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.

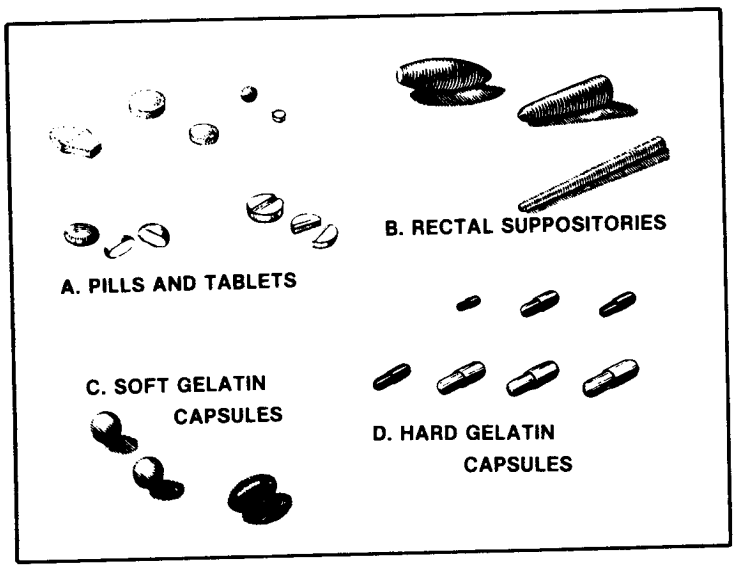

Figure 18-1. Solid preparation of drugs.

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
3	drachma	dram
3	uncia	ounce

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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?

$$1/4 \times 60 = \frac{60}{4} = 15 \quad \textit{Answer:}\ 15$$

b. To convert fluid ounces to milliliters, multiple by 30. *Example:* How many milliliters in 10 fluid ounces of water?

$$10 \times 30 = 300 \qquad \textit{Answer:}\ 300 \text{ ml}$$

c. To convert minims to milliliters, divide minims by 15. *Example:* How many milliliters in 10 minims of solution?

$$15/\overline{10.00} = .66 \qquad \textit{Answer:}\ 0.66 \text{ ml}$$

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.

Step 2: $\frac{500}{250} = 2$ *Answer:* 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 Methods

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.

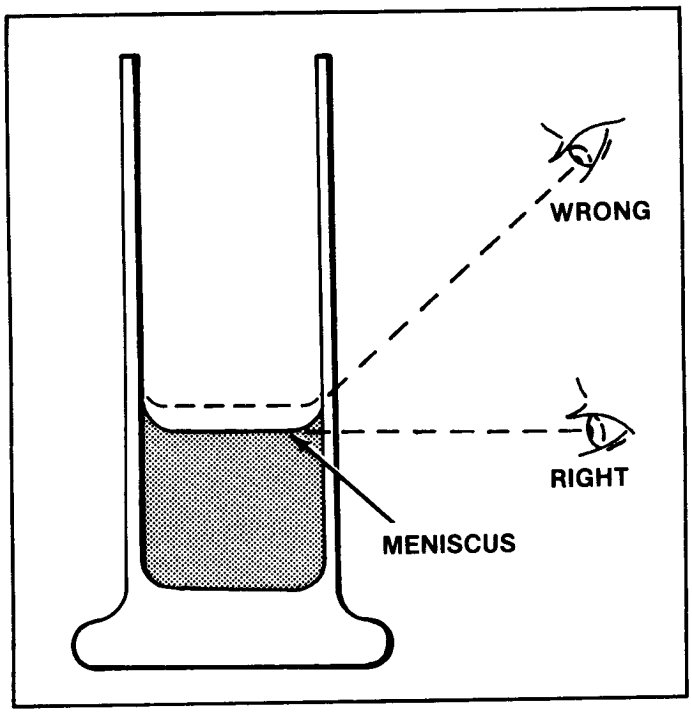

Figure 18-2. Technique for measuring liquids.

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.

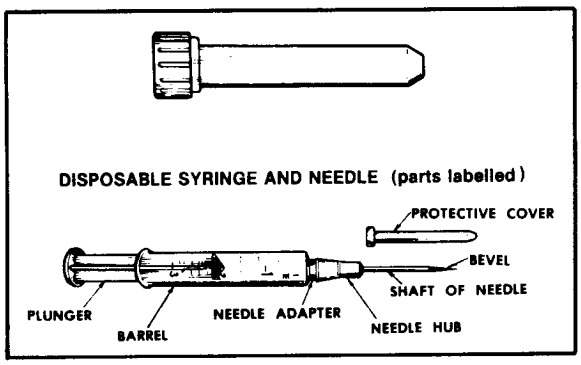

Figure 18-3. Disposable needle, syringe, and container.

(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).

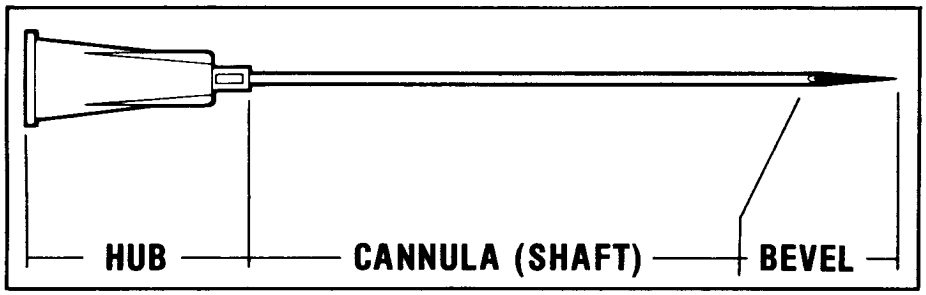

Figure 18-4. Parts of a needle.

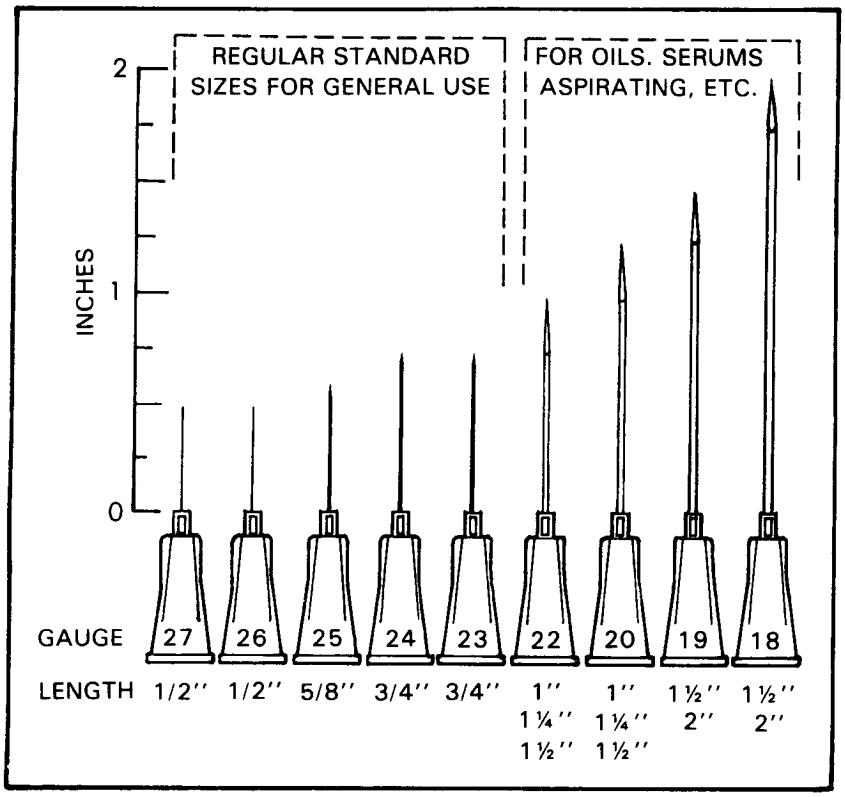

Figure 18-5. Needle sizes.

(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 in 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.

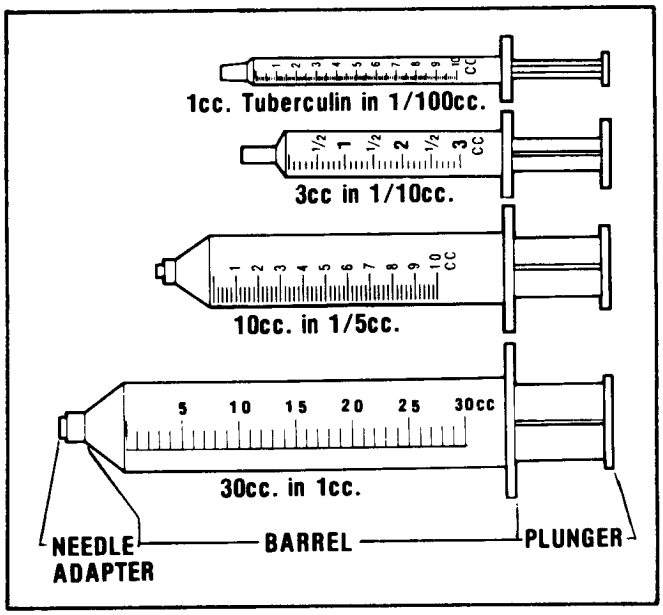

Figure 18-6. Examples of syringes.

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.

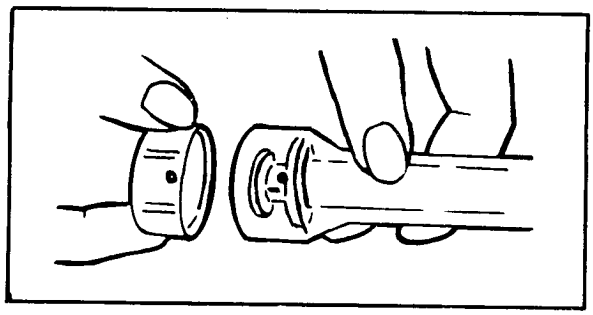

Figure 18-7. Opening rigid plastic package.

(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.

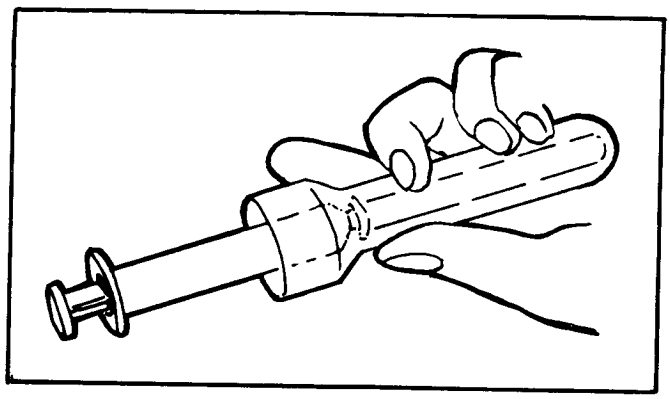

Figure 18-8. Removing syringe from protective plastic package.

(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.

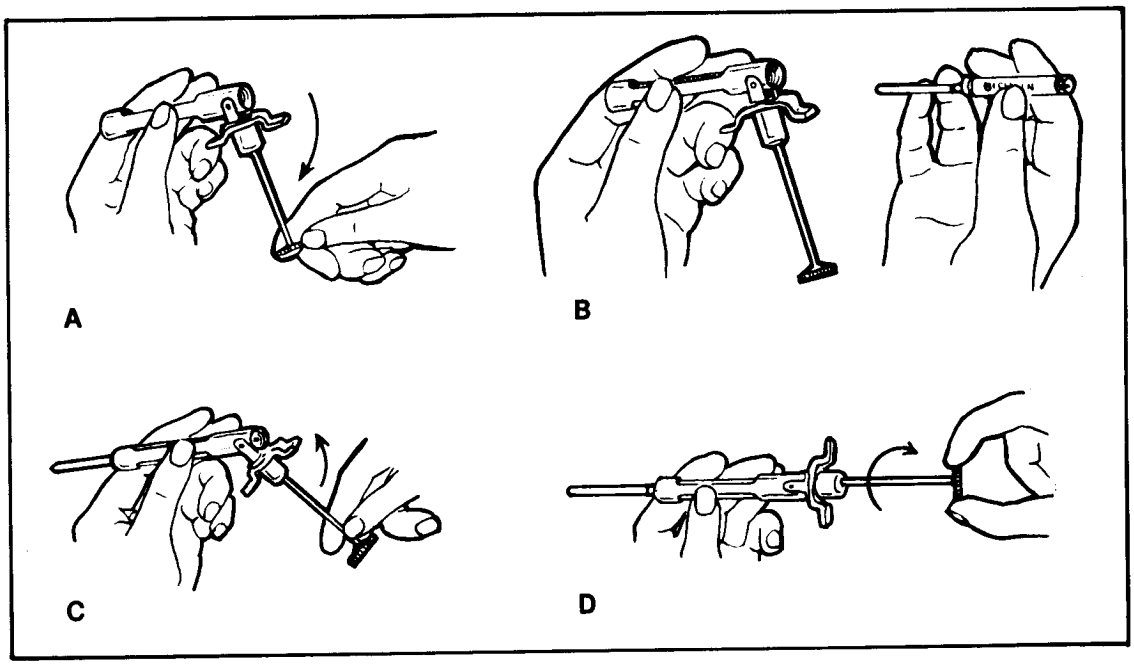

Figure 18-9. Preparing Carpuject syringe for use.

(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.

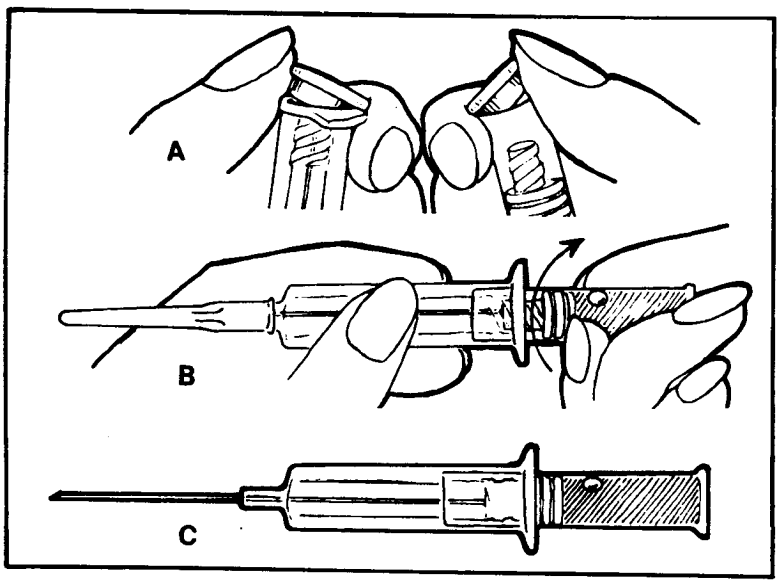

Figure 18-10. Preparing the Vari-ject syringe for use.

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:

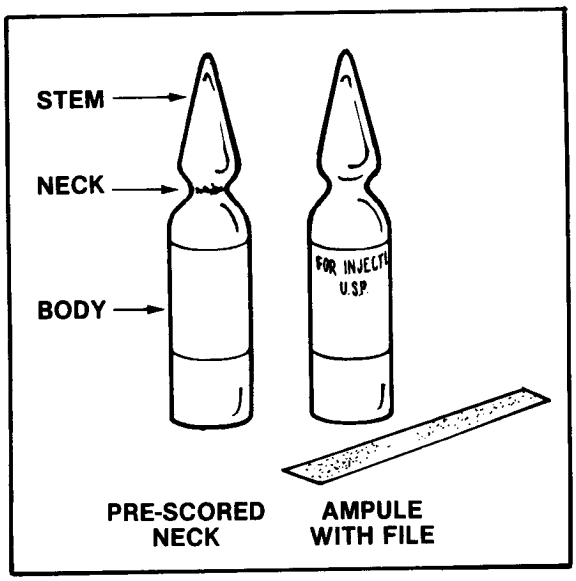

Figure 18-11. Types of glass ampules.

(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).

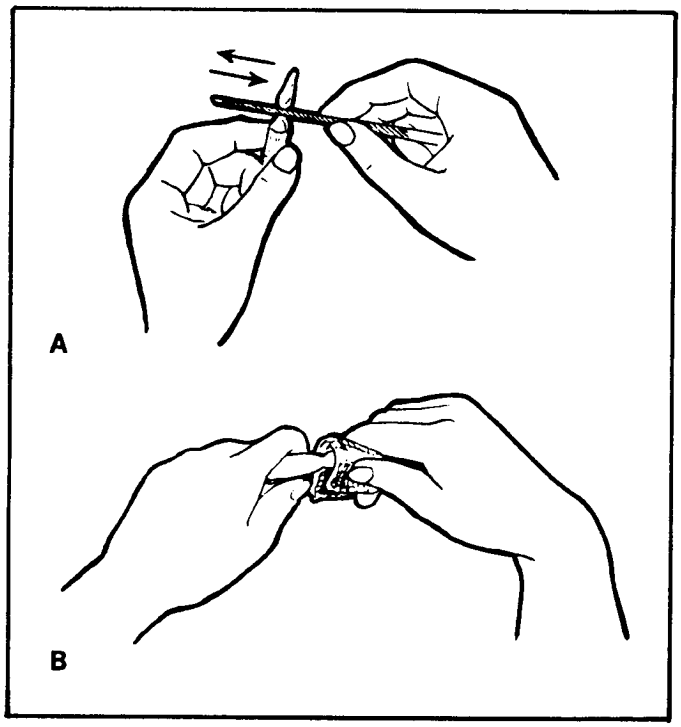

Figure 18-12. Opening glass ampules.

(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.

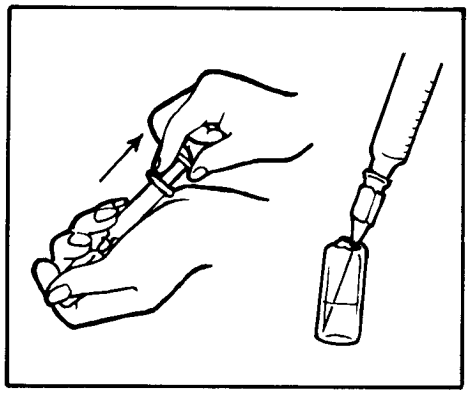

Figure 18-13. Drawing medication from ampule.

(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.

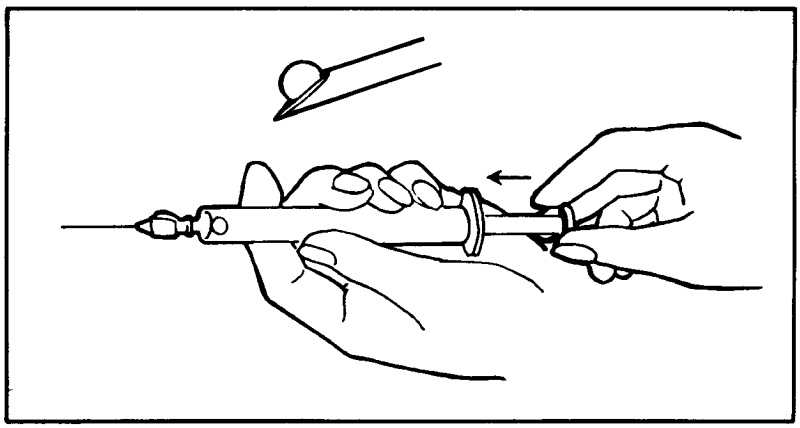

Figure 18-14. Expelling air bubbles from syringe.

(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).

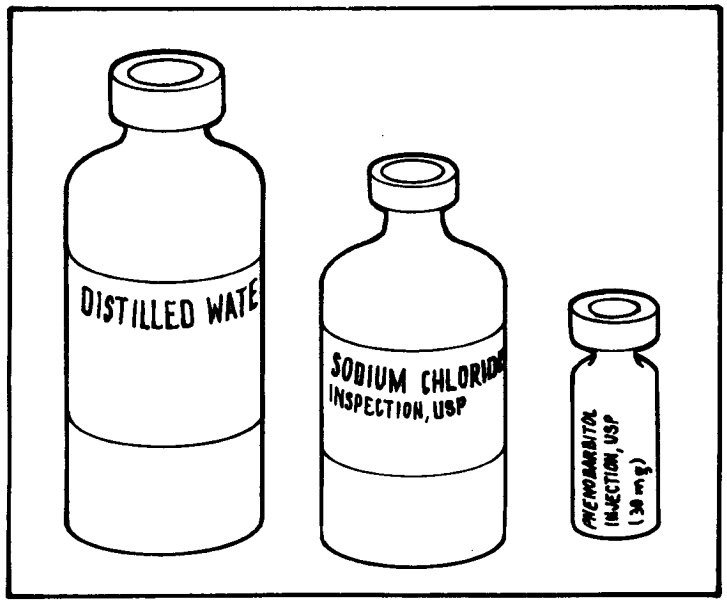

Figure 18-15. Examples of medication vials.

(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).

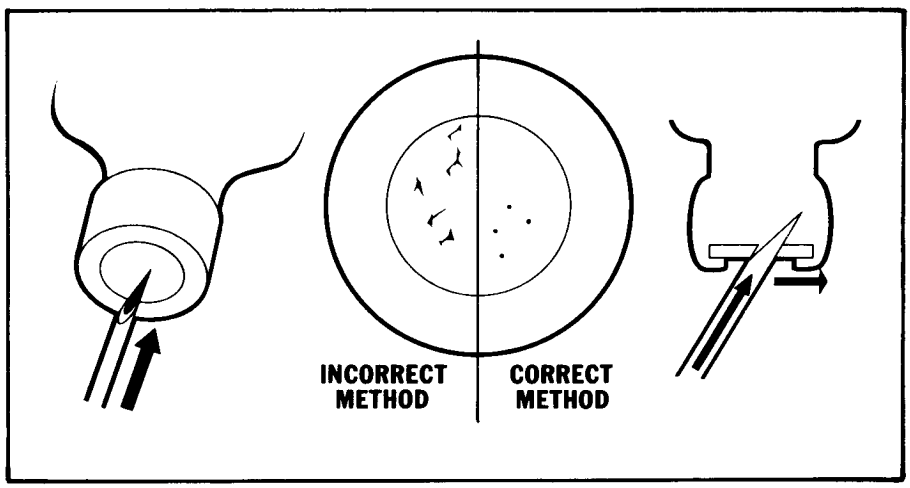

Figure 18-16. Inserting needle in vial.

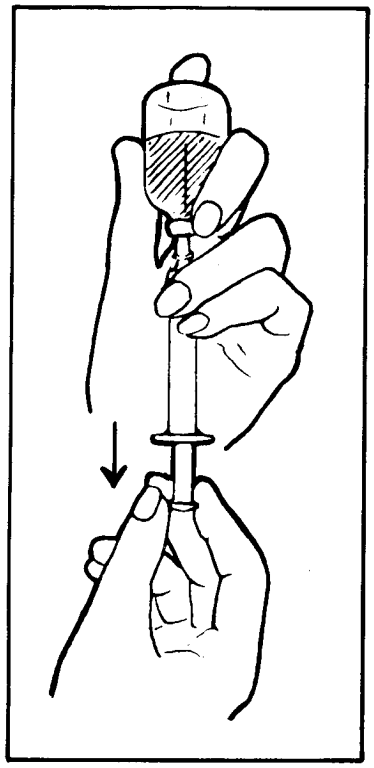

Figure 18-17. Drawing medication into syringe.

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.

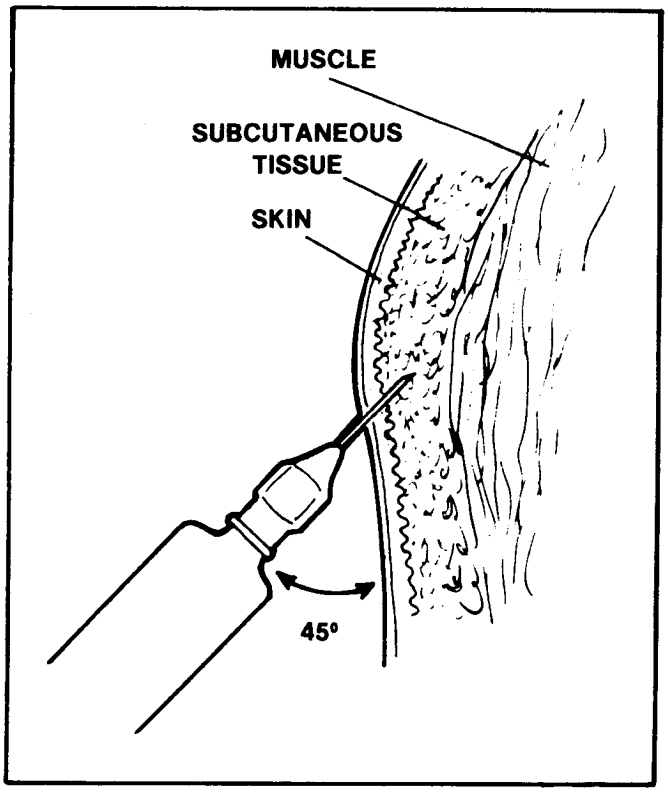

Figure 18-18. Administering a subcutaneous injection.

(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.

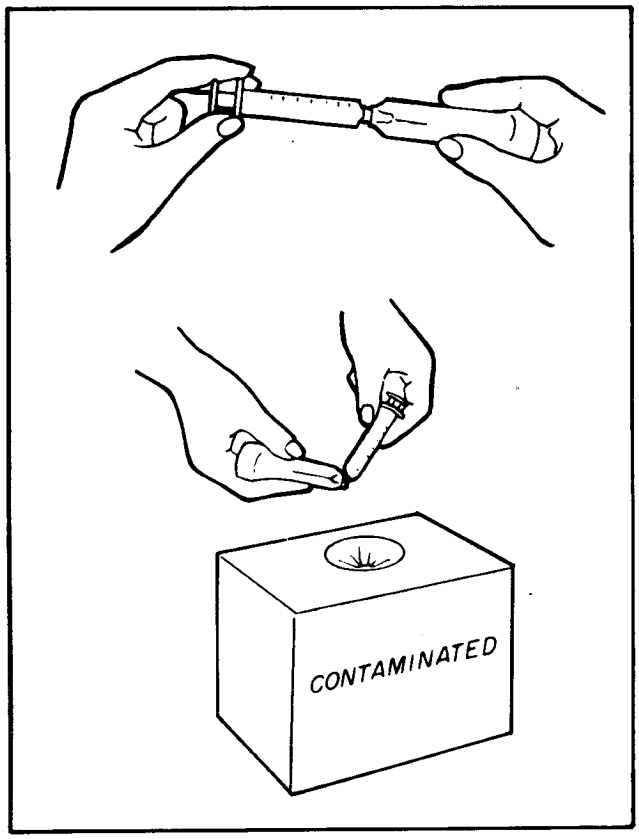

Figure 18-19. Disposal of used equipment.

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.

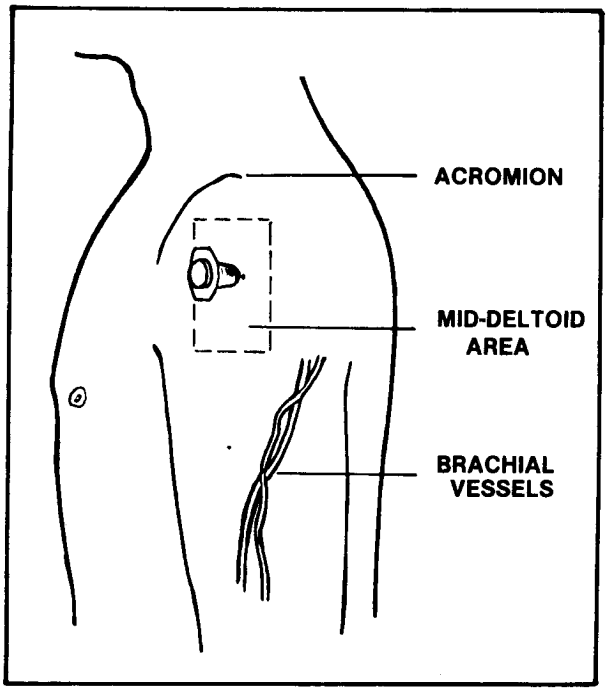

Figure 18-20. Administering intramuscular injection (deltoid muscle).

(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.

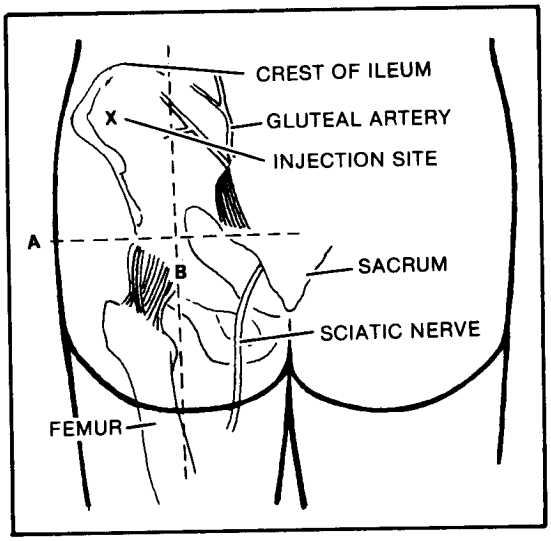

Figure 18-21. Administering intramuscular injection (gluteal muscles).

(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).

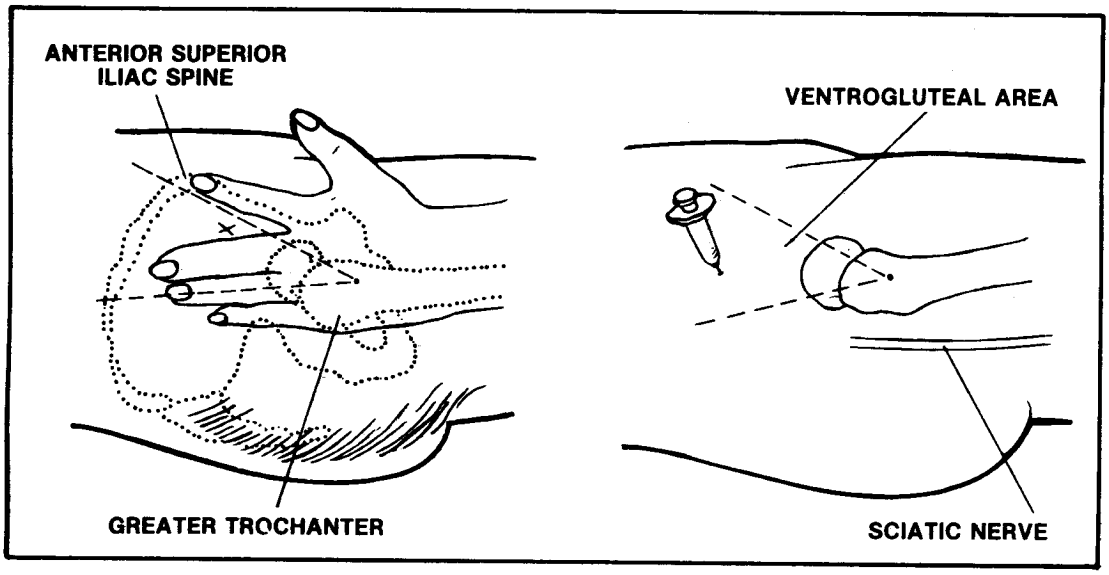

Figure 18-22. Alternate injection sites.

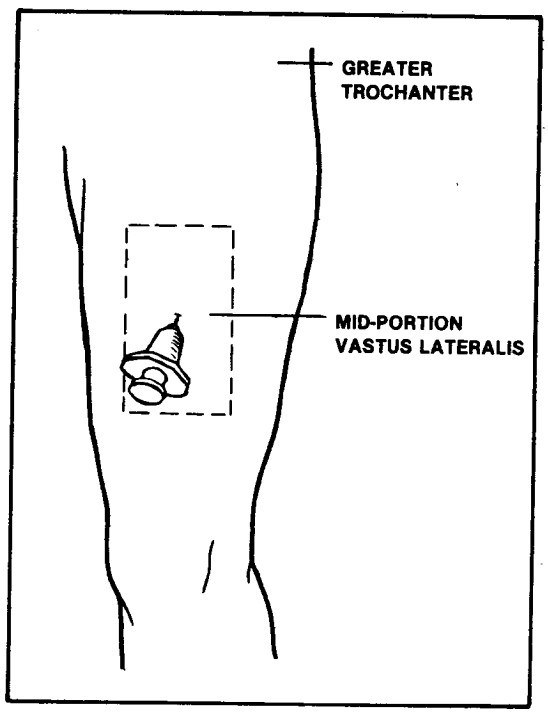

Figure 18-23. Vastus lateralis muscle injection site.

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.

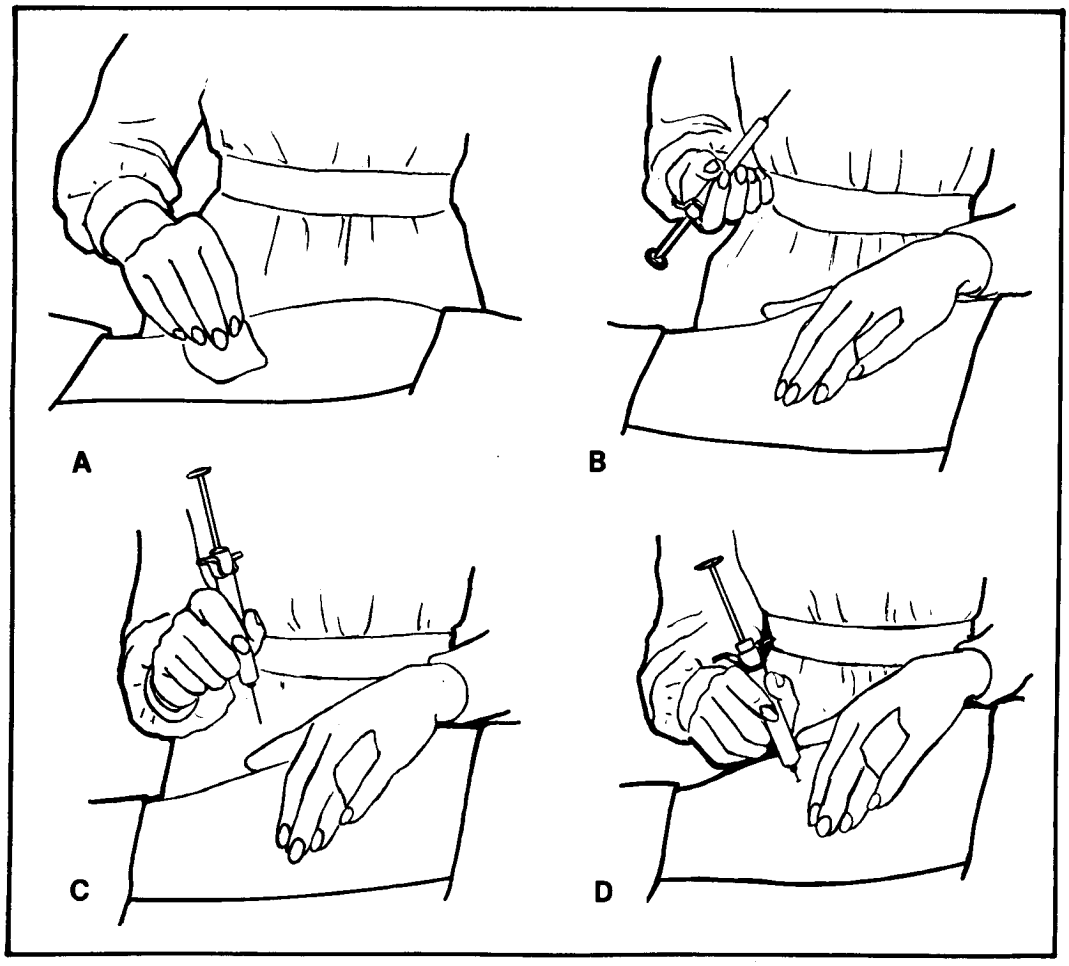

Figure 18-24. Preparing to administer IM injection.

(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.

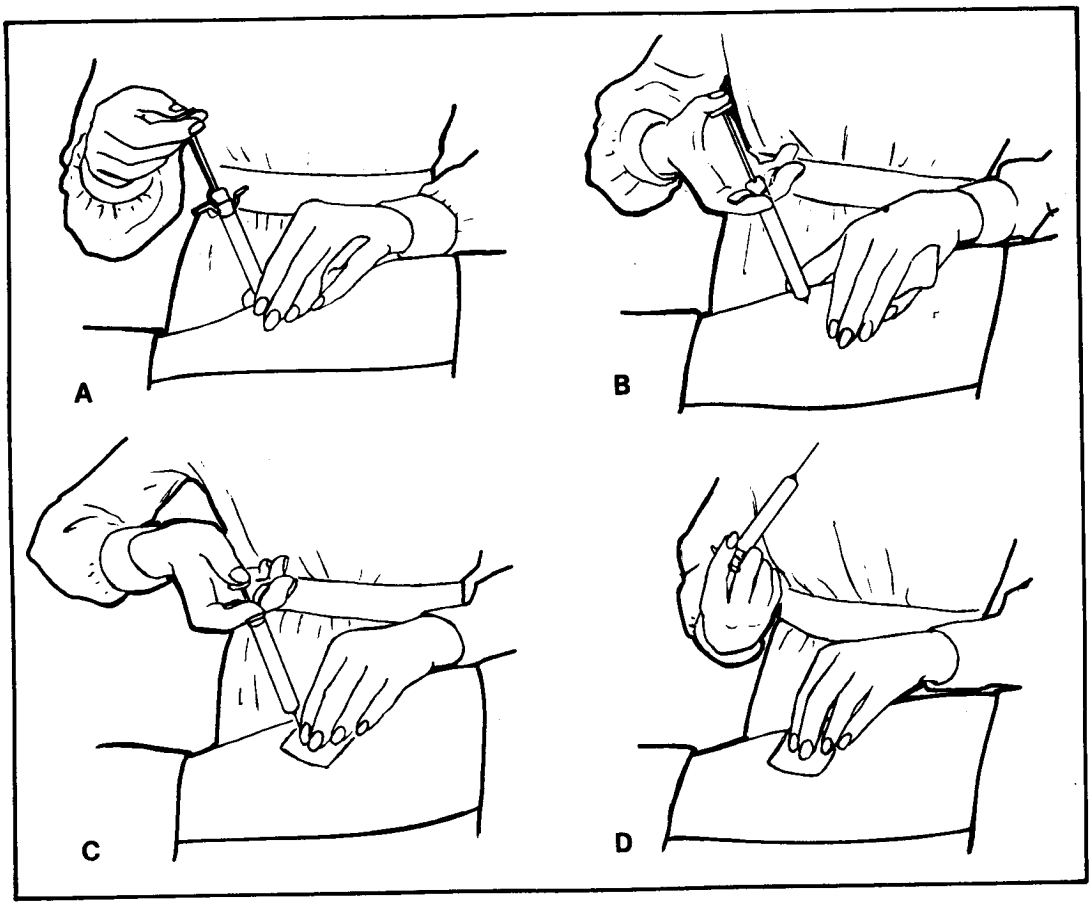

Figure 18-25. Administering IM injection.

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.

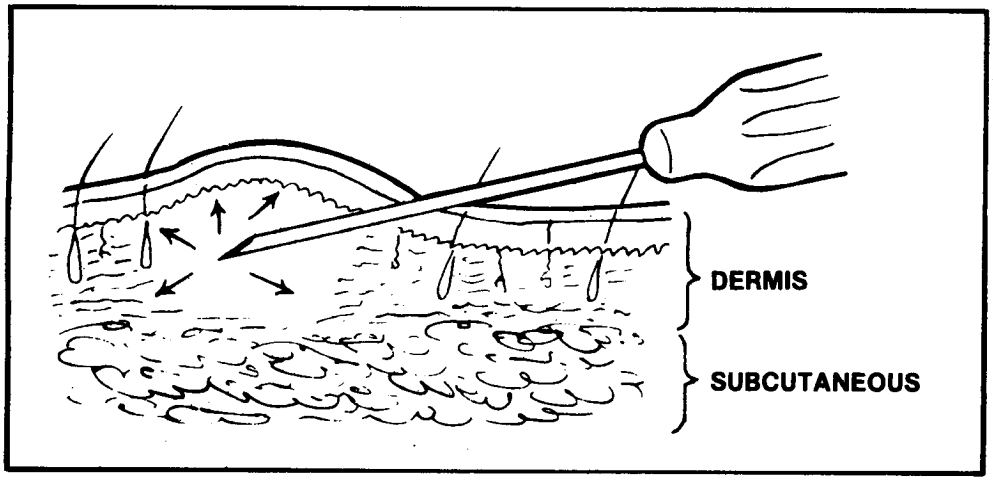

Figure 18-26. Intradermal injection.

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.

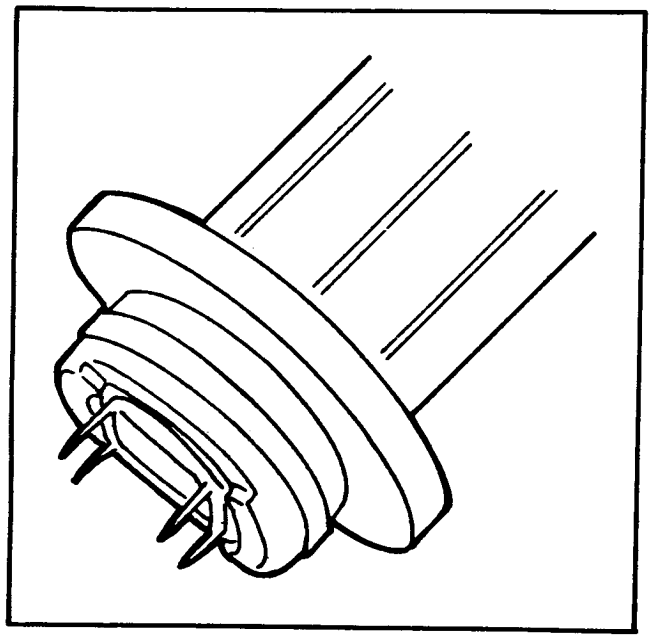

Figure 18-27. Tine device.

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.

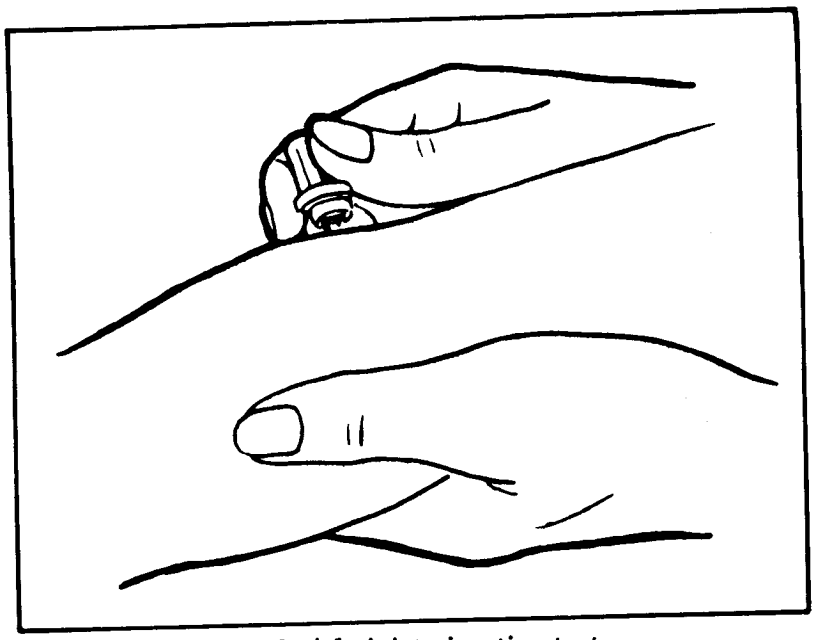

Figure 18-28. Administering tine test.

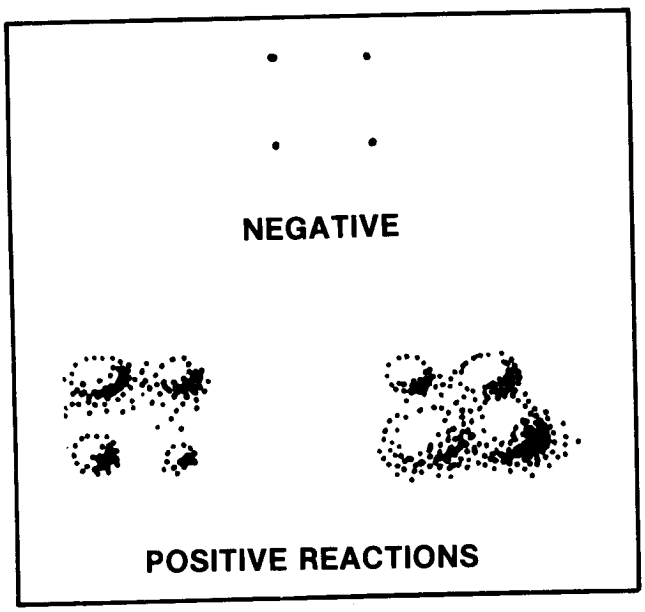

Figure 18-29. Reading tine test reactions.

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.

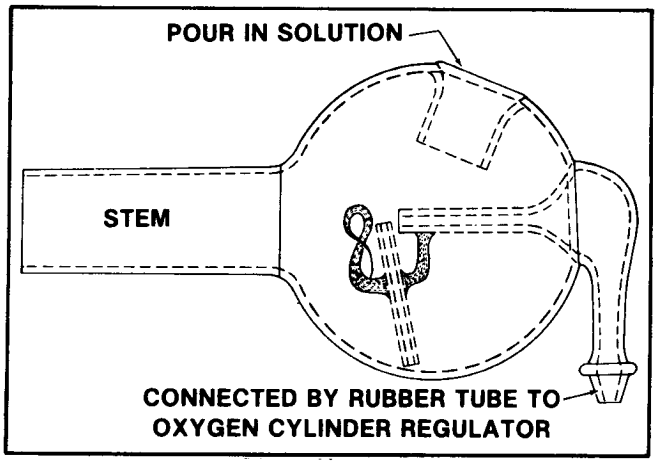

Figure 18-30. Nebulizer for aerosol inhalation.

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.