Medication

Objectives

- Introduction
- Types of drug preparations
- legal aspects of drug administration
- Routes of administration

Introduction

- Medication is a substance administered for the diagnosis, treatment, or relief of a symptom or for prevention of disease.
- **Prescription** is a written direction for the preparation and administration of a drug.

One drug can have four names

- Generic name,
- Trade name (or brand name),
- Official name,
- Chemical name

Generic name: A term referring to any drug marketed under its chemical name without advertising.

Example: Metformin, Doxazosin, Amoxicillin, Cefixime, Azithromycin.

Trade name (sometimes called the brand name) is the name given by the drug manufacturer and identifies it as property of that company.

Example: Glucophage.

Polymox, Trimox, Wymox.

Suprax. Zithromax, Zomax, Zitron, Zaha.

- **Official name** is the name under which a drug is listed in one of the official publications (e.g., the United States Pharmacopeia).
- **Chemical name** is the name by which a chemist knows it; this name describes the constituents of the drug precisely.

Example

Chemical Name

N-acetyl-p-aminophenol,

methylpropyl)phenyl)propanoic acid

Generic Name

Acetaminophen, ibuprofen

brand Name

Tylenol, Motrin

- **Pharmacology** is the study of the effect of drugs on living organisms.
- **Pharmacy** is the art of preparing, compounding, and dispensing drugs. The word also refers to the place where drugs are prepared and dispensed.

- **Pharmacist** is a specialist who often guides the primary care provider in prescribing drugs.
- The licensed pharmacist prepares, makes, and dispenses drugs as ordered by a physician, dentist, nurse practitioner, or physician assistant.

Drug Standards

- Drugs may have natural (e.g., plant, mineral, and animal) sources, or they may be synthesized in the laboratory.
- For example, digitalis and opium are plant derived, iron and sodium chloride are minerals.
- insulin and vaccines have animal or human sources,

Types of drug preparations

- **Aqueous suspension:** One or more drugs finely divided in a liquid such as water.

- **Caplet:** A solid form, shaped like a capsule, coated and easily swallowed.

- **Capsule:** A gelatinous container to hold a drug in powder, liquid, or oil form

- **Cream:** A non greasy, semisolid preparation used on the skin.
- **Lotion:** A medication in a liquid suspension applied to the skin.

- **Tablet:** A powdered drug compressed into a hard small disk; some are readily broken along a scored line; others are enteric coated to prevent them from dissolving in the stomach

Legal Aspects of Drug Administration

Nurses need to

- know how nursing practice acts in their areas define and limit their functions.
- be able to recognize the limits of their own knowledge and skill.

- Nurses are responsible for their own actions regardless of whether there is a written order.
- If a primary care provider writes an incorrect order (e.g., morphine 100 mg instead of morphine 10 mg),
- A nurse who administers the written incorrect dosage is responsible for the error as well as the primary care provider.

- Therefore, nurses should question any order that appears unreasonable and refuse to give the medication until the order is clarified.
- Another aspect of nursing practice governed by law is the use of controlled substances.

- The information required usually includes the name of the client, the date and time of administration, the name of the drug, the dosage, and the signature of the person who prepared and gave the drug.
- The name of the primary care provider who ordered the drug may also be part of the record.

- Some agencies may require a verifying signature of another registered nurse for administration of a controlled substance.
- When a portion or all of a controlled substance dose is discarded, the nurse must ask a second nurse to witness the discarding. Both nurses must sign the control inventory form.

Effects of Drugs

- **The therapeutic effect** of a drug, also referred to as the desired effect , is the primary effect intended, that is, the reason the drug is prescribed. For example, the therapeutic effect of morphine sulfate is analgesia, and the therapeutic effect of diazepam is relief of anxiety

- **Side effects** are usually predictable and may be either harmless or potentially harmful. For example, digitalis increases the strength of myocardial contractions (desired effect), but it can have the side effect of inducing nausea and vomiting. more severe side effects, also called adverse effects

- **Drug toxicity** (harmful effects of a drug on an organism or tissue) results from over dosage, ingestion of a drug intended for external use, or buildup of the drug in the blood because of impaired metabolism or excretion.
- **An example** of a toxic effect is respiratory depression due to the cumulative effect of morphine sulfate in the body.

- **Drug allergy** is an immunologic reaction to a drug.
- **Allergic reactions** can be either mild or severe. A mild reaction has a variety of symptoms, such as skin rash, pruritus, angioedema, rhinitis, lacrimal tearing, nausea, vomiting, wheezing and dyspnea, diarrhea.

Skin rash

Angioedema

Therapeutic Actions of Drugs

- **Palliative:** Relieves the symptoms of a disease but does not affect the disease itself.

  Example: Morphine sulfate, aspirin for pain.

- **Curative:** Cures a disease or condition.

  Example: Penicillin for infection

- **Supportive:** Supports body function until other treatments or the body's response can take over.

  Example: aspirin for high body temperature.

- **Substitutive:** Replaces body fluids or substances.

  Example: insulin for diabetes mellitus.

- **Chemotherapeutic:** Destroys malignant cells.

  Example: Busulfan for leukemia.

- **Restorative:** Returns the body to health.

  Example: Vitamin, mineral supplements

- A severe allergic reaction usually occurs immediately after the administration of the drug and is called an **anaphylactic reaction** .
- This response can be fatal if the symptoms are not noticed immediately and treatment is not obtained promptly.
- The earliest symptoms are a subjective feeling of swelling in the mouth and tongue, acute shortness of breath, acute hypotension, and tachycardia

- **A cumulative effect** is the increasing response to repeated doses of a drug that occurs when the rate of administration exceeds the rate of metabolism or excretion.
- As a result, the amount of the drug builds up in the client's body unless the dosage is adjusted. Toxic symptoms may occur.

Drug Misuse

- Drug abuse
- Drug dependence
- Illicit drugs, also called street drugs

Routes of administration

- Oral
- Sublingual
- Buccal
- Rectal
- Vaginal
- Topical

- Transdermal
- Subcutaneous
- Intramuscular
- Intradermal
- Intravenous
- Inhalation

Medication orders

- A physician usually determines the client's medication needs and orders medications, although in some settings nurse practitioners and physician assistants now order some drugs.

Essential parts of a drug order

- Full name of the client
- Date and time the order is written
- Name of the drug to be administered
- Dosage of the drug

Essential parts of a drug order Cont.

- Frequency of administration
- Route of administration
- Signature of the person writing the order

Basic units of drug measurement

- The measurements of volume (the liter) and of weight (the gram). These are the measures used in medication administration.

Basic units of drug measurement Cont.

- The kilogram (kg) is the only multiple of the gram used, and the milligram (mg) and microgram (mcg) are subdivisions.
- Fractional parts of the liter are usually expressed in milliliters (mL). for example, 2.5 liters or 2,500 mL

Converting units of weight and measure

- A primary care provider orders morphine gr 1/4. The medication is available labeled only in milligrams.
- The nurse knows that 1 mg = 1/60 gr or 60 mg = 1 grain.

Converting units of weight and measure Cont.

- To convert the ordered dose to milligrams, the nurse calculates as follows:

If 60 mg = 1 gr

Then x mg = 1/4 gr (0.25 gr)

$$x = \frac{(60 * 0.25)}{1}$$

x = 15 mg

change milligrams to grams

- the nurse divides the number of milligrams by 1,000. The simplest way to divide by 1,000 is to move the decimal point three places to the left:
- 500 mg = ? g

  Move the decimal point three places to the left:
- Answer = 0.5 g

Convert grams to milligrams

Multiply the number of grams by 1,000, or move the decimal point three places to the right:

0.006 g = ? mg

Move the decimal point three places to the right:

Answer = 6 mg

Methods of Calculating Dosages

- D = desired dose (i.e., dose ordered by primary care provider)
- H = dose on hand (i.e., dose on label of bottle, vial, ampule)
- V = vehicle (i.e., form in which the drug comes, such as tablet or liquid).
- Formula = $\frac{D * V}{H}$ = amount to administer

- **Example**
- Order: Erythromycin 500 mg
- On hand: 250 mg in 5 mL
- **Another Example**
- Order: Phenobarbital gr ii
- On hand: Phenobarbital 30 mg tablets

Medication administration errors

- The National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) (2013) estimates that 98,000 people die annually from medical errors that occur in hospitals and that a significant number of those deaths are due to medication errors.

Medication error

Cont.

Medication errors can occur at all stages of the medication administration process.

Tzeng, Yin, and Schneider 2013, p. 14) describe the four main types of medication errors that occur with hospitalized clients:

(1) prescription errors (e.g., wrong drug or dose).

Medication error

Cont.

(2) transcription/ interpretation error (e.g., misinterpretation of abbreviations).

(3) preparation errors (e.g., calculation error).

(4) administration errors (e.g., wrong dose, wrong time, omission, or additional dose).

Most medication errors occur during the administration stage.

Medication error

Cont.

- Medication administration errors result from system and individual factors.
- Individual factors include fatigue and stress.
- Systemic factors include interruptions and distractions during medication administration.
- Interruptions and distractions hinder the ability of the nurse to stay focused on the task

Medication error Cont.

- sources of interruption during medication administration. Sources include overhead pages, monitor alarms, telephone calls, and family inquiries, with the most common source being questions from nursing colleagues and other health care team members.
- **Critical thinking:** How interruptions and distractions can be reduced during medication administration.

Ten “Rights” of Medication Administration

- Right medication
- Right dose
- Right time
- Right route
- Right client

Ten “rights” of medication administration Cont.

- Right client education
- Right documentation
- Right to refuse
- Right assessment
- Right evaluation

Parenteral medications

Parenteral administration of medications is a common nursing procedure. Nurses give parenteral medications intradermally (ID), subcutaneously, intramuscularly (IM), or intravenously (IV). Because these medications are absorbed more quickly than oral medications and are irretrievable once injected.

Parenteral medications Cont.

- nurse must prepare and administer them carefully and accurately. because injections are invasive procedures, aseptic technique must be used to minimize the risk of infection.

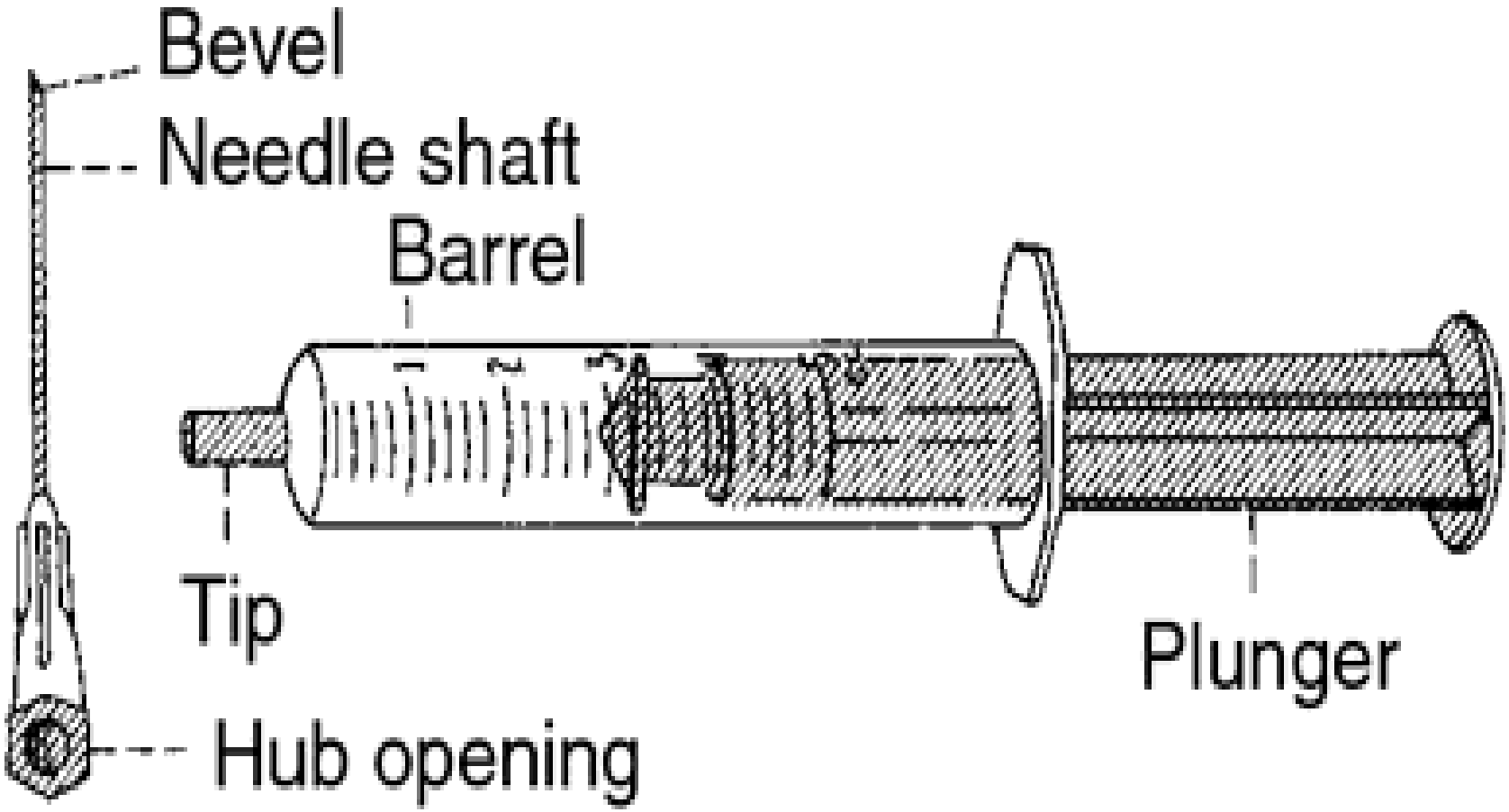
Equipment

- To administer parenteral medications, nurses use syringes and needles to withdraw medication from ampules and vials.
- Syringes have three parts: the tip, which connects with the needle; the barrel, or outside part, and the plunger, which fits inside the barrel.

A needle

has three discernible parts: the hub , which fits onto the syringe; the cannula , or shaft , which is attached to the hub; and the bevel, which is the slanted part at the tip of the needle.

Syringes have three parts



- A hypodermic syringe comes in 3- and 5-mL sizes. The choice of syringe depends on many factors, such as medication, location of injection, and type of tissue.
- The larger sized syringes (e.g., 10, 20, and 50 mL) are not used to administer drugs directly but can be useful for adding medications to IV solutions or for irrigating wounds.

3 mL syringe

5 mL syringe

Insulin syringe

Is similar to a hypodermic syringe, but the scale is specially designed for insulin: a 100-unit calibrated scale intended for use with U-100 insulin. This is the only syringe that should be used to administer insulin. Several low-dose insulin syringes are also available (e.g., 30-unit and 50-unit).

The correct choice of syringe is based on the amount of insulin required.

Insulin syringe

Avoiding puncture injuries

Use appropriate puncture-proof disposal containers to dispose of uncapped needles and sharps. These are provided in all client areas. Sharps include any items that can cut or puncture skin such as:

- Needles
- Surgical blades
- Lancets
- Razors
- Broken glass

Sharps container.

Recapping a needle using the one-handed scoop

(a) placing the needle cap and syringe with needle horizontally on a flat surface, (b) inserting the needle into the cap, using one hand. and then (c) using your other hand to pick up the cap and tighten it to the needle hub.

One-handed scoop method

Ampules and vials

- An ampule is a glass container usually designed to hold a single dose of a drug. It is made of clear glass and has a distinctive shape with a constricted neck.
- Ampules vary in size from 1 to 10 mL or more. Most ampule necks have colored marks around them, indicating where they are prescored for easy opening.


STERILE WATER
FOR INJECTION, USP
PRESERVATIVE-FREE

A vial is a small glass bottle with a sealed rubber cap. Vials come in different sizes, from single-use vials to multiple-dose vials. They usually have a metal or plastic cap that protects the rubber seal and must be removed to access the medication.

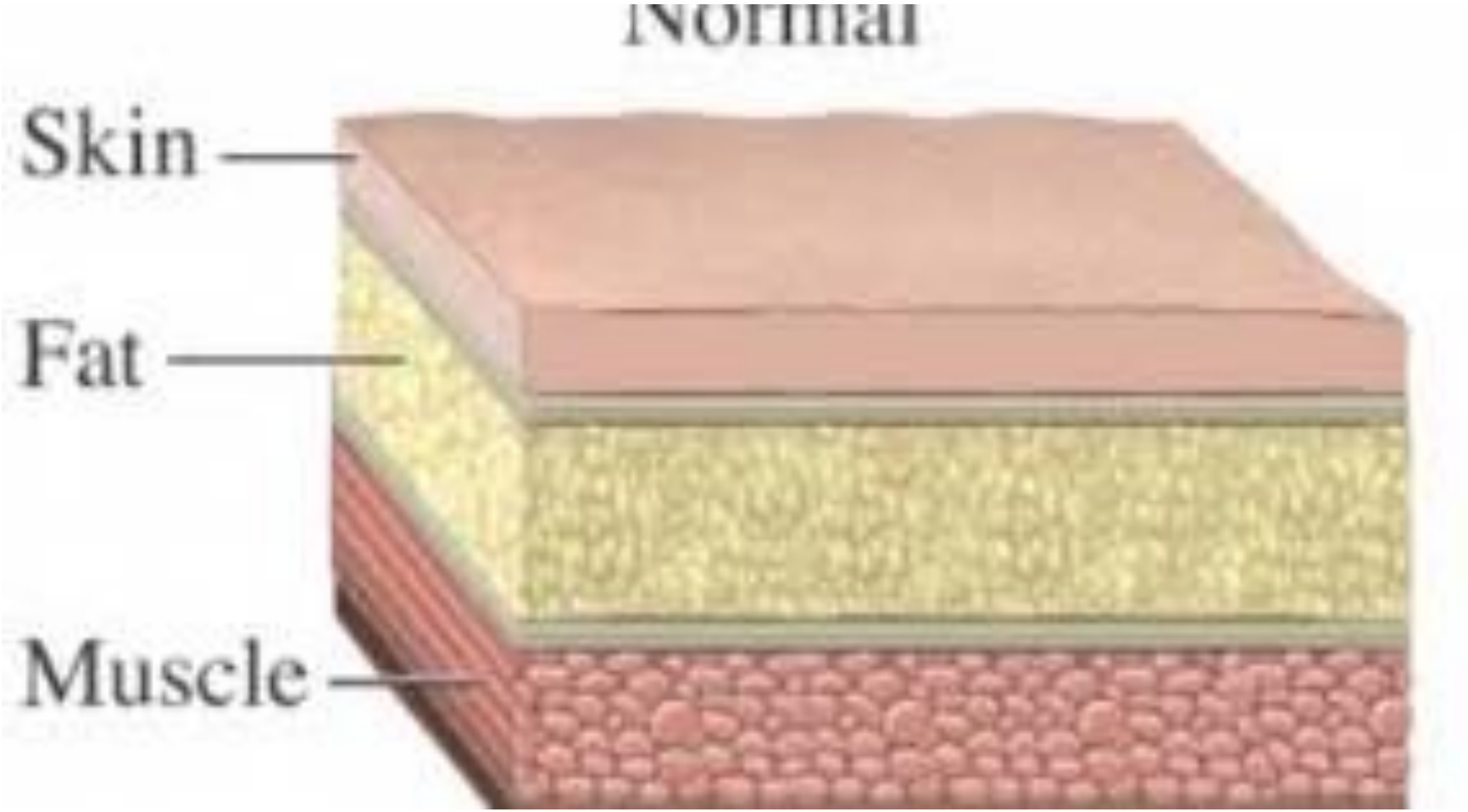
A single-use vial contains only one dose of medication and should only be used once. In contrast, a multi dose vial is a bottle of liquid medication that contains more than one dose, such as insulin or vaccination vials.


BACTERIOSTATIC
WATER
Novolin N
Sterile Water
for Inj., USP

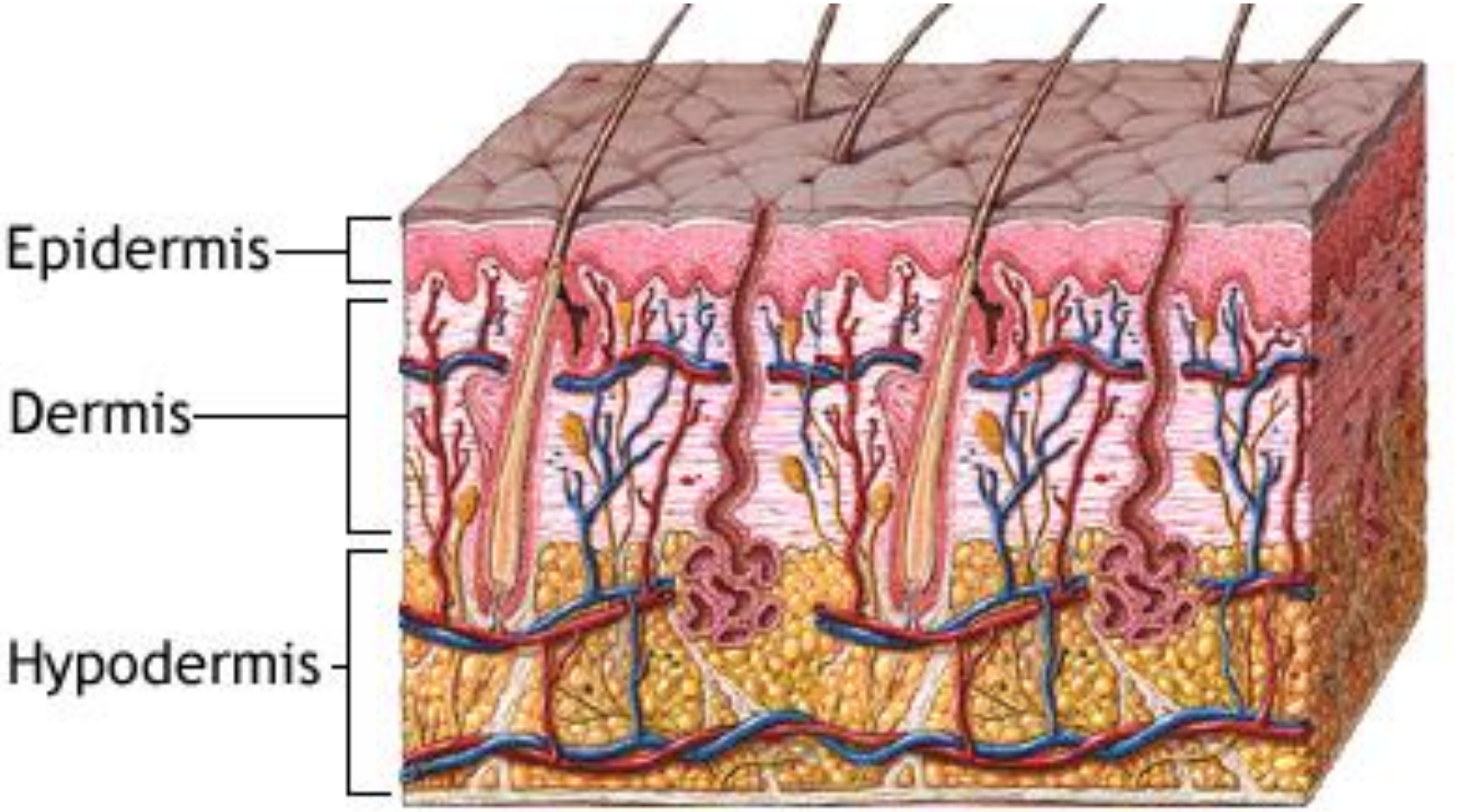
Intradermal injections

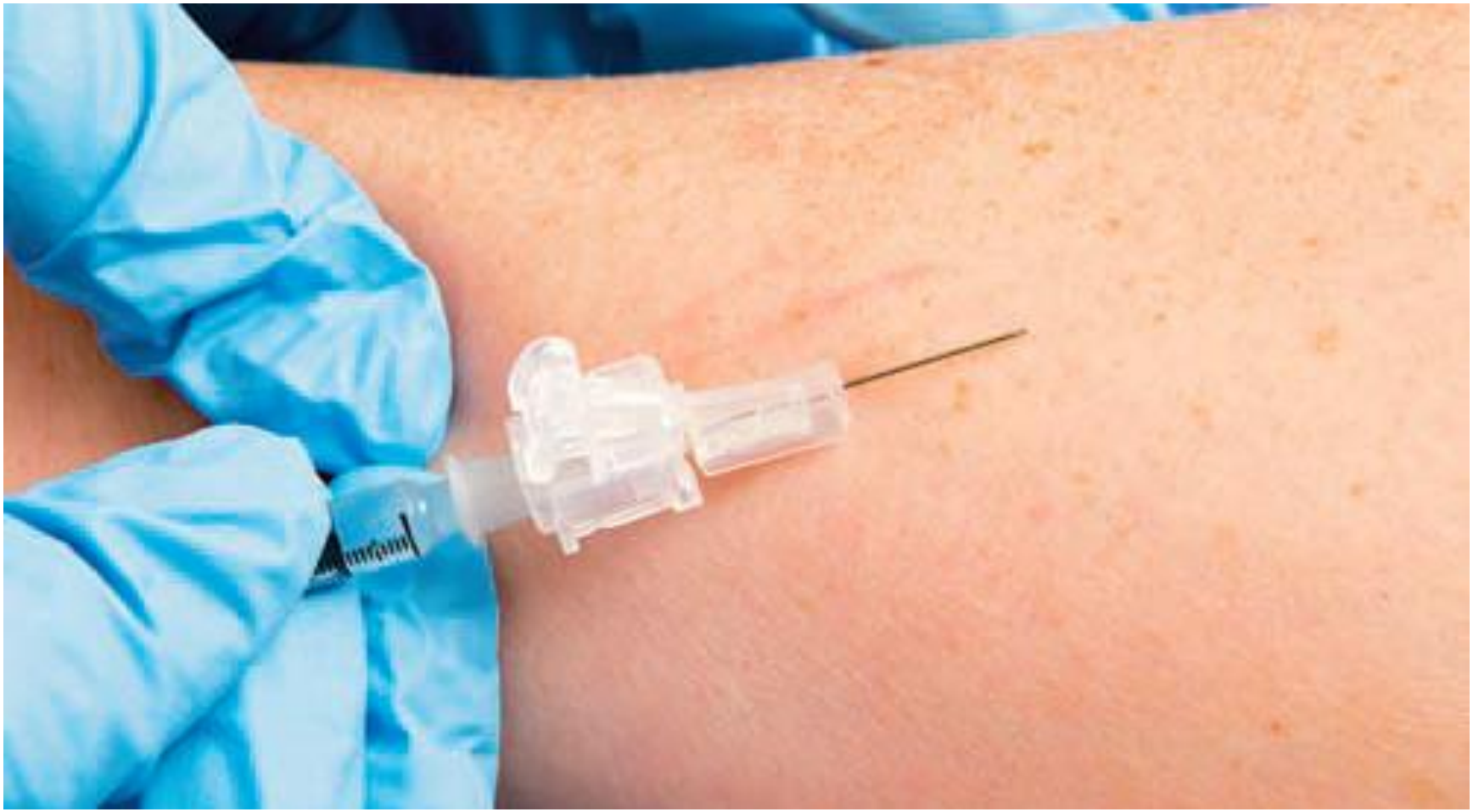
An intradermal (ID) injection is the administration of a drug into the dermal layer of the skin just beneath the epidermis. Usually only a small amount of liquid is used, for example, 0.1 mL. This method of administration is frequently used for allergy testing and tuberculosis(TB) screening.

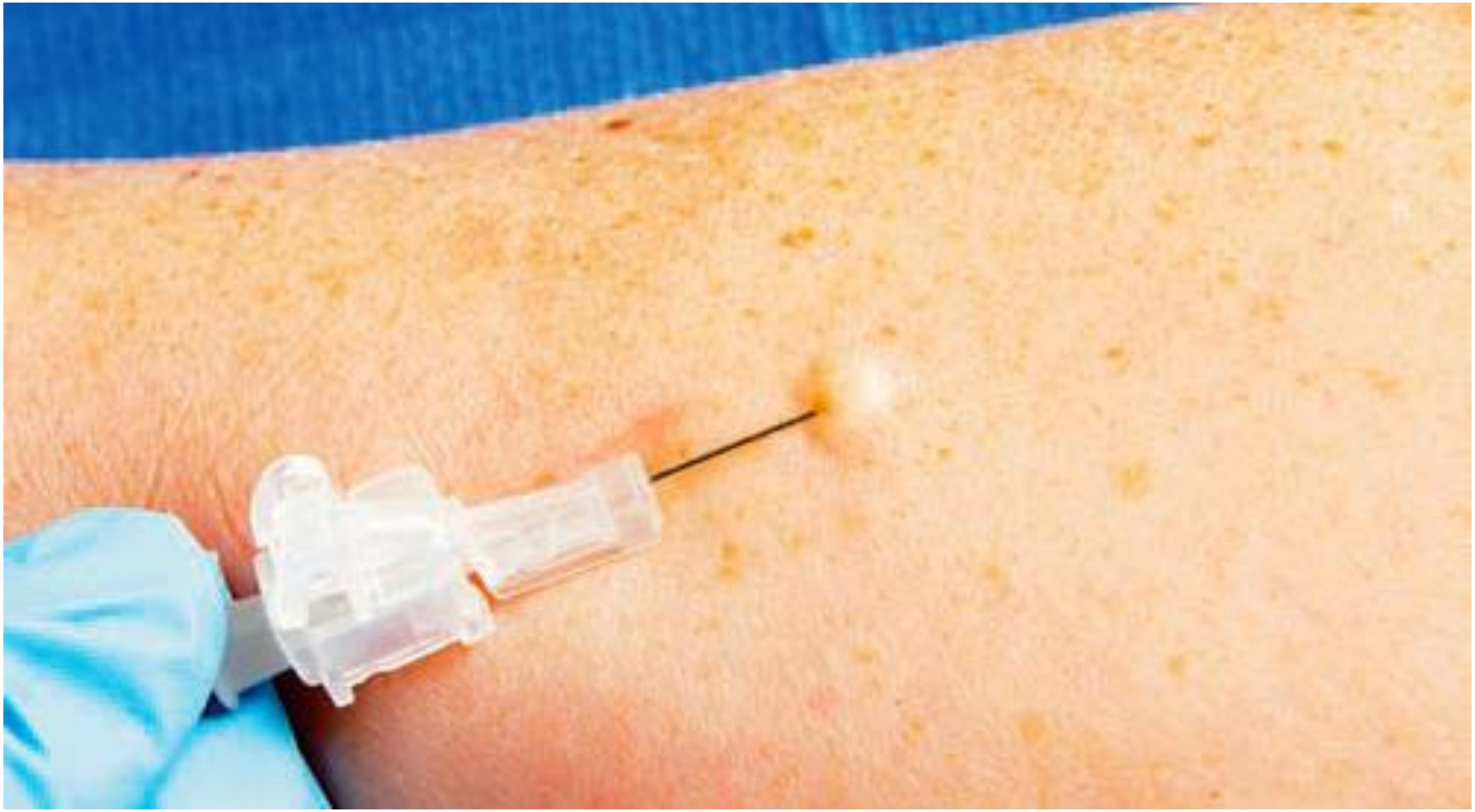
Common sites for intradermal injections are the inner lower arm, the back beneath the scapulae, and the upper chest.


Normal
Skin
Fat
Muscle

Layers of skin





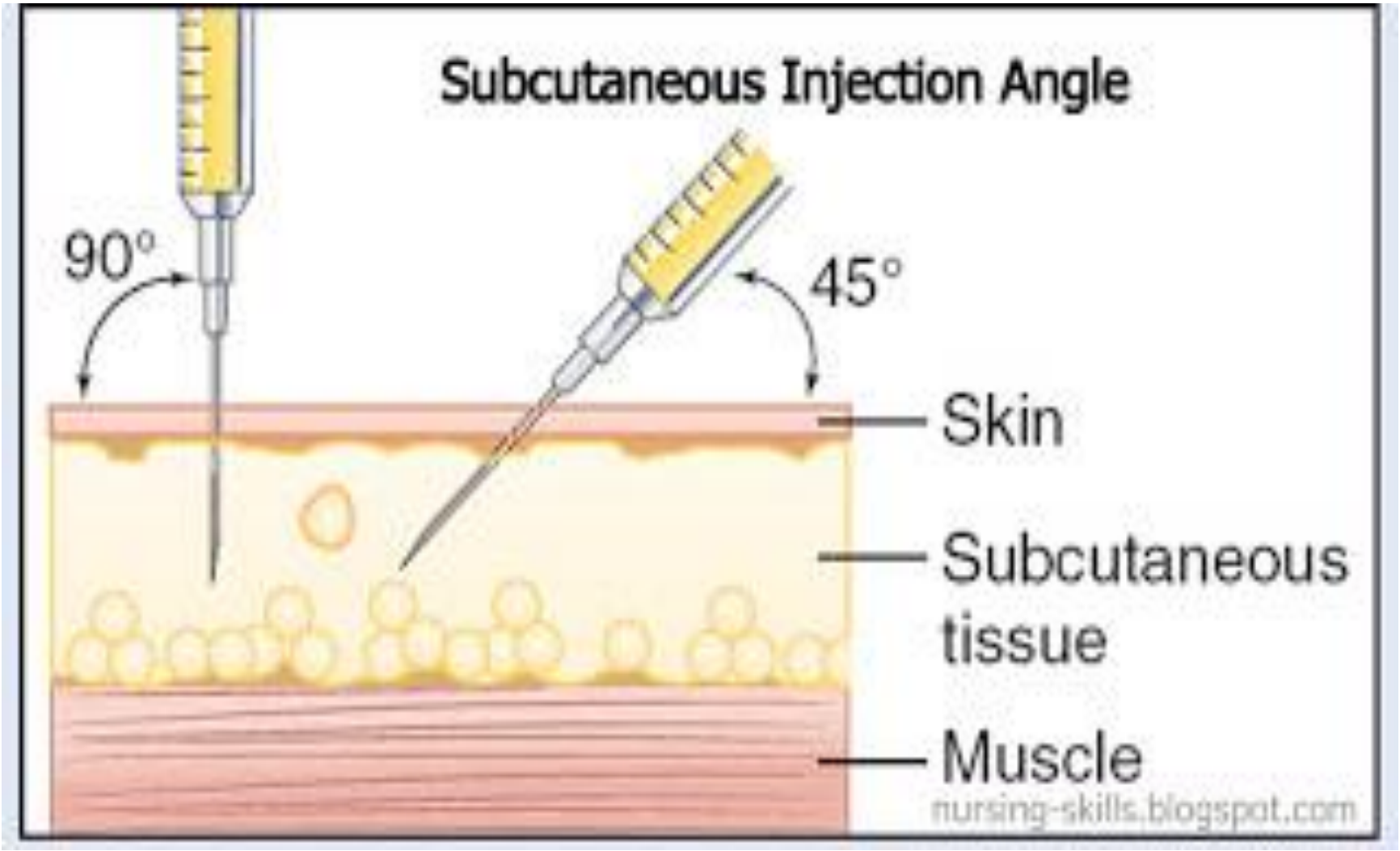


Subcutaneous Injections

Among the many kinds of drugs administered subcutaneously (just beneath the skin) are vaccines, insulin, and heparin.

Common sites for subcutaneous injections are the outer aspect of the upper arms and the anterior aspect of the thighs. These areas are convenient and normally have good blood circulation. Other areas that can be used are the abdomen, the scapular areas of the upper back, and the upper ventrogluteal and dorsogluteal areas.

The type of syringe used for subcutaneous injections depends on the medication being given. Generally a 1- or 2-mL syringe is used for most subcutaneous injections. However, if insulin is being administered, an insulin syringe is used; if heparin is being administered, a prefilled cartridge may be used.


Subcutaneous Injection Angle
90°
45°
Skin
Subcutaneous tissue
Muscle
nursing-skills.blogspot.com

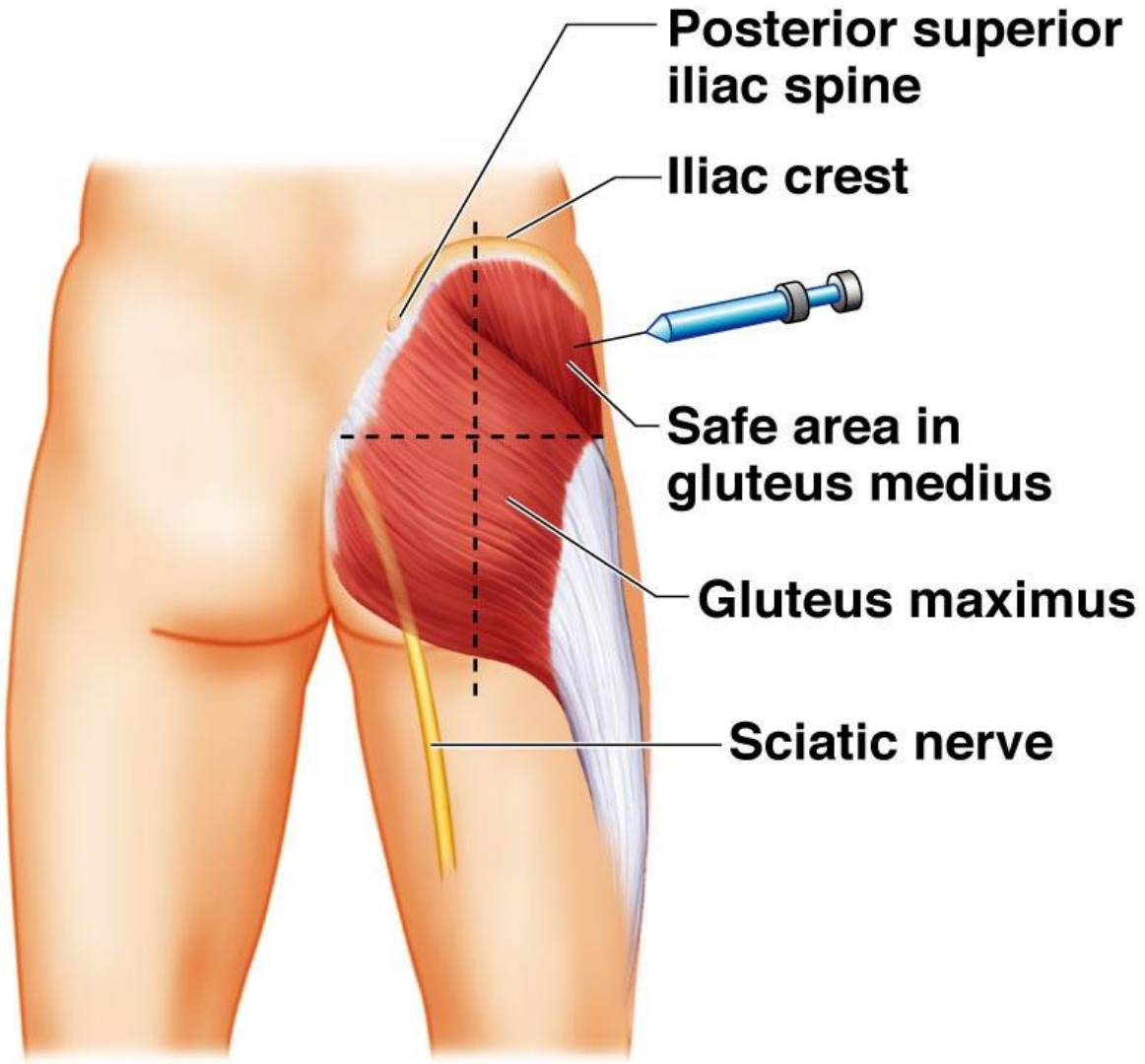
Sites on the Body Where
a Subcutaneous Injection
Can Be Given

- clients prefer the shorter and thinner needles because they are less painful. The risk of injecting into the muscle is lessened with the shorter needle.
- Subcutaneous injection sites need to be rotated in an orderly fashion to minimize tissue damage, aid absorption, and avoid discomfort.

Intramuscular Injections

Intramuscular (IM) injections or Injections into muscle tissue, are absorbed more quickly than subcutaneous injections because of the greater blood supply to the body muscles. Muscles can also take a larger volume of fluid without discomfort than subcutaneous tissues can, although the amount varies among individuals, chiefly based on muscle size and condition and the site used.

- An adult with well-developed muscles can usually safely tolerate up to 3 mL of medication in the gluteus medius and gluteus maximus muscles.
- A volume of 1 to 2 mL is usually recommended for adults with less developed muscles.
- In the deltoid muscle, volumes of 0.5 to 1 mL are recommended.



(b)

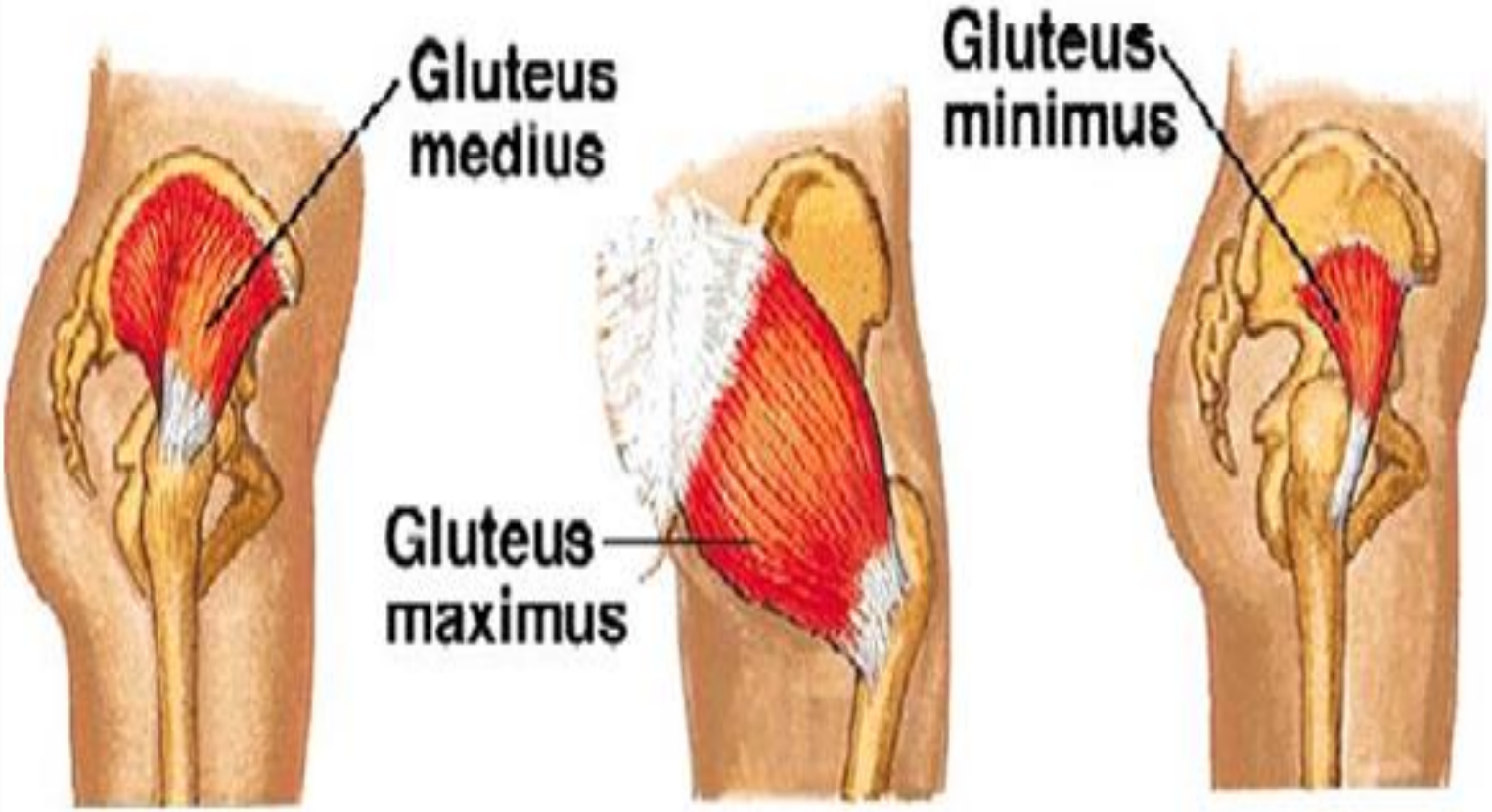
- **Several factors indicate the size and length of the needle to be used:**

- The muscle
- The type of solution
- The amount of adipose tissue covering the muscle.
- The age of the client.

1- Ventrogluteal Site

The ventrogluteal site is in the gluteus medius muscle, which lies over the gluteus minimus.

Gluteal Muscles



The ventrogluteal site is the preferred site for intramuscular injections because the area:

- Contains no large nerves or blood vessels.
- Provides the greatest thickness of gluteal muscle consisting of both the gluteus medius and gluteus minimus.
- Is sealed off by bone.
- Contains consistently less fat than the buttock area, thus eliminating the need to determine the depth of subcutaneous fat.

The client position for the injection can be a back, prone, or side-lying position. The side-lying position, however, helps locate the ventrogluteal site more easily. Position the client on his or her side with the knee bent and raised slightly toward the chest. The trochanter will protrude, which facilitates locating the ventrogluteal site.

To establish the exact site:

- the nurse places the heel of the hand on the client's greater trochanter, with the fingers pointing toward the client's head.
- The right hand is used for the left hip, and the left hand for the right hip.

- With the index finger on the client's anterior superior iliac spine, the nurse stretches the middle finger dorsally (toward the buttocks), palpating the crest of the ilium and then pressing below it. The triangle formed by the index finger, the third finger, and the crest of the ilium is the injection site

Ventrogluteal injection site.


X

Location of Gluteus Medius

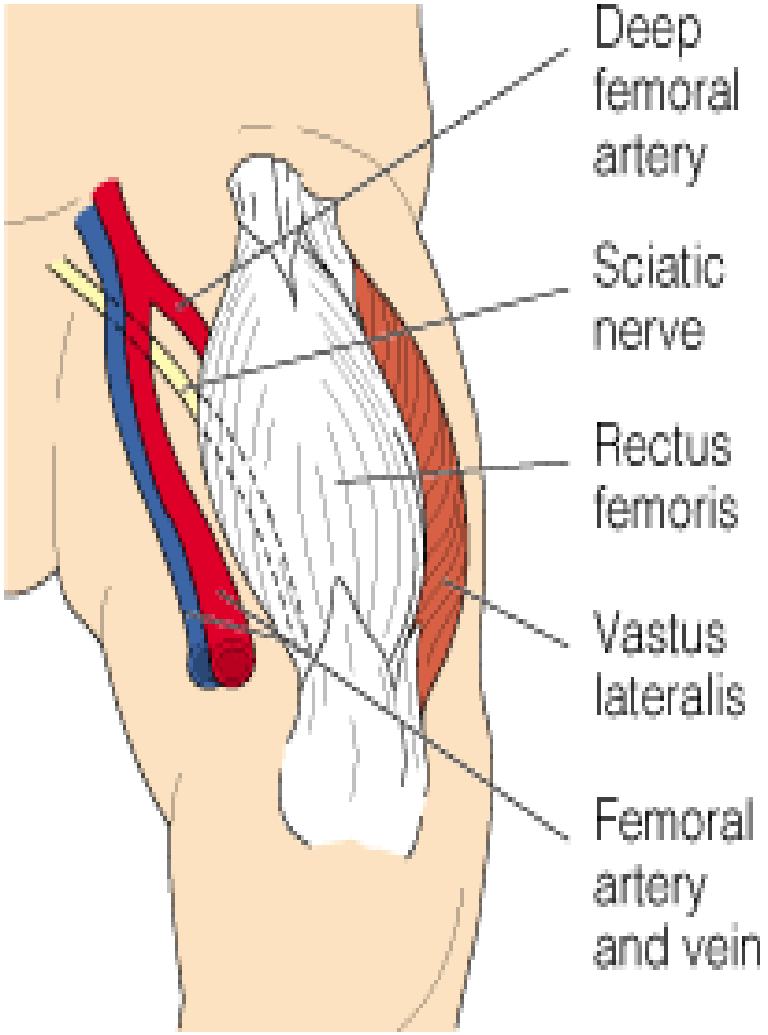
Injection Point
(between the knuckle of the
index & middle finger)

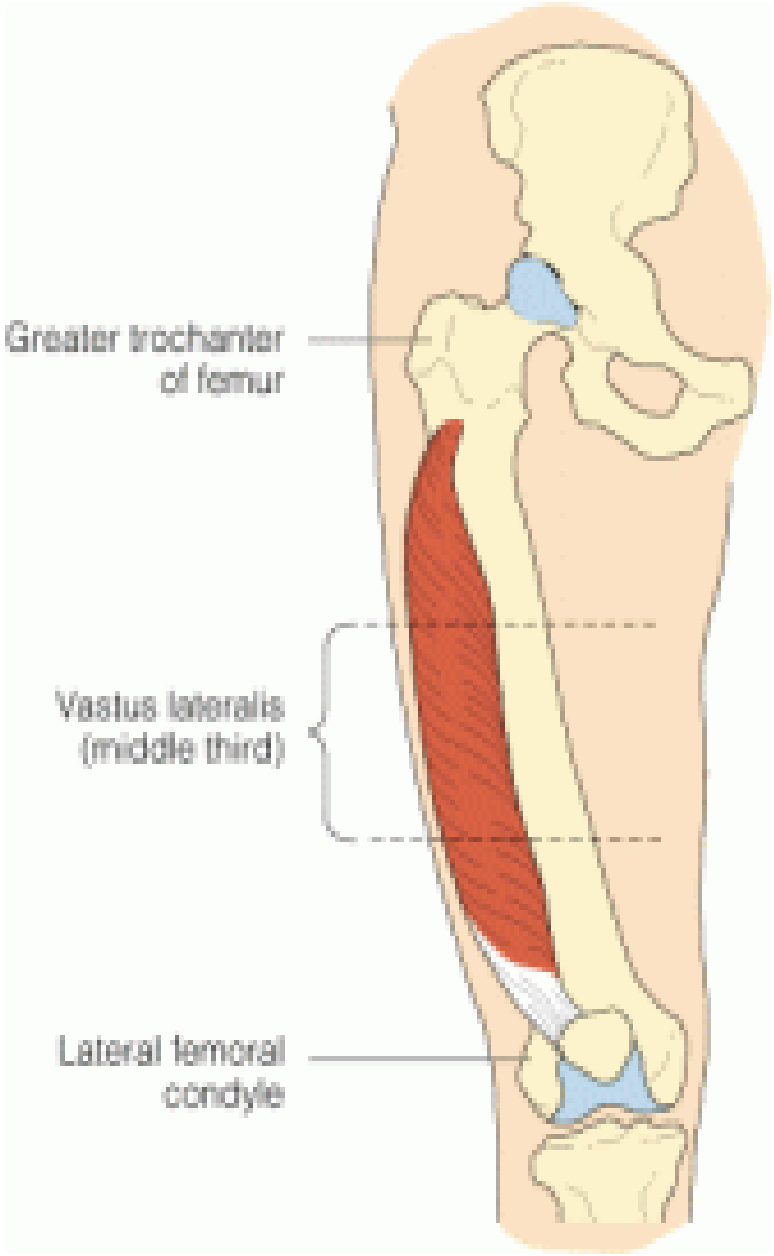
Greater Trochanter

2- Vastus Lateralis Site

The vastus lateralis muscle is usually thick and well developed in both adults and children. It is recommended as the site of choice for intramuscular injections for infants and young children because it is the largest muscle mass.

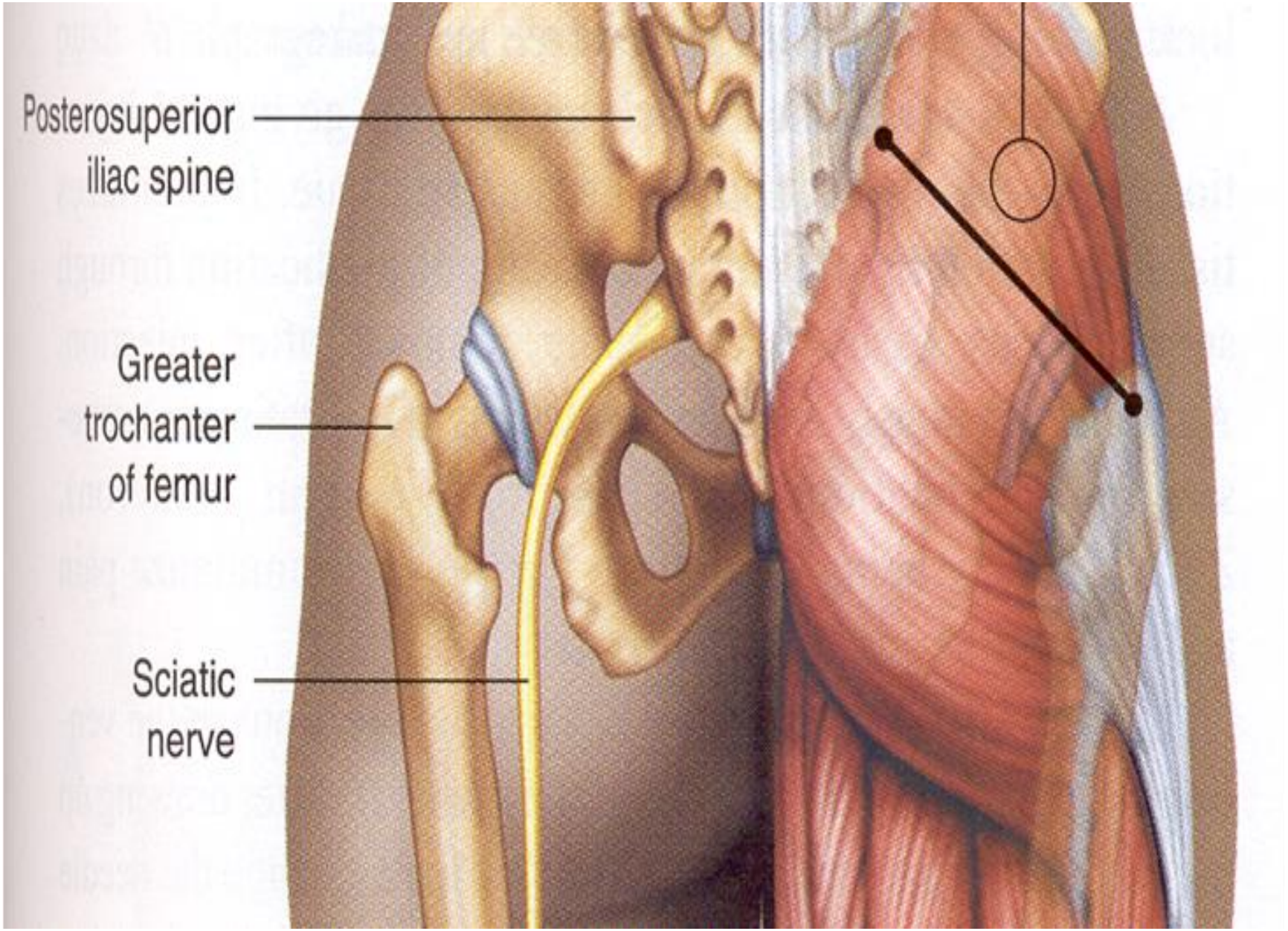
Because there are no major blood vessels or nerves in the area, it is desirable for infants whose gluteal muscles are poorly developed. It is situated on the anterior lateral aspect of the infant’s thigh.

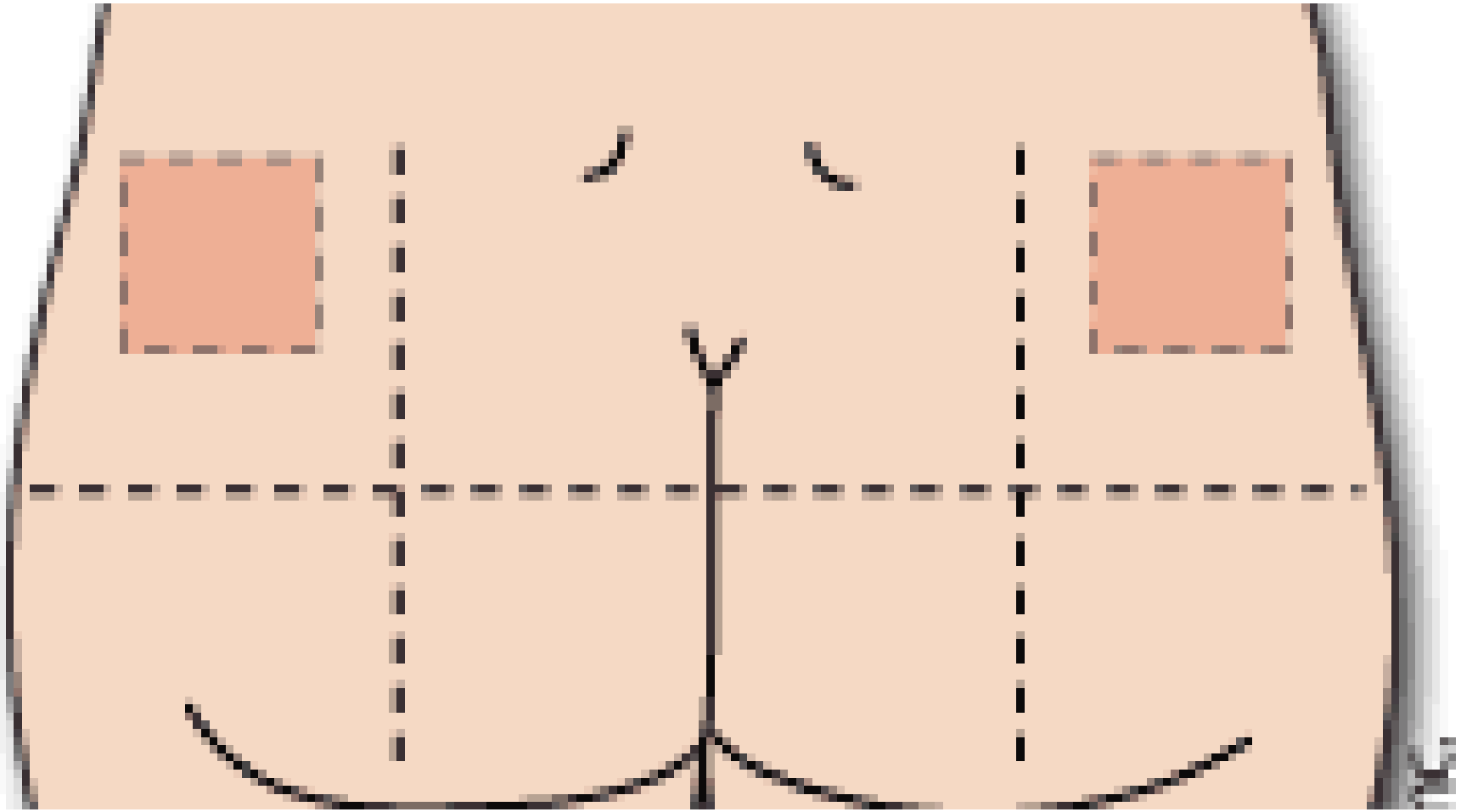

Deep femoral artery
Sciatic nerve
Rectus femoris
Vastus lateralis
Femoral artery and vein


Greater trochanter of femur
Vastus lateralis (middle third)
Lateral femoral condyle

3- Dorsogluteal Site

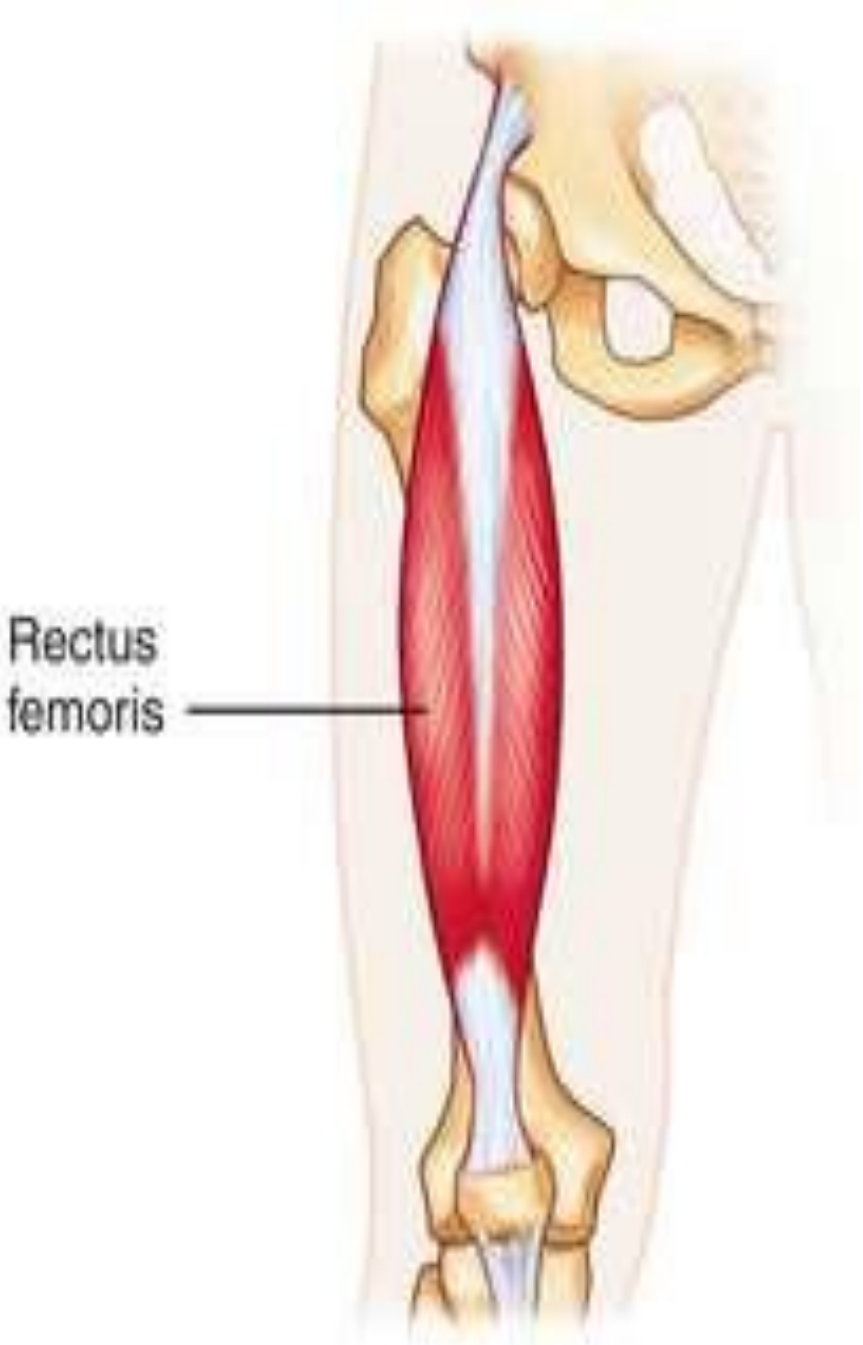
This site is close to the sciatic nerve and the superior gluteal nerve and artery. As a result, complications (e.g., numbness, pain, paralysis) occurred if the nurse injected a medication near or into the sciatic nerve. In addition, there tends to be more subcutaneous tissue at the dorsogluteal site. As a result, the medication may be injected into the subcutaneous tissue instead of the muscle, which can then affect the intended therapeutic effect.


Posterosuperior iliac spine
Greater trochanter of femur
Sciatic nerve



4- Rectus Femoris Site

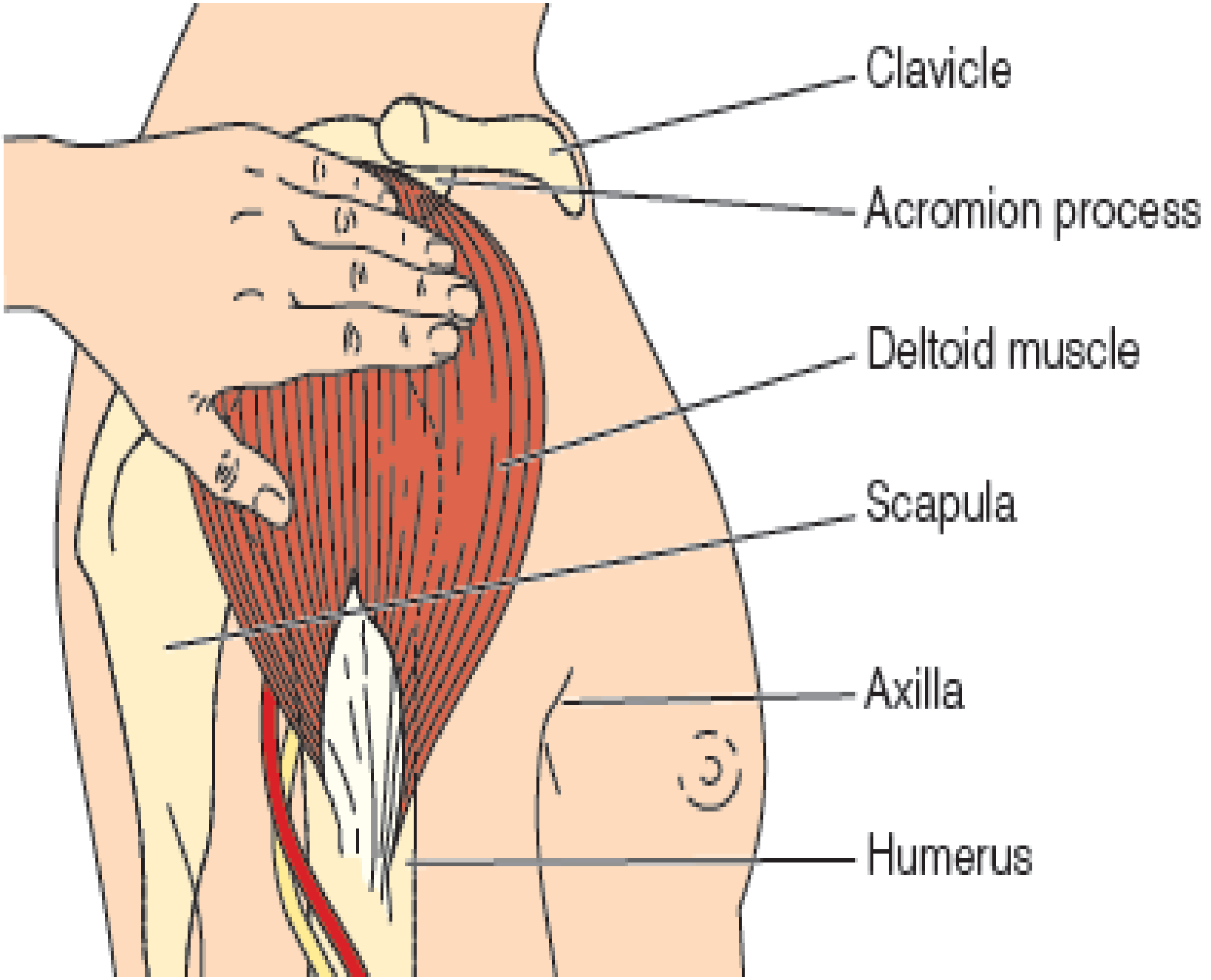
The rectus femoris muscle, which belongs to the quadriceps muscle group, is used only occasionally for intramuscular injections. It is situated on the anterior aspect of the thigh. Its chief advantage is that clients who administer their own injections can reach this site easily. Its main disadvantage is that an injection here may cause considerable discomfort for some people.

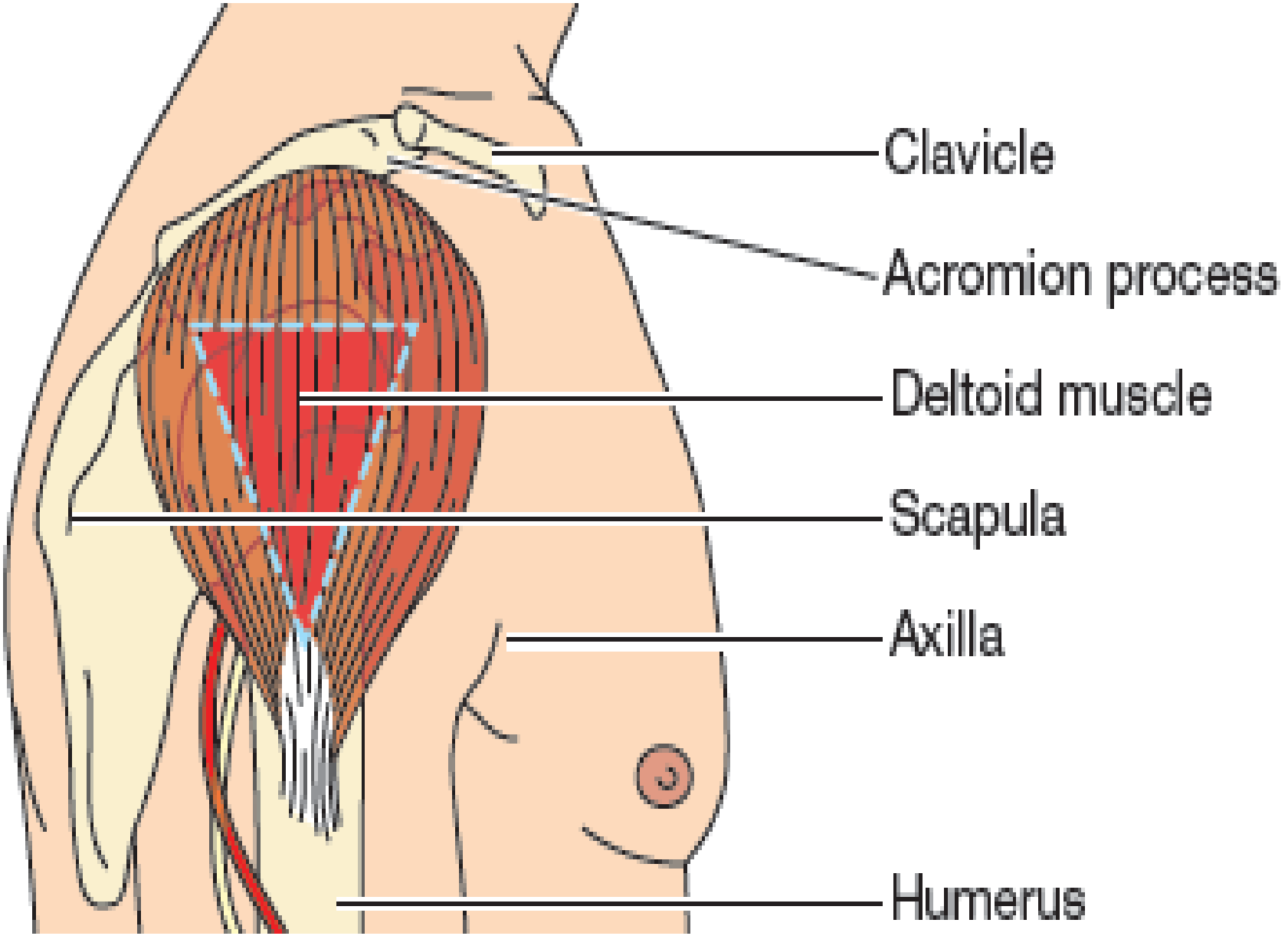

Rectus
femoris

5- Deltoid Site

The deltoid muscle is found on the lateral aspect of the upper arm. It is not used often for intramuscular injections because it is a relatively small muscle and is very close to the radial nerve and radial artery. It is sometimes considered for use in adults because of rapid absorption from the deltoid area, but no more than 1 mL of solution can be administered. This site is recommended for the administration of hepatitis B vaccine in adults.

The nurse locates the upper landmark for the deltoid site by placing four fingers across the deltoid muscle with the first finger on the acromion process. The top of the axilla is the line that marks the lower border landmark. A triangle within these boundaries indicates the deltoid muscle about 5 cm (2 in.) below the acromion process.


Clavicle
Acromion process
Deltoid muscle
Scapula
Axilla
Humerus


Clavicle
Acromion process
Deltoid muscle
Scapula
Axilla
Humerus

Type	Intramuscular (IM)
Syringe Size	Deltoid: 1-mL syringe Ventrogluteal: 3- to 5-mL syringes
Needle Size	Deltoid: #23–#25 gauge Ventrogluteal: #21 or #22gauge
Needle Length	Deltoid: 1 inch Ventrogluteal: 1.5 inches
Volume of Fluid	Deltoid: 0.5–1 mL Ventrogluteal: 3 mL max for adult with well-developed gluteal muscle 1–2 mL for adults with less developed gluteal muscle
Aspiration?	Deltoid: No Ventrogluteal: No scientific evidence confirming or rejecting aspiration
Common Sites	Deltoid Ventrogluteal
Common Uses	Deltoid: Immunizations Ventrogluteal: Medication that requires large muscle for absorption and/or volume greater than 1 mL

□

Intravenous Medications

- IV medications enter the client's bloodstream directly by way of a vein,
- it is appropriate when a rapid effect is required.
- when medications are too irritating to tissues to be given by other routes.
- When an IV line is already established.

Methods for administering medications intravenously

- Large-volume infusion of intravenous fluid
- Intermittent intravenous infusion (piggyback or tandem setups)
- Volume-controlled infusion (often used for children)
- Intravenous push (IVP) or bolus
- Intermittent injection ports (device).

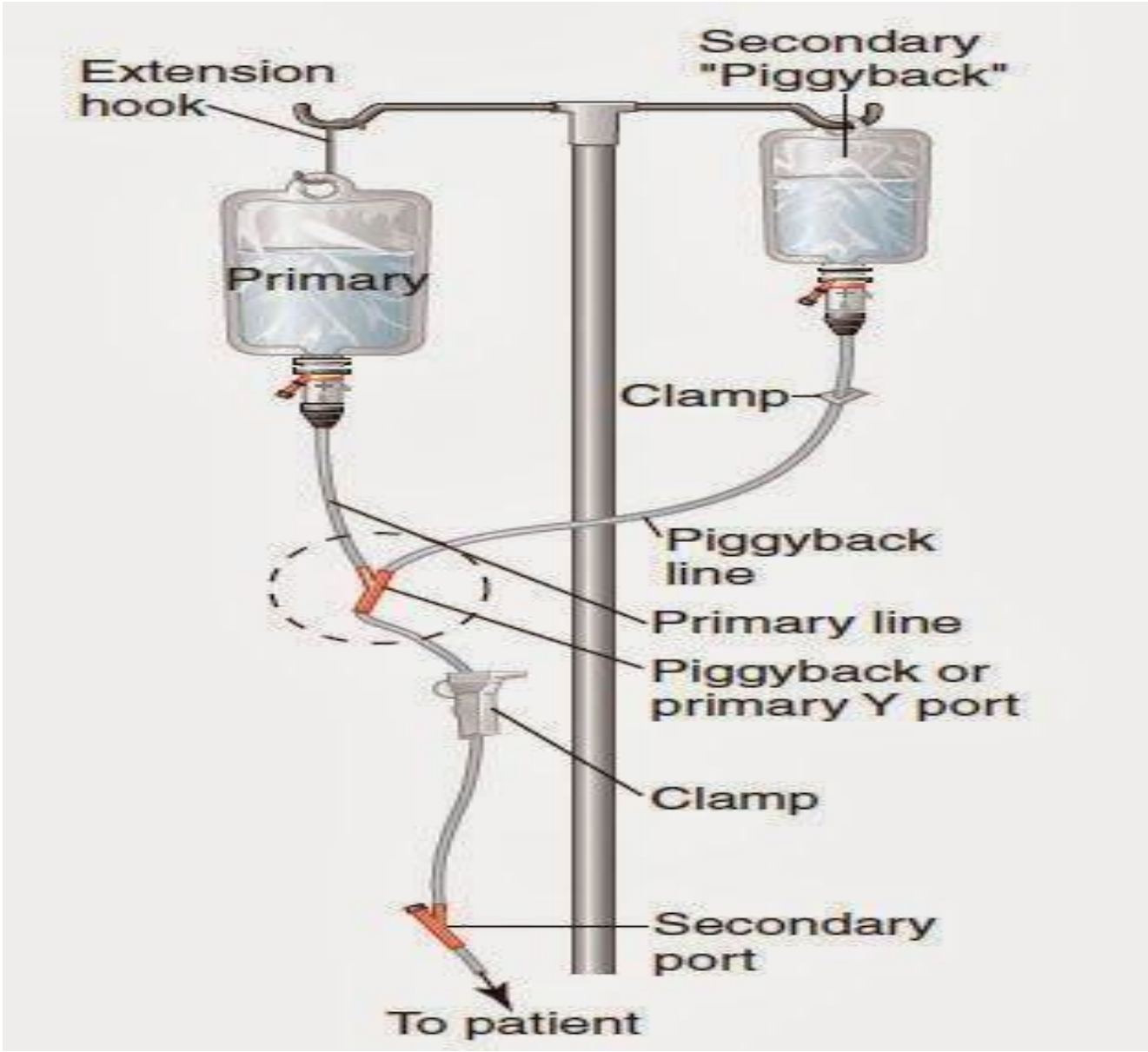
Large-volume infusions

- Mixing a medication into a large-volume IV container.
- The main danger of infusing a large volume of fluid is circulatory overload (hypervolemia)

Intermittent intravenous infusions

- An intermittent infusion is a method of administering a medication mixed in a small amount of IV solution, such as 50 or 100 mL.
- The drug is administered at regular intervals, such as every 4 hours, with the drug being infused for a short period of time such as 30 to 60 minutes.

- Two commonly used additive or secondary IV setups are the tandem and the piggyback.


Extension hook
Secondary "Piggyback"
Primary
Clamp
Piggyback line
Primary line
Piggyback or primary Y port
Clamp
Secondary port
To patient

Volume-control infusions

- Intermittent medications may also be administered by a volume control infusion set
- Such sets are small fluid containers (100 to 150 mL in size) attached below the primary infusion container so that the medication is administered through the client's IV line


PCA I
PCA Dose
mL/Inj
Delay
minutes
Basal Rate
mL/hr
Prime
Start / Stop
Silence
High Alt
Power
60ml
50
30
20
10

Intravenous push

- Intravenous push (IVP) or bolus is the intravenous administration of an undiluted drug directly into the systemic circulation. It is used when a medication cannot be diluted or in an emergency.
- IV bolus can be introduced directly into a vein by venipuncture or into an existing IV line through an injection port or through an IV lock.

Intermittent infusion devices

- Intermittent infusion devices may be attached to an intravenous catheter or needle to allow medications to be administered intravenously without requiring a continuous intravenous.
- Intermittent injection ports have either a resealable latex injection site for needle access or a port that allows a syringe or a needleless adapter to be connected for administering medications.

Intermittent infusion device with injection port and extension tubing.