Routes of drug administration

Routes of drug administration

Route of drug administration (RODA): is the mean that used to introduce different chemicals (such as medications and fluids) into the body .

The following factors can help in choosing the appropriate RODA:

- Drug properties (Solubility of the drug)
- Therapeutic goals (e.g. the need for rapid onset, long-term treatment, or local treatment).

Routes of Drug Administration

A) Enteral routes

B) Parenteral administration

C) Others

A-Enteral administration involves absorption of the drug via the GI tract. It includes:

1- Oral route as the drug can be swallowed

2- Sublingual route when a drug may be placed under the tongue

3- Buccal route as the drug can be placed between the gums and cheek leading to direct absorption into the bloodstream.

4- In addition, rectal administration may be classified as an enteral rout.

1- Oral route:

Absorption pattern: Variable and depending on many factors such as presence of food.

Advantages:

1- Easy and Preferred by patients.

2- "Slow-release" preparations may be available to extend duration of action

3-Time availability to reverse toxicity

Disadvantage:

1- Drug action is slow, thus not suitable for emergency.

2- Irritant drugs cannot be administrated.

3- May not be useful in the presence of vomiting.

4- Cannot be used for unconscious patient.

5- Digestive juices destroy some drugs (Penicillin G).

6- The drug must pass to the liver on its way to the general circulation (first pass metabolism).

2- Sublingual and buccal routes:

The highly lipid soluble and non-irritating drugs (e.g.: nitroglycerine) in the form of tablets or pellets is placed under the tongue (sublingual). Or (buccal route) placement of drug between the cheek and gum. The drug rapidly dissolves and is absorbed quickly in the general circulation

Advantage:

1- Rapid onset of action.
2- Easy to be used.
3- The effect can be terminated by spitting out the tablet.
4- Avoiding degradation of certain drugs by gastric acid & first pass metabolism in the liver.
5.As the pH of saliva is relatively neutral, the drug stability will not be affected

Disadvantage:

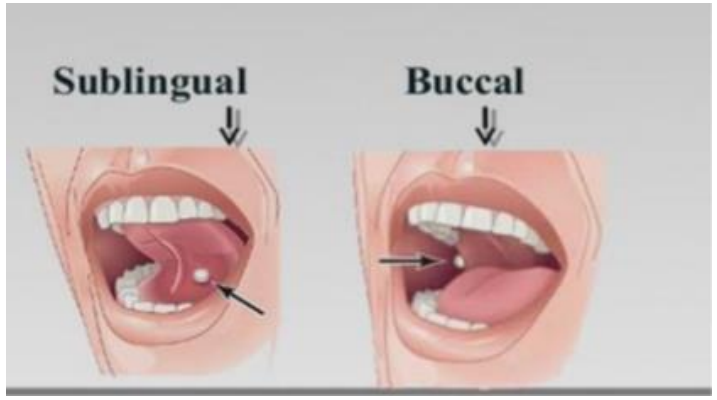
1- Irritation of mucus membrane. Absorption pattern: Depending on the physico-chemical properties of drugs as some of them are irritant or incompletely absorbed

2- Short duration of action.
3- Inconvenient for frequent use.

4- Limited drug that can be given by this route

5. Drug should be administered with small doses only.

6-Some drug doses can be lost if swallowed



3- Rectal route:

Drug absorption pattern: Erratic and variable

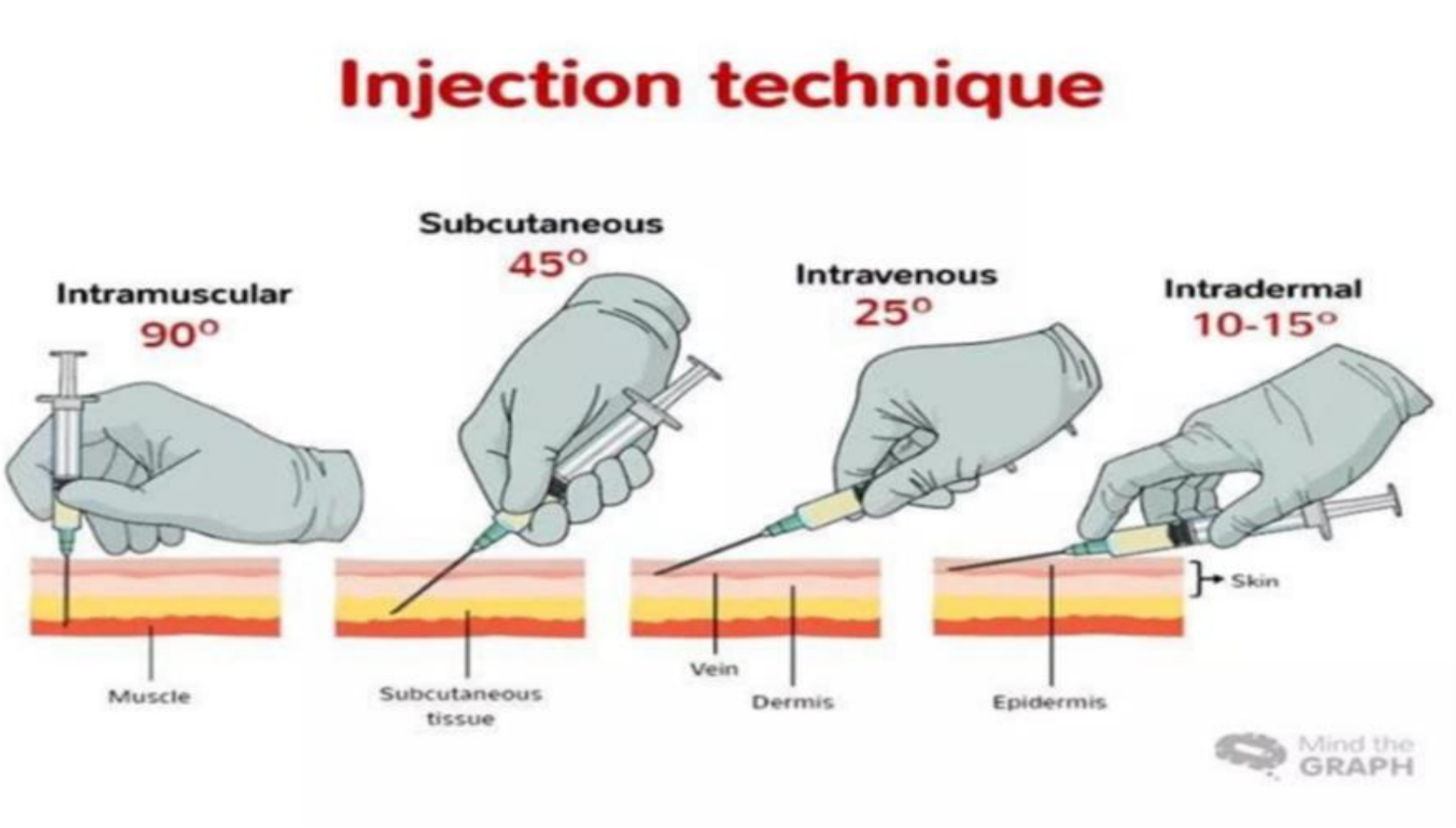
Rectal: (suppositories) Advantage:

1- Used with drugs that are irritant to the stomach.
2- Suitable in case of vomiting or unconsciousness.
3- As 50% of the drainage of the rectal region bypasses the portal circulation, the biotransformation of drugs by the liver is minimized with rectal administration.
4- Protects drug from gastric destruction
5- Provide local treatment
6- When lacking of cooperation (pediatrics).

Disadvantage:
1- May cause rectal inflammation.
2- Absorption incomplete
3- Inconvenient

Parenteral route

1)Intravenous (IV)
2) Intramuscular (IM)
3) Subcutaneous
4) Intradermal



1.Intravenous (IV)

Drug introduces directly to systemic circulation. (absorption not required)

Advantage:

1- Rapid effect and desired blood concentration can be obtained with a definite dose but it is at the same time the most dangerous route.
2- It is suitable for administration of drugs that are not absorbed from the gut or irritant to be given by other routes.
3- Suitable for unconscious patients and in case of vomiting.
4- Used in emergencies when rapid action is required.
5- Ideal if dosed in large volumes (bolus dose)
6- Allow rapid modification of dose (i.e. immediate cessation of administration is possible if unwanted effects occur).

Intravenous (IV)

Disadvantage:

1- If given too rapid may cause severe toxicity or adverse effect.
2- Infection of intravenous catheter. .
3- Can cause local venous thrombosis especially with prolonged infusion & with bolus doses of irritant formulation.
4- Bolus injection may result in sever adverse effects
5- Strict aseptic techniques needed
6- Skilled personnel

2- Intramuscular (IM)

Absorption : Depending on the used diluent. (i.e. Drugs administered IM if it is dissolved in an aqueous solution will be absorbed rapidly, or in specialized depot preparations will be absorbed slowly).

The soluble substances, mild irritants & suspensions can be injected by this route in large skeletal muscles (deltoid, triceps, gluteus maximus, rectus femoris).

Advantage:

1- Depot preparation (as benzathine penicillin) can be used at monthly or longer intervals.

2- Suitable for drugs not absorbed by gut.

Disadvantage:

1- Painful.

2-Adverse effect to depot cannot be removed.

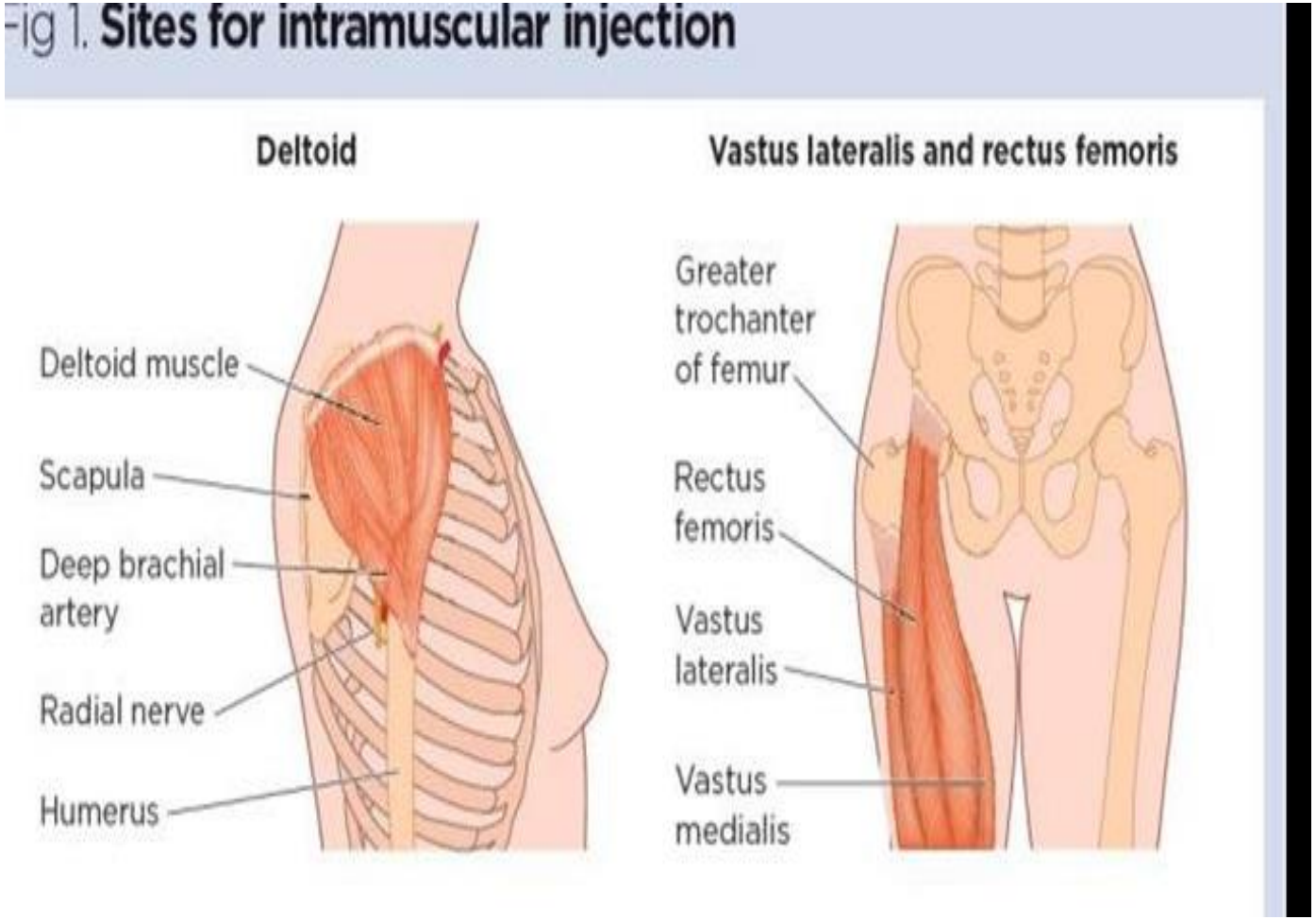
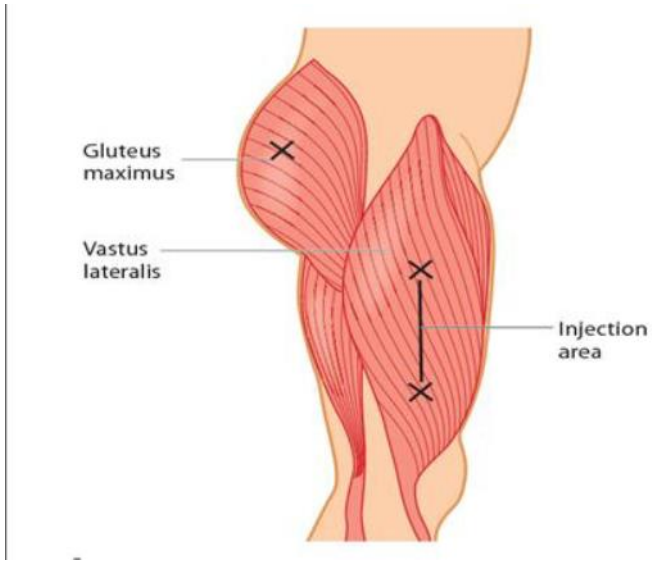
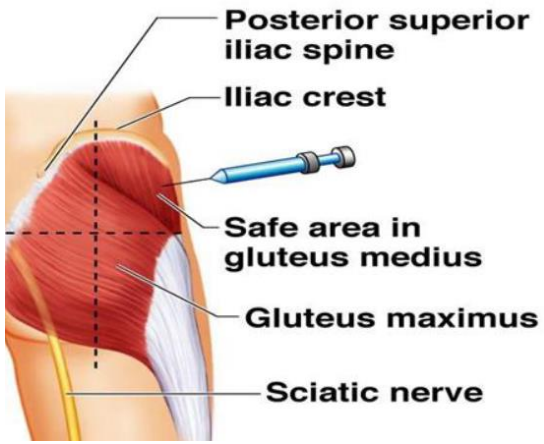


Fig 1. Sites for intramuscular injection
Deltoid
Vastus lateralis and rectus femoris
Deltoid muscle
Scapula
Deep brachial artery
Radial nerve
Humerus
Greater trochanter of femur
Rectus femoris
Vastus lateralis
Vastus medialis


Gluteus maximus
Vastus lateralis
Injection area


Posterior superior iliac spine
Iliac crest
Safe area in gluteus medius
Gluteus maximus
Sciatic nerve

3- Subcutaneous (SC)

A Non-irritant substances can be injected by this route in the outer surface of arm or front of thigh (e.g. insulin , heparin).

Advantage:

1- Self-medication is possible.

2- - Suitable for slow-release drugs and best route for some poorly soluble suspension.

Disadvantage:

1.Pain & necrosis if the drug is irritating

2.Unsuitable for drugs administered in large volumes as the accepted volume should be < 1 to 2 mL

4- Intradermal (ID) Injection into the dermis, the more vascular layer of skin under the epidermis used for vaccination e.g. BCG vaccine , or for drug sensitivity e.g penicillin injection.

Advantages: this route can be used for agents for diagnostic determination and desensitization

Disadvantages:

1- Small volume of drug can be injected usually less than 0.5 mL.

2- Can be painful

Other

1.Oral inhalation and nasal preparations:

Inhalation: provide rapid delivery of drug across the large surface area of respiratory tract epithelium

Advantage:

1- Rapid effect.
2- Convenient for patient with respiratory disorders and give local effect with minimal systemic side effect.
3- Ideal for gases e.g. salbutamol and sodium cromoglycate inhaler. And for anesthetic agents

Disadvantages:

1.Considered as the Most addictive route (drug can enter the brain quickly)

2.Patient may have difficulty in controlling and regulating dose.

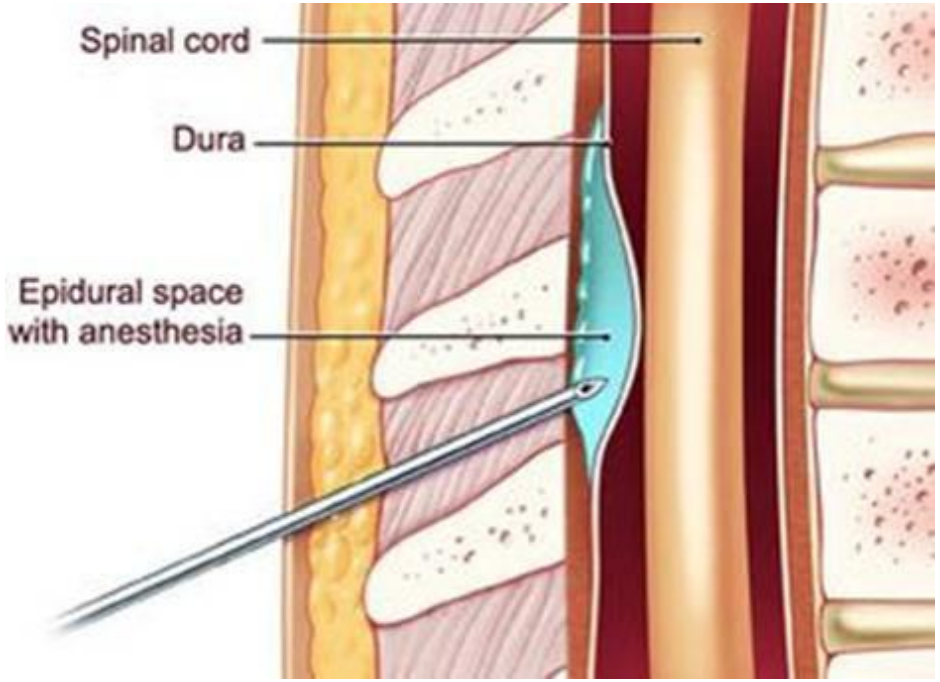
3.Patients may experience difficulties of using inhalers

4. Obstructed bronchi cause the therapy to fail

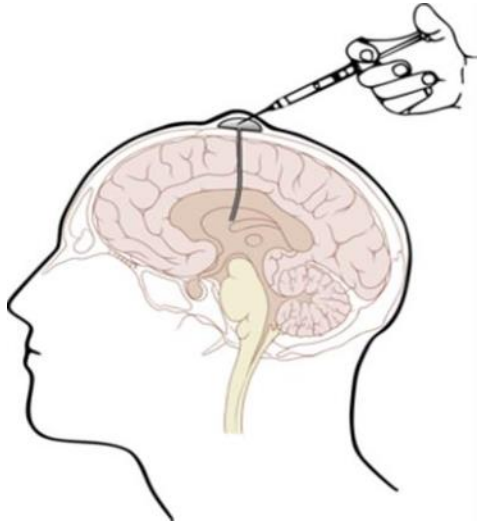
2- Intrathecal/intraventricular

The blood-brain barrier typically delays or prevents the absorption of drugs into the central nervous system (CNS).

When local, rapid effects are needed, it is necessary to introduce drugs directly into the cerebrospinal fluid. (meningitis, spinal anesthesia),



1.Intrathecal injection



2.Intracerebroventricular injection

3- Topical

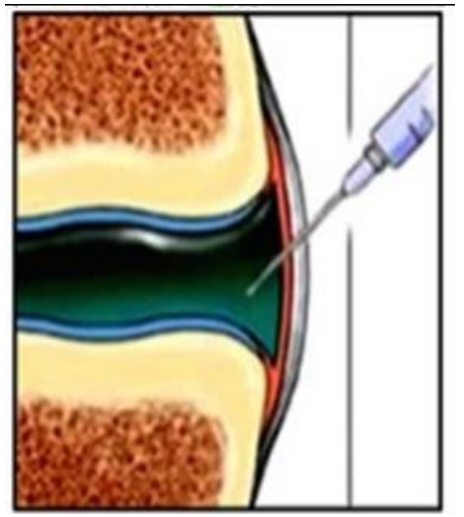
Topical application is used when a local effect of the drug is desired. (as ointments, creams, lotions) may be used for skin, eye, intranasal, minimize systemic absorption, easy for patient, e.g. hydrocortisone cream

4- Transdermal

This route of administration achieves systemic effects by application of drugs to the skin, usually via a transdermal patch. The rate of absorption can vary markedly, depending on the physical characteristics of the skin at the site of application, as well as the lipid solubility of the drug. As in cases of unstable angina.

5) Intra-articular:
Certain drugs (glucocorticoids) can be administered directly into a joint space for the treatment of local condition e.g. osteoarthritis.

Intra-articular



Thank you