



# ROUTES OF DRUG ADMINISTRATION

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# Routes of Drug Administration

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- Enteral

2

- Parenteral

3

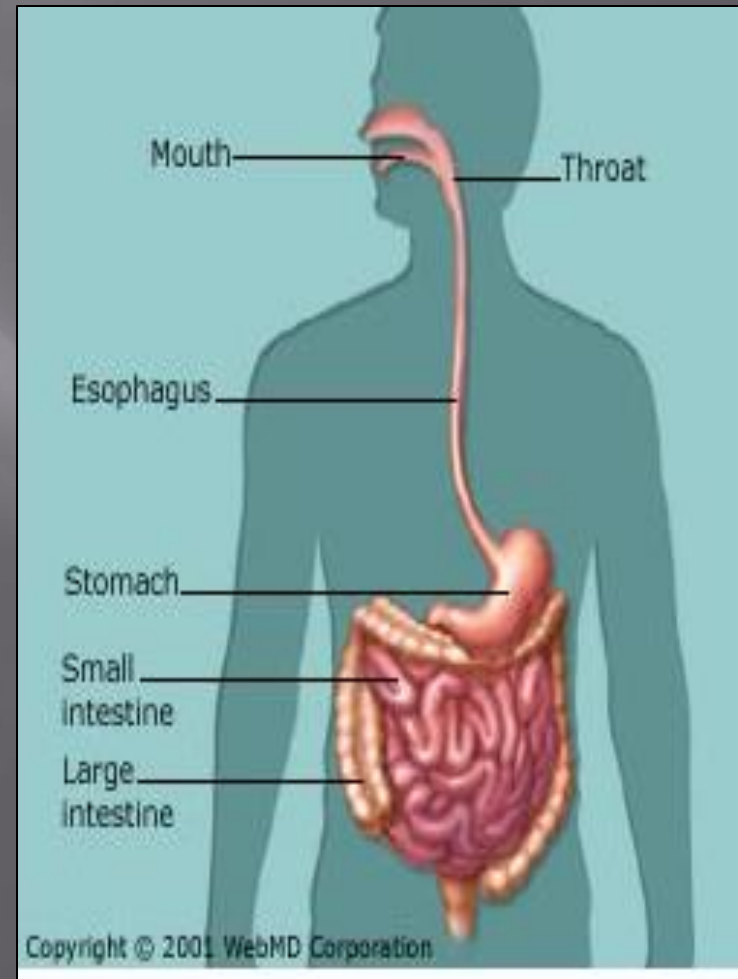
- Inhalation

4

- Topical

# Enteral route (through GIT)

1. oral
2. Buccal
3. Gavage
4. Rectal



# Oral route

- ❑ *Oral agents should be*
  - palatable
  - non-irritant
  - Stable at PH of GIT
  - Adequately absorbed to produce systemic effects.

- ❑ *Advantages:*

- 1) **Easy** (Self medication).
- 2) Most **convenient** & acceptable.
- 3) **Safe**: e.g. sterilization or devices to be administered.
- 4) **Economic**.



# *Disadvantages*

1) **Delayed onset of action**

2) **Not suitable in the following conditions:**

1- Uncooperative **or** unconscious patients.

**2- Stomach:** Vomiting **or** Drugs destroyed by gastric acidity (benzyl-penicillin) or by digestive enzymes (insulin).

irritant (e.g. emetine → vomiting)

**3- liver:** Drugs with **extensive first pass effect** e.g. glyceryl-trinitrate (nitroglycerine) & propranolol.

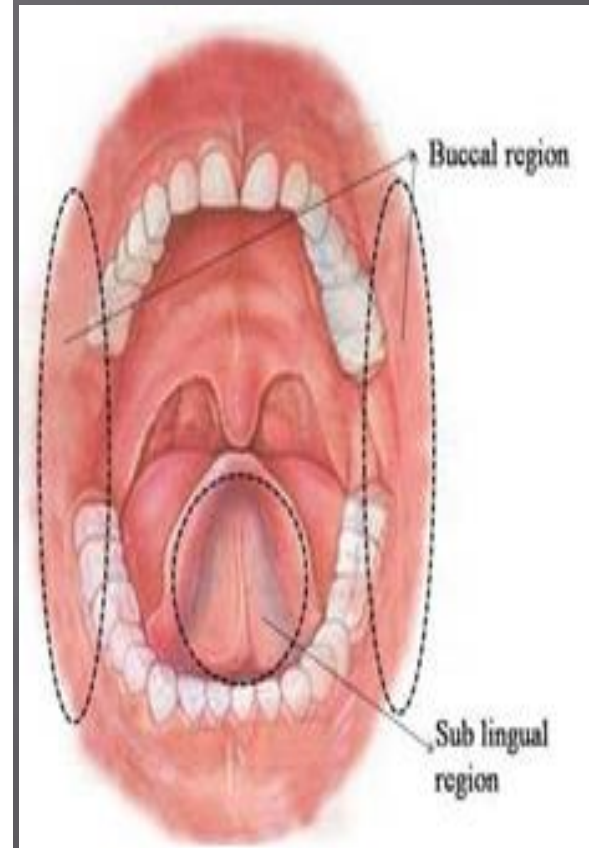
**4-Intestine:** **Hydrophilic** (e.g. gentamicin → not absorbed) & diarrhea.



1. **Emergency.**
2. **Convulsions.**
3. **Vomiting.**
4. **Coma.**

# Buccal route

- *The drug should be:*
  1. 1- Palatable.
  2. 2- Not irritant.
  3. 3- Very effective in small dose due to small surface area of absorption.
  4. 4- Highly soluble in saliva.
  5. 5- Highly non-ionized to diffuse freely across cell membrane.





## (1) **Sublingual** e.g. nitroglycerine.

### Advantages:

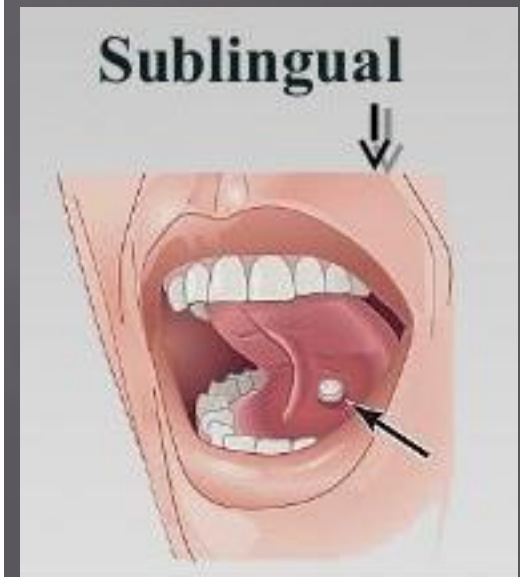
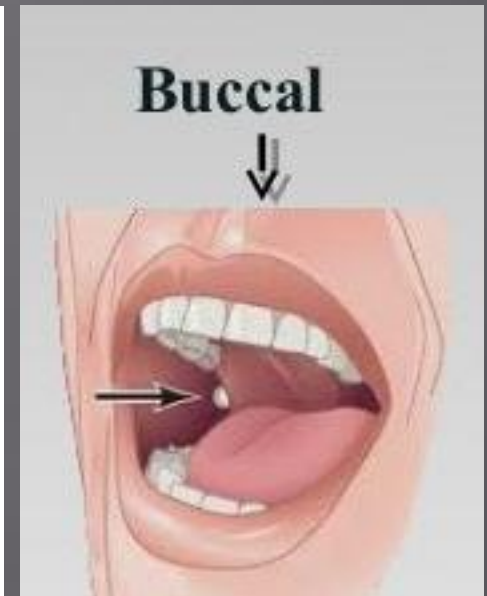
- 1- Easy administration.
- 2- Bypasses first pass metabolism.
- 3- Avoids GIT enzymes & PH.
- 4- Rapid onset.
- 5- The patient can get rid of excessive dose.

### Disadvantages:

- 1- Irritation of mucous membrane.
- 2- Excessive salivation promotes swallowing.

(2) **In the buccal pouch** (used for local effects) e.g. lozenges, mouth wash, gargle & oral gel.

(3) **Transbuccal patch** e.g. Fentanyl.





# Rectal route

- ☐ Drugs are absorbed through rectal mucosa → systemic circulation
- ☐ *Examples:* Aminophylline & NSAIDs (suppository, enema, special catheter)
- ☐ *Contraindications:* Diarrhea.

## Advantage



- **Less** first pass metabolism.
- Suitable for children, vomiting & coma
- Suitable for drugs irritant to gastric mucosa e.g. aspirin.
- **Rapid** onset & **prolonged** duration

## Disadvantages



- Irregular bioavailability (absorption is unreliable).
- **Disagreeable.**
- Chronic use leads to **proctitis.**

# Gavage

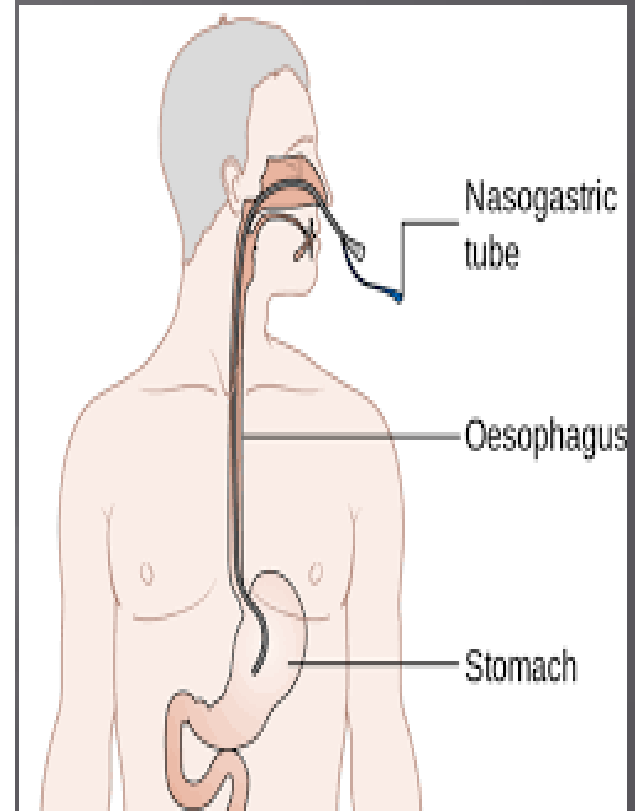
- ▣ ***Definition:***

Introduction of food or drugs into stomach by flexible tube e.g. Rayel tube.

- ▣ ***Used in:*** coma.

- ▣ ***Lavage :***

washing out stomach in poisoning.



# parenteral route

Drugs are administered by means of syringes

1

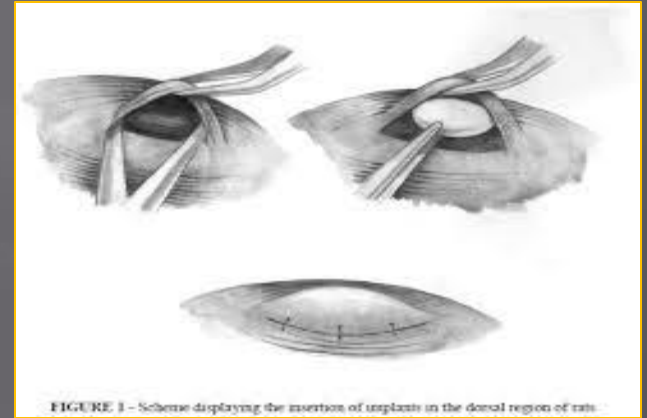
- *Injection*

2

- *Subcutaneous Implantation*

# *Subcutaneous Implantation*

- ❑ drugs implanted under the skin in a *solid pellet*
- ❑ Absorption occurs slowly over a period of *several weeks* or *months*
- ❑ examples:  
levonorgestrel (Norplant) provides effective contraception for up to 5 years.



# injection

- Drugs for injection are available in the form of solution, suspension or powder to be dissolved before use.



vials



ampoules



bottles

# Parental routes

**1- Intravenous**

**2- intramuscular**

**3- subcutaneous**

**4- intradermal**

**5- intrathecal**

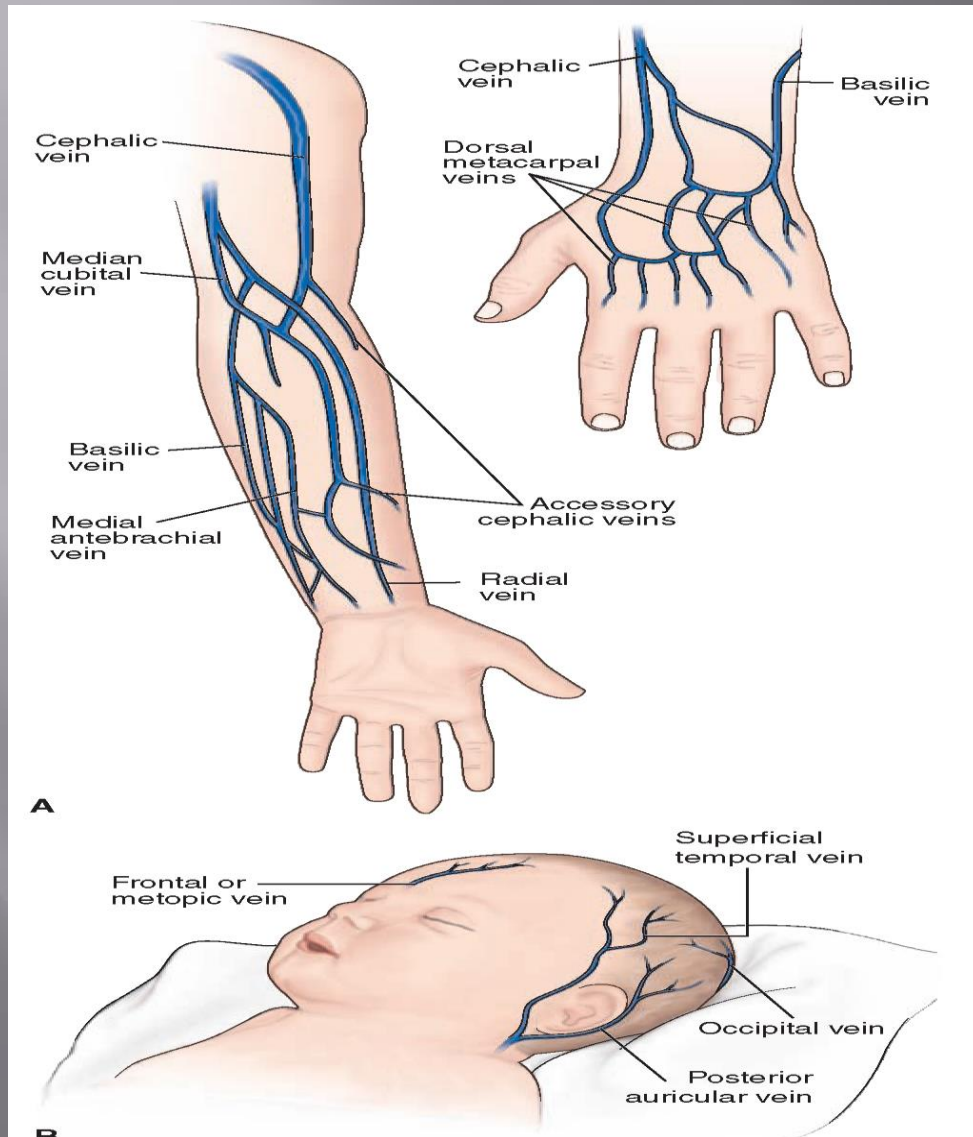
**6- Intra-arterial**

**7- Intra-articular**

**8- Intra-cardiac**

**9- Intra-umbilical**

# Intravenous route



## Sites of injection:

• Adult: superficial veins in the dorsum of hands and forearm.

• Infants: scalp vessels or umbilical vessels.

Subclavian or **internal or external jugular veins** for long term administration.



## *Indications:*

- 1- Fluid therapy e.g. blood transfusion, saline, glucose .... etc.
- 2- Emergencies.
- 3- I.V. anaesthetics & skeletal muscle relaxants.
- 4- Irritant drugs:  
    Strict I.V.  
    Vascular wall is not sensitive to pain.

## *Advantages:*

- 1- Immediate onset (emergency).
- 2- 100% bioavailability → highly predictable blood levels.
- 3- Suitable for irritant drugs & for large volumes.

## *Disadvantages:*

1. Needs trained person & aseptic conditions.
2. Risk of anaphylaxis.
3. Extravasation → local necrosis.
4. Transmission of some diseases e.g. viral hepatitis & HIV.
5. Once the drug is injected, it cannot be retrieved.
6. Prolonged infusion → high risk of thrombophlebitis.
7. Infection → bacteremia & phlebitis.
8. Wrong technique → air embolism.
9. Non-patency of veins.

# Intramuscular route (IM)

- It is suitable for **aqueous** or **oily** solutions and suspensions of insoluble drugs.
- ❖ *Oil-based preparations* are absorbed slowly.
- ❖ *Aqueous preparations* are absorbed rapidly.
- Drugs pass through capillary walls to enter the blood stream.



## □ Common sites for injection:

- 1- Gluteal muscles
- 2- Anterolateral aspect of the middle 1/3 of the thigh
- 3- Deltoid muscle of the arm.

## □ Precautions:

**Avoid** major blood vessels & nerves traveling the muscle.

**Change** site of injection to avoid muscle injury.



## *Advantages:*

- 1- **Rapid absorption** (onset of action between 10 – 15 min).
- 2- **High bioavailability.**
- 3- **Suitable** for depot preparations

## *Disadvantages:*

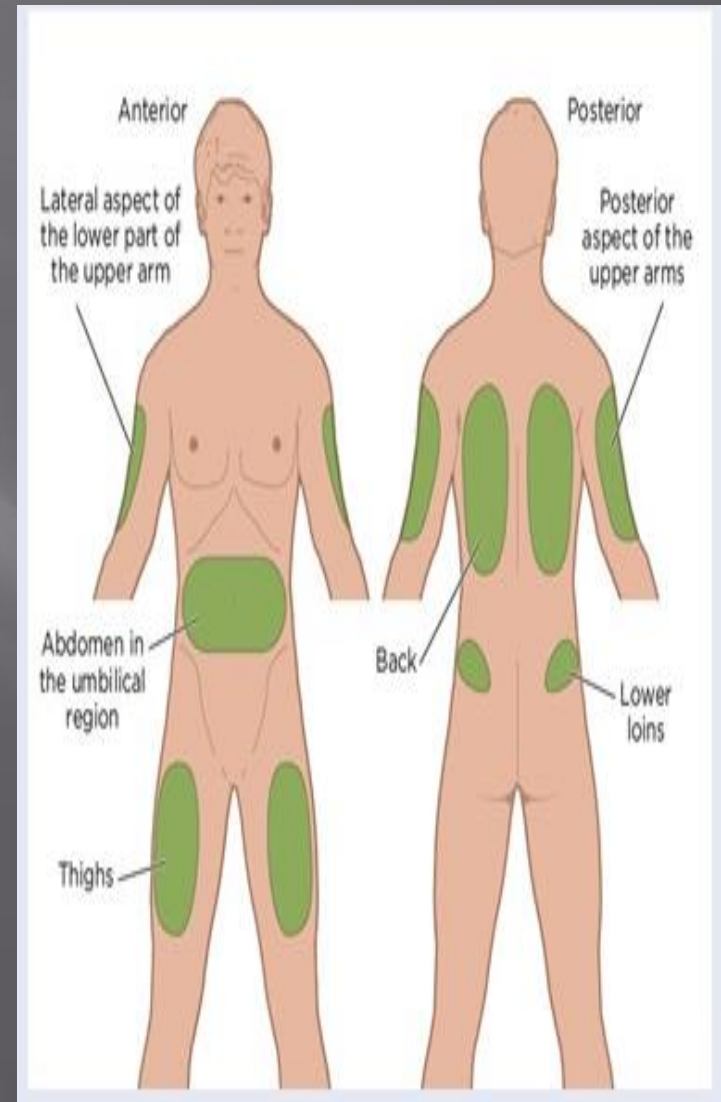
- ❑ 1- Unsuitable for large volumes (> 5 ml) & irritant drugs.
- ❑ 2- Accidental I.V. injection may occur.
- ❑ 3- Sterile or infected abscesses.
- ❑ 4- May be painful.

# Subcutaneous

**Definition :** Drugs are injected in the subcutaneous tissue (hypodermis) and absorbed through capillaries to reach systemic circulation.

## Site of injection:

1. areas that are relatively distant from nerves and major vessels:
2. Lateral aspect of the arms.
3. Thigh and abdomen for frequent injection.
4. Systemic rotation of injections helps to maintain these sites.



## Advantages:

- 1- Suitable for non-irritant drugs in the form of aqueous solution or suspension.
- 2- Prolonged duration of action.
- 3- Allows somewhat large volumes.
- 4- Acceptable for self-administration.

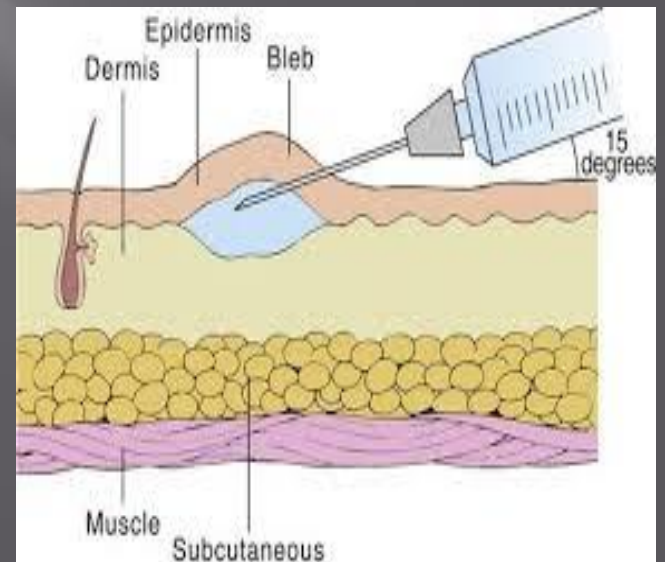
## Disadvantages:

- 1- Repeated injection at the same site → *lipoatrophy*.
- 2- Erratic absorption.
- 3- Irritant.



# Intradermal

- ▣ *Definition* Injection between dermis & epidermis (0.1 ml).
- ▣ *Site of injection:* ventral aspect of the forearm is the site of choice.
- ▣ *Indications:*
  - Allergy tests.
  - Vaccinations.
  - Desensitization.

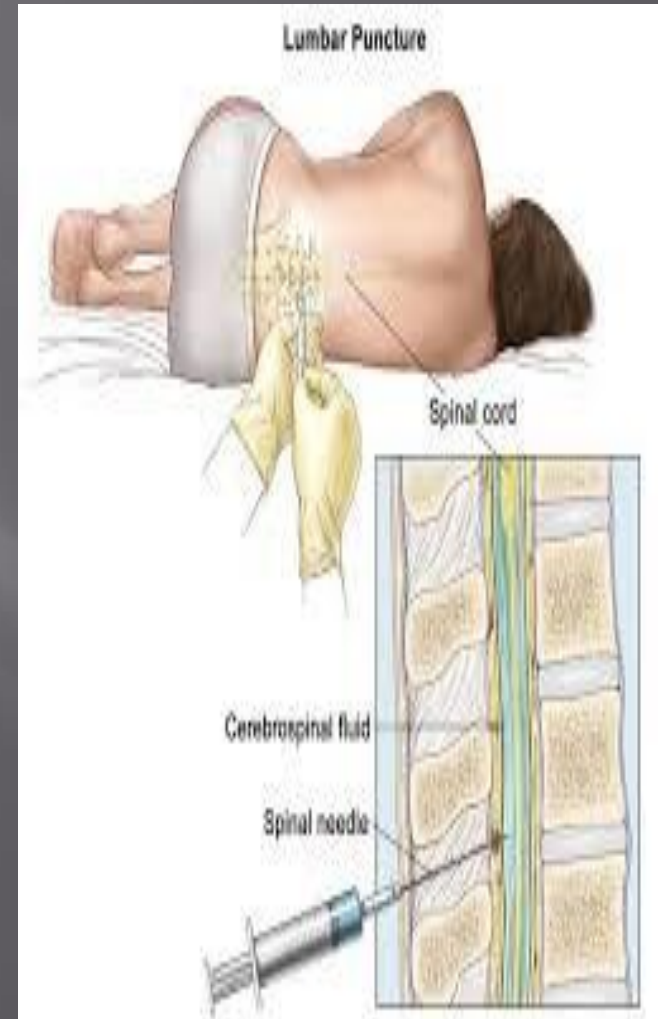


# Intrathecal

Injection of drugs into *subarachnoid space* using lumbar puncture needle between *L3-L4*.

## Indications:

1. Spinal anesthesia.
2. X-ray contrast media.
3. drugs which do not pass BBB  
e.g. antibiotics in treatment of meningitis.

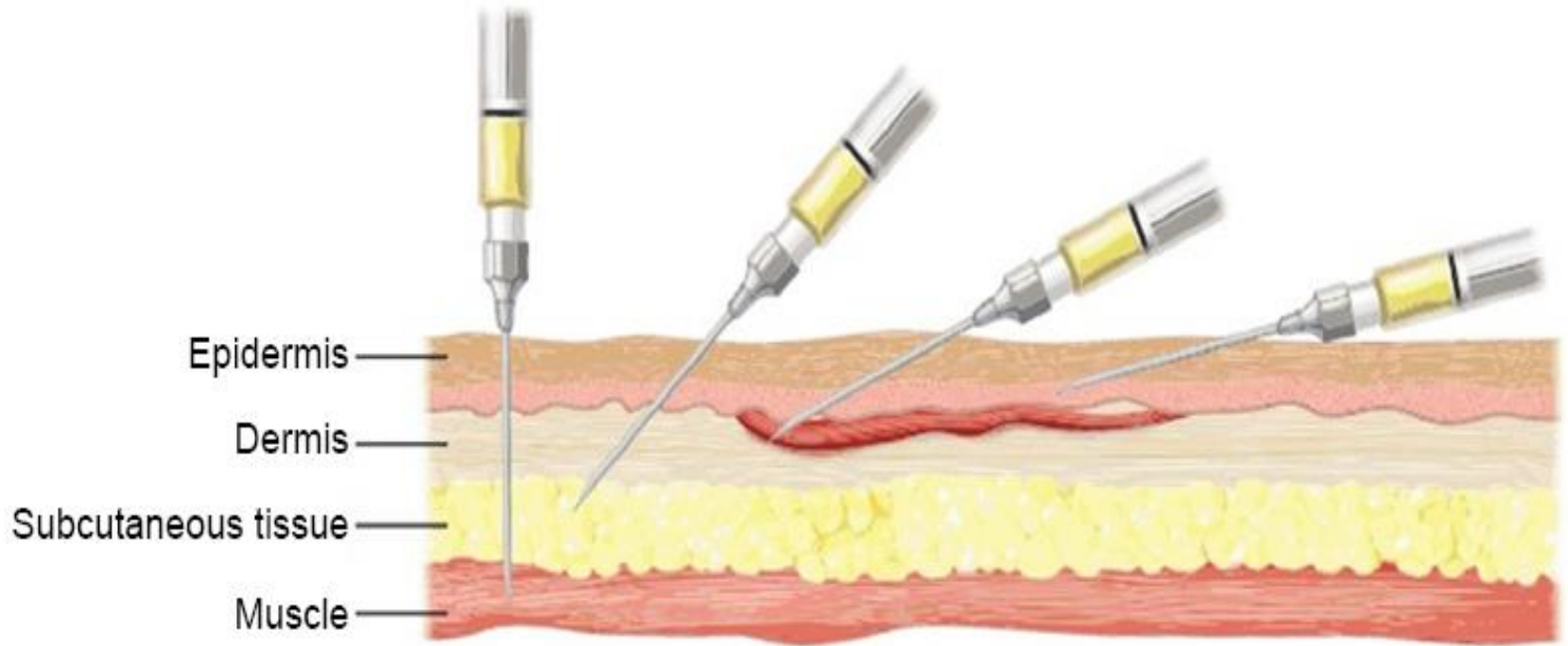


Intramuscular

Subcutaneous

Intravenous

Intradermal



Intramuscular



Subcutaneous



Intravenous



Intradermal

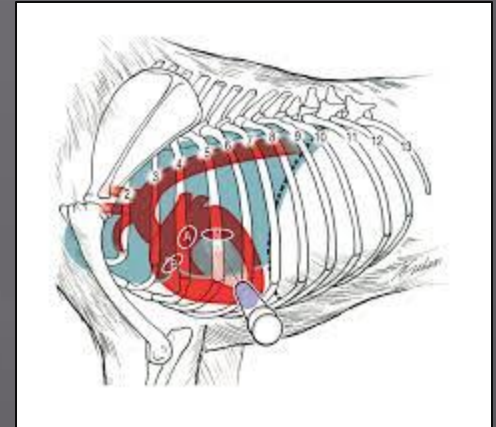
**Intra-articular**

**Intracardiac**

**Intraarterial**

**Intra-peritoneal**

**Intra-umbilical**



# Inhalation

## ▣ *For local effect on bronchial tree:*

1. Bronchodilators e.g. salbutamol.
2. Corticosteroids e.g. beclomethasone.
3. Mucolytics.
4. Mast cell stabilizers e.g. cromolyn.

## ▣ *For systemic effects:*

Absorption from the alveolar membrane is **rapid** because of its thin, large surface area & rich blood supply.

1. Gases e.g. O<sub>2</sub>.
2. General anaesthetics e.g. nitrous oxide.
3. Insulin & ADH.



## ➔ Advantages:

1. Immediate onset of action.
2. Minor first pass metabolism.
3. Low incidence of systemic side effects.
4. High concentrations in respiratory tract.
5. Large surface area for delivery of absorbable drugs.

## ➔ Disadvantages:

1. Needs cooperative patient.
2. Respiratory irritation e.g. cromolyn.
3. Hoarseness of voice e.g. corticosteroids (due to candida infection).
4. Irregular absorption & dosage.
5. Laryngitis.





# Topical Route

- ❑ These agents can be applied topically:  
antiseptics, local anesthetics, anti-inflammatory, fungicidals, anti-anginals and female sex hormones.
- ❑ *Active drugs, not prodrugs*, are given by this route.
- ❑ The drug can be applied to:
  1. *Mucous membranes* e.g. eye, nose, mouth... etc.
  2. *Skin*:
- ❑ Ordinary administration of **cream, ointment, spray, powder**.... etc.



# Transdermal delivery system (TDS) or Percutaneous route:

## ❖ Definition:

a patch containing the drug (seeps out of the patch, through the skin into the capillary bed) applied to the skin by adhesive plaster

## ❖ Examples

1. **Hyoscine** →for→ Motion sickness.
2. **Glyceryl trinitrate** →for→ Angina.
3. **Clonidine** →for→ Hypertension.
4. **Estradiol** →for→ Postmenopausal symptoms.



## ➔ Advantages:

1. Long duration of action.
2. No first pass metabolism.
3. Gradual onset of action.
4. No GIT irritation.
5. Not destroyed by GIT enzymes.

## ➔ Disadvantages:

1. Variable absorption.
2. Local allergy.
3. The sticking plaster may drop off & stick to another person.

Thank you!

