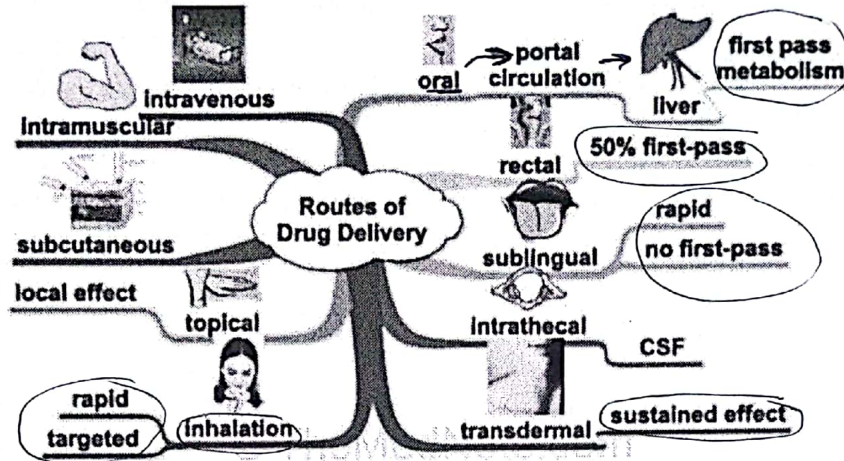


# Routes of Drug Administration

## Routes Of Administration



Duration of onset of action of Drug is directly related to route of administration.

The goal from the different routes of administration is to deliver the drug with high efficacy and low toxicity and side effect.

## 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.

## ① Ease of Administration

- Prescribers assess characteristics to determine route of administration
  - some patients are <sup>غير قادر</sup> 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

other routes of administration  
بمسالك أخرى

① إذا كان المكان الذي يصل إليه الدواء (site of action) هو نفس المكان الذي يصل إليه الدواء (site of action)   
 Local use   
 ② إذا كان الدواء يصل إلى (site of action) عن طريق الدم (systemic use)   
 Application   
 Local use   
 Systemic use

## ② 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 <sub>by distribution</sub>
  - even drugs meant for systemic administration are usually targeted to a specific site of action

③

## Onset of Action

liquids      فحسان صيد      tablet      تشتت      ربط      مع      ال

site of action

distribution  
+  
absorption  
+  
degranulation  
deaggregation

Onset rate varies with route of administration:

tablet      فحسان صيد

- 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

because — 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

bioavailability = 100%

ex: IV

■ Topical medications work quickly

■ localized therapeutic effects, especially those

■ applied to the skin

• inhaled into the lungs

■ instilled into the eye

(4)

## Duration of Action

Minimum effective (MEC) concentration ← دواء تركيزه  
دواء تركيزه

- 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 → for long period drop by drop
- Injections into the muscle and skin last longer than injections directly into the bloodstream

دواء تركيزه duration of action

(5)

## Quantity of Drug

- Sometimes route of administration is chosen because of the amount of a drug   
 Handled دواء تركيزه
- 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

## ⑥ 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      ↓ rectal / buccal / sublingual / IV

## 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

(7)

## 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  
ما في فرق كبير بين الـ therapeutic level و الـ toxic 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:

① Ease of administration, ② site of therapeutic action, ③ desired onset and ④ duration of action, ⑤ quantity of drug to be administered, ⑥ characteristics of metabolism and excretion, and toxicity.

(7)

# 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 because
  - complexity
  - widespread use
  - potential for therapeutic benefit and danger at the same
- The term parenteral comes from Greek words
  - para, meaning outside outside the intestine
  - enteron, meaning the intestine orally
- This route of administration bypasses the alimentary canal GIT

## 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

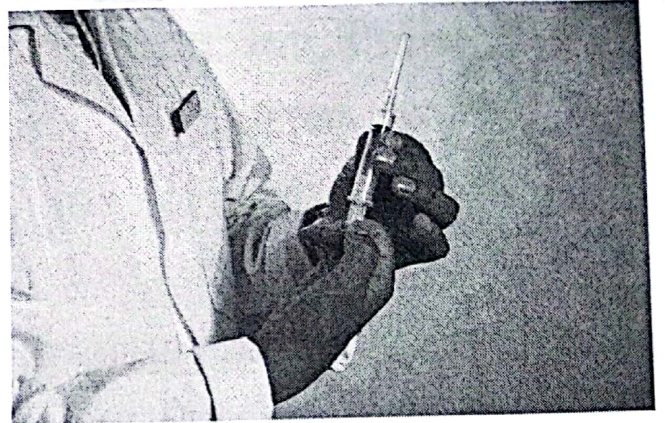
- IV route
  - directly into a vein
- Prepared in hospitals and home healthcare pharmacies
  - antibiotics
  - chemotherapy
  - nutrition
  - critical care medications

## 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  
because ➤ 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 <sup>الجلد و الجلد</sup>
  - 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

reconstitution

لازم يصير

powder

بالسليكون على شكل

حالة

التي

التي

stability

Most parenteral preparations are made up of ingredients in a sterile-water medium

the body is primarily an aqueous (water-containing) vehicle

sterile لازم يكون على

Parenteral preparations are usually:

solutions

suspensions

→

مستحلب

particle size

suspension

oil in water مستحلب

capillary Artery

occlusion

ممكن يحصل

patient severe side effect

Large particle size

## Dispensing and Administering Parenteral Medications

IV injections and infusions are introduced directly into the bloodstream

sterile لازم يكون

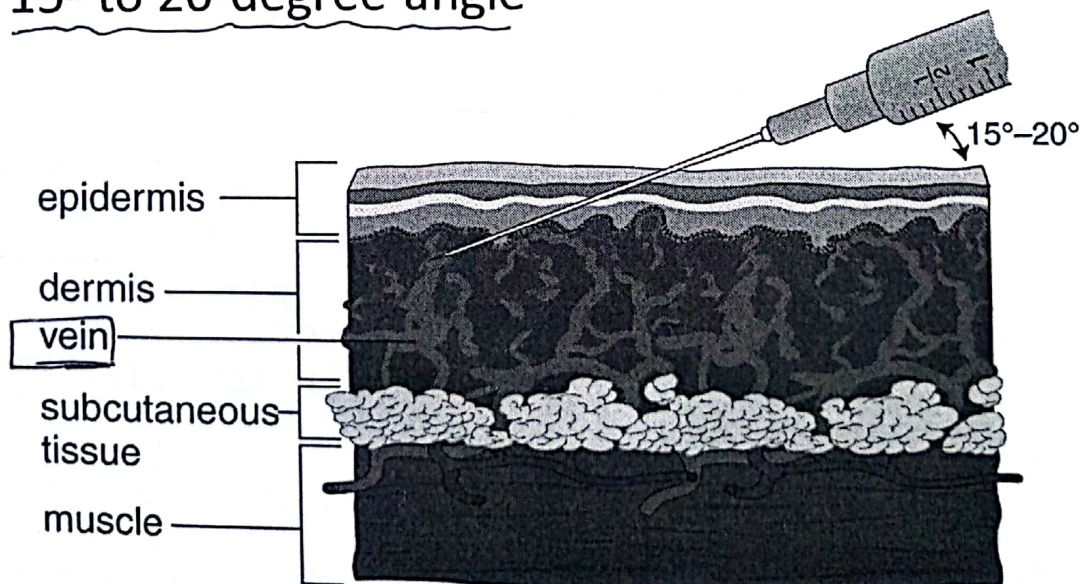
- must be free of air bubbles and particulate matter
- introduction of air or particles might cause embolism, blockage in a vessel, or severe painful reaction at the injection site

# Intravenous Injections or Infusions

- Fast-acting route because the drug goes directly into the bloodstream ← because
  - 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

جندب / ۱/۱۵۱۶ hitting a vein, artery, or nerve

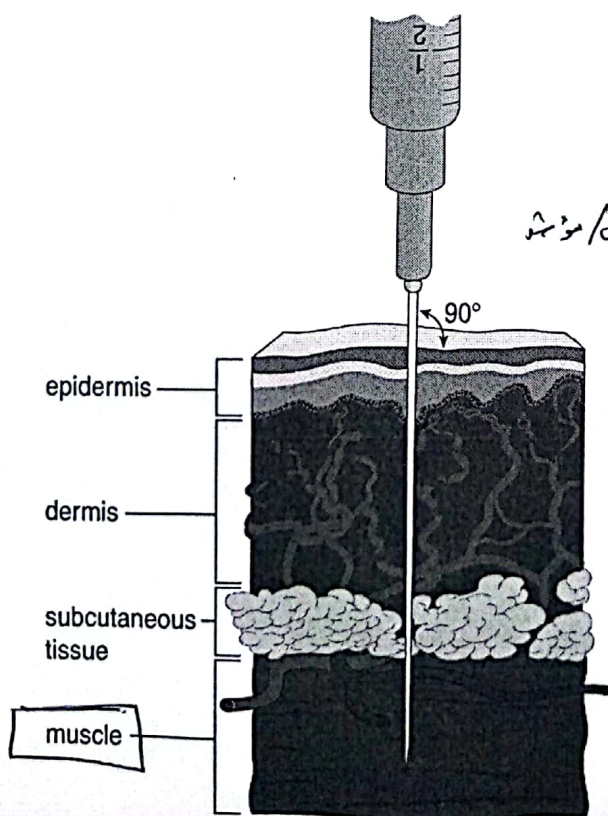
► In adults, IM injections are given into upper, outer  
portion of the gluteus maximus

► large muscle on either side of the buttocks

نقشہ  
لا. ب. ج. ا. ق. س. م.  
IM با مجزء ال upper + outer ال  
د. ن. ظ. ی.

► For children and some adults, IM injections are given  
into the deltoid muscles of the shoulders

## Intramuscular Injections



• Typical needle is 22- to 25-  
سقیاس / مؤشرو gauge 1/2- to 1-inch needle,

• Intramuscular (IM) injections  
are administered at a 90-  
degree angle

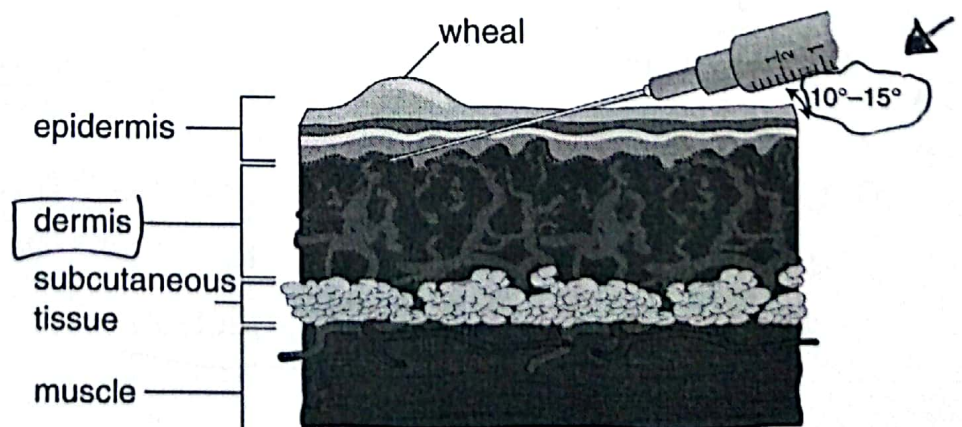
– volume limited to less than 3  
mL

# Intramuscular Injections

- Used to administer
  - antibiotics
  - vitamins  $\beta_{12}$
  - iron
  - vaccines تطعيم / لقاح
- Absorption of drug by IM route is unpredictable
  - not recommended for patients who are unconscious or in a shocklike state لا واعي / غيبوبة

## 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  
*الساعد ←*
  - allergy skin testing
    - small amounts of various allergens are administered to detect allergies
    - usually on the back *للكتف الظهر*

## Subcutaneous Injections

- Administer medications below the skin into the subcutaneous fat

- outside of the upper arm → *الذراع*

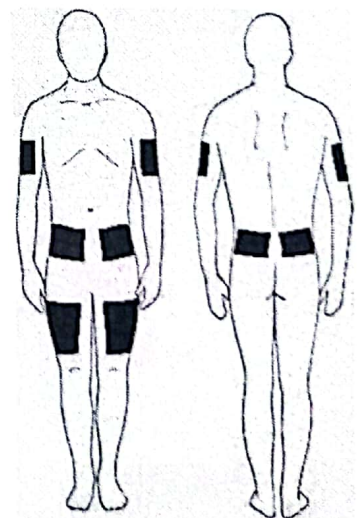
- top of the thigh → *الفخذ*

- lower portion of each side of the abdomen *البطن*

- 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

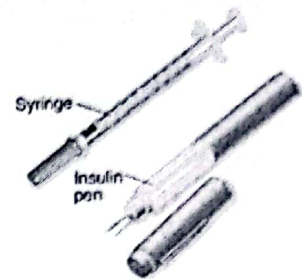


*لأنه روح تأثر على  
absorption*

# Subcutaneous Injections

Ex:

- 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

باللغة

- Keep insulin refrigerated
- Check expiration dates frequently <sup>مهملة</sup>
  - opened vials should be discarded after one month
- A vial of insulin is agitated <sup>يسخن</sup> and warmed <sup>درجة / تزدحم</sup> by rolling between the hands <sup>الرجاحة</sup> and should never be shaken
- The rubber stopper should be wiped <sup>مسح</sup> 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

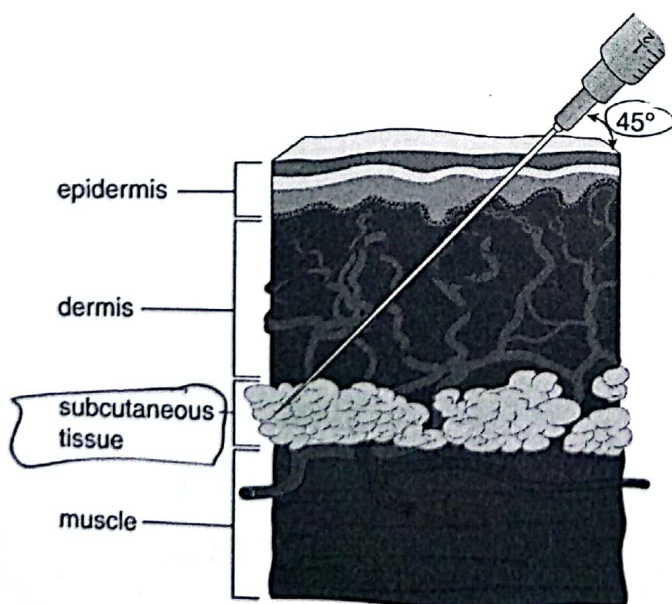
## Subcutaneous Injections

- 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

۱۱  
 تعرف  
 Angle  
 بکلی روش

