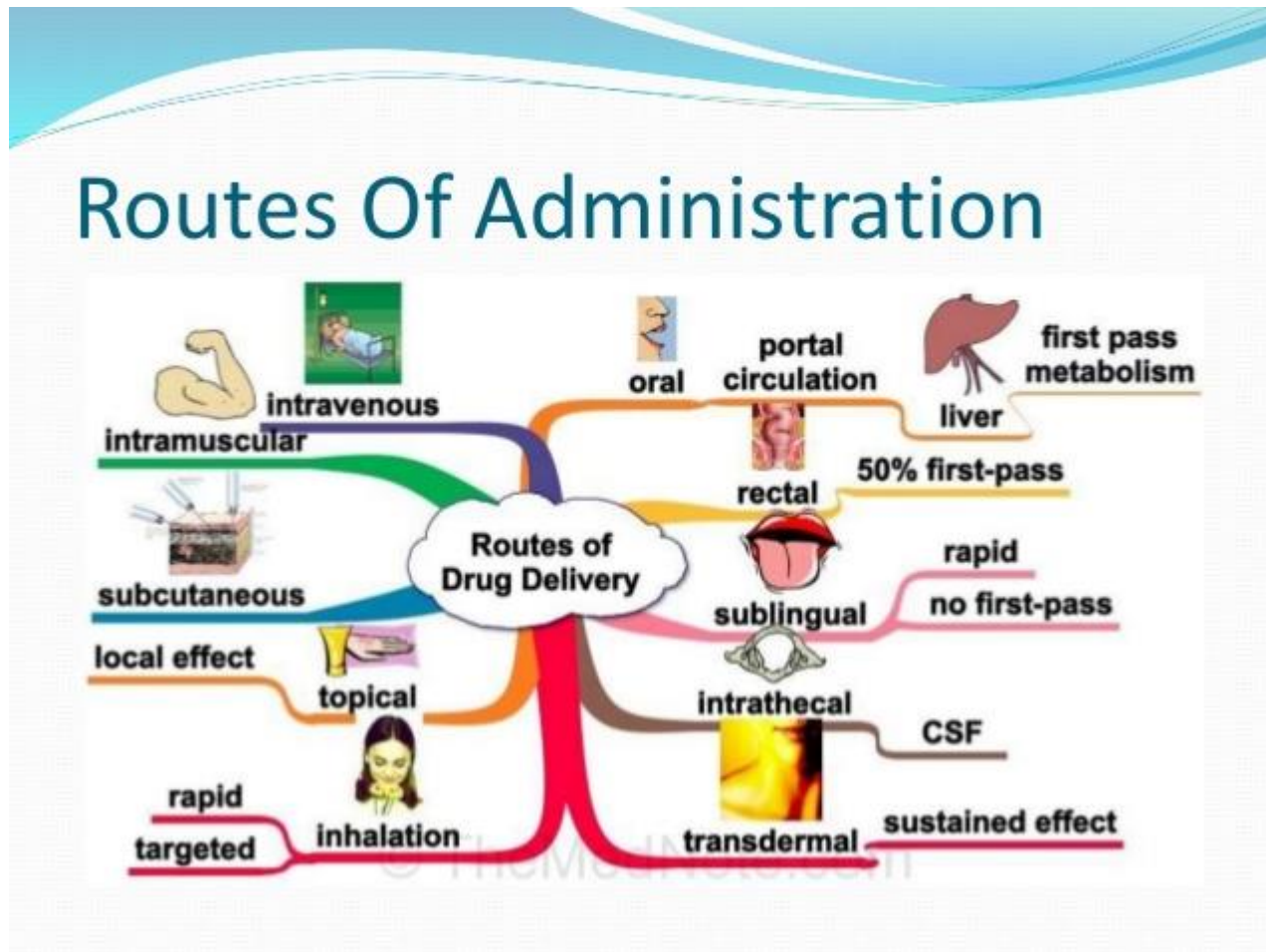


Routes of Drug Administration



Routes of Drug Administration

- A ***route of administration*** is the path by which a drug, fluid, poison or other substance is brought into contact with the body
- Drugs come in many different forms:
 - designed by pharmaceutical scientists for administration or application
- **Many factors determine the choice of route of administration**

Ease of Administration

- Prescribers assess characteristics to determine route of administration
 - some patients are unable to swallow
 - very young or older adult patients might have difficulty in swallowing
 - avoid solid, oral dose forms in favor of liquid dose forms or non-oral routes of administration
 - oral route of administration is inadvisable for a patient experiencing nausea and vomiting

Site of Action

- Choice of route of administration is influenced by desired site of action
- The term ***local use*** refers to site-specific applications of drugs
- The term ***systemic use*** refers to the application of a drug to the site of action by absorption into the blood and subsequent transportation throughout the body
 - even drugs meant for systemic administration are usually targeted to a specific site of action

Onset of Action

Onset rate varies with route of administration:

- Oral medications for systemic use must proceed through a series of steps before they exert their ***therapeutic effect*** (desired pharmaceutical action on the body)
- Liquid solutions or suspensions work faster than oral tablets or capsules
 - medication is more readily available for absorption

Onset of Action

- Tablets placed under tongue or between cheek and gums work quickly
 - medication bypasses stomach and liver, goes directly into bloodstream
- Drugs injected/infused directly into bloodstream are carried immediately throughout the body
- Topical medications work quickly
 - localized therapeutic effects, especially those
 - applied to the skin
 - inhaled into the lungs
 - instilled into the eye

Duration of Action

- The ***duration of action*** is the length of time a drug gives the desired response or is at the therapeutic level
- Controlled- /extended-release tablet may last for 12 to 24 hours compared with 4 to 6 hours for same drug in immediate-release formulation
- Transdermal patches deliver small amounts of a drug steadily over many hours or even days
- Sustained-duration effect can be achieved by means of intravenous (IV) infusion
- Injections into the muscle and skin last longer than injections directly into the bloodstream

Quantity of Drug

- Sometimes route of administration is chosen because of the amount of a drug
 - a tablet containing a lot of filler (diluent) might be preferred for a drug containing a very small amount of active ingredient
- IV infusion is an excellent method for systemic delivery of large quantities of material
 - rapidly diluted in the bloodstream
- IV injections and infusions can deliver a higher dose of medication to the target site
 - important in serious illnesses

Metabolism by the Liver or Excretion by the Kidney

- Liver metabolism breaks down active drug to inactive metabolites for elimination and to prevent drug accumulation
- The ***first-pass effect*** is the extent to which a drug is metabolized by the liver before reaching systemic circulation
 - influences activity of several drugs
 - such drugs have to be given in large oral doses or by another route of administration to bypass or overcome metabolism by the liver

Metabolism by the Liver or Excretion by the Kidney

- Age-related or disease-related changes in liver or kidney function can cause:
 - drug accumulation
 - toxicity
- Older patients are often prescribed lower doses of medication
- If patients are on multiple potent prescription drugs, there is a risk of a drug-drug interaction
 - drug accumulation
 - toxic blood levels increases

Toxicity

- ***Toxicology*** is the study of toxic effects of drugs or other substances on the body
- Physicians must weigh therapeutic benefit against the risk of toxicity
- Some drugs have a narrow therapeutic-toxic index called the “therapeutic window”
 - very little difference exists in the therapeutic versus toxic blood level
 - laboratory drug levels are ordered if the physician suspects toxicity
- Toxicity of a drug may affect route of administration

Summary

Factors that may influence the choice of a route of administration for a drug:

Ease of administration, site of therapeutic action, desired onset and duration of action, quantity of drug to be administered, characteristics of metabolism and excretion, and toxicity.

Parenteral Routes of Administration

- Parenteral administration is injection or infusion by means of a needle or catheter inserted into the body
- Parenteral forms deserve special attention
 - complexity
 - widespread use
 - potential for therapeutic benefit and danger
- The term *parenteral* comes from Greek words
 - para, meaning outside
 - enteron, meaning the intestine
- This route of administration bypasses the alimentary canal

Parenteral Dosage Forms

- Parenteral preparations must be sterile
 - free of microorganisms
- To ensure sterility, parenterals are prepared using
 - aseptic techniques
 - special clothing (gowns, masks, hair net, gloves)
 - laminar flow hoods placed in special rooms

Parenteral Dosage Forms

- IV route
 - directly into a vein
- Prepared in hospitals and home healthcare pharmacies
 - antibiotics
 - chemotherapy
 - nutrition
 - critical care medications

Parenteral Dosage Forms

- Intramuscular (IM) injections
 - into a muscle
- Subcutaneous injections
 - under the skin
- Intradermal (ID) injections
 - into the skin

Parenteral Dosage Forms

- ▶ Disposable syringes and needles are used to administer drugs by injection
- ▶ Different sizes are available depending on the type of medication and injection needed



IV Route

- The IV route is the fastest method for delivering systemic drugs
 - preferred administration in an emergency situation
- It can provide fluids, electrolytes, and nutrition
 - patients who cannot take food or have serious problems with the GI tract
- It provides higher concentration of drug to bloodstream or tissues
 - advantageous in serious bacterial infection
- IV infusion provides a continuous amount of needed medication
 - without fluctuation in blood levels of other routes
- Infusion rate can be adjusted
 - to provide more or less medication as the situation dictates

Disadvantages of the IV Route

- Traumatic injury from the insertion of needle
- Potential for introducing:
 - toxic agents
 - microbes
 - pyrogens
- Impossible to retrieve if adverse reaction occurs
 - injected directly into the body

The IM Route

- Intramuscular (IM) and subcutaneous routes of administration are convenient ways to deliver medications
- Compared with the IV route:
 - onset of response of the medication is slower
 - duration of action is much longer
- Practical for use outside the hospital
- Used for drugs which are not active orally

The IM Route

- For intramuscular (IM) and subcutaneous routes of administration, the injection site needs to be “prepped”
 - using alcohol wipe
- Correct syringe, needle, and technique must be used
- Rotation of injection sites with long-term use
 - prevents scarring and other skin changes
 - can influence drug absorption

The ID Route

- The intradermal (ID) route of administration is used for diagnostic and allergy skin testing
 - patient may experience a severe local reaction if allergic or has prior exposure to a testing antigen

Dispensing and Administering Parenteral Medications

- Most parenteral preparations are made up of ingredients in a sterile-water medium
 - the body is primarily an aqueous (water-containing) vehicle
- Parenteral preparations are usually:
 - solutions
 - suspensions

Dispensing and Administering Parenteral Medications

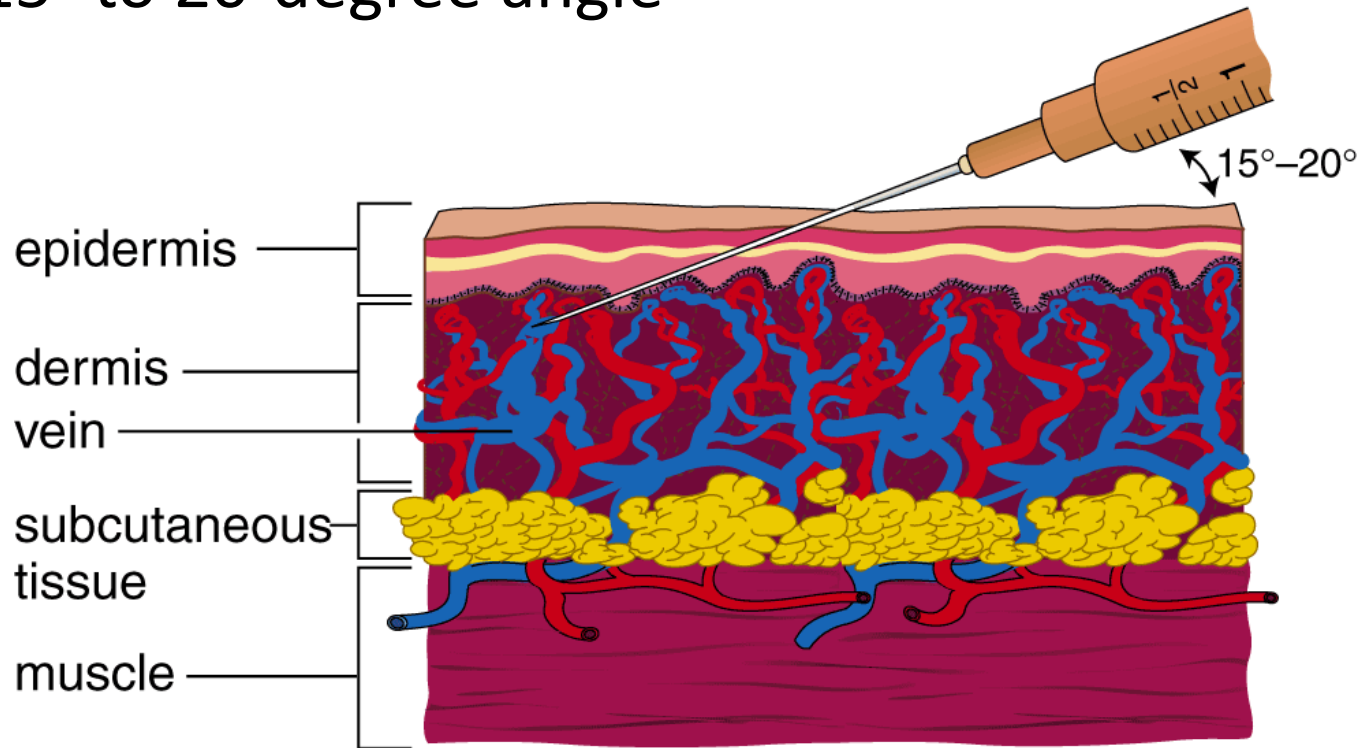
- IV injections and infusions are introduced directly into the bloodstream
 - must be free of air bubbles and particulate matter
 - introduction of air or particles might cause embolism, blockage in a vessel, or severe painful reaction at the injection site

Intravenous Injections or Infusions

- Fast-acting route because the drug goes directly into the bloodstream
 - often used in the emergency department and in critical care areas
- Commonly used
 - for fluid and electrolyte replacement
 - to provide necessary nutrition to the patient who is critically ill

Intravenous Injections or Infusions

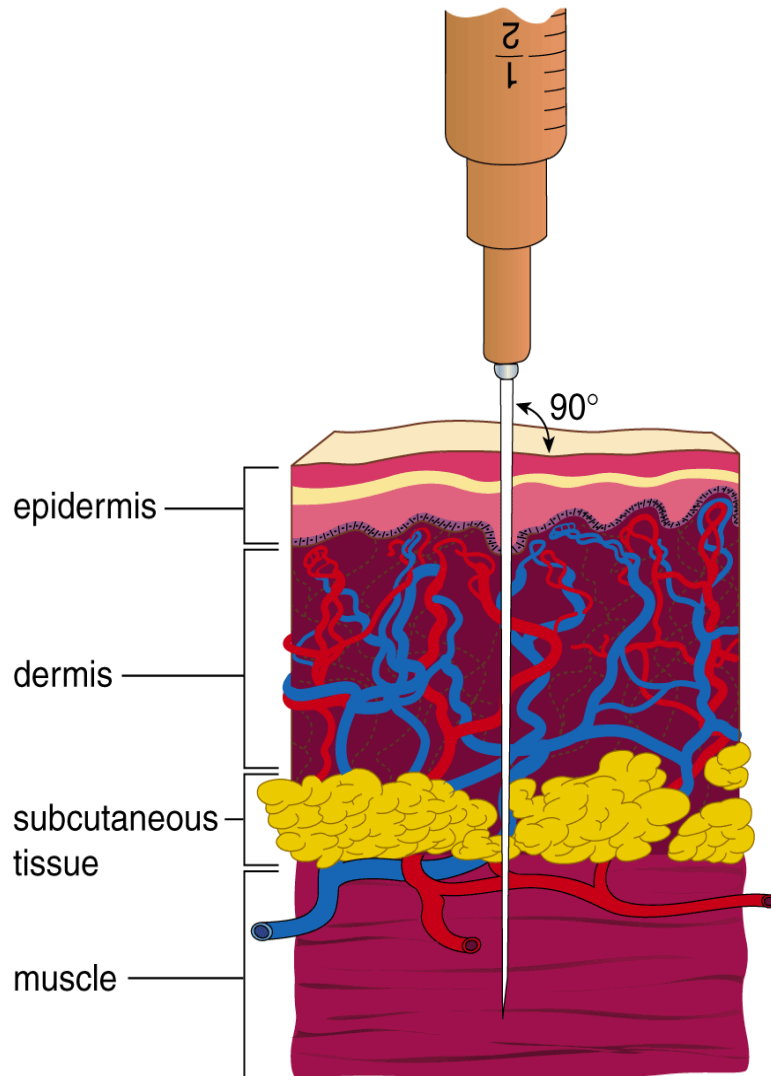
- Intravenous (IV) injections are administered at a 15- to 20-degree angle



Intramuscular Injections

- Care must be taken with deep IM injections to avoid hitting a vein, artery, or nerve
- In adults, IM injections are given into upper, outer portion of the gluteus maximus
 - large muscle on either side of the buttocks
- For children and some adults, IM injections are given into the deltoid muscles of the shoulders

Intramuscular Injections



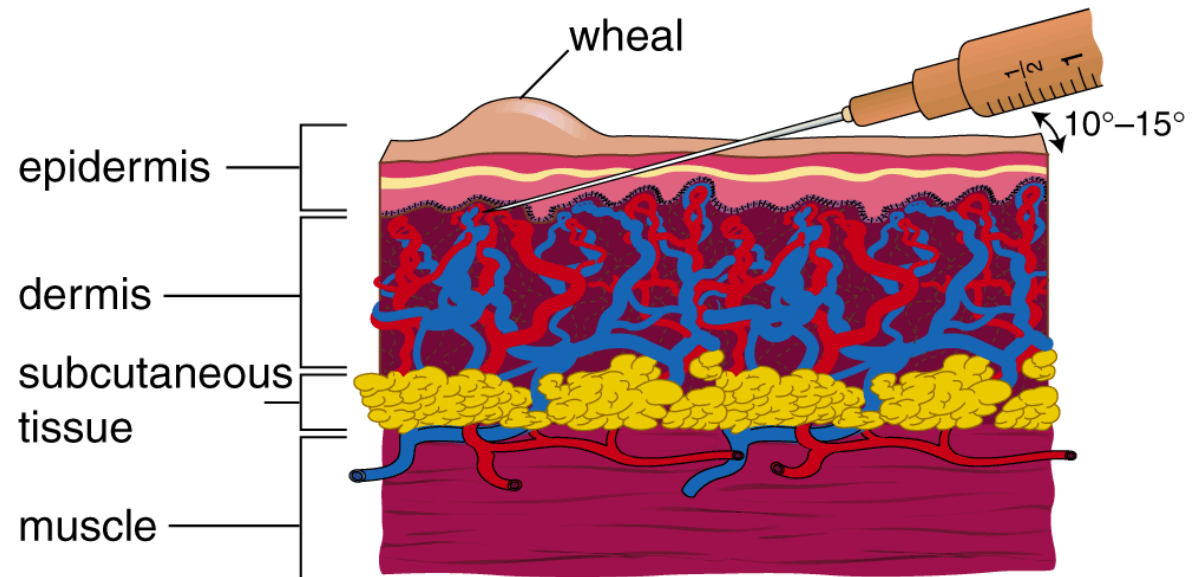
- Typical needle is 22- to 25-gauge ½- to 1-inch needle
- Intramuscular (IM) injections are administered at a 90-degree angle
 - volume limited to less than 3 mL

Intramuscular Injections

- Used to administer
 - antibiotics
 - vitamins
 - iron
 - vaccines
- Absorption of drug by IM route is unpredictable
 - not recommended for patients who are unconscious or in a shocklike state

Intradermal Injections

- Given into capillary-rich layer just below epidermis for
 - local anesthesia
 - diagnostic tests
 - immunizations

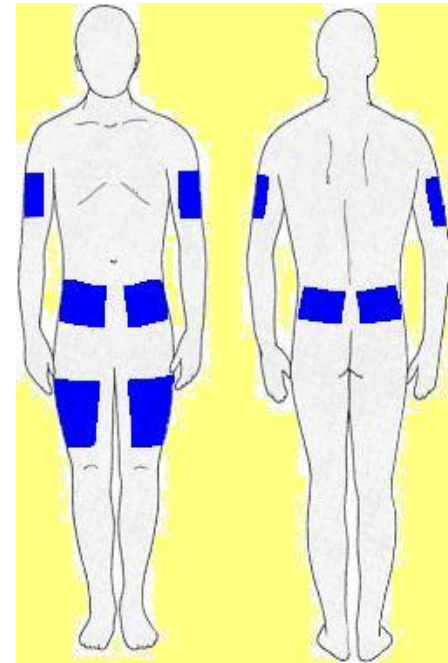


Intradermal Injections

- Examples of ID injections include
 - skin test for tuberculosis (TB) or fungal infections
 - typical site is the upper forearm, below the area where IV injections are given
 - allergy skin testing
 - small amounts of various allergens are administered to detect allergies
 - usually on the back

Subcutaneous Injections

- Administer medications below the skin into the subcutaneous fat
 - outside of the upper arm
 - top of the thigh
 - lower portion of each side of the abdomen
 - not into grossly adipose, hardened, inflamed, or swollen tissue
- Often have a longer onset of action and a longer duration of action
 - compared with IM or IV injection



Subcutaneous Injections

- Insulin is given using 28- to 30-gauge short needles
 - in special syringe that measures in units
- Insulin is administered following a plan for site rotation
 - to avoid or minimize local skin reactions
- Absorption may vary depending on
 - site of administration
 - activity level of the patient



Subcutaneous Injections

- Keep insulin refrigerated
- Check expiration dates frequently
 - opened vials should be discarded after one month
- A vial of insulin is agitated and warmed by rolling between the hands and should never be shaken
- The rubber stopper should be wiped with an alcohol wipe

Subcutaneous Injections

- When administering insulin, air is injected into vial
 - equal to the amount of insulin to be withdrawn
- Air is gently pushed from syringe with the plunger
- Patient should plan meals, exercise, and insulin administration
 - to gain the best advantage of the medication
 - avoid chances of creating hypoglycemia

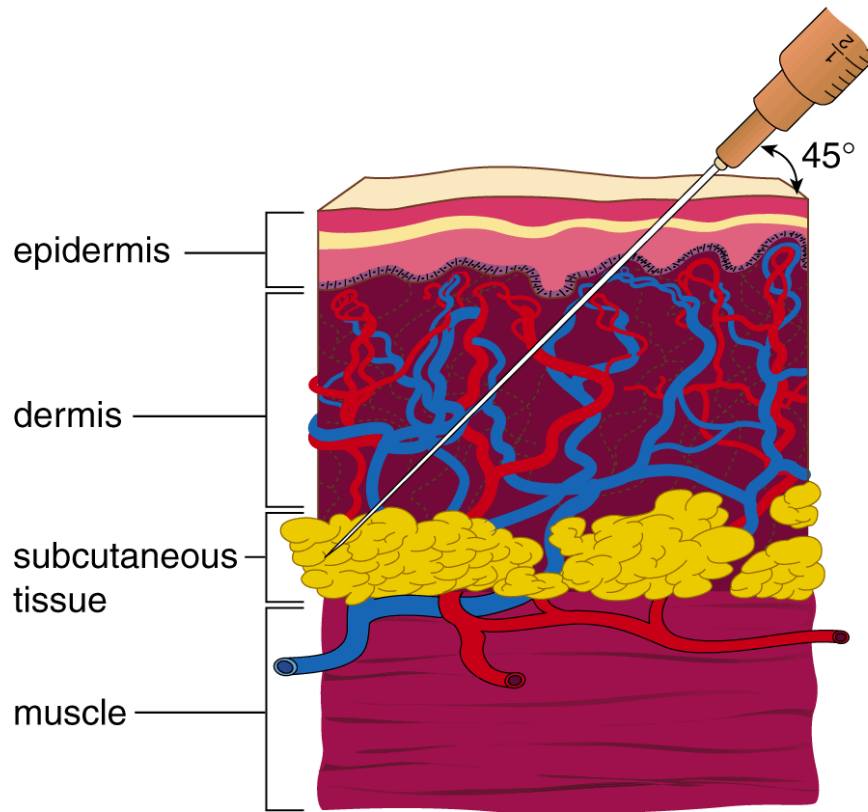
Subcutaneous Injections

- Medications administered by this route include:
 - epinephrine (or adrenaline)
 - for emergency asthmatic attacks or allergic reactions
 - heparin or low molecular–weight heparins
 - to prevent blood clots
 - sumatriptan or Imitrex
 - for migraines
 - many vaccines

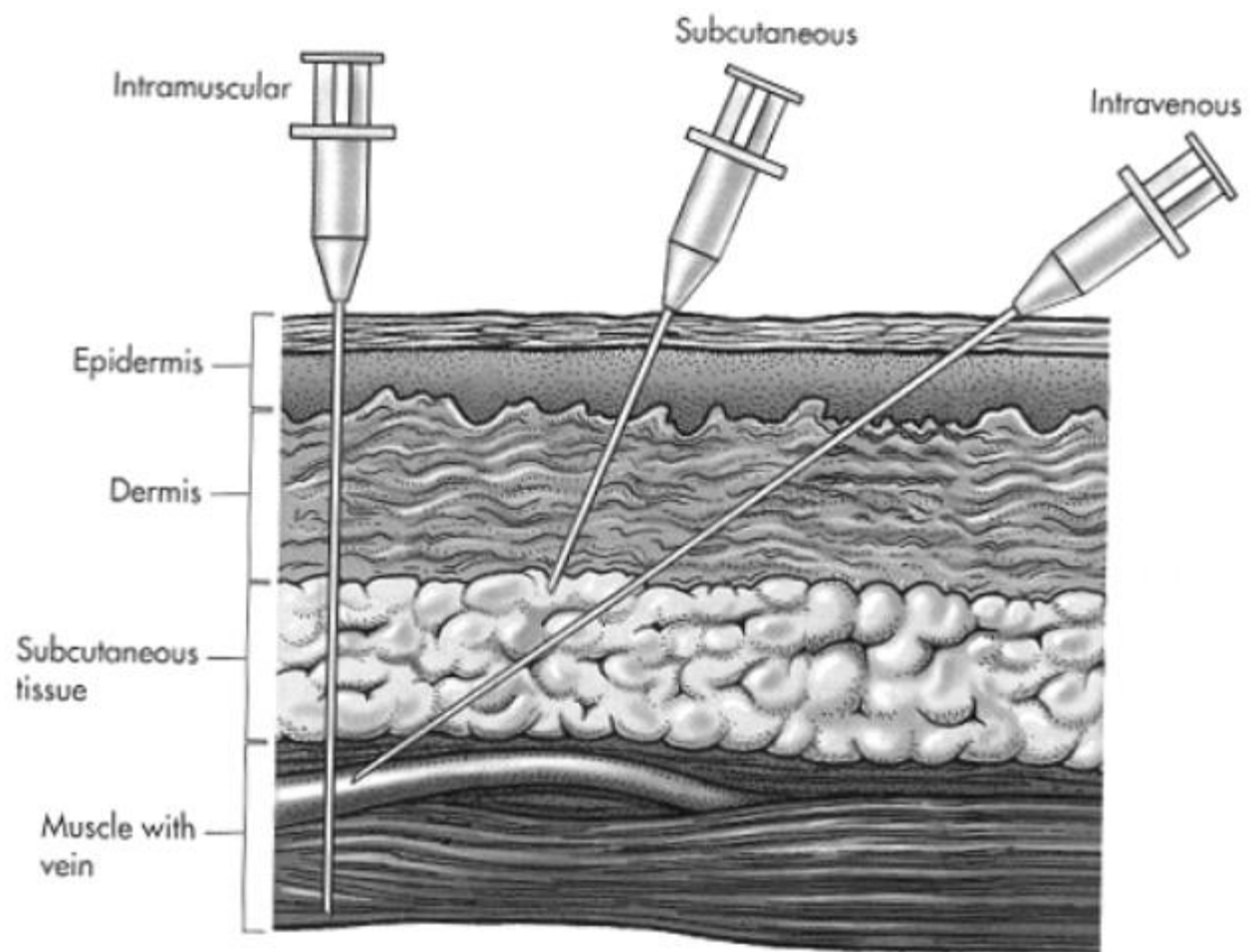
Subcutaneous Injections

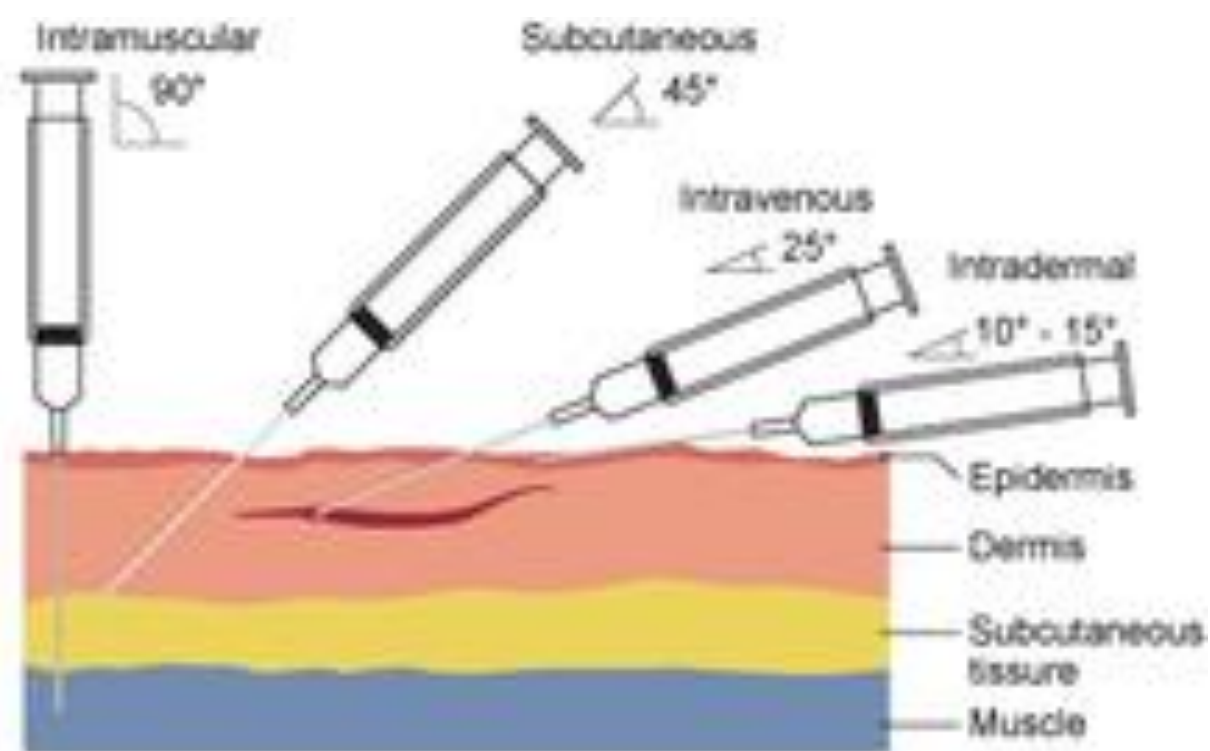
- Normally given with the syringe held at a 45-degree angle
 - in lean older patients with less tissue and obese patients with more tissue, the syringe should be held at more of a 90-degree angle
- Correct length of needle is determined by a skin pinch in the injection area
 - proper length is one half the thickness of the pinch

Subcutaneous Injections



- Given at a 45-degree angle
 - 25- or 26-gauge needle, 3/8 to 5/8 inch length
- No more than 1.5 mL should be injected into the site
 - to avoid pressure on sensory nerves causing pain and discomfort





Angle of injections

