is intact) or open (there is a wound over the fracture site). In an open fracture, the bone may or may not be protruding through the wound. Open fractures are more serious than closed fractures because the risks of contamination and infection are greater. A transverse fracture cuts across the bone at right angles to its long axis and is often caused by direct injury. The greenstick fracture is an incomplete fracture that commonly occurs in young individuals whose bones (like green sticks) are still pliable. Spiral fractures result from twisting injuries; the fracture line has the appearance of a spring. The fracture line of an oblique fracture crosses the bone at an oblique angle, or in a slanting direction. In impacted fractures, the broken ends of the bone are jammed together and may function as if no fracture is present. A comminuted fracture is one in which the bone is fragmented into more than two pieces (splintered or crushed) (Figure 13-34).

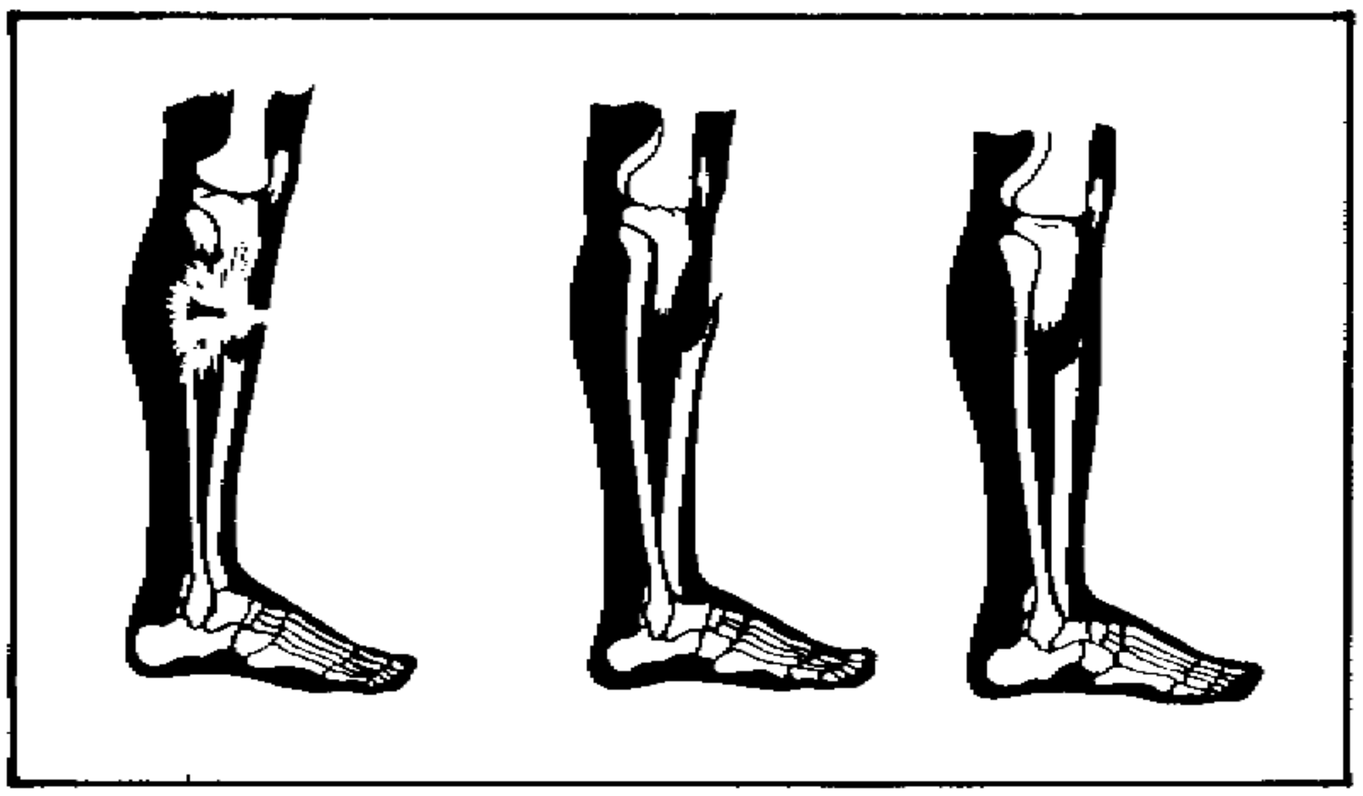


Figure 13-34. Common fractures.

o Fractures, even open fractures, seldom present an immediate threat to life. Their treatment should be deferred until life-threatening conditions have been treated, such as establishing an airway and controlling hemorrhage. A tourniquet is seldom necessary in treating an open fracture, even when a limb has been mangled beyond all possibility of salvage. Only after treating all life-threatening conditions should you identify and immobilize fractures.

o Immobilization is accomplished by splinting which—

■ Prevents a closed fracture from becoming an open one.

■ Prevents damage to surrounding nerves, blood vessels, and other tissues by the broken bone ends.

■ Lessens bleeding and swelling.

■ Decreases pain.

● *Dislocations.*

o A dislocation is the displacement of a bone end from its articular surface. Sometimes ligaments that hold the bone end in place are also torn. The shoulder, elbow, fingers, hips, and ankles are the joints most frequently affected.

o Symptoms of a dislocation are either pain or a feeling of pressure over the involved joint and a loss of motion. The sign of a dislocation is deformity. If the dislocated bone end is pressing on nerves or blood vessels, there may also be a compromise of other functions, such as numbness or paralysis below the dislocation. When dealing with a dislocation, always check the pulse, strength, and sensation distal to the injury. The treatment for a dislocation is to immobilize the involved part in the position in which it is found. Do not straighten or attempt reduction. If there is not a distal pulse in the involved extremity and it cannot be restored by gentle manipulation, transport the patient to an MTF promptly.

● *Sprains.* Sprains are injuries in which ligaments are partially torn. Sprains occur when a joint is suddenly twisted beyond its normal range of motion. Sprains most commonly affect the knees and ankles and are characterized by pain, swelling, and discoloration over the injured joint. Unlike fractures and dislocations, sprains usually do not show a deformity. However, treat the sprain as if it were a fracture and immobilize it. Elevate the sprained joint and apply an ice compress, if available.

● *Strains.* Strains are soft-tissue injuries or muscle spasms around a joint and are characterized by pain on movement. There is no deformity or swelling associated with a strain. Strains are best treated by avoiding weight-bearing on the injured area. If there is doubt as to the nature of the injury, immobilize the extremity.

13-34. General Principles of Splinting and Immobilization

In the treatment of musculoskeletal injuries, remember the following principles:

- Severely angulated fractures of long bones should be straightened before splinting. Explain to the patient that straightening the fracture may cause momentary pain, but that it will lessen significantly once the fracture is straightened and splinted. Any overlying clothing should be cut away.

- Do NOT straighten dislocations and fractures involving the spine, shoulder, elbow, wrist, or knee.

- The adage "splint them as they lie" should be changed to "immobilize them where they lie." Splinting may well be accomplished after extrication. If a pulse is absent, splinting may necessitate manipulation of the fracture to its normal position.

- In open (compound) fractures, do not attempt to push bone ends back beneath the skin surface. Simply cover them with a sterile dressing.

- Immobilize joints above and below the fracture (at the wrist and elbow for fractures of the radius and ulna).

- Splinting should be done firmly, but not so tightly as to occlude circulation. Check distal pulse after the splint is in place to be certain that the circulation is still adequate. If the pulse disappears, the splint should be loosened enough to permit its return. If used, air splints or MAST should be checked and rechecked to make certain that they are not overinflated. The ankle hitch on a traction splint should be inspected so that it is not applied too tightly across the foot; all areas of contact should be padded. The proximal end of a lower extremity splint should not press against the groin. Board splints should be long enough, well padded, and well secured to uninjured parts of the body.

- For fractures above the knee or about the hip, a traction splint is best (Thomas half ring or Hare traction). Such fractures can be managed by supporting the extremity with the hip and knee in slight flexion and the extremity stabilized by strapping it to the uninjured leg. MAST can splint both hips and knee joints.

- For massive trauma to the lower extremities, MAST can be used as a splint and will also help stop bleeding (see paragraph 13-59 for MAST application).

- All fractures should be immobilized before moving the patient.

- Fractures of the tibia or fibula can be managed with traction, wooden, or wire ladder splints. Whichever splint is used, the knee must also be immobilized. MAST should not be used for below-the-knee fractures.

- When other materials are not available, the long spine board can be used to manage almost any fracture.

- An upper extremity fracture can usually be immobilized against the chest.

- The fingers and toes should be exposed even though they are included within a splint.

13-35. Types of Splints

Any device used to immobilize a dislocation or fracture is considered a splint. There are several specific types: rigid, soft, and traction.

a. Rigid.

(1) A rigid splint consists of a firm material, either rigid or slightly flexible. It is applied along the sides, front, or back of the injured extremity. When applied, it will prevent motion of the extremity. Examples of rigid splints include padded wood, such as bass wood, tree limbs, or branches, metal or stiff plastic, wire ladder, and folded cardboard. The splint must immobilize both the joint above and below the fracture site.

(2) To apply a rigid splint, the extremity is grasped by one individual below the fracture site and gentle traction is applied. A second individual then places the padded splint on the injured extremity and secures it above and below the fracture site (Figure 13-35). Keep the toes and/or fingers exposed to insure distal circulation.

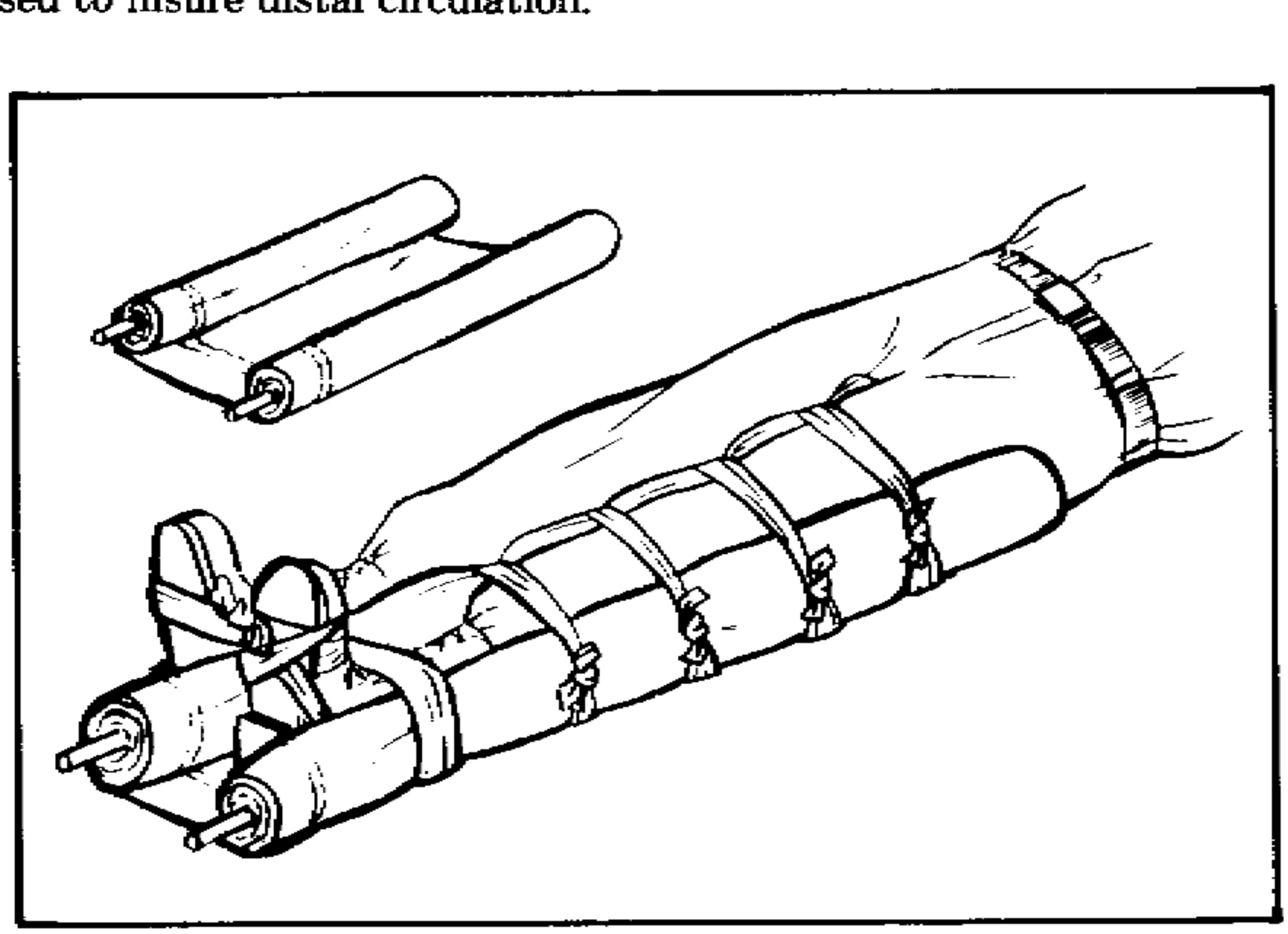


Figure 13-35. Rigid splint applied.

b. Soft Splints.

(1) An example of soft splints are the air splints (Figure 13-36), which are simple double-walled tubes made of heavy-duty clear plastic. These splints come in various shapes and sizes, some with zippers and some without.

The primary advantages of an air splint are comfort to the patient, uniform contact with the injured extremity, and gentle pressure on bleeding wounds. Other material suitable for soft splints are pillows and rolled blankets, which when wrapped and secured are very comfortable and provide effective immobilization. Slings with swathes and pistol belts are also considered soft splints and are excellent for immobilizing upper extremities.

(2) Application of air splints depends on whether or not the splint has a zipper. If there is a zipper, the open splint is gently placed around the extremity, zipped and inflated, insuring that a distal pulse is present. If a non-zipper type is used—

(a) Pull the splint onto your arm to hold the splint open; grasp the hand or foot of the injured extremity.

(b) Apply gentle traction and slide the splint from your arm to the injured extremity.

(c) Inflate the splint (by mouth), insuring the presence of a distal pulse.

NOTE

With an open wound or compound fracture, the air splint should be applied after the application of a sterile dressing.

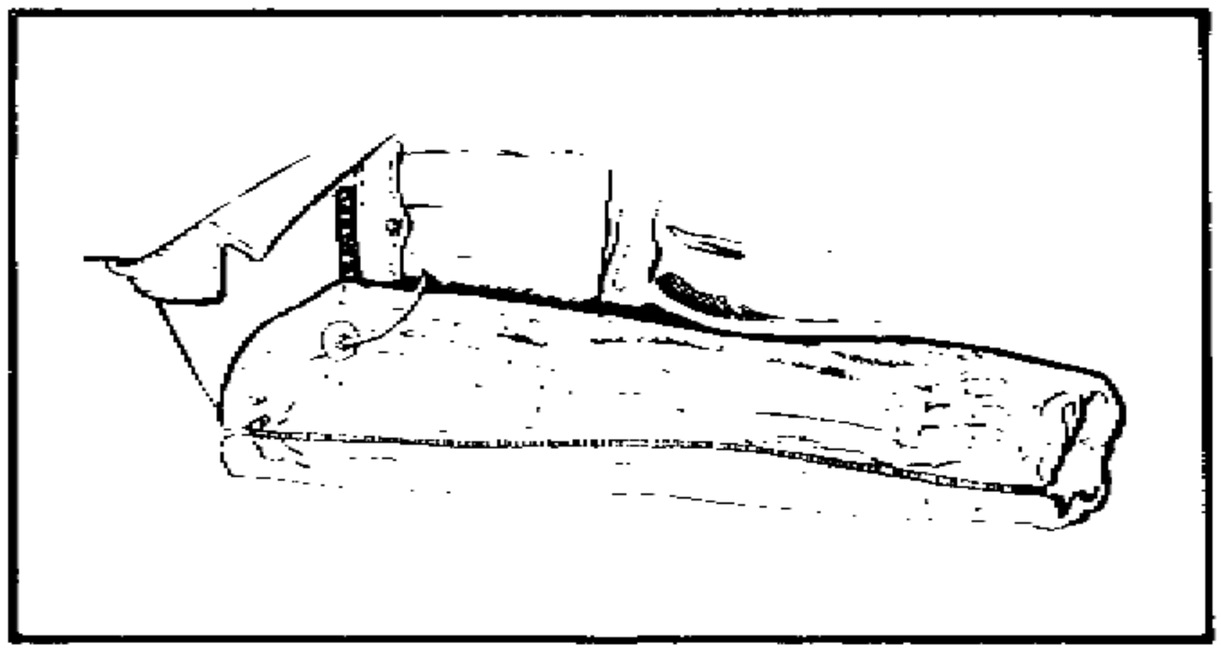


Figure 13-36. Air splint.

c. Traction Splints.

(1) A traction splint holds a fracture or dislocation immobile and maintains steady traction on the extremity. Because the axilla cannot tolerate the counter traction created by these splints, they are suitable for lower extremities only. There are two traction splints presently in use, the Thomas leg splint (Figure 13-37) and the Hare traction splint. For best results, a team of three individuals are needed to apply the Thomas leg splint.

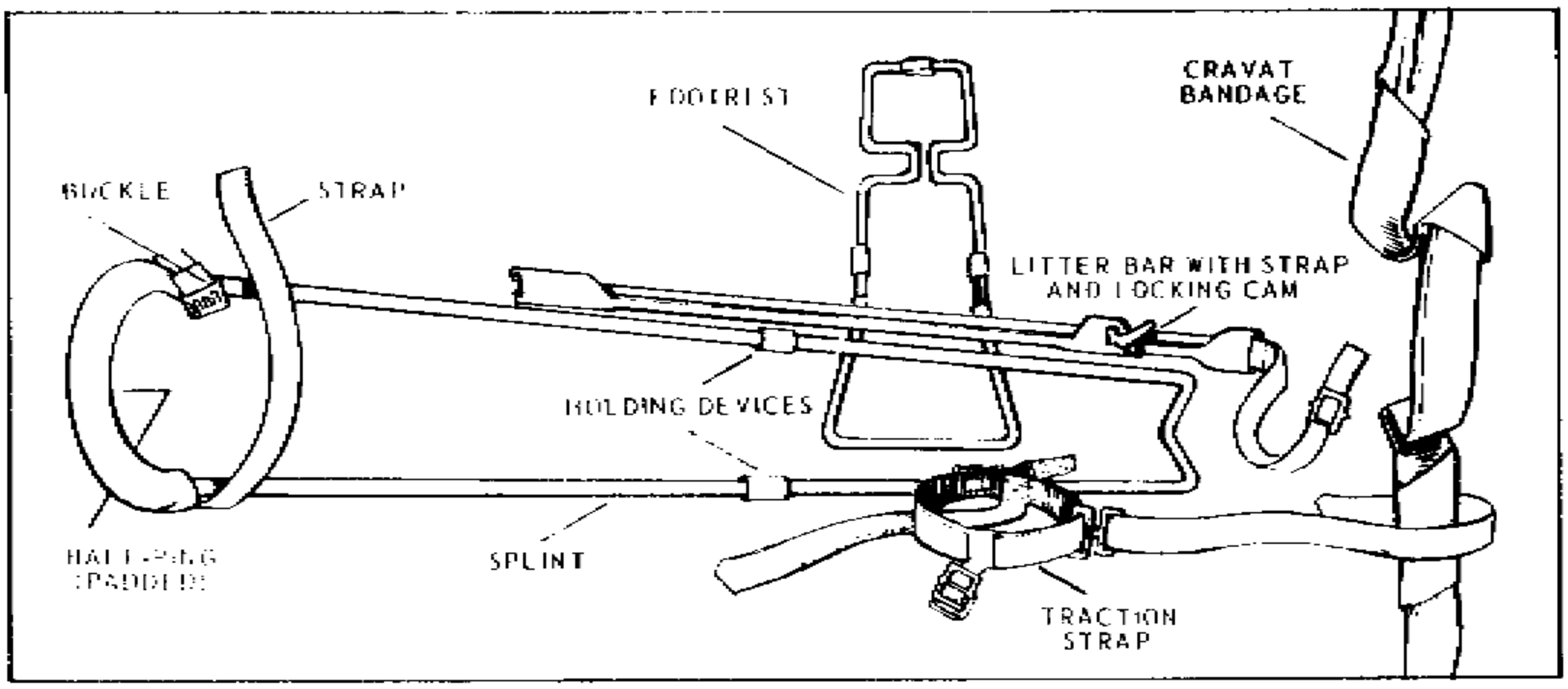


Figure 13-37. Thomas leg splint.

(2) **Application of the Thomas leg splint—**

(a) **Adjust the splint to the length which best serves the patient. Too short a splint will not leave sufficient room to apply traction to the foot. Too long a splint will not permit use of the traction strap. Place the splint beside the uninjured leg with the ring portion parallel to the ischium (bone in the buttock) and extend the splint about 6 to 8 inches beyond the foot. Lock the holding devices.**

(b) **Place the adjusted splint, with the buckle on the outside, alongside the broken extremity.**

(c) **No. 1 member: apply the traction strap over the shoe on the patient's foot (Figure 13-38). If the patient is shoeless or only has low quarter shoes, place plenty of soft materials over the areas on which the traction strap will pass. Fasten the strap, position yourself facing the sole of the patient's foot, run one hand through the large opening in the footrest and under the outside rod of the splint, and grasp the back of the patient's heel. With the other hand, grasp the dorsum of the patient's foot. Apply and maintain traction throughout the remainder of the application procedure. Maintenance of traction is very important. Release may cause serious and unnecessary damage.**

NOTE

No. 1 member does not release traction or change hand positions while the splint is being applied.

(d) **No. 2 member: raise and support the extremity; maintain this support throughout the application.**

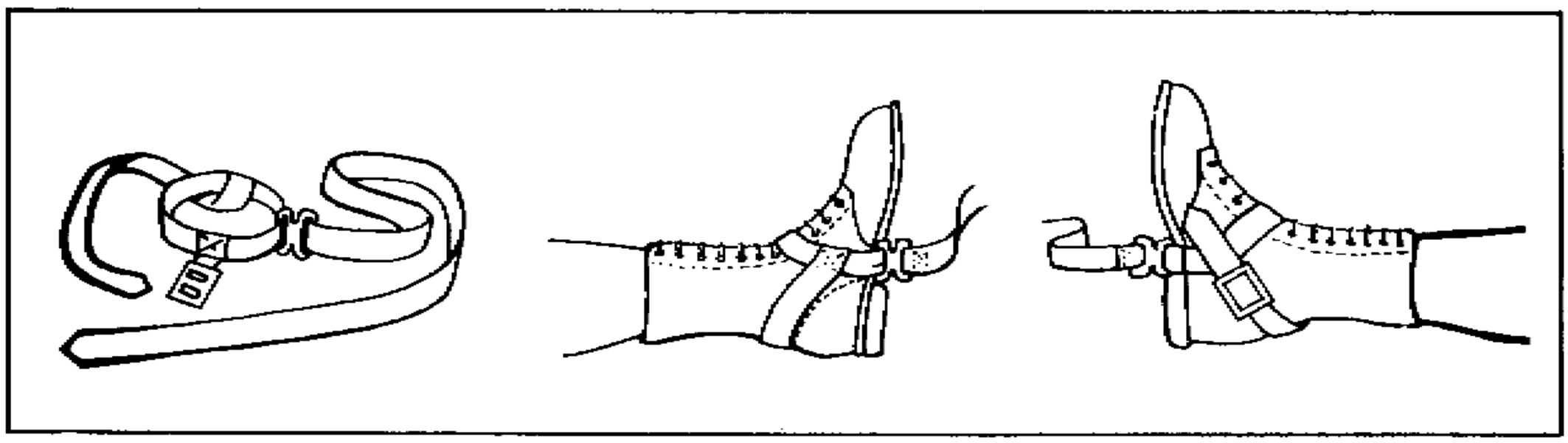


Figure 13-38. Application of traction strap.

(e) No. 3 member: apply the splint by attaching the supporting equipment as follows:

- With the buckle of the splint to the outside and the half-ring turned down at a right angle, ease the splint under the leg, setting the padded half-ring against the ischium (Figure 13-39).

- Place a pad over the thigh at the location of the splint strap and fasten the strap.

- Bring the long free end of the traction strap over and under the notched end of the splint; then pass it up through the link at the swivel (Figure 13-40A). Secure greater traction by pulling the strap toward the end of the splint. Fasten the strap securely (Figure 13-40B). No. 1 member must continue to support foot until the footrest is applied (Figure 13-40C).

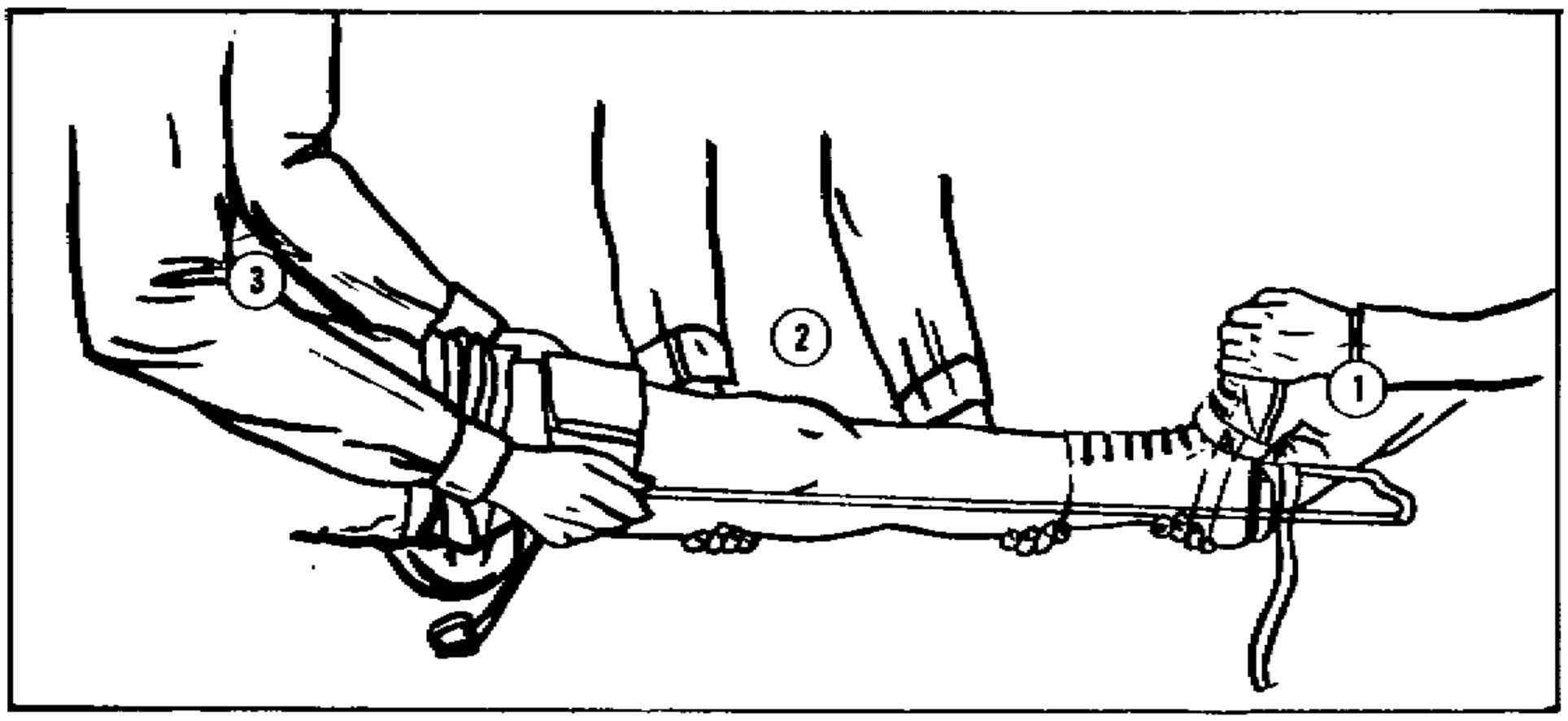


Figure 13-39. Applying the splint.

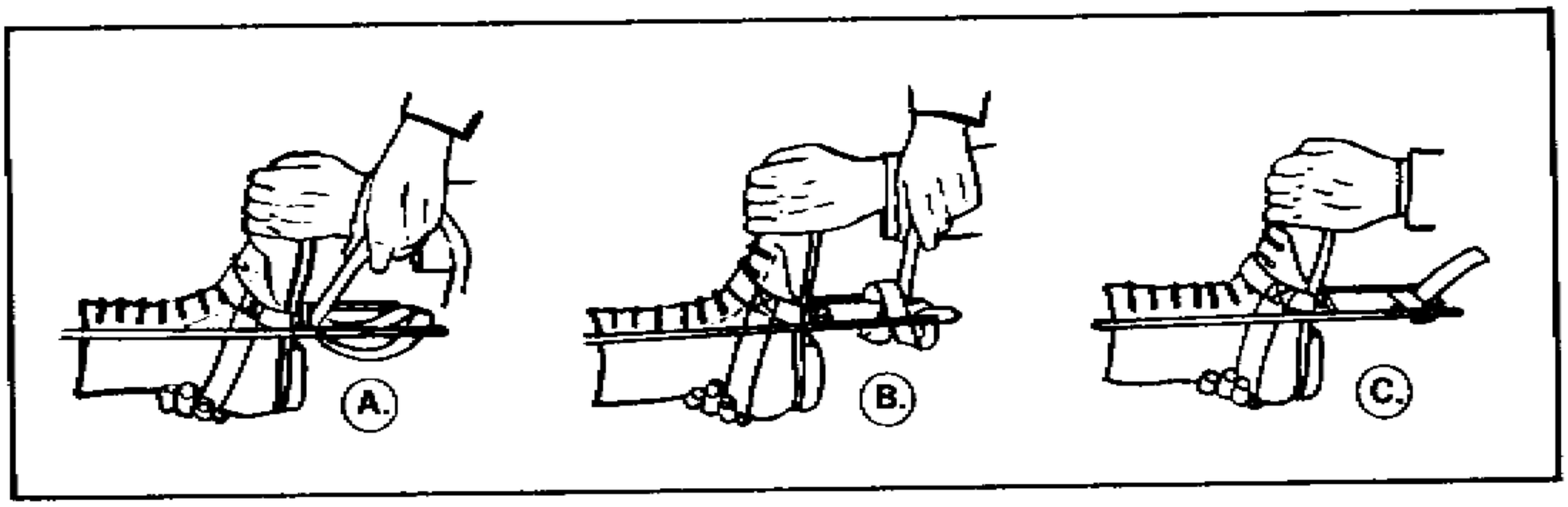


Figure 13-40. Securing the traction strap.

- Apply two cravat bandages to help support the leg. If triangular bandages are not available, use other strong cloth material that is at least 3 inches wide. Place each cravat across the rods of the splint (Figure 13-41A), with the long end of the bandage to the outside. Make sure that the cravats are not directly over the fracture. Bring the ends under the splint and loop them in opposite directions (Figure 13-41B). Bring the longer tail over the patient's leg and tie the two ends over the outside rod (Figure 13-41C). (No. 2 member must continue to support the leg.)

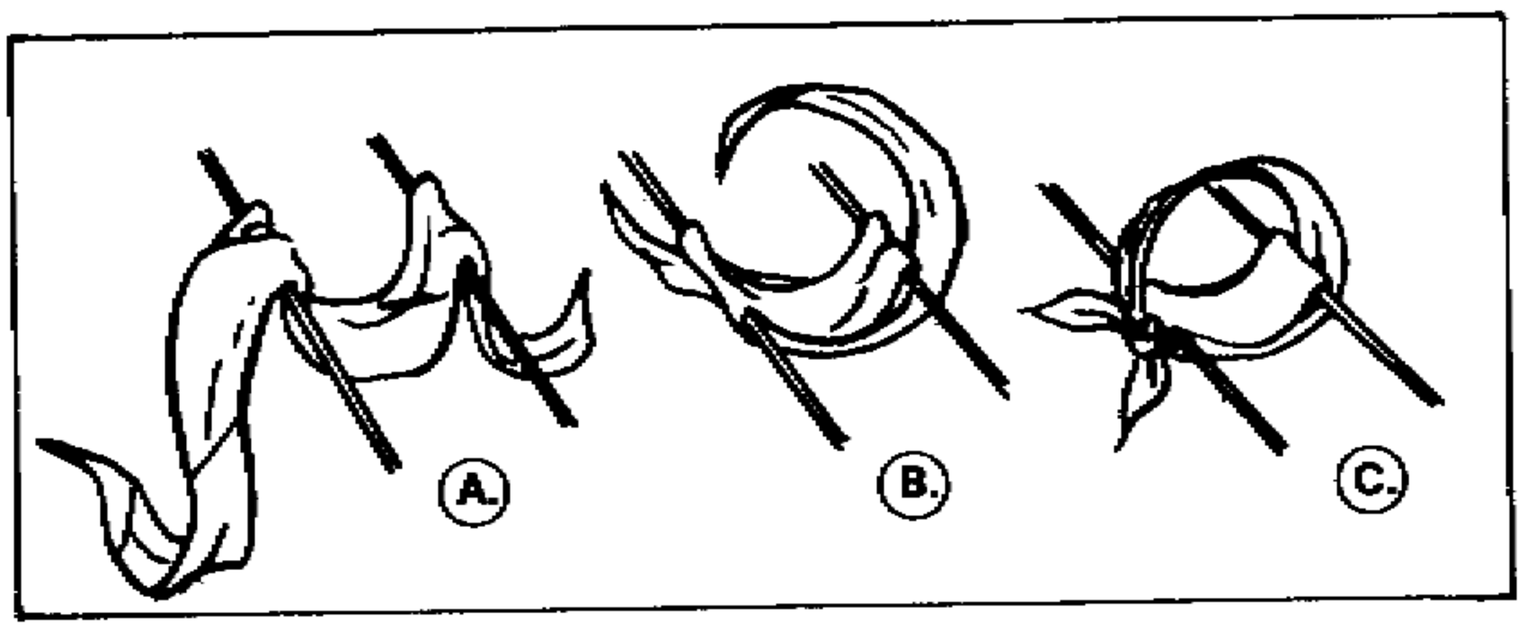


Figure 13-41. Placement of cravats on the Thomas splint.

- Slide the footrest over the end of splint and into place against the shoe or padding on the sole of foot (Figure 13-42). (No. 1 member continues to hold the patient's foot steady, adjusting the foot position slightly so that the heel and sole of the shoe or padded foot are in light contact with the footrest).

- Apply three or four cravat bandages as before to further support the extremity (Figure 13-43). Make sure that no bandage is placed directly over the fracture site. (No. 2 member shifts positions, then releases support as the bandages are tied.)

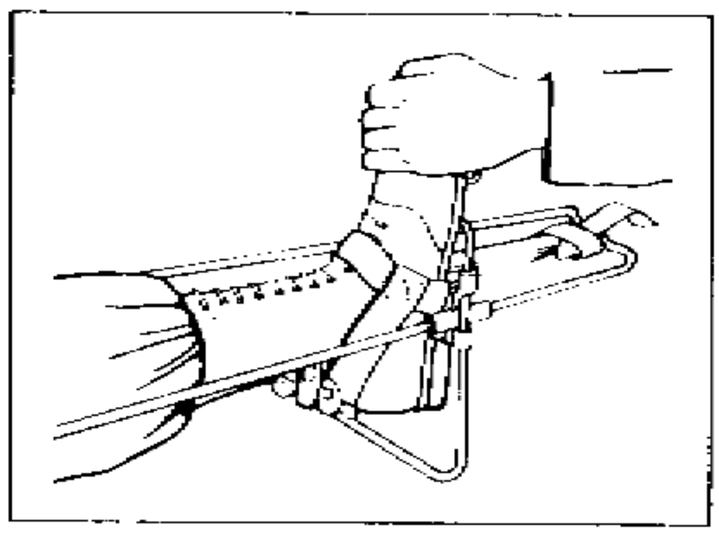


Figure 13-42. Footrest in place.

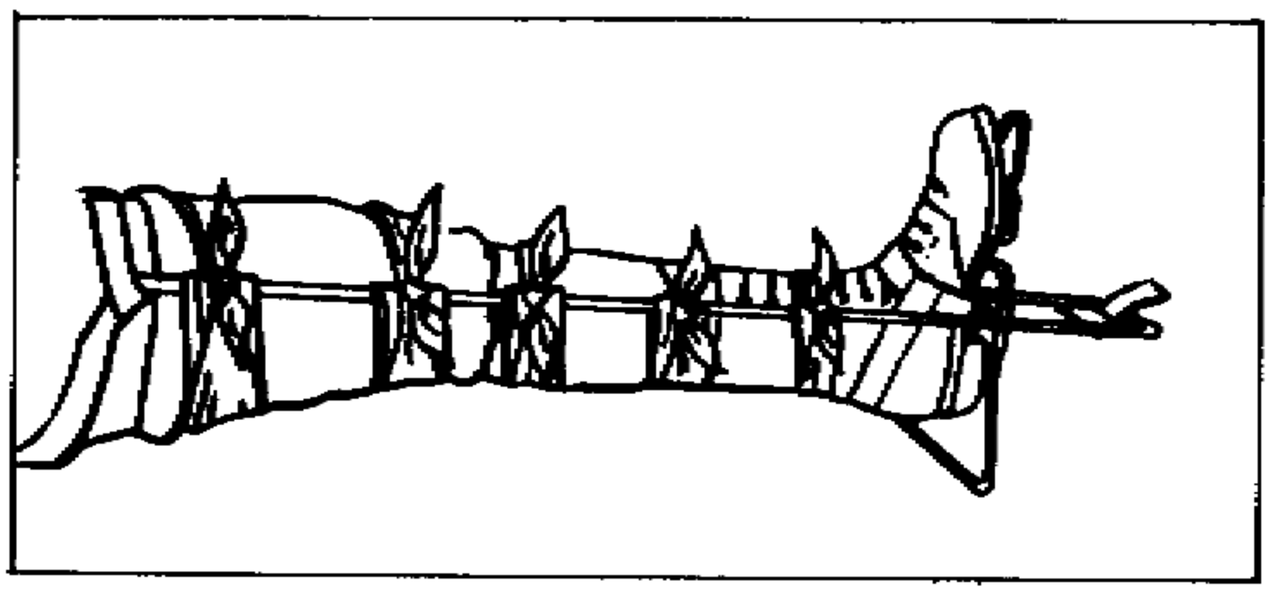


Figure 13-43. Support of extremity by splint, cravat bandages, and footrest.

● Finally, apply two cravat bandages to support the foot and ankle and secure the foot to the footrest (Figure 13-44). Place one cravat under the back of the shoe, bringing both ends up and crossing them on top of the shoe; then carry the ends toward the sole of the shoe and tie them on the outside of the footrest. Apply the second cravat around the toe of the shoe and footrest and tie. (No. 1 member releases as bandages are applied.)

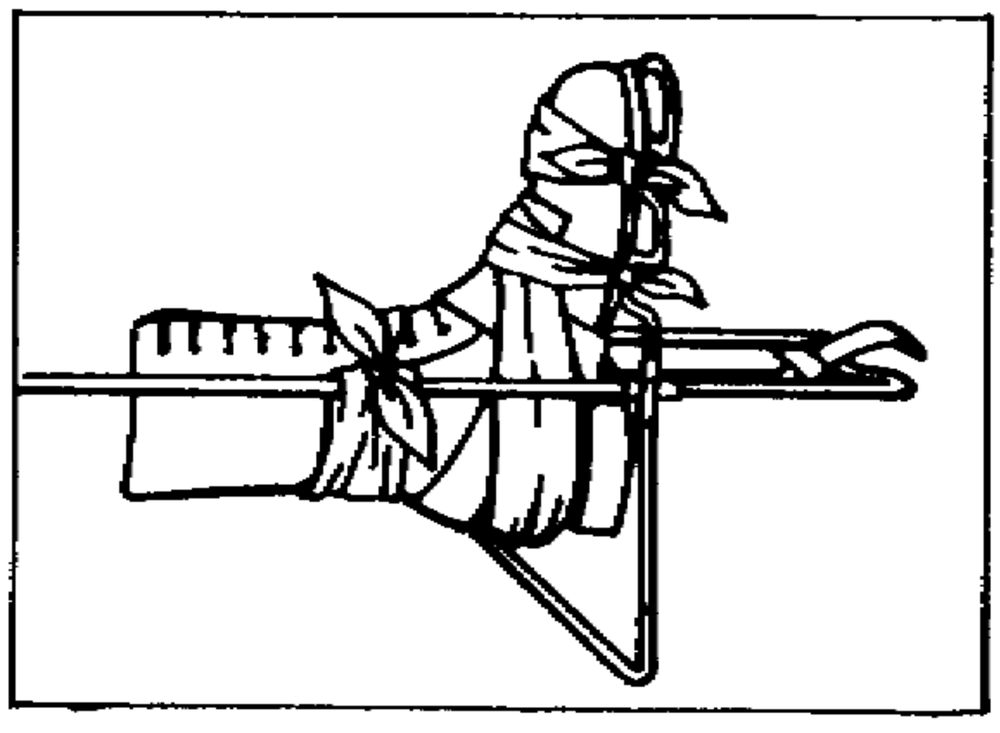


Figure 13-44. Foot supported and secured.

(3) Move the patient onto a litter.

(a) After the splint has been applied, move the patient onto a litter.

- No. 2 and 3 members kneel along side the patient on the side of the splinted limb. No. 1 member kneels on the opposite side. Each member kneels on the knee nearest to the patient's feet. No. 1 member places both hands under the patient's back and thighs, No. 2 member supports the legs, and No. 3 member the shoulders and back. All three then lift the patient onto the thighs of No. 2 and 3 members.

- No. 2 and 3 members support the patient on their thighs while No. 1 member places litter in position alongside their knees, which are touching the ground. No. 1 member then helps No. 2 and 3 members lower the patient gently onto the litter. As the patient is lowered, he is positioned so that the footrest on the splint is resting on the litter 2 inches from the border of and on the litter canvas.

(b) Secure the footrest to the litter with a grooved litter bar.

- No. 1 member: lift and hold the footrest steady a few inches above the litter canvas.

- No. 3 member: slide the litter bar under the footrest, guiding the bottom of the footrest into the groove in the litter bar. Start the bar from the direction of the fractured limb and slide it toward the other leg.

- Lock the litter bar to the footrest by turning the handle of the locking cam.

- No. 1 member: lower the footrest so that the litter bar is on the litter canvas.

- No. 3 member: buckle the litter bar strap tightly around the litter poles.

NOTE

If a traction strap and a litter bar are not available, roller bandage, cravat bandages, or similar strong material may be used as substitutes.

(c) Cover the patient with blankets or other materials as his condition and the situation warrant and place him in a position to prevent or lessen shock.

(4) Application of the Hare traction splint.

- Place the splint beside the patient's uninjured leg and adjust it to the proper length (Figure 13-45). Open and adjust the Velcro straps.

- Expose the entire injured limb.

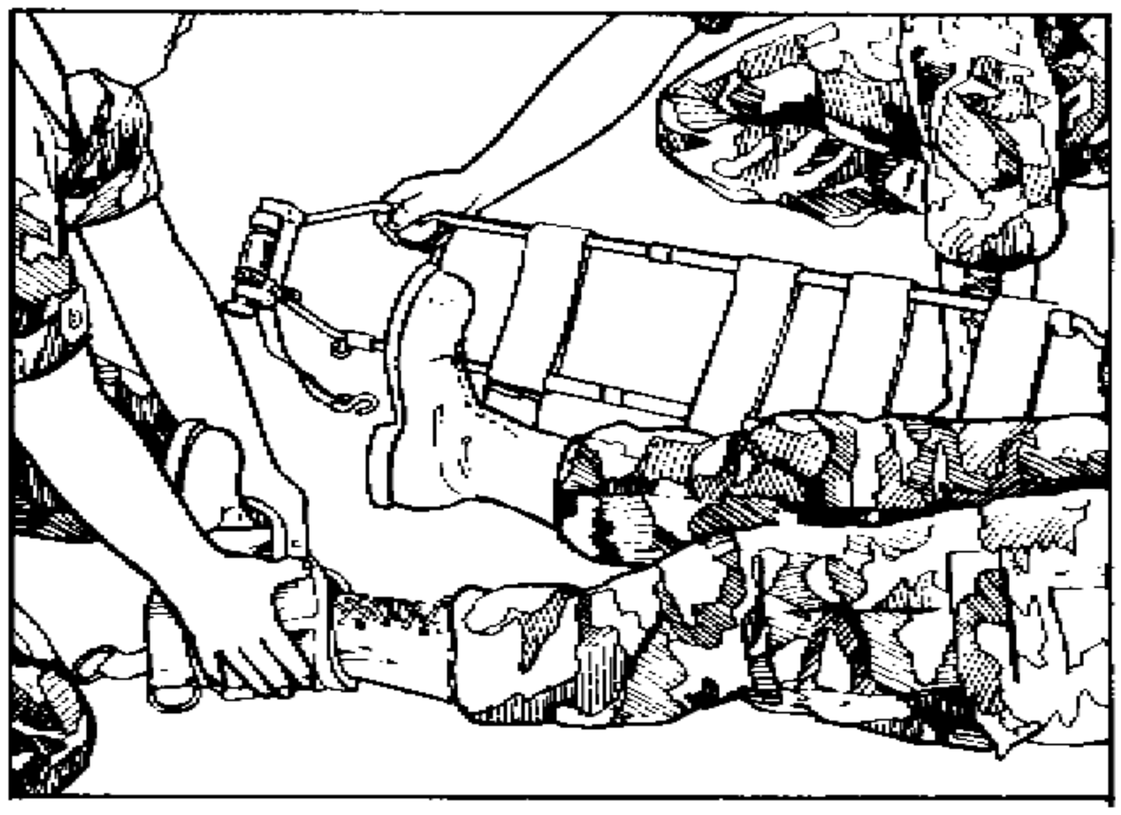


Figure 13-45. Adjusting the Hare splint.

● No. 1 member secures the leg from movement while No. 2 member applies the ankle hitch (Figure 13-46).

NOTE

The boot is usually left in place.

● No. 1 member lifts and supports the leg at the site of the suspected fracture while No. 2 member applies traction with his hands.

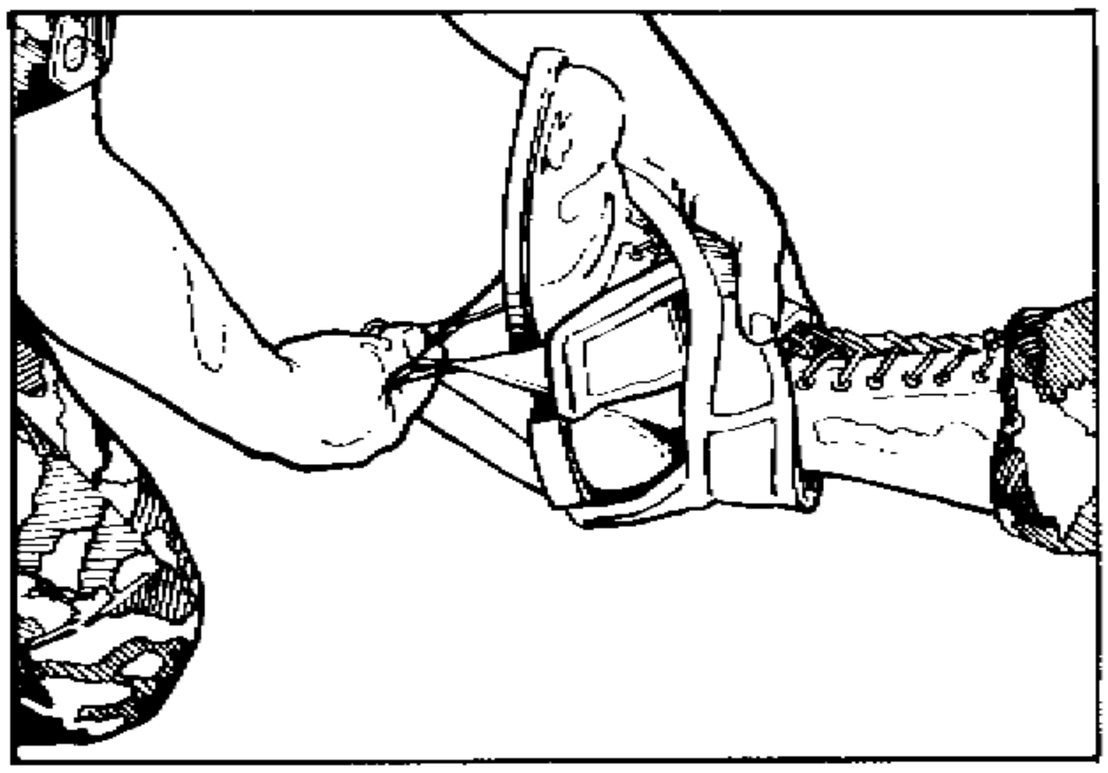


Figure 13-46. Applying the ankle hitch.

● No. 2 member maintains traction while No. 1 member slides the splint into position under the patient's leg and gently applies the ischial strap (Figure 13-47).

● No. 2 member maintains the traction with his hands while No. 1 member connects the ankle hitch to the splint (Figure 13-48).

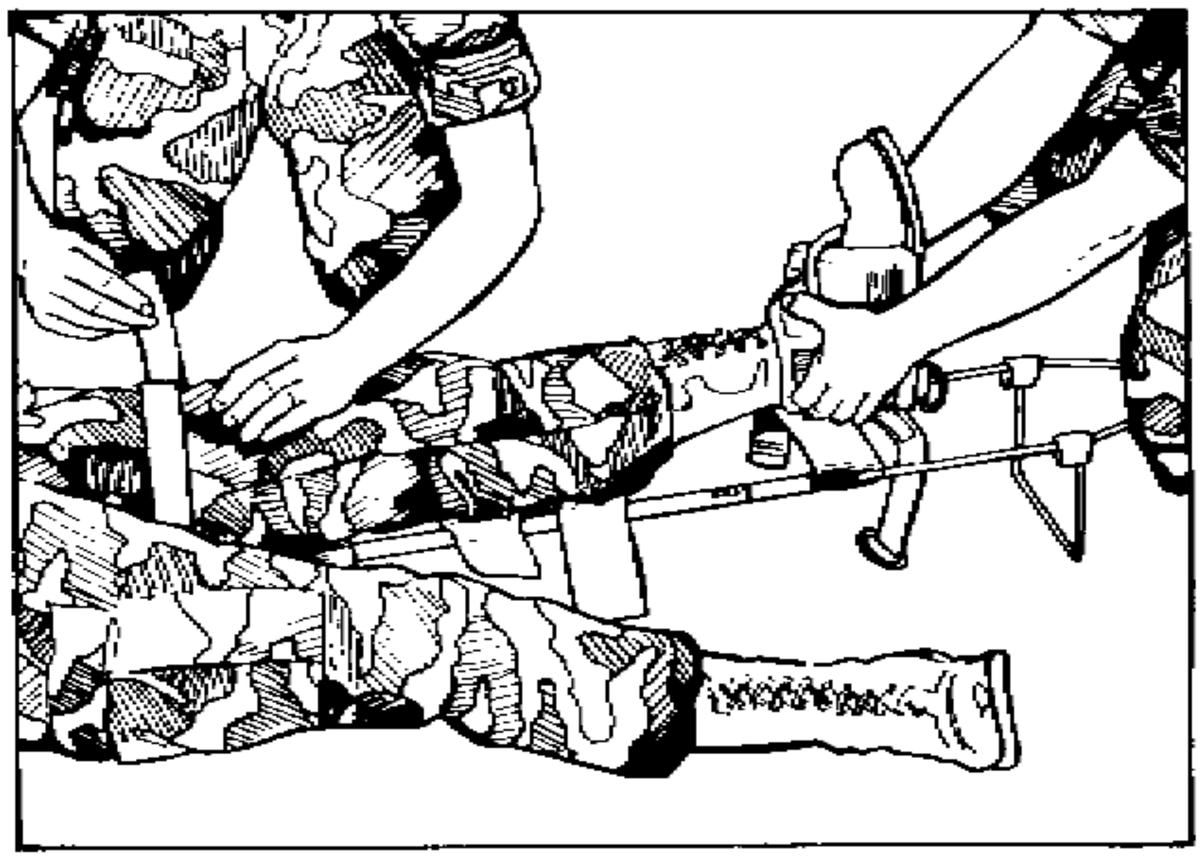


Figure 13-47. Securing ischial strap.

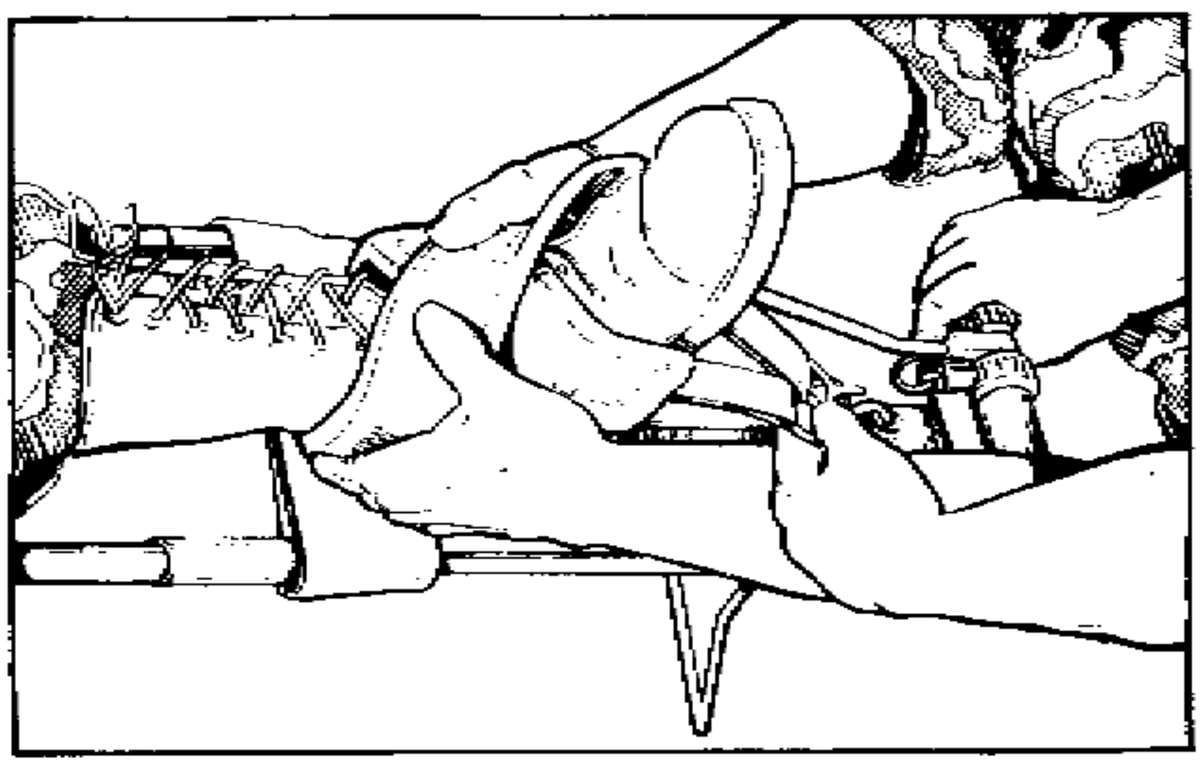


Figure 13-48. Connecting the ankle hitch to the splint.

- Apply traction with the splint (Figure 13-49).
- When proper traction has been applied with the splint, fasten the Velcro straps so that the limb is secured to the splint (Figure 13-50).

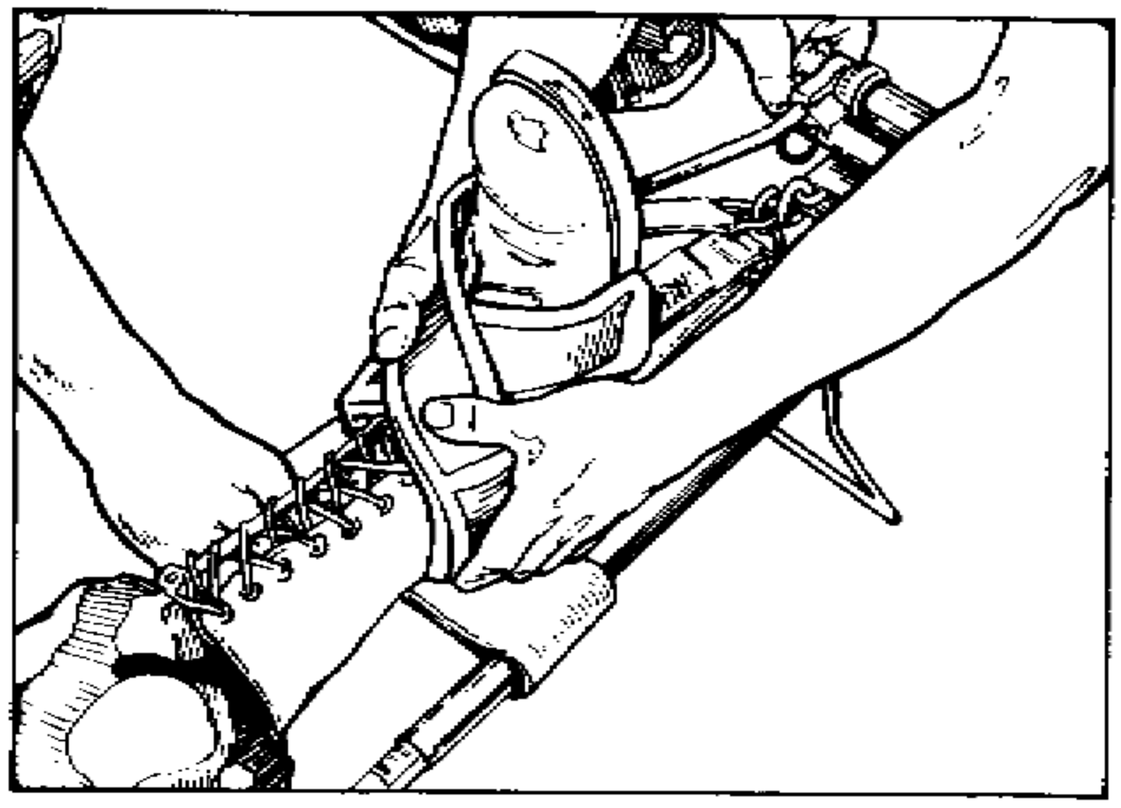


Figure 13-49. Applying splint traction.

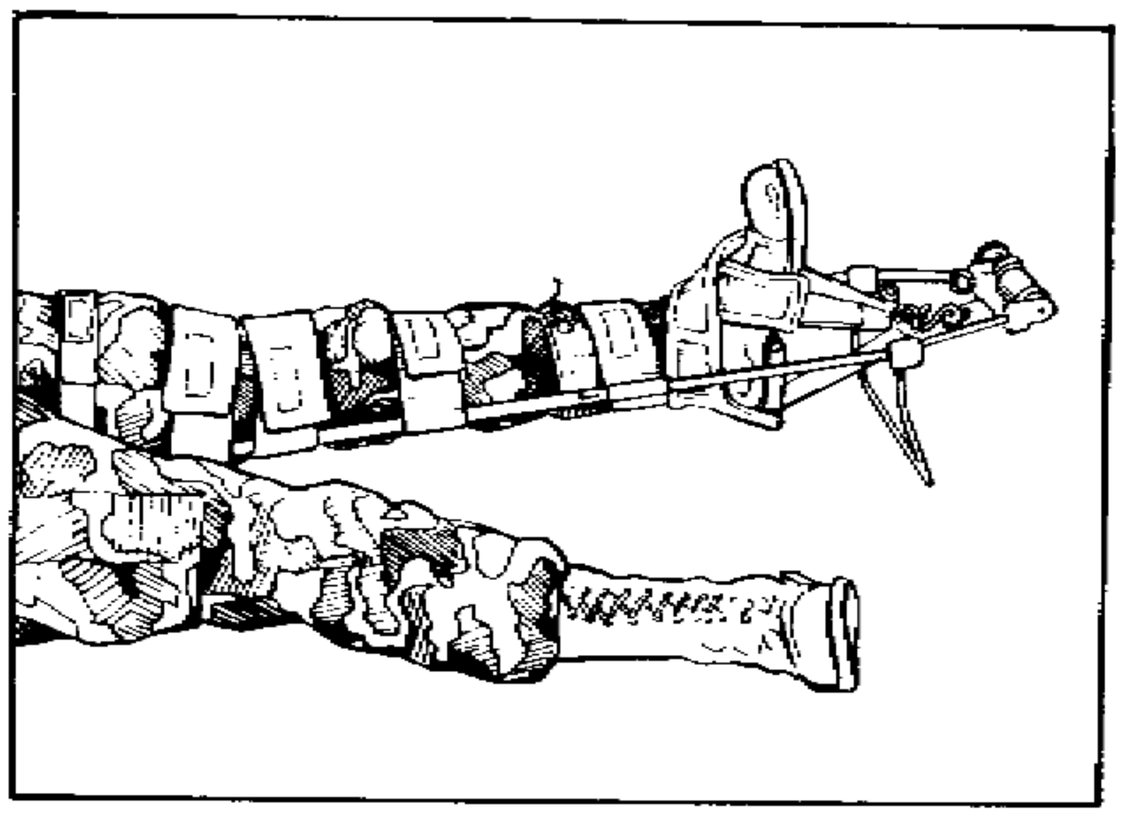


Figure 13-50. Fastening the Velcro straps.

13-36. Management of Fractures

a. Clavicle.

- Clavicular fractures can be detected by palpation and observation along the shaft of the clavicle.

- You can obtain immediate stabilization by using a sling and swathe to prevent shoulder motion.

b. Humerus.

- Proximal fractures of the humerus are usually sustained by falling on an outstretched arm. The diagnosis is sometimes difficult in such fractures because the broken parts are frequently impacted. Palpating the length of the humerus and gently rotating the humerus can identify the

presence or absence of most fractures. Fractures of the shaft usually cause gross deformity, swelling, and pain. In proximal head fractures, pain and tenderness beneath the deltoid muscle may be the only symptom, but in a fracture of the shaft, the patient will not be able to move the arm.

- The most effective method of stabilization is the sling and swathe which immobilize the fracture against the chest. Wood splints can be added for protection, but cannot be used alone because they do not immobilize the joint above the fracture. Initial stabilization can also be accomplished by using a long spine board and sandbags, keeping the patient's upper arm at his side with the forearm across the abdomen.

c. Hand.

- Fractures of the metacarpals and phalanges may be either impact or incomplete greenstick. Frequently diagnosis is based on pain alone. A typical "boxer's fracture" of the fifth metacarpal can result when the victim delivers a punch. This can be most easily detected by posterior palpation.

- Immobilize the injured hand by use of a splint and sling.

d. Elbow (Distal Humerus and Proximal Radius and Ulna).

- Pain and the inability to move the elbow indicates a fracture. These fractures are particularly serious because of the proximity of the fragments to nerves and blood vessels. Elbow fractures are the most frequent type of fracture associated with severe vascular compromise. Surgery is frequently necessary to reestablish blood flow to the extremity.

- Do NOT attempt to manipulate a fractured elbow. Immobilize the injury and evacuate the patient.

e. Forearm (Shaft and Distal Radius and Ulna).

- Fractures of the forearm are usually produced by a fall on the outstretched arm. Shaft fractures of the radius and ulna are diagnosed by palpation and rotational movements from the pronation (palms down) to supination (palms up). Even though midshaft fractures usually produce great deformity, it is not uncommon for fractures to be impacted and relatively stable. Therefore, x-ray is necessary to confirm that no fractures exist.

- The best method of managing this fracture is to apply a sling and swathe to stabilize the wrist. Complete immobilization must include the joint above the fracture, the elbow. This means, of course, that pneumatic splints or rigid splints must immobilize the arm in full extension. It is difficult to transport the patient in this position, and it is uncomfortable for the patient.

- A hemorrhage of 250 to 500 cc's of blood can occur in the area of the fracture.

- The fracture should be immobilized with 4 inch square gauze pads and a sling applied in the position of function. Straight splints such as tongue depressors or short pneumatic splints can also be used. Complications of these fractures are minimal.

f. Pelvis.

● A fractured pelvis commonly results from compression injuries and falls. Bilateral pressure applied to the anterior superior iliac spine can cause pain on movement of the pelvis, as can pressure over the symphysis pubis or bilateral pressure over the greater trochanter.

● Long spine boards or MASTs can immobilize such fractures. Intravenous fluid replacement must be carried out.

● Blood loss from pelvic fractures is probably the most extensive of any fractures. As much as two to two and a half liters of blood can be lost into the retroperitoneal space. Shock can develop from this fracture alone. Therefore, MASTs are especially beneficial in the management of these patients.

g. Hip.

● Fractures of the hip can either be of the surgical neck of the femur (acetabulum) or the shaft. These fractures are generally caused by a fall or other type of trauma, such as hitting the knees in a head-on vehicle crash. Shortening and external rotation of the leg with pain when moving the extremity are frequent physical findings.

● Traction splints are preferred for management of this type of fracture although a long spine board or the MAST can provide immobilization. Keep in mind that blood loss is usually minimal but can approach 250 to 500 cc's.

h. Femur.

● Tenderness or midshaft angulation of the femur are the most common physical findings. Rotation of the extremity can be helpful in the diagnosis of a femoral fracture.

● Management of this fracture is similar to management of hip fractures; traction splints are preferred. Pneumatic splints, other than the MAST, do not immobilize the joint above the fracture. They can be more harmful than no splint at all. Vascular obstruction or hemorrhage can occur, with blood loss from 750 to 1,250 cc's. Traction splinting of the leg should relieve most vascular obstruction. The simultaneous use of traction splinting and MAST is often necessary in severe hip or femur fractures when hypovolemic shock is present or is likely to develop. When this is necessary, *apply the MAST over the traction splint.*

i. Knee.

● Fractures of the knee are like those of the elbow. Impaction with minimal angulation may make these fractures difficult to identify, except by testing for tenderness.

● When treating a fracture of the knee, the knee must be immobilized. The hip and femur management techniques are used; however, pain and occasionally angulation of this fracture may prevent the use of traction splinting. Splinting the knee in the position most comfortable to the patient may require the use of wire ladder splints.

● The position of the fracture causes vascular complications similar to those in elbow fractures. An attempt to reestablish impaired circulation is necessary, but may not be successful. Only minimal pressure should be used to correct the deformity. Patients with knee fractures should receive treatment and transportation before those with fractures in the shaft of the femur without vascular impairment.

j. Tibia and Fibula.

● Fractures of the tibia and fibula, particularly those near the ankle, resemble a sprain or strain and can be difficult to identify. Although angulation may be present in the midshaft, pain and tenderness may be the only evidence of injury distally.

● Long leg pneumatic splints, traction splints, or rigid splints are all acceptable methods of immobilizing this fracture. The MAST does not immobilize the ankle and cannot be used for immobilization of fractures below the knee.

● Vascular complications, particularly around the ankle, are common. If vascular impairment is secondary to a fracture dislocation, reduction should be attempted in the field,even though the wound may be open, if evacuation will be delayed for more than 6 hours.

k. Foot.

● Like fractures of the hand, fractures of the metatarsals and phalanges are relatively benign and can be detected by palpation.

● Immobilization can be accomplished by the use of a pneumatic pillow or rigid splint. Complications rarely occur with these fractures; however, patients with heel fractures from falls should be examined for fractures of the hip or spine.

13-37. Management of Dislocations

Dislocations should be immobilized as they are found unless there is an absence of pulse distal to the injury. Dislocations are most easily treated shortly after they occur before severe muscle spasms develop.

a. Shoulder.

● Restricted motion will identify this dislocation.

● Immobilize the upper arm with a sling and swathe after padding the armpit. Frequently it may be necessary to use a pillow or blanket between the arm and the chest wall because the arm is fixed away from the chest.

b. Elbow.

● Dislocation of the elbow is diagnosed by painful movements of the elbow joint. The dislocation occurs when the full body weight is supported on an extended arm.

● Immobilize the elbow with a sling and swathe or with a padded long arm splint. Full extension or flexion of less than 90^{o} should be avoided to decrease the chances of vascular complications.

c. Phalanges.

● Both metacarpal-phalangeal and interphalangeal joint dislocations are identified by obvious deformity of joints and painful movement. Dislocations of the metacarpal-phalangeal and interphalangeal joints are managed by splinting in a position of function.

● Stabilize the fracture and/or dislocation to an adjacent toe or finger with tape, with padding between the toes or fingers. Traction applied proximally and distally to the involved joint relaxes the muscular spasm, allowing movement of the articular surfaces into their normal position.

d. Ankle.

● Dislocations of the ankle are frequently associated with fractures. Generally, there is gross deformity of the ankle and often it is not possible to distinguish a fracture from a dislocation.

● Treat an ankle dislocation as if it were a fracture—immobilize the ankle with a splint.

Section VI. BANDAGES AND BINDERS

13-38. General

a. Bandages and binders are used to—

● Apply pressure to control bleeding.

● Provide for immobilization of an injured body part, such as a fractured arm.

● Hold dressings in place.

● Protect open wounds from contaminants.

● Provide support and aid in venous blood return, such as when bandaging the leg of a patient suffering from impaired circulation.

b. Bandages and binders are applied so that pressure is evenly distributed to the affected area. If a joint is involved in bandaging, it is supported in its normal position with a slight flexion of the joint. Both the bandage and binder are wrapped securely to avoid friction or rubbing of the underlying tissue, which can cause severe irritation. It must be tight enough to stay in place but not so tight as to cut off circulation.

c. Signs of impaired circulation are *paleness* or *cyanosis, swelling, coolness,* and *pain*. Leave the tips of the fingers and toes visible on a bandaged extremity so that you can check for circulation.

d. When possible, elevate the extremity for 15 minutes before applying a bandage. This aids venous blood flow and reduces swelling in the hand or foot. If the extremity is wrapped while swollen, the bandage will become loose and slip when the edema subsides. Elevate the extremity by having the patient lie with the arm or leg resting on a supporting object above the level of the heart.

e. A bandage or binder is applied over a clean, dry area as a precaution against microorganisms which grow in warm, damp areas. Be sure that skin surfaces are not bandaged in contact with each other—they will sweat and provide a moist environment in which microorganisms can grow. Always pad (4 x 4 or ABD bandage) adjoining skin surfaces before bandaging or binding. Also, pad all bony prominences before bandaging to avoid pressure, which can lead to skin irritation. If left unattended for several days, such an irritation can become a decubitus ulcer (pressure sore). A bandage or binder applied to a draining wound must be changed frequently to keep it as clean and dry as possible. Discard all soiled bandages and binders.

13-39. Types of Bandages

a. There are several types of bandages available for use today (Figure 13-51). The type and width you select will depend upon the purpose of the bandage. The gauze roller bandage is used less frequently for bandaging the arm or leg because there is a difference in the size of the extremity. Other bandages that have more elastic or clinging ability provide a firmer wrapping that stays in place and provides better support.

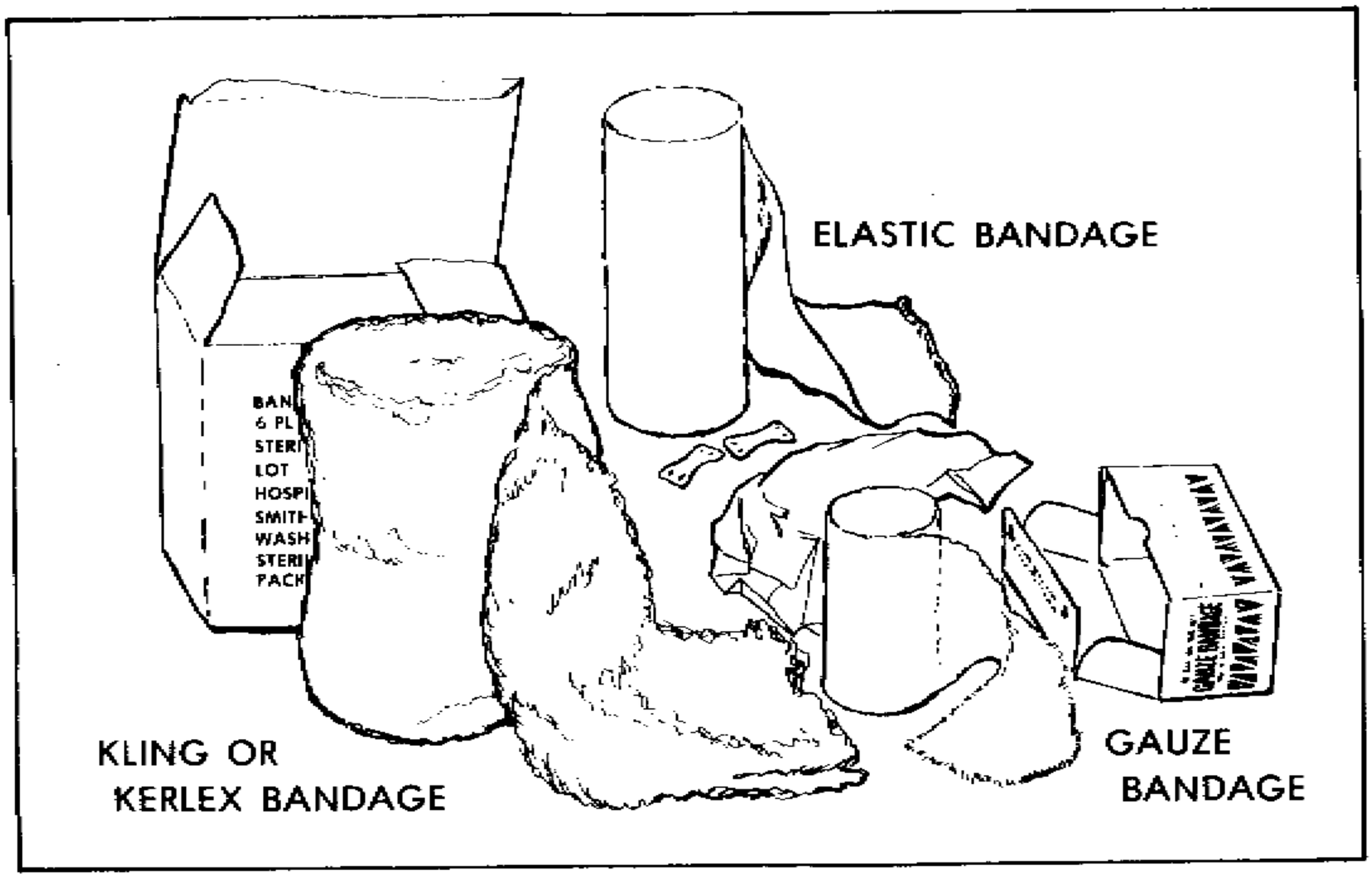


Figure 13-51. Types of bandages.

b. Elastic bandages are made of woven material that can be stretched and molded around the body part being bandaged. The Ace bandage and stockinette are two types of elastic material. These bandages can be removed, rewound, and used again for the same patient. Do not reuse for a different patient, or when a sterile bandage is required.

c. The cling bandage stretches but is not elastic. It molds around irregular and hard to bandage areas and is often used for holding dressings in place on the head, or on the stump of an amputated extremity. The clinging bandage may then be covered with an elastic bandage for firm support.

d. Approximate lengths and widths needed for bandaging body parts are:

Body Part	*Length*	*Width*
Head	6 yards	2 inch
Trunk	10 yards	3 to 6 inch
Leg	9 yards	2 to 4 inch
Foot	4 yards	1 ½ to 3 inch
Arm	7 to 9 yards	2 to 3 inch
Hand	3 yards	1 to 2 inch
Finger	1 to 3 yards	½ to 1 inch

13-40. Apply a Circular Bandage to an Arm

a. Wash your hands.

b. Place the patient in a comfortable position.

c. Remove the used bandage and wash the area that was bandaged (if needed).

d. Unroll the bandage and anchor it in place.

- Ask the patient to raise the injured arm slightly (about 6 to 12 inches) so that you can wrap it. If the patient is unable to lift the arm, you may need assistance.

- Unwind the bandage toward the right around the patient's arm. Hold the roll of bandage in your right hand so that it unwinds from the bottom (reverse hand positions and direction of wrap if you are left-handed). With moderate tension, hold the bandage in place with your left thumb. If you hold the bandage too loosely while wrapping, it will come off easily. If the bandage is wrapped too tightly, it will cut off the patient's circulation.

e. Make two initial circular turns to secure the bandage in place. Secure the free end of the bandage to the arm directly below the injury site. For the patient's comfort, the beginning (initial) and terminal end of the bandage are not to be placed directly over the wound, a bony prominence, the inner aspect of a limb, or a part that the patient will lie on.

f. Each circular turn should overlap one half the bandage width of the preceding turn. Each successive turn anchors (holds in place) the underlying layer of bandage. Use as much bandage as is needed to hold the dressing in place or to immobilize the part.

g. Secure the terminal end of the bandage (Figure 13-52). Use tape, metal clips, safety pins, or a knot.

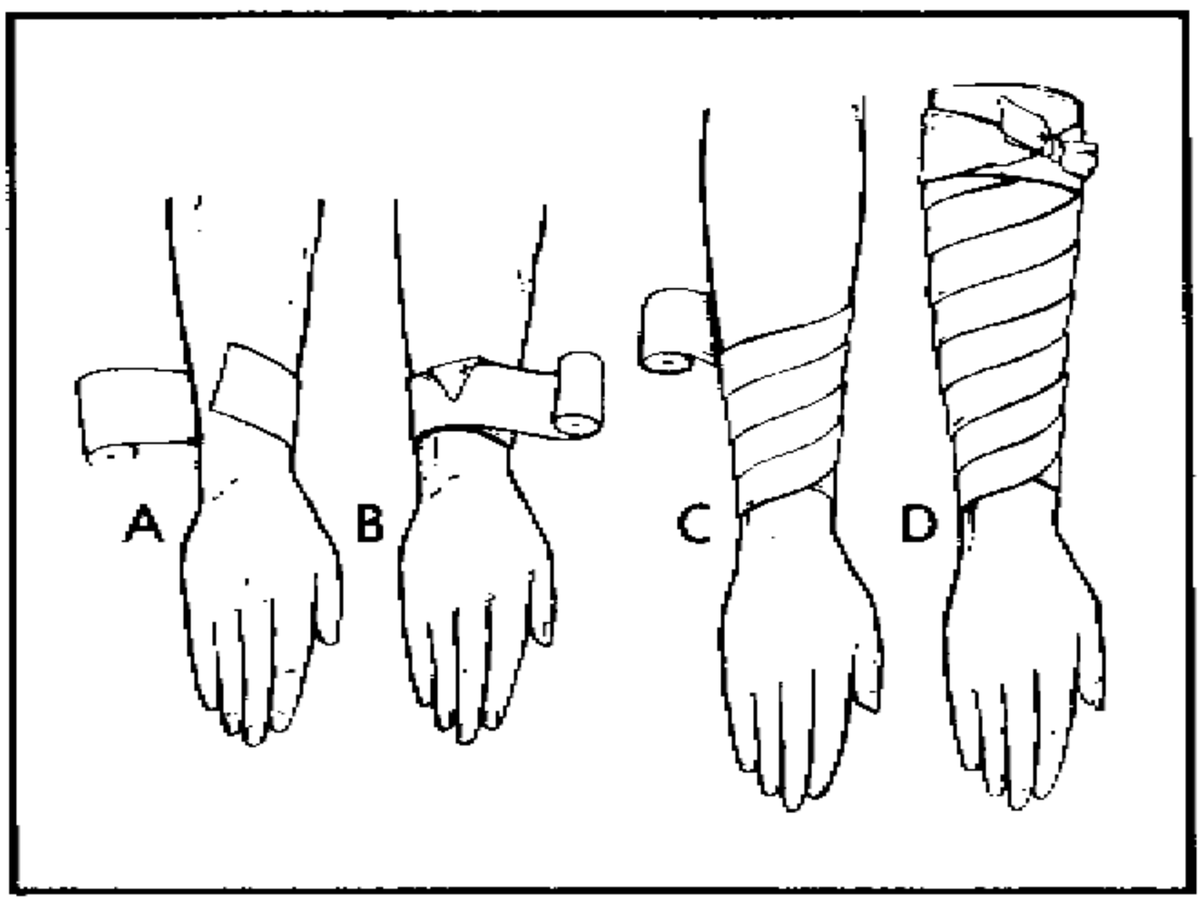


Figure 13-52. The circular bandage in place.

13-41. Apply a Figure-of-8 Bandage to an Ankle

The figure-of-8 bandage may be used by itself or with a circular, spiral, or spiral reverse bandage when a joint is included in the wrapping. The figure-of-8 bandage around the joint protects, supports, and limits the movement of the joint and promotes the venous blood return which reduces swelling or edema. The advantage of the figure-of-8 bandage is that it can support the joint in a position of flexion, or allow limited movement when necessary.

a. Anchor the bandage over the foot (Figure 13-53A). Place the initial anchoring turns around the foot, beginning near the toes.

b. Make a circular turn over the foot and around the ankle (Figure 13-53A).

- For support place the first turn at the upper part of the ankle. Place each successive turn lower over the ankle and heel.

OR

- For promoting venous blood return, place the first turn lower on the heel. Place each successive overlapping turn higher onto the ankle.

c. Continue the wrap by making a spiral turn down over the ankle and around the foot (Figure 13-53B).

d. Alternate the upward and downward spiral turns about the joint (Figure 13-53B). Overlap each layer with one half the bandage width. Make at least three complete turns. Continue bandaging the lower leg, if necessary.

e. Secure the end of the bandage (Figure 13-53D).

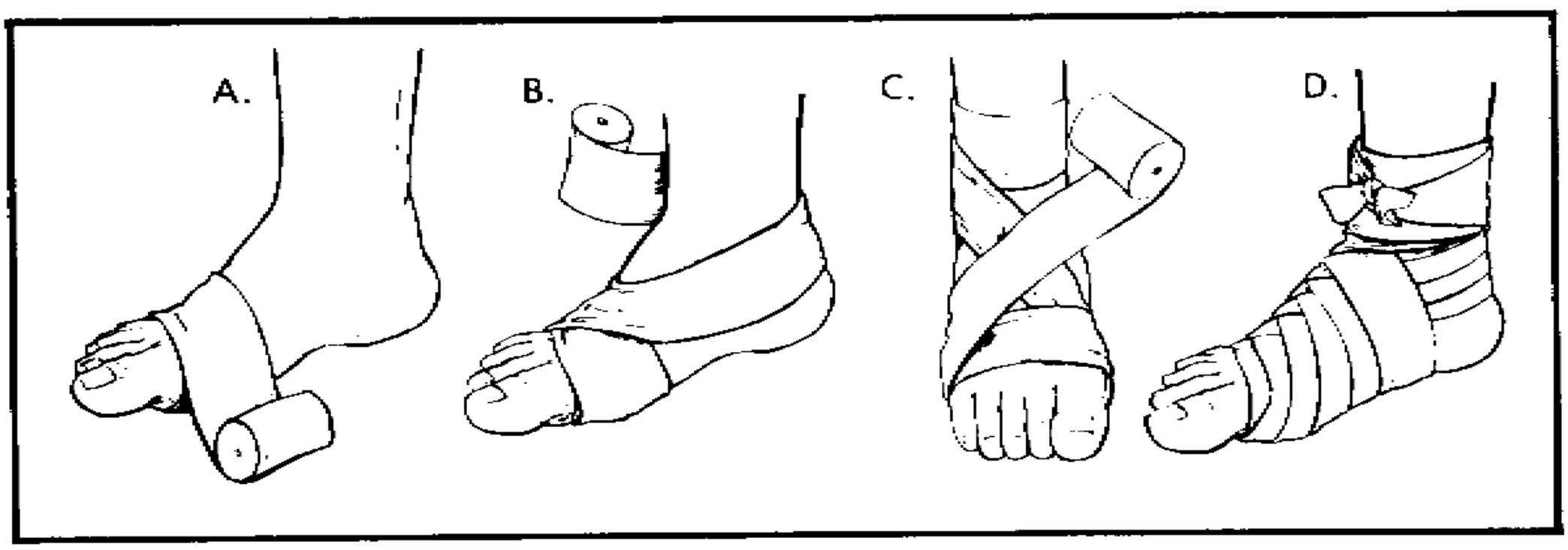


Figure 13-53. Figure-of-8 bandage applied to an ankle.

13-42. Apply a Figure-of-8 Bandage to a Hand

a. Anchor the bandage over the fingers (Figure 13-54A).

b. Make a circular turn over the hand and around the wrist (Figure 13-54B).

c. Continue the wrap by making a spiral turn down over the wrist and around the hand.

d. Alternate the spiral turns about the joint (Figure 13-54C). Overlap each layer with one half the bandage width. Make at least three complete turns.

e. Secure the end of the bandage (Figure 13-54D).

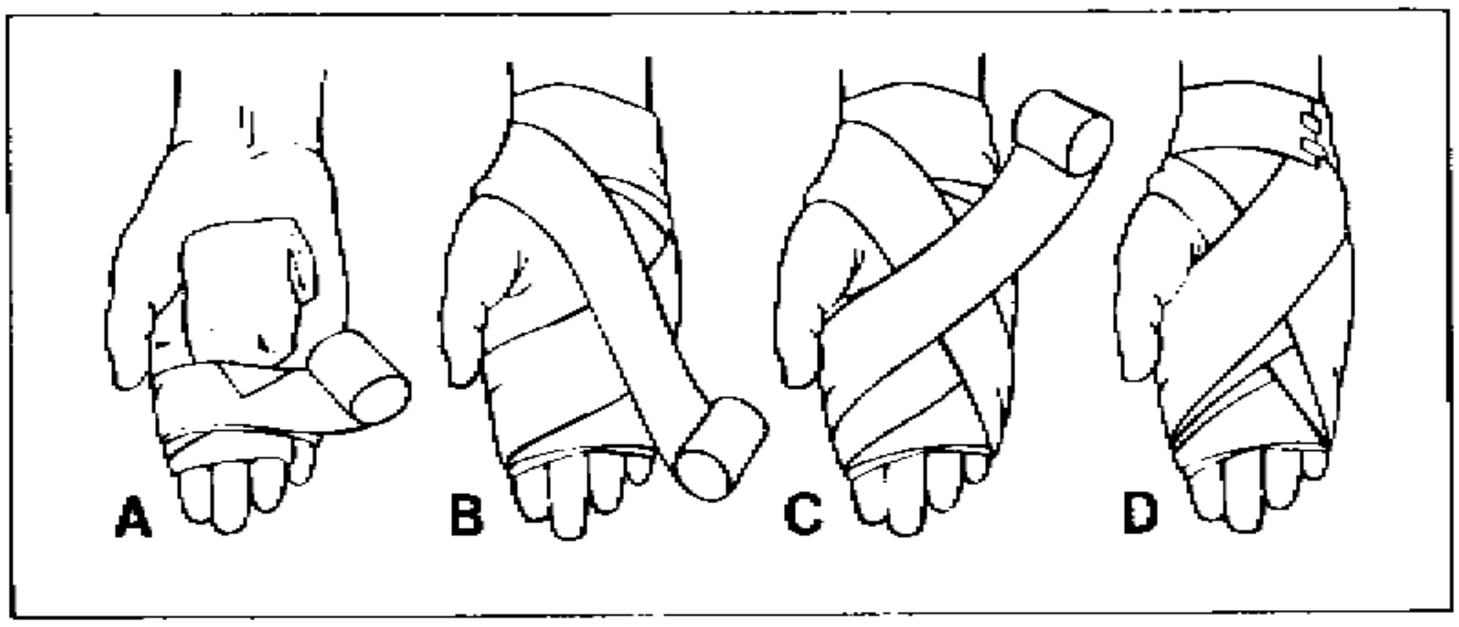


Figure 13-54. Applying a figure-of-8 bandage to a hand.

13-43. Apply a Figure-of-8 Bandage to a Forearm

a. Anchor the bandage over the wrist (Figure 13-55A).

b. Make a spiral turn over the length of the forearm and around the upper forearm just below the elbow (Figure 13-55B).

c. Make two anchor wraps around the upper forearm just below the elbow (Figure 13-55C).

d. Make a spiral turn between the wrist and upper forearm (Figure 13-55D).

e. Alternate the spiral turns between the wrist and upper forearm until a complete cover is provided for the forearm (Figure 13-55E).

f. Secure the end of the bandage (Figure 13-55F).

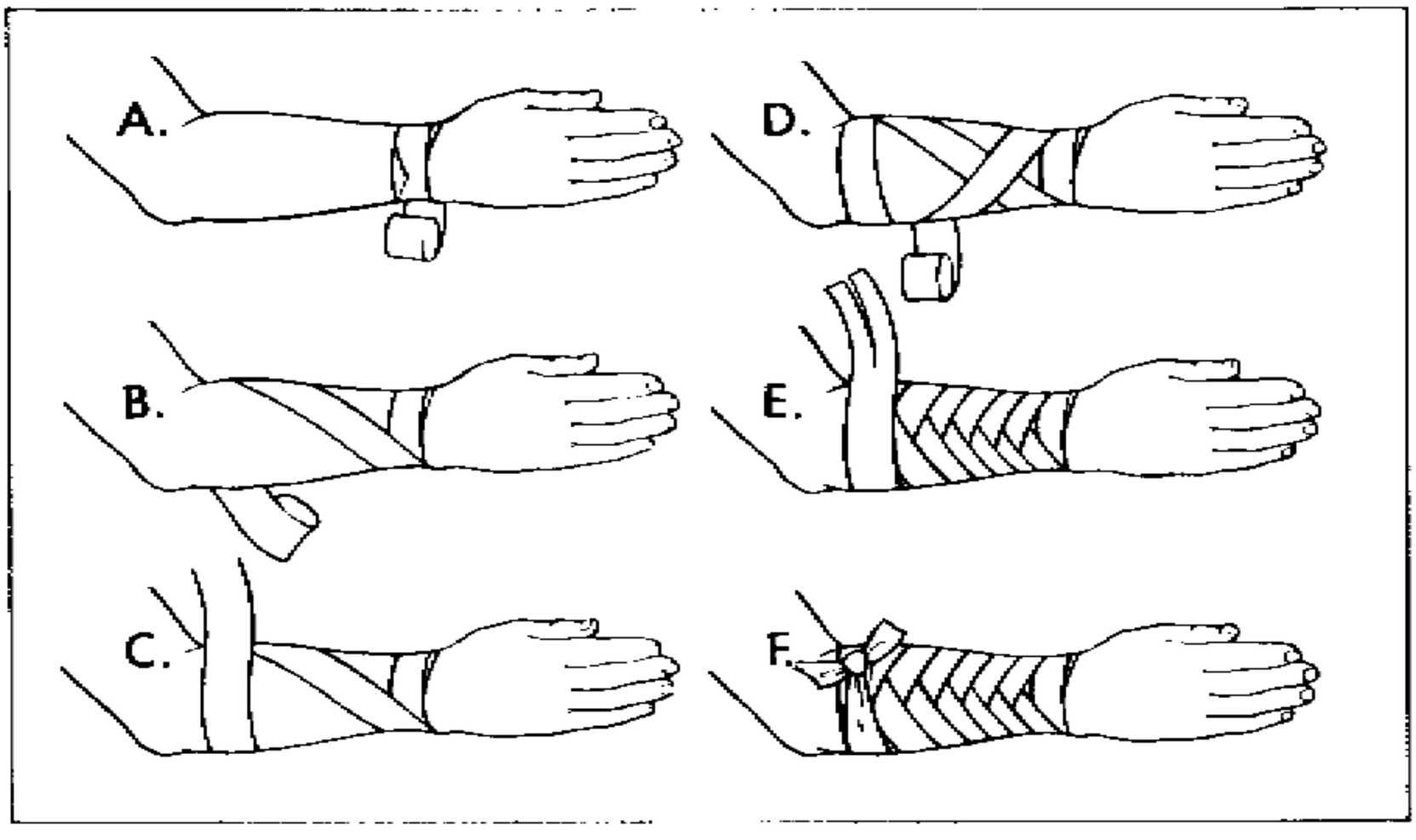


Figure 13-55. Applying a figure-of-8 bandage to forearm.

13-44. Apply a Figure-of-8 Bandage to a Knee

a. Anchor the bandage over the mid-calf of the leg (Figure 13-56A).

b. Make a circular turn over the knee and around the lower thigh (Figure 13-56B).

c. Continue the wrap by making a spiral turn down under the knee and around the calf of the leg (Figure 13-56C).

d. Alternate the spiral turns about the joint until a complete cover is provided for the knee (Figure 13-56D).

e. Secure the end of the bandage (Figure 13-56D).

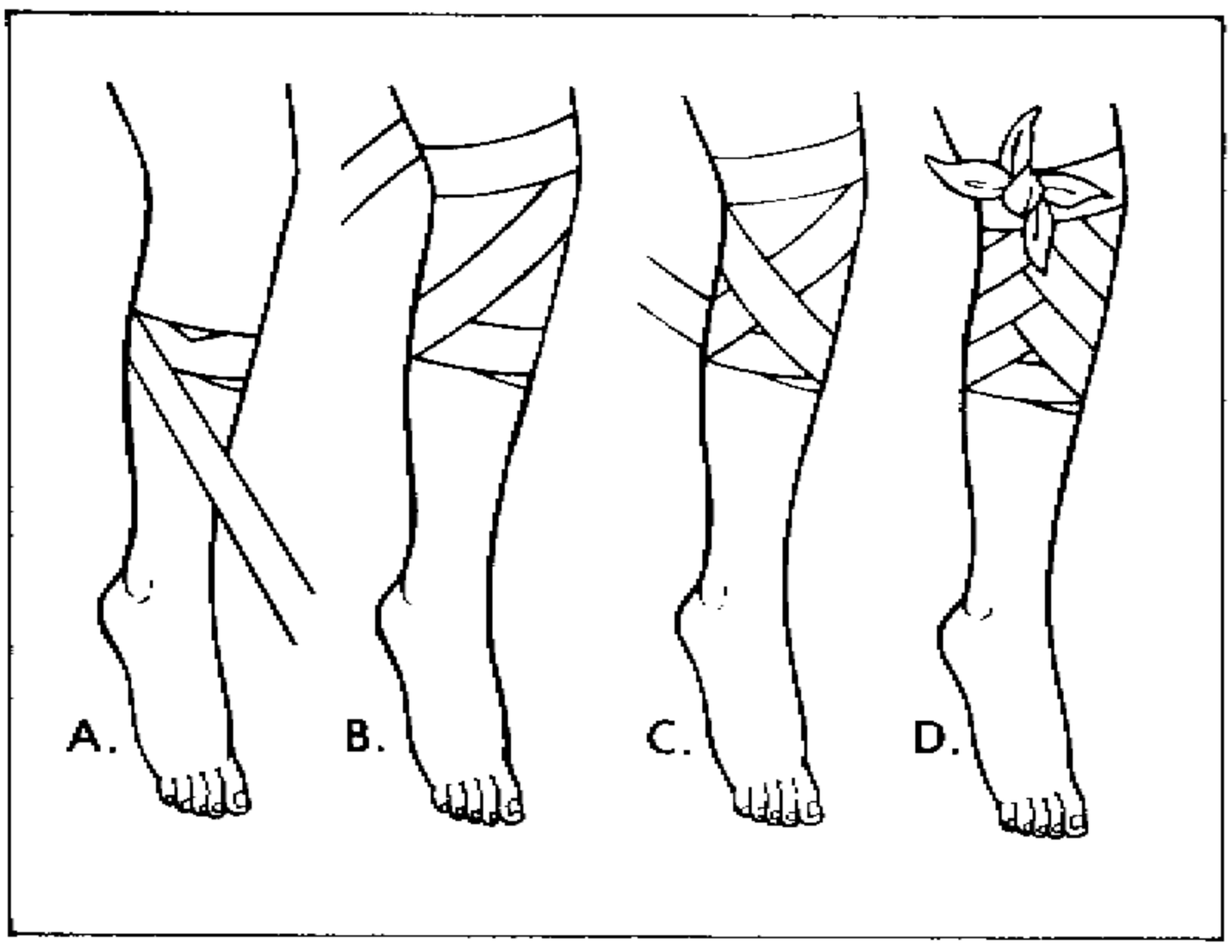


Figure 13-56. Applying a figure-of-8 bandage to a knee.

13-45. Apply a Spiral Bandage to a Leg

This procedure is used to apply an elastic bandage to an arm or leg. When the leg is involved, an elastic stocking may be used instead of the bandage. Read the directions on the package before applying. Frequently observe the circulation in the fingers or toes after application.

a. Begin by anchoring the bandage with two circular turns (Figure 13-57A). Often, you will need to bandage the foot to aid venous blood return before you apply a bandage to the leg. Use the figure-of-8 bandage on the foot and then proceed with the spiral wrapping of the leg, if necessary.

b. With each succeeding turn of the bandage, angle slightly upward around the leg (Figure 13-57B). The direction is upward and around, downward and around, like a spiral staircase, in the same direction as the blood flow returning to the heart. Each turn is parallel to the preceding turn and overlaps about one half the width of the bandage.

c. Wrap the bandage evenly and smoothly (Figure 13-57C). Hold the extermity firmly and wrap it securely. Do not wrap it so tightly that you cut off the circulation. As you wrap, ask the patient how it feels. Loosen it immediately if it is too tight.

d. Continue wrapping in the spiral fashion (Figure 13-57D). Wrap until the part is completely covered.

e. Secure the end of the bandage (Figure 13-57D). Use tape, clips, safety pins, or a knot. As before, do not start or finish the bandage over wounds or bony prominences.

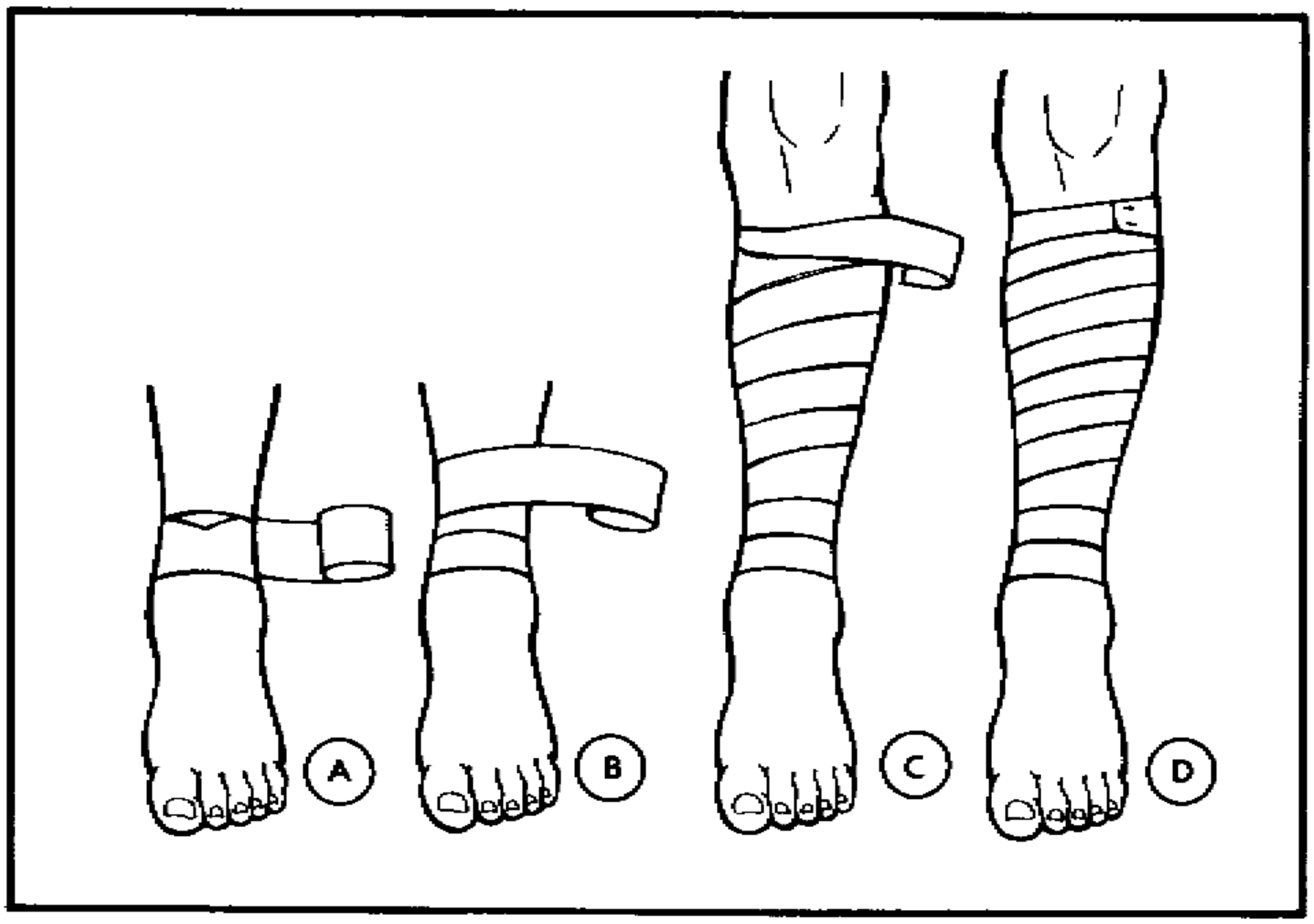


Figure 13-57. Applying a spiral bandage to a leg.

13-46. Apply a Spiral Bandage to a Forearm

a. Anchor the bandage with two circular turns.

b. With each succeeding turn of the bandage, angle slightly upward around the forearm. Overlap the preceding turn about one half the width of the bandage.

c. Wrap the bandage evenly and smoothly. Do not wrap the bandage too tightly; you may cut off circulation.

d. Continue wrapping in a spiral method until the forearm is completely covered.

e. Secure the end of the bandage.

13-47. The Spiral Reverse Bandage

This bandage is used to wrap an extremity that has varying thicknesses (such as the ankle which rises to a thicker area—the calf of the leg). This method of bandaging provides a means to make a secure, smooth, even-fitting bandage on an extremity.

a. Anchor the bandage with two complete turns (Figure 13-58A and 13-58B).

b. Make a spiral reverse turn (Figure 13-58C).

- Place your thumb on the upper edge of an anterior turn and hold firmly.

- Turn the bandage downward over the thumb and toward the lower edge of the previous turn.

- Cover about one half of the previous lap and continue the turn.

c. Continue making spiral reverse turns (Figure 13-58D). Wind the bandage in the same manner and place it as the previous layers. The spiral reverse bandage fits the contours of the extremity.

d. Secure the end of the bandage (Figure 13-58D).

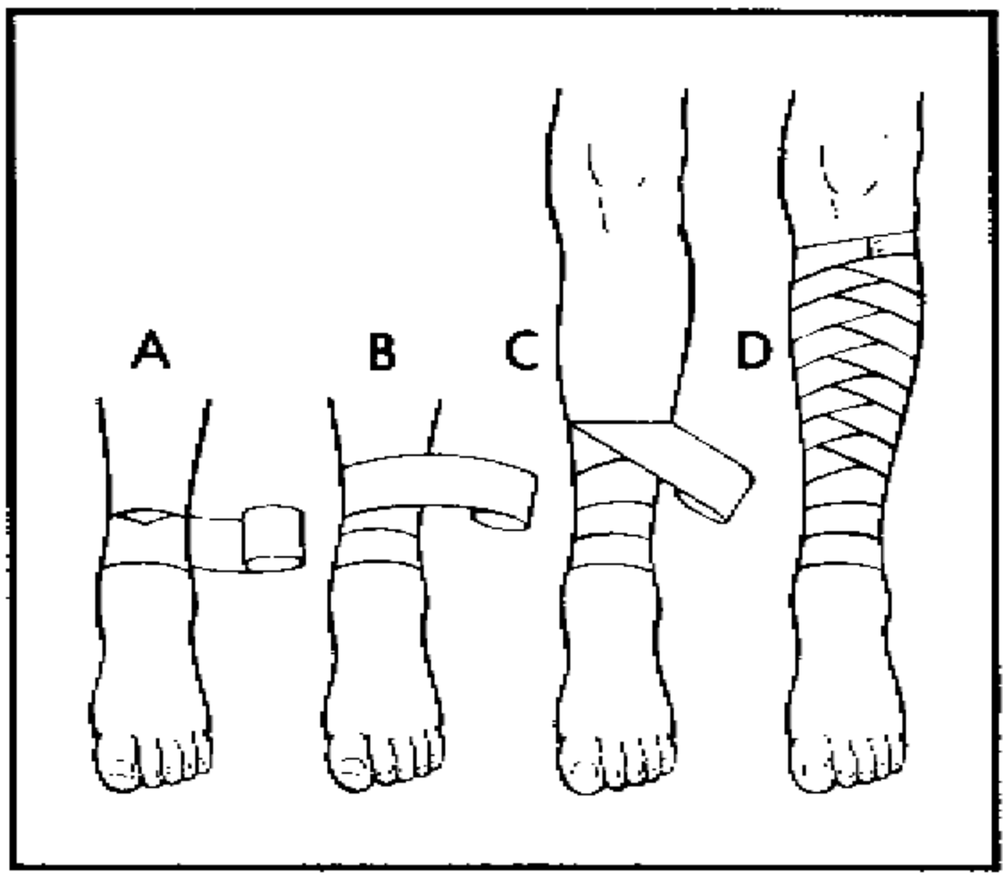


Figure 13-58. The spiral reverse bandage.

13-48. Apply a Recurrent Bandage

The recurrent bandage is applied to hold pressure dressings in place over the tip end of a finger, toe, fist, or stump of an amputated extremity, and on the head. Supplies needed consist of a bandage (elastic, cling, or roller type; width depends on site: 1 inch wide for finger, 3, 4, or 6 inches wide for stump or head).

a. Unroll the bandage and secure the end with two complete turns around the stump (Figure 13-59A). Wrap the bandage over the tip from the front to the back, then down over the tip to the front (Figure 13-59B). Hold the top layer of bandage securely on the anterior (front of) leg with your left thumb at the highest edge (Figure 13-59C). Continue to unroll the bandage downward over the tip of the stump then up the back (Figure 13-59D). Hold the bandage firmly on the posterior (back) aspect of the leg with the index finger.

b. Make a fold at the back and bring the bandage over the tip to the front. Move each successive turn alternately to the left, then to the right of the first layer over the tip of the stump in somewhat of a spiral manner (Figure 13-59D).

c. Continue wrapping until the stump end is completely covered. Overlap each layer about one half the width of the previous layer. Continue to hold each succeeding layer securely in place with your thumb and index finger.

d. When the stump is smoothly, evenly, and totally covered, reverse the direction of the bandage and make at least two circular turns to cover the gathered ends that you have been holding with your thumb and index finger (Figure 13-59E).

f. Secure the ends of the bandage (Figure 13-59E).

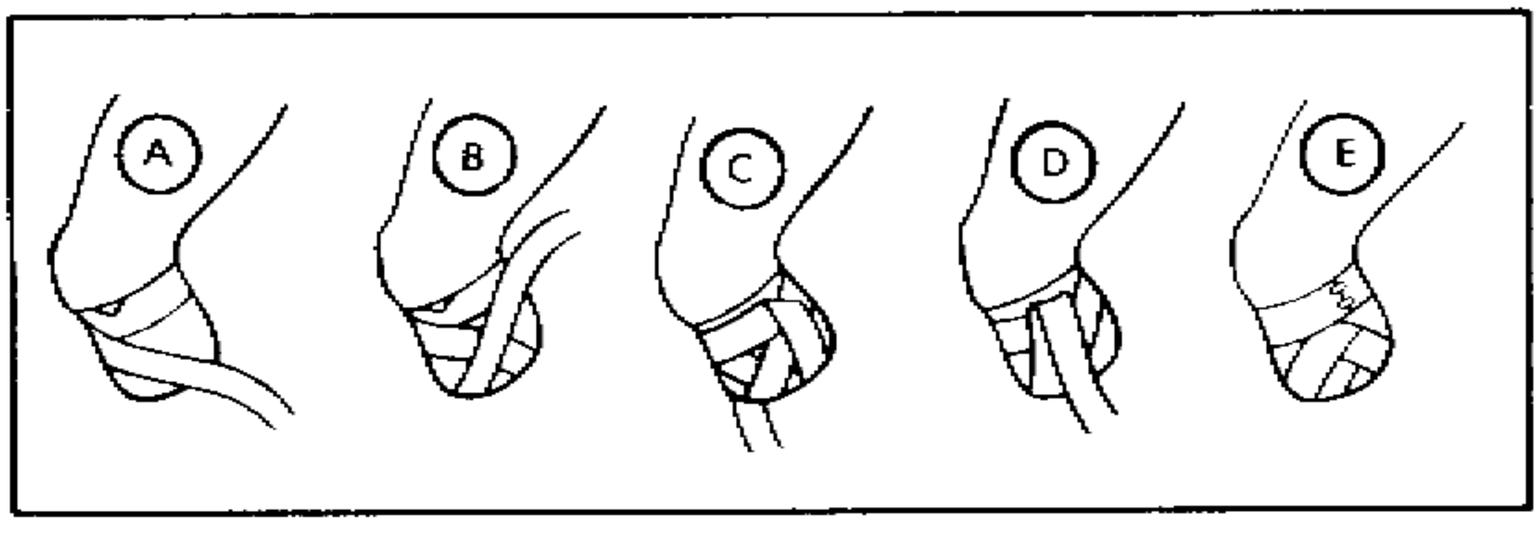


Figure 13-59. Applying a recurrent bandage.

13-49. Apply a Scultetus Binder

The scultetus (many-tailed) binder provides abdominal support after an abdominal operation, post-delivery, or post-paracentesis. The binder is made by sewing heavy flannel strips 3 to 4 inches wide and 4 feet long in overlapping layers of 1/2 inch. The middle third section of the strips is sewed together, leaving 16 inches free on each end.

a. Place the binder under the patient's hips. The solid portion of the binder should be centered under the patient's body, the ends lying flat, extending straight out from the patient. All tails on the binder overlap the next one. The unlapped beginning tail is placed face up at the lower edge of the hips. As each tail is applied, the next tail is unlapped and can be placed smoothly without wrinkles (Figure 13-60).

b. Bring the *bottom tail* across the lower hips (Figure 13-60).

- Begin in the direction in which the tail is going, to provide for smooth, successive spiral-type layers with a 1/2-inch overlap of each layer. Pull tightly. If the end is too long, you may need to fold it back on itself just far enough so that it fits smoothly.

- Incorrect placement of the overlapping tails can cause pressure and discomfort for the patient.

c. Alternate tails first from one side of the abdomen, then from the other side (Figure 13-60). Proceed toward the waist, slanting each succeeding tail slightly upward.

d. Secure the final tail with a safety pin. This type of abdominal bandage provides good support for the patient. If you have pulled it securely enough as you criss-crossed each strip and then firmly pinned it, the patient will be able to move freely about without having the bandage come loose.

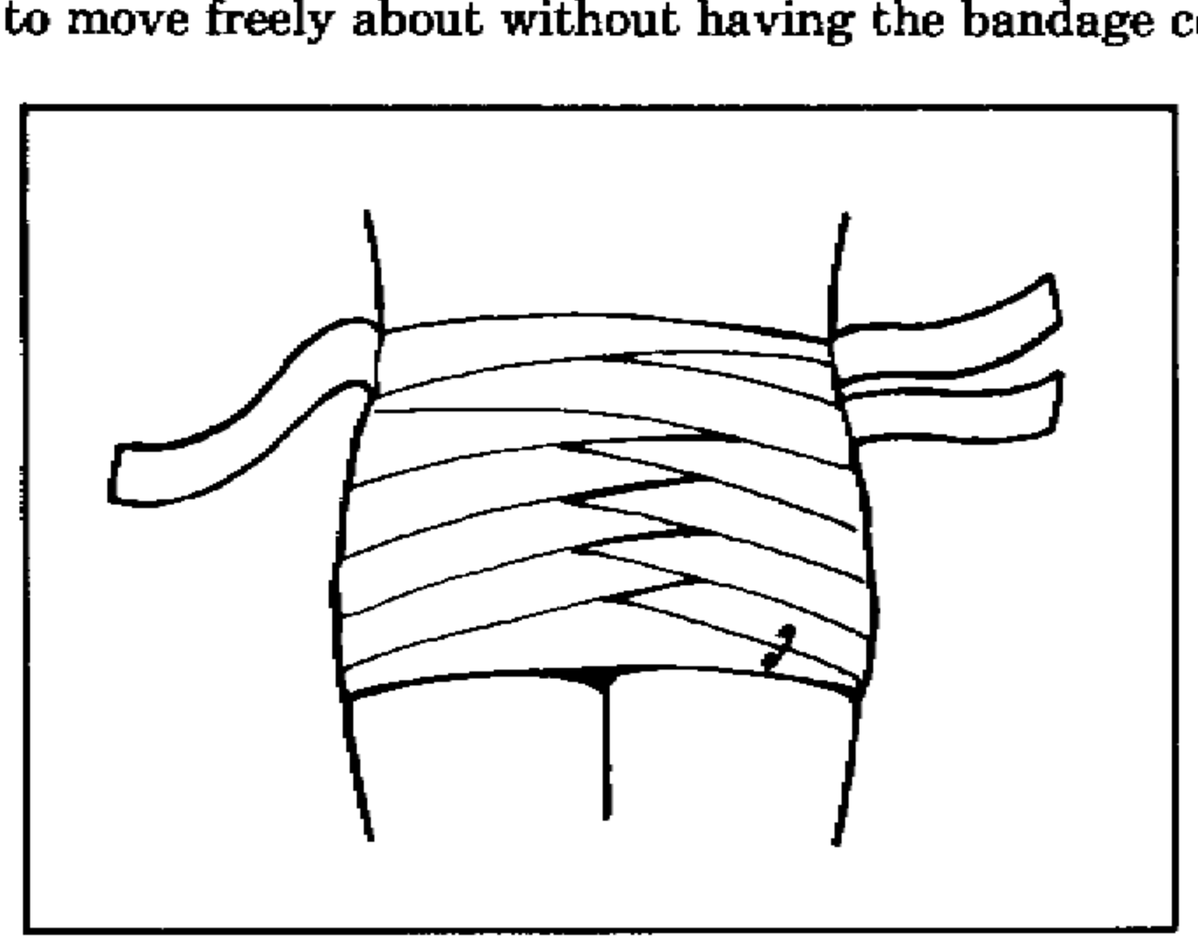


Figure 13-60. Applying a scultetus binder.

13-50. Apply a T-Binder or a Double T-Binder

These binders are used to keep peri-pads (rectal) and perineal dressings in place (Figure 13-61). The double T-binder is used for the male patient. Supplies needed are pins, T-binder, peri-pad, or dressing.

a. Put on the binder (Figure 13-62). Place the band of the binder around the waist and secure with a pin. Smooth out the tail at the back of the binder.

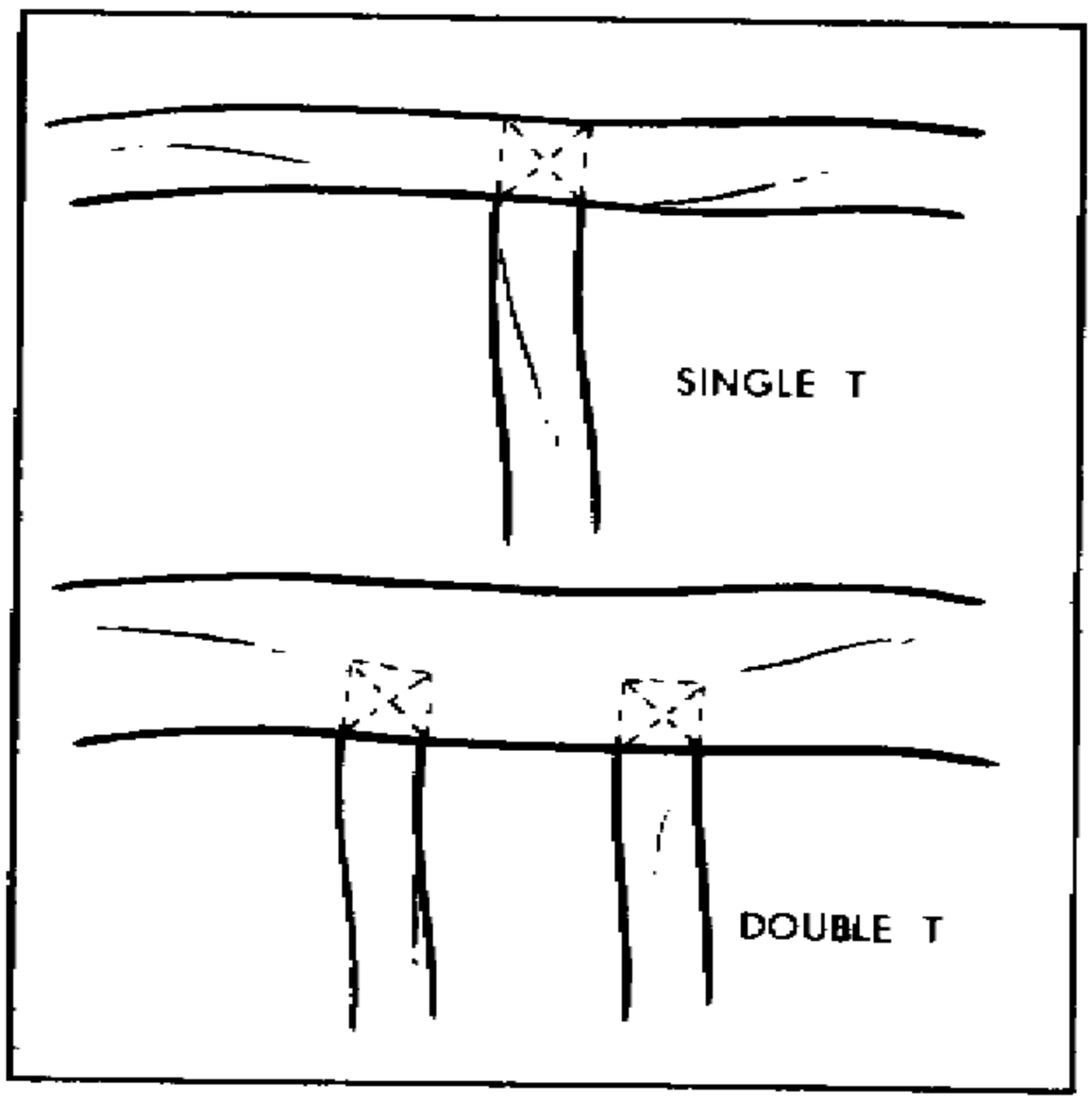


Figure 13-61. T-binder and double T-binder.

b. Apply the peri-pad or dressing to the rectal or perineal area (Figure 13-62). Avoid touching the side of the pad or dressing that will come in contact with the patient's skin.

c. Secure the pad in place. Bring each tail or strip forward, one on each side of the genital organs, and secure them to the waistband with pins (Figure 13-62).

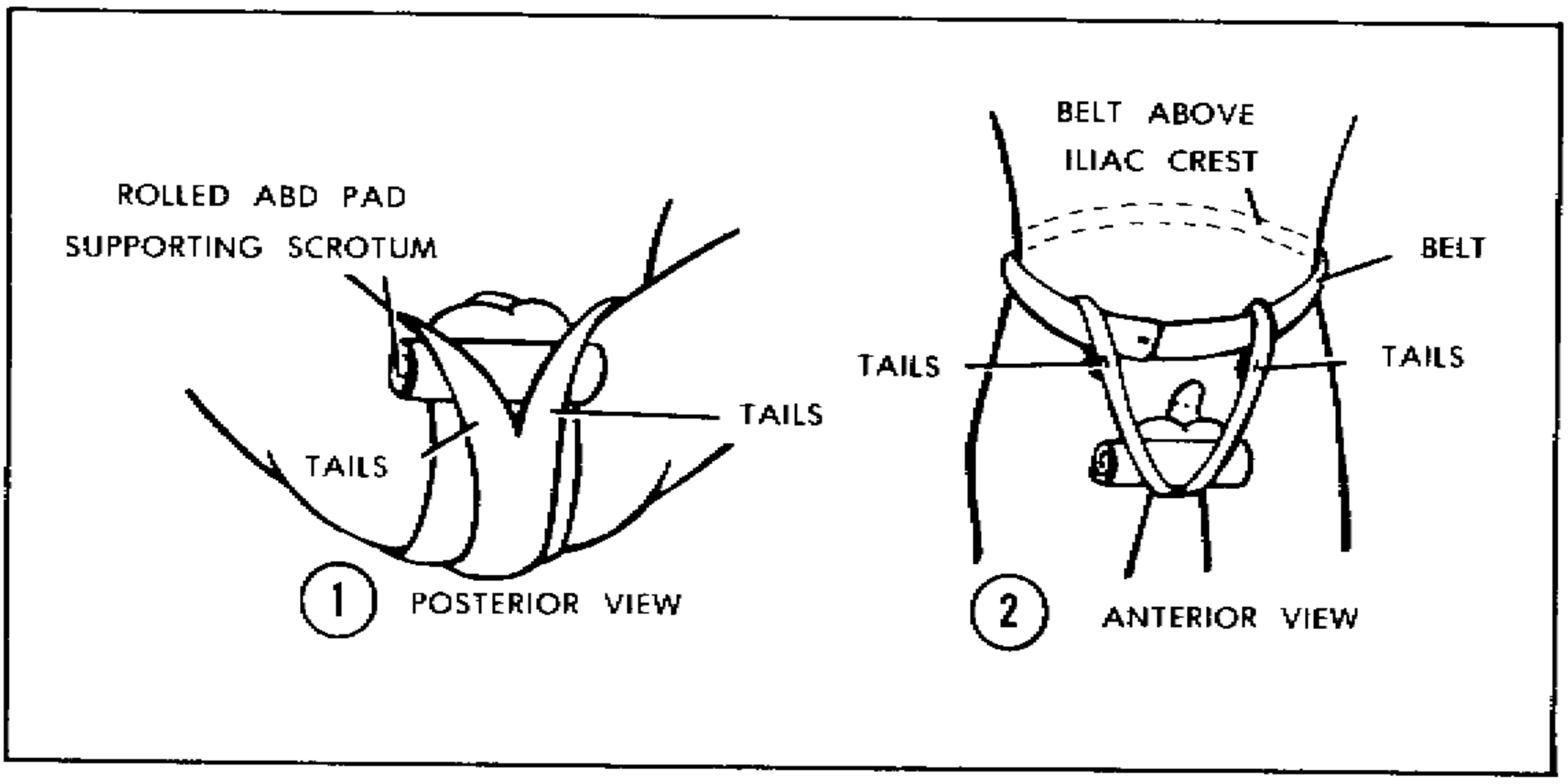


Figure 13-62. Applying a double T-binder.

13-51. The Sling

Patients who have an injury to the arm or shoulder often need to support the arm in an elevated position to avoid edema, pain, discomfort, and fatigue of the hand. A commercially made arm support can be placed about the arm and the straps adjusted around the neck. When this type of arm support is not available, you must improvise a sling using triangular bandages.

13-52. Apply an Arm Sling to an Arm Injury Not Involving the Shoulder

a. Place the upper end of the triangle over the shoulder on the injured side (Figure 13-63A). When placing the bandage between the chest and the injured arm be careful not to cause unnecessary movement which may cause further injury.

b. Place and extend the point (apex) of the bandage beyond the elbow (Figure 13-63A). Carefully bend the injured arm across the body with the thumb up.

c. Bring the lower end over the injured arm and over the shoulder on the uninjured side (Figure 13-63B). Have the patient keep the elbow bend at a right angle across the lower chest. The hand should be slightly higher than the elbow to prevent the fingers from swelling.

d. Bring the upper end around the back of the neck. Tie the two ends on the uninjured side (Figure 13-63C). Place the knot to the side (hollow) of the neck so that it will not be uncomfortable if the patient lies down, or will not cause continuing pull on the back of the neck when the arm is in the sling.

e. Fold the apex of the triangle over the elbow toward the front (Figure 13-63B). Secure it with a safety pin.

NOTE

Pigtailing method: twist the apex and tuck the twisted end (pigtail) into the bandage at the elbow.

f. Check the radial pulse and circulation in the fingers frequently. Observe the color of the fingernail beds; they should be pink. Feel the fingers; they should be the same temperature as the fingers on the uninjured hand. If the pulse is weak or absent, or if the fingers are cold and pale, report this condition to your supervisor immediately.

g. Apply a swathe.

- Fold a triangular bandage to a 6-inch width (Figure 13-63D).
- Place the swathe above the elbow and bring one tail around the patient's back and under the uninjured arm.
- Bring the second tail across his chest and above the injured forearm.
- Tie the swathe above the breast pocket on the uninjured side.

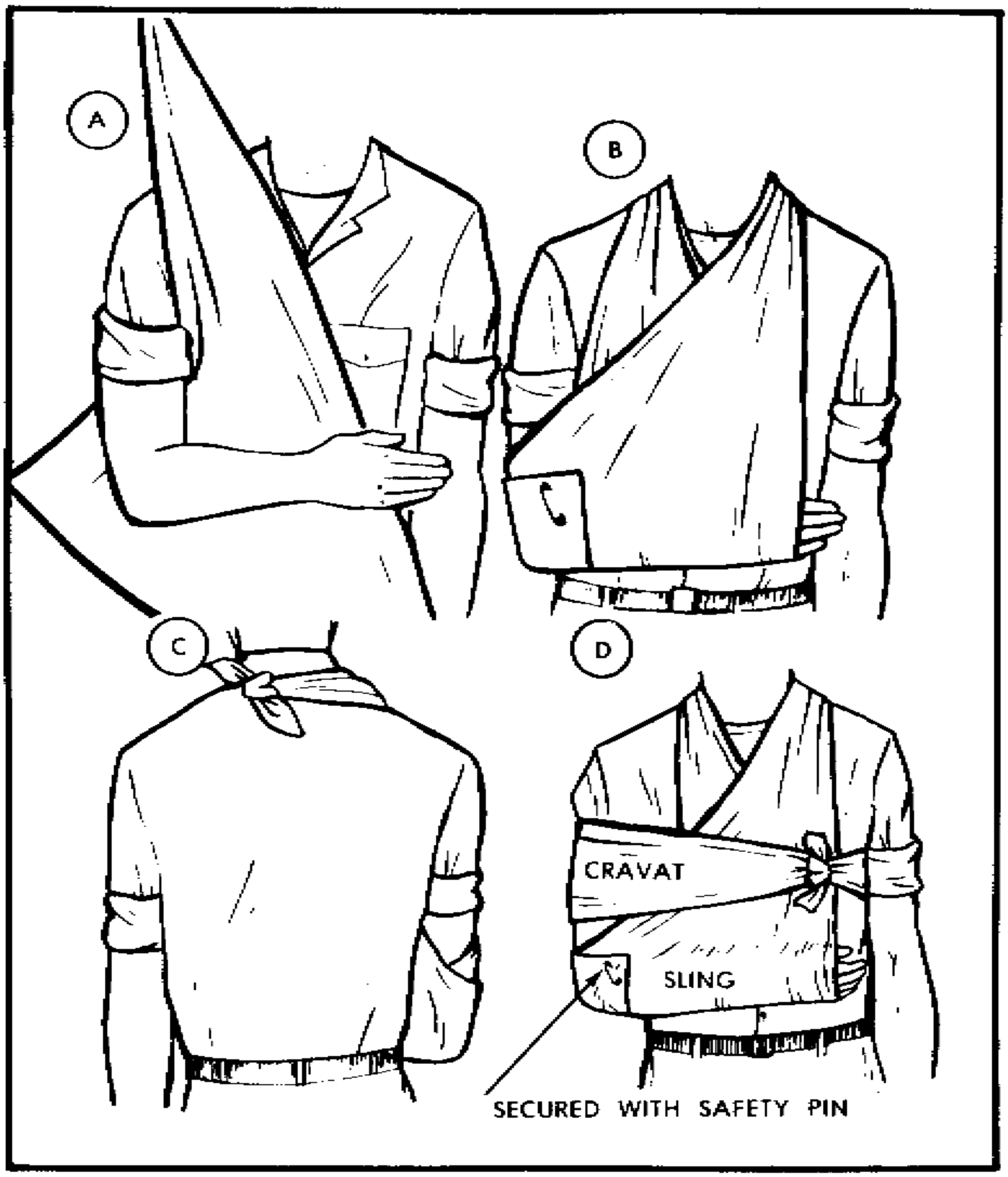


Figure 13-63. Sling and swathe applied to an arm injury.

13-53. Apply an Arm Sling for an Arm Injury With the Shoulder Involved

a. Place the upper end of the triangle over the shoulder on the uninjured side. The tail should extend to the center of the back (Figure 13-64A).

b. Place and extend the apex of the bandage beyond the elbow.

c. Bring the lower end of the bandage up over the forearm and under the armpit on the injured side (Figure 13-64B).

d. Tie the two ends in the center of the back (Figure 13-64C).

e. Fold the apex of the triangle over the elbow towards the front. Secure it with a safety pin.

f. Check the radial pulse and circulation in the fingers.

g. Apply a swathe.

- Fold a triangular bandage to a 6-inch width (Figure 13-64D).
- Place the swathe flush with the elbow and bring one tail around patient's back and under the uninjured arm.
- Bring the second tail across his chest and above the injured forearm.
- Tie the swathe above the breast pocket on the uninjured side.

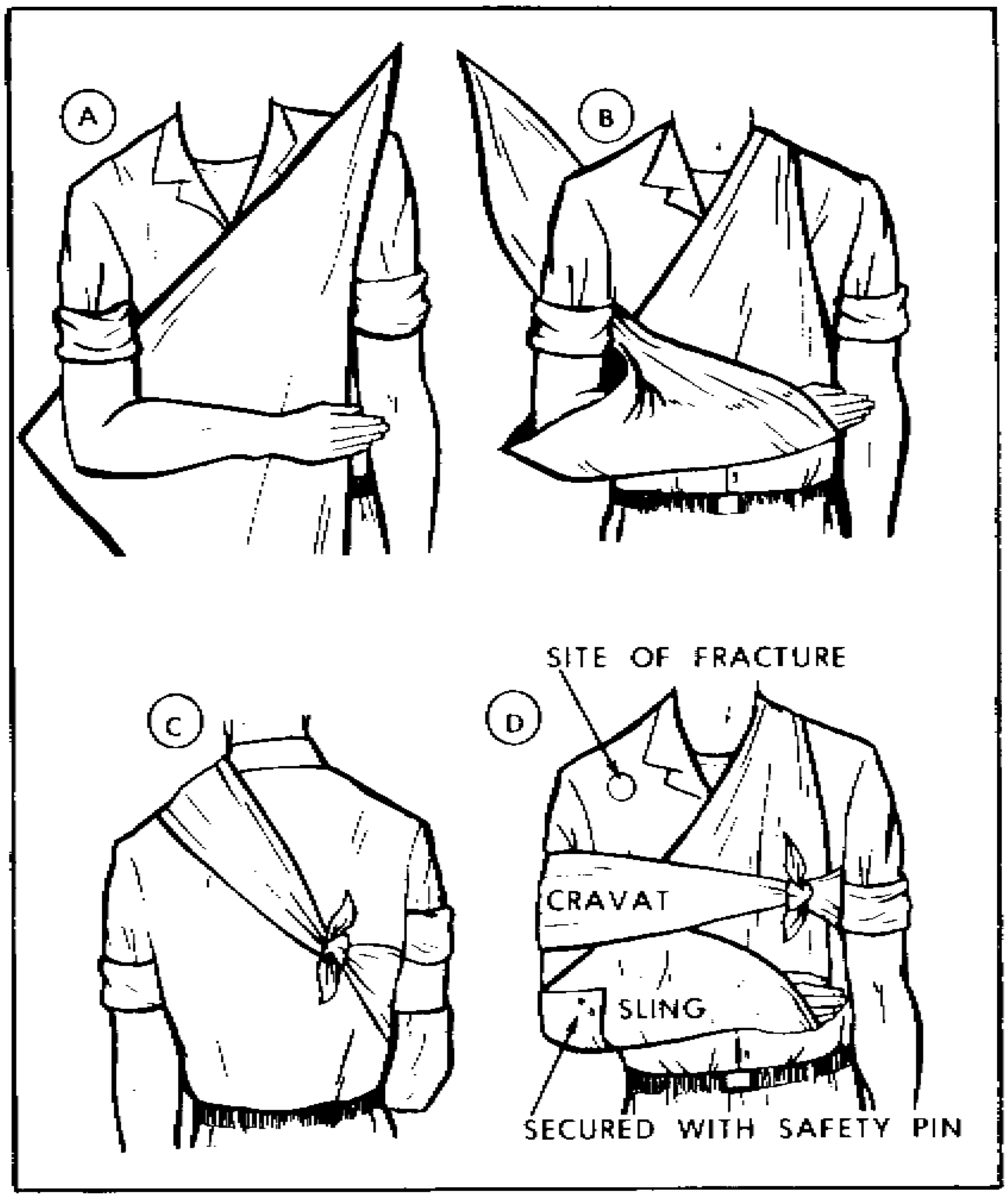


Figure 13-64. Sling and swathe applied to an injured arm and shoulder.

Section VII. SHOCK

13-54. General

a. The term *shock* has a variety of meanings. Generally in medicine, SHOCK means a state of collapse of the cardiovascular system or inadequate tissue perfusion. Shock occurs when the tissues or organs are inadequately supplied (perfused) with oxygenated blood. Inadequate perfusion may be accompanied by decreased arterial blood pressure. Three factors are necessary to maintain normal perfusion; abnormalities in any of these can produce shock:

- A functioning heart, or pump.
- An adequate blood volume.
- An intact vascular system capable of changes in response to changes in blood pressure.

b. Certain organs of the body are more susceptible than others to a lack of adequate perfusion. The brain, spinal cord, and peripheral nervous system cannot lose perfusion for more than 4 to 6 minutes without permanent damage to their cells. Damage in the kidney results after inadequate perfusion for a period of 30 to 40 minutes. The heart requires constant perfusion. A loss of perfusion for 2 hours to the skeletal muscles causes permanent damage. The gastrointestinal tract can exist with impaired perfusion for a number of hours. No part of the body can exist without perfusion for an indefinite period of time. Permanent injury results when the nervous system is damaged.

c. It is important that all medical personnel understand the concept of perfusion because it is the main element in shock. There are a number of separate causes for shock. However, there are only three ways in which each of these separate causes can induce shock. Whatever the cause, the damage comes about when perfusion in organs and tissues is inadequate and they start to die. The three major causes of shock are—

- The heart is damaged and it fails to work as a pump.
- Blood loss causes the volume of fluid within the vascular container to be insufficient.
- The blood vessels dilate so that the blood within them, even though it is a normal volume, is insufficient to provide adequate circulation.

d. In all cases the results are exactly the same—an insufficient perfusion of blood through the organs and tissues of the body. All normal body processes are affected. When a person is in shock, vital functions slow down. If the conditions causing shock are not promptly treated, death soon follows.

13-55. Types and Causes of Shock

Hypovolemic shock, the most common type found on the battlefield, is described in detail. Cardiogenic, septic, and neurogenic shock is discussed separately and compared to hypovolemic shock. Another type, anaphylactic, is only discussed in general terms.

13-56. Hypovolemic Shock

a. Hypovolemic shock occurs when fluid is lost from the intravascular compartment. This loss may result from internal or external hemorrhage, burns, vomiting, diarrhea, excess sweating, peritonitis, or pancreatitis. External hemorrhage is easily recognized as a source of blood loss. However, internal hemorrrhage may be hidden. Internal bleeding may occur in the thoracic or abdominal cavities following rupture of the liver, the spleen, or the great vessels within these cavities. Burns produce extensive and alarming losses of plasma and other body fluids into the burned tissues. Significant internal blood loss may occur with bone fractures, especially fractures of the pelvic and long bones. Pelvic fractures from crush injuries often tear associated blood vessels; 40 percent of these patients suffer shock. A fracture of one long bone may result in blood loss of 500 to 1,000 cc's into the surrounding tissues. Femoral-shaft fractures may produce blood losses of 1,000 to 2,000 cc's.

b. When dehydration (loss of body water) is present prior to the injury, the state of shock is worsened. This is commonly seen in personnel wounded in the tropics where constant exposure to the sun and high humidity causes excessive sweating.

c. There are many factors in the body's response to shock. When blood volume is lost, less blood returns from the body to the heart and decreases cardiac efficiency. The response is an increase in the discharge of norepinephrine and epinephrine. An increase of these substances results in contraction of peripheral blood vessels with a stronger and more rapid heart beat. These changes return the blood pressure toward normal limits; however, there is decreased circulation to peripheral tissues. This provides improved perfusion in the brain and lungs. When the volume of blood loss is so great that these mechanisms can no longer compensate, the blood pressure remains depressed. As the body continues to contract peripheral blood vessels, more and more body areas are deprived of blood flow.

13-57. Signs and Symptoms of Hypovolemic Shock

a. Hypovolemic shock is due to inadequate tissue oxygenation and the nervous system's response to decreasing blood pressure. The patient in hypovolemic shock often appears to be simply confused and disoriented. He may look apprehensive (scared). His respirations are rapid and shallow, and his pulse is fast and thready. Peripheral veins will be collapsed when you look for them to start an IV. The skin is usually cold, clammy, and pale. Cyanosis may be present. Finally, the blood pressure may be falling. DO NOT rely on blood pressure alone to diagnose shock. Falling blood pressure is a late sign of shock and signals the collapse of the cardiovascular system.

b. Use the blood pressure and pulse to estimate blood loss. A systolic blood pressure less than 70 mm Hg together with a pulse rate greater than 130 beats per minute implies at least a 40 percent loss of blood volume. When the blood pressure cannot be obtained at the arm, use the following as a rough guide: When a femoral pulse is palpable, the systolic blood pressure is probably at least 70 mm Hg; if a carotid pulse is palpable, the systolic pressure is probably at least 60 mm Hg; and if a radial pulse is palpable, the systolic pressure probably exceeds 80 mm Hg. It should be noted that the pulse and blood pressure should be evaluated to determine management.

c. To estimate blood loss from causes other than trauma, you may also use the postural test. To perform a postural test, take the patient's pulse rate while he is lying down. Then have him sit up and quickly retake his pulse. If the pulse rate increases by more than 20 beats per minute when the patient sits up, there has been a blood loss of at least one unit (500 cc's). In managing hypovolemic shock, the goal is to maintain perfusion in the vital body organs with oxygenated blood. The best indication of brain perfusion is the patient's level of consciousness. If the patient is conscious and alert, the brain is adequately perfused. If the patient is confused, disoriented, or unconscious, brain perfusion is probably inadequate.

d. An effective and simple method of classifying hypovolemic shock is as follows:

- Class 1 Hemorrhage—slight increase in pulse rate with normal blood pressure, respirations, and capillary blanch test. The acute blood loss is about 15 percent of the total circulating volume or a maximum of 750 cc's in a 70 kg male.

- Class 2 Hemorrhage—the pulse rate is above 100 with rapid breathing (tachypnea). The systolic pressure has dropped or is normal with an increased diastolic pressure. The acute blood loss is about 20-25 percent of the total circulating volume, or about 1,000-1250 cc's.

- Class 3 Hemorrhage—an acute blood loss of about 30 percent of the circulating volume, 1500-1800 cc's of whole blood. This patient presents the classical clinical signs of hypovolemia, including significantly depressed blood pressure.

- Class 4 Hemorrhage—there is as acute blood loss in excess of 2,000-2500 cc's. Blood pressure is barely or nondetectable. Carotid pulse only is detectable, if at all. The part of the brain which receives and interprets sensations (the sensorium) is depressed.

13-58. Treatment for Hypovolemic Shock

a. Evaluate and establish an airway. Insure that the patient's breathing and ventilation are adequate.

b. Determine adequate circulation by evaluating the cardiac efficiency. Check for a pulse at one location and record its—

- Character, such as normal, weak, or intermittent.
- Rate.
- Location, such as radial, femoral, or carotid.

NOTE

Capillary filling is abnormal if they take more than 2 seconds to refill.

c. Perform resuscitation, if necessary.

d. Apply military antishock trousers (MAST) (refer to paragraph 13-59 for use of MAST) to mobilize 1,500 to 2,000 cc's in the lower extremities and abdomen and to increase lower extremity peripheral resistance. This accomplishes three functions:

- It increases cardiac efficiency.
- It provides most blood circulation to the sensitive heart, brain, and lung.
- It also slows intra-abdominal hemorrhage. The inflation of the MAST is based on the patient's blood pressure. Measuring the pressure inside the trouser compartments is not an adequate method of determining changes in the patient's blood pressure. The trousers remain inflated until the patient's blood pressure returns to 100 mm Hg or higher.

e. Administer two large-bore peripheral IVs at a TKO rate. When the MAST trousers are inflated first, the peripheral veins are much easier to find.

NOTE

If MAST is not available in the field, elevate the lower extremities by raising the legs from the hips, keeping the knees straight. This maneuver will increase the blood flow returning to the heart and aid in combating shock. When the patient's legs cannot be elevated, place him on a litter and elevate the foot portion of the litter. However, in this position, the entire weight of the abdominal organs falls on the diaphragm and the patient may not be able to breathe as easily and may require assisted ventilation. DO NOT ELEVATE THE FEET MORE THAN 12 INCHES.

f. Check vital signs. The patient's vital signs, including pulse, capillary filling, circulation, respiration, skin color, diaphoresis (profuse perspiration), level of consciousness, and pupillary changes should be checked at least every 5 minutes throughout the assessment, stabilization, and evaluation phases.

g. Evacuate the patient. After stabilizing procedures have been completed, transport the patient as rapidly as possible to a treatment facility.

13-59. Antishock Garments

a. The Military Antishock Trousers, antishock garment, or pneumatic counter-pressure device is designed to counteract or reduce internal bleeding and aid in treating hypovolemic shock. The antishock garment does this by developing an encircling pressure around the lower extremities, pelvis, and abdomen. The pressure applied to the legs squeezes up to 2 units of blood

out of these extremities, where it is less critically needed, and into systemic circulation. This is the same principle used in applying local pressure to control hemorrhage. Normally, the pressure exerted is 100 mm Hg. This pressure—

- Stops or slows venous and arterial bleeding in the areas of the body enclosed by the pressurized garment.

- Forces available blood from the lower body to the heart, brain, and other vital organs.

- Prevents blood pooling in the lower extremities.

b. There are several advantages with the use of an antishock garment other than the prevention of further blood loss and the direction of circulating blood to vital organs. Some of the many advantages are—

- The MAST serves as an air splint for fractures of the lower extremities or the pelvis. However, femur fractures should be placed in a traction splint before applying the MAST.

- The garment often stabilizes a patient so effectively and quickly that other patients with more critical injuries can be treated first. Patient monitoring is still required.

- Diagnosis and preparation for surgery may be delayed for an hour or more when a patient is stabilized with the MAST. Without the use of MAST, often an unstable patient must be prepared for immediate surgery.

- A Foley catheter can be inserted while a patient is in an inflated MAST.

- Electrocardiograms (ECGs) and x-rays can also be taken while a patient is in an inflated MAST.

13-60. Indications for Use

Antishock garments are indicated for low volume shock or low resistance shock. Antishock garments are recommended if—

- Systolic blood pressure is 80 mm Hg or less.

- Systolic blood pressure is less than 100 mm Hg and other signs of shock are present.

NOTE

They may also be used for neurogenic shock, for temporary venous volume assistance in order to get an IV started, or for continuous pressure.

- Profuse bleeding is present from injuries to the lower extremities and pelvis, or there is intra-abdominal bleeding.

13-61. Contraindications for Use

Contraindications for use of the antishock garment are—

- Bleeding about the diaphragm since the possibility exists of increasing the bleeding as the blood pressure increases.
- Pulmonary edema will always worsen as fluid is moved up from the legs.
- Congestive heart failure.
- Heart attack.
- Cerebrovascular accident (stroke).
- Pregnancy, unless the abdominal compartment can be left uninflated.

13-62. Application of the MAST Garment

a. Lay out the MAST garment (Figure 13-65).

b. Place the patient on the garment face up with the top of the garment just below the lowest ribs.

c. Wrap the left leg of the garment around the patient's left leg and secure it (Figure 13-66A).

d. Wrap the abdominal section around the abdomen and secure it (Figure 13-66B).

e. Wrap the right leg of the garment around the patient's right leg and secure it (Figure 13-66C).

f. Attach the foot pump (Figures 13-67).

g. Inflate both legs at the same time until the garment is firm to the touch or the relief valves allows air to escape.

h. Close the inflation/deflation valves to keep the garment from deflating.

i. Check the patient's blood pressure. If it is within normal limits, the abdominal section need not be inflated. If the blood pressure is below accepted levels, inflate the abdominal section (except on pregnant patients) while monitoring the patient's blood pressure. Stop inflation and close the valve when the patient's blood pressure is within normal limits or air escapes from the relief valves.

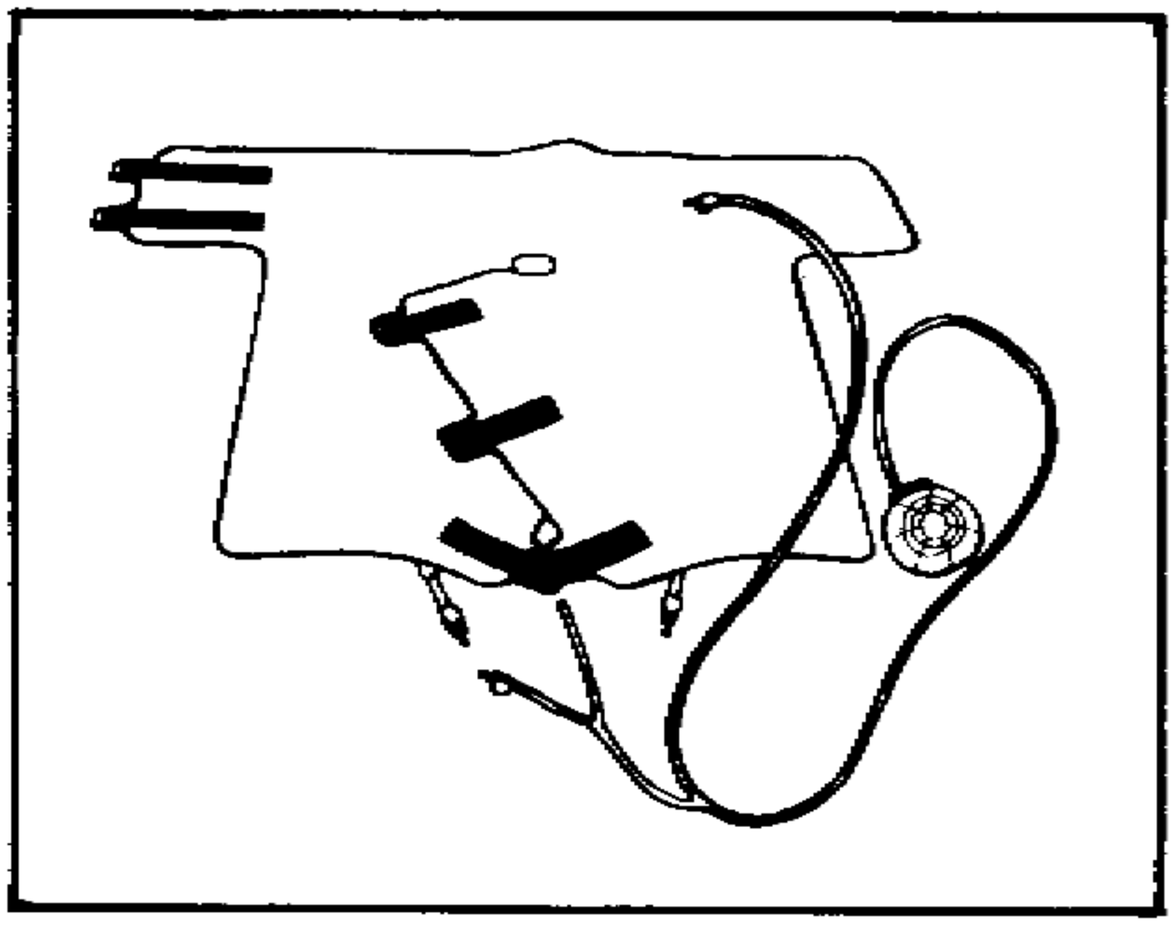


Figure 13-65. Layout the MAST garment.

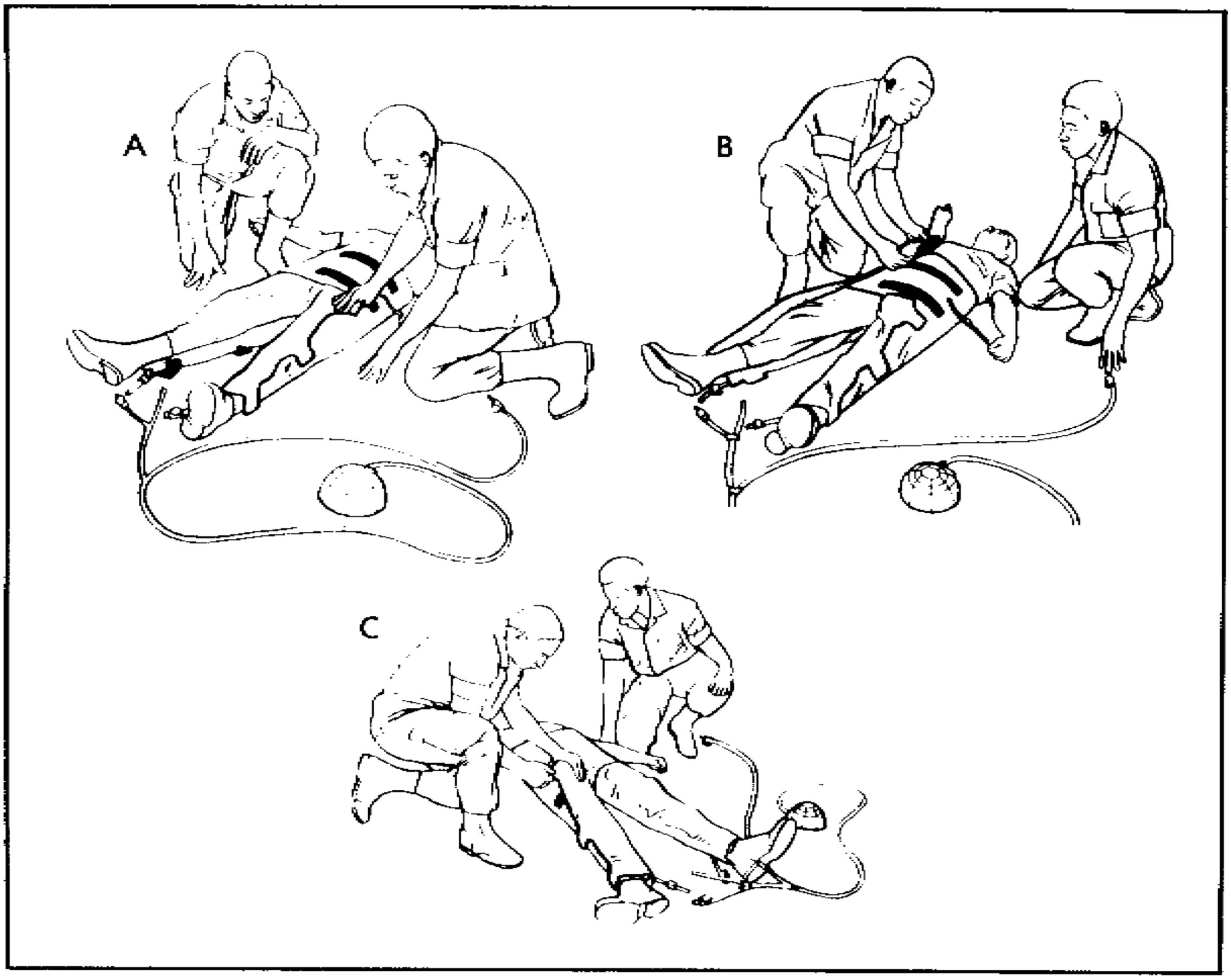


Figure 13-66. Applying the MAST garment.

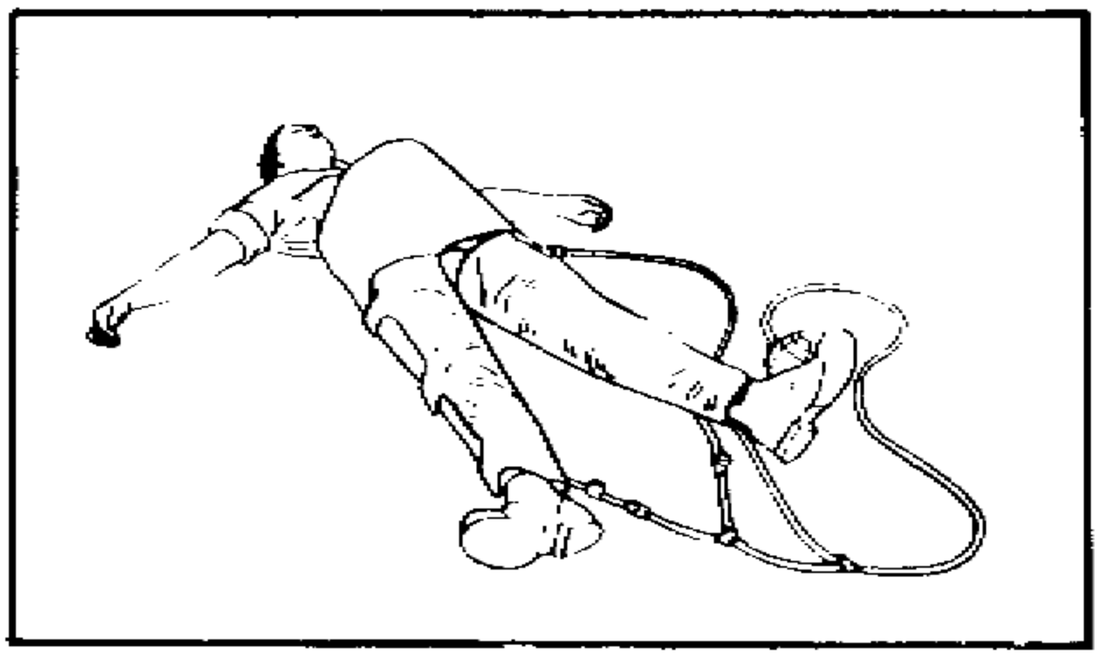


Figure 13-67. Attaching foot pump.

13-63. Deflation/Removal of MAST Garment

a. The garment can be removed *only after shock* is adequately managed and vital signs are within acceptable limits. Even at this point, the deflation is a gradual one. Remember, rapid deflation is equivalent *of losing two units of blood* (20 percent of the normal circulating volume)! The garment is to be removed only in a definitive treatment facility.

NOTE

If the patient is to be evacuated by helicopter, the pressure in the MAST will increase due to atmospheric changes. This is also true if the garment is applied in a cold environment and the patient is taken into a warm area. The reverse is true (the pressure decreases) if the garment is applied at high altitude and the patient is taken to a lower altitude or from a warm to a cold environment.

b. Deflation begins with the abdominal section. Slowly release the air while *continuously* monitoring the patient's blood pressure. Continue deflation until the patient's blood pressure shows a drop of 5 mm Hg. Stop the deflation at this point and administer intravenous fluid or blood until the blood pressure returns to normal. Continue the slow gradual deflation in this manner until the abdominal section is completely deflated. Then deflate each leg individually in the same way.

NOTE

The patient may be transferred to other facilities or to the operating room with the MAST garment in place. Transfer of the patient is not a reason to remove the garment.

13-64. Cardiogenic Shock

Cardiogenic shock is caused by an inadequate function of the heart. Circulation of the blood requires the constant action of a normal and vigorous heart muscle. Many types of disease cause the destruction or inflammation of this muscle. Within limits, the heart can adapt to these injuries; but if too much weakness or damage occurs, the heart no longer functions well. It may also be caused by cardiac arrhythmias, chronic congestive heart failure, or pericardial tamponade (blood in the pericardial sac compresses the heart and prevents effective heart action).

13-65. Signs and Symptoms

The physiologic effects of cardiogenic shock are similar to those of hypovolemic shock. However, in cardiogenic shock the signs and symptoms coexist with those of the underlying cardiac problems.

13-66. Treatment for Cardiogenic Shock

a. Establish an airway.

b. Administer oxygen (if available) and assist ventilation (if necessary).

c. Monitor vital signs and level of consciousness.

d. Start an IV with dextrose, 5 percent, in water (D5W) at a TKO rate.

e. Keep the patient at normal temperature. Use blankets if hypothermia develops.

f. Administer drugs to correct specific cardiac problems *only if they are ordered by the physician.*

g. Record treatment given.

e. Evacuate the patient.

13-67. Septic Shock

Septic shock develops in some patients with sepsis (the presence of bacteria in the blood stream). Sepsis most frequently occurs in a patient who has infections in other parts of his body. Common conditions that predispose to sepsis are diabetes, cancer, cirrhosis, immunosuppressive drug therapy, biliary tract obstruction, ulcerative colitis, and postpartum and postabortion infections. There are several physiologic effects of septic shock, such as increased cardiac efficiency, dilated peripheral blood vessels, hypotension, and peripheral blood pooling. These effects are partly caused by arteriovenous shunting (circulation of blood from arteries to veins, bypassing the capillary beds).

13-68. Signs and Symptoms of Septic Shock

The signs and symptoms of septic shock resemble those of hypovolemic shock. However, in septic shock, the skin may remain warm and dry. The patient in septic shock usually has an elevated body temperature due to the underlying infection.

13-69. Treatment for Septic Shock

a. Establish an airway.

b. Administer oxygen. Assist ventilation, if necessary.

c. Monitor vital signs and level of consciousness.

d. Start at least one IV line with a large-bore (14-16 gauge) catheter. Infuse normal saline or Ringer's solution at a keep open rate.

e. Keep the patient at normal temperature. Sponge if febrile, using cool water.

f. Monitor cardiac rhythm (if possible).

g. Record treatment.

h. Evacuate the patient.

13-70. Neurogenic Shock

Neurogenic shock results from loss of normal vasoconstriction. Neurogenic shock occurs with spinal cord transection or severe spinal cord injuries. Drugs that depress the central nervous system may produce neurogenic shock. There are transient and easily correctable forms, such as fainting at the sight of blood. Neurogenic shock differs from the other types of shock in the loss of response to decreased blood pressure. Peripheral vasoconstriction no longer occurs when the blood pressure decreases. The loss of vasoconstriction increases the capacity of the large veins without increasing the blood volume. Because the blood volume is then smaller than the vascular space, venous return decreases. Since the heart receives less blood from the veins, it has less blood to pump to the arteries and the cardiac efficiency falls, further lowering blood pressure. Sympathetic stimulation of the heart is also lost in neurogenic shock. This means that the rate and force of cardiac contractions do not increase when the blood pressure falls.

13-71. Signs and Symptoms of Neurogenic Shock

Because the sympathetic response to falling blood pressure is absent, the signs and symptoms of neurogenic shock differ significantly from those of other types of shock.

- The blood pressure is low, but the pulse may be normal or low.
- The skin is dry, warm, and may even be flushed.

13-72. Treatment for Neurogenic Shock

a. Neurogenic shock may be temporary. If it causes fainting, the patient should be kept flat, and the underlying problem (an upsetting environment) should be corrected.

b. For severe neurogenic shock—

(1) Establish an airway.

(2) Administer oxygen and assist ventilation, if necessary.

(3) Monitor vital signs and level of consciousness.

(4) Apply and inflate the MAST.

(5) Start at least one large-bore IV line. Rapidly infuse lactated Ringer's or normal saline (NS) solution if the MAST has not restored the blood pressure.

(6) Keep the patient at normal temperature. Use blankets to prevent hypothermia. Because vasodilation in skin arterioles increases body heat loss, these patients have difficulty maintaining a normal body temperature.

(7) Monitor cardiac rhythm, if possible.

c. Record treatment.

d. Evacuate the patient.

13-73. Anaphylactic Shock

Anaphylactic shock occurs when an individual has become sensitized to a substance and reacts violently to another dose or contact. Anaphylaxis is the most severe form of an allergic reaction. Substances that most often cause allergic reactions may be grouped as follows:

- Inhalants (substance breathed in). The inhalation of pollen, dusts, or materials to which a patient is sensitive may cause rapid and severe reactions.

- Insect stings. Stings of bees, wasps, yellow jackets, hornets, or ants can cause very rapid and severe anaphylactic reaction.

- Ingestables. Eating food such as fish, milk products, chicken, tomatoes, berries, and mushrooms, or taking medications such as oral penicillin can cause severe reactions.

- Injectables. Injectable medications such as penicillin, tetanus antitoxin, and a variety of other vaccines may cause anaphylactic reaction.

- Plants. Touching poison oak, ivy, sumac, and some flowers will cause a reaction.

13-74. Signs and Symptoms

Anaphylactic reaction occurs in minutes or even seconds following contact with the substance to which the patient is allergic. The respiratory system, circulatory system, and skin may all be affected.

● *Respiratory system.* The smaller bronchi constrict and air passage is increasingly difficult; wheezing results, especially on expiration. Fluid is drawn into the bronchi and the patient tries to cough it up. There is a tightness or pain in the chest with an irritating and persistent cough.

● *Circulatory system.* There is a noticeable drop in the blood pressure, a weak or rapid pulse, pallor, and dizziness. Faintness, coma, and even death may follow.

● *Skin.* Swelling of the lips may be seen. Cyanosis may become rapidly visible about the lips. The skin may be flushed, itching, or have a burning sensation, especially the face and upper chest. Hives may spread over large areas of the body. Edema, especially of the face and tongue, may occur.

13-75. Treatment for Anaphylactic Shock

Death is imminent unless treatment is begun immediately.

a. Establish an airway and administer oxygen (if available). In cases of airway obstruction from severe glottic edema, a cricothyroidotomy may be necessary. The most experienced medical person available should perform the emergency airway procedure, if required.

b. Monitor vital signs and level of consciousness.

c. Start at least one large-bore IV line with D5W or NS and administer epinephrine as *instructed by the physician.* If an IV is difficult to start; give 0.5 ml of 1:1,000 aqueous epinephrine subcutaneously.

d. Keep the patient at normal temperature.

e. Monitor cardiac rhythm (if possible).

f. Record treatment.

g. Evacuate the patient.

Section VIII. CONTROL OF HEMORRHAGE

13-76. Hemorrhage

a. Hemorrhage is excessive bleeding. It may be caused by a wound or by a disease. Whatever the cause, it is a serious threat to life and requires prompt control.

b. When a blood vessel wall is opened, the body reacts with measures to check bleeding. Two natural body responses to bleeding are blood clotting and retraction or constriction of blood vessels. The muscles in an injured vessel contracts and if the vessel is severed, the contraction pulls the damaged vessel back into the tissues, thus tending to close the leak. These natural responses must be helped by artificial means to control hemorrhage.

13-77. Treatment for External Hemorrhage

a. Cut, tear, or lift clothing or other material from the wound without causing additional injury to the patient..

b. Apply a pressure dressing to the wound. The purpose of applying the sterile dressing (Figure 13-68) with pressure to a hemorrhaging wound is threefold—

- *Assistance in clot formation.* The dressing is an absorbent material which spreads and slows the flow of the blood that it absorbs. This spreading and slowing action exposes a relatively large, thin surface of the outflowing blood to the air and speeds up the clot formation. One dressing partially filled with the patient's blood is more effective in controlling hemorrhage than are a series of others because the clot formation is in progress in the bloody dressing. The clot formation spreads back toward and into the wound diminishing air exposure. It is the clot that stops the hemorrhage. When blood begins to clot, it turns darker in color and becomes progressively darker as the clot takes form. A hard clot is almost black.

- *Vessel compression.* The applied pressure reduces the size of the vessel opening, reducing the amount and the velocity of escaping blood, aiding clot formation. Hemorrhage does not always immediately stop. At times, hard pressure on the dressing over the wound may be required for several minutes until a clot has formed with sufficient strength to hold with only the help of the dressing ties. Anchor the dressing over the wound with the dressing knots tied over the wound (Figure 13-69). Anchor the dressing snugly to prevent slipping, but not excessively tight. (The wounded body part, especially an arm or leg, will swell after a time. The swelling will tighten the bandage more, impairing or stopping circulation in the part.) Signs of renewed hemorrhage from the wound may appear after a dressing is snugly in place. The reapplication of manual pressure may be all that is necessary to assist in formation of a clot that will stop the hemorrhage. Signs of renewed bleeding are the reappearance of fresh blood or an enlargement of the bloodstain on the outer surface of the dressing. Also, blood trickling between the dressing and the skin is a sign of continued bleeding.

- *Protection from infectious organisms.* An external wound becomes contaminated with microorganisms at the moment of occurrence. The prompt application of a sterile dressing limits the entrance of additional infectious organisms. Once a dressing is applied, leave it in place, if possible. Removal permits entrance of microorganisms and may disturb the blood clot. Also, leaving the original dressing in place helps medical personnel treating the wound later to estimate the amount of blood loss. When dressing a wound, take care to avoid touching the wound or the surface of the dressing that is to be placed directly on the wound. Breathing on the dressing or wound, or stirring up dust around the patient will increase the hazards of contamination.

c. Elevate the wounded limb. Hemorrhage, especially venous bleeding, can be reduced by raising the wounded limb to a level above the heart. Elevation helps lower the blood pressure at the wound site. Elevation may be used before, during, or after application of a pressure dressing. Serious hemorrhage, especially arterial bleeding, may require simultaneous application of elevation, dressing, and pressure. As elevation drains the limb by gravity, an initial gush of blood downward from open veins may occur when the limb is first elevated. Broken bones must be splinted before elevating the limb.

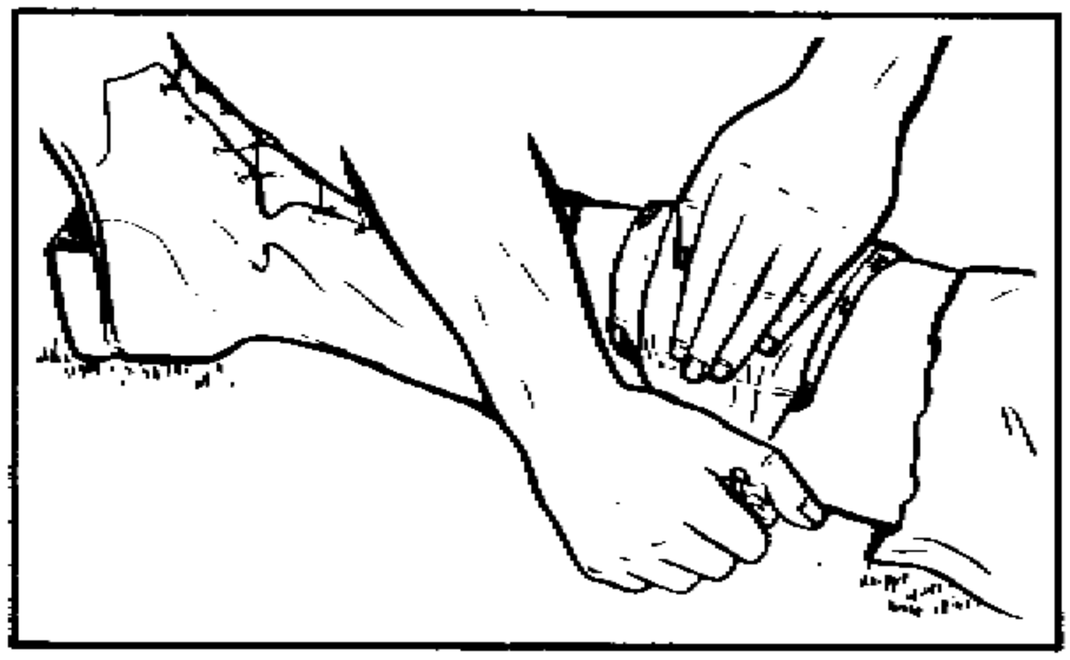


Figure 13-68. Application of pressure dressing.

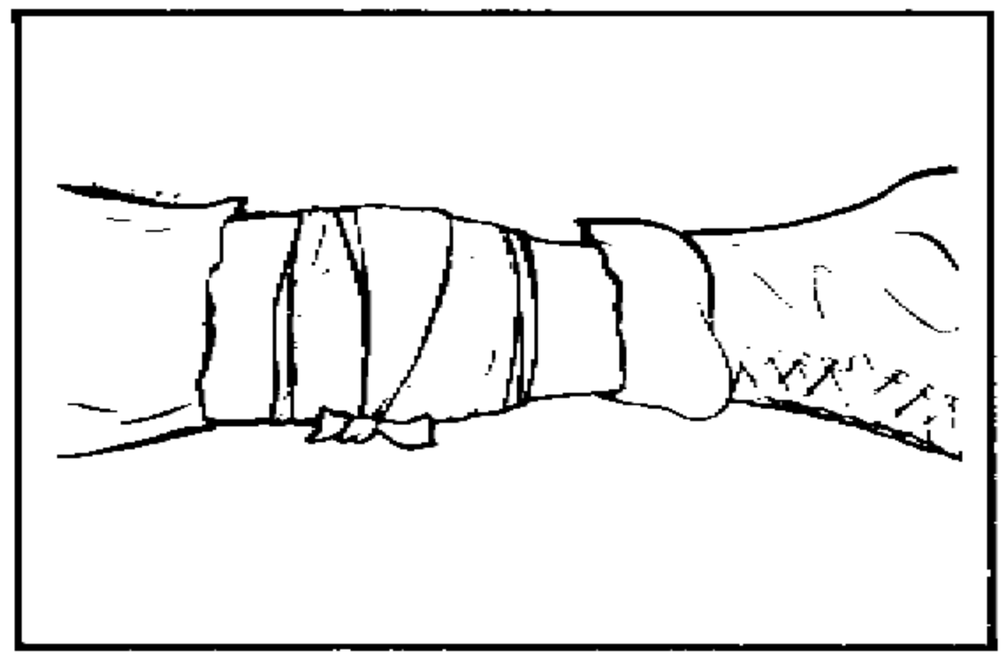


Figure 13-69. Pressure dressing knots tied over the wound.

d. Use pressure points. A pressure point is a place where a main artery supplying the wounded area lies near the skin surface and over a bone. Pressure at these points (Figure 13-70) is applied with the fingers, thumbs, or hands. The object of the pressure is to occlude the artery between the wound and the heart by compressing the artery against the bone, thus shutting off the blood flow from the heart to the wound. It is very difficult to maintain manual occluding pressure on a pressure point; therefore, this method is used only until a pressure dressing can be applied.

- *Temple or scalp.* Hemorrhage from the temple or scalp is controlled by compressing the main artery to the temple against the underlying skull bone (Figure 13-70A) just in front of the ear and above the prominent cheek bone (zygomatic arch).

- *Lower face.* Hemorrhage of the face below the level of the eyes is controlled by compressing the artery in the notch on the under side of the lower jaw (mandible) (Figure 13-70B). Locate this notch by running your finger from the angle of the jaw forward until the notch is encountered on the under side.

- *Neck.* Hemorrhage of the neck is controlled by compressing the carotid artery against the spinal column by pressing inward and slightly backward (Figure 13-70C). When this pressure point is used, care must be taken not to choke the patient.

- *Shoulder or upper part of upper arm.* Hemorrhage from either of these areas is controlled by compressing the artery against either the clavicle (Figure 13-70D) or the first rib; usually pressure against the rib produces less pain in the patient.

- *Mid-upper arm and elbow.* Hemorrhage from either of these areas is controlled by compressing the artery against the bone of the upper arm (humerus) (Figure 13-70E).

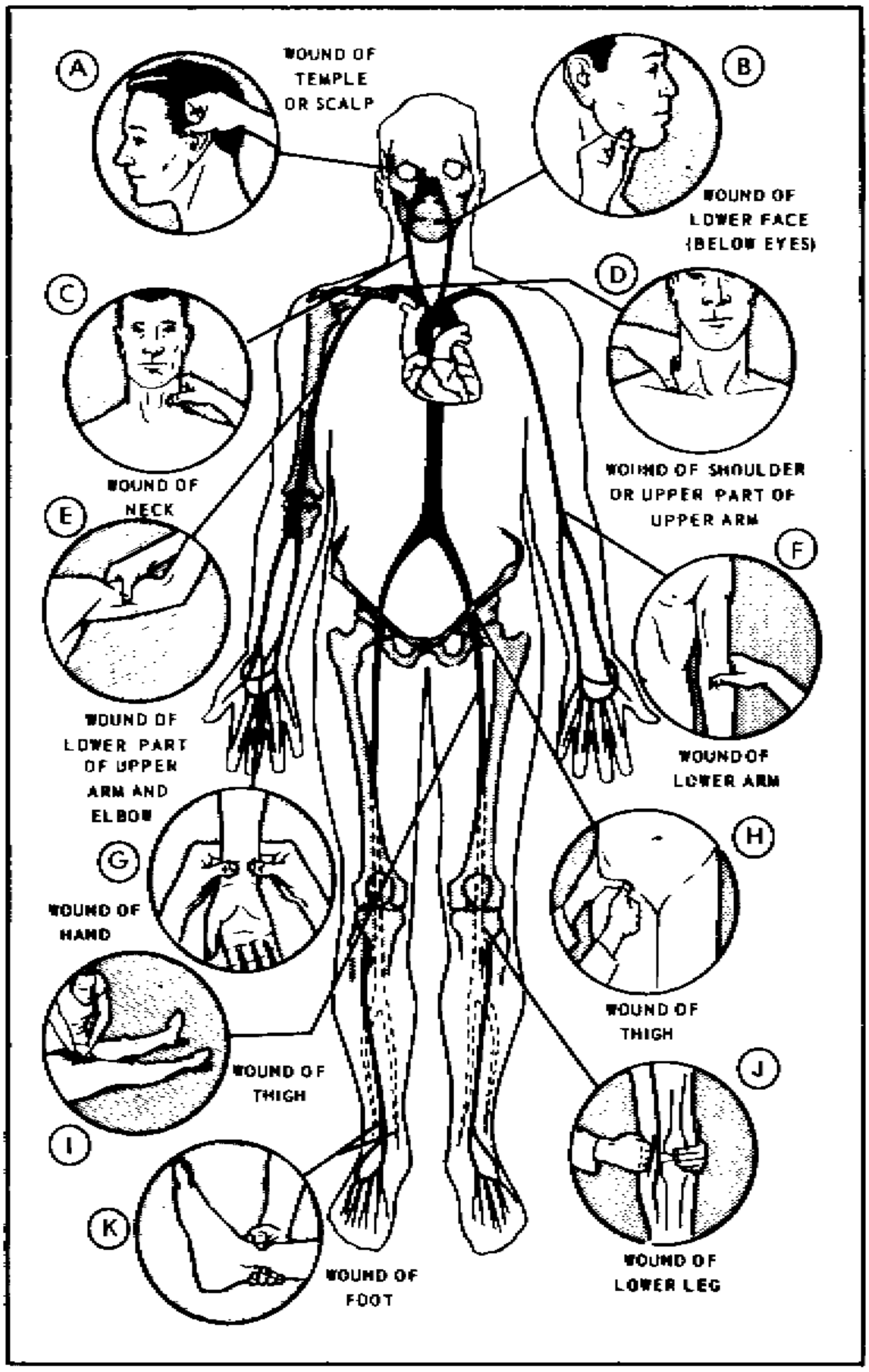


Figure 13-70. Pressure points for control of arterial bleeding.

- *Forearm.* Hemorrhage from the lower arm is controlled by applying digital pressure at the elbow (Figure 13-70F).

- *Hand.* Hemorrhage from the hand is controlled by applying digital pressure at the wrist (Figure 13-70G).

● *Thigh.* Hemorrhage from the thigh is controlled by digital pressure against the mid-groin from behind (Figure 13-70H), collapsing the artery against the bone of the thigh (femur). At times, pressure against the inner aspect of the mid-thigh may be more effective. If the mid-thigh pressure point is used, pressure should be applied with the heel of the hand while the hand is closed into a fist and is reinforced by the other hand placed on top (Figure 13-70I). Considerable pressure is necessary at this point to collapse the femoral artery against the femur because both are deeply imbedded in some of the heaviest musculature of the body.

● *Lower leg.* Hemorrhage from the leg between the knee and the foot is controlled by firm pressure at the knee. Pressure at one or both sides of the knee may be sufficient. If not, hemorrhage is controlled by holding the front of the knee firmly with one hand (Figure 13-70J) and thrusting a fist hard against the artery behind the knee (popliteal).

● *Foot.* Pressure by the hand around and just above the ankle is effective in controlling hemorrhage from the foot (Figure 13-70K).

e. Use of the Tourniquet. A tourniquet is a constricting band placed around the circumference of one of the extremities (arms and legs). When used, its purpose is to stop hemorrhage. The use of a tourniquet is a *LAST* resort; other control measures must be used FIRST.

● *Judgement.* In emergency medical treatment situations, mature judgment is required in making the decision to apply or withhold a tourniquet. Blood flow stops at the tourniquet. Without circulating blood, cells in the limb distal to the tourniquet soon begin to die. Surgical amputation of the limb distal to the tourniquet application point does not always follow. The decision to apply a tourniquet must be done with the realization that the distal portion of the limb may be sacrificed. The application of a tourniquet must represent a choice between saving a life and saving a limb. It must NOT represent a choice between the quick results it produces and the time-consuming application of a pressure dressing. The decision to apply a tourniquet is irreversible. Once a tourniquet has been applied, it must be left in place until it is removed by a physician/physicians' assistant. The physician/physicians' assistant must see the patient as soon as possible. Do not loosen the tourniquet in the mistaken belief that the portion of the limb distal to the tourniquet is being kept alive.

● *Guideline.* Pressure points, pressure dressings, and elevation of limbs are used first. Nonetheless, hemorrhage from a major artery of the leg or arm, or from multiple arteries as seen in a traumatic amputation may be beyond the control of these methods. There is no set rule as to how long one should continue trying to control hemorrhage by pressure dressing and elevation. However, in an emergency situation, the absorbent capacity of one first-aid dressing may be used as a guideline.

o If the blood lost by the patient is contained in the first-aid dressing applied to the wound, the blood loss is probably not more than 500 ml. This is the amount drawn from a blood donor. Thus, if the dressing becomes soaked through with blood and signs of clotting are present, continue pressure with elevation. Additional absorbent material placed over that already in place will aid in the clot formation and stop the hemorrhage.

o Do not assume that a traumatic amputation is not going to bleed. Initially a traumatic amputation may have little bleeding. A pressure dressing and a tourniquet is always needed on traumatic amputations.

f. Application of the tourniquet.

(1) Place the tourniquet around the limb between the wound and the heart. Never place it directly over a wound or fracture. Place the tourniquet approximately 2 inches above the wound site. For wounds just below a joint, place the tourniquet above the joint (Figure 13-71).

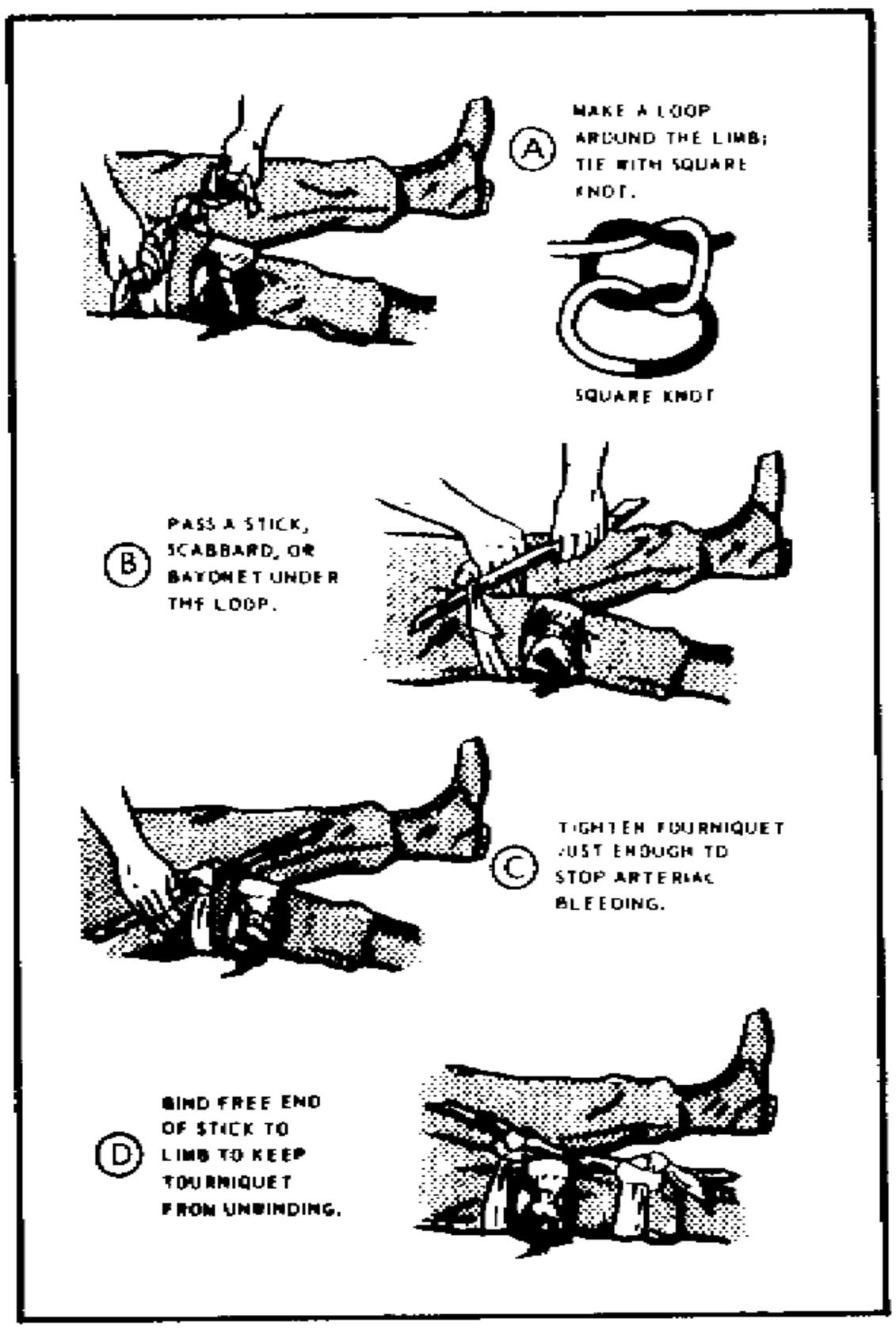


Figure 13-71. Application of a tourniquet to stop bleeding.

(2) In the absence of an issue tourniquet, an improvised tourniquet can be made from strong, soft, pliable material such as gauze, broadcloth bandage, clothing, or kerchiefs. This material is used with a rigid stick-like object. To minimize skin damage, the improvised tourniquet should be at least 1 inch wide after tightening. If gauze bandage is used, 3 inch and 4 inch widths are preferable to the 2 inch width.

(3) Apply the tourniquet with enough pressure to stop blood from passing under it. If a pulse has been detectable in the intact wrist or foot of the affected limb, tourniquet pressure is sufficient when that pulse ceases. If a pulse cannot be used as an indicator, you must rely on the reduction of blood flow from the wound. After a tourniquet is properly tightened, arterial hemorrhage will cease immediately, but venous bleeding in the distal part of the limb will continue until blood already in them is drained. You should not continue to tighten the tourniquet in an attempt to stop this drainage. When the tourniquet is tight, tie the tightening device parallel to the extremity.

(4) Protect the skin beneath the tourniquet from pinching, twisting, and tourniquet overtightening. Skin is relatively resistant to oxygen deprivation and may survive even though the limb beneath it requires amputation later. Damaging the skin with the tourniquet may deprive the surgeon of skin needed to cover the amputated stump. Skin damage will force the surgeon to amputate more of the limb than might otherwise have been necessary. Protect the skin by placing soft, *smooth* material such as a shirt sleeve or trouser leg around the limb and beneath the tourniquet before tightening. Protecting the skin also reduces the amount of pain inflicted on the patient.

g. Splinting. After arterial hemorrhage has ceased and the tourniquet is securely in place, splint the extremity to prevent further injury.

h. Covering and marking the patient. The patient's condition and the weather may require that he be covered. If so, arrange the covering so that the tourniquet remains in view. In addition, note the presence of a tourniquet by plainly marking the patient's—

- Forehead with a large letter "T" mark to indicate that a tourniquet is in place. Also indicate the time the tourniquet was applied.

- Field medical card with the time and date the tourniquet was applied.

i. Monitoring. Inspect the tourniquet and dressing every 15 minutes to assure that arterial hemorrhage has not started again until absence or stability of the bloodstained area on the outside of the dressing indicates that venous drainage has stopped. Afterwards the tourniquet and dressing should be inspected periodically and adjusted if either has slipped. If at any time, arterial hemorrhage is indicated, tighten the tourniquet further. Retighten the tourniquet without loosening, lifting, or removing the wound dressing.

13-78. Epistaxis

Although epistaxis (nosebleed) is considered a common occurrence, it can be a dangerous condition if not treated promptly and correctly. Some individuals have a history of simple nosebleed not complicated by other conditions. It can be caused by trauma, crusting of nasal mucosa from dry air, or irritation. However, in the case of a facial or a head injury, nosebleeding can be serious and require immediate treatment.

13-79. Treatment for Epistaxis

a. Treatment is usually simple and straightforward. However, if the patient is losing large amounts of blood, take steps to minimize the blood loss and prepare the patient for evacuation.

- Determine the cause of epistaxis.

- Tell the patient not to breathe through or blow his nose since this will aggravate the bleeding.

- Have him sit facing you and tilt his head slightly forward.

- Tell the patient to pinch the fatty part of his nose (around the nostrils) for approximately 5 to 10 minutes.

- Apply cold compresses, if available, to the bridge of the nose to aid in slowing down the bleeding.

- If the bleeding continues and there is danger of excessive blood loss and the possibility of subsequent shock, prepare the patient for evacuation.

b. Estimate the amount of blood loss. If the patient is vomiting large amounts of fresh (red) or old (color of coffee grounds) blood, there may be a significant blood loss. Evacuate the patient.

NOTE

The type and estimated amount of blood vomited should be reported.

c. Treat for shock, if necessary.

d. Obtain a short history of the patient (if the tactical situation permits). If the patient has a history of uncomplicated spontaneous bleeding from the nose, he may be able to control the present nosebleed.

e. Obtain and record the vital signs. Also, record treatment.

f. Evacuate the patient, if necessary.

Section IX. CARDIAC ARREST AND CARDIOPULMONARY RESUSCITATION

13-80. General

a. Cardiac arrest (sudden death) is an abrupt, unexpected cessation of pulse and circulation. Electrical shock, drowning, or massive blood loss can cause cardiac arrest. There are two stages of cardiac arrest.

(1) Clinical death is the stopping of the heartbeat and respiration. Time elapsed is zero minutes.

(2) Biological death follows clinical death in approximately 4-6 minutes. During this stage irreversible brain damage occurs. Therefore, emergency life saving actions must begin immediately (within 2 minutes).

b. Cardiac arrest accounts for over 250,000 deaths each year, with most deaths occurring before the victim reaches the hospital. Many of these deaths can be prevented by taking quick emergency steps within the first 2 minutes after the arrest.

13-81. Signs and Symptoms of Myocardial Infarction (Heart Attack)

Myocardial infarction is the single largest cause of cardiac arrest. The signs and symptoms include—

- An uncomfortable pressure, squeezing, fullness, or pain in the center of the chest behind the breastbone. This pain may radiate to the shoulders, neck, and arm, and it may last 2 minutes or longer, or may be intermittent.

- Sweating, nausea, shortness of breath and a feeling of weakness.

13-82. Treatment for Cardiac Arrest

a. Establish Unresponsiveness. Gently shake the patient's shoulder and ask "are you okay."

b. Call for Help. If the patient is unresponsive, call for help. Even if no one is in sight, call out in the hope that someone will hear.

c. Position the Patient. Position the patient in a supine position, if necessary. Cardiopulmonary resuscitation (CPR) cannot be administered in any other position. When positioning the patient, use care to prevent further injuries. Roll the patient over as a unit.

d. Open the Airway. Three methods of opening the airway in an unconscious patient are—

- Head tilt-neck lift method: Position yourself at the patient's side, place one hand beneath his neck and the other hand on his forehead. Gently lift his neck and at the same time apply backward pressure on his forehead (Figure 13-72).

- Head tilt-chin lift method: This technique is used when the head tilt-neck lift method is inadequate to open the airway. Place the fingers of one hand under the lower jaw on the bony part near the chin. Place the other hand on his forehead. Bring the chin forward while lifting so that the teeth are nearly brought together without completely closing the mouth (Figure 13-73).



Figure 13-72. Head tilt-neck lift method.

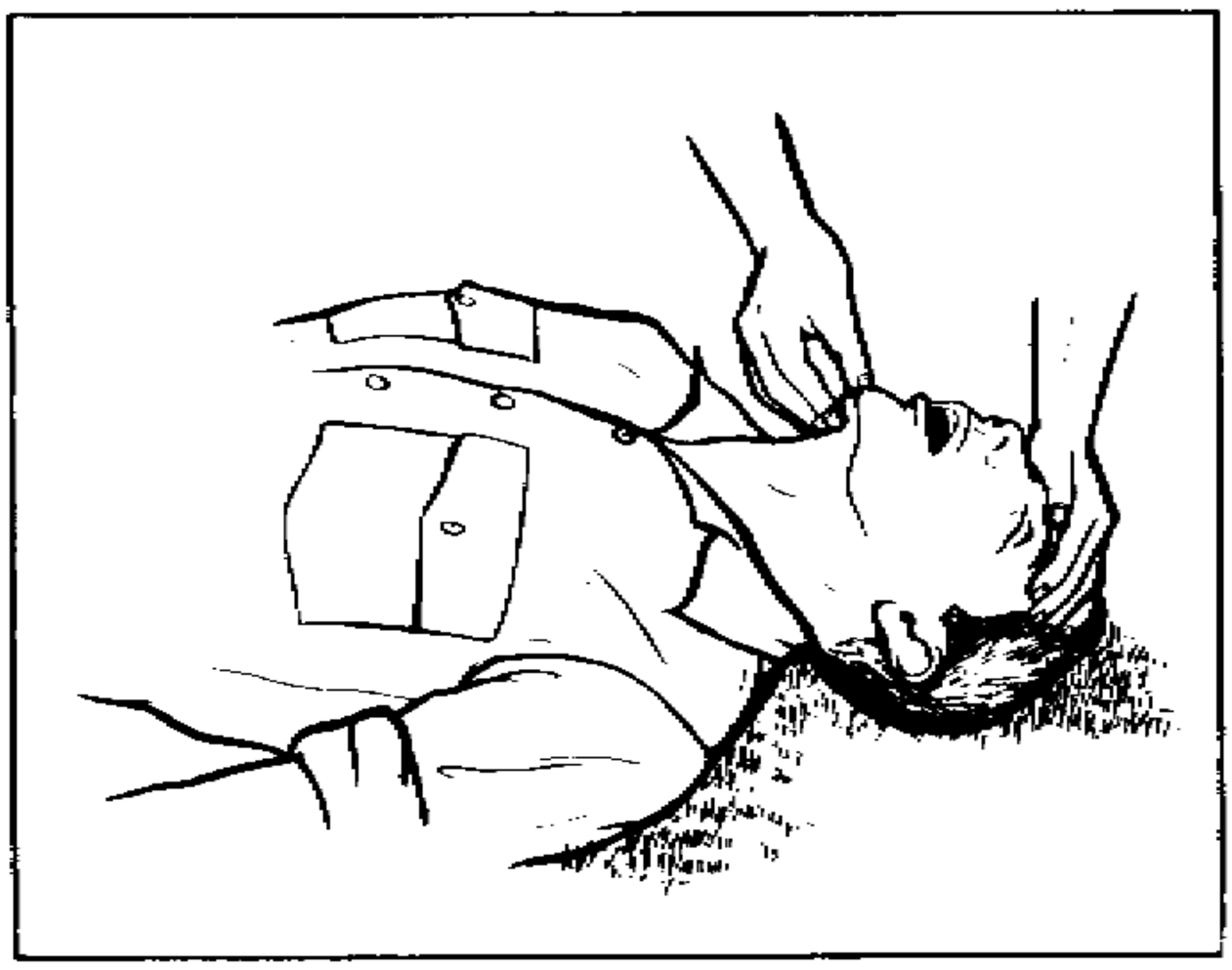


Figure 13-73. Head tilt-chin lift method.

● Jaw thrust method: This technique is the safest and first approach to opening the airway of a patient who has a suspected neck injury. In most cases, it can be accomplished without extending the neck. Grasp the angles of the patient's lower jaw and lift with both hands, one on each side, moving the jaw forward. For stability, rest your elbows on the surface on which the patient is lying. If the lips close, gently open his lower lip with your thumb (Figure 13-74).

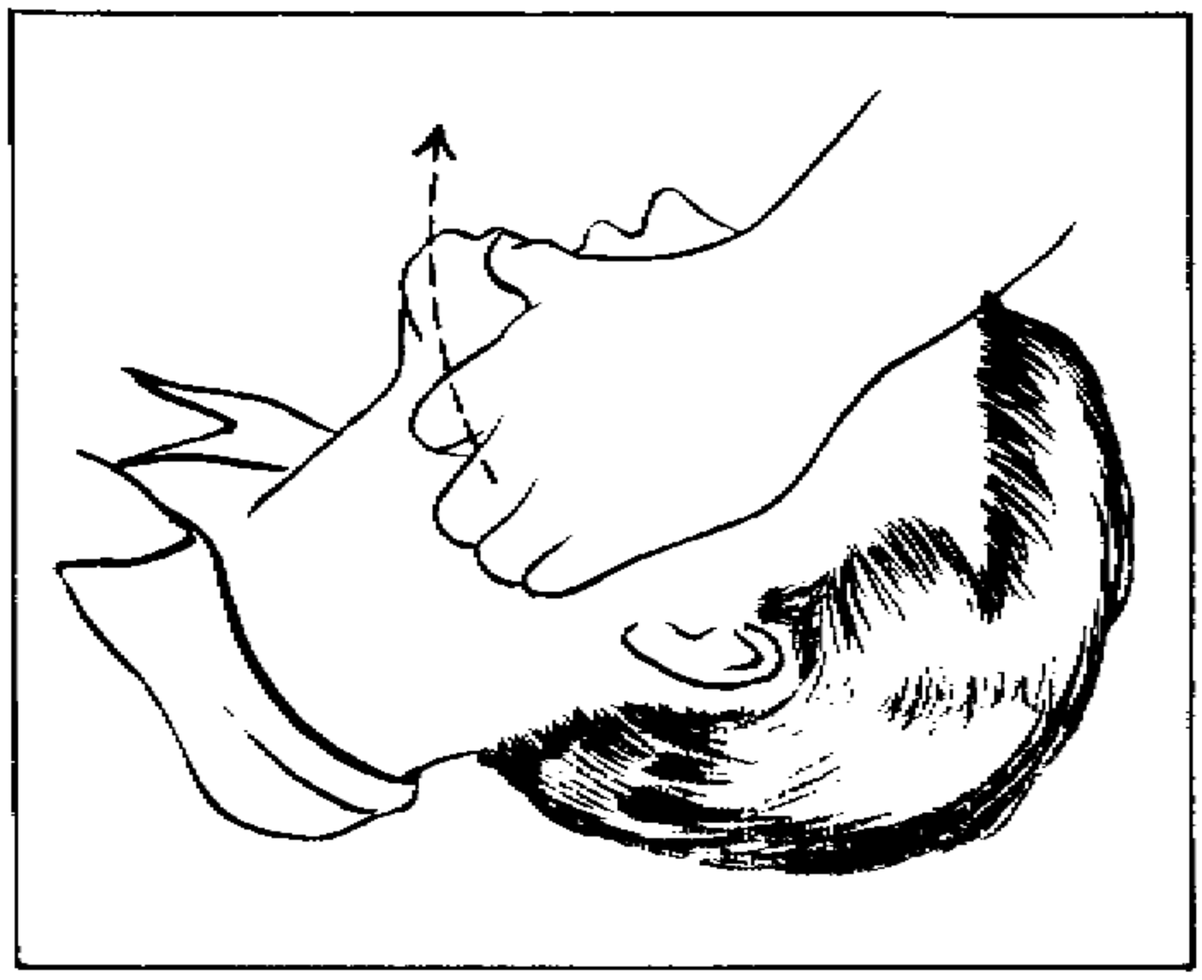


Figure 13-74. Jaw thrust method.

e. Establish Breathlessness. Place your ear over the patient's mouth and nose, look toward his chest and—(Figure 13-75).

- *LOOK* for his chest to rise and fall;
- *LISTEN* for air escaping during exhalation; and
- *FEEL* for the flow of air on your check. If the patient is not breathing, you must perform rescue breathing.

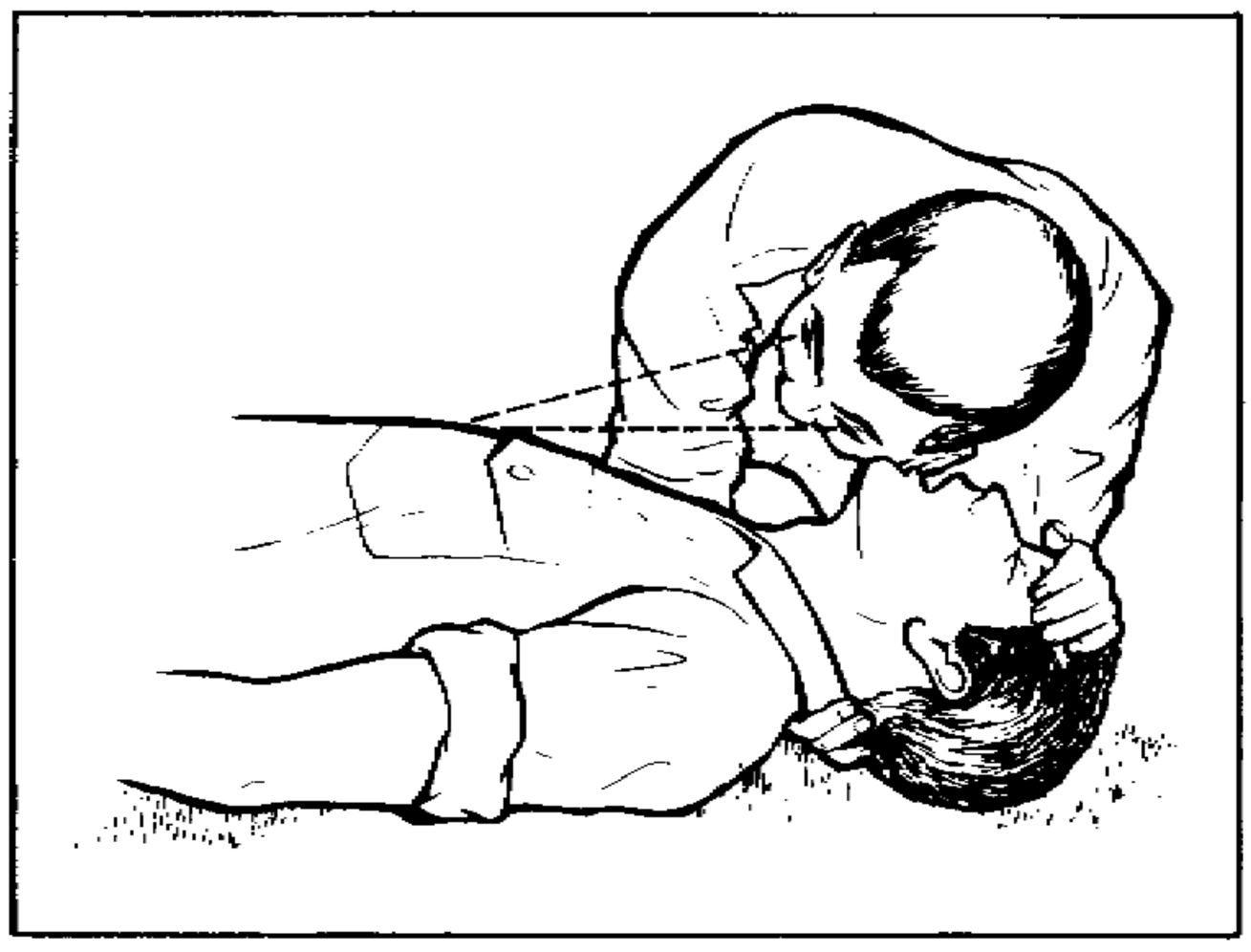


Figure 13-75. Establishing breathlessness.

f. Perform Rescue Breathing.

(1) Use the thumb and index finger of the hand on the patient's forehead to pinch off his nostrils so that air will not escape.

(2) Take a deep breath, open your mouth very wide and place it around the outside of the patient's mouth making a seal.

(3) Blow air into the patient's mouth and at the same time look out of the corner of your eye to see if his chest is rising. If it is, the lungs are being ventilated. Ventilation should only be forceful enough to raise the patient's chest.

(4) Initially give four quick full breaths without allowing time for full lung deflation between breaths. If breathing has stopped, even for a short time, some of the small air sacs of the lungs collapse. Four initial breaths maintain positive pressure in the lungs, thereby, more effectively filling and ventilating the air sacs (Figure 13-76).

(5) If pulse is present but patient is not breathing, you must perform rescue breathing. One breath is given every 5 seconds (for a respiratory rate of 12/minute). Between breaths you must put your head close to the patient's face to look, listen, and feel for spontaneous respirations. The pulse is checked once each minute.

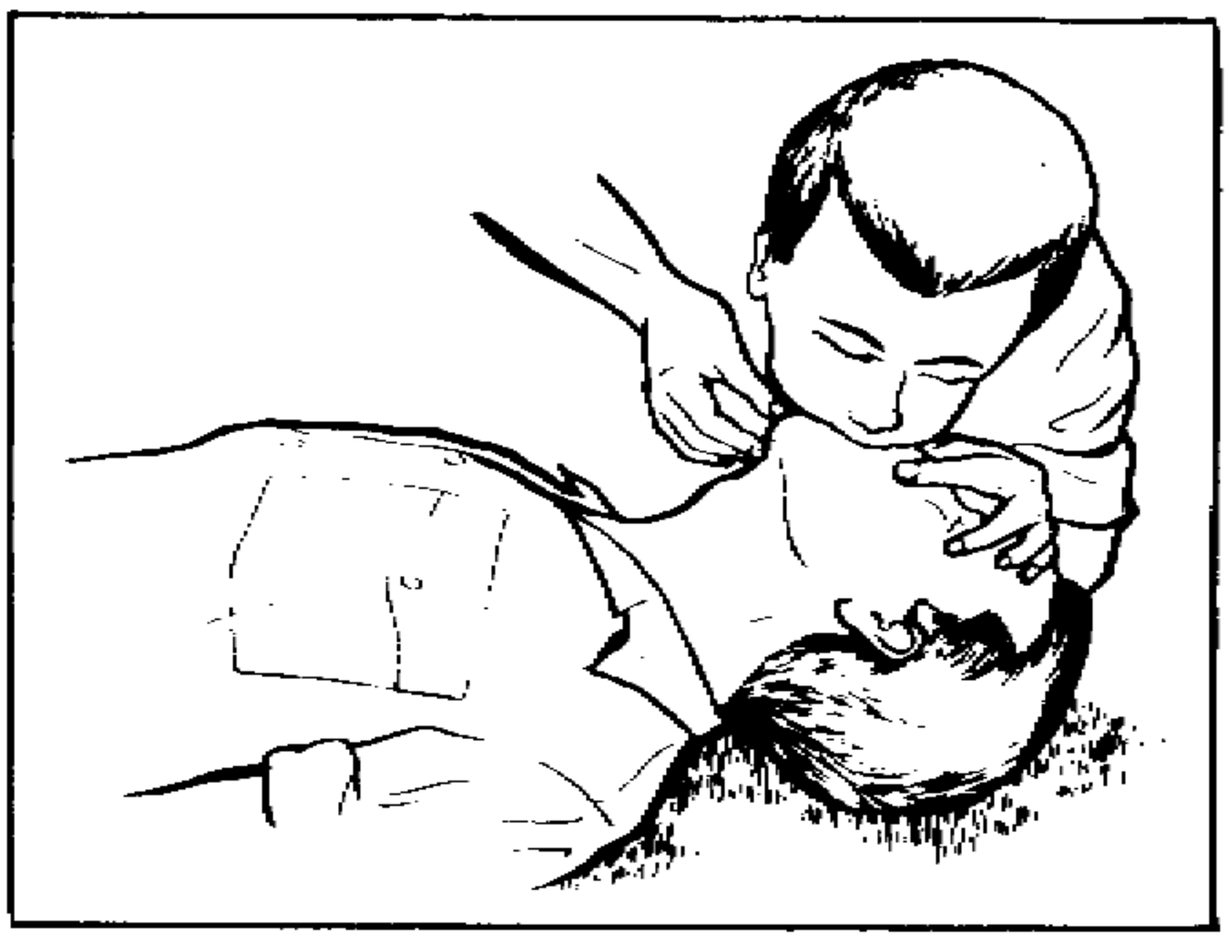


Figure 13-76. Rescue breathing.

g. Establish Pulselessness.

(1) Keep your left hand on the patient's forehead to maintain an open airway.

(2) Place the middle and index finger of your other hand on the patient's adam's apple, then move the fingers down toward the side of his neck (on the side nearest you), locating the carotid pulse (Figure 13-77).

(3) Use the carotid pulse because it is accessible and reliable.

(4) NEVER use your thumb because you may mistake your own pulse for that of the patient. The thumb has a pulse of its own.

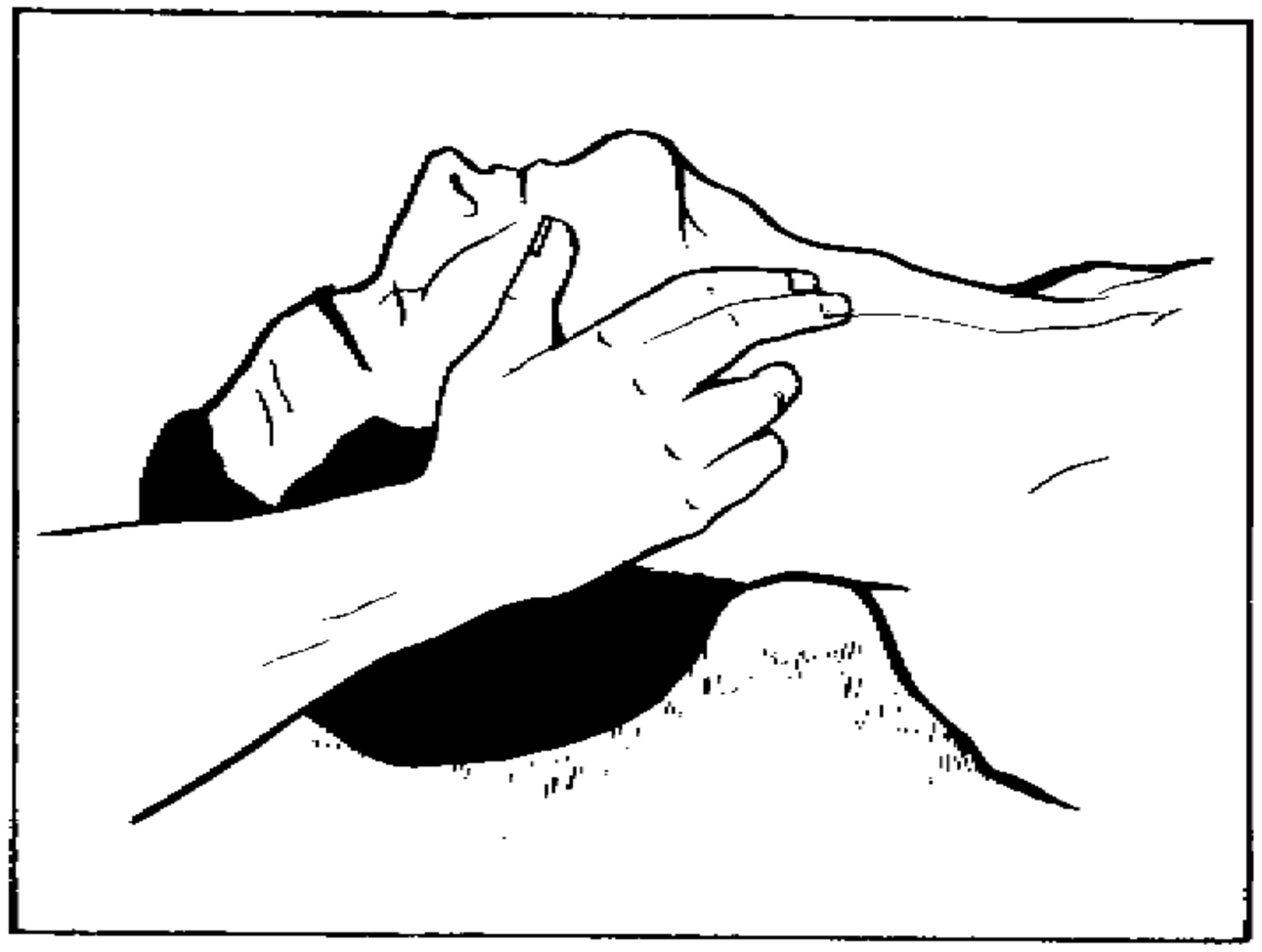


Figure 13-77. Establishing pulselessness.

(5) If a pulse is not detectable, you must perform external chest compressions.

h. Perform External Chest Compressions.

(1) With the middle and index finger of your hand nearest the patient's feet, locate the rib cage on the side next to you (Figure 13-78A).

(2) Move your fingers up along the rib cage to the notch where the ribs meet the sternum in the center of the lower chest (Figure 13-78B).

(3) With your middle finger on the notch and index finger next to it, place the heel of your other hand next to the index finger on the lower half of the sternum (Figure 13-78C).

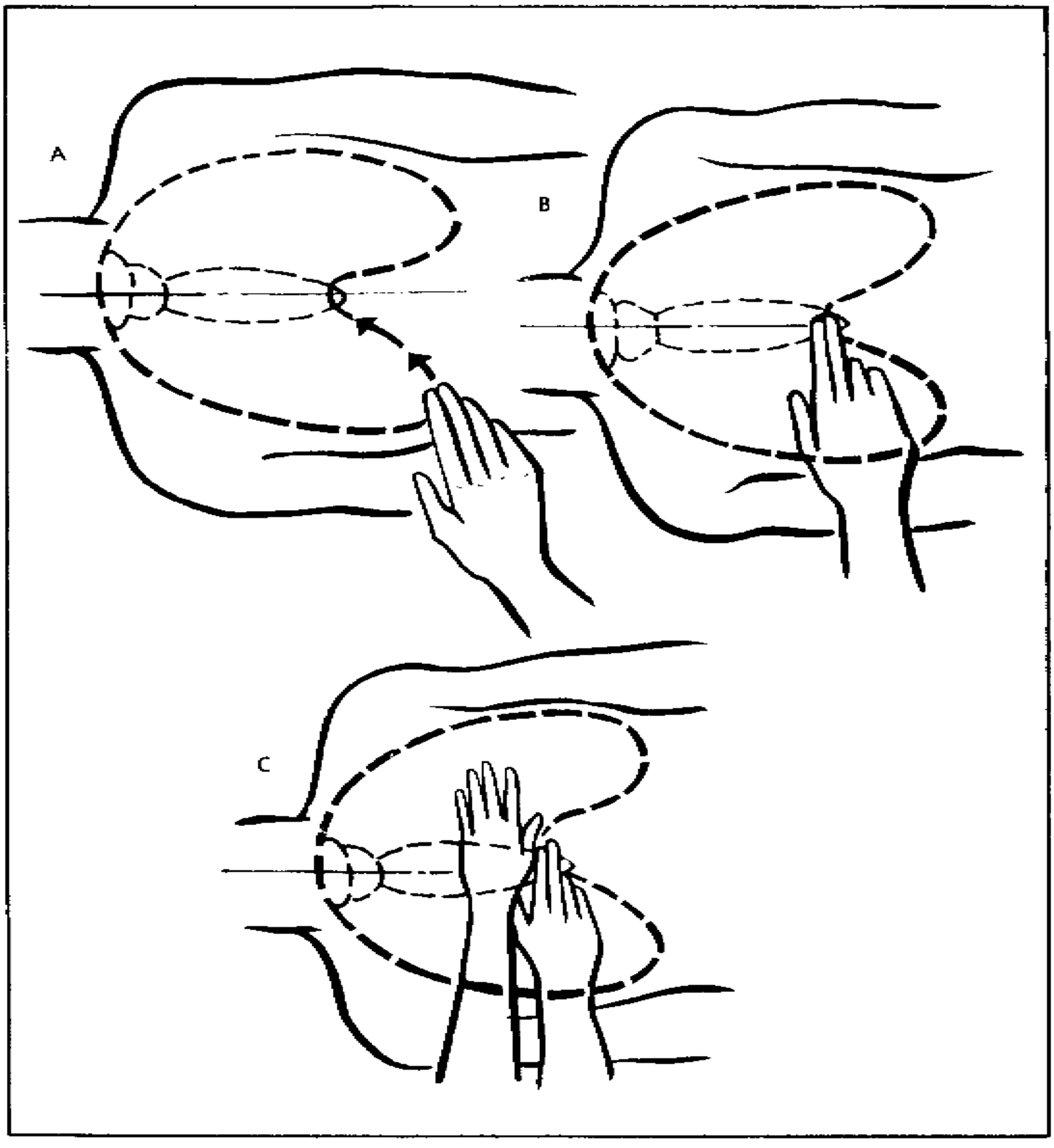


Figure 13-78. Locating hand position on lower sternum.

(4) Move the first hand from the notch and place it on top of the hand that is on the sternum. Keep both hands parallel with your fingers pointing straight away from you. The fingers may be extended or interlaced, but must be kept off the chest (Figure 13-79).

(5) To achieve the most pressure with the least effort, with your arms straight, lean forward until your shoulders are directly over your hands (Figure 13-80). Depress the patient's chest 1 ½ to 2 inches. Completely release this pressure allowing blood to flow into the heart. Repeat the depressions and release cycles.

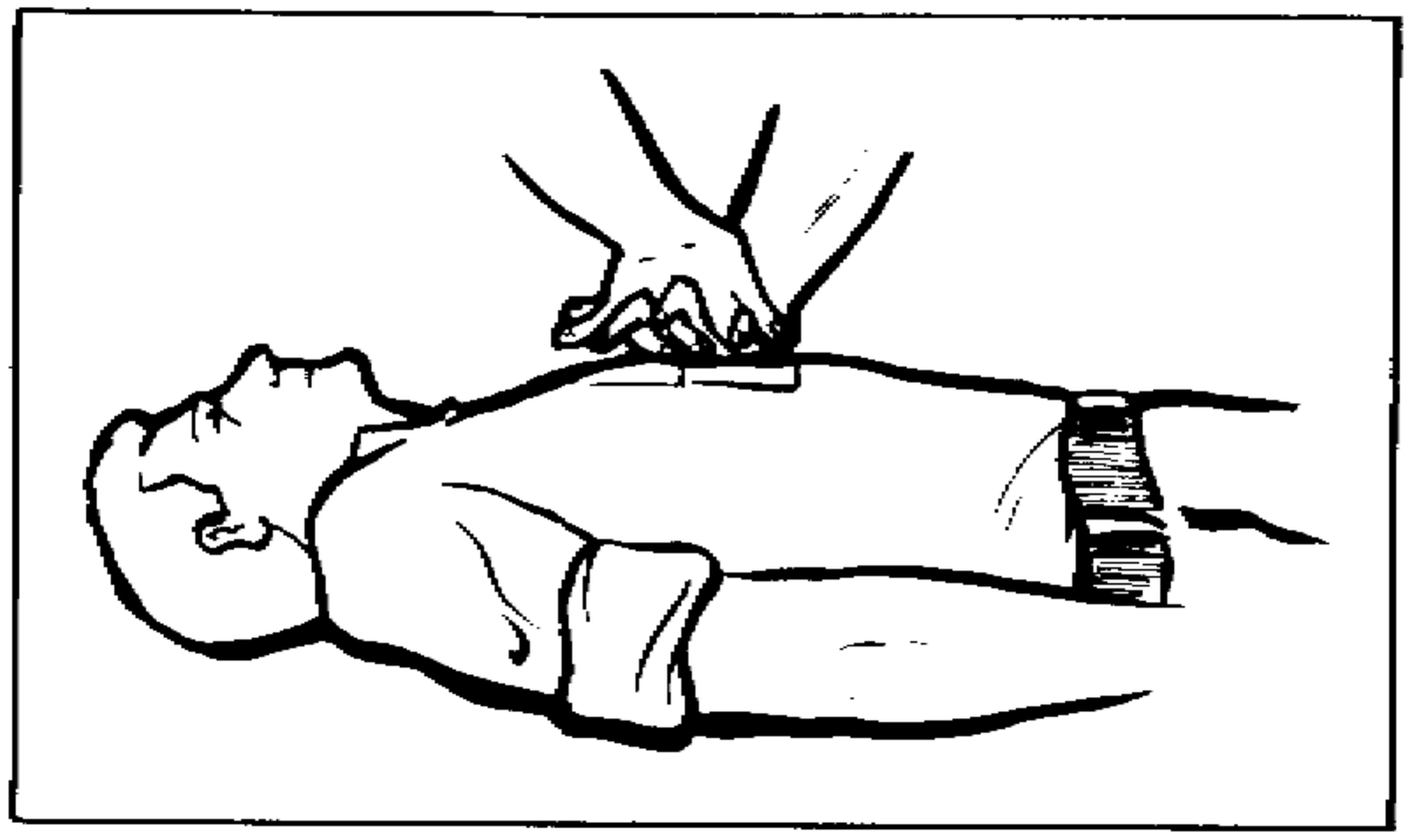


Figure 13-79. Position of both hands and fingers.

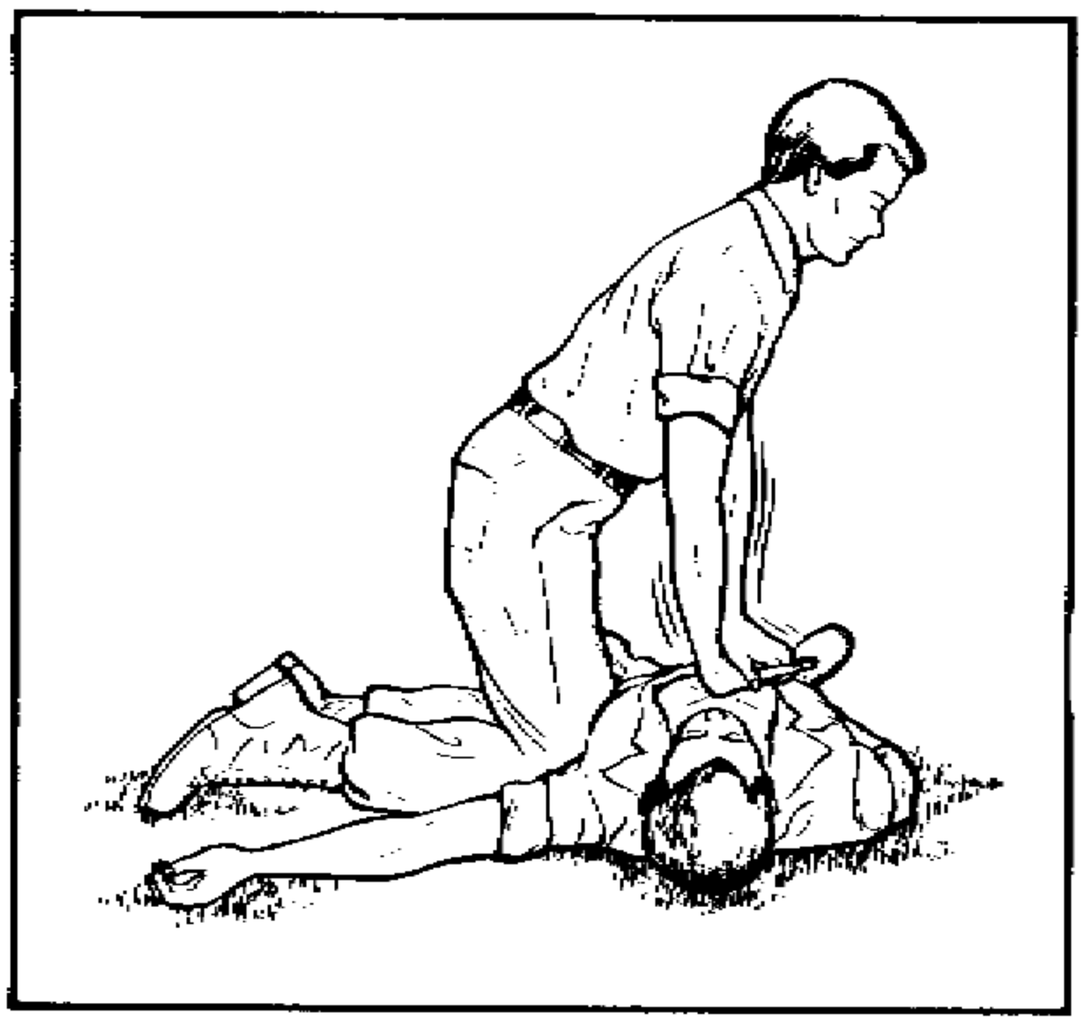


Figure 13-80. Chest compressions.

13-83. Perform One Rescuer Cardiopulmonary Resuscitation

a. To provide one rescuer CPR—

(1) Perform 15 compressions at the rate of 80 compressions per minute. Count one and two and three——to 15.

(2) After administering 15 compressions, quickly move to the patient's head, open the airway, and deliver two quick full breaths.

(3) Move back to the chest, relocate the hand position, and administer 15 compressions.

(4) Repeat this procedure for four cycles.

(5) After administering four cycles of 15 compressions and 2 ventilations, move to the patient's head, locate the carotid artery, and check for a pulse. If no pulse is felt, open the airway, administer two full breaths, and resume CPR.

(6) Check the pulse every few minutes. If a pulse is present, continue rescue breathing only.

b. Sometimes when performing one rescuer CPR, you may be approached by another individual who can assist you. You should begin two rescuer CPR immediately. It is more advantageous to administer two rescuer CPR rather than one because the patient receives more oxygen, the chest compressions are not interrupted, and the problem of rescuer fatigue is lessened. Two rescuer CPR should be performed with one rescuer on each side of the patient.

13-84. Perform Two Rescuer Cardiopulmonary Resuscitation

a. Changing to two rescuer CPR should be performed without interruption.

(1) The second rescuer identifies and positions himself on the opposite side of the patient next to his head.

(2) The second rescuer locates the carotid artery and checks for a pulse while the first rescuer is performing chest compressions (if compressions are being done correctly, a mechanical pulse should be felt).

(3) The second rescuer informs the first rescuer to stop chest compressions while he continues to monitor for a spontaneous pulse or respiration. First rescuer maintains his hand position.

(4) If no pulse or respiration is felt, the second rescuer interposes two breaths and informs the first rescuer of his findings and advises him to continue compressions.

(5) The rate of compressions for two rescuer CPR is 60 per minute. This is accomplished by the first rescuer counting one-one thousand, two-one thousand, three-one thousand, four-one thousand, five-one thousand, one-one thousand, and so on.

(6) After every fifth compression, the second rescuer interposes one breath. The ratio of compression to ventilation for two rescuer CPR is 5:1. Administer the ventilation on the UPSTROKE of the fifth compression. The rescuer performing the compressions does not stop to allow for the ventilation. The transition from five-one thousand back to one-one thousand should be smooth without any interruption. A pulse check should be made after the first minute (12 cycles) of two rescuer CPR and then every 3 to 4 minutes or when the rescuers change positions.

b. Changing position is essential in preventing fatigue.

(1) The first rescuer informs the second rescuer when he is ready to change by substituting the count of one-one thousand with change-one thousand, two-one thousand, and so on.

(2) On the upstroke of the fifth compression, the second rescuer administers one breath and changes position with the first rescuer.

(3) The first rescuer moves to the patient's head and assumes the role of the second rescuer. He locates the carotid pulse and checks it for 5 seconds. While this is being done, the second rescuer who has now assumed the role of the first rescuer finds the correct hand placement and waits for the rescuer at the head to check for a pulse and respiration. If neither is present, he administers two full breaths and informs the first rescuer to continue compressions. The procedure of two rescuer CPR is then resumed and not interrupted again until a change is necessary.

c. CPR should never be interrupted for more than 5 seconds and should only be terminated for the following reasons:

- The patient revives.
- The patient is pronounced dead by a physician.
- The rescuer(s) is/are relieved.
- The rescuer(s) becomes exhausted and unable to perform CPR.

Section X. UPPER AIRWAY OBSTRUCTIONS

13-85. General

Most upper airway obstructions are caused by large pieces of meat. However, a variety of foreign bodies have been the cause of obstructions. Obstructions may be either partial or complete. The individual with a partial obstruction may have a good air exchange. With a good air exchange, the patient can cough forcefully; however, it is common to have wheezing between coughs. Encourage the patient to continue coughing. Never attempt to interfere with his efforts to dislodge the foreign substance. A poor air exchange is usually indicated by high-pitched noises when inhaling and weak, ineffective coughing, with increased difficulty in breathing accompanied by cyanosis (bluish color of skin and fingernail beds). Partial obstructions with poor air exchange are treated as though they are a complete airway obstruction. A patient with a complete airway obstruction is unable to speak, breathe, or cough. He will have an absence of air movement and requires immediate assistance.

13-86. Signs of a Airway Obstructions

a. Signs of a complete airway obstruction in a conscious patient.

- Grasping his throat (Figure 13-81).
- Unable to speak.
- Unable to cough or breathe.

b. Signs of a partial airway obstruction in a conscious patient.

- Wheezing between coughs.
- High-pitched noise when inhaling.
- Weak, ineffective coughing.
- Increased difficulty in breathing.
- Unable to breathe.

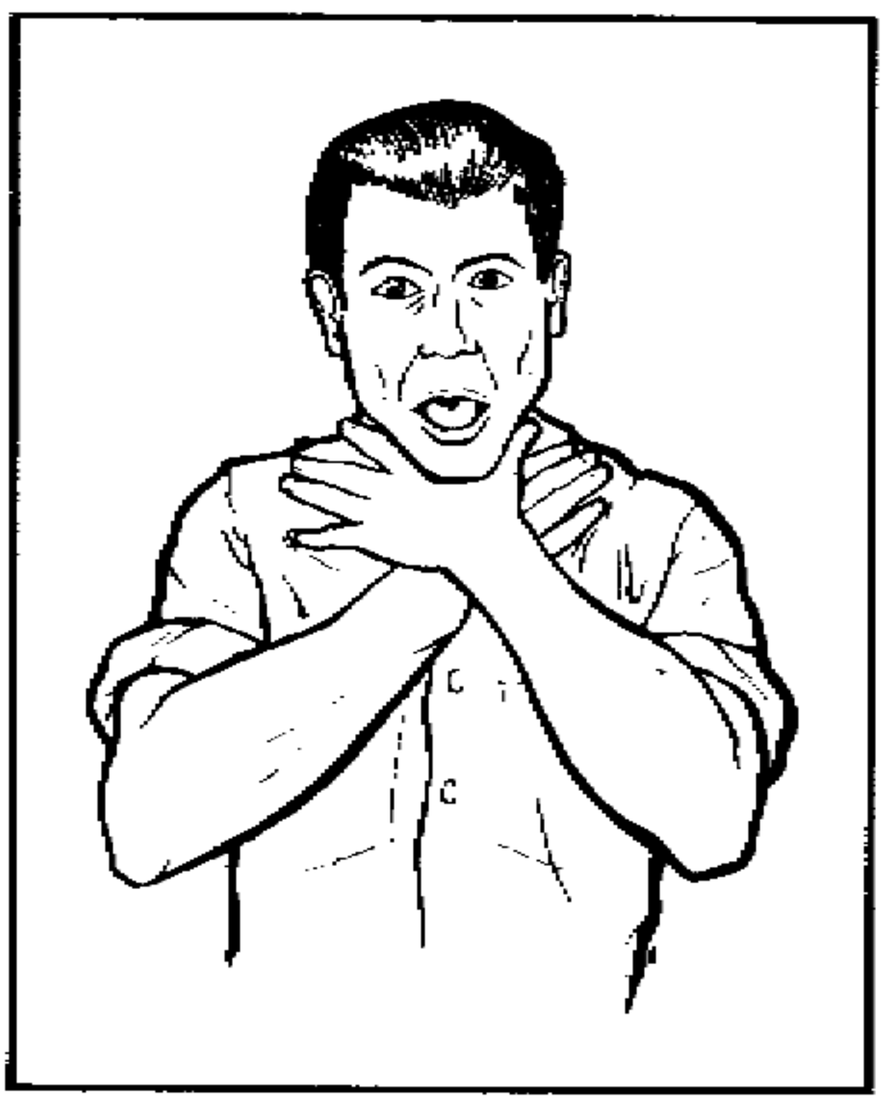


Figure 13-81. Patient grasping his throat.

13-87. Treatment for an Airway Obstruction in a Conscious Patient

a. Apply back blows.

(1) Place yourself to the side and slightly behind the sitting or standing patient.

(2) Place one hand over his sternum for support.

(3) Bend the patient at the waist while providing support with your hand at his sternum and deliver four sharp blows with your other hand in rapid succession between his shoulder blades (Figure 13-82).

(4) If the obstruction is not cleared, apply the abdominal thrust as described below.

CAUTION

Never use back blows for patients' with fractures or suspected fractures of the neck. Only use abdominal thrust for these patients.

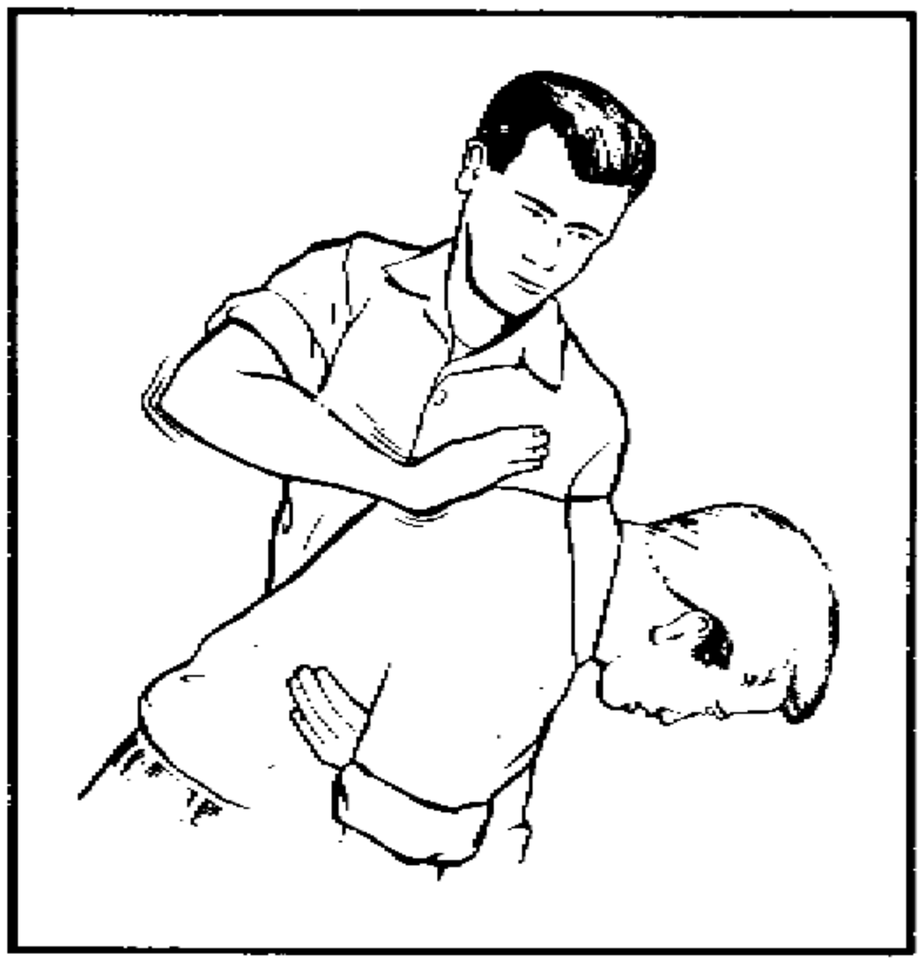


Figure 13-82. Back blows.

b. Apply abdominal thrust.

(1) Stand behind the standing or sitting patient and wrap your arms around his waist.

(2) Make a fist with one hand and grasp the closed hand with your other hand. Place the thumb side of your fist against the patient's abdomen between the umbilicus and xyphoid process (bottom tip of the sternum (Figure 13-83).

(3) Press your fist into the patient's abdomen four times with quick inward and upward thrusts.

NOTE

NEVER place your fist on the xyphoid process or the lower margin of the rib cage. Pressure on either of these areas can fracture the sternum or ribs, which may puncture the lungs.

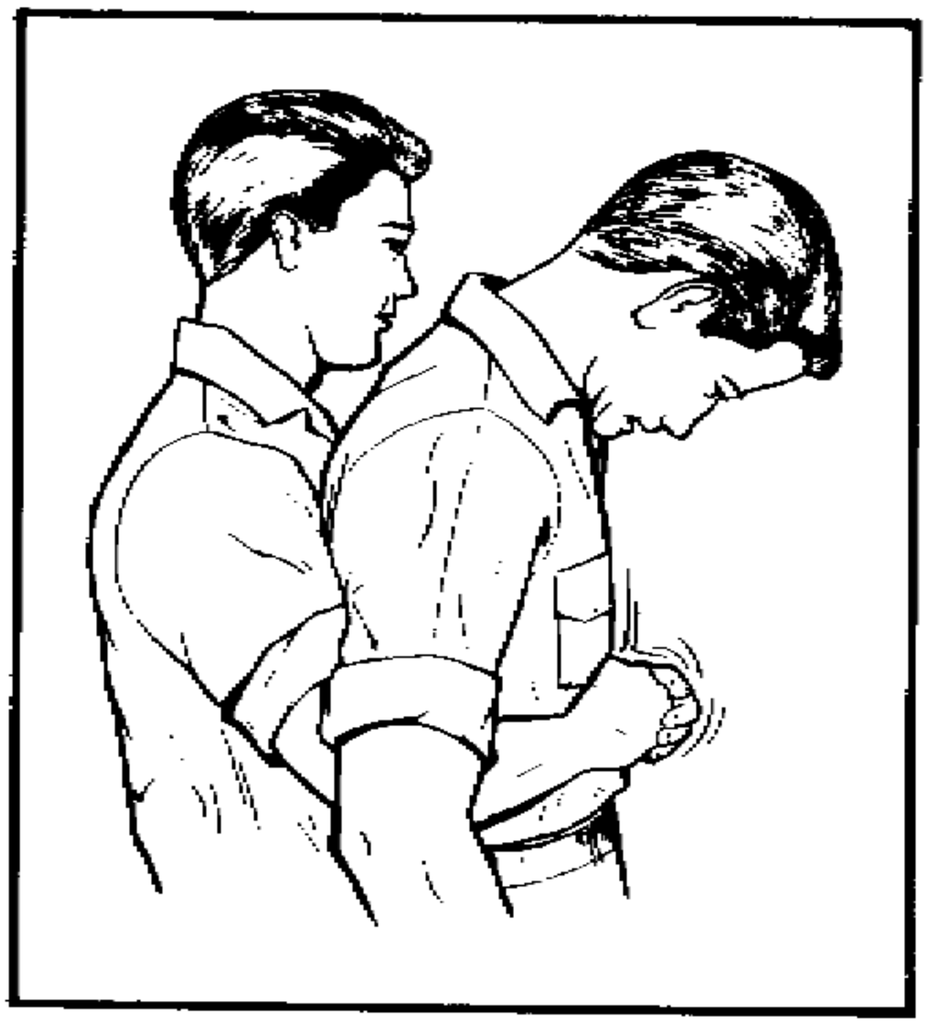


Figure 13-83. Abdominal thrust.

c. Apply chest thrust (alternate method used on obese or pregnant patients, or patients with abdominal wounds).

(1) Stand behind the sitting or standing patient.

(2) Place your arms directly under the patient's armpits and encircle his chest.

(3) Place the thumb side of your fist on the CENTER of his sternum.

(4) Grasp your fist with your other hand and exert four quick backward thrusts (Figure 13-84).

NOTE

Back blows and manual thrusts are repeated until the obstruction is dislodged, or until advanced medical treatment is begun.

d. If the patient loses consciousness, follow the procedures outlined in clearing an obstructed airway in the unconscious patient.



Figure 13-84. Chest thrust.

13-88. Treatment for an Airway Obstruction in an Unconscious Patient

a. Ventilate the patient.

(1) Establish unconsciousness and call for help.

(2) Open the airway and use the "Look, Listen, and Feel" procedures to establish breathlessness.

(3) If no respirations are noted, perform rescue breathing by giving four quick breaths.

(4) If unable to ventilate the patient, reposition his head and attempt to ventilate again.

b. If you are unable to ventilate the patient, apply back blows.

(1) Kneel and roll the patient onto his side with his chest against your thigh.

(2) Deliver four sharp blows to the patient's back between his shoulder blades (Figure 13-85).

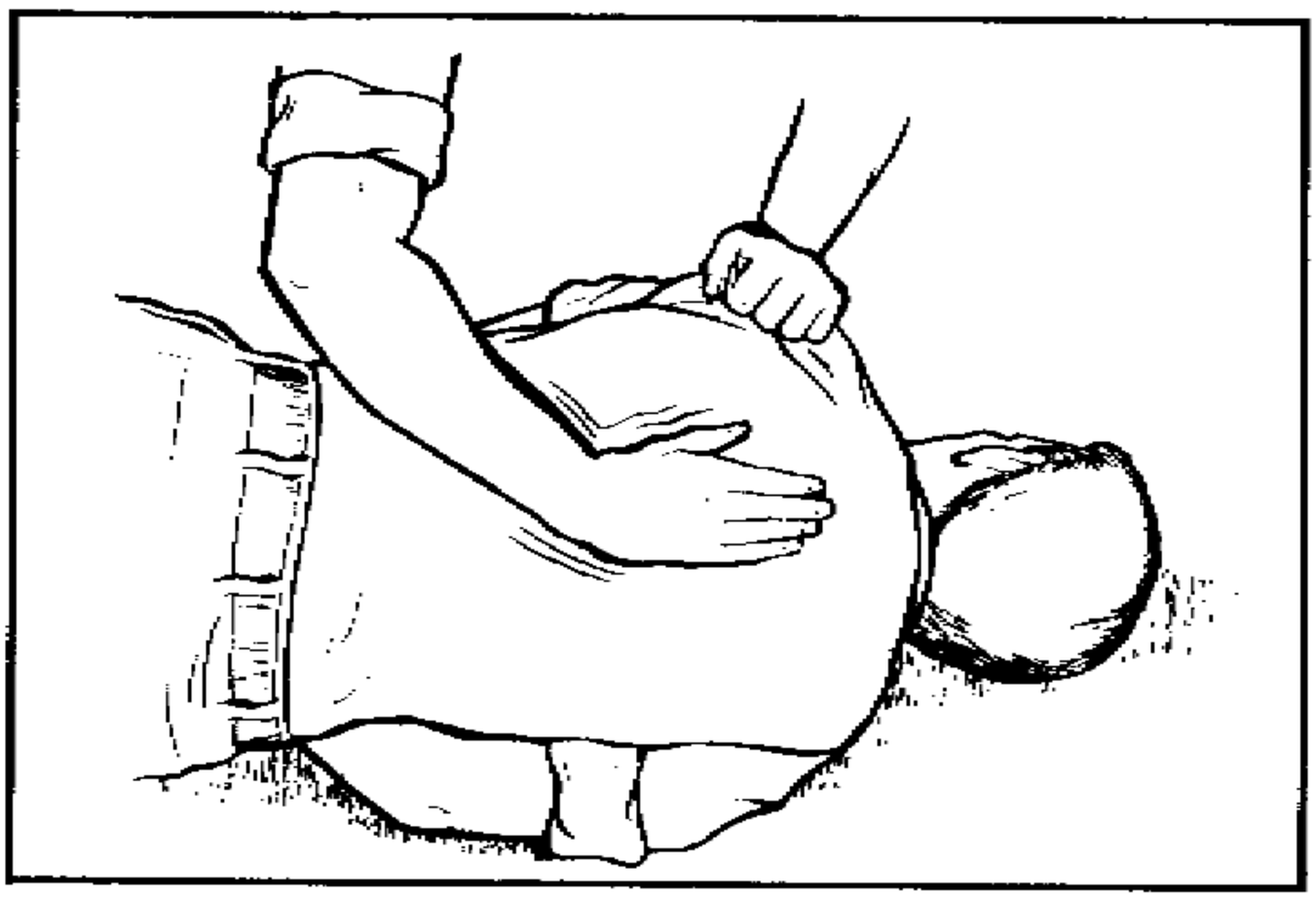


Figure 13-85. Applying back blows.

c. If unsuccessful, apply abdominal thrusts.

(1) Position the patient on his back and kneel beside him with your knees close to his hips or straddle him (Figure 13-86).

(2) Open his airway and turn his head to one side.

(3) Place the heel of your dominant hand against the patient's abdomen, in the middle between the xyphoid process and umbilicus (Figure 13-86).

(4) Move forward so that your shoulders are directly over the patient's abdomen.

(5) Press down on his abdomen with four quick inward and upward thrusts. Do not press to either side.

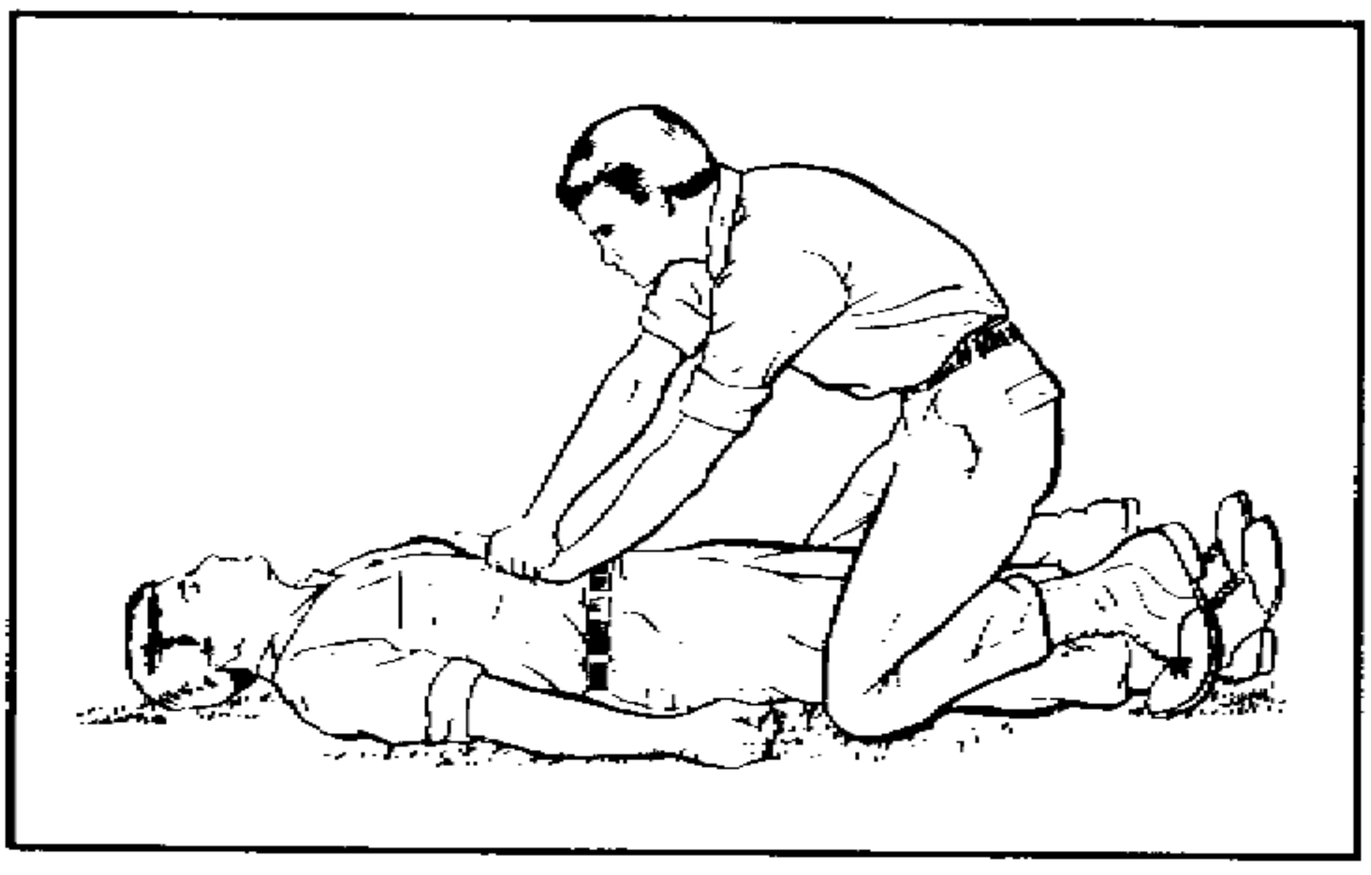


Figure 13-86. Abdominal thrusts (unconscious patient).

d. Apply chest thrust (alternative method used on obese or pregnant patients or patient with abdominal wounds).

(1) Place the patient on his back and kneel close to his side.

(2) Open the patient's mouth and turn his head to one side.

(3) Place your hands on the lower half of his sternum as you do in performing CPR.

(4) Exert four quick downward thrusts that compress his chest 1 1/2 to 2 inches as in CPR.

e. Apply finger sweep.

(1) With the patient's head up, open his mouth by grasping both his tongue and lower jaw between your thumb and fingers and lifting (tongue-jaw lift) (Figure 13-87). If you are unable to open his mouth, cross your finger and thumb (crossed-finger method) and push his teeth apart (Figure 13-88).

(2) Insert the index finger of your other hand down along the inside of his cheek to the base of the tongue.

(3) Use a hooking motion to dislodge the foreign body from the mouth (Figure 13-89).

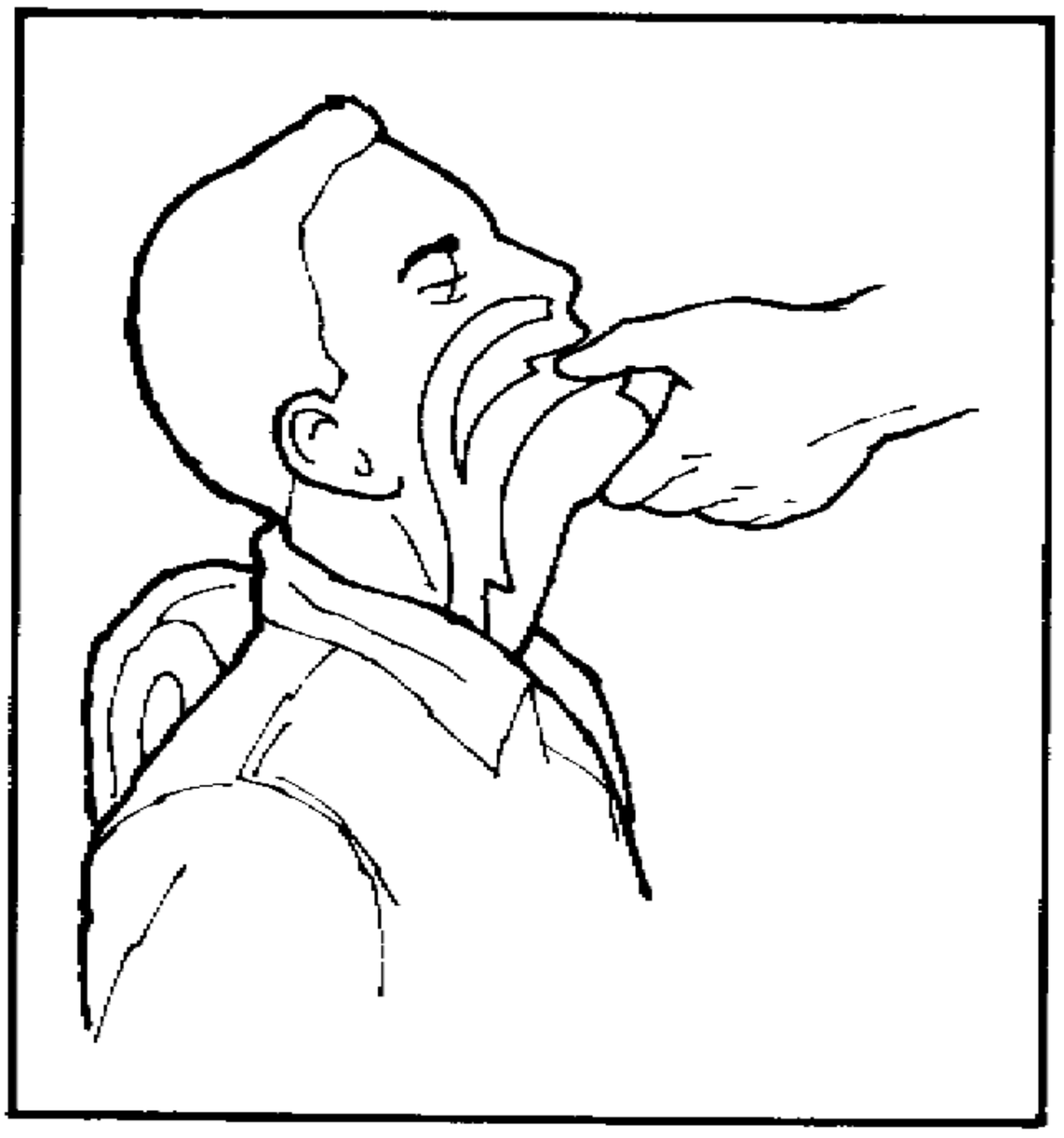


Figure 13-87. Opening the patient's mouth (tongue jaw lift).

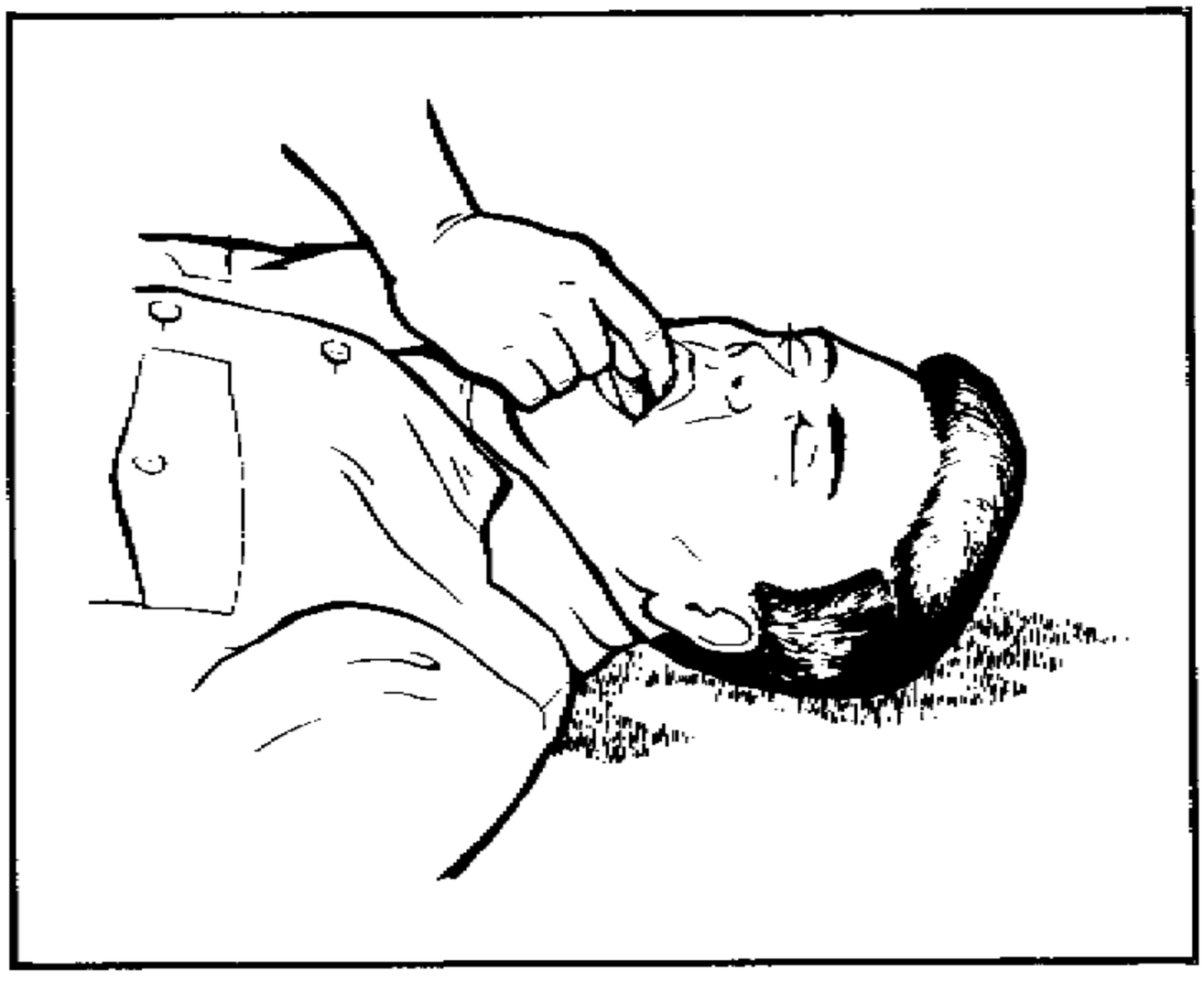


Figure 13-88. Opening the patient's mouth (crossed-finger method).

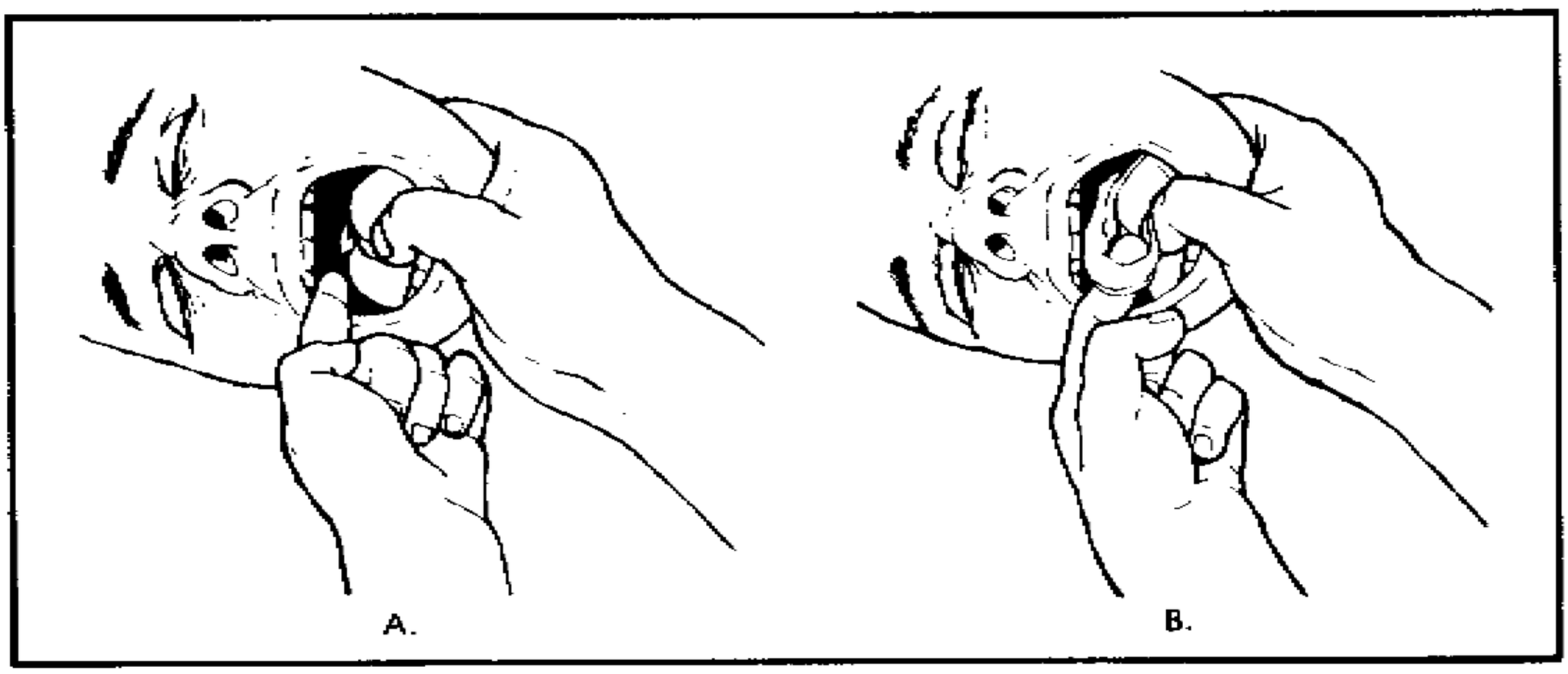


Figure 13-89. Using finger to dislodge foreign body.

NOTES

1. If a foreign body can be seen in the mouth, remove it with the fingers. If it cannot be seen, use a combination of back blows and manual thrusts to expel or dislodge it. Then remove it with the fingers.

2. Do not force the object deeper into the airway.

f. Attempt to ventilate the patient.

- If unable to ventilate the patient, repeat back blows, manual thrusts, and attempts to ventilate as often as necessary until the airway is cleared of the obstruction.

- If able to ventilate, perform rescue breathing (if patient has no spontaneous respirations).

g. Record treatment.

h. Evacuate patient, if necessary.

Section XI. MANAGEMENT OF CHEST INJURIES

13-89. General

Open chest injuries can be the result of many causes, but are *always* serious. Unless treated rapidly and correctly, the injury can cause permanent damage to the brain and nervous system. All penetrating chest wounds are treated as if they are sucking chest wounds; even though penetrating wounds in the thorax usually seal themselves. An opening in the chest wall that is approximately 2/3 the diameter of the trachea will severely compromise respirations.

13-90. Signs and Symptoms of an Open Chest Wound

- A "sucking" or"hissing" sound, produced whenever the patient inhales.

- Breathing difficulty.

- A puncture wound of the chest.

- An impaled object protruding from the chest.

- Froth or bubbles around the injury site.

- Coughing up frothy, bright red blood.

- Pain in the chest.

- Pain in the shoulder.

13-91. Treatment for an Open Chest Wound

a. Expose the wound by unfastening or cutting clothing away.

CAUTION

In a chemically contaminated environment immediately mask the patient (if not already masked) and quickly apply a dressing. Do not remove his clothing.

b. Examine the patient for an exit wound. Carefully palpate and/or visually examine the patient's chest and back to determine the presence and location of any exit wounds.

c. Treat the larger wound first.

d. Place an occlusive dressing on the chest wound.

(1) Cut the two short edges and one long edge of the field first aid dressing plastic outer wrapper and remove the contents.

NOTE

Vaseline gauze can be used, when available, for the initial dressing instead of the plastic wrapper. It can be covered by the sterile side of its plastic or foil wrapper.

(2) Open the wrapper carefully, touching only the edges. Apply the inner surface to the wound to provide a sterile covering (Figure 13-90). The covering should be large enough to extend two or more inches beyond the edges of the wound.

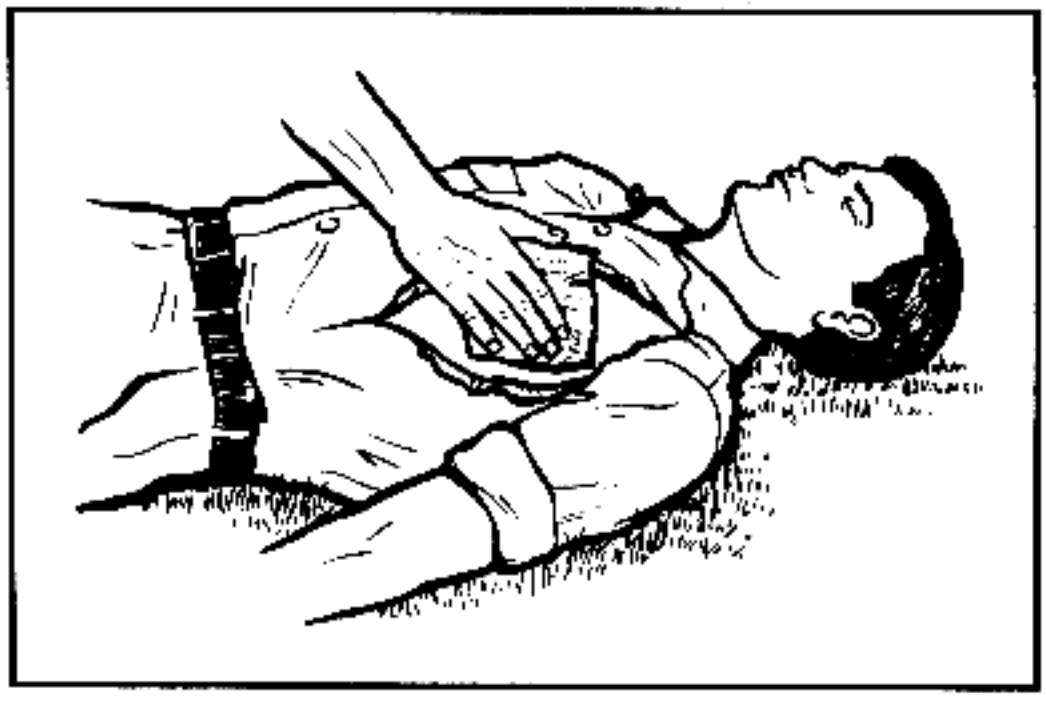


Figure 13-90. Applying occlusive dressing.

NOTE

In an emergency, use anything that can cover the wound and block air entrance.

(3) Tape the dressing on three sides to provide a flutter-type valve. As the patient breathes in, the dressing is sucked over the wound preventing air from entering. When the patient exhales, the open end of the dressing allows air to escape. Securely taping all edges of the dressing can cause a build up of air within the thoracic cavity and result in a tension pneumothorax.

NOTE

The bandage may be tied over the wound using a field first aid dressing, cravat, or other material if tape is not available.

e. Dress the wound by placing a field first aid dressing over the three-sided dressing and tie the dressing ends (tails) on the edge of the dressing loosely so as not to interfere with the flutter valve effect of the three-sided dressing (Figure 13-91). The purpose of the field dressing is to protect the wound and absorb secretions.

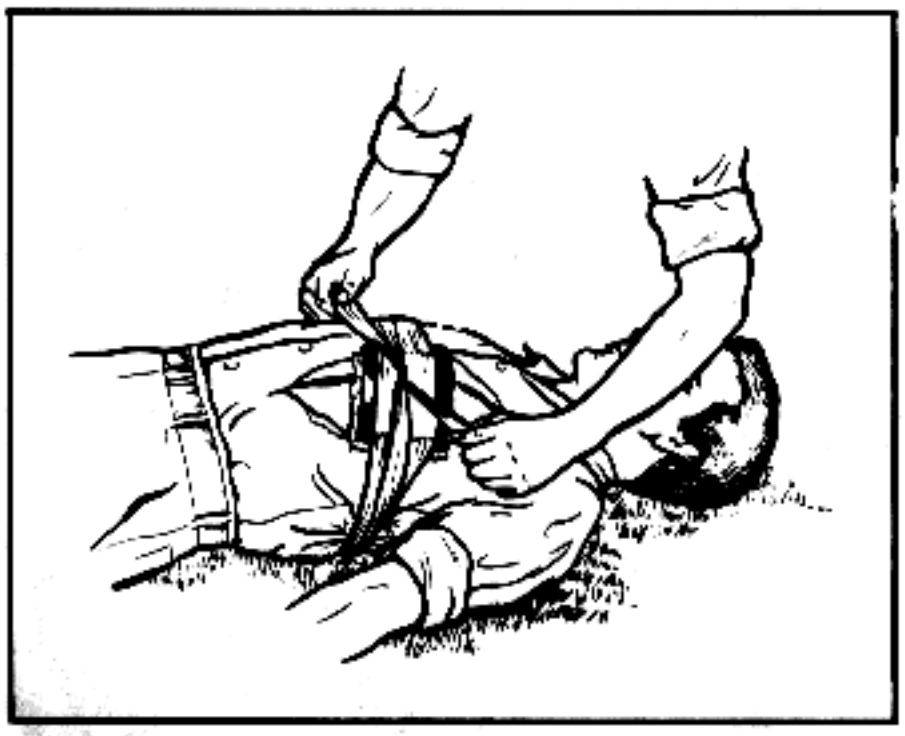


Figure 13-91. Applying a field first aid dressing.

CAUTION

Bandages tied tightly around the patient's chest can interfere with his ability to breathe.

f. Place the patient on his injured side to aid in the maintenance of an open airway (Figure 13-92). This position allows the good lung to function properly. It also prevents the collection of fluids in the chest cavity.

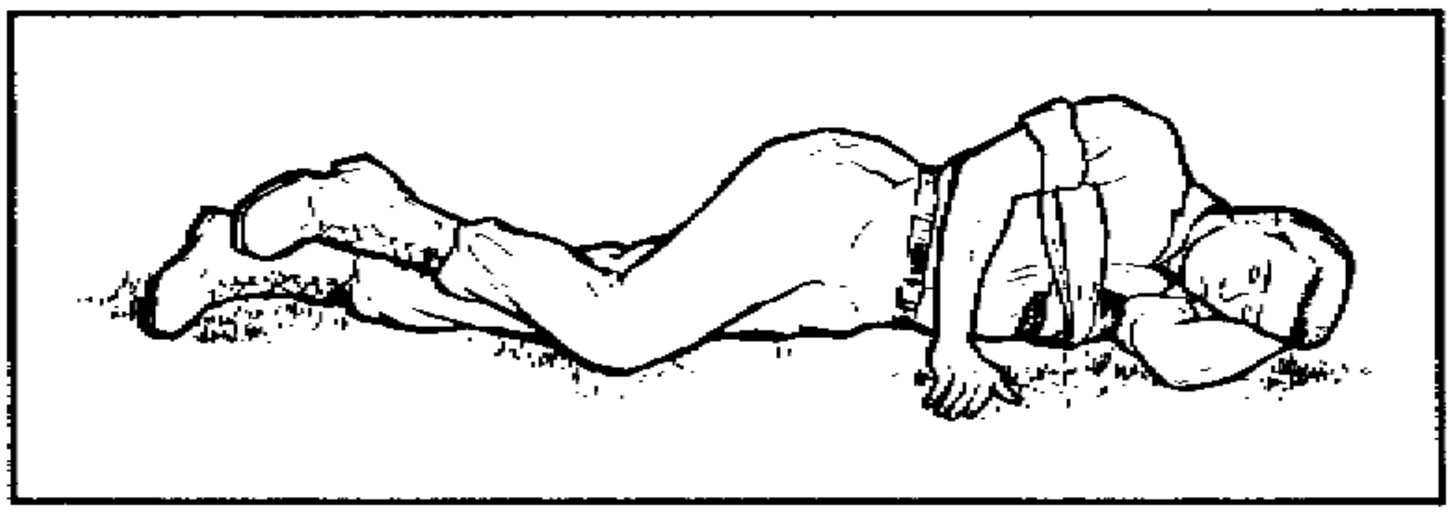


Figure 13-92. Patient on injured side.

g. Monitor the patient closely to maintain an open airway and a good seal on the wound.

h. Record treatment.

i. Evacuate the patient.

13-92. Closed Chest Wounds

a. The various types of closed chest injuries almost uniformly require the same initial care. The most important immediate consideration in any chest injury is to establish and maintain an open airway.

b. Fractured ribs result from direct blows and compression injuries to the chest. The ribs most often fractured are the fifth through the ninth. The first four ribs are rarely fractured because they are protected by the shoulder girdle. The lower (floating) ribs (11 and 12) are attached only to the spine and have a greater freedom of movement (Figure 13-93).

c. The most serious injury resulting from rib fractures is the "flail chest." This occurs when three or more ribs are fractured in two places or the sternum (breastbone) is fractured. The portion of the chest wall that is left unsupported by the fractured ribs causes paradoxical breathing (the reverse of normal respiration). That is, when the patient inhales, his chest moves inward. When he exhales, his chest moves outward. The lung under the fracture site does not expand because of the chest being sucked in during inspiration. This decreases the patient's oxygen intake.

d. Complications that can arise from closed chest injuries are—

- Pneumothorax—an accumulation of air in the chest cavity, but outside the lung (a fractured rib lacerating the lung).

- Spontaneous pneumothorax—due to the rupture of a bleb (blister) on the surface of the lung. A large bleb increases the possibility of a tension pneumothorax.

- Tension pneumothorax—a condition in which air enters the chest cavity through a hole in the lung which acts as a one-way valve. This valve allows air to enter the pleural space continuously, but not to leave the chest cavity. The increased pressure in the chest causes the lung to collapse but does not seal the hole in the lung. As the pressure on the affected side

continues to rise, the collapsed lung is pressed against the heart and opposite lung. This causes a mediastinal shift of the larynx, trachea, and heart toward the unaffected side. The uninjured lung is now mechanically compressed. As pressure in the chest cavity rises, it may cause the great vessels to become twisted or kinked and compromise or occlude the circulation. Blood can no longer be pumped from or return to the heart and death results rapidly. Definite signs of a tension pneumothorax are—

- Severe respiratory distress.
- Weak pulse and lower blood pressure.
- Bulging of the tissue between the ribs and above the clavicle.
- Distension of the veins in the neck.
- Tracheal deviation away from the affected side.
- Mediastinal shift away from affected side.

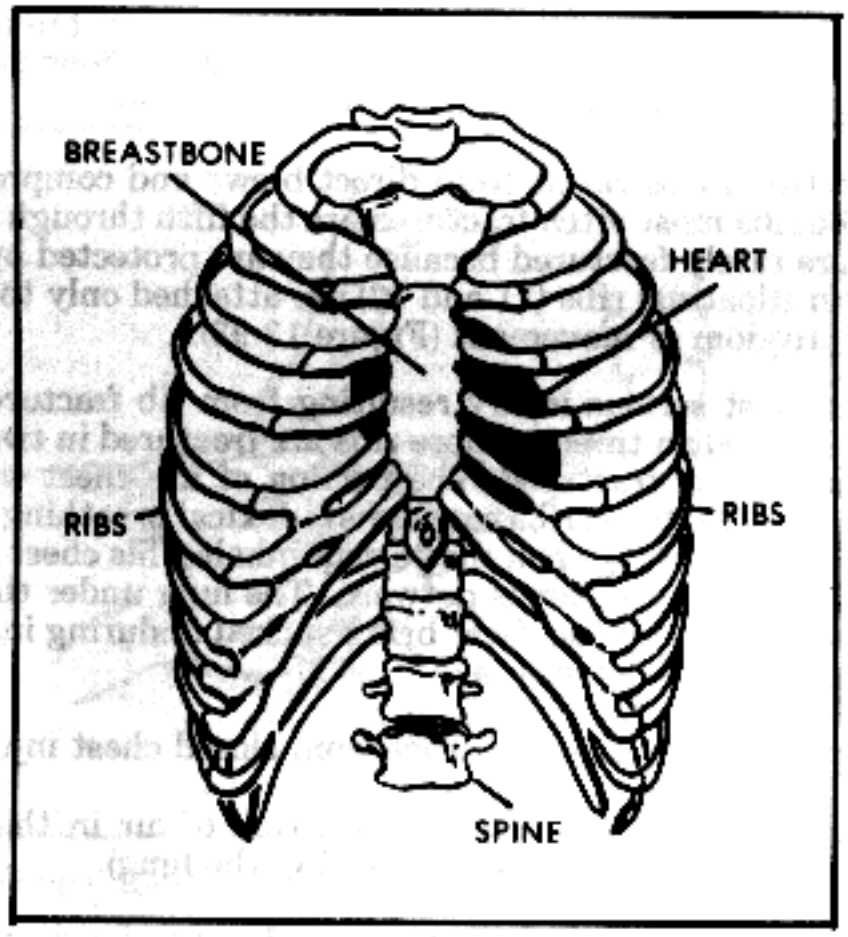


Figure 13-93. Rib cage.

- Hemothorax—an accumulation of blood in the chest cavity, but outside the lung. A hemothorax will frequently accompany a pneumothorax. The bleeding may come from lacerated vessels in the chest wall or lacerated major vessels in the chest cavity itself.

● Pulmonary contusion (lung bruise)—results from blunt injuries to the chest. This type of complication will react like a bruise to any other part of the body. Blood vessels in the lungs are injured and a considerable amount of blood is lost into the lung. The patient may or may not have respiratory distress.

● Rupture of major vessels—occurs within the chest cavity (superior and inferior vena cava, pulmonary arteries and veins, and the aorta). Injuries to any of these vessels may result in massive hemorrhage. Any patient in shock with evidence of a chest injury should be suspected of having injured one of the major vessels.

13-93. Signs and Symptoms of a Closed Chest Injury

● Pain at the site of the injury.

● Pleuritic pain—pain that is increased by or occurs with respirations. It is localized around the injury site.

● Hypoxia—low oxygen content in the blood.

● Dyspnea—shortness of breath or difficult breathing.

● Cyanosis—bluish color of the lips, fingertips, or fingernail beds.

● Subcutaneous emphysema—air in the subcutaneous tissue of the neck and chest.

● A rapid, weak pulse with low blood pressure—possible shock.

● Hemoptysis—coughing up blood or blood-tinged sputum.

● Failure of one or both sides of the chest to expand normally and equally on inspiration.

13-94. Treatment for Closed Chest Injuries

a. Simple rib fracture.

(1) Bind the patient's arms to his chest by using three cravats (Figure 13-94).

(2) Encourage the patient to take deep breaths to inflate his lungs. This will prevent hypoxemia and atelectasis (collapsed alveoli) by increasing the air volume and pressure in the alveoli (air sacs) of the lungs.

(3) Administer oxygen (if available).

(4) Record treatment.

(5) Evacuate patient.

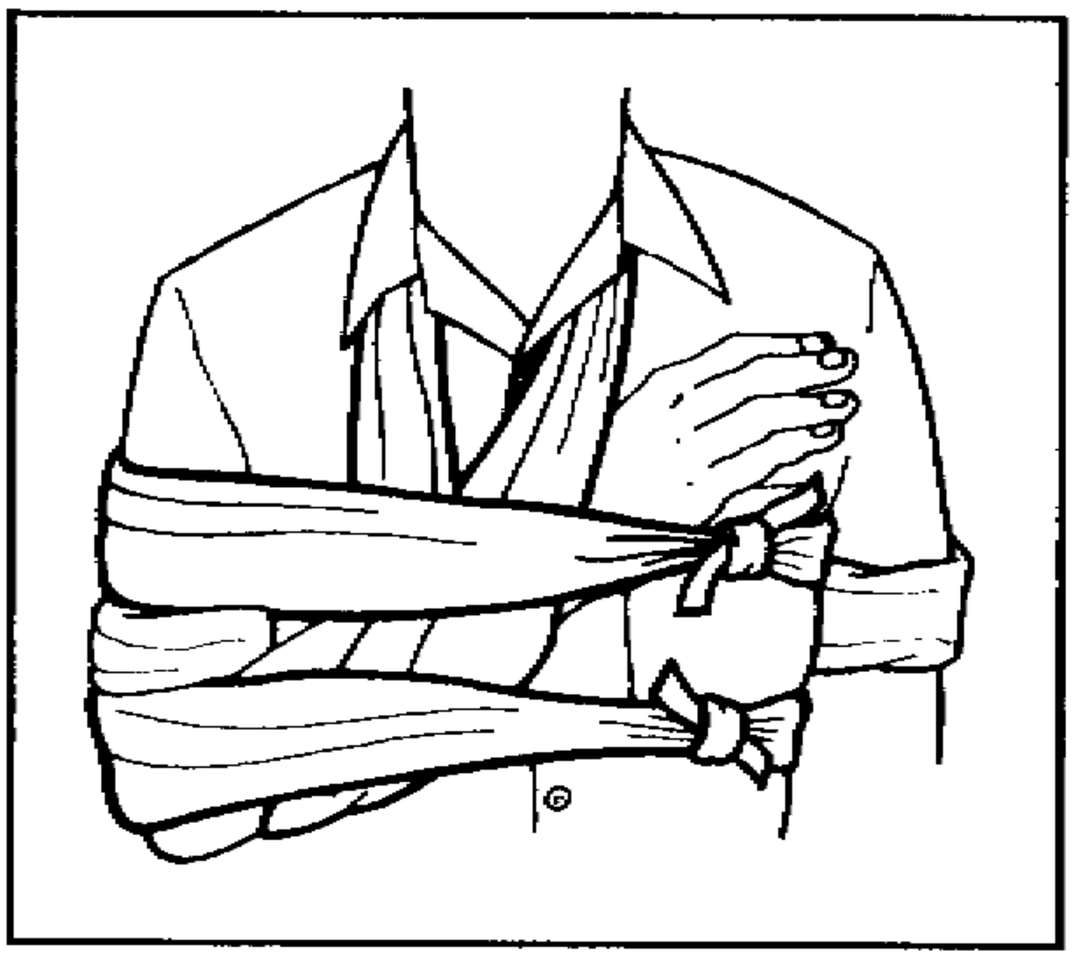


Figure 13-94. Binding a patient's broken rib.

NOTE

When binding a patient's arm to his chest, do not apply the cravats so tightly that they interfere with his breathing.

b. Flail chest.

(1) Establish the airway.

(2) Administer oxygen (if available).

(3) Assist the patient's respiration by using a Bag-Valve-Mask System, if available, or administer mouth-to-mouth or mouth-to-nose resuscitation (if necessary).

CAUTION

When administering assisted ventilation, monitor the patient closely for signs of a pneumothorax. Positive pressure breathing can worsen a pneumothorax or convert it into a tension pneumothorax.

(4) If a tension pneumothorax is suspected and the patient is cyanotic or manifests signs of cardiovascular compromise (frank hypotension—cold clammy skin), insert an 18 or 16 gauge needle into the chest cavity to decompress the pleural space (Figure 13-95). Slowly insert the needle in the second or third intercostal space at the mid-clavicular line until a "hiss" of air is heard. *Get your ear down there and listen!* Secure the needle to the patient and place a flutter valve, or improvised valve (cut finger of a rubber glove), over the end of the needle (Figure 13-96). The most experienced medical person available should perform this procedure.

CAUTION

Do not insert the needle on the underside of the superior rib. All of the blood vessels and nerves are in this area.

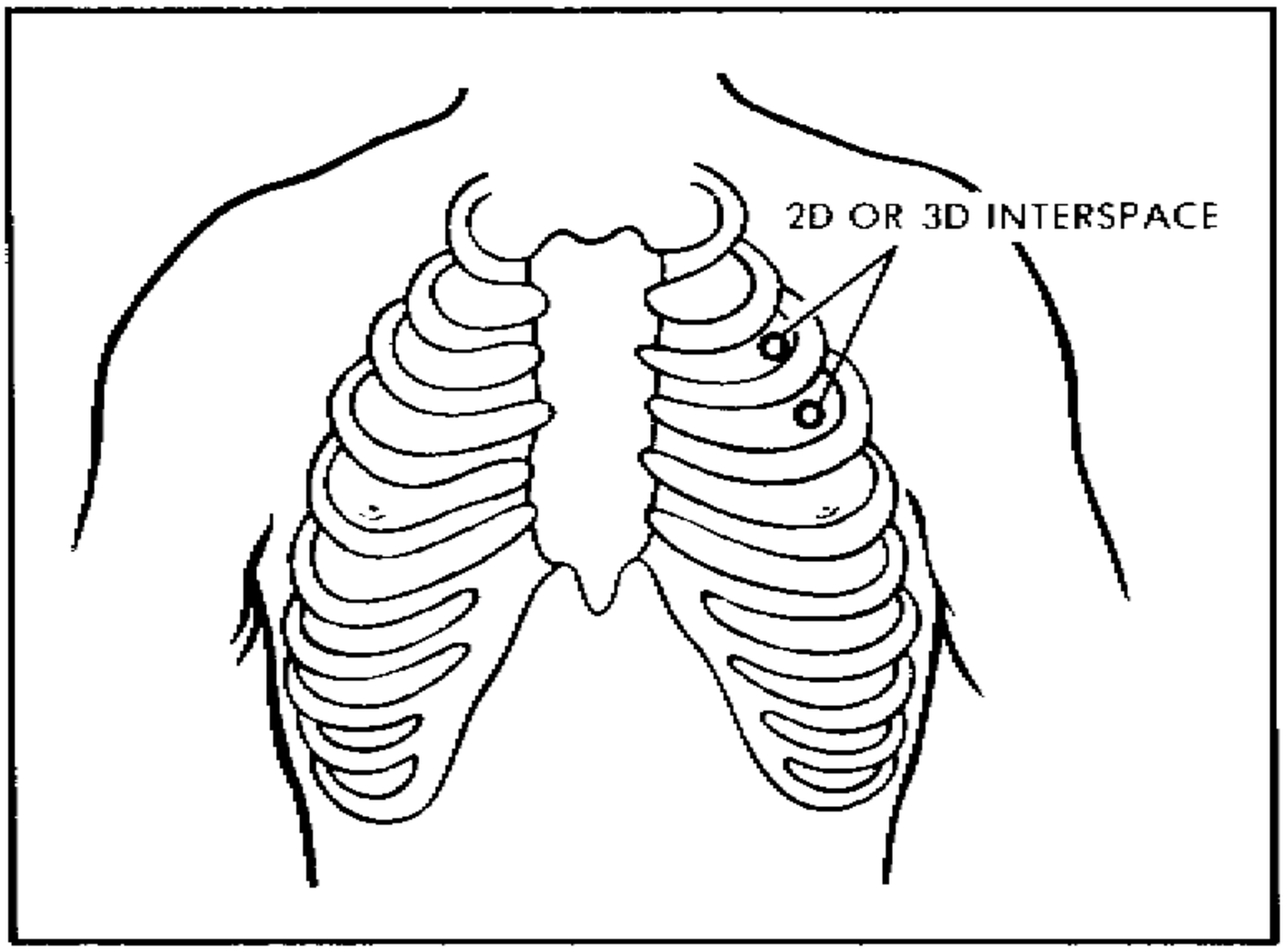


Figure 13-95. Needle insertion sites for tension pneumothorax.

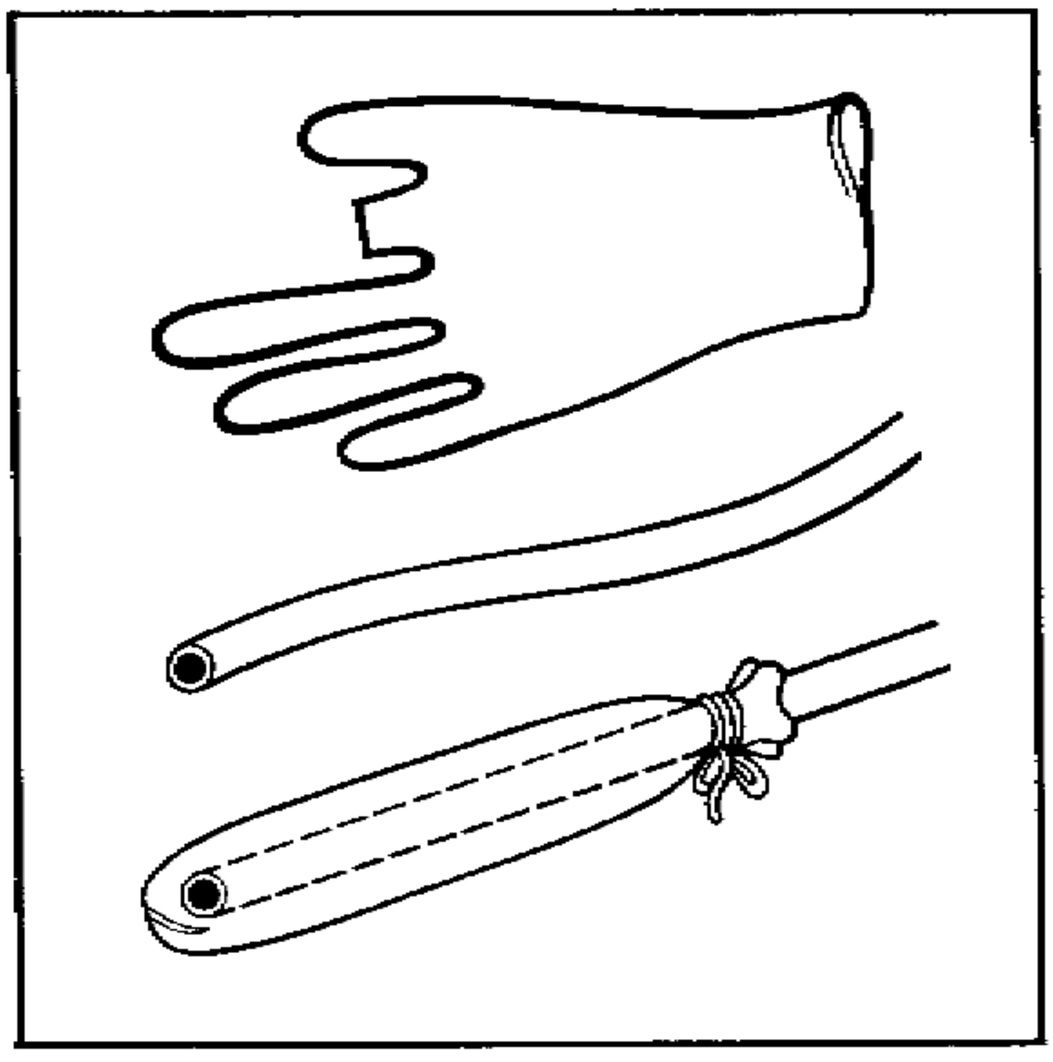


Figure 13-96. Improvised flutter valve.

(5) Start an intravenous infusion at TKO rate (if available).

(6) Stabilize the flail segment (Figure 13-97).

(7) Apply constant firm manual pressure by using sandbags, pillows, a folded blanket, a field jacket, or a poncho.

(8) Tape the pressure material in place with strips of tape.

(9) Have patient lie on the injured side.

NOTE

The chest should not be wrapped or taped around its diameter. This limits the ability of the chest to expand and increases breathing difficulties.

c. Treat patient for shock (if necessary).

d. Record treatment.

e. Evacuate the patient.

CAUTION

A patient with a pneumothorax who is to be evacuated by helicopter should have a flutter valve in place. This is to allow the air to escape that may accumulate in the chest cavity with atmospheric pressure changes. If a flutter valve is not in place, the aircraft should be flown as low as safety and the tactical situation permits. Closely monitor the patient.

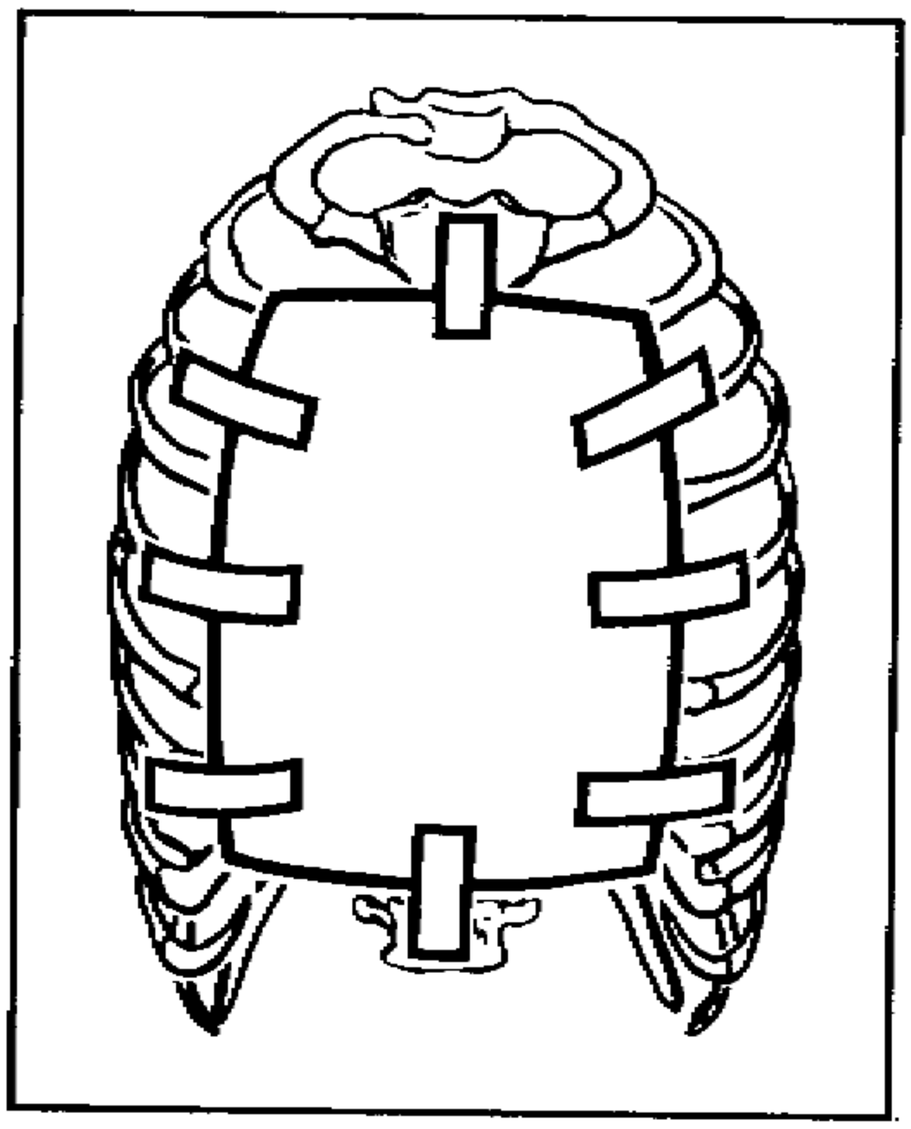


Figure 13-97. Stabilized flail chest.

Section XII. MANAGEMENT OF THE CONVULSIVE AND/OR SEIZURE PATIENT

13-95. General

a. Convulsions and seizures can occur at any age and are associated with many diseases and disorders. They follow no single pattern or form. They usually last from a few seconds to several minutes, but may be even further prolonged. Loss of consciousness may or may not occur. Do not use the terms *convulsion* and *seizure* interchangeably.

b. Terminology.

- *Convulsion* is involuntary muscular contractions, usually accompanied by unconsciousness.

- *Seizure* is the entire activity, such as, muscular contractions, incontinence of bowel and bladder, and unconsciousness.

- *Aura* is a sensation that warns a person of an uncoming convulsion.

- *Clonic* is the alternate muscular contraction and relaxation in rapid succession.

- *Tonic* is muscle tension (stiffness or rigidity).

c. Causes.

- Head trauma.
- Epilepsy.
- Cerebral vascular accidents (strokes).
- Drug and alcohol withdrawal.
- High fever.
- Other psychologic and neurologic disorders.

13-96. Types of Convulsions/Seizures with Signs and Symptoms

a. Petit mal. Patient appears to be day dreaming (staring into space).

b. Focal (Jacksonian). Usually involves one part of the body in tonic-clonic twitching (arm or face). It may progress from fingers, toes, or face twitching on one side to involve one entire limb or side of the patient's body. It may progress rapidly to a generalized seizure.

c. Grand mal (generalized). In this type of seizure, there is a loss of consciousness and an intense tonic-clonic activity. The patient may have incontinence and tongue biting, along with mental confusion. These symptoms may be followed by drowsiness or coma.

d. Status epilepticus. A series of convulsions without intervening periods of consciousness and is a medical emergency. Repeated convulsions (if uncontrolled) can lead to aspiration, anoxia (absence or lack of oxygen), brain damage, fractures of the long bones or spine, trauma to the head, and injury to the tongue (due to biting).

13-97. Treatment for Convulsive and/or Seizure Patients

The primary purpose of caring for a convulsive and/or seizure patient is to prevent him from injuring himself. Expedient actions and evacuation to an MTF are crucial to the patient's health and welfare.

a. Maintain the patient's airway.

(1) Loosen his clothing at the neck.

CAUTION

Patient may have excessive mucous and other secretions. Close observation is necessary to prevent aspiration and suffocation.

(2) Remove his dentures (if applicable) or other loose objects from his mouth.

WARNING

Do not forcibly open the patient's jaw if his teeth are clenched. To do so may cause injury to the teeth and gums.

(3) Insert a padded tongue blade between his back teeth (if jaw is relaxed) or an oropharyngeal airway (J-tube) to prevent him from biting his tongue and to assist in maintaining an open airway.

(4) Look for a medical warning tag.

CAUTION

Do not elevate his head since it may cause the tongue to fall back into the throat and obstruct the airway.

NOTE

Patient will not swallow his tongue.

(5) Turn his head slightly to one side, if possible.

b. Prevent injury to the patient.

(1) Remove or pad objects that may cause injury to the patient while he is thrashing about on the ground or floor.

(2) Do not restrain his limbs during the seizure as this can cause muscle injuries and long bone fractures.

c. Closely observe and accurately record all aspects of seizure activity.

(1) How long did the seizure last? (Be as accurate as possible.)

(2) Was there evidence of cyanosis, breathing difficulty, or a temporary absence of breathing?

(3) What was the level of consciousness (before, during, and after the seizure)?

(4) Was the seizure preceded by aura?

(5) Which muscles were involved and where did it start?

(6) What type of contractions (tonic, clonic, or both)?

(7) Was there bowel/bladder incontinence?

(8) Does the patient have a previous history of seizures, head trauma, or drug/alcohol abuse?

NOTE

In Jacksonian seizures, motor symptoms begin in a hand or foot and move up the extremity, or spread from a corner of the mouth.

d. After the convulsive state of the seizure—

(1) Place the patient on his side.

(2) Continue to maintain the airway.

(3) Have suction equipment nearby, if available.

(4) Observe for periods of temporary cessation of breathing.

(5) Place the patient in a quiet, reassuring atmosphere to minimize agitation and combativeness when he begins to wake up. Sudden loud noises may cause another seizure.

e. Record the patient's actions and the treatment given.

f. Evacuate the patient. The patient must be seen by a physician for follow-up care to determine the cause of the seizure.Evacuate the patient on a litter and administer oxygen en route, if available.

Section XIII. ABDOMINAL AILMENTS AND INJURIES

13-98. General

a. The term "acute abdomen" is used to indicate the presence of any one of a wide variety of abdominal disorders. An acute abdomen requires definitive care and usually surgical intervention. Severe pain is present in an acute abdomen.

b. The primary concerns in the acute abdomen is to *recognize the situation*, perform life-saving measures, and evacuate the patient. It is not important that the aidman be able to make a differential diagnosis.

c. The more common acute abdominal conditions are described in Table 13-3.

13-99. Signs and Symptoms of an Acute Abdomen

- *Abdominal pain.* Which quadrant is it in and is it localized or diffused (Figure 13-98)? If localized, it may give a clue as to the organ involved.

- *Abdominal tenderness.* Tenderness may be minimal or such that the patient may "guard" his abdomen by tightening his stomach muscles and will not allow his abdomen to be touched.

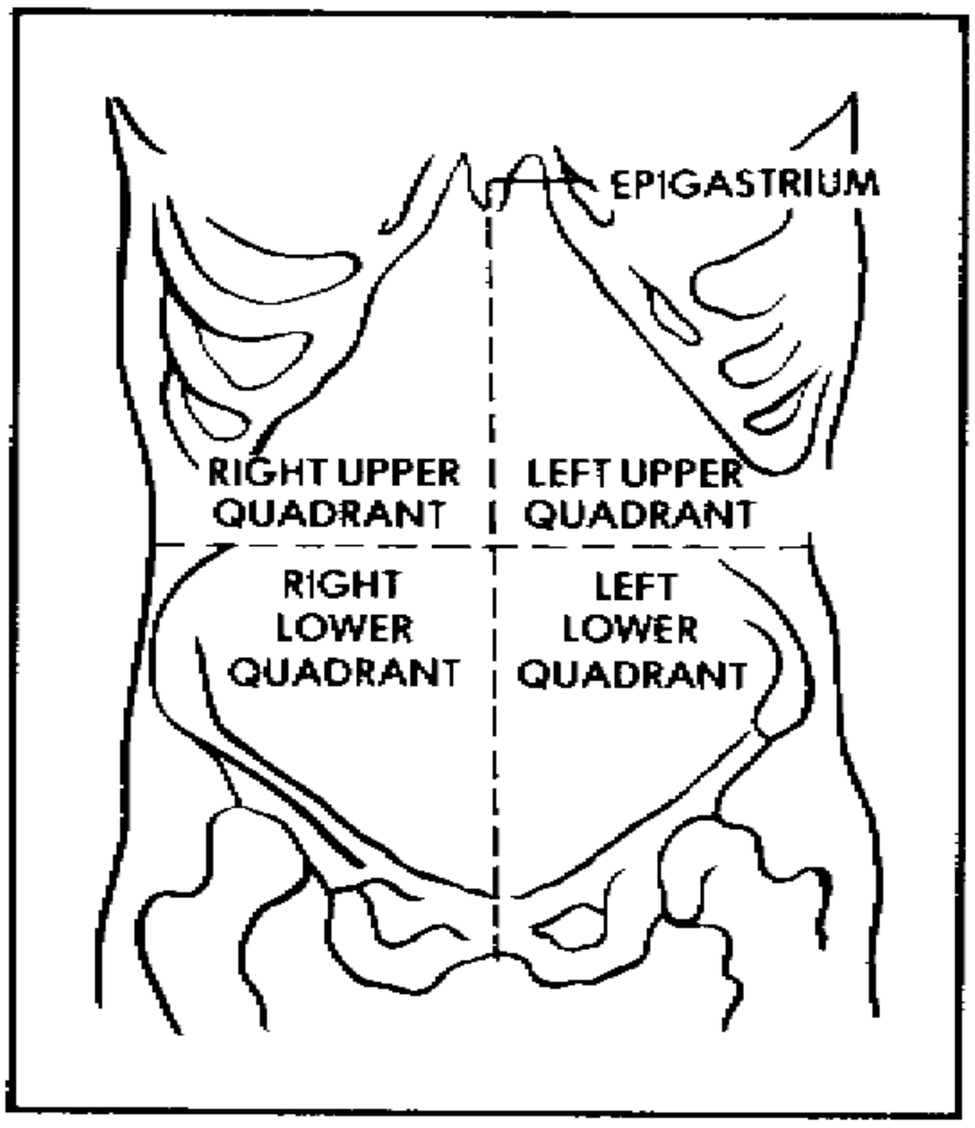


Figure 13-98. Quadrants of the abdomen.

- *Patient position.* The patient does not want to move because it hurts to do so. The position of the patient is an important clue. In some diseases, the patient is comfortable in only one position. For example, with appendicitis the patient may draw up his right knee or both knees. A specific position helps to relax the muscles adjacent to the inflamed organ and lessen the pain.

- *Rapid, shallow breathing.* If breathing is painful, severe peritonitis may exist. However, increased respiration with any acute pain is common.

- *Tachycardia.*

- *Low blood pressure.*

- *A tense, often distended (enlarged or swollen) abdomen.*

- *Vomiting.* Vomiting is not uncommon with an acute abdomen; it may be bloody or even fecal in nature.

13-100. Treatment for an Acute Abdomen

a. *Gently* palpate his abdomen (Figure 13-99) for signs of—

(1) Rigidity (stiffness) of the abdominal wall.

(2) Pulsating (throbbing) masses (lumps or enlarged organs).

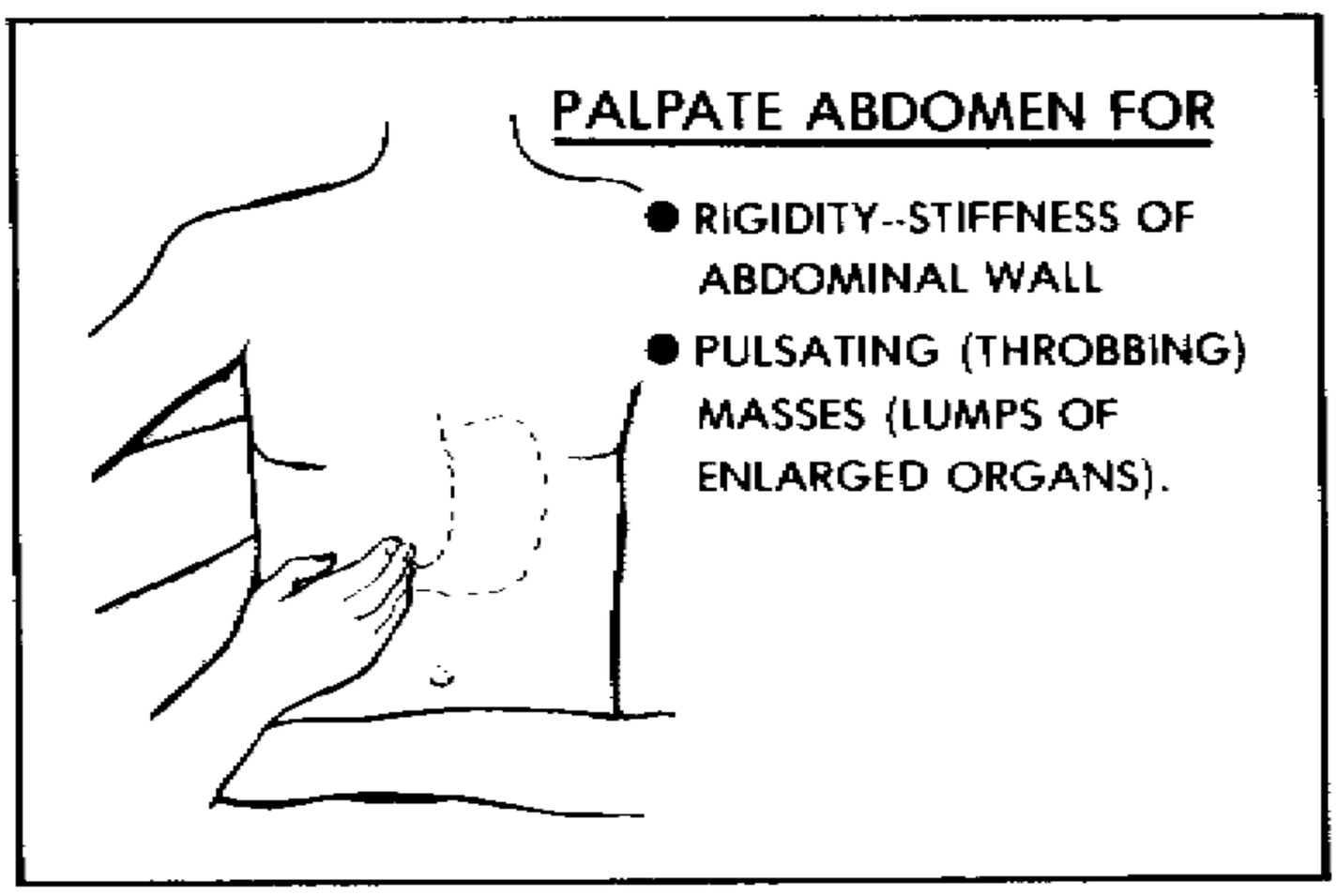


Figure 13-99. Palpate the abdomen.

CAUTIONS

1. Occasionally, an organ within the abdomen will be enlarged and very fragile. Palpating can cause rupturing of an aortic aneurysm (an out-pouching of the artery wall) and laceration (tearing) of the spleen.

2. Do not give pain medication to the patient. Pain medication will conceal the signs and symptoms prolonging the time required to diagnose the cause.

b. Check his vital signs.

c. Initiate intravenous infusion.

d. Treat for shock, if indicated.

CAUTION

Do not give the patient anything to eat or drink. This may further complicate his condition and cause vomiting. The patient may also require immediate surgery. Food in the stomach and intestines may cause complications during surgery (vomiting and aspiration of stomach contents).

e. Obtain a patient history. Inquire about—

(1) *Location of the pain.* Certain organs, like the stomach, give reasonably good localization of pain. In diseases of other organs, the patient may have pain anywhere in the abdomen.

(2) *Radiation of the pain.* Certain types of abdominal pain have typical areas of radiation. The pain of pancreatitis often radiates straight through to the back. Pain from an inflamed gallbladder may radiate around the right side to the scapula (shoulder blade).

(3) *Quality of the pain.* Cramping or intermittent pain suggests involvement of hollow organs.

- Colic—hollow organ.
- Burning—as with excessive acid.
- Boring—as with pancreatitis.
- Sharp—as with perforated organs.
- Pulling—as with ischemic bowel.

(4) *Duration of the pain.*

- Since onset—if more than 6 hours—pathological.
- Constant or intermittent.

(5) *Intensity of the pain (mild or severe).*

- Awakes patient from sleep.
- Causes patient to pass out.

(6) *Nature of onset of the pain.*

- If pain is rapid in onset—moderately at first and becoming rapidly worse, consider acute pancreatitis or strangulation of the small bowel.

- Gradual.

(7) *Presence or absence of vomiting.*

(8) Change in bowel habits or the stools.

- Constipation or diarrhea.
- Bloody or tarry (black) stools.
- Stool morphology (shape)—cylindrical or ribbon.
- Rectal bleeding.

f. Record the treatment given.

g. Evacuate the patient. When in doubt about the patient's condition or diagnosis, evacuate him as quickly and gently as possible.

13-101. Open Abdominal Injuries

a. The presence of an open abdominal injury can be a shocking discovery in the evaluation of a casualty. He is not in immediate danger if there is no profuse internal bleeding or perforated (punctured) organs. Severe abdominal wounds with perforated organs or heavy bleeding require complicated and prolonged treatment procedures to improve life expectancy. Triage would, therefore, require a priority of EXPECTANT in *a mass casualty situation.*

b. The most important concern in the initial treatment of abdominal injuries is shock caused by internal bleeding. Bleeding may be present initially or may develop later. The presence or absence of bleeding or the size of the wound are not safe indicators of the internal damage.

13-102. Treatment for an Open Abdominal Injury

a. Survey the patient.

CAUTION

Do not give the patient anything by mouth due to possible vomiting and aspiration. Fluids given by mouth can cause damaged internal organs to leak and result in further intra-abdominal contamination.

(1) If the patient is thirsty, use a wet gauze to moisten his lips.

(2) Place the patient on his back, unless other wounds prevent it, to keep the internal organs inside the wound.

(3) Turn the patient's head to one side to keep the airway clear, should vomiting occur.

CAUTION

When an open abdominal wound has arterial bleeding, the vessel(s) must be occluded (tied or clamped) to prevent shock or possible death. This is done ONLY by more highly trained medical personnel.

b. Apply a field dressing.

(1) Flex the patient's knees to relax the abdominal muscles and any internal pressure. This is usually the most comfortable position for bandaging and transporting the patient.

CAUTION

Do not attempt to replace protruding internal organs since this can cause further injury. Carefully place the organs on or near the wound before applying the dressing and to prevent further contamination. If a foreign object is protruding from the abdomen, treat the patient as for other impalement injuries.

(2) Only sterile field dressings are used to cover open abdominal wounds. The dressings must be large enough to cover the entire mass of extruded organs or area of the wound (Figure 13-100).

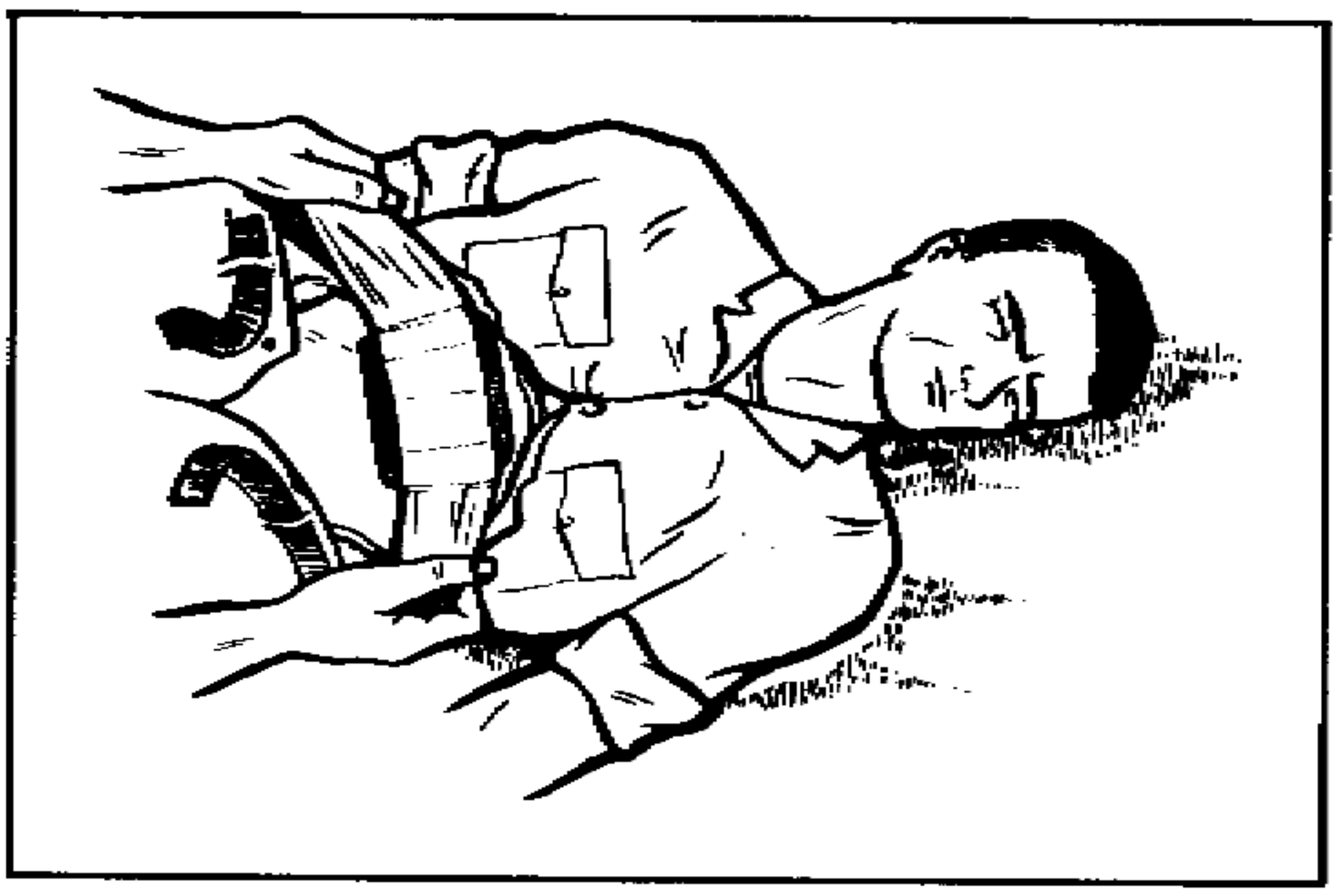


Figure 13-100. Field dressing placed on the wound.

(3) If the plastic wrapper is large enough to extend well beyond the protruding bowel, place the sterile side directly over the wound with the dressing on top.

CAUTION

Do not moisten the dressing. A moist dressing will act as a wick for bacteria to enter. Do not apply pressure to abdominal wounds or exposed internal organs. This can cause further injury, such as ruptured intestines. To avoid pressure on the injury, tie the dressing (tails) loosely at the patient's side, not directly over the dressing.

(4) If more than one dressing is needed to cover a large wound, repeat the previous procedures. Do not tie the dressing knots over each other.

(5) Cover field dressings with cravats for added support and protection. Tie the cravat on the side opposite the dressing ties (Figure 13-101).

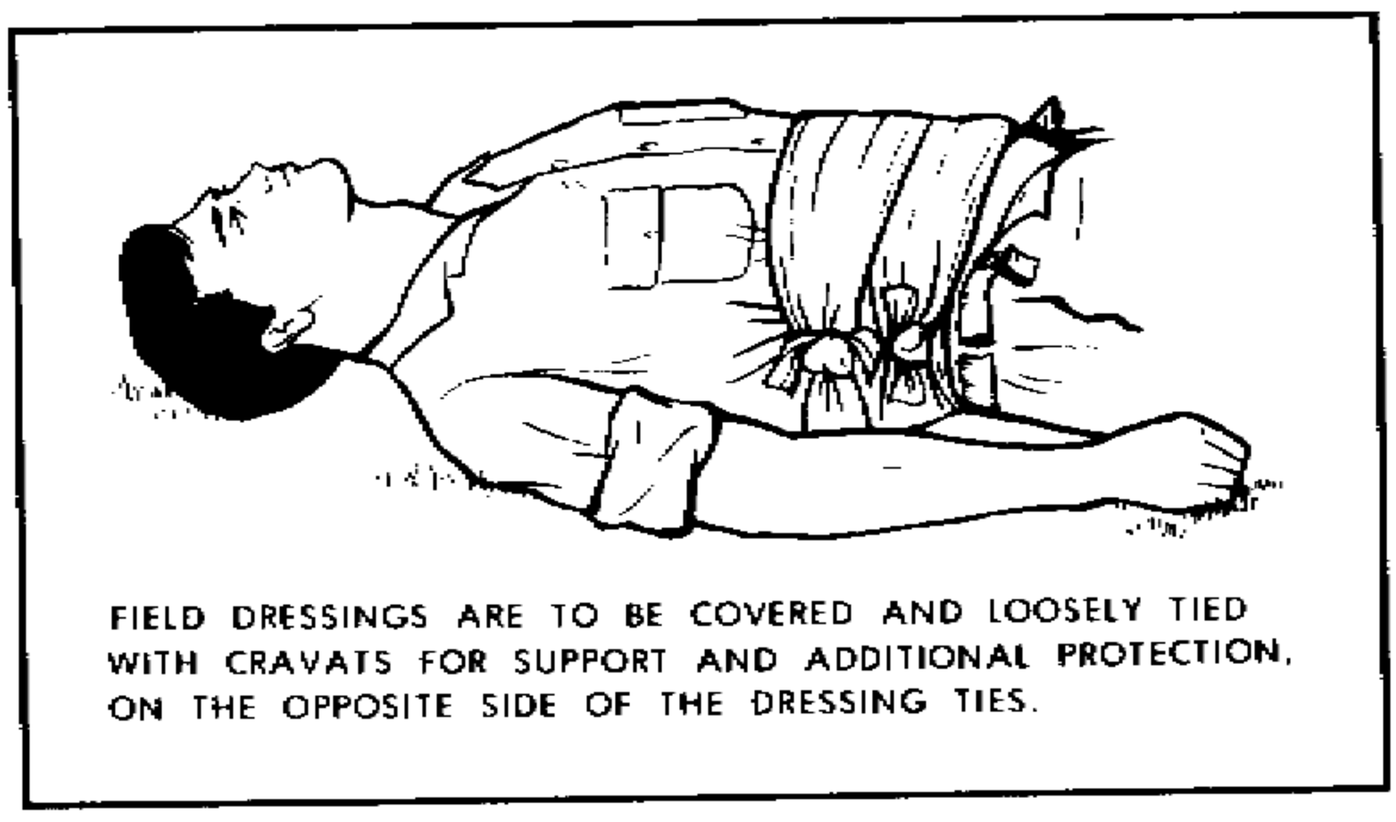


Figure 13-101. Cravats tied on the side opposite the dressing.

c. Insert a large bore IV and infuse lactated Ringer's solution.

NOTE

The IV is started at a rate of 10 milliliters per hour and is increased if signs of shock develop. If available, MAST trousers should be applied to treat shock. *DO NOT* inflate the abdominal section if internal organs are protruding from the wound.

d. Record treatment.

e. Evacuate the patient.

- If evacuation to the MTF is delayed, the patient must be monitored frequently (every 15 minutes or less, if possible) for signs of shock.

- Evacuate the patient with his knees flexed.

Section XIV. IRRIGATION OF THE EAR

13-103. General

a. Irrigation of the ear is the flushing of the external ear canal with a gentle stream of solution. The ear may be irrigated to—

- Cleanse the external auditory canal.
- Soften and remove impacted wax (cerumen).
- Apply heat to the tissues of the ear canal.
- Apply antiseptics or medications.

b. Never use irrigation procedures to remove foreign objects such as beans or corn. Moisture causes vegetable matter to swell. Irrigations are not used if a patient's eardrum is punctured. The additional irritation can cause middle ear infection by transmitting debris or discharge from the external canal to the middle ear.

13-104. Treatment for an Obstructed Ear

a. Verify the need for irrigation of the ear.

b. Perform patient care handwash.

c. Gather the necessary equipment.

(1) Collect the irrigating syringe, protective drapes, otoscope set, emesis basin, irrigating solution, and at least two 4- by 4-inch sponges.

NOTE

There are three general types of syringes used to irrigate the ear: a rubber bulb syringe, an asepto syringe, and a metal Pomeroy syringe (Figure 13-102). Common solutions used to irrigate the ear include tap water, normal saline, hydrogen peroxide and water mix, or a solution of bicarbonate of soda and water. The hydrogen peroxide and water mix is often used to soften and remove impacted ear wax.

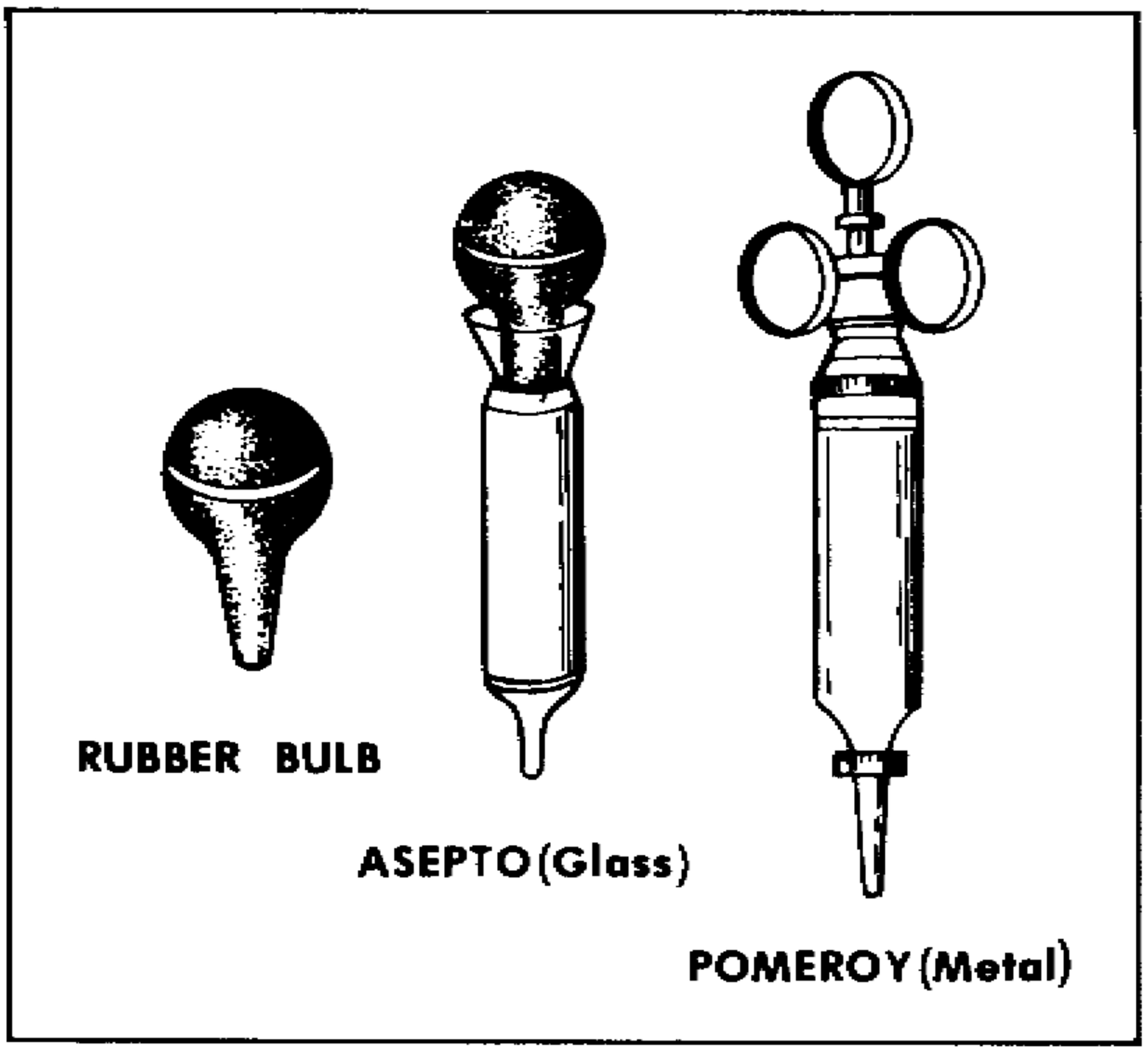


Figure 13-102. General types of syringes.

(2) Use the otoscope to see the external ear canal. It comes equipped with specula of differing sizes. The speculum is an instrument used to expose the interior passage of a body cavity (in this case, the ear).

(3) When viewing the external ear canal with the otoscope, use the largest speculum that will fit comfortable into the meatus (opening) of the ear in order to see the largest portion of the external ear. Before and after use, cleanse the speculum with alcohol.

d. Warm and test the irrigating solution. Warm the irrigating solution and test the temperature by allowing a small amount of the fluid to run on the inner part of your wrist. If the solution feels hot, wait until it cools. It may be necessary to prepare the irrigating solution. Request supervisor's assistance if solution mixing is necessary. Mixing solutions may be warmed by placing the container of solution in a pan of warm water. The irrigating solution should be about body temperature (95^{o} to 105^{o}F). Solutions that are warmer or cooler than the body temperature feel uncomfortable for the patient and may cause tissue injury, nausea, or dizziness.

e. Explain the irrigation procedure. Tell the patient what is to be done and ask for his cooperation and assistance. He may feel some discomfort when the solution is introduced into the ear, but he must remain as still as possible. If he moves, the syringe may damage the ear canal or tympanic membrane.

f. Insert an otoscope speculum into the external ear canal.

(1) Tip the patient's head toward the shoulder opposite the ear to be irrigated.

(2) Straighten the external ear canal by gently pulling the auricle upward and backward (Figure 13-103).

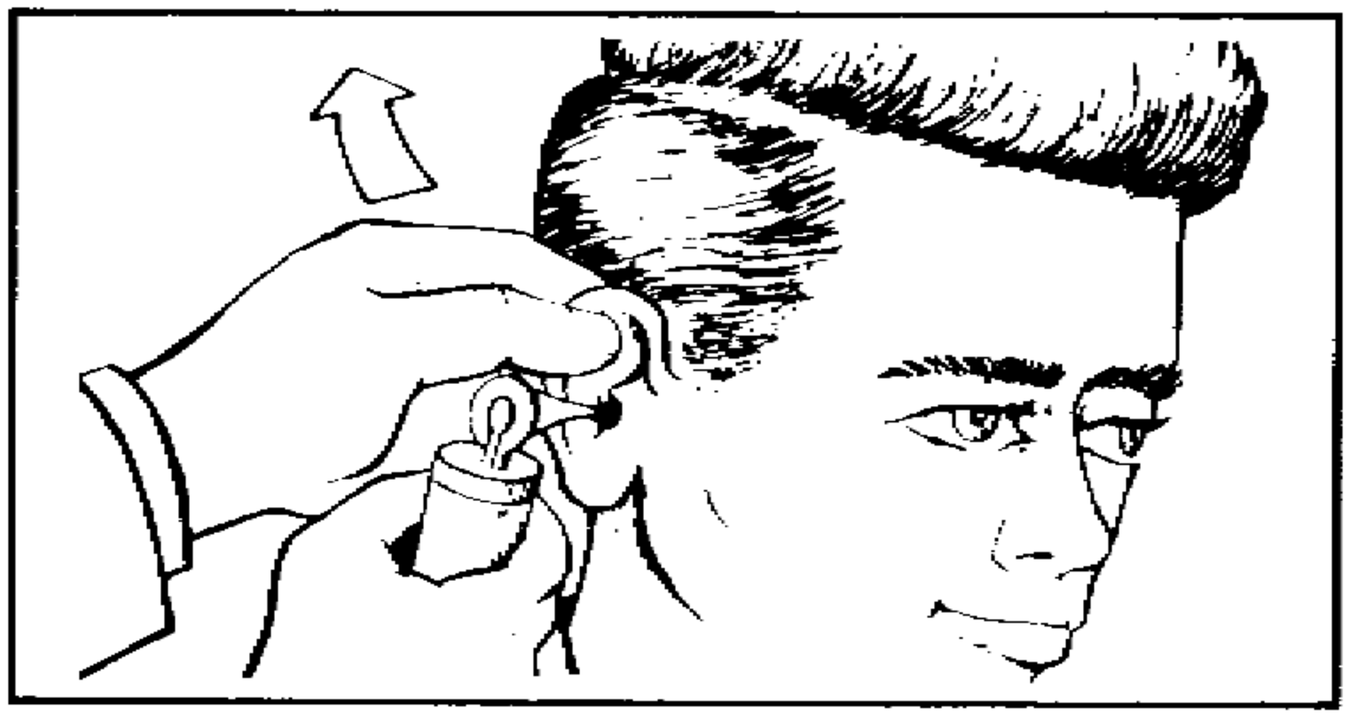


Figure 13-103. Straightening the external ear canal.

(3) Turn on the otoscope light and gently insert the speculum just inside the opening of the ear (Figure 13-104).

(4) Look into the ear canal through the lens of the otoscope.

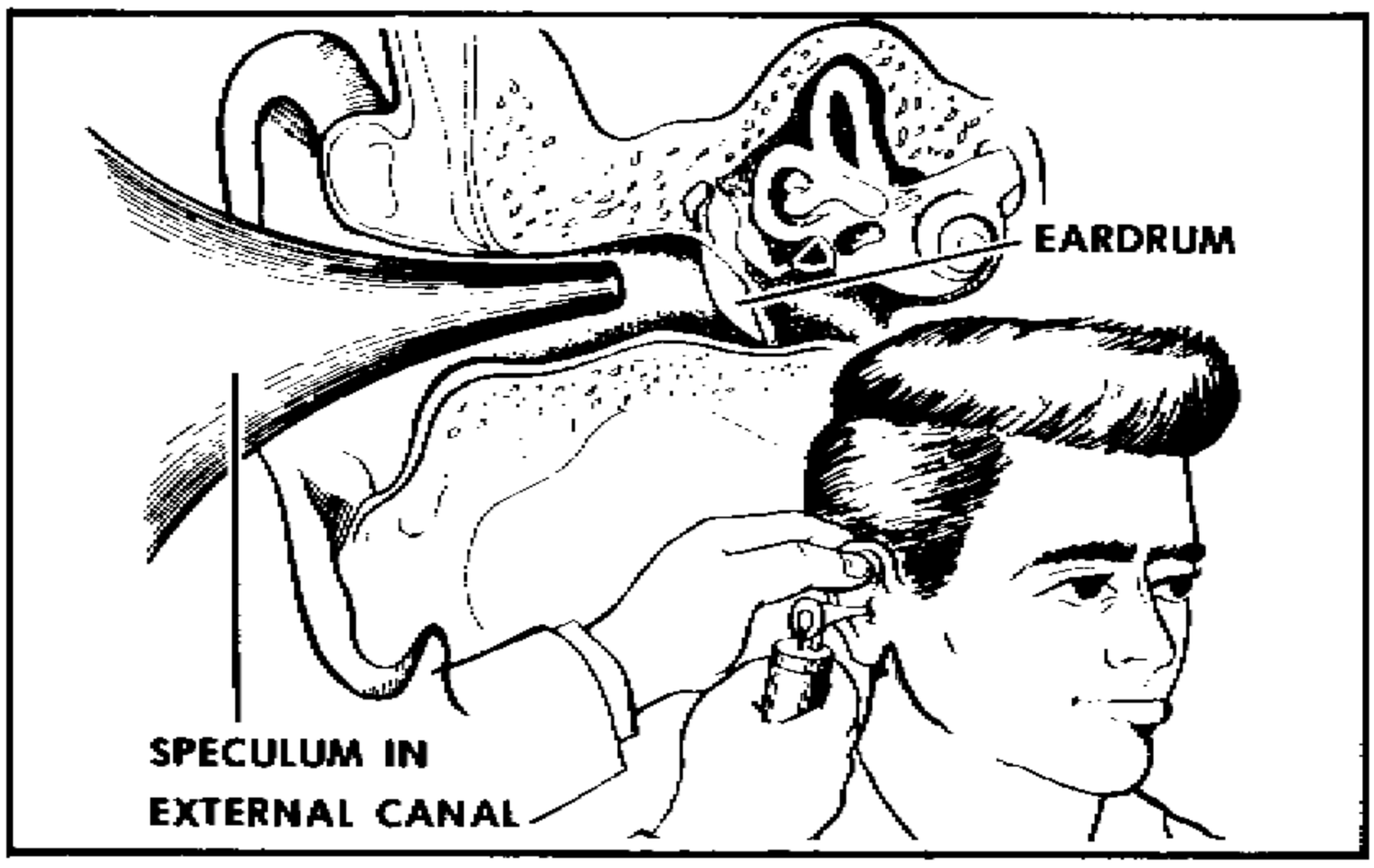


Figure 13-104. Speculum inserted in the ear opening.

NOTES

1. Ask the patient if he has had a history of draining ears or if he has ever had a perforation (puncture) of the eardrum or other complications from a previous irrigation. If the answer is yes, check with your supervisor before irrigating the patient's ears.

2. The inner two-thirds of the external meatus (opening) is sensitive to pressure. To avoid causing the patient any pain, insert the speculum gently and not too far into the ear canal.

g. Observe the external ear canal and tympanic membrane. Check the external ear canal for redness, swelling, drainage, or foreign bodies. Also check for bulging or perforation of the tympanic membrane in addition to the color.

NOTES

1. The external ear canal is normally clear, with small amounts of wax. If redness, swelling, or discharge are present, do not irrigate the ear, but report it to your supervisor.

2. A normal, healthy tympanic membrane is slightly cone-shaped, shiny, translucent, and pearly gray in color. When disease is present, the eardrum changes color. If a blue, yellow, amber, red, or pink color is observed, it usually indicates disease or infection and the ear should not be irrigated.

3. An outward bulging of the eardrum indicates the presence of pus or fluid in the middle ear. Do not irrigate the ear.

h. Reposition the patient, if necessary. Place the patient in a sitting or lying position, if necessary. Tilt his head slightly *toward the side to be irrigated.*

CAUTION

Do not turn the patient's head toward the unaffected side. This interferes with the return of the irrigating solution.

i. Drape the patient. Place a protective drape (towel) under the affected ear, covering the shoulder and upper arm.

j. Place one of the sponges in the irrigating solution, wring out excess solution, and clean any debris from the external ear and meatus of the ear canal.

NOTE

Cotton swabs can be used for cleansing the auricle (external ear) area only. This will prevent carrying any debris or discharge deeper into the ear canal when the speculum is inserted.

CAUTION

Do not insert the cotton swab too far into the ear. This could rupture the tympanic membrane.

k. Fill the irrigating syringe.

(1) Grasp the syringe bulb end or plunger.

(2) Depress the bulb or plunger of the irrigating syringe.

(3) Place the tip of the syringe into the solution.

(4) Release the bulb or pull back the plunger to fill the syringe.

l. Test the flow of the solution from the syringe. Discharge a small amount of solution back into the container. This will expel the air and aid in determining the amount of pressure required to make a steady, gentle stream. If necessary, fill and refill the syringe several times to obtain a"feel" for a smooth operation prior to irrigation.

m. Position the emesis basin. Place the emesis basin just below the ear on the affected side. Press the basin firmly against the patient's neck (Figure 13-105). Instruct him to hold the basin in place.

n. Straighten the ear canal. Gently grasp the auricle of the affected ear and gently pull up and backward.

o. Irrigate the patient's ear.

(1) Place the tip of the irrigation syringe just inside the meatus of the ear with the tip directed toward the roof of the ear canal (Figure 13-106). Directing the angle of the flow toward the roof of the ear canal prevents injuring the eardrum and forcing any material or debris into the canal. A circular current is set up with fluid flowing in along the top and out the bottom of the canal.

(2) Depress the bulb or plunger of the irrigating syringe.

(3) Direct a slow, steady stream of irrigating solution against the roof of the ear canal.

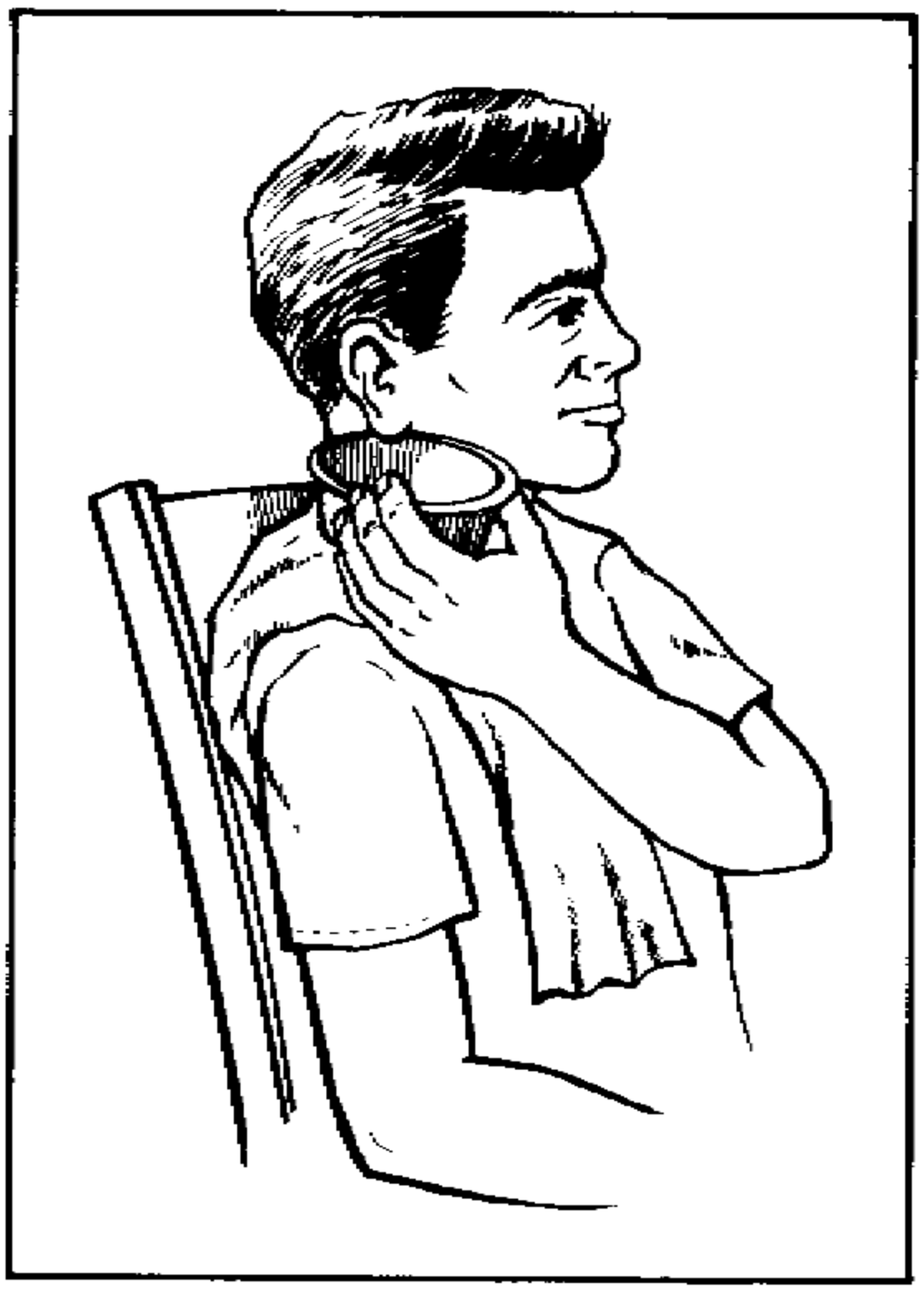


Figure 13-105. Basin placed below the ear.

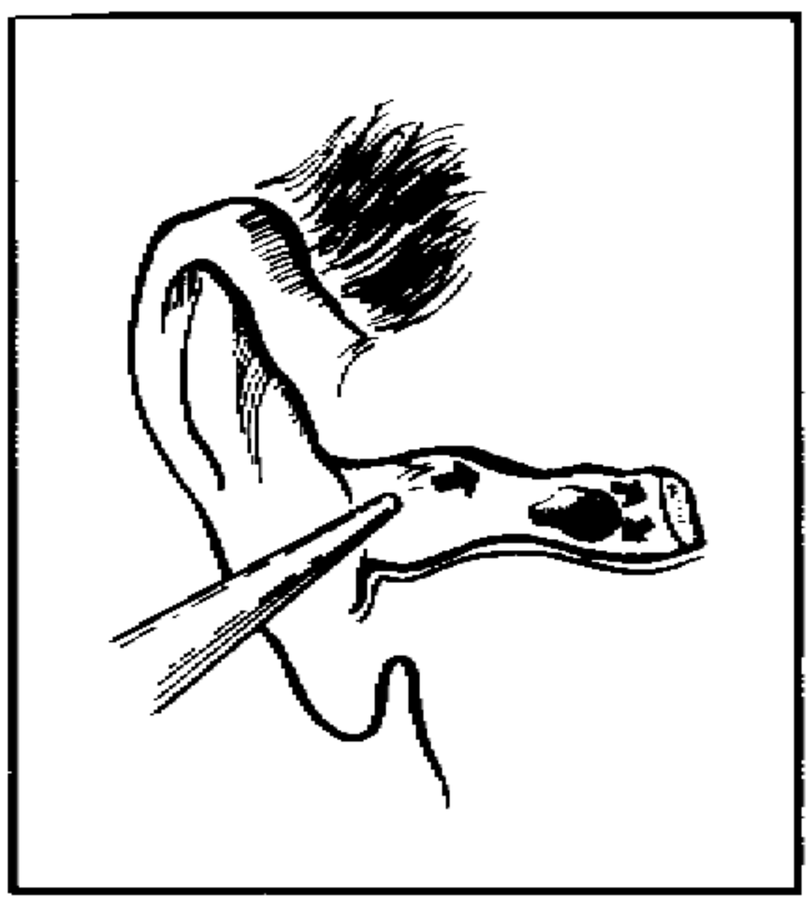


Figure 13-106. Irrigation syringe placed inside the ear.

CAUTION

Never completely block the ear canal with the irrigating syringe. If space is not left around the syringe tip, the solution will not be able to return and pressure in the canal will result.

p. Repeat steps *k.* through *o.* above until the irrigating solution returns free of wax and debris.

NOTE

If the physician or supervisor has not specified the amount of solution to be used, only use 500 cc's. This is sufficient for cleaning the canal. If no material comes out with the return flow from the ear, repeat the procedure or notify the physician.

q. Dry the external ear. Remove the emesis basin and wipe any solution from the external ear with a 4- by 4-inch sponge.

r. Have the patient keep his head tilted toward the affected side for a few minutes. This will allow any remaining solution to drain out of the ear.

s. Remove the drape.

t. Dispose of and/or clean and store the equipment used.

u. Perform patient care handwash.

v. Report and record the irrigation procedure. Include the date and time of irrigation, kind and amount of solution used, and nature of the return flow. EXAMPLE: 21 Mar 84, 1500: Right ear irrigated with 500 cc's warm tap water. Returning solution contained brown wax particles. John Doe, PFC, 91A10.

Section XV. MANAGEMENT OF EYE INJURIES

13-105. General

a. Emergency medical care for eye injuries is extremely important to the patient, especially on the battlefield. The eye injury may not only cause severe pain, but loss of orientation due to loss of or decreased sight. The patient with an eye injury may have total or at least partial loss of one of his senses. He must constantly be reassured that what is being done for him is to save his eyesight.

b. Even though only one eye is injured, both eyes must be bandaged. Since both eyes move together, any movement of the uninjured eye will cause the same movement of the injured eye. This involuntary movement can cause further damage to the injured eye.

13-106. Irrigating the Eyes

Eye irrigation is washing the eye surface or conjunctival sac with a gentle stream of liquid. The conjunctiva (mucous membrane) lines the eyelids and surrounds the eyeball. Irrigations are given for various forms of conjunctivitis (inflammation of the conjunctiva), for cleansing, to combat infection, or for treating chemical injuries to the eyes.

13-107. Procedure for Irrigating the Eyes

a. Verify the requirement for irrigation.

(1) Check the doctor's orders. Follow the supervisor's directive or the local SOP.

(2) Be sure you have the correct type and proper concentration of the irrigating solution.

(3) Make sure you know which eye requires treatment.

NOTE

Right eye—O.D. (oculus dexter);

Left eye—O.S. (oculus sinister);

Both eyes—O.U. (oculus uterque).

b. Verify the patient. Ask the patient his name. Check his identification band, if available.

c. Inform the patient. Tell him of the need for the eye irrigation. Explain the procedure.

d. Position the patient.

(1) If the patient is in bed or on a litter, have him lie on his back with his head turned slightly to the side to be irrigated.

(2) If he is sitting up, have him tilt his head slightly backward and to the side that is to be irrigated. Support his head while irrigating the eye.

e. Protect the patient from splash. Cover him with a waterproof cover and/or towel in areas that may be splashed by the solution.

NOTE

When irrigations are used for any type of conjunctival infection (pink eye), take every precaution possible to control the spread of the disease to health care providers, to other patients, or to the uninfected eye. A waterproof transparent protective dressing (Buller's shield) is recommended to protect the noninvolved eye of the patient. You may protect your eyes by wearing glasses or goggles.

f. Position the "catch" basin.

(1) Place an emesis basin next to the affected side of the face in a position to catch the outflow. If a basin is not available, have the patient hold a towel or sponge near the eye to catch the fluid.

(2) Show the patient how to hold the basin to the side of the face to receive the irrigating solution.

g. Position the light. If necessary, position the light so that you can see. However, do not shine the light directly into the patient's eye(s).

h. Perform patient care handwash.

i. Clean the eyelids. Before irrigation, carefully clean the eyelids with sterile water. Remove any secretions or particles that may be adhering to the lashes and that could be carried into the lacrimal area (the tear gland area).

MOIST HEAT is of great value in cleaning discharge and crusts from the eyelids. A gauze sponge soaked in comfortably warm water and squeezed free of excess water can be placed OVER THE CLOSED EYE for several minutes. This helps loosen and remove adherent crusts and matter. A small piece of moist cotton or gauze may then be used to remove any remaining debris.

j. Separate the eyelids. Separate the eyelids very gently by placing the thumb and index finger of your nondominant hand on the cheek and brow (just below and above the eyelids) and apply gentle tension to open the lids.

CAUTION

NEVER PUT PRESSURE ON THE EYEBALL. Pressure on the eye must be avoided. The eye is not rigid and is very sensitive to any pressure.

k. Irrigate the eye.

(1) Make sure that the prescribed irrigation solution is at body temperature. Direct the flow of the fluid gently from the INNER CANTHUS to the OUTER CANTHUS along the conjunctival sac (Figure 13-107). Instruct the patient to look down. Having the patient look down exposes the upper part of the eye for irrigation. Instruct the patient to look up. Having the patient look up exposes the conjunctiva in the lower part of the eye for irrigation.

(2) Use only that pressure (force) of the liquid stream that is required to maintain a steady flow. The amount of solution varies with the desired effect.

(3) Do not touch the eye during irrigation. You must avoid contamination of the solution or irrigator and possible injury to the eye.

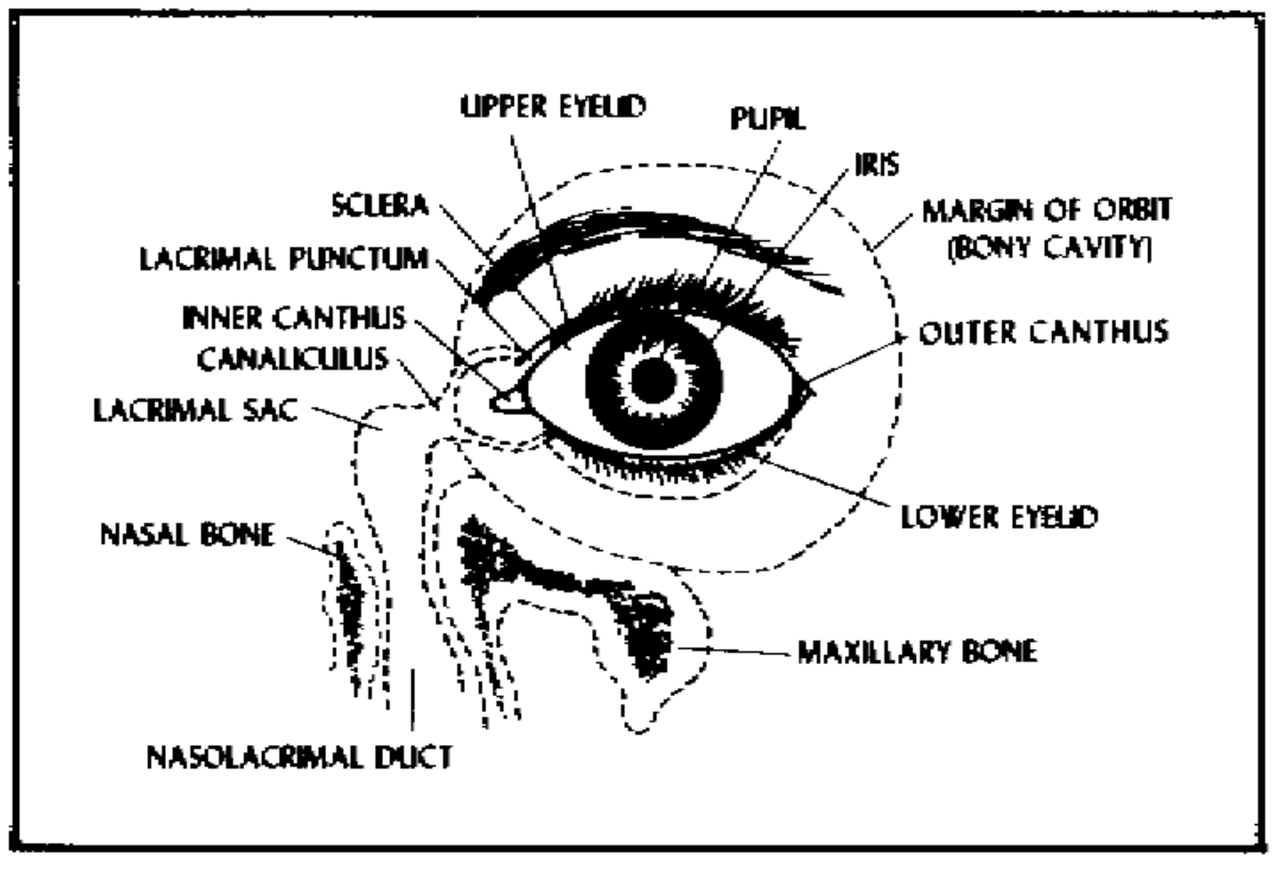


Figure 13-107. The eye.

l. Dry the eyelids. Gently pat the eyes after the sac has been thoroughly flushed.

m. Perform patient care handwash.

n. Record the treatment given. Record the kind and amount of fluid that was used and the effect on the patient.

13-108. Foreign Bodies in the Eye

Pieces of dirt and debris, particles of rust, or similar small objects can blow or fall into the eyes. The material usually sits on the surface of the eyeball or becomes stuck between the eyelid and eyeball. Often, if the patient closes his eyes for a few moments, the tears will move the object to the corner of the eye where it can be removed. Most other objects can be safely removed by gently washing them out with water. Other objects can be removed by gently wiping them away with a slightly moistened cotton swab or the edge of a clean handkerchief.

13-109. Treatment for Foreign Bodies in the Eye

a. Locate the foreign body.

CAUTION

If there is any evidence of damage to the eyeball, or if any object is suspected of sticking into the eyeball, **STOP**. Make no attempt at treatment. You may cause additional tissue damage. Put a light bandage on both eyes and evacuate the patient to an MTF.

(1) Method one.

- Pull down on the lower eyelid.
- Have the patient look up while you look for the foreign object.
- Next, have him look to one side, then the other while you look for the foreign object.
- Pull the upper eyelid up.
- Have the patient look down while you look for the foreign object.

(2) Method two.

- Ask the patient to look down.
- Grasp the eyelash of the upper eyelid with your thumb and index finger.
- Gently pull the lid away from the eyeball.

- Place a cotton-tipped applicator horizontally along the center of the outer surface of the upper eyelid.

- Pull the eyelid forward and upward, causing it to roll or fold back over the applicator. The under surface of the lid should be exposed.

- Look for the foreign object.

- Release the upper eyelid and pull the lower eyelid down.

- Have the patient look up.

- Look for the foreign object.

b. Remove the located foreign object.

(1) Gently wipe away or pick up the object with a slightly moistened cotton swab or the edge of a clean handkerchief or other soft cloth material.

OR

(2) Gently wash the object out by allowing water to flow from the inner canthus to the outer canthus of the eye (Figure 13-107). Use the thumb and index finger to keep the eye open. (Refer to paragraph 13-107, Procedures for Irrigating the Eyes.)

CAUTION

Do not apply excessive pressure on the eyeball. If required, pressure should be applied on the bony area surrounding the eye.

NOTES

1. If any foreign body cannot be removed easily by one of these methods, bandage the eye and evacuate the patient.

2. If the patient is having pain or if there is a loss of vision, bandage both eyes and evacuate.

c. Obtain a patient history.

(1) Determine the source and type of the foreign body. The type of foreign body will influence the amount of tissue destruction and the time necessary for healing. Particles of copper or brass are usually more irritating then iron or steel.

CAUTION

Never attempt to judge the seriousness of an eye injury by its external appearance. Superficial injuries are often more painful than deep penetrating ones.

(2) Were the particles high velocity or wind blown? High velocity particles are more likely to penetrate or perforate the cornea. Wind blow particles are more likely to only embed themselves superficially.

(3) What is the duration and/or time of onset of discomfort?

(4) Have any ointments or irrigation solutions been applied?

(5) Is there any history of previous injuries to the eye?

d. Record the treatment given.

e. Evacuate the patient, if necessary.

13-110. Lacerations, Contusions, and Extrusions of the Eye

Tissue damage to the area surrounding the eye or to the eyeball itself is classified as—

- *Lacerations.* Torn, ragged or mangled wounds of the tissue around the eye or to the eyeball.

- *Contusions.* Bruises of the tissue around the eye or bruises of the eyeball.

- *Extrusions.* The eyeball is pushed or forced out of its socket.

13-111. Examine Patient for Eye Injuries

a. Survey the patient.

b. Position the patient.

- Remove the patient's headgear.

- Place the conscious patient in a sitting position.

OR

- Place the unconscious patient on his back with his head higher than the rest of his body.

NOTES

1. Make the patient as comfortable as possible without causing him further injury. A sitting position helps control pain and bleeding.

2. Make sure that the unconscious patient's airway is clear. A small article of clothing rolled up and placed under the neck will hold the head in a position to keep the airway clear.

c. Check the patient's eyes for—

- Foreign objects protruding from the eye.
- Swelling or lacerations of the eyeball.
- Bloodshot sclera.
- Bleeding surrounding the eye or from the eyeball.

NOTE

During the examination, ask the patient if he is wearing contact lenses. If he is, record this information. Never force the eyelid open to check for contact lenses.

d. Determine the injury category.

- Laceration or contusion (injury to the tissue surrounding the eye(s)).
- Injury to the eyeball(s).
- Injury to the eye(s) with protruding object(s).
- An extruded or avulsed eyeball.

NOTE

An avulsed eye is one that is torn from the socket. It is also called an extruded eyeball or an enucleation.

13-112. Treatment for Lacerations, Contusions, and Extrusions of the Eye

a. Treat an injury to the tissue surrounding the eye(s) (Figure 13-108A), if applicable.

(1) Cover the injured eye with an eye pad or other small sterile dressing to keep it clean or to control bleeding (Figure 13-108B). Unlike other bleeding wounds, do not put pressure on eye wounds because this can cause

more damage. If the eyelid is injured with no injury to the eyeball, a dressing and bandage is placed over the wound. Handle torn eyelids very carefully to prevent further injury.

(2) Place a first aid field dressing over the eye pad. Gauze or other bandaging materials may be used.

(3) Secure the dressing.

(a) Wrap one tail over the top of the head (Figure 13-108C).

(b) Let the other tail hang free under the ear on the injured side (Figure 13-108D).

(c) Cross the tails under the ear on the injured side, then pass one under the chin (Figure 13-108E) and the other one over the head.

(d) Tie them on the opposite side from the injury (Figure 13-108F).

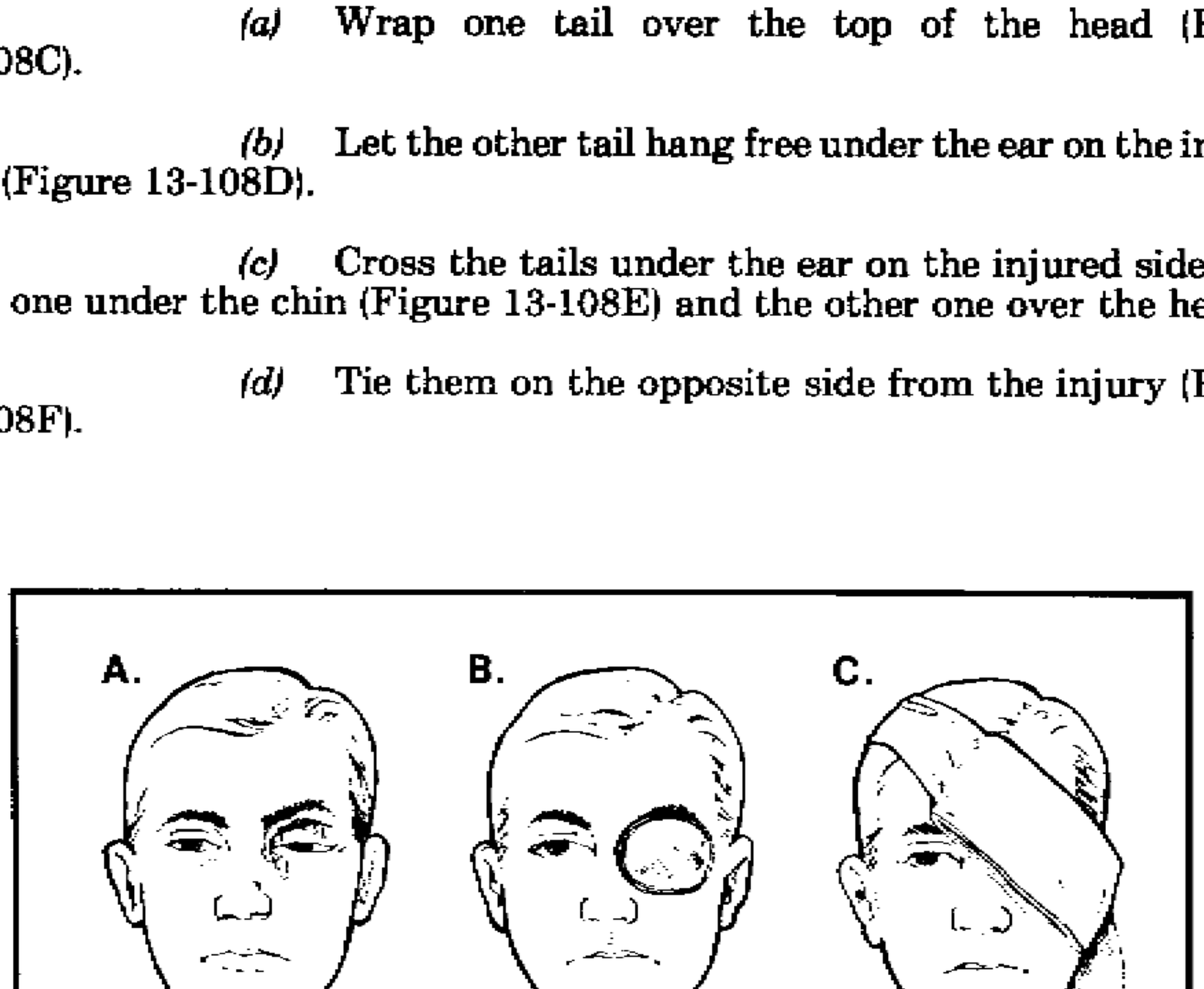


Figure 13-108. Injury to tissue surrounding the eye(s).

NOTES

1. Make sure that the tail under the chin does not slip down on the neck and interfere with the patient's breathing.

2. If the injury is to the tissue around the eye and not the eyeball, only bandage the injured eye.

3. Do not cover the nose, mouth, or ears with the dressing.

b. Treat an injury to the eyeball, if applicable.

(1) Follow procedure in *a*.

(2) Additionally, cover both eyes with pads and dressings.

NOTES

1. Bleeding may not be present.

2. Do not apply pressure to the eyeball. If the jelly-like vitreous humor fluid is squeezed from the eyeball, it cannot be replaced nor can the body replace it by natural regeneration. Loss of the fluid will result in blindness.

3. In hazardous surroundings you may leave the uninjured eye uncovered long enough to insure the patient's safe exit from the area.

(3) Tell the patient not to squeeze his eyelids together. Squeezing them together can exert pressure on the eyeball and cause further damage.

c. Treat an avulsed or extruded eyeball.

CAUTIONS

1. Do not attempt to replace the eyeball into its socket. Replacement must only be done by a physician under sterile conditions. To replace the eyeball under other than sterile conditions can increase the injury.

2. Detachment of the retina may result from such an injury if the patient is not kept quiet and on his back.

(1) Cut a hole in several layers of bulky dressing material, then moisten the material.

(2) Place the dressing so that the protruding eyeball is surrounded by the dressing (Figure 13-109). The dressing should be built up higher than the eyeball. A paper cup or cone-shaped thin cardboard can be use to cover the eye without placing pressure on it (Figure 13-110).

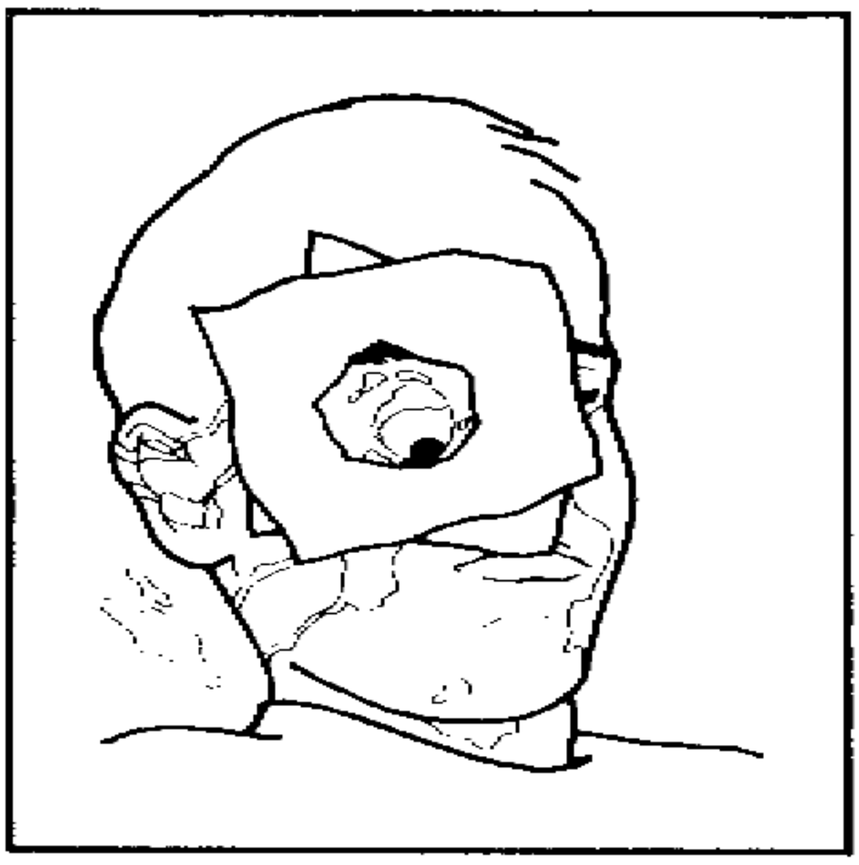


Figure 13-109. Dressing around protruding eyeball.

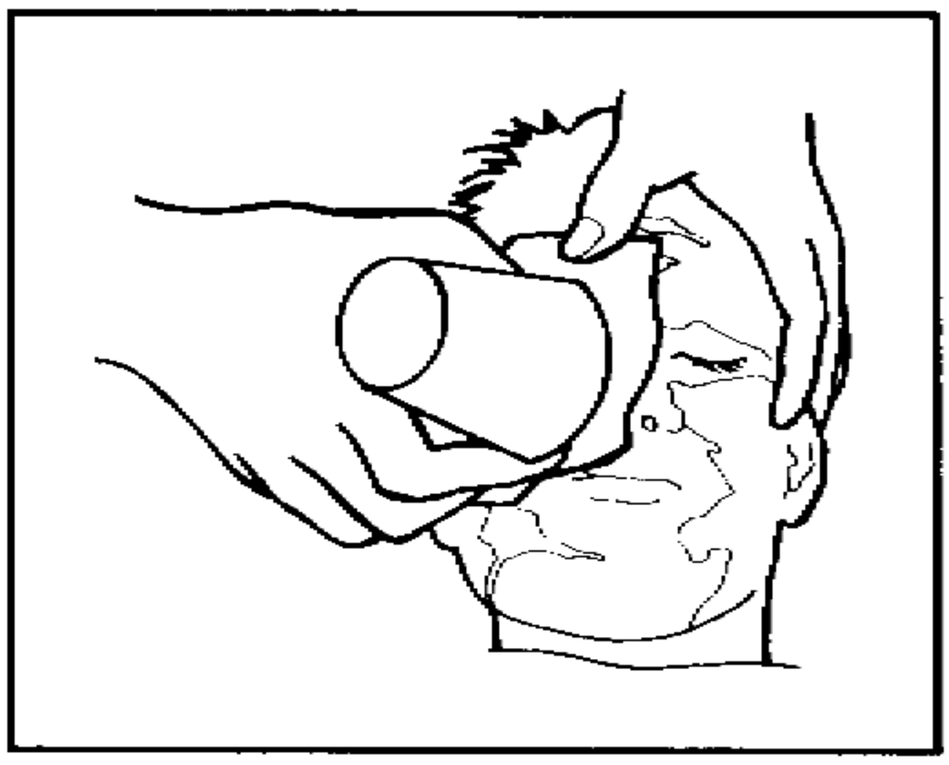


Figure 13-110. Placing a paper cup over protuding eye.

(3) Place a first aid dressing over the eye and built-up, moistened dressing.

(4) Bandage both eyes (Figure 13-111).

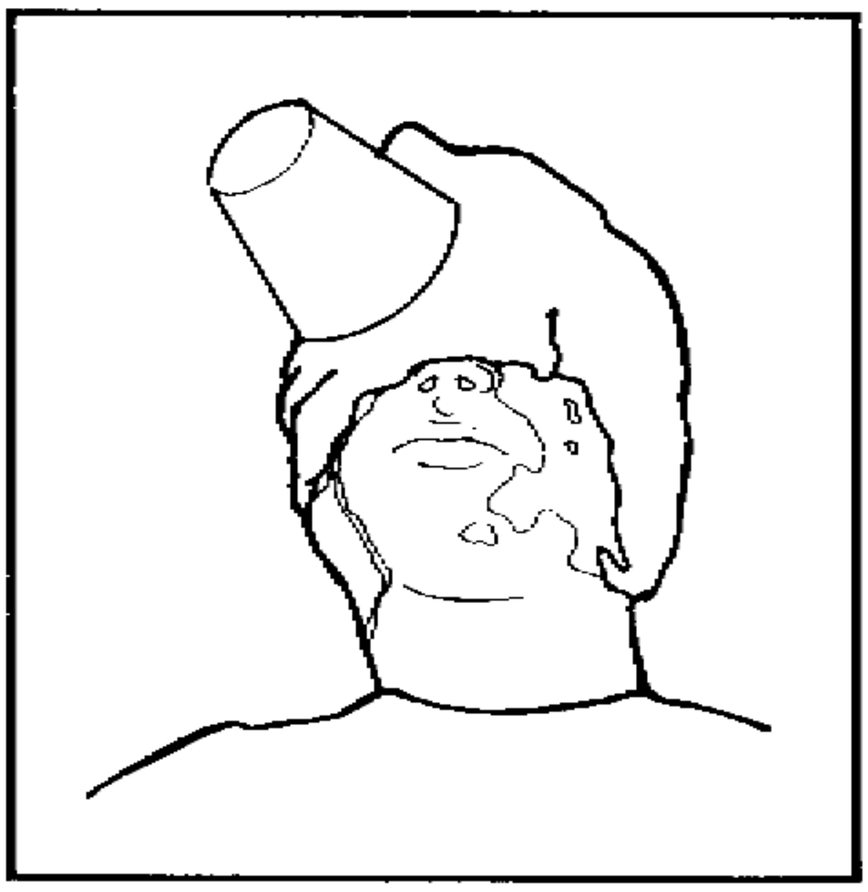


Figure 13-111. Both eyes bandaged with paper cup in place.

d. Record the treatment given.

e. Evacuate the patient. If the patient wears glasses, evacuate them with him even if they are broken. Always evacuate patients with avulsed or extruded eyes on a litter. They must remain on their back.

13-113. Burns of the Eyes

a. Three major types of burns that can affect the eye are: chemical, radiant energy (intensely bright light), and thermal. The correct initial emergency treatment applied to injured eyes will not only help relieve pain but will also help prevent further injury and possible loss of vision.

b. Chemical burns can cause severe eye injury and require immediate emergency treatment. Acid and alkali chemicals will eat into eye tissues if they are not flushed out immediately.

c. Radiant energy injuries are caused by bright visible light (electric welder arcs or laser sources), ultraviolet, infrared, or other forms of light energy that are not visible (including microwaves and radar waves) There are no specific immediate first aid treatment for these burns.

d. Thermal (heat) burns are given the same initial treatment as other burns of the face. No dressing is applied since burned eyelids swell and further protect the eyes underneath.

13-114. Treatment for Other Problems in Patient with Burns to the Eyes

a. Check for and treat any life-threatening conditions, such as, difficult breathing, heart failure, or severe bleeding.

b. Reassure the patient that medical aid will be provided.

(1) When the eyes are burned or injured, individuals are easily frightened and are fearful of losing their sight.

(2) Never try to cheer a patient with a favorable prognosis since it could be incorrect.

13-115. Signs and Symptoms of Chemical Burns of the Eyes

- Pain.
- Redness of the sclera and/or conjunctiva.
- Watering or tearing.
- Possible erosion of the corneal surface caused by long exposure to chemicals.

13-116. Treatment for Chemical Burns of the Eyes

a. Flush the eyes immediately with large amounts of water for 20 minutes.

b. Gently hold the patient's eyes open with your fingertips and pour large amounts of water directly into the eyes (Figure 13-112).

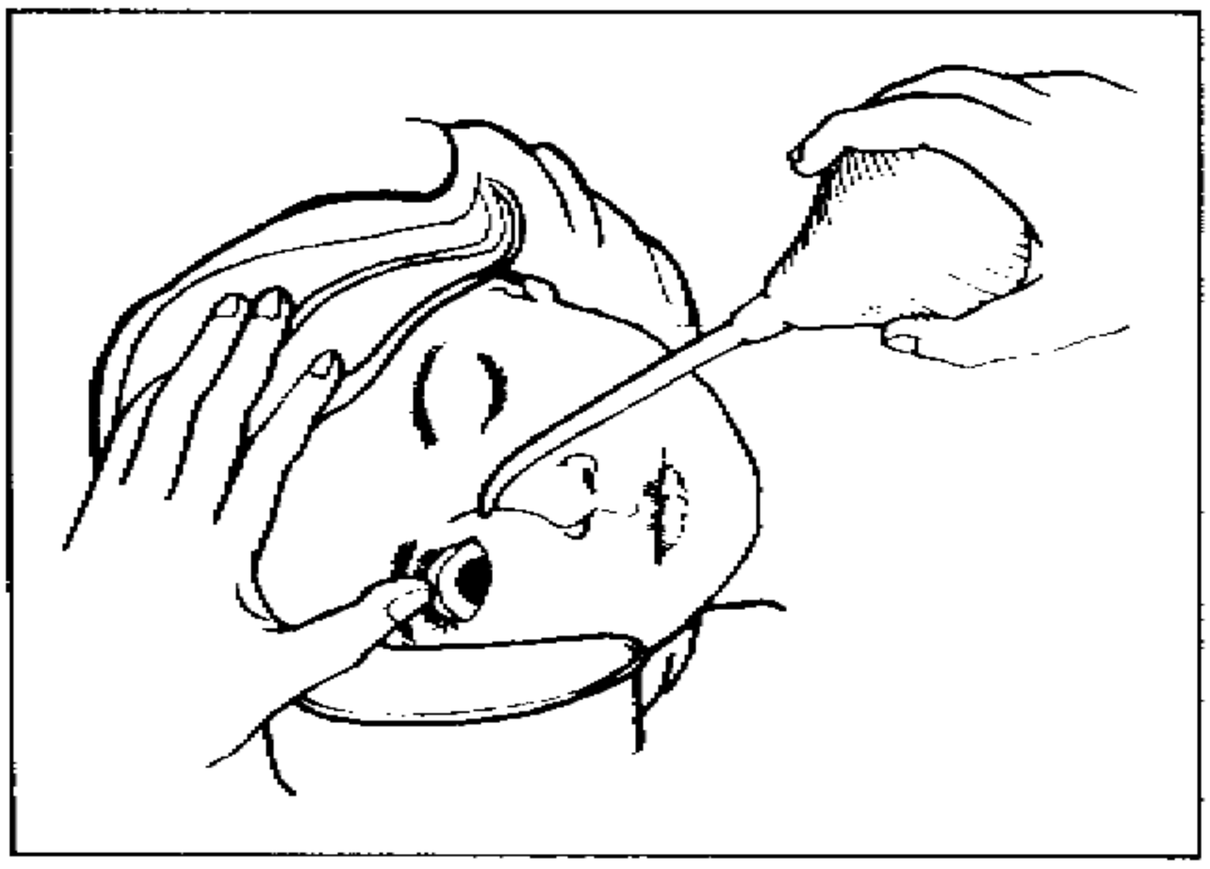


Figure 13-112. Flushing the patient's eye with water.

NOTE

The pain may make it very difficult for the patient to keep his eyes open.

c. If possible, use sterile water to flush the eyes. If it is not available, use potable (approved for drinking) water.

d. If water is not available, use an intravenous solution (saline solution, Ringer's lactate) with tubing.

e. Chemicals (particularly alkalis) tend to stick to the eye and may not be flushed easily. Continue flushing with water if alkali particles are in the eye.

f. If only one eye is involved, lean the head toward the injured side for flushing. Insure that no chemicals enter the uninjured eye.

g. Cover the eyes. Follow procedure outlined in paragraph 13-112.

NOTE

If eye burns are caused by petroleum products, flush the eyes with large amounts of water. Petroleum products such as gasoline, kerosene, jet fuel, or oil do not have a specific treatment. These products are very irritating and painful, but eye damage does not often result from a short exposure. Flushing the eyes with water provides relief and helps the patient feel more comfortable.

13-117. Signs and Symptoms of Radiant Energy Burns of the Eyes

The effects of radiant eye burns from electric welding processes often do not appear until several hours after exposure. Common symptoms are:

- Gritty feeling, as if something is in the eyes.
- Severe pain in the eyes.
- Inability to tolerate light.
- Watering or tearing of the eyes.

NOTE

Recovery and pain relief from these burns will usually take place within two to three days.

13-118. Treatment for Radiant Energy Burns of the Eyes

No specific treatment is recommended, although bandaging of the eyes often makes the patient more comfortable.

13-119. Signs and Symptoms of Laser Eye Injuries

- Pain is not usually present.
- Immediate decrease in vision caused by injury to the retina (inner back portion of the eyeball that is sensitive to light).

13-120. Treatment for Laser Eye Injuries

Immediate first aid is not usually required. Bandaging the eye may make the patient more comfortable and protect his eyes from further injury by exposure to other bright lights or sunlight.

13-121. Signs and Symptoms of Thermal Eye Injuries

- Charred or swollen eyelids.
- Singed eyelashes.
- Pain or irritation.

13-122. Treatment for Thermal Eye Injuries

a. Remove the patient from source of danger (fire or extreme heat) immediately.

b. If patient's clothing is on fire, roll him on the ground to extinguish the fire and minimize the chance of further burns.

c. Thermal burns of the eyes and eyelids are treated as burns of the face. No dressing should be used.

NOTE

Treatment for burned eyelids requires specialized care.

d. Protect patient from exposure to direct sunlight. Prolonged exposure can result in further tissue injury.

e. Record the treatment given.

f. Evacuate the patient.

Section XVI. APPLICATION OF RESTRAINING DEVICES

13-123. General

Restraints are employed to immobilize a patient and to prevent him from harming himself or others. The patient's response to being restrained is rarely submissive. In many instances, he views the application of restraints as a personal, physical assault; he is frightened and responds by becoming combative. He is fearful of what is happening and is trying to protect his freedom.

13-124. Principles for the Application of Restraining Devices

a. Do not attempt to apply restraining devices alone. There must be an adequate number of personnel available to safely and efficiently restrain the patient.

b. The ankles and wrists must be padded before applying the restraints. Padding prevents chafing or cutting the skin.

c. Restraints should fit snugly to prevent escape, but should not restrict circulation or impair breathing. To check the tightness, insert two fingers under the restraining straps. If the fingers can be comfortably inserted, the restraining strap is snug and should not restrict circulation or impair breathing.

d. Restraints must be placed so as not to cause injury or interfere with therapeutic treatment. However, the restraint must prevent the patient from removing therapeutic devices.

e. When ankle restraints are applied, wrist restraints must also be applied. The wrist restraints will prevent the patient from using his hands to place himself in a position to hang from his ankles or to release the ankle restraints.

f. Never restrain a patient on a portable commode or rocking chair. Both can be tipped over.

g. Do not attach the straps to the bed side rails. If the side rails are lowered, the patient could be injured.

h. Do not restrain a depressed patient or one having an altered level of consciousness on his back with his limbs at his side. Place these patients in a prone position prior to applying the restraints. Placement in a prone position prevents aspiration should the patient vomit.

NOTE

Aspiration and suffocation are potential dangers because the patient may have difficulty handling his secretions or emesis.

i. Check the patient at least once every half-hour for signs of distress. The patient needs to know that you are concerned about his physical and emotional needs and that he is not being punished. The patient needs to know that he has not been abandoned and that the restraints are a therapeutic tool used to help him.

j. Release the restraints one at a time and change the patient's position at least once every 2 hours. Release avoids excessive stiffening of muscles. Exercise each limb through its normal range of motion.

k. A restraint key must accompany the patient. Whenever a patient is placed in a locked restraint, all personnel must carry a key. In the event of a medical or environmental emergency, the restraint can be quickly unlocked.

l. A restrained patient should be in a comfortable position. The head of the bed or litter may be elevated so that the patient can see his environment. This will assist in the patient's reorientation and decrease his confusion.

13-125. Prepare to Apply the Restraints

a. Check the doctor's orders or the Therapeutic Documentation Care Plan (Nonmedications). Verify restraints or follow your supervisor's directive indicating that the patient is to be restrained and the type of restraining equipment to be employed.

NOTE

In a field environment the need for restraints may be your own decision, especially in the absence of a senior medical specialist or physician.

b. Obtain the necessary equipment. Gather prescribed type of restraining equipment and necessary padding. Improvised restraining materials may be used. The common improvised materials used are abdominal (ABD) pads, washcloths, gauze sponges, sponge rubber, roller gauze, and elastic bandages.

c. Identify the patient. Ask the patient to identify himself. Verify his name by checking his bedcard and identification band.

d. Explain the procedure. Speak in a quiet, calm, reassuring voice to explain to the patient why the restraints are being applied and to gain his cooperation. It may be necessary to repeat the explanation at frequent intervals, especially if the patient has been medicated with mind-altering drugs or is confused. It is essential that the patient's family and friends understand as well.

NOTE

If the patient is agitated or combative, keep the restraints out of his vision until he is in a position to be restrained.

e. Provide privacy. Place a screen/curtain around the patient's bed or close the patient's room door. Provide privacy to avoid upsetting other patients or causing embarrassment to the patient being restrained.

13-126. Apply the Restraints

Apply wrist and ankle restraints. Use wrist and ankle restraints when it is necessary to restrict movement of the limbs. They may be used for a patient who is potentially harmful to himself or to others, to prevent the patient from removing tubes or other appliances, or to immobilize a part while a procedure is being done. These restraints may be leather, linen, or improvised from other materials.

NOTE

Disposable and reusable linen may be used as wrist and ankle restraints, but only if the purpose is to limit movement. They are not a secure method of restraining violent patients.

a. Apply an adjustable limb holder.

(1) Clean the skin of the wrists and ankles and powder it.

(2) Pad the limb with an ABD pad. Some cloth restraints are prepadded with soft flannel or cotton which eliminates the need to apply additional padding.

(3) Position the restraint over the limb and bring the strap, which is sewn at the taped end, through the slot in the broad end (Figure 13-113).

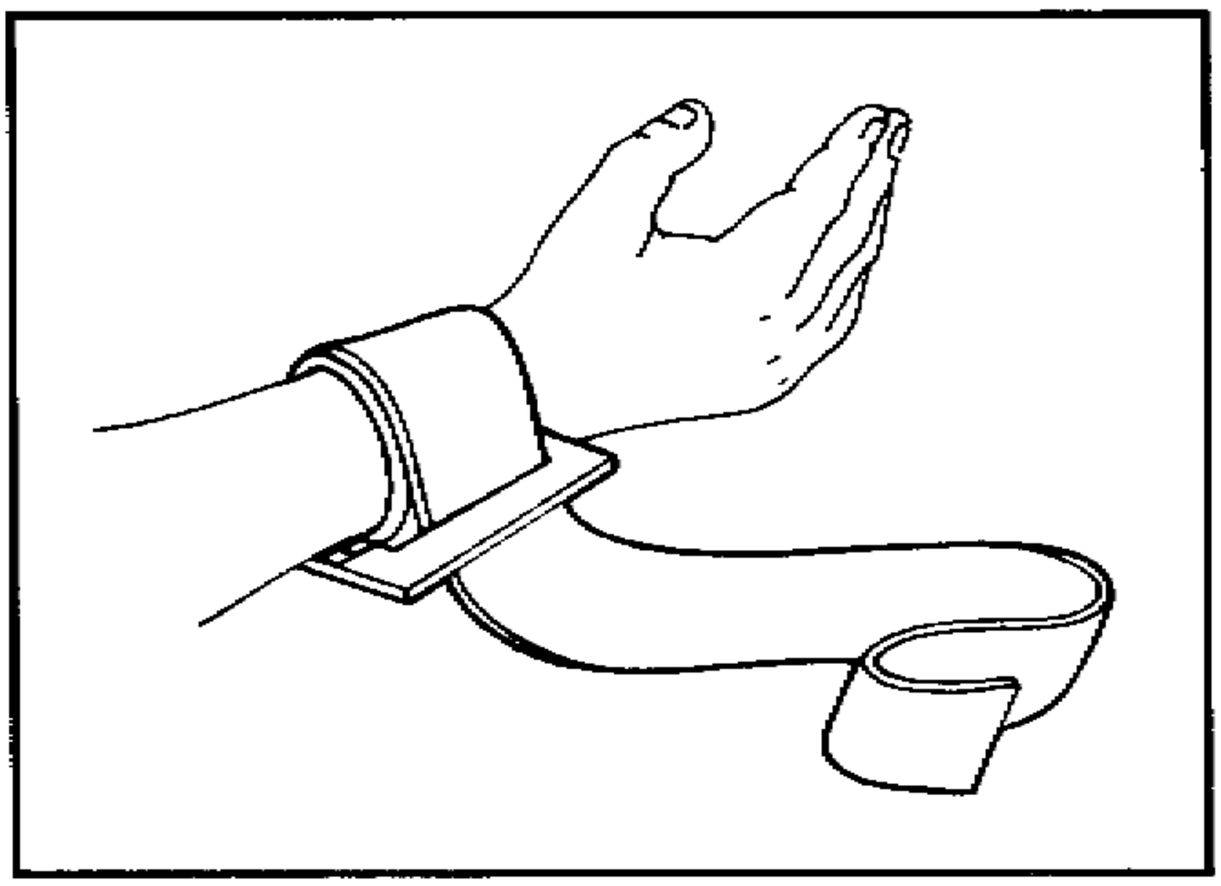


Figure 13-113. Limbholder or wrist restraint.

(4) Pull the strap snug enough to restrict free movement of the extremity and tie the strap to the bedframe.

CAUTION

Do not tie restraints with a square knot. The square knot will be difficult to release quickly in the event of an emergency. The bowknot is easily untied. It should be placed where the patient cannot untie it.

(5) Repeat the above steps to restrain the other three limbs.

b. Apply improvised restraint.

(1) Clean the skin of the wrists and ankles and powder it.

(2) Pad the limb with any soft cloth, such as towel, clothing, gauze, compresses, or clean handkerchief.

(3) Secure the restraining material to the limb with a clove hitch (Figure 13-114).

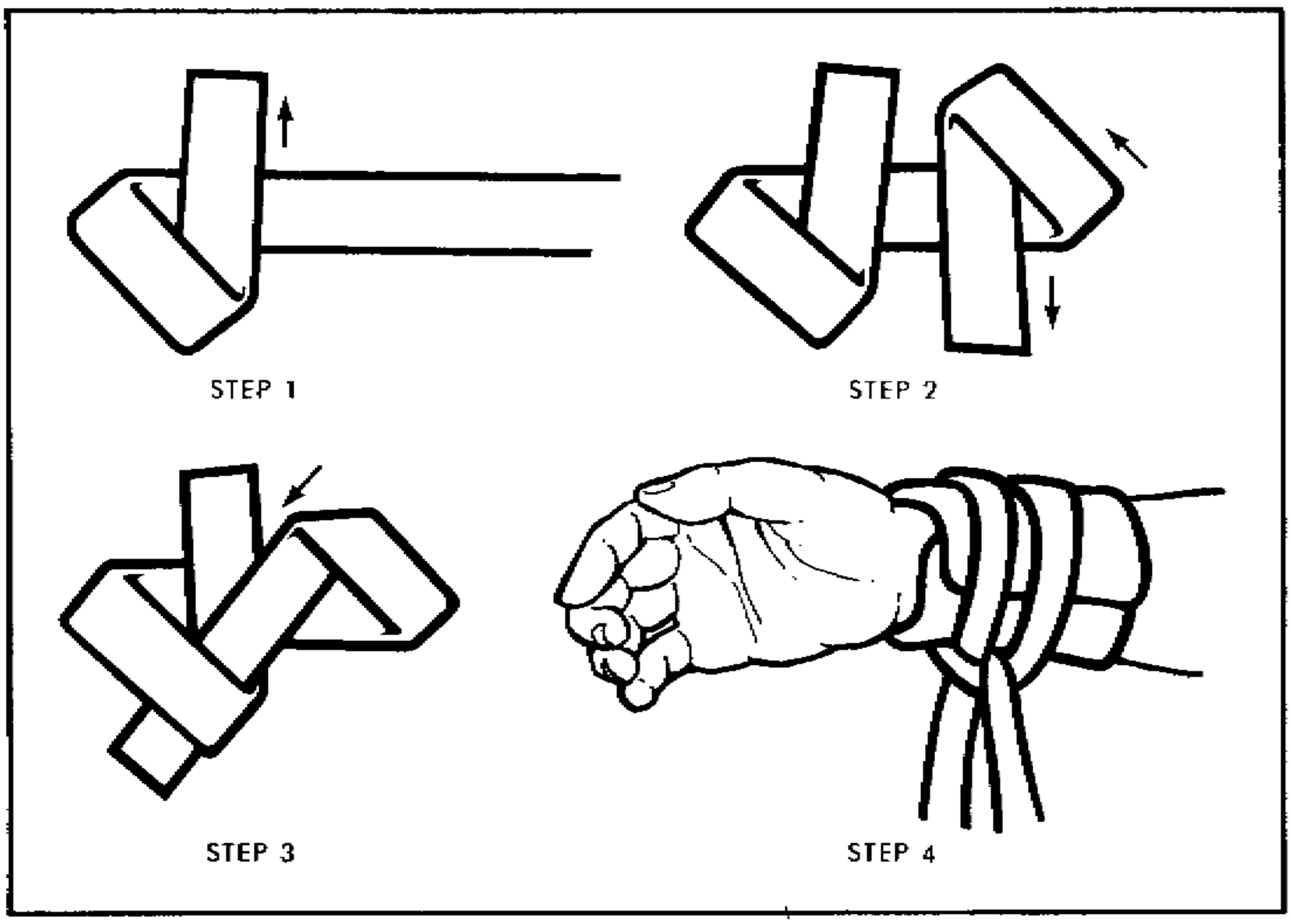


Figure 13-114. Improvised restraint.

(4) Pull the knot to fit the limb snugly and tie both free ends to the bedframe.

(5) Repeat the steps above for the other three limbs.

c. Apply mitt restraints.

(1) Place the patient's hand in a naturally flexed position.

(2) Place soft rolled dressing or a washcloth in the patient's hand and close the hand. The soft material allows unrestricted circulation and minimal strain to the muscles.

(3) Wrap the entire hand snugly with Kerlix bandage.

NOTE

Commercially prepared mitts may be used if available.

d. Apply restraint using a sheet and a litter.

NOTE

This restraint is extremely uncomfortable and it should only be used as a temporary restraint.

(1) Unfold a sheet and stretch it lengthwise, while holding at opposite corners. Twirl the sheet into a tight roll.

(2) Place the patient in a prone position on the litter with his head turned to one side.

(3) Place middle of the roll diagonally across the patient's upper back and shoulder.

(4) Bring both ends of the sheet under the litter. Cross the ends under the litter. Bring one end up over the shoulder and the other end over the upper back. Snugly tie the ends in the middle of the upper back.

(5) Secure one wrist to the litter, parallel to his thigh, using a wrist restraint.

(6) Secure the other wrist, overhead, to the nearest litter-carrying handle, using a wrist restraint.

NOTE

This position will prevent the patient from pushing himself up from the litter. It will also keep his arms and hands within the confines of the litter.

d. Apply restraint using a sheet and bed.

(1) Fold a sheet in half, lengthwise.

(2) Tuck approximately 2 feet of one end of the sheet under one side of the mattress, level with the patient's chest. Make sure there is enough sheet under the mattress to prevent it from being easily pulled from under the mattress.

(3) Bring the other end of the sheet under the patient's arms, over his chest. Tuck the free end of the sheet snugly under the other side of the mattress. Make the restraint snug enough to prevent the patient from wiggling free.

NOTE

Sheets may also be applied in the same manner across the patient's abdomen, legs, knees, and ankles, if further restriction is desired.

e. Apply field-expedient restraints. Under field conditions, standard restraining devices may not be available. Nevertheless, violent patients must be restrained, utilizing materials commonly carried by the soldier in the field. Field-expedient restraints may be improvised from such items as two litters, rifle slings, web belts, bandoleers, and cravats. Replace field-expedient restraints with regular restraints as soon as possible. Do not use field-expedient restraints for long periods of time. With any field-expedient restraint, follow the same considerations as in applying regular restraints.

(1) Mixed equipment. Mixed equipment can consist of rifle slings, web belts, bandoleers, cravats, and ropes. Apply mixed equipment restraints as shown in Figure 13-115.

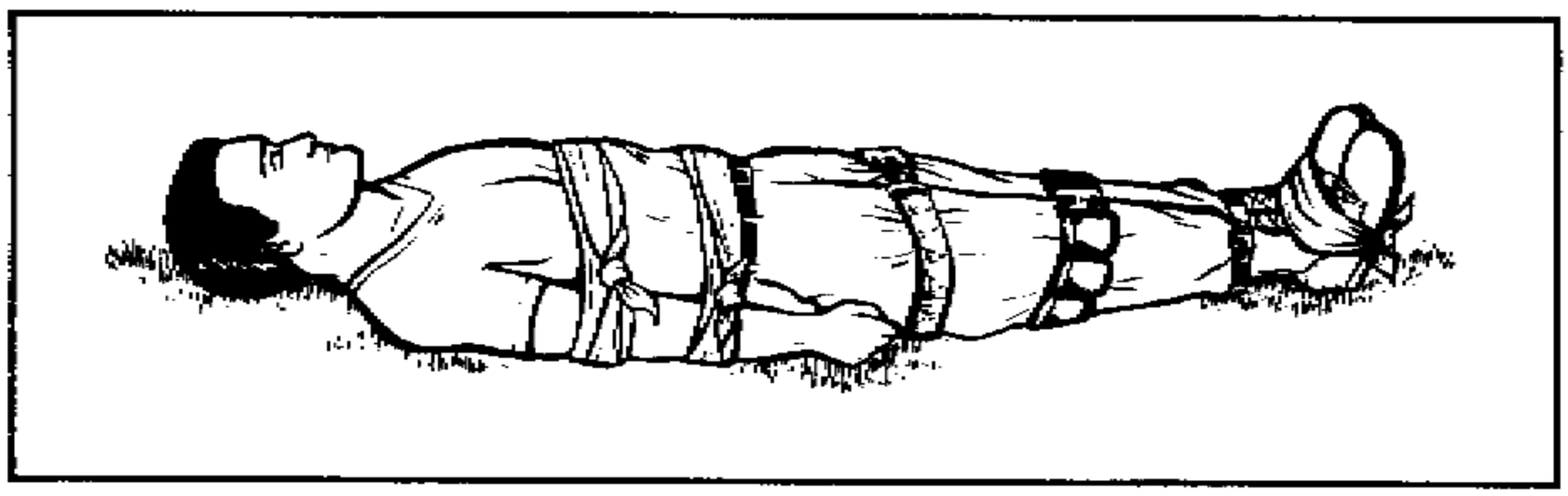


Figure 13-115. Mixed equipment restraint.

(2) Double litters with litter straps.

(a) Place the patient on a litter in the prone position with his head turned to one side.

(b) Place his hands along his thighs and secure them to the litter. This prevents the patient from pushing himself off the litter.

(c) Place another litter, carrying side down, on top of the patient.

(d) Bind the litters together with two or more litter straps. Place the straps buckles in a position which cannot be loosened by the patient (Figure 13-116).

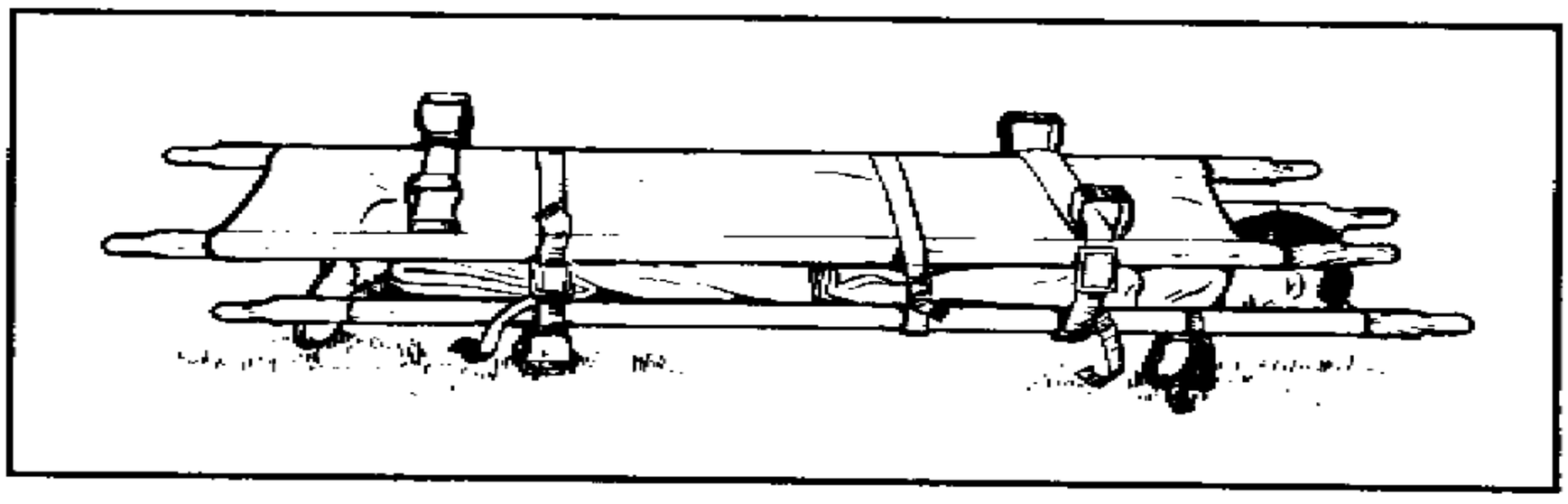


Figure 13-116. Double litter restraint.

f. Record and report action taken. Make sure the date and time the restraint was applied, type of restraint applied, the reason for application, and the patient's tolerance of the procedure are noted.

g. Evacuate the patient.

13-127. The Hazards of Restraints

a. Tissue damage under the restraint.

b. Damage to other parts of the body. Shoulder dislocations are especially problematic if the patient is combative during the application of the restraints or has a grand mal seizure while restrained.

c. Pressure areas may develop if the patient is kept restrained for long periods of time and/or does not have frequent position changes.

d. Nerve damage may occur if restraints are applied too tightly or if they become too constrictive after application.

e. Injury or death to the restrained individual due to fire or other occurrences. This is especially true if the restraints are tied in knots rather than bows or if all staff members fail to keep a restraint key easily accessible.

f. Inability to effectively resuscitate a cardiac arrest patient. The time required to remove the restraints and place a patient in a supine position may spell the difference between life and death.

Section XVII. MEDICAL EMERGENCIES

13-128. General

Most of the medical emergencies that you will see in the field have been previously discussed in other sections of this chapter. This section presents those emergencies which are more rarely encountered but still require action on your part. In many instances you will not be able to provide definitive medical care, but instead will stabilize the casualty as an interim measure.

13-129. Diabetic Emergencies

Diabetes mellitus is a disease that occurs when the pancreas cannot secrete enough insulin to control blood glucose levels. Insulin is a hormone produced by beta cells in the islets of Langerhans of the pancreas. When blood glucose rises, the beta cells release more insulin into the bloodstream, which increases glucose transport into muscle and fat cells. Insulin also promotes the synthesis of glycogen, large fat molecules, and protein. Many diabetics take insulin shots to compensate for their insulin deficiency. However, regulating the amount of glucose in the blood requires a delicate balance, and the insulin dose taken may be either too high or too low. When diabetics take too little or too much insulin, their blood sugar level becomes either too high (hyperglycemia) or too low (hypoglycemia).

13-130. Diabetic Ketoacidosis

a. Diabetic ketoacidosis occurs when the blood sugar level becomes too high—either because the insulin dose is too small or has been neglected. Ketoacidosis is often preceipitated by stress, such as that caused by infection. When serum insulin is low, glucose cannot enter the muscle and fat cells and accumulates in the blood. When insulin levels fall, glycogen breakdown increases; this forms more glucose, which enters the bloodstream, further increasing the blood glucose levels.

b. The increased number of glucose molecules in the blood increases the blood's osmotic pressure. In addition, the kidneys, which normally reabsorb all glucose, begin to excrete glucose into the urine, increasing the osmotic pressure in the urine. Because the kidneys can only concentrate urine to a certain osmotic pressure, they must excrete more water with the excess glucose. Therefore, increased blood glucose produces osmotic diuresis (increased urine output).

c. If the diabetic does not drink enough water to match the increased water excretion, he becomes dehydrated. Dehydration may be so severe that it produces hypovolemic shock. When insulin levels decrease, fat breakdown increases to provide an alternate energy source for cells that no longer receives glucose. Fat breakdown products are acids, which are called wither ketoacids or ketone bodies.

d. When more ketoacids are produced than the kidney can excrete, they accumulate and produce metabolic acidosis. The lungs attempt to compensate for the metabolic acidosis by increasing the rate and depth of respiration to blow off more carbon dioxide and return the pH to normal (7.4).

e. When the kidneys excrete ketoacids, they also excrete potassium. Serum potassium levels do not fall, however, because potassium leaves the cells (where most body potassium is found) when the body becomes acidotic. In fact, serum potassium may actually rise. However, dangerously low serum potassium levels may occur later when ketoacidosis is corrected; this condition occurs because potassium reenters the cells when the pH returns to normal.

f. The patient in diabetic ketoacidosis has a characteristic fruity-smelling breath due to the presence of acetone, a ketone body. Diabetic ketoacidosis usually progresses slowly, over 12 to 48 hours, with the patient gradually becoming comatose.

13-131. Signs and Symptoms of Diabetic Ketoacidosis

- Polyuria (excessive urine output) due to osmotic diuresis.
- Polydipsia (excessive thirst) due to dehydration.
- Polyphagia (excessive hunger), probably due to the body's inefficient use of nutrients.
- Nausea and vomiting, the latter worsening with dehydration.
- Tachycardia (rapid heart rate).
- Deep, rapid respirations (Kussmaul's breathing), in an attempt to blow off excess acids by carbon dioxide elimination.
- Warm, dry skin and dry mucous membranes, reflecting dehydration.
- A fruity odor on the breath due to acetone.
- Occasional fever, abdominal pain, and falling blood pressure.

13-132. Treatment for Diabetic Ketoacidosis

Treatment for ketoacidosis in the field depends on the diagnosis. It is safer to assume the patient in a coma is suffering from hypoglycemia than hyperglycemia. If, however, the patient's history and physical exam are consistent with ketoacidosis, start treatment aimed at hydration and supporting vital functions by administering 25 to 50 cc's of 50 percent glucose intravenously. To treat suspected ketoacidosis, you should—

(1) Maintain an open airway. Administer oxygen in comatose patients. Be alert for vomiting and have suction equipment ready.

(2) Start an IV, draw blood for serum glucose determination, and administer 1 liter of normal saline at a TKO rate or a rate ordered by the physician. The patient in ketoacidosis is severely dehydrated, often to the point of shock, and needs fluid volume.

(3) Monitor cardiac rhythm (if cardiac monitoring equipment is available).

13-133. Hypoglycemic Reactions

Hypoglycemia in an insulin-dependent diabetic is often the result of having taken too much insulin, too little food, or both. The brain depends on a constant glucose supply for its function. If the glucose level falls very low, the brain is unable to function properly. This causes severe excitment and then depression or, in extreme cases, convulsions followed by coma. In contrast to ketoacidosis, hypoglycemia develops very rapidly. It should be suspected in any diabetic manifesting bizarre behavior, altered neurologic signs, or paranoia, hostility, or aggression.

13-134. Signs and Symptoms of Hypoglycemia

- A weak, rapid pulse.
- Cold, clammy, pale skin.
- Weakness and incoordination.
- Headache.
- Irritable, nervous, or bizarre behavior.
- In severe cases, seizures and coma.

13-135. Treatment for Hypoglycemic Reaction

a. Treat an unconscious patient as any other comatose patient, by establishing an airway and administering oxygen.

b. Start an IV, draw blood for lab tests, and administer 5 percent dextrose (D5W) at TKO rate. Then give 50 milliliters (ml) of 50 percent dextrose by IV push. If the coma is indeed caused by hypoglycemia, the patient will awaken dramatically.

OR

c. Give orange juice sweetened with sugar, cola, or candy instead of D5W IV if the patient is awake, alert, and able to swallow.

NOTES

1. Diabetics are not the only patients who are prone to hypoglycemia. Alcoholics, patients who have ingested certain poisons, and others may develop the same syndrome. Therefore, you should not discount the possibility of hypoglycemia in any comatose patient. This is particularly true with an auto accident victim when there appears to be no real reason for the patient to be in a coma.
2. Any patient in a coma of unknown cause should receive glucose.

13-136. Poisoning

a. Poisoning is mainly a pediatric problem. Of the 1,000,000 poisonings reported in the United States each year, about 75 percent occur in children under 5, and most are caused by household products. Suicidal and homicidal attempts account for most adult poisonings.

b. It is beyond the scope of this manual to provide a list of all poisons. Detailed information can be obtained from all local poison control centers. In any case of poisoning, your supporting MTF should provide the specific antidotes for each agent.

c. Poisons can enter the body through ingestion, inhalation, surface absorption, or injection. Ingested poisons usually remain in the stomach a short time and the stomach absorbs only small amounts. Most absorption takes place after the poison passes into the small intestine. You should suspect poisoning in any patient who presents a sudden onset of unexplained illness, especially an illness characterized by abdominal pain, nausea, vomiting, or CNS problems. Thus management is aimed at trying to rid the body of the poison before it reaches the intestines.

d. In order to treat a poisoned patient, you must take a patient history, including answers to the following questions:

- What was ingested? The poison container and all its remaining contents, the plant, or a sample of what was ingested should be collected for the MTF. If a plant was ingested, find out what part of the plant (root, leaves, stems, flower, fruit) was actually swallowed. If the patient has vomited, send a sample of the vomitus in a clean, closed container to the MTF.

- When was the substance taken? Decisions about gastric lavage will depend on how much time has passed.

- How much of the substance was taken?

- Has the patient or a bystander tried to induce vomiting? Has anything been given as an antidote?

- Does the patient have a psychiatric history?

e. Look for signs characteristic of poisoning by a specific substance. Note the skin color. For example, flushed, red skin is indicative of carbon monoxide poisoning. Also check the patient's breath for the presence of petroleum products, alcohol, or other suggestive odors.

13-137. Treatment for Poisoning

a. Maintain the airway. The sleepy or comatose patient is in constant danger of asphyxiation and/or aspiration.

b. As a general rule, if the patient has ingested a poison within the past 3 to 6 hours, the stomach should be emptied, but there are important exceptions. *Never induce vomiting in*—

- Stuporous or comatose patients.

- Patients with seizures.

- Pregnant patients.
- Patients with possible acute myocardial infarction.
- Patients who have ingested corrosives (strong acids or alkalis).
- Patients who have ingested petroleum products (kerosene, gasoline, lighter fluid, furniture polish).

c. When in doubt, call for instructions.

d. For practically all other ingested poisons, you should promptly empty the patient's stomach. Vomiting is the most effective way to empty the stomach of ingested poisons. Empty the patient's stomach by—

(1) Giving syrup of Ipecac—15 cc with 2 to 3 glasses of water to a child over 1 year old, and 30 cc with 2 to 3 glasses of water to an adult.

(2) Placing the patient facedown, with his head lower than his hips, to reduce the possibility of aspiration.

(3) Repeating the dose of Ipecac once if vomiting does not occur within 20 minutes.

(4) Giving activated charcoal after vomiting stops. Make a slurry by mixing at least 2 tablespoons of activated charcoal in water just before administration.

NOTE

Do not mix the activated charcoal with syrup of Ipecac, because the charcoal will inactivate the syrup if Ipecac. Avoid activated charcoal in suspected cyanide poisoning.

(5) Performing gastric lavage if vomiting cannot be induced. The same contraindications that apply to inducing vomiting also apply to lavage. To perform gastric lavage—

- Pass a large nasogastric tube into the stomach (use the oral route for younger children).
- Position the patient on his left side, with his face down, to increase drainage and minimize aspiration.
- Aspirate the tube with a large syringe before beginning lavage. Save the contents.
- Instill saline (20 ml for small children, 50 ml for older children or adults) into the stomach through the nasogastric tube. Aspirate the tube and save the first aspirate for laboratory analysis.

● Repeat lavage until the fluid is clear. At this time, give activated charcoal (at least 3 tablespoons in tap water) through the nasogastric tube, which can then be pinched off and withdrawn. *Never pass a nasogastric tube in a stuporous or comatrose patient unless the airway has first been secured with a cuffed endotracheal tube.* Likewise, never pass a nasogastric tube in a patient who has ingested a substance like acid or lye.

(6) Start an IV with D5W at TKO rate. Draw blood for laboratory studies.

(7) Treat for shock, if necessary.

(8) Record treatment.

(9) Evacuate patient.

13-138. Treatment for Specific Poisonous Ingestions

a. For strong acids, such as toilet bowl cleaners, rust removers, and phenol, you should—

(1) *Never induce vomiting.*

(2) Give milk of magnesia, milk, egg white, or flour in water in an attempt to neutralize and dilute the acid.

(3) Start an IV with D5W at a TKO rate.

b. For strong alkalis, such as drain cleaner, washing soda, ammonia, and household bleach, you should—

(1) *Never induce vomiting.*

(2) Give diluted citrus fruit juice or equal parts of vinegar and water. Fifty ml of olive oil may ease the pain.

(3) Start an IV with D5W at a TKO rate.

c. For petroleum products, such as kerosene, lighter fluid, gasoline, furniture polish, and turpentine, you should—

(1) *Never induce vomiting* unless the patient drank a very large volume (more than 50 ml) of kerosene or gasoline. In these cases, potential toxicity to the brain and heart requires elimination of the poison.

(2) Protect the airway.

(3) Perform gastric lavage through a nasogastric tube.

(4) Give 100 percent oxygen with good humidification, if available.

(5) Start an IV with D5W at TKO rate.

(6) Monitor cardiac rhythm (if possible).

(7) Anticipate massive secretions and have suction ready, if available.

d. For methyl alcohol (methanol, wood alcohol), you should—

(1) Induce vomiting if the patient is conscious and give 1 ounce of 80 proof whiskey every hour (the dose must be reduced in children). Ethanol—the alcohol one normally drinks—inhibits methanol metabolism.

(2) Start an IV with D5W at a TKO rate.

(3) Monitor cardiac rhythm (if possible).

(4) Administer oxygen, if available.

OR

(5) Treat an unconscious patient as any other comatose patients.

13-139. Carbon Monoxide Inhalation

a. Carbon monoxide causes more poisoning deaths than any other substance. It is produced during the incomplete burning of organic fuels, most commonly in automobiles or home heating devices. Because home heating devices produce carbon monoxide, this poisoning occurs more frequently in the winter when it accumulates because a flue or ventilating system is blocked. However, at least half of all successful adult suicides are caused by carbon monoxide poisoning, and these may occur at any time of the year. An automobile in a small closed garage can produce a lethal concentration of carbon monoxide in 15 to 30 minutes. Carbon monoxide is a colorless, odorless, tasteless gas. These characteristics make its detection in the air difficult and thus increase the hazard. Usually the victim does not realize what is happening until it is too late.

b. Carbon monoxide binds to hemoglobin in red blood cells and displaces oxygen, preventing the transportation of oxygen to the tissues by the red blood cells. The result is suffocation at the cellular level. The level of carbon monoxide in the blood does not need to be high for poisoning to occur because this gas has an affinity for hemoglobin that is 200 times stonger than oxygen. Because the blood's ability to deliver oxygen is reduced, any condition that increases the need for oxygen—such as fever or physical exertion—increases the severity of carbon monoxide poisoning. Carbon monoxide poisoning is more severe in children, since their resting metabolic rate is higher than that of adults.

c. The warning symptoms of carbon monoxide poisoning include a sense of pressure in the head and a roaring in the ears. With acute poisoning, the patient is confused and unable to think clearly. The patient appears drunk, often vomits, and becomes incontinent; convulsions and coma then follow.

d. Examination of such patients reveals a bounding pulse, dilated pupils, and cyanosis or pallor. Cherry-red lips, although classically described, is rarely seen. In the comatose patient, rales—indicating pulmonary edema—may be heard. Symptoms vary greatly between individuals with the same carbon monoxide exposure. You should consider carbon monoxide poisoning whenever you are confronted with a group of people with different symptoms who are sharing accommodations when the symptoms started.

13-140. Treatment of Carbon Monoxide Poisoning

a. Provide maximal oxygenation. To accomplish this, you should—

(1) Remove the patient from the exposure site.

(2) Give him 100 percent oxygen by mask.

(3) Support respirations with a bag-valve mask if there is respiratory depression.

b. Record treatment.

c. Evacuate the patient. Move the patient rapidly to an MTF where high oxygen concentrations can be delivered more effectively.

13-141. Absorbed Poisons

a. Poisons, such as organic phosphate and cyanide, can also be absorbed through the skin. Treatment for absorbed poisons involves removing the substance from the skin. Flush the area with a copious stream of water. If dry lime is the poison, brush off the excess before flushing. Flush phenol off with alcohol in which it is soluble, rather than water, if large quantities of alcohol are available; if not, use water.

b. Do not waste time removing contaminated clothing or shoes until the patient has been flushed with water for several minutes; then remove his contaminated clothing and continue flushing. Do not use specific antidotes until the skin has been irrigated with copious amounts of water. After repeated flushing and removal of contaminated clothing, wash areas exposed to acids with soap and water. Wash areas exposed to alkalis with diluted lemon juice or vinegar.

13-142. Overdose

a. Obtaining a history from a patient who has taken an overdose is similar to taking a history from a poisoned patient. You should ask the following questions:

- What was taken? The bottle and its contents should be brought to the MTF. Its label may help identify the drug, and the number of pills remaining may give a clue to how much was ingested.

- When was it taken?

- How much was taken?

- Was anything else taken (other drugs or alcohol)?

- What has the patient or bystanders done to try to correct the situation? Has vomiting been induced? Street resuscitation procedures are frequently as dangerous as the overdose itself, and exactly what has been done for the patient is very important. The most common form of street resuscitation is "stimulation"—cold showers, and vigorous slapping. Check for broken teeth, blood in the mouth, or other signs of injury. If the patient has a barbiturate overdose, his friends may have tried to reverse this by giving him speed (Methedrine or Dexedrine). There is also a myth prevalent on the streets that salt or milk given intravenously will reverse an overdose. In fact, salt may cause pulmonary edema, and milk can induce pneumonia. All of these street remedies will complicate the situation; therefore, you should learn as much as possible about what has been done.

13-143. Treatment for an Overdosed Patient

a. Maintain an airway.

b. Administer oxygen, if available.

c. Induce vomiting if the drug was taken by mouth. There are, however, important exceptions. *Never induce vomiting in*—

- Stuporous or comatose patients.

- Patients who have ingested phenothiazines (including Thorazine, used as tranquilizers). Phenothiazines prevent vomiting, so the patient will end up with a stomach dangerously full of syrup of Ipecac and water if attempts are made to induce vomiting.

d. Start an IV with D5W at TKO rate.

e. Monitor cardiac rhythm (if possible).

f. Record treatment.

g. Evacuate patient.

13-144. Narcotics Overdose

a. The narcotic drugs include heroin, morphine, Dilaudid, methadone, codeine, Demerol, and Darvon. When narcotics are taken in excess, they cause marked respiratory depression. This is shown initially by slow, deep breathing that leads rapidly to apnea. Narcotic overdose also causes hypotension, stupor, and coma. The pupils characteristically become pinpointed, but this sign may be masked if the patient has overdosed on a combination of drugs.

b. You should suspect a narcotic overdose in any young patient found in an unexplained coma, especially when there are needle tracks along the veins of the arms or elsewhere. Cigarette burns on the chest are also seen among these patients; burns occur when the patient "nods out" (loses consciousness) while smoking.

c. Heroin overdose tends to occur in small epidemics. Heroin is sold on the street in an impure form. When a more concentrated supply of the drug reaches the street, users can miscalculate their doses and take more than they had intended.

13-145. Treatment for Narcotic Overdose

a. Maintain an airway.

b. Administer oxygen. Assist ventilation as needed.

c. Start an IV with D5W at TKO rate.

d. Record treatment.

e. Evacuate patient.

13-146. Sedative/Depressant Drugs Overdose

a. Barbiturates are among the most abused drugs. They are used in more drug-related suicide attempts than any other drug.

b. The chronic barbiturate abuser is characteristically lethargic, disheveled, and frequently nods off to sleep. The barbiturate abuser may be taking enormous doses to maintain a habit; therefore, a reduction in daily doses can lead to a dangerous state of withdrawal.

c. Diagnosing acute barbiturate poisoning may be difficult. A patient contemplating suicide may have large supplies of several drugs. It may be difficult to determine which drug(s) a comatose patient has taken. Patients may attempt suicide with barbiturates while consuming large amounts of alcohol. The odor of alcohol on the patient's breath can further confuse the diagnosis. You will often have to rely on circumstantial evidence such as empty medicine bottles, the characteristic color of tablets in the mouth, or gastric contents to diagnose barbiturate overdose.

d. Acute barbiturate poisoning mainly affects the CNS and the cardiovascular system. Signs and symptoms of moderate overdose resemble those of alcohol intoxication.

e. In severe overdose, the patient is deeply comatose. His pupils may be constricted early in the course, but later become fixed and dilated. (It is important for you to remember this sign during resuscitation efforts, because fixed and dilated pupils do not have the same significance in barbiturate overdose as in ordinary cardiac arrest.) Respiration is affected early and becomes very shallow, resulting in hypoventilation. Cheyne-Stokes breathing can occur. Aspiration and pneumonia are also common. Blood pressure falls and the patient may develop a shock syndrome, with weak, rapid pulse, and cold, clammy skin.

13-147. Treatment of Barbiturate Overdose

a. Maintain an airway.

b. Administer oxygen. Assist ventilation as required.

c. Start an IV with normal saline or D5W and administer at a rate to maintain blood pressure. If the patient is in shock, the MAST may be helpful.

d. Monitor cardiac rhythm (if possible).

e. Avoid giving stimulants. Stimulants increase the complications following barbiturate overdose.

f. Record treatment.

g. Evacuate patient.

13-148. Amphetamine Overdose

a. Amphetamines—such as Dexedrine and Methedrine—are frequently abused. These drugs stimulate the CNS and produce wakefulness.

b. The amphetamine abuser who has taken large quantities of the drug over a period of time displays excitement, loss of appetite, tachycardia, hypertension, sweating, dilated pupils, and tremors. He may demonstrate frank amphetamine psychosis as well, with paranoia and hallucinations. He may also be violent and you should be prepared for this reaction.

c. In most cases, the drug will wear off and the user will "crash." The patient will then go into a prolonged sleep, followed by a period of extreme hunger and depression. Field treatment of these patients consists primarily of reassuring them. If the patient is agitated, you should first ensure your own safety and then attempt to calm him down.

13-149. Treatment for Amphetamine Overdose

a. Determine whether the patient is violent and summon assistance if needed.

b. Talk to frightened or agitated patients calmly and reassuringly.

c. Provide the patient with a place to "crash." The hospital is often not a very good place for this. A quiet room in the house of a reliable friend where concerned people will be available to reassure the patient may be better. Consult the physician to help decide whether to bring the patient to the MTF.

d. Determine whether hospitalization will be necessary. If his blood pressure is significantly elevated, if arrhythmias are present, or if he is entirely out of control, hospitalization is required. Use assistance, if needed, to bring the patient to the MTF.

13-150. Overdose and Toxic Reaction to Hallucinogens

The symptoms of LSD intoxication includes excitement, panic, hallucinations (usually visual), unusual body sensations, and often psychotic reactions. Most authorities now advocate the "talking down" approach in dealing with these patients, avoiding drugs as much as possible. You should try to get the patient to a quiet place, away from crowds and noise. An emergency room is far from ideal in this respect. It is often better if you can arrange to have the patient looked after by a responsible friend. It is especially important that you deal with the patient in a calm, understanding manner.

13-151. Aspirin Overdose

a. Aspirin (salicylate) intoxication is primarily a pediatric problem and is one of the most frequent overdoses in children. Adults can also overdose on aspirin, either accidentally or in suicide attempts.

b. Salicylate is an acid and causes metabolic acidosis. The patient tries to compensate for the metabolic acidosis, with its excess carbon dioxide, by hyperventilating. As time passes, however, the patient tires and respirations become shallower.

13-152. Signs and Symptoms of Salicylate Intoxication

- Hyperpnea, tachypnea (deep and rapid respirations).
- Fever and sweating.
- Vomiting.
- Dehydration, sometimes so severe that it causes shock.
- Convulsions.
- Coma.

13-153. Treatment for Aspirin Overdose

a. Induce vomiting with syrup of Ipecac, if the patient is conscious.

b. After vomiting stops, give at least 2 tablespoons of activated charcoal mixed as a slurry in water.

c. Start an IV with D5W at a TKO rate.

d. If the patient's temperature is elevated above 104^{O}F, sponge his body with cool water.

e. Record treatment.

f. Evacuate patient.

13-154. Massive Gastrointestinal Bleeding

a. Massive gastrointestinal (GI) bleeding refers to bleeding that is severe enough to cause hypovolemic shock. Bleeding may occur from any part of the GI tract. Massive bleeding, however, most frequently occurs from the duodenum, stomach, or esophagus.

b. Massive GI bleeding is most often caused by a duodenal peptic ulcer. Other frequent causes of massive GI bleeding are a gastric peptic ulcer, gastritis, and esophageal varices (enlarged and twisted veins in the esophagus).

c. In peptic ulcer disease, digestive enzymes and gastric acid destroy a small area of the stomach or esophagus lining. If the damaged area includes the wall of a vein or artery, there is massive bleeding.

d. A duodenal peptic ulcer causes massive GI bleeding more frequently than does a gastric peptic ulcer. The typical duodenal ulcer patient is a male, over 33, who works under emotional and physical stress.

e. Gastric peptic ulcer is also more frequent in males, but is not related to stress. Gastric ulcers most often occur past the age of 40. They may be benign or may be caused by gastric cancer.

f. Acute gastritis is an acute inflammation of the superficial layer of the stomach lining. The disorder may be caused by viral or bacterial infection or by ingestion of alcohol or aspirin. Acute gastritis following alcohol or aspirin ingestion can cause massive GI bleeding. Aspirin and alcohol, however, also cause peptic ulcers to bleed. Therefore, a patient with a history of ingesting either drug does not always indicate acute gastritis.

13-155. Signs and Symptoms of Massive Gastrointestinal Bleeding

a. The symptoms of massive GI bleeding include those of hypovolemic shock. In addition, massive GI bleeding produces hematemesis (vomiting blood) and/or melena (black, tarry stools). Vomited blood may be bright red if it is fresh or may resemble coffee grounds if it has been partly digested.

b. Other signs and symptoms can indicate the cause of GI bleeding. The ulcer patient may be taking antacids; the acute gastritis patient may have recently ingested aspirin or alcohol. The patient with bleeding esophageal varices usually has symptoms of cirrhosis of the liver. These include liver and spleen enlargement, ascites (fluid in the peritoneal cavity), and dilated abdominal wall veins.

13-156. Treatment of Massive Gastrointestinal Bleeding

a. Administer oxygen.

b. Take vital signs.

c. Apply and inflate the MAST.

d. Start two or more IV's with large-bore catheters. Then rapidly infuse lactated Ringer's solution to maintain blood pressure.

e. If ordered by the physician, insert a nasogastric tube to aspirate blood present in the stomach.

f. Maintain the patient in a shock position with his feet elevated.

g. Keep the patient warm.

h. Monitor the patient's blood pressure, pulse, and state of consciousness.

i. Record treatment.

j. Evacuate patient.

13-157. Genitourinary Problems

a. It is rarely useful to distinguish the different possible causes of genitourinary problems in the field.

b. The genitourinary system includes the kidneys, ureters, bladder, urethra, and the reproductive organs. All of these organs are subject to trauma or disease. Nontraumatic emergencies involving these organs include inflammation, infection, and obstruction. EXAMPLE: The passage of a renal stone, which causes excruciating flank pain—is one of the most severe forms of pain a person can experience. Treatment in the field is not feasible.

13-158. Patient History—Respiratory Problems

a. Much can be learned from a few well-chosen questions. In taking a history from a patient with respiratory problems, you need to explore the patient's chief complaint in greater depth. In most cases the complaint will be dyspnea. But some patients may have serious respiratory problems without dyspnea, especially if their respiration has been depressed by drugs or trauma. Therefore, you must be alert for respiratory problems, even if the patient does not complain of shortness of breath. Assuming that the chief complaint, however, is dyspnea, obtain answers to these questions:

- How long has the dyspnea been present? Is the problem longstanding or of recent onset?
- Was the onset gradual or rapid?
- Is the dyspnea made better or worse by any position?
- Has the patient been coughing? If so, is the cough productive? What does the sputum look like?
- Is there associated pain? If so, what is its nature?
- Has the patient suffered any medical problems in the past? If so, when?
- What medications does the patient take regularly?

b. Observations made during history taking can provide valuable information on the patient's condition. When taking a history, you must also answer these questions:

- Is the patient anxious, uncomfortable, or in distress?

- Does dyspnea make it difficult for the patient to speak? Does he need to stop to catch his breath when answering questions?

- Does questioning easily distract the patient from symptoms?

- Are his answers to your questions coherent and appropriate, or does he answer in a confused and disoriented fashion?

- What position does the patient naturally assume?

c. In making such observations, you are performing the first step of the assessment of the patient's general appearance and mental status. Thus, you can note, for example, that the patient in severe respiratory distress is frightened and intensely uncomfortable, is usually sitting upright, is gasping or laboring to breathe, and is confused or disoriented.

d. After completing the primary survey, take the patient's vital signs. Carefully observe his respirations. Are his respirations abnormally rapid (tachypnea) or unusually deep (hyperpnea)? Is there an abnormal respiratory pattern?

e. The secondary survey of the respiratory system should begin with examination. Look for the following signs of respiratory distress:

- The nostrils opening wide on inspiration.

- The Adam's apple pulled upward on inspiration.

- Retraction of the intercostal muscles: the patient retracts these muscles on inspiration.

- The patient is using his neck and diaphragm muscles exclusively on expiration.

- Cyanosis is an unreliable sign; however, severe hypoxia may be present without cyanosis.

f. Next, observe the chest wall. Has its diameter increased (barrel chest)? Does the chest move symmetrically during respiration? During expiration, does any area bulge (flail)? Is the trachea in the midline, or does it deviate toward one side? Is the chest wall deformed or discolored?

g. After observing the patient, auscultate his chest. Firmly apply the stethoscope to the patient's chest and listen, both anteriorly and posteriorly, to at least one respiratory cycle at each apex and each base. Certain abnormal sounds detectable on auscultation of the lungs characterize different respiratory problems:

- Snoring is a familiar sound, occurring when the upper airway is partially obstructed by the base of the tongue.

- Stridor is a harsh, high-pitched sound heard on inspiration that is characteristic of tight upper-airway obstruction, as in laryngeal edema. The "seal bark" of the child with croup is an example of stridor.

- Wheezing is a whistling sound heard diffusely in asthma.

- Rhonchi are rattling noises in the throat or bronchi, often due to partial obstruction of the larger airways by mucous.

- Rales are fine, moist sounds, sometimes crackling or bubbling in quality, associated with fluid in the smaller airways (pulmonary edema, pneumonia).

h. Determine if breath sounds are equal on both sides of the chest.

i. Palpate the chest following auscultation. Feel the chest wall of the trauma victim for tenderness and instability over the ribs. Also palpate for subcutaneous emphysema (air in the subcutaneous tissues) which can be felt as a crackling sensation under the fingertips. Symmetry of breathing can be assessed by placing your thumbs on the xiphoid and spreading your hands over the anterior chest wall. If breathing is normal, the hands move symmetrically as the patient breathes.

j. The patient with respiratory problems is not immune to abnormalities elsewhere. Therefore, complete a head-to-toe survey.

13-159. Epiglottitis

A patient's upper airway can become obstructed by swelling of its tissues. Epiglottitis leads to marked swelling of the epiglottis and pain on swallowing and may cause complete airway obstruction.

13-160. Obstructive Airway Diseases

In obstructive airway diseases there is generalized obstruction to airflow within the lungs. The most common diseases are emphysema, chronic bronchitis, and asthma. These conditions are often classified together as chronic obstructive pulmonary disease (COPD) or chronic obstructive lung disease (COLD).

13-161. Emphysema

a. Emphysema is a pulmonary condition in which the air space beyond the terminal bronchioles is increased in size because of the destruction of the alveloar walls. Destruction of the alveolar walls also weakens the walls of the small bronchioles, lengthening expiration. Because alveolar walls are destroyed, the lungs hold more air.

b. When the ratio of air to tissue is increased characteristic physical signs become evident. Because air is a poorer carrier of sound than is tissue, breath sounds decrease in emphysema. When an overinflated lung is located between the chest wall and the heart, it is harder to hear heart sounds and to feel the impulse at the heart apex.

c. Emphysema leads to three potentially fatal complications: right ventricular heart failure, acute respiratory infection, and cardiac arrhythmias. Often, the patient with emphysema is thin, complains of increasing shortness of breath on exertion, and of progressive limitation of physical activity. Usually, coughing is not prominent and, when it occurs, produces only small amounts of whitish-gray, mucus-like sputum. Patients with emphysema usually are not cyanotic. The patient with advanced emphysema has decreased chest movement, hypertrophied (enlarged) accessory respiratory muscles, and breathes with pursed lips. Clubbed fingers are another sign of advanced emphysema.

13-162. Chronic Bronchitis

a. Chronic bronchitis is long-continued form of a pulmonary condition with a tendency to recurrence after stages of inactivity. Sputum composed of mucous and pus is common. In chronic bronchitis, the mucous-secreting cells in the respiratory epithelium produce characteristically large amounts of sputum.

b. Chronic bronchitis infections produce scarring in the lungs. Thus, patients with chronic bronchitis may have decreased total lung capacity.

c. Invariably, patients with chronic bronchitis have been heavy cigarette smokers and, in their forties, usually begin suffering from severe respiratory problems. Before this, they may have had many respiratory tract infections. Even between acute infections, chronic bronchitis patients produce at least 10 ml of green or yellow sputum daily. Like patients with emphysema, chronic bronchitis patients have prolonged expiration, but they also have inspiratory airway obstruction. Coarse rales, rhonchi, and wheezes may be heard through both lung fields.

d. Because the overinflated lungs are not located between the heart and the chest wall, heart sounds are heard more easily in chronic bronchitis than in emphysema. Pure pulmonary emphysema and chronic bronchitis represent two extremes of a single problem. Both conditions can occur in the same patient, producing signs and symptoms between the two extremes.

13-163. Treatment for Emphysema and Chronic Bronchitis

a. Establish an airway.

b. Place the patient in a sitting or semisitting position.

c. Administer oxygen. Monitor the patient's respiratory rate and depth. Provide assisted ventilation should respirations become depressed.

d. Establish an IV line with 5 percent dextrose in water (D5W) to keep open rate.

e. Administer aminophylline if ordered by the physician by adding 250 mg of aminophylline to a 250-ml bag of D5W, at a rate of 100 ml per hour.

f. Monitor vital signs and level of consciousness.

g. Encourage the patient to cough up any secretions.

h. Record treatment.

i. Evacuate patient, if necessary.

13-164. Bronchial Asthma

a. Bronchial asthma is characterized by an increased reaction to some stimuli of the trachea, bronchi, and bronchioles, with widespread narrowing of the airways (bronchospasm).

b. An acute asthma attack reflects airway obstruction due to bronchospasm, swelling of the mucous membranes in the bronchial walls, and plugging of the bronchi by thick mucus secretions. The attack may be brought on by an allergic reaction to inhaled irritants, by respiratory infection, or by emotional stress (including battle stress). Narrowing of airways and increased amounts of thick sputum interfere with airflow, especially on expiration. Airway constriction and increased amounts of sputum result in progressive difficulty for moving air in and out.

c. In a typical acute asthmatic attack, the patient is found sitting up, often leaning forward, and fighting to breathe. He may be coughing spasmodically and unproductively. Use of accessory muscles for respiration is prominent, and the chest is relatively fixed in the inspiratory position. Wheezing is usually audible even without a stethoscope, but may be absent if the attack is severe and there is little air movement.

13-165. Treatment for Bronchial Asthma

a. Establish an airway.

b. Administer humidified oxygen. If available, a nebulizer unit attached inline to a bag-valve mask may be useful in such circumstances.

c. Establish an IV line with D5W at 100 cc's per hour rate.

d. Administer epinephrine (1:1000), 0.3 to 0.5 ml SQ, if ordered by the physician.

e. If ordered by a physician, administer aminophylline in a dose level of 250 ml to a 250-ml bag or bottle of D5W. Piggyback this infusion into the IV and run it at the rate specified by the physician.

f. Administer bronchodilators such as epinephrine, isoproterenol (Isuprel), and isoetharine (Bronkosol) by aerosol, if ordered by the physician.

g. Monitor vital signs and level of consciousness.

h. Record treatment.

i. Evacuate patient, if necessary.

NOTES

1. Status asthmaticus is a severe, prolonged asthmatic attack that cannot be broken with epinephrine; the condition is a serious medical emergency. Upon examination, the patient's chest will be greatly distended. The patient will fight desperately to move air through the obstructed airways and make prominent use of accessory muscles of respiration. The patient is usually exhausted and dehydrated. The treatment is similar to that used for the acute asthmatic attack, but there is greater urgency in starting therapy and getting the patient to an MTF.
2. When dealing with any asthmatic patient, maintain a calm, reassuring attitude to lessen the patient's anxiety associated with difficulty in breathing.

13-166. Pneumonia

a. Pneumonia is caused by bacteria, viruses, or fungi. The pneumonia patient usually reports several hours to several days of fever, weakness, and productive cough, and sometimes chest pain worsened by coughing. The illness can occur abruptly, with a shaking chill, or set in gradually, progressively weakening its victim. The elderly and those with chronic diseases are more prone to pneumonia than are younger, healthier persons.

b. The pneumonia patient is often feverish, coughing, and may exhibit minimal or marked respiratory distress, depending on the degree of congestion. Auscultation of the chest will reveal rales and rhonchi over the affected lung.

c. Definitive treatment of pneumonia requires hospitalization. In the field, not much can be done. Administer oxygen and evacuate the patient in a comfortable position.

13-167. Drowning

a. Approximately 6,500 people in the United States die each year by drowning, making it the fourth leading cause of accidental death. Among adults, alcohol intoxication is a factor in about one-third of the cases. When treating the near-drowning victim, keep these points in mind:

- As the victim goes under, water enters the mouth and nose, and he begins to cough and gasp, swallowing large amounts of water.

- A small amount of water is aspirated into the larynx and trachea, setting off laryngeal muscles (laryngospasm) spasms. In 10 percent of the victims, laryngospasms seal off the airway and temporarily protects it from further aspiration. In the other 90 percent, water enters the lower airways and the laryngospasm offers no protection.

- Laryngospasm or aspirated water leads to asphyxia.

● If the victim aspirates fresh water, it rapidly crosses the alveolar membranes into the bloodstream. If the victim aspirates salt water, fluid is drawn into the alveoli from the bloodstream, causing serious pulmonary edema. Pulmonary edema mechanically obstructs gas exchange across the pulmonary membranes. Therefore, greater hypoxia occurs with salt water aspiration than with fresh water aspiration.

● Near drownings in cold water (less than $70^{o}F$) are of interest because the cold prolongs survival time. Many patients have been resuscitated without residual neurologic problems after immersions of 4 to 45 minutes. In general, successful resuscitations are related to age, water temperature, duration of immersion, and water cleanliness. The younger the patient, the colder and cleaner the water, and the shorter the time of immersion, the better the chances are for successful resuscitation.

b. Two physiologic mechanisms may account for the long survival times of near drownings in cold water. The first is the relatively rapid onset of hypothermia in patients in cardiopulmonary arrest who are submerged in cold water. The cold exerts a protective effect on the brain and other tissues, decreasing the rate of cellular degeneration that results from anoxia at normal body temperatures. The second is the mammalian diving reflex, in which the body redistributes blood flow from nonessential tissues to vital organs. The diving reflex occurs when the face is immersed in cold water. It is particularly strong in infants and children, which may help to explain the greater success of resuscitation in young patients.

13-168. Treatment for Near-Drowning Patients

a. Whether near drowning occurs in fresh water or in salt water, initial resuscitation involves cardiopulmonary resuscitation. First, try to reach the victim without endangering yourself. (An unqualified swimmer should not try to rescue a drowning victim because the rescue attempt may lead to two drowning victims.) After reaching the victim, establish an airway and begin ventilation—even before he is removed from the water. Do not waste time trying to remove water from his lungs early in resuscitation. If the near drowning occurred in fresh water, the water will have already been absorbed through the lungs. Even in salt water near drownings, laryngospasm may have protected the lower airway from aspiration. When dealing with a swimming pool near drowning, assume that he is the victim of a diving accident. Protect his cervical spine while giving mouth-to-mouth resuscitation and removing him from the water.

b. After removing the patient from the water, determine whether a pulse is present. Begin closed chest compression if it is needed. Protect the airway from aspiration during vomiting, which usually occurs during resuscitation from near drowning. Supplemental oxygen in the highest possible concentration should be administered as soon as possible. Carry out suctioning as needed.

c. Even if it appears that the patient has recovered at the scene, transport him to the hospital. Delayed death can occur in near drowning due to pulmonary edema and aspiration pneumonia. The patient should receive 100 percent oxygen during transport and be given resuscitation if necessary.

13-169. Inhalation Burns

a. Fatal burns to the respiratory tract can occur with little or no external evidence. Toxic combustion products and inhaled chemical irritants produce varying amounts of damage depending on the nature and duration of exposure. Inhalation of superheated air by itself rarely damages the lungs because dry air conducts heat poorly and the mucous membranes of the upper respiratory tract efficiently cool the air. Furthermore, a blast of hot air causes reflex closure of the vocal cords, thus further reducing the possibility of direct thermal injury to the lower respiratory tract. Only the inhalation of steam is likely to cause thermal injury to the lung mucosa. Combustion products of some common substances, however, are very toxic to airways and alveoli and cause upper airway obstruction (due to edema), bronchospasm, and damaged pulmonary capillaries, allowing fluid to leak out of them into the alveolar spaces.

b. When taking a history from a patient exposed to fire or toxic inhalants, gather the following information:

- The nature of the inhalant or the combusted material. Many irritant gases combine with water to form corrosive acids or alkalis that cause burns of the upper respiratory tract.

- The duration of the exposure.

- Whether or not the patient was in a closed area when the exposure took place. Victims trapped in closed areas with smoke or fumes are more likely to sustain respiratory tract injury, although smoke or fumes in open areas can also result in damage.

- Whether or not the patient lost consciousness. Reflex mechanisms that ordinarily protect the lower respiratory tract may have been impaired if the patient lost consciousness.

c. During the physical examination, carefully check the face and mouth, inspecting them for burns. Auscultate the chest, listening carefully for rales and wheezes. Examine the patient's throat.

13-170. Treatment for Inhalation Burns

a. Establish and maintain an airway. Assist ventilations as needed.

b. Administer oxygen in the highest concentration available.

c. Establish an IV line with Ringer's lactate or saline at TKO rate.

d. Monitor vital signs and level of consciousness.

e. Record treatment.

f. Evacuate patient.

13-171. Artificial Airways

a. The oropharyngeal and nasopharyngeal airways are the two most commonly used airways . Each is designed for use in different situations.

b. The oropharyngeal airway is a curved device that fits over the back of the tongue and holds it away from the posterior wall of the throat (Figure 13-117). This device is inserted upside down (tip upward) into the mouth and then rotated as the tip reaches the back of the tongue. Do not push the tongue backward into the throat while inserting the airway. Do not use the oropharyngeal airway on a conscious patient. It stimulates gagging and vomiting in individuals with functioning reflexes.

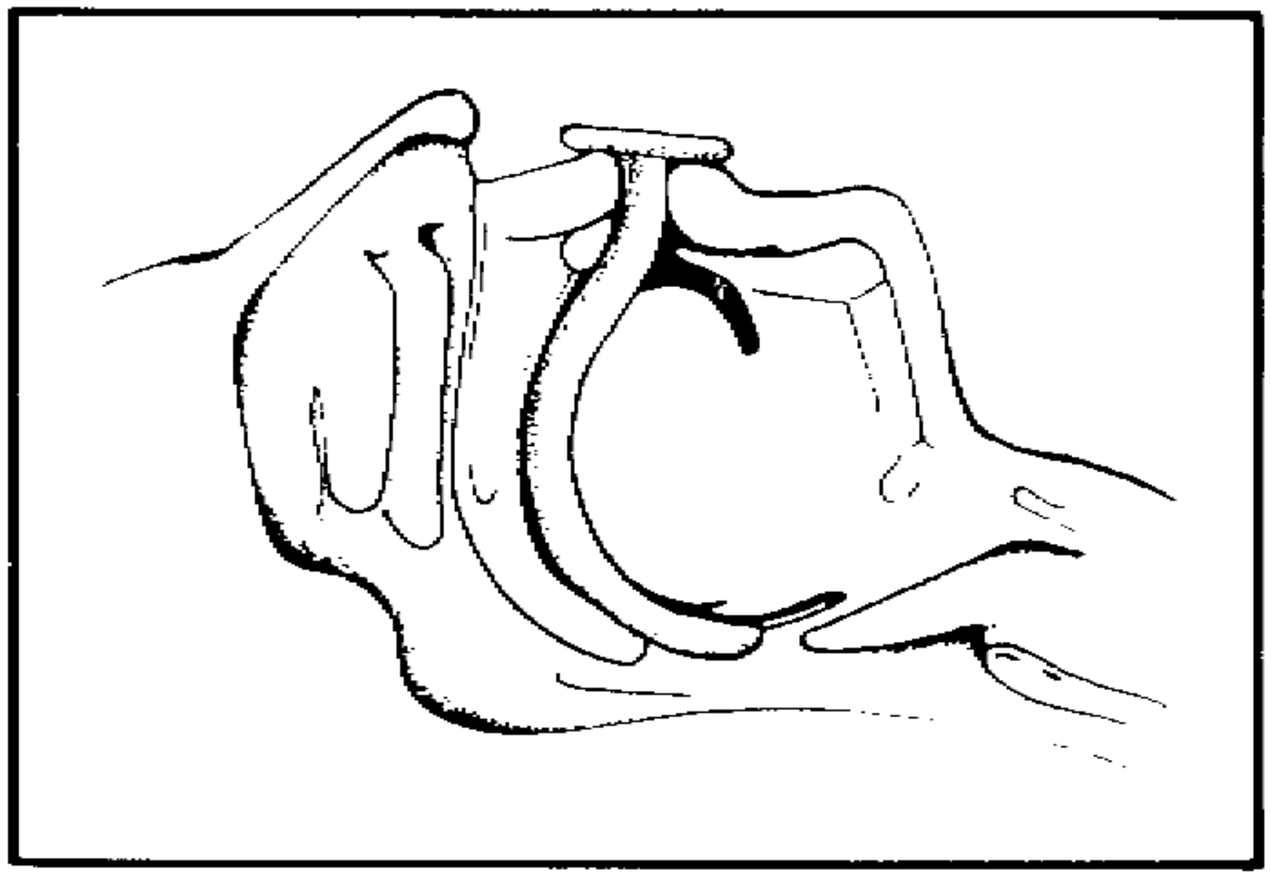


Figure 13-117. The oropharyngeal airway inserted.

c. The nasopharyngeal airway is a soft rubber tube, which is inserted through the nose into the pharynx behind the tongue, thus allowing air to pass from the nose to the lower airway. (Hard, plastic nasopharyngeal airways are unnecessarily traumatic and should not be used.) Lubricate the device with water-soluble jelly and insert it gently to avoid injury to or cause bleeding from the nasal passages. Semiconscious patients tolerate this airway more than the oropharyngeal airway.

13-172. Aids to Artificial Respirations

a. Two ventilation devices are used to treat patients requiring artificial respiration: the pocket mask and the bag-valve mask.

b. The pocket mask (Figure 13-118) with an oxygen inlet valve eliminates direct contact with the patient's nose and mouth and permits mouth-to-mouth ventilation with up to 50-percent oxygen with a flow rate of 10 liters per minute. An oxygen line connects to the mask's inlet valve. To use a pocket mask, open the patient's airway and place the rim of the pocket mask between his lower lip and chin. Retract the lip and hold the mouth open. With both thumbs along the side of the mask, clamp the remainder of the mask to the face. Grasp the jaw just beneath the angles with the fingers while maintaining a backward tilt of the head and a jaw thrust. Then exhale intermittently into the mask, forcing the breath, which is enriched with oxygen, into the patient's lungs. If the oxygen flow rate is high enough (control valve wide open), periodically occlude the opening of the mask with the tongue and allow the oxygen flow to ventilate the patient. This technique

will produce an inspired oxygen concentration much higher than 50 percent. As with any other means of artificial ventilation, when using the pocket mask, observe the chest for the rise and fall, which indicates adequate ventilation. Because both hands can be utilized by the rescuer to maintain an open airway, masks of this type are easier to use than bag-valve masks.

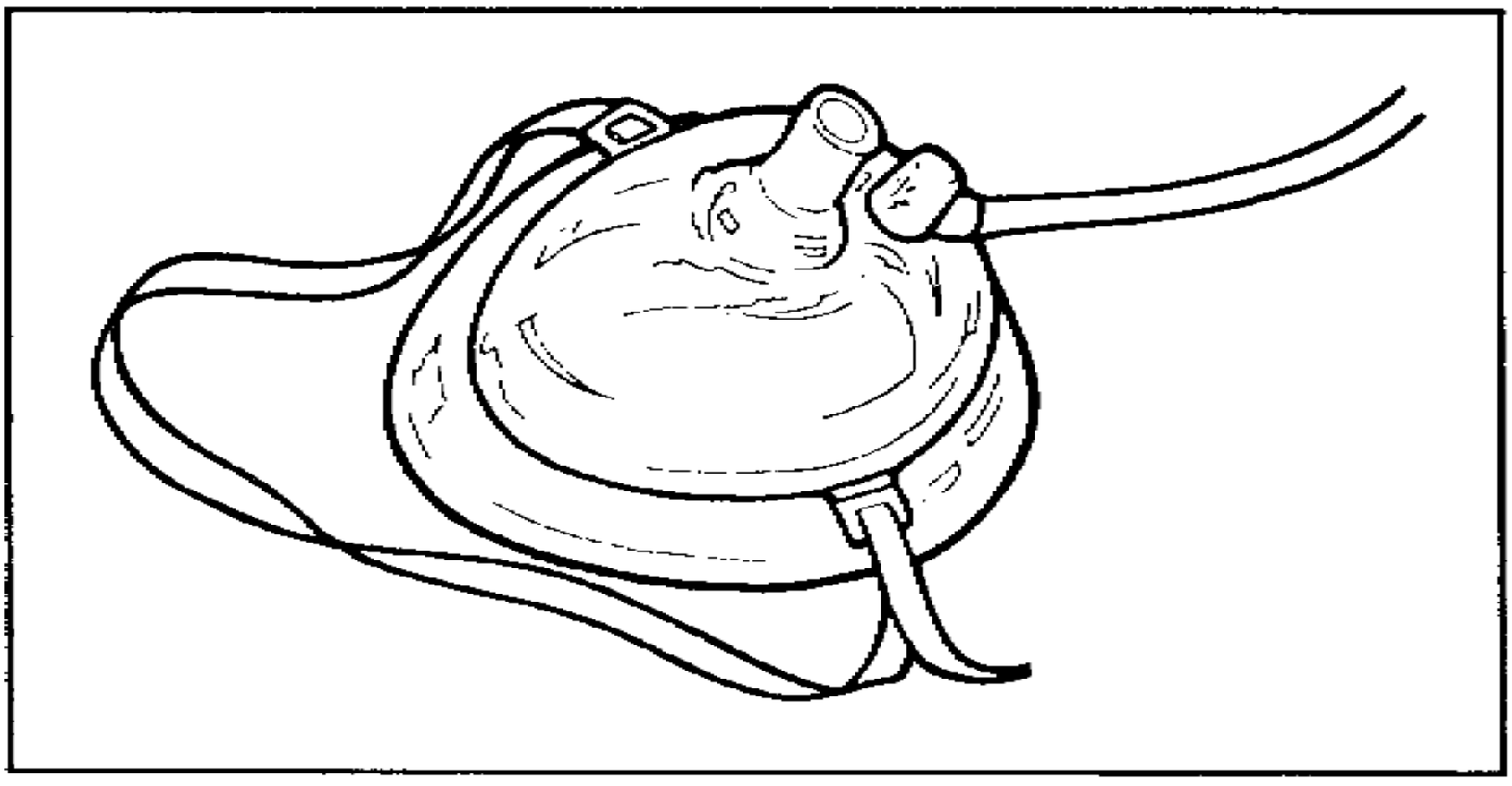


Figure 13-118. The pocket mask.

c. Bag-valve masks are self-inflating and, when used without supplemental oxygen, deliver room air (21 percent oxygen) to the patient. If an oxygen source with a flow rate of 12 liters per minute is attached to the bag-valve mask, the delivered oxygen concentration can be increased to 40 percent. Adding an oxygen reservoir to the bag can further increase the inspired oxygen concentration to about 90 percent.

d. The mask used with a bag-valve device should be transparent so that vomitus or secretions around the patient's mouth can be seen. To correctly employ the bag-valve mask—

(1) Apply the mask so that it fits snugly over the patient's chin, beneath his lower lip, and over the bridge of his nose (Figure 13-119).

(2) Place your thumb and index finger on the mask—thumb above the index finger and below the valve connection—and use the other fingers to grip the patient's mandible and form a tight seal.

(3) Tilt the patient's head back to open the airway and compress the bag with your other hand.

e. Watch for the rise and fall of the chest to be certain that ventilation is occurring. Often, an oropharyngeal or nasopharyngeal airway is desirable to keep the airway open.

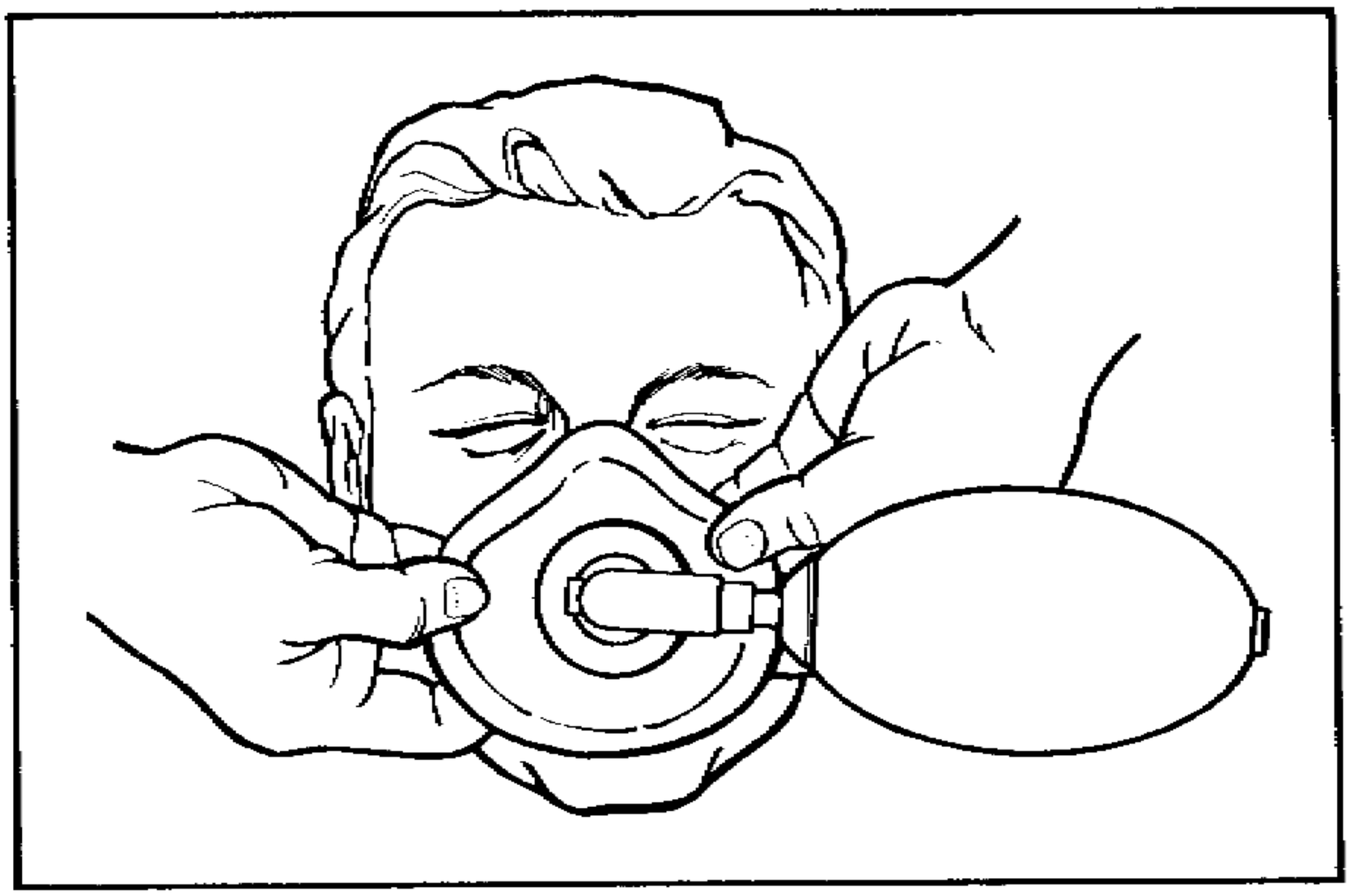


Figure 13-119. Inserting the bag-valve device.

f. The bag-valve mask is more convenient and delivers a more enriched oxygen mixture than mouth-to-mouth ventilation. Keep in mind, however, that the bag-valve mask rarely generates the tidal volumes possible with mouth-to-mouth ventilation. *Gastric distension is a problem with both techniques.*

g. Bag-valve masks with oxygen supplementation may be used to assist the ventilations of a spontaneously breathing patient. Apply the mask to the patient's face in the manner described above, and gently squeeze the bag as the patient takes a breath.

13-173. Demand Valve

Manually triggered ventilation devices, or demand valves, are available in many hospitals and are acceptable for emergency use if they deliver a flow rate of at least 100 liters per minute. These devices may be connected to a mask, an endotracheal tube, or an esophageal obturator airway and are used to assist ventilation in a spontaneously breathing patient. A slight negative pressure, produced by the patient's inspiratory effort, will trigger the oxygen flow. The flow continues until the negative pressure ceases and exhaled gases exit through a nonbreathing valve.

CAUTION

When treating an apnea patient, do not use an oxygen-powered breathing device for very long with a mask because it may cause severe gastric distension. Do not use the device at all on patients under 12 years of age, except under very special circumstances, such as airway obstruction due to croup or epiglottis. Because demand valves may develop high pressures, the use of such a device with an endotracheal tube must be undertaken with caution. Bag-valve masks provide finer control of ventilation and better assessment of the patient's lung compliance.

13-174. Esophageal Obturator Airway

a. The esophageal obturator airway is a long tube that superficially resembles an endotracheal tube. It is open at the top, sealed at the bottom, and contains numerous holes on the side near its upper end. A mask fits over the tube at its upper end, and an inflated cuff is located near its bottom end. When the esophageal airway is properly placed and the mask is seated firmly on the face, air that is blown in by mouth or bag-valve mask will enter the patient's pharynx through the side holes in the obturator. Since the inflated cuff obstructs the esophagus, and the mask seals off the mouth and nose, air can only travel into the trachea. Thus, the esophageal obturator prevents progressive gastric distension during assisted ventilation and also lessens the regurgitation of stomach contents. Using the esophageal airway, however, is not without hazards. Rough handling during insertion may damage structures in the pharynx, and excess inflation of the cuff may rupture the esophagus.

b. To insert the airway, place its top end through the port of the supplied face mask. Many of these masks have inflatable rims, which should be fully inflated before the airway is inserted. Slightly flex the patient's head and pull the jaw forward while the cuffed end of the tube is gently advanced into the esophagus until the mask sits firmly on the face (Figure 13-120). If the mouth is dry, the end of the obturator may need to be lubricated with a water-soluble jelly. Never jam the tube down. If you meet resistance, gently pull the tube back and try to advance it again. In most cases, the tube will follow the natural curvature of the throat and move easily into the esophagus. But because it is always possible to inadvertently intubate the trachea with this device, check the location of the tube: Tilt the patient's head back, hold the mask in place, ventilate through the airway, and watch the chest to see if it rises and falls. If the chest moves, the tube is in the esophagus, and the cuff can be inflated with 20 to 30 ml of air. To recheck the position of the esophageal airway, ventilate the chest again and listen for breath sounds. If there is no chest expansion or if breath sounds are absent, the airway may be lodged in the tachea. If this is the case, remove the airway at once (cuff deflated) and continue ventilation by another method. Try again to reinsert the obturator.

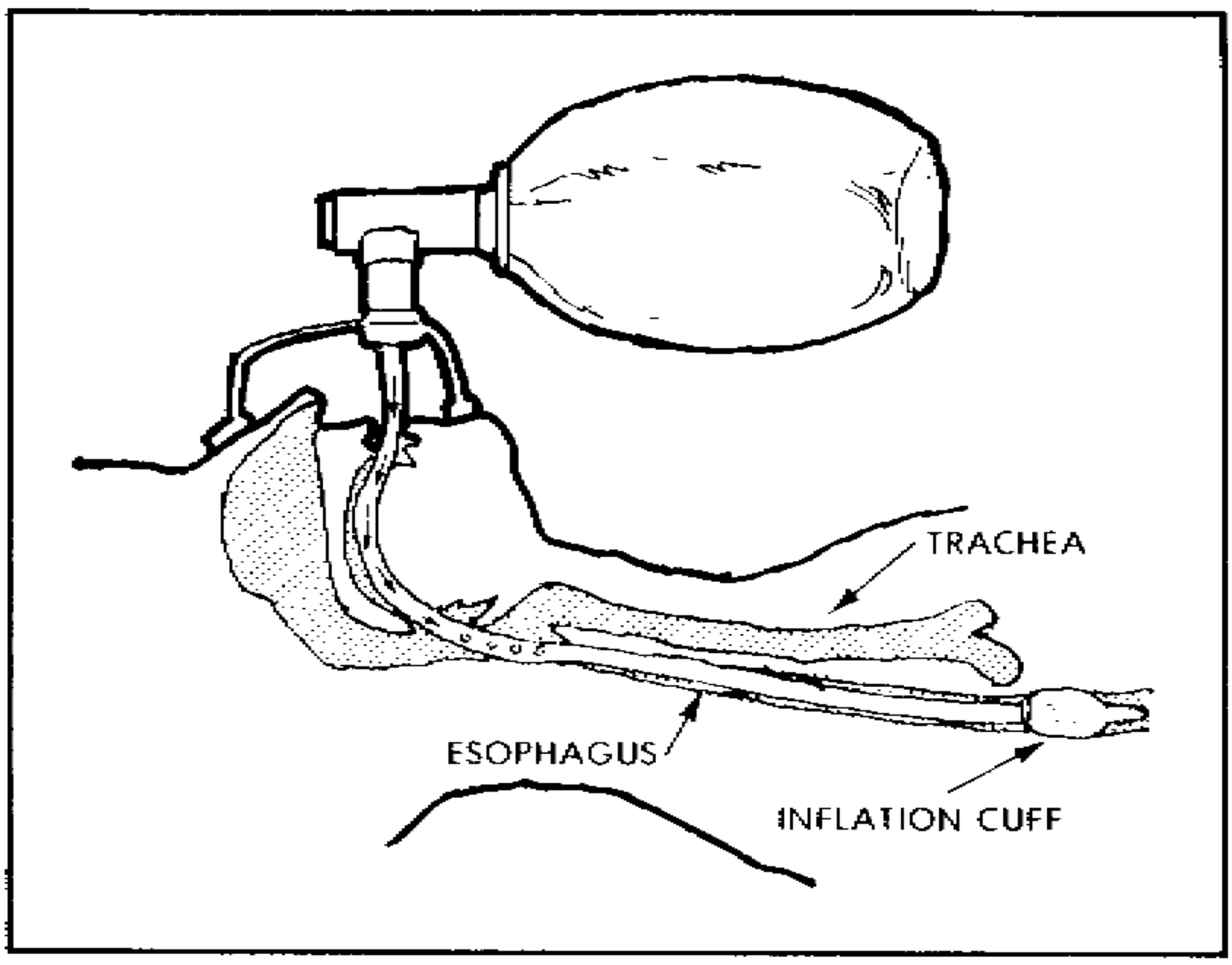


Figure 13-120. The esophageal obturator airway.

c. Observe these important guidelines when using the esophageal obturator airway:

(1) Use the esophageal airway only in unconscious patients. Its use causes gagging and vomiting on conscious and semiconscious patients.

(2) Do not use the esophageal airway on patients less than 16 years old or 5 feet tall.

(3) Do not use the esophageal airway on patients who have esophageal disease, cirrhosis of the liver, or who have ingested caustic substances.

(4) Do not remove the esophageal obturator airway from an unconscious patient until the airway has been secured with an endotracheal tube. Removal of the esophageal airway results in considerable regurgitation of stomach contents. Unless the trachea has first been protected with a cuffed endotracheal tube, regurgitated material will enter the lungs.

CHAPTER 14

CLINICAL PROCEDURES

Section I. INTRODUCTION

14-1. General

Providing casualties with immediate medical treatment on the battlefield is only one phase of your responsibilities as a medical specialist. When you are assigned to a clinic, hospital, or other medical treatment facility, you will be confronted with a number of different or unique treatment requirements on a daily basis. The clinical environment presents an entirely new set of patient care situations with which you will have to deal.

14-2. Your Role in Clinical Care

The importance of your role in patient care cannot be over-emphasized. Your technical skill and knowledge are major contributing factors in an individual patient's rapid and successful recovery. The techniques and procedures explained in the following sections are those that you will be working with in the course of your normal duties. They represent a wide selection of the treatment situations to which you will be exposed. While many of these procedures appear to require little, if any, explanation, they are fundamentally important and will serve as reference and review material.

Section II. VITAL SIGNS

14-3. General

Temperature, pulse, respiration (TPR), and blood pressure (BP) are called vital signs because they are important signs that indicate a patient's condition. Measurement of these signs aids in making a diagnosis and prescribing treatment. Any marked deviation from the normal range is a signal of distress from the body; the interpretation of changes is as important as the measurement itself.

14-4. Body Temperature

Body temperature is the result of a balance between the heat produced and the heat lost by the body. The hypothalmus is that portion of the brain that regulates body temperature by speeding up or slowing down the cells use of food (metabolic rate). The higher the rate of metabolism. the more heat the body produces. This heat is distributed by the circulating blood. Excessive heat is eliminated through the skin, lungs, and excreta. When the balance is disturbed, deviations in body temperature result.

a. Normal Temperature. Body temperature ranges between 96 and 100°F. The normal, or average, temperature of most people is 98.6°F. The temperature reading that you obtain will vary according to the site you use. The average oral temperature is 98.6°F. Rectal temperature is usually about one degree higher (99.6°F), and the axillary (armpit) temperature is about one degree lower (97.6°F) than when measured orally. A range of 0.5-1.0°F from the average normal temperature is usually considered to be within normal limits. When the body temperature changes from the normal average, it warns of body malfunction, infection, or dehydration.

b. Abnormal Temperature.

(1) Pyrexia (fever) is an elevation in temperature above the normal average. During pyrexia, heat is produced faster than the body can eliminate it. Fever is a common symptom of infection or other disease.

(2) Hypothermia is a deviation in temperature which persists below the average normal temperature. A subnormal temperature may be caused by shock, starvation, or a long-lasting illness. It indicates that body resistance to disease is low.

14-5. Measuring Body Temperature

a. The body temperature can be measured by the mouth, the rectum, or the axilla (armpit). The method used depends on patient's age, physical condition, and equipment available.

b. The clinical thermometer is a glass bulb containing mercury and a stem in which the mercury can rise. On the stem there is a graduated scale representing degrees of temperature with the lowest indicating 94°F and the highest 106°F. Two types, oral and rectal, are commonly used. Various manufacturers color code the tips of the thermometers for proper identification: blue tip for oral usage (Figure 14-1A) and red tip for rectal usage. The standard rectal thermometer (Figures 14-1B and 14-1C) comes in two shapes that are specifically designed to prevent perforation of the anus or the rectum.

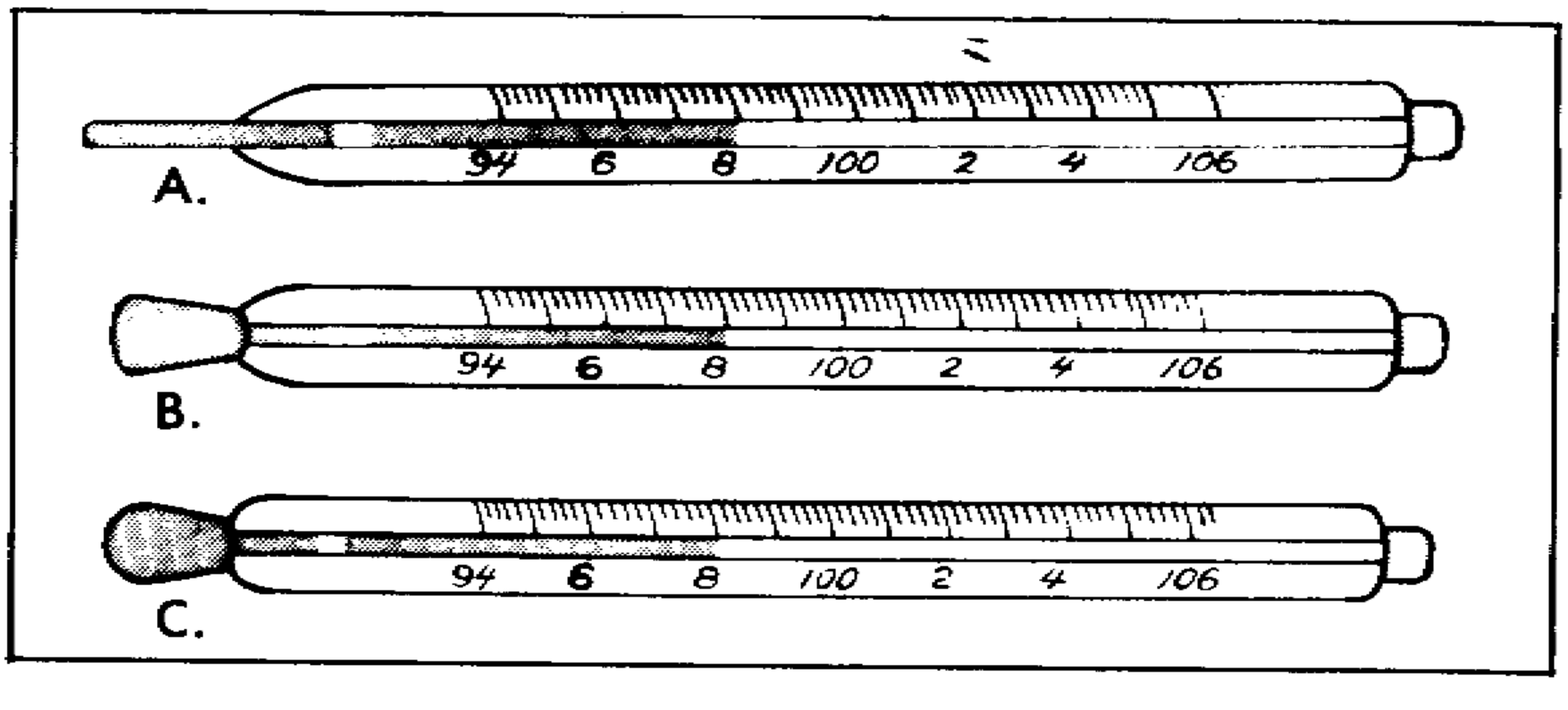


Figure 14-1. Clinical thermometers (oral and rectal).

14-6. Reading the Thermometer

The stem of the mercury-in-glass thermometer contains a temperature measuring scale. The scale has an arrow marking the normal temperature of 98.6°F. Long lines on the scale represent each degree, with only the even-numbered degrees written (for example, 94, 96, 98, 100). Short lines between

degree lines represent 0.2 (two tenths) of a degree. All temperatures are recorded as ending in an even number when using this thermometer (98.2°F, 99.6°F) because it does not measure in odd tenths. To read a clinical thermometer:

a. Hold the thermometer by the stem at eye level.

b. Notice the ridge side with numbers below and lines indicating number of degrees above (long lines = one degree; short lines = 0.2 of a degree).

c. Rotate the thermometer back and forth slowly until you can see the silver mercury strip.

d. Compare mercury strip level to printed markings.

14-7. Methods of Measuring Temperature Using Clinical Thermometers

a. Oral Temperature (Figure 14-2). This is the most convenient method and can be used for responsive adult patients. Before taking an oral temperature you should ask the patient if he has recently had any food or drink or if he has been smoking. If so, wait 15 minutes before taking the temperature.

CAUTION

When handling thermometers, handle by the stem end only.

(1) Wash your hands.

(2) Check thermometer to be sure it is clean and dry. Shake it down to 94°F if necessary. When shaking down the thermometer, grasp the stem end firmly and with a sharp downward wrist motion, shake the thermometer. Check the mercury column and repeat the shaking procedure, if necessary, to lower the column to the 94°F mark.

(3) Place bulb end under the patient's tongue (Figure 14-2A). Instruct him to close lips firmly around stem, but not to bite down (Figure 14-2B). Leave thermometer in place at least 3 minutes.

(4) Remove thermometer. Wipe with a gauze tissue from stem to bulb to remove any saliva. Read and record the temperature, using decimals (for example, "98.4°F").

(5) Place thermometer in "used" oral thermometer holder.

b. Rectal Temperature. This is the most accurate method. It is used for all infants and young children and for adults who are unconscious, irrational, or who have difficulty breathing with the mouth closed. It is *not* used on patients who have had rectal surgery or have a rectal disorder.

(1) Provide patient privacy (if possible). Then turn him on his side (Sims position) and expose the buttocks. The top knee should be flexed (bent).

(2) Insure that the tip of the thermometer is well lubricated. Use sterile lubricant for this procedure.

(3) Lift the upper buttock to expose the anus. Insert the well-lubricated bulb of the thermometer slowly and carefully about 1 1/2 inches into the rectum (Figure 14-3).

(4) *Hold thermometer* in place for 2 minutes.

(5) Remove thermometer. Wipe downward with a gauze tissue from stem to bulb. Read and record temperature, using the decimal followed by the initial R (for example, "99.8°F(R)").

(6) Place rectal thermometer in "used" holder.

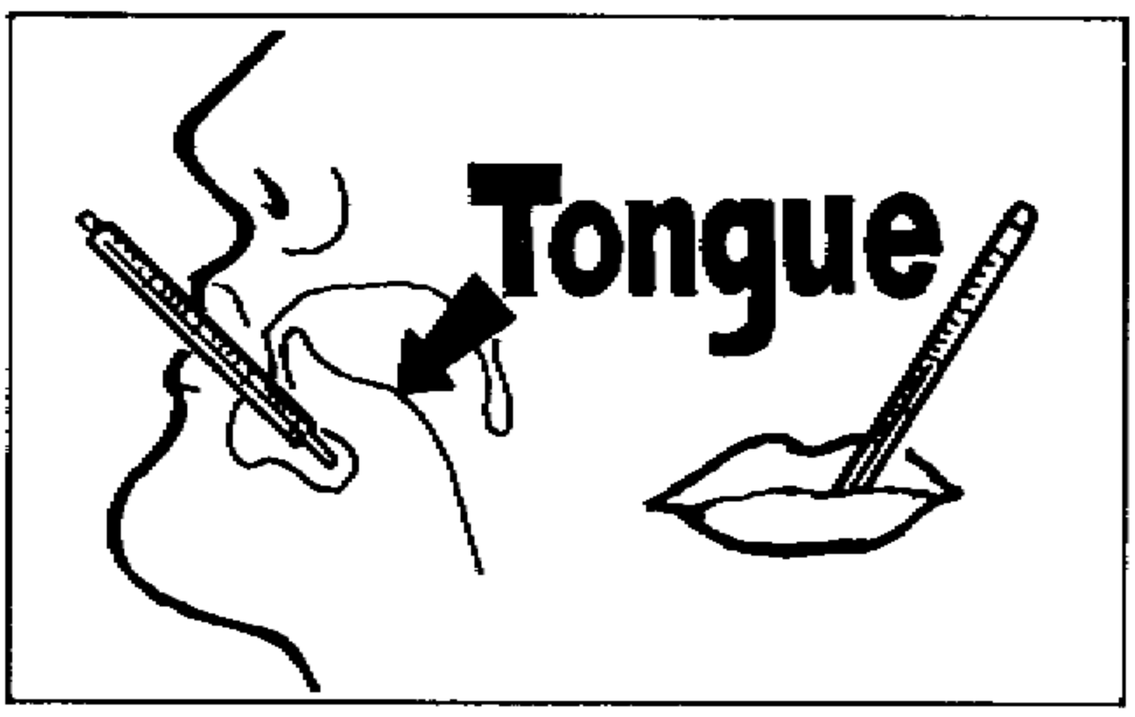


Figure 14-2. Measuring patient's oral temperature.

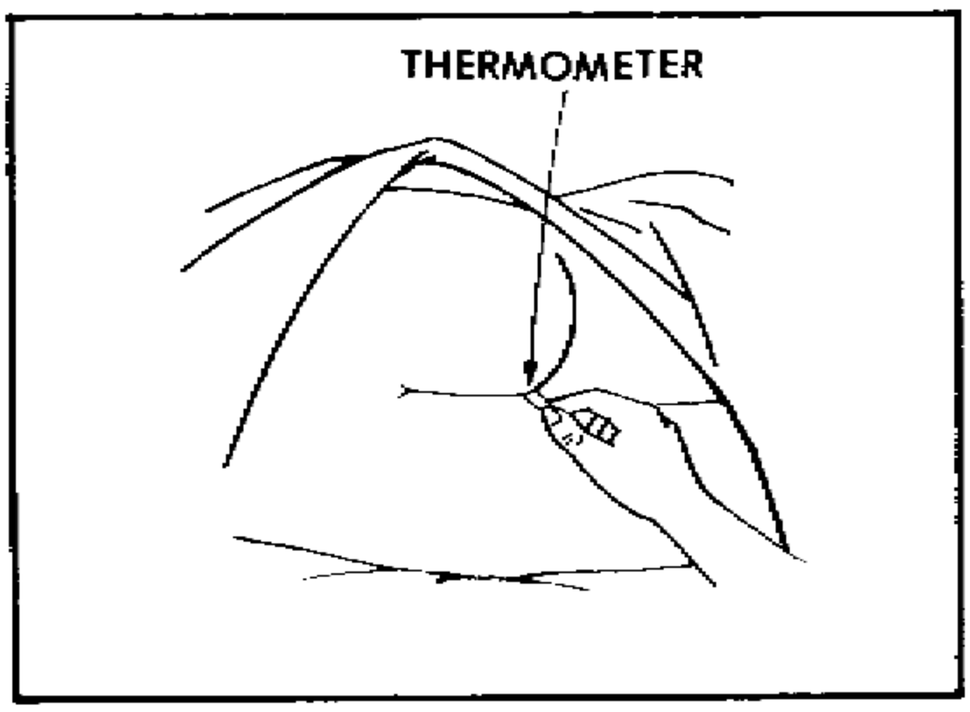


Figure 14-3. Insertion of the thermometer into patient's rectum.

NOTE

Instruct the patient to take a deep breath; this will relax the anal sphincter and allow easier insertion of the thermometer.

c. *Axillary Temperature.* When temperature can be taken neither orally nor rectally, it can be taken under the arm where the thermometer bulb can be surrounded by body tissue. To take the axillary (armpit) temperature, use an oral thermometer.

(1) Pat the armpit dry with a tissue or towel. Place the bulb of the oral thermometer in the center of the armpit and pointed towards the patient's head.

(2) Fold the patient's arm across his chest with his fingers on the opposite shoulder (Figure 14-4).

(3) Leave thermometer in place for at least 10 minutes.

(4) Remove thermometer. Read and record temperature, using the decimal followed by the initial A (for example, "100.2^{O}F(A)").

(5) Place thermometer in "used" holder.

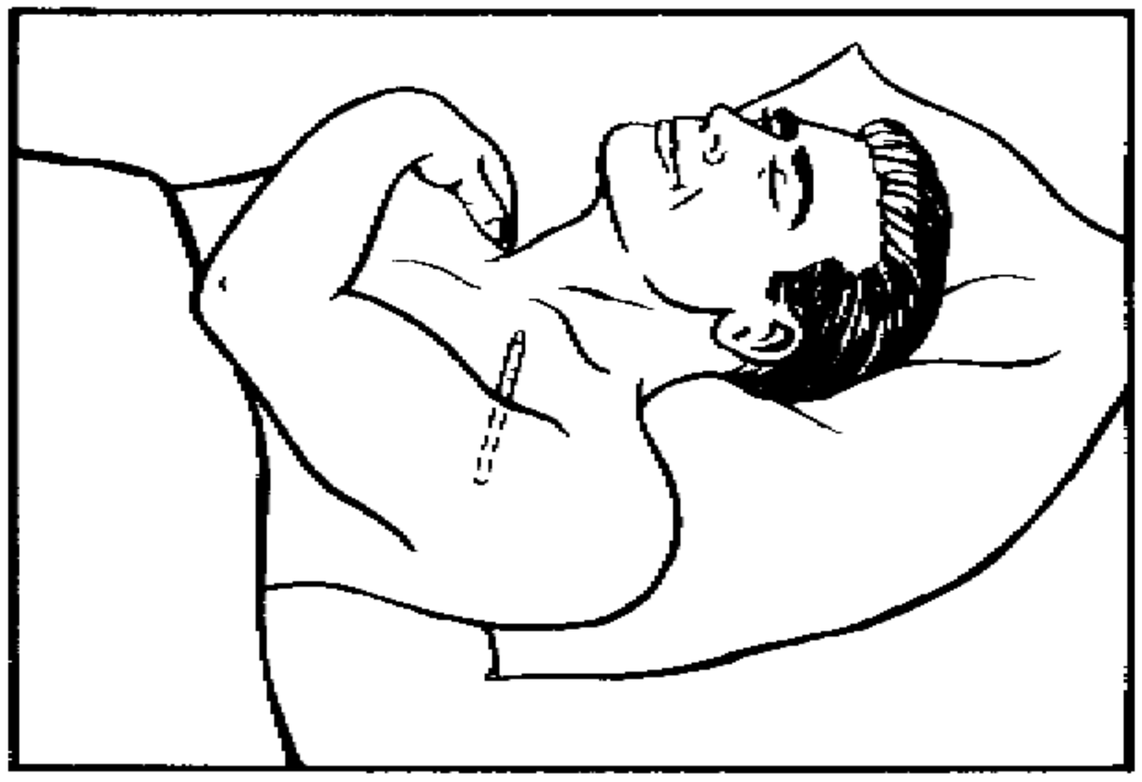


Figure 14-4. Take an axillary temperature.

14-8. Care of Thermometers (Clinical Environment)

a. Remove contaminated thermometers from "used" holder.

b. Cleanse thermometers with gauze pad soaked with Wescodyne/ Betadine solution. Cleanse each thermometer with a twisting motion from stem to bulb. Rinse the thermometer under cool running water (if available) or with a gauze pad saturated with water. Use a twisting motion from stem to bulb.

CAUTION

Most thermometer contamination is at the bulb end due to patient contact. Do not retrace or backtrack cleansing the thermometer. Doing so would recontaminate the thermometer.

c. Place thermometers in a basin of Wescodyne solution, 150 ppm, for 30 minutes.

d. Wash and dry thermometer holders. Place layer of cotton or gauze pads in the bottom of each.

e. Remove thermometers from Wescodyne solution, rinse under cool running water and dry.

f. Shake down thermometers to at least 94^{O}F and return to "clean" holder.

NOTE

If using thermometer tray, all containers should be disinfected at least once daily. Wescodyne solution should be changed daily or more often if needed.

14-9. Care of Thermometers (Field Expedient Method)

When assigned as an aidman to a TOE unit, you may have to modify the method of disinfecting thermometers while on field maneuvers. Prior to taking a patient's temperature, the thermometer should be thoroughly cleansed.

a. Remove thermometer from its plastic holder.

b. Cleanse thermometer with 70 percent isopropyl alcohol pad. Use a twisting motion to clean from stem to bulb end.

c. Rinse the thermometer with cool water or with a gauze pad saturated with water. Use a twisting motion from stem to bulb end.

d. Skake down thermometer to at least 94°F.

NOTE

This procedure is to be used prior to taking patient's temperature and after temperature is taken.

14-10. Pulse

Pulse is defined as the rhythmic expansion and contraction of an artery. This action is caused by the beating of the heart. When the heart contracts (systole), the blood is forced from its chambers into the arteries. This action causes the arteries to dilate (expand). When the heart relaxes (diastole), blood refills its chambers. This action causes the arteries to contract, or recoil, as the blood moves further along in the circulatory system. A patient's pulse is measured to aid in determining his condition by comparing it with a normal heart rate.

14-11. Palpation of the Pulse

The pulse can be felt at points where an artery lies close to the skin or where it crosses over a bony area or hard tissue. The pulse sites (Figure 14-5) can be found—

a. At the wrist, proximal to the thumb (radial artery), on the palm side of the hand.

b. At either side of the neck, near the windpipe (carotid artery).

c. On the inside of the elbow about 1/2 inch proximal to the elbow point (brachial artery).

d. Below the left nipple (5th intercostal space (apical artery)).

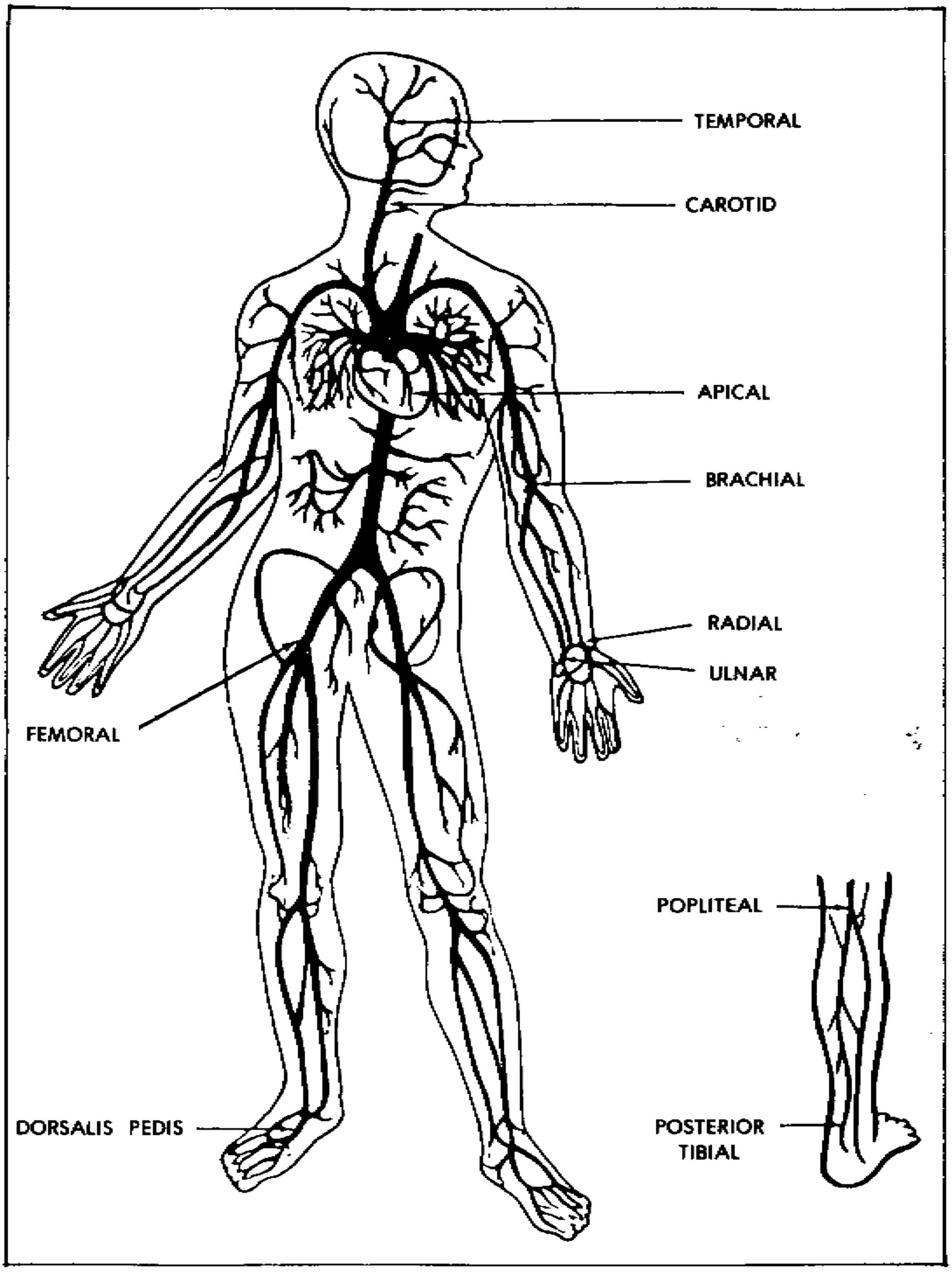


Figure 14-5. Pulse sites.

e. In front of the ear (temporal artery).

f. In the middle of the groin and leg joint (femoral artery).

g. In the center of the back of the knee along the inside medial tendon (popliteal artery).

h. Behind the inner ankle bone (posterior tibial artery).

i. Along the top (dorsum) of the foot (dorsalis pedis artery).

14-12. Pulse Rate

a. Normal Pulse Rate. Generally, the normal pulse is regular in rate, rhythm, and force (strength). A strong pulse is easily detected by the large amount of blood being pumped. The average range is between 60 and 100 pulse beats per minute. The rate of the normal pulse varies slightly in individuals as indicated in Table 14-1.

Table 14-1. Pulse Rates.

Commonly Accepted Pulse Rates	*Beats per Minute*
Normal pulse range	60 to 100
Some athletes	45 to 60
Adult males	72
Adult females	76 to 80
Child, age 5	95
Child, age 1	110
Newborn infant	115 to 130

b. Abnormal Pulse Rate.

(1) Bradycardia is a pulse rate below 60 beats per minute. A patient with heart disease may have a slow heart beat due to intake of cardiac drugs, such as digitalis. Athletes will tend to have a "normal" pulse rate of less than 60 beats per minute.

(2) Tachycardia is a pulse rate of over 100 beats per minute. Conditions causing the heart rate to rise are emotion, pain, exercise, excessive heat, fever, bleeding, and shock, which may raise the heart rate above normal, thus increasing the pulse rate.

14-13. Characteristics of Pulse Beats

When you count the pulse, the rate, rhythm, and force should be noted. There are several means of describing the characteristics of a pulse.

a. Pulse is normal when it is even in rate, rhythm, and force (strength) (Figure 14-6).

b. An irregular pulse is one that has a period of normal rhythm broken by periods of irregularity or skipped beats (Figure 14-7).

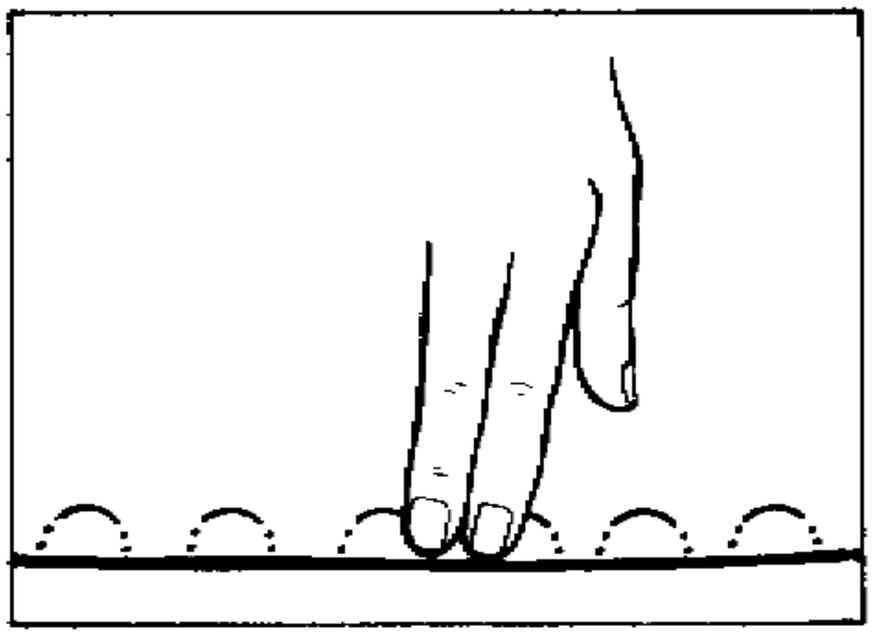


Figure 14-6. Regular pulse.

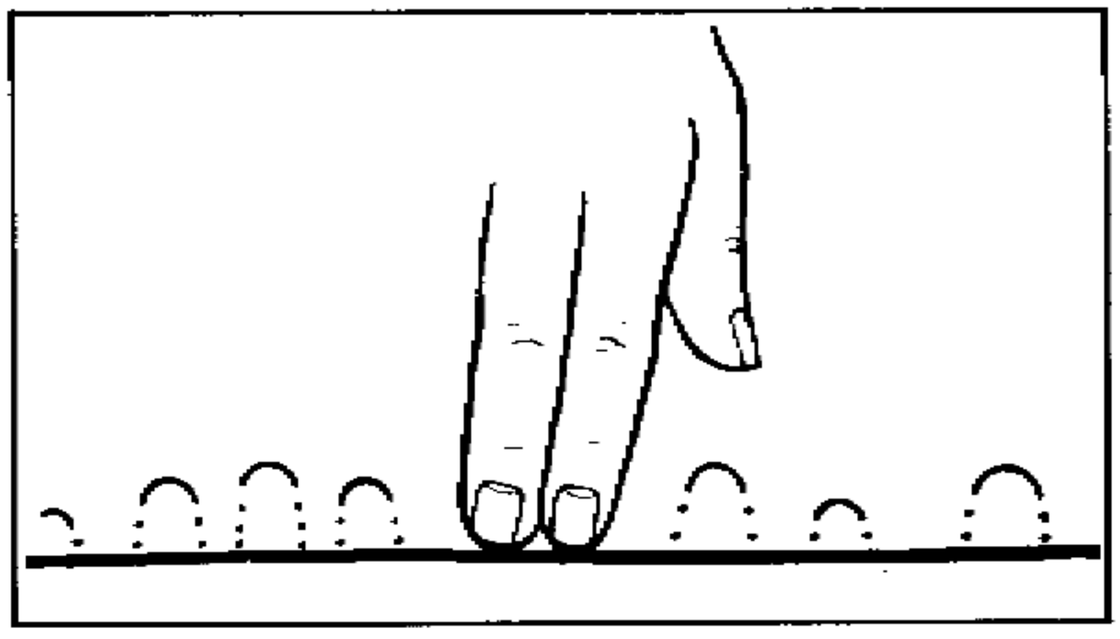


Figure 14-7. Irregular pulse.

c. A bounding pulse (Figure 14-8) occurs when exceptionally strong heartbeats make arteries difficult to compress. This may be caused by exercise, anxiety, or alcohol.

d. A pulse is weak, thready, or feeble (Figure 14-9) when only small amounts of blood are being pumped through the arteries.

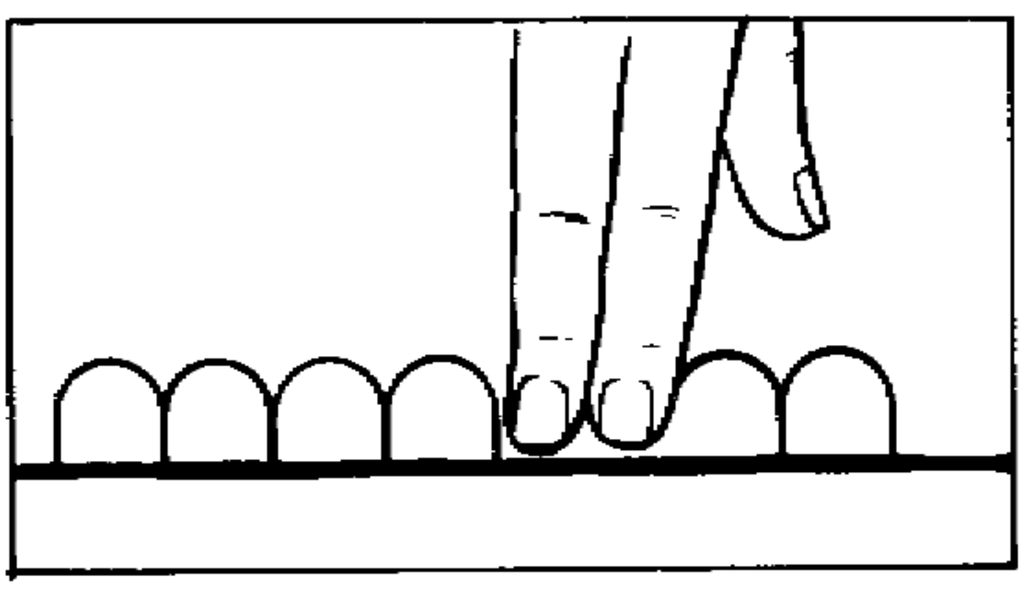


Figure 14-8. Bounding pulse.

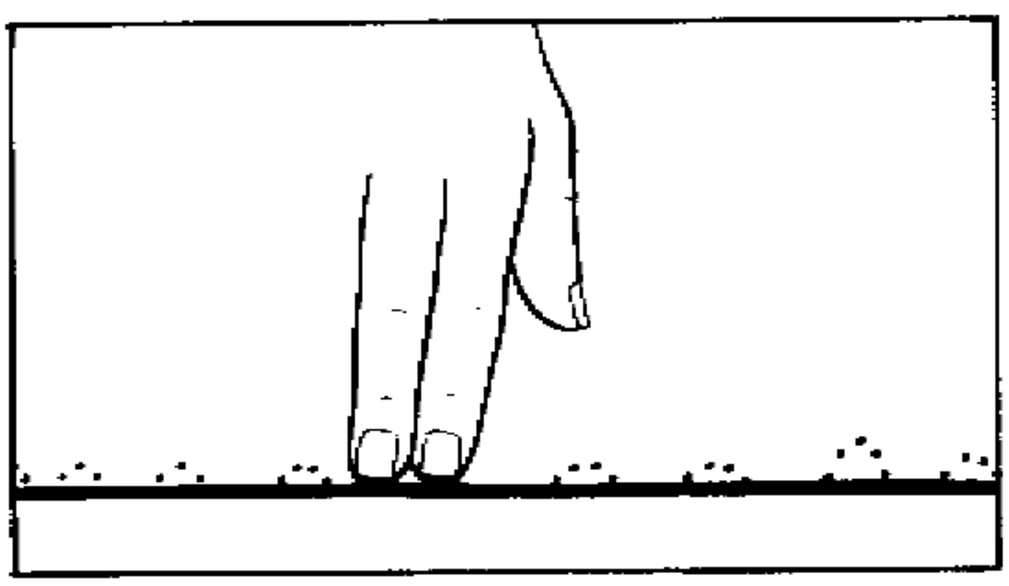


Figure 14-9. A weak, thready pulse.

14-14. Procedure for Measuring and Recording a Patient's Pulse

a. Position the patient either lying down or seated comfortably in a chair with palms up.

b. Locate the pulse point that is easiest to reach and use. Usual pulse sites are the radial, brachial, and carotid sites.

c. Palpate the pulse site by placing either the fingertips of index and middle fingers on pulse point, or index, middle, and ring fingers on pulse point (Figure 14-10).

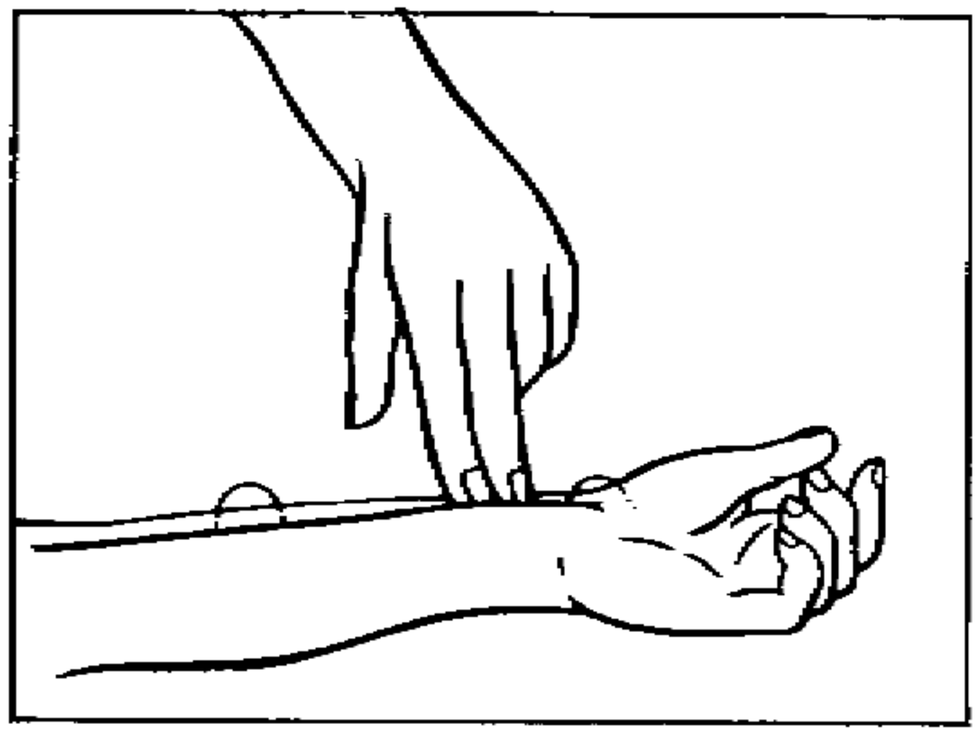


Figure 14-10. Palpating a radial pulse.

d. Count pulse for 1 full minute. Note rate, rhythm, and force (strength).

e. Record the pulse and report as appropriate.

14-15. Respiration

Respiration, commonly called breathing, is the process by which oxygen (0_2) and carbon dioxide (CO_2) are interchanged by the body. External respiration refers to the delivery of oxygen (0_2) to the lungs so that it can be taken into the blood stream. Internal respiration is the process by which oxygen from the blood is taken to the cells in the body and carbon dioxide (CO_2) is removed from tissues and carried into the blood. Both conscious and unconscious (involuntary) control of respiration is the function of a respiratory center in the brain (medulla oblongata).

a. Inhalation is the process of taking air into the lungs. During inhalation, the diaphragm descends as it contracts and the rib cage is lifted upward and outward, giving the lungs more room to expand and create a slight vacuum in the chest that draws air into the lungs.

b. Exhalation is the process of expelling air from the lungs. During exhalation, the diaphragm rises as it relaxes and the rib cage is drawn down and inward as air rushes out of the lungs.

14-16. Normal Breathing Rates

Normal breathing (eupnea) is easily done and does not require conscious thought. Normal respiratory rates are typically one-fourth of the normal heart rate. Respiratory rates vary according to age; the following are commonly accepted as being the normal limits:

	Respirations per Minute
a. Healthy adult	12 to 20
b. Adolescent youth	18 to 22
c. Children	22 to 28
d. Infants	30 or more

14-17. Patterns of Breathing

a. Normal Respiration. A normal, relaxed breathing pattern is effortless, evenly paced, regular, and automatic. Increased levels of carbon dioxide or lower levels of oxygen in the blood trigger an increase in the respiratory rate to restore the chemical balance and rid the body of excess carbon dioxide.

b. Abnormal Respiration. A head injury or any increased intracranial pressure (ICP) will depress the respiratory center and result in shallow or slow breathing. Certain drugs also tend to depress the respiratory rate (for example: Morphine, Demerol).

c. Breathing Variations.

(1) *Dyspnea:* Difficult and labored breathing, often with flared nostrils, anxious appearance, and statements such as "I can't get enough air." It is important to know how much exertion or activity causes the dyspnea. Does it occur when walking, trying to eat a meal, or when trying to talk?

(2) *Tachypnea:* Increased or rapid breathing; may be seen in fever and in a number of other diseases. Breathing rate increases markedly for each $1^{o}F$ increase in temperature.

(3) *Slow and shallow:* There is a limited amount of air exchanged and less oxygen is taken in. This type of breathing often leads to hypoxia, or decreased levels of oxygen in the blood. It is often seen in patients who are under sedation, recovering from anesthesia, have had abdominal surgery, or are in a weak or debilitated condition.

(4) *Cheyne-Stokes respirations:* A pattern of dyspnea followed by a short period of apnea (no respiration). Respirations are rapid and gasping in nature for about 30 to 45 seconds, then are followed by a period of no breathing for about 20 seconds. It is seen in critically ill patients with brain conditions, heart or kidney failure, or drug overdose.

(5) *Hyperventilation:* A pattern of breathing in which there is an significant increase in the rate of breaths and carbon dioxide is expelled from the body, causing the blood level of CO_2 to fall. The condition is seen after severe exertion and during high levels of anxiety or fear and with fever and diseases such as diabetic acidosis.

(6) *Kussmaul's respirations:* The increased rate and depth of respirations, with panting and long, grunting exhalation. It is frequently seen in diabetic acidosis and renal failure.

d. Noisy Respirations. As a rule of thumb, you should regard any noisy respirations as obstructed breathing. Some of the terms used to describe noisy respirations are—

(1) *Rales and rhonchi:* Rattling sound caused by secretions in the lung passageways.

(2) *Stertorous:* A snoring sound produced when patients are unable to cough up secretions from the trachea or bronchi.

(3) *Stridor:* A crowing sound on inspiration due to the obstruction of the upper air passageways as occurs in croup or laryngitis.

(4) *Wheeze:* A whistling sound of air forced past a partial obstruction as found in asthma or emphysema.

14-18. Procedure for Measuring and Recording a Patient's Respirations

For an accurate accounting of the respirations, the patient should be at rest and unaware of the counting process. If adult patients are aware that you are counting their respirations, they may voluntarily breathe faster or slower. The most satisfactory time to count respirations is after the patient's pulse count.

a. After taking the pulse, continue holding the patient's wrist. Lay the patient's arm across his chest.

b. Count respiratory rate for 1 full minute. Observe rate, depth, patterns, and sounds of respiration.

NOTE

One respiration includes both the inhalation and expiration.

c. Record the respirations and report as appropriate.

14-19. Blood Pressure

Blood pressure (BP) may be defined as the pressure exerted by the blood on the walls of the vessels. All parts of the vascular system are under pressure, but the term "blood pressure" usually refers to arterial pressure. The pressure is the product of (1) the force of the contraction of the ventricles of the heart, (2) the amount of blood pumped out of the heart, and (3) the resistance of the blood vessels to the flow of blood through them. By measuring the blood pressure, you obtain information about the effectiveness of the heart contractions, the adequacy of the blood volume in the system, and the presence of any obstruction or interference of flow through the blood vessels.

14-20. Normal Ranges of Blood Pressure

Blood pressure consists of the systolic pressure written as a fraction over the diastolic pressure. The systolic pressure is the level present during contraction of the heart. Diastolic pressure is the pressure during relaxation of the heart. The average blood pressure in a healthy young adult is considered to be 120/80 mm of mercury (Hg); 120 is the systolic pressure, 80 is the diastolic pressure.

Just as pulse and respiratory rates vary among individuals, so does blood pressure. The normal blood pressure range is—

MALE		FEMALE	
Systolic	100-140	Systolic	90-130
Diastolic	60-90	Diastolic	50-80

14-21. Factors Influencing Blood Pressure

As a result of the many factors influencing it, the blood pressure is a dynamic force that can vary from minute to minute as the heart adjusts to demands and responses of the body and brain. Many factors exert an influence on blood pressure:

a. Age: Blood pressure is lower in children than it is in adults.

b. Sex: Blood pressure is higher for men than women of the same age level.

c. Body Build: Obese persons usually have higher blood pressure than do those who are of average weight and build.

d. Exercise: Exertion temporarily elevates blood pressure.

e. Pain: Pain will usually elevate blood pressure.

f. Emotion: Fear, worry, or excitement will elevate blood pressure.

g. Drugs: Vasoconstrictors elevate blood pressure. Vasodilators decrease blood pressure. Narcotics decrease blood pressure.

h. Disease: Any disorder affecting the circulatory or renal system may increase blood pressure. A disease that weakens the heart may lower the blood pressure.

i. Hemorrhage: Decrease of blood volume lowers blood pressure and may lead to shock.

j. Intracranial Pressure: Pressure in the space between the skull and the brain can elevate blood pressure.

14-22. Abnormalities of Blood Pressure

a. Hypertension. Pressure elevated above the normal range is called hypertension. Prolonged hypertension can cause permanent damage to the brain, the kidneys, the heart, and the retina of the eye.

b. Hypotension: Low blood pressure is called hypotension. Hypotension associated with symptoms of shock or circulatory collapse is a dangerous condition that can rapidly progress to death unless treated.

14-23. Blood Pressure Measurement

Blood pressure is measured with a sphygmomanometer (an air-pressure device) (Figure 14-11) and a stethoscope (Figure 14-12). The cuff of the sphygmomanometer contains an oblong rubber bag or bladder. When the cuff is wrapped around the upper arm or the midthigh and inflated with air, the air pressure registers on the sphygmomanometer gauge. Taking a blood pressure requires practice. The individual must apply the cuff properly, manipulate the air bulb, and simultaneously listen through the stethoscope while watching the gauge.

NOTE

The pressure readings are in millimeters (mm) of mercury (Hg).

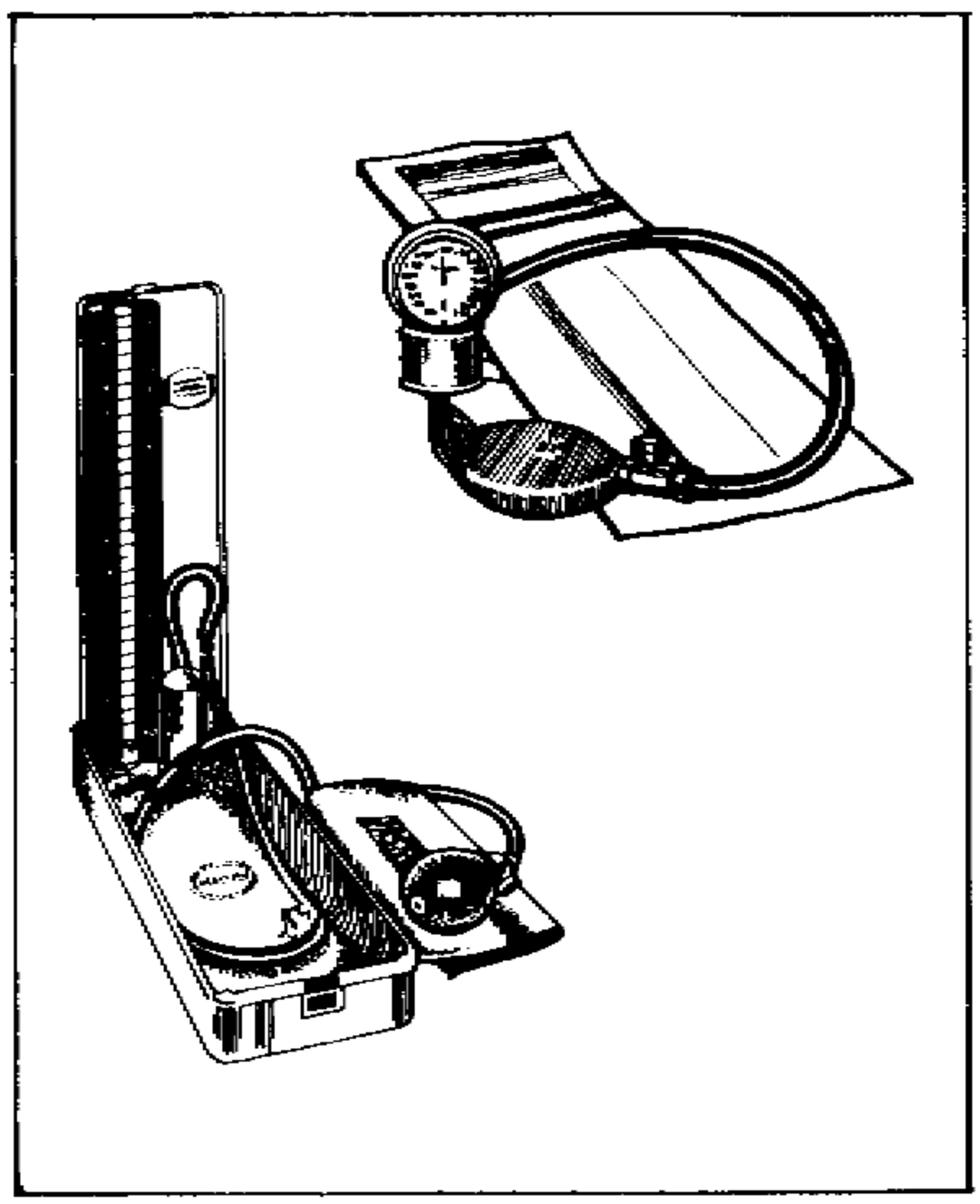


Figure 14-11. Sphygomomanometer (aneroid and mercury illustrated).

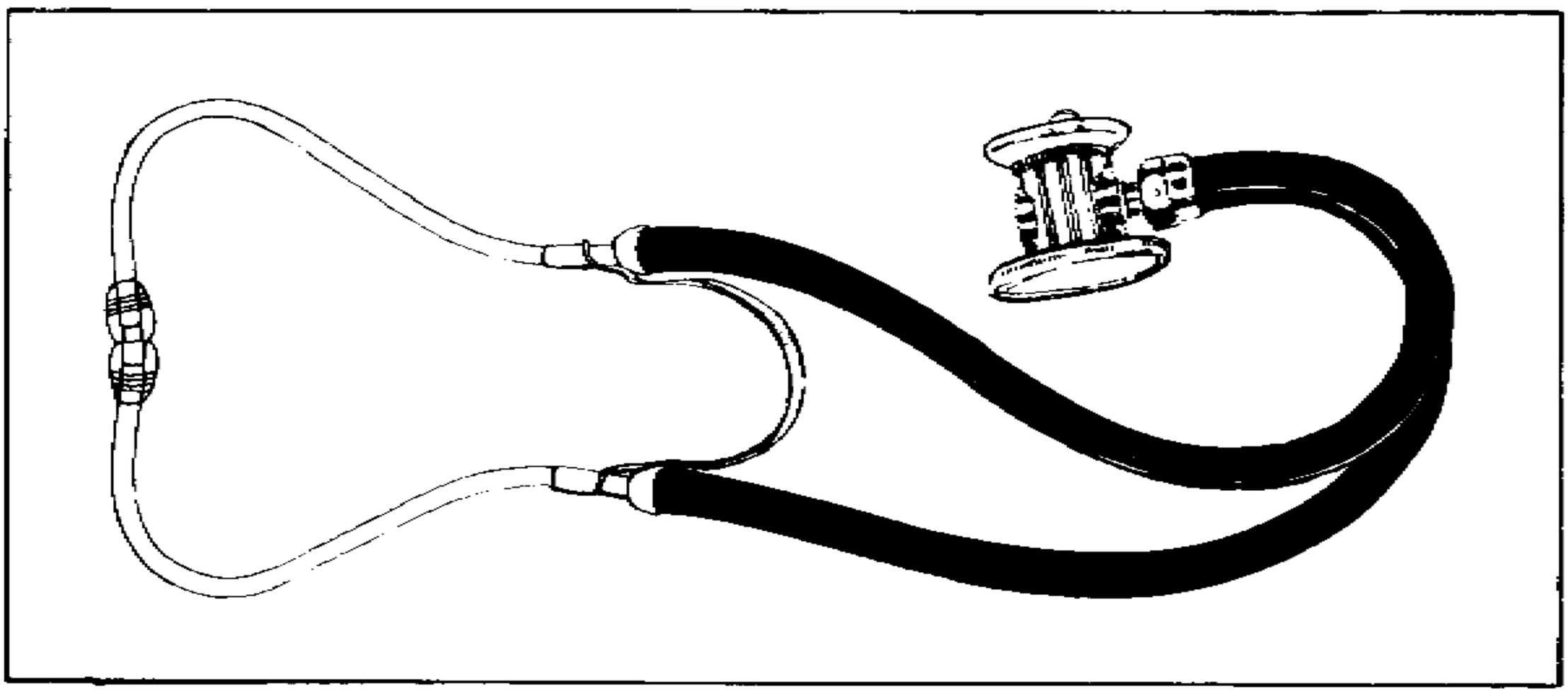


Figure 14-12. Stethoscope.

14-24. Procedure for Measuring and Recording a Blood Pressure Using the Brachial Artery

Determining blood pressure by auscultation is the most common method for determining blood pressure as a stethoscope is used to listen for characteristic sounds.

NOTE

Insure that cuff is completely deflated and the gauge registers zero.

a. Decontaminate stethoscope. Clean earpieces and diaphragm with 70 percent alcohol swabs and cotton-tipped applicators.

b. Explain procedure to the patient. Many people may be fearful of the technique, thinking it will be harmful or painful. Ask your patient if he has had his blood pressure measured before. If not, make him aware of the sensations that accompany the technique, most notable the discomfort caused by the cuff as it is inflated.

c. Position the patient.

(1) Patient should be seated or lying down.

(2) Support the arm to be used, palm up, at the level of the patient's heart.

CAUTION

If injured, patient should not be moved simply for the purpose of determining blood pressure. To do so may aggravate existing injuries. Blood pressure should be measured without moving the patient.

d. Expose the patient's upper arm. Remove garment if sleeve is tight.

e. Place the cuff on the patient's arm (Figure 14-13). Position the cuff 1 to 2 inches above the elbow. Apply the cuff securely but not overly tight.

(1) If using aneroid-type manometer, clip the gauge to the cuff in line with palm.

(2) If using mercury manometer, place column on a firm, level surface, outside patient's field of vision.

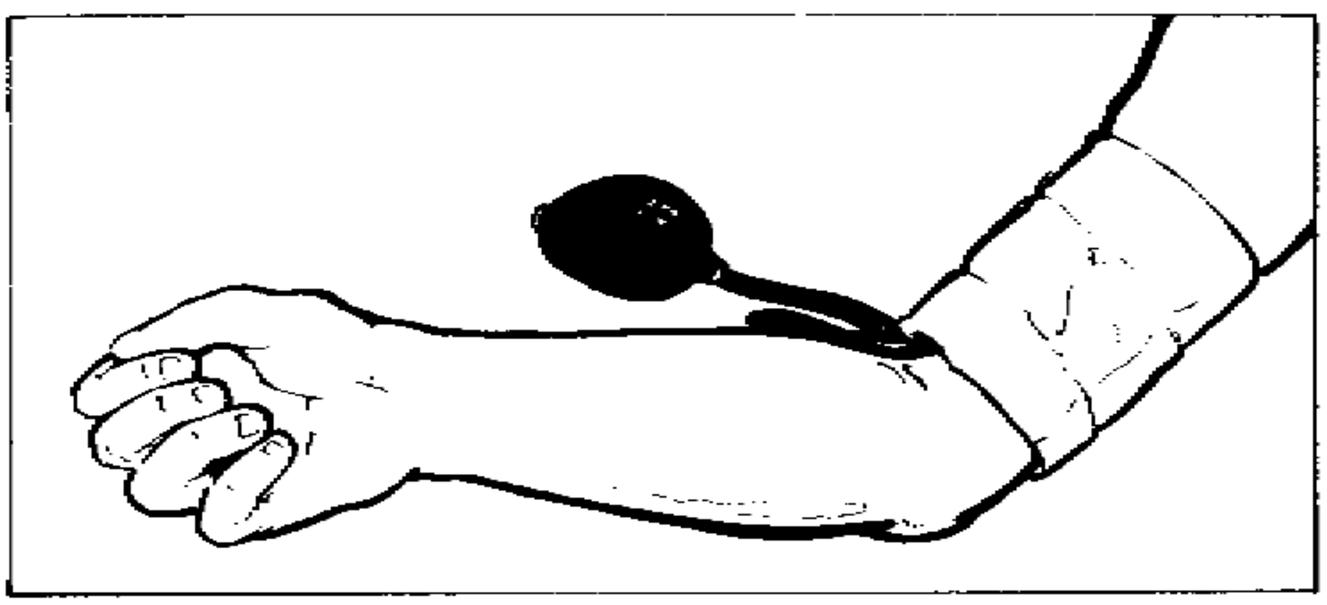


Figure 14-13. Cuff placement.

f. Locate pulse of brachial artery by palpating in the bend of the elbow.

g. Place the bell or diaphragm of the stethoscope over the pulse point (Figure 14-14). Do NOT apply the bell or diaphragm too firmly; excessive pressure distorts the pulse sounds.

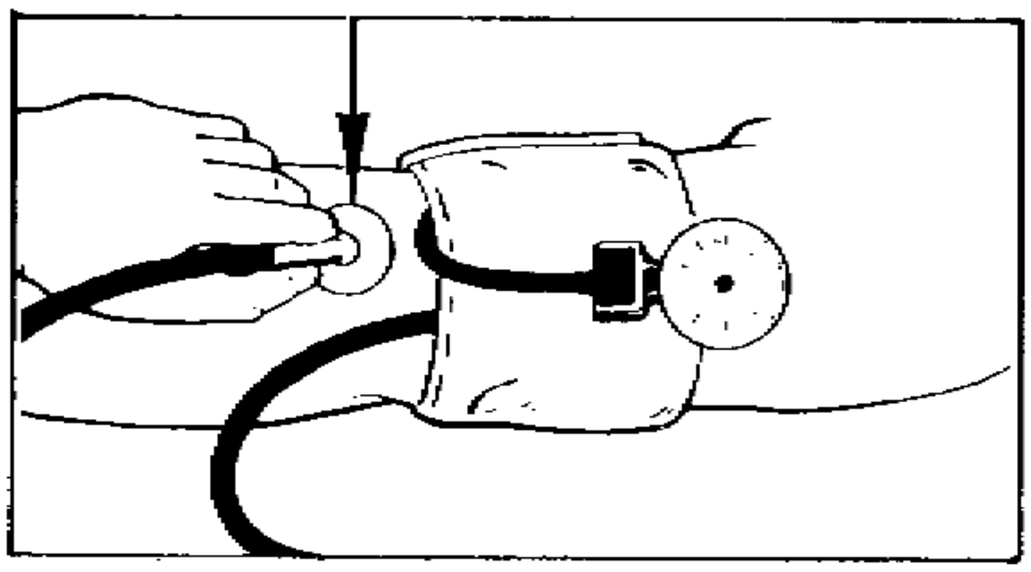


Figure 14-14. Placing the stethoscope.

h. Tighten thumbscrew of air bulb (clockwise) with one hand while holding stethoscope in place with other hand.

i. Inflate the cuff by pumping air bulb (Figure 14-15). You will hear the pulse sounds as the pressure in the cuff increases, then the sounds will disappear. Continue inflating the cuff until the pressure gauge indicates about 20-30 mm above where pulse sounds were last heard. It is at this point that the air pressure has caused the arterial wall to collapse.

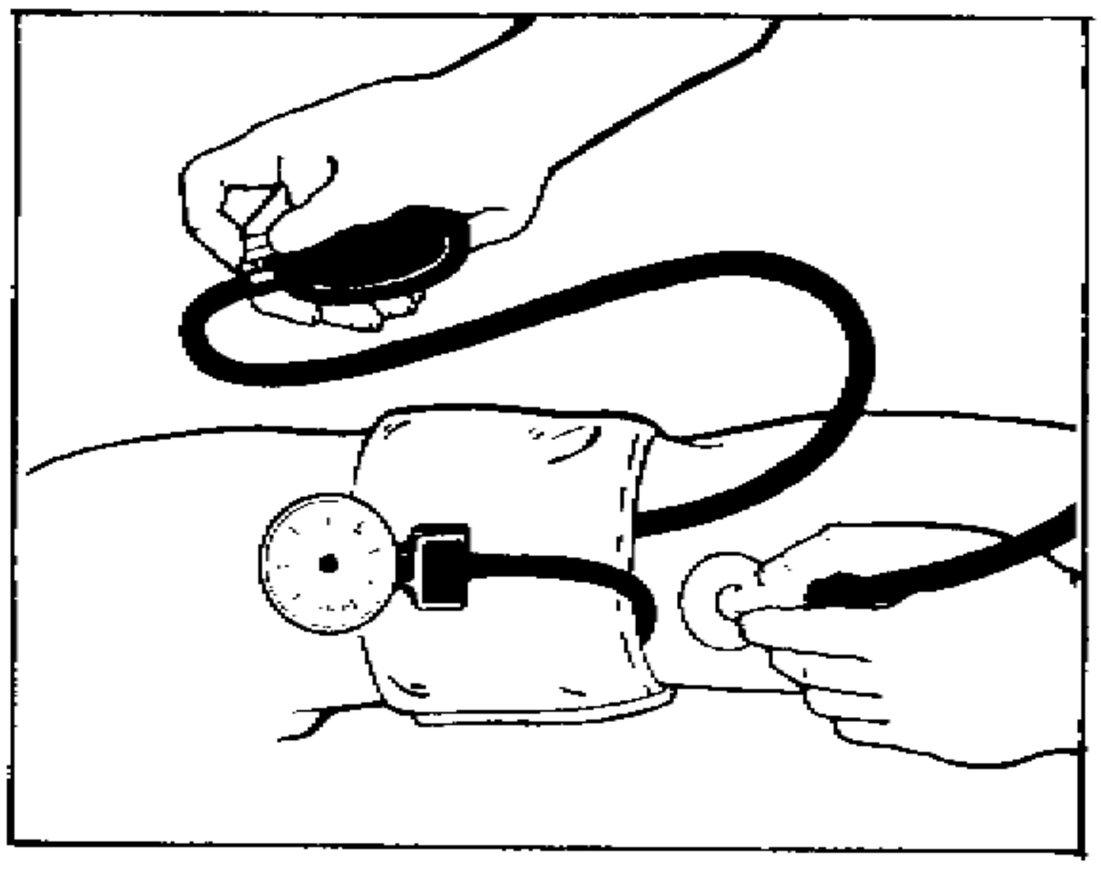


Figure 14-15. Inflating the cuff.

j. Loosen thumbscrew of air bulb (counterclockwise) and allow the air to escape slowly (about 2-4 mm Hg per second). At the same time, watch the gauge. When the first distinct sound is heard, note the number on the gauge; this is the systolic pressure.

k. Continue to release the air slowly. *Look and listen.* Note the number on the gauge at which the last distinct sound is heard. This is the diastolic pressure.

CAUTION

In some patients, sounds may be heard to extremely high or low levels.

Section III. ASEPSIS

14-25. General

a. Microorganisms abound in the world and people are constantly bombarded by them. Only a small percentage of the many types of microorganisms, called pathogens, cause disease; exposure to pathogens does not always lead to illness. Hospitals are potential reservoirs for countless microorganisms, both pathogenic types brought in by patients with infectious diseases and nonpathogenic types normally carried by everyone. Health care personnel must be continually vigilant in their efforts to control the growth of organisms and prevent infections. The most efficient methods are those aimed at controlling the factors causing infections. For example, reducing the number of organisms in the patient's environment is accomplished by good housekeeping procedures, frequent handwashing, and use of aseptic techniques. Virulence, which is the strength of the organism to cause disease, is difficult to control in rapidly growing organisms. The medical focus is aimed first at destroying the invading organism as quickly and completely as possible, and second, at treating the symptoms of the disease. Patients who

are ill or who have undergone the stress of surgery are less resistant to pathogenic organisms. Health care personnel must use their knowledge and skills to reduce the stresses affecting their patients and protect them against hospital-acquired infections.

b. An understanding of aseptic technique and the ability to use it correctly is an important means of providing for the patients' safety and welfare. In this section are the principles of asepsis and the procedural skills involved in maintaining a sterile field, using sterile instruments, opening sterile packages, putting on sterile gloves, and changing sterile dressings.

14-26. Invasion by Pathogens

a. In spite of modern antibiotic drugs, infections pose an ever-present potential danger to human beings. Infection develops when pathogens invade the body and overcome its defenses. Specific information about pathogens (which are classified as bacteria, viruses, protozoa, helminths, and fungi), their characteristics, and the diseases they cause can be found in books on microbiology.

b. The skin and mucous membranes provide the first line of defense against infection. They protect our bodies from external sources of harm, such as heat, cold, radiation, chemicals, and microorganisms. Under normal conditions, countless microscopic organisms exist on the surfaces of the skin, respiratory passages, the alimentary tract, and the vagina. When any of these surfaces are broken or injured, pathogens enter the body, where they seek out tissues suited to their specific needs and then proceed to multiply. As the pathogens multiply, they damage the normal cells, and the body's response to the damage gives rise to the symptoms of disease.

14-27. The Development of Infection

a. Health care personnel need to examine the way organisms spread, how infections occur, and how the body responds to cellular injury, in order to understand and effectively use aseptic technique as a major intervention. Pathogenic organisms wait, live, and multiply in reservoirs that may be human, animal, or nonanimal. However, the most common source of pathogens is another infected person.

b. In the infectious cycle, pathogens must escape from their reservoir and find another suitable host. Organisms are transmitted in the following ways:

(1) Transfer to host via—

- *Direct contact* with an infected person, contaminated instruments, or supplies.
- *Vectors* (carriers) may be human, animal, or insect.
- *Fomites*, inanimate objects that support organisms, such as furniture, clothing, food, milk, or water.

- *Air currents*, such as those produced by coughs, sneezes, draft, or air conditioning.

(2) Enter the body via—

- Open wounds in the skin.
- Open wounds in mucous membranes.
- Gastrointestinal tract.
- Respiratory tract.
- Genitourinary tract.

(3) Leave the body via—

- Open wounds.
- Gastrointestinal tract.
- Respiratory tract.
- Blood.

c. In health care settings and hospitals, there is a high potential for pathogenic organisms to cause infections, whether in patients or in health care personnel (Figure 14-16). Laxity in handwashing between visits to patients, careless handling of soiled articles, and contamination of wounds readily lead to infection. The development of an infection depends on three factors:

- The number of organisms entering the body.
- The virulence of the organisms.
- The resistance of the host.

Principles relative to these factors are basic to preventing and controlling infections, through the use of medical asepsis (isolation precautions) and the use of surgical asepsis (including reverse isolation).

14-28. Body Response to Injury

a. Inflammation is the body's response to any type of tissue injury. The injury can be biological (caused by microorganisms), chemical, or physical, caused by trauma, heat, cold, or radiant energy. The internal defenses are mobilized to localize the organisms and to limit the effects of the cellular damage. These defenses involve vascular changes, hormonal response, and increased white blood cells. Vascular changes produce the signs of the inflammatory process: swelling or edema of the injured part; redness owing to the increased blood supply; heat or increased temperature; pain stemming from pressure on nerves; and loss of function resulting from all of these changes. Some signs of inflammation—that is, swelling, redness, heat, pain,

and loss of function—may not be readily seen when internal organs or tissues are involved, but they are present to some degree. The signs and symptoms of the disease itself are partly due to the inflammatory process. Knowledge of the inflammatory process enables the medic to assess the patient more completely. If even one sign of inflammation is present, the alert medic can look for other signs to determine whether the patient has an infection.

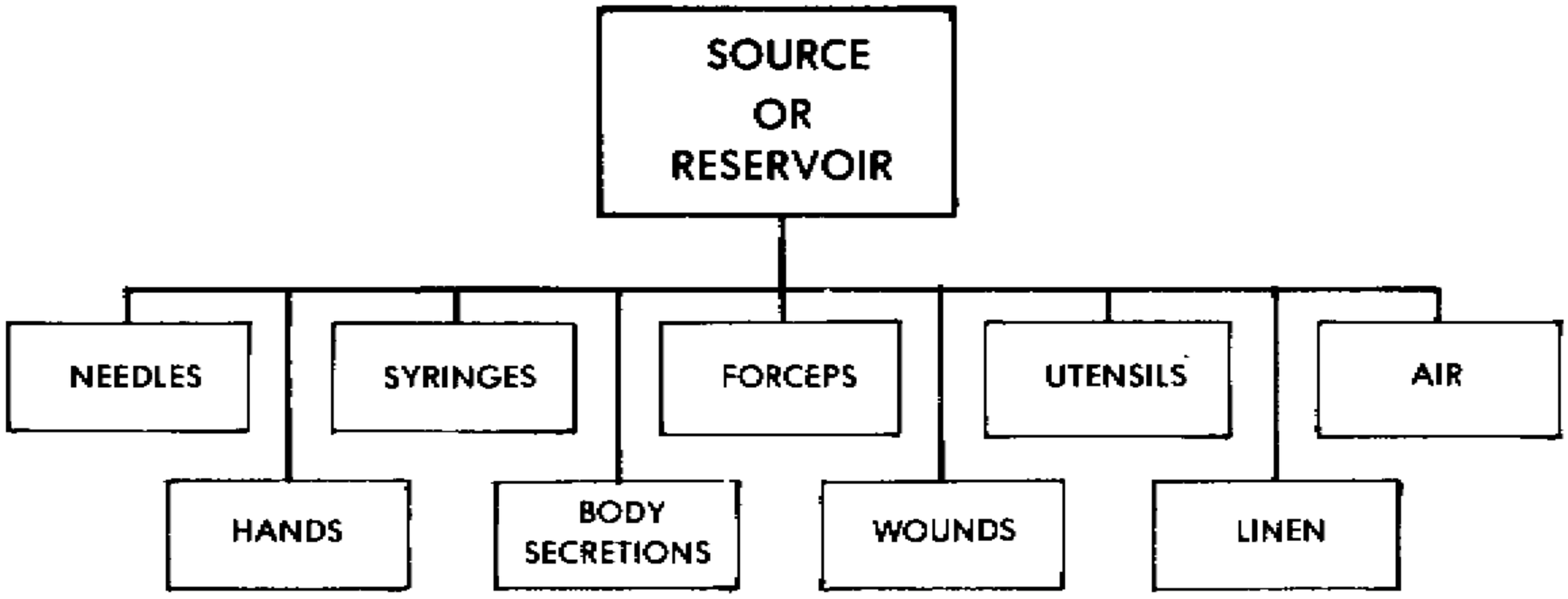


Figure 14-16. Common modes of transmission.

b. The following examples illustrate how you can relate the signs of inflammation to the symptoms produced by specific infections:

	Conjunctivitis	*Appendicitis*
Redness	of the inner eyelid and the eyeball	of the appendix, the end of the cecum (internal sign)
Heat	local warmth, slight temperature elevation	local warmth, temperature of 100-102°F, 37.7-38.8°C
Swelling	mild to moderate puffiness of lids	internally, moderate enlargement of appendix and neighboring structures
Pain	mild to moderate, sensitivity to light	moderate to severe over abdomen
Loss of function	difficulty in keeping eyelids open, vision impaired	loss of appetite, nausea, vomiting, decreased digestive action

c. The acute phase of an infection is characterized by a sudden onset of symptoms, as well as by the vascular changes of inflammation, especially swelling caused by fluid collecting in tissue. The acute phase is followed by an increase in white blood cells to overcome the infection and to clear away the damaged tissues so that healing can occur.

d. A bacterial infection of the skin or mucous membrane frequently causes fluid drainage from the wound or broken-down tissue. You must assess this drainage: its color, consistency, odor (if any), and amount. The color ranges from creamy yellow to dark green. Because purulent drainage contains dead phagocytes, bacteria, and tissue, it is thick in consistency. As the infection clears, the drainage has less odor, becomes more serous or watery, decreases in amount, and the color lightens. Signs of inflammation subside as healing occurs.

14-29. Rules for Asepsis

Sterility is the absence of microorganisms. Sterilization can be accomplished by different methods, such as boiling, dry heat, various chemicals, autoclaving (steam under pressure), and gases, such as ethylene oxide. There are four primary rules of asepsis—

a. Know What is Sterile. Most health care facilities now use commercially prepackaged sterile kits, packs, and supplies. These materials are disposable and can be discarded after use. When using these sterile supplies, you must inspect the outer layer or wrapping to insure that it is intact, without visible holes, tears, or damage. Paper and plastic materials are used for wrapping, which must be impervious to dust and resistant to moisture. These precautions are necessary because microorganisms are carried on dust particles and microscopic droplets of moisture. Some health care facilities find it more feasible to prepare their own sterile supplies. Standardized procedures should be followed to clean, assemble, wrap, label, and sterilize the instruments, linens, supplies, and other items.

b. Know What is Not Sterile. Some things cannot be sterilized and rendered free of microorganisms, most notable, human skin and mucous membranes. From a practical point of view, it would be difficult to sterilize furniture, complex equipment or machinery, and even such things as the air supply in a room. However, items that cannot be sterilized must be cleaned thoroughly and disinfected as much as possible. It is important to avoid creating air currents near a sterile field by shaking linen, coughing, sneezing, or talking unnecessarily. Even when using sterile items, you must be aware of what is not sterile. Microorganisms cling to all surfaces, whether solid, liquid, or gaseous in nature. When any sterile surface touches a nonsterile surface, it is no longer sterile. The outer wrapping of a sterile package or kit is unsterile, as is the outside of glass vials and ampules containing medications. The outer one-inch edge of any sterile field is also considered unsterile because airborne microorganisms may have settled on it. Any portion of a sterile drape or equipment that hangs below a table top or waist level is considered unsterile. Outdated autoclaved canisters as well as cloth- or paper-wrapped items and sterile items left exposed to the air and unattended even briefly are likewise regarded as nonsterile.

c. Separate Sterile From Unsterile. The use of commercially prepared sterile disposables has reduced the need to store sterile items separately. The sterile packages are individually labeled and wrapped to allow inspection for intactness. When kept on clean dry shelves, they will remain sterile for an indefinite time. However, hospitals that sterilize their own metal canisters and cloth- or paper-wrapped packs should store sterilized items separately from unsterile materials as there is no way to visually recognize what has and

what has not been rendered sterile. The covers and packages usually look the same before and after being sterilized, so you must keep them separate and rely on the use of indicators such as chemical tablets or tapes that turn color when sterilized. Sterile supplies in metal canisters or cloth-wrapped packages have a limited shelf life and must be resterilized periodically.

d. Remedy Contamination Immediately. Contamination occurs when a sterile surface comes in contact with any unsterile surface, whether solid, liquid, or gas. This can occur when you or others move too quickly and accidentally touch a sterile object with an unsterile one. The resulting contamination can be remedied by:

(1) Promptly removing the contaminated object(s) from the area.

(2) Covering the contaminated object(s) with a sterile towel or drape.

(3) Discarding the contaminated object(s) and starting over if the sterile field and the set-up (items required to carry out a sterile procedure) have also been contaminated.

14-30. Principles of Aseptic Surgical Technique

a. The following principles form the basis for surgical asepsis:

(1) Sterile surface touching sterile surface remains sterile.

(2) Sterile surface touching unsterile surface becomes contaminated.

(3) Sterile materials must be kept dry; moisture transmits microorganisms and contaminates.

(4) When there is doubt about the sterility of any item, it must be considered *not* sterile.

(5) Reaching across or above a sterile field with bare hands or arms or with other nonsterile items must be avoided.

(6) Coughing, sneezing, or unnecessary talking near or over a sterile field must be avoided.

(7) When wearing sterile gloves, hands must be kept in sight, away from all unsterile objects and above waist level.

(8) The wrapper of a sterile pack must be opened away from the body, the distal flap first, the lateral flaps next, and the proximal flap toward the body last, thus making it unnecessary to reach over the sterile field.

(9) The sterile zone is confined to the table top or to above waist level. Anything that hangs, falls, or touches below these levels is considered contaminated.

(10) An area of one inch surrounding the outer edge of the sterile field must be considered unsterile.

(11) The sterile field must be kept in sight at all times. Do not turn your back on it or leave it.

(12) The floor must be recognized as the most grossly contaminated area. Clean or sterile items that fall on the floor should be discarded or decontaminated.

b. Many activities and skills are based on practice of the principles of medical and surgical asepsis. In medical asepsis, the goal is to keep the organisms within a given area; in surgical asepsis, the area must be kept free from organisms. These concepts are equally important. Table 14-2 presents a comparison of factors in medical and surgical asepsis.

Table 14-2. Comparison Factors in Medical and Surgical Asepsis.

Factor	Medical Asepsis	Surgical Asepsis
Patient	Has infection, lowered resistance to other infections.	Potential host. Lowered resistance makes more susceptible.
Reservoir of infection	The patient—organisms spread by direct and indirect contact.	Organisms harbored by others and in the environment.
Location of barriers	Confine organisms within room, unit, or locale.	Prevent organisms from reaching patient or area.
Equipment and supplies	Disinfect, sterilize, or dispose of after contact with patient	Disinfect or sterilize before contact with patient.
Protective clothing: gown, gloves, masks	Clean items to protect worker from organisms. Discard after contact with patient	Sterile items (except masks) to protect patient. Remedy if contaminated.
Goal of actions	CONFINE ORGANISMS and prevent spread of infection to others.	REDUCE NUMBER OF ORGANISMS and prevent spread of infection to patient.

14-31. Use of Disinfectants and Antiseptics

a. Disinfectants are agents that destroy pathogenic organisms. Although the action of sunlight and heat is included in this category, medically the term applies to chemical agents that kill pathogens outside of the body. Disinfectants are used on objects such as equipment, furniture, walls, and floors; however, most of these chemicals are too harsh to use on living tissue.

b. Antiseptic agents inhibit the growth of organisms. While antiseptics also include disinfectants, antiseptics can be used on body tissue. They can be used to treat wounds, to prepare the skin for operation, and to reduce organisms on the skin. Disinfectants and antiseptics chosen for use in hospitals should meet the following criteria:

- Inhibit or kill the pathogens within a reasonable period of time.
- Not be harmful to materials or surfaces.
- Not be readily neutralized by soaps, detergents, or proteins.
- Be stable in solution.

Among the types of disinfectants and antiseptics frequently employed are the following: cyanide; phenolics; such as Staphene and Vas-phene; iodine and iodophors, such as povidone-iodine to destroy bacteria, viruses, and fungi; alcohol, to inhibit and destroy organisms; and chloride compounds, generally intended for use on floor surfaces.

14-32. Handwashing

All personnel and patients, regardless of position or diagnosis, should be recognized as potential carriers of pathogenic organisms. One of the most critical tasks in medical care duties is that of providing a safe atmosphere for you as well as for the patient. Because your hands carry millions of germs, frequent handwashing is one of the simplest techniques to help prevent the spread of disease and infection. This procedure is designed for use between *routine* patients when providing care. The entire procedure can be done effectively in about 2 minutes.

14-33. Types of Soaps

Soap combines with foreign matter on the skin and lowers the surface tension (clinging effects) of grease and dirt, thus permitting them to be easily removed from the skin surfaces. There are various types of soaps currently in use:

a. Antimicrobial—a disinfectant, germicidal, and fungicidal concentrate (Wescodyne/Betadine). This is a general-purpose germicide, suitable for hand cleansing as well as for disinfecting various types of equipment and instruments. This concentrate must be diluted with water to make at least a 75 parts-per-million (ppm) or higher solution. The clear, dark amber color of this solution is an indication of its germicidal effectiveness; when the color fades, a fresh solution must be prepared.

b. Liquid soap—a bacteria-inhibiting (bacteriostatic) liquid soap may be used for handwashing and disinfecting skin surfaces. The active ingredient in these types of soaps is hexachlorophene, which has a cumulative effect in reducing bacteria on the skin.

c. Soap bars—is the least effective method. The bar of soap can be a germ-carrier itself when contaminated by dirty water. Care must be taken to rinse the soap well before returning it to the soap dish. This reduces the chance of contaminating the soap.

14-34. Handwashing Procedure

Proper handwashing consists of three essential elements: soap, friction, and running water. In a field situation, you will rarely have a sink with faucets at your disposal. Therefore, you may use other methods for handwashing.

a. Equipment (two-basin method).

(1) Two basins.

(2) Canteen of water.

(3) Soap (bacteriostatic or Wescodyne, if possible).

(4) Paper towels.

(5) Assistant (to pour the rinse water).

b. Fill basin and canteen. Fill basin with just enough water to wash hands. Fill canteen with water for rinsing.

NOTE

Potable water should be used from a reliable source (Lyster bag, water pod, and so forth).

c. If Wescodyne/Betadine soap is to be used, mix the solution to prescribed strength (at least 75 ppm).

d. Remove jewelry. Jewelry should not be worn when performing patient care because microorganisms become lodged in the settings or stones or rings. The only exception is a plain wedding band. Fingernails should be kept clean and short.

e. Roll sleeves above elbows.

f. Wash both hands and forearms from fingertips to elbow.

(1) Wet hands, wrists, and forearms.

(2) Apply soap.

(3) Using firm circular movements,wash fingers, finger webbing, and fingernails first.

(4) Wash palms and back of hands second.

(5) Wash forearms to elbows last.

NOTE

Give particular attention to creases and folds in the skin when washing; these areas harbor many microorganisms.

g. Rinse hands and forearms from fingertips to elbows.

(1) Use canteen of water for rinse.

(2) Have assistant pour rinse water over soapy areas into the empty basin. He should not touch lip of canteen to skin as this would contaminate that area.

NOTE

If no assistant is available, you may pour the rinse water by holding the canteen with clean paper towels in your free hand.

(3) Hold hands slightly higher than elbows to prevent recontaminating hands and fingers.

h. Dry hands.

(1) Use clean paper towels for each hand. If not available and cloth towel is to be used, use opposite end for each hand.

(2) Dry thoroughly from fingertips toward elbow. *Do not* go back up toward fingertips as this would recontaminate the area.

i. Dispose of all dirty material in accordance with local policy. There are other methods and devices for washing hands in field conditions. These methods and devices are described in FM 21-10.

14-35. Opening Sterile Packs and Sets

a. Sterile materials and supplies are usually prepared commercially and are disposable for one-time use items. The packages, sets, or kits provide all of the items commonly required in medical procedures such as catheterization, suture removal, dressing change, irrigation, enema, and catheter care. Individually wrapped items can be obtained to supplement the packs as needed. The package or set is opened by removing the outer plastic or paper covering, taking out the inner package, and unfolding the wrapper to form a sterile field from which to work. The principles of asepsis apply regardless of whether the package is a disposable or a wrapped tray prepared by a hospital department. The principles to observe when opening sterile packages are—

- Wash your hands.
- Open sterile packages *away* from the body.
- Touch only the outside of the wrapper.
- Do not reach across a sterile field.
- Always face the sterile field; go around the sterile field, if necessary.

- Allow sufficient space (at least 12 inches) between your body and the sterile field.

b. Procedure for opening sterile packs.

(1) Obtain the sterile package containing the required item(s) (Figure 14-17A). The item should be placed on a table or flat surface while being unwrapped. Disposable packages have a plastic or paper covering. Hospital-prepared goods have cloth or paper covers and you must check package indicator for date and sterility of the package. Chemically treated indicators change color when sterilized. Heat-sensitive tape used at the external opening of packaged material will show distinctive diagonal stripes following exposure to a heat sterilization process.

(2) Remove the plastic covering and external wrap from the package. Remove the contents so as to avoid contaminating them. Touch only the outer surface of the wrapped contents.

(3) Open the wrapper (Figure 14-17B). Remove outside fastening. With one hand, lift the distal flap up and toward the back, away from the package. Let the distal flap drop gently over the back of the table. It is important to open the distal flap first so that your unsterile arm *does not* reach across the sterile contents.

(4) Open left and right flaps (Figures 14-17C and 14-17D). With your left hand, move the flap up and laterally away from the package.

(5) Open the proximal flap (Figure 14-17C). Lift the flap up and toward you, dropping it gently over the front of the table or your hand. Once the wrapper of the package has been opened, it should not be folded closed again. The contents should be used as soon as possible. Avoid contaminating the articles in the package by using sterile gloves or forceps when handling them.

14-36. Opening Individually Wrapped Supplies

Almost every sterile item you use is available as an individually wrapped or separate item, such as sterile packages of applicators, tongue blades, 4 x 4 gauze dressings, Vaseline dressings, ABD dressings, syringe, Foley catheters, and tube coverings or caps. Instructions usually appear telling where to open or indicating the direction in which to tear or peel at a certain point. When opening the package follow these instructions to avoid contaminating the contents (Figures 14-18A and 14-18B).

a. Grasp the package by the slightly extended edges provided. Bring both your hands together and grasp the edges of the package.

b. Peel along the sealed edge. Turn your hands outward to separate the sealed, sterile package. Peel in a downward motion. Do not touch the inside of the wrapper.

c. Place the package on a flat surface , OR

d. Hand the article to a sterile person , OR

e. Lift the sterile item from the wrapper by using sterile forceps (Figure 14-18). The inside area of the wrapper is sterile and may serve as a sterile field until the contents are used. Keep your fingers away from the edges. The sterile person then picks up the sterile item.

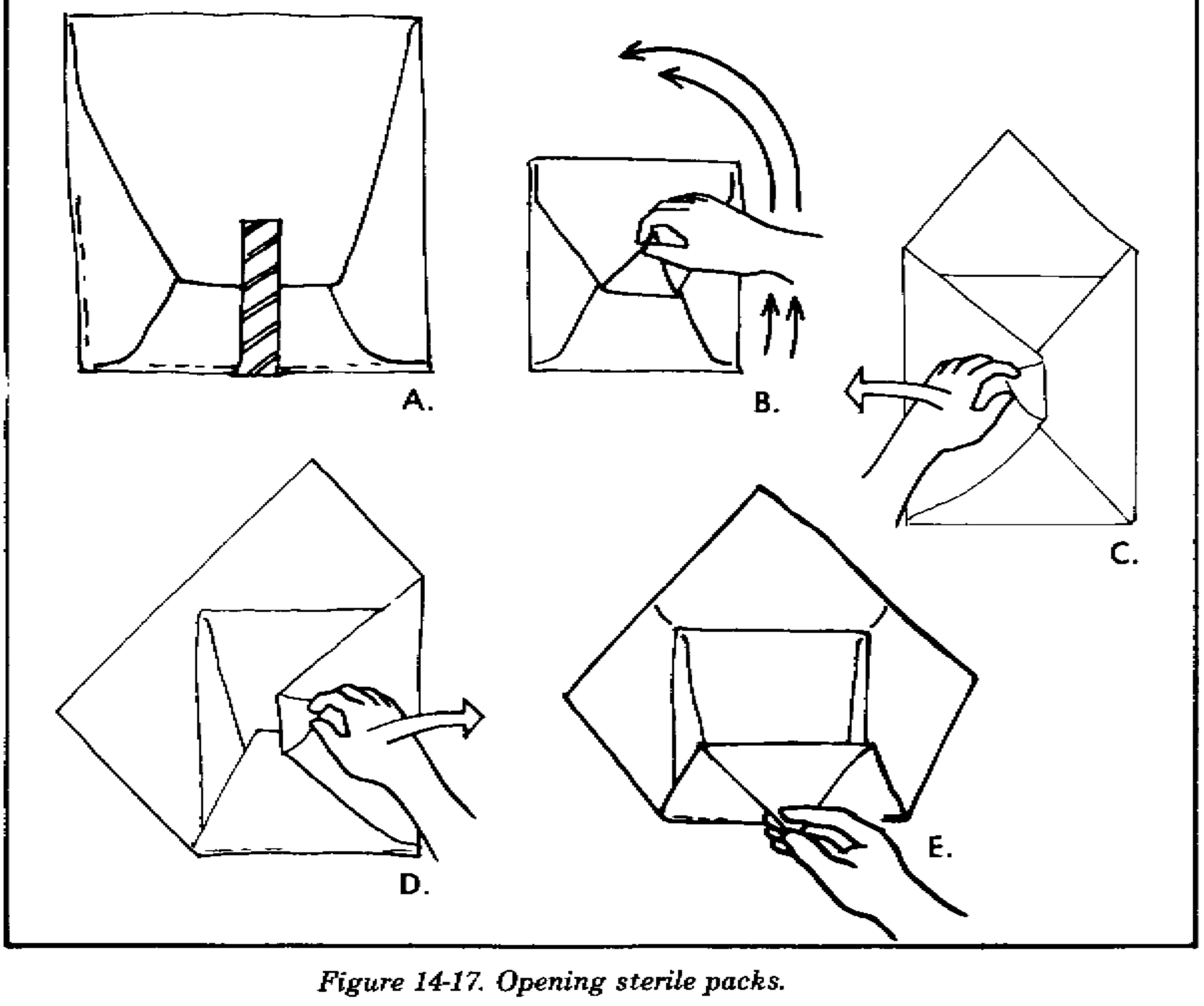


Figure 14-17. Opening sterile packs.

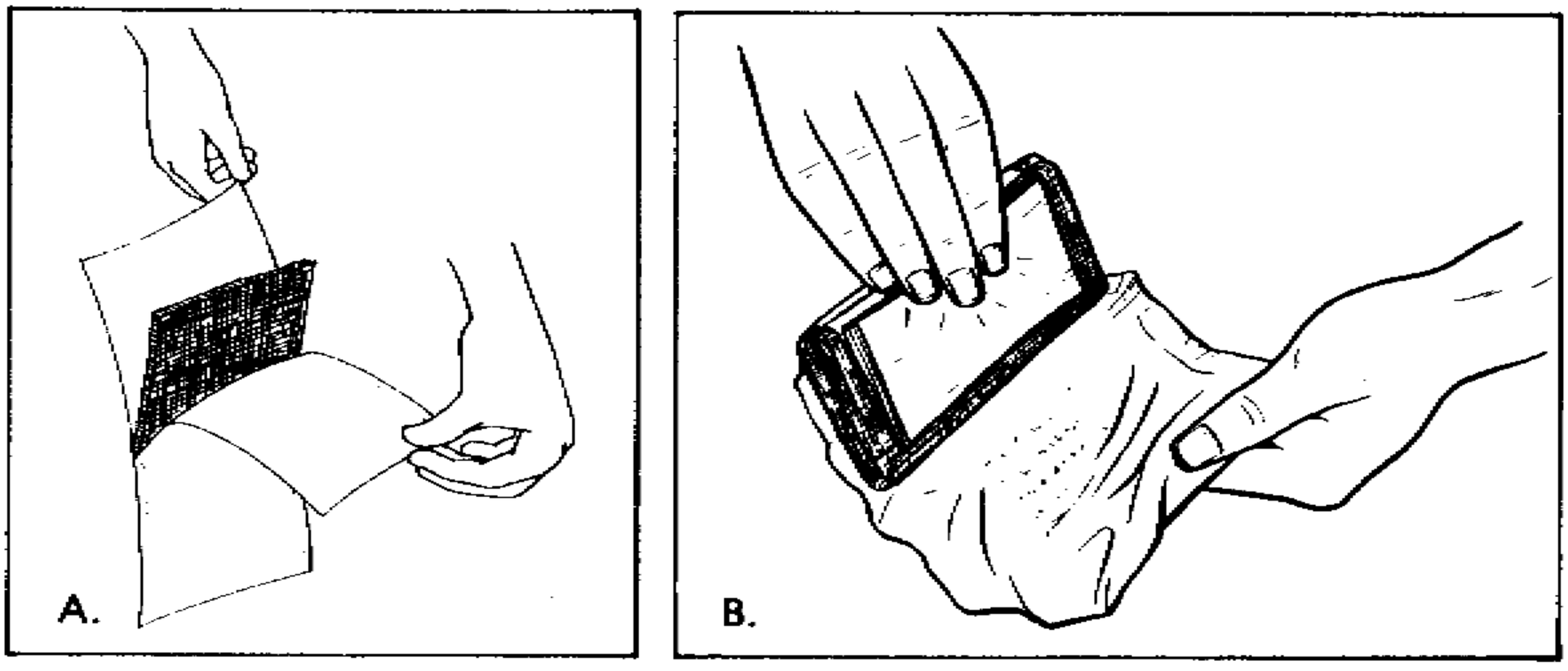


Figure 14-18. Opening individually wrapped supplies.

14-37. Donning and Removing Sterile Gloves

The following procedure should be used when donning and removing sterile gloves:

a. Obtain package containing correct size gloves.

b. Inspect the package for any signs of possible contamination (water spots, moisture, or tears in the package). If package appears contaminated, discard and select another package.

c. Perform patient care handwash.

d. Place package on clean, dry surface and peel back outer wrapper completely to expose the inner package.

e. Remove the inner package and place it so that the end of the package nearest you indicates the printed word "cuff."

f. Unfold the package by grasping the lower corner and opening the package to a fully flat position (Figure 14-19). Do not touch gloves. Gloves should be positioned with right hand in line with your right hand, and left hand in line with your left hand.

g. Grasp lower corners, or area designated in folder, and pull to side gently, without touching or contaminating gloves.

h. Grasp the cuff of one glove at the folded edge and remove from wrapper with one hand (Figure 14-20).

i. Step back from the table or tray.

j. While keeping hands above your waist, insert fingers of your other hand into the glove and pull on by only touching the cuff (Figure 14-21).

k. Pick up the second glove by inserting the tips of fingers of gloved hand under the folded cuff (Figure 14-22).

l. Insert fingers of ungloved hand into glove and pull up without contaminating either glove (Figure 14-23).

NOTE

Touch glove to glove and skin to skin to maintain sterility.

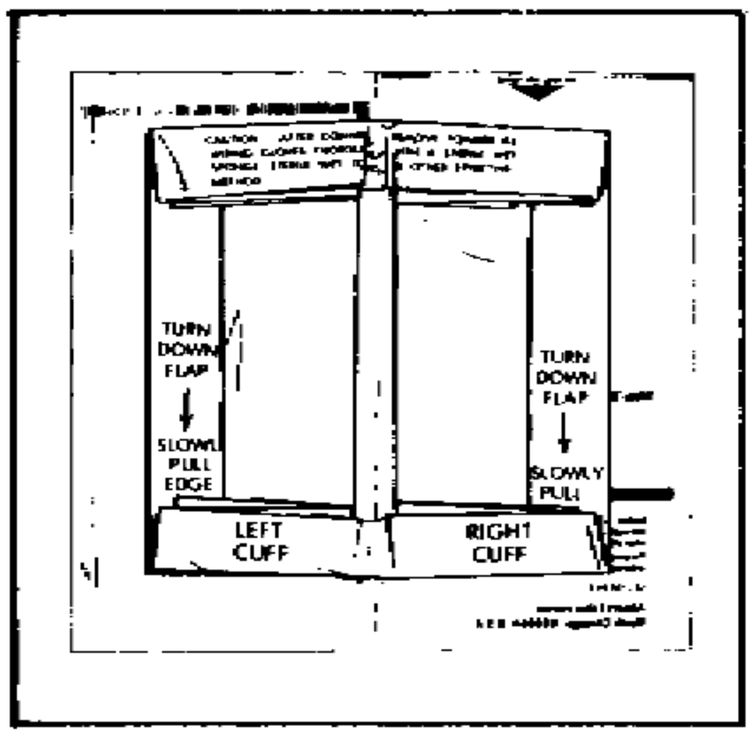


Figure 14-19. Package in fully flat position.

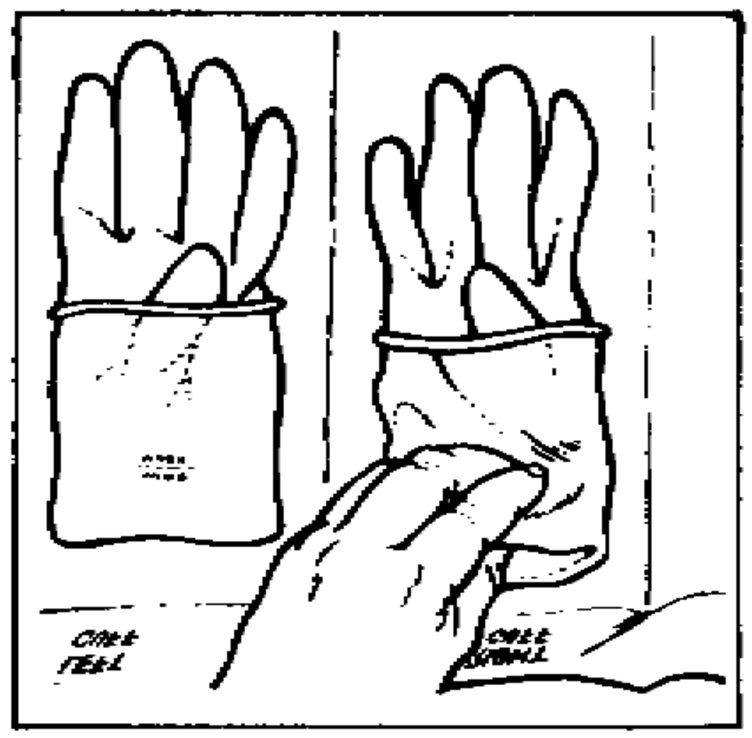


Figure 14-20. Remove from wrapper.

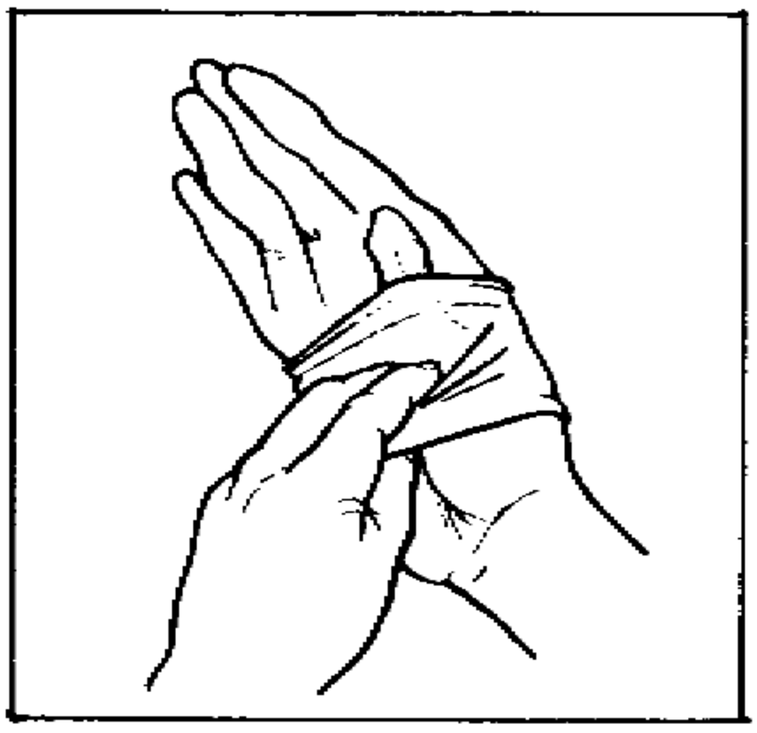


Figure 14-21. Insert fingers of other hand.

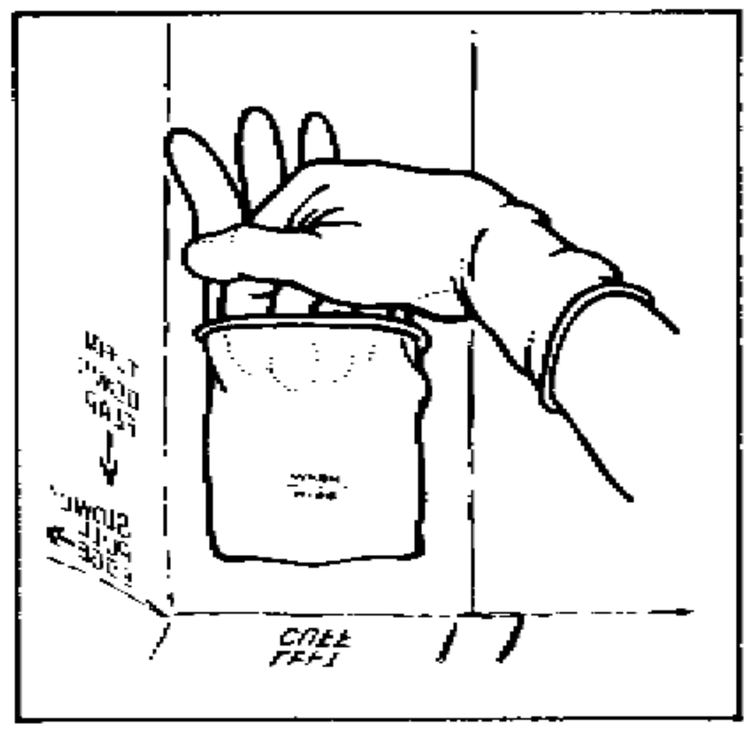


Figure 14-22. Pick up second glove.

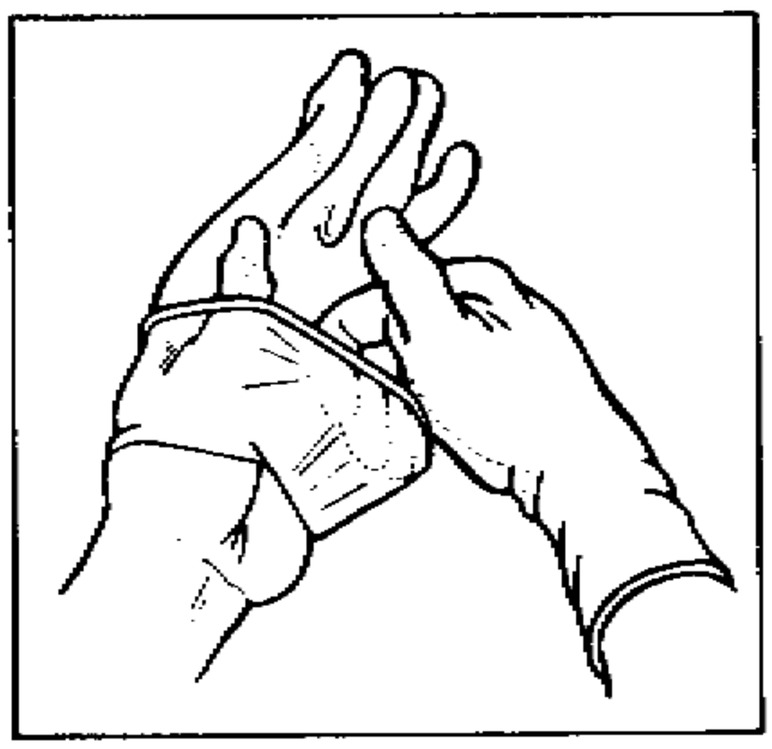


Figure 14-23. Insert fingers of ungloved hand into glove.

m. Adjust the gloves to fit firmly and comfortably without contaminating (either pull on individual fingers or interlock gloved fingers).

n. To remove gloves, begin by grasping the glove at the heel of the hand with the other gloved hand.

o. Peel off glove, retaining removed glove in palm of remaining gloved hand.

p. Insert one or two fingers of ungloved hand under the glove of the remaining gloved hand. Peel glove off hand without contaminating self.

NOTE

Remember to remove gloves "glove to glove" and "skin to skin."

q. Discard gloves according to local SOP.

r. Wash hands.

14-38. Assessment of Wounds

a. Assessment of the patient must include a complete inspection of all skin areas. Every abrasion, laceration, contusion, reddened pressure area, ecchymosis, and incision is noted. Be alert for signs of inflammation: redness, swelling, pain, heat, and loss of function. The location and the appearance of these skin wounds is charted each day in specific terms, since changes can occur quite rapidly. Assessment of wounds requires notations about the dressing even when the wound cannot be observed directly. After a traumatic injury or surgery, the initial dressing remains in place until the physician changes it or authorizes you to do so. The appearance of the dressing provides some information about the wound underneath. Dressings are kept as dry as possible to reduce capillary attraction of microorganisms and potential infection. Excessive drainage or increased bleeding should be reported to the physician.

b. An early sign of impaired healing is evidenced by hemorrhage, visible bleeding, or symptoms of concealed internal bleeding. When this occurs, the dressings on surgical incisions or wounds must be inspected; also look at the area under the patient because blood from wounds can leak out and form pools. Observe drainage tubes frequently for signs of bleeding. Monitor the patient's vital signs until his condition is stable. Improper healing can result in—

- An *abscess*, a localized infection in which there is an accumulation of pus. The liquid may be white, yellow, pink, or green, depending on the infecting microorganism.

- *Cellulitis*, an inflammation of the cellular tissue surrounding the initial wound.

- *Empyema*, the collection of pus in an already existing cavity, such as the gallbladder or lung.

- A *fistula*, an abnormal passage or communication usually formed between two internal organs, or leading from an internal organ to the surface of the body. A fistula may result from an infection. Common postoperative fistulas are designated according to the organs or parts with which they communicate, such as rectovaginal, fecal, anal, biliary, and the like.

- A *sinus*, a canal or passageway leading to an abscess.

14-39. Dry, Sterile Wound Dressing

a. A dressing is any sterile material used to cover a wound The sterile dressing—

- Protects the wound from bacteria.
- Protects the environment from bacteria in the wound.
- Absorbs drainage.

b. A well-applied dressing makes the patient feel like he is getting good health care. Psychologically, this makes the patient feel better.

14-40. Requirement to Change or Reinforce a Dressing

a. The physician or the supervisor orders tells you when to apply a dressing and how often to change the dressing. This order also specifies if the wound is to be cleansed.

b. Under field conditions, you will not change the dressing without a physician's order. Reinforce the dressing and place the date, time, and your initials on the dressing.

c. Sometimes a dressing may need to be changed because it is soaked with seepage. If the circumstances or the physician's or the supervisor's order prohibit the change, reinforce the area by covering it with another dressing. Label it "reinforcement," and write the date, time, and your initials on it.

14-41. Dressing Materials

Various types of dressing materials are used when applying or changing a dressing. The following are those most frequently used:

a. Coarse mesh gauze sponge (Figure 14-24A).

(1) Available in several sizes, but the ones used routinely are 2 x 2 in (5.08 x 5.08 cm), 4 x 4 in (10.16 x 10.16 cm), and 4 x 8 in (10.16 x 20.32 cm).

(2) Commonly used as intermediate layers in many dressings.

b. ABD Pad (abdominal pad, combines) (Figure 14-24B).

(1) Large, thick, multilayered absorbent dressing.

(2) Used primarily for postoperative abdominal incisions.

c. Telfa pad (Figure 14-24C).

(1) Pad with a plastic-like coating on one side of gauze dressing.

(2) Used to prevent the dressing from sticking to the wound.

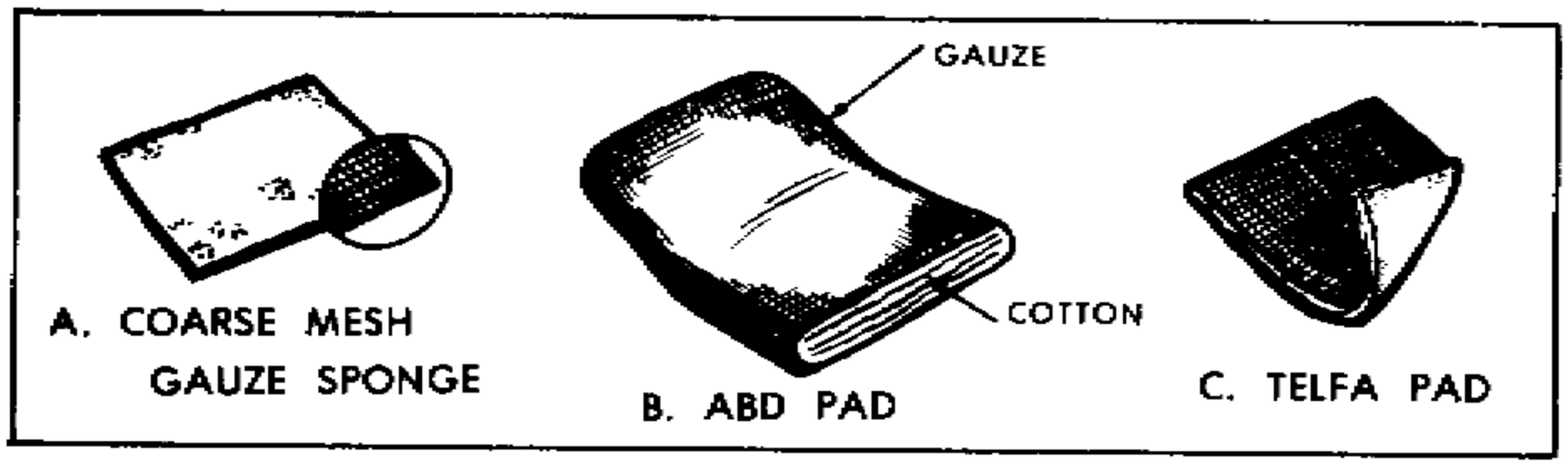


Figure 14-24. Dressing materials.

d. Petrolatum (Vaseline) gauze (Figure 14-25A).

(1) Consists of gauze coated with petroleum jelly.

(2) Used to protect tissue from drying, to prevent adherence to the wound, and to create an airtight seal.

e. Roller gauze bandage (Figure 14-25B). A loose mesh material available in various sizes from 1 to 4 in (2.54 to 10.16 cm) wide and 5 yd (4.57 m) long.

f. Kling and Kerlix bandage (Figure 14-25C).

(1) Loosely woven or knitted roller gauze bandages which are soft and conform easily.

(2) Used most often to secure dressings, are highly absorptive, and are appropriate when a bulky dressing is needed.

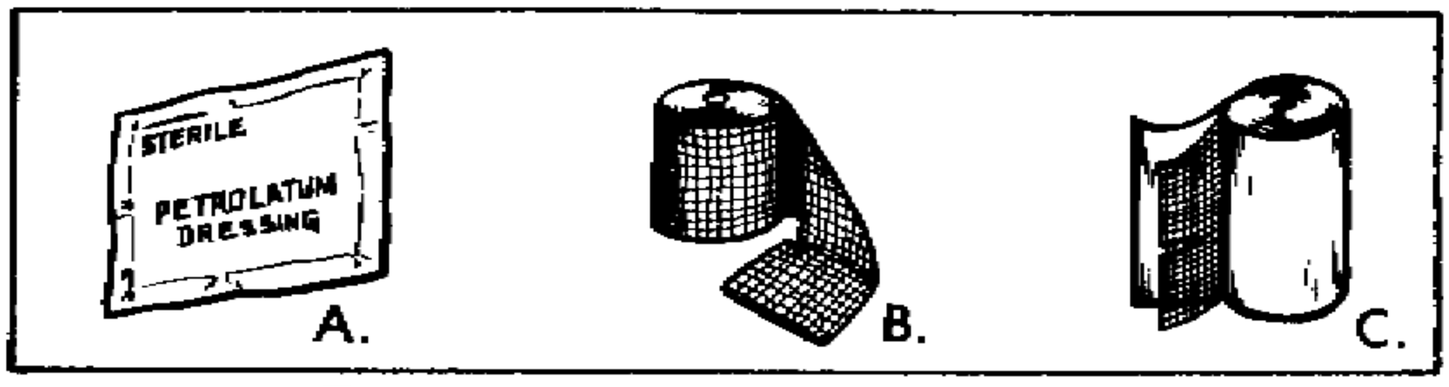


Figure 14-25. Gauze and bandages.

14-42. Tapes

The following tapes are used to secure dressings:

a. Adhesive.

(1) Made from cotton, cloth, paper, or foam.

(2) Available in several widths.

(3) In addition to being used to secure dressings, the adhesive tapes are used to secure splints, to strap joints to prevent or treat athletic injuries, and to immobilize various parts of the body.

b. Hypoallergenic.

(1) Made from paper.

(2) Porous—allows air exchange.

c. Plastic.

(1) Transparent.

(2) Porous—allows air exchange.

14-43. Procedure for Changing a Sterile Dressing

a. Identify the patient and provide privacy. Provide privacy if possible by placing a screen or curtain around the patient or by closing the door.

b. Explain the procedure. Gain the patient's confidence and cooperation by telling him why you are changing the dressing and what the procedure will be.

c. Perform patient care handwash.

d. Obtain necessary equipment and supplies.

(1) Dressings—4 x 4 in (10.16 x 10.16 cm) and 4 x 8 in (10.16 x 20.32 cm) sponges.

(2) Gauze pads or cotton-tipped applicators.

(3) Gloves.

(4) Scissors.

(5) Solution basin, if applicable.

(6) Sterile towels (for sterile field).

(7) Tape.

(8) Adhesive solvent.

(9) Container for adhesive solvent.

(10) Drain, if applicable.

(11) Disinfecting solution, if applicable.

(12) Sterile forceps.

e. Prepare the patient. Position the patient.

(1) Make the wound site easily accessible.

(2) Expose the wound.

(a) Remove the patient's clothing. Do not expose any more of the patient's body than is necessary.

(b) Fold the bed linens or pajamas away from the wound area.

f. Prepare the work area.

(1) Clear all items off the bedside stand.

(2) Clean and dry area.

(3) Cut the tape strips to the size that is required to secure the dressing.

(4) Attach one end of each tape strip to an area that can be easily reached.

(5) Pour adhesive solvent into the solvent basin.

(6) Pour the disinfecting solution into a solution basin.

g. Prepare sterile field, equipment, and supplies.

h. Remove soiled dressing from wound (Figure 14-26).

CAUTION

Do not put pressure on the wound. This will cause unnecessary pain, possible additional injury, and interfere with the healing process.

(1) Loosen the ends of the tape attached to the patient's skin.

(2) Peel ends toward the wound while holding the skin with the other hand.

(3) Do not remove tape away from the wound. Doing this will—

(a) Create tension on the wound.

(b) Disrupt the scab.

(c) Tear the skin.

(4) Note any abnormal seepage.

(5) Put on sterile gloves.

(6) Grasp the edge of the dressing with sterile forceps and gently roll the dressing off the wound. If the dressing sticks to the wound, moisten the dressing with sterile water to soften the surface of the wound.

(7) Throw away dressing in a contaminated waste container.

(8) Do not touch the contaminated side of dressing to you or to any surface.

i. Remove the adhesive from around the wound.

(1) Gently rub a solvent-soaked cotton-tipped applicator or gauze pad over the adhesive (Figure 14-26). Removing the adhesive when a dressing is changed reduces the potential for skin irritation.

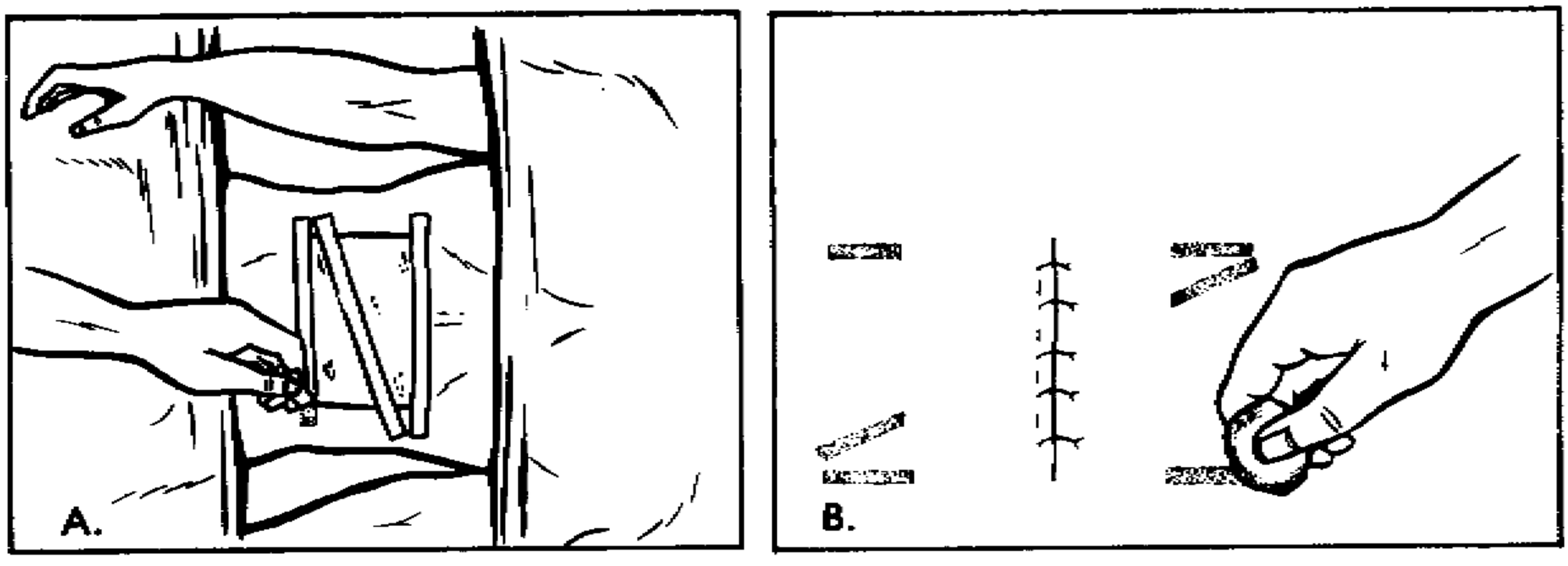


Figure 14-26. Removing sealed dressing and adhesive from around wound.

(2) Observe skin for signs of irritation (redness, rash, or swelling).

j. Inspect the wound. Look for signs of:

(1) Infection.

(2) Redness.

(3) Swelling.

(4) Pus (usually yellow fluid; may be blood tinged, greenish, or brown).

(5) Putrid (bad) odor.

(6) Color.

(7) Condition of suture (joining of wound edges).

(8) Condition of drains.

(9) Healing.

k. Cleanse the wound if order indicates. Dip the cotton swab into a cleaning or disinfecting solution.

(1) Cleansing a linear wound (Figure 14-27).

(a) Stroke 1. Swab the area directly over the wound. Discard the swab.

(b) Stroke 2. On the patient's right side, swab the area next to the wound. Discard the swab.

(c) Stroke 3. On the patient's left side, swab the area next to the wound. Discard the swab.

(d) Stroke 4. On the patient's right side, swab the area next to the second stroke. Discard the swab.

(e) Stroke 5. On the patient's left side, swab the area next to the third stroke. Discard the swab.

(2) Cleansing a circular wound (Figure 14-27).

(a) Stroke 1. Starting at the center of the wound, swab the area in an outward circular spiral.

(b) Stroke 2. Swab the area next to the wound in an outward circular spiral pattern for two revolutions. Discard the swab.

(c) Stroke 3. From the spot where the first stroke ended, continue swabbing in an outward circular pattern for two revolutions. Discard the swab.

(d) Stroke 4. From the spot where the third stroke ended, continue swabing in an outward circular pattern for two revolutions. Discard the swab.

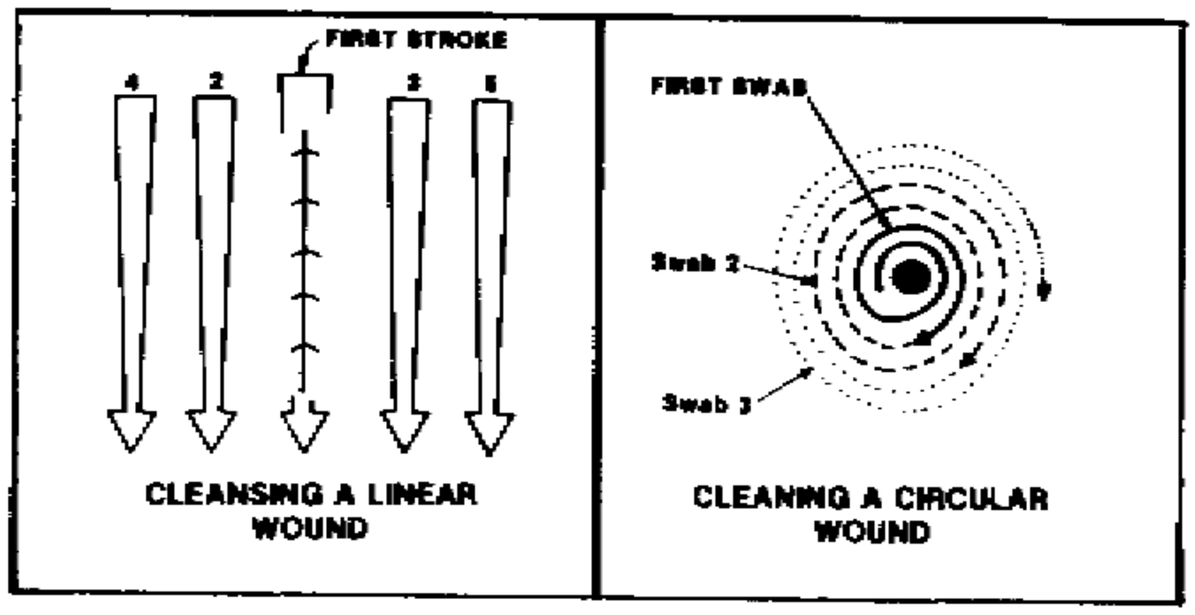


Figure 14-27. Cleansing linear and circular wounds.

l. Apply a sterile dressing (Figure 14-28). Cover the wound with a sterile dressing.

(1) Lay a dressing over the wound.

(2) Overlap the first dressing with a second dressing.

(3) Overlap the second dressing with a third dressing.

(4) Completely overlap all the dressings with a large dressing.

NOTE

If a drain is in place, cut one of the dressing squares halfway through with sterile scissors, and position it around the drain.

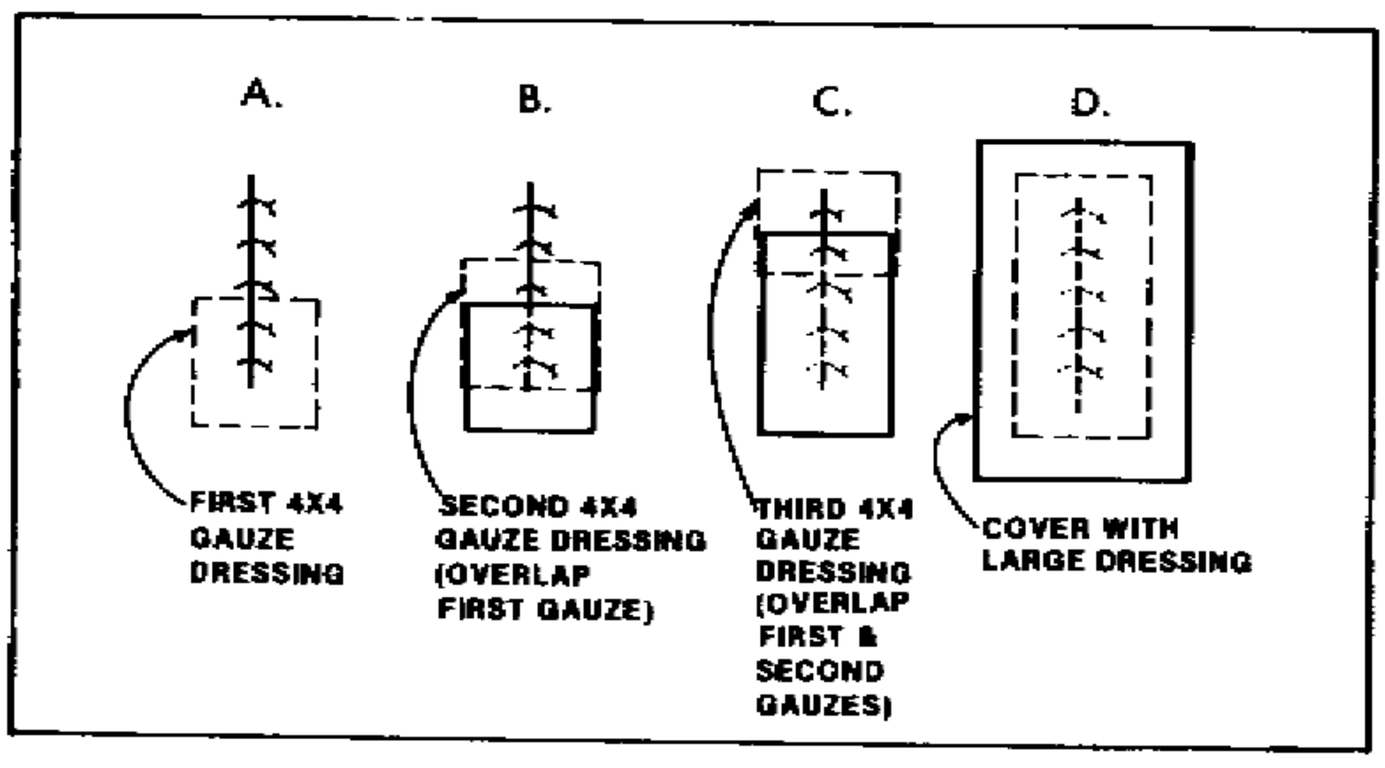


Figure 14-28. Applying a sterile dressing.

(5) Remove sterile gloves.

(6) Secure the dressing in place with tape.

(7) Write the date and time the dressing was changed on the tape and initial it.

m. Remove/discard contaminated materials.

n. Perform patient care handwash.

o. Report and record procedure.

(1) Tell the supervisor that the dressing has been changed. Report any observations made during the procedure.

(2) Record the following data:

(a) Date of dressing change.

(b) Time of dressing change.

(c) Appearance of wound before cleansing.

(d) Appearance of wound after cleansing.

(e) Amount of drainage.

(f) Characteristics of wound and drainage.

Section IV. OBTAIN A BLOOD SPECIMEN

14-44. General

a. Venipuncture is the act of puncturing a vein with a needle to—

(1) Obtain a blood specimen for laboratory tests.

(2) Inject medications or intravenous solutions.

b. Venipuncture can be done by using either a needle and syringe or by using the Vacutainer system.

14-45. The Vacutainer System

a. The Vacutainer system (Figure 14-29) is a type of syringe that consists of—

(1) A vacuum tube with a rubber stopper.

(2) A double-pointed needle. Two types of needles can be used:

(a) Single draw needles for single blood specimens.

(b) Multiple draw needles for multiple blood specimens. The shaft of the multiple draw needle is covered with a rubber sheath. The sheath slips back over the needle when the needle enters the stoppered vacuum tube to prevent blood from dripping into the holder.

(3) A plastic holder with a guideline. The needle is supplied in a sterile package. (The needle that is inserted in the vein *must be sterile.)*

b. The Vacutainer system provides a fast and easy way of collecting several blood specimens with only one needle puncture. However, this system has some drawbacks:

(1) It *cannot* be used when *sterile blood specimens* are needed for bacteriologic studies or cultures.

(2) It is impossible to draw back on the plunger to determine if the needle is in the vein.

(3) The suction of the vacuum in the tube can sometimes collapse the vein.

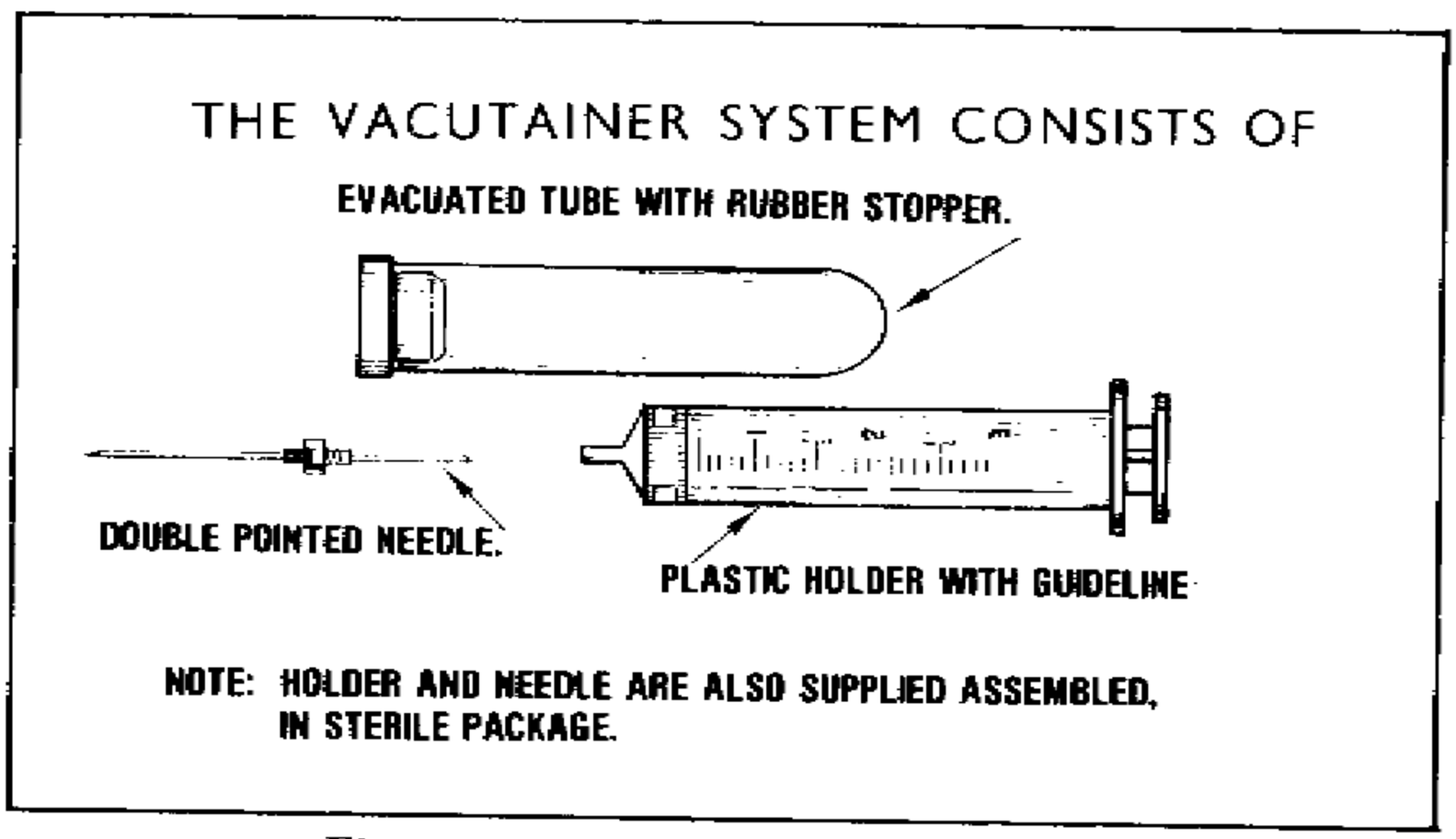


Figure 14-29. Vacutainer system.

14-46. Procedure for Obtaining a Blood Specimen Using the Vacutainer System

a. Obtain the necessary equipment and supplies.

(1) Blood specimen collection vacuum tubes. (Verify what type of tube is to be used. For some tests, an anticoagulant is used in the tubes to prevent clotting. In some laboratories, color coding is used on tubes for different tests.)

(2) Constricting band (flexible latex band or commercial band).

(3) Vacutainer system (plastic holder and single or multiple draw needle).

(4) Betadine or alcohol swab (prepackaged). (Betadine is preferred because it is more effective in reducing the number of skin pathogens.)

(5) Protective pad.

(6) Sterile 2 inch by 2 inch gauze sponge.

(7) Plastic strip.

(8) Rubber band.

(9) Gum-backed labels.

b. Label specimen tube.

(1) Write patient's name, hospitalization and social security numbers, prefix code, ward or clinic designation, name of facility, and date.

(2) Apply label to specimen tube.

c. Perform patient care handwash.

d. Assemble Vacutainer holder and needle without contaminating sterile parts.

(1) Put short end of needle into threaded end of holder.

(2) Attach firmly using a clockwise motion.

(3) Remove needle cover and inspect needle for burs, barbs, or discoloration. (Needle should have glossy, stainless appearance.)

e. Insert blood specimen tube into Vacutainer holder.

(1) Insert rubber-stoppered end of vacuum tube into holder.

(2) Advance until leading edge of stopper meets guideline on holder.

f. Identify the patient.

(1) *Inpatient:* Ask the patient his name, and compare name to bed card and Identaband.

(2) *Outpatient:* Ask the patient his name, and compare it to the medical records or laboratory request.

g. Position the patient. Assist the patient into a comfortable sitting or lying position—never standing.

h. Expose arm for venipuncture.

(1) Roll the sleeve well above the elbow area.

(2) Extend the patient's arm with his palm up. Support the arm by using a pillow, table, or other flat surface.

i. Select vein for venipuncture. Palpate and select one of the most prominent veins (Figure 14-30) in the antecubital fossa (hollow or depressed area in the joint between arm and forearm).

(1) *First choice:* The median cubital vein is—

- Usually visible.
- Large and palpable.
- Well supported.
- The least likely to roll.

(2) *Second choice:* The cephalic vein.

(3) *Third choice:* The basilic vein is—

- Usually the most prominent vein.
- Least desirable. Vein tends to roll, making venipuncture difficult.

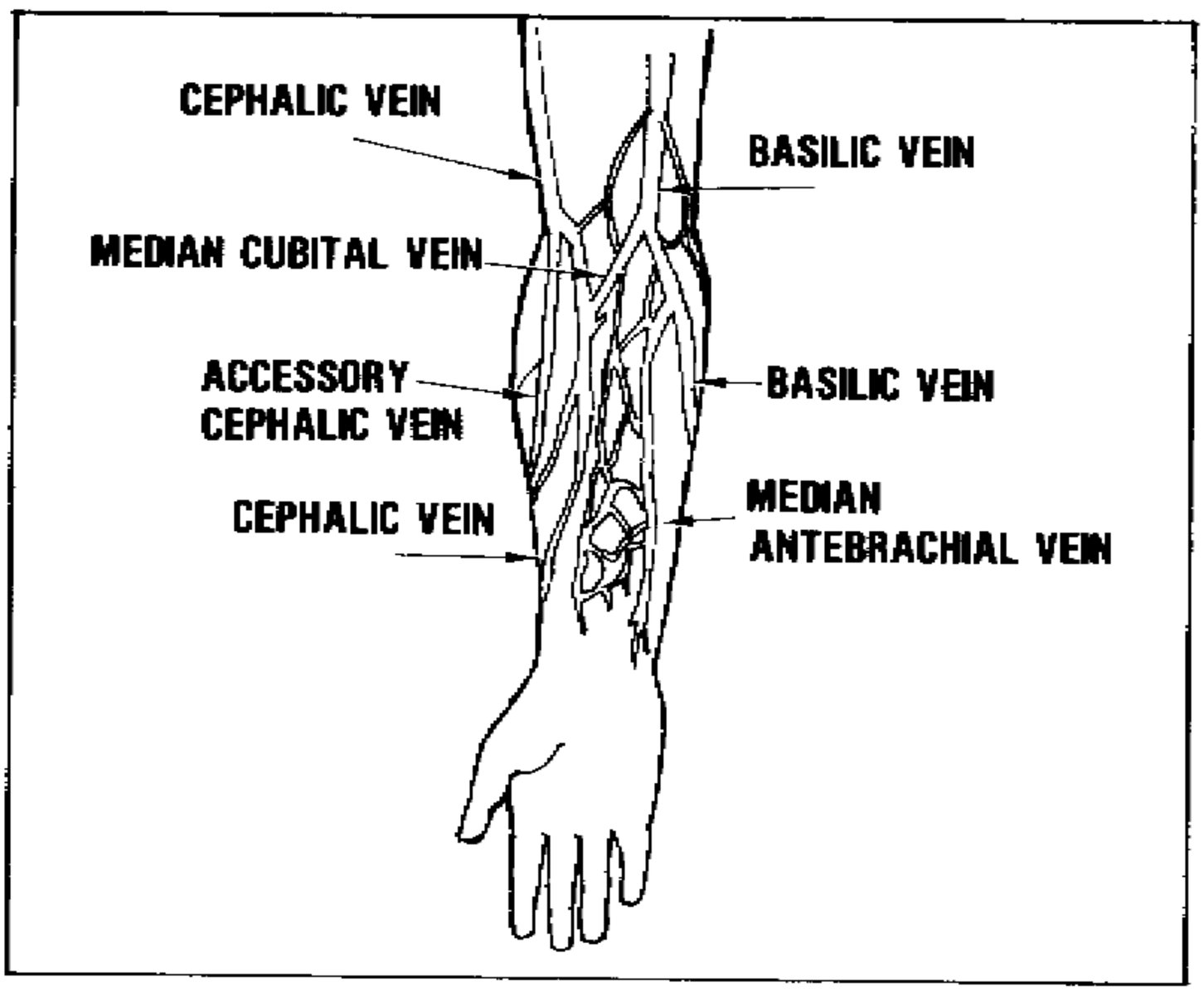


Figure 14-30. Prominent veins.

j. Prepare sponge for use.

(1) Open the Betadine or alcohol swab and the 2 inch by 2 inch sponge. Do not remove them from the packages until they are ready to be used.

(2) Place packages within easy reach.

k. Apply constricting band.

(1) *Latex tubing (Figure 14-31).*

(a) Wrap the tubing around the limb about 2 inches above venipuncture site. Use sufficient pressure to stop venous return without stopping arterial flow. (You should be able to feel a radial pulse.)

(b) Hold one end of tube so that it is longer than the other end.

(c) Form a loop with the longer end. Pass this loop under the shorter end so that the tails of the tubing are turned away from proposed site of injection.

(d) Instruct the patient to open and close his fist several times and to hold his clenched fist to trap blood in veins. This causes the veins to distend. If the vein of choice does not distend, gently tapping the venipuncture site may help distension.

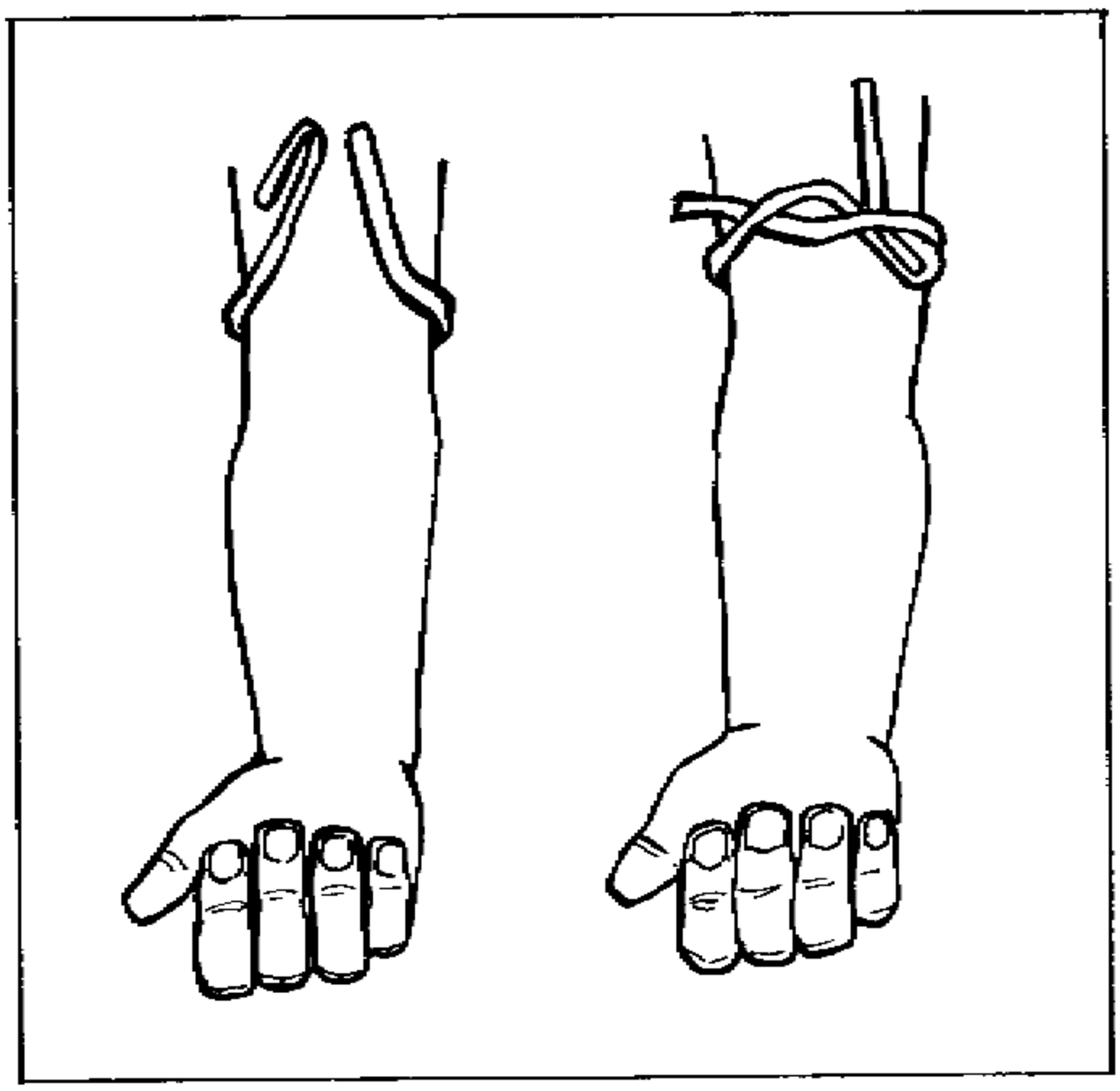


Figure 14-31. Constricting bands.

(2) *Commercial constricting band.*

(a) Follow step 14-46*k*(1)*(a)* above.

(b) Secure the band by overlapping Velcro ends.

(c) Follow step 14-46 *k*(1)*(d)* above.

l. Palpate selected vein. Palpate distended vein lightly with your index finger (Figure 14-32). Move the finger an inch or two in either direction to determine the size and direction of the vein.

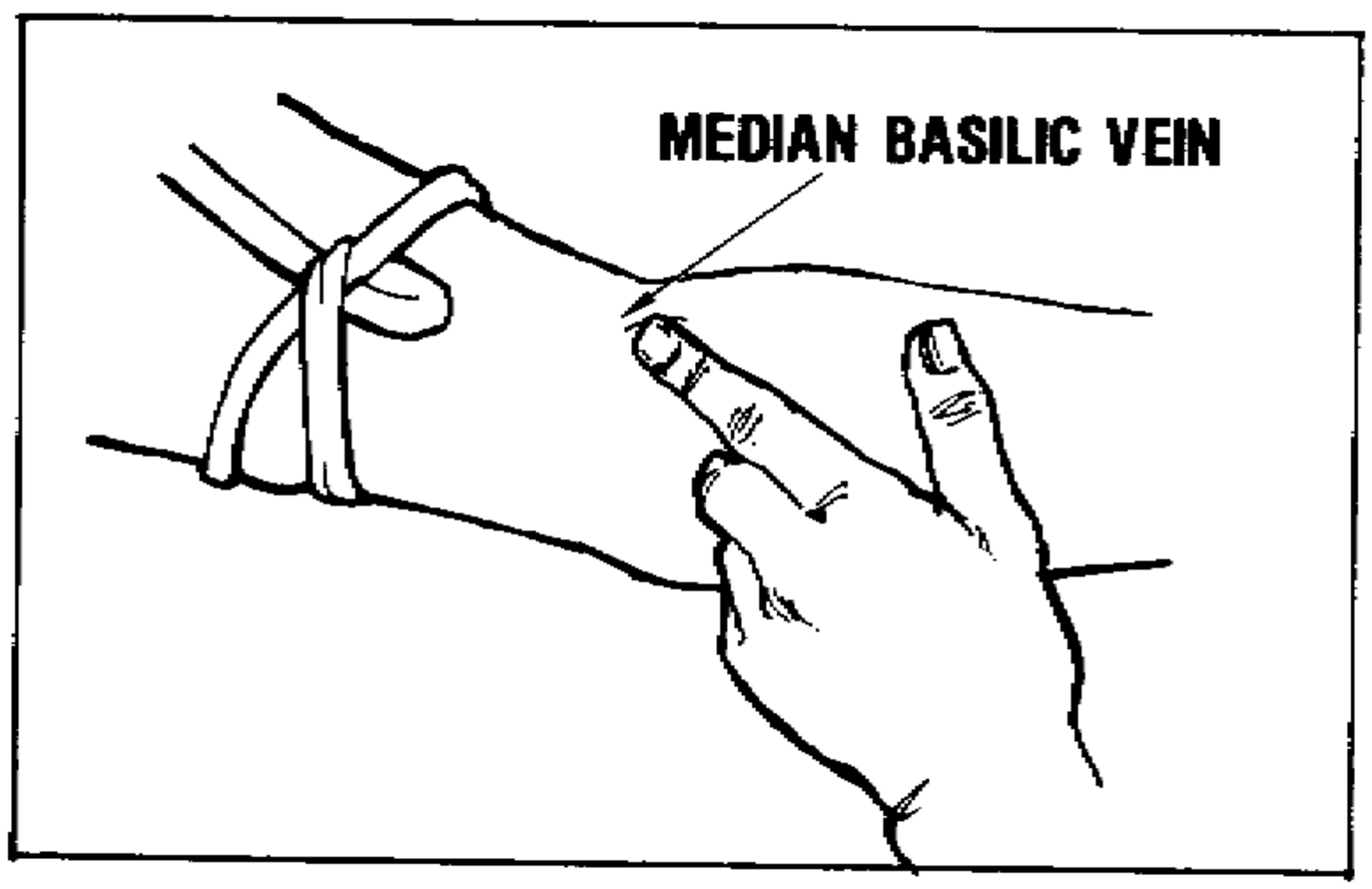


Figure 14-32. Palpate the distended vein.

m. Cleanse the skin.

(1) Cleanse skin over selected area with the Betadine or alcohol swab (Figure 14-33). Use firm, circular movements from the center outward. This motion will move surface skin contaminants away from the proposed venipuncture site.

(2) Discard swab.

(3) Allow the skin to dry, or dry with sterile gauze, if available.

CAUTION

Do not palpate the area again after cleansing.

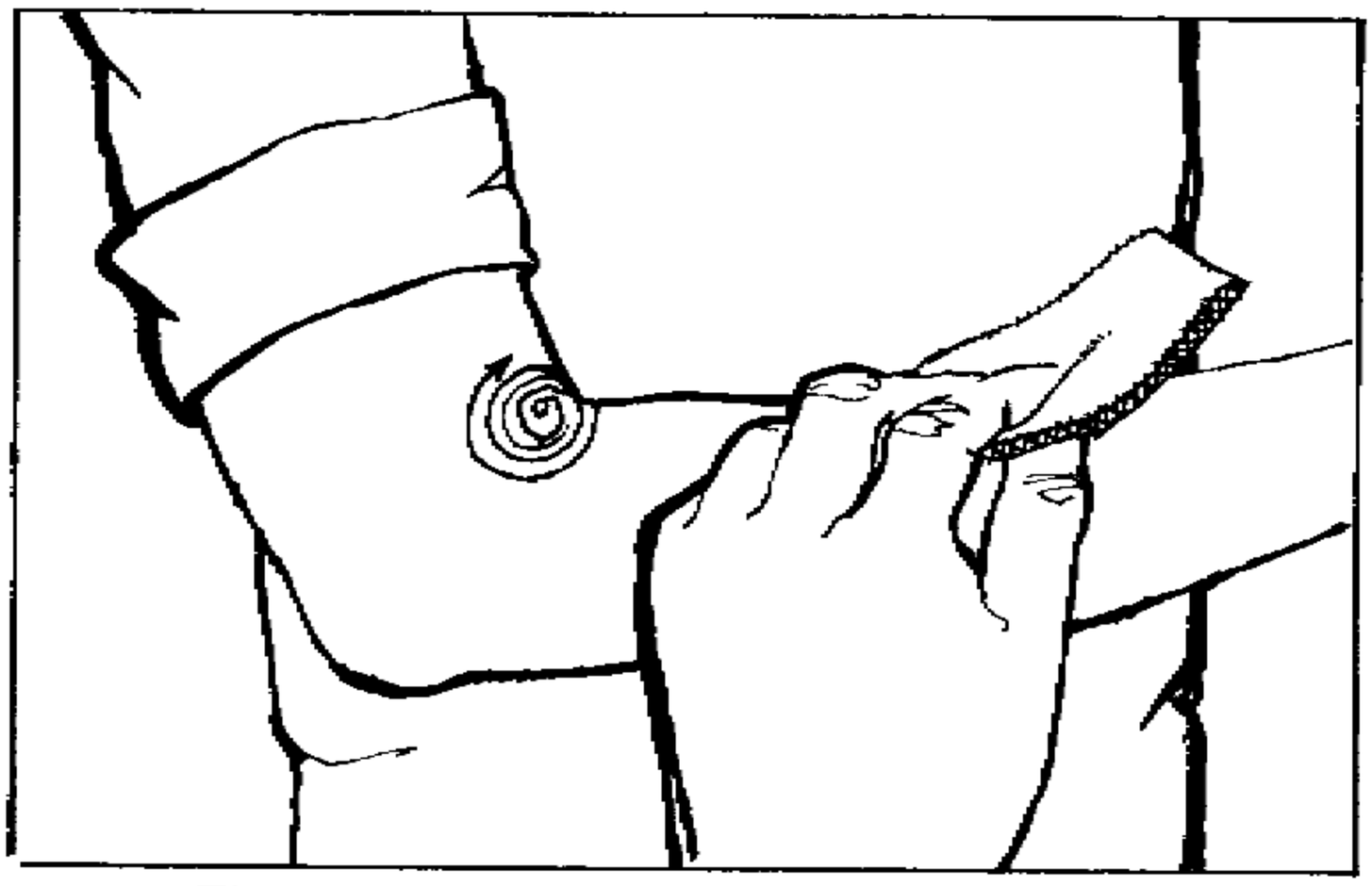


Figure 14-33. Cleanse skin over selected area.

n. Prepare for venipuncture.

(1) Remove protective cover from needle.

(2) Position needle in line with vein and hold patient's arm below cleansed area with free hand.

(3) Place your thumb 1 inch below entry site and draw patient's skin to hold skin taut over selected puncture site.

o. Puncture the vein.

(1) Take the needle, bevel up (Figure 14-34), and place it in line with the vein. Pierce the skin at approximately a 15^{0} to 45^{0} angle. (Enter the vein with the bevel up so that the sharp tip can pierce the skin first, preparing the way for the rest of the needle. Entering the vein with the bevel down causes painful tearing of the skin.)

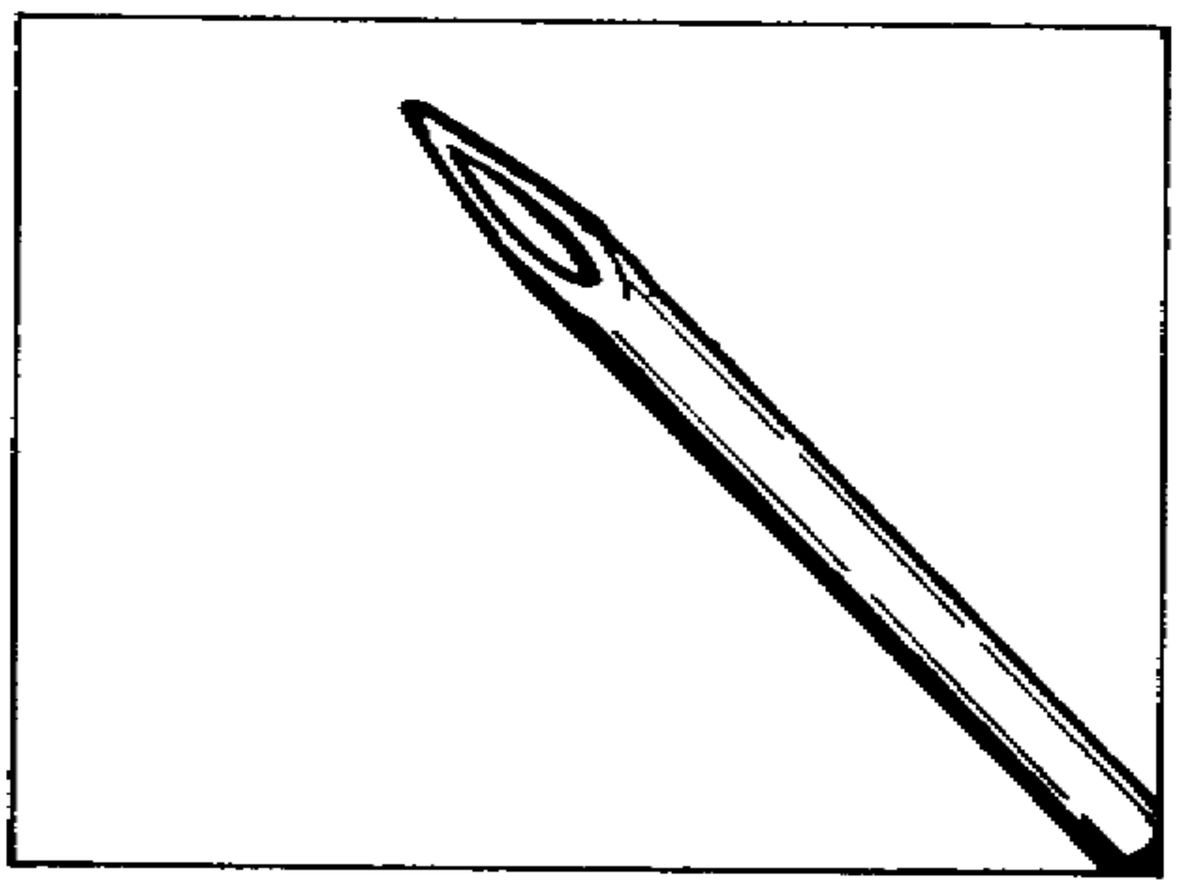


Figure 14-34. Needle, bevel up.

(2) Decrease angle until needle is almost parallel to skin surface.

(3) Direct needle into the vein, piercing vein wall. When the vein is punctured, you will feel a slight "give" on entry into the lumen (passage) of the vein.

(4) Advance needle slightly and watch for increased blood flow. Blood will appear in the hub of the needle.

CAUTION

Use care to prevent puncturing the opposing vein wall.

(5) If the vein is not punctured, pull the needle back slightly, but *not* above the skin surface. Try to direct the needle point into the vein again.

CAUTION

If the needle is withdrawn above the skin surface, obtain a new needle before trying venipuncture again.

(6) If venipuncture is still unsuccessful—

(a) Release the constricting band.

- *Latex tubing:* Pull on the long end of the loop.
- *Commercial band:* Release Velcro fastener.

(b) Place a 2 inch by 2 inch sponge lightly over the venipuncture site.

(c) Quickly withdraw the needle.

(d) Immediately apply firm pressure over the site.

(e) Notify supervisor before attempting to enter another vein.

p. Collect specimen. Hold the Vacutainer needle and unit steady with the hand used to do the venipuncture (Figure 14-35). Keep the needle at the same angle. This action prevents the needle from slipping out of the vein and from through-and-through penetration of the vein walls.

(1) Place the index and middle fingers of your free hand behind the flange of the holder.

(2) Place thumb of same hand on end of tube. Push on tube as far forward as possible. When the needle enters the tube stopper, the vacuum draws blood into the tube.

(3) Instruct patient to relax and ask him to unclench his fist after needle has entered vein.

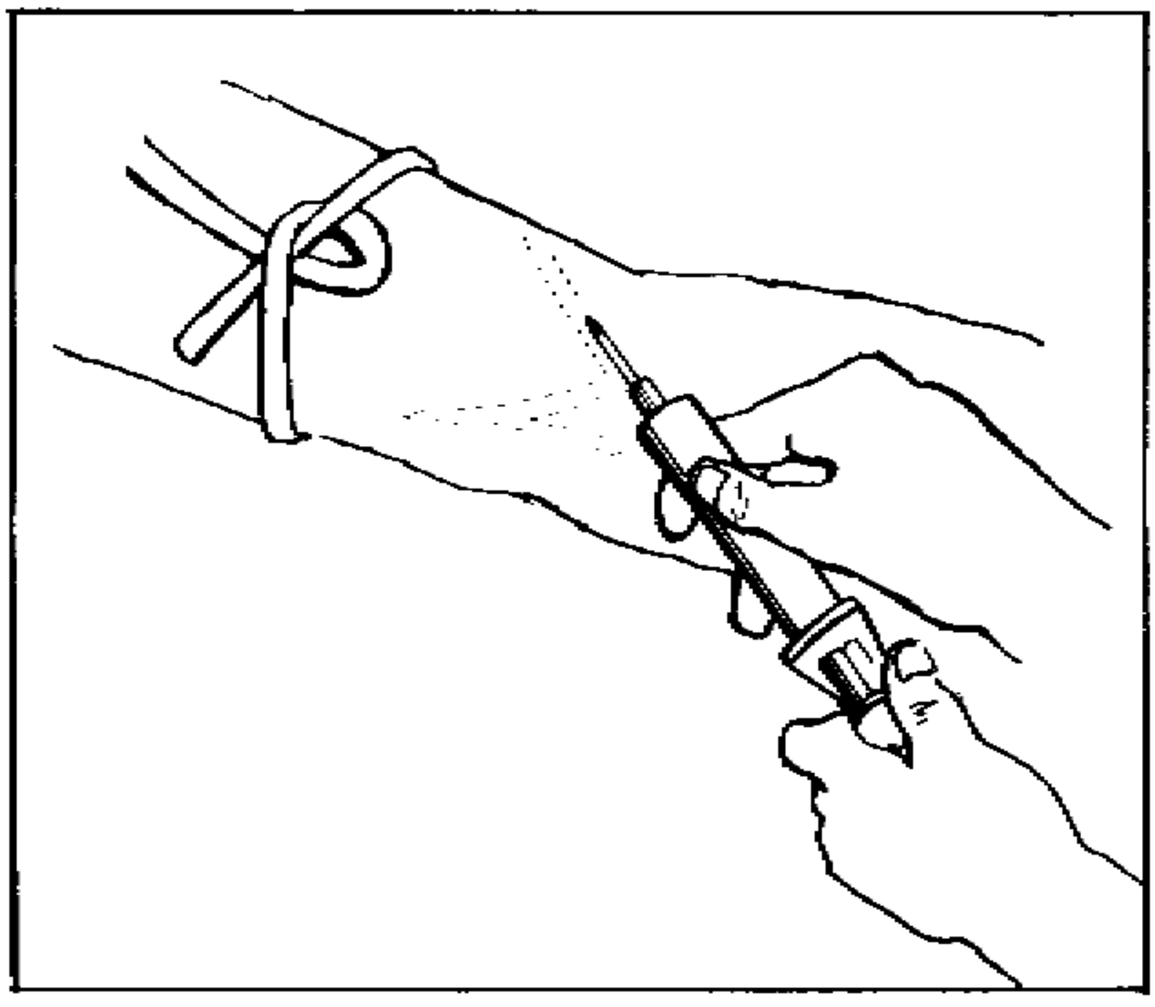


Figure 14-35. Withdrawal of blood.

(4) When tube is two-thirds full or if blood stops flowing into the tube, prepare to withdraw the needle.

NOTE

For multiple specimens, remove the filled tube and insert another tube. Repeat this procedure until the desired number of tubes are filled.

(5) Release constricting band after the required number of tubes are filled (Figure 14-36).

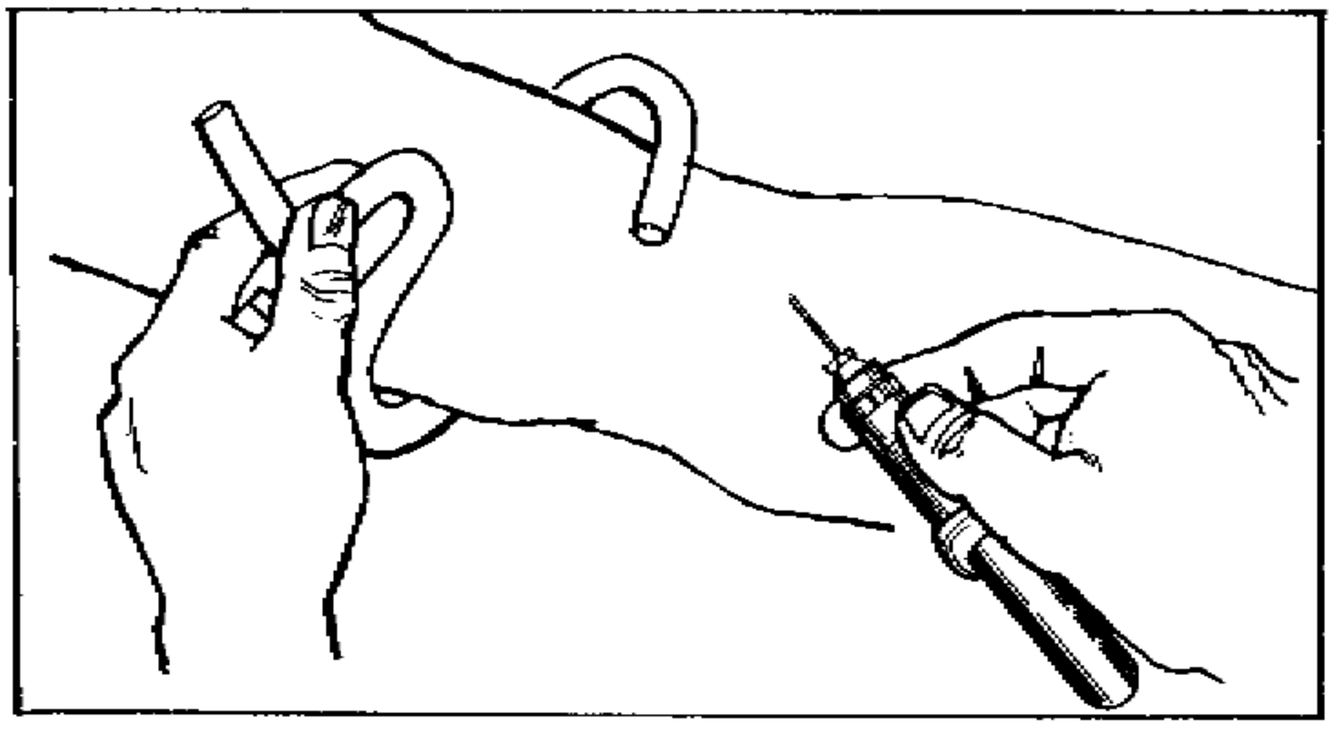


Figure 14-36. Release of constricting band.

q. Withdraw needle.

CAUTION

Do not withdraw the needle before the constricting band is released because of danger of blood loss and/or possible formation of hematomas. Hematomas are tumor-like clusters of blood under the skin.

(1) Place 2 inch by 2 inch sponge lightly over venipuncture site (Figure 14-37).

(2) Withdraw needle smoothly and quickly and immediately press a 2 inch by 2 inch sponge firmly over the venipuncture site. Keep the patient's arm fully extended. This position minimizes leakage around and through the venipuncture site and prevents bruising and possible formation of hematomas.

(3) Tell the patient to elevate his arm slightly, to keep it fully extended, and to apply firm manual pressure to the site for 2 to 3 minutes. If the patient is unable to do this for himself, you must do it for him.

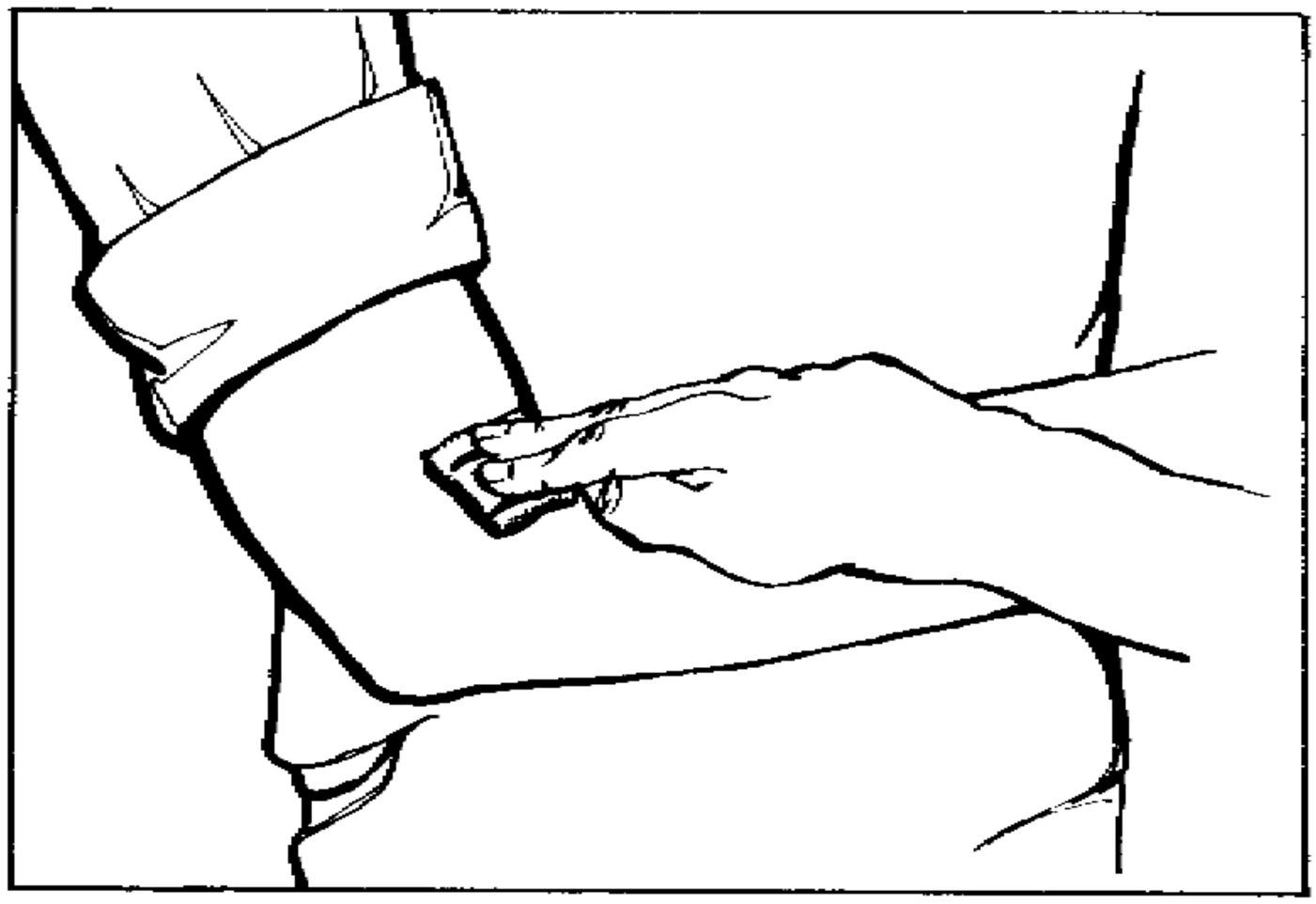


Figure 14-37. Place sponge over venipuncture site.

CAUTION

If a patient is receiving therapy to prevent or reduce blood clotting, continued bleeding may be a complication. Apply manual pressure to the venipuncture site for a longer period.

r. Remove specimen tube from holder.

(1) Put the protective cover over the needle.

(2) Pull the tube out of the holder.

(3) Gently invert tube several times to mix anticoagulant or other fixing agent, if used.

s. Apply plastic strip after bleeding stops.

t. Provide for patient's safety and comfort. Assist patient in rolling down his sleeve or putting on his garment.

u. Dispose of and/or store equipment.

(1) Collect all equipment and remove it from the area.

(2) Place all used sponges and other disposable material in the trash receptacle.

(3) Store the tourniquet and Vacutainer according to local SOP.

(4) Dispose of needle in the destructo-clip.

NOTE

If you accidentally puncture yourself with a used needle, tell your supervisor immediately, force the puncture site to bleed, and wash area well. Some diseases, such as hepatitis, can be transmitted by direct or indirect contact.

v. Check completeness of laboratory request (SF 546, Chemistry I; SF 549, Hematology; or local use laboratory request). As a minimum check for—

(1) Complete patient identification.

(2) Requesting physician's signature.

(3) Ward number, clinic, or dispensary designation.

(4) Date and time of specimen collection.

(5) Test(s) requested.

(6) Specimen source—blood.

(7) REMARKS—admission diagnosis or type of surgery.

(8) Completion of "urgency" block—

(a) ROUTINE.

(b) TODAY.

(c) PREOP.

(d) STAT.

Section V. ADMINISTRATION OF OXYGEN

14-47. General

a. Regardless of the source of respiratory insufficiency, certain general principles of patient management apply prior to the administration of oxygen (O_2):

- Any patient in respiratory distress should receive O_2.
- Any patient whose illness or injury suggests the possibility of hypoxia should receive O_2.

If there is any question whether O_2 should be administered or withheld (as in cases of suspected hypoxia), administer O_2.

b. Oxygen is a colorless, odorless gas normally present in the atmosphere in a concentration of approximately 21 percent. It is normally stored in steel cylinders under a pressure of approximately 2,000 pounds per square inch (psi). These cylinders (Figure 14-38) are given letter designations according to their size: "E" which is 4.5 inches by 30 inches and "G" which is 8.5 inches by 55 inches.

c. Oxygen flow is controlled by a regulator that reduces the cylinder's high pressure to a safe range of approximately 50 psi and controls the flow from 1 to 15 liters per minute. The regulator is attached to the cylinder by a yoke designed so that it will fit only one type of gas cylinder. Gas cylinders are colored-coded by contents; in the United States, oxygen cylinders are always green.

14-48. Oxygen Masks and Cannulas

a. Different masks and cannulas are available to provide oxygen to the patient with respiratory insufficiency. The main characteristics of these masks and cannulas are summarized in Table 14-3.

(1) The simple plastic face mask (Figure 14-39) can deliver up to 60 percent oxygen, depending on the oxygen flow rate and the patient's depth of respiration. Exhaled air is vented through holes in each side of the mask. At low flow rates with deep respirations, the patient may draw in a larger amount of outside air, thus diluting the oxygen concentration received. Generally, a flow rate of between 8 and 12 liters per minute will insure adequate oxygen delivery.

(2) The venturi mask is designed to mix oxygen with air and permit the delivery of accurate low oxygen concentrations. Masks are available to delivery 24 percent, 28 percent, 35 percent, and 40 percent oxygen. They are especially useful in the management of patients with chronic obstructive pulmonary disease and carbon dioxide (CO_2) retention.

(3) Nonbreathing masks have an oxygen reservoir. They are also equipped with a one-way valve to allow the inhalation of oxygen from the reservoir bag and exhalation through the valve. The oxygen flow rate is adjusted to prevent collapse of the bag during inspiration. The flow rate with this type of mask is usually 10 to 12 liters per minute. If the mask is fitted tightly to the face, it can delivery O_2 concentrations approaching 100 percent. This mask is well suited to situations where there is severe hypoxia.

(4) Nasal cannulas (prongs) (Figure 14-40) are made of plastic tubing and have two plastic tips that are inserted into the nostrils (Figure 14-40A). They will deliver an oxygen concentration of from 25 to 40 percent with a 4 to 6 liter per minute flow rate Nasal prongs are usually well tolerated but can cause soreness around the nostrils. They can deliver a limited amount of maximum oxygen concentration.

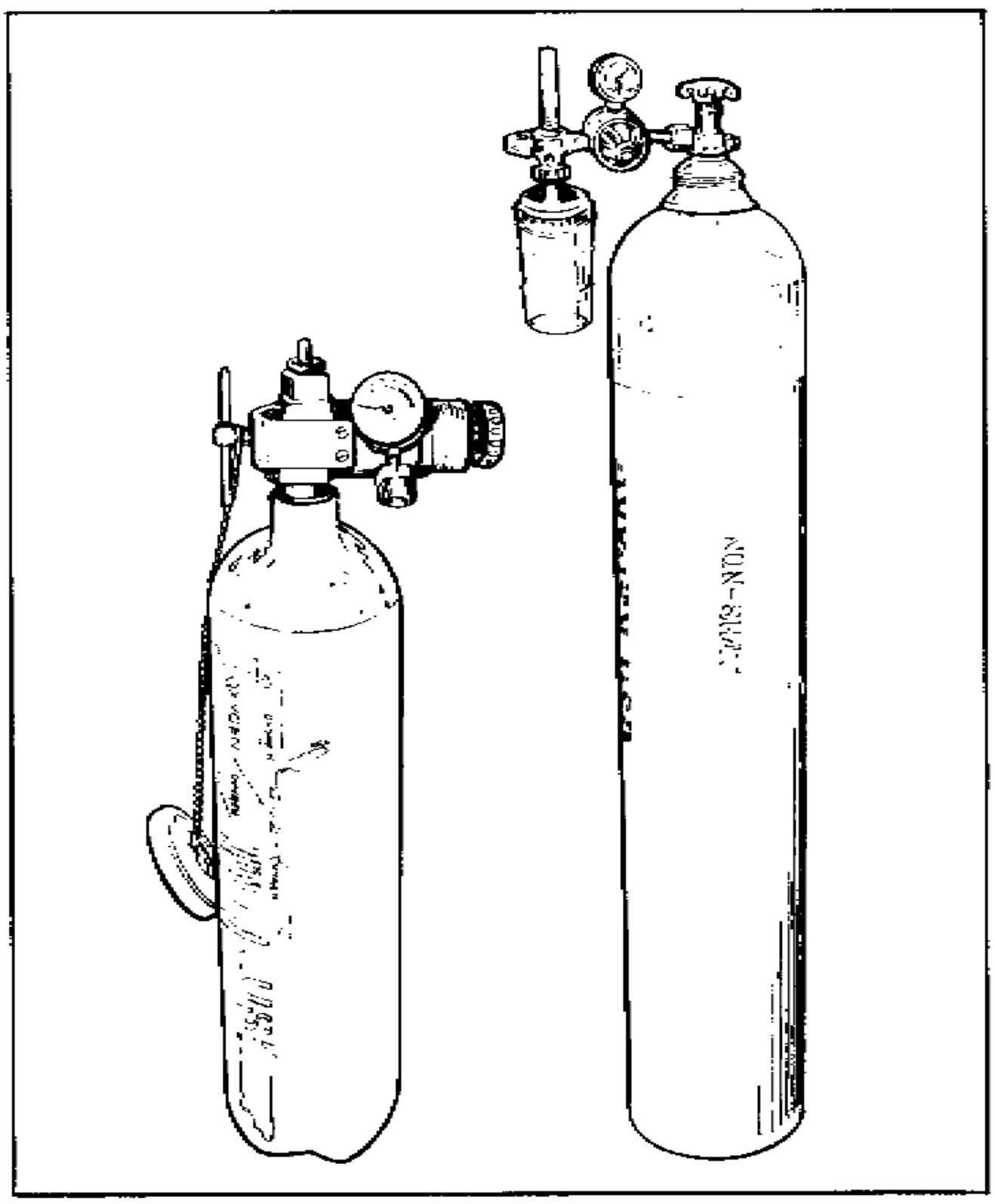


Figure 14-38. Oxygen (O_2) cylinders.

Table 14-3. Types of Masks and Cannulas for Providing Supplemental Oxygen

Device	Flow Rate Used (liters per minute)	O_2 Concentrations Delivered (percentage)	Comments
Nasal cannula	4-6	25-40	Usually well tolerated.
Plastic face mask	10	50-60	
Venturi mask			
24 percent	4	24	Long-term treatment of patients with COPD; limited usefulness in the field.
28 percent	8	28	
35 percent	8	35	
40 percent	8	40	
Nonbreathing mask	10-12	90	Permits administration of high concentration of O_2.

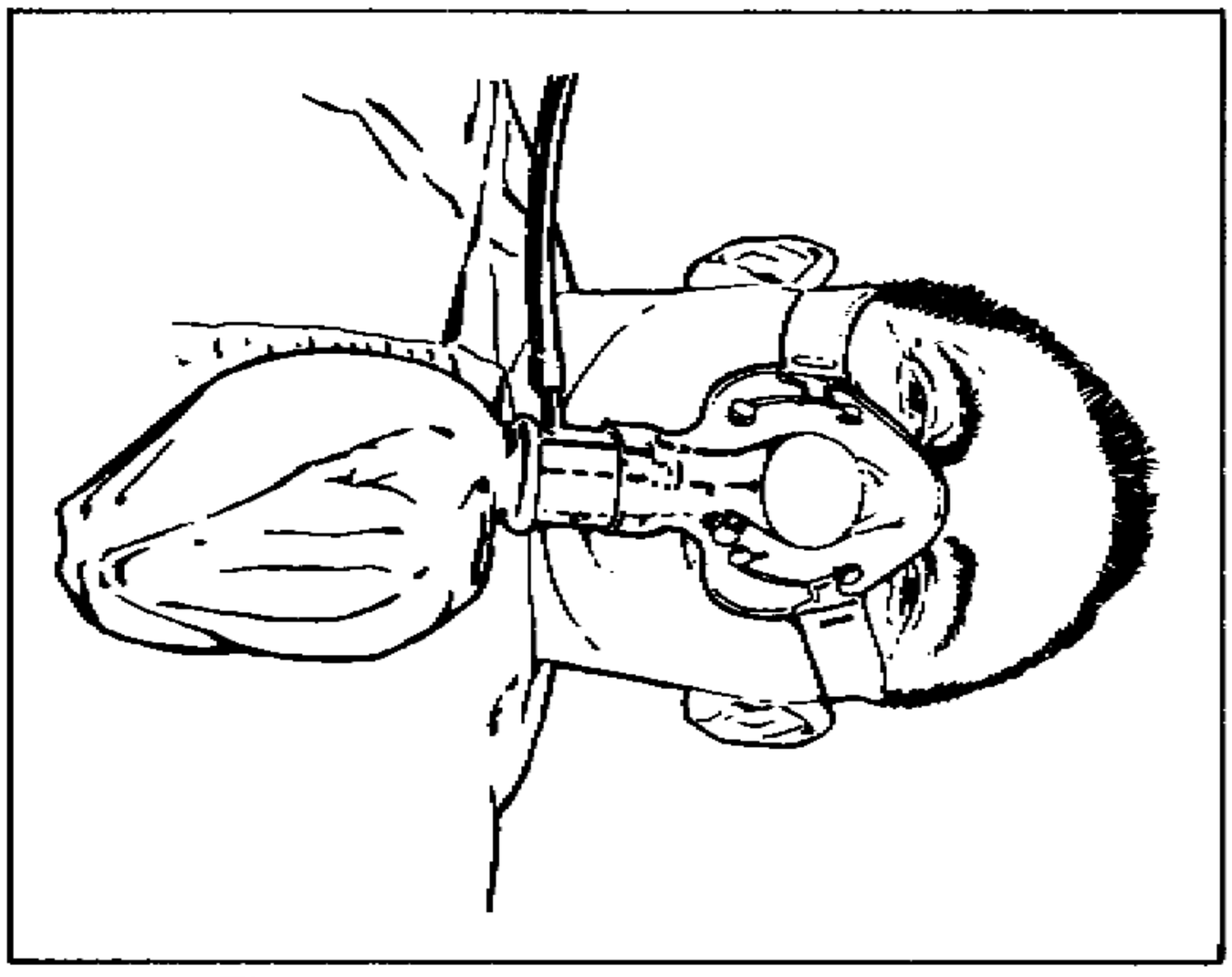


Figure 14-39. The plastic face mask.

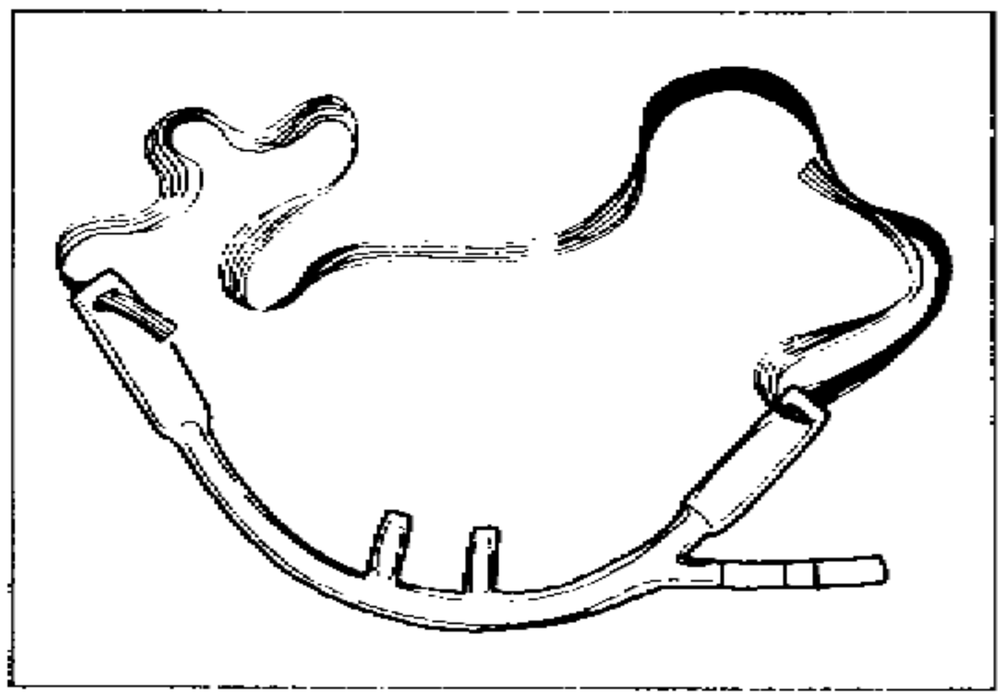


Figure 14-40. Nasal cannula.

b. The plastic face mask or nonbreathing mask is preferred in most cases because they can deliver higher concentrations of oxygen. There are some patients, however, who can barely tolerate the mask and complain of a suffocating feeling; for these patients the nasal cannula can be used. No matter which device is chosen, explain to the patient its function and why it is required. Let the patient know that the mask may feel confining but that it actually provides more air than unaided breathing. This explanation may help the patient accept the mask with less anxiety.

14-49. Administration of Oxygen

Use the following procedure in the administration of oxygen:

a. Secure the oxygen cylinder in an upright position.

b. With the wrench supplied, slowly open and quickly close the cylinder to flush out any debris.

c. Inspect the regulator valve to insure that it is the right type for an oxygen tank and that the washer is intact.

d. Install and tighten the regulator securely on the cylinder (Figure 14-41).

e. Open the main cylinder valve (Figure 14-41A) slowly to approximately one half turn beyond the point where the regulator valve becomes pressurized.

f. Open the control valve (Figure 14-41C) to the desired flow rate as indicated on the regulator gauge (Figure 14-41D).

g. To stop oxygen administration—

(1) Shut off the regulator control valve until the flow rate is zero.

(2) Shut off the main cylinder valve.

(3) Bleed the control valve and main cylinder valve by opening the control valve until the needle or ball indicator shows zero flow.

(4) Close the control valve.

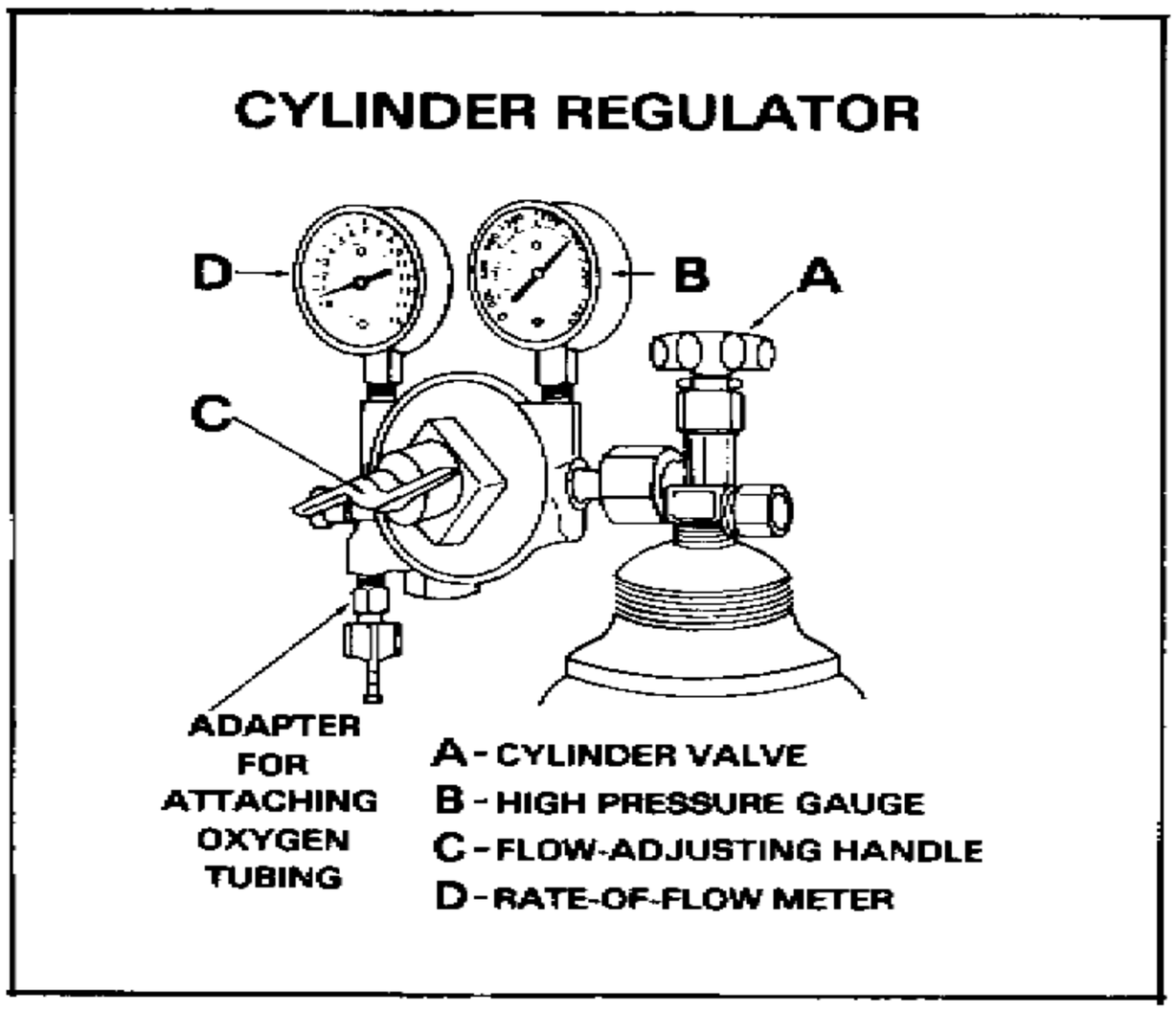


Figure 14-41. O_2 cylinder with regulator.

14-50. Safety Precautions When Handling Oxygen Cylinders

a. Keepcombustible materials such as oil or grease away from the cylinders, regulators, fittings, valves, or hoses.

b. Close all valves when oxygen cylinders are not in use, even if they are empty.

c. Secure oxygen cylinders to prevent them from tipping over. In transit, keep them in an appropriate rack or carrier, or space permitting, strap them onto the litter with the patient.

d. When working with an oxygen cylinder, always remain to one side. Never place any part of your body over the cylinder valves. A defective cylinder can launch a loosely fitting regulator with enough force to severely injure anyone in its path.

e. DO NOT smoke in any area where oxygen cylinders are in use or are being stored.

f. DO NOT subject the oxygen cylinders to temperatures above $120^{o}F$.

g. DO NOT use oxygen cylinders without properly fitted regulator valves. Never attempt to modify a regulator valve designed for another type of gas cylinder for use with an oxygen cylinder.

Section VI. CATHETERIZATION/THE URINARY (FOLEY) CATHETER

14-51. General

a. The Foley, or indwelling, catheter is inserted into the bladder to maintain a free flow of urine and is used for a variety of purposes:

- Emptying the bladder to allow an infected area to heal free of contaminated urine.
- Keeping an incontinent (unable to control bladder function) patient dry.
- Retraining or restoring normal bladder function.
- Maintaining an accurate intake and output record.

b. Foley catheters are available in various sizes; the size to be used depends upon the physical structure of the patient. The physician may designate the catheter size when he writes the order for the catherization. The Foley catheter is a double lumen rubber tube; the main tube is identified by the openings in the tip and the wide base at the opposite end. The second tube is connected and sealed along the side of the main tube; the end of the tube is fixed in a manner that allows it to be inflated with air or sterile liquid, causing an inflated balloon to be formed around the main tube. This balloon prevents the catheter from slipping out of the bladder. The plastic drain tube with the attached plastic drain pouch is inserted into the main tube of the catheter. The complete drainage set up is known as a closed drainage system (Figure 14-42).

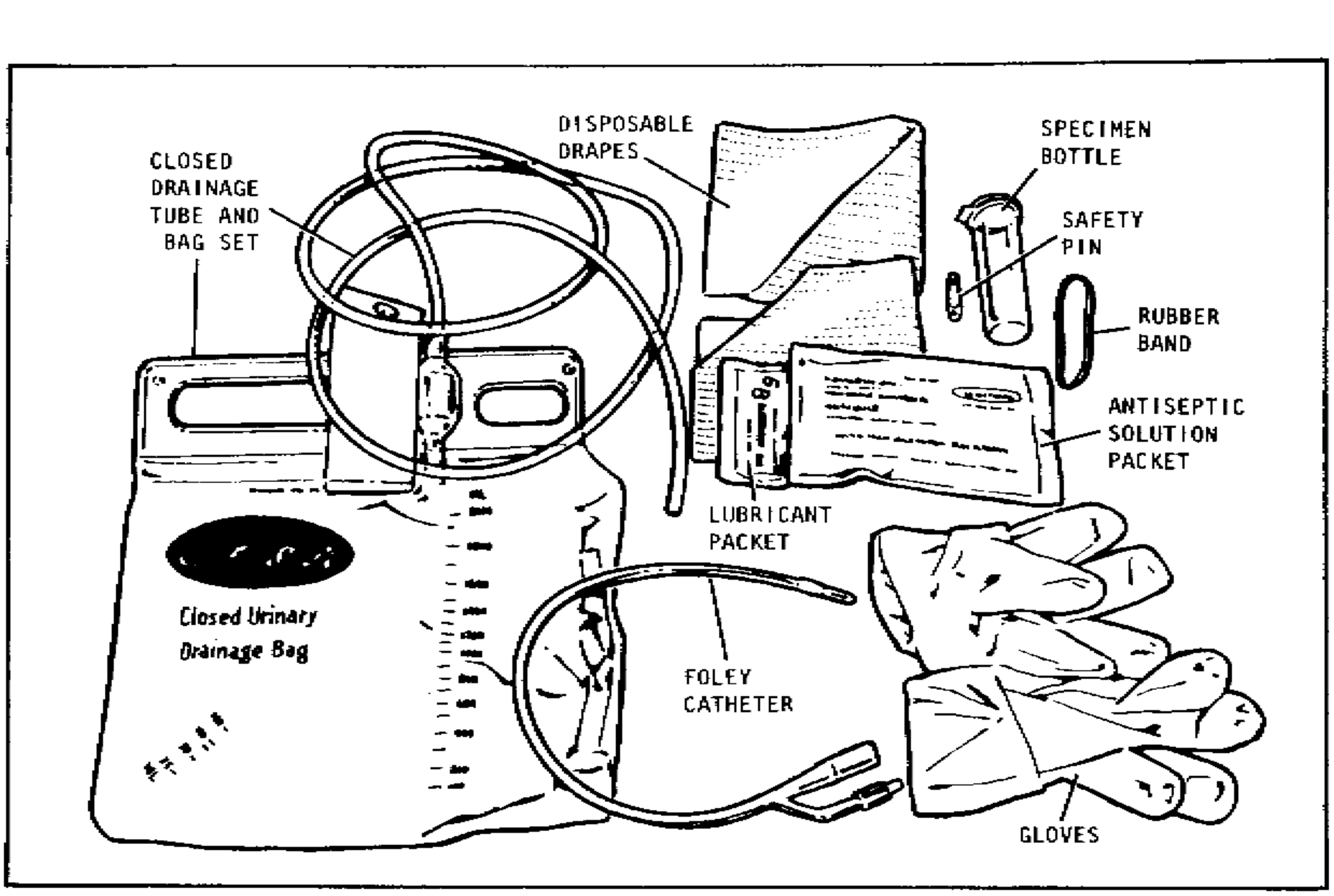


Figure 14-42. Foley catheter set up.

c. It is unlikely that you will have to perform urinary bladder catheterization in a field situation; however, when you are working in a hospital or clinical environment, there may be a requirement for you to use this skill. Catheterization can be an unpleasant experience for the patient; gaining his trust and confidence can do a great deal to make him more comfortable during the procedure.

14-52. Catheterization of the Urinary Bladder

a. Equipment necessary for the procedure.

- Sterile gloves.
- Sterile cleansing sponges.
- Antiseptic solution (pHisoHex or Betadine).
- Foley catheter with 5 ml balloon (normally a No. 14 French for women or a No. 16 for men).
- Sterile towels.
- Syringe with needle, containing 5 ml saline solution.
- Clamp.
- Water-soluble lubricant.
- Connecting tube and collecting bag.
- Sterile basin.

NOTE

Prepackaged catheterization sets are now widely available and suitable for this procedure. When such a set is to be used, the equipment listed above will not be needed.

b. Catheterization of a male patient (Figure 14-43).

(1) Place a towel beneath the patient's penis.

(2) Wash your hands and put on sterile gloves. Arrange equipment on the sterile towel so it is handy.

(3) Retract the patient's foreskin (if present) with the left hand and hold the penis by the shaft. This hand is now no longer sterile.

(4) Use the clamp to pick up a sterile sponge soaked in antiseptic solution with the right hand. Wash the glans in a circular motion from the urethral meatus outward. Cleanse the glans thoroughly three to five times using a new, sterile sponge each time.

(5) Touch nothing but the catheter with the right hand. Liberally lubricate the catheter with sterile surgical lubricant.

(6) Raise the shaft of the penis straight up with the left hand and *gently* introduce and pass the catheter. Slowly advance it almost to its bifurcation (the Y-shaped division in the catheter tube) before inflating the balloon.

(7) Inflate the balloon using the syringe containing saline solution.

NOTE

Some catheters require a needle to inflate the balloon and others have a Leuer-Lok connector. Be aware of the type you use to prevent problems when trying to inflate the balloon.

(8) Pull back gently on the catheter until slight resistance is felt. This indicates that the balloon is flush against the bladder wall.

(9) After obtaining a urine specimen, connect the catheter to the drainage system. Many prepackaged catheter kits already have the catheter and drainage systems connected.

(10) Tape the tubing (not the catheter) to the inner surface of the thigh. Avoid placing tension on the catheter.

(11) Never allow the bladder to empty all at once if it is full. Drain 500 cc's of urine at one time, clamp the catheter for 15 minutes, then drain another 500 cc's. Continue this procedure until the bladder is empty.

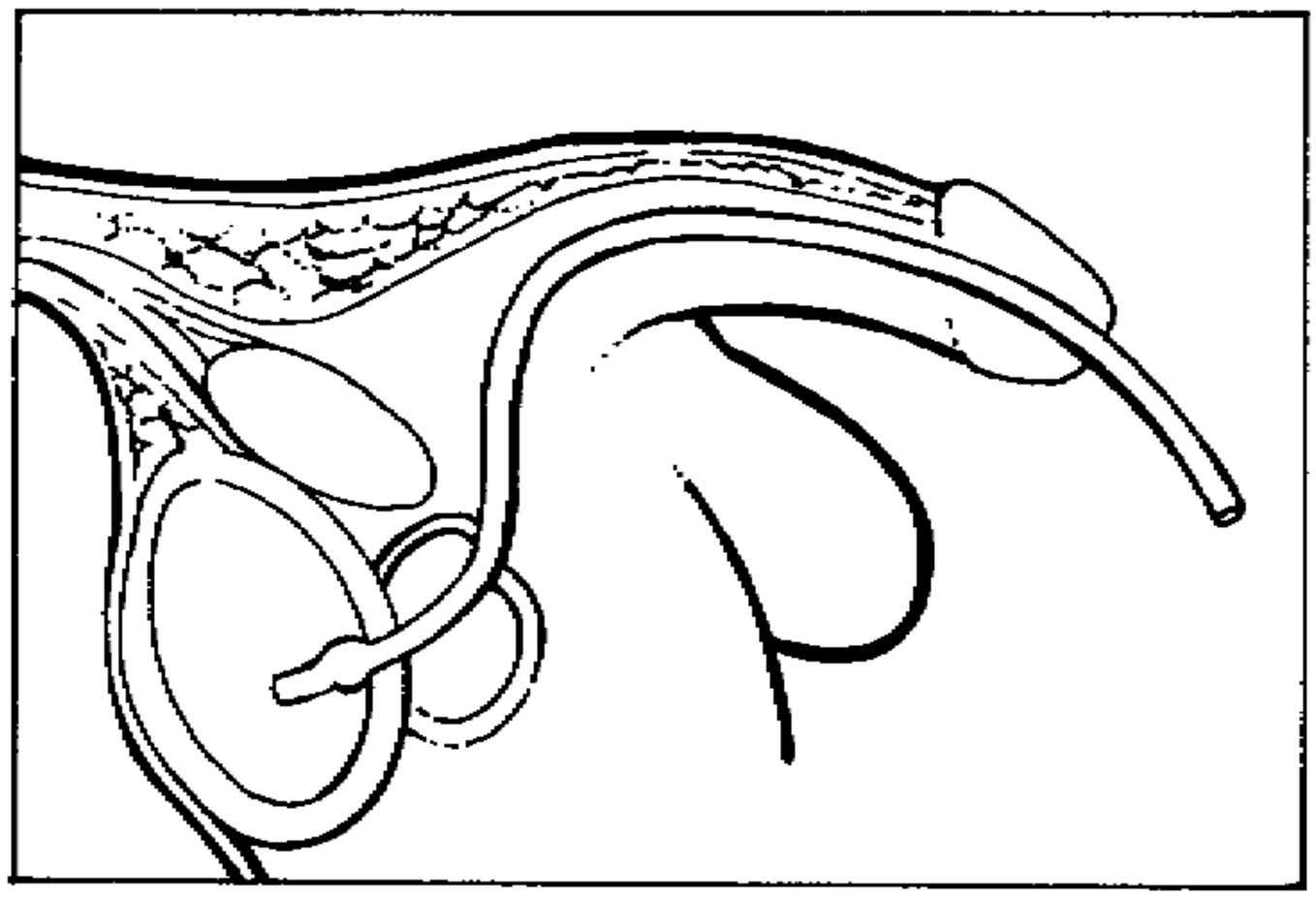


Figure 14-43. Male catheterization.

c. Catheterization of a female patient (Figure 14-44).

(1) Place the patient in a supine position (on her back), with knees bent. Place pillows or padding under the buttocks to insure that her hips are canted upward.

(2) Use the same sterile procedure described in paragraph 14-52*b* above.

(3) Clean the urethral meatus thoroughly with antiseptic solution.

(4) Lubricate the catheter tip and advance it *gently* into the urethra.

(5) Follow the remainder of the procedure outlined in paragraph 14-52*b*(7) through (11).

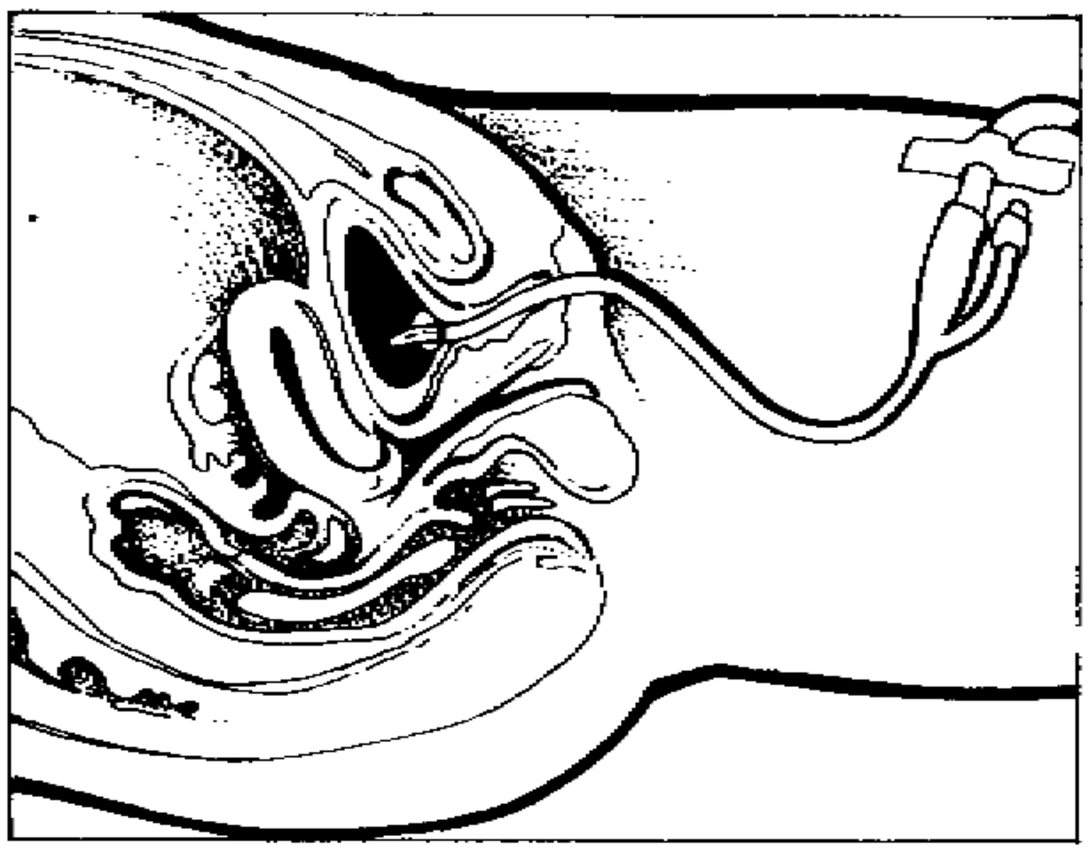


Figure 14-44. Female catheterization.

14-53. Care/Management of the Patient with a Foley Catheter

a. Procedure for care of a Foley catheter.

(1) Wash your hands thoroughly to reduce possible contamination.

(2) Place the patient in a supine position.

(3) Observe the skin at point of insertion and surrounding area. Check for redness, skin eruptions, or swelling.

(4) Gently cleanse the area with soap and water, rinse and blot dry. Apply antiseptic ointment to urethral meatus if ordered or in accordance with local SOP.

(5) Insure that the tubing remains close to the patient's body.

(a) Place nonallergenic tape around the drain tube approximately 12 to 18 inches from the point of insertion and secure it to the skin on the patient's thigh or abdomen.

(b) Place the tube so that it is comfortable for the patient and there is no tension or unnecessary pull on the skin.

(6) Maintain tubing alignment.

(a) The drainage tube should lie on top of the bed in a straight line. It must be kept free of kinking, twisting, and the pressure of added weight.

(b) Tubing must not be clamped together to allow urine to flow freely into the bottle.

(7) Keep the gravity-flow drainage even.

(a) Pin or tape the longest part of the tube to the bed linen to prevent the tubing from falling over the side of the bed. This also keeps the tubing above the drainage bottle to maintain an even free-gravity flow.

(b) Attach the drainage container to the side of the bed frame.

(c) Change the position of the drainage container as you change the position of the patient.

(8) Empty the drainage container.

(a) The drainage container can be emptied without disconnecting the closed system.

(b) Remove the cap from the drainage container outlet tube, release drainage clamp, and let contents flow into a graduated pitcher.

(9) Measure and discard, or save, the urine as indicated by the order.

(10) Position the bed side rails and leave the patient safe and comfortable.

(11) Record all applicable information on the patient's chart.

b. Additional catheter care information.

(1) At times, the patient will say that he has the urge to urinate. Check the catheter and drainage tube to insure that both are free of any solid matter. If clogging has occurred, the catheter may need to be irrigated with sterile saline solution to remove it.

(2) A second source of discomfort may be the position of the catheter in the bladder. The opening of the catheter may be lying against the bladder wall or it may be above the urine level so that it is impossible for the

urine to drain. Gently reposition the patient so that the flow will be continuous. Catheter size may affect urine flow, particularly if the catheter tube is too small for adequate drainage.

(3) Careful monitoring of the catheter patient will do a great deal to insure that pain and/or discomfort are kept to a minimum and that the catheterization procedure will serve its purpose.

Section VII. NASOGASTRIC TUBES

14-54. General

Gastrointestinal intubation is the insertion of a specific tube through the nose (naso) or throat into the stomach (gastro) or the intestine. The primary reasons for this relatively common procedure are to—

a. Drain the stomach or intestinal tract by means of a suction apparatus. It is used to prevent postoperative vomiting, postoperative obstruction of the intestinal tract, and gas formation in the stomach or intestine after an operation.

b. Diagnose a disease or to identify and determine the cause of a pathological condition.

c. Wash out stomach contents, as in the case of a person who has ingested poison.

d. Provide a route for feeding a patient who is unable to take food by mouth.

14-55. Types of Nasogastric Tubes

Several types of nasogastric tubes are commonly used for intubation; each has a specific purpose in addition to decompression and drainage of the gastrointestinal tract. The two most common types are the Levin tube and the vented sump (Salem sump).

a. The Levin tube (Figure 14-45) is a single lumen (bore) tube approximately 3 feet in length, fitted with holes along one side 6 to 9 inches from its distal tip.

b. The Salem sump tube (Figure 14-46) is a double lumen tube approximately 3 to 4 feet in length. The large lumen is designed to function in the same manner as a Levin tube. The second lumen (the small blue tube) is a vent which is left open to the atmosphere and equalizes the pressure or suction in the stomach. This reduces the chances of the sump becoming blocked by being pulled up against the lining of the stomach.

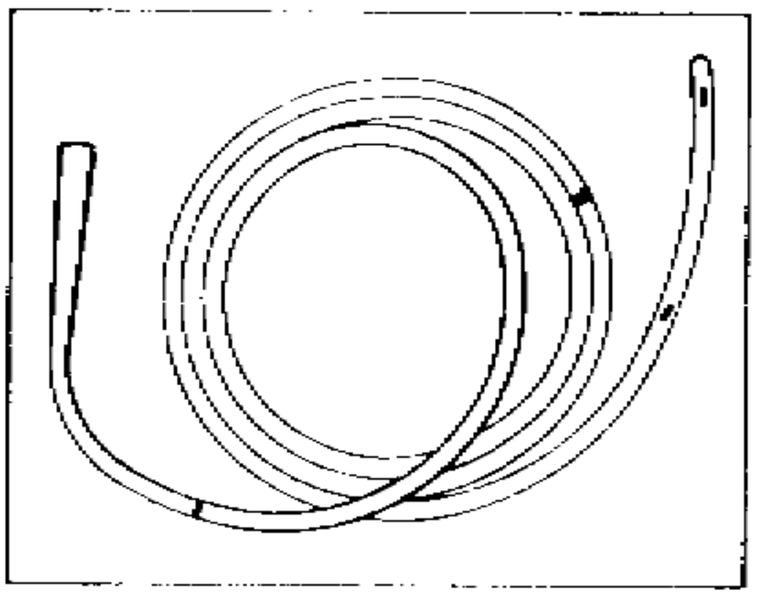


Figure 14-45. Levin tube.

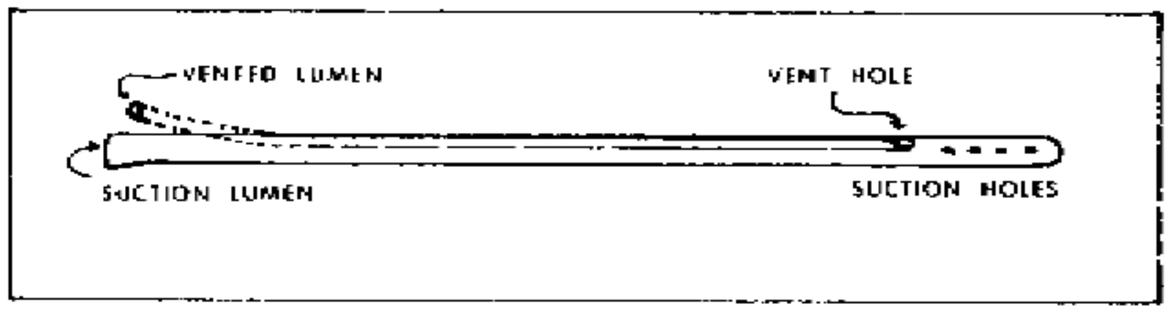


Figure 14-46. Salem sump tube.

14-56. Insertion of the Nasogastric Tube

a. Prepare the intubation equipment.

(1) Assemble an emesis basin, tissues, a water-based lubricant, a 20 to 50 cc's aspirating syringe, adhesive tape, and a glass of water.

(2) If the tube needs added stiffness for insertion, immerse it in a pan of ice until the desired degree of stiffness if obtained (usually 15 to 30 minutes).

b. Explain the procedure to the patient.

(1) The patient may be in pain and frightened of the procedure. You need to reassure him that you will be as gentle as possible and that you will tell him what is being done as the procedure progresses.

(2) Explain to the patient that passing the tube down the back of the throat is painless, but that it could cause gagging. Tell him to breathe deeply through his mouth so that he will be less likely to become nauseated and vomit.

c. Position the patient.

(1) The patient is usually placed in the Fowler's position (head raised 18 to 20 inches above the body) to allow the tube to move by gravity down the digestive tract. This also enables the patient to expel vomitus if necessary.

(2) The supine position can be used if the patient's condition warrants it.

d. Provide the patient with an emesis basin and tissues.

e. Measure the tube for insertion distance. Measure the distance from the patient's nose to the nearest earlobe and down to the navel. This is approximately the distance from the lips to the stomach. Mark this distance by placing a piece of tape at this point on the tube.

f. Assume a comfortable working position and lubricate the tip of the gastric tube.

(1) Stand at the right side of the patient. Grasp the tip of the tube in the right hand and hold the remainder of the tube in the left hand. (Reverse hand positions if left handed.)

(2) For easier insertion, use water or a water-base lubricant to moisten the tip of the tube. *Do not use an oil-base lubricant.*

g. Begin the tube insertion procedure.

(1) Have the patient swallow a mouthful of water as the tube is passed down the esophagus to the stomach. Bend the patient's head forward so that his chin rests on his neck.

(2) The tube is inserted one of two ways:

(a) Through the mouth—pass the tube over the top and middle of the tongue toward the back of the throat.

(b) Through the nose (Figure 14-47)—pass the tube gently up one nostril and down the back of the throat, rotating it slowly between your thumb and index finger. Check the position of the tube as it passes down the back of the patient's throat by having him open his mouth and holding down his tongue with a tongue depressor.

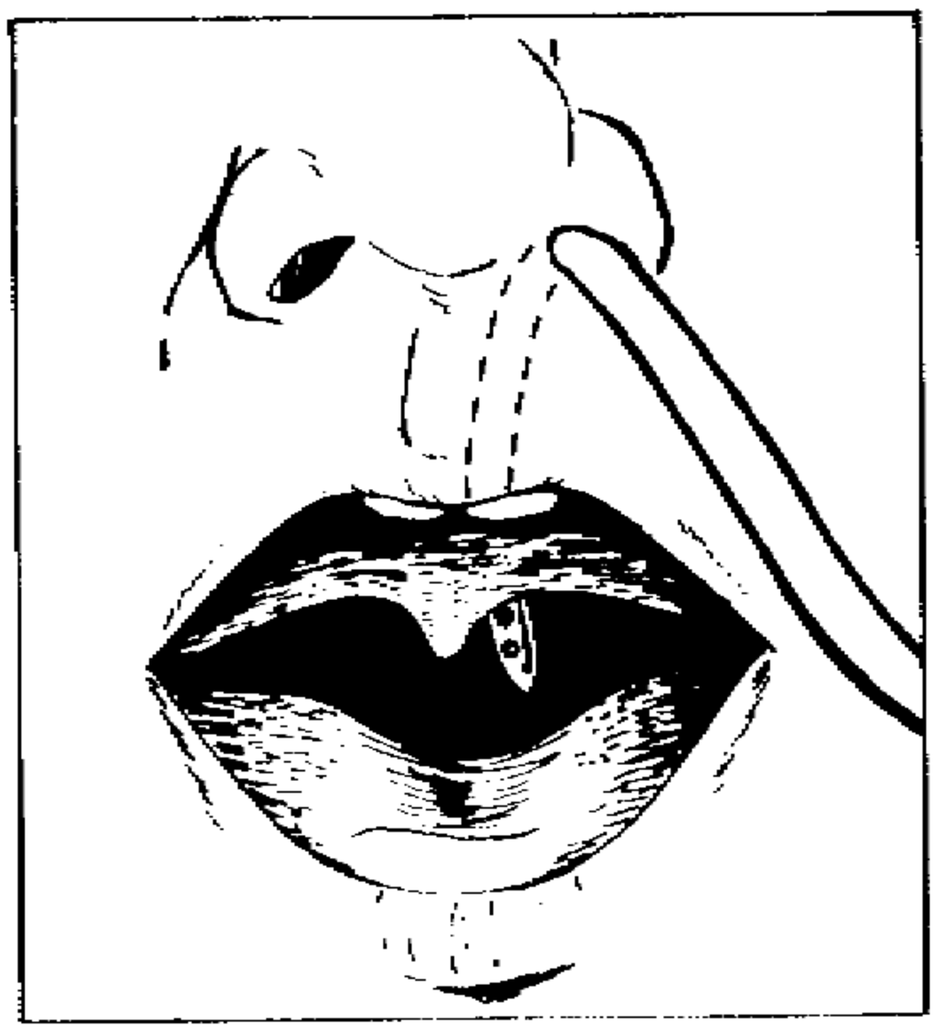


Figure 14-47. Tube insertion through nose.

h. Push the tube slowly, firmly, and gently into the stomach.

(1) Attempting to pass the tube too fast stimulates the nerve endings in the back of the throat which in turn stimulates the vomiting center of the brain, causing the patient to vomit.

(2) Continue to have the patient swallow water as the tube is passed (Figure 14-48). Movement of the throat caused by swallowing will ease the tube's passage.

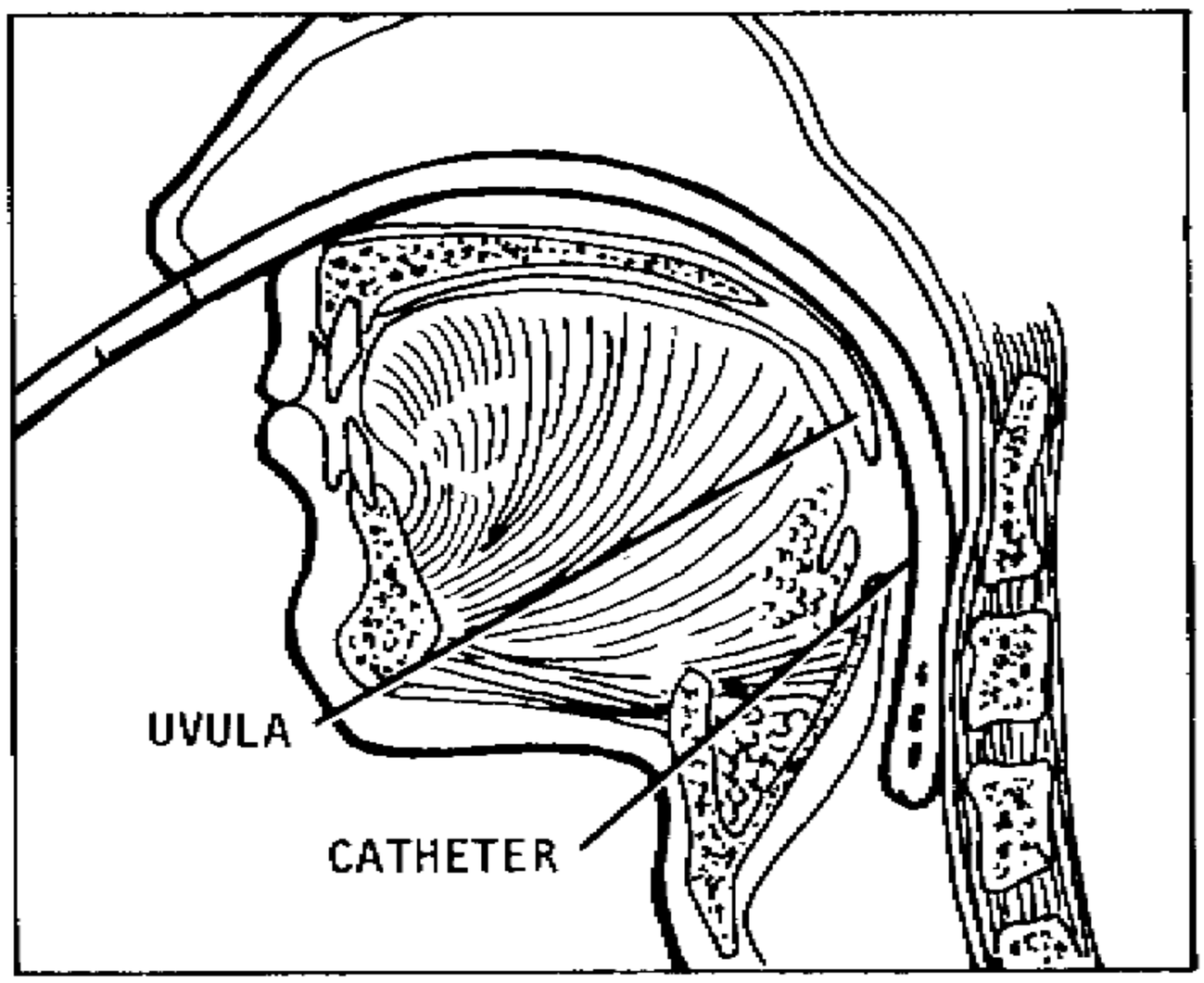


Figure 14-48. Movement of tube down throat.

i. Test to see if the tube is in the stomach.

(1) Attach an aspirating syringe to the open end of the tube and pull the plunger back. This action should pull gastric juice through the tube into the syringe.

(2) Use a bulb or Asepto syringe to inject 15 to 30 cc of air into the suction lumen of the tube while you listen with a stethoscope placed over the stomach. You should be able to hear a "gurgling" sound as the air in injected.

CAUTION

The tube MUST be tested to determine if it is in the trachea instead of the stomach:

(a) Observe the patient for cyanosis (bluish tinge to the skin) or dyspnea (difficult breathing).

(b) Place the free end of the tube in a glass of water and observe for air bubbles.

(c) Hold the free end of the tube near your ear and listen for a crackling sound.

(d) Instruct the patient to try and hum. If he is unable to do this, the tube is properly placed. If any of the conditions noted in (*a*), (*b*), or (*c*) are observed, REMOVE THE TUBE IMMEDIATELY.

j. Secure the tube to the patient's face with adhesive tape.

(1) When the tube is placed in the patient's stomach, tape the outside end to the bridge of his nose and to his forehead or cheek.

(2) Insure that the tube lays flat and is not kinked or twisted.

k. Attach the free end of the tube to the suction machine.

(1) The physician orders the kind of suction machine used to remove gas and drainage from the stomach. He states the degree of suction and whether continuous or intermittent (on-off) suction is indicated.

(2) If there is no suction action after the tube is attached, call your supervisor immediately so that appropriate corrective action can be taken.

NOTE

As the patient's condition improves, the physician may test his tolerance for gastric content by clamping the tube for a few hours. During this time, loop the tubing in a loose circle, secure it with adhesive tape, and pin it to the patients' hospital clothing. This will help prevent uncomfortable pulling for the patient.

14-57. Gastric Tube Irrigation

a. Irrigation is the process of clearing the blocked or plugged passageway of the gastric tube.

b. If the tube becomes plugged, the physician will order an irrigation to be done at stated intervals.

c. Gastric tube irrigation procedure.

(1) Obtain an aspirating syringe, irrigating solution (usually normal saline), and a receptacle for the returned solution. This is a clean procedure but not a sterile one.

(2) Disconnect the gastric tube from the drain tube on the suction machine and turn off the suction power. Hold the gastric tube in a fist-like grasp with the last three fingers of your left hand.

(3) Hold the aspirating syringe between the index finger and thumb of your left hand. Place the tip of the syringe in the solution and use your right hand to pull the plunger up to obtain 15 to 30 cc of solution.

(4) Attach the filled syringe to the free end of the gastric tube and inject 10 to 15 cc of solution slowly into the tube. Pull back on the plunger to withdraw. Repeat this process until the passageway is clear.

CAUTION

If fresh bleeding is apparent, stop the procedure and notify the physician immediately.

(5) Observe the contents of the irrigating solution. Note the color, consistency, and odor on the patient's chart.

(6) When the irrigation is complete, attach the gastric tube to the drain tube of the suction machine and turn the power on to the machine.

NOTE

Other methods can be used to unplug the tubing:

(a) Change the position of the tube by gently pushing it in and pulling it out. Suction must be turned off and the tube disconnected from the suction machine.

(b) Use a gentle "milking" action on the tube to free the blockage. Hold the tube securely and gently squeeze the tubing between your palm and fingers. Move carefully along the tubing in this manner until suction is restored.

(7) Insure that the patient is left clean and comfortable after the irrigation procedure is complete.

14-58. Care of the Patient with a Nasogastric Tube

a. One of the most uncomfortable aspects of the nasogastric tube is the constant irritation by the tube on the back of the throat. The physician may permit the patient to suck on ice chips, throat lozenges, or hard candy to keep his throat and the tube slightly moist.

b. The patient's nose may also become tender, sore, and cracked. Good hygiene procedure must be followed to keep this irritation to a minimum and reduce the chance of infection.

c. The patient is often hypersensitive to odors; his room and belongings must be kept immaculately clean and sanitary. Unsavory stimuli in the environment can cause him to become nauseated and to vomit.

d. When caring for patients with a gastric tube, you should remember to:

(1) Provide frequent and meticulous oral hygiene and nose care—

(a) Since a patient with a gastric tube is to be given nothing by mouth, the mouth can become very dry and the lips may become cracked.

(b) To keep the mouth and lips moist, swab the oral cavity with a cotton swab that has been moistened in equal parts of glycerine and lemon juice. Mouth wash may also be used if the patient is able to spit the liquid out; it must not be swallowed.

(2) Provide for the patient's freedom of movement as much as possible by securing the suction tubing to the patient's clothing or skin.

(3) Insure that the patient does not lie on the tubing; do not permit the tubing to become kinked.

(4) When you are checking suction machine operation, first check to see that it is properly attached to the wall outlet and the patient, that the power is turned on, and that the tubes are not kinked; also check to see that the drainage bottle is not overflowing. If the machine still does not provide suction after these checks have been made, notify your supervisor at once.

(5) Observe and record the contents of drainage bottles accurately. Report any unusual contents immediately to your supervisor.

14-59. Suction Devices Used with Nasogastric Tubes

a. Portable electric suction machine (Figure 14-49).

(1) This machine has a gauge that permits regulation of the amount of suction. It is particularly useful when the drainage becomes thick and viscous.

(2) When the machine is used, your main responsibility will be to see that the drainage bottle does not overflow. If this should occur, drainage could back up into the vacuum bottle, then into the motor itself.

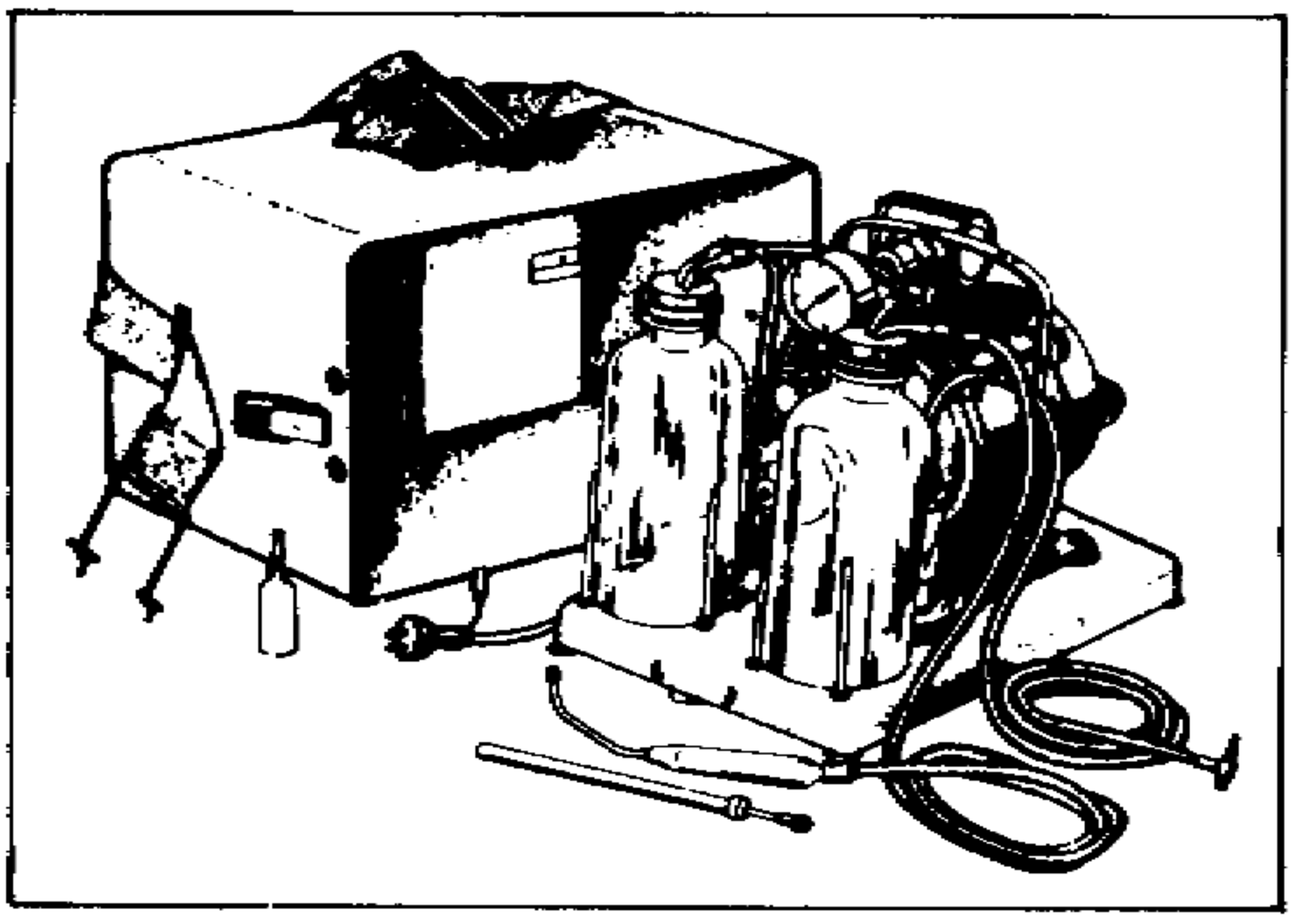


Figure 14-49. Portable electric suction machine.

b. Gomco thermotic pump (Figure 14-50).

(1) This is an electric pump that provides intermittent suction through alternating air pressure by expanding and contracting the air. Suction can be regulated by a "low" or "high" pressure button.

(2) Again, close observation of the drainage bottle contents is important to prevent overflow. Check the machine frequently to be sure that it is pulling the drainage from the stomach or intestine. As the pressure alternates during the suction cycle, red and green lights will alternate on the operating unit.

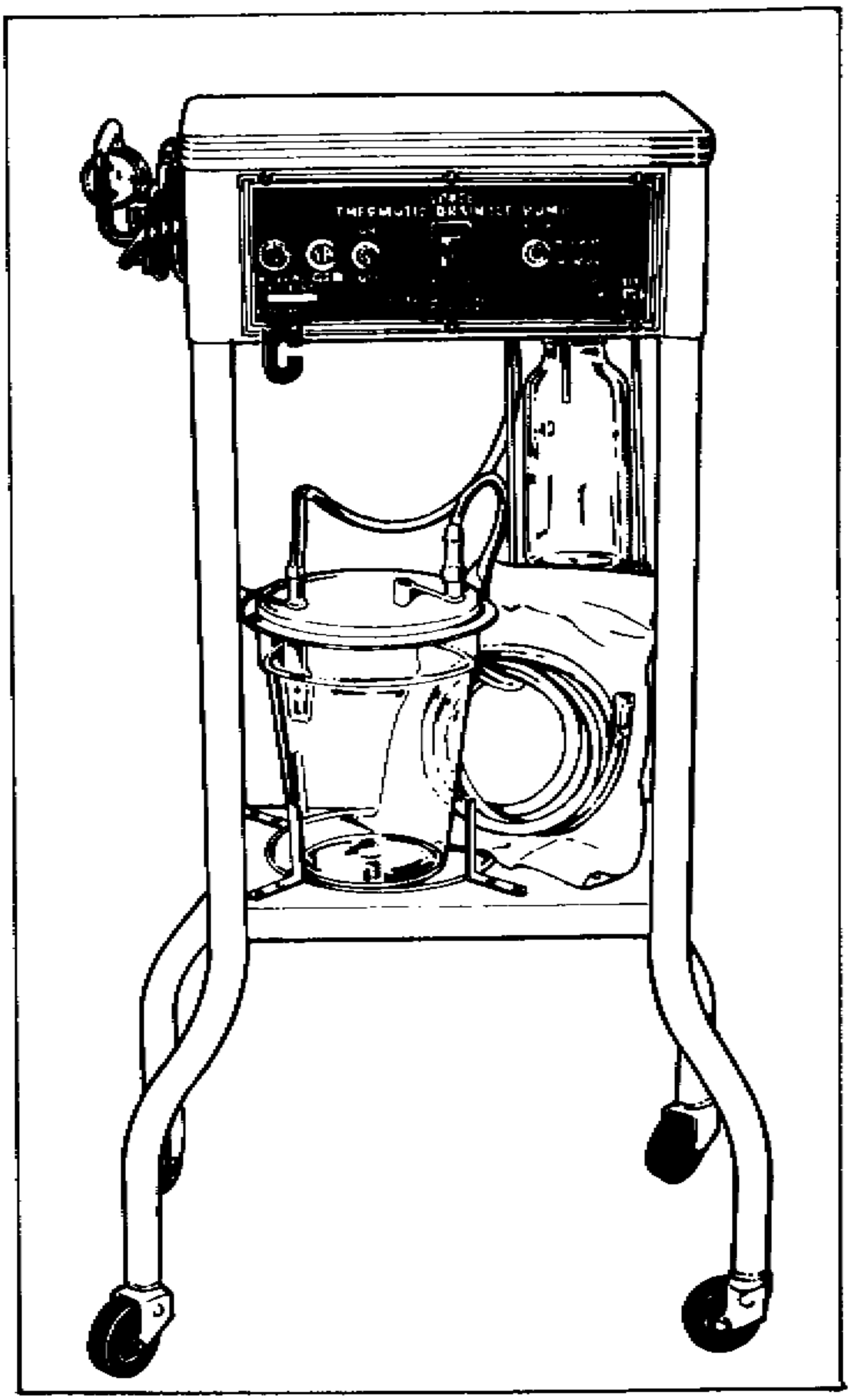


Figure 14-50. Gomco thermotic pump.

Section VIII. PATIENT/SURGICAL PREPARATION

14-60. General

Most wounds will require suturing or other minor surgical procedure. The wound area must be thoroughly cleansed prior to any operative procedure in order to remove any bacteria. You will frequently be called upon to prepare a wound area for a physician. The general rules of medical and surgical asepsis must be followed to prevent infection with possible loss of limb or life.

14-61. Procedure for Operative Treatment Preparation

a. Assemble and prepare equipment.

(1) Sponge basin.

(2) Solution cup.

(3) Gauze pad, 4 inch by 8 inch.

(4) Asepto syringe.

(5) Safety razor and blade.

(6) Sterile water or saline.

(7) Povidone-iodine (Betadine) solution.

(8) Protective pad.

(9) Sterile gloves.

(10) Antimicrobial soap.

b. Prepare the patient.

(1) Position the patient as indicated by the physician or your supervisor.

(2) Place the protective pad under the area to be treated.

(3) Explain the procedure to the patient to insure his understanding and cooperation.

(4) Expose the wound/injury site by removing or cutting away clothing and bandages of dressings. Do not expose any more of the patient's body than is necessary.

(a) Moisten any stuck bandages/dressings with sterile saline to loosen them.

(b) Use blunt-tipped bandage scissors to cut clothing and bandages.

(5) Focus available light on the area to be treated.

c. Perform patient care handwash.

d. Prepare to treat wound.

(1) Remove stoppers/caps from solution bottles.

(2) Open prep set.

(a) Open outer wrapper with bare hands.

(b) Glove one hand and open inner wrapper.

CAUTION

Do not touch unsterile items with gloved hand.
Keep gloved hand above work surfaces.

(c) Use your ungloved hand to pick up bottle and pour a small amount of solution into trash receptacle.

(d) Pick up sterile basin with gloved hand, step back slightly and pour sterile solution into basin.

(e) Pour povidone-iodine into solution cup.

(f) Glove bare hand.

e. Irrigate the wound.

(1) Use an aseptic syringe.

(2) Use large amounts of saline solution. If saline solution is not available, use sterile water.

CAUTION

Do not begin irrigation except under the direct supervision of a physician. Bleeding may occur when the wound is irrigated as clots are dislodged and washed away.

f. Cleanse the wound area.

(1) Place a sterile gauze pad over the wound and hold in place.

(2) Cleanse the skin area using povidone-iodine solution.

(3) Cleanse the area 3 to 4 inches (7.62 to 10.16 centimeters) around the wound.

(4) When cleansing the wound area, use gentle friction and a circular motion, working outward from the edges of the wound.

g. Shave the wound area.

(1) Check the physician's orders to be sure that the shaving procedure is to be accomplished.

(2) Shave any hair you can see at the edge of the wound or in the area being cleansed.

(3) Shave an area at least 3 inches (7.62 centimeters) around the wound and scrub with antimicrobial soap.

NOTES

1. Do not shave inside the wound. Any hair inside can be removed after the area is anesthetized.

2. Apply tension to the skin by gently pulling the skin taut. Shave with short gentle strokes to minimize pulling.

3. Clip long, thick hair first; then shave.

h. Repeat cleansing procedure.

(1) Upon completion, rinse with sterile saline to remove loose hair and prevent hair from entering wound.

(2) Blot skin dry with sterile gauze.

(3) Replace sterile gauze over wound.

(4) Notify physician that wound area has been prepared. Do not dress wound in the event that sutures are required.

i. Remove gloves and place them in the contaminated waste container.

j. Remove prep equipment.

(1) Remove protective pad from under patient. Use care not to contaminate clean area.

(2) Discard all disposable items in the contaminated waste container.

(3) Clean and store nondisposable items according to local SOP.

k. Perform patient care handwash.

l. Record procedure on Field Medical Card or Chronological Record of Medical Care Card.

14-62. Wound Irrigation

A wound irrigation (washing) is performed to—

a. Clean a wound by using large amounts of fluid to remove secretions, clots, foreign matter, or microorganisms.

b. Instill (administer drop-by-drop) medication in a wound.

14-63. Procedure for Irrigating a Wound

a. Verify that a wound irrigation is to be performed.

(1) Check the physician's orders, the Therapeutic Documentation Care Plan, or follow supervisor's instructions.

(2) The instructions will specify the amount and type of solution to be used to irrigate the wound.

b. Obtain the necessary equipment and supplies.

(1) Asepto (bulb-ended) syringe (300 to 500 milliliter capacity). If this syringe is not available, use the largest regular syringe stocked.

(2) Prescribed irrigating solution (normal saline is usually the preferred irrigating solution).

(3) Emesis basin.

(4) Sterile gloves.

(5) Mask.

(6) Sterile dressing.

(7) Sterile 4 inch by 8 inch gauze sponges.

(8) Sterile solution basin.

(9) Protective pad.

(10) Sterile drapes or towels.

c. Provide privacy and explain the procedure to the patient.

(1) Place a screen or curtain around the patient's bed. If he is in a private room, close the door.

(2) Explain the procedure to the patient to lessen his apprehension and gain his confidence and cooperation.

d. Position the patient to allow maximum exposure of the wound.

e. Position the protective pad.

(1) Assist the patient, if necessary, to raise his body.

(2) Place the protective pad directly under the wound. The pad serves as protection for the patient's bedding.

f. Carefully remove soiled dressings and bandages.

g. Perform patient care handwash.

h. Put on protective face mask to prevent contamination of the wound by microorganisms.

(1) Place the mask on your face and pull the elastic band over your head.

(2) Do not touch or adjust your mask while you are irrigating the wound.

i. Prepare wound irrigation equipment.

(1) Create a sterile field.

(2) Remove the solution basin from its package using sterile technique.

(3) Pour the prescribed irrigation solution into the basin without contaminating the sterile field.

(a) Insure that you are using the correct solution before you begin.

(b) If you are using a standard sterile water solution or normal saline solution, check the date and time on the bottle. If you open a new bottle, write the date and time that it was opened.

NOTE

Once opened, the water or saline solution is considered sterile for 24 hours.

(c) Open the package containing the Asepto syringe and place it on the sterile field using sterile technique.

(d) Open the 4 inch by 8 inch sponges and place them on the sterile field using sterile technique.

j. Don sterile gloves.

k. Place sterile drapes around the wound area to absorb excess drainage flow from the wound during the irrigation procedure.

l. Position the basin on the sterile drape adjacent to the area of the body to be irrigated.

m. Irrigate the wound.

(1) Grasp the syringe, depress the bulb, and insert the tip of the syringe into the irrigating solution.

(2) Release the bulb and allow the bulb to fill.

(3) If you are using a regular syringe, pull back on the plunger to aspirate the solution into the syringe.

(4) Hold the tip of the syringe as close to the wound as possible without touching it.

(5) Depress the bulb (or plunger) of the syringe and direct the flow of solution to all parts of the wound. Use firm pressure, but not excessive force.

NOTES

1. Pay particular attention to those areas showing debris, exudate (cellular material deposited by blood vessels, usually as the result of inflammation), and/or drainage.

2. Take extra care when irrigating a wound in which an abscess has formed.

   a. If the pressure within an abscess is unrelieved, it may cause a sinus tract.

   b. All internal surfaces of the wound should be inspected for tracts. You may have to use your gloved hand or a sterile object to gently pull back the flesh. Use care to prevent tearing of healing tissues.

(6) Repeat steps (1) through (5) until all of the irrigating solution is used or until all debris, exudate, or drainage is flushed out of the wound.

(7) Observe the wound drainage for quality and characteristics of debris, such as pus, blood color, odor, and consistency.

n. Dry the wound and apply a sterile dressing, if applicable.

(1) Remove a 4 inch by 8 inch sterile gauze sponge from the sterile field.

(2) Pat the wound dry, starting from the center and moving outward toward the edges.

(3) Remove emesis basin and drapes.

(4) Apply a sterile dressing to the wound, if applicable.

(5) Remove protective pad.

o. Reposition the patient.

p. Clean and store irrigation equipment.

(1) Discard contaminated waste according to local SOP.

(2) Clean and store nondisposable items according to local SOP.

q. Perform patient care handwash.

r. Report and record necessary information on patient's chart.

14-64. Patient Isolation

a. The primary purpose of placing patients in isolation is to minimize the possible spread of communicable diseases. The physician will determine the equipment for isolation; however, the responsibility for proper management of the isolated patient belongs to everyone involved including the patient himself.

b. Care for the isolated patient is essentially the same as it is for any patient, but there must be a marked increase in the emphasis on the principles of medical asepsis. For more detailed information concerning the management of isolated patients, refer to your local infection control or isolation SOP.

Section IX. INTRAVENOUS INFUSIONS

14-65. General

a. Intravenous infusions (IV) are started for two primary reasons.

(1) To provide a route for replacement of fluid, electrolytes, or blood products.

(2) To provide a direct way of administering drugs. In cases of low cardiac output (shock),blood is shifted away from the skin and skeletal muscles; drugs administered subcutaneously or intramuscularly are absorbed at a slow and unpredictable rate. Intravenous infusion insures that drugs reach the circulatory system promptly.

b. Intravenous needles (cannulas) are designed for three different applications.

(1) Hollow needle (also known as the butterfly).

(2) Plastic catheter inserted over a hollow needle (angiocath).

(3) Plastic catheter inserted through a hollow needle.

The over-the-needle catheter is generally preferred because it is more easily secured and less cumbersome than the other types. The catheter used should be a large bore (14 to 16 gauge for an adult), particularly if large quantities of fluid must be infused.

14-66. Procedure for Starting an Intravenous Infusion

a. Explain to the patient what is going to be done.

(1) Very few people are entirely free from anxiety about needles and IV's; when they are ill, these anxieties increase.

(2) Try to reduce this fear by explaining why the IV line is necessary and exactly what you are going to be doing.

b. Assemble the supplies and equipment needed.

(1) Select the fluid ordered by the physician and inspect the container.

(2) The container should be checked for leakage, contamination, cloudiness, and expiration date.

(3) Select the appropriate infusion set and cannula.

c. Also assemble the following:

(1) Antiseptic cleansing solution (preferably an iodine swab).

(2) Sterile 2 inch x 2 inch gauze dressing.

(3) Adhesive tape cut into strips of appropriate length.

(4) Constricting band (preferably soft rubber).

d. To select a suitable vein:

(1) Apply the constricting band at the patient's midarm above the elbow. Check to make sure that a pulse is still present after the band is in place.

(2) Inspect the hand and forearm for a vein that appears to be straight and lies on a flat surface. It should be well fixed, not roll, and should feel springy when palpated. You should avoid:

(a) IV's in those areas that require immobilizing a joint.

(b) Areas where an arterial pulse is palpable close to the vein.

(c) Veins of the lower extremities which can hamper the patient's ambulation.

(d) Veins near injured areas or distal to injuries.

e. Prepare the venipuncture site.

(1) Scrub the selected area with iodine swab, starting from the area above the vein.

(2) Wipe the area in widening circles around the site, leaving a wide margin.

f. Enter the vein.

(1) Stabilize the vein by applying pressure on it below the point of entry.

(2) Puncture the skin with the bevel of the needle pointing upward.

(a) Enter the vein from either side or from above.

(b) You should be able to feel the needle "pop" through into the vein.

(c) When you have entered the vein, blood will return through the needle.

(3) If using an over-the-needle catheter, advance it approximately 2 millimeters beyond the point where the blood return was first encountered.

(4) Slide the catheter over the needle into the vein and withdraw the needle.

(5) Release the constricting band and connect the infusion line to the catheter.

(6) Observe line for fluid flow in a steady stream. If flow is slow, pull back very slightly on the catheter to move the tip from the wall of the vein.

(7) After a good flow is established, check for infiltration.

(8) Cover the puncture site with povodine-iodine ointment, cover with sterile dressing, and tape the catheter securely in place.

(9) Loop the IV tubing and tape it to the skin adjacent to the infusion site.

CAUTION

Do not tape the connecting point between the catheter and the infusion set.

(10) Adjust the infusion flow to the rate ordered by the physician.

14-67. Solutions Used in Intravenous Therapy

a. Dextrose in water (D5W) solution—used to treat dehydration, to supply small amounts of calories for energy, and to supply water for body needs.

b. Lactate Ringer's solution—resembles the electrolyte structure of normal blood serum. Used to treat dehydration and to restore normal fluid after extracellular shift (a result of burns or infection).

c. Normal saline, 0.9 percent solution—used to correct excessive fluid loss or to correct excessive acid or alkalinity in body fluids.

14-68. Care of the Patient with an Intravenous Infusion

a. After starting an IV infusion, it will be necessary for you to maintain the infusion and manage the procedure in a safe and accurate manner. You must strictly adhere to aseptic procedures and techniques.

b. Proper patient care also requires you to take steps to intervene to prevent IV infusion complications and disturbances while managing the patient. Table 14-4 shows possible complications and the proper corrective actions. Table 14-5 shows possible IV disturbances and the intervention measures to be taken.

Table 14-4. Complications of IV Therapy

COMPLICATIONS	SYMPTOMS	CAUSES	CORRECTIVE ACTIONS	PREVENTIVE MEASURES
1. *Infiltration* catheter/ needle becomes dislodged or penetrates through the vein allowing IV fluid to leak and to accumulate into surrounding venipuncture tissue).	• Discoloration of site. • Swollen site. • Pain, tenderness, burning, or irritation at the infusion site.	• Solution is flowing at a sluggish rate.	• Stop infusion. • Remove IV and restart it in an alternate location. • Apply cold pack to site if infiltration has occurred within the past one-half hour. A cold pack will help reduce the pain and swelling. • Apply warm wet compresses to promote absorption if infiltration has occurred for over 30 minutes. A warm wet compress will stimulate circulation, therefore promoting the absorption of the infiltrated solution into surrounding tissues.	• Use splint for stability (a splint prevents dislodgement of IV catheter/needle). • Tape catheter/ needle securely. Avoid looping of tubing below bed level.

Table 14-4. Complications of IV Therapy, continued

COMPLICATIONS	SYMPTOMS	CAUSES	CORRECTIVE ACTIONS	PREVENTIVE MEASURES
2. *Phlebitis* (inflammation of the wall of the vein). Associated problems of phlebitis include— • thrombo-phlebitis, which is an inflammation of the vein accompanied by the formation of the clot. • thrombosis, which is the formation of a clot in a blood vessel without accompanying inflammation.	• Swelling and redness around venipuncture site. • Tenderness of tissue around venipuncture site. • Foul-smelling discharge from venipuncture site.	• Injury to vein during venipuncture or from later needle movement. • Irritation to vein by— • Long-term therapy. • Irritating or incompatible additives. • Use of vein that is too small to handle the amount or type of solution. • Sluggish flow rate that allows clot to form at end of needle.	• Stop infusion. • Remove IV and restart it in an alternate location. • Document observations.	• Keep the infusion flowing at the prescribed rate. • Stabilize the catheter/needle with a splint. • Select a large vein when irritating drugs and fluids are given. • Maintain strict aseptic techniques. • Change catheters and tubing every 48 to 72 hours. • Change bags, bottles, and dressings every 24 hours.
3. *Circulatory overload* (state of increased circulating volume usually due to transfusions or administering too much IV fluid that increase the blood pressure in the veins).	• Rise in blood pressure. • Dilation of veins with neck veins sometimes visibly engorged. • Rapid breathing, shortness of breath, rales. • Wide variance between liquid input and urine output.	Fluid is delivered too fast.	• Slow down the infusion to keep the vein open. • Raise patient's head to slow down the rapid circulation to the heart. • Notify the physician.	• Check the flow rate at frequent intervals to insure the desired rate is being maintained.

Table 14-4. Complications of IV Therapy, continued

COMPLICATIONS	SYMPTOMS	CAUSES	CORRECTIVE ACTIONS	PREVENTIVE MEASURES
4. *Air embolism* (the obstruction of a blood vessel by air carried via the bloodstream).	• Abrupt drop in blood pressure. • Chest pain. • Weak, rapid pulse. • Cyanosis (slightly blue, dark purplish, or gray discoloration of the skin. • Loss of consciousness.	• Solution runs dry. • Air bubbles are present in IV tubing.	• Notify supervisor immediately. • Administer oxygen. • Turn the patient on his left side and place him in a shock position to keep air in the right side of the heart . This position allows the pulmonary artery to absorb small air bubbles.	• Clear all air from tubing before attaching it to the patient. • Monitor solution closely and obtain new container, if required. Do not allow solution to run dry. • Check to see that all connections are secure.
5. *Infection* (the state or condition in which the body or part of it is invaded by disease-producing bacteria or viruses).	• Swelling, redness, and soreness around infusion site (localized infection is usually accompanied by inflammation, but inflammation may occur without infection). • Foul-smelling, yellowish discharge from venipuncture site. • Sudden rise in temperature and pulse.	• Poor aseptic technique. • Unsterile venipuncture technique. • Contamination of equipment during manufacture, storage or use. • Failure to keep the site clean or to change the IV equipment regularly. • Cross-contamination from one patient to another. • Excessive movement of the needle.	• Stop infusion. • Report observations to supervisor. • Send IV equipment to the laboratory for bacterial analysis. • Clean site, apply antimicrobial ointment, and apply a new sterile dressing. • Document all changes of dressing and equipment with your initials, time, and date.	• Use complete aseptic techniques when initiating an IV infusion. • Anchor catheter/needle firmly with tape. • Check vein daily for evidence of tenderness of signs of inflammation. • Apply antimicrobial ointment to infusion site at the time of insertion and at periodic intervals in accordance with the local SOP.

Table 14-5. Disturbances of IV Therapy

COMPLICATIONS	SIGNS OF DISTURBANCES	CAUSES	INTERVENTION MEASURES
Disturbance of infusion (any disturbance or failure of infusion equipment to deliver correct prescribed solution infusion rate).	• Flow rate slowing down or speeding up. • Solution flow stopping.	• Solution container is empty. • Drip chamber is less than half full. • Control clamp is closed. • Defect in the equipment. • Tubing is kinked or caught under patient.	• Frequent observations of flow rate and equipment. • Stop flow and notify supervisor. • Squeeze drip chamber until it is half full. • Consult supervisor and readjust it to restore prescribed drip rate. • Report defect immediately to supervisor. • Untangle the line or reposition patient so that the solution flows through the tube at the prescribed rate.

14-69. Procedure for Managing a Patient with an Intravenous Infusion

a. Document the IV therapy.

(1) Label the IV site dressing once the infusion has started and with each change of dressing.

(2) Change the dressing every 24 hours to keep the site clean and to prevent irritation and contamination.

(3) To label the IV dressing—

(a) Cut a piece of adhesive tape and write your initials, the time, and the date.

(b) Place the labeled tape gently over the dressing.

CAUTION

Do not label the tape after it has been placed on the dressing. This could irritate or injure the IV site.

(4) Label solution containers after the infusion has started and with each change of solutions. Bags and/or bottles should be changed every 24 hours to prevent irritation and contamination.

(5) To label containers, cut a piece of adhesive tape and write the patient's name and ID number, the flow rate, the date and time the container was started, and your initials. Place the tape on the bag or bottle.

(6) Prepare and attach a solution timing label.

(a) Place a piece of adhesive tape vertically on the container.

(b) Write on the tape the approximate time the solution should reach each volume mark on the container.

(c) Indicate on the bottom of the label the time the container should be empty.

(7) Label IV tubing once the infusion has started and with each change of tubing. Tubing should be changed every 48 to 72 hours. (Your local SOP will specify the exact frequency for tubing changes.)

(8) To label IV tubing—

(a) Wrap a strip of tape around the tubing, leaving a tab.

(b) Mark the date and time the tubing was changed on the tab.

(9) Record the following information on the appropriate patient chart:

(a) Date and time of puncture.

(b) Type of solution.

(c) Flow rate.

(d) Type and gauge of needle/cannula set.

(e) Insertion site.

(f) Patient's condition.

b. Replace the intravenous solution container. Adhere to strict aseptic techniques throughout the following replacement procedure:

(1) Perform a patient care handwash.

(2) Select a new container of the correct solution.

(3) Clamp the tubing shut to prevent air from entering during the replacement procedure.

(4) Remove the old container from the IV stand. If a solution bag is used, remove the spike.

(5) Hang the new container on the IV stand. Insert spike in new bag, if applicable.

(6) Adjust the flow rate in accordance with instructions.

(7) Label the solution container.

c. Replace the IV tubing.

(1) Change tubing in accordance with local SOP. (This is also a convenient time to change the IV site dressing.)

(2) Perform a patient care handwash.

(3) Slow the infusion to keep the vein open. Flow rate should be adjusted to 7 to 10 drops per minute.

(4) Disconnect the old tubing from the bottle or bag.

(5) Cover the open end of the disconnected tubing with the spike cover from the new tubing. Be careful to maintain sterility—the other end of the tubing is still connected to the catheter.

(6) Prime the new tubing and substitute for the old tubing.

(a) Place a sterile gauze under the catheter/needle hub.

(b) Grasp the new tubing between the fingers of one hand.

(c) Grasp the catheter/needle hub with a sterile gauze pad between thumb and index finger and carefully disconnect the old adapter.

(d) Remove the protective cap from the new tubing adapter and quickly connect the adapter to the hub.

(e) Secure tubing and dressing to the patient's arm.

d. Change the dressing. Use the following procedure to change the dressing every 24 hours:

(1) Perform a patient care handwash.

(2) Obtain the necessary equipment—

(a) Adhesive tape.

(b) Antiseptic swab.

(c) Sterile gauze pads, 2 inch x 2 inch.

(d) Antimicrobial ointment.

(3) Hold needle hub while loosening the old dressing. Discard the old dressing in the contaminated waste container.

(4) Clean skin around the insertion site with antiseptic swab. Check for infection and inflammation.

(5) Apply small amount of microbial ointment over the insertion site to help prevent infection.

(6) Secure catheter/needle, tubing, and new dressing to patient's arm.

e. Discontinue the infusion.

(1) Perform patient care handwash.

(2) Remove tape and dressing without dislodging needle.

(3) Clamp the tubing to stop the flow of solution. This will keep the solution from leaking into the tissue.

(4) Remove the needle gently and press an antiseptic sponge over the injection site.

(a) Do not twist, raise, or lower the needle—this could damage the vein.

(b) Pull the needle straight out without hesitation, following the course of the vein.

(c) Apply pressure with a gauze sponge for a short time. Follow this with a small dry pressure dressing (use either a plastic strip or an antiseptic sponge secured in place with a piece of tape).

(d) Remove the IV equipment and store/dispose of according to your local SOP.

Section X. MEASURING PATIENT INTAKE/OUTPUT

14-70. General

a. Observations concerning a patient's intake and output provide the physician with essential information about the patient's fluid balance. This information is considered to be an important sign regarding a patient's condition. Most postoperative patients and patients with indwelling catheters or those on IV infusion therapy are designated as requiring intake-output measurement. If there is any doubt that a patient is taking enough fluid for optimum kidney function or there is a need to verify the effectiveness of a drug, all fluids consumed or excreted are measured to aid in making a diagnosis.

b. Definitions.

(1) *Intake.* Intake consists of all fluids taken into the patient's body. Items that require intake measurement include—

(a) All fluids taken orally.

(b) Foods such as gelatin, ice cream, or ice that are fluid at room temperature.

(c) Foods such as melons that contain a large amount of liquid.

(d) Intravenous infusions.

(e) Blood transfusions.

(f) Nasogastric and bladder irrigations that are not returned.

(2) *Output.* Output consists of all liquids released by the body. Items that require output measurement include—

(a) Urine—both voided and drained.

(b) Liquid stool.

(c) Vomitus.

(d) Drainage from any suction device such as a nasogastric tube.

c. Intake and output records. A DD Form 792 (Twenty-Four Hour Patient Intake and Output Worksheet) is kept at the patient's bedside. It provides space in which to record the time, type, description, and amount in cubic centimeters (cc's) of fluid intake and output. Intake equivalents are shown on this form, with a list of serving levels (in cc's) of the most common serving containers used in the health care environment.

14-71. Procedure for Measuring a Patient's Intake

a. Verify the requirement to measure the patient's intake.

b. Explain the procedure to the patient.

(1) Tell him that all fluids taken by mouth must be recorded for accurate measurement.

(2) Insure that he is aware of any restrictions on the amount of fluids he may consume.

(3) Encourage him to drink extra liquids if the physician or supervisor has indicated a need to force fluids.

c. Identify the items requiring intake measurement including—

(1) Fluids taken orally.

(2) Intravenous infusion fluids.

(3) Blood transfusions.

(4) Irrigating solutions not returned.

CAUTION

If a patient is on restricted fluids or has only certain amounts of fluids available for consumption during a shift, note the amount allowed. **DO NOT GUESS.**

d. Calculate amount of fluid intake.

(1) Use graduated calibrated containers (cylindrical vessels marked by a series of lines).

(2) Be aware of the amounts customarily contained in drinking utensils to determine the amount consumed. Plastic utensils contained in field equipment have different capacities.

(3) For partially consumed contents, estimate the portion consumed by noting the amount the container holds. Subtract the existing cc's from the total amount in a full container to determine the amount consumed.

(4) For IV intake:

(a) Estimate the amount of fluid remaining in the glass bottle by reading the fluid level on the graduated scale or tape.

(b) Estimate the amount of fluid remaining in the plastic bag by grasping the sides of the bag, pulling them until taut, and reading the fluid level on the tape or graduated scale.

(c) Subtract existing cc's from the total number of cc's in a full container to determine the amount infused.

(d) Record intake. Enter time that IV is discontinued and amount of solution infused. Compute total intake at the end of an 8-hour shift, or as directed.

14-72. Procedure for Measuring a Patient's Output

a. Verify the requirement to measure the patient's output.

b. Explain the procedure to the patient. Remind ambulatory patients to—

(1) Male patients—void in urinal provided in designated area or in a graduated container.

(2) Female patients—void in bedpan or in specially designed container placed under toilet seat. Contents of this container must be poured into a graduated vessel for accurate measurement.

c. Identify the types of output items that require measurement. An output estimate will be used if accurate measurement is not possible.

d. Measure output.

(1) Collect urine, liquid stool, vomitus, and nasogastric drainage in appropriate vessels.

(2) Pour into calibrated graduated container.

(3) Place graduate on level surface to read scale. Note level reached by top of fluid in graduate.

NOTE

Accurate output measurement is sometimes impossible. Estimate output amount as small, moderate, or large when— (1) the patient is urine or stool incontinent; (2) the patient has not vomited into a container; (3) you encounter wound drainage, bleeding, or profuse perspiration.

e. Clean and store or discard supplies and equipment.

(1) Discard disposable items in proper waste receptacle.

(2) Dispose of collection vessel contents in accordance with local SOP.

(3) Wash, rinse, and store vessels.

f. Perform patient care handwash.

g. Record output in appropriate section of DD Form 792.

(1) Note time, type, and amount of output.

(2) Color, odor, and consistency are also to be noted, if required.

Section XI. ORAL AND NASOTRACHEAL SUCTIONING

14-73. General

a. Suctioning is performed for the purpose of removing accumulated secretions from the patient's nose, mouth, and/or tracheobronchial tree in order to maintain an open airway as well as to remove lung secretions that

block gaseous exchange. Removal of these secretions can be carried out through the oropharyngeal (mouth) or nasotracheal (nose) routes or through artificial airways such as endotracheal or tracheostomy tubes. (An endotracheal tube is inserted into the trachea through the nose or mouth; a tracheostomy tube is inserted through a surgical incision into the trachea.)

b. Suctioning is performed on patients who have lost their ability to swallow and to cough up secretions, due to unconsciousness, a stroke, or other disease process. The suctioning procedure should be performed ONLY when needed. Frequent suctioning causes trauma to the mucous linings of the respiratory tract. Edema and hemorrhage can occur in the airway from irritation caused by the suctioning catheter.

c. Nasotracheal suctioning can also cause the following complications:

(1) Trauma to the mucosal linings of the respiratory tract.

(2) Hypoxemia.

(3) Infections in the lungs (pneumonia).

(4) Atelectasis (collapsed lung).

(5) Cardiac arrest.

Postoperative patients must be turned and encouraged to cough and deep breathe frequently (usually every 2 hours) following surgery. This practice will be helpful in preventing postoperative complications, such as pneumonia and reducing the need for suctioning.

d. There is no specific order to follow when suctioning a patient using different routes. Whenever routes are changed, the catheter and gloves must be changed. Numerous organisms are normally found in the nose and pharynx. Sterile techniques must be used for all nasotracheal suctioning to prevent the introduction of "foreign" organisms into the lungs.

14-74. Procedure for Performing Oral and Nasotracheal Suctioning

a. Verify need for suctioning. Check patient for:

(1) Increased respirations accompanied by labored or difficult breathing.

(2) Moist, noisy, rattling, or gurgling sounds while breathing.

(3) Secretions drooling from the mouth.

(4) Check the physician's orders, Nursing Care Plan, or the supervisor's directive. These documents will normally indicate the frequency of suctioning.

b. Perform patient care handwash.

NOTES

1. When performing suctioning, every effort must be made to prevent the introduction of pathogens into the patient's lower airways.

2. Clean technique and thorough handwashing are essential for suctioning of the oral and nasal cavities. Sterile technique is MANDATORY for deep suctioning in the tracheobronchial tree and suctioning through the endotracheal and tracheostomy tubes. Follow aseptic techniques for all suctioning of the airway to minimize the spread of microorganisms that are not normally found in the air passages.

c. Obtain the necessary equipment.

(1) Disposable suction equipment (if available) contains a catheter, gloves, carton for solution, and packet of solution.

OR

(2) Sterile, disposable suction catheters (sized by use of the French scale: the smaller the number, the smaller the catheter (12 is smaller than 14 according to this scale). These two sizes are the most commonly used for suctioning the adult patient.

AND

(3) Sterile saline.

(4) Sterile solution basin.

(5) Sterile gloves.

(6) Suction apparatus (Figure 14-51).

NOTE

Suctioning of the airway requires a source of vacuum. Most hospitals that have piped-in oxygen also have a piped-in vacuum source (Figure 14-51A). When a piping system is not available, portable suction units must be used (Figure 14-51B). Most portable suction units must be connected to an electrical source; however, a portable field unit is nonelectrical.

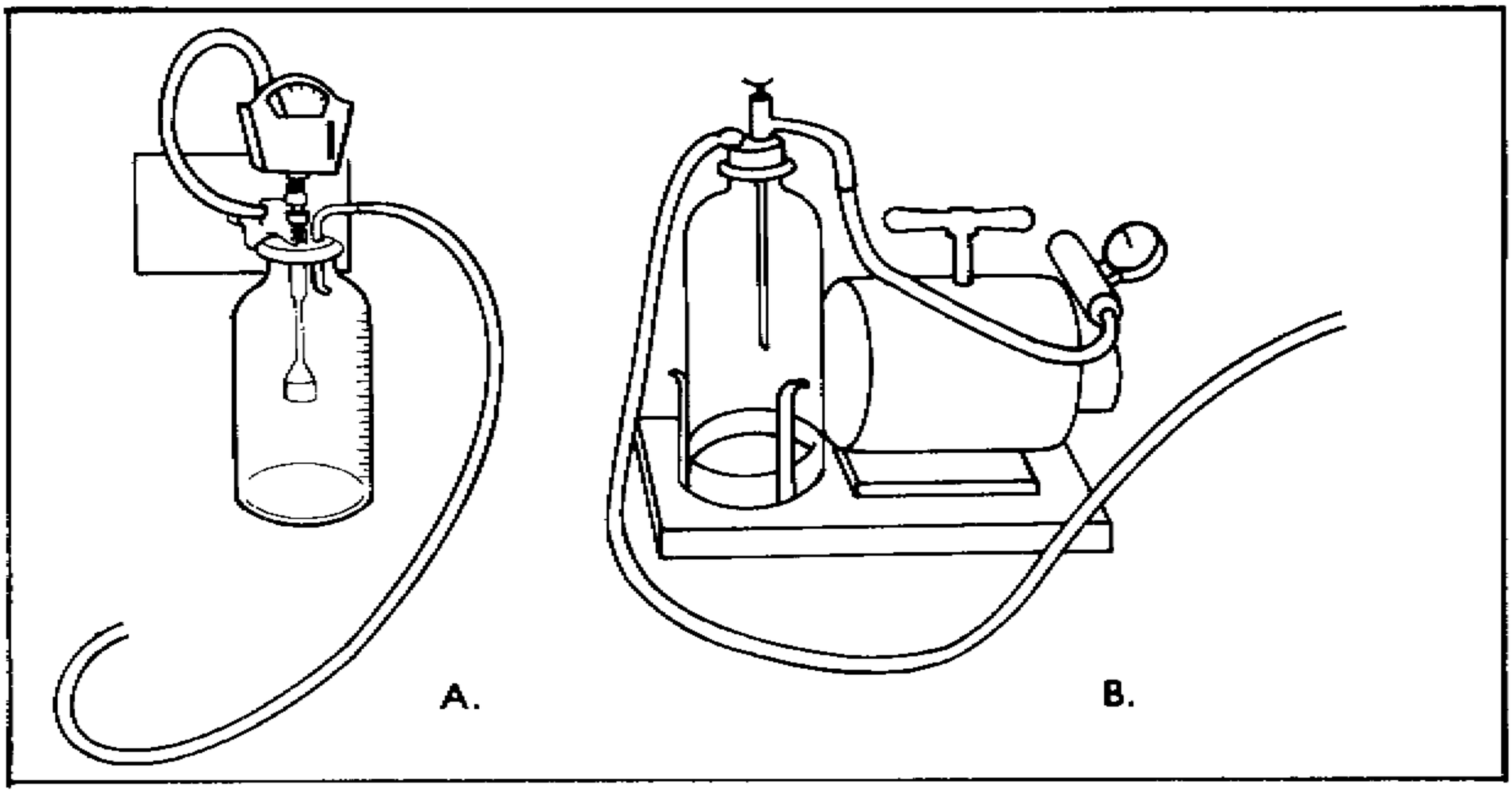


Figure 14-51. Suction apparatus.

d. Identify the patient.

(1) If the patient is conscious, ask him his name and check his bed card or identification band

(2) If the patient is unconscious, compare the name on the bed card and identification band . Insure that the name is the same on both.

e. Explain the procedure. Explain the suctioning procedure to the patient to lessen his fears and gain his cooperation.

f. Provide privacy. Place screen or curtain around the patient's area or close the door if he is in a room.

g. Position the patient. Place the patient in a semi-Fowler's position.

(1) The semi-Fowler's position is a semi-sitting position in which the patient manages secretions better and breathes easier.

(2) In some cases (such as spinal injuries), the patient will have to be suctioned in whatever position he is in at the time.

h. Check pressure on the suction apparatus.

(1) Turn on the suction apparatus.

(a) Suction pressure is usually expressed in inches (in) of mercury (Hg) on the portable unit and in millimeters (mm) of mercury (Hg) on the wall-mounted units.

(b) Recommended pressure settings for adult patients:

- Portable unit—7 to 15 inches Hg.
- Wall-mounted unit—120 to 150 mm Hg.

(c) If pressures are not within these limits, notify your supervisor before continuing.

(2) Place thumb over the end of the suction tubing and observe the pressure gauges (Figure 14-52).

CAUTION

If the pressure is too low, the secretions cannot be removed. If the pressure is too high, the mucous lining may be forcibly torn away and pulled into the catheter openings.

(3) Turn off the suction unit after the correct pressure has been verified.

i. Prepare the necessary materials. Open the disposable suction set (if used) or prepare materials for separate setup.

(1) Open the sterile solution basin on the bedside table.

(2) Pour sterile solution into solution basin without contaminating solution, basin, or sterile field.

CAUTION

Catheters should not be left in solutions. Even antibacterial solutions can promote the growth of certain types of bacteria.

(3) Open suction catheter package (following package directions) to expose the suction part of the catheter.

(4) Open sterile gloves. If gloves are wrapped separately from suction catheter, open catheter package first.

j. Oxygenate the patient (tracheal suctioning only). Provide additional oxygen for the patient prior to endotracheal stimulation and suctioning to prevent further hypoxemia (oxygen deficiency in the blood).

(1) If the patient is on oxygen therapy, increase the percentage of oxygen to 100 percent for 1 minute.

(2) If the patient is not on oxygen, have him take a minimum of five deep breaths.

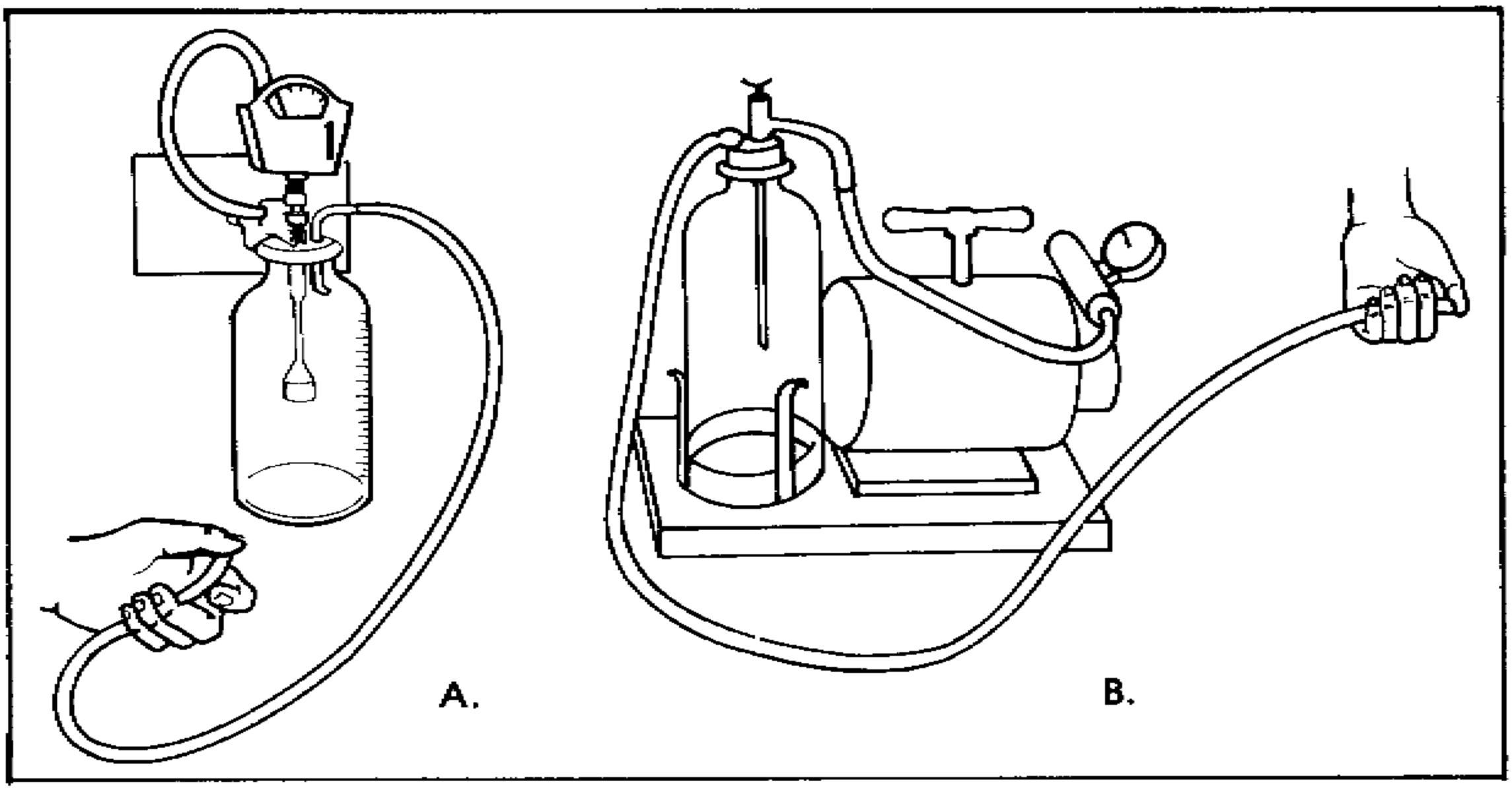


Figure 14-52. Checking pressure gauges of suctioning apparatus.

NOTES

1. Suctioning not only removes accumulated secretions but the oxygen as well.

2. If the patient is not on oxygen therapy, the bag-valve-mask method can also be used for oxygenation.

3. Endotracheal suctioning is used for patients receiving oxygen and for those with artificial airways.

k. Put on sterile gloves. Put sterile glove on dominant hand. Some suction kits provide only one glove for use on the dominant hand that handles sterile items.

l. Remove catheter from package. Remove the sterile catheter from the package with gloved hand. Keep the catheter coiled to prevent contamination.

m. Attach catheter to suction tubing. Attach suction catheter to tubing from suction apparatus. Attach the suction part of the catheter to the tubing held by the ungloved hand (Figure 14-53).

(1) Turn the suction apparatus on with ungloved hand.

(2) Hold the catheter in the gloved hand and insert the tip in the basin of sterile solution.

(3) Place thumb over the suction port and observe saline entering the drainage bottle.

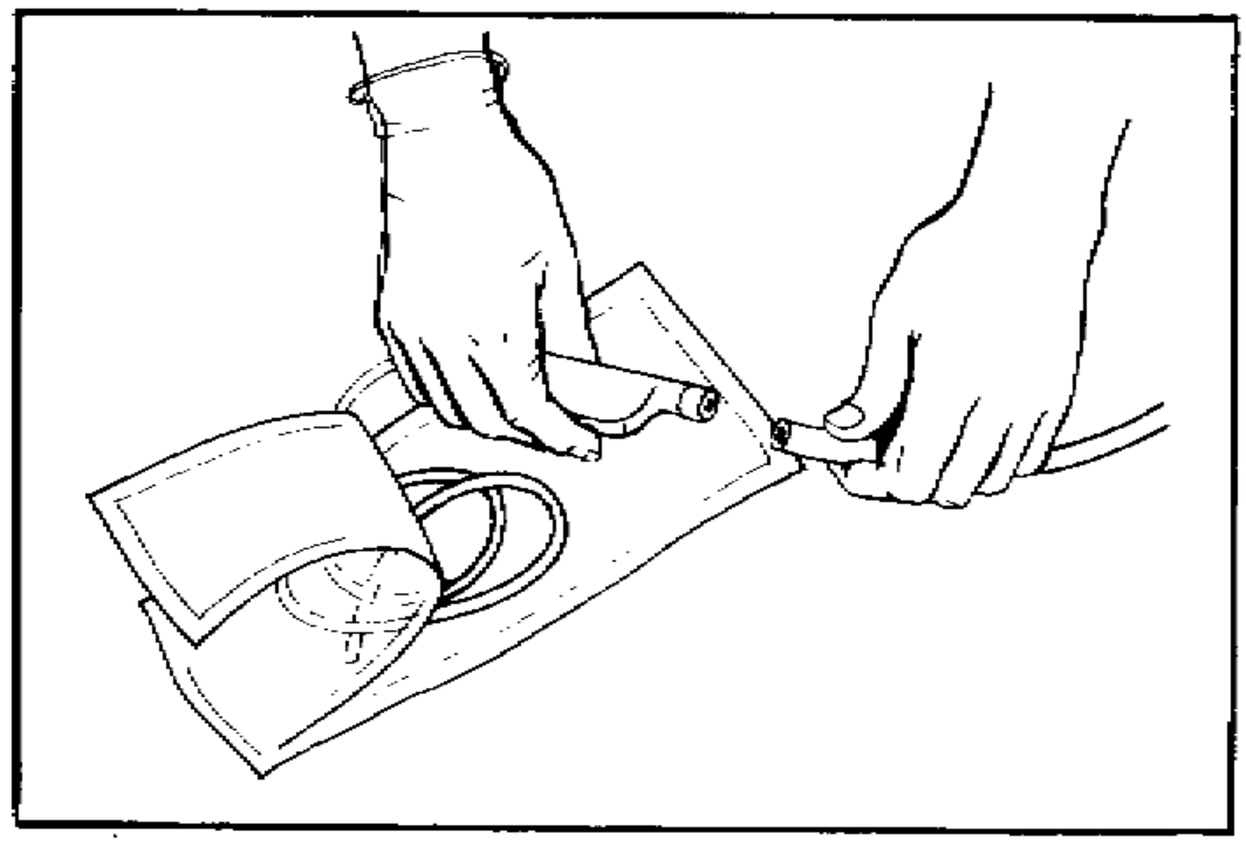


Figure 14-53. Connecting catheter to suction apparatus.

NOTE

If no saline enters the drainage bottle, the catheter is blocked and another catheter should be used.

n. Suction the patient.

(1) Oral route.

(a) Insert the tip of the catheter into the patient's mouth without suction.

NOTE

If the patient is uncooperative (clenches teeth, bites, or chews catheter), suction by the nasopharynx may be required for removing secretions from the back of the throat. In this case, insert the catheter into the nose, without suction, 3 to 5 inches. Apply suction, and withdraw the catheter using a rotating motion. This will also remove secretions from the nose.

CAUTION

Be aware that advancing the catheter too far into the back of the patient's throat may stimulate the patient's gag reflex, which could lead to vomiting and aspiration of stomach contents.

(b) Apply suction by placing the thumb of the ungloved hand over the suction port. This aspirates secretions from the back of the throat, along the outer gums and cheeks, and around the base of the tongue.

(c) Suctioning should not be continuous for more than 10 to 15 seconds. Suctioning removes oxygen as well as secretions; therefore, longer periods of continuous suctioning may result in an oxygen deprivation that is too severe for the patient.

(d) If the patient is alert and cooperative, tell him to cough to help bring secretions up to the back of the throat so they can be easily removed.

(e) Clear the catheter by inserting the tip in the saline solution and suction the solution through the catheter until it is clear.

NOTE

If an oral pharyngeal airway is in place, insert the catheter alongside the airway, then back into the pharynx.

(f) Repeat steps *(b)* and *(c)* above until all secretions have been aspirated.

NOTES

1. When the patient's breathing efforts become less labored and difficult, and noisy, rattling, or gurgling sounds are no longer noted, the suctioning should be discontinued.

2. With some patients, the complete absence of gurgling or rattling sounds cannot be achieved. If the sounds are still present after aspirations, notify the supervisor.

3. If the suctioning must be repeated, allow the patient to rest between each aspiration.

(g) Turn off the suction apparatus and disconnect the suction catheter from the tubing. Discard the catheter in the contaminated trash receptacle.

(2) Nasotracheal route.

(a) Instruct the patient to open his mouth and stick out his tongue (Figure 14-54A).

(b) Insert the suction catheter into the nasopharynx without suctioning (Figure 14-54B).

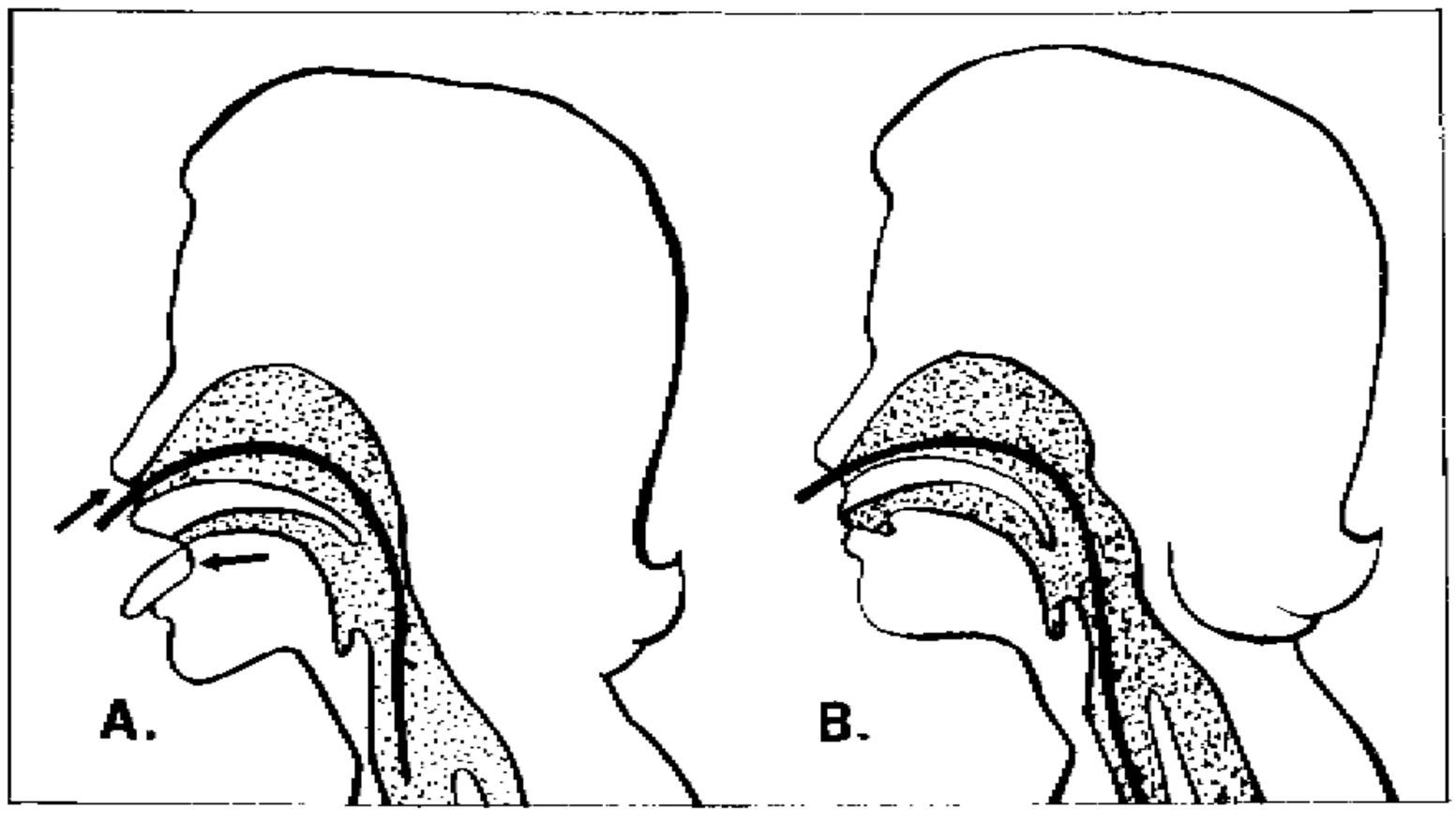


Figure 14-54. Inserting catheter into trachea.

NOTES

1. To estimate the distance the catheter is to be inserted, measure from the patient's nose to the ear, then to the larynx.
2. Generally, it is easier to insert a catheter into the right nostril than into the left, due to less septal deviation (a slight deformity of the wall separating the two nasal cavities, causing a partial or complete blockage of the nostril). If an obstruction is met, remove the catheter and try the left nostril. If an obstruction is still met, remove the catheter and call for assistance.

(c) Stimulate the cough reflex by gently moving the catheter.

(d) Quickly and gently advance the catheter into the trachea when the patient coughs.

NOTES

1. When the patient coughs, the epiglottis (a lid-like cartilage overhanging the larynx and trachea) is raised (opened), permitting easier insertion of the catheter.
2. If the patient can cough up enough secretions to clear his lungs and/or the bronchial tree adequately, the rest of the procedure may not be necessary.

(e) Suction secretions by placing your thumb over the suction port.

(f) Aspirate the patient for brief periods and allow him to rest between suctionings. Introduce the catheter carefully and suction thoroughly but quickly.

(g) Check the patient during and after the procedure for skin coloration change or increased pulse rate.

NOTE

Pulse rate increases with hypoxemia. Listen for changing breathing sounds. As secretions are removed, breathing should become quiet again.

(h) Rinse the catheter as required between suctionings.

o. Remove catheter and glove(s).

(1) Disconnect the catheter from the suction tubing and discard in trash receptacle.

(2) Remove glove(s) and discard in trash receptacle.

p. Leave the patient comfortable.

(1) Straighten and tighten bed linens.

(2) Place the patient in the semi-Fowler's position if his condition permits.

(3) Raise the bedside rails, if indicated.

(4) Place call bell/light within easy reach of the patient.

q. Discard used items.

(1) Discard disposable items in trash receptacle.

(2) Clean and store nondisposable items in accordance with the local SOP.

(3) Replenish supplies as needed.

r. Record procedure. Record the following:

(1) Time.

(2) Respirations (rate, labored, noisy).

(3) Procedure: route (oral, nasopharynx, nasotracheal).

(4) Type and amount of secretions obtained.

Section XII. APPLICATION OF HEAT AND COLD

14-75. General

The application of heat and cold discussed in this section is limited to those commonly administered in a ward or clinic. A doctor's order or local SOP is necessary for all applications of heat and cold. The physician will usually indicate the form of application, the area to be covered, the temperature of the application, and the duration and frequency of treatment. It is your responsibility to apply the prescribed form of heat or cold so that the treatment is beneficial, rather than injurious, to the patient.

14-76. Effects of Heat

Heat applied to the skin surfaces provides soothing comfort and speeds up the healing process. Heat dilates the superficial blood vessels (vasodilation) in the area of application. This increases blood supply and adds nutrients and oxygen to the tissues, supporting and maintaining body tissue and stimulating the growth of new tissue. There is an increase in white blood cells, which ward off infection, combat disease organisms, and aids to decrease the formation of pus (suppuration). The dilated blood vessels and increased blood supply in the area of heat application cause the skin to appear pinkish or reddish, although this color is more difficult to detect in dark-skinned or black patients. Heat is used to relieve pain due to muscle spasm, to relieve inflammation, to promote localization of purulent material (containing pus) and its drainage, and to relieve chilling.

14-77. Effects of Cold

a. When cold is applied to the skin or a part of the body, constriction of the superficial blood vessels (vasoconstriction) occurs. The skin becomes pale and cool. The diminished blood flow in the area of application reduces the oxygen and nutrients available to the cells and slows down cellular metabolism. This decreased cellular activity leads to the numbing or anesthetic effect associated with cold. Prolonged exposure to cold lessens pain as well as sensation. If cold continues to interfere with adequate circulation, it can cause damage to body tissues, such as necrosis (death of tissue) caused by severe frostbite.

b. Medically, the effects of cold applications are employed to reduce edema resulting from sprains, strains, and contusions. Hypothermia is often used to cool the patient's body in order to reduce metabolic needs and the amount of anesthetic required during prolonged surgery. Cold packs are used to control bleeding (ice collars applied after tonsillectomy) and aid in the reduction of edema following an injury. The physician usually will indicate the temperature to be used for cold applications (tepid, cool, cold, or very cold).

14-78. Effects on the Autonomic Nervous System

Although the procedure of applying heat or cold to the body is relatively simple, the effect on the body is much more complex. Changes in the body's external temperature activate the autonomic nervous system, which produces systemic responses in the body.

a. Heat. The systemic response begins with the thermal receptors in the skin, which send messages to the temperature control center in the brain (hypothalmus) indicating that the skin is now warmer. The hypothalmus responds by dilating the vessels in the area to allow more blood to flow through them and to distribute the heat. This regulatory function helps to

maintain a uniform internal temperature and to prevent damage to the tissue cells. The amount of blood diverted to the skin through vasodilation reduces the amount of blood circulating through internal organs and other structures. This protects the internal organs and delicately balanced body functions from harmful effects due to increased temperature. Application of heat to a small area of skin produces a milder systemic response than application to a larger area. Systemic circulatory changes may cause faintness, a faster pulse, and some degree of dyspnea. For these reasons, you must take the patient's vital signs frequently, and observe the skin when heat is applied to a large area of the body.

b. Cold. The systemic effects of cold are the reverse of those occurring in the application of heat. The diversion of blood volume from the skin to the vital interior organs insures their continuing function. The body acts to conserve body heat when cold affects the entire body or large portions of it. Muscles are stimulated to contract; the resulting shivering action produces some heat and squeezes more blood out of vessels with in the muscles.

14-79. Patient Safety

a. The body is able to tolerate large changes in external temperatures; however, moist applications to the skin of temperatures that are warmer than 110^{o}F (43.3^{o}C) or colder than 40^{o}F (4.4^{o}C) can seriously damage body tissue. Individual sensitivity to temperature changes varies; the very young and the very old particularly are unable to tolerate such changes. When the temperature affects a large body area, the skin becomes less tolerant to extremes of temperatures. The skin is better able to tolerate brief treatments than prolonged applications of heat or cold. Also, thin-skinned areas of the body and those not usually exposed tend to be more sensitive to temperature changes than areas like the palm of the hand or the sole of the foot, which are exposed and have thicker layers of skin.

b. There is always a problem when the treatment is ordered by descriptive adjective, since the questions of "how hot is hot?" and "how cold is cold?" must be answered. The range of temperature from hot to cold, in relation to therapeutic applications, falls within these limits:

ACCEPTED TEMPERATURE RANGES FOR APPLICATION OF HEAT:

Fahrenheit		Centigrade
105^{o} to 115^{o}	very hot	41^{o} to 46^{o}
98^{o} to 105^{o}	hot	37^{o} to 41^{o}
93^{o} to 98^{o}	warm	34^{o} to 37^{o}

ACCEPTED TEMPERATURE RANGES FOR APPLICATION OF COLD:

Fahrenheit		Centigrade
80^{o} to 93^{o}	tepid	26.7^{o} to 33.9^{o}
65^{o} to 80^{o}	cool	18.3^{o} to 26.7^{o}
55^{o} to 65^{o}	cold	12.3^{o} to 18.3^{o}
Below 55^{o}	very cold	below 12.5^{o}

Added to the temperature in degrees is the moisture factor—moist heat and cold are both more penetrating and more intense in their effect on body tissue.

14-80. Local Application of Heat

A local application is one that is used on a specific part of the body. These applications are usually in the form of either dry or moist heat. To protect the patient from burns due to heat applications—

a. Measure the temperature with a solution (bath) thermometer, if possible.

NOTE

When a thermometer is not available, place the pack against the inner aspect of your arm. If any doubt exists that the application is too hot, cool it down. You must always remember that what might feel comfortably warm on normal, healthy skin could be dangerously hot if applied to the skin of infants, old people, or individuals with impaired circulation.

b. Always use a protective cloth cover. Never apply directly against the skin.

c. Observe the condition of the skin frequently for signs of burning or blistering and be attentive to any complaints by the patient.

d. Caution the patient not to attempt to increase the temperature of water in hot water bottles.

(1) *Dry heat.* Heat is commonly used as dry applications and may be applied by a hot water bottle or a chemical heating pad. There are also various other methods such as thermoregulated electric pad and heat cradle, but these are used infrequently.

(a) Hot water bottle.

1. Fill a pitcher with hot water. Test the temperature with a bath thermometer. The temperature should not be more than 120^{o}F.

2. Pour water into bottle to one-half capacity. Expel air by gradually resting the bottle flat on a table until the water reaches the neck of the bottle. Expelling the air makes the bottle pliable so that it will conform to body contours.

3. Secure the stopperless closure by folding over the the neck tabs in proper sequence (A tab first, B tab second, and so on) (Figure 14-55).

4. Test for leaks. Wipe surface dry. Cover with a hand towel or other dry cloth cover.

5. Apply to prescribed area. Tell the patient that it is intended only for the area to which applied.

6. Check skin area before refilling and reapplying. Do not apply if an area of heat-induced redness is apparent.

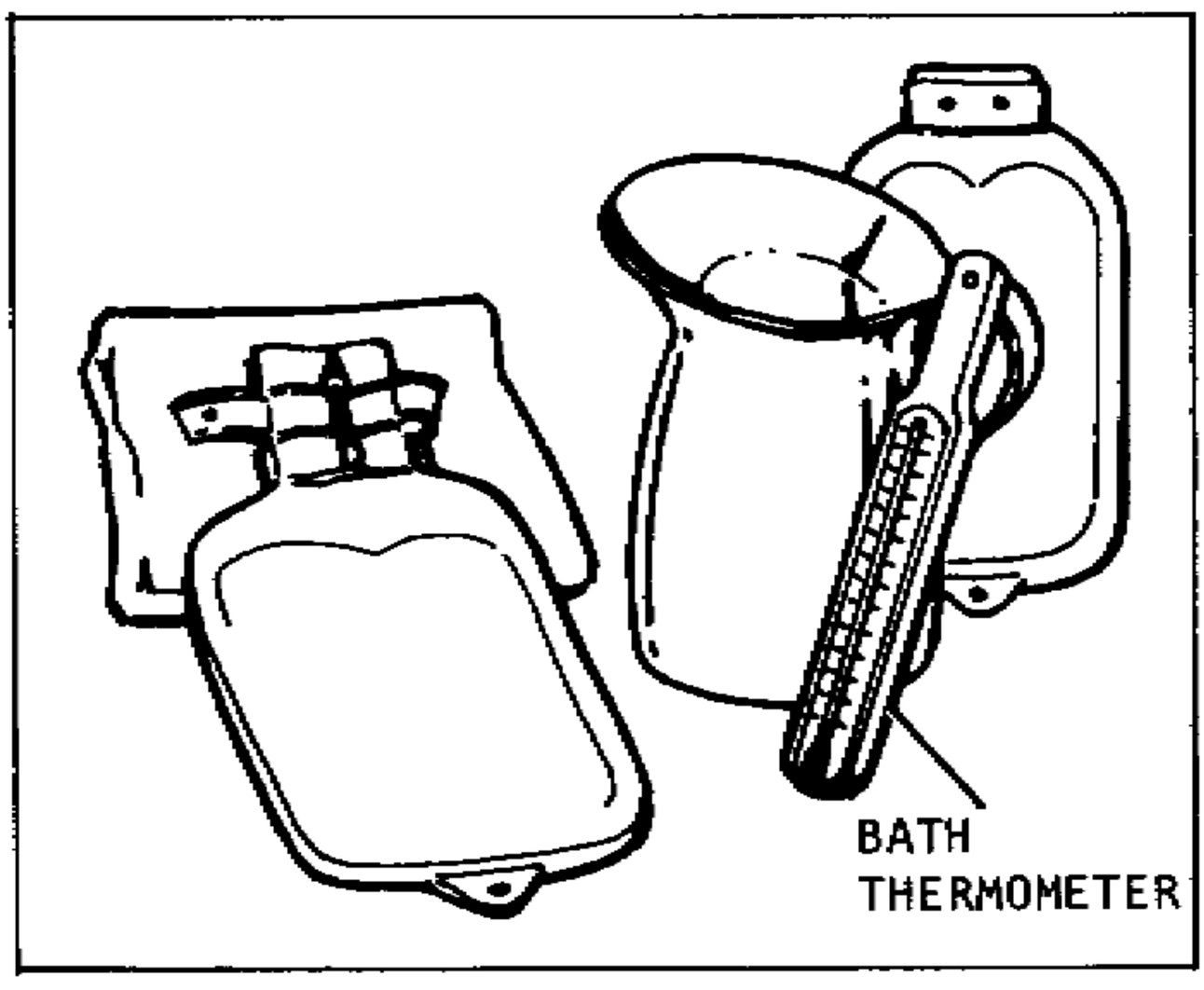


Figure 14-55. Preparation of hot water bottle.

(b) Chemical heating pad, water-activated (Figure 14-56).

1. The chemical heating pad comes complete with a stick and a waterproof cover.

2. Clear the opening in the upper corner of the pad with the small stick and pour in 30 cc's of cold water.

3. Manipulate (knead) the bag briskly between your hands to mix the water and chemicals. Place the bag in the waterproof container, or wrap it in a towel or other covering, and apply the pad to the patient as directed.

CAUTION

The amount of heat that continues to be generated for several hours by chemical reaction *cannot* be controlled; you must check frequently to be sure the pad is not too hot for the patient. Apply additional padding between the patient and the heating pad if it is too hot.

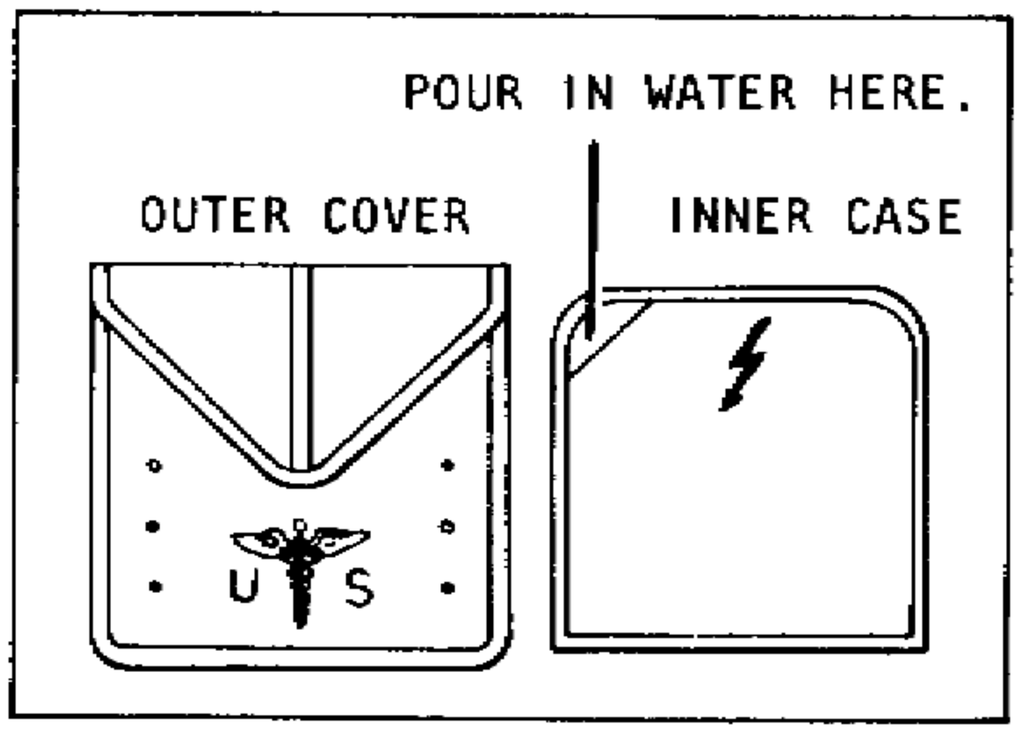


Figure 14-56. Chemical heating pad, water-activated.

(2) *Moist heat.* Moist heat is usually applied as a soak, compress, or pack. Solutions such as sterile water, normal saline, and a number of medicated solutions will usually be specified by the doctor if other than tap water is to be used. You must remember that water is more effective than air as a conductor of heat. In addition to observation for reaction to heat, skin exposed to moisture for a prolonged period must be observed for any sign of maceration (destructive softening, puffiness, or wrinkling of the surface). Maceration is prevented by exposing the skin to air for 1/2 to 1 hour between reapplications of moist heat; this step is important when moist heat is prescribed as a "continuous application."

14-81. Arm or Foot Soaks

a. A soak is the direct immersion of a body part (arm or foot) in warm water or in a medicated solution. Tap water is generally used for soaks. The physician usually indicates the type of solution, the body area to be soaked, the temperature of the solution (usually 105^{o}-110^{o}F), and the duration of the treatment.

b. Procedure.

(1) Assemble supplies and equipment. Choose a container for the solution sufficiently large enough to accommodate the area to be soaked.

(2) Explain the procedure to the patient. Heat the solution to the prescribed temperature.

(3) Position the patient. Drape him so that the area is exposed, but maintain his privacy and warmth.

NOTE

If patient has soiled dressings, use aseptic technique to remove them and discard the soiled dressing in accordance with local SOP.

(4) Pour the heated solution into the soaking basin. If medication is to be added to the solution, this is the time to add it. Be sure that it is mixed thoroughly with the solution.

(5) Test the temperature of the solution and keep it constant during the treatment. If no thermometer is available, use the anterior aspect of your wrist to test the temperature. A solution that feels hot on the wrist will probably be too hot for the patient.

(6) Immerse the specified body part gradually into the solution so that the patient becomes accustomed to the temperature change. Soak the body part for the specified period of time.

(7) Remove affected body part from the solution. Support the body part as you remove it and remove the soaking basin. Dry the affected part thoroughly. If there is an open wound, pat dry around it, not directly on it. Apply a dressing if needed.

NOTE

When ordered for treatment of an open wound, sterile equipment and solution are used to reduce contamination; once the part is immersed, however, any organisms present contaminate the solution and sterility cannot be maintained. The initial use of sterile equipment and a sterile towel to dry the area provides a margin of safety.

14-82. Local Application of Moist Heat, Clean Technique

a. Use clean technique for local applications, compresses, or packs applied to intact skin. The difference between a compress and a pack is in the material used and the body area on which it is used. A pack (also referred to as massive wet dressings) is usually applied to an extensive body area such as an entire leg or arm; a compress is normally applied to a limited body area and consists of warm, moist gauze pads or clean folded washcloths.

b. Compresses and packs differ from soaks in that they are used for a longer period of time and are usually applied at a higher temperature. They are applied at the hottest temperature the patient can tolerate without burning the superficial tissue. The material can be wrung out manually (hands or forceps) so that it does not drip on the patient when applied, but it must remain moist enough to conduct the desired amount of heat.

c. Because compresses and packs usually cool off rapidly, the length of time they retain heat depends on the temperature of the solution, the thickness of the material, and the type of insulation used. Generally, they remain hot for 15 to 20 minutes, then have to be reheated and reapplied.

d. Procedure for applying moist, hot compresses to a bed patient.

(1) Place a hot plate on a table convenient to use. Plug in the plate and turn switch to low heat setting.

(2) Place basin of water, at a temperature of 110^{O}-115^{O}F, on the hot plate. Do not allow solution to be hotter than the hands can comfortably stand. Place gauze pads or folded washcloths in the hot solution.

(3) Place patient in comfortable position, with protective pad under the body part to be treated in order to protect bed.

(4) Lift hot wet compress from basin. Wring out as dry as possible. Test heat of compress against inner surface of forearm. Lay hot compress gradually on area to be treated, lifting corners to eliminate any steam.

(5) Observe skin carefully for redness before reapplying compress. If no unfavorable skin reaction is observed, exchange the cooled compress for a heated one, continuing reapplications for the prescribed length of time, usually for 20 minutes.

(6) Turn off hot plate and disconnect wall plug after each treatment. Compress may be reused if not soiled.

NOTE

If compresses are to be self-applied by the patient, demonstrate the entire procedure to the patient and have him repeat it. Check from time to time to see that instructions are being followed and to observe skin area.

e. Moist hot packs (clean).

(1) Gather appropriate equipment. Place a hot plate on a table convenient to use.

(2) Place basin of solution, at a temperature of 110^{O}-115^{O}F on the hot plate. Solution should be no hotter than your hands can comfortably stand. Place two bath towels (folded in half) in the basin of hot solution.

(3) Place patient in comfortable position with extremity to be treated elevated properly and completely exposed. Place protective pads under the extremity and over the pillows. On top of protective bed covering, place dry bath towel and rubber or plastic sheeting to bind the hot pack in place.

(4) Wring out and test hot towels by touching one to your forearm. Place one hot folded towel under and one over the extremity to be treated in order to completely inclose it. Fold plastic or rubber layer over the extremity to inclose the hot moist towels. Then fold over the dry towel and pin or fold securely to keep the pack in place.

(5) Apply hot water bottles or chemical heating pad to the outside of the towel binding as needed to maintain the pack's heat.

(6) Reapply hot pack as prescribed, checking condition of the skin each time. When properly applied, it is possible to maintain the required amount of heat and moisture for about 1 hour with each hot towel application.

(7) When hot pack is discontinued, pat skin dry.

(8) If pack is to be continued day and night, set up a schedule for reapplying to allow a required period of skin exposure to air. Use clean towels next to the skin to prevent a sour odor. Wash and gently dry the inclosed skin area to remove perspiration and skin secretions before the air exposure period.

14-83. Local Applications of Cold

a. Cold is applied to small localized areas of the body in dry form by means of an ice bag or in moist form by means of iced, moist compresses. Continuing contact with cold produces numbness as well as constriction of bood vessels. While both of these effects may be desired, the area to which cold is applied must be watched closely since the patient may not complain of symptoms indicating possible tissue damage. Local signs of unfavorable reactions to cold include pallor, blueness, or mottling (blotchy) discoloration of the skin. If these signs are noticed, discontinue the application immediately and report the observation. When continuous moist cold is ordered, remove for 20 minutes every 2 hours.

b. Application of ice bag. The ice bag may be a dual-purpose, hot water bottle or an ice collar. (A securely tied plastic sack or latex rubber glove may also be used when a flexible, lightweight container is needed to apply ice to an eye or the nose.)

(1) Crack or crush the ice to eliminate large pieces or sharp edges.

(2) Fill the container only half full with ice; expel all air so that it will be flexible. Close securely and test for leaks.

(3) Wipe the surface of the container dry. Inclose it completely in a dry cloth, cloth bag, stockinette, several layers of gauze, or a hand towel.

(4) Apply container so that it is in contact with the designated local area, propping where necessary to relieve weight and pressure.

(5) Check and refill as necessary to keep the local area cold for the prescribed period.

NOTE

Always change the cover if it becomes moist.

(6) Observe the skin area carefully. Discontinue application and report unfavorable reactions immediately (STAT).

(7) When treatment is discontinued, drain, wash, dry, and inflate the bag with air before returning it to its proper storage place.

c. Application of cold compresses. The compress should be several layers thick and of sufficient size to cover the designated area. Gauze pads or clean, folded washcloths are used. These are often self-applied, following instruction and initial assistance.

(1) Place protective cover under the part to be treated to protect the bedding.

(2) Place large pieces of ice and a small amount of water in a hand basin or sponge bowl. Place compresses or clean folded washcloth (in sufficient number to permit frequent exchange) in the ice water.

(3) Squeeze excess moisture from a chilled compress and apply the compress quickly to designated area. Do no cover the compress.

(4) As the compress loses its coolness, exchange it for a freshly chilled and moistened one. This step is repeated every 5 or 6 minutes for the 15- or 20-minute application period.

(5) When treatment is discontinued, wash and dry the basin.

(6) Start each application with clean water and ice. Replace gauze or washcloth as they become soiled.

14-84. General Application of Cold

A general application is one that is applied to the entire body. Cooling of the entire body is usually accomplished by means of a special hypothermia unit (cooling blanket) used under the supervision of an anesthetist, or by using a cooling sponge bath.

14-85. Sterile Technique for Applications

a. Sterile technique must be followed when applying moist hot or cold applications to broken, infected, or burned skin area, and medical asepsis must be observed when draining wounds are involved. An important goal is to prevent the contamination of a wound and to control the spread of organisms from an infected wound. The clean procedures described for soaks, compresses, and packs must, therefore, be modified to include the use of aseptic supplies and techniques.

b. Sterile applications are most often used for smaller body parts, and various medications can be prescribed by the doctor. The necessary supplies include—

- Bottle or flask of sterile solution.
- Disposable sterile irrigating set.

- Sterile gauze dressings.
- Sterile gloves or forceps, as required.

If the irrigating set is not used, a sterile basin may be needed to hold the solution. When using the sterile irrigating set, the solution is poured aseptically into the container and drawn up in the Asepto syringe, and the sterile dressings are moistened with the solution. Sterile gloves or forceps may be needed to wring out the excess solution from the compresses and apply them in place. A sterile dry pad or dressing applied over the moist one helps retain the temperature of the compress or pack.

Section XIII. THERAPEUTIC BATHS

14-86. General

a. When there is a need to quickly decrease a patient's temperature, a tepid or cold sponge bath may be required. This technique is based on the principle that the body loses heat through the conduction of heat to a cooler substance such as water or alcohol.

b. To verify that a sponge bath is needed, the patient's rectal temperature should be taken. If the rectal temperature is greater than 106°F (41°C), immediate cooling of the patient is necessary. The rectal temperature should be checked every 10 minutes and not allowed to fall to less than 101°F (38°C).

c. The following equipment is needed to administer a tepid sponge bath:

(1) Two bath blankets.

(2) Basin of tepid water.

(3) Two bath towels.

(4) Eight wash cloths.

(5) Rectal thermometer.

(6) Sphygmomonometer.

(7) Stethoscope.

14-87. Administering the Sponge Bath

a. Before starting sponge bath, the patient's vital signs must be taken. These vital signs will serve as a baseline for comparison to determine

the effectiveness of the treatment. The most important vital sign is the patient's temperature. Before sponging the patient, apply cold, wet compresses to the groin, axillae, and neck.

b. Sponging is done by slowly stroking the skin surface area with long, soothing strokes, using the wet washcloths. The areas to sponge are the face, trunk, and abdomen for about 5 minutes, the entire back and buttocks for about 5-10 minutes, then each extremity for about 5 minutes. Each area should be gently dried with a towel after it is sponged.

c. Observe the patient closely for shivering. If shivering occurs, cover him completely with the bath blanket and apply gentle friction to the torso and extremities. Remember the patient's first reaction to the bath is chilliness; this disappears as the body adjusts to the cold temperature. The bath must be continued for at least 25-30 minutes. The rectal temperature must be checked every 10 minutes after the bath is stopped. The temperature can be expected to drop further to normal. The bath should be discontinued if cyanosis and/or shivering does not stop when friction (rubbing) is applied to the skin.

d. In the field you must decide when a tepid, cold, or alcohol sponge bath is necessary. If the patient's temperature is 106°F (41°C) or higher, a sponge bath is indicated. You will need--

(1) Tepid water.

(2) Ice, if available.

(3) Alcohol, if available.

In certain situations it may not be feasible to remove the patient's clothes. Therefore, you must be able to improvise as needed to cool the patient immediately.

14-88. The Field Expedient Sponge Bath

a. Unbutton the clothing as much as possible after the temperature is taken, then apply cool compresses to the groin, axillae, and neck.

b. After the cool compresses are applied, use a cravat or field dressing to sponge the patient, using soothing strokes over the skin, one side at a time.

CAUTION

Do not use alcohol in sensitive areas of the body such as the face, axillae, or groin.

c. Another method used to cool the patient is to pour water over him and use whatever is available to fan him for approximately 20 minutes. After 20 minutes, check the vital signs and temperature. If temperature is still above 101°F (38°C), repeat the procedure.

d. Observe the patient closely for shivering. Shivering increases the production of body heat; if this happens, the effectiveness of the bath is lessened.

e. Stop treatment if pulse increases, cyanosis (bluish discoloration) is noted, or shivering starts.

14-89. Completion of the Sponge Bath

After the bath, provide for the patient's safety and comfort. Dry the patient and provide dry clothing, if necessary. Record the treatment, vital signs, length of treatment time, date, patient's tolerance, and type of bath.

Section XIV. MANAGING A PATIENT REQUIRING CHEST TUBE DRAINAGE

14-90. General

a. Normal breathing in a human operates on the principle of negative pressure (the pressure in the chest cavity is lower than the pressure of outside air, causing air to rush into the lungs). Whenever the chest is opened (by surgery or trauma), there is a loss of negative pressure, which can cause a collapse of the lungs.

b. Pleura is the membrane that covers the chest walls and lungs and produces a serous fluid (moist and slippery secretions) to reduce friction during respiration. The parietal pleura lines the chest cavity and the visceral pleura covers the lungs. When conditions produce a space between these pleural layers, breathing is changed and the lungs can no longer fully expand (Figure 14-57).

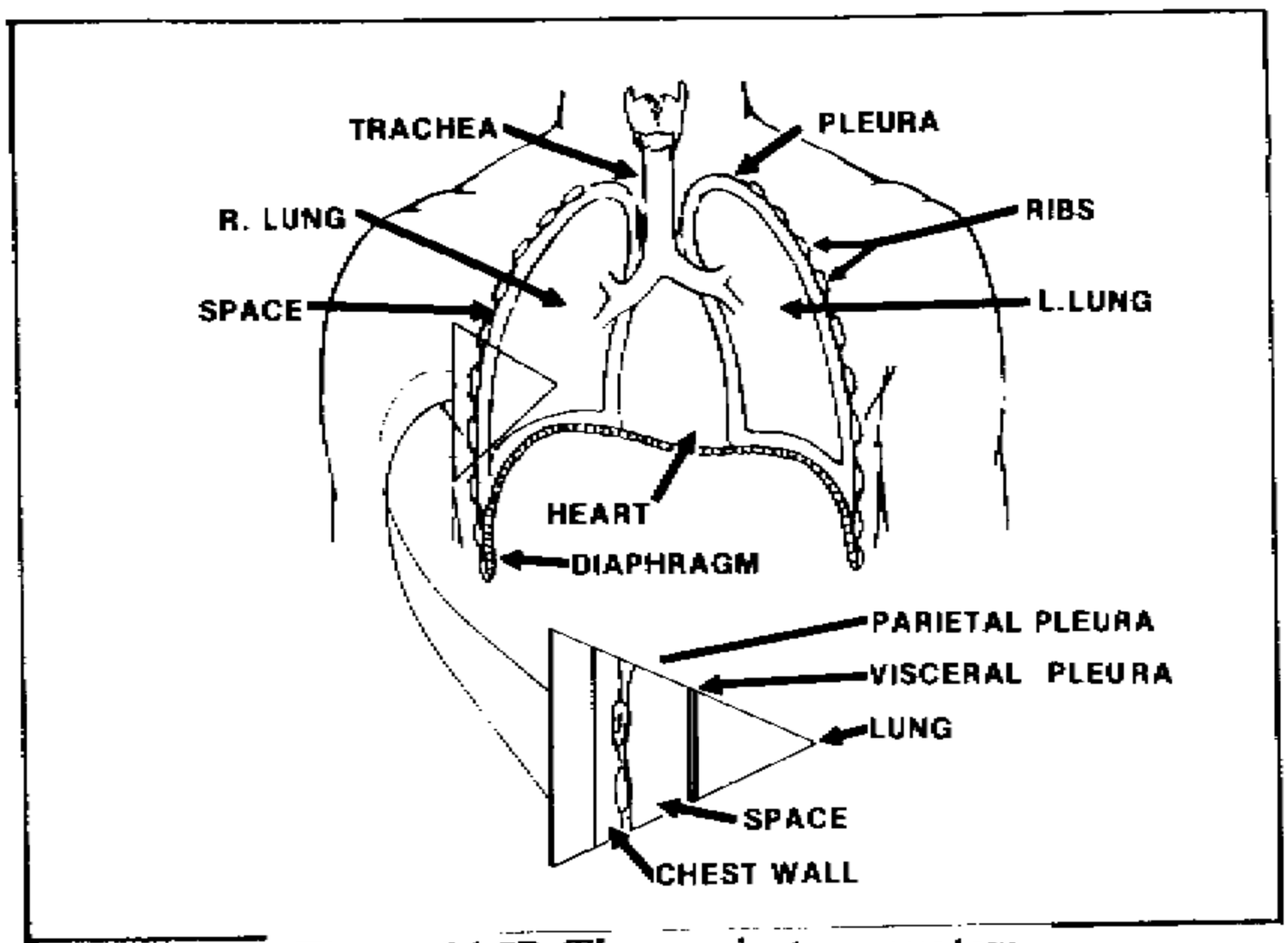


Figure 14-57. The respiratory system.

c. Blood and air collect in the pleural space as a result of penetrating wounds, a fractured rib that punctures a lung, the rupture of a blister (bleb) on the lung surface, or a surgical procedure. A chest tube is inserted by a physician as an emergency treatment or at the completion of surgery. It is connected to an underwater-seal drainage bottle or to a disposable pleural drainage system.

d. There are many connections in the drainage system, and the breakdown of any one could cause a second collapse of a lung. Most equipment problems are the result of the system not being airtight. This is usually caused by a loose hose or connector and can lead to serious complications if not detected and corrected.

e. There are two basic types of apparatus used for underwater-seal chest drainage:

(1) Drainage without suction, including 1-, 2-, and 3-bottle setups. The 1-bottle setup is most commonly used when suction assistance is not required.

(2) Drainage with suction is used when water-seal drainage alone does not eliminate free air from the pleural cavity in sufficient quantities to permit lung expansion.

14-91. Managing a Patient Requiring Chest Tube Drainage

a. Wash hands and put on sterile gloves.

b. Attach drainage tube from the pleural cavity to the tubing that leads to a long tube with the end submerged in sterile normal saline (Figure 14-58).

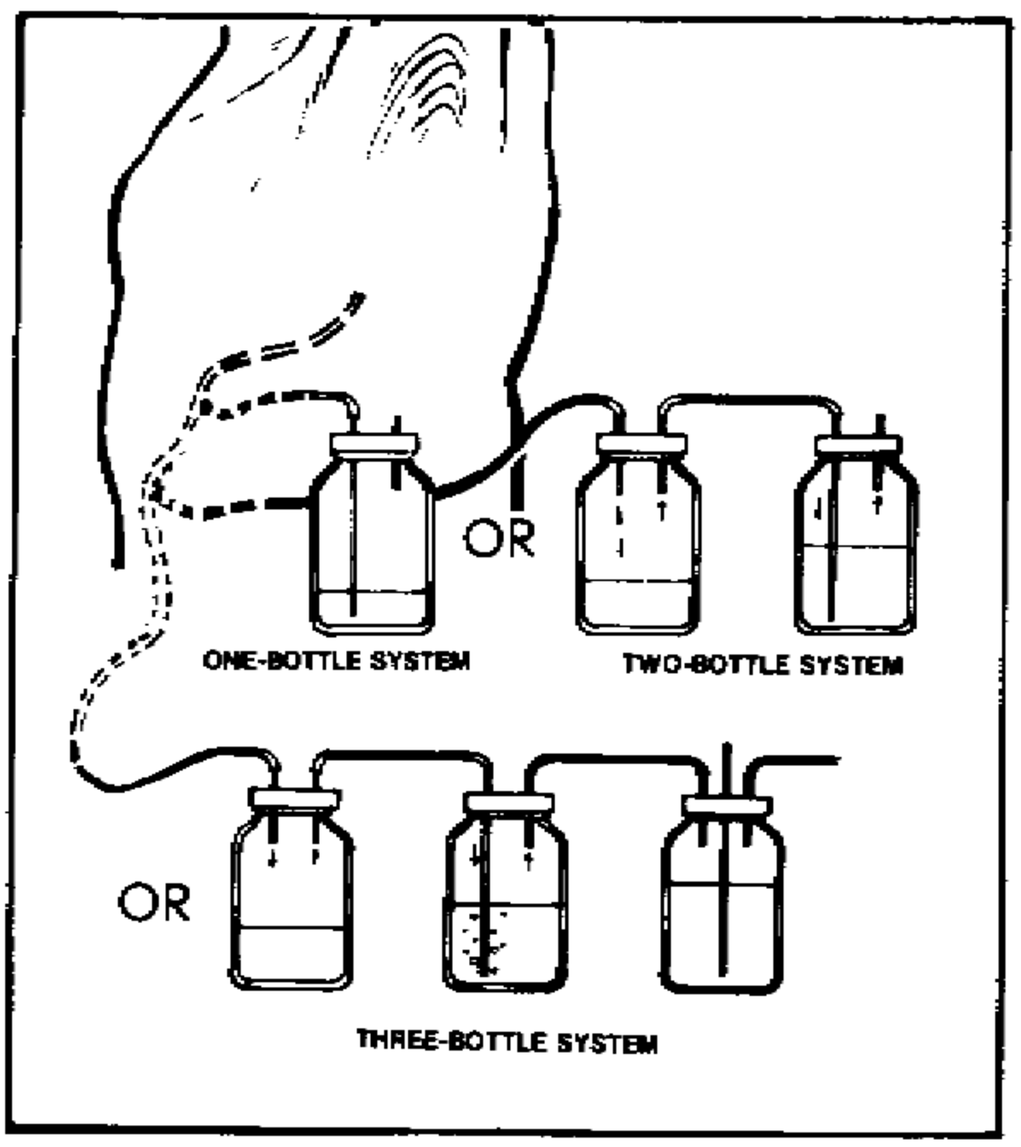


Figure 14-58. Drainage system.

c. Tape points where tubing is connected. Taping the connections insures that the tubing and connectors do not become loose or slip apart and an airtight seal is maintained.

d. Place tube approximately 1 inch (2.5 cm) below the water level (Figure 14-59).

e. Vent short tube so that it is left open to the atmosphere (Figure 14-59).

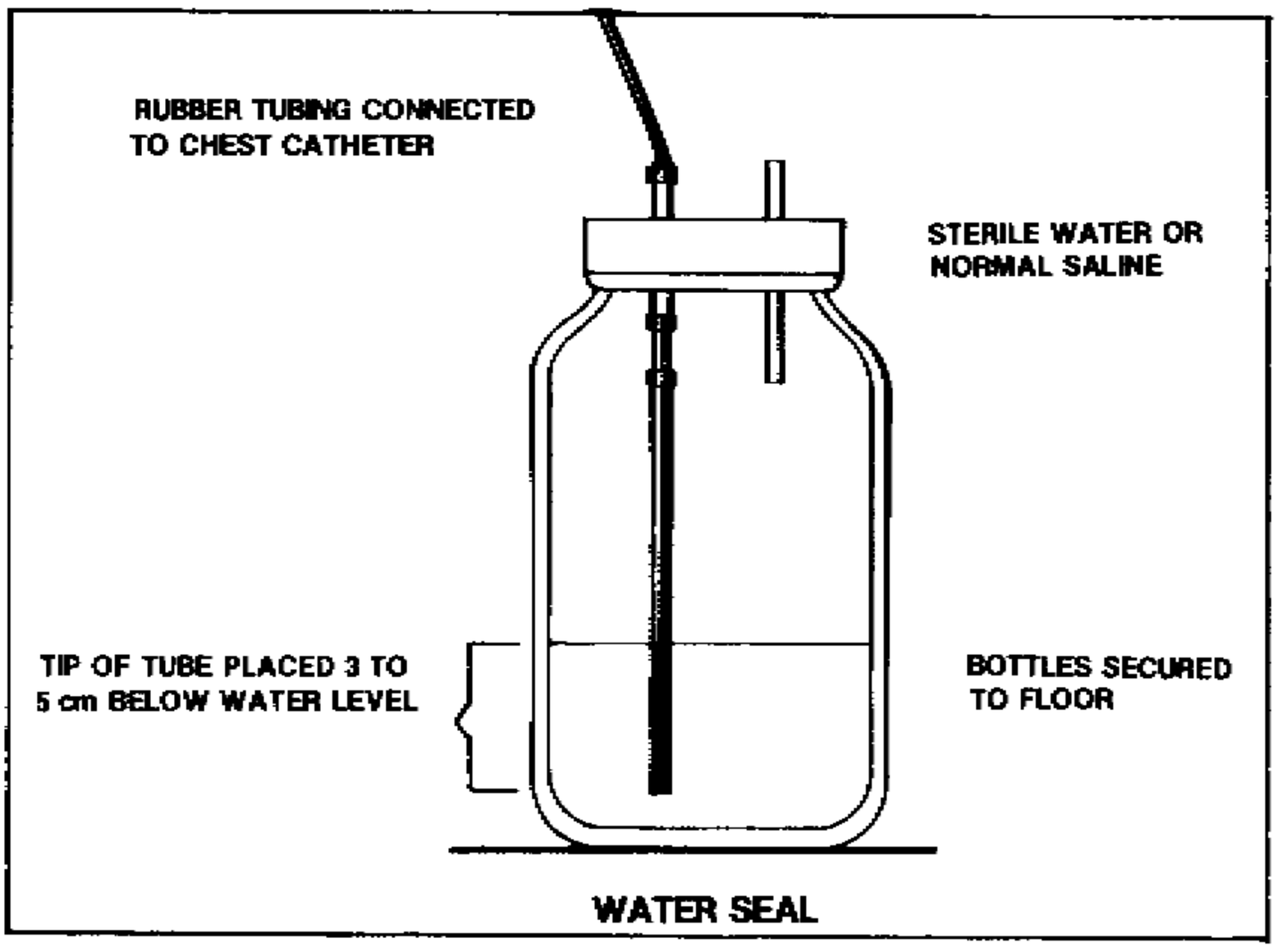


Figure 14-59. Tube below water level and vent short tube.

f. Mark original fluid level with tape on the outside of the drainage bottle (Figure 14-60). Mark hourly/daily increments as ordered (date and time) at the drainage level.

CAUTION

Grossly bloody drainage will appear in the bottle during the immediate postoperative period and if more than 100 cc/hr, notify your supervisor *immediately*.

NOTES

1. Marking will show the amount of fluid loss and the rate fluid is collecting in drainage bottle.

2. Drainage usually declines progressively after 24 hours.

3. When drainage bottles are changed or discontinued, subtract the measured water from the total to obtain the fluid drainage total.

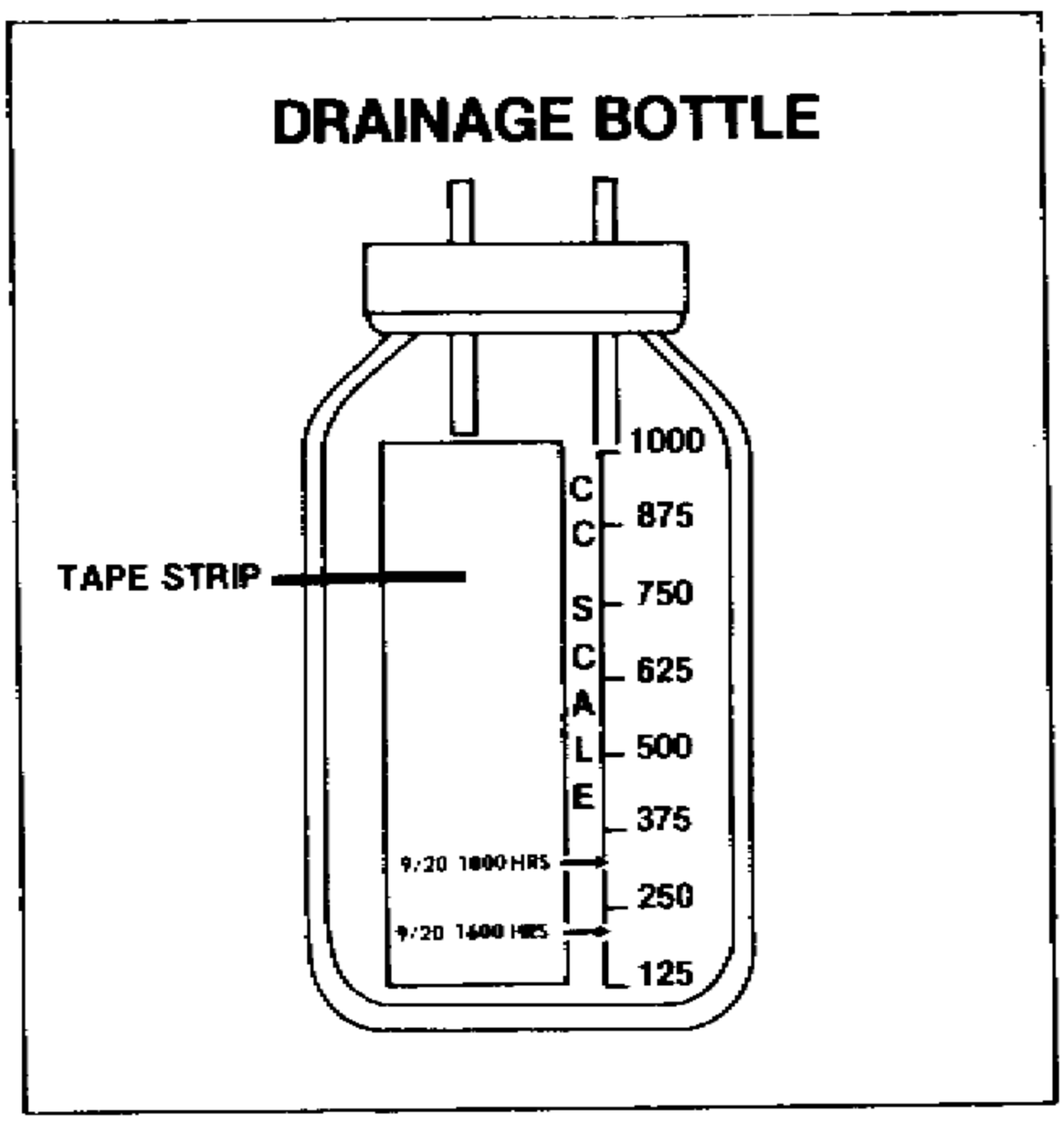


Figure 14-60. Original fluid level mark.

g. Assure that the chest drainage system is airtight at all times.

(1) Vigorous bubbling of the chest tube bottle *when suction is not being applied* indicates a leak in the system. All connections should be checked to insure that an airtight system exists. Vigorous bubbling may be caused by a loose connection or a defect in the lung. Report this to your supervisor *immediately*.

(2) If a connector is completely disconnected or the drainage bottle is broken, immerse the end of the tube in a container of sterile water, thereby providing a water seal. Notify your supervisor *immediately*. An entire sterile drainage system will need to be reconnected to the chest tube.

NOTE

When the system is not completely airtight and in water seal, the patient will have an immediate pneumothorax. If a container of sterile water is not available, attach a Heimlich valve (Figure 14-61) to the open end of the tubing and the system will be complete until the underwater seal can be obtained. A field expedient Heimlich valve can be made by dampening the inside of a penrose drain and taping it to the open end of the tube or taping a finger of a sterile glove to the open end of the tube and cutting the tip of the finger (Figure 14-61). These methods provide a flutter valve effect which will allow air to escape on expiration and seal on inspiration so that air cannot enter the plural cavity through the tubing.

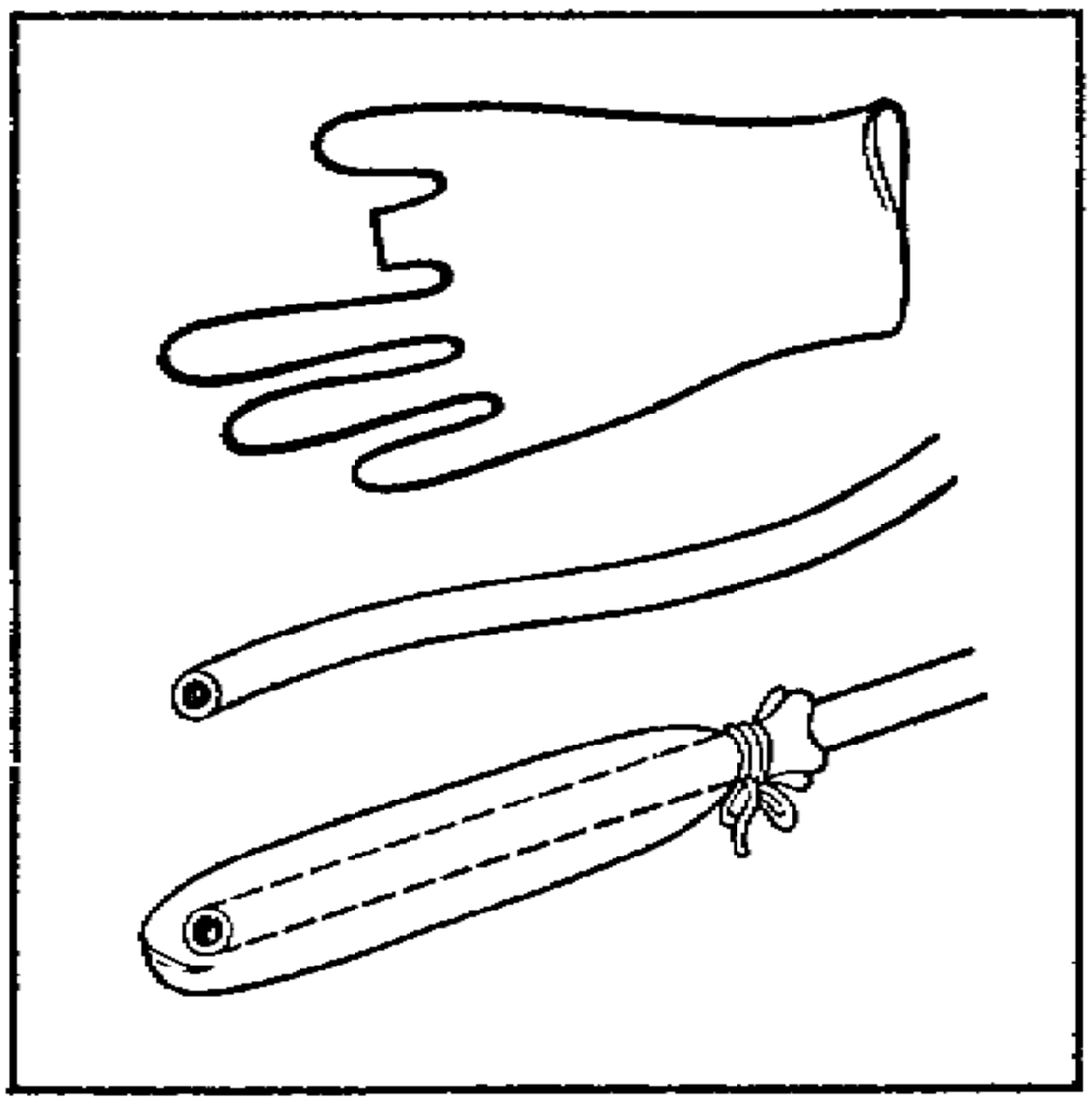


Figure 14-61. Finger of glove as Heimlich (flutter) valve.

h. Fasten tubing to drawsheet with rubber bands and safety pins. This will allow gravity flow to occur.

CAUTION

1. Kinking, looping, or pressure on the drainage tube can produce back pressure, and possibly force drainage back into the pleural space, impede drainage from the pleural space, or cause a tension pneumothorax.

2. Tubing should not loop or interfere with the patient's movement.

3. Do not clamp a chest tube unless directed by and under the supervision of a physician.

i. Allow the patient to assume a comfortable position.

(1) Encourage good body alignment.

(2) Encourage patient to change positions frequently.

(3) Place a rolled towel under the tubing when the patient is in the lateral position.

NOTES

1. Often patients are most comfortable in the Fowler's or semi-Fowler's position.

2. Proper positioning helps breathing and promotes better air exchange. Pain medication may be indicated to enhance comfort and deep breathing.

3. Frequent position change prevents postural deformity and contractures, as well as promoting drainage.

4. The rolled towel will protect the tubing from the weight of the patient's body.

j. Initiate range-of-motion exercises of the arm and shoulder on the affected side several times daily to help avoid ankylosis (stiff joint) of the shoulder and assist in lessening postoperative pain and discomfort.

k. "Milk" the tubing in the direction of the drainage bottle on an HOURLY basis. (See Figure 14-62).

l. Insure that there is fluctuation of the fluid level in the long glass tube.

NOTES

1. Changes in the water level in the tube indicates that there is effective communication between the pleural cavity and the drainage bottle, provides a visual indication that the system is operating properly, and is a gauge of intrapleural pressure.

2. Changes in the level of fluid in the tubing will stop when—

   (a) The lung has reexpanded.

   (b) The tubing is obstructed by blood clots or fibrin.

   (c) A loop develops.

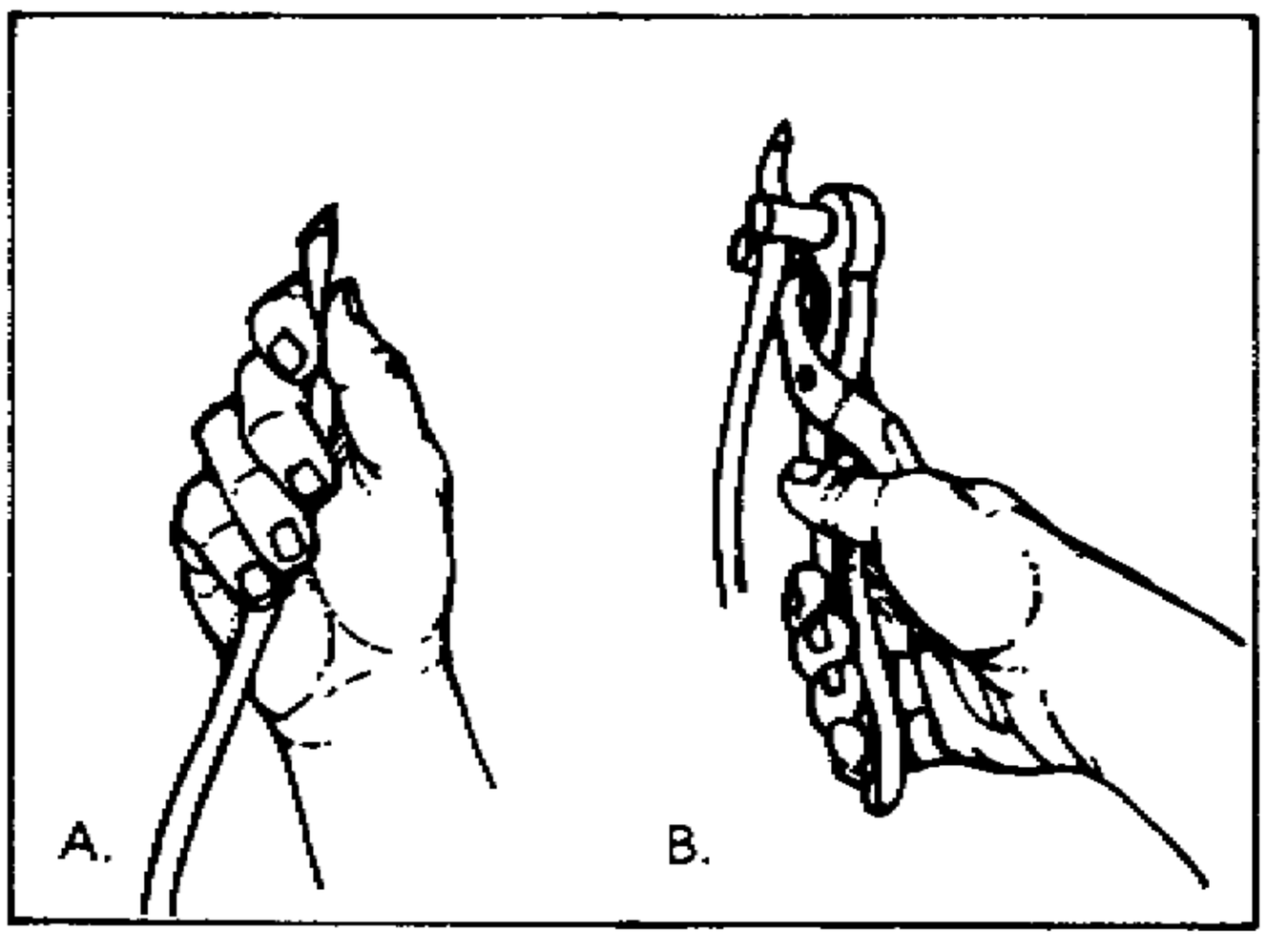


Figure 14-62. "Milking" by hand (A) or by mechanical device (B).

m. Observe for air leaks in the drainage system:

(1) This is indicated by constant bubbling in the underwater-seal bottle. However, if the system is hooked to a suction device, the underwater-seal bottle will bubble.

(2) For just a few seconds, clamp the tubing close to the chest wall if there are any air leaks, but *ONLY WHEN ORDERED BY THE PHYSICIAN.*

CAUTION

1. Leaking and trapping air in the pleural space can result in a tension pneumothorax.

2. If the leak is in the patient and the tube is clamped for more than a few seconds, air may back up in the pleural cavity and extend the patient's pneumothorax.

n. Report excessive bubbling in the water-seal chamber immediately in accordance with local SOP.

o. Observe for and immediately report the following:

(1) Rapid, shallow breathing.

(2) Cyanosis (bluish skin color).

(3) Complaints of pressure in chest or sharp chest pain.

(4) Subcutaneous emphysema (palpate for "crackling" sensation).

(5) Symptoms of hemorrhage.

NOTES

1. Many clinical conditions may cause these signs and symptoms.

2. Cyanosis results from poor oxygenation of the circulating blood.

3. When palpating for subcutaneous emphysema, the "crackling" sensation may also be felt.

p. Encourage the patient to breathe deeply and cough at frequent intervals.

(1) Deep breathing and coughing assist in raising the intrapleural pressure, thus emptying the accumulation in the pleural space and removing secretions from the tracheobronchial tree, with an expansion of the lung and prevention of atelectasis (collapsed or airless lung).

(2) If there are signs of incision pain, adequate pain medication is indicated.

q. Stabilize the drainage bottle on the floor with tape or in a special holder.

CAUTION

If any part of the apparatus is damaged, the closed system of drainage will be destroyed and the patient will be endangered by atmospheric pressure in the pleural space, with possible collapse of the lung. The drainage system must be kept airtight to reestablish negative intrapleural pressure.

r. If the patient must be transported on a stretcher, place the drainage bottle below chest level, as close as possible to the floor. The drainage apparatus must be kept at a level lower than the patient's chest, to prevent backflow of fluid into the pleural space.

s. Assist physician in removing tube.

(1) Remove tape, dressing, and sutures.

(2) Instruct the patient to perform the Valsalva maneuver (forcible exhalation against a closed glottis, holding the breath).

(3) Quickly remove the chest tube.

(4) Simultaneously, apply a small bandage made airtight with petrolatum gauze covered by 4 inch by 4 inch gauze.

(5) Cover thoroughly and seal with adhesive tape.

NOTES

1. The tube is removed as directed after the lung has re-expanded (usually from 24 hours to several days).

2. It is the physician's responsibility to remove the tubes and apply the dressing after tube removal.

3. During tube removal, the priorities are preventing air from entering the pleural cavity as the tube is withdrawn and preventing infection.

(6) Dispose of soiled items in accordance with the local SOP. Nondisposable items should be thoroughly cleaned and stored.

14-92. Indications of a Properly Working Drainage System

a. Observe for moderate bubbling in the suction control chamber of the Pleur-Evac or bottle system (if the patient is receiving suction or has a pneumothorax).

(1) If bubbling stops, check for properly operating suction apparatus.

(2) Excessive bubbling may indicate an air leak in the tubes or the patient's chest. Notify your supervisor immediately.

b. Observe for water level fluctuation in the water-seal chamber or Pleur-Evac bottle system, as patient inhales or exhales.

(1) If fluctuation ceases, check for kinked, looped, or wedged tubes. Look for clots in the tubes. Notify your supervisor if these measures do not help.

(2) Cessation of fluctuation may mean that the lung has re-expanded and no longer requires drainage.

14-93. Observations to be Made During Chest Drainage Procedure

a. Observe the following through the plastic connector between the chest tube and the drainage tube:

(1) Amount of drainage.

(2) Color.

(3) Consistency.

(4) Bloody drainage.

CAUTION

If any bloody drainage in excess of 100 ml per hour is noted, notify your supervisor IMMEDIATELY.

(5) Maintain up-to-date information on the drainage bottle label.

(6) Check the plastic connector hourly for the first 24 hours after chest tube insertion and every 8 hours thereafter.

b. Record the following information on the appropriate documents:

(1) Date and time of drainage bottle change.

(2) Amount, type of fluid, and color (example: pinkish; light red; dark red; or yellowish).

(3) Name of person changing drainage bottle.

(4) Statement indicating drainage specimen was/was not sent to the laboratory.

CHAPTER 15

OBSTETRIC AND GYNECOLOGIC EMERGENCIES

Section I. THE FEMALE REPRODUCTIVE SYSTEM

15-1. General

In this chapter, the basic structures and functions of the female reproductive system will be discussed, as well as the stages of pregnancy and the progression of normal labor and delivery.

15-2. Anatomy and Physiology

a. The female reproductive system includes the ovaries, fallopian tubes, uterus, and vagina. The female reproductive organs are located in the pelvic cavity. The uterus is situated in the pelvic cavity between the bladder and the rectum. The bladder orifice, or urethra, is above the vaginal opening. The rectum and its opening, the anus, is located below the vagina. The vaginal, urethral, and rectal orifices open into the perineum (Figure 15-1). Any trauma to the reproductive organs can also cause injury to the bladder, urethra, rectum, and/or anus because of the close location of these organs to each other.

b. The ovaries, two almond-shaped organs that produce ova (eggs), are located in the left and right lower quadrants. During reproductive years, the ovaries release a mature ovum about once a month. Progesterone and estrogen, the female sex hormones, also are produced by the ovaries. In the nonpregnant woman, estrogen and progesterone secretions vary each month. In the pregnant woman, these hormone secretions vary according to the stage of pregnancy.

(1) *Estrogen* thickens the lining of the uterus (endometrium), fallopian tubes, and vagina. In addition, estrogen produces secondary female sexual characteristics. Estrogen also affects kidney functions. It decreases sodium chloride which decreases urine output and increases extracellular fluid volume.

(2) *Progesterone* can act only on tissues that have been filled by estrogen. Progesterone prepares the reproductive tract for implantation of a fertilized egg. It also prepares the breasts for lactation (milk production).

c. The *fallopian tubes* permit passage of the ova from the ovaries to the uterus. At their ovarian ends, the fallopian tubes are funnel-shaped and fringed with small, finger-like structures, which insure that the ova reach the fallopian tubes from the ovaries. The fallopian tubes are narrower at their uterine ends.

d. The *ovum* travels through the fallopian tube into a pear-shaped, muscular organ called the uterus (womb). In the nonpregnant woman, the uterus is about 3 inches high, 2 inches wide, and 1 inch thick. It is located between the bladder and the rectum. In the pregnant woman, the uterus enlarges and rises upward. By the end of pregnancy, the uterus is approximately 12 inches high, 9 inches wide, and 8 inches thick.

e. The *uterus* has three layers: the perimetrium, the myometrium, and the endometrium. The perimetrium is the peritoneal covering of the uterus that separates it from the abdominal cavity. The myometrium, a thick,

muscular wall, forms most of the uterus. The thickness of the endometrium, the inner lining of the uterus, varies cyclically each month in nonpregnant women.

f. During the early part of the menstrual cycle, the endometrium thickens to prepare for ovulation (release of a mature ovum). If the ovum is fertilized, it will implant in the endometrium and develop into a fetus. If the ovum is not fertilized, however, the uterus sheds its endometrial lining 14 days after ovulation. A menstrual period, a discharge of bloody fluid from the uterus, is produced by the shedding of the endometrial lining.

g. During labor and delivery, the fetus and placenta pass through the cervix and the neck of the uterus, which is fully dilated at delivery. The cervix connects the uterus to the vagina. The vagina is a muscular tube leading to the external genitalia. The vagina serves also as the birth canal during labor and delivery.

h. The ovaries, fallopian tubes, uterus, and vagina receive blood from the ovarian, uterine, and vaginal arteries. The blood supply to the internal reproductive organs is complex and if injured and/or left untreated, bleeding may be excessive and/or fatal.

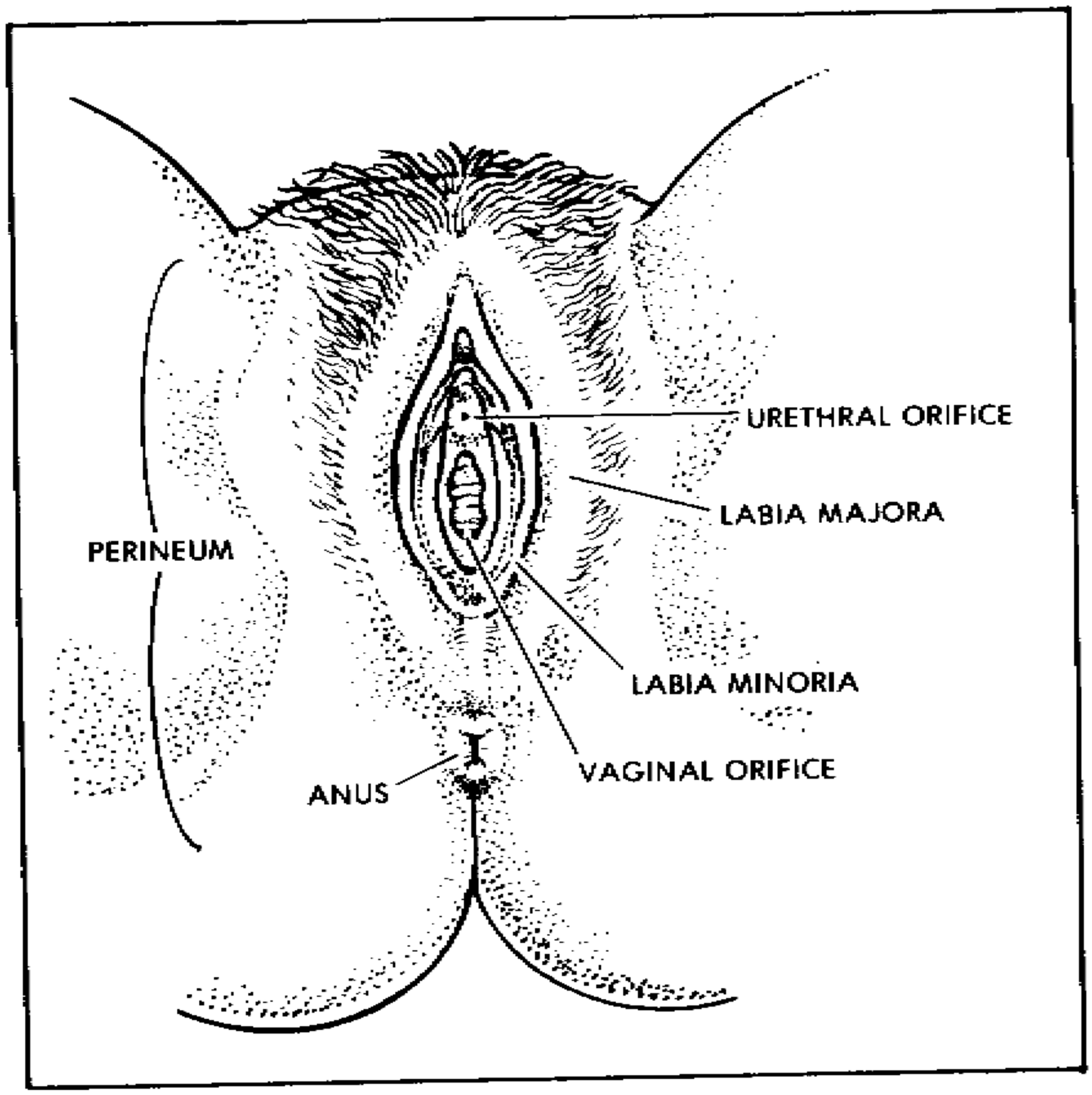


Figure 15-1. Perineum.

i. The external female genitalia include the vulval structures, the labia majora and the labia minora. The labia majora are large, rounded, lateral skin folds. The labia minora are smaller skin folds that are between the labia majora and vaginal opening and are usually hidden by them.

j. The breasts are secretory glands located on the anterior chest wall. During pregnancy, estrogen and progesterone act on the breasts to prepare them for lactation following delivery. After delivery, hormones (prolactin and oxytocin) secreted by the pituitary gland, stimulate the breasts to produce milk.

Section II. PREGNANCY AND CHILDBIRTH

15-3. General

Pregnancy begins when an ovum unites with a sperm cell that has been introduced into the female reproductive tract. The union of the ovum and sperm cell is called fertilization, and occurs in the outer third of the fallopian tube. The fertilized ovum passes into the uterus and implants in the endometrium. Implantation usually occurs in the upper part of the uterus.

a. The fertilized ovum develops into a fetus. The fetus is nourished by the placenta. The placenta, a special disk-shaped organ, develops during pregnancy and attaches to the inner wall of the uterus. Oxygen and nutrients pass from the mother's bloodstream into the fetal bloodstream through the placenta. Carbon dioxide and waste products also pass from the fetal blood vessels into the mother's blood vessels through the placenta. Maternal and fetal blood vessels are in close contact with the placenta, but the two bloodstreams do not mix.

b. Fetal blood enters and leaves the placenta through blood vessels contained in the umbilical cord (Figure 15-2). These umbilical blood vessels enter the fetus through the umbilicus, or navel. Two umbilical arteries carry unoxygenated blood from the fetus to the placenta. A single umbilical vein returns oxygenated blood to the fetus. The combined blood flow into the placenta from the fetal and maternal circulation is large in volume; therefore, any disturbance to the placenta (example, separation from the uterine wall or change in position) will cause extensive bleeding and can endanger both the fetus and the mother. In addition, blood supply to the entire uterus increases during pregnancy; therefore, uterine injuries also can produce extensive bleeding.

c. While in the uterus, the fetus is inclosed in the amniotic sac (bag of waters). This sac contains amniotic fluid in which the fetus floats freely. The amniotic fluid helps protect the fetus from mechanical injury. At the end of pregnancy, the amniotic sac contains about 1 liter of amniotic fluid. During or before labor, this sac ruptures, and amniotic fluid flows out through the cervix and the vagina. This is the "breaking of the waters." It usually means that delivery will occur within a few hours. During this time, the baby's head begins to enter the birth canal (Figure 15-3).

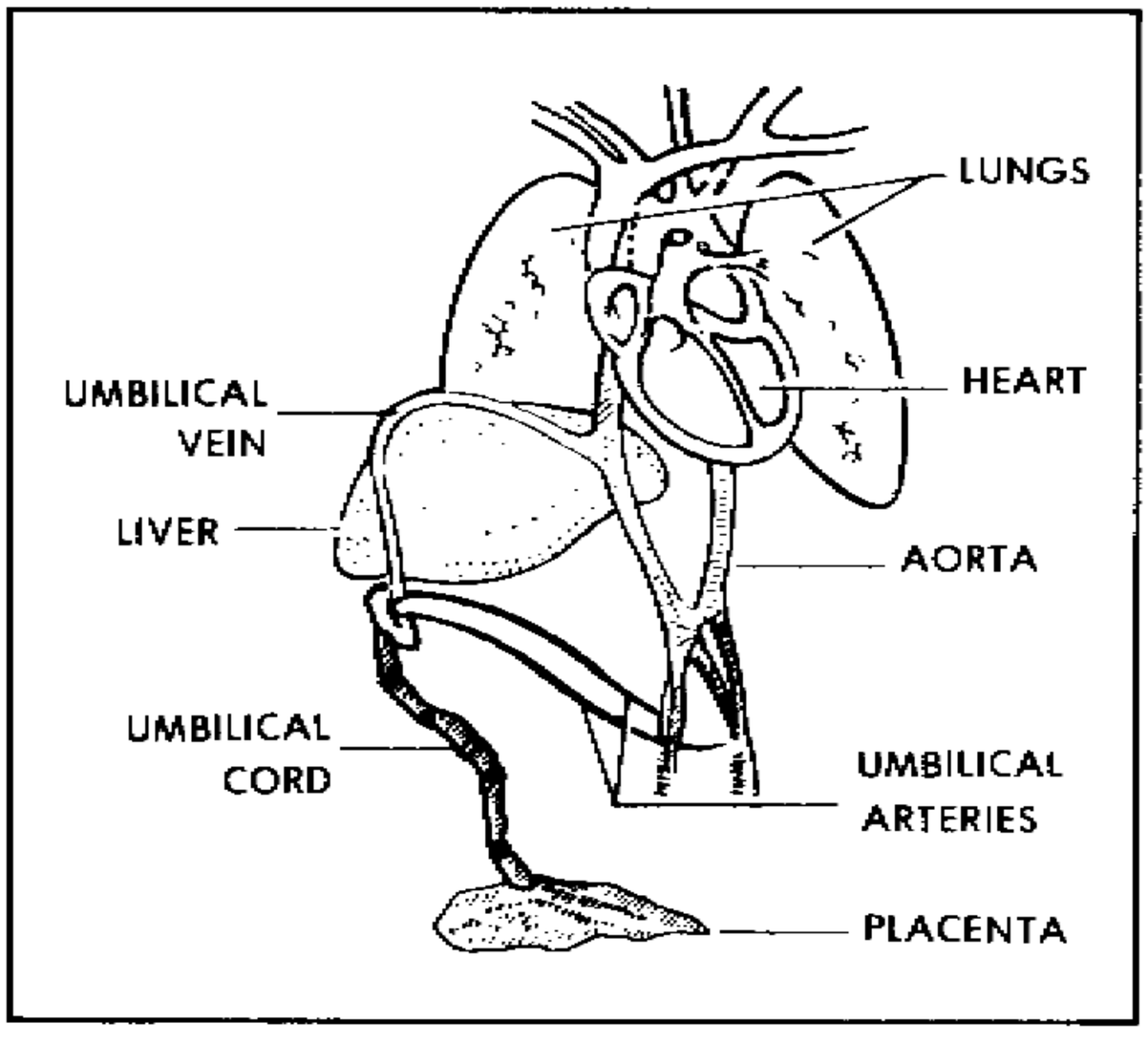


Figure 15-2. Fetal blood supply.

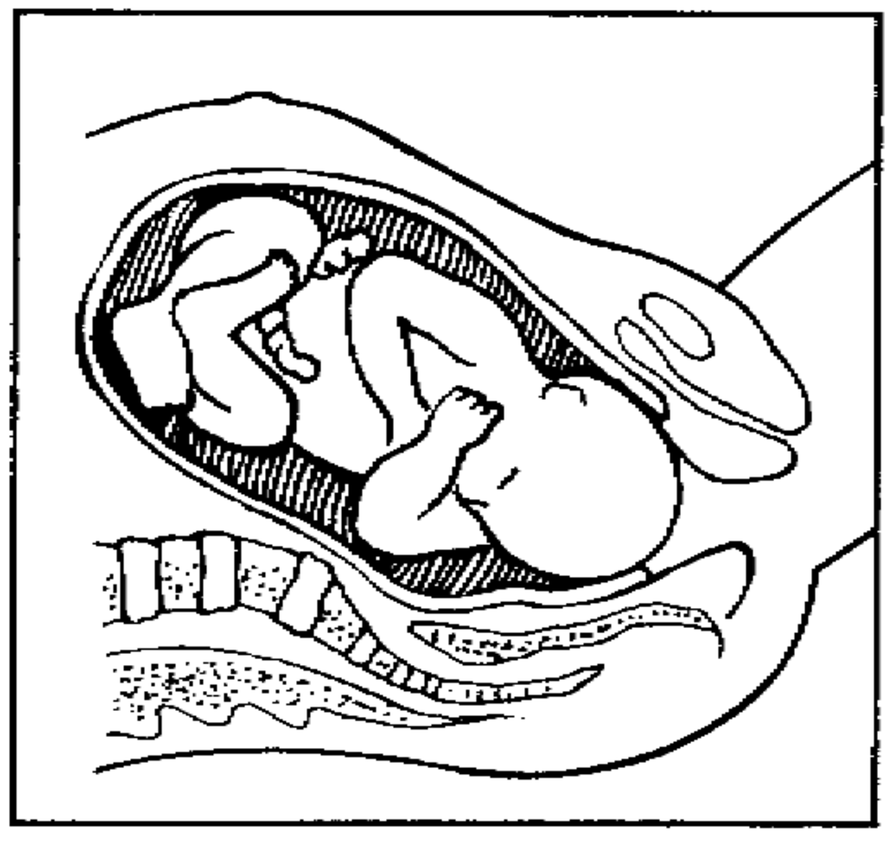


Figure 15-3. Movement of baby through birth canal.

d. Although it is impossible to determine exactly when fertilization actually occurs, it is easy to determine when the last menstrual period began. The date of the last menstrual period will provide an approximate date of delivery—called the estimated date of confinement. *Each 4-week period of pregnancy is called a lunar month. There are 10 lunar months in a normal pregnancy.* Each 3-month period is called a trimester.

e. During the first 4 weeks of pregnancy (1st lunar month), the pregnant woman stops menstruating, her breasts enlarge, and she sleeps more than usual. Because the pregnant uterus presses on the bladder, she may also urinate more frequently.

f. From the 5th through the 8th week (2d lunar month) she may experience nausea and vomiting (morning sickness) in addition to the above symptoms. In the 9th through 12th weeks of pregnancy (3d lunar month), the uterus can be felt above the symphysis pubis, and urinary frequency returns to normal. The pregnant woman begins to feel fetal movement between the 16th and 18th weeks (4th lunar month).

g. The fetal heart sounds can be heard after the 12-14 week with an ultrasonic stethoscope and at 20 weeks or 5 months with a fetoscope. By the end of the 24th week (6th lunar month), the examiner can feel fetal movement. Figure 15-4 shows the location of the top of the uterus at each month of pregnancy.

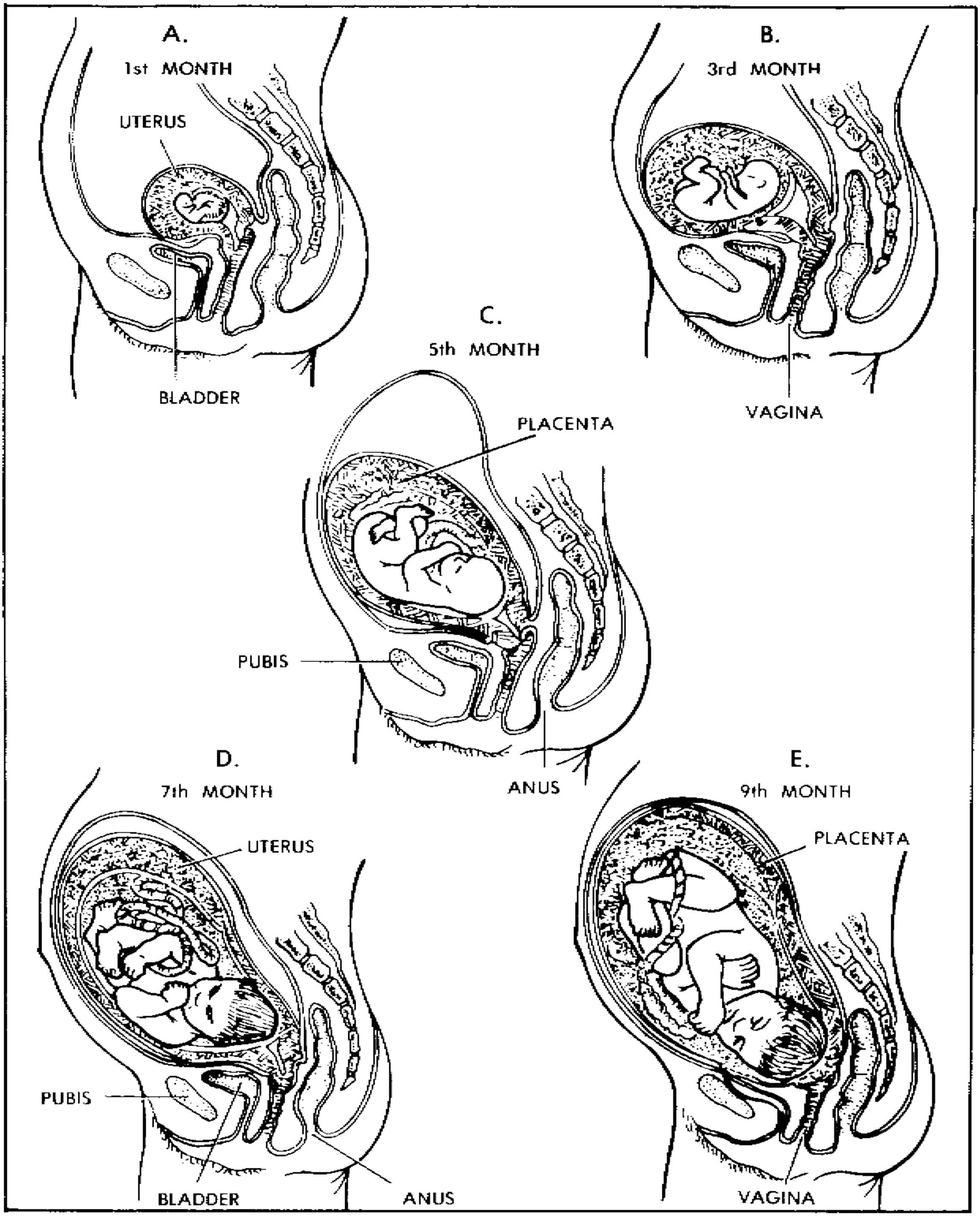


Figure 15-4. Fundus uteri at each month of pregnancy.

h. During the 37th through 40th week (10th lunar month), the uterus drops back down as the presenting part descends into the pelvis. The uterus presses on the bladder and rectum, causing urinary frequency and constipation.

i. Labor is the process by which the uterus expels the fetus, placenta, and membranes through the birth canal (vagina) by means of uterine contractions. Labor is divided into three stages and will be discussed later in this chapter.

j. Before labor begins, the head of the fetus settles into the pelvis. The cervix then begins to efface (thin). Effacement may be completed before labor begins or may continue during the first stage of labor.

k. At the beginning of labor, contractions are far apart. As labor progresses, contractions occur closer together. During the most active stage of labor, contractions occur every 2 to 3 minutes and last 30 to 45 seconds.

l. The first stage begins with the first uterine contraction and ends when the cervix is completely effaced and dilated (open). A completely dilated cervix is about 10 centimeters wide. The first stage lasts about 12 hours in a woman who has previously borne a child. The amniotic sac frequently ruptures when the cervix is completely expanded. A small amount of blood and mucus may be expelled from the vagina at the start of labor. This blood and mucus has formed a plug in the cervix and is called the "bloody show"; it appears as the cervix (the mouth of the uterus) begins to open.

m. The second stage of labor begins when the cervix is fully dilated and ends with the birth of the baby. Normally, the head descends first; this type of delivery is called cephalic (head). If the buttocks descend first, it is called a breech delivery. During the second stage of labor, the woman will bear down with each contraction. As the presenting part of the fetus presses on the rectum, the woman will feel an urge to defecate. The presenting part will appear and disappear at the vaginal opening between contractions. Eventually, the presenting part will remain visible between contractions. This is called crowning (Figure 15-5). In a normal delivery, the head will appear first and the shoulders and trunk soon after. The second stage of labor lasts about an hour in a woman having a first baby and from 15 to 20 minutes in a woman who has previously borne a child.

n. The third stage of labor is from the birth of the baby to the complete expulsion of the placenta and membranes. When the placenta separates from the uterine wall, a small amount of blood gushes out through the vagina. The placenta and membranes are then expelled from the uterus and through the vagina by uterine contractions (Figure 15-6). The third stage of labor usually lasts about 15 minutes.

15-4. Normal Delivery (Childbirth)

a. Assisting in the birth of a baby is one of the few instances in which you have the opportunity to participate in a unique situation because you are dealing with two patients, the mother and the baby, both of whom require skilled attention.

b. When you arrive at the scene of a woman in labor, you must first determine whether there is time to transport the patient to the hospital. To make this decision, you should answer the following questions:

(1) Has the mother had a baby before? Labor during a first pregnancy is usually slower than in subsequent pregnancies; therefore, there may be more time for transport during a first labor.

(2) How frequent are the contractions? Contractions more than 5 minutes apart are a good indication that there will be enough time to get the patient to a nearby hospital. Contractions less than 2 minutes apart, especially in a multiparous woman (a woman who has had more than one pregnancy) signal impending delivery.

(3) Has the amniotic sac ruptured and, if so, when? If the sac ruptures more than 12 hours before birth occurs, the likelihood of fetal infection is increased, and the hospital staff should be alerted. Furthermore, delivery may be more difficult when the amniotic sac has ruptured prematurely because amniotic fluid serves as a lubricant.

(4) Does the mother feel as though she has to move her bowels? This sensation is caused by the fetal head in the vagina pressing against the rectum and indicates that delivery is imminent.

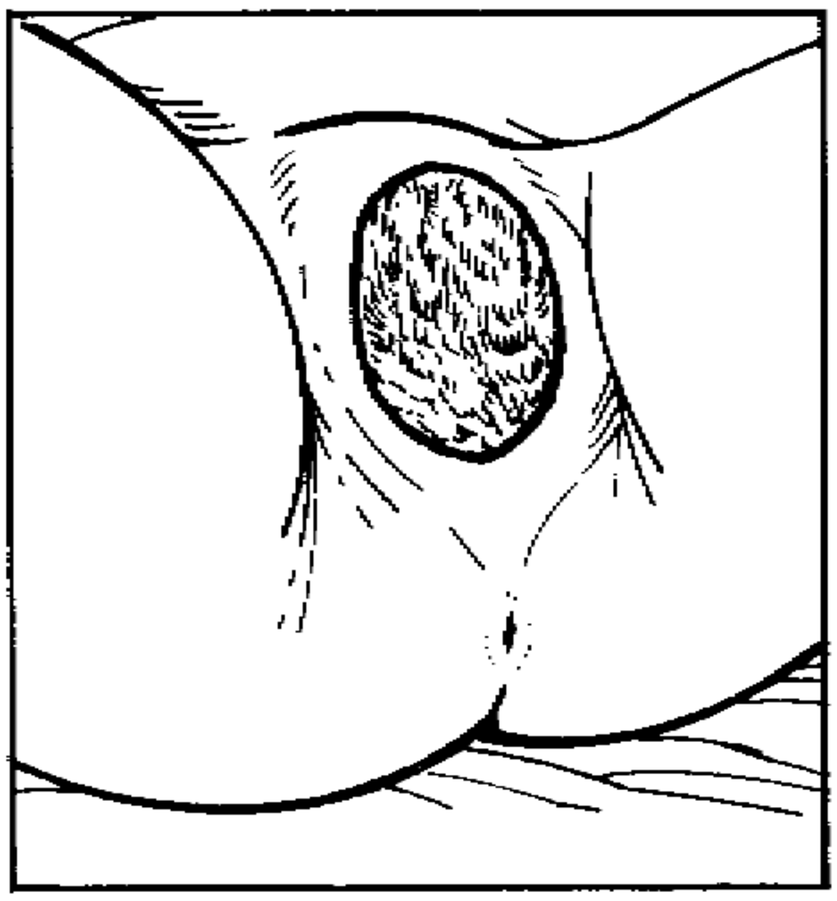


Figure 15-5. Crowning.

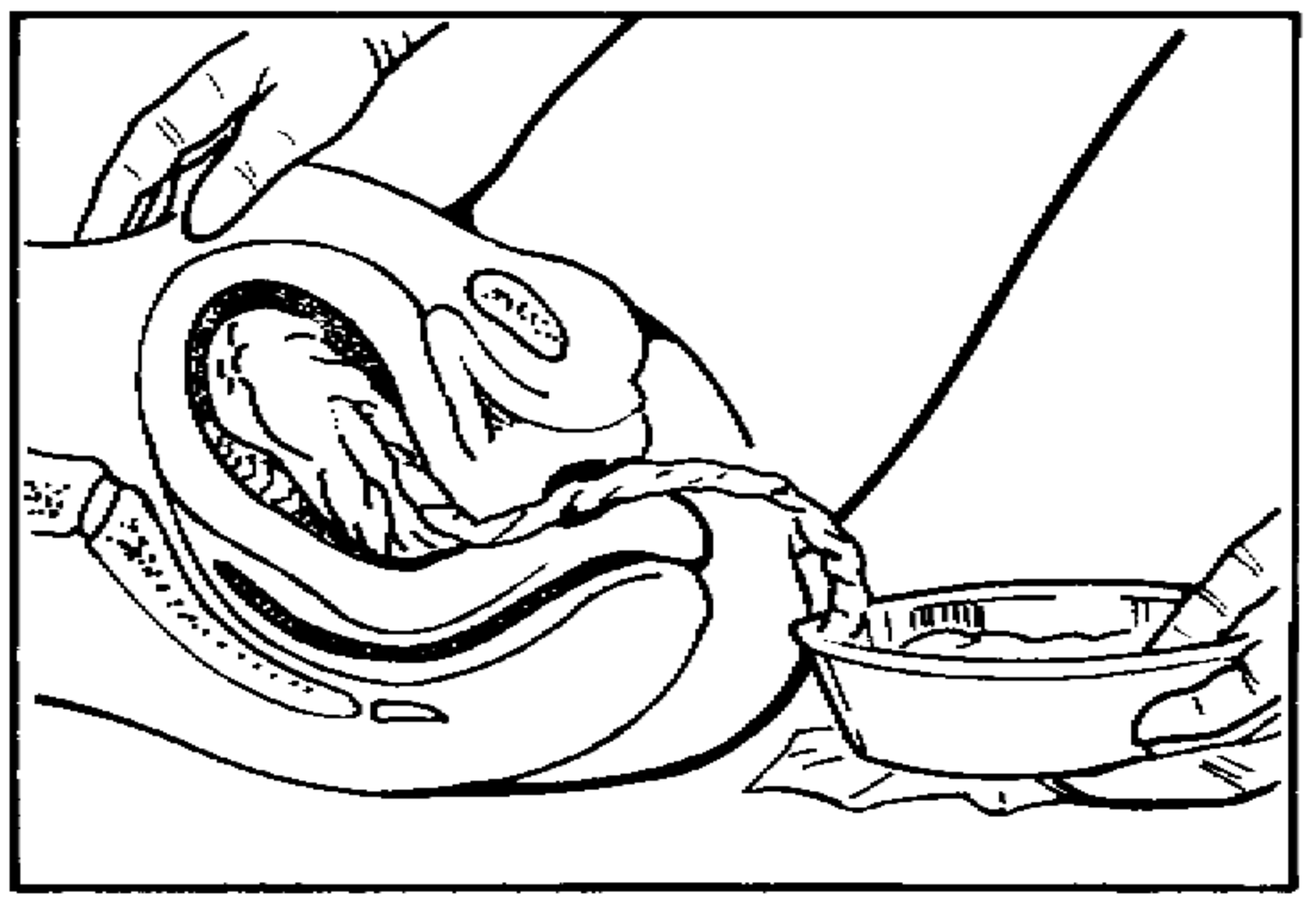


Figure 15-6. Delivery of the placenta.

(5) Is the baby's head presenting and visible through the vaginal opening (crowning)? The mother should be examined to see if this is occurring. When crowning does occur, the vaginal opening will bulge outward and the presenting part of the fetus will be visible at the opening (see Figure 15-5). Crowning indicates that the fetus is about to be born and that there will not be time to go to the hospital before delivery. The examination is a visual inspection only. If there is enough time to transport the patient to the hospital, she should be placed in a reclining position. Any underclothing that may obstruct delivery should be removed. You should:

- Never allow the mother to go to the toilet.
- Never hold the mother's legs together.
- Never attempt to delay or restrain delivery in any way.

To do so can result in the death of both the mother and the baby.

c. The patient should be positioned on her back and made as comfortable as possible. Make the environment as clean as possible using a clean sheet, articles of clothing, and/or newspaper. If available, a folded sheet drape should be placed under her buttocks. She then should bend her knees and spread her thighs apart as shown in Figure 15-7. As soon as the medical specialist and the assistant finish positioning the mother, the assistant should start an intravenous (IV) line of lactated Ringer's solution at TKO (to keep open) rate. You should move to the mother's head and be prepared to turn it to the side if she vomits. An oxygen tank and suction apparatus should be available, if possible.

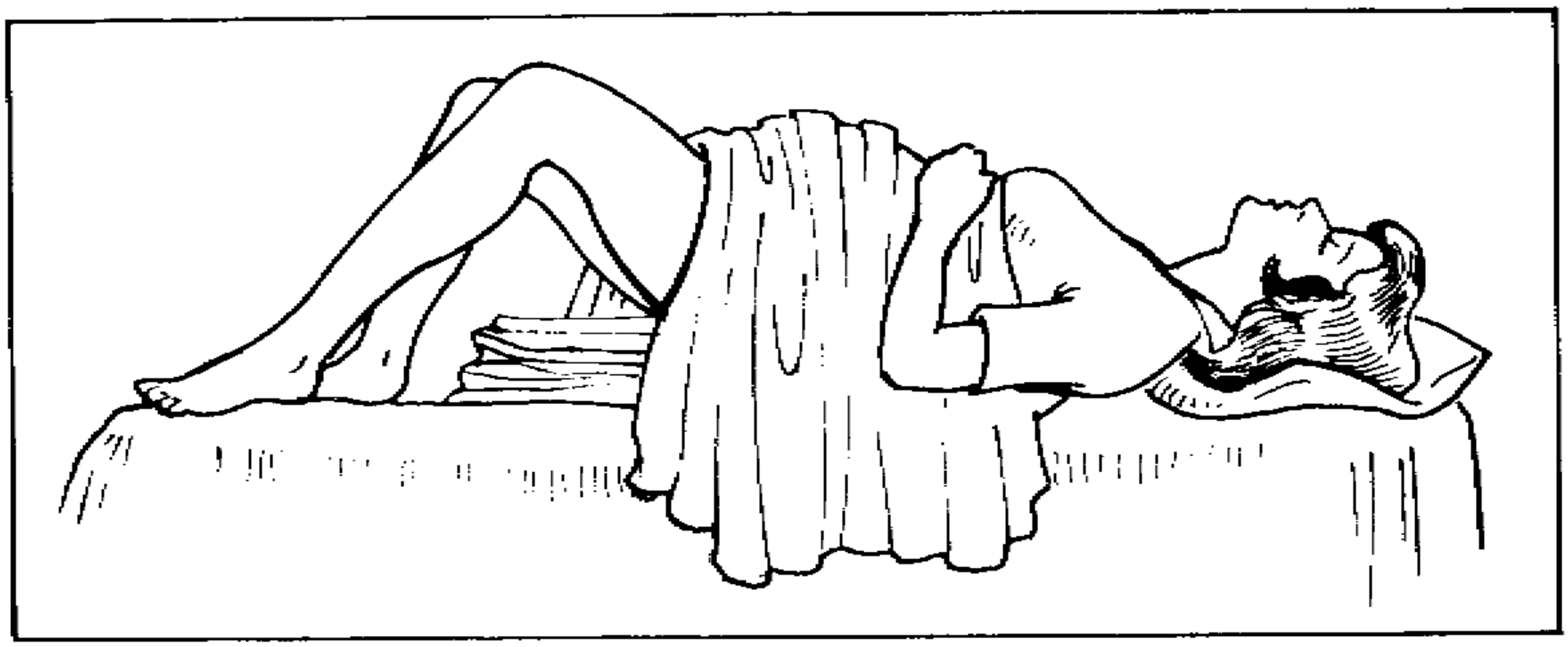


Figure 15-7. Mother in birth position.

d. Hands should be washed thoroughly before the obstetrical (OB) kit is opened (if an OB kit is available). Betadine scrub solution should be kept with the kit for this purpose. The OB kit should be opened and you should put on sterile gloves. The mother should be draped with four towels so that everything except the vaginal opening is throughly covered. If the baby is

coming fast, it is more important for you to assist in the delivery than to put on drapes or gloves. You should encourage the mother to relax and to take slow, deep breaths through her mouth and should continue to reassure her and explain everything that is being done.

e. Your role is to assist the mother in the delivery. You do not actually deliver the baby or pull the baby out. The baby is born with the assistance of the mother; you guide it and support it as it passes through the vagina (birth canal) and is born.

f. When the baby's head begins to emerge from the vagina, it should be supported gently to prevent explosive delivery. The head is the largest part of the baby's body; once the head is born, the rest will come out almost spontaneously. This procedure is illustrated in Figure 15-8.

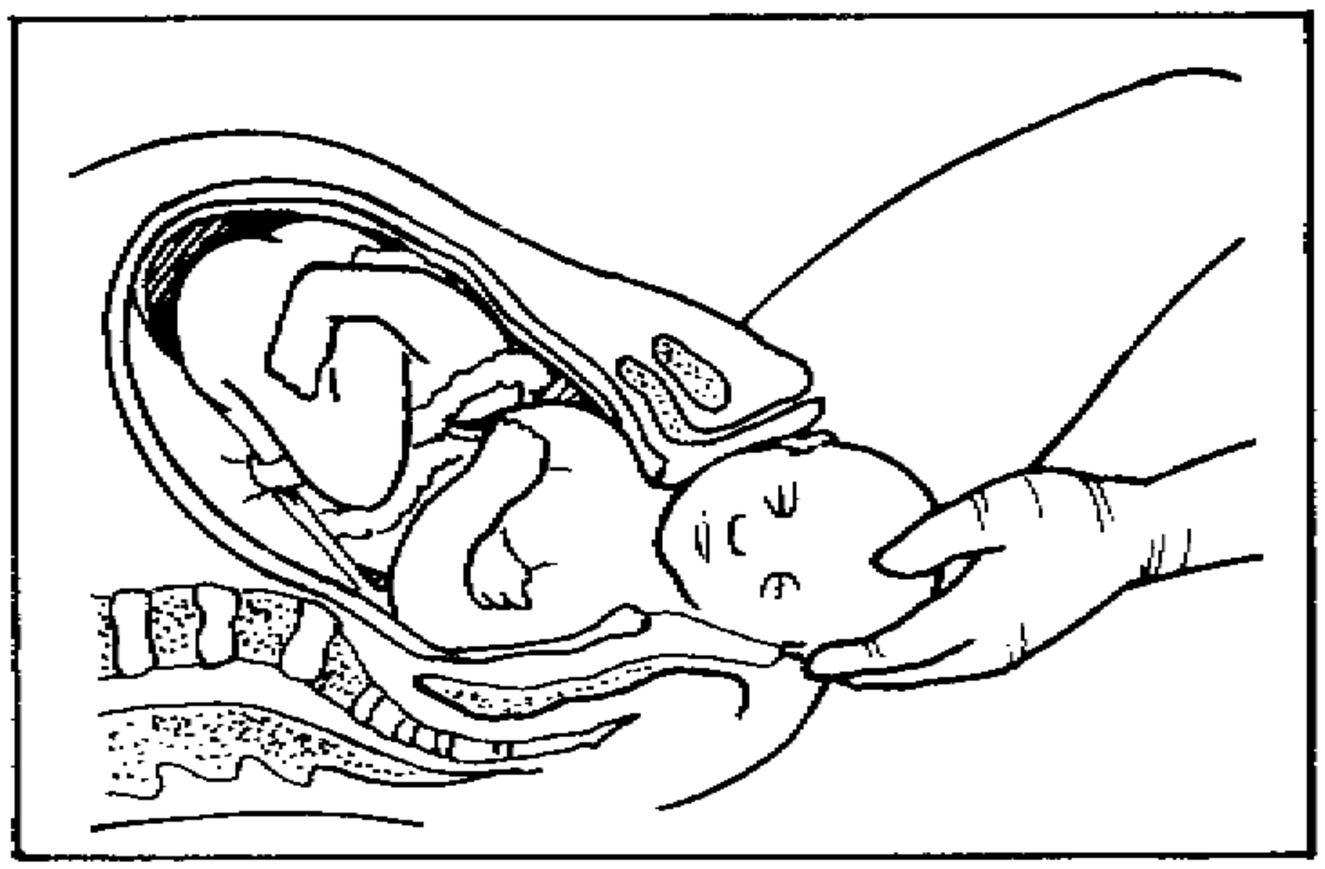


Figure 15-8. Support baby's head at birth.

g. You should never attempt to pull the baby from the vagina. If the membranes cover the head after it emerges, the amniotic sac should be torn with fingers or forceps and removed from the infant's face to permit the amniotic fluid to escape, enabling the infant to breathe.

CAUTION

ANY INSTRUMENT TO TEAR THE AMNIOTIC SAC SHOULD BE USED WITH EXTREME CARE.

h. You must be sure the umbilical cord is not wrapped around the infant's neck; if so, it should be slipped gently over the shoulder or head as illustrated in Figure 15-9.

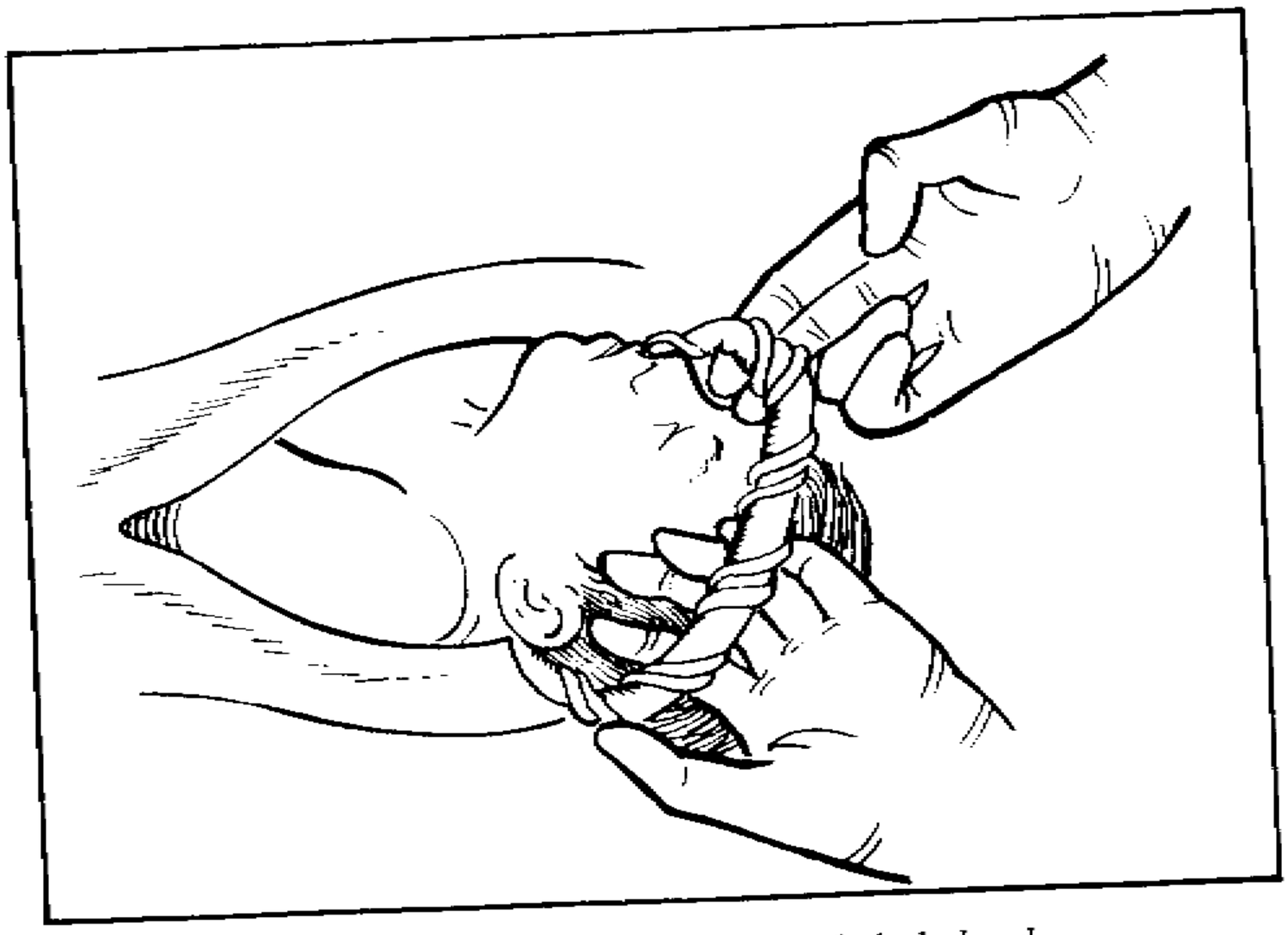


Figure 15-9. Slipping cord over baby's head.

i. If this maneuver fails and the cord is still wrapped tightly around the baby's neck, umbilical clamps (or tie off with a string) should be placed rapidly on the cord 2 inches apart and the cord should be cut between the clamp or string to release pressure from the infant's neck (Figure 15-10).

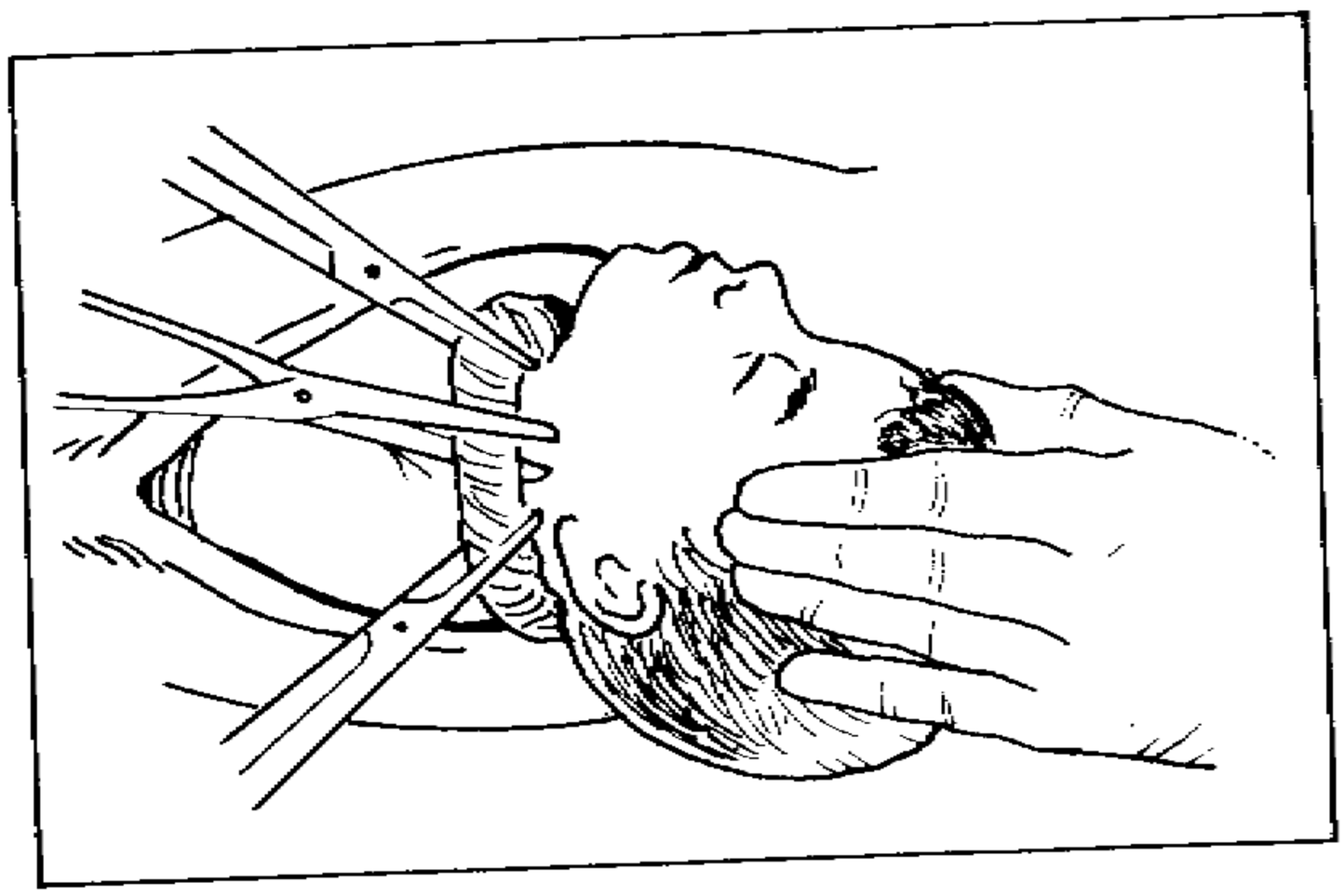


Figure 15-10. Cutting the cord.

j. Continue to support the head as the shoulders emerge (Figure 15-11).

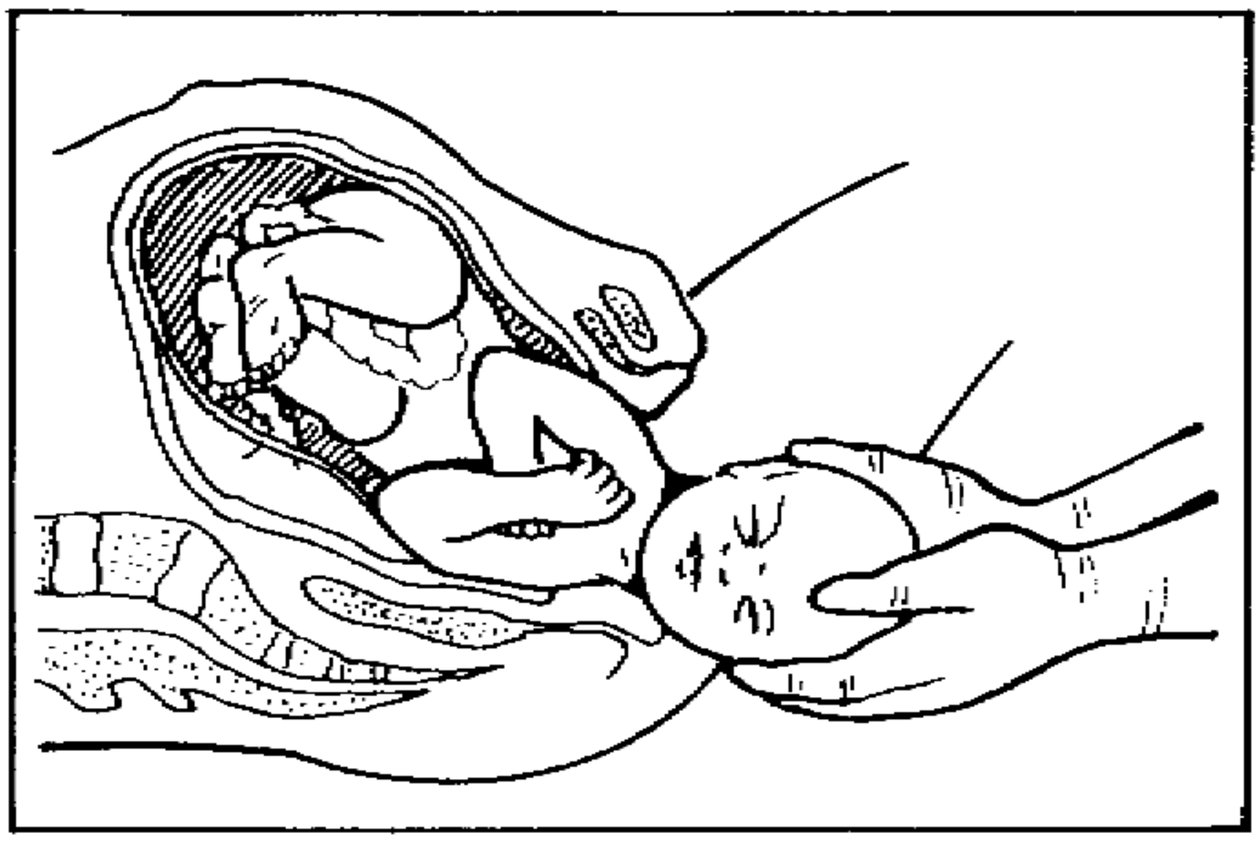


Figure 15-11. Supporting the head as shoulders emerge.

k. The shoulders and body should be delivered as shown in Figures 15-12A and 15-12B. You should avoid touching the mother's anus during delivery.

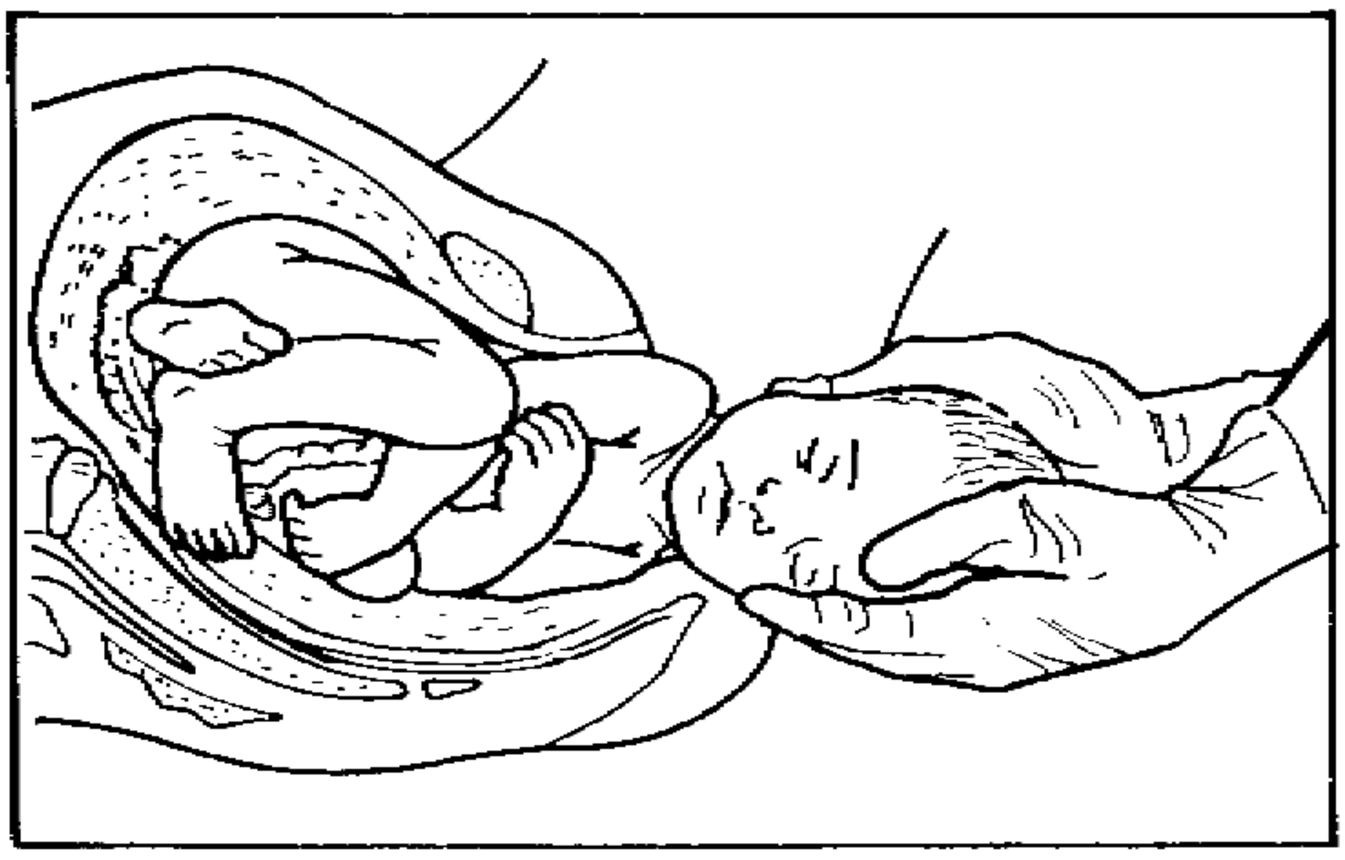


Figure 15-12A. Assisting in delivery of shoulders.

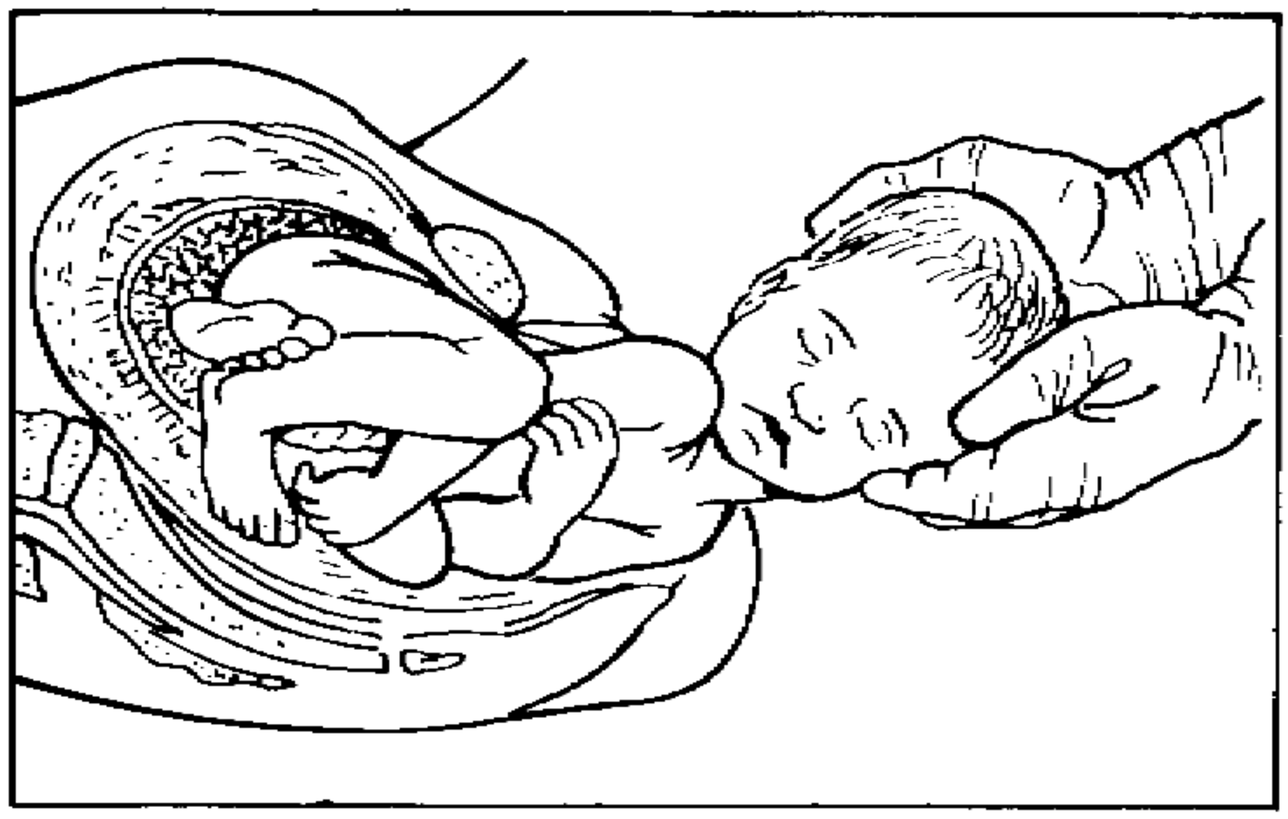


Figure 15-12B. Assisting in delivery of shoulders.

l. The time of birth should be recorded.

m. After the baby is fully delivered, it should be supported along the length of your arm, with one arm and shoulder supported by your cupped fingers. The infant's head should be held downward to aid in drainage (see Figure 15-13). Wrap the baby in a clean blanket, article of clothing, or newspaper to keep the infant warm. It is essential to prevent heat loss from the infant.

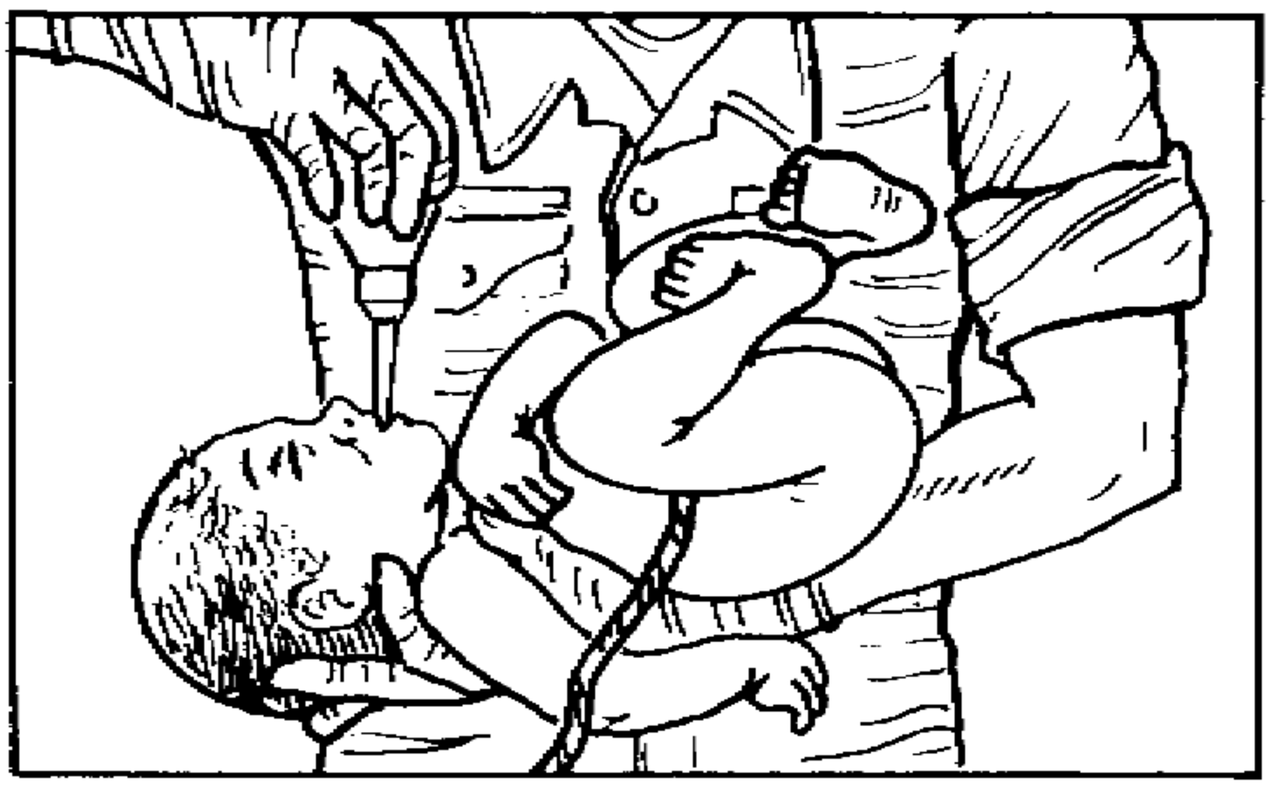


Figure 15-13. Post-delivery action.

n. Newborn infants must be held carefully because they are slippery. Blood and mucus from the nose and mouth should be wiped away with a piece of sterile gauze. The mouth and both nostrils should be suctioned with a bulb aspirator. You should squeeze the bulb before inserting the tip of the aspirator and then place the tip in the mouth or nostrils and release the bulb slowly. This procedure is illustrated in Figure 15-13. Clear the bulb syringe of its contents and repeat suctioning the infant as often as needed.

c. If the baby does not breathe spontaneously, you should stimulate the infant by rubbing the back gently or slapping the sole of the feet. If there is still no response, you should start mouth-to-mouth or mouth-to-nose resuscitation, remembering that newborn infants are very little and require very small puffs of air. Mechanical resuscitation devices should never be used on a newborn infant. If spontaneous breathing begins, 5 liters of oxygen (0_2) should be administered by mask for a few minutes until the baby's color is pink. If breathing is still absent, however, and no precordial (atrium) pulse can be determined with the stethoscope, cardiac compression should be started and cardiopulmonary resuscitation (CPR) should be continued en route to the medical treatment facility (MTF). The baby should be kept wrapped in a blanket as much as possible.

15-5. Care of the Umbilical Cord

a. If the infant has been delivered normally and is breathing well, the cord should be clamped about 6 inches from the infant's navel with two clamps set 3 inches apart as shown in Figure 15-14.

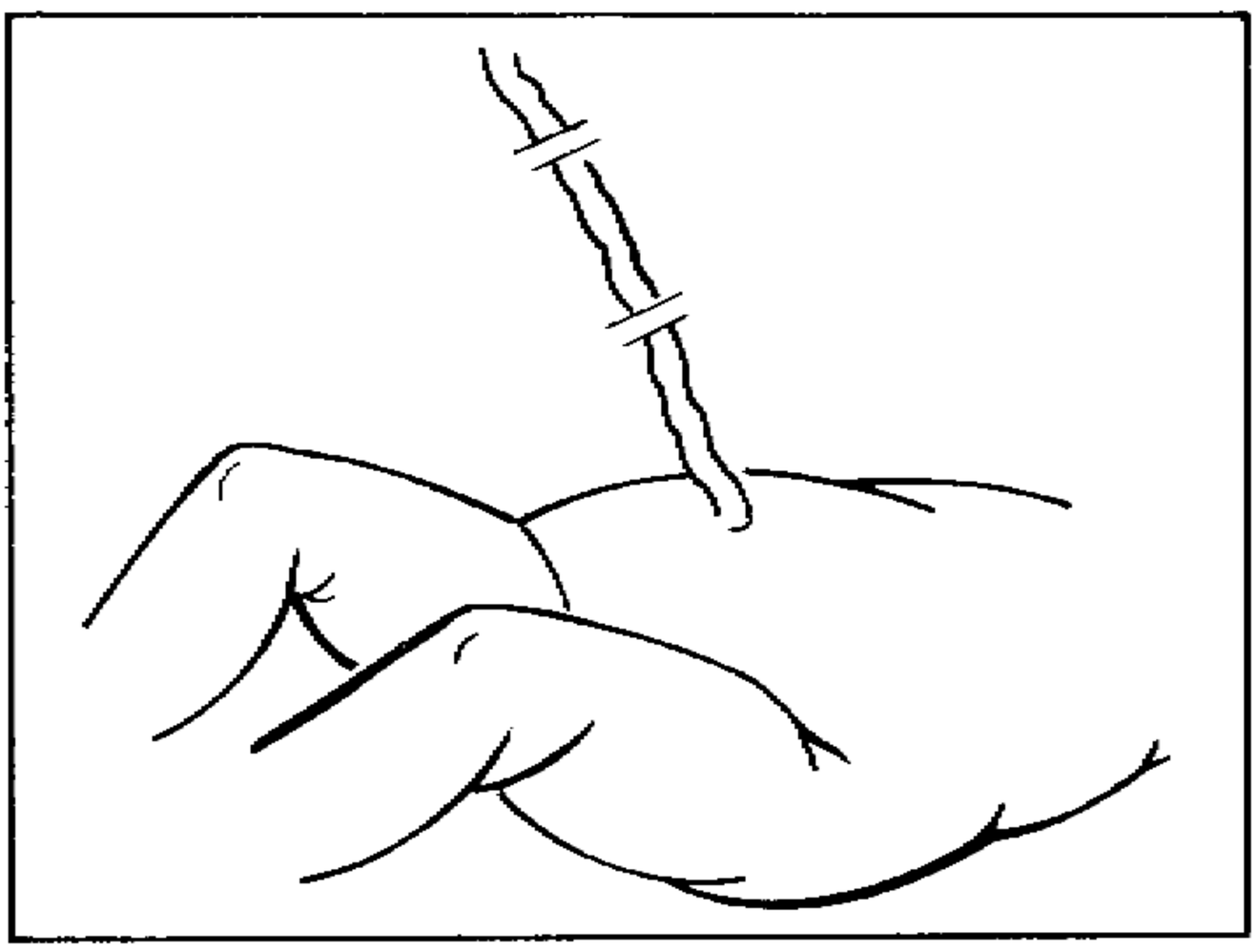


Figure 15-14. Tying off the umbilical cord.

b. If clamps are unavailable, two umbilical ties can be substituted. The cord should be cut between the two ties and handled gently because it will tear easily. The end of the cord that is attached to the infant must be examined to be certain there is no bleeding. If there is bleeding from the cut end, the cord nearest the clamp should be tied and re-examined. The baby should then be wrapped in a sterile blanket to maintain body temperature.

15-6. The Placenta

a. The third stage of labor is the delivery of the placenta and membranes (afterbirth). One individual should stand at the mother's head and keep an eye on the infant, while you tend to the delivery of the placenta. The placenta usually is delivered spontaneously within 15 to 30 minutes after the infant's birth (Figure 15-6).

b. Bleeding can be expected as the placenta separates from the uterine wall. When vaginal bleeding occurs, the uterus should be gently massaged as shown in Figure 15-15. The uterine massage will stimulate the uterus to contract, thus constricting blood vessels within its walls and decreasing bleeding. Allowing the infant to nurse following the delivery of the placenta will control bleeding because nursing stimulates the release of oxytocin. Oxytocin, in addition to causing milk ejection, stimulates uterine contraction which constricts uterine blood vessels.

c. *You should never pull the umbilical cord* to deliver the placenta. Pulling can invert the uterus (cause it to turn inside out). When the placenta is delivered, it should be *placed in a basin, towel, or plastic bag and taken to the medical treatment facility* where it will be examined for completeness. This procedure is necessary because pieces of placenta retained in the uterus cause persistent bleeding.

d. The perineum (the skin between the anus and the vagina) should be examined for lacerations, and pressure applied to any bleeding tears with a sanitary napkin. A sanitary napkin should be placed over the vagina and the mother's legs lowered; she then should be prepared for transport to a medical treatment facility. *If the physician orders it,* an IV line of lactated Ringer's solution may be started. Ten units of oxytocin (Pitocin) may be added to the IV solution and administered at the prescribed rate of flow.

e. If the placenta is not delivered within 15 to 30 minutes after the baby is delivered, the mother and baby should be transported without delay to a medical treatment facility so a physician can remove it. If the placenta does not deliver and there is heavy bleeding, do not wait at all, but transport the mother and baby immediately.

f. If the mother is hemorrhaging, do the following things during transport:

(1) Place the mother in the shock position with the legs elevated and keep her warm.

(2) Give oxygen (O_2), if available.

(3) Place a sterile pad (sanitary napkin) over the vaginal opening. DO NOT put anything into the vagina.

(4) Gently massage the mother's lower abdomen as shown in Figure 15-15 to cause the uterus to contract and expel the placenta. You will feel a grapefruit-sized object, which is the uterus. DO NOT push the uterus toward the vagina, but rub it with a light circular motion. You will be able to feel it contract and become firm.

(5) If the baby is in good condition, place the baby at the mother's breast to encourage it to nurse. Breast stimulation will help the uterus to contract and thereby reduce bleeding.

g. Normally, after the placenta and membranes are expelled, there is a loss of about ½ pint of blood. *Always* take the placenta to the medical treatment facility for a doctor to examine so that he can be sure none of it is left in the uterus. Even a small part of it retained in the uterus can cause continued bleeding and infection.

h. After the placenta and membranes are expelled, put a sterile pad over the vaginal opening. Lower the mother's legs and support them together. Normally, nothing more will be passed from the vagina. Care should be taken to insure the mother, baby, and placenta arrive at the medical treatment facility safely.

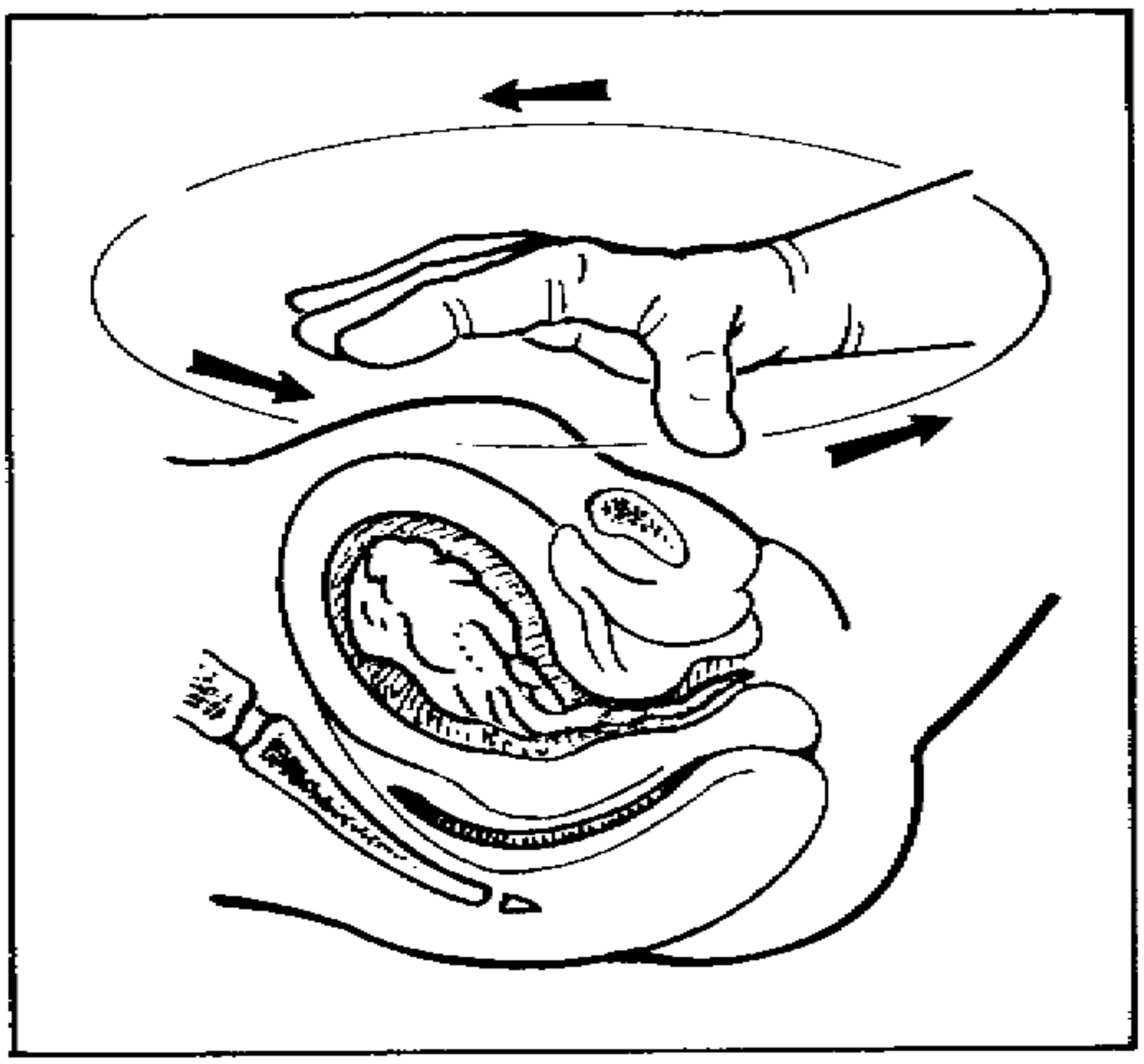


Figure 15-15. Massaging the uterus.

15-7. Complications of Delivery

a. Three types of problems that can accompany delivery will be discussed in this section:

- Postpartum hemorrhage.
- Uterine inversion.
- Pulmonary embolism.

You should be prepared to treat each of these situations as it occurs.

b. *Postpartum hemorrhage* occurs after delivery and is characterized by internal or external bleeding.

(1) Internal bleeding may be caused by—

- Retained placental tissue.
- Inadequate uterine contractions.
- Clotting disorders.

If bleeding is severe, uterine massage as shown in Figure 15-15 should be continued and the baby should be allowed to nurse. You can add 10 units of oxytocin (Pitocin) to the IV solution of lactated Ringer's and administer at the prescribed rate of flow. If bleeding persists, the circulation can be supported with an IV line of normal saline, lactated Ringer's solution, or plasma derivative. The patient should be transported rapidly to a medical treatment facility and the usual measures for shock should be applied. *Vaginal examination or blind packing of the vagina should be avoided.* Gentle uterine massage should be continued en route to the hospital.

(2) External bleeding is bleeding from perineal tears and can be managed with firm pressure. It may be essential to open the labia to apply packs to the bleeding site.

c. Inversion or turning inside out of the uterus can occur as a result of excessive pressure on the uterus or from pulling on the umbilical cord in an effort to deliver the placenta. Shock commonly accompanies *uterine inversion.* Should this condition occur in the field, you should perform the following procedures:

(1) Keep patient flat.

(2) Administer oxygen (O_2), if available.

(3) Start two IV lines with Ringer's solution or colloid, running them as fast as necessary to maintain blood pressure (B/P).

(4) Never try to remove the placenta if it is still attached. Try once to replace the uterus manually by exerting pressure first on the area closest to the cervix. If the uterus cannot be replaced easily, pack all protruding tissues lightly with moist, sterile towels, and move the patient rapidly to a medical treatment facility.

d. Sudden dyspnea, trachypnea, trachycardia, and/or hypotension in the deliverying or delivered mother can signal *pulmonary embolism*, either from a blood clot or from amniotic fluid. Field treatment is the same as for any patient with pulmonary embolism and includes administration of oxygen, electrocardiogram monitoring, and rapid transport to a medical treatment facility.

15-8. Abnormal Deliveries

Deliveries in which the fetal head does not present first are classified as abnormal deliveries. Three abnormal presentations will be discussed in this section.

- Breech presentation.
- Prolapsed umbilical cord.
- Limb presentation.

These three situations can be potentially life threatening to the infant and you should become familiar with the special problems of each emergency situation.

a. Breech Presentation. Breech presentation occurs when the buttocks rather than the head present first. Breech delivery is not simple. If delivery is imminent, the mother should be prepared as discussed earlier and the buttocks and trunk of the baby should be allowed to deliver spontaneously (Figure 15-16). Once the legs are clear, the baby's body should be supported on the palm of the hand and the anterior surface of the arm, thus allowing the head to deliver. If the head is not delivered within 3 minutes, action must be taken to prevent suffocation of the baby. Suffocation can occur when the baby's face is pressed against the vaginal wall or when the umbilical cord is compressed by the baby's head in the vagina. To establish an airway for the baby, you should—

(1) Place a gloved hand in the vagina, positioning the palm toward the baby's face.

(2) Form a "V" with the fingers on either side of the baby's nose.

(3) Push the vaginal wall away from the baby's face until the head is delivered.

(4) To relieve pressure on the umbilical cord, use one of the techniques listed below:

(a) Place the patient in a Trendelenburg (supine) position.

(b) Place a gloved hand inside the vagina with fingers separated and allow the cord to pass through the opening created by the fingers between the cervical side wall and the baby's head.

(5) *Never try to pull the baby out of the vagina or allow an explosive delivery.* If the head DOES NOT deliver within 3 minutes after an airway has been established, the mother should be placed in a supine position and transported immediately to the nearest medical treatment facility. *The baby's airway should be maintained throughout transport.*

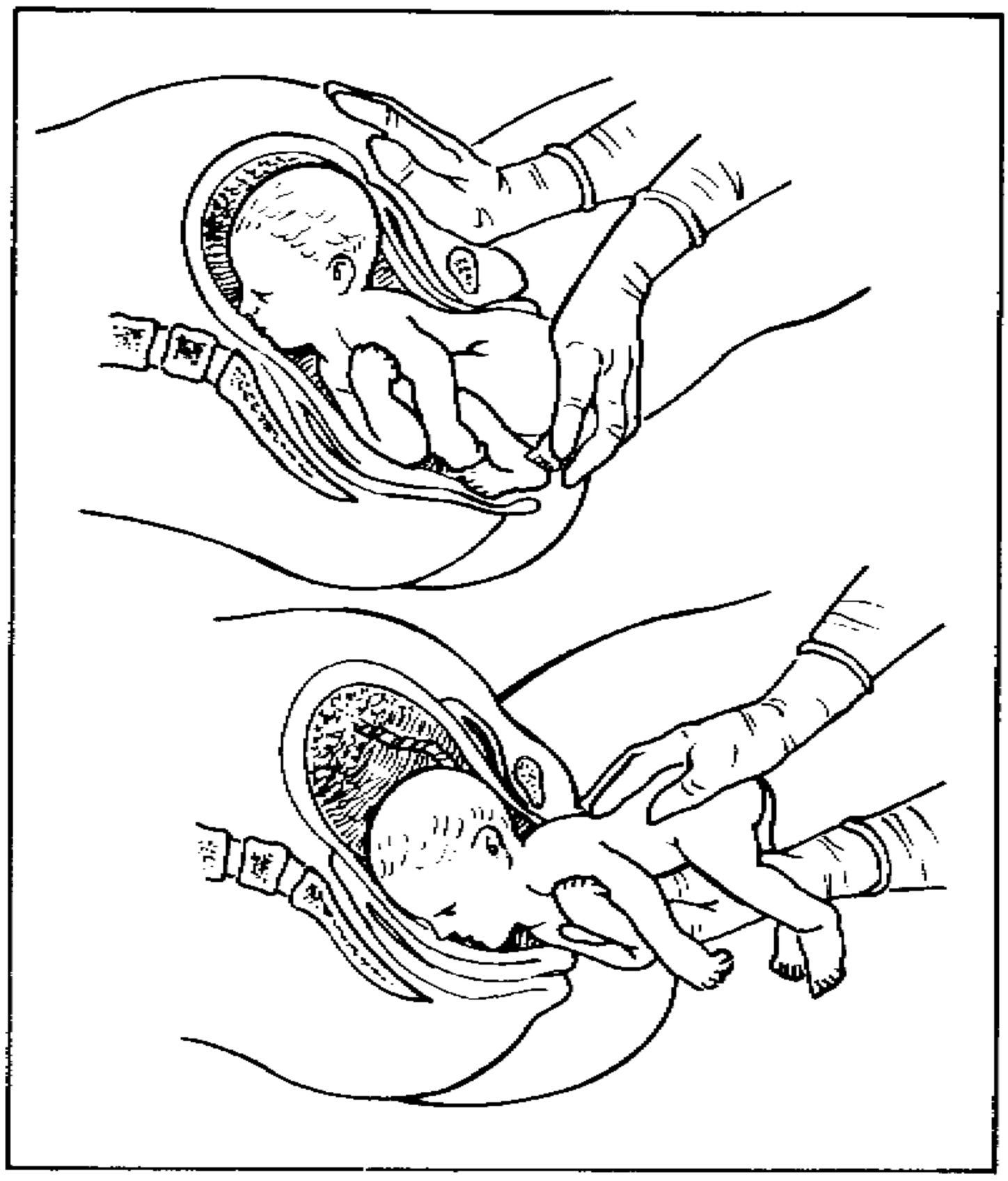


Figure 15-16. Breech presentation.

b. Prolapsed Umbilical Cord. Prolapsed umbilical cord occurs when the cord comes out of the vagina before the baby as shown in Figure 15-17. The baby is in danger of suffocation; therefore, you should do the following:

(1) Immediately place the mother into Trendelenburg's or knee-chest position.

(2) Administer oxygen to the mother, if available.

(3) Keep the mother warm.

(4) With the gloved hand in the vagina, gently elevate the baby's head or presenting part to relieve pressure on the cord. Once this is done, do not withdraw your hand. You must keep pressure off the cord until delivery of the baby (see Figure 15-18).

(5) *NEVER* attempt to push the cord back, or reposition the cord.

(6) Transport the mother and the baby to the hospital at once while elevating the baby's head. The pressure should be evenly distributed to avoid injury to the baby's soft skull.

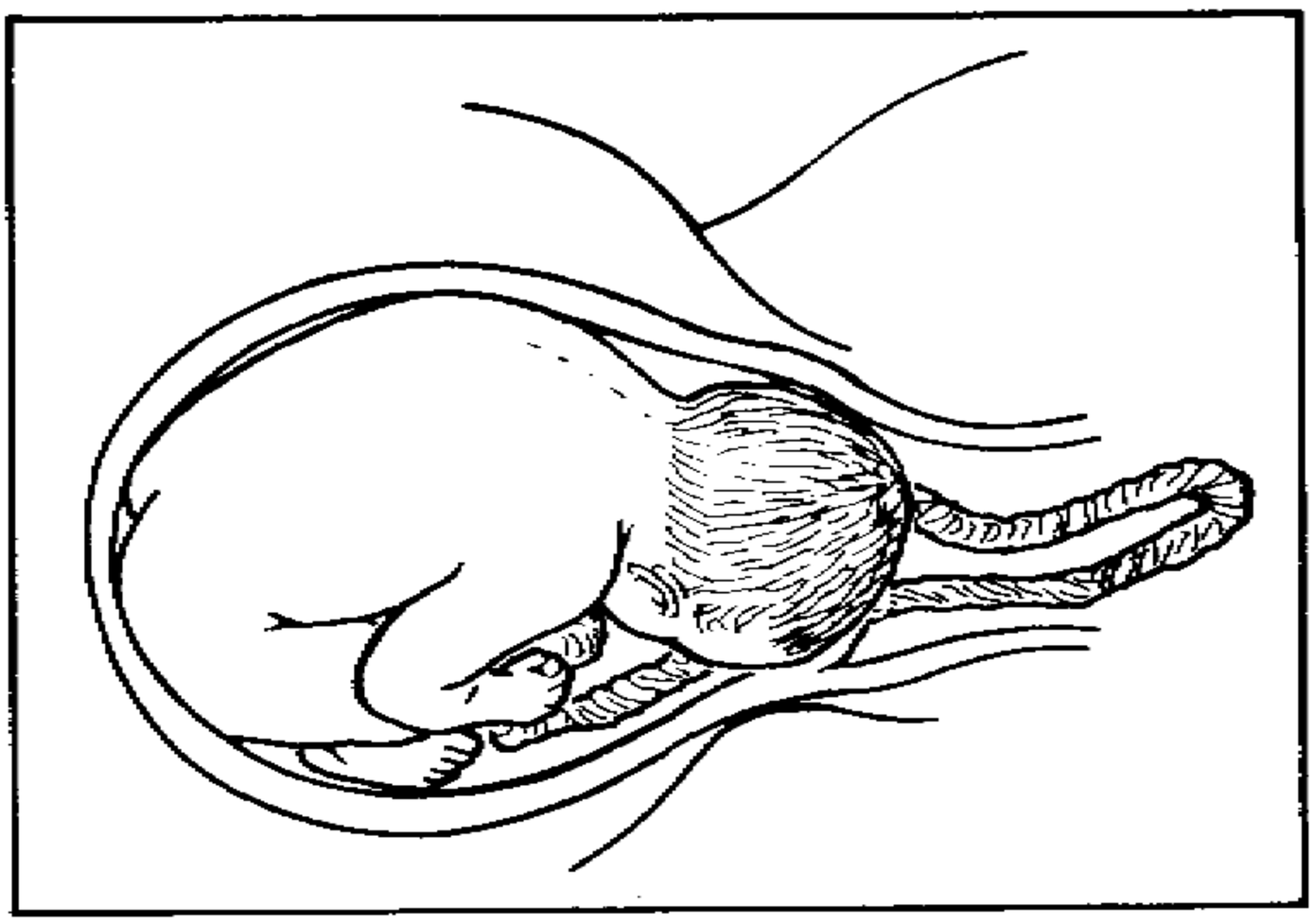


Figure 15-17. Prolapsed umbilical cord.

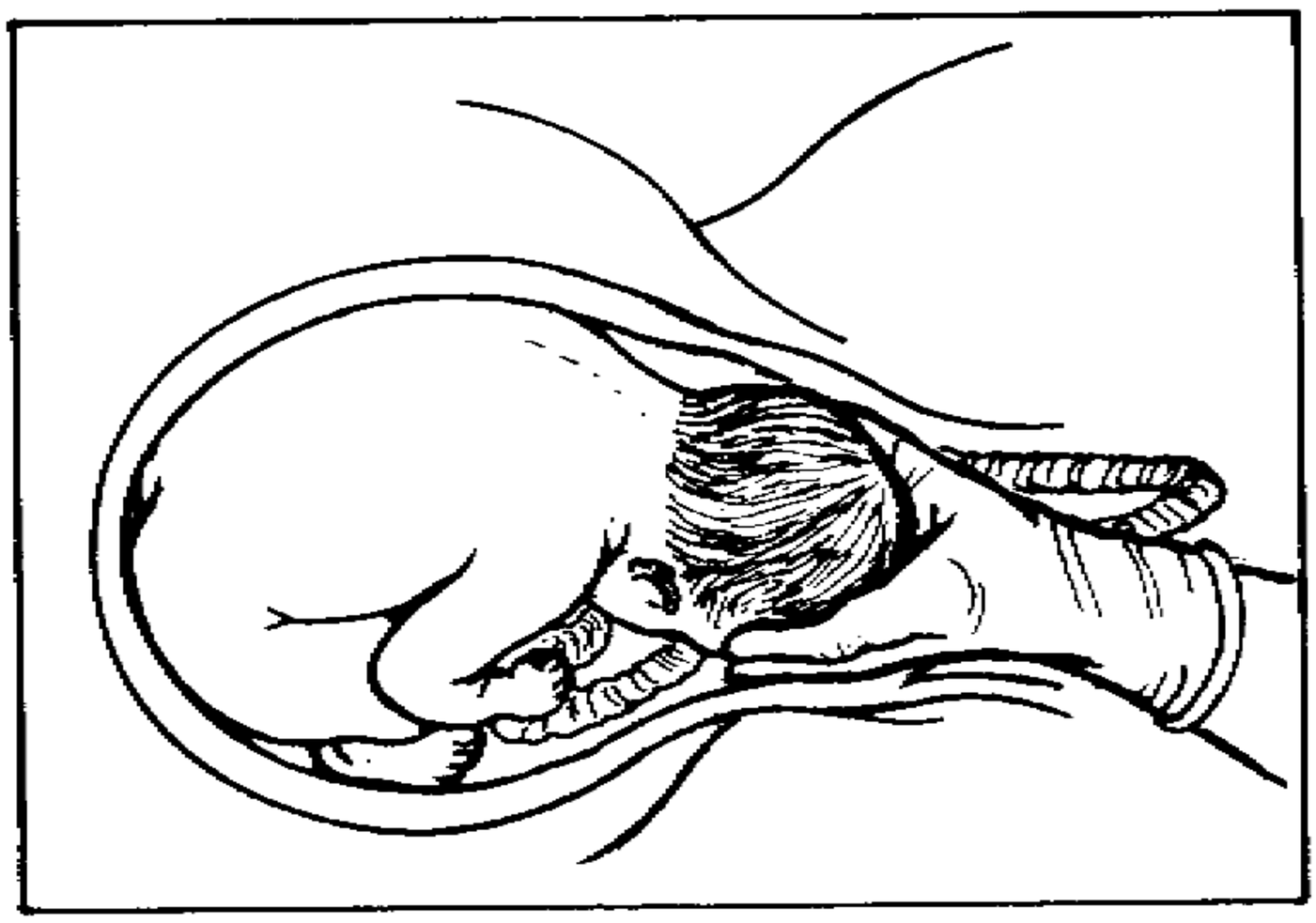


Figure 15-18. Initial corrective action—prolapsed cord.

NOTE

Breech presentation and prolapsed umbilical cord are the only two circumstances in which the medical specialist should place his hand in the mother's vagina.

c. Limb Presentation. The presentation of an arm or leg through the vagina is an indication for immediate transport to the nearest medical treatment facility—the only place where such a delivery should be attempted.

15-9. Multiple Births

Multiple births usually do not present any unique problems. Twins are delivered in the same manner as single babies. Twins should be expected if the mother's abdomen appears unusually large, or if it remains large after the first baby is delivered. If twins are expected, the mother should be transported to the nearest medical treatment facility as rapidly as possible consistent with the mother's safety. The cord should be tied to prevent hemorrhage from the twins after the first baby is born. The mother should be transported to the nearest medical treatment facility for the delivery of the second twin if the second baby is not delivered within 10 minutes of the first. Twins are usually smaller than single births, like premature infants, and need special protection against a fall in body temperature. It is very important that the twins be kept warm during transport to the nearest medical treatment facility.

15-10. Premature Births

a. Premature birth is defined as any baby born after 19 weeks but before 37 weeks of pregnancy. Low birth weight infants weigh less than 5.5 pounds (2.500 grams) and may also be premature. Premature births need special care. Birth weight alone is not an adequate definition for prematurity because low birth weight infants may be fully mature. Premature babies may be over 5.5 pounds (2,500 grams) if they are edematous, or if the mothers are diabetic. To distinguish premature from mature infants, you should observe the creases on the soles of the baby's feet, the breast size, type of scalp hair, and presence or absence of cartilage in their outer ears. Premature infants develop problems because they are so small and their organs are immature. Premature infants have trouble maintaining a normal body temperature because they have more surface area relative to their size than older infants and, therefore, lose heat more rapidly in a cool environment; they also have less subcutaneous fat to insulate them against heat loss.

b. Small blood losses are also more serious in premature infants because of their small size. The 5.5 pound infant has a total blood volume of about 275 milliliters (ml). Therefore, 30 ml blood loss represents 10 percent of the infant's total blood volume.

c. Premature infants often develop respiratory problems because their lungs are immature. Alveoli and alveolar capillaries begin developing at 28 weeks gestation. Surfactant, which lowers alveolar surface tension and allows even expansion of the alveoli, develops at about 28 weeks gestation.

d. Hypoxemia due to respiratory problems leads to cardiovascular problems in the premature infant. Before birth, blood is shunted past the lungs and oxygenated in the placenta. After birth, special mechanisms change the blood flow pattern so that blood is oxygenated in the lungs. These special mechanisms, however, depend on adequate oxygenation of the blood by the lungs. When oxygenation is inadequate because of lung immaturity, blood continues to be shunted past the lungs. This worsens the hypoxemia.

Hypoxemia, because of respiratory and cardiovascular problems, produces cyanosis and leads to bradycardia and hypotension. Bradycardia in newborn infants is a heart rate less than 100 beats per minute.

e. The premature infant also does not tolerate asphyxia that normally occurs during labor and delivery as well as the full term infant. The mature infant survives some asphyxia during labor and delivery by metabolizing liver and heart glycogen stores. The premature infant has less stored glycogen and, therefore, is less able to tolerate asphyxia.

f. To manage the premature infant, you should—

(1) Keep the baby warm; wrap the baby in aluminum foil and blankets to reduce heat loss (Figure 15-19).

(2) Keep the baby's mouth and nose clear of fluid with a bulb syringe.

(3) Prevent bleeding from the umbilical cord because these infants cannot tolerate the loss of even small amounts of blood.

(4) Give oxygen (if available) into a tent constructed from aluminum foil above the infant's head. *DO NOT BLAST it directly into the infant's face.*

(5) Prevent contamination because premature infants are highly susceptible to infection.

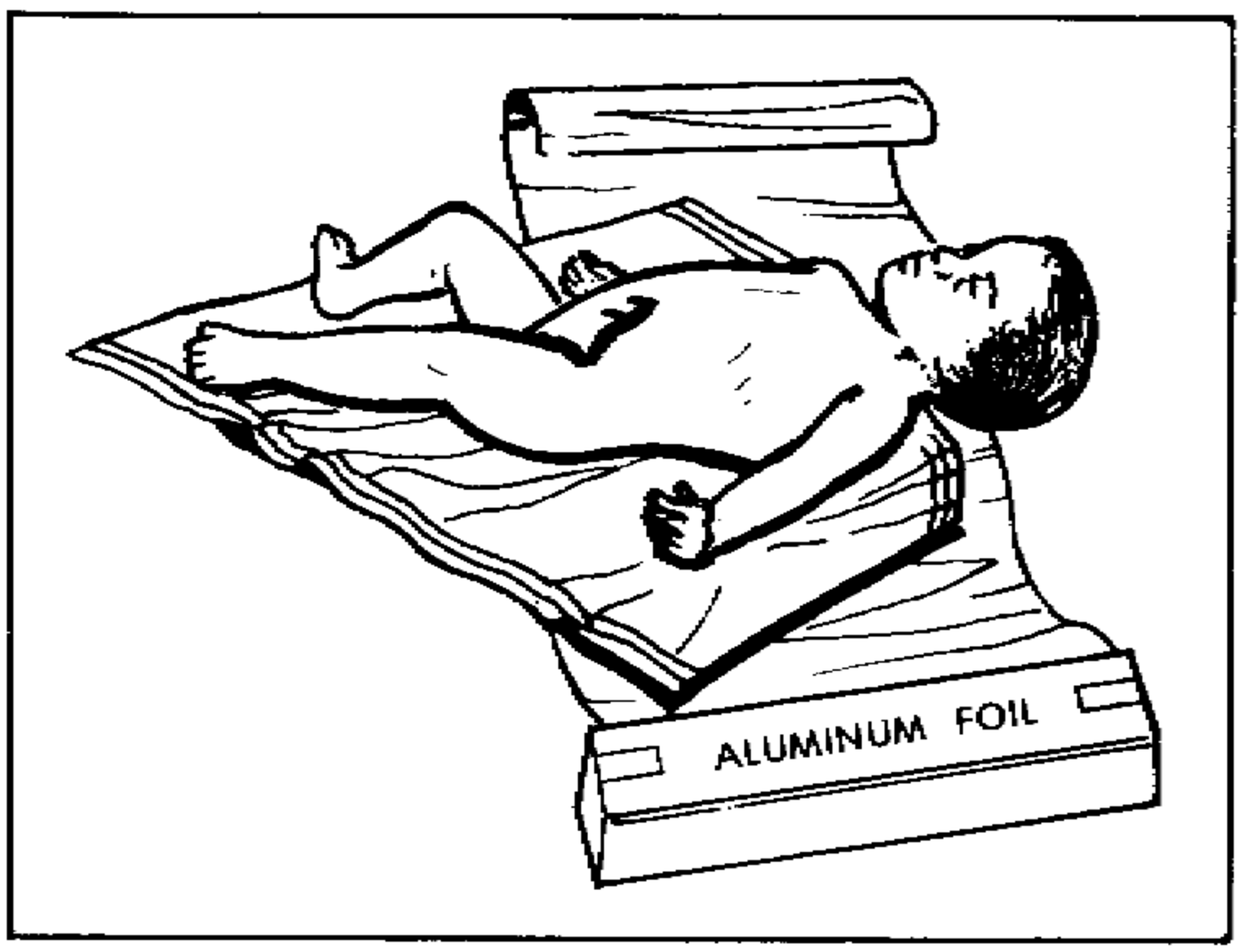


Figure 15-19. Premature infants need special care.

15-11. APGAR Scoring

It is essential for the newborn to be completely evaluated immediately after birth to determine adequacy of vital function. The scoring system is based on heart rate, respiratory effort, muscle tone, reflect irritability, and color. Sixty seconds after the birth of the infant, these five signs are evaluated and each given a score of 0, 1, or 2. When added together, numerical ratings yield a total score of 10. The total score of 10 indicates that the infant is in excellent condition. The majority of infants are vigorous and have a total score of 7 to 10; they cough or cry within seconds of delivery and require no further resuscitation. Infants with a score in the 4 to 6 range are moderately depressed. They may be pale or blue 1 minute after delivery with poorly sustained respiration and flaccid muscle tone. Such infants will require some form of resuscitation. In the APGAR scoring, the five signs to be evaluated are most easily remembered by using the acronym APGAR as shown in Table 15-1.

Table 15-1. APGAR Scoring System

		Score (points given according to status)		
Clinical Signs		**0**	**1**	**2**
A—	Appearance (color)	Blue, pale	Body pink, extremities blue	Completely pink
P—	Pulse (heart rate)	Absent	Slow or less than 100 beats per minute	Greater than 100 beats per minute
G—	Grimace (reflex irritability)	No response	Grimace reflex irritability)	Cough or sneeze
A—	Activity (muscle tone)	Limp	Some flexion of extremities	Active motion
R—	Respiration (respiratory effort)	Absent	Slow, irregular	Good crying

15-12. Delivery Without Sterile Supplies

At times it is necessary to assist a patient in delivering a baby when proper equipment and supplies are not available. The technique described below will be useful under those circumstances.

a. Place the mother on a firm surface on her back as shown in Figure 15-7, with her knees up, her feet flat on the surface, and her legs spread apart. The mother's head and shoulders should be propped up with one or two pillows. Lift the buttocks about 2 inches above the table surface by placing a pad (newspaper, sheets, or blankets) under the buttocks.

b. Clean sheets and towels which have not been used since previous laundering are safe and may be used for preparing the patient. Sheets and newspaper should be spread around the delivery area to help mop up the large quantities of amniotic fluid that will be released during birth.

c. Your hands should be washed as thoroughly as possible. Conduct the delivery of the baby as if gloves were available. As soon as the baby is born, turn the head to one side and use a clean finger to finger sweep (wipe) out the baby's mouth, taking precaution not to induce vomiting (Figure 15-20).

d. *DO NOT* tie or clamp the cord with string, shoelaces, or the like, and *DO NOT CUT THE CORD.* Keep the baby at the side of the mother's buttocks at the same level or below the entrance of her vagina but out of the pool of amniotic fluid and blood. As soon as the placenta is delivered, wrap it in newspaper or a towel, leave it attached to the baby, and place it with the baby who can now be moved. The placenta always should be slightly above the baby. This can be accomplished by placing it on folded blankets or towels stacked beside the infant. The mother, baby, and the placenta can now be transported as safely and as rapidly as possible to the nearest MTF.

e. The baby must be kept warm. If necessary, wrap it in an article of clothing or whatever is available. In case of hemorrhage by the mother, the baby should be put to the breast and the uterus gently massaged as described in Figure 15-15.

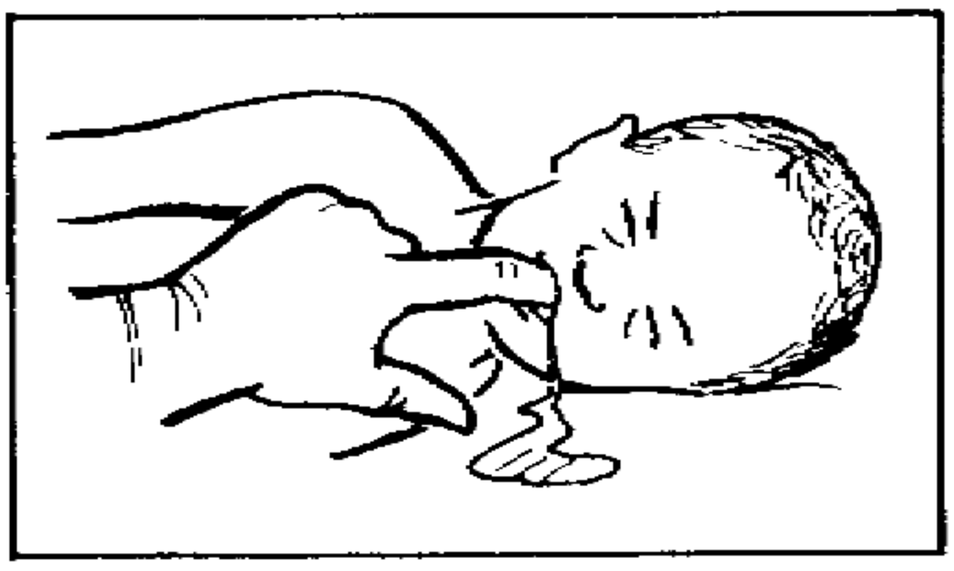


Figure 15-20. Finger sweep.

Section III. PATHOPHYSIOLOGY AND MANAGEMENT OF GYNECOLOGIC EMERGENCIES

15-13. General

In general, there is little that you can do to treat gynecologic emergencies in a field environment. Most common gynecologic emergencies require the attention of a physician or the use of specialized treatment resources not found in the aid bag or emergency vehicle. However, you can greatly aid the physician and the hospital staff by obtaining an adequate history from the patient.

15-14. Abdominal Pain

A gynecologic problem, that is, a problem related to the female reproductive organs, should be suspected in any woman who complains about abdominal pain. The following questions should be asked to obtain information necessary for possible treatment.

a. When was the patient's last menstrual period? Was it unusual in any way? Has she had any bleeding between menstrual periods or bleeding following menopause?

b. Has she missed a menstrual period? Does she use any form of contraception? Could she be pregnant?

c. Has she had any vaginal discharge? What color was it? Was it foul smelling?

d. Where is the pain located? What is it like (sharp, dull, constant, intermittent)? What makes it better? What makes it worse? Is it made worse by sexual intercourse? How long has it been between the onset of the pain and the last menstrual period?

e. Pelvic inflammatory disease (PID) often results from gonorrhea and is one of the most common sources of abdominal pain in women. The pain is localized to one of the lower quadrants. It may spread to the right shoulder and is often quite severe. In many cases, the pain begins about the time of the menstrual period. It may be accompanied by fever and vomiting. The pain frequently is worsened by sexual intercourse. The patient usually complains of moderate to heavy vaginal discharge. The patient's recent menstrual history is often characterized by missed periods and by bleeding between periods.

f. Physical examination often reveals a very ill-appearing patient. In general, blood pressure is normal and pulse is elevated. Fever may be present. Palpating the abdomen causes moderate to extreme pain and should be done very gently. No treatment in the field is necessary for patients with PID. Such patients should be made comfortable in whatever position they prefer and transported gently to the hospital.

g. Other possible sources of abdominal pain in women include ectopic pregnancy (that is, the fetus growing in a location outside of the uterus, for example, in the fallopian tube), ruptured ovarian cyst, and nongynecologic causes such as appendicitis and cystitis (bladder inflammation). Differentiating these conditions in the field is not vitally important, because management for the most part consists of support and transportation of the patient. Ectopic pregnancies, however, must be distinguished from other causes of abdominal pain as they can lead to hypovolemic shock. Recognition and treatment of ruptured ectopic pregnancies are discussed in paragraph 15-19 below.

15-15. Vaginal Bleeding

a. Vaginal Bleeding with No History of Trauma. In questioning a patient who complains of vaginal bleeding, it is important for you to try to estimate the amount of blood lost. What may seem like an alarming amount to the patient may be clinically insignificant. The patient should be asked how

long she has been bleeding and how many sanitary napkins and/or tampons she has used. You should determine whether the bleeding has been heavier or lighter than during a normal menstrual period, as well as what the patient has used to absorb the blood (towels generally soak up less blood than a sanitary napkin). Blood loss can be assessed further in the physical examination by checking for variations in pulse rate because of change in posture. An increase in pulse rate of more than 20 beats per minute when the patient goes from a supine to a sitting position suggests blood loss greater than one unit. If this finding is positive, you should treat the patient like any other patient in impending shock by:

- Administering oxygen (if available).
- Placing the patient supine with the legs slightly elevated.
- Starting an IV line with lactated Ringer's solution and infusing it rapidly.
- Closely monitoring the vital signs en route to the hospital.

b. Vaginal Bleeding Accompanied by Genital Trauma. Rape or other trauma may result in lacerations of the external female genitalia. Lacerations may be accompanied by heavy bleeding. Usually this bleeding can be controlled simply by applying external pressure over the laceration. Bleeding from the internal genitalia can be massive. It is both useless and dangerous to introduce packs blindly into the vagina in an attempt to control the bleeding. A pack should be used only if bleeding is life threatening, in which case a sterile towel or sterile 2-inch gauze tape should be packed tightly into the vagina. The Military Anti-Shock Trousers (MAST) apparatus will probably not help control bleeding from the internal genitalia but will provide an autotransfusion effect of approximately two units and should, therefore, be applied. In a case of massive hemorrhage, the patient with severe vaginal bleeding needs at least one and preferably two or three IV lines for rapid infusion of lactated Ringer's solution, or a plasma derivative. Other standard measures for shock can be applied. Vital signs must be monitored minute by minute, and transportation to the hospital should be rapid.

Section IV. MANAGEMENT OF OBSTETRIC EMERGENCIES

15-16. General

a. Emergency obstetrics situations in which you will be likely to become involved include normal labor and delivery, complications of labor and delivery, and conditions that can be life threatening to the pregnant woman or to the fetus before labor.

b. Serious medical problems that the pregnant woman may encounter before labor are termed antepartum complications. In this section, several antepartum complications are discussed, including hemorrhage, supine hypotensive syndrome, and toxemia.

15-17. Antepartum Hemorrhage Complications

Hemorrhage complications occurring before delivery are classified as antepartum complications. Five antepartum hemorrhage conditions are discussed in this section: abortion, ectopic pregnancy, abruptio placentae, placenta previa, and uterine rupture.

15-18. Abortion

Abortion is defined as loss of pregnancy before the 20th week of gestation (the 20th week of fetal growth). It often is referred to as a "miscarriage." Abortions can occur spontaneously or can be induced. Induced abortions performed under sterile conditions in authorized medical settings are termed therapeutic abortions. Abortions that occur naturally fall into one of the four categories discussed below.

a. Threatened Abortion (Figure 15-21A). Signs and symptoms of threatened abortion include vaginal bleeding, pain resembling menstrual cramps, and, occasionally, dilation of the cervix. This condition can progress to complete abortion, or may subside and the pregnancy may continue. A woman with a threatened abortion should be evaluated at the hospital. The treatment is bedrest.

b. Inevitable Abortion (Figure 15-21B). An abortion that cannot be prevented is termed an inevitable abortion. Signs of an impending abortion include vaginal bleeding (which can be very heavy), uterine contractions, and cervical dilation. For a patient with such symptoms, you should start an IV line with lactated Ringer's solution. The patient should be transported to the hospital as quickly as possible.

c. Incomplete Abortion (Figure 15-21C). An incomplete abortion occurs when part of the fetus is expelled and a portion of the products of conception remain within the uterus. This situation causes hemorrhage and continued cervical dilation. The patient should be treated for shock if it is present. Products of conception protruding from the cervix should be gently removed to prevent sepsis. You should consult a physician for instruction in treating a patient with an incomplete abortion.

d. Missed Abortion (Figure 15-21D). In a missed abortion, the fetus dies before 20 weeks gestation but is retained in the uterus for at least 2 months after death. When the uterus hardens, fetal heart sounds are no longer present. The patient with a missed abortion should be taken to the hospital for further treatment.

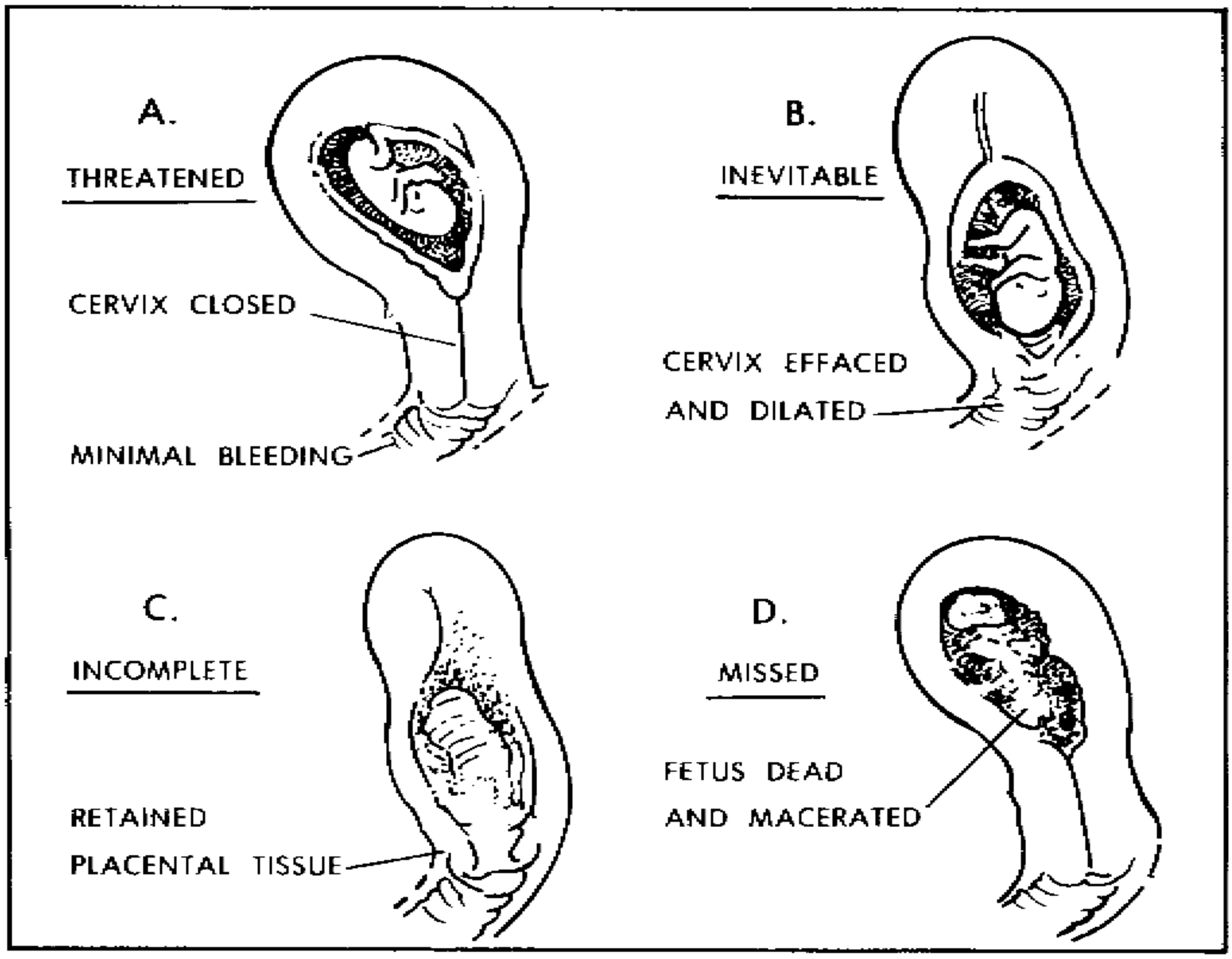


Figure 15-21. Types of abortion.

15-19. Ectopic Pregnancy

a. The fertilized ovum may implant abnormally in the fallopian tube, ovary, or abdomen, rather than in the uterus. Implantation in the fallopian tube (tubal pregnancy) is far more common than implantation in either the ovary or the abdomen (such a condition is very rare). Ectopic pregnancy is also 10 times more frequent in women who become pregnant with an intrauterine device (IUD) in place.

b. Fertilization normally occurs in the fallopian tubes. In a tubal pregnancy, the fertilized ovum fails to travel into the uterus and is implanted in the fallopian tube as shown in Figure 15-22. Abnormalities of either the ovum or the fallopian tubes can prevent the ovum from reaching the uterus.

c. When the fertilized ovum implants in the muscular layer of the fallopian tube, it invades maternal blood vessels. The fallopian tube does not enlarge as the fetus grows, and the tube eventually ruptures. This rupture may be either internal in the tube lumen or external in the abdominal cavity, and the resulting blood loss may be entirely hidden.

d. The patient with a ruptured tubal pregnancy may complain of severe pain localized to one lower quadrant. She may have vaginal bleeding. If blood enters the abdominal cavity, it will irritate the peritoneum and cause fever. The accumulated blood produces a mass that is tender to palpation.

e. As blood loss continues, hypovolemic shock develops. The pulse becomes rapid and the skin becomes pale, cold, and moist. When the body can no longer compensate for the decreased blood volume, the blood pressure falls. Hypovolemic shock due to ruptured ectopic pregnancy should be treated in the same way as hypovolemic shock due to other causes. To treat this type of shock in a pregnant patient, you should:

- Administer oxygen (if available).
- Support ventilation, if necessary.
- Take vital signs.
- Apply and inflate the MAST. (Do not inflate abdominal section.)
- Start two or more large-bore (14- to 16-gauge needles) IV lines, and then rapidly infuse lactated Ringer's solution.
- Place the patient in a supine position with her feet elevated 30^{o} (no higher than 12 inches).
- Keep the patient warm.
- Monitor state of consciousness, pulse, and blood pressure during transport.

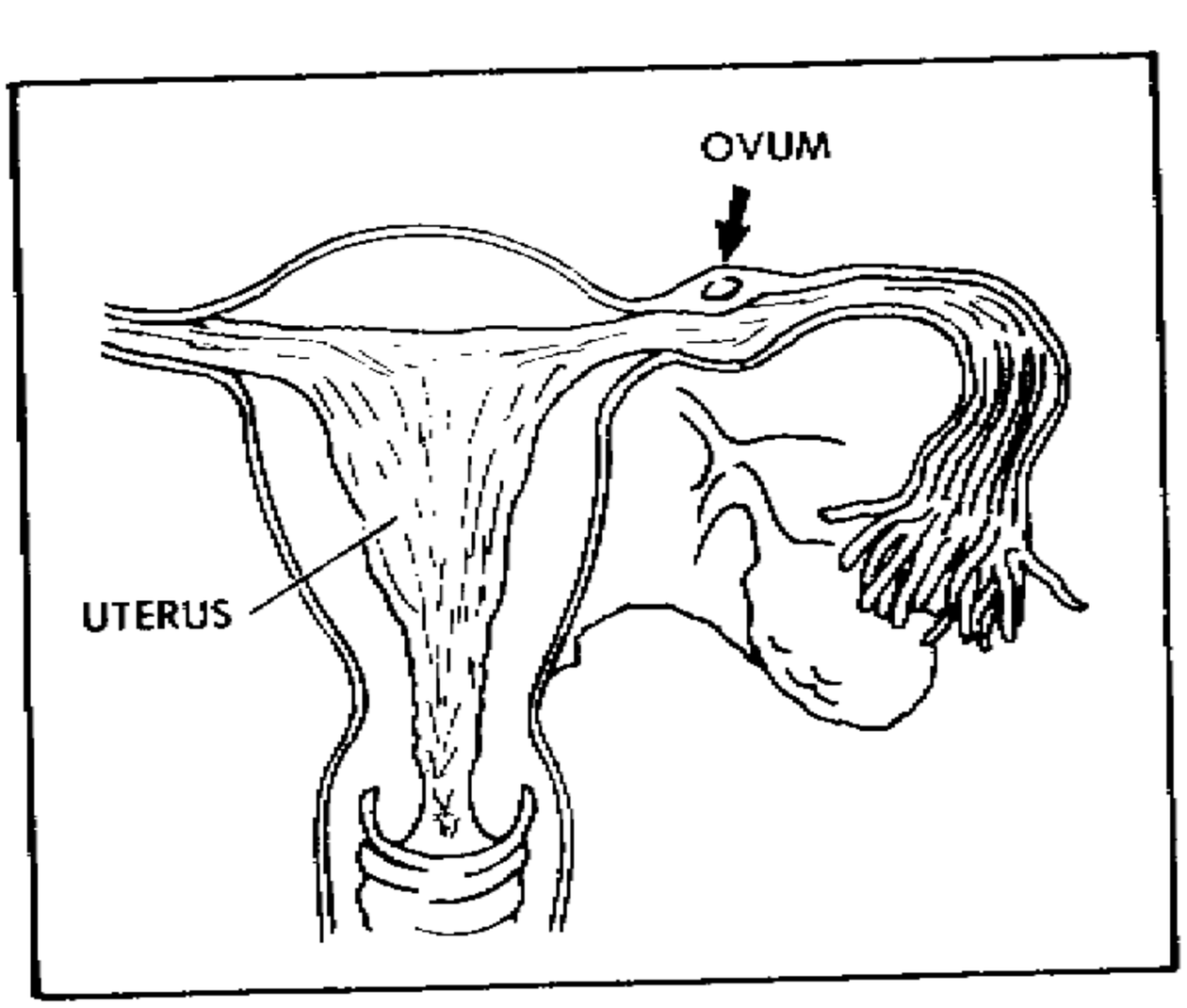


Figure 15-22. Tubal pregnancy.

15-20. Abruptio Placentae

Abruptio placentae occurs when a normally implanted placenta separates prematurely from the uterine wall during the last trimester of pregnancy. The patient experiences severe lower abdominal pain and the uterus becomes rigid. Shock may be more severe than the apparent blood loss would seem to indicate. Figure 15-23 shows the baby and abruptio placentae.

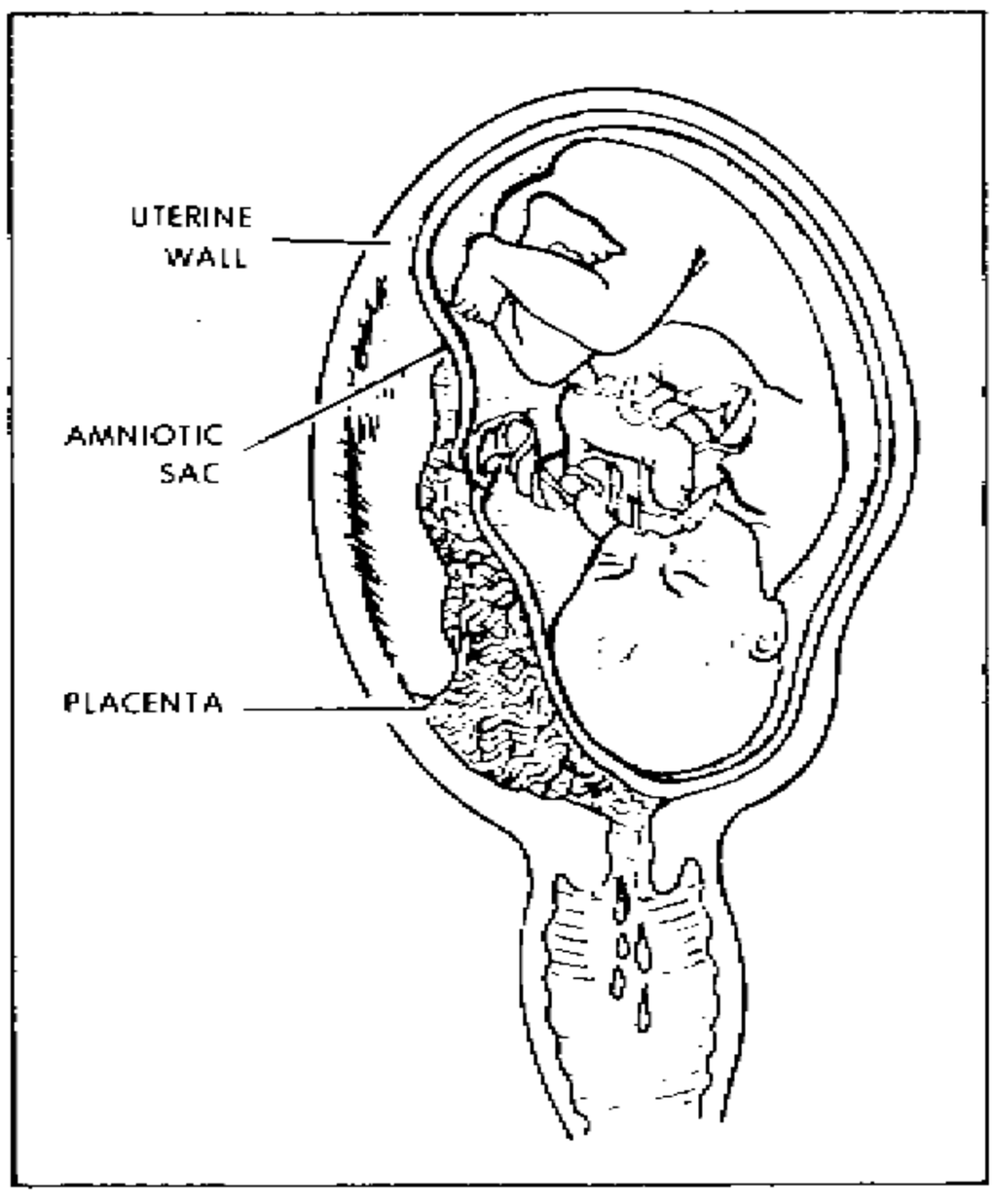


Figure 15-23. Baby and abruptio placentae.

15-21. Placenta Previa

Placenta previa is a condition in which the placenta—rather than the baby—is the presenting part. This condition occurs in the third trimester. Again, hemorrhage may be severe from the highly vascular placental tissue. Pain is frequently absent in this disorder. Figure 15-24 shows the baby and placenta previa.

15-22. Uterine Rupture

a. Uterine rupture is manifested by sudden, severe abdominal pain. Bleeding may not be apparent externally, but profound shock can occur from internal hemorrhage.

b. To treat the patient for shock, you should:

(1) Place the patient horizontally on a stretcher, preferably on her left side.

(2) Administer oxygen (if available).

(3) Apply the MAST to produce autotransfusion. (Do not inflate abdominal section.)

(4) Start at least two large-bore IV lines, and administer 5 percent dextrose in normal saline (D5NS), 5 percent dextrose in lactated Ringer's solution, or a plasma derivative as rapidly as needed to maintain blood pressure.

(5) Transport the patient to the hospital.

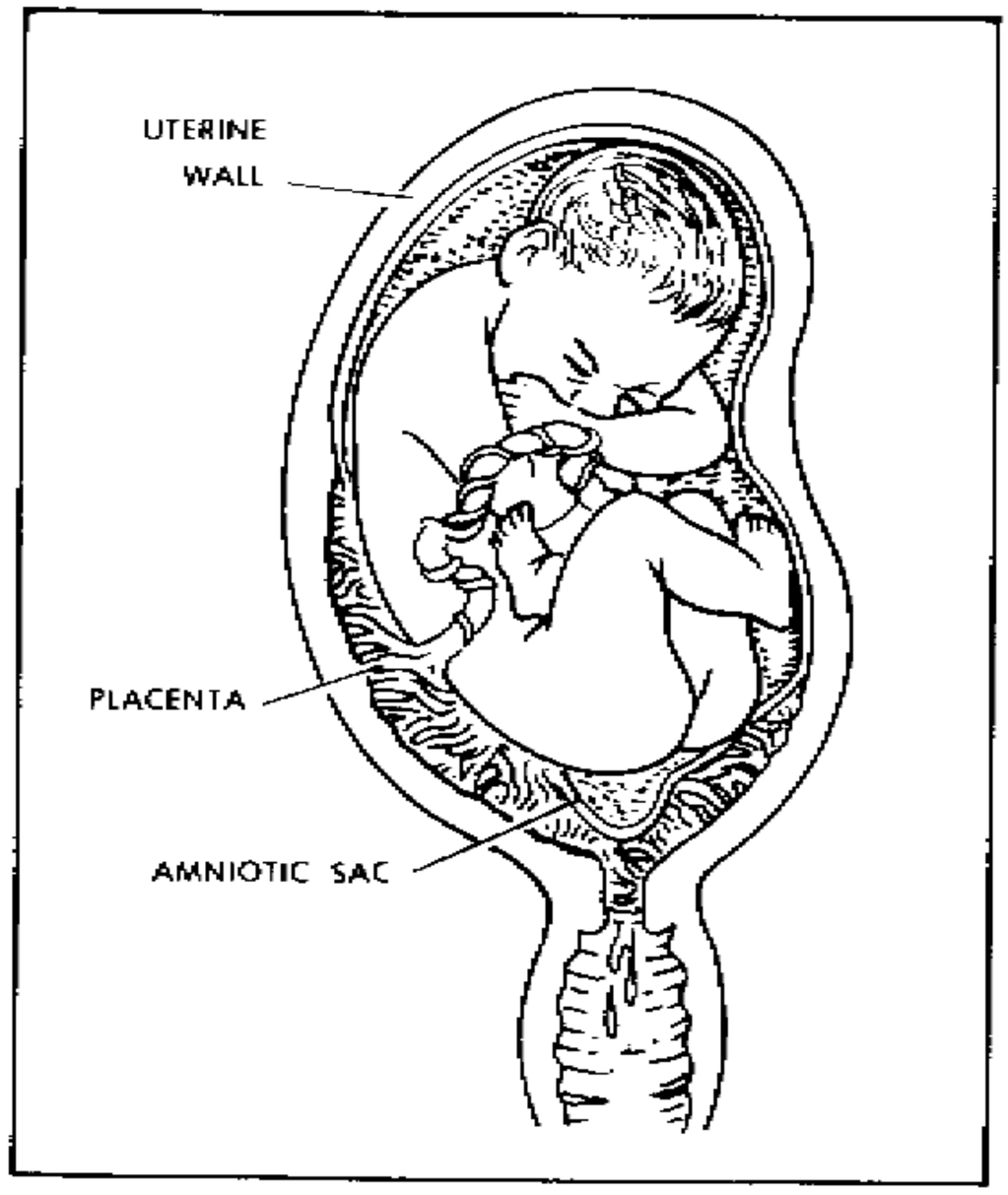


Figure 15-24. Baby and placenta previa.

15-23. Other Antepartum Conditions

You may also encounter other serious antepartum conditions such as supine hypotensive syndrome and toxemia.

a. Supine Hypotensive Syndrome. The pregnant woman near term has a large, heavy mass in her abdomen. When she is supine, this mass, which includes the weight of the uterus, fetus, and placenta, tends to compress the inferior vena cava. Venous return to the heart is thereby reduced and, as a result, cardiac efficiency decreases. These changes are especially pronounced when the mother's vascular volume is low to begin with, such as in antepartum hemorrhage. When a pregnant patient near term who is hypotensive or complains of dizziness is encountered, she should be placed on her left side. Severe hypotension indicates a possibility of significant internal hemorrhage. Severe hypotension should be treated like hypovolemic shock as discussed above.

b. Toxemia of Pregnancy. Toxemia of pregnancy has two stages, preeclampsia and eclampsia. Preeclampsia is characterized by hypertension (blood pressure greater than 140/90), proteinuria (protein in the urine), and edema during the last 3 months of pregnancy. Eclampsia follows preeclampsia and includes convulsions and coma in addition to the signs of preeclampsia.

(1) In preeclampsia, renal blood flow and glomerular filtration are below the normal level for pregnant women. Thus, urine output and sodium excretion decrease. This condition increases extracellular fluid volume and produces edema in the ankles, fingers, and face. Other symptoms of preeclampsia are headache, midupper quadrant abdominal pain, and blurred vision. Elevated blood pressure and edema, however, are necessary for a

diagnosis of preeclampsia. You, therefore, should report the blood pressure and the presence or absence of edema in every pregnant woman examined. The patient with preeclampsia should be evaluated by a physician in the emergency department for possible hospitalization. When transporting the patient, you should remember to be prepared to treat preeclampsia, because it can progress to eclampsia with convulsions and coma.

(2) Eclampsia can occur before, during, or after labor. It begins with convulsions that are usually followed by coma.

(a) The eclamptic patient, like the preeclamptic patient, has pronounced hypertension and edema. Her urine will be scant and bloody. She also may show signs and symptoms of pulmonary edema.

(b) Although the physician should be contacted for specific directions in treating eclampsia, you can do the following:

1. Establish and maintain an airway; administer oxygen (if available).

2. Start an IV line with D5W to keep open. *DO NOT USE normal saline or lactated Ringer's solution, as they will increase the fluid overload.*

3. Transport the patient to the hospital as soon as possible.

NOTE

In antepartum hemorrhage of any kind, you should not attempt to examine the patient internally.

Section V. THE RAPE VICTIM

15-24. General

Rape presents a difficult and complex problem, involving physical and emotional trauma as well as possible legal ramifications. It is essential that a complete history be obtained from the rape victim. In questioning the patient, you must use tact and sensitivity. The patient may find it extremely difficult to discuss what has happened and may fear or feel hostile toward a male medical specialist. ***A FEMALE CHAPERONE SHOULD ALWAYS BE PRESENT DURING AN EXAMINATION OF A FEMALE PATIENT.*** Every effort should be made to understand the patient's feelings and to respond with kindness and reassurance. The emotional trauma of rape is usually more prolonged and severe than the physical trauma. The attitude shown toward the patient during her care can have a serious influence on her future psychological and physical recovery.

15-25. Clinical Procedures

a. A primary assessment should be conducted of the rape victim. You should observe whether the patient's clothes are torn or in disarray. You also should check for trauma elsewhere on the patient's body, especially around the thighs, lower abdomen, and buttocks. If vaginal bleeding is significant, it should be treated as outlined in paragraph 15-15.

b. *The report you submit should state only what the patient said*, not what you observed. Your personal opinion should not be included in the report. *Every rape is a potential court case, and the report is a legal document.* Therefore, you should be thorough and accurate.

CHAPTER 16

FIELD SANITATION

Section I. INTRODUCTION

16-1. General

a. This chapter provides information and instruction in the employment of established, practical measures designed to prevent disease and preserve the health of troops under field conditions.

b. Manpower is the Army's most valuable asset. Everything possible must be done to conserve this asset. In recent wars, more deaths resulted from disease than from enemy action. During the Civil War, a total of 199,720 soldiers died from disease compared to 138,154 battlefield deaths. Records of World War II, the Korean, Lebanese, and Vietman conflicts show 15,828,940 disease casualties as opposed to 640,254 combat casualties.

c. The control or prevention of disease is the responsibility of every soldier. By practicing proper personal hygiene, food and water sanitation, waste disposal, and insect and rodent control, the potential for disease can be kept to a minimum.

16-2. Command Emphasis

a. The commander of a military organization is responsible for the health of his command. In fulfilling this responsibility, he is assisted by a staff of medical personnel. Using the technical advice and guidance of these individuals, he issues orders and enforces measures that will most effectively maintain sanitation and protective practices conducive to the health and well-being of his troops. The maintenance of their health and, consequently, their fighting efficiency is one of his greatest responsibilities.

b. To provide a healthy field environment for the troops, the company, battery, or detachment commander appoints a field sanitation team and arranges for the team members' training that they need to accomplish their duties (AR 40-5). The duties include instructing, supervising, inspecting, and reporting, as applicable, to insure that field sanitation facilities are established and maintained, and effective hygiene and sanitation measures are practiced by troops.

16-3. Medical Specialist

The medical specialist may be, and in many situations is, the key medical advisor to the commander. You must know the basic elements of hygiene and sanitation to effectively advise the commander.

Section II. DRINKING WATER TREATMENT

16-4. General

a. Isolated units may not be able to obtain water from established water points. In this case, they must obtain and treat their own water.

b. The sources of water are public water supply systems, surface water (lakes, rivers, streams, and ponds), ground water (wells and springs), rain water collected from roofs or other catchment surfaces, ice or snow, and distilled sea water. The source that appears to be the cleanest should be selected. Water taken from any of these sources must be properly treated before use since these sources are presumed to be contaminated. There are four ways of disinfecting water in the field:

(1) Chlorination by calcium hypochlorite. This is supplied in 0.5 gram ampules along with chlorine residual testing vials and tablets (Chlorination Kit, Water Purification); or in bulk powder (Calcium Hypochlorite, 6-oz jar).

(2) Iodine tablets, supplied in bottles of 50.

(3) Commercial bleach (5 percent sodium hypochlorite).

(4) Boiling.

16-5. Disinfecting Water in a Water Purification (Lyster) Bag

a. Set up Lyster bag. (See Figure 16-1.)

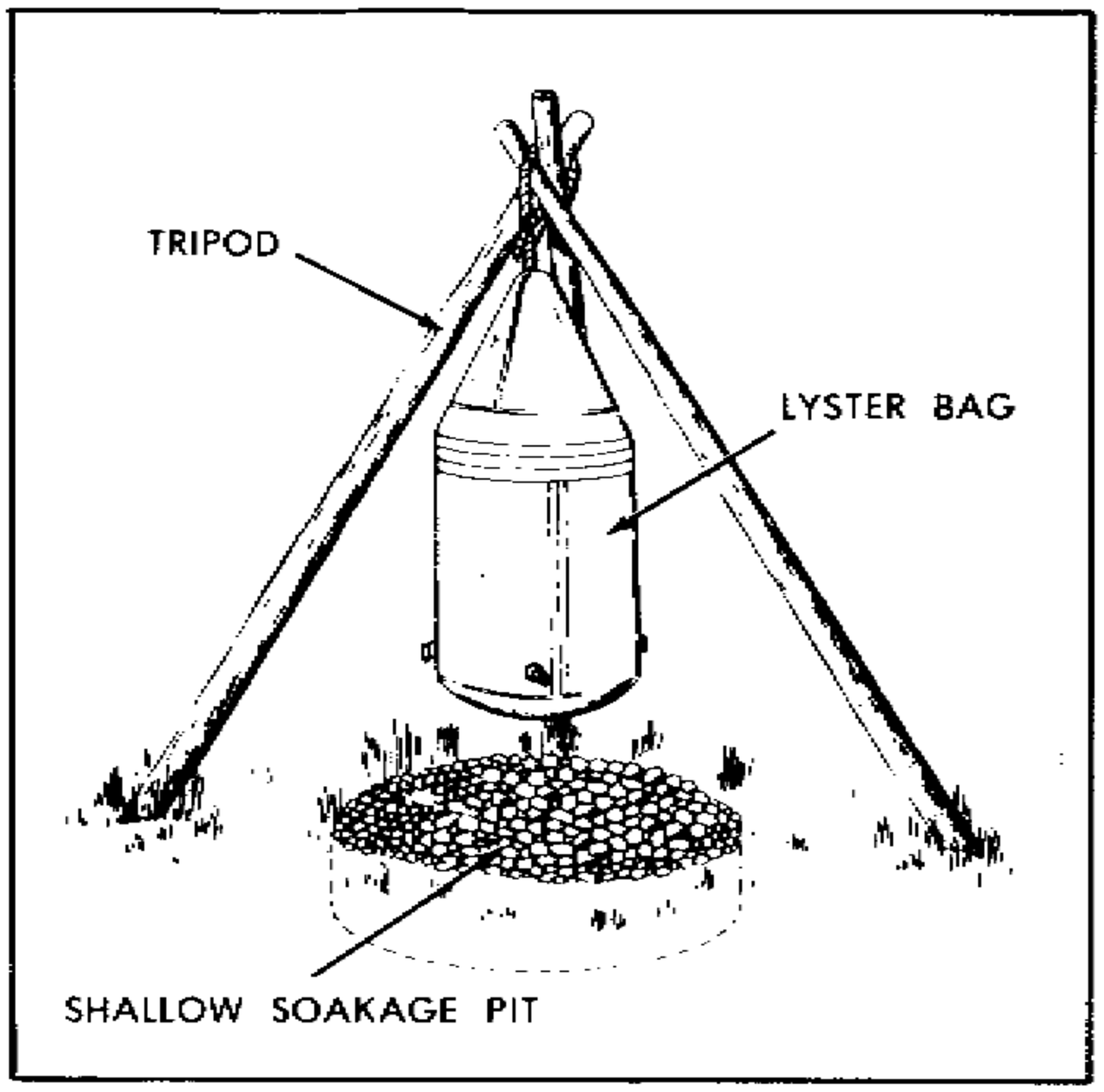


Figure 16-1. Lyster bag set up.

b. Fill the Lyster bag with water.

(1) Clean the Lyster bag thoroughly before filling it with water.

(2) Use settled or filtered clear water, if possible.

(3) Fill the bag to the 36-gal mark (approximately 4 inches from the top). BE CAREFUL—when full the bag weighs about 300 pounds.

c. Mix stock disinfecting solution.

(1) Add contents of three ampules of chlorine to a canteen cup half full of water.

(2) Stir with a clean implement to dissolve the calcium hypochlorite.

NOTES

1. Stock solution is a mixture of chlorine adequate to provide the initial treatment prescribed by the command surgeon. See the Job Performance Aid (JPA) packed with the Chlorination Kit, Water Purification, for procedures used in opening the ampules.

2. The command surgeon may prescribe other dosages, but the normal dosage is 5 mg/l chlorine residual (three ampules for the initial dose) (see Table 16-1). Chlorine residual is the amount of chlorine remaining after the disinfection demand has been satisfied.

Table 16-1. Chlorine Dosage Requirements

Dosage mg/l (ppm)	Required Ampules
1	1
5	3 or 4
10	5 or 6

d. Add the stock solution to the Lyster bag.

(1) Pour the stock solution from the canteen cup into the Lyster bag.

(2) Mix it well using a clean mixing device.

(3) Cover the Lyster bag and flush the faucets by running a small quantity of water through them.

CAUTION

The water is not safe to drink or use at this time.

(4) Allow the chlorine to react with the water contaminants for 10 minutes.

e. Test the water for chlorine residual.

(1) Select the testing vial (1 mg/1, 5 mg/1, or 10 mg/1) for required residual testing.

(2) Crush one chlorine test tablet (packed in the bottle inside the plastic testing tube) in the cap of the testing vial using the bottom of the test tablet bottle.

(3) Place the powder in the vial.

(4) Flush a faucet of the Lyster bag.

(5) Fill the testing vial to the lower edge of the color band with water from the Lyster bag.

(6) Place the cap on the testing vial and shake it until the crushed tablet is completely dissolved.

(7) Compare the color of the solution to the color band.

(8) If the color of the water is as dark as the color band, the chlorination is acceptable. Discard the water used for testing.

(9) If the desired residual has been satisfied, wait an additional 20 minutes to provide a total disinfection (contact) time of 30 minutes.

(10) If the color of the water is lighter than the color band, more chlorine is necessary. Repeat (1) through (7) above, using an additional chlorine ampule. *Wait an additional 10 minutes before retesting.* If the residual is the desired color, proceed to (9) above.

f. Recheck the chlorine residual.

(1) After the 30 minute contact time and before using the water for any purpose, recheck for chlorine residual by following the same procedure as (1) through (7) above.

(2) If the chlorination is now acceptable, the water may be used.

(3) If the chlorination is not acceptable, repeat the entire chlorination and testing procedure (steps *c* through *e* above) again beginning with the mixing of the stock disinfecting solution.

NOTES

1. Routinely recheck large containers of water for chlorine residual 2 or 3 times a day, since the chlorine residual decreases with time and increased temperature.

2. A 400-gallon trailer arriving from an approved supply point must be tested for chlorine residual in accordance with the procedure outlined in *e.* above. If the required chlorine residual is met, the water is safe. If there is no chlorine residual, dissolve 30 chlorine ampules in a canteen cupful of water or dissolve one mess kit spoonful of the bulk powder (Calcium Hypochlorite, 6-oz jar) in a canteen cup of water. Pour this stock solution into the water trailer. Stir the water with a clean stirring device. Wait 10 minutes, then test the chlorine residual.

3. If the desired residual has been reached, wait 20 minutes, then release the water for drinking. If the desired residual has not been reached, repeat the procedures above with 10 ampules or ⅓ mess kit spoonful of the bulk powder.

16-6. Disinfecting Water in a Canteen

When safe water is not available, each soldier must produce his own potable water by using his canteen and iodine purification tablets, calcium hypochlorite ampules, or commercial bleach (for example, Clorox).

a. Treat a canteen of water using iodine tablets.

(1) Fill the canteen with the cleanest, clearest water available.

(2) Take needed iodine tablets from the bottle. Check for good tablets not crumbled or stuck together. If the tablets are stuck together or crumbled, replace them.

(3) Add one iodine tablet to a 1-quart canteen of clear water (two tablets if the water is cloudy or very cold). Double these amounts for the 2-quart canteen.

(4) Place the cap on the canteen.

(5) Wait 5 minutes.

(6) Shake the canteen vigorously, loosen the cap, invert the canteen, and allow leakage to rinse the threads around the neck of the canteen.

(7) Tighten the canteen cap.

(8) Wait an additional 20 minutes before using the water for any purpose.

b. Treat a canteen of water using calcium hypochlorite ampules.

(1) Fill the canteen with the cleanest water available.

(2) Fill a canteen cup half full of water.

(3) Add the calcium hypochlorite from one ampule to the canteen cup filled half full of water.

(4) Stir with a clean device until the powder is dissolved.

(5) Fill the cap of a plastic canteen half full of the solution. Use a capful for the 2-quart canteen.

(6) Add this solution to the water in the canteen.

(7) Place the cap on the canteen and shake the canteen thoroughly.

(8) Loosen the cap slightly and invert the canteen, letting the water leak onto the threads around the neck of the canteen.

(9) Tighten the canteen cap again and wait 30 minutes before using the water for any purpose.

c. Treat a canteen of water using a commercial household bleach.

(1) Add two drops of bleach to a 1-quart canteen full of clear water (if the water is cloudy or very cold, add four drops of bleach to the canteen). Double these amounts for the 2-quart canteen.

(2) Place and tighten the cap on the canteen.

(3) Shake the canteen thoroughly.

(4) Loosen the cap slightly and invert the canteen, letting the treated water leak onto the threads around the neck of the canteen.

(5) Tighten the canteen cap.

(6) Wait 30 minutes before using the water for any purpose.

NOTE

Refer to FM 21-10 for additional information concerning field hygiene and sanitation.

d. Disinfect drinking water by boiling. Boil the water for at least 2 minutes. Allow the water to cool before drinking. In an emergency, boiling for 15 seconds will help reduce the harmful organisms. Protect the water; boiling will not prevent recontamination.

Section III. WASTE DISPOSAL

16-7. General

a. Waste includes all types of refuse resulting from the living activities of humans or animals, such as—

(1) Feces.

(2) Liquid (wash, bath, kitchen, and urine).

(3) Garbage (food).

(4) Rubbish (nonfood).

b. Waste must be disposed of properly to prevent the spread of disease (dysentery, cholera, and typhoid). The methods used for the disposal of wastes depend upon the military situation and the unit location.

16-8. Methods of Disposal and Types of Devices

a. Methods of disposal.

(1) Burial. Human wastes are usually disposed of by burial. If soil conditions (hard, frozen, or rocky) make digging difficult, a pail or burn-out latrine may be used.

(2) *Burning.* Solid garbage and combustible rubbish may be burned in temporary camps (longer than one week in duration). Garbage and rubbish must be buried when the tactical situation precludes burning.

(3) *Soakage.* Liquid wastes from bath and kitchen are drained into either a soakage pit or trench.

b. Types of waste disposal devices (Figure 16-2) are—

(1) Cat hole latrine.

(2) Straddle trench (short bivouac).

(3) Deep pit latrine.

(4) Pail latrine.

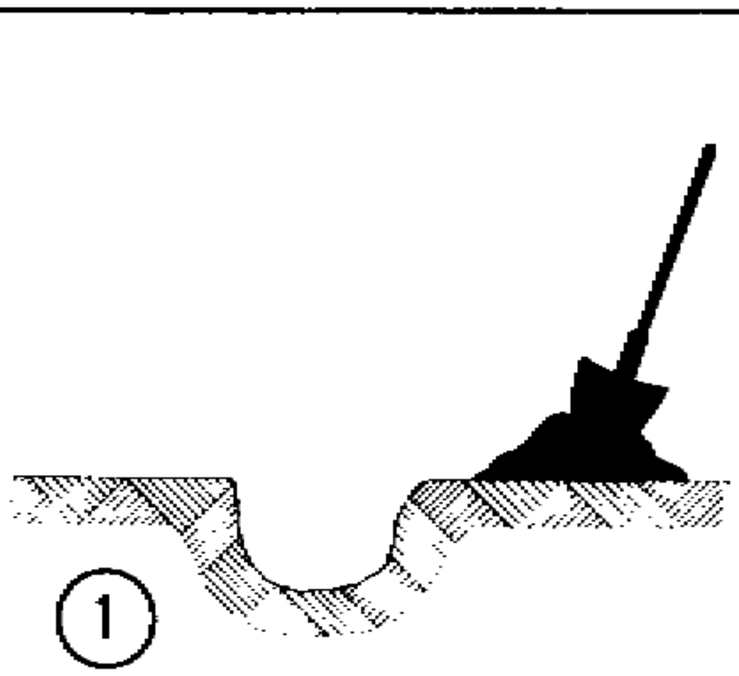
(5) Burn-out latrine.

(6) Trough urinal.

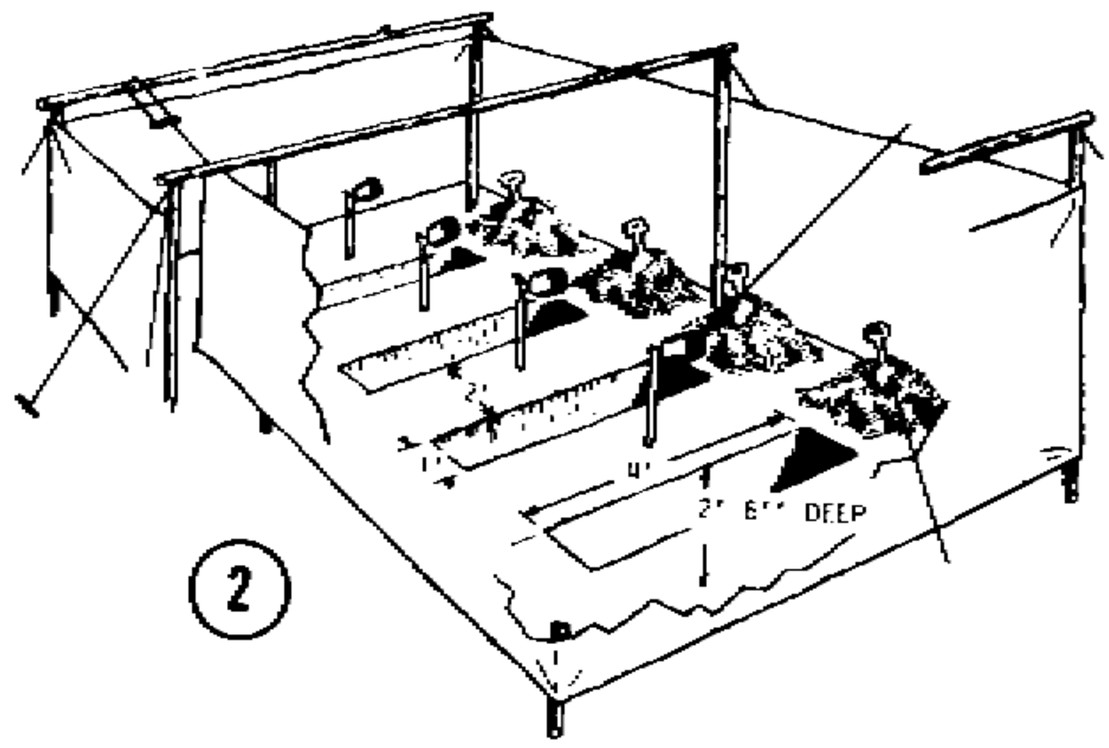
(7) Garbage pits.

(8) Soakage pit.

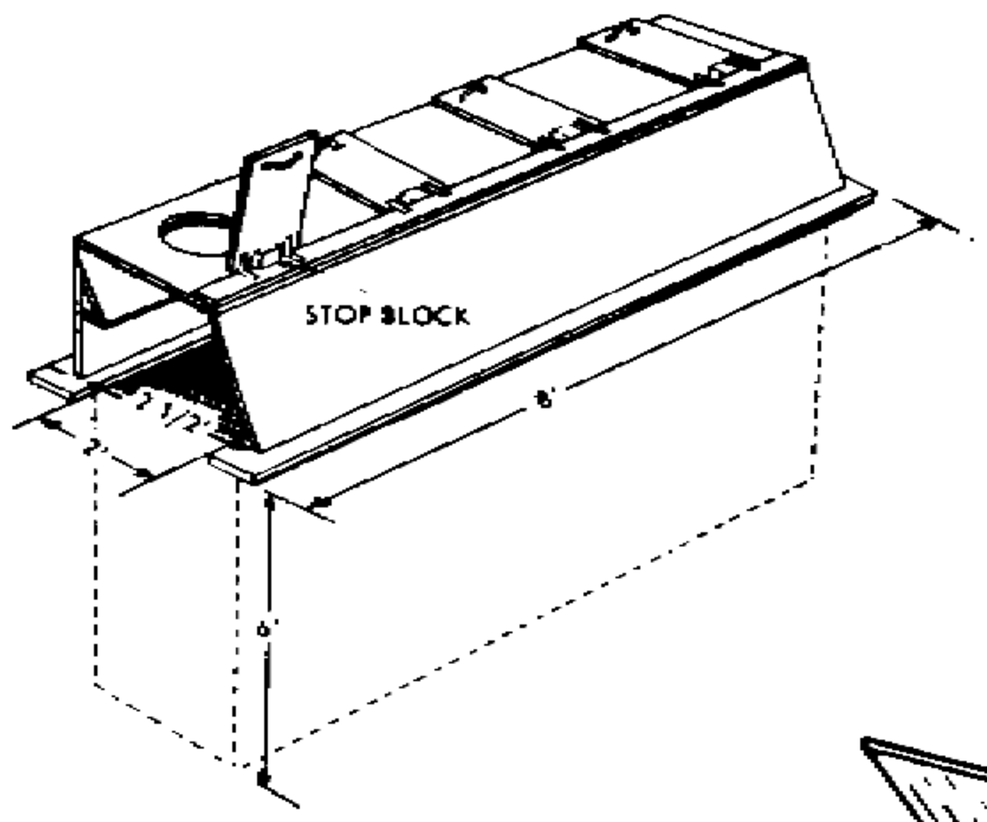
(9) Soakage trench.



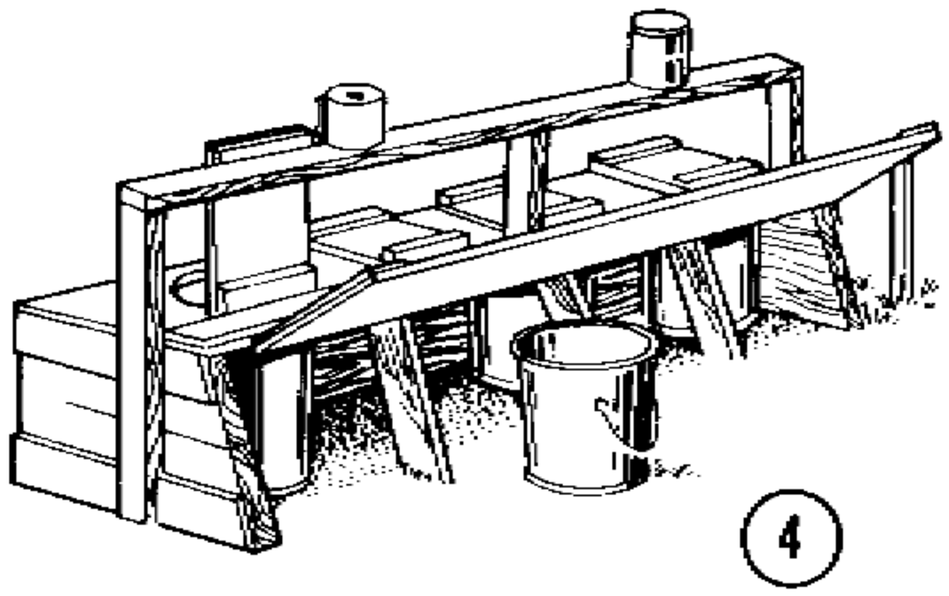
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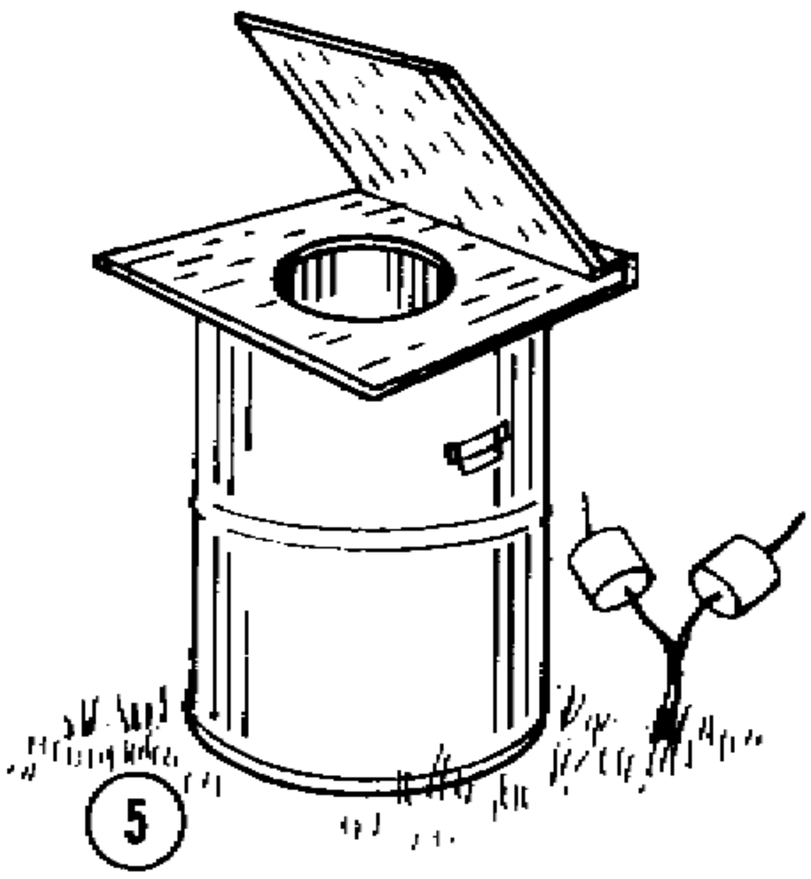
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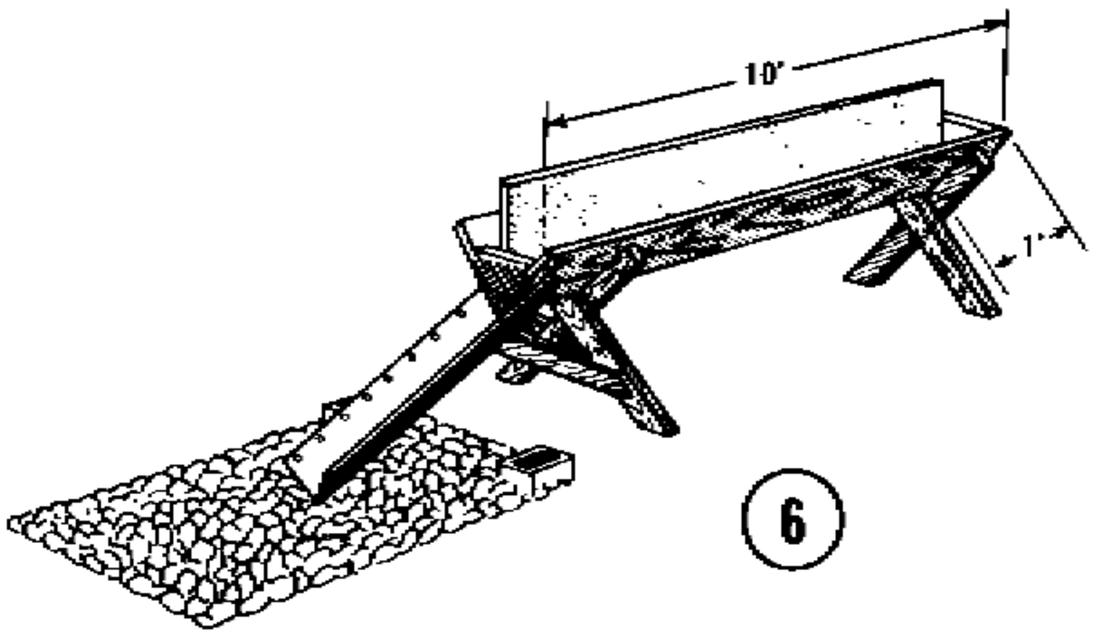


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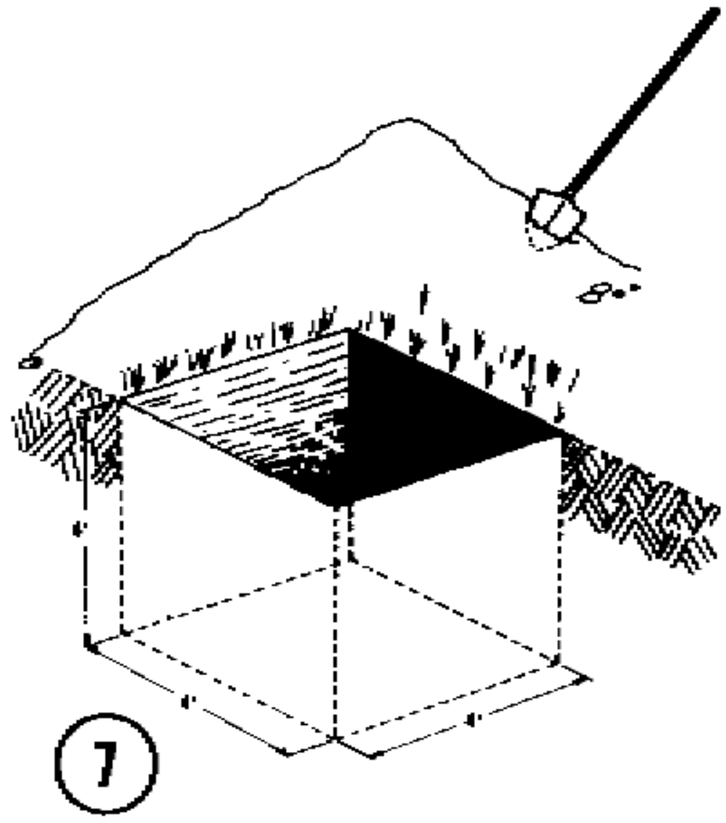


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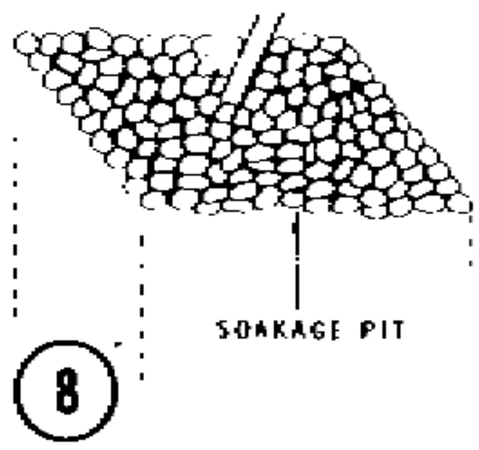
Figure 16-2. Types of waste disposal devices.



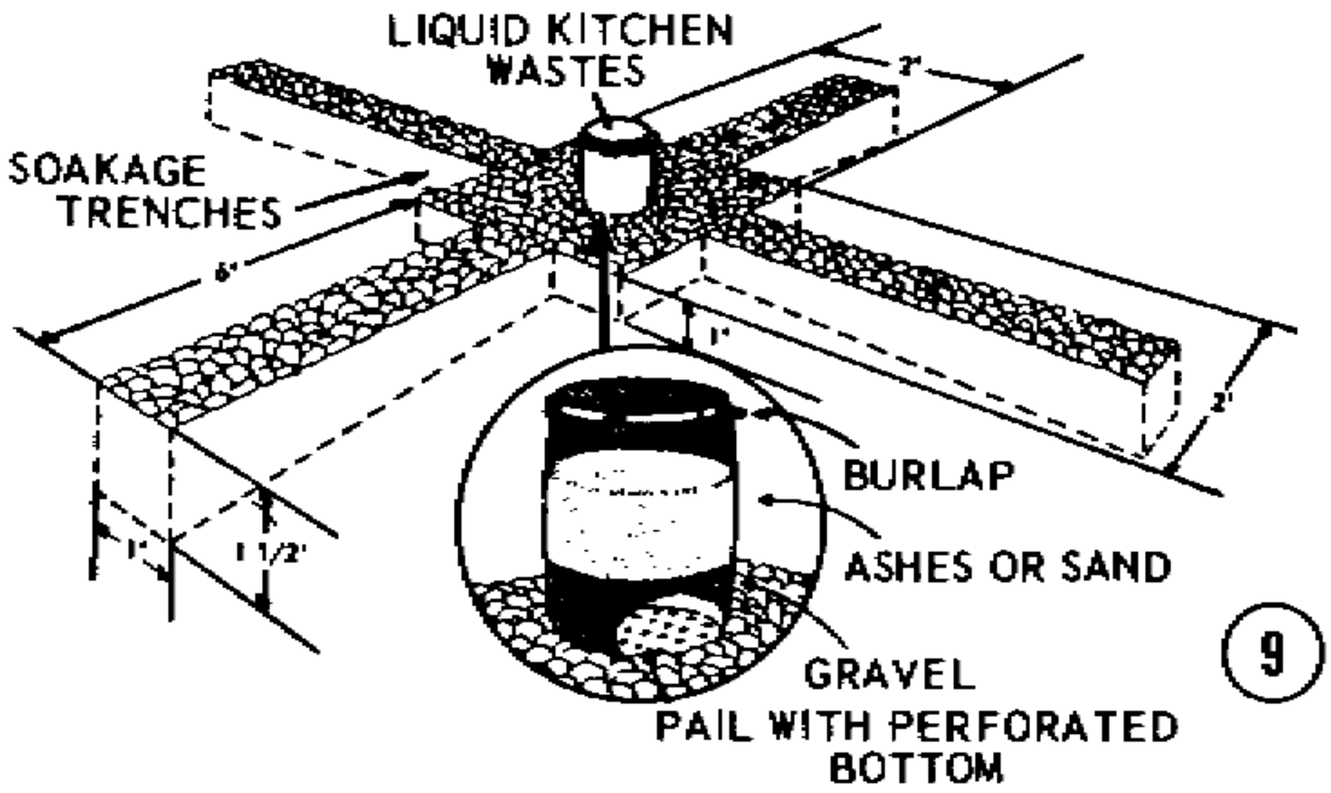
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9

Figure 16-2. Types of Waste Disposals — continued

Section IV. FOOD SANITATION

16-9. General

Even the most appetizing food can cause illness if it has become contaminated with disease organisms through improper handling. Outbreaks of food poisoning, dysentery, infectious hepatitis, and typhoid fever can result from unsanitary practices in kitchens and dining areas. Persons who handle food must always maintain the highest standards of personal hygiene and sanitation.

16-10. Food Sanitation Measures

a. Cook hot foods sufficiently. For example, pork and pork products should be cooked throughout to a minimum internal temperature of 150°F in order to kill the trichinae (trichinosis).

b. Do not drink any liquids, eat food, or use ice from an unapproved civilian vendor.

c. Wash your hands before eating, whenever possible.

d. Keep hot foods hot until eaten. Hot food temperature should be at least 140°F.

CAUTION

Proteins, dairy products, and sauces spoil quickly. They must be kept hot (140°F) or cold (45°F or below).

e. Refrigerate or ice down cold food. Cold food temperature should be 45°F or below.

f. Inspect canned foods for damage and/or contamination. Do not use cans if damage is evident (rust, badly dented, top and/or bottom of can bulging).

g. Clean mess kit and utensils. Wash in warm soapy water. Rinse in clear boiling water. Disinfect by immersing in a second can of clear boiling water for 30 seconds.

NOTE

See FM 21-10 for additional information concerning food sanitation.

16-11. Insect Control

a. Keep food and garbage covered.

b. Use screens or nets to keep flies out of the food preparation area.

c. Spray outside infested areas. Read the label on the pesticide container before use. Apply the pesticide as instructed. Use care when spraying the food service facility. DO NOT spray the food storage and preparation area while preparing or serving food. Aerosol spray may be used in

the preparation area to keep the fly population down; however, care must be taken to keep the insecticide out of the food and off the food contact surfaces of the equipment and utensils.

16-12. Rodent Control

a. A rodent can be any one of several animals; however, this discussion will be limited to control of rats and mice.

b. Methods of rodent control:

(1) Store soft-packaged food in metal containers.

(2) Close cracks and openings in the food storage area.

(3) Bury or burn garbage/rubbish.

(4) Trap/poison rodents that get into the food storage area.

(5) Keep garbage/rubbish that is not burned in tightly closed containers.

Section V. PERSONAL HYGIENE

16-13. General

a. Personal Hygiene. Personal hygiene is often thought of as being the same as personal cleanliness; while cleanliness of the body is important, it is only one of the many essentials of healthful living. Personal hygiene is practiced by an individual to—

- Protect his own health.
- Protect the health of his unit and other units.
- Improve morale.

b. Personal Cleanliness. Before it was known how disease organisms were spread, civilized people gave attention to personal cleanliness because of a desire to please themselves as well as to be attractive to others. It is now known that there are also sound medical reasons for keeping the body clean. Dirt, filth, and invisible disease organisms are inseparable. Keeping the body and clothing clean are simple, effective means of reducing the number of disease organisms which can invade the body. Personal cleanliness is only one of the measures practiced in personal hygiene to prevent disease.

16-14. Maintaining Personal Hygiene and Proper Foot Care

a. Practice personal hygiene.

(1) Cleanse your skin, hair, and teeth daily, or as often as possible.

(2) Change clothing daily or as often as possible. Avoid wearing unwashed clothing for long periods of time (this is an open invitation to lice and disease).

b. Take proper care of your feet.

(1) Wash your feet daily.

(2) Dry them thoroughly, especially between the toes.

(3) Apply foot powder lightly and evenly twice a day.

(4) Change socks at least daily.

c. Wear proper footwear.

(1) Use only issued footwear.

(2) Make sure footwear is properly fitted so that your feet will not slide forward or backward when walking.

(3) Avoid binding or pressure spots.

NOTE

See FM 21-10 for additional information on personal hygiene.

CHAPTER 17

MEDICAL INFORMATION AND RECORDS

Section I. CONFIDENTIALITY OF MEDICAL INFORMATION

17-1. General

This section discusses Department of the Army (DA) policies and procedures concerning the confidentiality of private medical information.

17-2. Explanation of Terms

a. Private Information. Information that belongs only to a patient and should not be open to public scrutiny. This information, if divulged, may cause personal embarrassment or harm.

b. Confidentiality. Guarding the privacy of medical information. Information gained through the examination or treatment of a patient is private and confidential. Medical confidentiality is NOT, however, a security classification of CONFIDENTIAL.

c. Privileged Communications. A communication made within a confidential relationship that as a matter of public policy is protected. Information disclosed by patients to Army Medical Department (AMEDD) health personnel is not privileged. See paragraph 151C(2), Manual for Courts-Martial, 1969 (Revised).

d. Medical Information. This is information that pertains to evaluations, findings, diagnosis, or treatment of a patient. The term also includes any other information given to AMEDD health personnel in the course of treatment or evaluation. Medical information is *confidential* and *private*. Paramedical documents such as immunization registers and dosimetry records are not considered medical information even though they are kept in the same file with medical records.

17-3. Responsibilities

a. The medical treatment facility (MTF) commander will issue local rules to enforce the policies and procedures stated in this section.

b. Persons and agencies within DA that use medical information for official purposes must protect the privacy and confidentiality of that information.

17-4. Protection of Confidentiality

DA policy states that medical confidentiality for all patients will be protected as fully as possible.

a. Within DA, medical information will be used in diagnosis, treatment, and prevention of medical and dental conditions. It will also be used in connection with the health of a command, medical research, and other official purposes.

b. At no time will personnel who are not involved in a patient's care or in medical research have access to the patient's records. Exceptions to this are allowed when access is required by law, regulation, or judicial proceeding; when needed for hospital accreditation; or when authorized by the patient.

(1) Medical information is seen by clerical and administrative personnel (such as secretaries, stenographers, and medical record administrators). This is needed for an MTF to properly process medical records; however, it does not give those persons any inherent right of access. All of them have a professional and ethical obligation to keep medical information confidential and private when working with it.

(2) Unauthorized disclosure of medical information is grounds for administrative or disciplinary action against the informant.

c. When medical information is officially requested for a use other than patient care, only enough will be given to satisfy the request.

17-5. Disclosure Procedures

Although medical information is private and confidential, it may be disclosed under certain conditions. All requests for medical information will be handled by the patient administrator. In his absence, requests will be handled by another chosen representative of the MTF commander. Medical information obtained from nonmilitary sources will be filed with, but not considered a part of, the patient's medical record. Such information is available for further diagnosis and treatment of the patient and other official DA uses. Any further redisclosure is prohibited. This information is the property of the nonmilitary facility and can be released only by that facility. The patient or other requester will be told that additional information is contained in the record and it may be requested from the originating facility. This does not apply to medical information on patients treated under supplemental or cooperative care. Such information may be released as a part of the patient's medical record.

a. Official Department of the Army Requests. Army personnel seeking medical information about a patient must request it in writing from the MTF commander. They must present their official credentials and state their need, citing the authority supporting the need.

(1) DA Form 4254-R (Request for Private Medical Information) (Figure 17-1) will be used for requests. This form will be locally reproduced. Submitted forms are filed under file number 901-02, AR 340-18-9, by the receiving MTF.

REQUEST FOR PRIVATE MEDICAL INFORMATION
For use of this form, see AR40-66; the proponent agency is the Office of The Surgeon General

DATE 6 NOV 83

PATIENT'S NAME AND SOCIAL SECURITY NUMBER
DOE, JOHN P 555-33-6666

MEDICAL TREATMENT FACILITY (Name and Location)
5TH MASH
NTC, CALIFORNIA

REASON FOR REQUEST
ASSAULT

PRIVATE MEDICAL INFORMATION SOUGHT (Specify dates of hospitalization or clinic visits and diagnosis, if known)
IN HOSP 7-26 OCT 83
INFORMATION NEEDED TO COMPLETE
LINE OF DUTY DETERMINATION.

REQUESTOR'S NAME, TITLE, ORGANIZATION AND SOCIAL SECURITY NUMBER
EDWARD J. RICHT, CPT, IN, CDR 2/6 INF, 888-88-9876

FOR USE OF MEDICAL TREATMENT FACILITY ONLY

Check applicable box
[ ] APPROVED [ ] DISAPPROVED (State reason for disapproval)

SUMMARY OF PRIVATE MEDICAL INFORMATION RELEASED

SIGNATURE OF APPROVING OFFICIAL

DATE

DA FORM 4254-R, 1 Jul 74 (Paper size 8 x 10½", image size 7 x 9-4/10".)

Figure 17-1. DA Form 4254-R.

(2) MTF commanders or patient administrators will determine the legitimacy of the request. Advice of the local Staff Judge Advocate should be sought if there is any doubt about the need for information or about the credentials of the requester.

(3) In certain situations (cases of rape, assault, or death), the need for the information may be urgent. In these cases, both the request for information and permission for disclosing it may be given verbally. Immediately after giving permission, the MTF commander or his representative will prepare a memorandum on the release. The requesting agent will follow up his verbal request with a written one using DA Form 4254-R.

b. Official Request from Personnel Outside Department of the Army. See Chapter 3, AR 340-21.

c. Unofficial Requests. See Chapter 2, AR 40-66.

d. Requests from Patients. If a patient requests information from his medical record or copies of the documents in it, it will be given to him. Access to the information will be denied, however, if a physician or dentist judges that it could adversely affect the patient's physical or mental health. When such a decision has been made, the information may be released to another physician or dentist, one named by the patient. In such a case, the patient must be told that he may name the physician or dentist (paragraph 2-6*e*, AR 340-21). Such medical records will be identified with a conspicuous strip of tape (see paragraph 4-4*a*(10), AR 40-66). Direct access by a patient to his original record will be allowed only in the presence of the custodian or his designee.

e. Release of Medical Information to Members of the Public. See paragraph 2-9*a*, AR 340-17.

17-6. Alcohol and Drug Abuse Records

No information concerning the treatment, identity, prognosis, or diagnosis for alcohol or drug abuse patients will be released except in accordance with the provisions of AR 600-85.

Section II. MEDICAL RECORDS ENTRIES

17-7. General

a. Content. Entries will be made on medical record forms by the health care provider who observes, treats, or cares for the patient. Although AR 40-66 prescribes the amount of information that must be given for entries, health care providers must always remember that entries serve as a useful record for continued and future care. Therefore, all entries must be clinically pertinent and kept up-to-date.

b. Legibility. All entries must be legible; they are usually typed but may be handwritten. Handwritten entries will be made in permanent black or blue-black ink, except when pencil entries are either directed or necessary under field conditions. Rubber stamps may be used only for standardized entries, such as routine orders.

c. Signatures. All entries must be signed. The first entry made by a specific person will be signed; later entries on the same page by that person will be signed or initialed. Military members must add grade and corps. A rubber-stamped signature will not be used in place of written signatures or initialing. However, the use of rubber block stamps under written signatures is recommended because it establishes a method to identify the authors of entries. Block stamps for military members should contain printed name, grade, and corps.

d. Dating Entries. All entries must be dated. Dates will be written in the day-month-year sequence; month will be stated by name, not by number. For example, a correct entry is 17 Jun 84.

e. Corrections to Entries. To correct an entry, a single line is drawn through the incorrect information; this information must remain readable. The new information is then added, dated, and signed (with title) by the person making the correction.

17-8. Patient Identification

The "Patient's Identification" section will be completed when each record document is begun. Patient identification will be typed or handwritten in black or blue-black ink. Patient identification must include at least the patient's name, rank, grade, or status.

17-9. Facility Identification

The MTF providing care will be clearly named in all medical records and reports (such entries on SF 600 (Chronological Record of Medical Care) will be made by rubber stamp when possible). Since patients are often treated at several MTFs, the MTF that is custodian of the patient's records will be named also. For outpatient records and health records, this may be done using the patient recording card.

Section III. RECORDING DIAGNOSES AND PROCEDURES

17-10. General

a. Diagnostic nomenclature will be recorded in language accepted as good professional usage. Vague and general expressions will be avoided.

b. The affected body part will always be stated when relevant to the condition and when not given in the name of the condition. In addition, the body part will be described in as much detail as is needed (that is, skin of, tissue of, region of). Terms such as "right," "left," "bilateral," "posterior," and "anterior" will also be added when applicable. For dental diagnoses and procedures see TB MED 250.

c. Few abbreviations should be used in medical records. Only those listed in the appendix of AR 40-66 and the medical terminology section are authorized. The chief of the MTF clinical and professional services will insure that those listed are properly used. Abbreviations not listed in the appendix of AR 40-66 may be used in long narratives but only if defined in the text. For example: Nerve condition time (NCT) is changed by many factors. NCT varies with electrolytes or with temperature.

17-11. Special Instructions for Certain Diseases

Food poisoning and food infection are terms that refer to certain diseases in which the causative organism or agent enters the body via food or drink. Food infection applies to a disease caused by ingesting pathogenic organisms that lodge in the gastrointestinal tract. Food poisoning applies to a disease caused by ingesting food that contains a preformed toxin of bacterial origin. Neither term is correct for recording illness from nonbacterial poisons. Illness due to food that was toxic in its natural state (for example, fungi, shellfish) should be recorded as "toxic effect of noxious foodstuffs" (naming the food). If due to food which becomes adulterated with nonbacterial poison (for example, cadminum) during preparation, the illness should be recorded as a poisoning and the cause named. In all cases, the suspected food and the organism or causative agent should be named.

17-12. Special Instructions for Certain Diagnoses

a. Alcoholism and Nondependent Abuse of Alcohol. The term "alcoholism" is used only for persons whose alcohol intake is great enough to damage their physical health or their personal or social function. For other individuals whose use of alcohol has brought them to medical attention, the appropriate term is "nondependent abuse of alcohol." This term applies to people formerly diagnosed as "simple drunkenness" cases. It also applies to people not suffering from alcoholism but who are seen by a physician because of driving-while-intoxicated charges, an altercation involving alcohol, AWOLs, or absences from work due to overuse of alcohol.

b. Nondependent Abuse of Drugs (Improper Use of Drugs). This term is used for a person who is treated or observed because of the effects of drug use (including positive test findings). It is not used for people addicted to or dependent on drugs. The known or suspected drug will be named.

c. Malingerer. This term is used for a person who claims to be ill or unduly exaggerates a disability. It is used only when the medical officer believes there is no actual illness or disability or only a slight one (see paragraph 194, Manual for Courts-Martial).

17-13. Recording Psychiatric Conditions

See paragraph 3-7, AR 40-66.

17-14. Recording Injuries

a. Details To Be Recorded.

(1) The same details will be given and the same terms used when recording both battle and nonbattle injuries. To be complete, the recording of an injury must include the details given below. On DA Form 3647 (Inpatient Treatment Record Cover Sheet) (ITRCS), the details listed in *(c)* through *(h)* below will be recorded in Item 33.

(a) The nature of the injury. The exact nature of the injury must be recorded as well as the condition caused by it. Conditions like traumatic bursitis, traumatic neuritis, traumatic myositis, or traumatic synovitis must be explained by describing the original injury. For example, a contused wound resulting in bursitis would be recorded as bursitis due to contusion.

(b) The part or parts of the body affected. In the case of fractures and wounds, state if any nerves or arteries were involved; major nerves or blood vessels must be named.

(c) The external causative agent. In the case of acute poisoning for example, the poison must be named.

(d) How the injury occurred. State what the person was doing when injured (in action against the enemy, work detail, marching, or drilling). For motor vehicle accidents, state the kind of vehicle involved and if military owned or otherwise.

(e) When the injury was self-inflicted. If the injury was deliberately self-inflicted, state if it was an act of misconduct (to avoid duty) or an act of the mentally unsound (a suicide or attempted suicide).

(f) The place where injured. If on-post, state the building or area (barracks, mess tent, motor pool); if off-post, state the place and person's status (home on leave, in transit while AWOL).

(g) The date of the injury.

(2) Examples of properly recorded diagnoses are as follows:

(a) "Fracture, open comminuted, upper third of shaft of femur, left, no nerve or artery involvement; bullet entering anterior upper portion of left thigh and lodging in femur. Caused by rifle bullet, accidentally incurred when patient's rifle discharged while he was cleaning it in Arms Room, Bldg 902, Ft Dix, NJ, 8 Jul 84."

(b) "Bursitis, acute, knee, right, due to contusion, anterior aspect. Accidentally incurred when patient tripped and fell, striking knee on floor while entering Barrack 1380, Ft Sam Houston, TX, 9 Jul 84."

b. Wound or Injury Incurred in Combat.

(1) In addition to the details described in *a* above, records of wounds or injuries incurred in combat must state:

(a) The wound resulted from enemy action. The definition of wounded in action (battle casualty) is given in Appendix C, AR 40-400. The abbreviation WIA (wounded in action) will be used. However, this abbreviation by itself is not acceptable as a diagnosis.

(b) The kind of missile or other agent that caused the wound.

(c) The time the wound occurred.

(d) The general geographic location where the person was wounded. Entries such as "near Saigon, Vietnam" are sufficient; map coordinates alone are not sufficient.

(2) The following is an example of a correctly recorded WIA case: "WIA wound, penetrating, left arm; entrance, posterior lateral, proximal third, severing brachial artery without nerve involvement. Incurred during search and destroy mission when struck by enemy mortar shell fragments, 16 Dec 69 near Bao Tri, RVN."

c. Injuries or Diseases Caused by Chemical or Bacteriological Agents by Ionizing Radiation.

(1) For the injuries, record the name of the agent or type of ionizing radiation (if known). If the agent or radiation is not recognized, record any known properties of it (odor, color, physical state).

(2) Record the date, time, and place where contamination took place.

(3) Estimate and record the time that lapsed between contamination and self-decontamination or first aid (if any). The procedures will also be stated.

(4) For those injured by ionizing radiation, estimate and record the distance from the source. If the exposure is to external gamma radiation, state the dosage ("measured 200 R"). If not known, the dosage should be estimated and recorded ("est 150 R").

(5) State, if known, whether exposed through airburst, ground burst, water surface burst, or underwater burst.

17-15. Recording Deaths

a. The following terms will be used to record a death when the cause is unknown.

(1) *Sudden death.* Used in the case of sudden death known not to be violent.

(2) *Died without sign of disease.* Used in case of death other than sudden death known not to be violent.

(3) *Found dead.* Used in cases not covered by (2) above when a body is found.

b. For additional information, see Section II, AR 40-66.

Section IV. OUTPATIENT TREATMENT RECORD

17-16. General

a. Treatment Record. DA Form 3444 (Outpatient Treatment Record) (OTR) will be prepared for all patients treated as outpatients other than active duty personnel.

b. Responsibilities. Medical and dental officers and other care providers will insure that information is promptly and accurately recorded on OTR medical and dental forms. They will also insure that records prepared and received from other MTFs are promptly reviewed and filed in the OTR.

c. Outpatient Treatment Record Forms and Documents.

(1) DA Form 3444 (see Figure 17-2) series folders will be used as OTR file folders. On these folders, the "Outpatient Treatment" box is checked if the folder is used as a medical record and the "Dental (Non-military)" box if used as a dental record. (For the preparation and filing of the DA Form 3444 series folder, see Chapter 4, AR 40-66.)

(2) The forms used in medical OTR are listed in Table 17-1. These forms will be filed from top to bottom in the order they are listed in the table. Copies of the same form will be grouped and filed in reverse chronological order; that is, the latest on top.

17-17. Initiating and Keeping Outpatient Treatment Records

The OTR will be kept at the MTF that provides primary medical care. Only one medical OTR and one dental OTR will be kept at the MTF for each patient. Keeping partial or multiple records is prohibited except in obstetrical cases (see paragraph 17-21*d*).

17-18. Transferring Outpatient Treatment Records

To insure a patient's record is complete, the MTF providing care should include all outpatient records prepared at other facilities. OTR should be transferred to the next MTF when patients are transferred.

a. Mailing Outpatient Treatment Records.

(1) When a patient moves, the OTR may be handcarried or mailed to the next MTF. However, the following OTR must be mailed and will be sent directly to the next MTF, ATTN: Patient Administration Division. They will not be sent to installations, organizations, or area commanders or to personnel officers.

- *Special category records.*
- *OTR of patients who will be ineligible for care at a military MTF after the move.*

(2) When mailing an OTR to the next MTF, the procedures below will be followed:

(a) The MTF will complete DD Form 2138 (Request for Transfer of Outpatient Records) and instruct the sponsor to present the card at the next MTF.

(b) When the losing MTF receives the DD Form 2138, it will mail the OTR to the requesting MTF. The losing MTF will file the DD Form 2138 alphabetically and keep the form until the retirement of that year's records.

(3) A patient whose OTR must be mailed ((1) above) may be given a copy of certain parts of the OTR or an extract. This may be done if the patient needs medical care en route to or upon arrival at another MTF. The extract or copies will be given to the patient or any other authorized person as described in b below. Documentation of the treatment en route should be included in the original OTR; the patient should be told to give this documentation to the next MTF.

b. Handcarrying Outpatient Treatment Records. If the patient (other than those described in *a*(1) above) requests it, he may handcarry the OTR to the next MTF. These procedures will be followed when OTR are handcarried:

(1) The patient will sign for the OTR on DA Form 3705 (Receipt for Outpatient Treatment/Dental Records). When preparing DA Form 3705, the "address" blocks must be completed. Once signed, DA Form 3705 will be filed like DD Form 2138.

(2) An adult's OTR will not be released to anyone other than the patient unless a signed authorization is presented to the MTF. Any statement approving release to another person will be acceptable if signed and dated by the patient. This statement will be attached to the DA Form 3705.

c. Troop-Unit Changes of Station. When troop units change station, the losing and gaining MTFs will coordinate to transfer the OTRs. If mailed, the losing MTF will securely package and seal all OTRs destined for the same MTF and send them by registered mail.

LAST NAME FIRST MI

0 1 2 3 4 5 6 7 8 9 R S

6

PATIENT IDENTIFICATION

0 1 2 3 4 5 6 7 8 9 R S

ALPHABETICAL AND
TERMINAL DIGIT FILE FOR

TREATMENT RECORD

For use of this form, see AR 40-66; the proponent agency is Office of The Surgeon General.

NOTE TO PHYSICIAN:

- ☐ MEDICAL CONDITION (Medical Warning Tag)
- ☐ PERSONNEL RELIABILITY PROGRAM (SCREENING)
- ☐ RADIATION SCREENING PROGRAM
- ☐ FLIGHT STATUS
- ☐ MEDICAL REGISTRIES
- ___ BLOOD TYPE

TYPE OF RECORD:

- ☐ INPATIENT (CLINICAL)
- ☐ OUTPATIENT TREATMENT
- ☐ HEALTH
- ☐ HEALTH-DENTAL
- ☐ DENTAL (NON-MILITARY)

IF FOUND RETURN TO
ANY US POST OFFICE

POSTMASTER - FORWARD TO:
HQ, Department of Army
Washington, DC 20310

DA FORM 3444-6, 1 JAN 79

REPLACES DD FORM 722, JUL 53, AND DD FORM 722 L, JUL 53, WHICH WILL BE USED UNTIL SUPPLIES ARE EXHAUSTED.
REPLACES DA FORM 3444-6, NOV 68, WHICH WILL BE USED FOR CLINICAL AND NONMILITARY RECORDS ONLY.

Table 17-1. Forms and Documents of the Medical OTR

LEFT SIDE OF FOLDER	
Form No.	*Form Title and Notes*
DA Form 3180/3180A	Personnel Screening and Evaluation Record. (See AR 50-5 and Chapter 4, AR 380-380.)
*SF 601	Health Record—Immunization Record.
*SF 545	Laboratory Report Display. Filed with SFs 546 through 557 mounted.
*SF 519/519A	Medical Record—Radiographic Report.
SF 520	Clinical Record—Electrocardiograph Record. Reports of electrocardiograph examinations with adequate representative tracings should be attached to the back of this form or on another attached sheet of paper.
DA Form 3647	Inpatient Treatment Record Cover Sheet. (Formerly DA Forms 8-275 series and DD Form 481 series.) File with it a copy of SF 502 (if prepared). Also filed here is SG Form 84, AF Form 565, NAVMED 6300/5, or DD Form 1380 (formerly DA Form 8-27).
—	Authorization for release of medical information. File with this a synopsis of any information released and related correspondence. (The synopsis may be entered on SF 544, which would be filed here.)
—	Administrative documents and other correspondence.

Table 17-1. Forms and Documents of the Medical OTR—continued

RIGHT SIDE OF FOLDER	
DA Form 4515	Personnel Reliability Program Record Identifier. See AR 50-5.
*SF 600/SF 558	Health Record—Chronological Record of Medical Care. File here also any other basic chronological medical care records (for example, SF 558 (Medical Record— Emergency Care and Treatment) and AMOSIST Encounter Forms).
DA Form 3763	Community Health Nursing—Case Referral. See paragraph 4-2*b*, AR 40-407.
DA Form 4530	Electroencephalogram Request and History.
DA Form 4700	Medical Record—Supplemental Medical Data.
SF 513	Medical Record—Consultation Sheet.
SF 522	Medical Record—Request for Administration of Anesthesia and for Performance of Operations and Other Procedures.
—	Other SF 500 series forms in numerical sequence.
DD Form 771/771-1	Eyewear Prescription/Eyewear Prescription—Plastic Lenses.
—	Reports or certificates prepared by neuropsychiatric consultation services.
—	Correspondence on hearing aids.
—	Medical documents from civilian sources.
DA Form 3365	Authorization for Medical Warning Tag.
*DA Form 4410-R	Disclosure Accounting Record.
*DD Form 2005	Privacy Act Statement—Health Care Records.

*This form must be included in all OTRs.

17-19. Transfer Requests Other Than DD Form 2138

Although DD Form 2138 is the only form authorized for use as a request for transferring OTR in ordinary circumstances, this does not preclude prompt response to other types of requests such as DD Form 877 (Request for Medical/Dental Records or Information). Charge-out information for such requests will be filed and kept at the losing MTF as described in AR 40-66.

17-20. Disposition of Outpatient Treatment Records

Outpatient Treatment Records will be disposed in accordance with AR 340-18-9.

17-21. Preparation of Outpatient Treatment Records

Each contact with the AMEDD as an outpatient will be recorded in the OTR. Periods of treatment as an inpatient will be described on DA Form 3647 and SF 502 (Medical Record—Narrative Summary) and put into the OTR.

a. Preparation and Use of SF 600. SF 600 is the basic record form of the medical OTR. It is a chronological record of outpatient visits. For the preparation and use of SF 600, see paragraph 5-14*a*(1) and 5-14*a*(3) through (7) of AR 40-66. See Figure 17-3.

b. Preparation and Use of SF 601 and PHS Form 731.

(1) An SF 601 (Health Record—Immunization Record) will be prepared and permanently kept for each person who has an OTR. It will be put into the record when:

(a) The OTR is initiated.

(b) The patient next reports for immunizations or sensitivity tests.

(c) Reactions are noted.

(2) PHS Form 731 (International Certificates of Vaccination) will be prepared or posted when a patient reports to an MTF for immunizations. Only the following identification information is entered on the form:

(a) The patient's name on the "Traveler's Name" line.

(b) The patient's address on the address line.

(c) The county of the individual's address on its appropriate line.

(3) Individuals preparing SF 601 and PHS Form 731 will insure that all entries are recorded on both forms and that both forms are current with each other.

(4) In accordance with international rules, entries on PHS Form 731 for immunization against smallpox, yellow fever, and cholera will be authenticated. Each entry must show the DOD immunization stamp and the signature of the medical officer or his chosen representative. (See AR 40-562.) For other entries on PHS Form 731 and all entries on SF 601, the signature block may be stamped or typewritten and initialed by the medical officer.

c. Preparation of the Outpatient Treatment Record Folder for Patients Allergic to Medications. On the outside front cover of the DA Form 3444 series folder, the "Medical Condition" block will be marked and a DA Label 162 (Emergency Medical Identification Symbol) affixed. This will be done when SF 601, PHS Form 731, or DA Form 3365 (Authorization for Medical Warning Tag) is prepared. (See AR 40-15 and AR 40-562.)

d. Obstetrical Cases. A pregnancy diagnosis will be entered on SF 600. After the pregnancy, all forms related to it will be filed in the Inpatient Treatment Record (ITR). When the records are filed, the following will be entered on SF 600: "Prenatal care records filed in ITR of (patient's name, FMP, and SSN), (location of MTF), and (date)."

17-22. Use of Outpatient Treatment Records

The OTR will be given to physicians, dentists, and other medical personnel attending an outpatient or inpatient. When an outpatient is to be treated over a short period of time in a clinic, the OTR may be kept in that clinic; however, it will be made available to other medical personnel when required during this retention period. Further, the OTR should accompany a patient admitted to a military MTF and be constantly available for use by the attending physician. A strict audit trail will be kept for any OTR temporarily out of the file.

Section V. HEALTH RECORDS

17-23. General

The primary purpose of the health record (HREC) is to insure that AMEDD personnel have a concise but complete medical history of everyone on active duty or active duty for training. It will help medical officers advise commanders on retaining and using their personnel. Similarly, the record will help physical evaluation boards appraise the physical fitness of Army members and their eligibility for benefits.

17-24. Responsibilities

a. Unit Commanders. Unit commanders will insure that HRECs are always available to AMEDD personnel. They will also insure that information in the HREC is kept private and confidential. If a commander acquires the HREC or records belonging in HREC, he will insure that they are treated confidentially and sent to the proper HREC custodian without delay. In some instances, some commanders may act as the custodians of their units' HRECs or appoint a competent person to do so. They may act as custodians only if no AMEDD personnel are locally available.

b. AMEDD Officers.

(1) AMEDD officers will serve as custodians of the HRECs. In their charge are the HRECs for members of the units to which they supply primary medical care. Also in their charge are the HRECs of other individuals they are currently treating. AMEDD officers will use the HRECs for diagnosis and treatment. They will also use them for conservation and improvement of health. In doing so, they will see that all needed information is promptly entered into the HREC in their custody. If any such information is omitted, they will take the needed action to have it included.

(2) When an AMEDD officer examines or treats a person whose HREC is not in his custody (that is, "casuals"), he will send copies of the proper records to the person's HREC custodian. These records will be sent sealed in an envelope stamped or plainly marked "Health Records." In addition to the address, the envelope also will be plainly marked "Health Record of (person's name, grade, and SSN)." The person's unit of assignment will also be shown. (If the HREC custodian is not known, the document will be sent to the MEDDAC (Medical Department Activity) or MEDCEN (Medical Center) commander of the person's assigned installation.)

17-25. For Whom Prepared and Kept

HRECs will be prepared and kept for all Army personnel. These include active duty personnel, Reserve Component personnel, and cadets of the US Military Academy. When transferred to Army custody, HRECs for members of the Navy and Air Force will also be kept.

17-26. Forms and Documents of the Health Record

The medical forms authorized for use in the HREC are listed in Table 17-2. To make access to information easier in these folders, the forms will be filed from top to bottom in the order they are listed in the tables. Copies of the same form will be grouped and filed in reverse chronological order; that is, the latest on top.

Table 17-2. Forms and Documents of the Health Record

LEFT SIDE OF FOLDER	
Form No.	**Form Title and Notes**
DA 4186	Medical Recommendation For Flying Duty. See AR 40-501.
DA Form 3180/3180A	Personnel Screening and Evaluation Record. See AR 50-5.
*SF 601	Health Record—Immunization Record.
DD Form 1141	Record of Occupational Exposure to Ionizing Radiation. Also automated dosimetry records, DD Form 1952 (Dosimeter Application and Record of Occupational Radiation Exposure), results of investigation of alleged or actual overexposure, and any other record of personnel dosimetry. See AR 40-14.
*SF 545	Laboratory Report Display. (Formerly SF 514.) Filed with SFs 546 through 557 mounted.
*SF 519/519A	Medical Record—Radiographic Report.
SF 520	Clinical Record—Electrocardiograph Record. Reports of electrocardiograph examinations with adequate representative tracings should be attached to the back of this form or on another attached sheet of paper.
DA Form 3647	Inpatient Treatment Record Cover Sheet. (Formerly DA Forms 8-275 series and DD Forms 481 series.) File with it a copy of SF 502 (Medical Record—Narrative Summary), if prepared. File here also SG Form 84, AF Form 565, NAVMED 6300/5, DD Form 1380 (formerly DA Form 8-27 (Emergency Medical Tag)), or any other narrative summaries from the Veterans Administration, Public Health Service, or other Government MTF.
DA Form 3365	Authorization for Medical Warning Tag.

Table 17-2. Forms and Documents of the Health Record—continued

RIGHT SIDE OF FOLDER	
DA Form 4515	Personnel Reliability Program Record Identifier. See AR 50-5.
*SF 600/SF 558	Health Record—Chronological Record of Medical Care. File here also any other basic chronological medical care records (for example, SF 558 (Medical Record— Emergency Care and Treatment) and AMOSIST Encounter Forms).
SF 602	Health Record—Syphilis Record. (Formerly DA Form 8-114.)
—	Civilian or foreign military treatment records.
DA Form 199	Physical Evaluation Board Proceedings.
*DA Form 1811	Physical Data and Aptitude Test Scores upon Release from Active Duty. See AR 601-210. For personnel separated to continue on active duty in the same or another status, file this form directly in front of the last SF 88 in the HREC continued in use. For personnel reentering service after the HREC has been retired, file this form as the last document in the temporary HREC; when the permanent HREC is received, file the form directly in front of SF 88.
DA Form 2173	Statement of Medical Examination and Duty Status.
DA Form 3349	Medical Condition—Physical Profile Record. (Formerly DA Form 8-274.) File here also any correspondence on a revision of physical profile serials.
DA Form 3947	Medical Board Proceedings. (Formerly DA Form 8-118.)
DA Form 4060	Record of Optometric Examination. (This form became obsolete after 1 October 1974.)
DA Form 4530	Electroencephalogram Request and History.
DA Form 4700	Medical Record—Supplemental Medical Data.
*SF 88	Report of Medical Examination.
*SF 93	Report of Medical History. (Formerly SF 89.) File here any other medical history form.

Table 17-2. Forms and Documents of the Health Record—continued

SF 513	Medical Record—Consultation Sheet.
SF 522	Medical Record—Request for Administration of Anesthesia and for Performance of Operations and Other Procedures.
—	Other SF 500 series forms in numerical sequence.
DD Form 771/771-1	Eyewear Prescription/Eyeware Prescription—Plastic Lenses.
DD Form 2215	Reference Audiogram.
DD Form 2216	Hearing Conservation Data.
—	Reports or certificates prepared by neuropsychiatric consultation services or psychiatrists.
—	Correspondence on hearing aids.
—	Documents and correspondence on flying status. That is, restrictions, removal of restrictions, suspensions, and termination of suspensions. See AR 600-107.
—	Other medical documents important enough to keep on file. This includes correspondence on release of medical information, statements instead of physical examinations for the promotion of officers and warrant officers, and so forth.
DA Form 4465	ADAPCP Military Client Intake and Follow-up Record. File here also any other authorized alcohol and drug forms.
*DA Form 4410-R	Disclosure Accounting Record. To be included if DD Form 722 is used as the folder instead of the DA Form 3444 series.
*DD Form 2005	Privacy Act Statement--Health Care Records. To be included if DD Form 722 is used as the folder instead of the DA Form 3444 series. See paragraph 1-6c, AR 40-1

**This form must be included in all health records.*

17-27. Access to Health Records

All personnel having access to HRECs will protect the privacy of medical information. The extent of access allowed certain personnel is described below.

a. Medical Personnel. AMEDD personnel are allowed direct access to HRECs for purposes of diagnosis, treatment, and the prevention of medical and dental conditions. They also have access to work for the health of a command and to do medical research.

b. Service Members. If a service member requests information from his HREC or copies of the documents in it, they will be given to him. For special category records, see paragraph 2-6*e*, AR 340-31.

c. Inspectors. Personnel inspecting an MTF are allowed direct access to the HRECs. This includes personnel conducting Technical Proficiency Inspections under AR 20-1; it also includes Technical Standardization Inspections conducted by the Defense Nuclear Agency. Inspectors may have access to the HRECs to evaluate the compliance of AMEDD personnel with regulations. All inspectors must respect the confidentiality of the HRECs they inspect.

d. Graves Registration Personnel. Graves registration personnel are allowed direct access to the HREC of personnel killed in action or missing. They may have access to extract medical and dental information needed by their service.

e. Other Nonmedical AMEDD Personnel. Nonmedical personnel may need information from a person's HREC for official reasons. Such personnel include unit commanders, inspectors general, officers of the Judge Advocate General's Corps, military personnel officers, and members of the US Army Criminal Investigation Command or military police performing official investigations. When officially needed, information from the HREC or copies of documents in it will be supplied by the MTF commander or patient administrator.

17-28. Cross-Servicing of Health Records

AR 40-66 and similar regulations in the other services allow and direct cross-servicing of the HREC. Procedures for maintaining and transferring Navy and Air Force HRECs are similar to those described for Army HRECs.

a. When members of other services are attached to Army MTFs for primary care, custody will be assumed for their HREC. These will be maintained as discussed in this regulation.

b. HRECs not sent with Navy and Air Force patients will be requested when needed for treatment. Similarly, Army HRECs will be sent to Navy or Air Force HREC custodians when Army personnel are given care by MTFs of those services.

c. When cross-servicing HRECs, Army personnel are not required or allowed to check or complete records for any periods before the HREC came under Army custody.

17-29. DA Form 3444 Series Folder

For preparation of this folder, see Chapter 4, AR 40-66 (Figure 17-2). For health records, check the "Health" box under "Type of Record"; for dental records, check the "Dental (military)" box. Handwritten entries will be made in dark ink and boldly printed. (The member's current organization; for example, "Company A, 163d Infantry," will be handwritten but must be done in soft pencil.)

17-30. SF 600

One copy of SF 600 will be put in the health record. (See Figure 17-3.) The following parts of the form are completed:

a. Person's name.

b. Sex.

c. Year of birth.

d. Component. (Do not include branch.)

e. Department.

f. Grade.

g. Organization.

h. SSN.

PATIENT'S IDENTIFICATION (Use this Space for Mechanical Imprint)

PATIENT'S NAME (Last, First, Middle initial)			SEX
DOE JOHN P.			M
YEAR OF BIRTH	RELATIONSHIP TO SPONSOR	COMPONENT/STATUS	DEPART/SERVICE
1958		A D	ARMY
SPONSOR'S NAME			RANK/GRADE
			SP4
SSAN OR IDENTIFICATION NO		ORGANIZATION	
555-33-6666		2/6 INF DIV	

CHRONOLOGICAL RECORD OF MEDICAL CARE

Standard Form 600
600-106-01

Figure 17-3. SF 600 (Patient Data).

17-31. SF 601 and PHS Form 731

a. One copy of SF 601 will be put in the health record. The identification parts of this form will be completed as described for SF 600 in Figure 17-3. At reception stations, procedures will be set up to insure that immunization information is entered on the copy of SF 601. For persons allergic to medication, the "Medical Condition" block on the front of the HREC folder will be checked. Also, DA Label 162 will be put on the front of the folder.

b. A copy of PHS Form 731 will be sent with the health record for later entries of immunization data. This form should be clipped or fastened to SF 601 and it will not be punched. The name and SSN of the person will be typed or written in ink on the front of the form. The address put on the form for officers and warrant officers is HQDA (DAPC-PSR-R), Alexandria, VA 22332. The address for enlisted personnel is Commander, US Army Enlisted Records Center, Fort Benjamin Harrison, IN 46249. The name of the person's unit will be entered below the double line at the bottom of the form; it will not be entered until he reaches his first training or duty station.

17-32. SF 88 and SF 93

The original copies of SF 88 (Report of Medical Examination) and SF 93 (Report of Medical History) will be put in the health record.

17-33. CDC 9.2936A

If a CDC 9.2936A (Venereal Disease Epidemiologic Report) has been received with a person's records, it will be stapled to a blank letter-sized sheet of paper. It will then be fastened in the health record under SF 601.

17-34. Transferring Health Records

a. Sending Health Records. Both parts (health and dental) of a person's HREC are transferred when his Military Personnel Records Jacket (MPRJ) is transferred (AR 740-10). When a person is to be transferred to another unit or station, the military personnel officer of the losing unit will get both parts of the HREC from their respective custodians. The HREC will be sent with the MPRJ except when:

(1) The losing and gaining units receive primary (outpatient type) care from the same medical and dental facilities. In this case, the military personnel officer will inform the HREC custodians about the unit change. The person's unit designation will be changed on the folders of both the health and dental records.

(2) An inpatient is assigned to a medical holding unit that already has the health record. The MTF commander will inform the military personnel officer that the MTF has the health record. When requesting the MPRJ, the MTF commander will also request the dental record.

(3) The HREC custodian sends the records directly to the gaining custodian. If the HREC custodian feels a person should not hand carry his HREC, he will send it directly to the commander of the person's next MTF. The servicing military personnel officer will be promptly informed that the HREC will be sent and not carried. If the custodian does not know the address of the person's next MTF, he will send the HREC to the servicing military personnel officer; it will be sent to the person's next HREC custodian.

b. AMEDD Personnel.

(1) The officer in charge must insure that any health problems of a newly arrived individual are treated. Thus, he must insure that the person's HREC is reviewed when received. This review may be made by the medical officer, a physicians' assistant (MOS 911A), or other qualified individuals. (The HRECs of all personnel working with nuclear weapons or nuclear reactors will be reviewed by medical officers or designated physicians' assistants in accordance with the Personnel Reliability Program (AR 50-5).) Each MTF commander will establish qualifications for people who are not physicians to review the HRECs. Each MTF will also perform audit reviews to insure the HRECs are referred to medical officers when needed. The responsible medical personnel will develop written quidelines for the review of the HRECs by nonmedical officers. These guidelines will insure that reviews check for pending actions, health care problems, and record inadequacies. When writing guidelines, the medical officer must insure that reviews include the actions listed below. These may be modified or expanded to fit the local situation:

(a) Consultation reports will be studied for incomplete or pending actions and profile recommendations.

(b) X-ray reports will be studied for unresolved pathological findings.

(c) Laboratory reports will be studied for unresolved abnormalities.

(d) Drug reactions and idiosyncratic responses will be noted.

(e) Recurrent problems such as repeated bouts of pneumonia, urinary tract infections, cardiac arrhythmias, emotional problems, and drug and alcohol abuse will be noted.

(f) Significant deviations from normal weight, blood pressure, and hearing and visual acuity will be noted.

(g) The HREC folder will be checked to insure that the person's blood type is entered. Also, it will be checked to insure that any allergic reaction to medication was entered and DA Label 162 affixed (AR 40-15).

(2) The medical officer will review all noted health problems to determine if examination or treatment is needed. All pertinent findings will be recorded on SF 600. Also recorded will be the date of the HREC review and the name of the reviewer.

(3) If the individual's record shows that he has been diagnosed as an alcohol or drug abuser within the previous 360 days, the Alcohol and Drug Control Officer will be notified (AR 600-85).

(4) If a CDC 9.2936A is in the individual's record, the medical officer will immediately have the person examined and start an SF 602 (Health Record—Syphilis Report), if needed. If the CDC 9.2936A is not for syphilis, comments on the examination and any treatment given will be made on SF 600. When no longer useful in the case, the CDC 9.2936A will be removed from the HREC and destroyed.

c. Health Records Not Received. The military personnel officer will request information on the missing records from the individual's last known unit. If neither he nor the last unit can find an officer's or warrant officer's HREC, the military personnel officer will send a request for the missing HREC to HQDA (DAPC-PSR-R), Alexandria, VA 22332. If an enlisted member's HREC cannot be found, a request will be sent to Commander, US Army Enlisted Records Center, Fort Benjamin Harrison, IN 46249. A copy of this request will be kept in the member's MPRJ until a reply has been received. If the individual is transferred before the reply arrives, the copy of the request will be indorsed to his next unit. When the request reaches the individual's next unit, it will be put in his "temporary" HREC. (A notation of a reply to the request will be made on SF 600 and the reply inserted in the HREC.)

d. Movements of Units with the Medical Treatment Facility. When a unit and its attached MTF move, the unit's HRECs will be retained and moved by the MTF. This will be done only if the MTF continues to give primary medical and dental service to the unit during and after the move. If another MTF will give primary service to the unit during or after the move, the HRECs will be sent to the record custodian of the MTF that provides care during the move.

17-35. "Temporary" and "New" Health Records

a. "Temporary" Health Record. When receipt of a health record is delayed, a temporary one will be prepared if the individual needs any medical attention. This will also be done if any documents meant to be included in a health record arrive before it. A manila folder rather than the DA Form 3444 series folder will be used. The date the temporary record was begun will be printed on the folder. Documents concerning the member's medical care will be added to the temporary health record as they are used; they will not be prepared until needed. For example, SF 601 would not be prepared for a temporary health record until an immunization was given. When a delayed HREC is received, the forms in the temporary record will be filed in it.

b. "New" Health Record. If a delayed HREC is not received within 60 days after a temporary record is prepared, a new HREC will be prepared. This will also be done when information is received that a record has been destroyed.

(1) When a new health record is prepared, an SF 601 will be added if necessary.

(2) Should a lost health or dental record be found after a new record has been prepared, the new record forms will be filed in the original record. The custodian will note on SF 600 or SF 603 (Health Record—Dental) that the original health or dental record was received.

c. Personnel Returned to Military Control. When personnel who have been missing in action, interned, or captured are returned to military control, their original HREC will be acquired and continued in use.

17-36. Filing the Health Record

a. Health Record Files. Health records will be filed at the MTF that provides primary medical care. The records may be filed alphabetically or in terminal digit sequence. A charge-out system will be used when the HREC is temporarily removed from the record room.

b. Keeping Health Record Files Current. The following procedures will be followed to keep HREC files current:

(1) The MTF and division surgeon will give the military personnel office (MILPO) a list of the MTFs and the units they serve.

(2) The MILPO will give the MTF quarterly personnel rosters of the units they serve.

(3) HREC files for active duty personnel will be screened semiannually against current personnel rosters. This will insure that the file holds only the records of personnel served by the MTF. When an HREC or medical form is found to be held by the wrong custodian, MTF records personnel will send the documents to the correct custodian.

c. Handling Identifiable Health Records and Medical Forms. When a record or form contains enough information that it can be identified as belonging to a specific person, it is an identifiable form. To keep files current, identifiable HRECs and forms will be handled as follows:

(1) When a member outprocesses at an MTF, the MTF will give the serving MILPO his HREC. This is done so that it can be sent with the MPRJ to the new custodian. When the HREC is sent to the MILPO, the MTF will record identification of the new custodian so that any late-arriving medical records, such as laboratory slips or SF 600s can be forwarded to him.

(2) When the MTF cannot find the member's health or dental record, a suspense card will be prepared. This card will contain the member's name, rank, SSN, the complete address of his new unit, the MEDDAC that serves his new unit, and the date the card is put in suspense. The suspense card will be kept in a charge-out folder; the folder kept in the files where the member's records should have been. These suspense cards will be kept until the record is found and sent to the new custodian or until the files have been given two semiannual reviews, whichever comes first. They will then be destroyed.

d. Handling Stray Records and Forms. Stray records and forms found during the semiannual files review will be handled as follows:

(1) The record and forms will be screened against the MTF files (including the suspense cards). Those that can be identified (matched with a record or suspense card) will be sent to the proper custodian. The letter of transmittal will name the member's assigned unit.

(2) When the proper custodians cannot be determined, the MTF will make a list of the members to whom the records belong. This list will give each member's full name and SSN. The list will be sent to the MILPO. With it will be sent a cover letter requesting that the names be checked against installation rosters, clearance files, and with the Standard Installations/ Division Personnel System (SIDPERS) Interface Branch that keeps a

worldwide locator file. It will request that the member's unit of assignment be named, if possible. The MILPO response will be kept by the MTF in a reference paper file (File Number 901-07) for 1 year. (See AR 340-18-9 for information on reference paper files.)

(3) If the MILPO cannot find the address of the proper custodian before the files are given two semiannual reviews, the MTF will draft a letter stating that the serving MILPO has done the proper screening and cannot find the correct custodian. With this letter, the identifiable records and forms will be disposed of as outlined in Table 17-3.

Table 17-3. Disposition of Stray Records and Forms

RULE	A If the records or forms belong to	B then send them to (see Note)
1	An Army officer or warrant officer	HQDA (DAPC-PSR-R) Alexandria, VA 22332
2	Army enlisted personnel	Commander US Army Enlisted Records and Evaluation Center Fort Benjamin Harrison, IN 46249
3	Army retired personnel	Commander US Army Reserve Components Personnel and Administrative Center 9700 Page Boulevard St. Louis, MO 63132
4	Navy/Marine personnel	Chief, Bureau of Medicine and Surgery ATTN: Code 7424 Navy Department Washington, DC 20372
5	Air Force personnel	Headquarters, US Air Force ATTN: AFMPC/DPMDR Randolph Air Force Base, TX 78148

Note: HRECs that contain only blank forms will not be sent to the agencies listed above. Reusable folders and forms will be returned to stock; folders and forms that cannot be reused will be destroyed.

e. Handling Unidentifiable Records and Forms. An unidentifiable record or form is one that contains either no data or such a small amount that trying to identify the person it belongs to is impossible. Before destroying these records, the patient administrator will send a report to the MTF committee that audits medical records. This report will list the type of record; that is, laboratory forms, X-ray reports, SF 600s, and the number of each type to be destroyed. This report and the committee's action on it will be entered in the committee minutes. Following the committee's approval, the patient administrator or his chosen representative will destroy these records and forms.

17-37. Disposition of Health Records

Upon discharge, release from active duty, retirement, death, or transfer from US Army Reserves (USAR) to Army National Guard (ARNG), HRECs will be disposed of in accordance with Appendix E, AR 635-10. ARNG HRECs will be disposed of like an MPRJ. (For officers and warrant officers, see NGR 640-100; for enlisted personnel, see NGR 600-200.)

17-38. Preparation of the Health Record

Throughout the soldier's military career, each contact with the AMEDD as a patient is recorded in the HREC. Periods of treatment as an inpatient, described on DA Form 3647 and SF 502, are put in the health record. Quarters referrals are reported as to duration and treatment. Outpatient medical care is recorded each time the person is seen. Medical care at MTFs that do not keep the HREC is recorded and sent to the HREC custodian.

17-39. Use of the Health Record

a. Use Within Medical Treatment Facilities. Precise procedures for using the HREC within MTFs are not set by this publication. Such procedures should be set locally to insure the most efficient handling of the HRECs. The procedures set by MTF commanders will insure that:

(1) HRECs are readily available to AMEDD personnel who are treating patients.

(2) Access to information in the HREC is controlled.

b. Use in Primary (Outpatient) Medical Care.

(1) Normally a person's health record will be kept by the MTF that gives his unit primary medical care. Each time the person is treated, the health record will be removed from the file and used by the physician. Each time a physician uses a record, he will comment on the case on the SF 600. When an MTF refers a patient elsewhere for outpatient care, the health record may be sent also. This is decided by either the referring or consulting physician. If it is sent, the consulting physician will comment in the record on his findings and treatment. If it is not sent, the consulting physician will enter his findings on SF 513 (Medical Record—Consultation Sheet) or any other medical forms (including SF 600) he deems proper. These consultation and treatment records will be filed in the person's HREC.

(2) A person may report for outpatient treatment to an MTF that does not keep his health record. In this case, the findings and treatment will be recorded on an SF 600 and any other medical forms that are needed. After treatment, the SF 600 and other records will be sent to the custodian of the person's health record.

c. Use in Inpatient Care.

(1) Normally, the HREC will be sent to the MTF when a person is admitted for treatment. When an MTF receives the HREC (or a portion of it), the patient administrator becomes the custodian. He will insure it is accessible to authorized personnel. When received, the HREC will be sent to the patient's ward. It will be kept there during his stay for use by his attending physician and other medical personnel involved in his case. The patient administrator will insure that a copy of each of the forms required for the HREC prepared by the MTF is put in the HREC. He will also insure that the entries needed for inpatients on SF 600 are made.

(2) When a patient is released from the MTF, the patient administrator will forward the HREC as follows:

(a) For attached patients returned to duty. Send the HREC to the record custodian of the MTF that provides the person with primary outpatient care. If the primary MTF is unknown, send the HREC to the hospital commander at the person's assigned installation.

(b) For assigned patients returned to duty. Send the HREC to the military personnel officer of the person's assigned unit. If the person is locally reassigned, send the HREC to the custodian as in (a) above.

(c) Patients transferred to another medical treatment facility. Send the HREC with the inpatient record to the other MTF.

(d) For deceased patients. Send the HREC to the officer holding the patient's personnel records.

(e) For patients AWOL in excess of ten days. Send the HREC to the custodian of the MPRJ.

17-40. Preparation and Use of SF 600

SF 600 is a chronological record of each treatment in a person's military health history. The MTF initiating an SF 600 will complete the identification data at the bottom of the form. Entries on the form may be typed but will usually be written in ink; if written, entries must be legible. Each entry will show the date and time of visit and the MTF involved; these entries will be made by rubber stamp when possible. (As long as the patient is treated by the same MTF, the name of that MTF need not be repeated in every dated entry.) Each entry on the form will also be signed by the person making it. (See Figure 17-4 for examples of entries of SF 600.)

Standard Form 600
[illegible] and
[illegible] Medical Records
[illegible] Exception Approved by NARS
[illegible] 1 Aug 79

HEALTH RECORD	CHRONOLOGICAL RECORD OF MEDICAL CARE
DATE	SYMPTOMS, DIAGNOSIS, TREATMENT, TREATING ORGANIZATION (Sign each entry)
8 APR 1984	HX: 101° FEVER
TMC #1 BERLIN BDE APO NY. 09742	IMP: URI
0400 HRS.	DISPOSITION: ADMIT TO WARD 4B. Mark L. Moore cpt. M.C.

PATIENT'S IDENTIFICATION (Use this Space for Mechanical Imprint)

PATIENT'S NAME (Last, First, Middle initial): DOE JOHN P.
SEX: M
YEAR OF BIRTH: 1958
RELATIONSHIP TO SPONSOR:
COMPONENT/STATUS: A D
DEPART/SERVICE: ARMY
SPONSOR'S NAME:
RANK/GRADE: SP4
SSAN OR IDENTIFICATION NO: 555-33-6666
ORGANIZATION: 2/6 INF DIV

CHRONOLOGICAL RECORD OF MEDICAL CARE
Standard Form 600
600-106-01

Figure 17-4. SF 600 (Medical Care).

a. Entries for Outpatient Care.

(1) Entries should be concise but complete; that is, medically and adjudicatively adequate. They should include:

(a) A description of the nature and history of the patient's chief complaint or condition.

(b) Findings of any examination or test.

(c) Diagnoses and impressions (if made).

(d) Treatment, disposition, and any instructions given to the patient for follow-up care. All prescribed drugs will be recorded. These entries may be recorded in a "subjective, objective, assessment plan" format. SF 558 (Emergency Care and Treatment) will be used for emergency cases.

(2) Each visit will be recorded and the complaint described even if the patient is returned to duty without treatment. If a patient leaves before being seen, this will also be stated.

(3) When admission as an inpatient is imminent, the entries discussed in (1) above may be made on SF 509 (Medical Record-Doctor's Progress Notes) instead of SF 600. This will then be the inpatient admission note filed in the patient's inpatient record. Other referred or deferred inpatient admissions will be recorded on SF 600.

(4) All requests for consultation, prescriptions, or other services will be recorded on SF 600.

(5) With patients seen repeatedly for special procedures or therapy (for example, physical and occupational therapy, renal dialysis, or radiation), the therapy will be noted on SF 600 and interim progress statements will be recorded. Also, a final summary will be given when the special procedures or therapy are ended. This summary will include:

- Results of evaluative procedures.
- Treatment given.
- Reaction to treatment.
- Progress noted.
- Condition on discharge.
- Any other pertinent observations.

Initial notes, interim progress notes, and any summaries may be recorded on any authorized form but must be referenced on SF 600.

(6) If an injury is treated, the cause and circumstances ("how-when-where-leave status") will be entered.

(7) For persons taking part in research projects as test subjects, entries will include:

- The drugs given or appropriate identifying code.
- Investigative procedures performed.
- Significant observations, including effects.
- The physical and mental state of the subject.
- Tests and laboratory procedures performed.

(8) Outpatient care received at civilian facilities will also be recorded on SF 600. If available, copies of records concerning this care will be put in the HREC. Personnel who prepare payment vouchers for civilian care (AR 40-3) will acquire a summary of diagnosis and treatment when processing the vouchers. They will then send this information to the person's HREC custodian.

b. Entries for Periods of Medical Excuse from Duty. Except during combat, each admission to an MTF or referral to quarters will be recorded on SF 600.

(1) In addition to the information described in *a* above, entries for MTF admissions will include:

- The time and date of admission.
- The name and location of the MTF.
- The cause of admission.

(2) In the case of referral to quarters, detailed comments will be made regarding:

- Care given.
- Estimated duration.
- Extensions of quarters status.
- When the patient will be returned to duty.

c. Entries for Physical Examinations. The term "Physical Examination" and the date will be entered on SF 600 for each complete physical examination made and recorded on SF 88. Entrance medical examinations will not be entered.

d. Entries for Orthopedic Footwear. When a person is authorized the issue of orthopedic footwear, the term "orthopedic footwear authorized" will be entered on SF 600. Also entered will be the prescription and date.

e. Entries for Syphilis Treatment. The preparation of an SF 602 and the date it was done will be noted on SF 600. Later information recorded on the SF 602 will not be noted on SF 600.

f. Entries for Drug Abuse Treatment. When a person has been judged by a clinical evaluation to be an alcohol or other drug abuser, entries will be made on the SF 600. (See paragraph 6-3*a*(6), AR 600-85.)

17-41. Preparation and Use of SF 601 and PHS Form 731

An immunization record on SF 601 will be prepared and kept for each person who needs an HREC. The PHS Form 731 is a personal record of immunizations received; it is normally needed for international travel. Usually, active duty personnel have custody of their PHS Forms 731; they will insure their safekeeping. PHS Forms 731 for Reserve Components personnel will be filed with their personnel records. The form will usually be issued to the person only upon mobilization, activation, or when traveling internationally.

a. Responsibilities.

(1) The unit commander will insure that each assigned or attached member receives the immunizations required by AR 40-562. To do this, he will periodically check the immunization status of each unit member. He will then consult with the local medical officer to insure that immunizations are given when due.

(2) When personnel report for immunization, the medical officer will check the accuracy of the entries on SF 601 and PHS Form 731. He will insure that immunizations given are recorded on both forms and that the entries are properly authenticated.

b. Authentication of Entries. In accordance with international rules, entries on PHS Form 731 for immunizations against smallpox, yellow fever, and cholera will be authenticated. Each entry must show the DOD immunization stamp and the signature of the medical officer or his chosen representative (AR 40-562). For other entries on PHS Form 731 and all entries on SF 601, the signature block may be stamped or typewritten and authenticated by initialing.

c. Entries.

(1) Immunizations and sensitivity tests will be recorded on SF 601.

(2) Remarks and recommendations for any entry on SF 601 may be added at the MTF. The reasons for waiving any immunization will be recorded in enough detail for later medical evaluation. Any attacks of diseases for which immunizing agents were used must be noted; the year and place of attack must also be given. Any untoward reactions to immunizations (including vaccines, sera, or other biologicals) will be recorded.

d. Loss of SF 601 or PHS Form 731. If PHS Form 731 is lost, a duplicate will be made by transcribing the SF 601 kept in the HREC. If the SF 601 kept in the HREC is lost, a duplicate will be made by transcribing the PHS Form 731. If both forms are lost, new forms will be prepared.

e. Disposition on Separation from Service. When released from active duty or separated from the service, personnel will be encouraged to keep their PHS Form 731 for future use.

17-42. Preparation and Use of SF 602

a. The medical officer who diagnoses syphilis will prepare an SF 602 (original only) on the infected person. Examinations and laboratory procedures used to make the diagnosis will be noted on SF 600 when the case is given outpatient treatment; SF 602 is completed after the diagnosis is made and antiluetic therapy is begun. When SF 602 is prepared, the medical officer will enter all identification data at the bottom of the form. A careful history and physical examination will be made; all pertinent findings will be recorded in Sections I and II. A detailed account of all laboratory studies and all treatments will be entered in Sections III and IV. In Section II, the patient will sign and date his statement. Section VII on the form will not be used.

b. The medical officer treating or observing the case will record each periodic follow-up in Section V of the form. The period of time follow-up examinations must be made before the record may be closed is given in TB MED 230. The medical officer who treats and follows up syphilis cases will keep suspense files or appointment records needed to insure that current cases are observed long enough.

c. The medical officer treating the patient closes the record by signing Section VI of the form. After closing, it will be kept as a permanent part of the HREC. The record will be closed for any one of the following reasons:

(1) The treatment and follow-up are completed with satisfactory results.

(2) The patient is separated from active service.

(3) The patient deserts or is otherwise lost to military control.

(4) The patient dies.

d. A syphilis record will be reopened for the following reasons:

(1) *Relapse.* The patient record files in the HREC will be used for needed information. On that form, entries about the case will be continued.

(2) *Reinfection.* If reinfection occurs before the record is closed, the current record will be continued. Also, the follow-up will be extended for an additional period of observation. Interim progress notes will be entered; they will give all pertinent information and state a new diagnosis. They will also cite the clinical and laboratory data that prove the new diagnosis. If reinfection occurs after the record is closed, a new syphilis record will be prepared.

e. When the patient and his HREC are transferred before the record is closed, the medical officer of the losing command will put a statement in the health record that the person needs more follow-up studies. This statement will be fastened with SF 602 at the top of the inner right-hand side of the HREC. Once noted by the physician giving the follow-up care, the SF 602 will be put in its normal place in the record.

17-43. Other Forms Filed in the Health Record

a. When the following forms are prepared, one legible copy will be filed:

(1) DA Form 3647.

(2) SF 502.

(3) DA Form 199 (Physical Examination Board Proceedings, prepared in accordance with AR 635-40).

(4) DA Form 3947 (Medical Board Proceedings, prepared in accordance with AR 40-3).

b. Copies of the other HREC forms will be filed as follows:

(1) *SF 88 and SF 93.* The original of each of these forms prepared under AR 40-501 will be filed.

(2) *DD Forms 771 (Eyewear Prescription) and 771-1 (Eyewear Prescription—Plastic Lenses).* Each time one of these forms is prepared, a copy will be filed permanently in the HREC.

(3) *DA Form 3349 (Medical Condition—Physical Profile Record).* When a person's physical profile serial is revised in accordance with AR 40-501, a copy of this form will be put in the HREC.

(4) *DA Form 4465 (ADAPCP Military Client Intake and Follow-up Record).* This form will be prepared, kept, and used in accordance with AR 600-85.

(5) *Dosimetry records.* DD Form 1141 (Record of Occupational Exposure to Ionizing Radiation), automated dosimetry records, DD Form 1952 (Dosimeter Application and Record of Occupational Radiation Exposure), and earlier records of personnel dosimetry must be kept in the HREC. When a person changes station or leaves the service, these records will be moved with his HREC. The dosimetry records of personnel whose work exposes them to ionizing radiation may be removed from their HREC and filed separately. This is done when the medical officer who keeps and uses the records does not have easy access to the HREC of these personnel. In these cases, the separate file of dosimetry records will be kept as described in AR 40-14.

(a) When dosimetry records are temporarily withdrawn from the HREC, OF 23 (Charge-Out Record) will be filed in their place. Under the column "Identification of Record" on OF 23, enter the numbers of the forms removed. In the column "Charged To," enter the name of the medical officer (or other authority) borrowing the records and the name and address of the MTF (or activity) where these records will be kept. Enter the date the record is removed in the "Date Charged Out" column.

(b) The OF 23 will not be removed from the HREC until the dosimetry records have been returned.

17-44. Maintenance of Health Records Under Combat Conditions

a. Theater commanders are authorized to name units or areas covered by the provisions of this paragraph and to change them as needed in current military circumstances. Under combat conditions, military personnel officers will keep the HRECs of US military personnel. They will file both parts of the HREC with the MPRJ. They will also file in the HREC the documents they receive from the MTF and send the HREC with the MPRJ when a person's MPRJ moves. Normally HRECs will not be sent to or kept at an MTF; this will be done only when the HREC is needed and requested by a fixed hospital for treatment of a patient. Evaluations or releases of medical information contained in the HREC will be sent to the closest MTF.

b. Identification entries on SF 600 and DD Form 1380 (Field Medical Card) (FMC) for outpatient treatment will include at least the patient's name, grade, and SSN; other data will be entered as time permits. These forms will be kept at the MTF only until treatment is completed (and statistical or other reports prepared). They are then sent to the military personnel officer keeping the HREC.

(1) *DD Form 1380.* Instructions for preparing the FMC are given in paragraph 17-63. When the FMC is put into the HREC, it will be mounted on an SF 600. To mount it, staple along the top margin only so that no entries on the SF 600 are hidden and both sides of the FMC can be read.

(2) *SF 600.* SF 600 is prepared the same under combat conditions as under normal ones (paragraph 17-30).

Section VI. INPATIENT (CLINICAL) TREATMENT RECORDS, AR 40-66

17-45. General

a. An ITR will be prepared for:

(1) Every bed patient (military/civilian) in a hospital, fixed health clinic, or convalescent center.

(2) Each liveborn infant delivered in one of those MTFs.

(3) Carded for record only (CRO) cases (paragraph 3-12, AR 40-66).

(4) NATO patients.

b. An ITR will not be prepared for:

(1) Stillbirths.

(2) MTFs supporting combat operations if the surgeon considers their use impractical and FMCs are used (Section 4, FMC).

c. For nonfixed MTF using ITR, instructions for preparation will be provided by MEDDAC/MEDCEN in whose geographical area the nonfixed facility is operating. Disposition will be in accordance with AR 340-18-9.

17-46. Responsibilities

a. Each MTF commander will insure that an adequate and timely ITR is prepared for each patient who must have one.

b. Health care providers will record promptly and correctly all patient observations, treatments, and care.

17-47. Forms and Documents

a. All ITR forms will be fastened into the proper DA Form 3444 series folder. During treatment, the forms will be arranged in the order prescribed by the MTF commander. When the patient is discharged or transferred, the forms will be arranged in the order they are listed in Table 17-2. The same numbered forms will be grouped chronologically (an exception to this is laboratory and radiology orders).

b. All ITRs transferred with a patient are to be kept as a part of his current ITR. However, forms from transferred records will not be interfiled.

c. Although administrative documents are not a part of the ITR itself, they should be filed in the ITR folder.

17-48. Preparation and Use of Inpatient Treatment Records

ITRs must be accurate, complete, and current. The ITR must reflect the patient's current status and treatment. An ITR cover sheet "worksheet" is prepared in the admitting office. This cover sheet and all available medical records will be given to the attending physician without delay.

17-49. Inpatient Treatment Records of AWOL Patients

The ITR of a patient who has been AWOL for 10 consecutive days will be closed and disposed of in accordance with AR 340-18-9.

17-50. Use of SF 539

a. SF 539 (Abbreviated Medical Record) (Figures 17-5A and 17-5B) may be used for cases of a minor nature that require no more than 72 hours hospitalization. For example, it may be used for lacerations, plaster casts, removal of superficial growths, and accident cases held for observation.

b. SF 539 may be used by military members who are hospitalized for uncomplicated conditions not requiring hospitalization in the civilian sector (for example, measles and upper respiratory infection).

c. For further information, see paragraph 7-20, AR 40-66.

17-51. Use and Preparation of DA Form 4256

a. Use of DA Form 4256 (Clinical Record—Doctor's Orders) (Paragraph 7-22, AR 40-66). DA Form 4256 (Figure 17-6) is a three-copy, carbonless form. The original copy (white) remains with the patient's permanent record. The second copy (pink) is sent to the pharmacy, where it is kept until the patient is discharged. The pharmacy must receive a copy of all orders to insure appropriate surveillance of food-drug and laboratory-drug interactions. The ward copy (yellow) is used to give orders to the nursing staff. It may be used as a medication or treatment reminder and will be discarded when no longer needed.

b. Preparation. All entries will be made with ballpoint pen using blue-black or black ink. Entries must be legible on all three copies. In each "Patient Identification" section, addressograph plates should be used. If not, print patient name (last, first, middle initial), rank, grade or status, SSN, sex, and age of patient. More than one order may be written in each section, but no more than one may be written on a single line. The prescriber will record the date and time each order is written. Each order must be accounted for separately; use of the entry "ROUTINE ORDERS" is prohibited. However, a group of orders written at the same time for a patient needs only one signature.

c. Method of Discontinuing Orders. To discontinue a medication or treatment, the prescriber must write and sign a stop order. Automatic stop orders (for example, for antibiotics or controlled drugs) will be governed by written local policy. When an order is stopped, it must be accounted for and then noted on DA Form 4677 (Therapeutic Documentation Care Plan (Non-Medication)) or DA Form 4678 (Therapeutic Documentation Care Plan (Medicated)). This is done by putting "DC/DATE/INITIALS" and drawing a single line through the "HR" and "Date Completed/Dispensed" blocks beside stopped order.

d. Verbal Orders. Verbal orders will be used only for emergency "STAT" orders. The nurse accepting the order must write it on the form and enter after it "VERBAL ORDER (doctor's name/nurse's name, grade, ANC)". The prescriber must countersign as soon as possible after the emergency.

MEDICAL RECORD | **ABBREVIATED MEDICAL RECORD**

PERTINENT HISTORY, CHIEF COMPLAINT, AND CONDITION ON ADMISSION *(Enter date of admission)*

PHYSICAL EXAMINATION

PROGRESS *(Enter date of discharge and final diagnosis)*

SIGNATURE OF PHYSICIAN	DATE	IDENTIFICATION NO.	ORGANIZATION

PATIENT'S IDENTIFICATION *(For typed or written entries give Name (last, first, middle), grade, date; hospital or medical facility)*

JONES, JIMMY L.
SFC 972-39-6217
M 43
A Co., 1/508 INF

REGISTER NO.	WARD NO.
	2A

ABBREVIATED MEDICAL RECORD
Standard Form 539
GENERAL SERVICES ADMINISTRATION AND
INTERAGENCY COMMITTEE ON MEDICAL RECORDS
FPMR 101-11.808-8
OCTOBER 1975 539-105

Figure 17-5A. SF 539, Abbreviated Medical Record.

DOCTOR'S ORDERS (*Date and sign all orders*)

TEMPERATURE–PULSE–RESPIRATION						NURSE'S NOTES
DATE AND TIME	T	P	R	STOOLS	WEIGHT	MEDICATION AND NURSE'S NOTES

CLINICAL RECORD - DOCTOR'S ORDERS

For use of this form, see AR 40-400; the proponent agency is the Office of The Surgeon General.

THE DOCTOR SHALL RECORD DATE, TIME AND SIGN EACH SET OF ORDERS. IF PROBLEM ORIENTED MEDICAL RECORD SYSTEM IS USED, WRITE PROBLEM NUMBER IN COLUMN INDICATED BY ARROW BELOW.

PATIENT IDENTIFICATION

MARTIN, TOBY N.
596-35-8212
MSG M 39
5TH MASH

NURSING UNIT	ROOM NO.	BED NO.
2A	16	

DATE OF ORDER	TIME OF ORDER	LIST TIME ORDER NOTED AND SIGN
16 JULY 1984	0600 HOURS	
ADMIT TO 2A		0610/B
REGULAR DIET		0610/B
CBC		0610/B
U/A		0610/B
CXR		0610/B
ROUTINE VITAL SIGNS		0610/B
Allen Boaz MAJ/MC		
DATE OF ORDER	TIME OF ORDER	
16 JULY 1984	1800 HOURS	
NPO P 2400HRS		1805/HF
SHAVE PREP LLQ & PUBIS		1805/HF
NO PRE-OP MEDS		1805/HF
START DEEP BREATHING EXERCISES Q2°		1805/HF
THANK YOU!		1805/HF
Lowery L Bragg LTC/MC		

PATIENT IDENTIFICATION

MARTIN, TOBY N.
596-35-8212
MSG M 39
5TH MASH

NURSING UNIT	ROOM NO.	BED NO.
2A	15	

DATE OF ORDER	TIME OF ORDER	
17 JULY 1984	1300 HOURS	
NPO UNTIL 1800HRS THEN SIPS P.O.		1330/B
(30cc P.O./HR ONLY)		1330/B
NG TO LOW GOMCO SUCTION - MAY		1330/B
D/C AT 2400HRS IF P.O.'s TOLERATED		1330/B
VITAL SIGNS Q 4 HRS		1330/B
COUGH & DEEP BREATHE Q 2°		1330/B
D5½NS @125cc/HR Allen Boaz MAJ/MC		1330/B

PATIENT IDENTIFICATION

MARTIN, TOBY N
596-35-8212
MSG M 39
5TH MASH

NURSING UNIT	ROOM NO.	BED NO.
2A	15	

DATE OF ORDER	TIME OF ORDER	
18 JULY 1984	0700 HOURS	
D/C NG TUBE		0700/FP
CLEAR LIQUID DIET		0700/FP
ENCOURAGE AMBULATION		0700/FP
D5½NS TO RUN AT 100cc/HR		0700/FP
TYLENOL #3 1-11 TABS PO Q 4° PRN PAIN		0700/FP
Allen Boaz MAJ MC		

DA FORM 1 APR 79 4256 REPLACES EDITION OF 1 JUL 77, WHICH MAY BE USED.

Figure 17-6. DA Form 4256, Clinical Record—Doctor's Orders.

17-52. Use of DA Form 5009-R

DA Form 5009-R (Medical Record-Release Against Medical Advice) (Figure 17-7) will be used when the patient leaves the MTF at his own insistence and against advice of the attending physician(s). DA Forms 5009-R will be reproduced locally.

Section VII. PREPARATION AND USE OF LABORATORY FORMS

17-53. General

a. Laboratory forms are used to request laboratory tests and to report the results of those tests. The forms are three-part sets (original and two copies). When requesting a test, the whole set is sent to the laboratory. After the results are recorded, the third copy is kept in the laboratory files. For disposition instructions, see AR 340-18-9. The original is routed for immediate filing in the ITR, OTR, or HREC. The second copy is routed to the requesting practitioner for use and disposition.

b. Carbon copies of laboratory reports will not be filed in the Medical Record. The MTF commander will insure that each patient's laboratory test reports are prepared correctly.

17-54. Instructions for Filling Out Forms

General instructions for preparing these forms are given in Table 17-4. Instructions for each form are given in Table 17-5.

MEDICAL RECORD	RELEASE AGAINST MEDICAL ADVICE For use of this form, see AR 40-66; proponent agency is the Office of The Surgeon General.

STATEMENT OF PATIENT RELEASING HOSPITAL FROM LIABILITY
UPON LEAVING HOSPITAL AGAINST MEDICAL ADVICE

1. This is to CERTIFY that I am leaving _____ (Name of Med Treatment Facility) at my own insistence and against the advice of the hospital authorities and my attending physician(s).

2. I have been advised of the dangers involved in leaving the hospital at this time.

3. I hereby release the hospital, its staff and the Federal Government of all responsibility for any ill effects brought about by my failure to remain in the hospital.

_____ (Signature of Patient)

_____ (Signature of Witness)

_____ (Date and Time)

STATEMENT OF REPRESENTATIVE OF PATIENT RELEASING HOSPITAL FROM LIABILITY
UPON LEAVING HOSPITAL AGAINST MEDICAL ADVICE

1. This is to CERTIFY that I _____ (Name), _____ (Relationship to Patient) of _____ (Name of Patient) insist that he/she be discharged from _____ (Name of Med Treatment Facility) without the authorization of the patient's attending physician(s).

2. I have been informed of the dangers to the patient in his/her leaving the hospital at this time, including the possibility that it may worsen or aggravate the patient's condition.

3. I hereby release the hospital, its staff and the Federal Government of all responsibility for any ill effects brought about by _____(Name of Patient) leaving the hospital against medical advice.

_____ (Signature of Representative)

_____ (Signature of Witness)

_____ (Date and Time)

PATIENT IDENTIFICATION	REGISTER NUMBER	WARD NUMBER
JONES, JOHNNY 011-55-3661 M E-7 46 YRS. C 1/351 INF		

DA FORM 5009-R, OCT 81

Figure 17-7. DA Form 5009-R, Medical Record—Release against Medical Advice.

Table 17-4. General Instructions for Preparing Laboratory Forms

Block	Laboratory	Completed by Clinic/Ward	Instructions	Remarks
Patient Identification		X	Enter patient's name, register number and FMP/SSN of inpatients (only FMP/SSN of outpatients), treating MTF, ward or clinic, date test is requested.	Enter this information correctly. If possible, enter it by mechanical imprinting, using the ward plate or patient's recording card. If not, use ballpoint pen or typewriter.
Urgency		X	Check the proper box.	This block is not on SF 553 or 554. This entry may be used to identify and monitor the request form in the laboratory.
Specimen Lab. Report No.	X		Enter the specimen or laboratory report number.	
Patient Status		X	Check the proper box.	"NP" and "DOM" are not used by the Army.
Specimen Source		X	Check the proper box or write in the needed information.	Some forms request other specimen information: *a.* On the SF 548, give specimen interval information. *b.* On SF 553 and 554, give infection information. Extra information is needed on these forms to identify sensitivities and the infecting organisms. Enter this information in the "Clinical Information" and "Antibacterial Therapy" blocks. *c.* On SF 556, give specimen source information for obstetric patients.
Requesting Physician's Signature		X	Enter clearly the name of the practitioner ordering the test. If a military member, enter also grade and corps.	The signature is not needed.
Reported by	X		The technologist signs here after the test results have been verified as correct.	The chief of the laboratory will insure that test results are accurate.
Date	X		Enter date the report is completed by the laboratory.	
Lab ID No.	X		Enter laboratory identification number.	Like the Specimen/Lab. Rpt. No., this entry may be used to identify and monitor the request form.
Remarks	X		Enter any special information for the practitioner or the patient's records.	
Specimen Taken	X	X	Enter date and time the specimen is taken.	This block is completed by whoever takes the specimen, either the laboratory or ward/clinic personnel.
Tests Requested		X	Put an "X" beside the test that is needed. For tests not listed, write their names at the bottom of the list.	On most forms the correct box is marked (X).
Results	X		Write or stamp the results for each test performed.	

Table 17-5. Specific Instructions for Preparing Laboratory Forms

Form	Use	Remarks
SF 545	A display form for mounting laboratory forms.	Instructions for mounting laboratory forms are printed on the bottom of this form. When a patient needs the same type of test several times, use the same display sheet for each test result form. When only a few tests are made, mount the forms on alternate strips (for example, 1, 3, 5, 7). When there is a mixed assortment of forms, mount them in the most practical sequence. After mounting the forms, check the proper boxes in the lower right corner to show what forms are displayed.
SF 546	Requesting blood chemistry tests.	At the bottom of the list of tests, there is a block for requesting a battery or profile of tests. When requesting this, write in the name of the profile.
SF 547	Requesting blood gas measurements, T3, T4, serum iron, iron binding capacity, glucose tolerance, and other chemistry tests.	
SF 548	Requesting chemistry tests on urine specimens.	Remember that a check in the "Other" box under "Specimen Interval" must be explained.
SF 549	Requesting routine hematology (including differential morphology), coagulation measurements, and other hematology tests.	
SF 550	Requesting urinalysis tests (both routine and microscopic).	Use "HCG" for requesting and reporting measurements of human chorionic gonadotropin. Use "PSP" for requesting and reporting phenolsulfonephthalein measurements.
SF 551	Requesting tests that measure serum antibodies (including tests for syphilis).	Definitions for the serology test abbreviations are as follows: RPR—Rapid Plasma Reagin card test for syphilis. COLD AGG—Cold Agglutinins. ASO—Antistreptolysis O titers. CPR—C—Reactive Protein. FTA—ABS—Fluorescent Treponemal Antibody—Absorption Test. Febrile AGG—Febrile Agglutinins. COMP FIX—Complement Fixation. HAI—Hemagglutination-Inhibition TPHA—Treponema Pallidum Hemagglutination Write the name of the specific antibody determination in the COMP FIX or HAI block.

Table 17-5. Specific Instructions for Preparing Laboratory Forms — continued

Form	Use	Remarks
SF 552	Requesting tests for intestinal parasites, malaria, other blood parasites, and most feces tests.	
SF 553	Requesting most bacteriological isolations and sensitivities	Complete section marked "Antibacterial Therapy" with the antibiotic medications the patient is receiving; "Clinical Information" includes fever, site of infection, or culture; and "Infection would include tentative diagnosis which could assist in identifying infecting organism. SF 553 and SF 554 may take as long as 72 hours to be completed by the laboratory.
SF 554	Requesting tests for fungi, acidfast bacteria (tuberculosis), and viruses.	Same as above.
SF 555	Requesting spinal fluid tests	When requesting bacteriological studies on spinal fluid specimens, submit an SF 553 or 554 also. Bacteriological cultures must grow at least 24 hours before the results can be observed. The extra request form allows complete identification of the specimen. It also allows the quick return of the cell count and chemistry results to the physician without his having to wait for the bacteriological results. When requesting electrophoresis measurements, submit also an SF 557. These measurements take many hours to complete and the report is a tracing by densitometer on special paper. The extra request form allows complete identification of the specimen; it also allows the cell count and chemistry results to be returned quickly to the physician without waiting for the electrophoresis results to be completed.
SF 556	Requesting blood grouping, blood typing, and blood	Do not use this form as a request for blood crossing
SF 557	Requesting tests, such as electrophoresis and assays of coagulation factors, which are not ordered on other forms.	
DD Form 1892 (Drug Screening Urinalysis Record)	Requesting Drug Screening Urinalysis Tests.	

Section VIII. NURSING RECORDS AND REPORTS (PERMANENT CLINICAL FORMS)

17-55. General

Initiation of permanent clinical records is an essential part of the inpatient admission procedure (AR 40-407). A permanent outpatient treatment record is maintained on each outpatient seen in an Army MTF. Authorized clinical record forms which nursing personnel are responsible for or use frequently are described in this section.

17-56. Recording Data

All entries will be made with a pen, using reproducible black or blue-black ink, except when specifically stated otherwise.

17-57. Correcting Errors

Erasures are prohibited. A line will be drawn through an incorrect entry, and the initials of the person making the entry will be placed above the lined-out portion. The correct information or statement will be recorded following the lined-out entry.

17-58. DA Form 4256

For additional information concerning DA Form 4256, see AR 40-407 or AR 40-66.

17-59. SF 510

a. General. SF 510 (Clinical Record—Nursing Notes) is a single sheet, identical on both sides, which is maintained in the patient's chart. Nursing notes will be written by the person whose name and grade appear on the notes (Figures 17-8 and 17-9).

b. Preparation. Enter all patient identification, including SSN and other data as indicated in spaces at the bottom of the form.

c. Admission and Discharge Notes. Initial entry will include date, time, manner of admission, reported known allergies, and a brief, clear description of symptoms and pertinent observations. In the absence of a discharge planning form, note the date, time, manner of discharge, and concise summary of discharge plan. This will include documentation of health teaching appropriate to the disease and desired behavior outcome.

d. Content. Nursing Notes will contain objective observations of the patient's condition, to include physical and mental status, symptoms, response to diagnostic or therapeutic procedures, or any changes noted. The Nursing Notes must reflect the patient response/status to all nursing care measures documented on the Medical Record Nursing Assessment and Care Plan (DA Form 3888 and DA Form 3888-1). Since Nursing Notes aid in diagnosis, furnish reference material for research and teaching, and provide important evidence in the event of litigation; it is essential that all entries contain significant and pertinent data relative to nursing care. At the minimum, entries are required on SF 510 once every shift for intensive nursing care and moderate nursing care patients; every 24 hours for minimal nursing care patients; and once a week for self-care patients.

e. Medications. Accomplishment of orders for Narcotic and PRN or STAT medication will be entered on SF 510. Each entry will include time, medication, and indication for administration. Assessment of effectiveness of action of medication will be noted following administration. If, for any reason, scheduled medication or treatment is not given, enter this fact and reason for its omission.

f. Special Procedures. Diagnostic, therapeutic and special nursing procedures, and usual occurrences will be described in SF 510. Notation will include time, name of procedure, by whom performed, brief description of what was done, patient's condition before and during the procedure, and the patient's reaction after the procedure.

NOTE

Nursing Notes may also be written in the "signs and symptoms, observations, assessment, and plan" (SOAP) format as shown below.

17-60. SF 511

a. Preparation of SF 511 (Clinical Record—Temperature - Pulse-Respiration). Enter patient's identification data and social security number in the space at bottom of the form. This form will be maintained in the patient's chart (Figure 17-10).

b. Recording Data. Number the "Hospital Day" line of blocks with day of admission as 1, and continue consecutively. The day of surgery or other event is the operative day. The day following surgery is noted as the first post-operative day. The day and hour blocks will be properly labeled. Represent temperature by dots (.) placed between the columns and rows of dots and joined by straight lines. If route of determination is other than oral, it should be indicated by (R) for rectal and (A) for axillary. Show pulse determination by use of (o) connected by straight lines. Enter respiration and blood pressure on the indicated rows below the graphic portion. Record frequent blood pressure readings on the form's graphic portion by entering an "X" between the columns and row of dots at points equivalent to systolic and diastolic levels. Connect the two with a vertical solid line. Use blank lines at bottom of the sheet to record special data such as 24-hour total of patient's intake and output.

(1) When the diastolic blood pressure falls below the recorded pulse symbol (o), and the straight line connection is drawn between the blood pressure symbol (x), the connecting line will be drawn to the edge of the blood pressure symbol on each side, top and bottom to form the connecting link but never completely through the pulse symbol or the temperature symbol.

(2) If the systolic blood pressure and the pulse are to be recorded on the same line, the pulse will be recorded with its normal symbol and the systolic pressure symbol will be recorded around it with an imaginary (x). In Figure 17-10, the straight connecting line (o) will be drawn as described above and the same basics will be used in the application of recording a temperature and blood pressure. Symbols for vital signs will never be drawn completely through each other when recorded on the temperature, pulse, and respiration (TPR) graphic sheet.

CLINICAL RECORD — **NURSING NOTES** (*Sign all notes*)

DATE	HOUR A.M.	HOUR P.M.	OBSERVATIONS (Include medication and treatment when indicated)
9 JUN 84		1300	4940 WHITE MALE ADMITTED TO WARD 2A VIA GURNEY FROM SURGICAL/UROLOGY CLINIC C DIAGNOSIS OF (R) RENAL CALCULUS. VS: T-99[B] P-102 R-24 BP-148/92. PT COMPLAINS OF SEVERE (R) FLANK PAIN. PT IS DIAPHORETIC, PALE, & HOLDING (R) SIDE. ADMISSION CXR, CBC, U/A, & URINE CULTURE COMPLETED IN CLINIC. DENIES ALLERGIES. IV OF D5 1/2 NS STARTED IN (L) FOREARM C 18 ABBO-CATH TO INFUSE AT 150 cc/HR. PT INSTRUCTED TO STRAIN ALL URINE. John Jones LT/ANC
		1340	DEMEROL 75mgm AND VISTARIL 50mgm IM (L) GLUTEUS FOR RELIEF OF (R) FLANK PAIN. Alice Anderson CPT/ANC
		1415	RESTING COMFORTABLY. PT STATES PAIN HAS BEEN RELIEVED "QUITE A BIT." Alice Anderson CPT/ANC

PATIENT'S IDENTIFICATION (*Use typed or written entries give: Name - last, first, middle grade; date; hospital or medical facility*)

STONE, GREGORY P.
772-33-1234
LTC M 49
USA MEDDAC

REGISTER NO

WARD NO 2A

NURSING NOTES
Standard Form 510
General Services Administration and Interagency Committee on Medical Records
FPMR 101-11.806-8—October 1975
510-109

Figure 17-8. SF 510, Clinical Record—Nursing Notes.

CLINICAL RECORD — **NURSING NOTES**
Sign all notes

DATE	HOUR A.M.	HOUR P.M.	OBSERVATIONS Include medication and treatment when indicated
TB SEP 83		1300	**S:** I have severe Rt lower back pain and am sick to my stomach. Denies any allergies.
			O: 32 YO black male admitted via w/c from urology clinic c diagnosis of Rt Renal Calculi. T 97^{6} P102 R24 BP $^{140}/_{88}$. Diaphoretic appears in severe pain. Extremely restless. Unable to stand in upright position. Lab-work and X-Rays done on way to ward.
			A: Severe Rt. flank pain and nausea secondary to Rt. Renal Calculi
			P: Continuous monitoring of Rts voidings and effectiveness of analgesic. Instruct pt. to strain urine. Elbert Humphery CPT, ANC.
TB SEP 83		1320	**I:** Demeral 75 mg and Phenergan 25 mg given Im in Lt gluteus. Elbert Humphery CPT, ANC.
			E: Resting comfortably. Pt states pain is now bearable.

PATIENT'S IDENTIFICATION
(Use typed or stencil name: give Name, Last, in middle, grade; date in-patient or medical number)

ELBERT, HUBERT A. SFC
666-66-5420
M-32 1ST DIV CLR CO.

REGISTER NO: 06215 | WARD NO: 6A

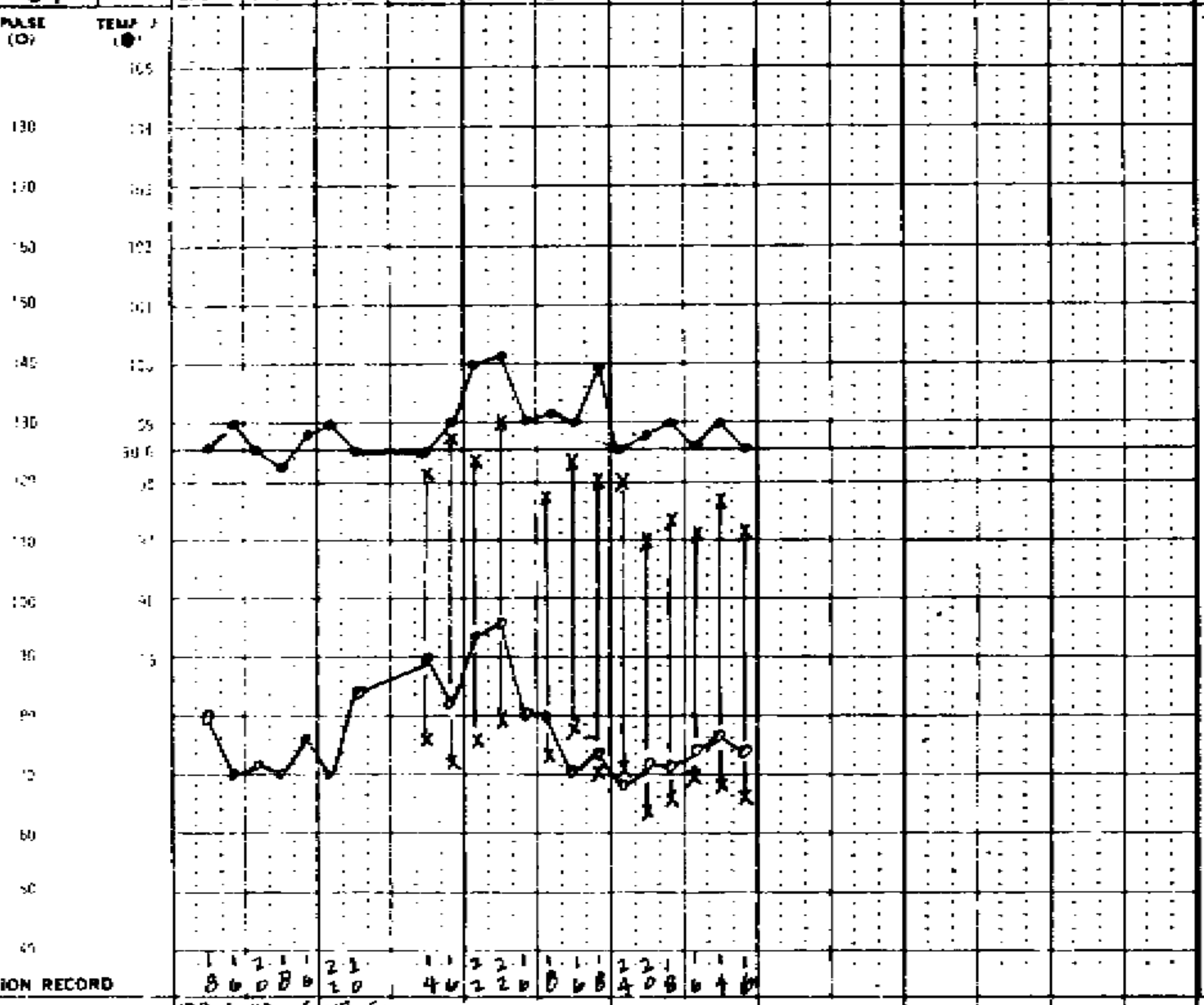
NURSING NOTES
Standard Form 510
General Services Administration and
Interagency Committee on Medical Records
FPMR [01-21 806-8—October 1975
510-109

Figure 17-9. SF 510, Clinical Record—Nursing Notes in SOAP format.

MEDICAL RECORD — VITAL SIGNS RECORD

HOSPITAL DAY		1	2	3	4	5	6	7	
POST-OP DAY			DOS	1	2	3	4	5	
MONTH-YEAR	DAY	16	17	18	19	20	21	22	
JUL 19 84	HOUR	2600 2600	2600 2600	2600 2600	2600 2600	2600 2600	2600 2600	2600 2600	

PULSE (O) — TEMP. °F (●) — TEMP. °C



RESPIRATION RECORD: 18 16 20 18 16 20 24 40 22 20 18 16 18 24 20 18 16 14 16

BLOOD PRESSURE		120/80 110/60 122/64	112/72 114/64 110/68	118/74 120/82					
HEIGHT 74"	WEIGHT	188½							
ORAL				0	280	1670			
IV				3,600	3,000	2400			
TOTAL INTAKE				3,600	3,280	4,070			
URINE				450	1,250	1,600			
NG				200	150	0			
EMESIS				150	50	0			
TOTAL OUTPUT				800	1,450	1,600			

Record enemia data only when ng or lavage

PATIENT'S IDENTIFICATION (For typed or written entries give: Name -last, first, middle, rank, rate, hospital or medical facility):

LEE, ROBERT E.
PFC 619-30-3012
C Co., 307 MED BN (ABN)

REGISTER NO.

WARD NO. 2A

511-112

VITAL SIGNS RECORD

STANDARD FORM 511 (REV. 9-79)
Prescribed by GSA and Interagency Committee on Medical Records
FPMR (41 CFR) 101-11.806-6

Figure 17-10. SF 511, Medical Record—Vital Signs Record.

17-61. Temporary Nursing Records

The following DA forms are part of the Temporary Nursing Record, and information on these forms can be found in Chapter 3, AR 40-407.

a. DA Form 3872—Nursing Service Personnel Time Schedule.

b. DA Form 3889—Nursing Unit 24-Hour Report.

c. DA Form 3889-1—Nursing Unit 24-Hour Report-Continuation Sheet.

d. DA Form 3950—Temperature, Pulse, and Respiration Record Worksheet.

e. DA Form 3951—Nursing Service—Assignment Roster.

f. DD Form 792—24-Hour Patient Intake and Output Worksheet.

g. DA Form 1924—Surgical Checklist.

h. DA Form 4028—Prescribed Medication.

Section IX. USE OF THE US FIELD MEDICAL CARD

17-62. General

a. The US Field Medical Card (DD Form 1380)(AR 40-66) is used to record data similar to that recorded on the ITRCS. The FMC will be used by aid stations, clearing stations, and nonfixed troop or health clinics working overseas, on maneuvers, or attached to commands moving between stations. It may also be used to record an outpatient visit when the HREC is not readily available at an MTF. The FMC is used in the theater of operations during time of hostilities. It also may be used to record CRO cases.

b. The FMC is made so that it can be attached to the casualty. The cards are issued as a pad, with each pad consisting of an original card, a sheet of carbon paper, a carbon protective sheet, and a duplicate.

c. Use of the FMC is covered by NATO STANAG 2132.

17-63. NATO STANAG 2348 Requirements

The ITRs of NATO personnel treated by Army MTFs are prepared the same as ITRs for other patients. This applies to DA Form 1380 (Record of Individual Performance of Reserve Duty Training), DD Form 1380, and DD Form 602. In addition, the following policies cover NATO personnel:

a. If a service member is transferred to hospitals of other nations, his ITR will go with him. When he is discharged from an Army MTF, his record will be sent to his national military medical authority. (See Table 2-4, AR 40-400 for a list of these authorities.) Sometimes DD Form 1380 or DD Form 602 (STANAG 2132) will be prepared as well as an ITR. If so, these forms will go with the ITR.

b. The amount of information put in an ITR should be STANDARD for all forces. All items normally recorded for US personnel will be recorded for NATO personnel. In addition, the marital status of the NATO member will be recorded.

17-64. Preparation of Field Medical Cards

a. An MTF officer will complete the FMC or supervise its completion. However, the company aidman first attending the casualty may initiate an FMC. To do this, he will record the name, SSN, and grade of the patient (Figure 17-11). He will also briefly describe the medical care of treatment given and enter as much information as time permits (Figure 17-11). After doing this, he will put his initials in the far right side of the signature block (Item 29, Figure 17-11). The supervising AMEDD officer will then complete, review, and sign the FMC.

b. An FMC will be prepared for any patient treated at an MTF. For transfer cases, the FMC will be attached to the patient's clothing. It will remain with him until his arrival at a hospital, his death and interment (burial), or his return to duty. If a patient dies, the FMC will remain attached to the body until interment when it will be removed. If the body cannot be identified when it is to be interred, the registration number given the remains by the Graves Registration Service will be noted on the FMC.

c. Under combat conditions, the aidman may only partially complete the FMC for patients being treated. Otherwise, all entries will be completed as fully as possible. The blocks that must be complete are 1, 2, 4, 13, 14, 20, 21 (if a tourniquet is applied), 22, and 29. This also applies to the battalion aid station when patients are being transferred to another MTF during a combat situation. Instructions for completing items on the ITR cover sheet apply to similar items on the FMC; all abbreviations authorized for use on the cover sheet may also be used on the FMC. Except for those listed below, however, abbreviations may not be used for diagnostic terminology.

Abr W—Abraded wound

Cont W—Contused wound

FC—Fracture (compound) open

FCC—Fracture (compound) open comminuted

FS—Fracture simple (closed)

LW—Lacerated wound

MW—Multiple wounds

Pen W—Penetrating wound

Perf W—Perforating wound

SV—Severe

SL—Slight

d. FMC may also be used for "CARDED FOR RECORD ONLY" cases. Certain cases not admitted to MTF will be CRO. For CRO cases, DA Form 3647 or DD Form 1380 will be prepared; and a registrar number assigned. When DA Form 3647 is used, Items 7, 10, 14, 24, 27, 30, and the name of the admitting officer need not be completed. When the FMC is used, Item 11 need not be completed.

17-65. Supplemental Field Medical Cards

When more space is needed, another FMC will be attached to the original. This second one will be labeled in the upper RIGHT corner "FMC #2" and will show the patient's name, grade, SSN, and nation. See Figure 17-12.

1. NAME (Last - First-Middle initial) / NOM, PRENOMS: DOE, JOHN P.
2. SERVICE NUMBER / NUMERO MATRICULE: 555-33-6666
3. GRADE / GRADE: SGT
4. NATION / NATION: USA
5. FORCE / ARMEE:
6. BRANCH AND TRADE / ARMEE (e.g. Infantry):
7. UNIT / UNITE:
8. SERVICE (Yrs) / DUREE DES SERVICES (ans):
9. AGE / AGE:
10. RACE / RACE:
11. RELIGION / RELIGION:
12. FACILITY WHERE TAGGED / LIEU D'ETABLISSEMENT DE LA FICHE:
13. DATE AND HOUR TAGGED / DATE ET HEURE D'ETABLISSEMENT DE LA FICHE: 1530 6 Nov 83
14. DIAGNOSIS (Including cause) / DIAGNOSTIC (Cause comprise): GUNSHOT WOUND TO RIGHT THIGH
15. LINE OF DUTY / EN RELATION AVEC LE SERVICE:
19. DATE & HOUR INJURED / DATE ET HEURE DE LA BLESSURE:
NATURE OF CASUALTY OR ILLNESS / NATURE DE LA BLESSURE OU MALADIE
16. DISABILITY / INCAPACITE
17. INJURY / BLESSURE — ENEMY ACTION / DU FAIT DE L'ENNEMI: [ ] YES / OUI [ ] NO / NON
18. SICK / MALADE — [ ] YES / OUI [ ] NO / NON
19. WHAT WAS HE DOING WHEN INJURED / QUE FAISAIT-IL LORSQU'IL FUT BLESSE:
20. TREATMENT GIVEN / For antibiotics specify which and give dose, hour and date / TRAITEMENT EFFECTUE / Si des antibiotiques ont été donnés, préciser leur nature, la dose, l'heure et la date: PRESSURE BANDAGE
21. TOURNIQUET / Yes or No, Time & date applied / MISE EN PLACE D'UN GARROT / Oui ou Non, heure et date: YES 6 Nov 83 1545

TREATMENT / TRAITEMENT EFFECTUE	a. DOSE / DOSE	b. HOUR AND DATE / HEURE ET DATE
22. MORPHINE / MORPHINE	15 mg	1550 6 Nov 83
23. MORPHINE-2nd / MORPHINE 2ème		
24. MORPHINE-3rd / MORPHINE-3ème		
25. TETANUS TOXOID / VACCIN ANTITETANIQUE		
26. A.T. SERUM / SERUM ANTITETANIQUE		

27. DISPOSITION / DISPOSAL / DESTINATION DONNEE AU BLESSE:
28. HOUR AND DATE / HEURE ET DATE:
29. MEDICAL OFFICER (Signature & Grade) / SIGNATURE ET GRADE DU MEDECIN: JKS

DD FORM 1380, 1 JUN 62 — U. S. FIELD MEDICAL CARD / FICHE MEDICALE DE L'AVANT ETATS-UNIS

Figure 17-11. DD Form 1380, US Field Medical Card.

FMC #2

1. NAME (Last - First-Middle initial) / NOM, PRENOMS
2. SERVICE NUMBER / NUMERO MATRICULE
3. GRADE / GRADE
4. NATION / NATION (e.g. Etats Unis)
5. FORCE / ARMEE
6. BRANCH AND TRADE / ARMEE (e.g. Infantry)
7. UNIT / UNITE
8. SERVICE (Yrs) / DUREE DES SERVICES (ans)
9. AGE / AGE
10. RACE / RACE
11. RELIGION / RELIGION
12. FACILITY WHERE TAGGED / LIEU D'ETABLISSEMENT DE LA FICHE
13. DATE AND HOUR TAGGED / DATE ET HEURE D'ETABLISSEMENT DE LA FICHE

Figure 17-12. "FMC #2".

17-66. Disposition of Field Medical Cards

a. For Patients Admitted and Discharged and CRO Cases. The original FMC of CRO case or of an admission with a disposition other than to a hospital will be sent to higher headquarters within the command for coding. After coding, the FMC will be disposed of in accordance with AR 340-18-9.

b. For Transfer Patients. When a patient arrives at a hospital, his FMC will be used to prepare his ITR. This FMC will then become part of his ITR (see Table 7-1, AR 40-66).

c. For Outpatients. The original of an FMC used to record outpatient treatment will be filed in the patient's HREC or OTR.

d. Carbon Copies. All carbon copies of FMC will be destroyed locally after 3 months.

17-67. DA Form 4006

DA Form 4006 (Field Medical Record Jacket) may be used as an envelope for the FMC. To keep the jacket from being opened while the patient is in transit, pertinent personnel and medical data on the patient may be recorded on the outside. The movement of the patient may also be recorded. When the jacket has been so used, it must become a part of the ITR.

17-68. Instructions for Completing DD Form 1380

a. Item 1 (Name).

b. Item 2 (Service Number). Enter SSN for US military personnel. Enter service number for foreign military personnel (including prisoners of war). Leave blank for all others.

c. Item 3 (Grade). Enter patient's grade. Use abbreviations listed in Table 17-6.

d. Item 4 (Nation). Enter country of whose armed forces the patient is a member (for example, enter "USA" for US Armed Forces).

e. Item 5 (Force). Enter specific armed service of patient.

f. Item 6 (Branch and Trade). Enter branch or corps for US officers. Enter Special Skill Identifier (SSI) or brief description of occupation (for example, "rifleman;" for foreign military enter similar information).

g. Item 7 (Unit). Enter military unit. For civilian, enter enough information to identify patient (for example, "wife, Army SGT").

h. Item 8 (Service). Enter length of service for military personnel. Include all active duty during previous tours or enlistment even if interrupted. Show length of service less than 1 month in days (for example, "23/365") service less than 2 years in completed months (for example, "13/24") and service of more than 2 years in completed years (for example, "3 YRS" for 3 years and 9 months).

i. Item 9 (Age). Enter patient's age.

j. Item 10 (Race). Enter "Cau" for Caucasian; "Neg" for Negroid; "Oth" for other races; "Unk" for unknown.

k. Item 11 (Religion). Enter patient's religious preference. If none, enter "None."

l. Item 12 (Facility Where Tagged). Enter MTF and location. Describe location in broad geographic terms (for example, "Near Cu Chi, RVN").

m. Item 13 (Date and Hour Tagged). Enter date and time initial treatment was started. Enter time using the 24 hour system.

n. Item 14 (Diagnosis). Enter disease or injury requiring treatment.

(1) *Punctured, penetrating, or missile wounds.* Give point of entry and name organs, arteries, or nerves involved, if known.

(2) *Injuries not incurred in combat.* State the nature of the injury; the causative agent; the body parts affected; the circumstances causing the injury; if accidentally incurred, deliberately self-inflicted, or deliberately inflicted by another; and the place and date.

(3) *Injuries incurred in combat.* Add to the details described in (2) above that the injury was the result of enemy action. Also include causative agent and general geographical location (for example, "Near Seoul, Korea").

(4) *Injuries or diseases caused by chemical or bacteriological agents or by ionizing radiation.* Add to the details described in (2) above, the name of the agent or type of ionizing radiation. (If the name is not known, provide information that is known about the physical, chemical, or physiological properties of the agent (odor, color, physical state)). Also state date, time, and place of contamination; time between contamination and treatment; and nature of treatment. For those affected by ionizing radiation, also report the approximate distance from the source; if exposure was to gamma rays, the actual or estimated dosage (for example, "est 150 rad" or "measured 200 rad") and if exposed via airburst, ground burst, water surface burst, or underwater burst.

o. Item 15 (Line of Duty). Enter "Yes" or "No."

p. Item 16 (Injury). If injury, check Item 16 and indicate whether injury was caused by enemy action or not caused by enemy action; that is, if enemy action check "Yes."

q. Item 17 (Sick). If disease (sick), check Item 17 and indicate whether disease was caused by enemy action or not caused by enemy action.

r. Item 18 (Date and Hour of Injury). Self-explanatory. If injury occurred prior to treatment, estimate as accurately as possible the date and time of injury.

s. Item 19 (What Patient Was Doing When Injured). Enter circumstances leading to injury.

t. Item 20 (Treatment Given). Enter any antibiotics, drugs, blood plasma, and other treatment given. Enter name of antibiotic and/or drugs, and each dose, hour, and date it was given. If more space is needed, use Item 32 on reverse side of the FMC.

u. Item 21 (Tourniquet). Enter "Yes" or"No." If yes, enter date and time applied.

v. Item 22 through 26. Enter the dose, time, and date if any of the drugs in Items 22 through 26 were given.

w. Item 27 (Disposition). Enter one of the following:

(1) "*Transfer.*" When transferred to another MTF. When MTF is not known, enter general destination and means of transportation.

(2) "*Duty.*" Inpatient return to duty.

(3) "*Died.*" Died after admission.

(4) "*CRO.*" For military patients carded for record only and returned to duty, enter "CRO—Duty." For deaths carded for record only, enter "CRO—Death." (Death on Arrival (DOA).)

x. Item 28 (Hour and Date of Disposition). Self-explanatory.

y. Item 29 (Medical Officer). Enter signature, grade, and organization of MTF commander, medical officer, or selected enlisted members authorized to sign the FMC.

z. Item 30 (Religious Information). Completed by chaplain.

aa. Item 31 (Diet). Check appropriate box.

bb. Item 32 (Remarks). Use this item to continue or expand any information given on the front of the form, cross-reference the item being continued. Use this item also to give any additional information that might be needed for a patient being evacuated through the MTF. For transfer cases, enter the date and hour of transfer. When additional treatment is given en route, state the nature of the treatment, where it was given, and the date and hour it was given. For deaths en route, state the date, hour, cause, and approximate place of death as well as any other pertinent information. For patients returned to duty when they arrive at the MTF, enter that they were returned, the date, the MTF, and the hour returned. For these cases, no ITRCS is needed but IPDS (Individual Patient Data System) coding is required.

Table 17-6. Officer and Enlisted Grade Structure.

ARMY	MARINES	NAVY/ COAST GUARD	AIR FORCE	DATA CODES
GENERAL OF THE ARMY (GA)	— —	FLEET ADMIRAL (FADM)	GENERAL OF THE AIR FORCE (GenAF)	G5
GENERAL(GEN)	GENERAL (GEN)	ADMIRAL (ADM)	GENERAL (GEN)	G3
LIEUTENANT GENERAL (LTG)	LIEUTENANT GENERAL (LtGen)	VICE ADMIRAL (VADM)	LIEUTENANT GENERAL (LtGen)	G3
MAJOR GENERAL (MG)	MAJOR GENERAL (Maj Gen)	REAR ADMIRAL (RADM)	MAJOR GENERAL (Maj Gen)	G2
BRIGADIER GENERAL (BG)	BRIGADIER GENERAL (BrigGen)	COMMODORE (Commodore)	BRIGADIER GENERAL (BGen)	G1
COLONEL (COL)	COLONEL (Col)	CAPTAIN (CAPT)	COLONEL (Col)	06
LIEUTENANT COLONEL (LTC)	LIEUTENANT COLONEL (LtCol)	COMMANDER (CDR)	LIEUTENANT COLONEL (LtCol)	05
MAJOR (MAJ)	MAJOR (Maj)	LIEUTENANT COMMANDER (LCDR)	MAJOR (MAJ)	04
CAPTAIN (CPT)	CAPTAIN (Capt)	LIEUTENANT (LT)	CAPTAIN (Capt)	03
FIRST (LIEUTEANT (1LT)	FIRST LIEUTENANT (1st Lt)	LIEUTENANT, JUNIOR GRADE (LTJG)	FIRST LIEUTENANT (1stLt)	02
SECOND LIEUTENANT (2LT)	SECOND LIEUTENANT (2dLt)	ENSIGN (ENS)	SECOND LIEUTENANT (2dLt)	01
CHIEF WARRANT OFFICER (CW4)	CHIEF WARRANT OFFICER (CWO4)	CHIEF WARRANT OFFICER (CWO-4)	CHIEF WARRANT OFFICER (CWO-4)	W4
CHIEF WARRANT OFFICER (CW3)	CHIEF WARRANT OFFICER (CWO3)	CHIEF WARRANT OFFICER (CWO-3)	CHIEF WARRANT OFFICER (CWO-3)	W3
CHIEF WARRANT OFFICER (CW2)	CHIEF WARRANT OFFICER (CWO2	CHIEF WARRANT OFFICER (CWO-2)	CHIEF WARRANT OFFICER (CWO-2)	W2
WARRANT OFFICER (WO1)	WARRANT OFFICER (WO)	WARRANT OFFICER (WO-1)	WARRANT OFFICER (WO)	W1
SERGEANT MAJOR OF THE ARMY (SMA)	SERGEANT MAJOR OF THE MARINE CORPS (SgtMaj)	MASTER CHIEF PETTY OFFICER OF THE NAVY (MCPON)	CHIEF MASTER SERGEANT OF THE AIR FORCE (MSAF)	E9

Table 17-6. Officer and Enlisted Grade Structure—continued.

ARMY	MARINES	NAVY/ COAST GUARD	AIR FORCE	DATA CODES
COMMAND SERGEANT MAJOR (CMS)	SERGEANT MAJOR (Sgt Maj)	MASTER CHIEF PETTY OFFICER (MCPO)	CHIEF MASTER SERGEANT (MSgt)	E9
STAFF SERGEANT MAJOR (SSM)	MASTER GUNNERY SERGEANT (MGySgt)	— —	— —	E9
FIRST SERGEANT (1SG)	FIRST SERGEANT (1st Sgt)	SENIOR CHIEF PETTY OFFICER (SCPO)	SENIOR MASTER SERGEANT (SMSgt)	E8
MASTER SERGEANT (MSG)	MASTER SERGEANT (MSgt)	— —	— —	E8
PLATOON SERGEANT PSG) or SERGEANT FIRST CLASS (SFC)	GUNNERY SERGEANT (GySgt)	CHIEF PETTY OFFICER (CPO)	MASTER SERGEANT (Msgt)	E7
SPECIALIST 7 (SP7)	— —	— —	— —	E7
STAFF SERGEANT (SSG)	STAFF SERGEANT (SSgt)	PETTY OFFICER FIRST CLASS (PO1)	TECHNICAL SERGEANT (TSgt)	E6
SPECIALIST 6 (SP6)	— --	— —	— —	E6
SERGEANT (SGT) (SGT)	SERGEANT (Sgt)	PETTY OFFICER (PO2)	STAFF SERGEANT (SSgt)	E5
SPECIALIST 5 (SP5)	— —	— —	— —	E5
CORPORAL (CPL)	CORPORAL (Cpl)	PETTY OFFICER THIRD CLASS (PO3)	SERGEANT (Sgt)	E4
SPECIALIST 4 (SP4)	— —	— —	— —	E4
PRIVATE FIRST CLASS (PFC)	LANCE CORPORAL (LCpl)	SEAMAN (Seaman)	AIRMAN FIRST CLASS (ALC)	E3
PRIVATE (PVT)	PRIVATE FIRST CLASS (PFC)	SEAMAN APPRENTICE (SA)	AIRMAN (Amn)	E2
PRIVATE (PVT)	PRIVATE (Pvt)	SEAMAN RECRUIT (SR)	AIRMAN BASIC (AB)	E1

CHAPTER 18

PHARMACOLOGY AND DRUG ADMINISTRATION

18-1. General

Safe and effective administration of drugs is an essential part of patient care. The medical specialist may be required to administer prescribed drugs. Since administration of drugs is an accepted function of a professional nurse, it is customary that instruction and supervised experience in drug administration be conducted by an Army Nurse Corps officer in AMEDD training and medical treatment facilities. The medical specialist who has demonstrated his competence in administering drugs will perform this duty in accordance with written local policy directives.

18-2. Definitions

a. Pharmacology. The science of drugs, especially the actions of drugs on the body. No drug can introduce a new action in the body; it can only modify actions already there. Drugs can either increase or decrease the actions or functions of cells.

b. Therapeutics. The actions of drugs in the treatment of disease.

c. Drug. Any substance, or mixture of substances, used in the treatment, prevention, or diagnosis of disease. The terms drug and medication can be used interchangeably.

d. Poison. A substance which, when absorbed or ingested into the body, may alter physiology by damaging body tissues or cells.

e. Toxicology. The study of poisons and their actions, the treatment of poisoning, and the use of antidotes.

f. Pharmacy. The art and science of preparing and dispensing drugs for medical purposes. Pharmaceutical is the adjective which means "pertaining to pharmacy."

g. USP. The United States Pharmacopeia is an official reference on the source, preparation, potency, and doses of commonly used and valuable drugs.

h. NF. The National Formulary is an official companion reference to the USP. It contains many commonly used drugs and preparations not included in the USP. It designates their sources, methods of preparation, standards of purity, and dosage.

i. PDR. This abbreviation refers to Physician's Desk Reference, published yearly by a private company. Drug manufacturers cooperate in the preparation of this book, and major products of the companies are listed.

18-3. Drug Legislation

State and Federal legislation provide for the enforcement of drug standards to protect the public from fraud or from exposure to unsafe or unreliable drug preparations. Three Federal laws covering drugs are the Food, Drug, and Cosmetic Act (FDCA), the Harrison Narcotic Act, and the Drug Abuse Control Act.

a. The Food, Drug, and Cosmetic Act. The FDCA provides broad coverage on the manufacture and distribution of drugs in interstate commerce to prevent false and misleading statements and to provide for controlled dispensing of drugs considered unsafe for self-medication. Amendments to the FDCA require that drug preparations be labeled and that all habit-forming and potentially toxic drugs have on the label this statement: "CAUTION: Federal law prohibits dispensing without prescription."

b. The Harrison Narcotic Act. This act is the Federal narcotic control law which regulates the importation, manufacture, prescription, sale, and use of drugs defined as addictive. All derivatives of opium and cocaine are covered except for some specific exemptions. The law provides for distribution of controlled drugs through medical channels and for legal medical use only. All personnel handling the drugs specified in the law are accountable for their use. Careful and accurate records must be maintained, subject to Federal inspection and, except as specified in the law, the possession of narcotics is a Federal crime.

c. The Drug Abuse Control Act. This act governs the distribution and control of barbiturates, amphetamines, and habit-forming drugs. Drugs which have a potential of abuse because they produce a depressant, stimulating, or hallucinogenic effect on the central nervous system also come under this law.

18-4. Drug Nomenclature

Three name classifications of drugs are the chemical-scientific name, the generic name, and the brand or trade name.

a. Chemical-Scientific Name. This name specifically identifies the compound and is useful to technically trained personnel.

b. Generic Name. The generic or official name of a drug is assigned by the producer of the drug in collaboration with the Food and Drug Administration and Council on Drugs of the American Medical Association. The generic name may be used by any interested person and is usually the name found in the USP and NF. The generic listing is often used in the Federal Supply Catalog and in AMEDD pharmacies. A generic drug name is not capitalized; for example, aluminum hydroxide.

c. Brand or Trade Name. Trade names are copyrighted terms selected by a manufacturer to designate a particular product. Copyright laws prevent any other person from using the name, and other laws prevent pharmacists from substituting chemically identical products for the trade name article. When there are no longer any legal restrictions on the use of a brand name, the most widely accepted and familiar name may become the official or generic name. Aspirin is an example—in 1963, this drug, previously listed as acetylsalicylic acid, officially became aspirin, USP.

18-5. Sources of Drugs

There are five main sources from which drugs are obtained.

a. Mineral. Many mineral substances found in nature are used in drugs. *Examples:* iodine, zinc oxide, and magnesium sulfate (epsom salt).

b. Plant. Certain drugs are derived from vegetables and plants. *Examples:* digitalis, morphine, and senna pod extract.

c. Animal. The organs, tissues, and body fluids of animals (including man) are the source of some drugs. *Examples:* certain hormones, antitoxic serums, and gamma globulin from human blood.

d. Synthesis. Synthesis is the artificial building of a chemical compound by the union of its elements. Drugs such as epinephrine that were once available only from natural sources can now be artifically reproduced through synthesis. Other drugs such as the sulfonamides were originally created through synthesis.

e. Microorganisms. Microorganisms such as fungi and bacteria are also sources of drugs. *Examples:* penicillin, tetracycline, and some vaccines.

18-6. Types of Drug Preparations

Drugs are compounded into various types of preparations (Figure 18-1), depending upon each drug's physical characteristics, the purpose for which intended, and the method by which it is to be administered. Some drugs are prepared in more than one form so they may be administered several ways. To give them bulk or form, drugs may be mixed with other substances called vehicles which have no action or medicinal value. For a drug in aqueous solution, water is the vehicle; for a drug in an ointment, fatty substances such as petrolatum or lanolin are used as the vehicle. Drugs or mixtures of drugs that are divided into definite doses are dosage forms. Examples of these forms are capsules, tablets, ampules, and cartridge units. Some dosage forms prepared for oral administration are coated with a special coating (enteric) that resists the action of the stomach juices but dissolves in the intestine. This helps prevent nausea, irritation of the stomach lining, or destruction of the drug. Scored tablets are marked with an indented line across the surface so that they can be broken in half, if a half dose is required. Drugs prepared with flavored coatings or those in flavored vehicles are exceptionally hazardous to children if left within easy reach. All drugs dispensed from an AMEDD pharmacy bear labels stating, "CAUTION: Keep out of reach of children."

a. Solid Preparations.

(1) *Capsule.* A drug placed in a gelatin container.

(2) *Tablet.* A drug compressed or molded into a flat disk or other shape.

(3) *Pill.* A powdered drug molded into a sphere. The word "pill" as a general term used for tablets is a misuse of the word.

(4) *Lozenge.* A drug preparation in a flat disk which is to be held in the mouth until dissolved.

(5) *Suppository.* A drug which is molded into shape for insertion into a body opening other than the mouth. Its vehicle, such as cocoa butter, melts at body temperature and the drug is released.

(6) *Ointment.* A drug suspended in a semi-solid base such as petrolatum.

(7) *Powder.* A drug which is ground up and used in powder form.

b. Fluid Preparations.

(1) *Fluid extract.* A concentrated fluid preparation. Fluid extracts are 100 percent strength (1 ml of the preparation contains 1 Gm of the crude drug).

NOTE

The abbreviation for gram is Gm, with the first letter always capitalized. The abbreviation for milligram is mg and for milliliter is ml. Milliliter is the preferred fractional measure of the liter; formerly cubic centimeter (cc) was used.

(2) *Tincture.* An alcoholic solution of a drug. Tinctures of potent vegetable drugs are 10 percent in strength; those of less potent drugs are 20 percent in strength.

(3) *Elixir.* A solution containing water, alcohol, sugar, and flavoring substances, in which one or more drugs may be dissolved.

(4) *Spirit.* An alcoholic or hydroalcoholic solution of a volatile drug.

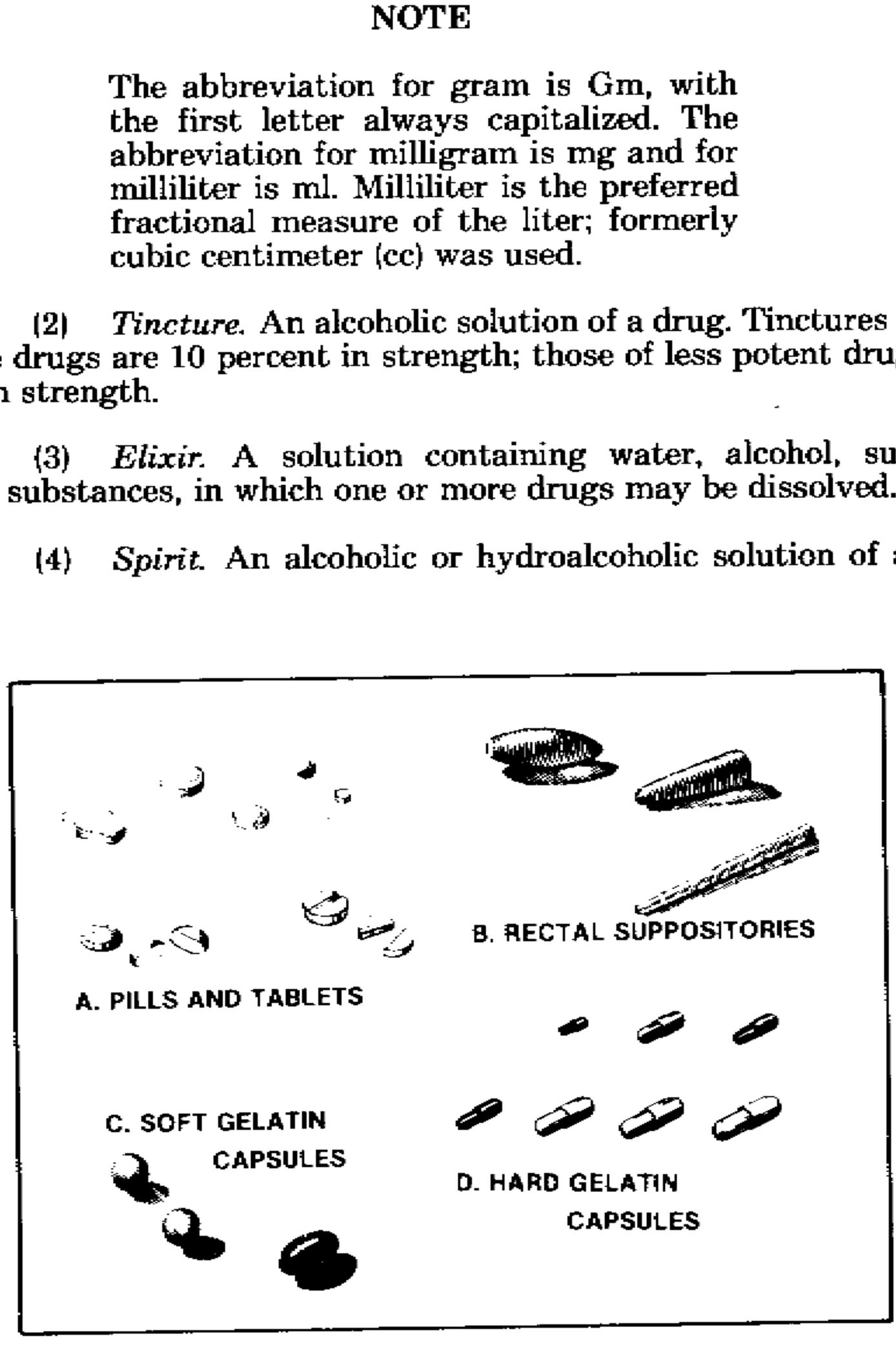


Figure 18-1. Solid preparation of drugs.

c. Abbreviations. The following abbreviations are commonly used in prescriptions, written orders, and on labels of drug containers. The abbreviation and its meaning must be learned; the derivation is necessary only to show the connection with the abbreviation. Most are Latin words or phrases which are abbreviated as shown in Tables 18-1, 18-2, and 18-3.

Table 18-1. Abbreviations Used in Dosage and Directions.

Abbreviation	Derivation	Meaning
aa	ana	of each
ad	ad	up to
ad lib	ad libitum	as much as desired
b	bis	twice
C		centigrade
c	cum	with
cc		cubic centimeter
caps	capsula	capsule
F		Fahrenheit
Gm	gram	gram, grams
gr	granum, grana	grain, grains
gtt	gutta	drop, drops
IM		intramuscular
IV		intravenous
kg	kilogram	thousand grams
l	liter	liter
Lb., lb	libra	pound
mg	milligram	thousandth of a gram
ml	milliliter	thousandth of a liter
ocul	oculus	the eye
o.d.	oculo dextro	in right eye
o.s.	oculo sinistro	in left eye
o.u.	oculus uterque	in each eye
p.o.	per os	by mouth
q.s.	quantum sufficit	a sufficient quantity
℞	recipe	take
s	sine	without
SQ, s.c., sub q	sub cutem	subcutaneous
sig	signa	label, let it be labeled
s.o.s.	si opus sit	if necessary
ss	semis	one-half
tab		tablet
tsp	teaspoon	teaspoonful
tbsp	tablespoon	tablespoonful
ℨ	drachma	dram
℥	uncia	ounce

Table 18-2. Abbreviations Indicating Time of Administration.

Abbreviation	Meaning
a.c.	before meals
b.i.d.	twice a day
h.	hour
h.s.	at bedtime
p.c.	after meals
p.r.n.	when needed
q.a.m.	every morning
q.d.	every day (daily)
q.p.m./h.s.	every afternoon/night
q.2h., q.3h., q.4h.	every 2, 3, or 4 hours
q.i.d., or 4 i.d.	four times a day
q.o.d.	every other day
stat	at once
t.i.d.	three times a day

Table 18-3. Abbreviations Indicating Hours of Administration.

Abbreviations	Meaning
q.i.d.	0800, 1200, 1600, 2000
q.2h.	0600, 0800, 1000, 1200, etc.
q.3h.	0900, 1200, 1500, 1800, etc.
q.4h.	0800, 1200, 1600, etc.
q.6h.	0600, 1200, etc.
b.i.d.	1000, 1600
t.i.d.	1000, 1500, and 1800
a.c.	½ hour before meals: 0630, 1130, 1630
p.c.	0800, 1400, 1800

18-7. Prescriptions

a. Definition. A prescription is an order written by a physician or a dentist to a pharmacist, directing him to supply the patient named in the prescription with the quantities of drugs specified. Directions for use of the drugs are given by the physician or dentist and written on the label by the pharmacist. A prescription is a legal document and must be signed by an individual authorized to write prescriptions. Prescription forms must be dated, the patient specifically identified, and in the AMEDD, the metric system used.

b. Parts. A prescription consists of—

(1) Date it was written.

(2) Name of the patient and, in the military, his ward or organization.

(3) The symbol R, an abbreviation of the Latin word "Recipe" meaning "Take thou..."

NOTE

This list contains examples of hours of administration of drugs when the instructions of the physician indicate only the number of doses to be given each day. A local policy directive should be consulted since hours of administration of drugs are customarily coordinated with local hospital hours for meal service, "lights out" at night, or other routine hospital activities.

(4) Names and quantities of the drugs. Army prescriptions are written in English with amounts in the metric system.

(5) Instructions to the pharmacist.

(6) Instructions to the patient.

(7) Signature of the physician.

18-8. Pharmaceutical Weights and Measures

a. Two systems of weighing and measuring drugs are used, the metric system and the apothecary system. The metric system is the official system used by the Army. However, there may be occasions when drugs are prescribed in the apothecary system and a medical specialist qualified to administer drugs must know how to convert apothecary measurements to metric measurements. Table 18-4 lists metric doses with approximate apothecary equivalents. These equivalents represent the quantities usually prescribed under identical conditions in either the metric or the apothecary systems of weights and measures.

b. Certain abbreviations are commonly used and are shown in Table 18-4.

Table 18-4. Metric Doses with Approximate Apothecary Equivalents.

Liquid Measure		Liquid Measure	
Metric	**Approximate Apothecary Equivalents**	**Metric**	**Approximate Apothecary Equivalents**
1,000 ml	1 quart	3 ml	45 minims
750 ml	1½ pints	2 ml	30 minims
500 ml	1 pint	1 ml	15 minims
250 ml	8 fluid ounces	0.75 ml	12 minims
200 ml	7 fluid ounces	0.6 ml	10 minims
100 ml	3½ fluid ounces	0.5 ml	8 minims
50 ml	1¾ fluid ounces	0.3 ml	5 minims
30 ml	1 fluid ounce	0.25 ml	4 minims
15 ml	4 fluid drams	0.2 ml	3 minims
10 ml	2½ fluid drams	0.1 ml	1½ minims
8 ml	2 fluid drams	0.06 ml	1 minim
5 ml	1¼ fluid drams	0.05 ml	¾ minim
4 ml	1 fluid dram	0.03 ml	½ minim
Weight		**Weight**	
Metric	**Approximate Apothecary Equivalents**	**Metric**	**Approximate Apothecary Equivalents**
30 Gm	1 ounce	30 mg	1/2 grain
15 Gm	4 drams	25 mg	3/8 grain
10 Gm	2½ drams	20 mg	1/3 grain
7.5 Gm	2 drams	15 mg	1/4 grain
6 Gm	90 grains	12 mg	1/5 grain
5 Gm	75 grains	10 mg	1/6 grain
4 Gm	60 grains (1 dram)	8 mg	1/8 grain
3 Gm	45 grains	6 mg	1/10 grain
2 Gm	30 grains (½ dram)	5 mg	1/12 grain
1.5 Gm	22 grains	4 mg	1/15 grain
1 Gm	15 grains	3 mg	1/20 grain
0.75 Gm	12 grains	2 mg	1/30 grain
0.6 Gm	10 grains	1.5 mg	1/40 grain
0.5 Gm	7½ grains	1.2 mg	1/50 grain
0.4 Gm	6 grains	1 mg	1/60 grain
0.3 Gm	5 grains	0.8 mg	1/80 grain
0.25 Gm	4 grains	0.6 mg	1/100 grain
0.2 Gm	3 grains	0.5 mg	1/120 grain
0.15 Gm	2½ grains	0.4 mg	1/150 grain
0.12 Gm	2 grains	0.3 mg	1/200 grain
0.1 Gm	1½ grains	0.25 mg	1/250 grain
75 mg	1¼ grains	0.2 mg	1/300 grain
60 mg	1 grain	0.15 mg	1/400 grain
50 mg	¾ grain	0.12 mg	1/500 grain
40 mg	⅔ grain	0.1 mg	1/600 grain

18-9. The Metric System

The metric system is used in measuring length, volume, and weight. The meter is the basic unit of length, the liter is the basic unit of volume or capacity, and the gram is the basic unit of weight. Subdivisions and multiples of metric units are based upon the decimal system, which means that they are divided or multiplied by 10, 100, or 1000 parts.

a. Subdivisions. When added to meter, liter, and gram, the prefixes below show that the basic metric unit is to be subdivided.

(1) Milli- means 1/1000 of a unit (0.0001). *Examples:* millimeter (length), milliliter (volume), and milligram (weight).

(2) Centi- means 1/100 of a unit (0.01). *Examples:* centimeter, centiliter, and centigram.

(3) Deci- means 1/10 of a unit (0.1). *Examples:* decimeter, deciliter, and decigram.

b. Multiples. These are expressed by adding the following prefixes to meter, liter, and gram:

(1) Kilo- means 1000 times a unit (kilometer, kiloliter, and kilogram).

(2) Hecto- means 100 times a unit (hectometer, hectoliter, and hectogram).

(3) Deka- means 10 times a unit (dekameter, dekaliter, and dekagram).

c. Importance of the Decimal Point. The placement of the decimal point in the metric system indicates the decimal progression by tens, hundreds, or thousands. In writing the fractional part of a metric unit, a zero is placed before the decimal point to help prevent misreading the decimal fraction, which could be very dangerous when working with drugs. Table 18-4 shows that fractional parts of metric units are preceded by zero.

18-10. Converting Between Units in the Metric System

As a general rule, drug quantities less than 0.1 Gm are expressed as milligrams; quantities more than 0.1 Gm are expressed as grams.

a. Grams to Milligrams. To convert grams to milligrams, move the decimal point three places to the right (multiply by 1000). *Examples:* 0.075 Gm = 75 mg; 0.25 Gm = 250 mg.

b. Milligrams to Grams. To convert milligrams to grams, move the decimal point 3 places to the left (divide by 1000). *Examples:* 1000 mg = 1 Gm; 500 mg = 0.5 Gm.

18-11. Converting Measurements From Apothecary to Metric

When an apothecary measurement must be converted to a metric measurement and there is no conversion table available for referral, it is essential to know how to convert the necessary measurements by calculation.

a. To convert grains to milligrams, multiply grains by 60 to obtain milligrams. *Example:* How many milligrams in 1/4 grain of morphine sulphate?

$$1/4 \text{ X } 60 = \frac{60}{4} = 15 \quad \textit{Answer:}\ 15$$

b. To convert fluid ounces to milliliters, multiple by 30. *Example:* How many milliliters in 10 fluid ounces of water?

$$10 \text{ X } 30 = 300 \qquad \textit{Answer:}\ 300 \text{ ml}$$

c. To convert minims to milliliters, divide minims by 15. *Example:* How many milliliters in 10 minims of solution?

$$15/\ 10.00 = .66 \qquad \textit{Answer:}\ 0.66 \text{ ml}$$

18-12. Calculation of Doses From Tablets or Capsules

If the dose to be given does not correspond with the dose indicated on the drug container label, it is necessary to calculate how many tablets or capsules available will contain the required dose. The rule to be used is—divide the desired dose by the dose on hand to determine the number of tablets or capsules required.

a. Example 1. The order is written to give tetracycline hydrochloride 0.5 Gm. The label on the drug container reads, "tetracycline hydrochloride 0.25 Gm."

$$\frac{0.50}{0.25} = 2 \qquad \textit{Answer:}\ \text{Give 2 capsules, each containing 0.25 Gm.}$$

b. Example 2. The order is written to give tetracycline hydrochloride 500 mg. The label on the drug container reads, "tetracycline hydrochloride 0.25 Gm." An additional step is needed in this example; since the order is written in milligrams, grams must be converted to milligrams.

Step 1: Convert grams to milligrams. 0.25 = 250 mg.

$$\text{Step 2: } \frac{500}{250} = 2 \qquad \textit{Answer:}\ \text{Give 2 capsules, each containing 0.25 Gm.}$$

18-13. Calculation of Doses From Drugs in Solution

Drugs for injection are usually dispensed as sterile solutions in sealed, single-dose glass ampules or in rubber-stoppered, multiple-dose vials. The strength of the solution is written on the label of the drug container; for example, "10 mg per ml." The problem is to determine what quantity of solution available contains the dose of drug required. The rule to be used for this type of problem is: amount of drug is to finished solution as the ratio of strength. The method of solving the problem is by ratio and proportion.

a. Example 1. solution of diphenhydramine hydrochloride contains 10 mg per ml. The dose to be given is 5 mg.

Amount of drug : finished solution : : ratio of strength

5 mg : X ml : : 10 mg : 1 ml

5 mg : X ml :: 10 mg : 1 ml

$$10X = 5$$

$$X = \frac{5}{10} = 0.5 \text{ ml}$$

Answer: Give 0.5 ml of solution, which contains 5 mg diphenhydramine hydrochloride.

b. Example 2. A solution of chlorpromazine hydrochloride contains 25 mg per ml. The dose to be given is 0.025 Gm.

Step 1. Change grams to milligrams—0.025 Gm = 25 mg.

Step 2. Amount of drug: finished solution : : ratio of strength

25 ml : X ml : 25 mg : 1 ml

$$25X = 25$$

$$X = 1 \text{ ml}$$

Answer: Give 1 ml of solution which contains 25 mg of chlorpromazine hydrochloride.

18-14. Calculations of Intravenous Drop Rates

Intravenous (IV) fluids are administered at prescribed rates of flow which are expressed as cc/hr or ml/hr. The rate of flow must be measured precisely so that the patient does not receive too great or too little a volume of fluids. To calculate the flow rate, the medical specialist must know the rate of delivery for the IV tubing set being used. The most common IV tubing used has a delivery rate of 20 drops per cc. This means that 20 drops from the drip chamber will be equal to 1 cc of IV fluid administered. Other IV tubing sets have delivery rates of 60 drops per cc, 15 drops per cc, or 10 drops per cc. The IV tubing package will state the rate of delivery for that particular IV set. The medical specialist must also know the volume to be infused over the prescribed time.

Example: The physician orders an IV rate of 100 cc/hr. The tubing used delivers 20 drops per cc.

Rate = 100 cc/hr

gtt/cc = 20

Time in minutes = 60

$$\text{gtt/min} = \frac{\text{volume to be infused X gtt/cc of administration set}}{\text{infusion time in minutes}}$$

$$\frac{100 \text{ X } 20}{60} = 33.33$$

You will adjust the IV flow rate to 33 drops per minute to deliver 100 cc/hr. If your calculated flow rate comes out as a decimal, round it off to the nearest whole number.

18-15. Actions of Drugs

Drugs act by increasing or decreasing the actions or functions of body cells. Stimulation results in increased cell activity. Depression results in decreasing cell activity. Drugs which act at the site of application on the skin or mucous membrane have a local action. Drugs which act after absorption into the blood stream and distribution to all parts of the body have a systemic action. It is important to realize that some drugs applied externally to the skin or mucous membrane (such as nose drops containing phenylephrine) are absorbed and have both a local and a systemic action; others, although taken internally (such as aluminum hydroxide), have a local action because they are not absorbed from the mucous membrane of the gastrointestinal tract.

18-16. Administration of Drugs

Administration of drugs and medicines deals with the various methods by which they are applied to the body for local effect, or introduced into the body for systemic or general effect. Some drugs may be used either way.

18-17. External Administration

Topical (external) application of a drug is usually made for the local effect it will have on the skin or mucous membrane of a specific area. Sometimes such an application is made for its effect on underlying tissues. The preparations most commonly used are—

a. Solutions. Applied locally as antiseptics, cleaning agents, astringents, vasoconstrictors, counterirritants, or emollients (soothing agents). Solutions are also used as wet dressings, mouthwashes, gargles, irrigations, and soaks. Since solutions evaporate, the effect produced is often temporary.

b. Ointments. Provide a means of applying drugs for a prolonged local effect. The drug is mixed in a fatty material such as lard, petrolatum, or lanolin, which becomes soft or liquid when warm but does not evaporate. Thus, the drug is kept in contact with the body for a long period. Ointments are not used on discharging wounds because they prevent free drainage.

c. Suppositories. Used for insertion into a body cavity; for example, in the rectum or vagina. The drug is mixed with a solid inert base which melts at body temperature. The mixture is shaped into a cone or cylinder which can be easily inserted. An example of a suppository base is cocoa butter. After the base melts in the cavity, the active drug comes in contact with the mucous membrane. If the nature of the drug is such that it is absorbed through the membrane, a systemic effect may be produced. An example of a drug which produces a systemic effect when administered as a rectal suppository is aspirin.

18-18. Internal Administration

Drugs may be given internally by several methods. When they are so given, the effect may be upon the whole body, or on one of the systems, or only at the site where the drug is administered. The common methods of internal administration are—

a. Oral. The most common way to give a medicine is by mouth, either in solid or liquid form. Giving a drug by mouth is the simplest way; it requires no special apparatus; it is painless; and absorption takes place in a natural manner.

b. Sublingual. A limited number of drugs are administered by placing a tablet or drop under the tongue. The drug is held there until dissolved. It is not swallowed, and a drink must not be taken until it has completely dissolved. The absorption and action of drugs given this way is rapid. (The drug most commonly used sublingually is nitroglycerine.)

c. Rectal. Medications are given by rectum for the purpose of evacuating the colon, for local treatment of a diseased rectum or colon, or for general absorption. To induce a bowel movement, drugs may be given by an enema. Irrigations may be used to medicate the mucous membrane of the rectum or colon. Rectal suppositories also are frequently used. Another method by which substances are administered through the rectum is proctoclysis. Fluid is allowed to run into the rectum slowly, drop by drop, so that it is absorbed and does not enlarge the rectum. The disadvantages of rectal administration are the uncertainty of absorption and the chance that the drug may be expelled.

d. Inhalation. Medications may be administered by inhaling them into the lungs. This may be done by inhalation of aqueous preparations such as medicated steam, sprays, or aerosols. Drugs given by inhalation include various preparations for respiratory infections and diseases, medicinal gases such as oxygen, and certain general anesthetics. Oily preparations are not given by inhalation since the oil would damage lung tissue.

e. Injection. Drugs given by injection are administered with a sterile needle and syringe; injection methods are also referred to as parenteral (outside the intestine). An injection is used when rapid action by the drug is desired, when the drug might be destroyed by digestive juices or vomited if given by mouth, or when the patient is unconscious or injured so that he cannot be given the medication by mouth.

(1) *Subcutaneous (hypodermic).* The drug is injected into the tissue just beneath the skin. A preparation for subcutaneous use must be a sterile liquid capable of complete absorption or it will irritate the tissues. Although the subcutaneous injection may be given in almost any area of the body, the usual sites are the lateral (outer) aspect of the upper arms, the lower abdomen, and the anterior (front) of the thighs.

(2) *Intramuscular.* The drug is injected into a muscle in the buttocks region, or in the upper arm or thigh. The needle is inserted, at a right angle to the skin, through the skin and subcutaneous tissue into the underlying muscle. This method gives more rapid absorption of the drug than a subcutaneous injection.

(3) *Intravenous.* Drugs administered by vein act very rapidly because the entire dose passes directly into the blood stream. A comparatively small amount of sterile solution is given by intravenous injection; large amounts, administered drop by drop, are given by intravenous infusion. The usual site of injection is into the median basilic or median cephalic vein at the bend of the elbow. Intravenous injection is used when the drug is too irritating to be injected into other tissues, when immediate action is necessary, or when circulation is so poor that absorption from other tissue would be retarded. The IV administration of drugs is the responsibility of a medical officer or nurse; it is not a routine procedure performed by nonprofessional nursing personnel. When so performed, it must be in accordance with local policy directives.

(4) *Intradermal.* The drug is injected into the upper layers of skin, rather than under the skin as in a subcutaneous injection. Minute amounts (0.1 ml and less) are given intradermally, usually to test for drug sensitivity before administering larger amounts by other methods. Absorption from intradermal injection is slow. The medial (inner) surface of the forearm is the site most frequently used.

(5) *Intraspinal (intrathecal).* Drugs injected into the spinal canal are usually injected into the subarachnoid space. Some anti-infective drugs as well as spinal anesthesia are administered in this manner. The administration of drugs in this manner is the responsibility of the medical officer.

(6) *Other.* Drugs may also be injected into the peritoneum (intraperitoneal), into the heart muscle (intracardiac), into bone (intraosseous), and joints (intrasynovial). All of these procedures must be carried out by a medical officer.

18-19. Factors Influencing Dosage and Actions of Drugs

Experience has shown that people usually react to similar drugs in similar ways. The responsibility of prescribing the dosage of drugs rests with the medical officer. Dosage is the determination and regulation of doses. Dose is the quantity of drug to be given at one time. The individual responsible for administering the dose prescribed should be informed about the factors considered by the doctor when the drug is ordered—

a. Primary Factors. These include the drug, the dose, the patient, and the judgment of the medical officer prescribing the drug.

(1) *The drug.* The potency of a drug may be altered by the age of the drug, its form, or the way in which it is administered.

(2) *The dose.* A minimal dose may be prescribed. This is the smallest amount of drug that will produce a therapeutic effect. A maximal dose is the largest amount of drug that will produce the desired effect without accompanying symptoms of toxicity.

(3) *The patient.* The body weight, sex, age, and physical or emotional condition of the patient may affect the action of a drug. In general, a heavy person requires more of a drug than a small person. When a definite concentration of drug in the blood is desired, the dosage is frequently determined by computing the amount of drug per kilogram of body weight. Dosage of drugs for pregnant women is an important factor that must be taken into consideration because of the possible effect on the fetus. Older people and children usually require less than the usual dosage of a drug. Pediatric dosage forms containing suitably reduced concentrations of drug may be specified by the physician as the dosage form to be administered.

(4) *Judgment.* The written order for a drug is based on the medical officer's judgment of what is required for a specific patient and the order may not be altered by the individual who is to administer the drug. If the drug ordered is not available or is not in the form required for administration, the medical officer must be informed and a new order obtained.

b. Other Factors. Other factors that are considered by the medical officer in determining the dosage include—

(1) *Idiosyncrasy.* An unusual reaction to a drug which differs from its characteristic pharmacological action. An example of idiosyncrasy whould be excitement or restlessness after receiving a drug that normally produces relaxation or sleep.

(2) *Hypersensitivity.* A patient with this response is allergic to the drug or the vehicle in which it is incorporated. The tissues react with symptoms ranging from itching, skin rash, or hives, to respiratory difficulty and shock (circulatory collapse).

(3) *Side effect.* A drug given for a certain effect may have other effects sometimes undesirable. These reactions are called side effects. For example, morphine acts with a desirable effect when given to relieve severe pain but causes an undesirable side effect by depressing respiration.

(4) *Tolerance.* This is a lack of reaction to a drug, usually resulting from prolonged use. When this occurs, the dose must be progressively increased to get the desired effect. Tolerance may be acquired for morphine, barbiturates, and other drugs.

(5) *Antagonistic action.* Drugs that have an opposite effect to other drugs are considered antagonistic. Such drugs can be very useful in counteracting undesired effects as in the case of poisoning.

(6) *Cumulative effect.* Sometimes, after numerous doses, a drug accumulates, or builds up, in the body and continues to produce effects after its use has been discontinued. This is due to the inability of the body to dispose of the drug as rapidly as it is being given. An example of a drug which has this stockpiling effect is digitalis.

(7) *Habituation.* This is emotional dependence upon a drug. Barbiturates are among the drugs whose prolonged use can produce habituation.

(8) *Addiction.* Addiction is a condition in which continued use of a drug is necessary for the body to function normally. In addiction there is usually tolerance as well, so relatively large doses of the drug must be taken to obtain the drug effect. Among the drugs which may produce addiction are morphine and other opium derivatives and drugs described by law as narcotics.

18-20. Responsibility of the Medical Specialist in Drug Administration

Although it is the responsibility of the doctor to prescribe medication, it is the medical specialist's responsibility to follow orders intelligently and with a constant awareness of variations which occur in procedures for pouring and administering drugs and in reactions of patients to drugs. He must comply with several basic rules when he is assigned to administer drugs. He must—

- Be familiar with the drug prescribed.
- Not hesitate to check with a nurse, doctor, or pharmacist if he has any doubt as to the nature of the prescribed medication, dosage, or method of administration.
- Use proper techniques in the preparation of drugs he will administer.
- Remain with the patient until the medication has been swallowed if it is administered orally.
- Always record the medication on the patient's medical record in accordance with local policy.
- Observe the patient closely for any signs of unfavorable reactions and report them at once to a nurse or doctor.

18-21. General Rules for Preparation and Administration of Medication by Any Methode

General rules for preparation and administration of medications by any method are summarized in table form for ready reference (Table 18-5).

Table 18-5. General Rules for Preparation and Administration of Medications by Any Method.

DO	DO NOT
1. Have written order from the doctor for all medications.	**Caution.** Do not allow any distraction such as conversation while preparing and administering medication of any kind at any time.
2. When the therapeutic documentation care plan (medicated) is used: a. Make certain that the data on the sheet corresponds exactly with the doctor's written order. b. Identify each medication prepared by comparing it with the medication sheet.	
3. Know how drugs act; whether a local or systemic effect is desired and what possible bad effects might occur.	• Do not give a drug with which you are unfamiliar.
4. Wash hands immediately before preparing medication.	
5. Read the drug container label three times when preparing a medication. Make this a deliberate procedure, checking the drug label against the order or the medicine card each time: a. Before taking container from shelf. b. Before removing drug from container. c. Before returning the container to its proper place.	• Do not use drugs from unlabeled containers or from a container whose label is not legible.
6. Measure the dose accurately. If liquid, measure at eye level. If calculation is necessary, recheck calculation. If any doubt exists, verify by checking with some responsible person—nurse, doctor, pharmacist.	• Do not give drugs that have been poured by some other person. • Do not return any excess drug to the container.
7. Request that all ambulatory patients remain at their bedsides, as medication will be brought to them.	
8. Identify the patient by asking his name and checking his identification band.	• Do not rely on room, bed number, or name on bedcard to identify patient.
9. Remain with the patient until oral medication has been swallowed. EXCEPTION: If a written order requires medication at the bedside, record the order on the medication card. At time of administration: a. Check supply of drug at bedside. b. Verify by requesting patient to repeat doctor's instructions.	• Do not leave a medication at bedside unless specifically ordered to do so by the physician.
10. Use memo pad and pencil for on-the-spot observations.	• Do not rely on memory for important observations.

18-22. Preparation and Administration of Oral Medications

a. Observe carefully the general rules listed in Table 18-5.

b. Check equipment required. This will include: medication orders, tray or medicine cart, medicine glasses or calibrated paper cups, dropper, graduate or dropper calibrated in minims, pitcher of water, paper cups for water, drinking tubes, tongue blade or glass stirring rod, paper tissues, paper towels, memo pad, pencil, and watch with second hand.

c. Prepare individual medications.

(1) *Pills, tablets, and capsules.* Shake required number into container cap and transfer to medicine glass or cup.

(2) *Liquid medications poured from bottle.*

(a) Place cap upside down on shelf or table. Hold medicine glass so that the calibration mark of the prescribed amount is at eye level (Figure 18-2) and place thumbnail on this mark.

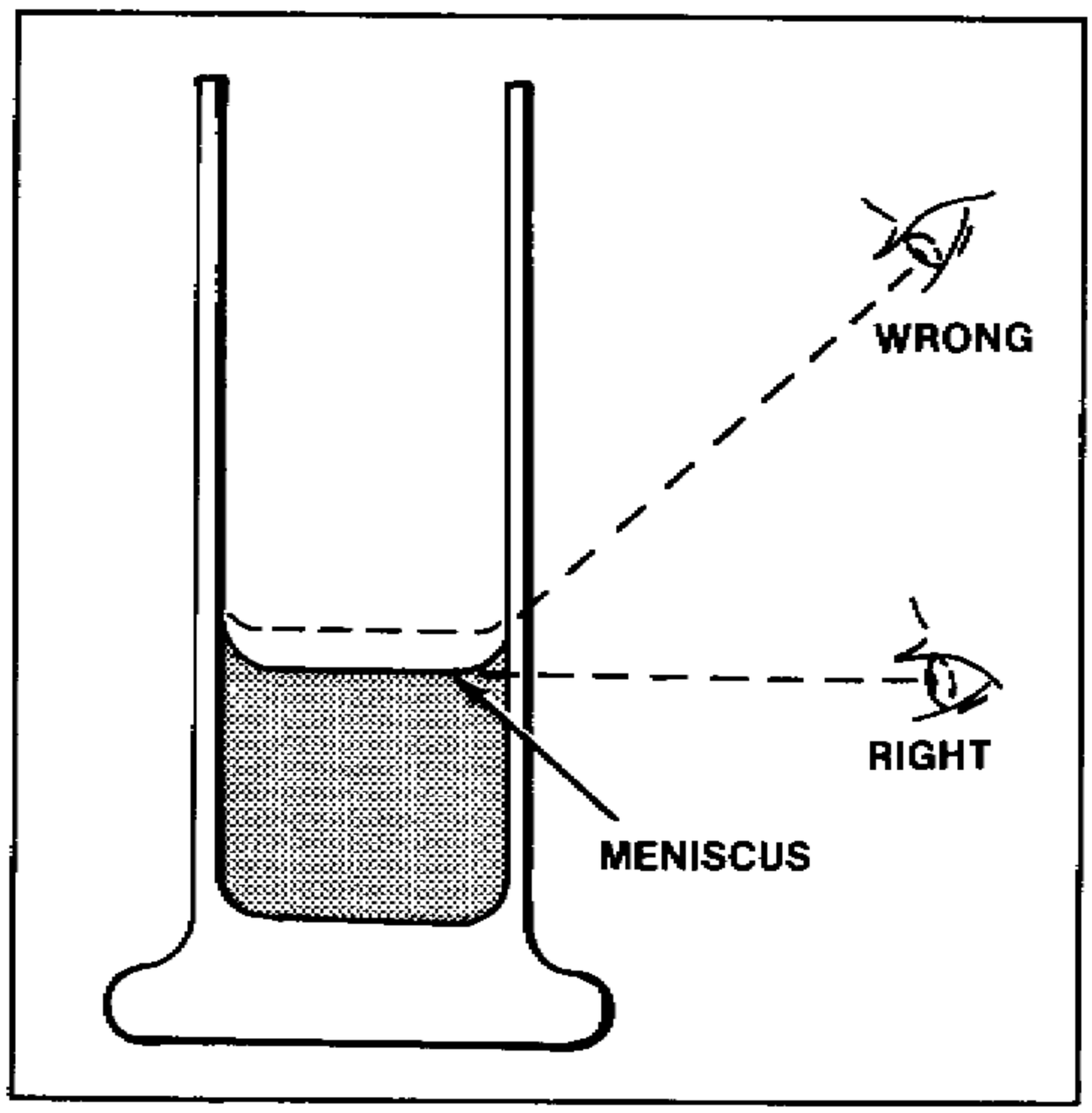


Figure 18-2. Technique for measuring liquids.

NOTE

When liquid is poured into a cylinder, surface forces cause its surface to become concave; that is, the portion in contact with the cylinder is drawn upward. This is known as a meniscus (Figure 18-2) and in determining the volume of liquid, the reading must be made at the bottom of the meniscus. This can be done by holding the container up so that the level of liquid is at the line of sight or, with heavy objects, lowering the body until the line of sight is even with the level of liquid.

(b) Hold bottle label next to palm of hand, and pour from side opposite label so that if a drop runs down outside of bottle it will not obscure the label. Wipe neck of bottle with a damp paper towel before replacing cap.

(c) Dilute poured medication, unless otherwise indicated, with about 15 ml water or as illustrated.

(3) *Liquid medication measured in drops.* Draw up approximate amount of solution into dropper. Count aloud the prescribed number of drops into the medicine glass. Discard solution remaining in the dropper. Dilute measured drops with 15 ml water, unless given other instructions.

(4) *Liquid medication measured in minims.* Use minim-calibrated dropper or minim-calibrated graduate when medication order requires minim measurement. A minim and a drop are NOT equivalent measures.

(5) *Powders and granules.* Measure required amount into glass or cup, but do not add water until at the patient's beside. At this time, add water and stir. Rinse glass with small additional amount of water to remove all residual drug and give this to the patient also.

(6) *Cough syrups.* Do not dilute with water. Have patient drink water before taking medication and instruct him not to drink for 15 minutes after taking medication.

(7) *Sublingual medications.* If sublingual (under the tongue) medications are to be used, give no water and instruct the patient not to swallow saliva until the taste of the drug has disappeared. These medications dissolve rapidly and are absorbed rapidly through the oral mucous membrane; they are less effective if swallowed.

(8) *Lozenge.* If a lozenge is given, tell the patient to hold it in his mouth and let it dissolve slowly. There will be a relatively high concentration of drug in the mouth and in the swallowed saliva; this effect is desirable for absorption.

(9) *Drugs with special requirements prior to administration.* Before administering a drug such as digitalis, record the patient's name, the time, and the apical pulse rate. DO NOT administer digitalis to a patient whose apical pulse is below 60 beats per minute.

18-23. General Procedures for Preparing Medication for Injection

a. Patient Safety. Patient safety is a critical factor. You must learn how to administer medications correctly. Once the medication is injected, you cannot retrieve it. Incorrect injections may seriously harm or kill a patient. Aseptic technique must be strictly maintained during the preparation and administration of a drug. Foreign particles or other types of contamination on a needle could be injected directly into the body. A secondary infection may be introduced through the needle puncture in the skin. Improper technique or a dull needle can cause irreparable damage to a major nerve or other structure.

CAUTION

Read syringe calibrations carefully to insure correct dosage. Observe the patient closely for any signs of adverse reaction to the medication.

b. Instruments Used to Administer a Parenteral Injection. Administering medicine by injection requires needles and syringes that are sterile, accurate in measuring dosages, and convenient for use. This equipment should produce as little discomfort or danger to the patient as possible when medication is injected. Figure 18-3 illustrates a disposable rigid plastic container, a disposable needle, and a syringe.

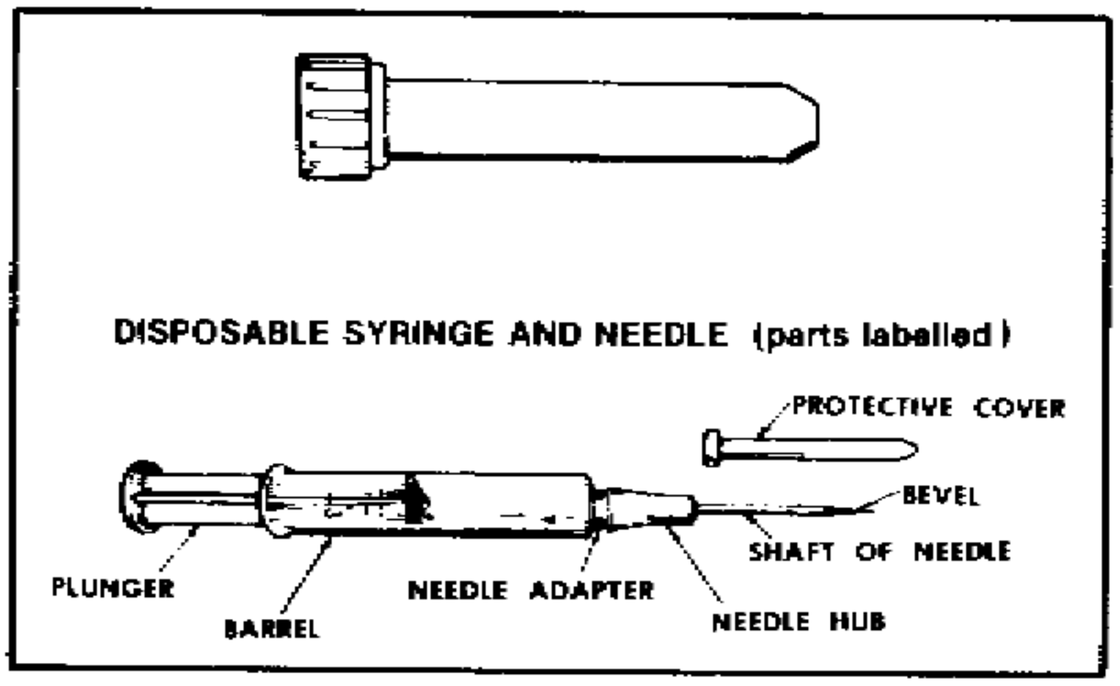


Figure 18-3. Disposable needle, syringe, and container.

(1) *Needle.* The needle is a tube with a cutting edge that punctures beneath the protective area of the skin. It is made of steel or other metal and is generally disposable. The parts of a needle consist of a lumen (cavity through which medication flows), bevel (slanted tip/cutting edge), hub, and cannula (shaft) (Figure 18-4). The needle comes in standard lengths from 1/2 inch to 6 inches long. The length is determined by measuring from the tip of the point to the junction of the shaft. The needle used must be sharp and smooth to prevent damage to the patient. The choice of needle gauge and length depends upon the thickness (viscosity) of the medication. The gauge (size) is indicated by numbers 14 to 27. The higher the gauge number, the smaller the diameter of the needle. A small gauge (large diameter) is needed for viscous medications; a large gauge (small diameter) is needed for thin or watery medications (Figure 18-5).

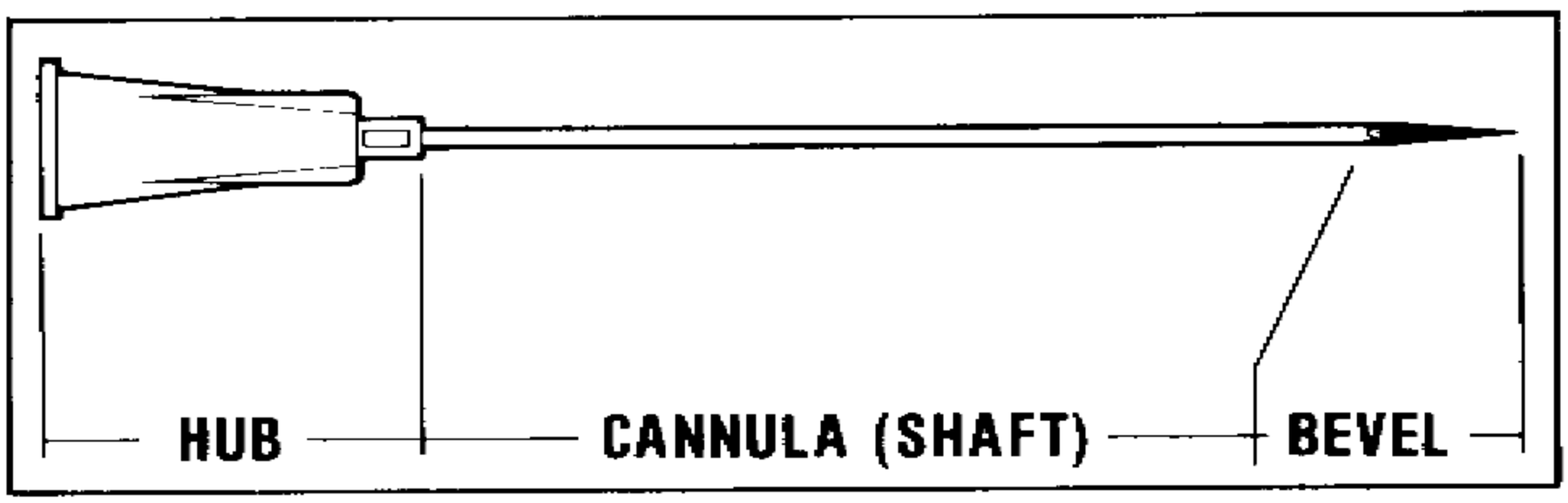


Figure 18-4. Parts of a needle.

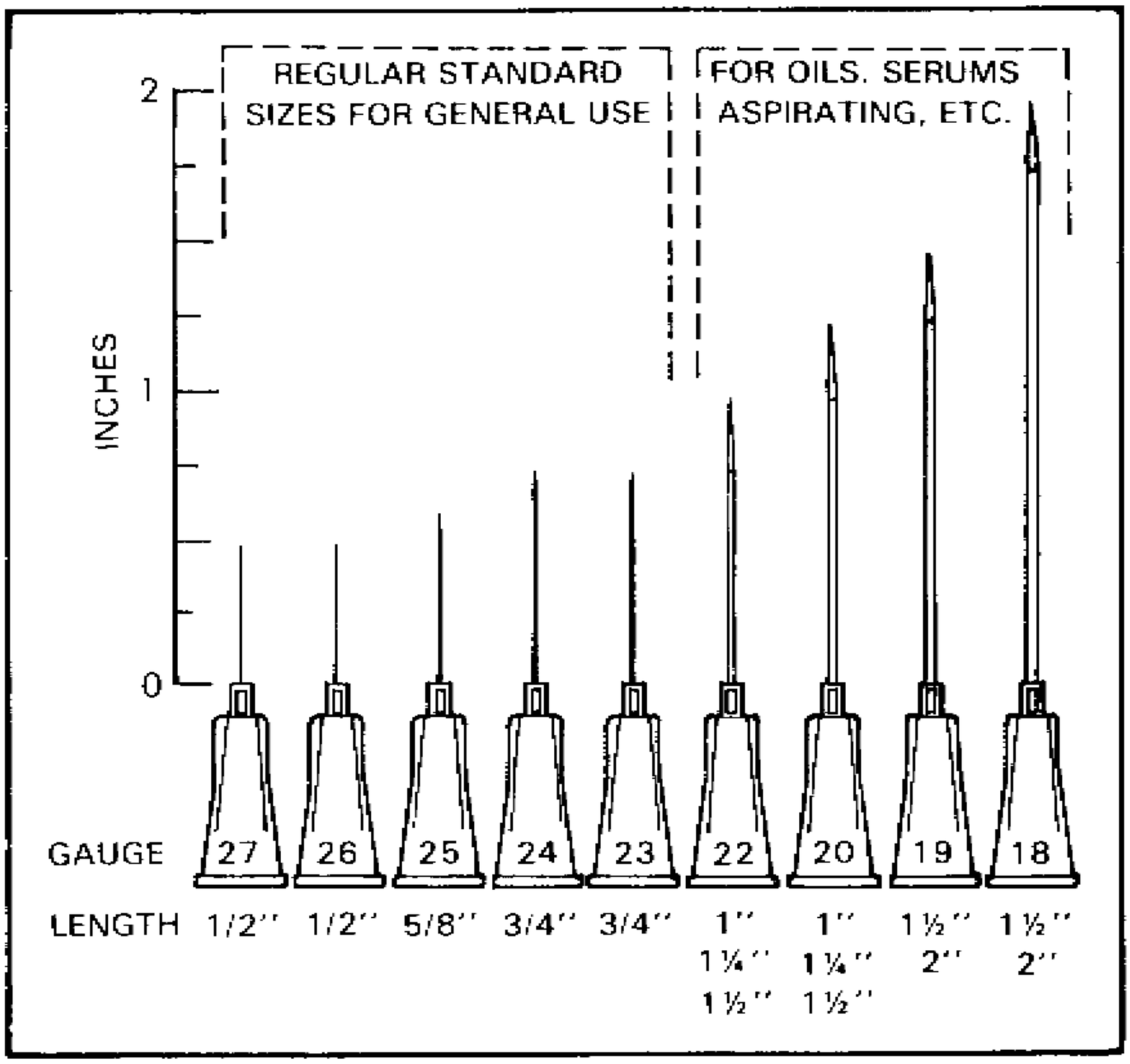


Figure 18-5. Needle sizes.

(2) *Syringe.* The syringe is the instrument used for giving injectable liquids. It consists of a barrel, plunger, and needle adapter that attaches the needle (Figure 18-6). The plunger pushes the medication through the barrel into the needle. The barrel is marked in cc's (ml's). Syringes come in different sizes and lengths. The size of the syringe used depends on the amount of solution and the type of medication. The outside appearance of a syringe may be confusing because some syringes are marked iu very small units, yet they may be longer than others marked in larger units. Check calibrated markings closely. The amount of medication in a syringe is read from the top

part of the black tip of the plunger, which is the part nearest the needle. The type of medication determines whether a glass syringe or disposable plastic syringe should be used. As a general rule, you may use disposable plastic syringes unless you have specific guidance to do otherwise.

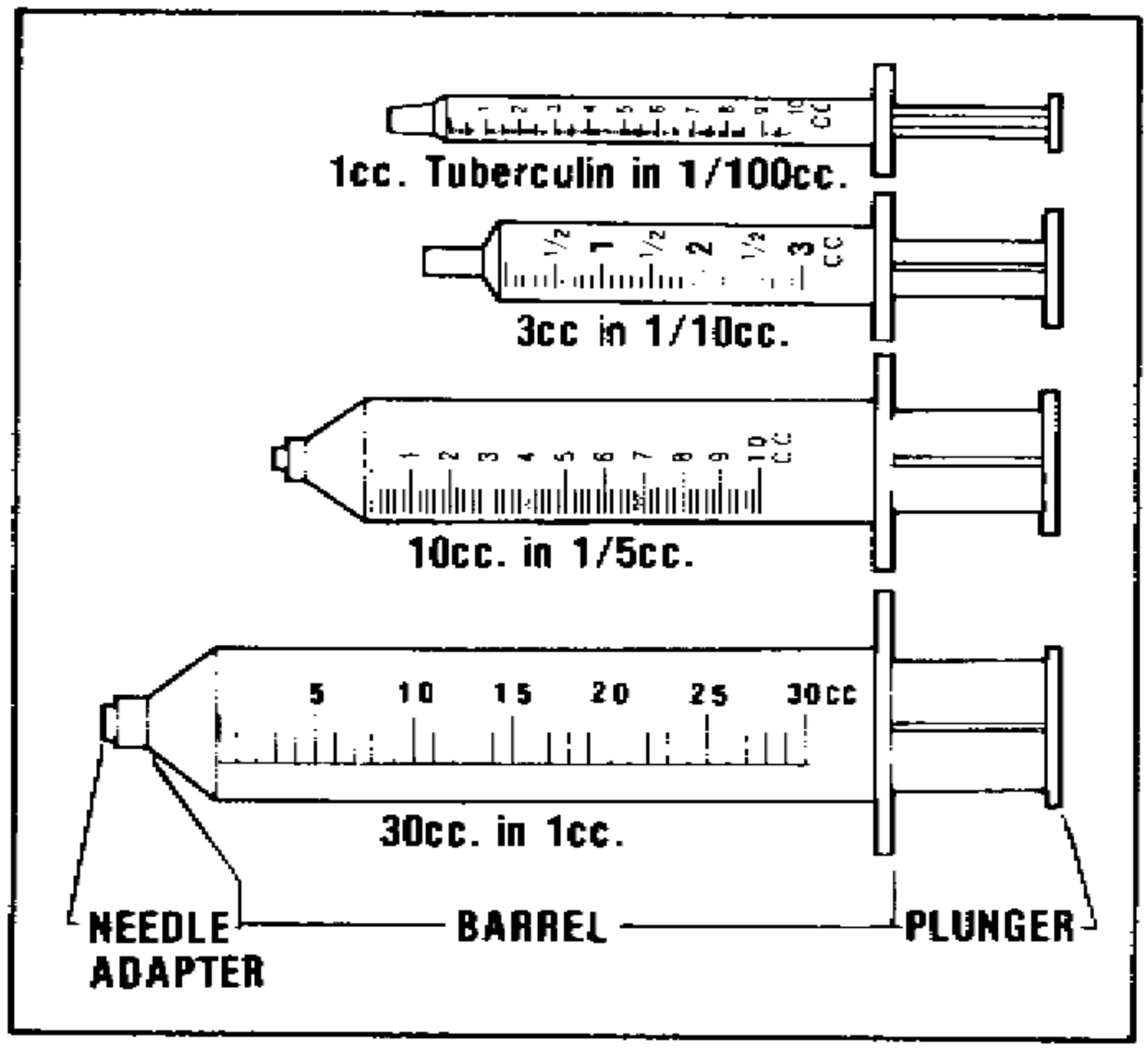


Figure 18-6. Examples of syringes.

18-24. Preparing the Syringe for Use

Although the following information applies to the disposable type of syringe, the principles are the same for the reusable type. When preparing syringes—

- Use aseptic technique in handling the syringe and needle. Protect the surfaces that must remain sterile: the needle, tip, inner barrel, and plunger.

- Discard the syringe or needle if it becomes contaminated.

a. Select the Appropriate Syringe and Needle.

(1) As you prepare to give an injection, the first step is to select the appropriate size and type of needle and syringe. The needle and syringe may be supplied in a preassembled unit; some hospitals stock them separately and the desired types can be selected.

(2) Guidelines for types of needles and syringes have been established for the various methods of injecting parenteral medications. When giving intramuscular injections, the 3 ml syringe and a 19 or 22 gauge, 1 1/2 inch needle are generally employed. The 3 ml syringe and a 25 gauge, 5/8 inch needle are used to give a subcutaneous injection. These sizes are modified as necessary to accommodate different medications, sizes of dose, and the needs of the patient.

b. Remove Protective Package.

(1) *Rigid Plastic Package.*

(a) Select the desired size of needle and syringe.

(b) Twist the plastic cap counterclockwise (Figure 18-7). This breaks the sterile seal of the plastic syringe package.

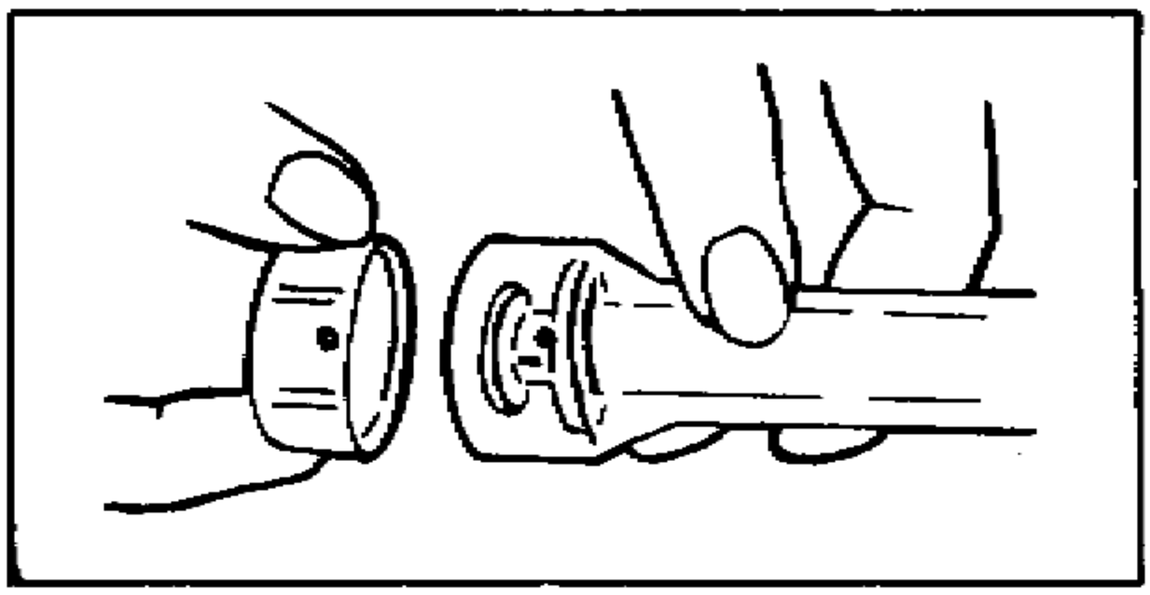


Figure 18-7. Opening rigid plastic package.

(c) Remove the sheath from the barrel of the syringe (Figure 18-8). The barrel of the syringe and the protective needle slip out of the top of the sheath. Tap the needle protector lightly to make it easier to remove.

(d) Remove the protective sheath from the needle by pulling it straight off. DO NOT CONTAMINATE. The sheath is used to protect the needle after the dose has been drawn into the syringe. If the needle comes off with the sheath, replace it, give the unit a twist to anchor the needle in place, and then pull off the sheath. The syringe is now ready for use.

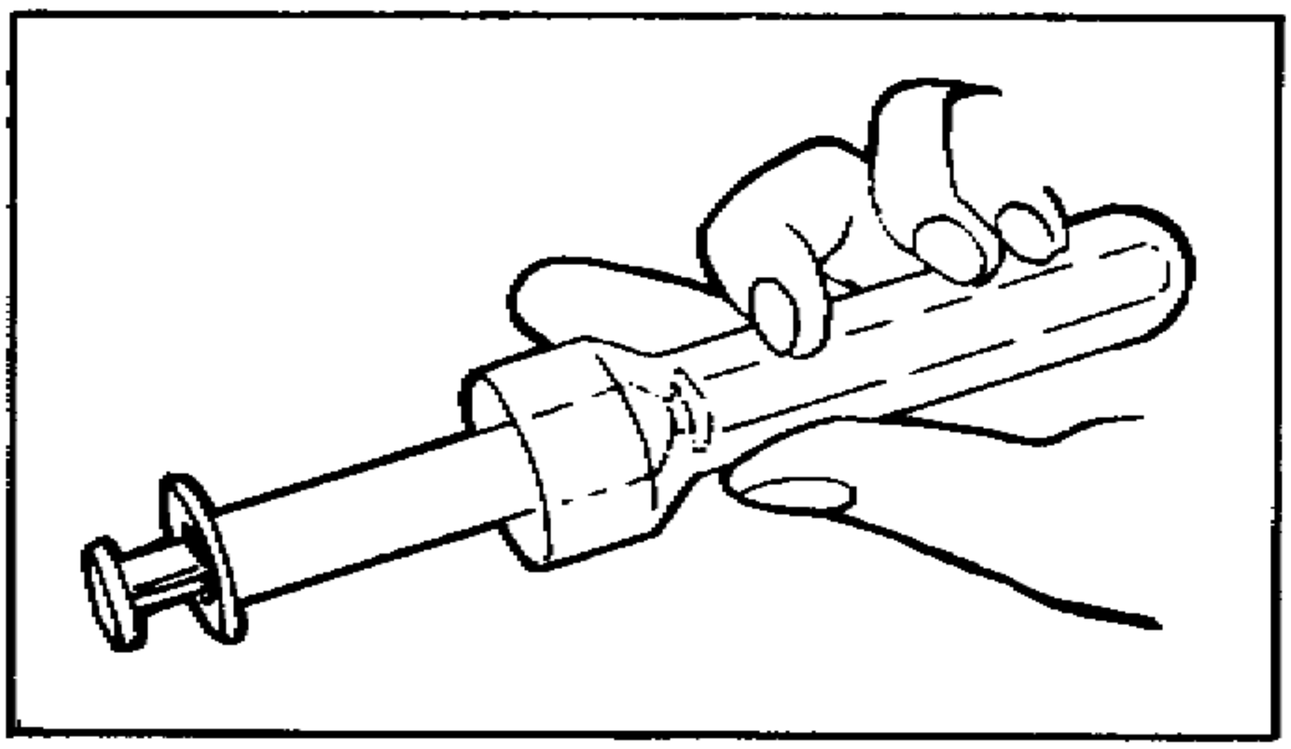


Figure 18-8. Removing syringe from protective plastic package.

(2) *Paper-Wrapped Syringe.*

(a) Select the desired size and type of syringe.

(b) Check the package for holes or water spotting. If any defect is found, discard the equipment.

(c) Peel open the wrapper. The procedure is the same as that for opening sterile dressings.

(d) Pick up the syringe and remove the protective sheath from the needle. DO NOT CONTAMINATE the needle or the syringe. The sheath is used to protect the needle after the medication has been drawn up. The syringe is now ready to use.

(3) *Carpuject or Tubex Metal Syringe (Figure 18-9).*

(a) Obtain the unit dose cartridge and the cartridge holder.

(b) Withdraw the plunger of the cartridge holder (Figure 18-9A). Carpuject—pull the plunger back. Tubex—grasp the barrel in one hand and pull back on the plunger until it drops downward and locks at a 90 degree angle.

(c) Insert the unit dose cartridge with needle into the barrel and secure it (Figure 18-9B and C). Insert the needle end into the barrel and secure it by rotating clockwise. The threads at the front end of the barrel mesh with those on the cartridge.

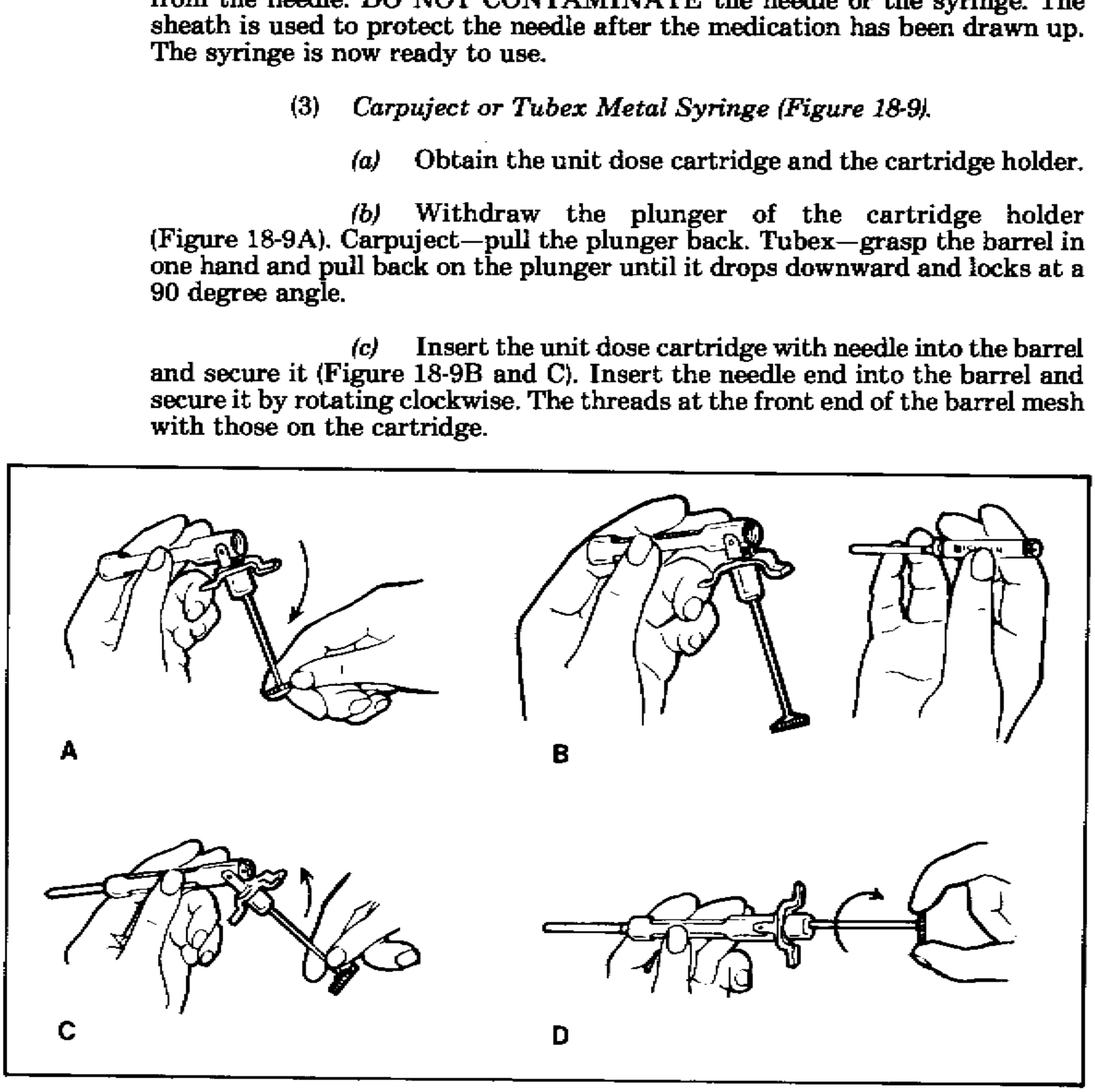


Figure 18-9. Preparing Carpuject syringe for use.

(d) Attach the plunger to the end of the unit dose cartridge (Figure 18-9D). Rotate the plunger so that the end threads join those on the cartridge to form a stable unit.

(e) The unit is now ready for use. Calculate the dosage. If a smaller amount is to be given, remove the needle protector and expel the excess amount carefully. Recap the needle.

(f) To remove the cartridge, reverse this procedure, cut off the end of the needle, and dispose of the cartridge. Return the cartridge holder to the medication preparation area.

(4) *Vari-ject System.*

(a) Obtain the syringe and the unit dose cartridge.

(b) Snap off the protective caps of the syringe and the medicine vial (Figure 18-10A). Place your thumbs under the lips of the caps and push upward.

(c) Insert the unit dose cartridge into the syringe and secure it (Figure 18-10B). Rotate the cartridge clockwise to engage the threads on the rubber stopper to the inside of the barrel. Rotate three full turns until you feel resistance, then one more full turn to insure that the needle is in contact with the medicine.

(d) The syringe is now ready for use (Figure 18-10C). Calculate the dosage. If a smaller amount is to be given, remove the needle protector, expel the excess amount, and recap the needle.

(e) To remove the cartridge, reverse this procedure, cut or break off the needle, and dispose of the cartridge. Return the cartridge holder to the medication preparation area.

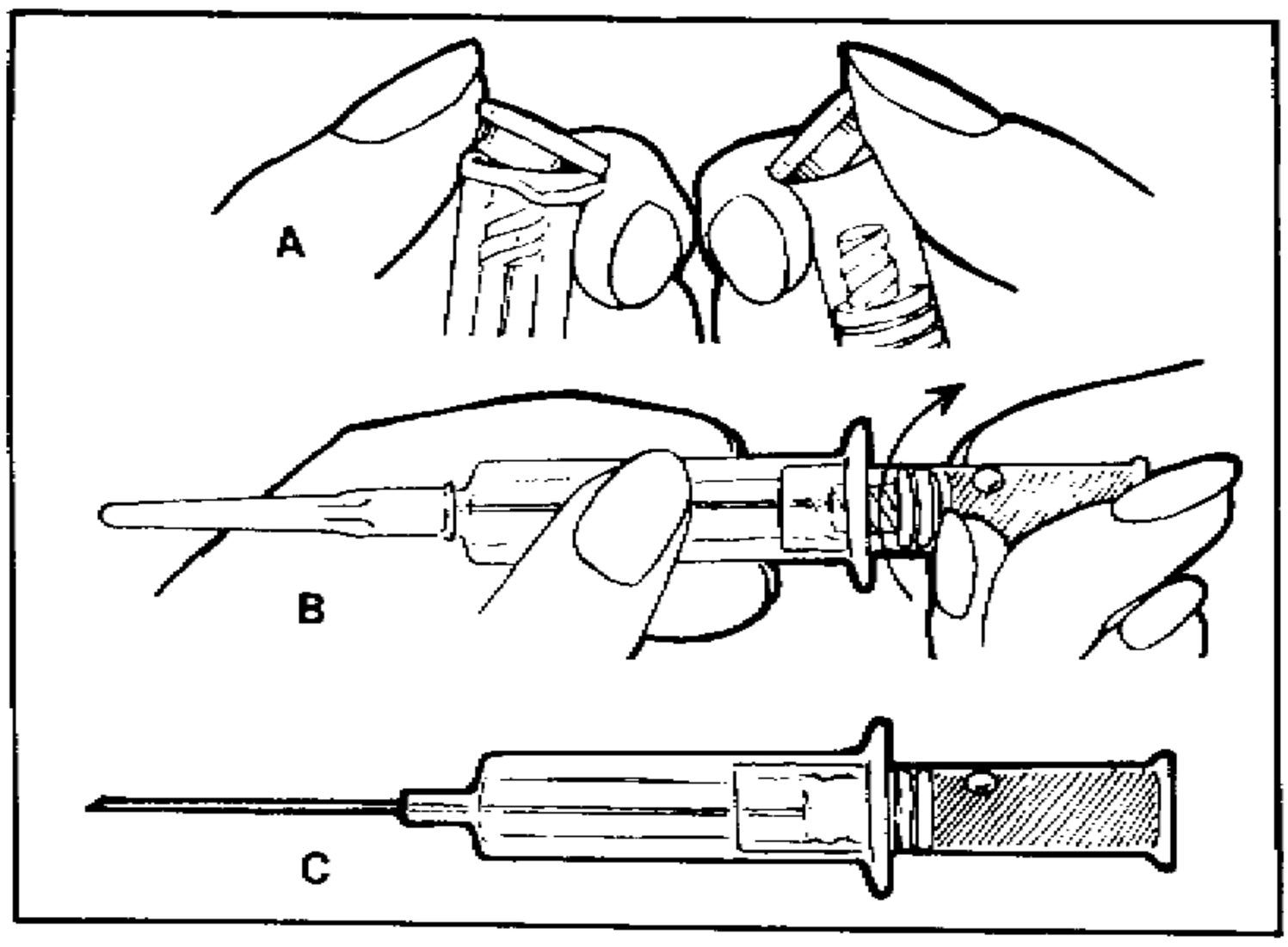


Figure 18-10. Preparing the Vari-ject syringe for use.

c. Parenteral Solutions. Medications for injection are dispensed in various kinds of units: glass ampules containing a single dose, the single dose vial, and the multiple dose vial. The unit dose cartridge consists of a vial with an attached needle for use with the Tubex or the Carpuject holders. Parenteral medications must be sterile and should not irritate the local tissues.

(1) *Use of ampules.* Ampules, which are made of glass and contain a single standard dose of the drug, consist of a body holding the medication; the constricted portion, or the neck; and a narrow stem on the top. Most manufacturers now prescore, or etch, the neck so that the glass will break more evenly with slight pressure. If the ampule is not prescored, use a small file to etch a breaking line (Figure 18-11). Before opening the ampule, make sure that all of the medication is in the ampule body, not in the stem. Tap or flick the stem several times with your finger to free any trapped solution, or grasp the stem and slowly make a circle with the ampule. The centrifugal force of this action causes the solution to leave the stem. Before breaking open the ampule, wrap the neck with a sponge or gauze to avoid accidental cuts. To withdraw medication from an ampule:

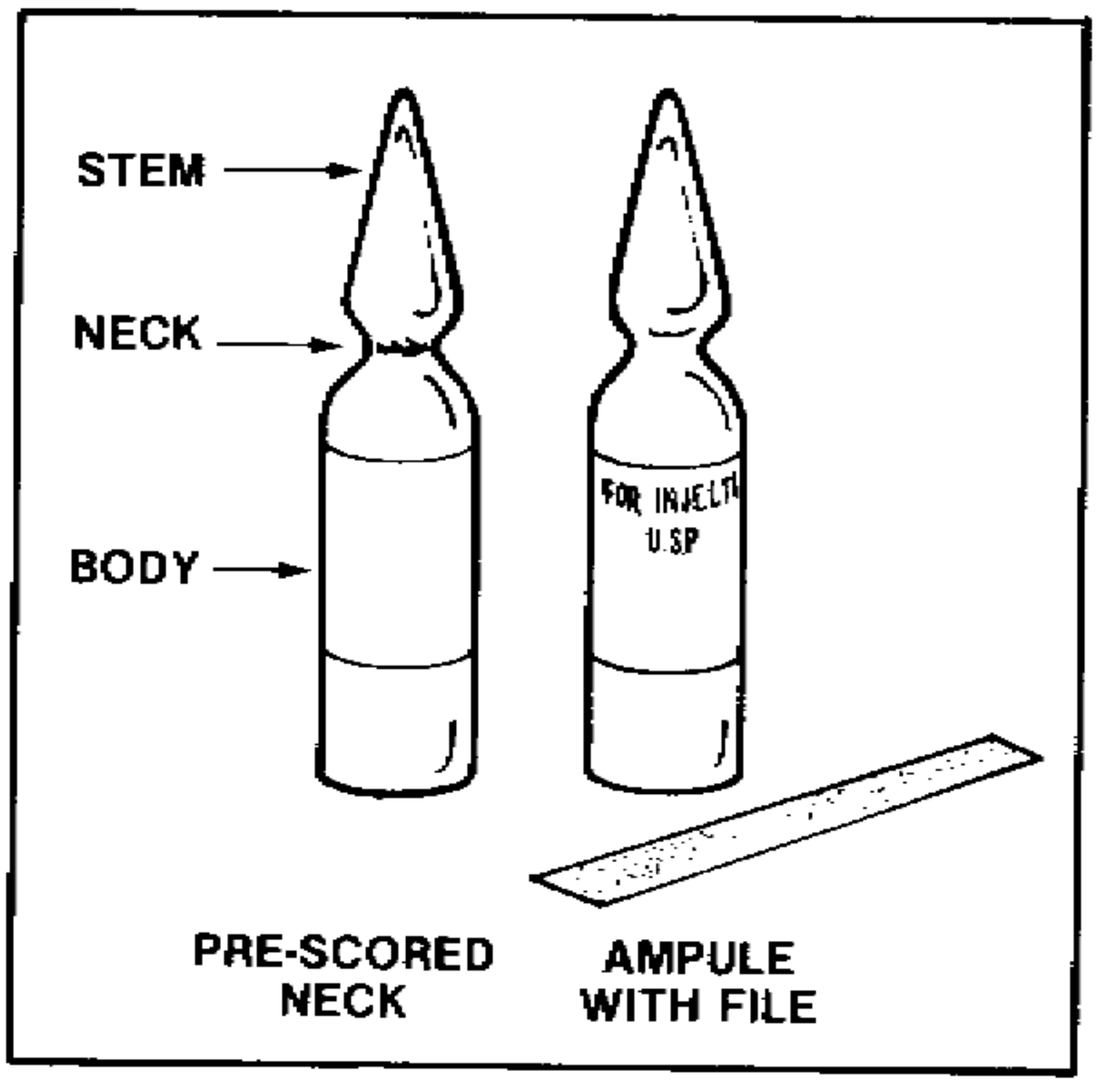


Figure 18-11. Types of glass ampules.

(a) Compare the medication order with the doctor's order. It is essential to follow the *five rights* of medication administration.

- Right patient.
- Right drug.
- Right dose.
- Right route.
- Right time.

(b) Obtain the ampule of medication and calculate the dosage.

(c) Dislodge the fluid from the stem by tapping the stem or using centrifugal force.

(d) Open the ampule. File the neck if necessary to make a smooth line for breaking. Wrap it with gauze, paper tissue, or a sponge. Place both your thumbs together and apply pressure away from you to snap the top off (Figure 18-12A and B).

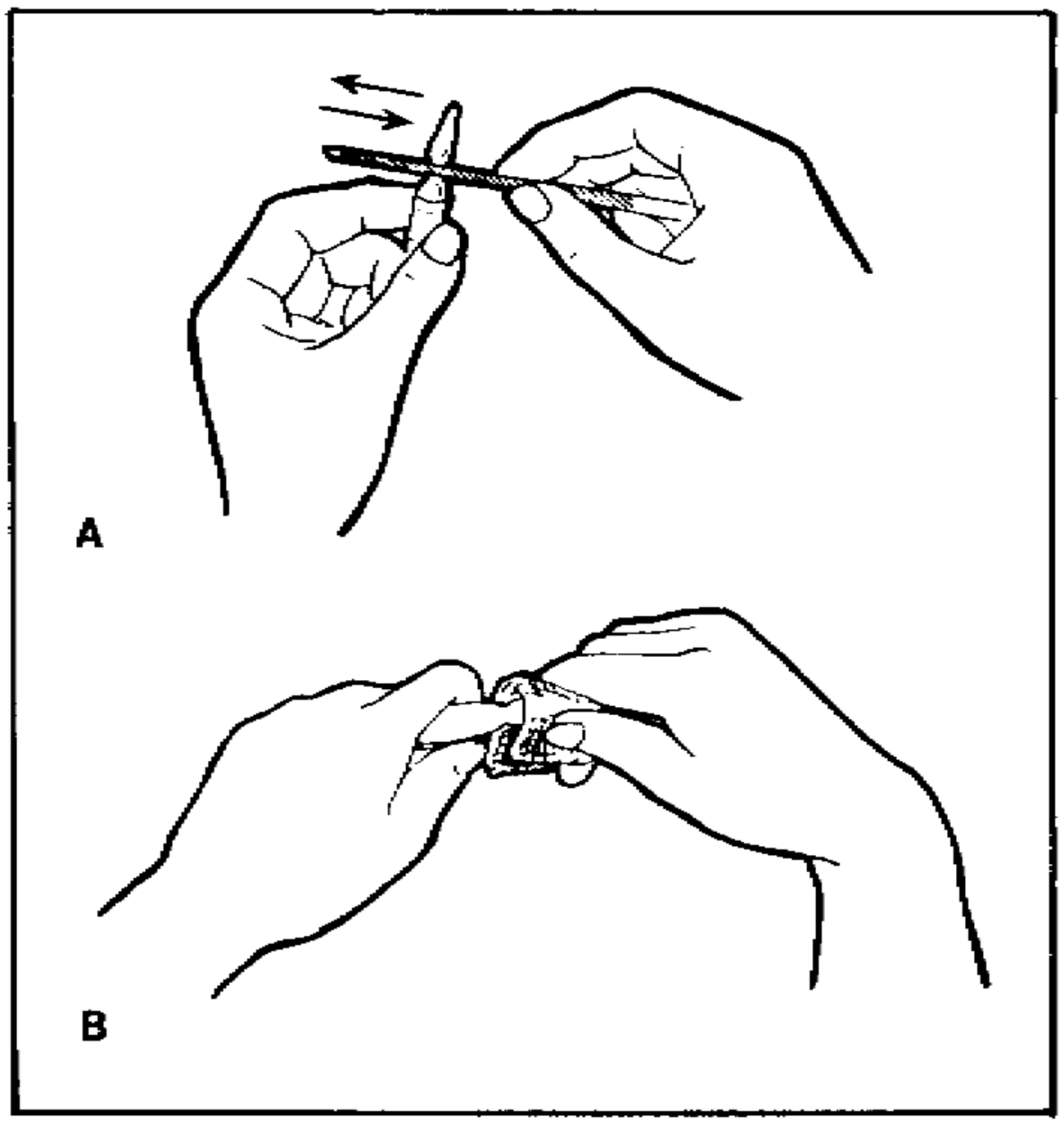


Figure 18-12. Opening glass ampules.

(e) Insert the needle and draw up the correct dosage (Figure 18-13). Hold the ampule between your index and middle fingers while grasping the syringe with your thumb and fourth finger. Pull back on the syringe plunger to the correct measure on the scale with your other hand. When inserting the needle, avoid touching the sides of the ampule. Make sure that the needle is below the level of the solution to avoid drawing in air.

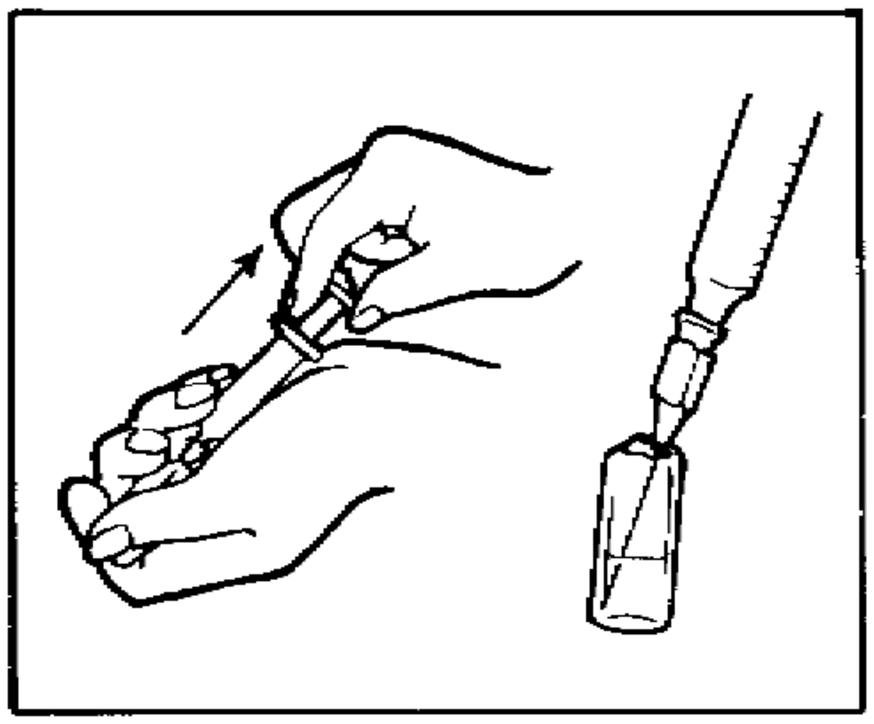


Figure 18-13. Drawing medication from ampule.

(f) Expel air bubbles from the syringe and verify the correct dose (Figure 18-14). Air bubbles must be expelled before the dose can be measured accurately. Draw more air into the syringe to make a larger bubble, then hold the syringe and needle up at a 90 degree angle, tap with your finger to move the air bubble to the top under the needle, and slowly push the plunger to expel the air. Stop when one drop of liquid appears in the bevel of the needle. Verify your calculation and the amount of medicine in the syringe with the medication record. Place the needle protector over the needle until ready for use.

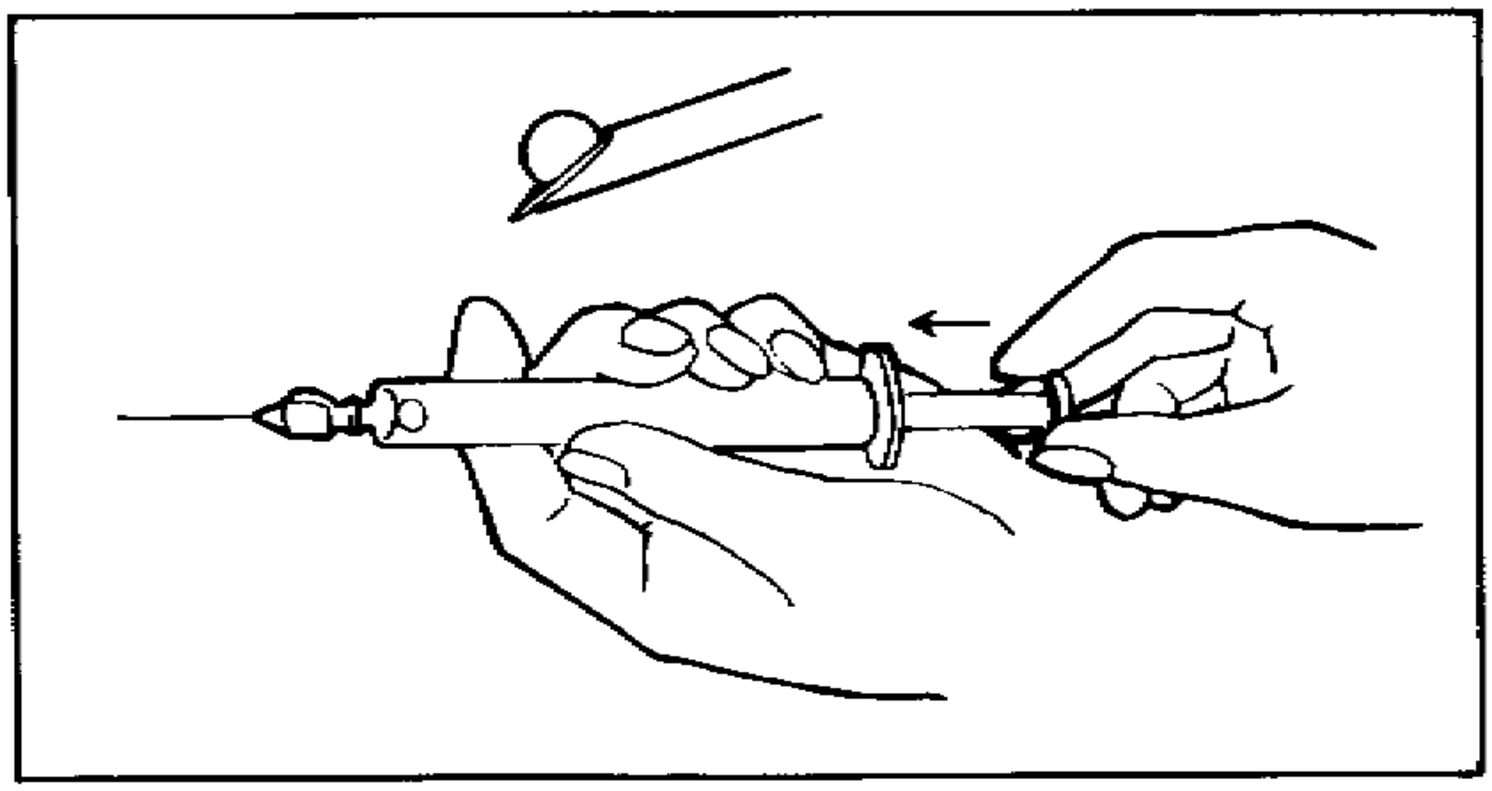


Figure 18-14. Expelling air bubbles from syringe.

(2) Use of Vials. A vial is a small bottle that contains one or more doses of medication. Single dose vials are small, usually 1 or 2 ml in size; multiple dose vials are 5, 10, 20, 30 ml or larger in size. The solution is kept sterile by a rubber stopper attached to the bottle with a metal band. The desired amount of the medicine is removed by inserting the needle of the syringe through the rubber stopper, after it has been wiped with an alcohol swab, and drawing up the solution (Figure 18-15).

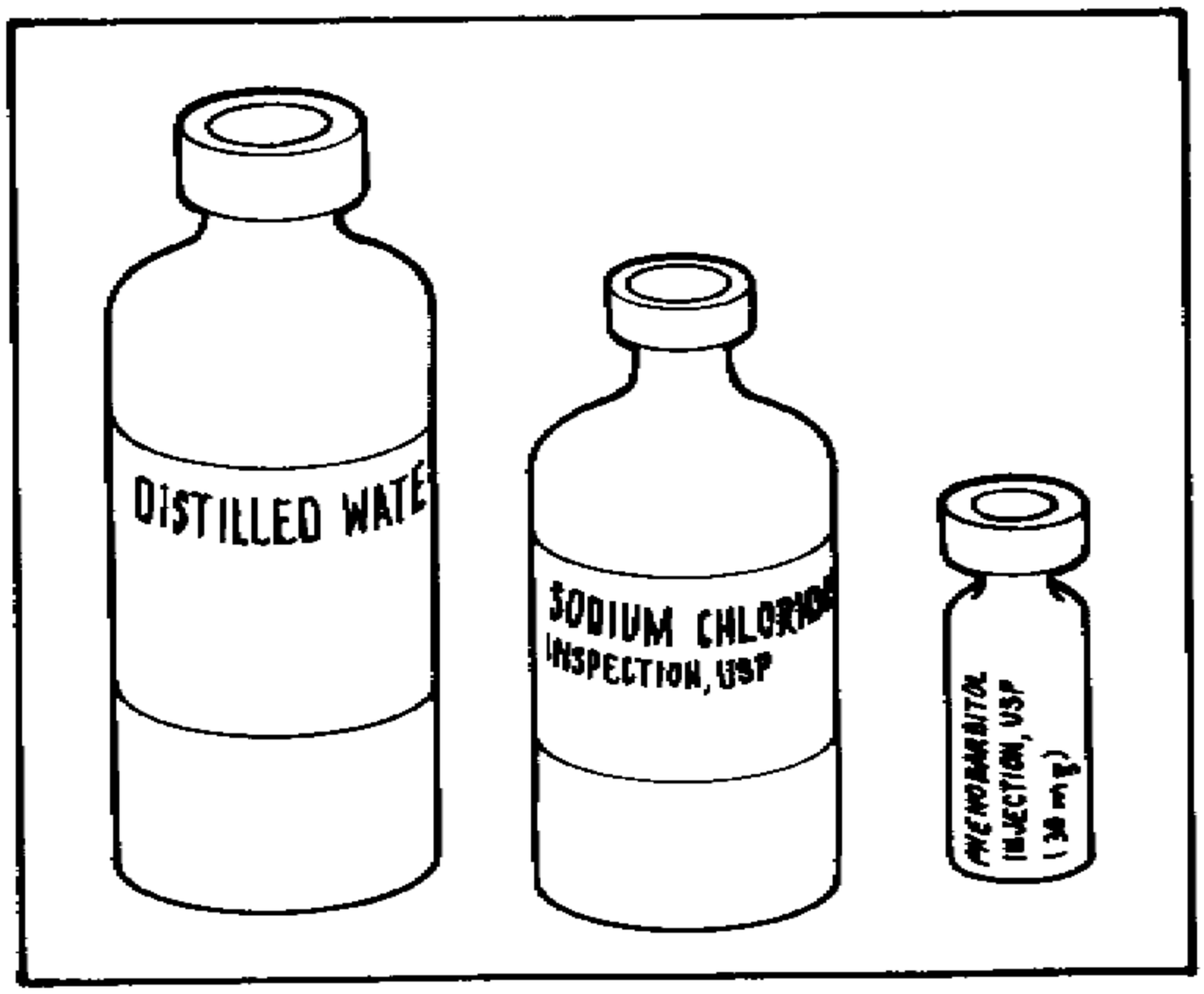


Figure 18-15. Examples of medication vials.

(3) Other drug forms. Drugs that are unstable in a solution are prepared in a powdered or solid form. The solute in the vial is mixed with a diluent (diluting agent) before the drug is drawn up into a syringe. Sterile water and sterile normal saline are typical diluents. The label or the drug insert packaged with the vial provide instructions concerning the type of diluent to use and the proper amount to mix with the drug.

(a) When using vials, withdrawal of solution creates a vacuum unless an equal amount of air is injected since the bottle is a closed system. Calculations for the dosage can be double-checked by drawing air into the syringe to the point on the scale that equals the desired dose and then injecting this amount into the vial.

(b) When the needle is inserted into the vial, care must be taken to avoid coring the stopper (Figure 18-16A). The sharp edges of the needle can create small cores or plugs that can be pushed into the bottle. The recommended method is to insert the needle at a slight angle with a forward thrust and simultaneously exert a slight lateral pressure until the needle has pierced the rubber stopper (Figure 18-16B and C).

(c) Corings could plug the needles and become a possible source of contamination. The following procedure will be used for withdrawing medications from a vial:

1. Compare the medication order with the doctor's order.

2. Obtain the vial of medicine and calculate the dosage. Observe the five rights; read the label carefully. Do not hesitate to have another person verify the dosage, especially if it is a fraction of the amount provided in the vial.

3. Clean the vial stopper. Take an antiseptic compress and rub the stopper in a vigorous rotary motion. This helps to prevent contamination by microorganisms when you insert the needle.

4. Draw an amount of air into the syringe equal to the dose of the medicine. Pull the plunger of the syringe back to the exact mark on the barrel equaling the prescribed amount of the drug.

5. Insert the needle into the vial and draw up the correct dose. Insert the needle at a slight angle to prevent coring. Hold the vial between your thumb and third finger, with your index finger as a counterforce on the bottom of the vial.

6. With the needle tip through the stopper and *above the liquid line,* push the plunger into the barrel to inject the air replacement. Hold the vial at eye level.

7. Turn the vial upside down; with the needle inserted *into the medicine,* pull the plunger down the barrel of the syringe until 0.2 cc more than the required amount of medicine is in the syringe (Figure 18-17).

8. Remove the needle from the vial, verify the dose, and expel the air bubbles from the syringe. Verify the dosage in the syringe with the medication record; expel any extra medication, if necessary.

9. Protect sterility of the needle and prepare to give the drug. Replace the needle in the needle guard (do not contaminate the needle by touching the outside of the sheath).

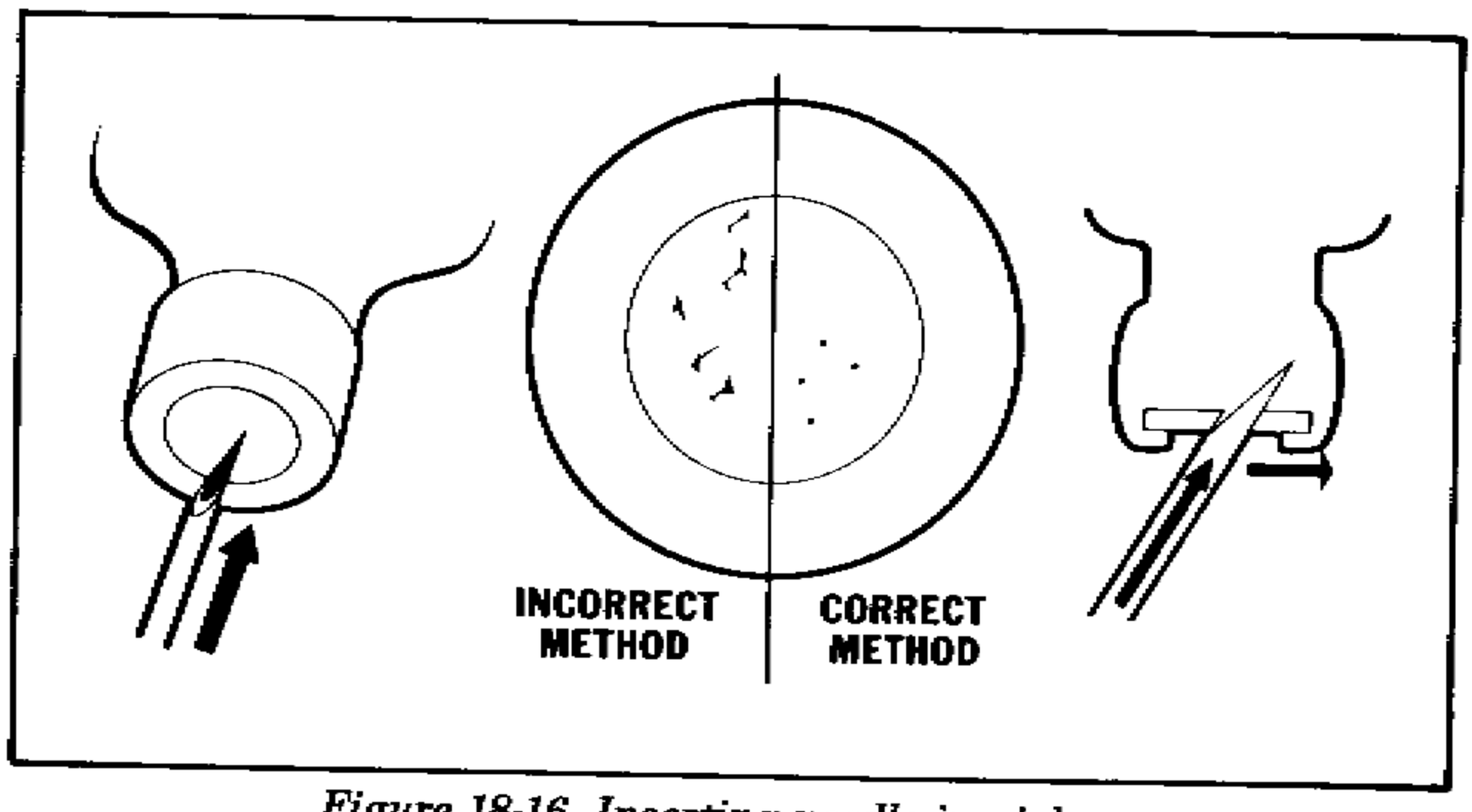


Figure 18-16. Inserting needle in vial.

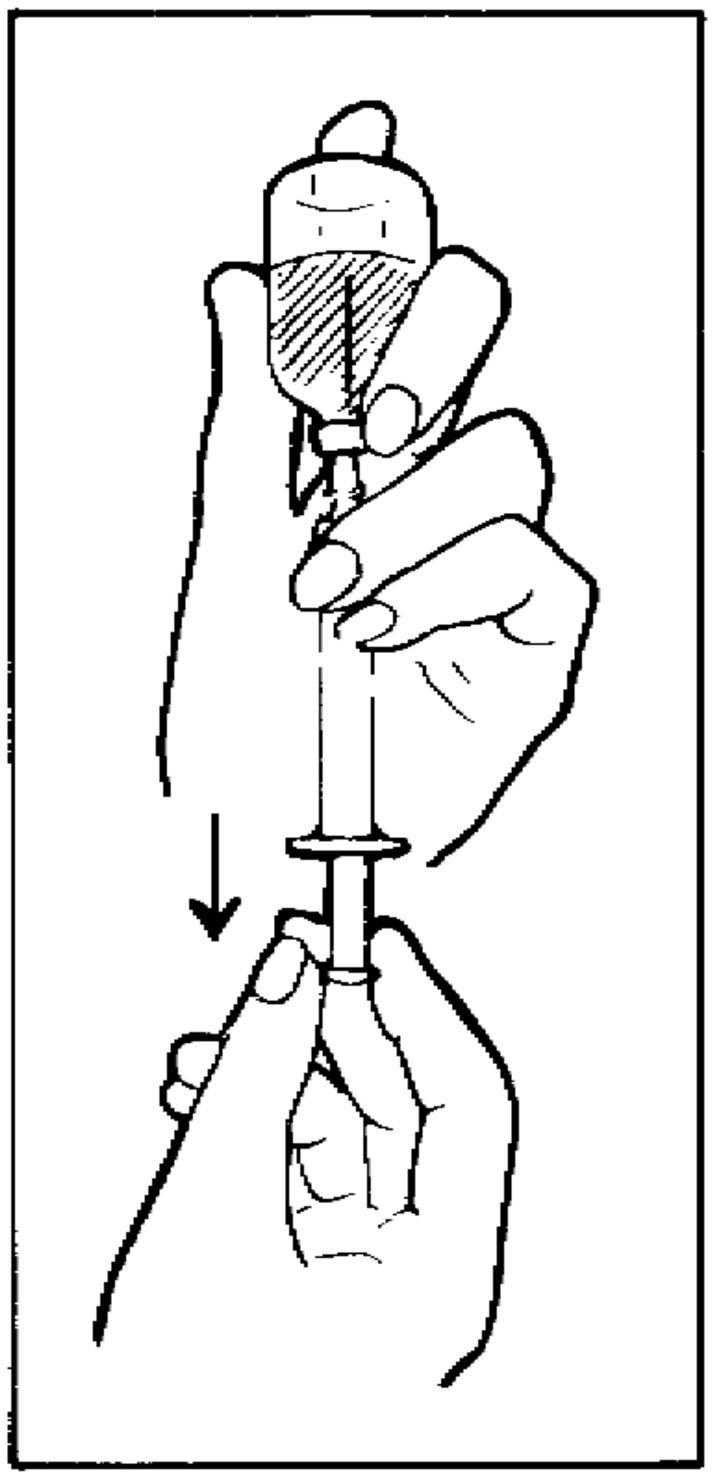


Figure 18-17. Drawing medication into syringe.

18-25. Subcutaneous Injections

a. Subcutaneous injections have been used since 1855, when Alexander Wood, M.D., of Edinburgh published the first accounts of drugs injected subcutaneously via a needle and syringe. Techniques have changed very little over the years.

b. Medications administered by the subcutaneous route are absorbed rapidly by the body. This route is often used to give medications to nauseated, vomiting, unconscious, or irrational patients. Preoperative medications, narcotics to relieve pain, and insulin are usually injected.

c. There are several areas of the body available as sites for subcutaneous injections:

- The lateral and posterior surfaces of the upper arms.
- The skin over the scapula on the back.
- The surface around the lower edge of the rib cage.

- The buttocks.
- The anterior and lateral aspects of the thighs.
- The surface over the lower abdomen.

The skin in these areas is thinner, easier to penetrate, and capable of stretching to accommodate small doses of medication. For most patients, the preferred sites are the lateral surfaces of the upper arm or the back, and lateral aspects of the thigh. If the patient receives repeated medications, you should follow a rotation plan to avoid tissue fibrosis, which could cause pain and disfigurement.

d. Diabetic patients who must give themselves injections of insulin are taught to use various areas of the body, and to rotate these sites. For example, the patient can easily reach the abdomen and thighs. However, when insulin is administered by another person, posterior sites can be used.

e. The following procedures are used when administering a subcutaneous injection:

(1) *Wash your hands.* Obtain all necessary equipment and supplies, including the filled syringe with needle protected by covering, medicine identification (card, label), and antiseptic sponges.

(2) *Explain the procedure to the patient.* Check the patient's identification. Tell him that you are going to give him a shot in the arm or whatever site is selected, and that there will be momentary discomfort.

(3) *Select the injection site and cleanse the area.* Expose the area and insure that you have ample lighting so that you easily see the injection site. Open the antiseptic sponge package and cleanse the selected site using a circular motion until approximately a 2-inch area is cleansed. Allow the skin to dry; the antiseptic evaporates quickly from the skin.

(4) *Pick up the prepared syringe.* Remove the needle guard by pulling it straight away from the guard to avoid contamination. If you contaminate the needle, it must be removed and replaced with a sterile one. Hold the syringe in your left hand with the needle pointing upward.

(5) *Support the skin at the site.* By picking up the skin with your thumb and index finger, you can assess the thickness of the skin and subcutaneous layer into which you will inject the drug.

(6) *Insert the needle at a 45 degree angle into the skin.* Hold the barrel in your hand between the thumb and index finger, letting the syringe rest on the remaining three fingers. Insert the needle through the patient's skin with a firm, quick, forward thrust. Release the skin and hold the syringe securely. (See Figure 18-18.)

(7) *Pull back on the plunger to aspirate for blood.* If your needle has hit a blood vessel, you can injure the inner blood vessel wall by injecting medications that are not prepared for IV use. Also, if you inject the medication directly into the circulatory system, the effect is almost instantaneous and can produce a shock effect. If blood appears in the syringe, withdraw the needle. Discard both the needle and the syringe, and start again. Injecting bloody solution into the subcutaneous tissue can produce a chemical irritation.

(8) *Inject the medicine.* With your right thumb, press the plunger into the barrel slowly and steadily until all of the medication is injected.

(9) *Remove the needle.* Do this quickly; pull it straight out at the same angle at which it was inserted. Put the used needle back in its guard.

(10) *Massage the site with an antiseptic sponge.* Use a gentle circular motion to help disperse the medication in the subcutaneous tissue so that it will absorb readily. The peak action of a subcutaneous injection is expected within 30 minutes. Discard the sponge in a designated container. Apply a Band-Aid if there is superficial bleeding. Some people who have a very intricate superficial vascular system will bleed slightly regardless of how careful you are.

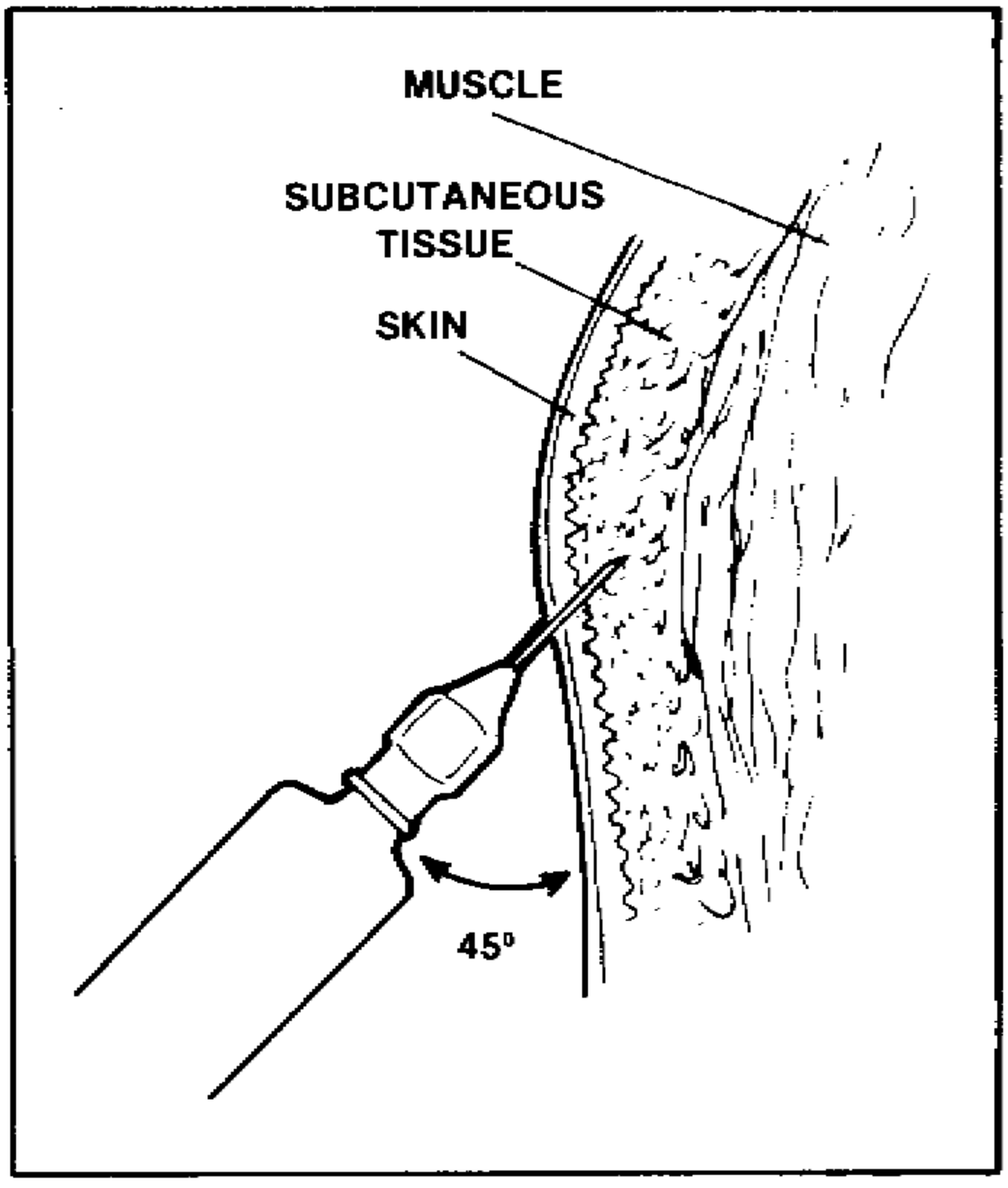


Figure 18-18. Administering a subcutaneous injection.

(11) *Dispose of the used equipment (Figure 18-19).* Take the syringes and needles to the work area and discard them in the designated needle and syringe container. Bend the needle so that the tip breaks off the syringe and remains lodged with the hub of the needle or use a snipper to cut off the needle. Discard the broken syringe and needle in a designated container.

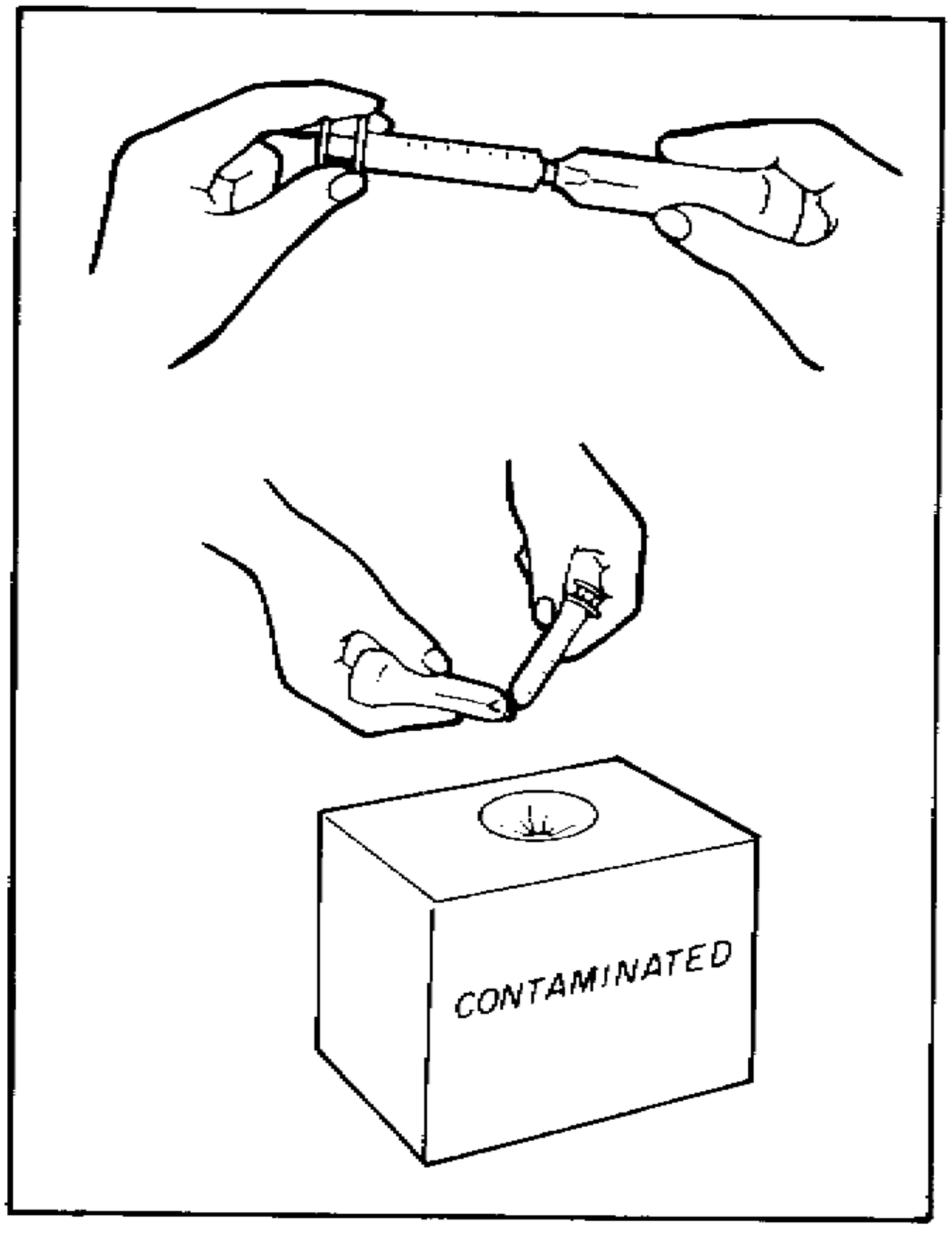


Figure 18-19. Disposal of used equipment.

18-26. Intramuscular Injections

Intramuscular (IM) injections are utilized if the patient cannot take medicine orally or if the medication is not prepared in an oral form. Intramuscular injections provide quick but sustained action because muscular tissue is highly vascular. Selection of the injection site is a critical decision for the health practitioner. Improper site selection can result in damaged nerves, abscesses, necrosis and sloughing of skin, as well as pain. Therefore, the stage of development, body build, and the individual's physical condition must be considered when giving an injection. From 2 to 5 cc of fluid may be injected into a muscle, depending on the size of the patient. If more than 5 cc of medication must be given at one time, the doses should be divided in half and given in two different sites.

a. Injection Sites for Adults.

(1) The usual sites for IM injection in the adult are the deltoid muscle in the arm, the gluteal muscles, and the ventrogluteal and vastus lateralis muscles of the thigh.

(2) The mid-deltoid muscle is a common location for IM injections (Figure 18-20); however, the actual area involved is limited because of the major vessels, nerves, and bones. Only small amounts of medication can be injected in this site. The area for the arm injection is rectangular, on the lateral upper third of the arm, about 2 inches below the shoulder, or at the lower edge of the acromion.

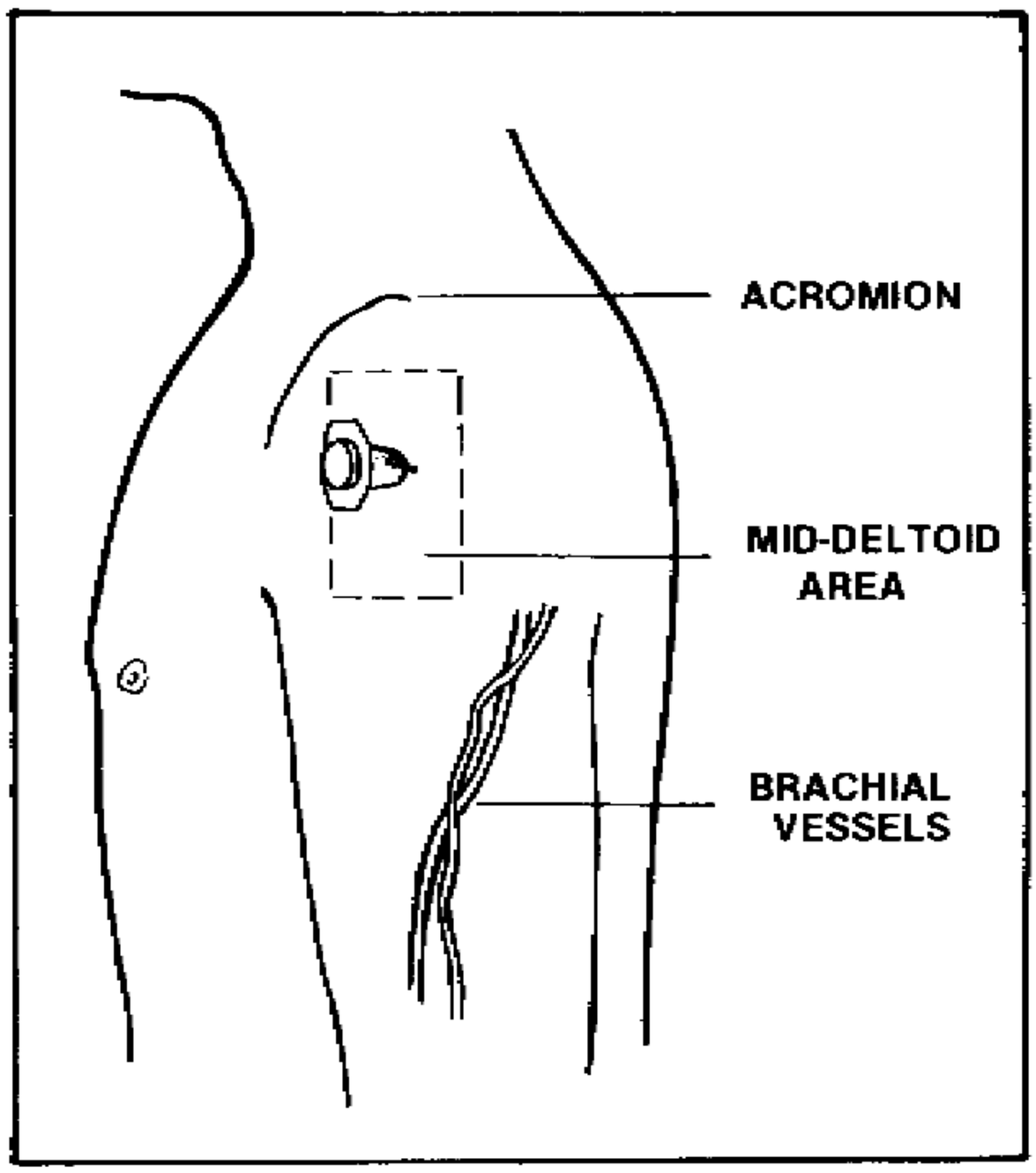


Figure 18-20. Administering intramuscular injection (deltoid muscle).

(3) The gluteal muscles are generally used for IM injections (Figure 18-21). When using this site you must be careful to avoid injuring the large nerves and blood vessels located in this area. The fleshiest portion of the buttocks is not the safest for injections because the sciatic nerve and the superior gluteal artery lie underneath. Injections in this area can cause severe pain and even paralyze the lower extremity when these structures are damaged.

(4) To locate a safe area for injection, use one of two methods. The first is to divide the buttocks into fourths,or quadrants.Palpate the ridge of the ilium and draw an imaginary line down to the lower edge of the buttocks. Draw a horizontal line from the upper edge of the acetabulum over to the spine and use the upper outer quadrants for intramuscular injection.

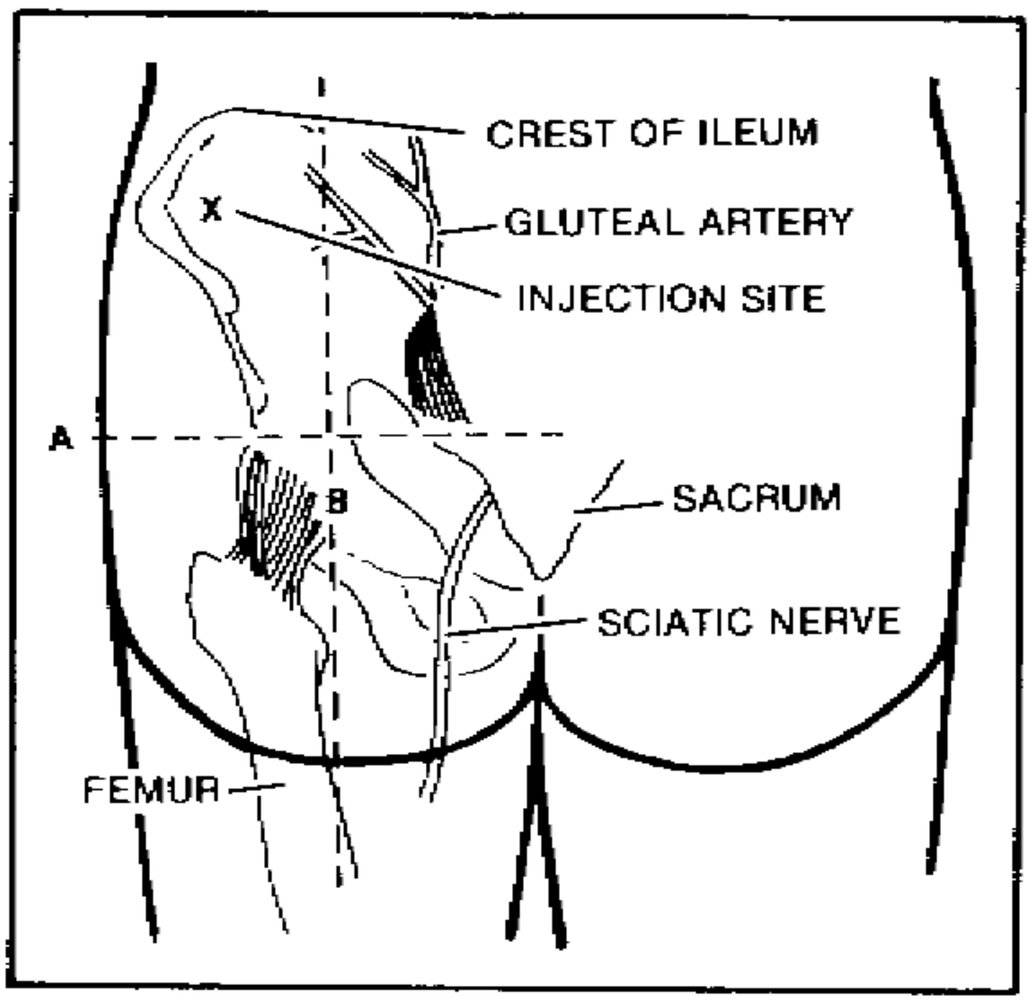


Figure 18-21. Administering intramuscular injection (gluteal muscles).

(5) The second method is to locate an imaginary line from the posterior iliac spine to the greater trochanter of the femur. Give the injections above and lateral to the line; this avoids the danger area (Figure 18-22A).

(6) You will find it easier to give IM injections, and the patient will have less discomfort if the muscle is relaxed. Since the gluteal muscles are tense when the hip is extended or the leg is externally rotated, the muscles are relaxed when the patient (1) lies in a prone position with toes turned inward, (2) lies in a Sims position, or (3) stands with the toes pointed inward.

(7) The ventrogluteal area (Figure 18-22B), also known as von Hochstetter's site, is a safe IM injection site. The muscle layer is thick and has a very small fatty layer. This site can be used both for adults and children and is especially helpful if the patient must recline in either the Sims or the prone position.

(8) To locate the injection site, place your palm over the head of the femur, put your index finger on the anterior iliac spine, and spread your middle finger as far as possible to touch the iliac crest. The center of the V bounded by your fingers is the precise injection site.

(9) The vastus lateralis muscle is also a common IM injection site for both adults and children. The area extends from the mid-anterior front of the thigh to the mid-lateral thigh, a hand's width below the proximal end of the greater trochanter and a hand's width above the upper knee (Figure 18-23).

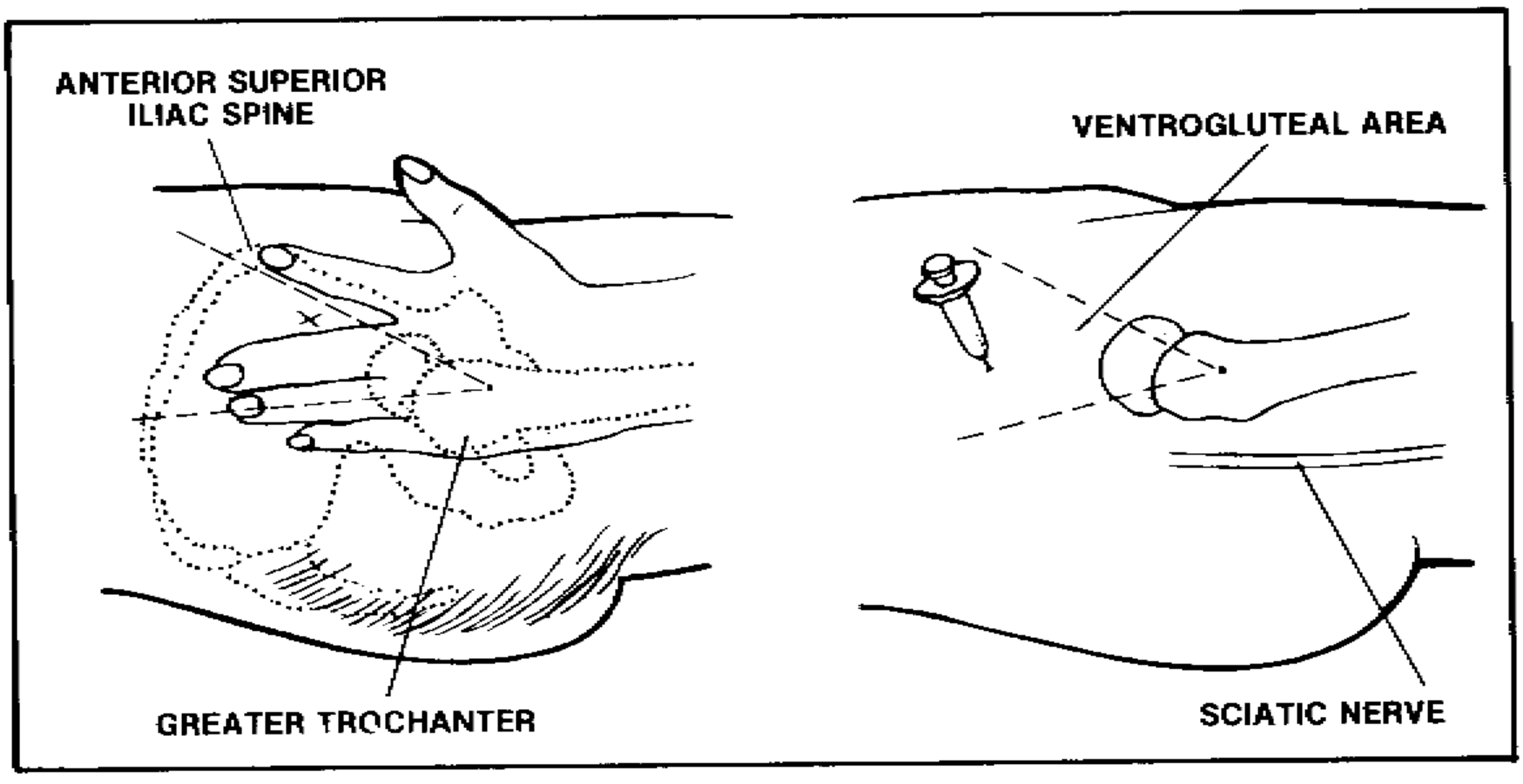


Figure 18-22. Alternate injection sites.

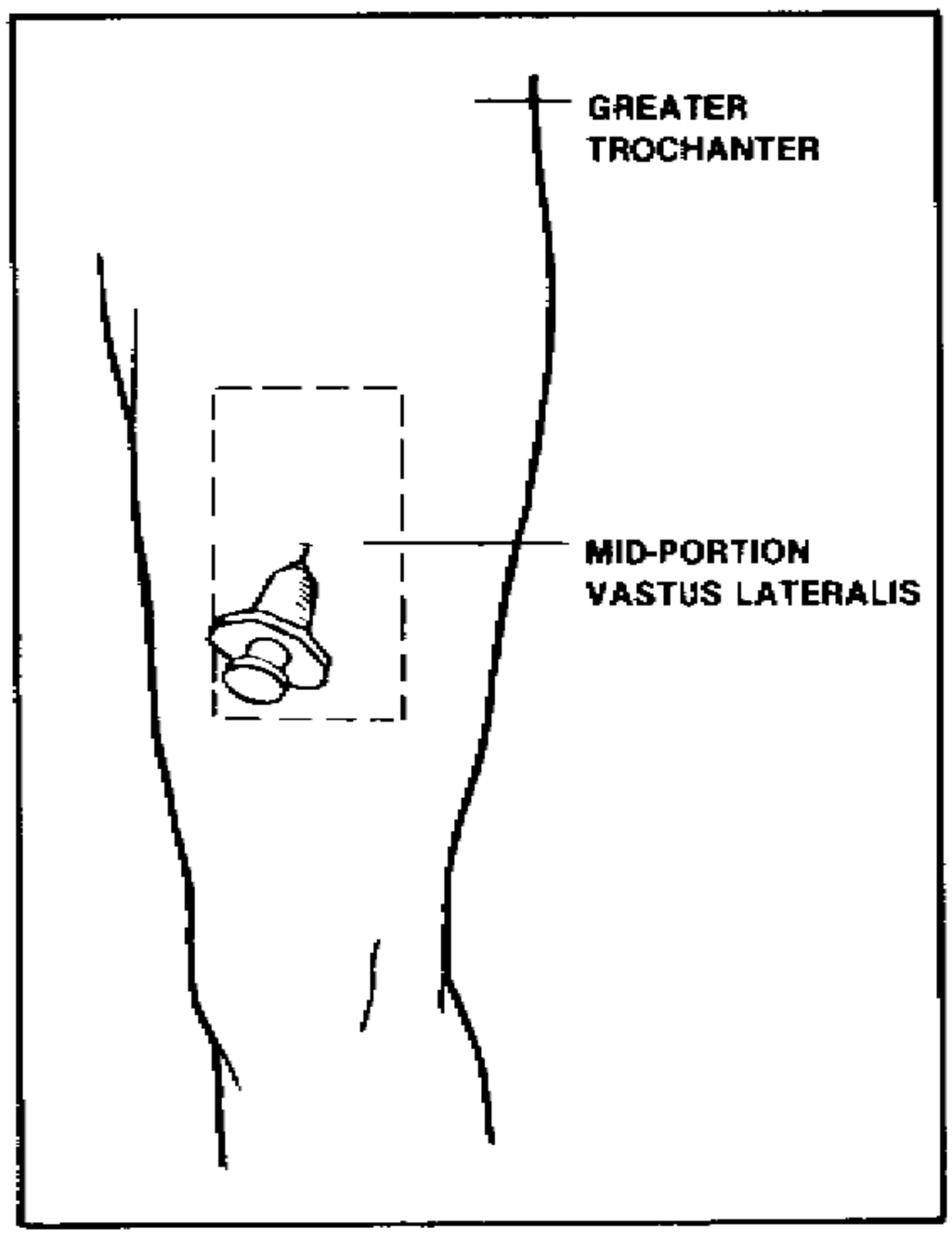


Figure 18-23. Vastus lateralis muscle injection site.

b. Administration of the IM Injection (Figures 18-24 and 18-25). Preparation of the needle and syringe and drawing up the correct dose follow the procedures discussed in previous paragraphs. Read the medication labels three times so that you can check the accuracy of the medication and desired dose as you remove the medication from storage, as you draw up the medication, and as you return the unused medication to the storage area or discard the empty vial or ampule.

(1) *Wash your hands and obtain the necessary equipment and supplies.* Place the prepared medication on a tray and take it to the patient, together with the record.

(2) *Explain the procedure to the patient.* Verify the identification of the patient. *Always* tell the patient what you are going to do even though there is a possibility he cannot understand (for example, infant, small child, confused or unconscious person).

(3) *Select the injection site and cleanse it with an antiseptic sponge (Figure 18-24A).* Expose the injection site in order to have an unobstructed view. If the gluteal region is being used, have the patient lie on his abdomen with his toes turned slightly inward. This position provides the greatest muscle relaxation. Remove an antiseptic sponge from the package and cleanse the injection site. Use a firm circular motion to cleanse a 2-inch area and allow the area to dry.

(4) *Spread the skin at the site (Figure 18-24B).* Press firmly around the site to compress the subcutaneous and muscle tissue. The taut skin reduces resistance to the needle when it enters the tissues.

(5) *Insert the needle quickly at a 90 degree angle (Figures 18-24C and 18-24D).* Grasp the barrel of the syringe firmly between your thumb and index finger like a dart and plunge the needle firmly into the muscle at a 90 degree angle to the full depth of the needle.

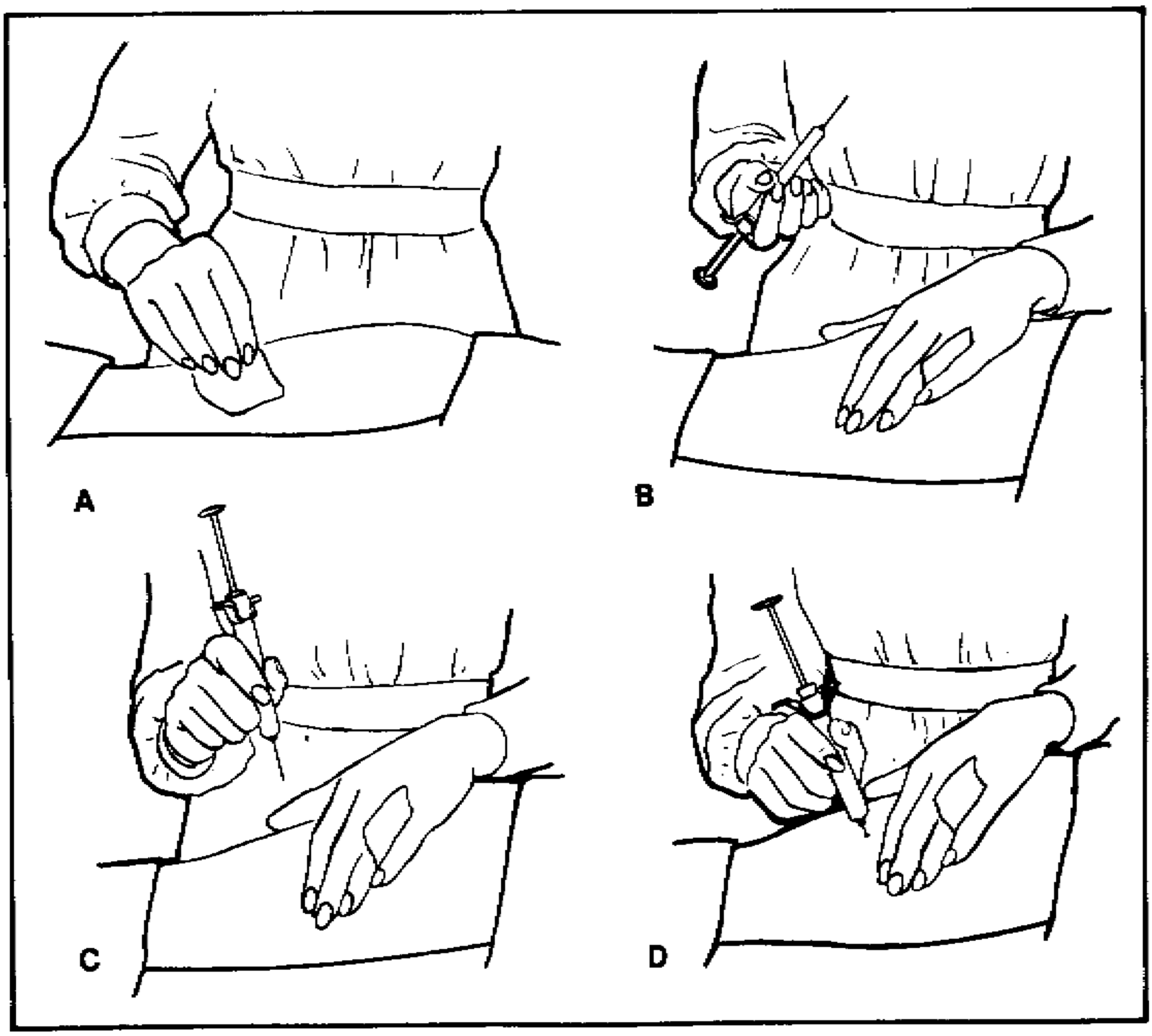


Figure 18-24. Preparing to administer IM injection.

(6) Pull back on the plunger to aspirate for blood (Figure 18-25A). You will need to reposition your hand to hold the barrel of the syringe and to steady the needle while you draw back on the plunger with your dominant hand. If blood returns in the syringe, withdraw the needle and syringe and discard them. Begin the procedure after drawing up solution in a new needle and syringe.

(7) *Inject the medication (Figure 18-25B).* Using the fingers as a counterforce, push the plunger into the barrel with a slow continuous movement.

(8) *Withdraw the needle (Figure 18-25C).* Apply pressure with the antiseptic sponge at the needle site as you remove the needle with a quick, upward motion. This external pressure also helps to keep the medicine from leaking into the tissues.

(9) *Massage the injection site (Figure 18-25D).* Doing this with a gentle but firm circular motion helps to disperse the medicine so that it can be absorbed more quickly.

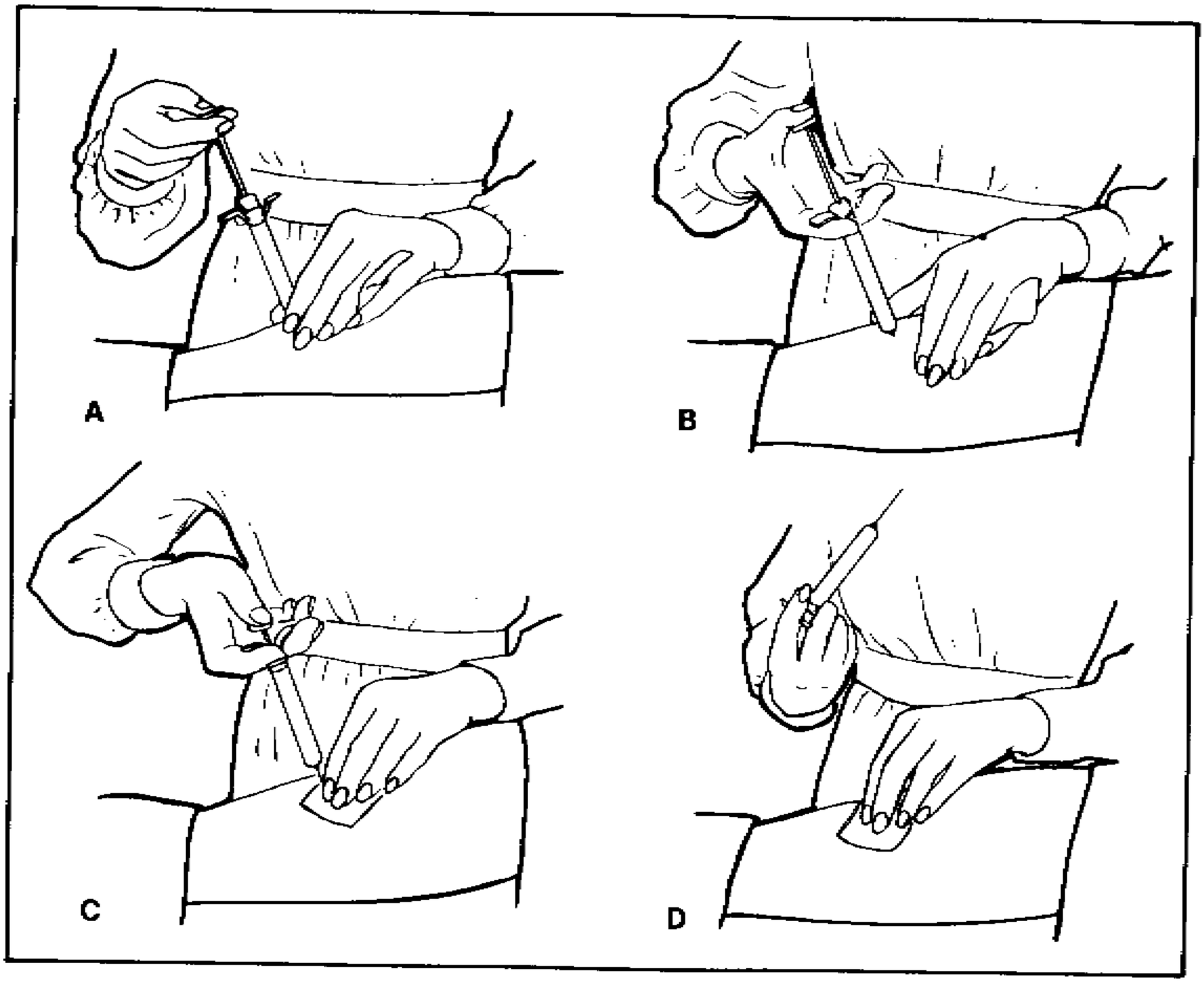


Figure 18-25. Administering IM injection.

18-27. Intradermal Injections

Intradermal injections are commonly used to inject minute amounts of a drug into the outer layers of the skin (Figure 18-26). A positive reaction to antigens such as bacteria, pollen, or foods causes the skin to become red and indurated. In the intradermal route, the amount of solution injected is usually 0.1 ml. You must be extremely careful to measure the dosage accurately because the solutions are capable of producing severe reactions; only a small amount is required. Use a syringe that has calibration marks to assure accurate measurement of 0.01 ml dosages, such as the tuberculin and the U100/ml insulin syringes. Select a fine gauge (25, 27, or 29), short (1/4 to 5/8 inches in length) needle. The dorsal aspect of the forearm is the customary injection site

for intradermals, but when this site cannot be used or in cases of extensive skin-testing, the dorsal and lateral sides of the upper arm can be used because they are readily observable. Insert the needle at an angle of about 10 degrees between the upper layers of the skin. The injected solution will raise the epidermis to form a bubble. It is then slowly absorbed from the site because the blood vessels are located in the deeper structures of the skin.

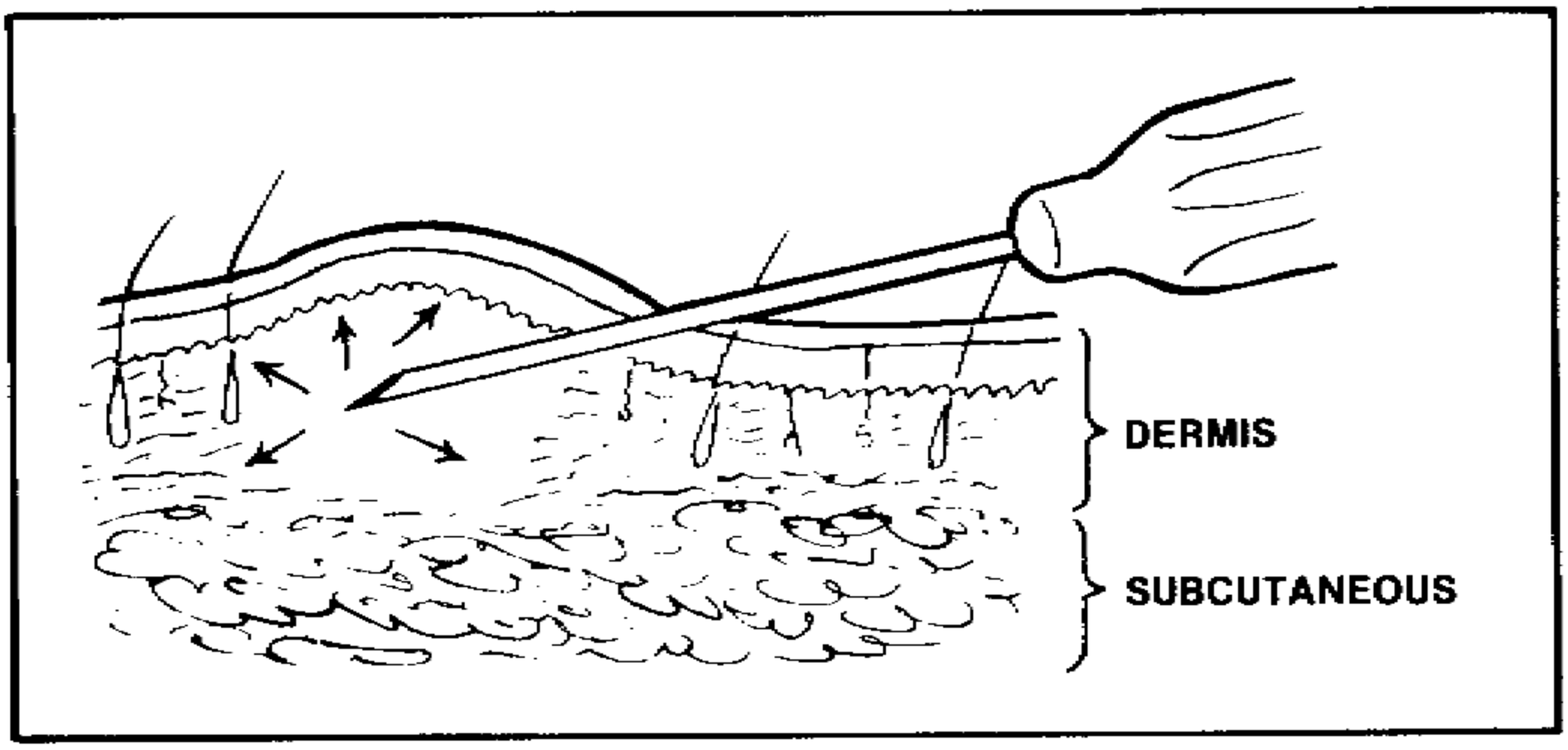


Figure 18-26. Intradermal injection.

a. Procedure for Preparation of Medication.

(1) Assemble your supplies. Needle, syringe, and medication are required.

(2) *Wash your hands.*

(3) Identify the medication. Compare the medication with the order.

(4) *Cleanse the vial stopper.* Wipe it with an alcohol compress.

(5) *Remove the needle and syringe from the protective sheath.*

(6) *Pick up the vial and insert the needle.*

(7) *Withdraw the correct dosage of the medication into the syringe.* Keep the needle sterile by using the needle protector.

(8) *Remove the needle from the vial.* Place the vial to one side.

b. Give an Intradermal Injection.

(1) *Explain the procedure to the patient.* Take the prepared needle and syringe on a medicine tray with the medication record to the patient. Verify patient identification.

(2) *Select the injection site.* Expose the area, usually the anterior forearm, so that you have an unobstructed view.

(3) *Cleanse the injection site.* Remove the antiseptic sponge from the package and use a firm, gentle circular motion to clean an area approximately 2 inches in diameter.

(4) *Expel air bubbles.* Hold the syringe vertically and gently push on the plunger to expel air bubbles. Recheck the accuracy of the dose to be given.

(5) *Grasp the forearm to be injected.* While standing in front of the patient, turn the patient's anterior forearm upward, facing you. Grasp the arm on the posterior side, toward the middle of the forearm. With your nondominant thumb on one side of the arm and your index finger on the other side, pull the anterior skin taut.

(6) *Insert the needle.* With the bevel of the needle facing upward, insert the needle under the outer layer of the skin at an angle almost parallel to the skin (10 to 15 degrees) (Figure 18-26). Insert the needle so that only the bevel penetrates the skin. Avoid penetration next to hair follicles.

(7) *Inject the solution slowly.* If you have inserted the needle correctly, a small circular bubble of solution forms just under the thin outer layer of the skin. You should be able to feel some resistance at the needle point if it is in the dermal layer. If the tip moves freely, you have inserted the needle too deeply. In this event, withdraw the needle slightly and check again for resistance. Continue to reassure your patient as you inject the solution and observe for unusual reactions.

(8) *Withdraw the needle.* Wipe the area *very gently* with the antiseptic sponge as you remove the needle. Do not apply pressure. You must not disperse the medicine into the underlying tissues.

(9) *Caution patient not to rub or scratch the injection site even though it may itch.* Irritation of the site may give a false positive reading.

(10) *Remove the equipment.* Return the supplies to the designated storage area and dispose of the used needle and syringe in the designated containers.

(11) *Record the procedure.* For example: 8:10 P.M.—Tetanus antitoxin 0.1 ml given I.D. on right forearm. 8:25 P.M.—Skin test positive for TAT, 1 cm wheal at injection site.

18-28. The Tine Test

a. The tine test is one of several screening tests for tuberculosis and is used primarily for mass screening.

b. A preparation of concentrated old tuberculin (OT) is used. The individually packaged puncture device (Figure 18-27) contains a dried dose of OT on the tines and is discarded after one-time use. All positive reactions except vesiculating reactions should be retested by the Mantoux method.

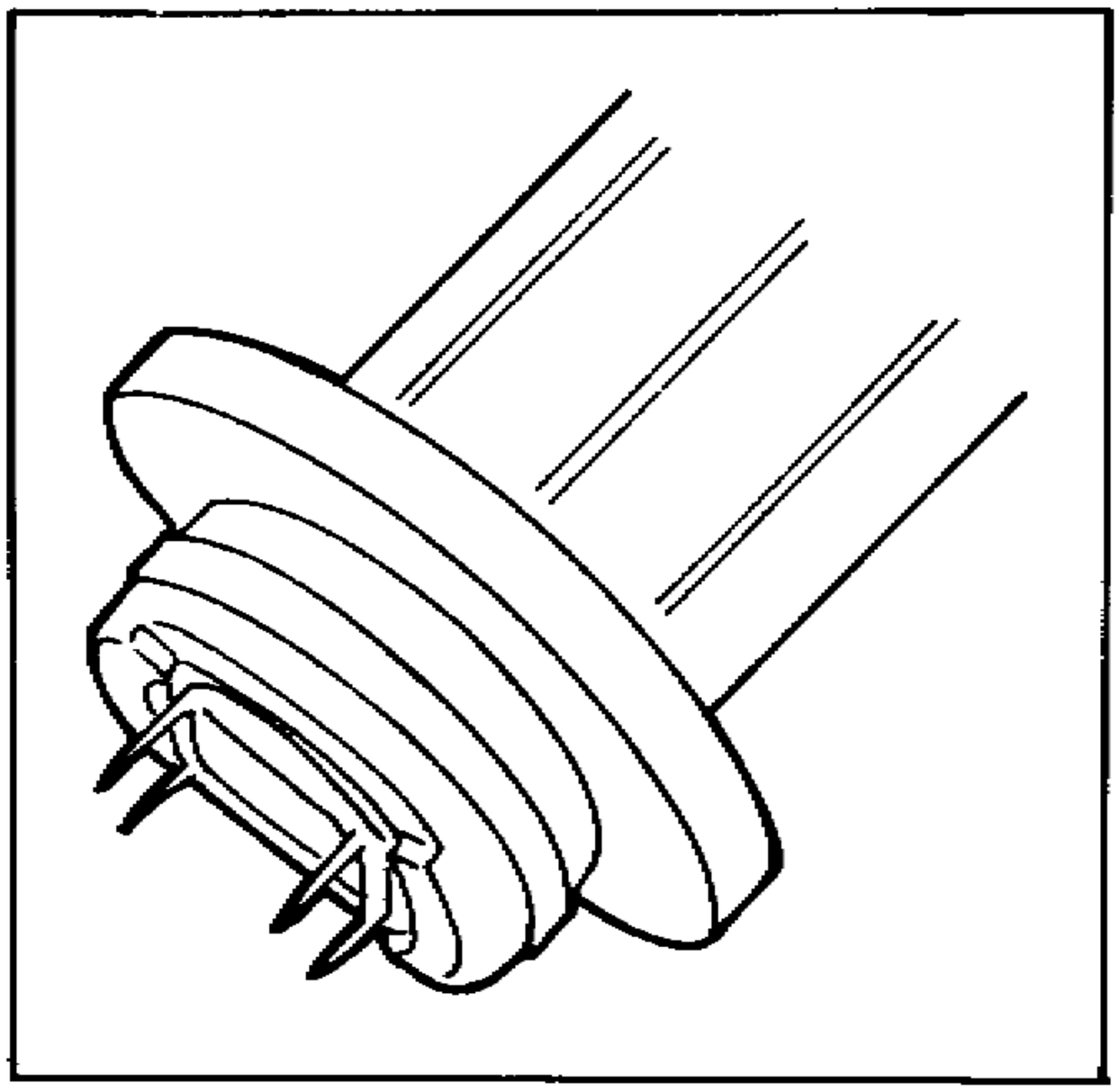


Figure 18-27. Tine device.

c. Procedures for the tine test.

(1) *Assemble the supplies.* An alcohol/acetone swab and a tine set are required.

(2) *Wash your hands.*

(3) *Identify the patient and explain the procedure.*

(4) *Expose the right forearm.* Cleanse the arm with an alcohol/acetone swab, then discard the swab in a designated container.

(5) *Puncture the forearm (Figure 18-28).* Remove the tine set from the package and discard after use. The tuberculin on the tines is injected into the skin.

(6) *Instruct the patient.* The site must be inspected in 48 or 72 hours. Follow your agency's procedure.

(7) *Record the test.* Mark it on the patient's record.

(8) *Read the reaction (Figure 18-29).* Inspect the site in 48 to 72 hours. NEGATIVE TEST: Nothing has appeared on the skin except the puncture sites. POSITIVE TEST: Presence of reddish, raised indurations of 2 mm or more around one or more of the puncture sites.

NOTE

Alcohol/acetone or acetone swabs must be used to cleanse the area when administering the tine test. Alcohol, when used alone, will inactivate the tuberculin culture.

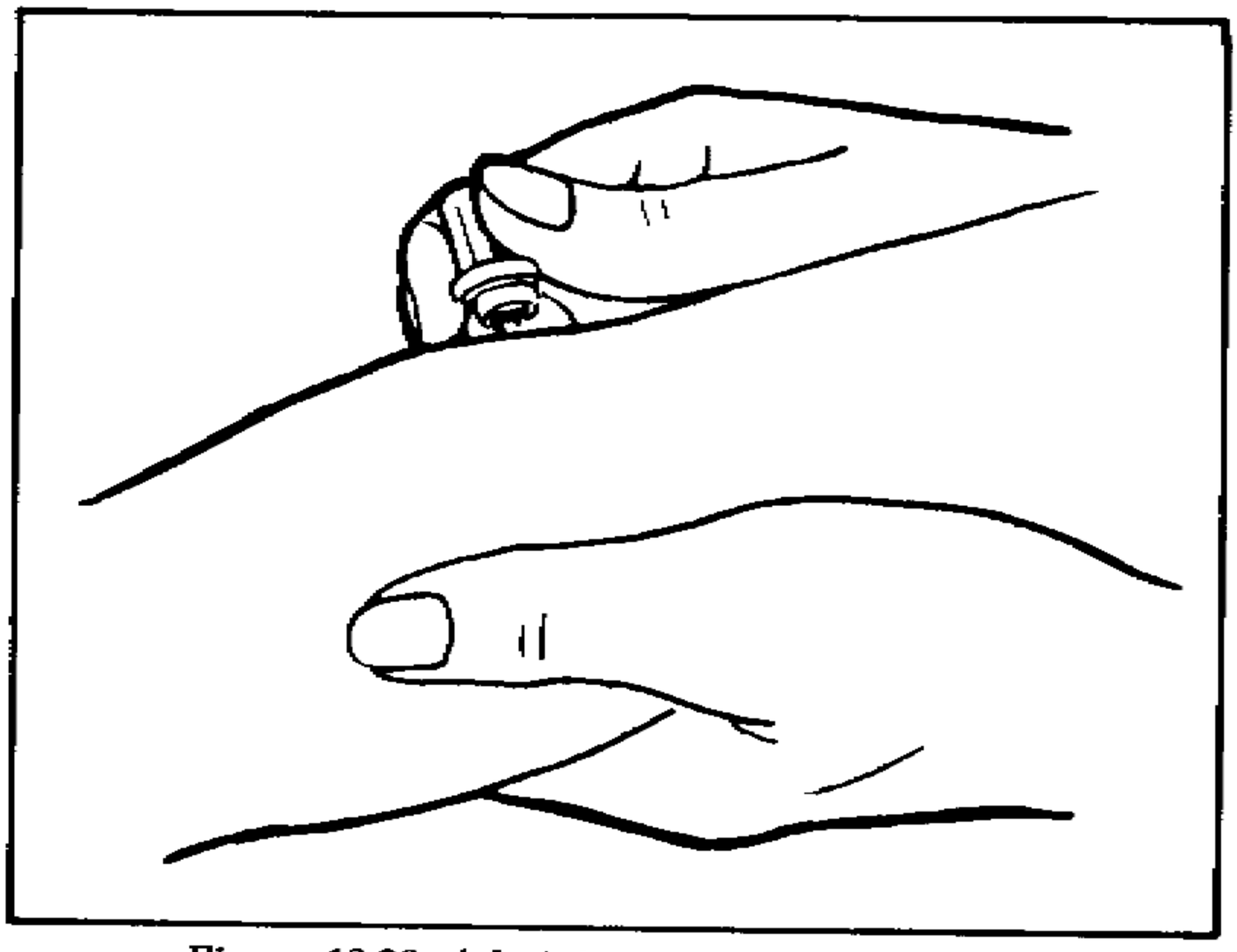


Figure 18-28. Administering tine test.

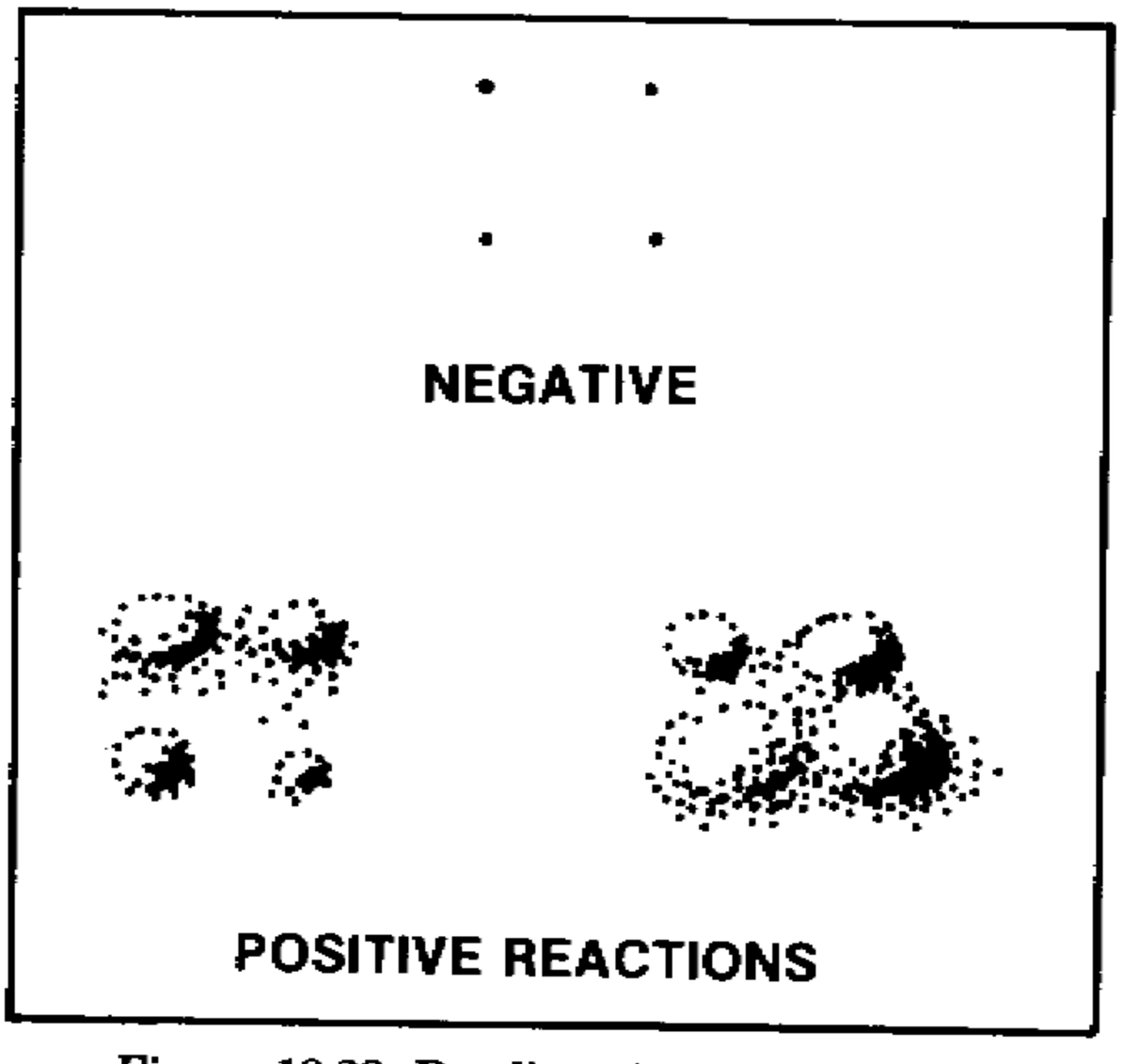


Figure 18-29. Reading tine test reactions.

18-29. Administration of Eye Drops and Eye Ointments

a. Containers. Drug preparations for the eye are dispensed from the pharmacy in individual dropper bottles, dispensing squeeze vials, or ointment tubes. These containers are labeled "ophthalmic" and usually identified with an individual patient's name. When the drug is administered, take the prepared medicine card identifying the eye to be treated, the properly identified drug container, and a container of tissue wipes to the patient's bedside.

b. Physical Considerations—the Conjunctiva. In treating the eye, remember a few basic facts concerning its structure. The conjunctiva (the mucous membrane which covers the front portion of the eyeball and lines the eyelid) absorbs medication placed in the eye. If the medication is applied to the inner surface of the lower lid, the natural blinking reflex of the eye distributes the ointment.

c. Precautions in Instilling Medications.

(1) Wash hands immediately before treating the eyes. Have fingernails short and clean.

(2) After removing cap from ointment tube, squeeze a small amount on sterile gauze to remove any crust that might have formed; discard this gauze.

(3) Do not invert dropper after withdrawing solution as there is danger that small particles of rubber might become mixed with the medication.

(4) Do not touch tip of dropper or tip of squeeze vial or ointment tube to the skin of the face or lids. This will contaminate the sterile medication.

d. Instillation of Eye Drops or Eye Ointment.

(1) Instruct patient to tilt head backward and look upward with eyelids open.

(2) Place forefinger on skin below lower eyelid and pull down gently. This creates a small conjunctival pocket in the lower lid in which to instill the medication.

(3) With the tip of the dropper close to but not touching the pocket, instill the required number of drops of medication. If ointment is used, run a thin ribbon of ointment just above surface of the pocket, from the inner aspect to the outer aspect of the conjunctival pocket.

(4) Release the skin held by the fingertip. The normal blink reflex will distribute the medication evenly. No rubbing or pressure on the upper lid is necessary or desirable.

(5) Blot closed margin of eyelid gently with a clean tissue and wipe to remove excess medication. Blot from inner canthus (junction of the eyelids) outward.

18-30. Administration of Nose Drops

Vasoconstrictor drugs are dispensed in solution, in dropper bottles, or in jellies in nasal-tipped applicator tubes. These drugs are instilled into the nostrils to shrink the nasal mucosa. This will open the nasal passages and allow better drainage of the paranasal sinuses. Position the patient properly or the instilled medication will run into the nasopharynx, be expectorated by the patient, and lose its intended effect. After washing hands:

a. Position the patient flat in bed, with his head extended over the edge of the bed.

b. Place prescribed number of drops of the solution in each nostril. Instruct the patient to remain in position for 3 minutes.

c. Do not return a dropper which has touched the nostril to the bottle of solution, as the entire bottle will be contaminated. Use individual clean droppers for each instillation. Discard any solution remaining in the dropper.

18-31. Administration of Ear Drops

Ear drops may be ordered for treatment of infections of the external ear or for skin disorders that are noninfectious. Since otitis (external ear disorders) can be extremely painful, handle the auricle and tragus gently. Ear drops such as Burow's solution may be ordered to soothe and cleanse the inflamed membranes of the ear canal. Other prescribed drops may be solutions of antibiotics. To instill ear drops, obtain the medicine card, the prescribed drops, and some cotton compresses. After washing hands:

a. Check the medication for accuracy and have the prescribed number of drops in the dropper.

b. Tilt the patient's head so that the affected ear is uppermost.

c. Gently pull the auricle of the ear up and back on an adult, down and back on a child.

d. Direct the tip of the dropper toward the vestibule of the ear. Instill the required number of drops.

e. Place a cotton compress in the vestibule but do not push into the ear canal. The compress will serve as a wick.

18-32. Administration of Drugs by Aerosol Inhalation

Drugs in a distilled water solution are administered by aerosol inhalation (Figure 18-30). A nebulizer attached to a compressed air (or oxygen) supply converts the solution into a fine mist which is inhaled deeply into the trachea and bronchi. (An ordinary spray atomizer cannot be used for aerosol inhalation because the droplets are too large and disperse in the throat, rather than deep in the respiratory tract.) When continuous aerosol therapy is necessary, a specially designed jet humidifier is used in combination with an oxygen hood or croupette. The drugs used in aerosol therapy may be a mucolytic detergent agent to liquefy bronchial secretions; an antibiotic drug in solution; a bronchodilator; or a combination of all three types of medication. When aerosol therapy is ordered, the patient needs special instruction for effective administration of the medication. When oxygen is used, all safety precautions for the use of oxygen must be observed.

a. Equipment. Various styles and types of nebulizers are utilized depending upon local availability and policy. Compressed air or oxygen is used to produce nebulization of the medication. The nebulizer is connected to the air or oxygen supply using oxygen tubing; an oxygen humidifier is not used unless ordered. The measured amount of medication and diluting solution is placed in the nebulizer and the oxygen or air flow is adjusted according to the physician's order or manufacturer's instructions.

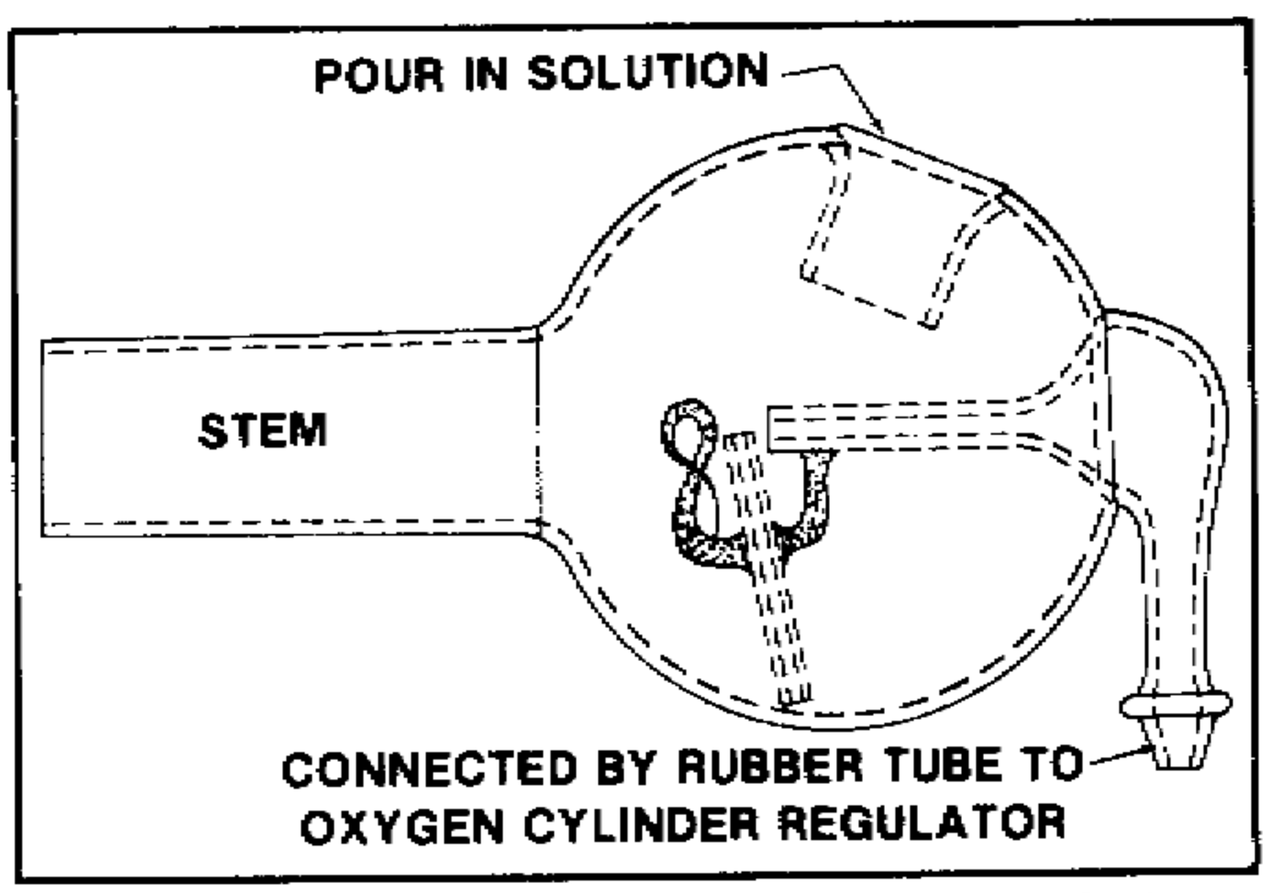


Figure 18-30. Nebulizer for aerosol inhalation.

b. Administration.

(1) Have the patient sit upright, supported in a chair or by the elevated hospital bed.

(2) Instruct patient in use of nebulizer in accordance with the manufacturer's instructions. The patient should inhale deeply through his mouth. The treatment is continued until all medication in the nebulizer is used, or for a specified time if ordered.

(3) Following each treatment, rinse the nebulizer thoroughly with cold water to remove any residual medication and to prevent clogging. Use an individual nebulizer for each patient. When this is not possible, disinfect the nebulizer by proper use of the prescribed chemical germicide.

18-33. Administration of Rectal Suppository

Drugs contained in a rectal suppository may be intended for a local effect on the mucous membrane of the rectum or for general systemic effect following absorption. Thus, if the suppository is expelled before it has melted, little or no therapeutic effect can be anticipated. The medical specialist must always know why the suppository is being administered; for example, is it a local analgesic, an evacuant to induce a bowel movement, or an antispasmodic for relief of asthma?

a. Equipment. Prescribed suppository (often stored in the refrigerator), rectal glove, surgical lubricant, tissue, and emesis basin.

b. Procedure. Screen patient; turn patient on side to expose anal sphincter; lubricate suppository and gloved index finger. Instruct patient to breathe through the mouth to relax the anal sphincter, and insert suppository. With gloved finger, advance suppository into the rectum. Apply pressure over anal sphincter until the reflex to expel the suppository has subsided.

18-34. Doses and Uses of Drugs in Field Medical Sets

a. Drugs discussed in this section are those frequently used by a medical specialist in the field, a TMC, or a hospital emergency room. Local policy will limit the medications a medical specialist may administer or dispense.

b. Drugs are presented under generic or nonproprietary names and are listed under a therapeutic usage classification.

18-35. Analgesics

a. Nonnarcotic.

(1) Aspirin. Aspirin is an analgesic and an antipyretic. As an analgesic, it is effective in treating mild pain, such as headaches and minor muscular pain. As an antipyretic, aspirin is used to reduce body temperature in patients with a fever (it does not affect normal body temperature). Aspirin is normally issued as 0.324 g. tablets with the normal adult dose being 1 to 2 tablets every 4 to 6 hours. Since aspirin may cause gastric irritation, patients should be told to drink a full glass of water when taking the drug, or take it with milk or meals.

(2) *Acetaminophen tablets (Tylenol).* A proven analgesic and antipyretic. Tylenol is particularly well suited as an analgesic-antipyretic in the presence of aspirin allergy. Tylenol has rarely been found to produce side effects; however, large doses may contribute to liver failure. Usual dosage for adults is 1 or 2 tablets every 4 to 6 hours.

b. Narcotic. Narcotics are derivatives of opium. They depress the central nervous system and respirations, are constipating, and may cause addiction. They must be accounted for in the narcotic register. Normally, a medical specialist will only administer narcotics in actual combat situations. The most commonly used narcotic to relieve severe pain is morphine. When used, the normal dose administered is 10 mg. Morphine can severely depress respirations and level of consciousness. Morphine is not administered to patients with an altered level of consciousness, head injury, or impaired respirations.

18-36. Anesthetics

These drugs produce anesthesia in a limited area around the site of their injection or application by preventing transmission of pain impulses along the sensory nerves. They are used by the medical specialist to anesthetize an area of the body prior to treatment or to relieve pain.

a. Lidocaine hydrochloride. This drug is supplied as a 1 or 2 percent solution for injections. Often, it is also combined with epinephrine to prolong the anesthetic action. Lidocaine is used in local surgical procedures to produce local anesthesia in a dose determined by the physician. When supplied as a jelly, it can be applied topically to produce local anesthesia.

b. Tetracaine hydrochloride. This drug normally is supplied as ophthalmic ointment. It is used in the eye to relieve local pain due to injection or injury. It does not dilate the pupil of the eye or cause other noticeable side effects.

c. Cetylpyridinium chloride and benzocaine lozenges (Cepacol). These are used for temporary relief of pain or discomfort due to minor sore throat and pain and discomfort associated with tonsillitis and pharyngitis. Allow to dissolve slowly in the mouth. Cepacol is also used as a mouth wash.

d. Eugenol (oil of cloves). Eugenol is a surface anesthetic. It is used in dentistry to give temporary relief from toothache. Eugenol is supplied in a bottle for topical application by means of a cotton compress. Application of eugenol is a temporary measure and the patient should be referred to a dentist immediately.

18-37. Antacids (Aluminum Hydroxide-Magnesium Trisilicate Tablets)

Antacid tablets (Gelusil) are used to relieve acidity in the stomach and the pain that may accompany the acidity. Patients should be told to chew the tablets and to swallow with water. By chewing the tablets, the effectiveness of the antacid is greatly increased. This drug comes in liquid form also.

18-38. Antibiotics

The proper choice of an antibiotic in the treatment of a disease and the total amount administered is of particular importance. The authorized prescriber will select a drug and a total dose of the drug the patient must receive. This will be based on the particular disease and the patient's overall condition. It is important that the patient receive the correct amount of drug at the proper time. Any variation from this dosage regimen may decrease the effectiveness of the antibiotic. The antibiotics discussed are those topical antibiotics a medical specialist will most frequently use.

a. Bacitracin or Neomycin Ointment. These antibiotic preparations are supplied in 1/2 ounce (14.70 ml) tubes for local application to superficial skin infections, such as an infected insect bite. The skin area should be cleansed of any crusts or purulent secretions by thorough washing with a surgical soap or detergent-antiseptic solution before the ointment is applied. A dressing is omitted unless the area must be protected from contact with clothing.

b. Antibiotic Ophthalmic (Eye) Ointments. These are sterile ointment preparations (such as polymyxin B, bacitracin, and neomycin ophthalmic ointment) used to treat bacterial infections of the eyelids and surface of the eye. They are supplied in small, applicator-tipped tubes for use on an individual patient. Before each application, it is desirable to clean away the crusts that accumulate along the infected lid margins. Warm moist compresses to the eye are recommended cleansing agents. A thin ribbon of

ointment is applied to the inner lining of the lower lid and the natural blinking of the eye distributes the ointment. Antibiotic ointments may also be ordered as prophylactic treatment when the cornea has been injured. *Antibiotic eye ointments are used only when prescribed by a medical officer.*

c. Polymyxin B-Neomycin-Hydrocortisone (Cortisporin Otic). This drug is for the treatment of superficial infections of the external auditory canal caused by organisms susceptible to the action of the antibiotic. Dosage for adults: 4 drops of the solution should be instilled into the affected ear three or four times a day.

18-39. Sulfonamides

Silver Sulfadiazine (Silvadene) Cream is a topical antimicrobial drug indicated as an adjunct for the prevention and treatment of wound sepsis in patients with second and third degree burns.

18-40. Antifungal Agents

a. Tolnaftate (Tinactin) Solution 1 Percent. This drug is used to treat a variety of fungal infections, such as athlete's foot and ringworm. The drug is normally applied twice daily for at least two to three weeks.

b. Fungicidal Foot Powder. This powder normally is supplied in 1 ounce (14.18 g) cans. It is dusted onto the skin in the treatment of fungus infections of the skin, especially athlete's foot. It should be applied in the morning.

18-41. Antihistamines

The drugs discussed below have as a side effect drowsiness or dizziness. Individuals receiving these drugs should be cautioned against driving an automobile or engaging in other activities requiring alertness.

a. Triprolidine Hydrochloride and Pseudoephedrine Hydrochloride (Actifed). This drug is an ingredient in a combined-drug tablet used to treat the symptoms of hay fever and colds. The usual dose is one tablet three times a day. Side effects occur with less frequency than with Benadryl, but the individual must be cautioned that he might become drowsy or dizzy.

b. Brompheniramine Maleate (Dimetapp). Dimetapp is for the symptomatic treatment of seasonal and perennial allergic rhinitis, allergic manifestation of upper respiratory illnesses, acute sinusitis, nasal congestion, and otitis. Administer with care to patients with history of cardiac, peripheral vascular diseases, or hypertension. Dosage for adults is one tablet every 12 hours.

18-42. Antiparasitic Agents

a. Gamma Benzene Hexachloride Ointment (Kwell) R_x. This ointment normally is supplied in 1 ounce (59.15 ml) tubes. It is for topical use against lice and mites which cause scabies (itch). Usually one application of the ointment is enough. It is irritating to mucous membranes and should not be allowed to touch the eves. The individual should not bathe or wash the hair for

24 hours following application of the drug. After a cleansing bath and shampoo, clean clothing and bed linen should be used. The infested clothing and bed linen must be laundered. The preparation may not destroy the nits (eggs) of body lice, so a second application may be necessary one week later. The hairy parts of the body should be closely examined for nits as they cling to hair shafts.

b. Lindane, 1 Percent. This powder is used to treat pediculosis (infestation by lice). It should be dusted on the hairy portions of the body and left there at least 24 hours. The treatment should be repeated after one week. The powder should also be dusted onto the seams of the patient's clothing and bed linen. After the delousing treatment, the clothing and bed linen are changed and the infested articles are laundered. The patient should be dusted again if he bathes between the two dustings.

18-43. Antiseptics

Providone-Iodine (Betadine) is a solution that contains iodine and is useful as an antiseptic prior to surgery. It is used to cleanse the area around the site of the incision. Providone-iodine should be used undiluted. The patient must be questioned about allergies to iodine prior to use.

18-44. Astringents

An astringent (aluminum acetate and acetic acid solution, Burow's solution) is a soothing, wet dressing for relief of inflammatory conditions of the skin such as insect bites, poison ivy, swelling, or athlete's foot.

18-45. Oxidizing Agent

Hydrogen peroxide (a cleaning agent) is used for suppurating wounds and inflamed mucous membranes. It aids in the arrest of minor bleeding by promoting healing and toughening skin.

18-46. Emollients and Protectives

a. Emollients.

(1) Petrolatum gauze is used to protect the skin area surrounding a draining wound. Normally, it is supplied in sterile foil-sealed packets. The required length of gauze is removed, using aseptic technique. Once the packet has been opened, the sterility of the remaining contents is lost.

(2) Surgical lubricant is a sterile jelly supplied in tubes. It is a water-soluble preparation used on the skin and for lubrication of catheters, rectal thermometers, and rectal gloves. It contains a preservative to maintain its sterility after the seal is broken, provided that aseptic technique is used in squeezing the required amount from the tube and in replacing the cap.

b. Protectives.

(1) *Benzoin tincture, compound.* This drug is normally issued in a 1 pint (0.47 liter) can. When it is used to protect the skin under adhesive strapping, it is painted on the required area with an applicator swab. It must

then dry on the skin before the adhesive is applied. Because of its aromatic nature, benzoin tincture is also added to the water used for steam inhalations to relieve bronchial congestion and irritation.

(2) *Calamine lotion, phenolated, mentholated.* This drug is used as a soothing and drying lotion with phenol and menthol added for their antipruritic effect.

18-47. Vasoconstrictors

a. Systemic. Epinephrine (Adrenalin) (a systemic vasoconstrictor) is normally supplied in a clear, sterile solution of 1:1,000 for subcutaneous or intramuscular injections, the amount determined by a physician. It is inactive when given orally. For topical application to check hemorrhage, as in nosebleed, concentrations of 1:1,000 to 1:10,000 are used. A 1 percent solution is used for inhalation. Epinephrine must be used cautiously in patients with cardiovascular disease or high blood pressure as it acts as a vasoconstrictor and a heart stimulant. Its effect on blood vessels is marked. A wide white area may develop at the site of injection of epinephrine. Epinephrine is also used in subcutaneous injection to treat severe asthma and allergic or anaphylactic reactions.

b. Topical.

(1) *Phenylephrine hydrochloride (Neo-Synephrine).* Phenylephrine hydrochloride is generally used in 0.25 percent of 1 percent solutions, or in the form of a 0.5 percent jelly for application to nasal membranes. Used in this manner, the drug causes a local vasoconstriction and acts as a nasal decongestant for about 4 hours. Phenylephrine hydrochloride should be used cautiously in patient with heart disease or high blood pressure.

(2) *Oxymetazoline hydrochloride (Afrin).* Oxymetazoline hydrochloride is a long-acting nasal decongestant with a duration of action of 12 hours. This drug must also be used cautiously in patients with heart disease or high blood pressure.

18-48. Anti-Inflammatory Agents

Hydrocortisone Cream 1 Percent is used topically to treat numerous types of local dermatitis conditions. The drug should be applied in a thin film over the affected area. Hydrocortisone is often found in combination with topical antibiotics, such as neomycin, hydrocortisone, polymyxin B, and Bacitracin ointment. When using a drug combining an antibiotic and hydrocortisone, the drug must be continued for 2 to 3 days after the signs of infection disappear.

18-49. Antidiarrheal Agent

Kaolin-pectin (an antidiarrheal agent) is normally supplied as a powder to which water must be added. Kaolin-pectin is effective in treating only very minor forms of diarrhea. Its normal dose is 4 to 6 tablespoonfuls after each bowel movement.

18-50. Expectorant

Guaifenesin syrup (an expectorant) is used in the relief of dry unproductive coughs associated with the common cold, pertussis, measles, and influenza. Usual adult dosage is 1 to 2 teaspoonfuls every 3 to 4 hours.

18-51. Emetic

Ipecac syrup is used as an emetic to induce vomiting for emergency treatment of drug overdose and in certain cases of poisoning.

CAUTION

DO NOT give to an unconscious patient. Usual dosage is 15 cc with warm water.

CHAPTER 19

ENVIRONMENTAL HEALTH

Section I. INTRODUCTION

19-1. General

History has shown that more time was lost due to environmental illnesses and injuries than to combat injuries. The death rate from illness and injuries have also surpassed those due to combat injuries. As recently as the Vietnam conflict, the communicable illness and injury rate exceeded the combat injuries by a margin of 4 to 1.

19-2. Employment of Protective Measure/

The number of environmental illnesses and injuries can be reduced significantly by applying simple commonsense protective measures. As the unit medical specialist, you can assist the commander in identifying problem areas and developing protective measures. The use of insect repellents can reduce the number of mosquito bites, which in turn can reduce the number of malaria cases. Treating water with iodine or other purification materials can reduce the probability of personnel getting typhoid fever from drinking contaminated water. Keeping food cold, 45^{o}F, in storage or hot, 140^{o}F, on the serving line can reduce the chances of food poisoning.

Section II. COMMUNICABLE DISEASES

19-3. General

Communicable disease is an illness due to a specific infectious agent or its toxic products which arises through transmission of that agent or its products from an infected person or animal or a reservoir to a susceptible host, either directly or indirectly, through an intermediate plant or animal host, a vector, or the environment.

19-4. Types of Organisms Which Cause Communicable Diseases

The following is a classification of disease organisms and examples of the diseases they can cause:

- Bacteria: plaque, staphylococcal wound infections, typhoid fever, gonorrhea.
- Viruses: influenza, hepatitis, measles, rabies, yellow fever.
- Rickettsia: typhus, rocky mountain spotted fever.
- Fungi, yeasts: athletes foot, yeast infections.
- Protozoa: malaria, amebiasis.
- Helminths (worms): hookworms, filariasis.

19-5. Infection

An infection is a condition caused by the entry and development or multiplication of pathogens. Pathogens are disease-producing micro-organisms. Pathogenic agents of one kind or another are present in all areas where life exists naturally. They inhabit the air, soil, and water. They are also in waste products, respiratory tract, alimentary tract, and skin of humans and animals. Some of these organisms can survive for only a few minutes outside the human body, while others can survive for years.

19-6. Communicability and Transmission

a. The communicability of the causative organisms is affected by the following:

- *Reservoir*—Any person, animal, plant, soil, or substance in which an infectious agent lives and multiplies, on which it depends for survival, from which it can be transmitted to a susceptible host.

- *Transmission*—Any mechanism by which an infectious agent is spread through the environment, or directly to another person. It includes the exit from an infected host and the entry to a susceptible host.

- *Host*—A person or other living animal that gives subsistence to an infectious agent under natural conditions. A host may have variable symptoms or an inapparent (asymptomatic) infection. Figure 19-1 illustrates the chain of infection.

b. Principles of communicable disease prevention and control are illustrated in Figure 19-2.

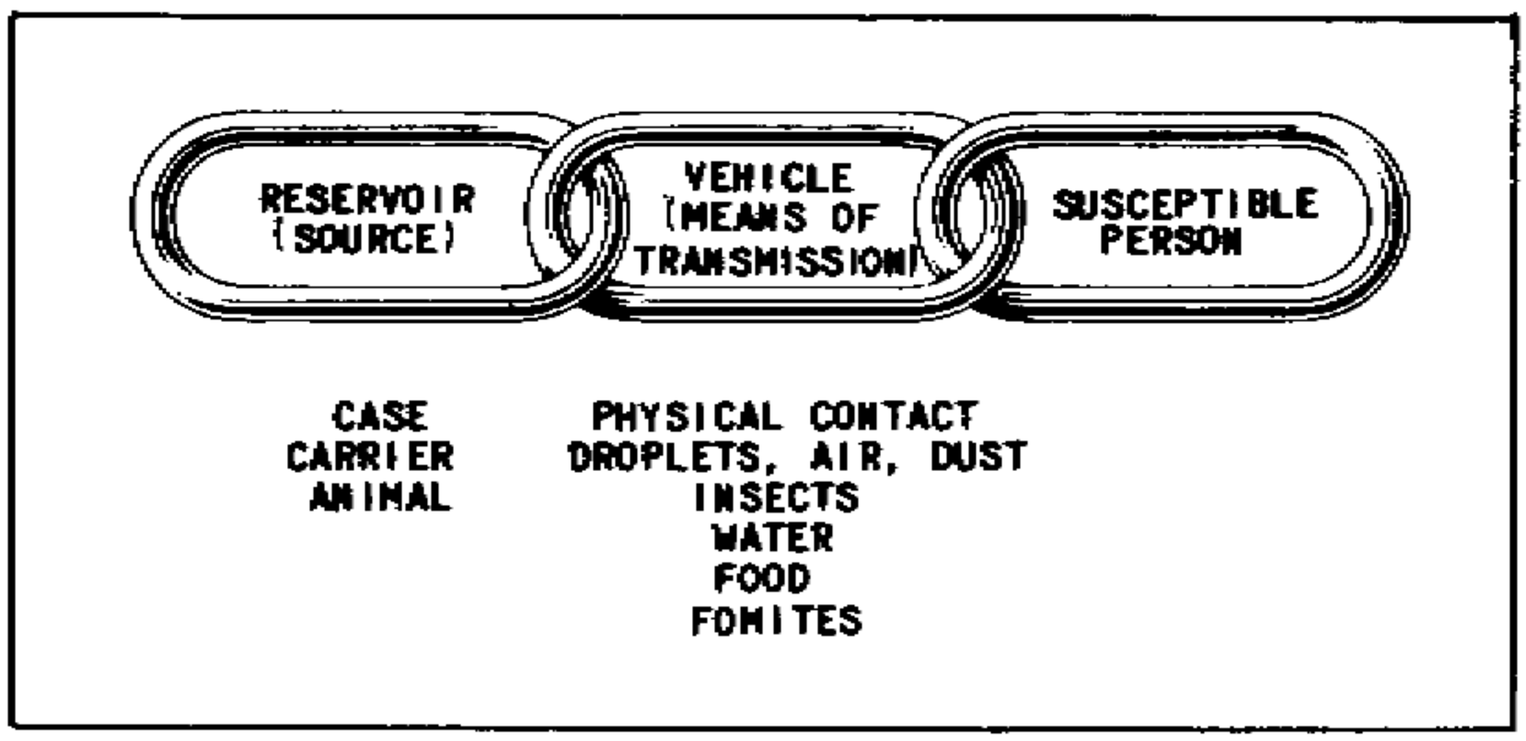


Figure 19-1. Chain of infection.

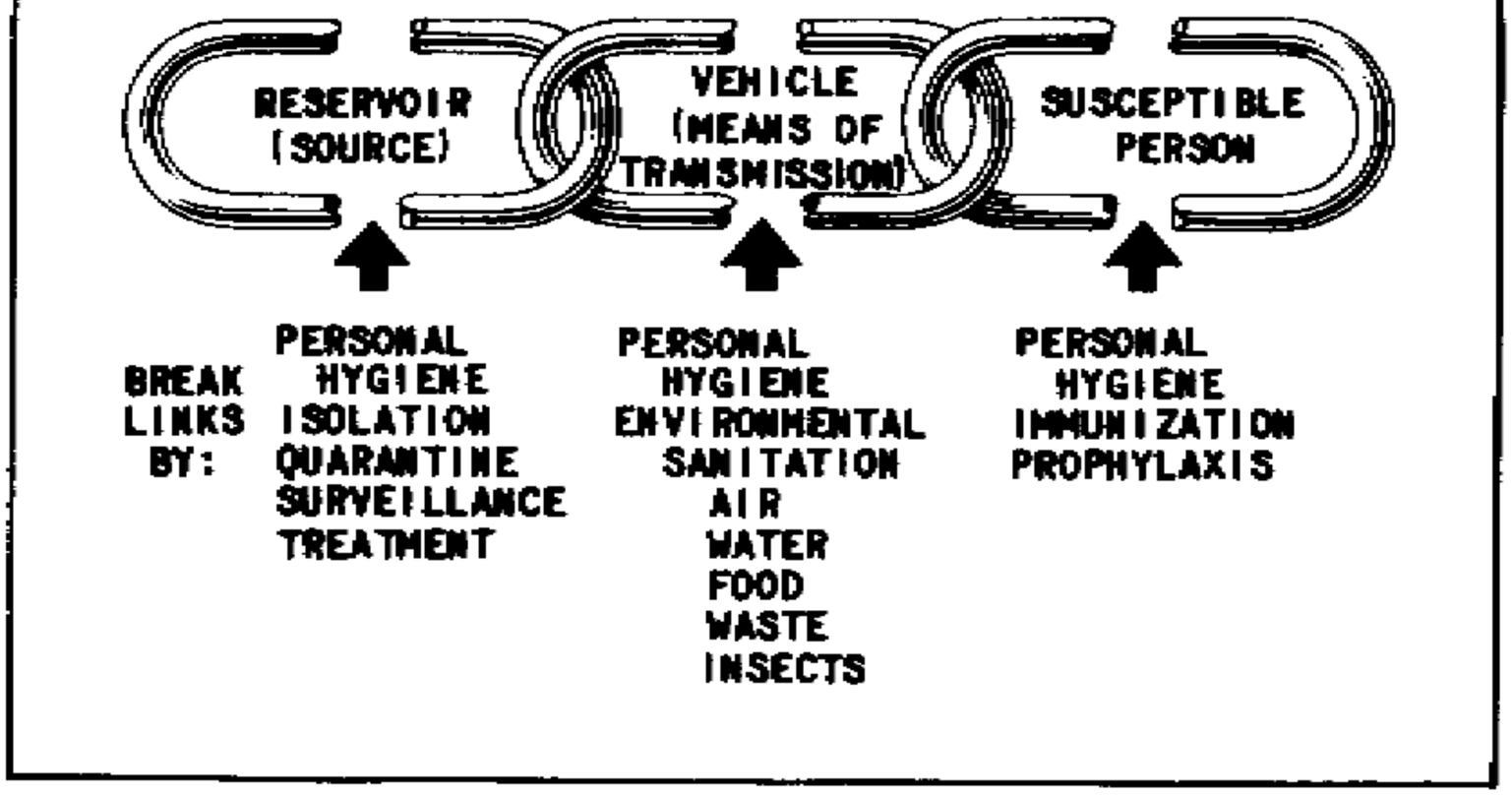


Figure 19-2. Principles of control.

19-7. Reservoirs of Disease

Major reservoirs of disease and control measures include:

	Reservoirs	*Control*
a.	Humans	Medication to prevent malaria. Treatment of venereal disease contact.
b.	Animals (mammals)	Immunization of pets. Quarantine of animals.
c.	Arthropods (ticks, insects)	Insecticides. Control of breeding areas. Immunizations.

19-8. Modes of Transmission

The major routes or modes of transmission control measures are:

	Mode of Transmission	*Control*
a.	Airborne droplets/nuclei (tuberculosis, influenza, other respiratory infections)	Cover nose and mouth while coughing. Avoid crowds during flu season.
b.	Fecal-oral (dysenteries, Hepatitis A)	Wash hands after using latrine. Stay home from work when ill with disease.

c.	Skin, mucous membrane (impetigo, carbuncles common cold, venereal diseases, hookworm)	Handwashing. Isolation. Treatment of patient. Wearing of shoes. Proper disposal of wound dressings.
d.	Food and water (dysentery, hepatitis, staph enteritis)	Handwashing by food handlers. Proper cooking of food. Chlorination of water.
e.	Fomites—articles contaminated with infections, micro-organisms (bed linens, eating utensils, handkerchiefs)	Proper washing of linens. Sanitize eating utensils.
f.	Arthropods (mosquitoes, ticks)	Insecticide sprays, repellents. Immunizations.

19-9. Communicable Diseases of Military Importance and Their Control

a. Respiratory diseases (common cold, influenza, pneumonia).

(1) Modes of transmission—coughing, sneezing, and oral contact.

(2) Control measures—individual immunizations, personal hygiene, and adequate ventilation.

b. Intestinal diseases (diarrhea, dysentery, and typhoid).

(1) Modes of transmission—contaminated food and water, flies, and infected individuals.

(2) Control measures—eat only approved food and drink only treated water, dispose of waste matter properly, maintain good personal hygiene (wash your hands before eating), practice insect and rodent control, and keep immunizations current.

c. Insect-borne diseases (malaria, typhus, and encephalitis).

(1) Modes of transmission—insect bites and mechanical transmission (disease-causing organisms deposited by insects on food, drink, or open sores).

(2) Control measures—keep immunizations current; take prescribed prophylaxis (malaria pills); bathe daily and change your clothing daily (if not daily, as often as the circumstances will permit); blouse your pants legs, button your shirt sleeves and collar; use insect repellents; and spray pesticides to eliminate or control insects.

NOTE

See FM 21-10 for insect control methods.

CAUTION

When using pesticides in control programs, follow the container's label instruction.

d. Venereal diseases (syphilis, gonorrhea, Herpes Simplex II).

(1) Mode of transmission is contact with infected persons.

(2) Control measures—

- Attend sex education classes and obey "off limits" restrictions.
- Maintain personal hygiene (wash genitals thoroughly; use condoms).
- Identify and report all infected sexual partners.
- Report visible signs of infection.
  - o MALE—Sore(s) on genitals or discharge from penis.
  - o FEMALE—Vaginal discharge, lesions of the skin and mucous membranes, or moist papules in folds of skin in the genitalia.
- Secure prompt medical treatment.

NOTE

Contracting venereal disease (VD) is not a cause for disciplinary action, but failure to report for proper medical treatment or violating "off limits" restrictions could result in such action.

Section III. HEAT INJURIES

19-10. General

a. Heat Injuries. Heat injuries are frequently preventable conditions. Prevention depends on the availability and consumption of adequate amounts of water, acclimatization, and protection from undue heat exposure. A soldier's ability to function in a hot climate will depend largely on factors such as general health, age, acclimatization, obesity (being overweight), and use of drugs or alcohol.

(1) A general preventive measure is to drink sufficient amounts of liquids and replace body salt lost through perspiration. Instruction to individuals on how to live and work (or fight) in hot climates will also contribute to the prevention of heat injuries. Heat injuries can be fatal if not treated promptly and correctly. The availability of sufficient water during

training or combat operations in hot weather is very important. Perspiration can cause the loss of more than a quart (480 cc's) of body fluids (water) in an hour. Since the body depends on water to help cool itself, lost fluids must be replaced immediately. The best way for soldiers to function in extreme hot climates is to drink water frequently. Individuals should not rely on thirst alone as an indicator for water replacement needs.

(2) Individuals who have suffered one heat injury are prone to suffer another one. A patient suffering from a heat injury should have recovered enough not to risk a recurrence before returning to duty. Other conditions which may increase heat stress and cause heat injury include infections, pyrexia (fever), a recent illness or injury, obesity, dehydration, exertion, heavy meals, and alcohol or drugs.

b. Diet. A balanced diet usually provides enough salt even in hot weather. However, when soldiers are on reducing or other special diets, salt may need to come from other sources. A special diet must be prescribed by a physician or dietitian to insure that it provides all essential requirements.

c. Clothing and Equipment. The types of clothing and equipment a soldier wears and the way he wears them also affect the body and acclimatization. Clothing protects the body from radiant heat but excessive or tight-fitting clothing, web equipment, and packs reduce the ventilation needed to cool the body. During periods of inactivity when such items are not needed, they should be removed, mission permitting.

19-11. Category of Heat Injuries

The categories of heat injuries are—

- Heat cramps.
- Heat exhaustion.
- Heat stroke.

19-12. Heat Cramps

Heat cramps are caused by an excessive loss of salt in the body. Salt imbalance causes changes in nerve impulses to muscles which, in turn, cause spasms and the inability of muscles to relax. After prolonged exertion in hot weather, the signs and symptoms of heat cramps will appear in the arms, legs, and/or stomach.

a. The signs and symptoms of heat cramps.

- The patient is experiencing muscle cramps of his extremities and/or abdomen after prolonged exertion in hot weather. He grasps or massages the affected arm or leg, or bends over at the waist (indicating cramps of the abdomen).
- The patient is pale and has wet skin.
- He is experiencing dizziness and extreme thirst.

b. Treatment for heat cramps.

(1) Have individual drink 250 cc's (1/4 canteen) of water.

(2) Administer one canteen of water with ¼ teaspoon of table (C-ration packet) salt added. Have the patient drink the canteen of salt solution over a 30-minute period.

CAUTION

Do not give the patient salt water if he is nauseated. Have him drink a canteen of unsalted water.

(3) If conditions permit, move the patient to a shaded area.

(4) Have him sit or lie in a comfortable position.

(5) Loosen all tight-fitting clothing.

(6) Allow him to rest until cramps have subsided.

c. Record the treatment given if he is being evacuated.

d. Evacuate the patient to an MTF if cramping symptoms persist.

19-13. Heat Exhaustion

Heat exhaustion is caused by dehydration and loss of body salt. It is basically a hypovolemic problem (an abnormal decrease in the volume of circulating fluid (plasma) in the body).

a. Signs and symptoms of heat exhaustion.

- The patient feels dizzy, weak, and/or faint.
- His skin feels cool and moist to the touch.
- He may feel nauseous (sick to his stomach) or may have a headache.

b. Treatment for heat exhaustion.

(1) Have the patient drink one canteen of water to relieve the symptoms.

(2) If he complains of cramps, give him one canteen of water with ¼ teaspoon of table salt added. Have him drink the canteen of salt solution over a 30-minute period.

CAUTION

Do not administer salt if the patient is nauseated. Have him drink a canteen of unsalted water.

NOTE

If the patient is unable to drink water due to nausea and/or if symptoms have not improved within 20 minutes after liquids have been given orally, then he must be evacuated to an MTF.

(3) If conditions permit, move the patient to a shaded area. Have him lie in a comfortable, supine (flat on his back) position.

(4) Loosen all tight-fitting clothing.

(5) Elevate his feet above the level of his heart. If a litter is available, have the patient lie on the litter in a supine position and elevate the foot of the litter.

c. Record the treatment given if the patient is being evacuated.

d. Evacuate the patient to the nearest MTF if symptoms persist.

19-14. Heat Stroke

Heat stroke (hyperthermia) is a MEDICAL EMERGENCY caused by failure of the heat-regulating mechanism of the body. Persons who are not acclimatized to heat, the elderly, and those with cardiovascular (heart and blood vessel) problems are particularly vulnerable. Also, obesity, dehydration, excessive use of alcohol or drugs, poor health, and the lack of sleep contribute to the possibility of hyperthermia.

a. Signs and symptoms of heat stroke.

- The patient may have a headache and visual disturbance (impaired vision).

- He may have a high fever (elevated temperature) and will not be sweating (skin may appear dry). His skin will appear abnormally hot to the touch.

NOTE

Oral temperature may range up to 105°F (40°C) or higher and the rectal temperature may range up to 107°F (42°C) or higher.

- His pulse may be rapid or irregular.

- The patient may have muscle cramps and convulsions.

- The patient may feel dizzy or nauseated.

- The patient may be unconscious.

b. Treatment (emergency management) for heat stroke. Reduce the body temperature to 102°F (39°C) as quickly as possible, using one or more of the methods indicated below.

CAUTION

If individual is unconscious, insure that he has adequate respiration (open the airway) and adequate circulation. Also, insure that the patient has not gone into shock. If necessary, initiate treatment for shock.

● *First Method.* If a thermometer is available, immerse patient in cool water (including torso, trunk, and extremities). While patient is immersed, massage his arms and legs (extremities). Massaging allows skin capillaries to dilate and transmit a cooling effect.

CAUTION

It is vital to determine when the patient's temperature cools to 102°F (39°C). When this happens, he must then be taken out of the water immediately. Once the patient's temperature falls to 102°F, it will drop even more rapidly if he is left immersed and worsen his condition.

● *Second Method.* If no thermometer is available, immerse only the patient's trunk in the cool water. Be careful not to overcool him, as this would cause the patient's temperature to go to the other extreme (below 98.6°F (37°C). Massage the patient while immersed in cool water to help skin (capillaries) transmit cooling effect.

● *Third Method.* If facilities are not available for immersing the patient, pour cool water over the patient or sponge him liberally, then fan him to permit the cooling effect of evaporation.

c. Record the treatment given.

d. Evacuate the patient to an MTF as soon as possible for definitive treatment. If available, place ice bags at the sides of the patient's neck and under his armpits while transporting to the MTF.

Section IV. COLD INJURIES

19-15. General

a. Cold weather operations pose a particular threat to the combat soldier since it is possible for him to sustain a serious injury unrelated to combat or training.

b. Cold injuries to the body can occur when an individual is exposed for prolonged periods to temperatures at or below 50°F, or to extreme cold for shorter periods.

c. Such exposure can cause surface tissue damage or it can cause generalized body chilling which can result in death.

d. Specific preventive measures are directed toward conserving total body heat and avoiding prolonged exposure to cold and moisture. Regular water intake is especially necessary in cold weather to avoid dehydration.

e. The medical specialist must be able to recognize the signs and symptoms of all forms of cold injury. While some injuries are superficial and not serious enough to require evacuation, others can cause permanent injury or death. The windchill chart (Table 19-1) will help you to judge the severity of the environment. Some weather conditions require reducing the exposure time of individuals engaged in patrols, guard duty, or motor movement in unheated vehicles despite the adequacy of clothing and equipment. These possible conditions can frequently be anticipated by the use of meteorological data and existing weather conditions to predict the hazard for the following 12-hour period.

Table 19-1. Windchill Chart

Wind speed (MPH)	LOCAL TEMPERATURE (°F) 32	23	14	5	-4	-13	-22	-21	-40	-49	-58
	EQUIVALENT TEMPERATURE (°F)										
CALM	32	23	14	5	-4	-13	-22	-31	-40	-49	-58
5	29	20	10	1	-9	-18	-28	-37	-47	-56	-65
10	18	7	-4	-15	-26	-37	-48	-59	-70	-81	-91
15	13	-1	-13	-25	-7	-49	-61	-73	-85	-97	-109
20	7	-6	-19	-32	-44	-57	-70	-83	-96	-109	-121
25	3	-10	-24	-37	-50	-64	-77	-90	-104	-117	-117
30	1	-13	-27	-41	-54	-68	-82	-97	-109	-123	-137
35	-1	-15	-29	-43	-57	-71	-85	-99	-113	-127	-142
40	-3	-17	-31	-45	-59	-74	-87	-102	-116	-131	-145
45	-3	-18	-32	-46	-61	-75	-89	-104	-118	-132	-147
50	-4	-18	-33	-47	-62	-76	-91	-105	-120	-134	-148
	LITTLE DANGER FOR PROPERLY CLOTHED PERSONS		CONSIDERABLE DANGER					VERY GREAT DANGER			
	DANGER FROM FREEZING OF EXPOSED FLESH										

19-16. Chilblain

Chilblain results from repeated prolonged exposure of bare skin to temperatures from 60°F (16°C), down to 32°F (0°C), for acclimated, dry unwashed skin. It is usually not serious enough to require evacuation.

a. Signs and Symptoms of Chilblain.

- Skin becomes acutely red, swollen, hot, tender, and/or itching.
- Bleeding lesions may surface from continued exposure.

CAUTION

Continued exposure may lead to ulcerative (surface) or hemorrhagic (bleeding) lesions. Lesions are sores that occur where layers of skin have broken down.

b. Treatment for Chilblain.

(1) Within minutes rewarm the affected part of the body.

- **FACE.** Cover the affected area of face with warm hands until feeling/sensation returns.

- **HANDS.** Have the patient place his bare hands next to the skin in the opposite armpit.

- **FEET.** In the most sheltered area available, place the bare feet under the clothing and against the abdomen of another soldier.

(2) Protect lesions with a field dressing. Do not apply ointments because the moisture will cause further skin breakdown in a cold environment.

c. Record the Treatment Given.

d. Evacuate the Patient. Evacuate all persons with cold injuries to an MTF.

19-17. Frostbite

Frostbite results when tissues exposed to temperatures below 32°F (0°C) freeze. The degree of injury depends upon the windchill factor, duration of exposure, and adequacy of protection. Individuals with a history of cold injury are prone to repeated episodes. A sudden blanching of the skin occurs in the nose, ears, cheeks, face, fingers, or toes, followed by a momentary tingling sensation. When the face, hands, or feet stop hurting, look for frostbite. Frostbite is divided into two categories:

- Superficial.

- Deep.

a. Signs and Symptoms of Superficial Frostbite. The most commonly affected areas are the hands, feet, ears, and exposed areas of the face.

- Redness, followed by powdery flaking of the skin. Affected areas of dark-skinned persons may appear dull and grayish.

- Blister formations 24 to 36 hours after exposure, followed by flaking of superficial skin in large sheets.

b. Signs and Symptoms of Deep Frostbite.

- Lack of pain or loss of feeling in the affected area.

- When the frostbitten area thaws, it is painless, pale yellow, and waxy-looking.

- Frozen tissue may feel solid or "wooden" to the touch, but not brittle.

- When exposed to inside temperatures, the skin surface collects drops of moisture. Unless rewarming is rapid, blisters appear in 12 to 36 hours.

- Discoloration (red-violet) appears suddenly 1 to 5 days after the injury.

- Gangrene usually results when the patient does not receive proper treatment.

c. Treatment for Frostbite.

(1) Determine whether the frostbite is superficial or deep and treat accordingly.

- If the exposure time was short, the frostbite will probably be superficial.

- If the exposure time was for a longer duration, the frostbite will probably be deep.

NOTE

Do not rub the frostbitten area with snow or apply cold water soaks, or rewarm the affected area by massaging or exposing it to open fire.

(2) Move the casualty to a warm and sheltered area.

(3) Rewarm the face, nose, or ears by placing your hands on the frozen area.

(4) Rewarm frostbitten hands by placing them under clothing and against the body. Close the clothing to prevent further loss of body heat.

(5) Rewarm the feet by removing the boots and socks. Place the bare feet under the clothing and against the abdomen of a buddy. Once the feet are warmed, put on dry socks and boots, if available. If the patient must wear the wet socks and boots, he should exercise his feet by wiggling his toes.

NOTE

1. If another soldier is unavailable, you may have to use your own body heat.
2. Identify multiple casualties by severity of cold injury and determine whether the frostbite patient is in need of immediate care or can walk to the MTF.

(6) Loosen constricting clothing and remove jewelry. Loose layers of clothing are effective insulators. Air is trapped between layers of clothing and is warmed by the body.

(7) Increase insulation and exercise.

NOTE

Do not allow patient to use alcohol or tobacco. Alcohol increases loss of body heat; tobacco causes constriction of blood vessels in the extremities.

(8) Reassure the patient.

(9) Protect frozen tissue from further cold or trauma.

(10) Deep frostbite—occurs most seriously in the feet and less common in the hands and ears.

(a) Move the patient to a sheltered area.

(b) Immediately make arrangements to get the patient to an MTF.

CAUTION

Avoid thawing if it is possible that the injury may refreeze before reaching the MTF.

(c) If possible, do not let the patient walk if his feet are frozen.

(d) Avoid treating or thawing the affected area.

d. Record the Treatment Given.

e. Evacuate the Patient.

19-18. Hypothermia

Hypothermia is whole body cooling, with core body temperature (temperature measured centrally from within the rectum) below 95°F (35°C). Hypothermia is a MEDICAL EMERGENCY. Predisposing factors of hypothermia are fatigue, poor physical conditioning, dehydration, faulty blood circulation, alcohol or other drug intoxication, trauma, and immersion. Hypothermia may be accompanied by varying degrees of frostbite.

a. Signs and Symptoms of Hypothermia.

- Shallow or absence of respiration.
- Faint or unpalpable peripheral (apical) pulse.
- Patient is at first cold, then stops shivering.

- Loss of sensation or feeling.

- Sluggish or absence of pupillary reflexes.

- Mental disorientation, withdrawn appearance, depressed mood, uncoordinated movements, and/or slurred speech. Listlessness, indifference, and/or glassy stare are also good clues.

b. Treatment for Hypothermia.

(1) Determine the patient's level of consciousness.

CAUTION

Dangers exist from cardiac arrhythmia and shock. Cardiac arrhythmia may occur when the heart reaches a low temperature.

(2) Move the patient to a sheltered area to prevent further heat loss.

(3) Replace the patient's wet clothing with dry clothing, blankets, or sleeping bags. Provide heat by using a hot water bottle, electric blanket, campfire, or your own body heat. The most effective method, if available, is to immerse the patient's torso (not the limbs) in a tub of warm water (105°F (42°C) to 110°F (44°C)).

CAUTION

The patient is unable to generate his own body heat. Therefore, merely placing him in a blanket or sleeping bag is not sufficient.

(4) Provide the patient with something warm/hot and nutritious to drink. Calories may be added by using sugar or glucose tablets in hot, sweet drinks.

NOTE

Hypothermia patients have revived after as long as 30 minutes of immersion in cold water.

c. Record the Treatment Given.

d. Evacuate the Patient to the Nearest MTF.

19-19. Immersion and Trench Foot

a. Immersion foot is an injury sustained as a result of prolonged exposure (usually in excess of 12 hours) in water at temperatures usually below 50°F (10°C). It is not limited to the feet, but may involve other areas following immersion. Exposure for several days in water at 70°F (21°C) at tropical latitudes has produced severe injury.

b. Trench foot is an injury sustained as the result of exposure to cold and wet conditions, short of freezing. The average duration of exposure resulting in trench foot is 3 days.

c. The signs and symptoms of immersion foot or trench foot can be divided into three phases·

- The anesthetic phase, with loss of pain sensation and a weak pulse in the injury area.

- The reactive hyperemic phase, in which the limbs feel hot and as if burning with shooting pains.

- The vasospastic phase, in which the blood vessels contract, causing a decreased pulse and skin discoloration.

- Blisters, swelling, redness, skin surface heat, hemorrhage, and gangrene may develop in any phase.

d. Treatment for immersion foot/trench foot.

(1) Gradually rewarm the affected area by exposure to warm air. NEVER MASSAGE THE SKIN.

NOTE

Avoid extreme heat and ice application. In a field environment, warm air from a heated source may not be available. Rewarm as for a frostbite casualty.

(2) Dry the affected area immediately.

(3) Protect the affected area from trauma and secondary infections. Dry, loose clothing or several layers of warm coverings are preferable to heat.

(4) Elevate the affected parts. (This aids in reducing the amount of edema fluid.)

e. Record the treatment given.

f. Evacuate the patient to an MTF as soon as possible.

19-20. Snow Blindness

a. Snow blindness occurs when the ultraviolet rays of the sun are reflected from a snow covered surface. This condition can occur even in cloudy weather. In fact, it is more likely to occur in hazy, cloudy weather than when the sun is shining.

b. Signs and symptoms of snow blindness.

- The patient experiences a scratchy feeling in his eyelids. It may feel as if he has sand in his eyes.
- Observe his eyes for redness and watering.
- Ask him if he has a headache.

c. Treatment for snow blindness.

(1) Blindfold the patient using a dark cloth. If the patient has not developed a severe case of snow blindness, an emergency pair of sunglasses (Figure 19-3) may be made from a thin piece of wood or cardboard the width of the face. Cut slits for the eyes and attach strings to hold the improvised glasses in place.

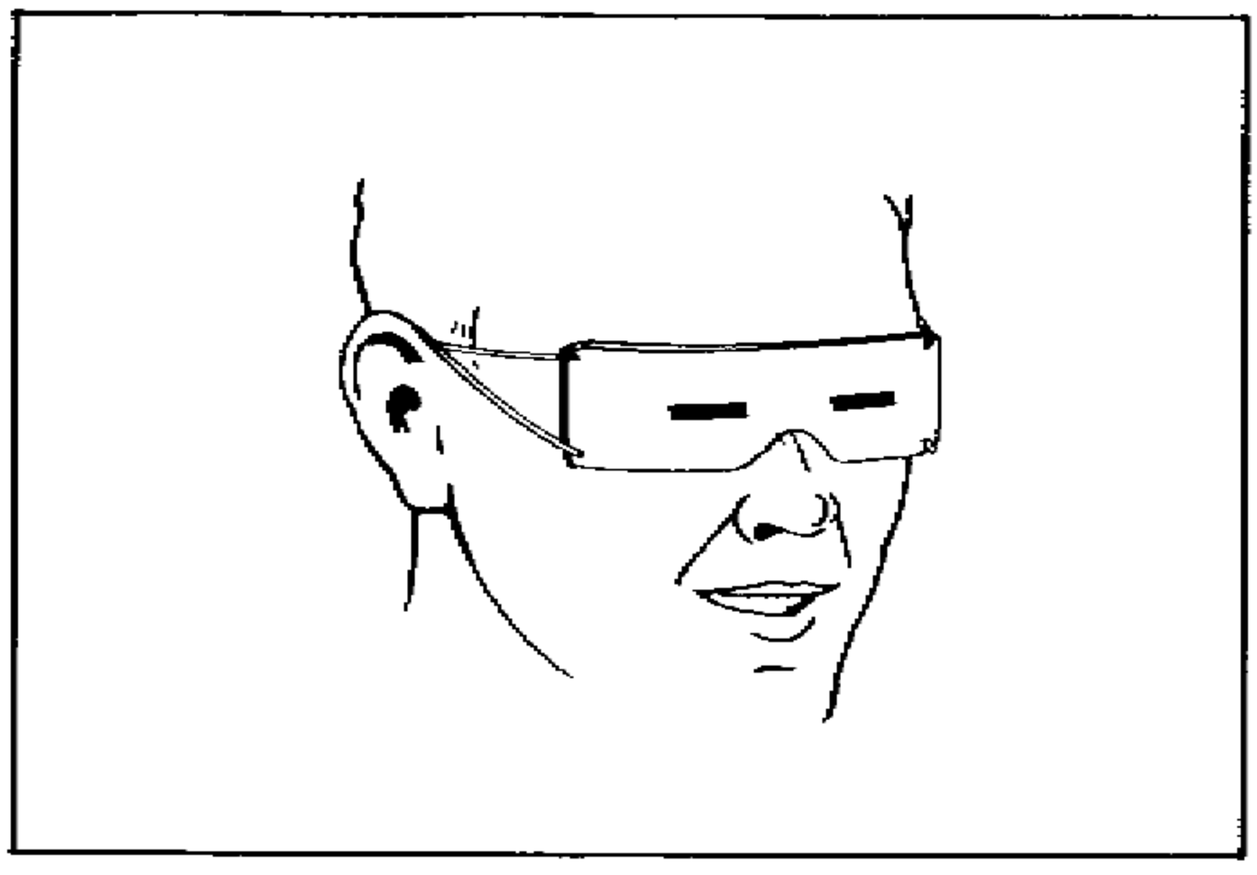


Figure 19-3. Improvised sunglasses.

(2) Reassure the patient.

d. Record the treatment given if evacuation is necessary.

e. Evacuate the patient to an MTF, if necessary.

Section V. BITES AND STINGS

19-21. General

In the Continental United States, insect bites and stings from venomous arthropods may result in severe reactions and can cause death. Arthropods most frequently reported as responsible for bites and stings are wasps, bees, ants, spiders, and scorpions. In certain geographical locations in CONUS, some arthropods have only seasonal importance while others are present throughout the year. Because of the potential for arthropod poisoning to humans, their identification, distribution, behavior, and control are important factors in the prevention of insect bites and stings.

19-22. Black Widow Spiders

a. The black widow spider (Figure 19-4) is easily identified by its jetblack color and the reddish hourglass-shaped figure found on the underside of its abdomen. This spider is found in grass, shrubs, rock piles, latrines, and similar locations. The black widow spider prefers to remain hidden and is generally nonagressive; however, if molested, it will bite.

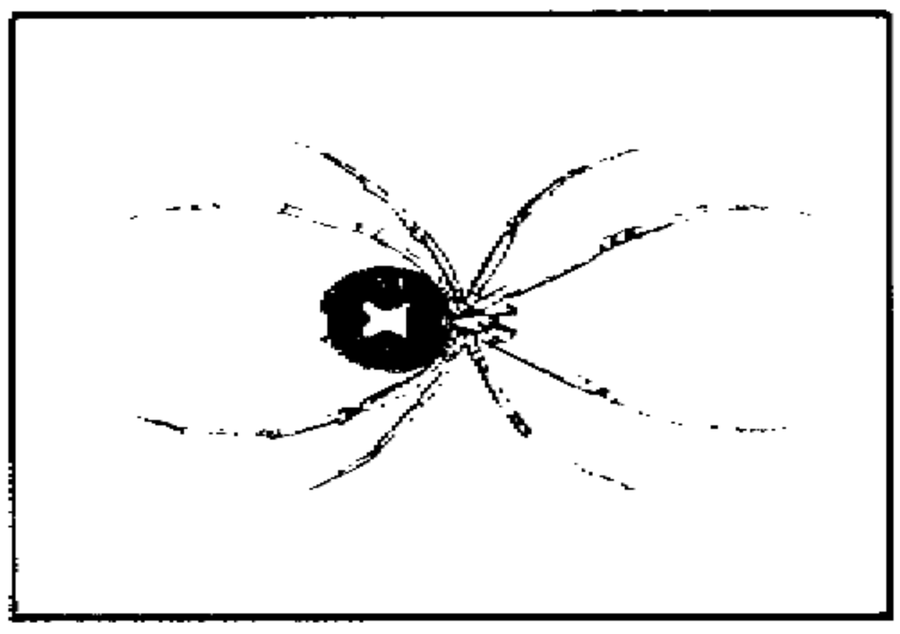


Figure 19-4. Black widow spider.

b. Signs and symptoms of a black widow spider bite.

- A dull, numbing pain at the bite site.
- Two red puncture marks with only a slight, local topical reaction.
- Severe muscular pain and spasms. The pain peaks in 1 to 3 hours and persists for 12 to 48 hours.
- Profuse sweating.
- Nausea.
- Rigid and boardlike abdomen with pain.
- Tightness in the chest with pain during inhalation.
- Possible convulsions, paralysis, or signs of shock.

c. Treatment for a black widow spider bite.

(1) Expose bite area by—

(a) Removing clothing and/or shoes to the extent necessary to expose the bite area.

(b) Removing jewelry as soon as possible to prevent restricting circulation as swelling (edema) occurs. If the jewelry cannot be removed because of swelling, place ice locally to reduce or prevent further swelling.

(c) Jewelry should be given to the patient, placed in his pocket, or otherwise protected/secured.

(2) Ask the patient if he can identify what bit him.

(3) Do not apply a tourniquet or attempt to remove the venom by incision or suction.

(4) Keep patient quiet and warm.

(5) Cleanse the bite area.

(6) Apply ice to the bite area, if available. Ice relieves pain and swelling and slows down circulation, restricting the spread of the venom.

(7) Monitor vital signs.

(8) Treat for anaphylactic shock, if necessary.

d. Record the treatment given.

e. Evacuate the patient to the nearest MTF.

19-23. Brown Recluse Spiders

a. The recluse spider (Figure 19-5) is about 3/8 inches long and is differentiated from other brown spiders by a dark brown violin shaped area on its back. This spider is found primarily in grass and weed shelters, around rocky bluffs, and in rock piles. It sometimes seeks refuge in blankets, bedrolls, shoes, clothing, or wadded-up paper. The brown recluse spider prefers to remain hidden and is generally nonaggressive; however, when molested, it will bite.

b. Signs and symptoms of a brown recluse spider bite.

- Mild to severe pain at the bite site. This usually occurs 1 to 8 hours after the bite, as there is little (if any) immediate pain.

- Redness at the bite site.

- Star-shaped, firm area of deep purple color at the bite site (usually 3 to 4 days following the bite).

- A central area of depression and ulceration (usually 7 to 14 days following the bite).

- Chills, nausea, and vomiting.

- Scar formation which follows approximately 21 days after the bite.

c. Treatment for a brown recluse spider bite.

(1) Calm the patient with reassuring words.

(2) Clean the bite site.

(3) Monitor the patient's vital signs.

d. Record the treatment given.

e. Evacuate the patient to the nearest MTF.

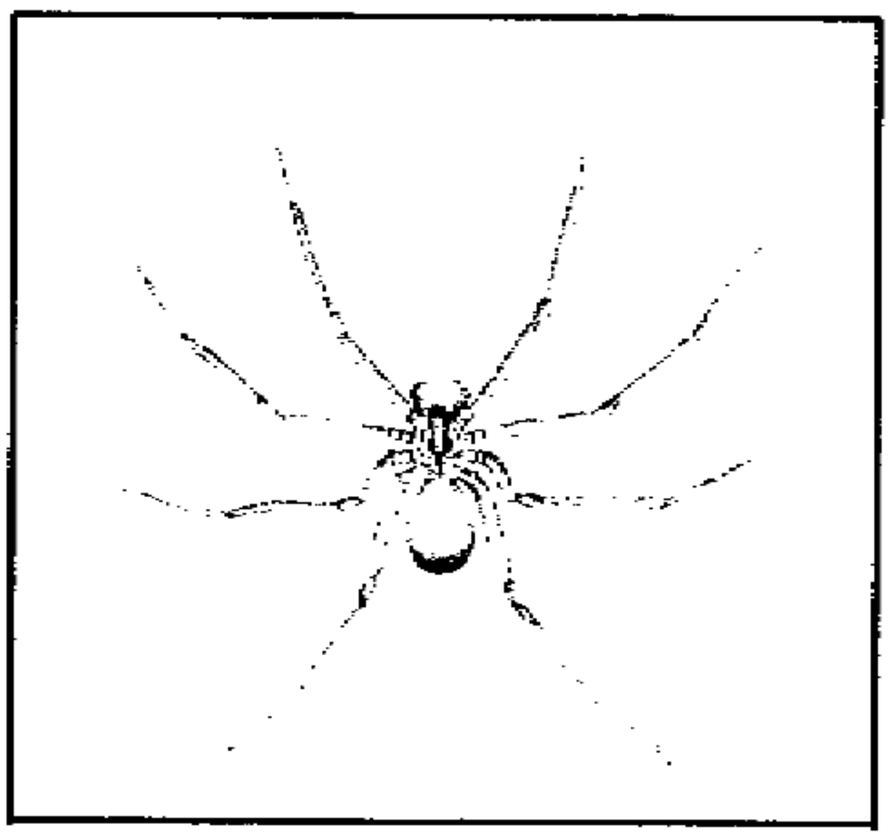


Figure 19-5. Brown recluse spider.

19-24. Scorpions

a. Scorpions are easily recognized by their crablike appearance with a long, segmented tail which ends in a sharp spine or stinger (Figure 19-6). Scorpions are most commonly found in warm climates. They prefer damp locations and are particularly active during the night. Most scorpions found in the US are capable of only causing painful stings.

b. Signs and symptoms of scorpion stings.

- Severe pain at the sting site.

- Burning sensation at the sting site.

- Local swelling and discoloration at the sting site.

NOTE

The above symptoms are characteristic of the harmless species of scorpions.

- Other signs and symptoms of the deadly species are—
  - o "Pins and needles" sensation at the sting site.
  - o Impaired speech and drowsiness.
  - o Nose, mouth, and throat itching.
  - o Generalized/localized muscle spasms.
  - o Respiratory distress.

NOTE

Scorpion stings of the deadly species normally do not cause swelling or discoloration.

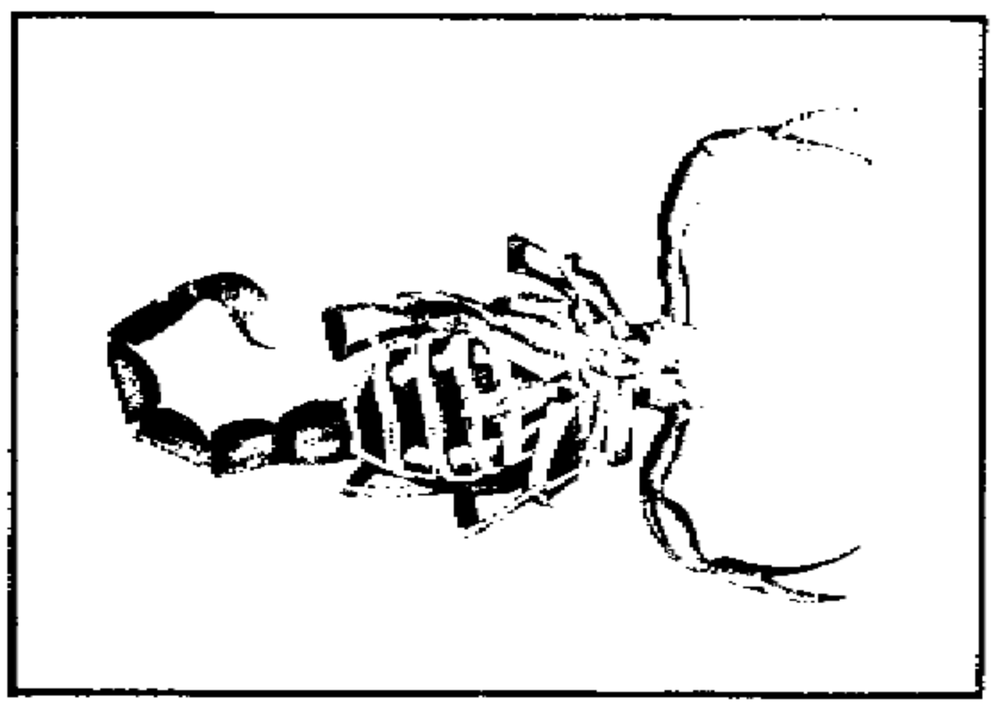


Figure 19-6. Scorpion.

c. Treatment for a scorpion sting.

NOTE

If a person is stung by a scorpion on the face, neck, or genital organs, he should be treated immediately by a medical officer.

(1) Immobilize the patient. Apply a constricting band proximal to the sting site. The band is sufficiently tight when one finger can be inserted between the band and the body part.

(2) Pack the area with ice and extend it beyond the constricting band. This is done to restrict venous flow but not to stop arterial flow.

(3) Remove the constricting band after 5 minutes.

(4) Monitor the patient's vital signs.

d. Record the treatment given.

e. Evacuate the patient to the nearest MTF, if necessary.

19-25. Bees, Wasps, Hornets, and Yellow Jackets

a. The bee has a characteristic rounded abdomen. When it stings, its stinger remains in the victim. The bee will fly away and die. On the other hand, a wasp, hornet, or yellow jacket has a slender, elongated body and retains its stinger and can sting repeatedly (Figure 19-7).

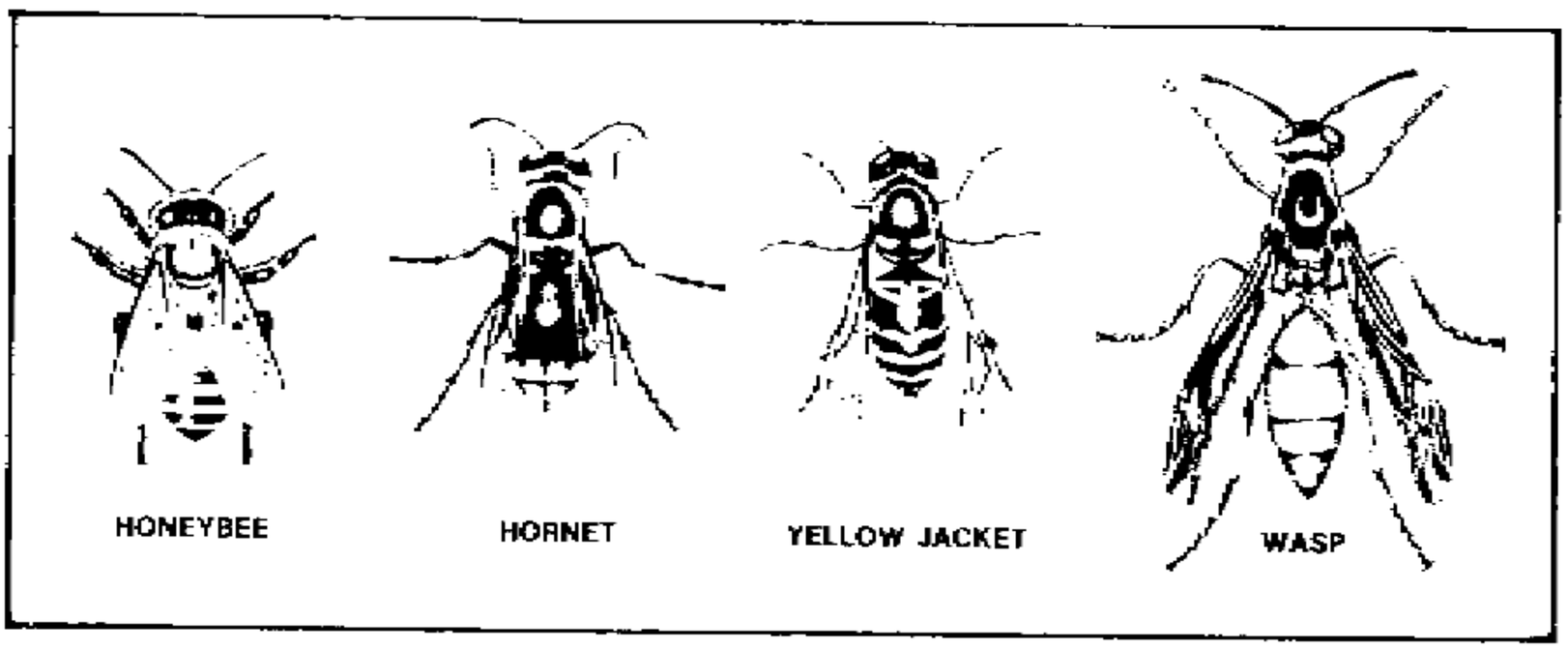


Figure 19-7. Bee, hornet, yellow jacket, and wasp.

b. Signs and symptoms of bee, wasp, hornet, and yellow jacket stings.

- Pain at the sting site.
- Development of a wheal and redness at the sting site. Intense swelling may develop in the area of the sting.
- Itching and anxiety indicate a mild reaction.
- Wheezing, vomiting, dizziness, abdominal pain, tightness in the chest, or generalized edema. Any of these signs/symptoms indicate a moderate reaction which usually appears within 20 minutes.
- Labored breathing, difficulty in swallowing, and confusion indicate a severe reaction.
- Shock. If present, immediately initiate treatment for anaphylactic shock.

c. Treatment for bee, wasp, hornet, and yellow jacket stings.

(1) Remove the stinger from the sting site (bee stings), by gently scraping it with the fingernail, a knife blade, or a thin metal object. (Removal prevents further venom injection from the venom sac.) Do not jerk the stinger out as this action releases more venom.

(2) Wash the sting site with soap and water.

(3) Apply an ice pack or a solution of 10 percent ammonia.

(4) Treat for shock, if necessary.

d. Record the treatment given.

e. Evacuate the patient to the nearest MTF, if necessary.

19-26. Fire Ants

a. The fire ant was brought into the United States from South America in earth used as buoyance in cargo ships. They were first found in the Mobile, Alabama area. Since there are no natural enemies to this insect in the United States, they have invaded all of the Gulf Coast States.

b. Signs and symptoms of fire ant bites.

- Severe burning pain at the bite site.
- Wheal formation. The wheal will usually last a few minutes.
- A clear, fluid-filled bubble at the bite site. This bubble usually forms within minutes of the bite.
- A cloudy, fluid-filled bubble at the bite site. This bubble usually appears 2 to 4 hours after the bite.
- A bubble with a red base. This bubble usually appears 8 to 10 hours after the bite.
- Tenderness at the bite site.
- A lesion at the bite site. The lesion usually appears 3 to 8 days after the bite and may leave a scar.

c. Treatment for fire ant bites.

(1) Wash the bite site with soap and water.

(2) Apply an ice pack or cold compress to the bite site.

(3) Treat for anaphylactic shock, if necessary.

d. Record the treatment given.

e. Evacuate the patient to the nearest MTF, if necessary.

19-27. Ticks

a. Ticks are common in woods and fields throughout the United States. They are divided into two groups: the hard ticks and the soft ticks. The hard tick has a hard shield on its back, and its mouth parts can be seen from above (Figure 19-8). The soft tick does not have a hard shield on its back, and its mouth parts cannot be seen from above (Figure 19-9).

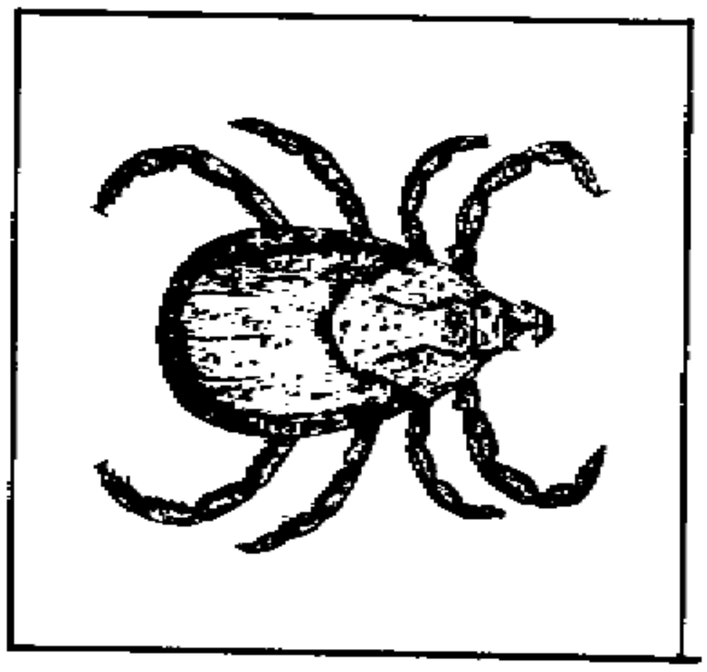


Figure 19-8. Hard ticks.

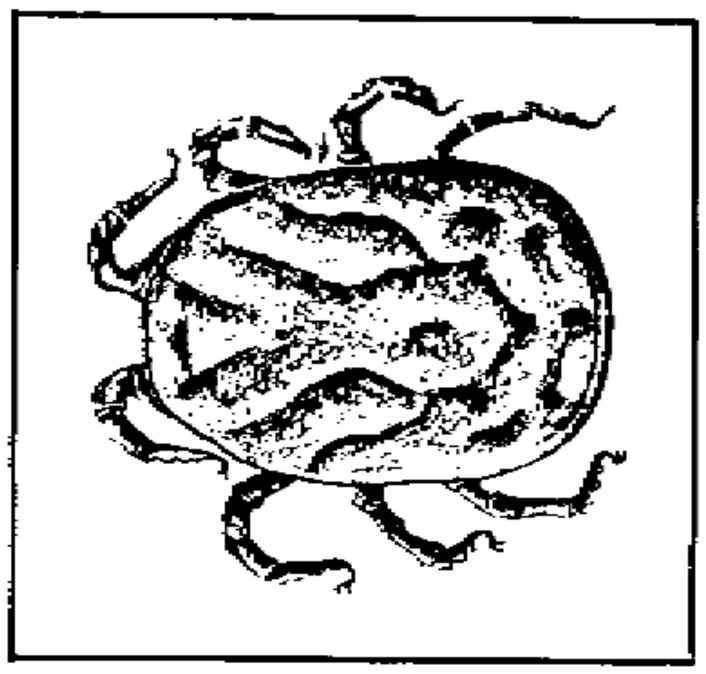


Figure 19-9. Soft ticks.

b. Signs and symptoms of tick bites.

- Tick with mouth parts inbedded in patient's skin.
- Itching and/or redness at the bite site, tick already removed.
- Pain in patient's arms or legs.

NOTE

After several days, the patient may develop tick paralysis which could result in respiratory failure.

- Breathing difficulties a few days following the tick bite.

CAUTION

Some species of ticks transmit Rocky Mountain Spotted Fever which may appear 3 to 12 days after the bite.

c. Treatment for tick bites.

(1) Perform rescue breathing immediately if breathing difficulties are present.

(2) Remove the tick by—

(a) Soaking a tissue/gauze pad with mineral, salad, or machine oil, or alcohol and covering the tick (at the bite site). This blocks the tick's breathing pores, causing it to withdraw.

(b) If the tick does not disengage after ½ hour, remove it with tweezers or forceps. Grasp it as close to its mouth as possible. Do not grasp the tick's abdomen since germs may be injected into the patient by the pressure.

(3) Wash the bite site with soap and water.

d. Record the treatment given.

e. Evacuate the patient to the nearest MTF, if necessary.

19-28. Unknown/Nonspecific Insect Bites

a. Many insects not involved in disease transmission are medically important because of their bite or sting and cause concern by their presence.

b. Signs and symptoms of unknown/nonspecific insect bites.

- Breathing difficulties.
- Possible shock.
- Swelling at the bite site.
- Pain at the bite site.

c. Treatment for unknown/nonspecific insect bites.

(1) Perform rescue breathing, if necessary.

(2) Perform anaphylactic shock treatment, if necessary.

(3) Wash the bite site with soap and water.

(4) Apply an ice pack or cold compress to the bite site.

(5) Monitor the patient's vital signs.

d. Record the treatment given.

e. Evacuate the patient who shows signs of respiratory distress and/or shock and who is not responding to initial treatment given.

19-29. Types of Snakes

a. Except for a few species in Southeast Asia and Africa, snakes are shy and will usually avoid contact with humans unless injured, trapped, or disturbed. However, both poisonous and nonpoisonous snakes show some

agressiveness during their breeding periods. All species of snakes can swim and many are able to stay under water for long periods without drowning. Snakebites sustained in water are as dangerous as those sustained on dry land.

b. Nonpoisonous snakes (Figure 19-10) have four to six rows of teeth and do not have fangs.

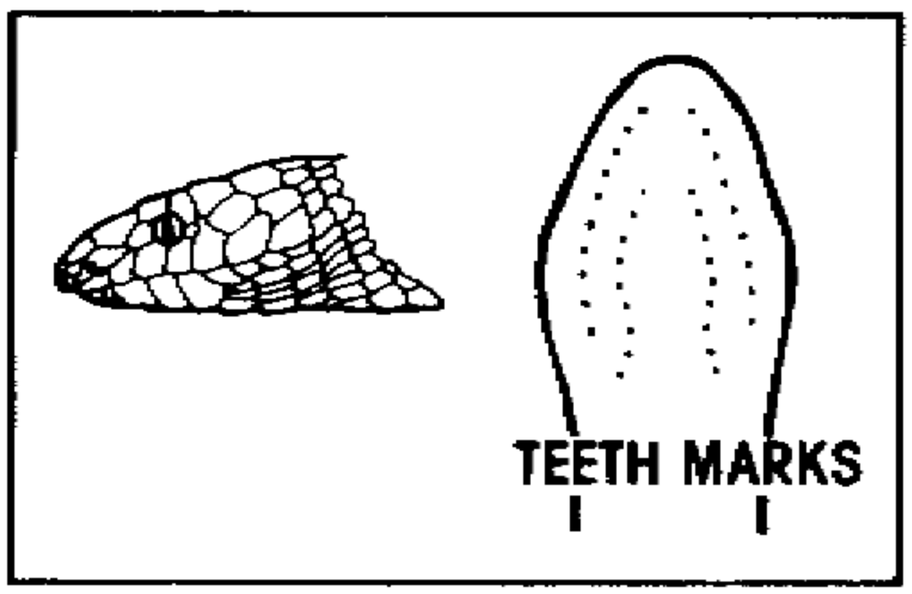


Figure 19-10. Tooth marks of nonpoisonous snakes.

c. Poisonous snakes include the pit vipers (rattlesnakes, water moccasins, and copperheads) and coral snakes.

(1) Pit vipers (Figure 19-11) have two rows of teeth and fangs that create puncture wounds.

(a) North American pit viper snakes are also characterized by vertical pupils, a flat triangular-shaped head distinct from the neck, and a deep pit between the eyes and nostrils.

(b) These snakes may be more than 5 feet in length, and all are capable of injecting hemotoxin venom. This venom can disintegrate red blood cells in humans and animals. The cottonmouth water moccasin can inject both hemotoxin and neurotoxin venom.

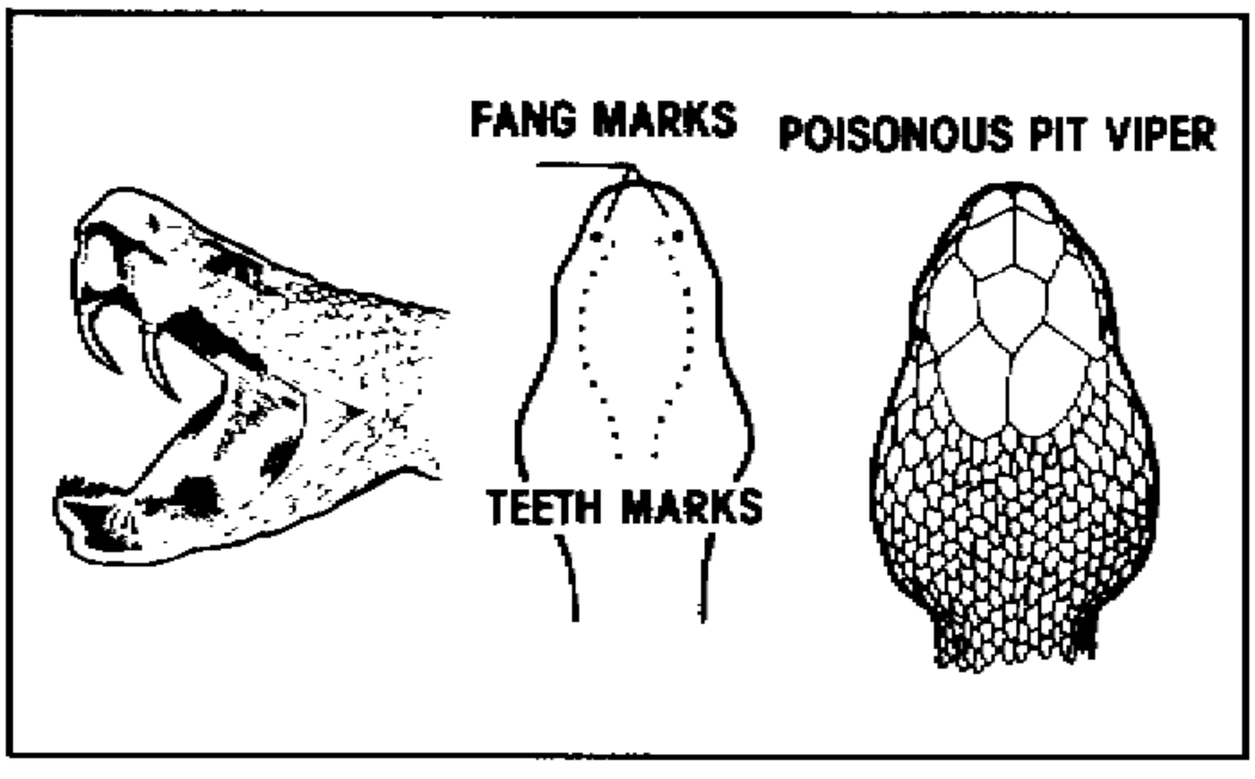


Figure 19-11. Fang marks of poisonous pit viper snakes.

(2) Coral snakes have different markings and colors, depending upon their variety. The average coral snake is usually less than 2 feet long with a body diameter of about ½ inch, and has short, rigid, grooved fangs. The Eastern coral, Texas coral, and Barber's coral have broad alternating bands of red and black separated by narrow bands of yellow circling their bodies in a regular pattern. These snakes have round pupils. The Sonora coral has broad alternating bands of red and black, separated by narrow white bands circling its body in a regular pattern. The coral snake venom is a neurotoxin (destroys nerve tissue).

d. Signs/symptoms of snakebites.

- Immediate pain.
- Progressive swelling at the bite site.
- General skin discoloration (bluish).
- Dizziness.
- Blurred vision.
- Hearing difficulty.
- Fever and/or chills.
- Severe headache.
- Vomiting and nausea.
- Breathing difficulty.

NOTES

1. The patient may exhibit one or all of the above signs/symptoms.

2. If the snake can be killed without risking another bite, it should be brought to the MTF for identification.

3. Some snakebite symptoms may not develop until 6 to 8 hours later.

e. Treatment for a nonpoisonous snakebite.

(1) Cleanse the bite area using soap and water or an antiseptic solution (such as iodine).

(2) If the patient does not have a current immunization, tetanus toxoid, refer him to an MTF for the immunization.

(3) Return the patient to duty.

NOTE

If the bite cannot be positively identified as nonpoisonous, treat it as a poisonous snakebite.

f. Treatment for a poisonous snakebite.

(1) Place the patient in a prone position (preferred).

(2) Keep him as calm as possible.

(3) Tell him not to move.

(4) Explain what you are doing.

(5) Tell him that evacuation will be accomplished as soon as possible.

(6) Expose the wound as necessary by removing patient's clothing, shoes, and jewelry.

(7) If the patient has been bitten on an extremity, keep the bitten part at or below the heart level to slow down the spread of the poison to the heart.

(8) Exercise caution regarding placement of the arm if the patient is being moved by a stretcher. If the bite is on the hand or arm, it may already be swelling and stretcher straps will increase the pressure and possibly cut off circulation.

CAUTION

Do not give the patient any medication containing alcohol or sedatives. While certain analgesics may decrease the pain, they may also increase the effects of the toxin. Do not allow the the patient to eat or smoke.

(9) Place constricting bands (Figure 19-12) one or two fingers' width above and below the bite site. These bands should be only tight enough to stop superficial venous and lymphatic circulation but not interfere with the arterial pulse. You should be able to insert one finger between the constricting bands and the skin with minimal pressure. If the bite is on the hand or foot, only one band should be placed above the ankle or the wrist (depending on the location of the bite).

(10) If swelling spreads, move the bands beyond the edges of the swelling.

(11) Cleanse the wound area, using soap and water or an antiseptic solution.

(12) DO NOT cut the wound.

(13) Place an ice bag or a chemical ice bag over the bite area, but not in direct contact with the skin. The ice bag should remain over the area until the patient reaches the MTF, but no longer than a few hours. Do not use dry ice, ethyl chloride, or wet ice brine. Be careful not to freeze the area or severe damage can result to the vascular structures and limbs. Only a cooling is to be attempted.

(14) Monitor the patient to prevent cold injury.

NOTES

1. If signs/symptoms of poisonous (envenomation) snakebite are present, and the snake has been identified, a medical specialist who is authorized to use and carry antivenin should administer it. However, this should be done only if you can positively identify the snake. Its use presents risks and only those with specialized training should attempt using the antivenin. Test the patient for sensitivity. The method of administration should follow package instructions. The medical specialist should also be able to deal with severe hypersensitivity reactions to the serum.

2. A possible complication is respiratory failure. If the patient stops breathing, perform rescue breathing. If there is no pulse, perform cardiopulmonary resuscitation (CPR).

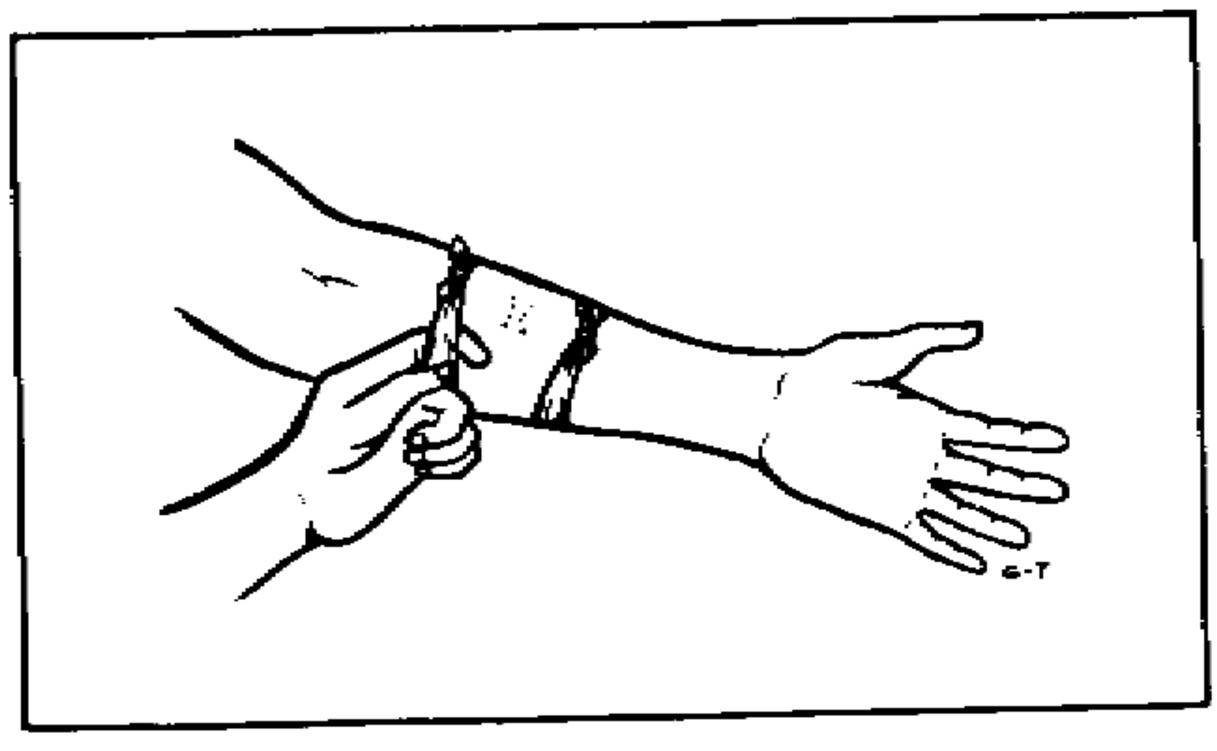


Figure 19-12. Placing constricting bands.

g. Record the treatment given.

h. Evacuate the poisonous snakebite patient to the nearest MTF.

Section VII. POISONOUS PLANTS

19-30. General

a. Contact poisoning is a skin eruption which is caused by direct or indirect contact with the sap (or juice) of poisonous plants. In the United States alone, several thousand cases of contact poisoning occur each year. The most common plants which cause these skin eruptions are poison ivy, poison oak, and poison sumac.

b. These skin eruptions can be prevented by learning how to identify poisonous plants and by taking the proper control measures.

(1) The skin eruptions first appear as redness and swelling accompanied by severe burning and itching.

(2) Blisters appear later.

c. Poisonous plants are most likely to exist in areas of dense vegetation. Poison ivy, poison oak, and poison sumac contain a sticky sap which has a toxic ingredient known as urushiol.

(1) Urushiol is contained in all parts of these plants and is even present in their dead stems and roots.

(2) Urushiol is the agent that causes the skin irritation. Contact with urushiol may also be made indirectly by touching urushiol-contaminated tools, weapons, clothing, and pets, and from another person having urushiol on the skin or clothing. Even smoke from plants that are burning contain droplets of urushiol which can get on the skin or enter the nose, throat, and lungs.

19-31. Preventive Measures for Poisonous Plant Injuries

a. Be able to identify the plants which cause contact poisoning.

b. Avoid selecting bivouac areas which are infected with poisonous plants.

c. Wear gloves and be fully clothed (with sleeves unrolled and buttoned and collar buttoned) when working in an area likely to have poisonous plants.

d. Wash all exposed skin areas with a strong soap solution or with alcohol if exposure to poisonous plants is known or suspected.

e. Use hot water and soap to wash all clothing and equipment known or suspected to be contaminated.

f. Burn poisonous plants on the DOWNWIND side of the bivouac or troop area to avoid contamination with the smoke which contains urushiol droplets.

CAUTION

Urushiol droplets contained in the smoke will cause internal swelling which could result in extreme breathing difficulty.

19-32. Treat Poisonous Plant Injuries

a. Recognize the poison ivy (Rhus radicans) plant (Figure 19-13).

(1) Poison ivy grows as a small plant, either vine, or shrub.

(2) It grows everywhere in the United States except California and parts of the adjacent states. Eastern oak leaf ivy is one of its varieties.

(3) The leaves of this plant always consist of three glossy leaflets.

(4) This plant may also be known as three-leaf ivy, poison creeper, climbing sumac, poison oak, and mercury.

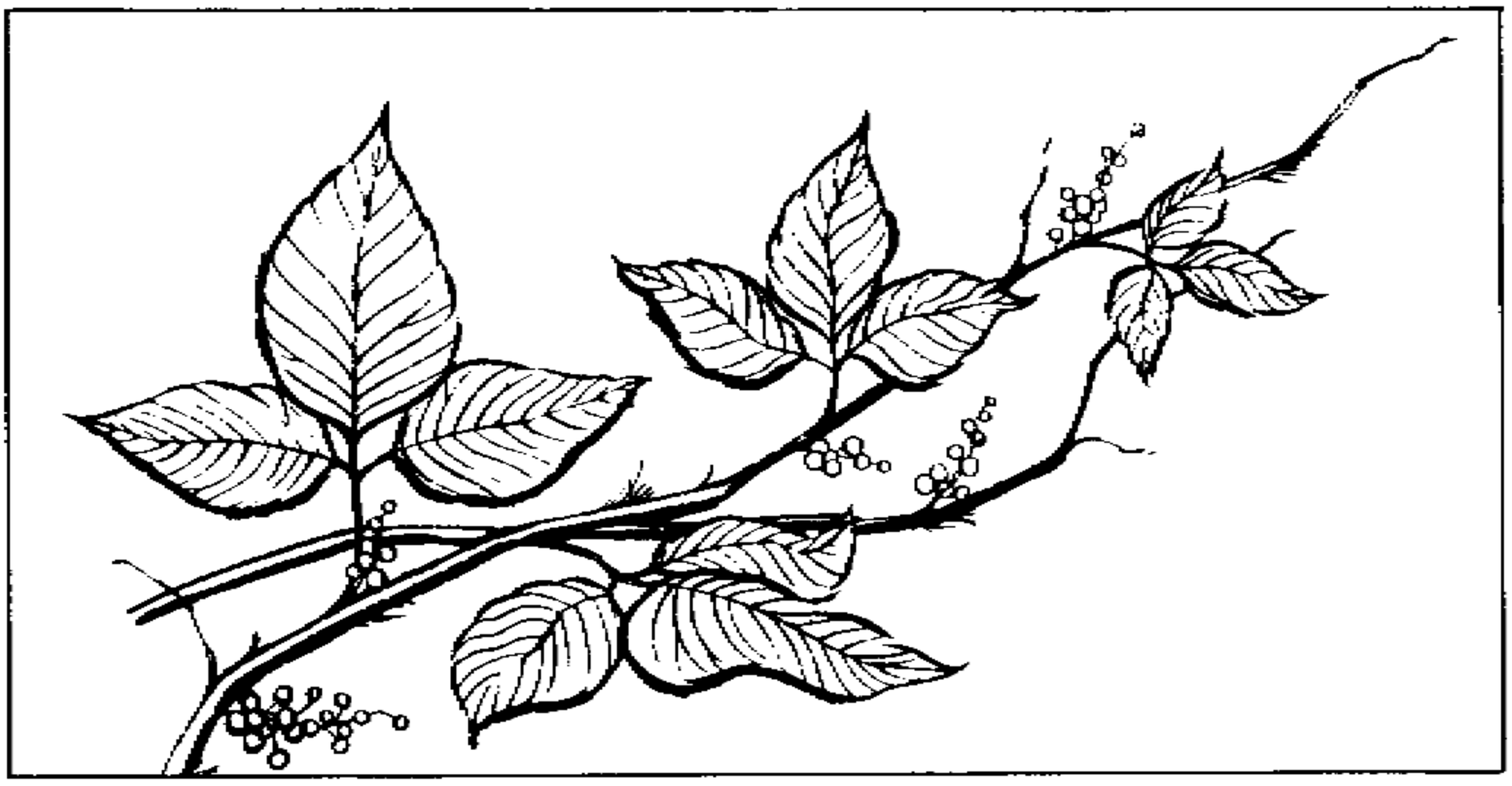


Figure 19-13. Poison ivy.

b. Recognize the poison oak (Rhus diversiloba) plant (Figure 19-14).

(1) Poison oak grows as a shrub and sometimes as a vine.

(2) It grows throughout the United States.

(3) It is sometimes called poison ivy.

(4) Its leaves always consist of three smaller leaflets.

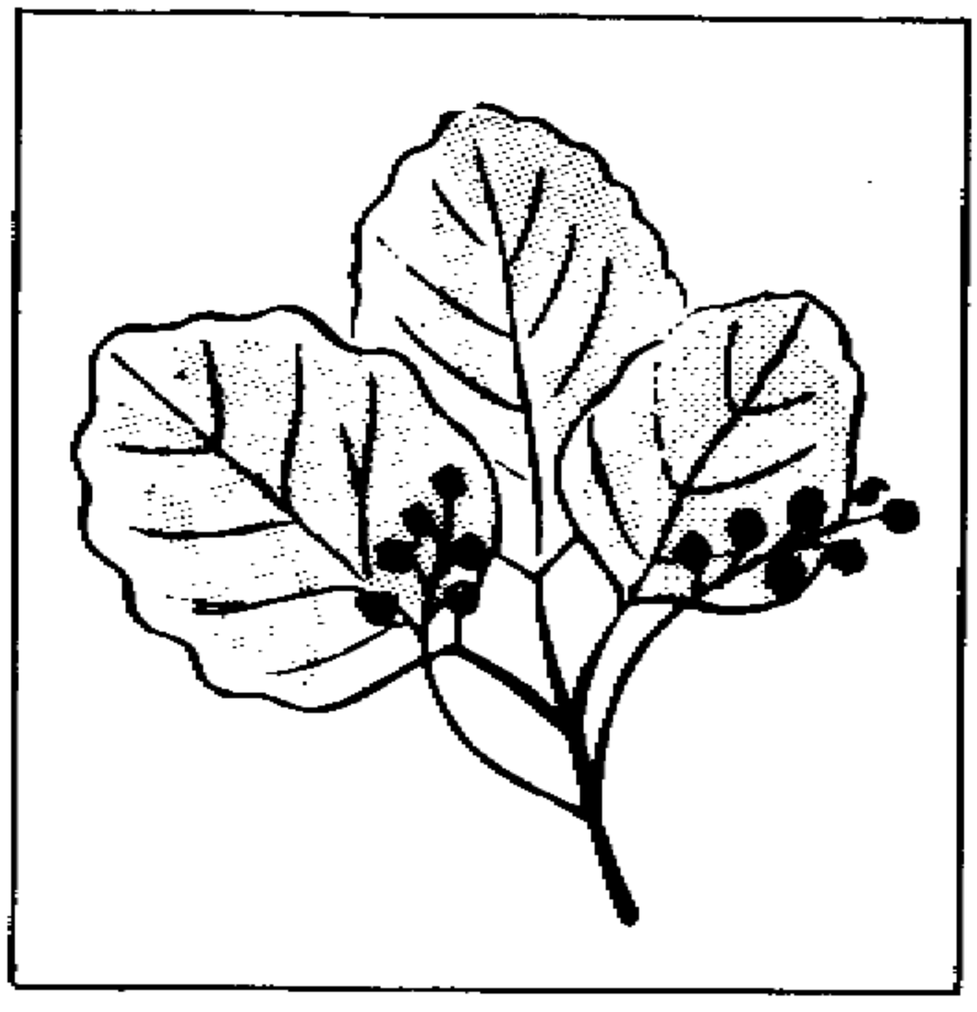


Figure 19-14. Poison oak.

c. Recognize the poison sumac (Rhus vernix) plant (Figure 19-15).

(1) Poison sumac grows as woody shrubs or small trees having compound leaves and clusters of small greenish flowers, succeeded by red, hairy fruits.

(2) It grows in most of the eastern third of the United States.

(3) This plant may also be known as swamp sumac, poison dogwood, and thunderwood.

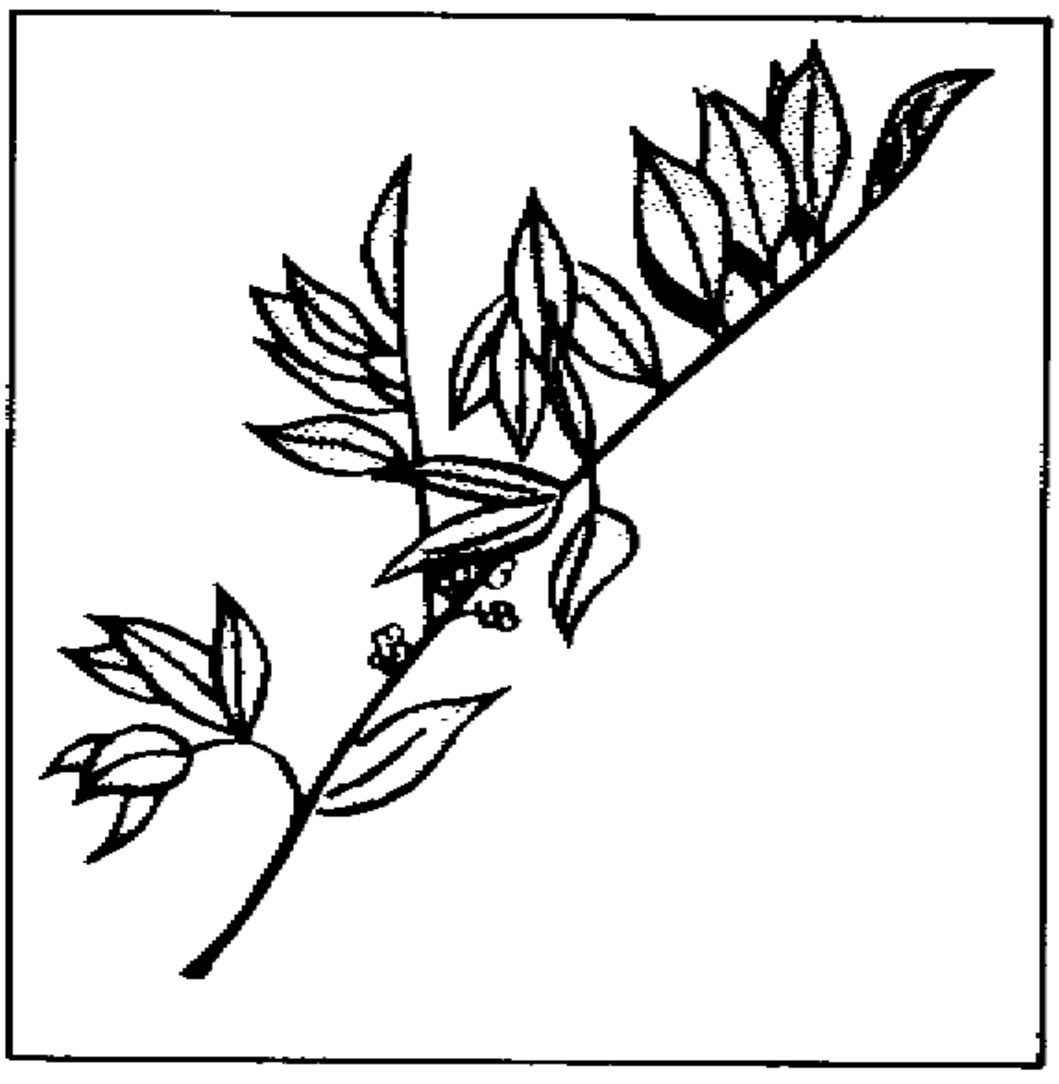


Figure 19-15. Poison sumac.

d. Signs and symptoms of contact poisoning.

- Redness and swelling of involved skin.
- Headache.
- Burning sensation on involved parts of the body.
- Skin eruptions (rash).
- Skin itching.

NOTE

The rash may appear from within a few hours to as many as 48 hours after exposure.

- Blisters on the involved skin. The blisters break after 2 to 4 days and leave a raw surface which becomes encrusted. They will usually heal within 2 weeks.

NOTE

The redness and swelling generally appear first, followed by the blisters.

e. Treatment for contact poisoning.

(1) Thoroughly wash the exposed area(s) of the patient's skin with soap and water or with alcohol to remove or reduce the amount of urushiol on the skin.

(2) Confine the washing to the affected area to avoid spreading the poison to other parts of the body.

(3) Wash the area several times in succession. Use a fresh solution for each wash.

(4) Apply alcohol to the affected area to further cleanse it and to help prevent secondary infections.

(5) Apply Calamine lotion to soothe the contaminated area and help in healing. DO NOT apply Calamine lotion to raw areas, as this may cause infection.

(6) Administer Benadryl to decrease the allergic reaction.

(7) Do not dress the affected area, as this will cause retention of moisture and will not allow the contaminated area to dry.

(8) Avoid contact with the contaminated water in the event you are allergic to the source.

(9) Thoroughly wash your hands and any part of your body which may have come in contact with the urushiol; also, remove all of your clothing exposed to urushiol. This will help in preventing your contracting the poison following the administration of treatment to the patient.

f. Record the treatment given.

g. Evacuate the patient, if necessary. Depending on the severity of the contamination, limited duty or evacuation to an MTF may be necessary.

CHAPTER 20

NUCLEAR, BIOLOGICAL, AND CHEMICAL INJURIES

Section I. INTRODUCTION

20-1. General

The introduction of nuclear, biological, or chemical (NBC) warfare on the battlefield will greatly strain the capabilities of the medical specialist in his role as the first level of medical care to combat forces.

20-2. Employment of NBC Weapons

The enemy may use one or more types of warfare agents in the same area of operations. You may encounter patients suffering from the effects of radiation and chemical agents at the same time. Sections II through IV discuss the types of injuries you will see and will need to provide care for. Additionally, you will continue to see injuries and illnesses caused by other sources in addition to those caused by NBC warfare.

Section II. NUCLEAR CASUALTIES

20-3. General

Nuclear injuries can be divided into three types: blast, thermal, and radiation sickness. Each type of injury can occur without the others, all three can occur at the same time, or in a combination of any two.

20-4. Blast Injuries

a. The types of blast injuries caused by nuclear weapons are more varied than those caused by conventional weapons. Blast injuries are the result of the direct action of the blast wave over pressure, the indirect action of flying debris, or the violent slamming of individuals against other objects. Blast injuries may be complicated by thermal and/or radiation injuries.

b. Signs and symptoms of blast injuries are—

- Wounds.
  - o Cuts.
  - o Abrasions.
- Impalements.
- Soft tissue cavitation (with or without perforating wounds of the chest or the abdomen).

c. The treatment for nuclear blast injuries is the same as for any other type of blast injury caused by day to day accidents or conventional weapons. (See Chapter 13 for treatment of trauma injuries.)

20-5. Thermal Injuries

a. Large numbers of burn casualties from most conventional weapons are uncommon. However, in nuclear warfare, burns are frequently seen injuries. This creates a very serious problem for health service support personnel.

b. The signs and symptoms of thermal injuries are the same as for burns from any other heat source and include discoloration, blisters, charred skin and tissue, and severe edema in all burn areas. Clothing may be stuck to the skin over large areas of the body. The respiratory track may be involved due to inhalation of heat with burns extending deep into the alveoli.

c. The treatment for thermal injuries is the same as for non-nuclear burns. See Chapter 13 for treatment procedures.

20-6. Radiation Injuries

a. Radiation injury (sickness) can result from—

- A single exposure to radiation at the time of detonation of a nuclear weapon, *or*
- An exposure to high levels of fallout radiation, *or*
- Exposure to induced radiation, *or*
- A repeated exposure to any of these sources.

b. The sickness pattern is manifested in three syndromes. These are the hematopoietic, gastrointestinal, and central nervous system syndromes. The hematopoietic (bone-marrow depression) syndrome occurs at lower doses than the others and is the most common form of radiation sickness seen in nuclear combat. As the lethality probability nears 100 percent with higher doses, the gastrointestinal syndrome will dominate. This syndrome develops from a combination of bone-marrow depression and gastrointestinal tract damage. The central nervous system syndrome appears when supralethal doses are absorbed. Aircrews exposed to prompt nuclear radiation from high level detonation and personnel protected from blast and thermal effects by below surface sites are more susceptible to this syndrome.

c. The signs and symptoms of radiation sickness follow similar patterns as the syndromes. They can be divided into three phases.

(1) *Acute incapacitation.* The initial phase of transient acute incapacitation is during the first few hours of exposure and is characterized by the rapid onset of nausea, vomiting, and malaise. This phase only lasts for a few hours and should not be severe enough to require evacuation if exposure is to low doses of radiation.

(2) *Latent period.* Following recovery from the initial phase there will be a period during which the exposed individual will be symptom-free. The length of this period varies with the dose and nature of the initial phase. The longest period is 2 to 6 weeks preceding bone-marrow depression. Prior to the gastrointestinal syndrome, it lasts from a few days to a week. It is shortest preceding the nervous system syndrome, lasting from a few hours to 3 days.

(3) *Clinical period.* During the gastrointestinal syndrome there will be a severe fluid loss and bloody diarrhea; the bone-marrow depression syndrome will follow. The bone-marrow depression will be manifested by problems of bleeding, anemia, and decreased resistance to infection.

d. The central nervous system syndrome is associated with higher acute doses of radiation. The clinical picture for this syndrome is a steadily deteriorating state of consciousness with eventual coma and death.

e. Treatment for radiation sickness by the medical specialist consists of fluid replacement when fluid loss is significant and symptomatic care until the patient is evacuated to an MTF for definitive care/treatment.

Section III. BIOLOGICAL AGENT CASUALTIES

20-7. General

The microorganisms used for the production of biological agents are disease-producing organisms which may have been altered or may actually be the disease organism as found in every day life. Other biological agents, such as yellow rain, are laboratory made. The synthesized agents are known as micro-toxins (toxins). The biological agents may be delivered to the battlefield by the use of modern weapons, as well as through contaminated food products, water, and insect vectors.

20-8. Signs and Symptoms of Biological Agent Casualties

The signs and symptoms of biological agents are as unlimited as the sources of infective disease organisms. The signs and symptoms are the same as for nonwarfare-agent infections and diseases. (FM 8-33 provides the signs and symptoms for most disease-producing organisms.) The signs and symptoms for some toxins are massive mucous membrane tissue hemorrhage and severe skin rashes.

20-9. Treatment for Biological Agent Casualties

Treatment for biological agent patients may be the same as for nonwarfare-agent patients with the same type of illness. Example: biological agent-induced typhoid fever would be treated the same as for nonwarfare-agent-induced typhoid. (See FM 8-33 for specific treatment.) The treatment for toxins is symptomatic.

Section IV. CHEMICAL AGENT CASUALTIES

20-10. General

Chemical warfare agents affect specific body functions and systems. The agents are classified by their physiological action and military use.

a. Physiological Action.

● Nerve agents such as Soman (GD), Tabun (GA), Sarin (GB), and VX inhibit cholinesterase enzymes throughout the body. Since the normal function of these enzymes is to hydrolyze acetylcholine wherever this compound is liberated, such inhibition results in the accumulation of excessive concentrations of acetylcholine at its various sites of action. These include:

o The endings of the parasympathetic nerves to the smooth muscle of the iris, ciliary body, bronchial tree, gastrointestinal tract, bladder, and blood vessels; to the secretory glands of the respiratory tract; to the cardiac muscle; and to the endings of the sympathetic nerves to the sweat glands.

o The endings of motor nerves to voluntary muscles and of nerves to autonomic ganglia.

o The central nervous system.

● Blister agents (vesicants, which include the mustards, arsenicals (Lewisite), and phosgene oxime) produce the following:

o Local irritation and damage to the skin and mucous membranes.

o Pain and injury of the eyes.

o Reddening and blistering of the skin.

Also, when inhaled, blister agents damage the respiratory tract, with resultant development of bronchopneumonia. If tissue damage is severe, shock may occur. Systemic absorption of the vesicant may also be followed by bone-marrow depression.

● Choking agents, such as phosgene, irritate and damage the lower respiratory tract, resulting in pulmonary edema and possibly secondary pneumonia.

● Blood agents (cyanides) stop essential physiological processes. Blood agents such as hydrocyanic acid (AC) and cyanogen chloride (CK) are absorbed into the blood and are carried to all body tissues where the action is a local one inhibiting oxidative processes so that oxygen cannot be transferred from red blood cells to tissue cells. With hydrogen cyanide, respiration is first stimulated and then depressed; convulsions may occur. Cyanogen chloride rapidly causes dyspnea (labored breathing) and has an additional local irritant action on the nose, throat, eyes, and respiratory tract.

b. Military Use.

● Toxic chemical agents are used to produce serious injury or death. They include nerve agents, blister agents, and blood agents.

● Incapacitating agents are used to produce temporary physical or mental effects, or both.

20-11. Protective Measures and Handling of Casualties

a. The protective mask with hood must be put on at once when the alarm or the command is given, or when any of the following conditions are observed:

- Your position is hit by a concentration of artillery, mortar, or rocket fire, or by aircraft bombs.
- Your position is under attack by aircraft spray.
- Smoke or mist of an unknown source is present or approaching.
- A suspicious liquid is present.
- You are entering an area known to be or suspected of being contaminated with a toxic chemical.
- You have several of the following symptoms:
  - o An unexplained runny nose combined with-
  - o A feeling of choking or tightness in the chest or throat.
  - o Dimming of vision and difficulty in focusing the eyes on close objects.
  - o Irritation of the eyes (could be caused by presence of several toxic chemical agents).
  - o Unexplained difficulty in breathing or increased rate of breathing.
- Inappropriate laughter or unusual behavior noted in others, or a sudden feeling of depression, dread, anxiety, restlessness, muscle tightness, dizziness or light-headedness, slurred speech, stumbling, or dryness of mouth noted in yourself.

b. Hold your breath until the mask is on and the facepiece is cleared and checked. The mask should be worn until test procedures indicate that no chemical agent is in the air and the "all clear" signal is given. (See FM 21-40 for unmasking procedures.) If vomiting occurs, the mask should be lifted momentarily, with the eyes closed and the breath held, and replaced, cleared, and properly checked before another breath is taken.

c. Casualties contaminated with a chemical agent will endanger unprotected personnel. Handlers of these casualties must wear the chemical protective overgarment, mask, and gloves.

d. Most chemical agents can poison water and food. They can make supplies or equipment dangerous to handle without wearing a mask and rubber gloves. Water and food supplies suspected of contamination should be examined by chemical test procedures before consumption. The water should be decontaminated, if necessary. Contaminated food should be discarded or the outer layers removed (see TM 3-220) and the residue examined before it is used. The contaminated material should be washed thoroughly with copious

amounts of water (or otherwise decontaminated) by personnel wearing masks, impermeable protective gloves, chemical protective overgarments, and impermeable shoes or boots.

e. Military commanders and medical personnel should be continually on the alert for the possibility of anxiety (combat stress) reactions among combat personnel during toxic chemical attacks. All possible steps must be taken to prevent or control the anxiety situations.

20-12. Personal Decontamination

Following contamination of the skin, clothing, or eyes with a chemical agent, personal decontamination must be carried out immediately since there is a definite time limit after which decontamination is useless. Decontamination consists of either removal or neutralization of an agent, or both, before serious injury occurs. For step by step procedure, refer to TM 8-285 or FM 8-9.

20-13. Nerve Agents

a. Chemical nerve agents are very fast-acting. A soldier exposed to a significant dose of these agents will be unable to aid himself and will need immediate care.

b. Nerve agents are among the deadliest of chemical agents. Nerve agents enter the body by inhalation, by ingestion, and through the skin. Depending on the route of entry and the amount, nerve agents can produce injury or death within minutes and achieve their effects with small amounts. Nerve agents are absorbed rapidly and the effects are felt immediately upon entry into the body.

c. Signs and symptoms of nerve agent poisoning.

(1) Early symptoms in the usual progression.

- Runny nose.
- Red, tearing eyes.
- Sudden headache.
- Excessive flow of saliva (drooling).
- Tightness in the chest, creating difficulty in breathing.
- Reduced vision.
- Muscular twitching in the area of exposed/contaminated skin.
- Stomach cramps.
- Nausea.

(2) Severe symptoms. A nerve agent casualty in the SEVERE stage may exhibit all or most of the following symptoms, plus any of the EARLY symptoms.

- Strange and confused behavior.
- Gurgling sounds made when breathing.
- Severely pinpointed pupils.
- Severe muscular twitching.
- Loss of bladder/bowel control.
- Convulsions.
- Not breathing.
- Vomiting.

NOTE

Soldiers exhibiting severe symptoms will NOT be able to care for themselves.

d. Treatment for nerve agent poisoning.

(1) Mask the patient, if necessary.

(a) Position the patient face up (Figure 20-1).

(b) Open the *patient's mask carrier* and remove the mask.

(c) Situate yourself near the patient's head.

(d) SQUAT (do not kneel) low behind the patient's left shoulder, facing his feet.

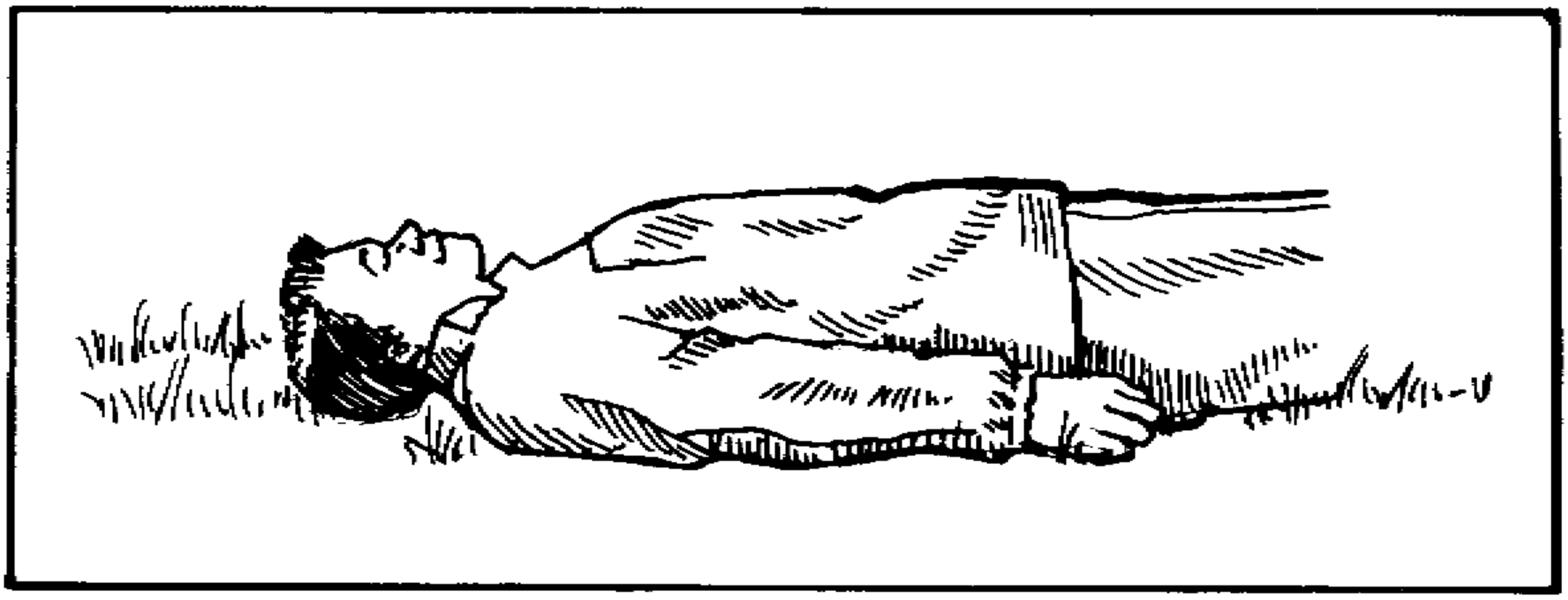


Figure 20-1. Positioning the patient.

(e) Open the mask.

- Grasp the mask with your thumbs outside and your fingers inside the cheek pouches (Figure 20-2).

- Spread the mask open and position it on the patient's chin.

(f) Lift the head and slide the head harness over it as follows:

- Position your thumbs through the two bottom straps of the head harness.

- Cup the patient's head with the fingers of your hands and lift it slightly.

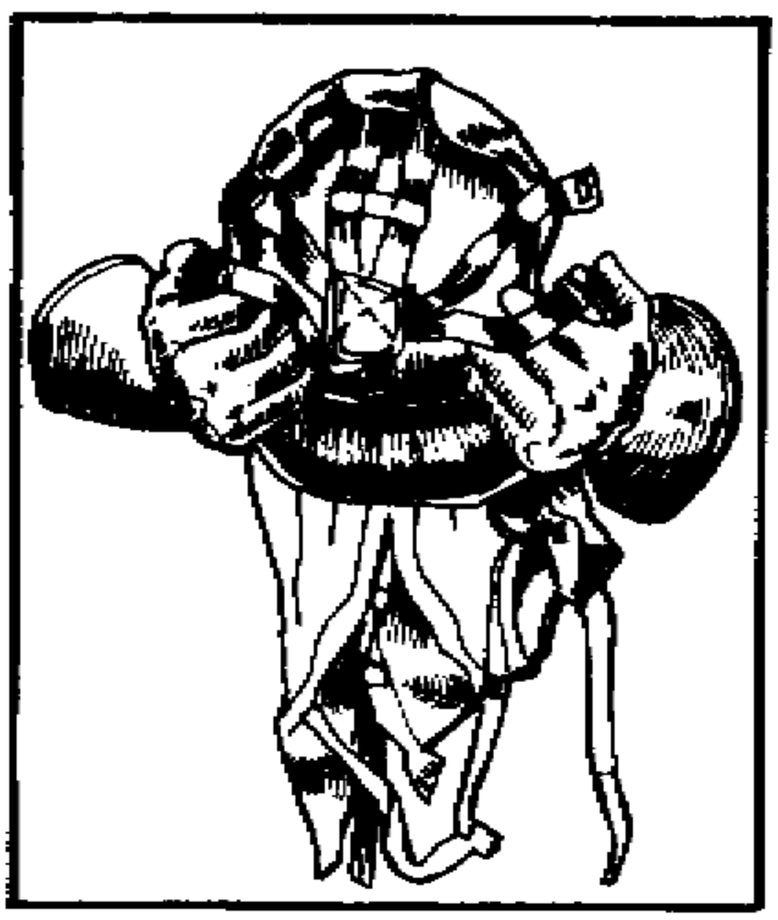


Figure 20-2. Opening the mask.

- Move your thumbs back and down behind the patient's ears.

- Make sure the head pad is centered in the middle of the back of the head.

NOTE

If the casualty is able to follow directions, instruct him to clear his mask.

(g) Check for a complete mask seal by covering the mask's inlet valves. The mask will collapse if properly fitted, indicating a good seal.

NOTE

There is no way to be sure that an unconscious, nonbreathing casualty's mask has a good seal.

(h) Pull the protective hood over the head, neck, and shoulders.

(2) Administer the nerve agent antidote.

(a) Position yourself near the patient's left thigh (this will make it easier to reach into his mask carrier).

NOTE

If the patient has already received three doses of antidote, proceed to step *(2)(p)* below.

(b) Remove one set of antidote autoinjectors (Figure 20-3) from the inside pocket of the patient's mask carrier.

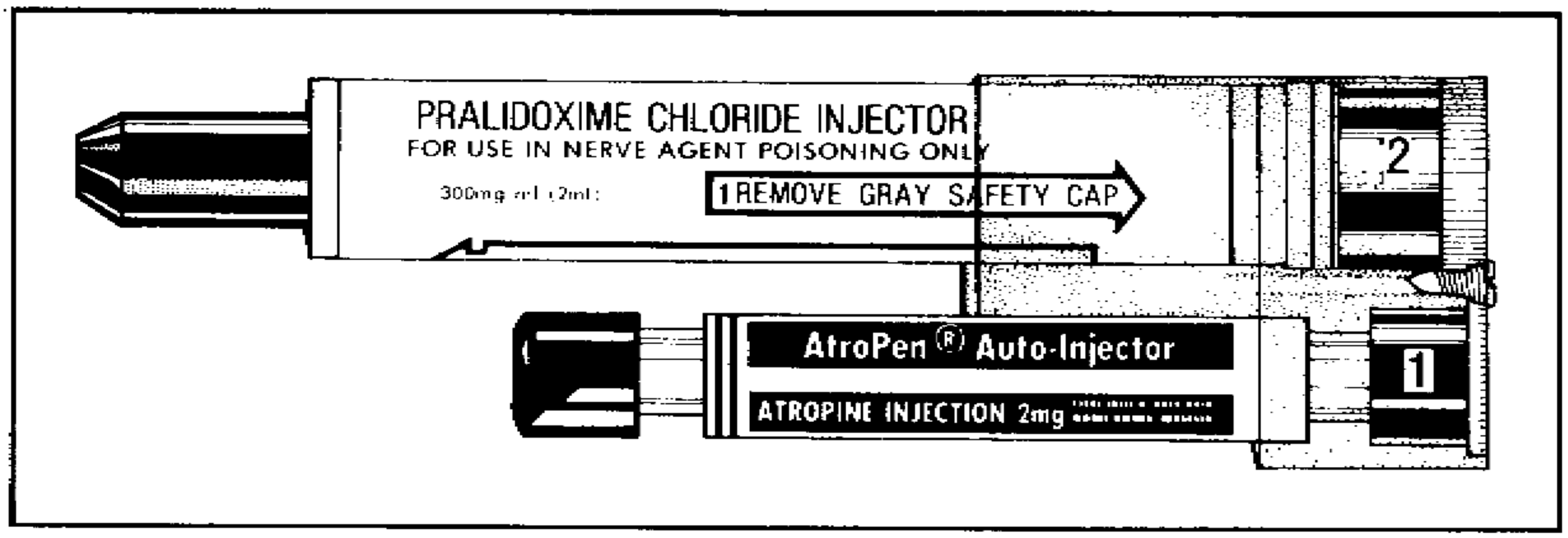


Figure 20-3. Nerve agent antidote autoinjectors.

NOTE

Do not use your autoinjector on a casualty. If you do, you may not have any antidote for self-aid.

(c) Hold the set of injectors by the plastic clip (Figure 20-4), with the big injector on top and in front of your body at eye level.

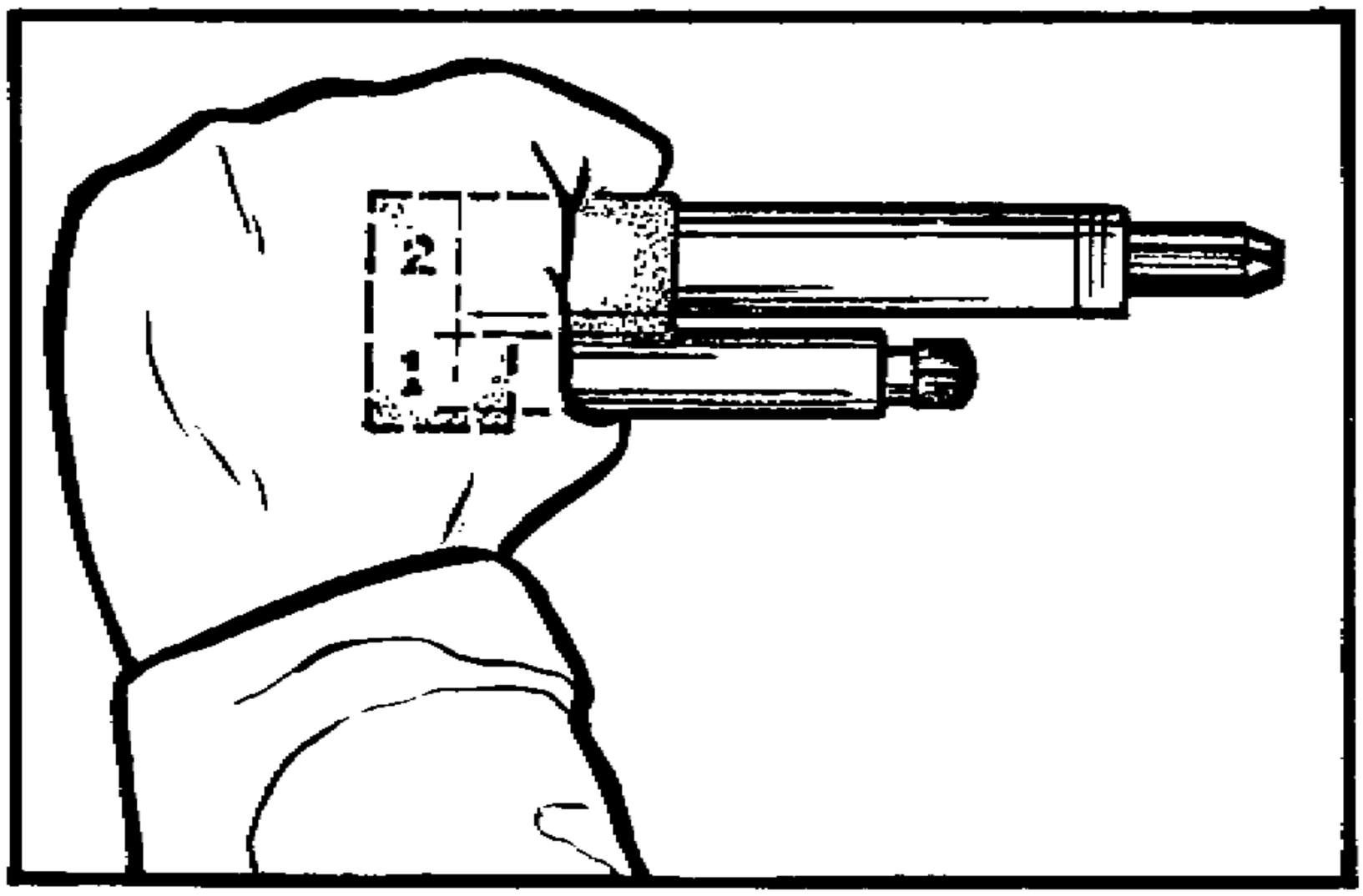


Figure 20-4. Holding the set of injectors.

(d) Grasp the atropine autoinjector (the smaller of the two injectors) with your thumb and first two fingers of your other hand (Figure 20-5).

CAUTION

Do not cover/hold the needle end with your hands or fingers— you may accidentally inject yourself.

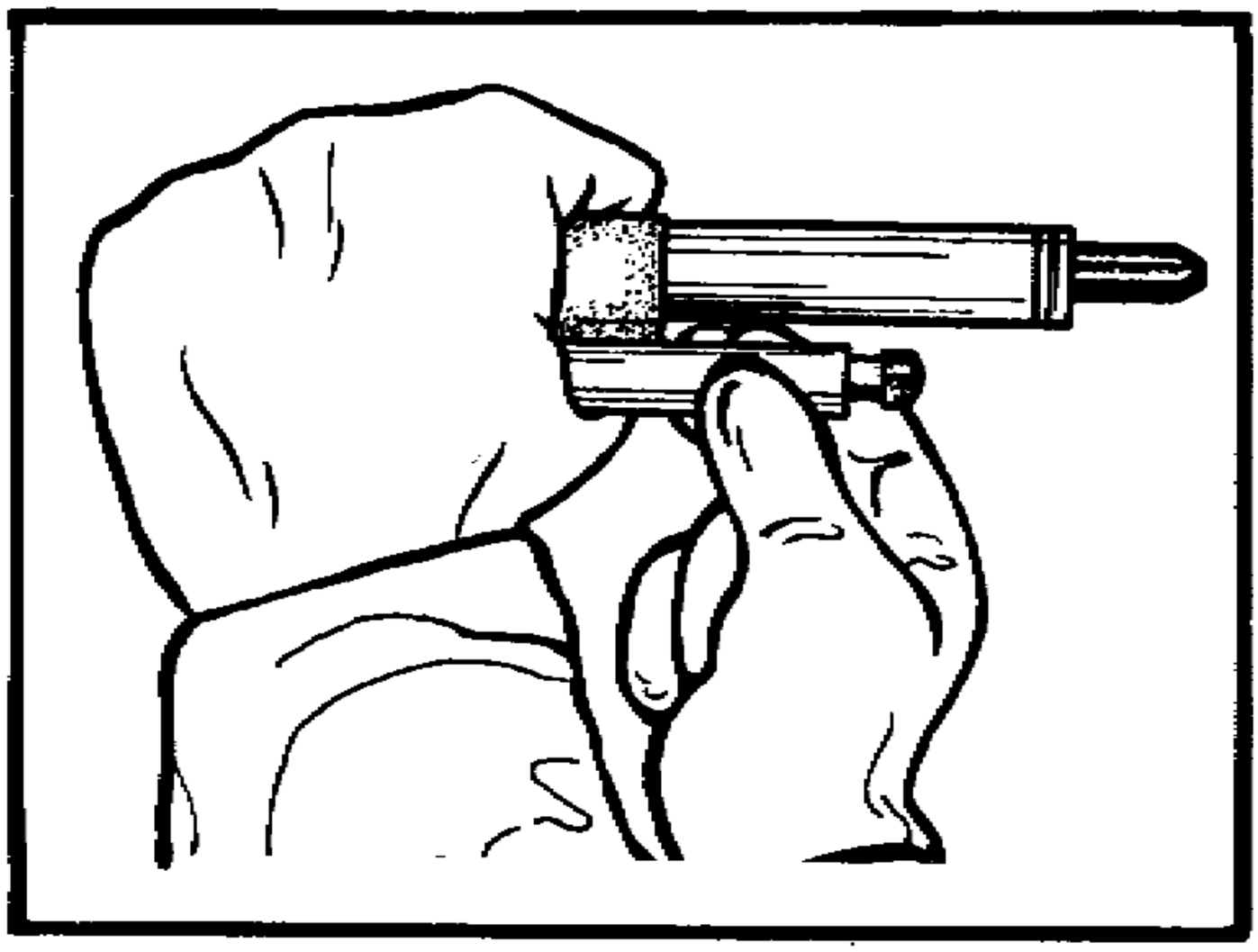


Figure 20-5. Grasping the injectors.

(e) Pull the injector out of the clip with a smooth motion.

(f) Form a fist around the injector.

(g) Place the green (needle) end of the injector against the patient's outer thigh muscle (Figure 20-6).

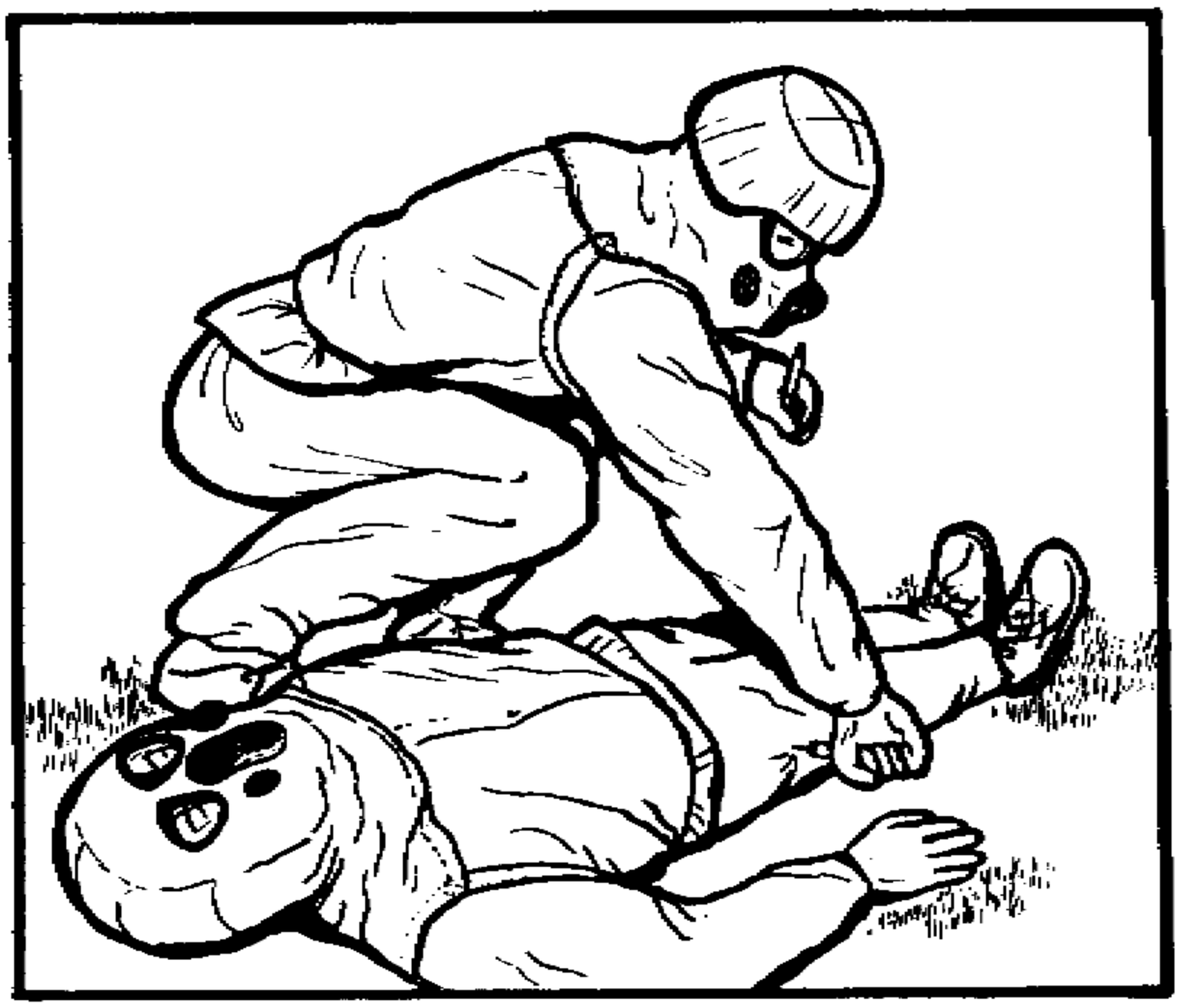


Figure 20-6. Injecting the patient's thigh.

(h) Apply firm, even pressure to the injector until it functions by pushing the needle into the patient's muscle, making sure you do not hit any objects in his pocket.

CAUTION

Do not use a jabbing motion to inject the patient.

(i) Hold the injector in place for at least ten seconds by counting one thousand one, one thousand two, and so forth.

(j) Remove the injector.

CAUTION

Watch out for the needle. Do not accidentally inject yourself.

NOTE

If the individual is very thin, you can inject him in the buttocks. Be careful to inject him only in the upper outer part of the buttocks (either side) because there is a nerve that crosses the buttocks and hitting this nerve can cause paralysis (Figure 20-7).

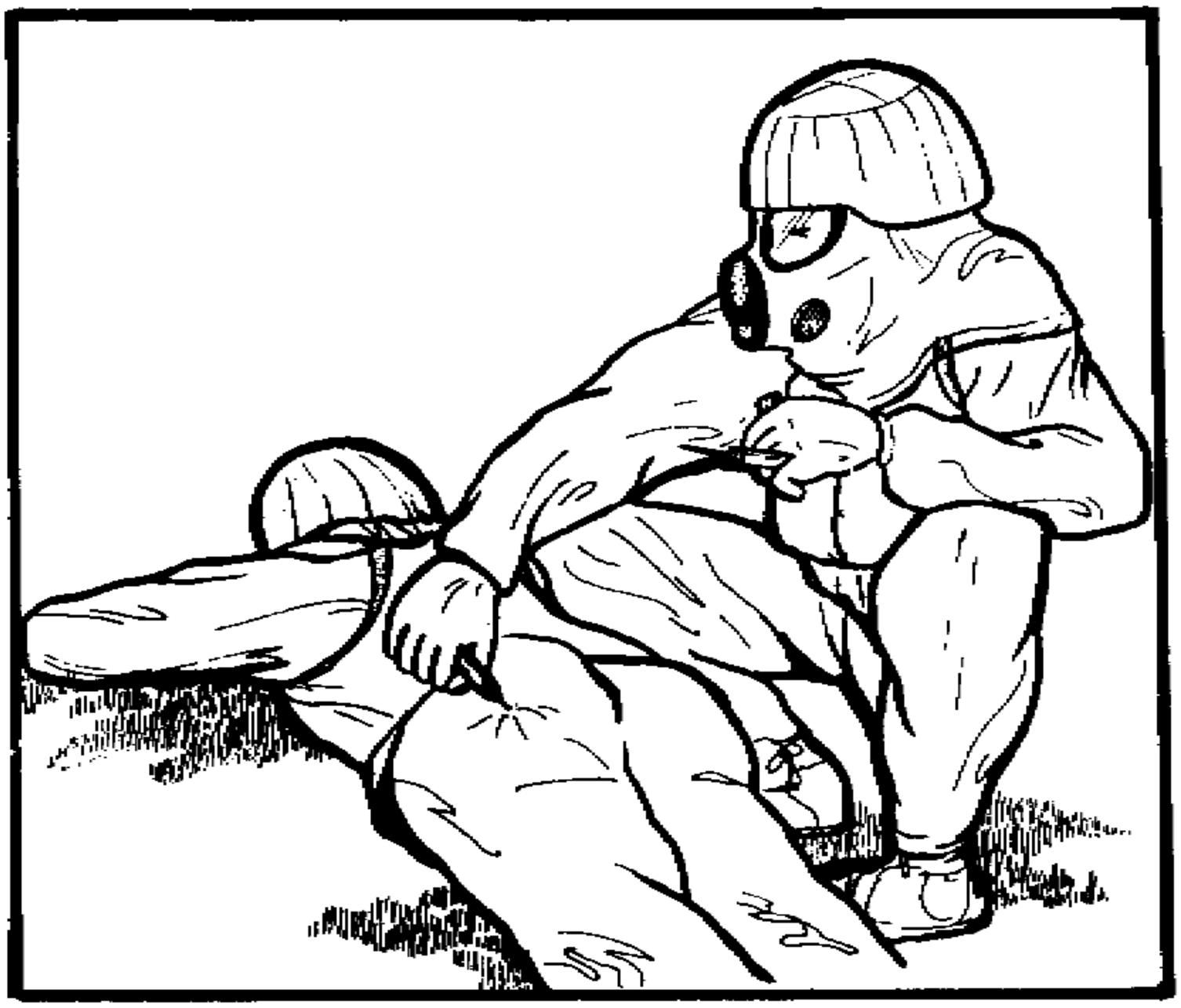


Figure 20-7. Buttock injection sites.

(k) **Place the used injector carefully between the last two fingers of the hand that is holding the clip (Figure 20-8).**

(l) **Pull the 2 PAM C1 injector (the larger of the two injectors) (Figure 20-9) from the clip and inject the patient in the same manner as steps *(e)* through *(j)* above, holding the black (needle) end against the patient's outer thigh (or buttock).**

(m) **Drop the clip without dropping the used injectors.**

(n) **Attach the used autoinjectors to the patient's clothing by—**

- **Pushing the needles of the used injectors, one at a time, through the left pocket flap. This will tell other medical personnel how many injectors were administered to the patient.**

- **Bend the needle to form a hook. Be careful not to tear your protective gloves while bending the needle.**

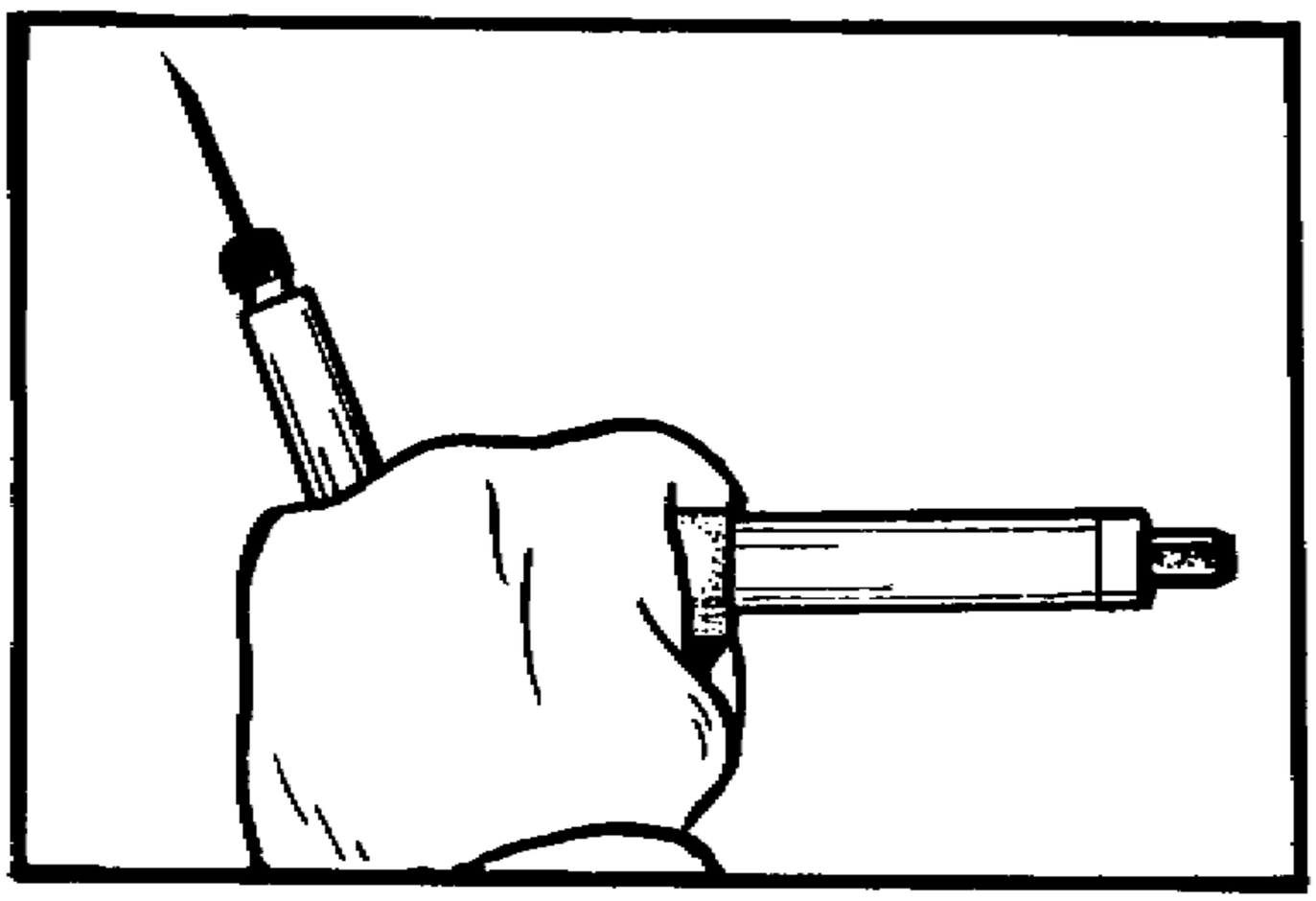


Figure 20-8. Placing the used injector between the last two fingers.

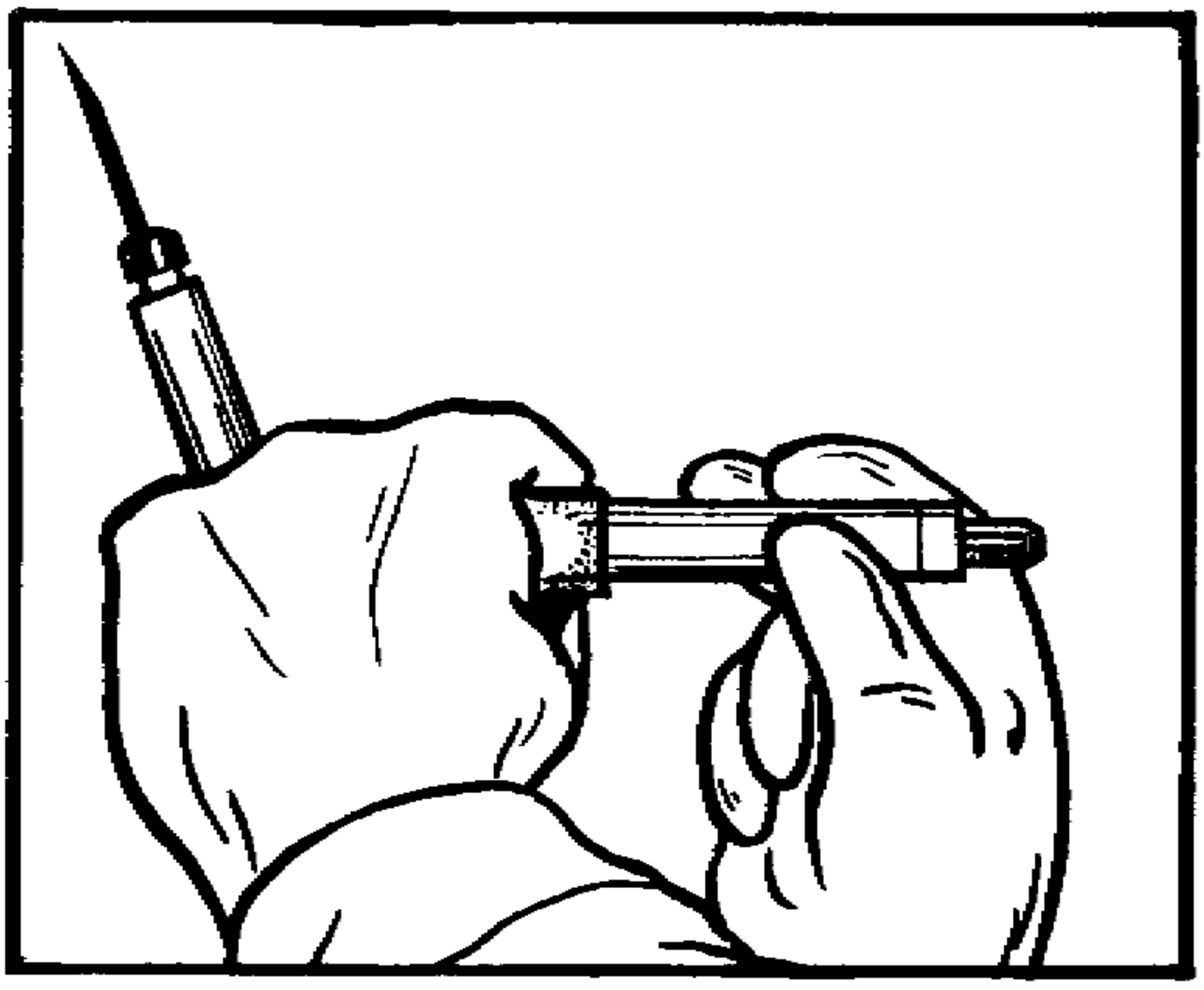


Figure 20-9. Pulling out the 2 PAM Cl injector.

(o) Immediately repeat the above steps, using the second and third sets of antidote autoinjectors.

NOTE

If a patient requires additional antidote, administer atropine only until his heart rate is above 90 beats a minute.

(p) Administer artificial respiration if needed or oxygen if available.

(q) Administer anticonvulsant medication if convulsions are not controlled by atropine.

(3) Evacuate the patient if necessary.

20-14. Blood Agents

a. Blood agents (cyanides) are very fast-acting chemical poisons. A soldier exposed to a significant dose will be unable to aid himself and will need immediate care.

b. Blood agents produce their effects by interfering with the body cells' absorption of oxygen. Inhalation is the usual route of entry. Hydrocyanic acid (AC) and cyanogen chloride (CK) are the important agents in this group. Cyanogen chloride also acts as a choking agent.

c. The standard protective mask gives adequate protection against field concentrations of blood agents. The chemical protective overgarment, as well as the mask, is needed to protect individuals from liquid AC.

d. Signs and symptoms of blood agent casualties.

NOTE

Other chemical agents may be mixed with blood agents during a chemical attack.

- A fast breathing rate (blood agents affect the circulatory and respiratory systems by preventing body cells from using oxygen).
- Dizziness and headache.
- Cherry red skin.
- Heart rate slows down.
- Convulsions.
- Eyes, nose, throat, and lungs have a stinging sensation.

CAUTION

Cyanogen chloride (CK) also causes damage to the tissues in the lungs. Any damage to the respiratory tract may result in fluid in the lungs and blood-tinted frothing at the mouth.

- Reddish fluid will be coming from the mouth.
- Hyperventilation, followed by a depressive phase of hypotension, and shallow respiration.
- Respiratory arrest.

e. Treatment for blood agent casualties.

(1) Immediately mask the casualty, if necessary. Determine whether or not he is breathing. If he is not breathing, put his mask on first (paragraph 20-13 *d*(1) above) and then apply the back-pressure, arm-lift method of artificial respiration.

CAUTION

Place the patient on an uncontaminated surface if possible (such as, poncho or plastic bag).

(2) Administer antidote. Administer sodium nitrite and sodium thiosulfate intravenously, if available. The recommended treatment is an intravenous injection of sodium nitrite 4 to 5 mg/kg of body weight followed by a slow injection of sodium thiosulfate 200 mg/kg of body weight.

NOTE

Above antidotes to be administered by medical personnel only. This is not self-aid or buddy aid treatment.

20-15. Blister Agents

a. Blister agents (vesicants) are mustard (HD), nitrogen mustards (NH), Lewisite (L), and other arsenicals; mixtures of mustards and arsenicals; and phosgene oxime (CX).

b. Vesicants act on the eyes, lungs, and skin. They burn and blister the skin or any other part of the body that they touch. They damage the respiratory tract when inhaled and cause vomiting and diarrhea when absorbed. The nitrogen mustards and the arsenicals are the most dangerous in causing vomiting and diarrhea.

c. Some vesicants often have a more serious effect than is immediately apparent. Vesicants are insidious in action with little or no pain at the time of exposure, except Lewisite and phosgene oxime which cause immediate pain on contact. The physiological effects of blister agent exposure usually take a few hours to appear. The soldier may be exposed to a blister agent for a long time and not realize it. However, when the symptoms do appear, they are usually widespread.

d. In the event of exposure to a blister agent, decontamination must begin immediately; speed is absolutely essential. Every soldier is responsible for his own personal decontamination if he is physically capable. If he is incapacitated, decontamination must be performed by others as soon as possible.

e. Signs and symptoms of blister agent eye burns.

(1) The eyes are the most vulnerable body part to blister agents (vesicants) and are usually the first to be affected. The symptoms are—

- Inflammation of the inner eyelids.
- Redness of the eyes.
- Swelling of the eyelids.
- Watery eyes.

f. Treatment for blister agent eye burns. Decontaminate the eyes as follows:

(1) Remove the patient's canteen and open it.

CAUTION

Patient must be masked in order to avoid inhaling contaminated air.

(2) Have him take a deep breath and hold it. He must NOT breathe while the mask is off. The breath should be held as long as possible. The mouth should be kept closed during the decontamination procedure to prevent absorption of the contaminant through the mucous membranes.

(3) Lift the mask from his chin to expose his eyes.

(4) Flush or irrigate one eye at a time.

- Insure that all liquid blister agents are flushed. The risk of leaving the agents in the eyes is much greater than the risk of eye exposure to blister agent vapors.
- If the patient is wearing contact lenses, remove them before treating the eyes.
- Tilt his head to one side and have him look up.
- Slowly pour water into each eye so that the water will run off without further contamination.

(5) Reseal and clear the patient's mask.

g. Signs and symptoms of blister agent injuries involving the skin and respiratory tract do not occur immediately after exposure. They usually occur 4 to 6 hours after exposure. However, symptoms may appear from 24 to 48 hours later. Skin contamination may be detected with M8 chemical detector paper or visually by observing for swelling, redness, or blisters. Contamination of the skin or face may also be indicated by signs of extreme pain exhibited by the casualty. The severity of a chemical burn is directly related to the concentration of the agent and the duration of the contact with the skin.

(1) Skin:

- Swelling, inflammation.
- Redness, sunburn-like.
- Itching, burns, and/or blisters (usually large).

(2) Respiratory tract:

- Throat burns and feels dry.
- Voice becomes hoarse.
- A dry, harsh cough develops.
- Respiratory tract becomes inflamed.

(3) Other signs/symptoms:

- Headache.
- Nausea.
- Runny nose.
- Frequent sneezing.

h. Treatment for blister agent skin and respiratory tract injuries.

(1) Do not put field dressings over injured (blistered) areas. Such action may spread the contamination or cause pain to the patient.

(2) If necessary, have the patient decontaminate himself using his M258A1 kit. The key to successful use of the decontamination kit is IMMEDIATE action upon finding the contamination. Decontamination procedures should begin within 60 seconds of contamination; otherwise, this procedure may be of little use. Decontamination of the skin should be done in a sheltered area. A sheltered area provides protection from further contamination by a blister agent. The medical specialist should stress the importance of the buddy system for decontaminating the skin that cannot be reached or seen by the individual.

CAUTION

If blisters have already appeared, do not decontaminate the blistered area.

(3) Treatment for respiratory tract injuries are to maintain the airway until the patient can be evacuated.

20-16. Choking Agents

a. Choking agents are chlorine and phosgene. The main lethal effect is that they disrupt the alveolar capillary integrity of the lungs and cause a leaking of plasma and fluids into the alveoli. This results in a progressive oxygen shortage and can cause death due to pulmonary edema. This form of death has been called "DRY LAND DROWNING."

b. The early symptoms of choking agent poisoning are—

- Local irritation.
- Dry throat.
- Coughing.
- Tightness in chest.
- Nausea.
- Vomiting.
- Headache.

NOTE

The early signs and symptoms will subside rapidly and the individual can continue his mission without incapacitation. These symptoms are very general and in some instances of little value in prognosis. Some patients with severe cough fail to develop serious lung injury, while others with no signs or symptoms go to fatal pulmonary edema, so it is vital that the medical specialist observe all individuals for possible signs of respiratory distress even though the mission is being carried on.

c. Delayed severe signs and symptoms of choking agent poisoning usually appear 4 to 12 hours after initial contact or exposure and are—

- Anxiety.
- Severe coughing.
- Rapid shallow breathing.
- Chest wall retraction.
- Tachycardia.
- Cyanosis.
- Production of frothy, blood-tinted sputum.

- Shock.
- Respiratory arrest.

NOTE

Death can occur within 48 hours. A casualty who survives for more than 48 hours usually recovers without after effects.

d. Treatment for choking agent poisoning.

(1) Treat symptomatic conditions as they develop.

(2) For patients with severe symptoms, movement should be limited; they should be kept comfortable and warm until evacuated.

(3) Administer oxygen, if available.

(4) Evacuate the patient.

CHAPTER 21

MANAGEMENT OF PSYCHOLOGICAL/ BEHAVIORAL PROBLEMS

Section I. BATTLE FATIGUE (STRESS)

21-1. General

During combat, soldiers can experience conditions of overwhelming stress, both physical and emotional. The conditions that can produce battle fatigue include physical exertion, the requirement for constant alertness, the trauma of seeing other soldiers wounded or killed, the fear of being killed or maimed, and the necessity of killing. Transient (temporary) debilitating psychological disorders may develop, even in previously stable personalities. Psychological reactions to combat are generally not so incapacitating as to demand removal from the combat environment. When a soldier can no longer function effectively in his job, the medical specialist or other soldiers may provide appropriate initial treatment or psychological first aid.

21-2. Types of Psychological Reactions

Although psychological reactions may manifest themselves in many ways, there are two types of reactions thought to be the most common in a combat situation:

a. Battle Fatigue. This stress reaction, which has fear as its biggest factor, is brought about primarily by extended exposure to a combat situation. It is frequently seen in units that have been committed to long-term continuous combat. Battle fatigue is also referred to as *combat stress reaction, shell shock, psychoneurosis, anxiety state, psychoneurosis mixed, conversion hysteria, combat fatigue, flying fatigue, operational fatigue, or traumatic war neurosis.* Although there are other psychological reactions such as transient battle reactions (discussed below), this chapter will deal primarily with battle fatigue, its symptoms, and its treatment.

b. Transient Battle Reactions. These reactions are also temporarily debilitating in nature but may be more drastic than battle fatigue. Fatigue is normally not a factor in transient reactions. Soldiers not previously engaged in combat may experience transient battle reactions; however, most individuals can adapt and learn to cope with abnormal amounts of stress.

21-3. Battle Fatigue and Its Severity

Battle fatigue is a psychological condition encompassing the physical and emotional stresses experienced in combat. These stresses are experienced by every individual in a combat situation. Physical fatigue and/or fear (emotional fatigue) can produce battle fatigue. Battle fatigue can be exhibited by minor reactions such as impairment of self-confidence, trembling or irritability, or more severe reactions such as panic running, hallucinations, or hysterical paralysis. Battle fatigue may occur in individuals who have been in continuous prolonged combat, individuals not previously in combat but who experience a short-term intense combat situation, or those soldiers who spend long periods of time waiting to go into combat. From 70 to 90 percent of battle fatigue patients can return to duty after rest and treatment. Those patients who do

not respond after 48 hours of treatment require evacuation for definitive psychiatric care. Battle fatigue can be broken down into three levels of severity:

- *Mild*—the soldier relates sensations of fear in battle with no evidence of anxiety. This level does not require removing a soldier from combat.

- *Moderate*—the soldier displays tears, gross trembling, or difficulty on concentrating.

- *Severe*—the soldier can no longer relate to his environment and can suffer from hysterical blindness and paralysis.

21-4. Emotional Reactions of Battle Fatigue

a. Fear—an emotional experience in response to real danger. Under combat conditions, this can include—

- Fear of death, pain, injury, or mutilation.

- Fear of incapacitation through over-reaction to a frightful experience.

- Exhibiting fear and losing prestige with peers in the combat group.

b. Panic—the pathological counterpart of normal fear, involving temporary major disorganization of thinking and loss of control.

c. Anxiety—an expectation of danger, involving feelings of apprehension, uncertainty, and insecurity.

d. Noise Sensitivity—becoming sensitive to noise. Can lead to *abnormal noise sensitivity* which is a nervous reaction to a noise that does *not* represent a threat.

e. Sleeping Difficulty—a normal reaction resulting from tension, the need to remain alert, lack of comfort, and presence of combat noises. Can lead to *abnormal sleeping difficulty*, when the nighttime environment becomes terrifying for no apparent reason.

f. Apathetic Tendency—a frequent response to the stress of battle which results in some decrease in drive, flow of speech, initiative, readiness to undertake new tasks or problems, range of interests, and feeling of well-being. These complaints may be of considerable magnitude and they constitute a true apathy or depression extending well beyond the period of battle stress.

g. Irritability—a normal characteristic of someone subjected to long, continuous battle.

h. Resentment—a normal response for the soldier who has lost close friends and has faced danger. Resentment is strong where there is shirking or discrimination against the combat soldier.

i. Postcombat Behavior—various temporary behavior patterns exhibited after combat. These include overwhelming physical fatigue combined with apathy and subnormal reactions to stimuli. Eventually, tension creates a "letdown" and, consequently, the soldier can react with alcohol, sexual or social behavioral excesses.

k. Depression—a low level of functioning which manifests itself through feelings of sadness, despair, hopelessness, dejection, discouragement, self-condemnation, and/or disorders in eating and sleeping. Depression may develop during a lull in combat or as postcombat behavior.

NOTE

By knowing these definitions, the concerned soldier or supervisor can determine the severity of battle fatigue. You should advise your supervisor or unit commander about the suspected status of the battle-fatigued soldier. The responsible level of command can then take definite action.

21-5. Lethality and Its Effect on Battle Fatigue

Lethality refers to the accuracy and killing power of modern weapons. The high intensity and greater deadliness of modern weapons and weapons systems will increase the level of individual psychological stress. The battlefield environment may now include possible use of nuclear, biological, and/or chemical weapons. These weapons increase the number of soldiers killed or wounded in combat; this in turn creates fear which is a major cause in the increased rate of battle fatigue cases.

21-6. Principles of Battle Fatigue Treatment

There are three principles of treatment for battle fatigue—proximity, immediacy, and expectancy. When treated according to these principles, an estimated 80 to 90 percent of battle fatigue soldiers develop no long-term disability. In addition, the chances of later psychiatric problems (delayed or hidden reactions) are reduced.

a. Proximity—treatment as far forward as practicable increases the potential for full recovery. It also reduces the suggestion of serious disability and usually avoids the necessity of evacuation that would upset the soldier's morale and disrupt his sense of group identity.

b. Immediacy—initial treatment (psychological first aid) is to be applied as soon as possible to limit later effects.

c. Expectancy—refers to the ideas that you should communicate to the battle-fatigued soldier:

- Instill the expectation of a rapid recovery after a brief rest. You should also avoid giving the impression that the soldier has an incurable mental illness.

- Reassure the soldier of the fact that he is expected to return to duty. He will realize that his skills are needed and that he is a part of the combat team. In this way, he is also reassured that battle fatigue is only temporary.

NOTE

The soldier should wear his uniform and be treated in a "non-hospital" environment. This includes being housed in tents rather than in a hospital-type ward with involvement in light duty and exercise. This environment suggests to him that he is taking only a brief therapeutic rest and will soon be ready for duty. The soldier should be encouraged to believe that *fatigue, not stress,* is the greatest factor involved.

21-7. Symptoms of Battle Fatigue

a. Common Reactions to Combat.

(1) There is a wide range of reactions to fear and anxiety that affect all soldiers to some degree. Within this variety of reactions, you will need to recognize those that are manageable and found in combat. You should also be able to recognize those soldiers with more severe (disruptive) stress reactions.

(2) Not all stress reactions can be recognized immediately; however, your observations of changes or modifications in behavior among personnel in your unit can identify the early stages of stress reactions. In many instances, you may have to rely on information from supervisors or from the soldier's close associates.

b. Manageable Reactions.

(1) Muscular tension—increases with exhaustion.

- Headaches.
- Inability to relax.
- Cramps.

(2) Shaking and tremors.

- Mild shaking—may appear when undergoing shelling or bombing. Appears and disappears rapidly and is a normal reaction to dangerous conditions.
- Marked or violent shaking—sometimes incapacitating; may also persist after the cause has ceased.

(3) Perspiration—it is normal to experience either mild or heavy sweating or sensation of chills under combat stress.

(4) Digestive and urinary systems reactions.

- Nausea and vomiting which may occur during or immediately after a fire fight, shelling, or intensive battle conditions.

- Loss of appetite.

- Acute abdominal pain which may occur during shelling.

- Urinary frequency, particularly at night, or urinary incontinence during actual battle.

- Inability to control bowel functions may occur under catastrophic combat stress.

(5) Circulatory and respiratory systems reactions.

- Heart palpitations.

o Elevated blood pressure and increased pulse rate are common reactions.

o Rapid heartbeat, a sense of pressure in the chest, and chest pains may be felt.

- Hyperventilation—may be identified by rapid respirations, shortness of breath, dizziness, and a choking sensation.

- Sensations of faintness or giddiness—may occur with physical fatigue and extreme stress, together with generalized muscular weakness and lack of energy.

(6) Sleep disturbances.

- Difficulty in falling asleep.

o Inability to sleep when the tactical situation permits or in the absence of disruptions due to the combat situation.

o Physical environment may not permit restful sleep (excessive heat, cold, insects, or lack of food or water).

- Nightmares.

o Terror dreams, battle dreams, and nightmares of other kinds may cause sleeping difficulty.

o Sleep disturbances in the form of dreams are part of the coping process. This process of "working through" combat experiences is a means of increasing the tolerance level to combat.

- Restless sleep. When a person is asleep, the sleep may not be restful or refreshing. The individual wakes up as tired as when he went to sleep.

- Excessive sleep. This can be a sign of extreme depression or possible drug abuse.

(7) Death anxiety.

- Fear of death, pain, and/or injury causes anxiety reactions. After a soldier has been in combat and has seen his fellow soldiers killed or wounded, he loses whatever feeling of invulnerability he may have had.

- The death of a buddy can lead to a serious loss of emotional support along with feelings of guilt. The soldier may feel blessed that he was not killed and he may experience guilt about having such feelings.

(8) Body arousal. In response to a threat, the brain sends out chemicals that arouse various body systems, making the body ready to fight or take flight.

- Hyperalertness. The general focusing on certain external stimuli that may signal danger. A hyperalert soldier is ready to immediately respond to danger. His senses are alert to danger and possible threats, such as the noise of a mortar being fired which can send him running for cover long before the shell lands in the vicinity.

- Startle reactions. These reactions are a part of an increased sensitivity to minor external stimuli known as the on-guard reaction. These reactions include leaping, jumping, cringing, jerking, or other forms of involuntary self-protective motor responses to sudden noises. This type of reaction may occur not only to noises but also to sudden movement or sudden light. A sound as simple as the crumpling of cellophane may cause someone to jump and/or become angry. The unexpected movement of a person or animal may result in inadvertent weapon firing.

(9) Irritability—ranges from angry looks or sharp words to acts of violence.

- Snappishness, verbal flareups, and tears are common. Irritability is manifested externally by over-reaction to normal, everyday comments or incidents, flareups with profanity, and tears in response to even relatively minor frustrations.

- Explosions of aggressive behavior. Sporadic and unpredictable explosions of aggressive behavior (violence) may occur with little or no provocation. The stimulus may be a noise, an accidental bumping, or a normal conversation.

(10) Short attention span. Individuals under stress may have a short attention span and find it difficult to concentrate. A short attention span can cause a soldier to have difficulty following orders. The soldier may hear, but fail to comprehend, what others are saying. He may also have difficulty following directions, aiding others, or performing unfamiliar tasks.

(11) Depression (numbing of normal responsiveness). Soldiers may respond to stress with protective defensive reactions against painful perceptions. Emotional dulling (or numbing) is a result. These reactions are easily observed changes in the individual's usual personality:

- Low energy level. This can result in decreased effectiveness on the job, decreased ability to think clearly, excessive sleeping or difficulty in falling asleep, and chronic tiredness. Such qualities as pride, shame, grief, and gratitude may no longer be of importance to the soldier.

- Social withdrawal. A soldier may be less talkative than usual or show limited response to jokes. He may be unable to enjoy relaxation and companionship, even when the tactical situation permits. Tears and/or crying may be noted.

- Change in outward appearance. In a depressed mood, very little body movement and an almost blank, expressionless (mask-like) face may be noted.

(12) Substance abuse. Some soldiers may use substances such as alcohol or other drugs as a means of escaping stress. The use of these substances in a combat area can make soldiers less capable of functioning on the job. The soldiers may be less able to adapt to the tremendous demands placed upon them during combat.

c. Disruptive Reactions.

(1) Soldiers with more severe (disruptive) stress reactions are those who:

- Cannot function on the job.

- Compromise their own safety and the safety of others.

- Exhibit panic running (rushing about without any self-control).

- Have visual and/or hearing problems (perceived by the individual), and partial paralysis. These physical symptoms enable the individual to escape or avoid a stressful situation. The paralysis is usually confined to one arm or leg. A prickling sensation, tics, or rigidity of the larger joints may occur.

- Utter incoherent language. A soldier may babble like a child, be unable to speak logically, and have a bewildered appearance.

- Have loss of appetite which results in the loss of 5 pounds per week or more.

- Suffer from persistent and severe abdominal pain.

- Have continuing inability to control bowel function after stress stimulus (combat) has ended.

21-8. Initial Treatment Procedures for Battle Fatigue

a. Treat the Battle Fatigue Casualty.

(1) Provide initial treatment as time and tactical situation permit. The initial treatment for battle fatigue should be based on the factors of proximity, immediacy, and expectancy (PIE).

(2) Provide a place for the soldier to rest. At least 4 hours rest should be provided in a comparatively secure area.

(3) Provide food, when available.

(4) Provide an opportunity for the individual to ventilate (put his strong feelings into words). An individual with battle fatigue needs to express pent-up thoughts and feelings. Problems seem more tangible and manageable once they have been put into words. Working with a group of two or more persons can help reverse the stress reactions by using the soldier's natural coping skills (strength) in a group environment. The individual should be allowed to express emotions without interruption. Tears, anger, intense fear, and worries are commonly expressed. Arguments or opposing positions should be avoided and the soldier should be able to express feelings that are usually considered to be "unacceptable."

b. Evacuate the Soldier or Return Him to Duty.

(1) Evacuate the soldier. Recognize *disruptive* battle fatigue reactions and recommend immediate evacuation if the tactical situation permits. Soldiers who have undergone 48 hours of treatment without resolution of symptoms should be evacuated for definitive psychiatric care. It may be necessary to use physical restraint on soldiers with disruptive battle fatigue reactions.

(2) Return the soldier to duty if he is able to function on the job. A soldier's unit is stronger when he is functioning on the job. Without the soldier, a greater burden is placed on those who remain in the unit. Returning him to his original unit (and to his original job) is the best mental health assistance that can be provided and is the "treatment of choice." To return to normal duty after severe stress, most soldiers need to perform familiar useful work and receive group support. The soldier's unit can provide such an environment. Despite anxieties and traumatic experiences, every soldier is expected to perform combat duties. Experience in past wars is clear—failure to return to duty can lead to permanent disability.

Section II. ALCOHOL AND DRUG ABUSE

21-9. General

a. Alcohol and drug abuse is an increasingly serious problem in the military services. It affects combat readiness, job performance, and the health of military personnel and their families. It also costs millions of dollars in lost time and productivity; more specifically, it affects the individual.

b. The reasons for alcohol and drug abuse are as varied as the individuals who use them. People apparently abuse these substances to change the way they feel. They may want to feel better and happier or escape from pain, stress, or frustration. Some may want to remember or to forget; others may want to be accepted or just be sociable. Other people abuse alcohol and/or drugs to escape boredom or out of curiosity. Peer pressure can also be a very strong motivating factor in their abuse.

c. People often feel better about themselves when they use alcohol or drugs, but these effects do not last. Alcohol and drugs never solve problems—they merely postpone them. People who abuse alcohol and drugs to solve one problem run the risk of continued usage, which creates new problems and makes old problems worse.

d. In your work environment, there may be situations in which alcohol or drug abuse is suspected. In such situations, it will be necessary to use your knowledge of the appropriate signs and symptoms to determine suspicion of alcohol or drug abuse and to report your findings.

e. This section will assist you in identifying a suspected alcohol or drug abuser. To accomplish this, it is necessary to be aware of the terminology associated with, as well as the signs and symptoms of, alcohol or drug abuse. In addition, it will be necessary to know the proper procedures and referral methods that are necessary when handling a patient who is a suspected abuser.

21-10. Terms Specific to Alcohol and Drug Abuse

a. Drug or Substance Abuse. Drug or substance abuse is the pathological use of a chemical substance (licit or illicit) which results in impairment of a person's social or occupational functioning for a duration of at least several months.

b. Drug Dependence. Drug dependence is the use of a drug to such an extent that there is an increased tolerance for the drug or stopping the use of the drug would result in withdrawal symptoms.

(1) Psychological dependence exists when a drug's effect becomes necessary for an individual's continued mental well-being. Withdrawal of the drug results in compulsive drug-seeking behavior.

(2) Physical dependence exists only if withdrawal symptoms occur when the drug use stops or if tolerance to the drug has developed.

NOTE

Withdrawal symptoms are physical (such as vomiting, muscle tremors) and not psychological.

c. Tolerance. Tolerance is a physical condition that develops from the continued use of certain drugs and which requires larger amounts of these drugs to produce the same effects.

21-11. Classification of Drugs

Drugs are classified as central nervous system (CNS) depressants, narcotics, stimulants, or hallucinogens.

NOTE

Drugs are classified by their intended use and dosage level. For example, Valium can be classified as a muscle relaxant, an antianxiety agent, and a psychotherapeutic agent. Phencyclidine (PCP), for example, is pharmacologically classified as a basal anesthetic, but at abuse-level dosage, it acts as a hallucinogen.

a. CNS Depressants.

(1) Alcohol (ETOH).

(2) Barbiturates (sedative/hypnotics).

- Pentobarbital (Nembutal) (Yellows).
- Secobarbital (Seconal) (Reds).
- Combination of Amobarbital and Secobarbital (Rainbows).

(3) Nonbarbiturates (sedatives/hypnotics).

- Dalmane.
- Chloral hydrate.
- Methaqualone (Quaalude).
- Paraldehyde.
- Valium.
- Librium.

b. Narcotics (Analgesics).

- Opium.
- Morphine.
- Heroin.

- Demerol.
- Methadone.

c. Stimulants.

(1) Amphetamines.

- Dexedrine.
- Benzedrine.
- Methedrine.

(2) Cocaine.

(3) Caffeine.

(4) Nicotine.

d. Hallucinogens (Psychedelics).

- Marijuana, hashish tetrahydrocannabinol (THC).
- LSD (lysergic acid diethylamide).
- Psilocybin.
- Mescaline.
- Dimethyltryptamine (DMT), diethyltryptamine (DET), 2, 5-dimethxoxy-4-methylamphetamine (DOM or STP), 3, 4 methylenedioxy-amphetamine (MDA)
- Phencyclidine (PCP).

21-12. Signs and Symptoms of Use and Abuse of Depressants, Narcotics, Stimulants, and Hallucinogens

You need to recognize the signs and symptoms of depressants, narcotics, stimulants, and hallucinogens. Early recognition and referral of an abuser of these substances could play an important role in rehabilitating him and possibly saving his life.

a. Depressants.

(1) Intoxication.

(a) Mental.

- Memory losses (blackouts).
- Decreased emotional control (such as inappropriate crying or laughing).

- Impaired judgment.
- Inability to speak coherently.

(b) Physical.

- Decreased muscular control (staggering, loss of reaction time).
- Breathing difficulty (respiratory depression).
- Nausea and vomiting.

CAUTION

These combined effects can lead to the individual inhaling his own vomitus and suffocating.

(2) Alcohol abuse.

(a) Liver disorders.

- Alcoholic (Laennec's) cirrhosis—chronic diffuse liver disease which can lead to serious metabolic problems and death. May also be seen as fatty cirrhosis or fatty liver when the liver breakdown is associated with extensive fatty infiltration.

- Alcoholic hepatitis—an acute inflammation of the liver which results in excess plasma bilirubin. The excess bilirubin causes yellowish skin and eyes (jaundice) and may result in death.

(b) Stomach disorders.

- Gastritis—an acute inflammation of the stomach lining which causes pain, nausea, vomiting, and loss of appetite (anorexia).
- Gastric ulcers—an erosion of the stomach wall by digestive juices which causes pain and bleeding and may lead to perforation, infection, and death.

(c) Circulatory disorders.

- Anemia—a red blood cell shortage which results in weakness and fatigue that is typically caused by iron or vitamin deficiency.
- Heart disease—weakening of the heart muscles leading to congestive heart failure.

(d) Nervous system disorders.

- Brain cell deterioration which leads to impairment of memory, judgment, balance; severe organic brain syndrome may be observed.

- Psychotic disorders (alcohol hallucinosis, toxic psychosis) which may be characterized by disorientation, confusion, hallucinations, and/or incoherent speech.

b. Drugs.

(1) Barbiturates/abuse. There are no known specific physical disorders commonly associated with barbiturate abuse.

(2) Narcotics.

(a) Drug intoxication.

- Rush (warm flushing of the skin and sensations in the lower abdomen described by addicts as similar to sexual orgasm).
- Euphoria.
- Drowsiness.
- Decreased anxiety.
- Decreased appetite.
- Decreased sexual drive.
- Decreased blood pressure.
- Decreased respiration.
- Constipation.
- Tolerance develops.
- Psychological dependence may develop.
- Physical dependence may develop.

(b) Abuse.

NOTE

Most disorders and diseases associated with narcotic abuse (hepatitis, venous collapse, poisonings, malnutrition) are the indirect result of the drug abuse and are caused by poor diet or lack of hygiene.

(c) Withdrawal symptoms.

- Tearing, runny nose, sweating.
- Yawning.

- Nausea and vomiting.
- Diarrhea.
- Muscle aches and abdominal cramps.
- Anxiety and irritability.
- "Goose-flesh".

(d) These symptoms usually begin 3 to 8 hours after the last dose of the drug, peak at 36 to 72 hours, and diminish within 5 to 10 days.

c. Stimulants.

(1) Intoxication.

- Euphoria.
- Increased self-confidence.
- Alertness and energy.
- Irritability.
- Talkative.
- Insomnia.
- Loss of appetite.
- Rapid pulse.
- Dry mouth.
- Dilated pupils.
- Shakiness.

(2) Problems caused by abuse.

- Weight loss.
- Exhaustion.
- Mental deterioration.
  - o Impaired judgment.
  - o Increased suspiciousness.
  - o Increased aggressiveness.

- Indirect effects (due to poor diet, lack of hygiene, and self-injection with contaminated products).
    - o Skin ulcers.
    - o Abscesses (pockets of infection in organs, blood vessels, joints, and the brain caused by contaminated drugs and needles).
- Overdose (usually clears up within 10 days after last dose).
    - o Violent behavior.
    - o Toxic psychosis (paranoid ideation, hallucinations).
- Tolerance develops.
- Psychological dependence may develop.

(3) Drug withdrawal has the following features:

- Depression—may be severe or suicidal.
- Exhaustion.
- Muscle cramps.

d. Hallucinogens.

(1) Intoxication.

(a) Mental symptoms.

- Altered thinking and feeling states.
- Distorted perceptions.
    - o Time and space.
    - o Visual, auditory, and tactile (touch) sensations.
- Hallucinations.
- Impaired judgment.
- Increased suggestibility.

(b) Physical symptoms.

- Increased pulse rate
- Dilated pupils.
- Lack of coordination in extremities.

(2) Abuse of hallucinogens can cause the following symptoms:

● "Bad trips"—usually temporary adverse drug reactions such as severe panic, withdrawal, delusions, and hallucinations.

● "Flashbacks"—a spontaneous hallucinogenic experience without any drug intake that may occur weeks or months after the last drug use.

● Toxic psychosis—may be caused by the drug or by it being mixed in contaminants.

o Paranoid ideation.

o Hallucinations.

● Psychological dependence may develop (rare).

● Tolerance develops rapidly but disappears with drug withdrawal.

● No well defined withdrawal syndrome.

21-13. Psychosocial Signs/Symptoms of Alcohol/Drug Abusers

The following are additional psychosocial signs and symptoms of alcohol/drug abusers:

a. General personality changes.

b. Mood/behavioral changes—

● Irritability.

● Nervousness.

● Agitation.

● Argumentative attitude.

c. Changes in work habits—

● Lowered quality/quantity of output.

● Inconsistent work pace (likely to change frequently without apparent reason).

● Errors in judgment.

● Lack of interest in work.

d. Frequent or increased—

- Tardiness to work.
- Absence from work area.
- Marital problems.
- Financial difficulties.
- Avoidance of family and friends.
- Deterioration of appearance, dress, and personal hygiene.
- Physical changes such as marked weight loss, exhaustion, and a lack of coordination.
- Frequent changes on or off the job.
- Slurred speech.
- Frequent skin problems (ulcerations, abscesses).
- Dilated or constricted pupils.

21-14. Procedures for Reporting and Referring of a Suspected Alcohol/ Drug Abuser to a Physician

a. In a medical treatment facility (for example, ward, clinic, dispensary), the medical specialist will inform the patient's physician of suspected alcohol/drug abuse.

b. At unit level (for example, company, battalion), the medical specialist will—

(1) Annotate on the DD Form 689 (Individual Sick Slip) that the suspected abuser exhibits behavior other than normal.

(2) Refer the suspected abuser to a physician at the nearest medical treatment facility. Inform the physician directly of the information and observations regarding the patient.

NOTE

In the medical chain of command, only the physician can notify the unit commander of the suspected alcohol/drug abuser.

Section III. THE SUICIDAL PATIENT

21-15. General

a. Suicide is a major problem in our country. It is the tenth leading cause of death in the United States and the third 'eading cause of death for adolescents and adults under thirty. Additionally, the suicide rate for this group is increasing.

b. Seventy-five percent of potential suicides visit a medical facility within 6 months prior to their death. Timely awareness of pre-suicidal signs and symptoms can lead to correct intervention and prevention. For each documented suicide, a comparable number of persons die as a result of actions which likely were intended to be self-destructive but could not be verified. For example, such actions could be "accidental" overdoses of medication or taking needless chances while driving.

c. In wartime, the suicide rate among soldiers tends to decrease. Aggressive drives are channeled toward the enemy. However, some deaths due to inappropriate behavior during combat may, in reality, be suicides.

d. A soldier who is a potential suicide may be identified by the medical specialist, after which he will be referred to trained medical personnel for appropriate action. For each of the individuals who committed suicide, it is estimated that an additional 10 individuals attempted suicide but survived. On the basis of numbers alone, it is likely that you may be involved directly with persons who are potentially suicidal.

21-16. Definitions and Terms

a. Behavior Signs. Actions or behaviors that a person takes, such as spending more money than usual or increasing alcohol consumption. These signs may also give some indication of the person's thinking.

b. Crisis. The point at which customary problem-solving or decision-making methods are no longer adequate. At this turning point, a person may choose suicide as a way to solve the problem.

c. Depression. Refers to feelings (moods) of sadness, despair, and discouragement, and as such may be a normal state. Depression which may be disruptive to the soldier is commonly manifested in decreased thinking processes or purposeful physical activity, guilt, self-condemnation, hopelessness, and disorders of eating and sleeping.

d. Intervention. Treatment by health care personnel when there is some question of the individual's ability to cope with his own resources and requires assistance. This action is also known as "crisis intervention" when the individual shows signs of reaching a crisis point.

e. Stress. Any situation or action that places physical or psychological demands upon a person. Exhaustion refers to prolonged and unrelieved strain and tension generated in a person by situations encountered in life.

f. Stressors. Specific situations that may trigger stress in a person (for example, taking a test, playing a game of football, receiving or not receiving a promotion, a permanent change of station).

g. Suicide. The act of intentionally killing oneself.

h. Suicidal Attempt. The act of self-damage inflicted with self-destructive intention, however vague and ambiguous. Sometimes this intention has to be inferred from the person's behavior.

i. Verbal Signs. Spoken words or acts or interpersonal communication, such as telephone calls or an ordinary conversation. These signs may reveal the thoughts of a person.

21-17. Suicide Factors

a. A person who decides to commit suicide has become overwhelmed by problems he cannot face and solve. He feels powerless to find a solution to his intolerable situation and may think that no one really cares about him. He may be suspicious of the people who try to help him and suicide may seem to be the only way out.

b. Basically, it is not the patient's problems that make his life seem intolerable; it is the way he feels about these problems. For example, blindness may be a reason for one person to attempt suicide but a motivating factor for another person to become a great composer. Many factors influence a patient's decision to try to end his own life; loneliness seems to be a primary reason. The patient who does not identify himself with some group (such as a family, church, or community) is more susceptible to suicidal tendencies. The psychiatric patient who is also physically ill may resort to suicide, particularly if he is in pain, his prognosis is poor, he feels that he is a burden to others, or he is severely disfigured. Loss of a loved one accompanied by feelings of guilt and depression or inability to transfer affections to someone else may be an influencing factor in suicide. Loss of prestige or decline in social position may also be contributing factors.

c. A patient's psychiatric condition may cause him to attempt suicide. The patient who is recovering from an attack of depression may feel unable to cope with the stress and strain of living. He may be discouraged to the point of trying to take his own life. The patient who recognizes the symptoms of an oncoming attack of depression may feel he cannot go through the painful experience again. A patient may have delusions or hallucinations which threaten him or command him to kill himself. A confused, disoriented patient suffering from an organic mental disorder or from substance abuse is also likely to commit suicide. This is especially true at night when he tends to be the most confused.

d. It is also possible for a patient to have an unconscious motive which drives him to attempt suicide. For example, the patient who cannot direct his aggression against a person whom he hates may turn these feelings of hatred and aggression against himself. When he kills himself, he is symbolically killing the hated person. A patient may kill himself for spite or revenge. He may feel that by destroying himself he can make certain persons grieve and repent for real or imagined wrongs that they have done to him. Or, he may feel that only death is severe enough punishment for his own imagined wrongs. Not every patient who attempts suicide plans for the outcome to be self-destruction. He may see a suicidal attempt as the only way to get people to understand exactly how badly he feels and to do something for him. He intends for someone to rescue him in time to prevent death.

21-18. Planned and Unplanned Suicides

One patient may plan suicide for weeks or months; another one may act on impulse. The patient who plans his suicide schemes to obtain and hide necessary articles. He carefully works out every step in the plan. He may have two or more plans in the event one fails. The patient who attempts suicide impulsively may act in response to bizarre ideas or voices he hears. He attempts suicide when an opportunity arises. Such an opportunity may be presented by careless personnel who are not alert to hazards or who inadequately observe and supervise patients' activities.

21-19. Physical and Psychosocial Symptoms and Warning Signs

a. Physical Symptoms.

(1) Many of the physical symptoms of suicidal intent are due to depression. However, stress caused by traumatic personal injury, severe illness, or pain may trigger this depression and these symptoms.

(2) An individual who uses drugs or alcohol may also exhibit some of these physical symptoms.

b. Procedures and Steps.

(1) Observe the individual for physical symptoms of suicidal intentions. Physical symptoms of suicidal intentions are—

(a) Change in eating habits.

- Extreme weight gain.
- Extreme weight loss.

(b) Change in sleeping habits (must be more than a casual cycle of change).

- Inability to sleep.
- Excessive sleep.

(c) Change in normal energy level.

- Low energy level (chronic tiredness).
- Overactivity (agitation).
- Restlessness.
- Physical exhaustion.
- Change in mental response.
- Difficulty in decision making.
- Confused thinking.
- Short attention span.

(d) Complaints about physical problems. The potentially suicidal individual may come to you with a physical complaint. You need to be alert to possible emotional problems which may be signaled by surface physical complaints, such as—

- Chest, stomach, back.
- Head, extremities.
- Constipation.
- Decreased sexual desire or performance.

(e) Personal injury/accidental dismemberment (carelessness around field equipment may cause accidental loss of limbs).

(2) Observe individual for psychosocial symptoms of suicidal intentions.

NOTE

Psychosocial symptoms are nonphysical symptoms that refer to human emotions and to any change in the life pattern of an individual. Many of these symptoms are caused by stress due to a recent situation.

(a) An individual who abuses drugs or alcohol may exhibit some of these psychosocial symptoms. Observe the individual for—

- Depressed moods (feels low, sad, gloomy).
- Expresses low self-esteem.
- Is fearful and/or trembling.

(b) Changes in appearance can be indicative of a person's mood and deteriorating self-image.

- Self-neglect.
  - o Personal hygiene.
  - o Lack of concern for appearance.
- Body movements.
  - o Sluggish—moves in "slow motion."
  - o Posture stooped and bent.
- Facial expression—blank or sad.

- Changes in work habits.
  - o Lowered quality/quantity of work.
  - o Inconsistent work pace, likely to change frequently without apparent reason.
  - o Lack of interest in his work.
- Changes in usual patterns of behavior.
- Loss of interest in recreation or hobbies.
- Loss of interest in people.
  - o Avoidance of family and friends.
  - o Decreased sexual drive.
- Marital and family problems.
  - o Separation/divorce.
  - o Difficulties with spouse.
  - o Child-rearing problems.
  - o Loss of self-control.
  - o Social isolation.
- Financial problems.
  - o Debts.
  - o Living within a restrictive budget.
- Interpersonal problems.
  - o Lovers' quarrels.
  - o Difficulty in accepting authority.
  - o Homesickness.
  - o Loss of supportive community or family ties.
  - o Difficulty with people at work.

(3) Observe individual for signs of suicidal intentions.

(a) Warning signs.

- Statements of hopelessness/helplessness (for example, "I can't take it any longer.").

- Statements of loss of meaning in life (defeat, failure) (for example, "I never seem to do things right." "I never asked to be born.").

- Statements of an end to a personal relationship (for example, "My girlfriend ran off with someone else.").

- Questions about death and/or suicide.

(b) Direct verbal signs indicate recognition of a need for immediate intervention.

- Statements that the soldier intends to commit suicide must be taken seriously especially when physical or psychosocial symptoms are also noted.

- Statements that the soldier has a specific plan to commit suicide. This may include the time, date, and means to be used. Such a person is a greater risk because he is more likely to follow through with his expressed plan.

(c) Behavioral signs are nonverbal communication that indicate a need for outside assistance (intervention). You should be alert for a pattern of behavioral warning signs that indicates possible suicidal intentions, such as—

- Preparations for death (making a will; making funeral arrangements).

- Drastic change in possessions/finances (giving expensive gifts; giving away prized possessions).

- Putting his affairs in order.

- Extreme risk-taking behavior.

  o Driving a car or motorcycle at an excessive rate of speed.

  o Refusal to follow medical advice or take life-essential prescribed medication.

  o Refusal to use safety equipment or follow safety rules.

- Increased alcohol use.

- Withdrawal from social relationships.

- History of suicide attempt(s).

  o A person who has already attempted suicide once is statistically more likely to attempt suicide again.

o Information about an attempt to commit suicide may come from medical records, friends, verbal interaction with the individual, or other sources.

o Physical signs (such as scars on the wrist) may be noted.

o Deliberate attempts to commit suicide by means of a gun; jumping from a high place; overdose of medication (most common); wrist slashing; or hanging.

(4) Intervene and take immediate action when the soldier shows sign of suicidal intentions.

(a) Communicate with the soldier.

- Tell him that you care and hope that solutions to his problems can be found.

- Convey a willingness to listen and try to understand him.

(b) Assessment of suicidal risk is not easily accomplished. If there is any suspicion of possible suicidal intentions, you should take the individual to specially trained personnel, such as a Behavioral Science Specialist (91G) or a Neuropsychiatric Specialist (91F).

(c) If an individual confronts you with an immediate means of suicide (such as medication, a knife, or a gun) intervention may be necessary—but *extreme caution* should be exercised so as not to endanger yourself or others.

(5) Notify supervisor of possible need for immediate intervention. DO NOT LEAVE THE INDIVIDUAL ALONE.

- If physical and psychosocial symptoms are observed and indirect verbal and behavioral warning signs are noted, immediately request evacuation, or contact the hospital for an emergency appointment.

- Accompany the individual to the referral agency or to the consulting professional for assessment, or turn the individual over to the evacuation personnel.

NOTE

An individual who is a potential suicide should be referred to medical personnel for appropriate action. The survival ratio for attempted suicides as opposed to aborted suicide attempts is 10:1.

Section IV. DEATH AND DYING/POSTMORTEM CARE

21-20. General

a. All of us must eventually die, since death follows living; it is a natural process. In our society, birth is a cause for celebration, but death normally is a dreaded and unspeakable issue.

b. Death reminds us of our human weaknesses in spite of all our modern advances. We may want to delay death, but we cannot escape it. Death is the last and loneliest experience for all of us. Therefore, it is difficult to help others face it.

c. As a medical specialist, you are frequently faced with the reality of another person's death; this is often painful and stressful. It is only natural for fears of death and personal concerns to intensify whenever you are in contact with someone who is dying. To effectively work with the dying patient, you must recognize and understand the individual's needs, feelings of tension, and discomfort.

21-21. Characteristic Elements and Health Care Action

Denial, anger, bargaining, depression, and acceptance are the five basic stages of dying. The patient may or may not follow these stages in a fixed pattern. He may go back and forth, or he may never get beyond a certain stage, such as denial.

a. Denial.

(1) *Patient reaction.* The patient may—

- Seek additional opinions from other physicians.
- Request that certain tests be repeated or flatly refuse the results and say that these results belong to another person.
- Express denial verbally (for example, "No, not me!" "It can't be true!" or "There must be some mistake!").

(2) *Health care provided by the medical specialist.*

- Listen—but do not contradict the patient.
- Reinforce prescribed medications/diet routine indicated by the physician.
- Respect the patient's wish to deny impending death.

b. Anger.

(1) *Patient reaction.* Patient may—

- Attack you or other members of the staff on a personal or professional level and may tend to be very critical of the care received (even that received from his family).

his anger.

- Feel angry inwardly/outwardly, making you the object of

NOTE

You should be aware of the negative feelings of the patient and not take these angry feelings personally.

- Replace the denial stage with questions and feelings of rage, resentment, and envy. This is characterized by "Why me?" "Why is this happening to me?" "I didn't do anything to deserve this punishment."

(2) Health care provided by the medical specialist.

- Be patient and tolerant.

- Let the patient know that you accept and understand his feelings.

- Permit the patient to express his anger and any other feelings that he may have.

NOTE

Do not react with anger or avoidance. Just allow the patient to express his anger. Do not attempt to answer all of his questions.

c. Bargaining.

(1) *Patient reaction* (this stage may be short, irregular, and possibly not even apparent). Patient may—

- Attempt to postpone death.

- Replace the previous question of "Why me?" to "Yes, it is me, but...," or "Why now?"

NOTE

The medical specialist may hear the patient say that he would do anything if he could live a little longer ("I promise I will...").

(2) *Health care provided by the medical specialist.*

- Listen and be available to the patient for assistance.

- Know that when the patient bargains it is helpful to him.

- Do all you can to keep the patient comfortable.

NOTE

Remember that this stage may not always be perceptible since the patient may bargain privately.

d. Depression.

(1) *Patient reaction.* The patient may—

- Be anxious to put his affairs in order.
- Feel a sense of great loss.
- Have apparent feelings of sadness and guilt over not having provided for his family.

(2) *Health care provided by the medical specialist.* Allow the patient to mourn, cry, or talk about his losses.

e. Acceptance.

(1) *Patient reaction.* The patient—

- Has prepared to die.
- Is now at peace.
- Is tired.

(2) *Health care provided by the medical specialist.*

- Respect the patient's need for quiet and offer reassurance by being there when possible.
- Although you may feel sad or uncomfortable about the dying patient, you must learn to control your feelings so that they will not affect the patient.
- Do not whisper, as this may upset the patient if he can hear you talking but cannot understand what is being said.

NOTE

The last sense believed to leave the body is that of hearing. The patient often understands what is being said even though he may not be able to answer verbally.

21-22. Hospital Death

When a patient dies in a hospital, the physician is responsible for examining the body, declaring the patient legally dead, and notifying the next of kin. You, as the medical specialist, are expected to perform postmortem (after death) care. When providing this care, you must conduct yourself so as to preserve the dignity and respect of the body.

21-23. Procedures for Providing Postmortem Care in a Hospital Environment

a. Obtain Special Instructions. Ask your supervisor for any special instructions in caring for the deceased.

b. Perform Initial Postmortem Care.

(1) Place screens around the bed, draw the curtains around the bed, or close the door to provide privacy for the body.

(2) Close the patient's eyelids by applying light pressure downward with your fingertips.

(3) Adjust the bed to a flat position. Use one pillow under the head of the body to prevent discoloration of the face. (Facial discoloration results when blood is pooled in the head region.)

(4) Inspect the body for soiling. Wash soiled areas. You should wear gloves during cleaning. Change the hospital gown if it is soiled.

(5) Align the body in the natural anatomical position: supine (on the back) position, arms at the side, and palms turned toward the thighs. Poor alignment will result in deformities due to rigor mortis (profound stiffening of the limbs and body as a result of death).

(6) Replace the bed linens, if soiled, and straighten top bedding.

(7) Clean and replace dentures according to local SOP. Comb the hair. If necessary, close or support the patient's mouth by using rolled ABD pads to prevent the jaw from sagging. (Most local policies discourage the use of chin straps since discoloration of the face may occur.)

(8) Clean the deceased patient's area and remove all unnecessary equipment.

NOTE

If the family wishes to view the body, it is accomplished at this point. Be supportive and compassionate with the relatives and friends who visit the body.

(9) Perform a patient care handwash.

c. Perform Final Postmortem Care. Final postmortem care on the ward begins after the patient's family has viewed the body. After it has been viewed, prepare it for transfer to the morgue.

(1) Obtain the necessary equipment.

(a) Gather commercially or locally prepared death pack or equipment according to local SOP. Generally, a death pack includes:

- Mortuary sheet.
- Absorbent cotton or some type of underpads.

- Gauze or bandage rolls (ties).
- Safety pins.
- Instruction sheets for completing required forms.
- Required forms:
  - o Death tags (3).
  - o Hospital Report of Death.
  - o Authorization for Autopsy.
  - o Disposition of Body.
  - o Local forms.
    - ■ State death certificate information worksheet.
    - ■ Form for organ donor designation.

(b) Gather additional equipment.

- Clean sheets.
- Diapers.
- Basin of warm water and soap.
- Clean gloves.
- Paper bag.
- Acetone/benzine (optional) per local SOP.
- Stretcher.
- Litter straps (2).
- Laundry hamper/bag.
- Comb.
- Washcloth, towel.

(2) Provide privacy. Continue to provide privacy for the body by placing screens around the bed, drawing the curtains around the bed, or closing the door.

(3) Put on clean gloves.

(4) Remove clothing, bedding, and personal belongings.

- Top bedding except for a drape sheet.
- Pajamas/gown.
- Soiled dressings (discard with contaminated waste).
- Jewelry and personal items (get-well cards, eyeglasses, religious articles).

NOTE

Throughout final care, note and remove any remaining jewelry and personal articles. Notify your supervisor regarding any such items found. Never leave valuables unattended.

(5) Tie off or clamp all drains and tubes.

- Do not remove any drains or tubes from the body unless specifically directed by your supervisor.
- If there is to be an autopsy, tubes are generally left in the body.
- Prevent unnecessary exposure of the body.

(6) Wash the body and remove adhesive markings from the skin (if applicable). Remove adhesive markings with solvent as prescribed in the local SOP.

(7) Apply new dressings over wounds, using a minimum amount of tape and dressings.

NOTE

New dressings reduce the possibility of odor caused by microorganisms.

(8) Pad the anal and urinary areas with adult diapers or by folding a drawsheet and pinning it in place. The perineal pad is placed to absorb feces and urine which are expelled as the sphincters relax; also, this pad is used to absorb drainage from the vagina.

(9) Remove gloves if you are wearing them.

(10) Secure ankles and wrists.

- Pad ankles with an ABD pad and secure them with a gauze roller bandage or according to the local SOP.
- Pad wrists with an ABD pad, cross the right wrist over the left wrist, and secure them with a roller gauze bandage or according to the local SOP.

(11) Attach two body tags to the body.

- Obtain completed and signed death tags from your supervisor.
- Tie a death (body) tag to the right great toe.
- Tie a death (body) tag to the left wrist.

NOTE

Do not tie the tag so tight as to cause pressure. Pressure causes severe skin discoloration.

(12) Wrap the body.

- With assistance, roll the body to the side of the bed.
- Place one clean sheet diagonally under the body.

NOTE

Method of wrapping the body may differ between hospitals. In some hospitals the body is placed in a zippered bag; in others, a specially prepared shroud is used. Follow your local SOP.

- Roll the body back to the center of the sheet.
- Fold the upper corner of the sheet loosely over the head and face. Fold the lower corner over the feet.
- Fold the right and left corners of the sheet over the body.
- Fasten the sheet corners with a safety pin.

(13) Attach signed exterior body tag to the outside of the sheet.

(14) Transfer the body to a cart or stretcher.

- With assistance, lift the wrapped body onto the cart/stretcher.
- Secure the body to the cart/stretcher with straps at the chest and just above the knees. Avoid using pressure (this will cause discoloration of the skin).
- Cover the wrapped body with a clean sheet.

(15) Transport the body to the morgue.

- Obtain all records and forms which are to accompany the body to the morgue from your supervisor.

- Notify the morgue that the body is being transferred.

NOTE

A ward staff member must accompany the body when it is being transported to the morgue. Service elevators and seldom used corridors should be used for transporting. Avoid transferring the body in the view of visitors and patients; they may become depressed, develop anxious feelings, or become frightened.

- Assist the morgue attendant with the transfer of the body from the cart/stretcher to the morgue equipment.

- Give the morgue attendant all the available records.

- Return the stretcher to the ward and clean it according to the local SOP.

(16) Perform a patient care handwash.

d. Clean the Deceased Patient's Area. Give the patient's area a terminal cleaning. Follow the principles of medical asepsis and local SOP.

e. Report the Procedure. Report completion of postmortem care to your supervisor.

GLOSSARY

Section I. ACRONYMS AND ABBREVIATIONS

ABC's	airway, breathing, and circulation surveys
ABO	Blood typing system
ABG	arterial blood gases
AC	hydrocyanic acid (blood agent)
ACTH	adrenocorticotrophic hormone
ADH	antidiuretic hormone
ADAPCP	Alcohol and Drug Abuse Prevention and Control Program
AF	Air Force
AMEDD	Army Medical Department
AMOSIST	Automated Military Outpatient System
ANC	Army Nurse Corps
AR	Army Regulation
ARNG	Army National Guard
ATTN	attention
AWOL	absent without leave
BMR	Basal metabolic rate
B/P or BP	blood pressure
BSA	body surface area
Bx	biopsy
C	centigrade
Cau	Caucasian
CBC	complete blood count
cc	cubic centimeter
CDC	Center for Disease Control
CHF	congestive heart failure
CK	cyanogen choloride (blood agent)

cm	centimeter
cmm	cubic millimeter
CNS	central nervous system
CO_2	carbon dioxide
COLD	chronic obstructive lung disease
CONUS	Continental United States
COPD	Chronic obstructive pulmonary disease
CPR	cardiopulmonary resuscitation
CRO	carded for record only
CSF	cerebrospinal fluid
CX	phosgene oxime (blister agent)
CT	connective tissue
D5NS	5 percent dextrose in normal saline
D5W	dextrose 5 percent in water
DA	Department of the Army
DET	diethyltryptamine
DIFF	differential count
DMT	dimethyltryptamine
DOA	death on arrival
DOD	Department of Defense
DOM or STP	2, 5-dimethxoxy-4-methylamphetamine
ECG or EKG	electrocardiogram
EEG	electroencephalogram
est	estimate
ETOH	alcohol

F	Fahrenheit
FBS	fasting blood sugar
FCT	fibrous connective tissue
FDCA	Food, Drug, and Cosmetic Act
FM	field manual
FMC	Field Medical Card
FMP	family member prefix
Fr	French (denotes size of catheter or tube)
FTCA	Federal Torts Claims Act
g	grain
ga	gauge
GA	Tabin (nerve agent)
gal	gallon
GB	Sarin (nerve agent)
GB series	gallbladder series
GD	Soman (nerve agent)
GI	gastrointestinal
GI series	gastrointestinal series
Gm	gram
HCT	hematocrit
HD	mustard (blister agent)
Hgb	hemoglobin
HQDA	Headquarters, Department of the Army
hr	hour
HREC	health record

ICP	intracranial pressure
ID	identification
IM	intramuscular
in	inch
IPDS	Individual Patient Data System
ITP	inpatient treatment record
ITRCS	inpatient treatment record cover sheet
IUD	intrauterine device
IV	intravenous
IVP	intravenous pyelogram
JPA	job performance aid
K	potassium
Kg	kilogram
L	Lewisite (blister agent)
Lab.	laboratory
lbs.	pounds
lig.	ligament
LP	lumbar puncture
LSD	lysergic acid diethylamide
LUL	left upper lobe (of lung)
LUQ	left upper quadrant
Lymphs	lymphocytes
m	meter
MAST	military anti-shock trousers
M.D.	medical doctor

MDA	methylenedioxyamphetamine
MEDCEN	Medical Center
MEDDAC	Medical Department Activity
mg	milligram
MG/L	milligram per liter
MI	myocardial infarction
MILPO	Military Personnel Office
ml	milliliter
mm	millimeter
MM/Hg or mm hg	milliliters of mercury
MOS	military occupational speciality
mph	miles per hour
MPRS	military personnel records jacket
MTF	medical treatment facility
NATO	North Atlantic Treaty Organization
NATO STANAG	North Atlantic Treaty Organization Standardization Agreement
NAVL	nerves, arteries, veins, and lymphatics
NAVMED	Navy medical
NBC	nuclear, biological, or chemical
NCT	nerve condition time
NF	National Formulary
Neg	Negroid
NGR	National Guard Regulation
NH	nitrogen mustard (blister agent)
NO.	number
NS	normal saline

0_2	oxygen
OB	obstetrical
O.D.	oculus dexter—right eye
OF	optional form
O.S.	oculus sinister—left eye
OT	old tuberculin
OTH	other
OTR	outpatient treatment record
O.U.	oculus uterque—both eyes
oz	ounce
Pap	Papanicolaou
PCP	phencyclidine
PDR	Physician's Desk Reference
PE	physical examination
PERLA	pupils equal and react to light
PHS	Public Health Service
PID	pelvic inflammatory disease
ppm	parts-per-million
PREOP	preoperative
psi	pounds per square inch
rad	radiation absorbed dose
RBC/rbc	red blood cell
RTC	return to clinic
RES	reticuloendothelial system
Rh	Rhesus factor
RLL	right lower lobe (of lung)

RLQ	right lower quadrant
RML	right middle lobe (of lung)
Rpt	report
RTD	return to duty
RUL	right upper lobe (of lung)
RUQ	right upper quadrant
SF	Standard Form
SG	Surgeon General
SIDPER	Standard Installation Division Personnel System
SL	sublingual, under the tongue
SOAP	subjective (signs and symptoms), objective (observations), assessment, and plan (a format for progress notes)
SOP	standing operating procedure
Sp Gr	specific gravity
SQ	subcutaneous
SSE	soap suds enema
SSI	special skill identifier
STAT/stat	Statim (immediately)
SSN	social security number
TB MED	technical bulletin, medical
THC	tetrahydrocannabinol
TKO/Tko	to keep open
TMC	troop medical clinic
TPR	temperature, pulse, and respiration
TOE	Table of Organization and Equipment

unk	unknown
USAR	United States Army Reserves
USC	United States Code
USP	United States Pharmacopeia
VD	venereal disease
VX	unnamed nerve agent
WBC/wbc	white blood cell
WIA	wounded in action
yrs	years

Section II. DEFINITIONS AND TERMS

Addiction	A marked psychological and physiological dependence on a substance such as alcohol or a drug, which has gone beyond voluntary control.
Anaphylaxes	An unusual or exaggerated allergic reaction to foreign proteins or other substances.
Aneurysm	A permanent blood-filled dilation of a blood vessel resulting from disease or injury of the blood vessel wall.
Antibody	A protein substance in the body that develops the body's immunity to a specific pathogen.
Battle casualty	Any casualty incurred in action. "In action" characterizes the casualty status as having been the direct result of hostile action; sustained in combat or relating thereto; or sustained going to or from a combat mission provided that the occurence was directly related to hostile action. Included are persons

	killed or wounded mistakenly or accidentally by friendly fire directed at a hostile force or what is thought to be a hostile force.
Body resistance	The body's ability to oppose an infection, but does not imply immunity.
Brackish water	Highly mineralized, salty-tasting water that contains dissolved solids in excess of 500 parts per million.
Carded for record only (CRO)	A term which applies to those special cases for which a medical record is required to be prepared in the same manner as for an admission, although no admission has actually occurred.
Cartilage	A tough, white connective tissue that covers the joint surfaces of bone.
Chlorination	Disinfection of water by the addition of a chlorine compound such as calcium hypochlorite.
Chlorine demand	The amount of chlorine which reacts with and is consumed by organic material, bacteria, and other substances in water.
Chlorine dosage	The amount of chlorine added to a given quantity of water.
Chlorine residual	The amount of chlorine remaining after the demand has been satisfied. Dosage minus demand equals residual.
Clinic	A medical treatment facility intended for and staffed and equipped to provide emergency treatment and ambulatory services. A clinic may be equipped with beds for observation of patients awaiting transfer to a hospital, and for those cases which cannot be cared for on an outpatient status, but which do not require hospitalization.
Contagion	Communication of a disease from one person to another by direct or indirect contact.

Contaminate	To soil, pollute, or taint; any contact with unsterile or radioactive materials or surfaces.
Contaminated water	Water that is unfit for human consumption even though it may be palatable. Contaminated water contains disease-producing organisms and/or excessive amount of mineral and organic matter, toxic chemicals, or radioactive materials.
Convalescent leave	Convalescent leave is an authorized leave status granted to active duty uniformed service members while under medical or dental care which is a part of the care and treatment prescribed for his recuperation (convalescence).
Cravat	Triangular bandage that is used for fashioning a sling or swathe.
Crepitation	Crackling; the sensation felt or heard over the fracture site when broken bone ends rub together.
Definitive medical treatment	That specialized care of the sick and wounded given by highly trained medical personnel, ordinarily the physician.
Delivery	The procedure of delivering a liveborn infant or stillbirth (and placenta) by manual, instrumental, or surgical means.
Diaphysis	The main, central shaft of a long bone.
Died of wounds received in action (DOW)	The term used to describe all battle casualties who die of wounds or other injuries received in action after having reached any medical treatment facility.
Disease	A condition in which physical and/or mental health is impaired as the result of some process other than that caused by accident, violence, or poisoning.
Disinfect	To reduce the numbers of micro-organisms, usually by germicides or boiling water.

Disinfection	Treatment with chemicals or by boiling to destroy disease-producing organisms.
Dislocation	Displacement of a bone from its joint.
Dispensary health clinic	*See* Clinic.
Ecchymosis	The purplish discoloration of skin caused by the passage of blood from ruptured blood vessels into subcutaneous tissue; bruise.
Emergency medical care	The early care given by trained medical personnel.
Epigastrium	The upper and middle regions of the abdomen with the sternal angle.
Epiphysis	The end portions of a long bone.
Ethanol	Ethyl alcohol; the type of alcohol present in alcoholic beverages.
Existed prior to service (EPTS)	A term added to a medical diagnosis to signify that there is clear and unmistakable evidence that the disease or injury, or the underlying condition producing the disease or injury, existed prior to the individual's entry into military service.
Fomites	Any objects (books, clothing) that can harbor and transmit infectious organisms.
Forceps	An instrument used to grasp, pull, and extract objects; there are many types, varying according to their usage.
Fracture	A break in the continuity of bone.
Closed fracture	One in which the skin overlying the site is intact.
Comminuted fracture	One in which the bone is broken into more than two pieces.
Greenstick fracture	An incomplete fracture commonly found in children.
Impacted fracture	One in which the broken ends of the bone are jammed together.

Oblique fracture	One in which the fracture line crosses the bone at an oblique angle or in a slanting direction.
Open fracture	One in which there is an open wound over the fracture site.
Spiral fracture	One in which the fracture line twists around and through the bone.
Transverse fracture	One in which the fracture line is straight across at a right angle to the long axis of the bone.
Geriatric	A term that refers to the elderly.
Germicide	A chemical substance that destroys bacteria.
Habituation	A situation in which a patient produces a tolerance to a drug and becomes psychologically dependent on the drug.
Hallucinogen	An agent or drug that has the capacity to stimulate hallucinations.
Hexachlorophene	A bactericidal or bacteriostatic substance contained in certain soaps.
Hives	A vascular reaction of the skin marked by the transient appearance of smooth, slightly elevated patches (wheals) which are redder or paler than the surrounding skin and often attended by severe itching. Hives are usually caused by reactions to foods, drugs, or emotional stress.
Hospital	A health treatment facility capable of providing definitive inpatient care. It is staffed and equipped to provide diagnostic and therapeutic services in the field of general medicine and surgery, preventive medicine services, and has the supporting facilities to perform its assigned mission and functions.
Hygiene	The individual employment of practices that will keep one healthy. These practices include proper diet and body cleanliness.

Hyperglycemia	An abnormally increased concentration of sugar in the blood.
Hyperthermia	An abnormally increased body temperature; hyperpyrexia.
Hypoglycemia	An abnormally diminished concentration of sugar in the blood.
Hypothermia	An abnormally reduced body temperature.
Infection	A condition in which the body is invaded by a pathogenic agent that under favorable conditions multiplies and produces injurious effects.
Immobilization	Prevention of the movement or use of an injured structure.
Inpatient	An inpatient is an individual, other than a transient patient, who is admitted (placed under treatment or observation) to a bed in an MTF which has authorized or designated beds for inpatient medical or dental care.
Inpatient treatment record (ITR)	The medical record used at an MTF for recording inpatient medical or dental care. It is begun on admission to the MTF and completed at the end of hospitalization. This record applies to all beneficiaries.
Inpatient Treatment Record Cover Sheet (ITRCS)	A medical and administrative summary of each continuous, uninterrupted period of inpatient treatment and is prepared for each case an ITR is needed. (For CRO cases, the ITRCS may be the entire ITR.) ITRCS are also essential documents for HREC and OTR. In addition, they serve as source documents for statistical information of major military and medical interest.
Insulin	A hormone secreted by the islets of Langerhans in the pancreas; essential for proper metabolism of blood sugar and maintenance of proper blood sugar levels.

Intoxication	A state of being excited or stupefied by alcohol or a narcotic to the point where physical and mental control is markedly diminished.
Killed in action (KIA)	Refers to personnel who are killed or who die of wounds or other injuries received in action before reaching any MTF.
Lavage	A washing-out of a hollow organ (such as the stomach).
Length of patient stay	The number of occupied bed days from date of admission to disposition. This excludes days subsisting out, on convalescent leave, on other authorized or unauthorized leave, or on pass in excess of 72 hours.
Ligament	A strong band of tissue that connects two or more bones.
Marrow	The soft, fatty substance that fills the medullary canal; responsible for the formation of blood.
Medical Center	A medical center is a large hospital which has been so designated and staffed and equipped to provide health care for authorized personnel; includes a wide range of specialized and consultative support for all medical facilities within a specific geographic area of responsibility; and postgraduate education in health professions.
Medical records	Refers to inpatient treatment records, outpatient treatment records, health records, x-rays, and US Field Medical Cards.
Medical Treatment Facility (MTF)	Any facility that receives, sorts, treats, and dispositions the sick and wounded. The facility may be fixed, nonfixed, numbered and unnumbered. This includes aid stations, clearing stations, clinics, hospitals, convalescent centers, dental clinics, veterinary dispensaries, and veterinary hospitals.

Medullary canal	The hollow central portion of the bone; contains the bone marrow.
Methanol	Methyl alcohol; wood alcohol; poisonous if ingested, causing extreme metabolic acidosis and blindness.
Military personnel	Any person on active duty or active duty for training in the US Armed Forces, including cadets of the Armed Forces academies.
Narcotic	A drug used to depress the central nervous system, thereby relieving pain and producing sleep.
Nonbattle injury	An injury which is not the direct result of action by or against an organized enemy or other battle casualties which may be so classified by departmental regulation.
Outpatient	An individual receiving health service for an actual or potential disease or injury that does not require admission to a medical facility for inpatient care.
Outpatient treatment record (OTR)	A medical record documenting outpatient treatment of the nonactive-duty beneficiary.
Palatable water	Water that is pleasing to the taste but which may be unsafe (contaminated).
Parts per million (ppm)	A unit of measurement for expressing the number of units of a substance in one million units of water by weight.
Pathogen	Microorganism capable of producing disease.
Pathogenic	Capable of producing disease.
Periosteum	The outermost layer of bone.
Peritoneum	The membrane that lines the abdominal cavity.
Physical dependence	*See* addiction.
Polydipsia	A condition of excessive thirst.
Polyphagia	A condition of excessive hunger.

Polyuria	A condition of excessive urination.
Position of function	Maintenance of the normal position of a joint or limb.
Potable water	Water that is safe for human consumption. Potable water is free from disease-causing organisms and excessive amounts of mineral and organic matter, toxic chemicals, and radioactive materials. The water may not be pleasing to the taste.
Prime beneficiary	An individual who because of his status is eligible for medical care in accordance with AR 40-3.
Primary cause of admission	The immediate condition which necessitated the patient's admission to the MTF.
Psychological dependence	*See* addiction.
Purulent (suppurative)	Forming or containing pus.
Pus	A liquid product of inflammation made up of tissue debris, bacteria, leukocytes, and serum.
Quadrant	The term used to designate one of the four quarters of the abdomen.
Quarters patient	An active duty uniformed service member receiving medical or dental treatment for a disease or injury that is of such a nature that inpatient care is not required, but he cannot perform his duties. The quarters patient is treated on an outpatient basis, remains in his quarters between treatment, and normally returns to duty within a 72-hour period.
Reduction	Restoration of the ends of a fractured bone to their normal anatomical position.
Retroperitoneum	The area behind the peritoneum.

Sanitation	The effective use of measures that create and maintain healthful environmental conditions. Among these measures are the safeguarding of food and water and the control of disease-carrying insects and animals.
Self-aid, first-aid, and buddy aid	Emergency medical procedures carried out by anyone, whether trained or untrained in medicine.
Sling	A bandage that is suspended from the neck to support an injured arm or hand.
Splint	Any device used to immobilize a fracture or dislocation.
Spore	A reproductive cell produced by plants and some protozoans that has a thick wall enabling it to withstand unfavorable environments.
Sprain	Injury in which ligaments are partially torn.
Strain	Soft-tissue injuries or muscle spasms around a joint.
Swathe	A bandage used in conjunction with a sling that is wrapped around the body to secure the injured arm.
Tendon	A fibrous cord or band that connects a muscle to a bone.
Tolerance	A diminished susceptibility to the effects of a drug or toxic substance acquired after continued ingestion of it.
Toxin	A poisonous substance of plant or animal origin.
Traction	Method used to realign fractures and dislocations by application of a pulling force to the site.
Transient patient	A patient en route from one medical treatment facility to another medical treatment facility.

Transmission	Transfer from one individual to another, such as a disease or hereditary characteristic.
Urticaria	Hives.
Vasoconstriction	The narrowing of the diameter of a blood vessel.
Vasodilation	The widening of the diameter of a blood vessel.
Venomous poison	A poison derived from reptiles or insect bites.
Virulence	Relative power or strength of a pathogen to produce disease.
Water treatment	Removal of undesirable elements in water through coagulation, sedimentation, filtration, and/or disinfection.
Withdrawal	A symptom produced by abstinence from a drug to which one is addicted.

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