ROUTES OF DRUG ADMINISTRATION

CLASSIFICATION

SYSTEMIC

Enteral

Oral

Sublingual

Rectal

Parenteral

Inhalational

Injections

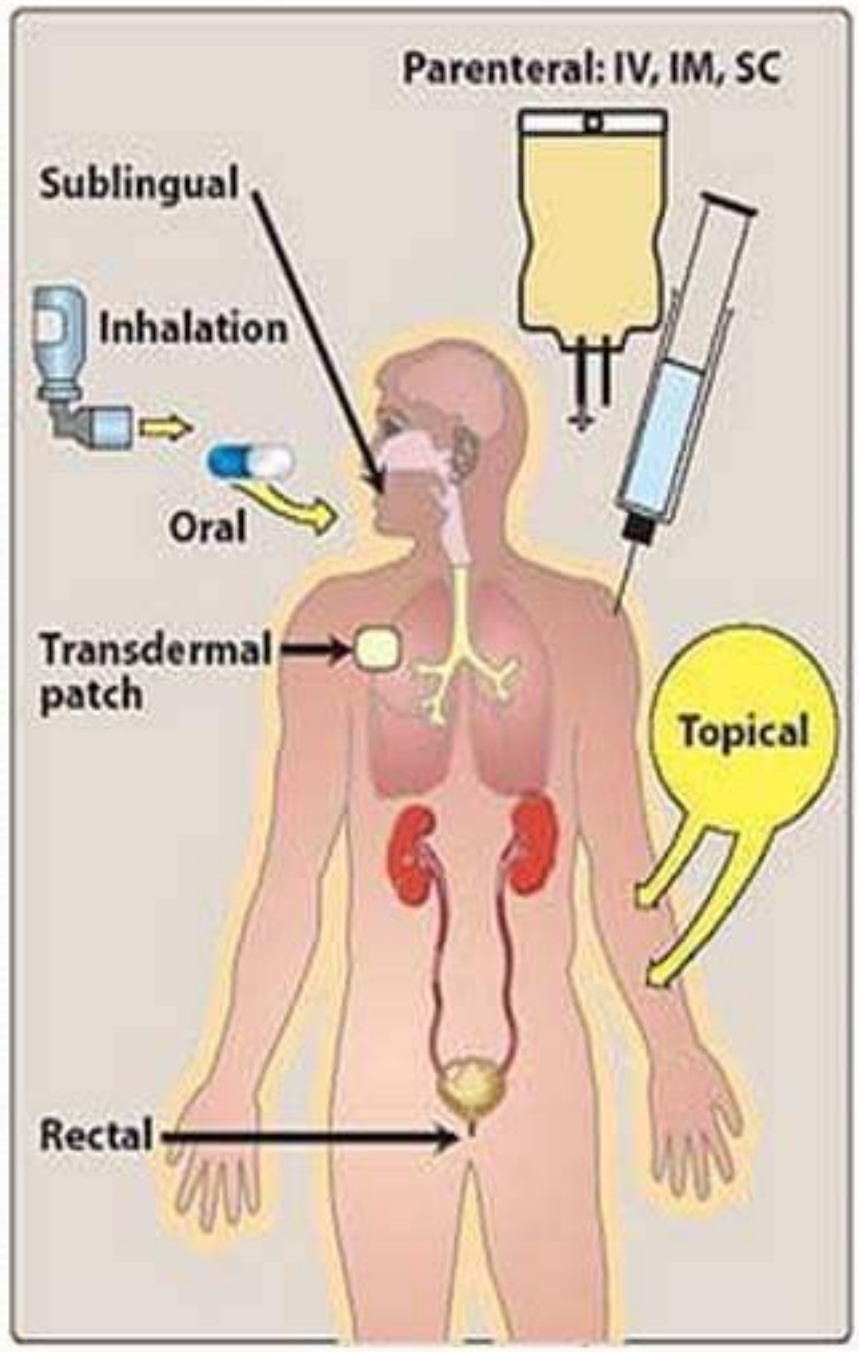
Transdermal

- Intravenous
- Intramuscular
- Subcutaneous
- Intra-arterial
- Intra-articular
- Intrathecal
- Intradermal

LOCAL

- Skin topical
- Intranasal
- Ocular drops
- Mucosal-throat, vagina, mouth, ear
- Inhalational
- Transdermal

- Enteral; oral, sub-lingual (buccal), rectal. Note soluble, enteric coated or slow release formulations
- Parenteral; iv, im, sc, id, it, etc. Different rates of absorption, different plasma peaks. Note iv infusors
- Skin; for local or systemic effect - note patches
- Lungs; inhalation; local or systemic effect?
- Vaginal; (usually local)
- Eye; (usually local)



FACTORS GOVERNING CHOICE OF ROUTE

- Physical & chemical properties of drug- **solid/liquid/gas; solubility, stability, PH, irritancy**
- Site of desired action- **localized and approachable or generalized and non approachable**
- Rate & extent of absorption from various routes
- Effect of digestive juices & first pass effect
- Rapidity of the desired response- **emergency/routine**
- Accuracy of dosage
- Condition of the patient- **unconscious, vomiting**

ORAL ROUTE

- The most common route of drug administration.
- Drug is given through oral cavity.

ADVANTAGES

- Safe
- Convenient- self- administered, pain free, noninvasive and easy to take
- Economical- compared to other parentral routes
- Usually good absorption- takes place along the whole length of the GI tract
- No need for sterilization

ORAL ROUTE

DISADVANTAGES

1. Slow absorption ➞ slow action - can not used in emergency
2. Irritable and unpalatable drugs- nausea and vomiting
3. Cannot be used Unco-operative, vomiting and unconscious patients
4. Some drugs destroyed
5. Sometimes inefficient drug absorbed, some drugs are not absorbed like streptomycin
6. First-pass effect- Due to Biotransformation
7. Food–Drug interactions and Drug-Drug interactions

Dosage forms

Capsules, powders

Tablets, spansules

Syrup, emulsion

Suspension, elixirs

Syrup

Tablets

Hard- gelatin capsule

Soft- gelatin capsule

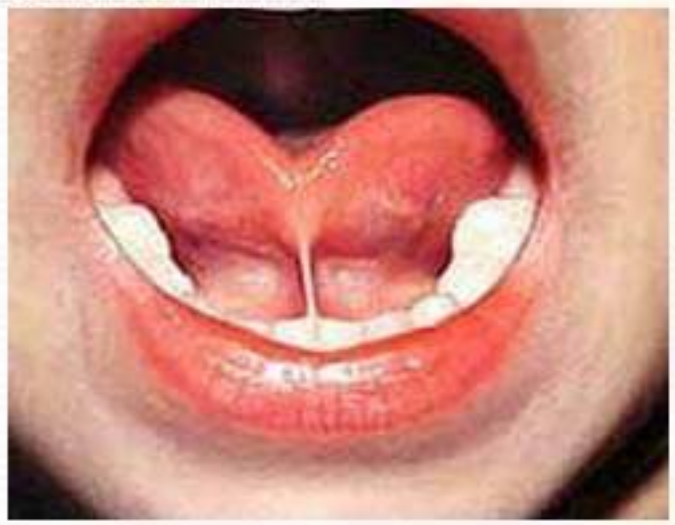
Spansule

SUBLINGUAL/BUCCAL ROUTE

Tab or pellet containing the drug is placed under tongue or crushed in mouth and spread over the buccal mucosa. Ex- GTN, buprenorphine, desaminooxytocin

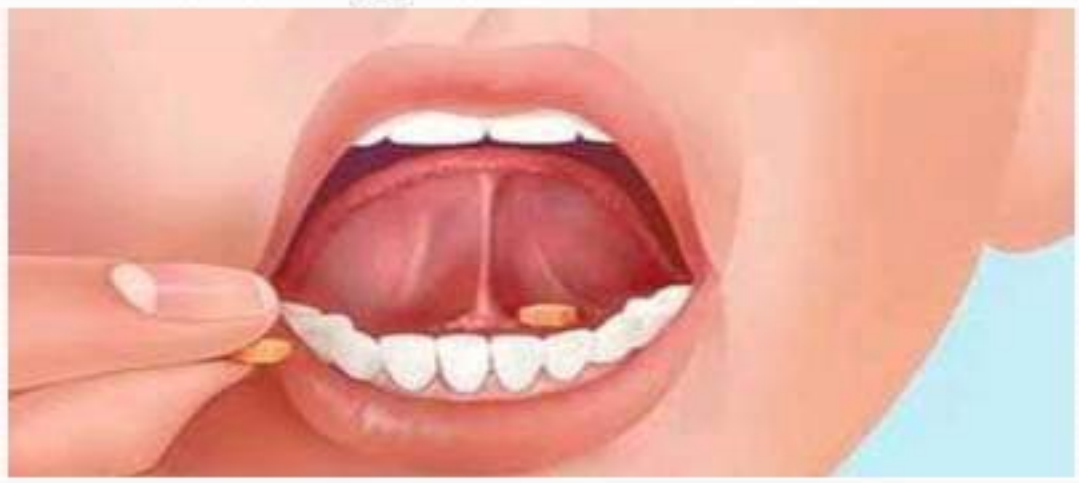
ADVANTAGES

- Drug absorption is quick
- Quick termination
- First-pass avoided
- Can be self administered
- Economical



DISADVANTAGES

- Unpalatable & bitter drugs
- Irritation of oral mucosa
- Large quantities not given
- Few drugs are absorbed



RECTAL ROUTE

- Drugs that are administered rectally as a suppository.
- In this form, a drug is mixed with a waxy substance that dissolves or liquefies after it is inserted into the rectum.
- ex- Diazepam, indomethacin, paraldehyde, ergotamine

ADVANTAGES

- Used in children
- Little or no first pass effect (ext haemorrhoidal vein)
- Used in vomiting or unconscious
- Higher concentrations rapidly achieved

DISADVANTAGES

- Inconvenient
- Absorption is slow and erratic
- Irritation or inflammation of rectal mucosa can occur

PARENTERAL ROUTES

- **Direct delivery of drug in to systemic circulation without intestinal mucosa**

Intradermal (I.D.) (into skin)

Subcutaneous (S.C.) (into subcutaneous tissue)

Intramuscular (I.M.) (into skeletal muscle)

Intravenous (I.V.) (into veins)

Intra-arterial (I.A.) (into arteries)

Intrathecal (I.T.) (cerebrospinal fluids)

Intraperitoneal (I.P.) (peritoneal cavity)

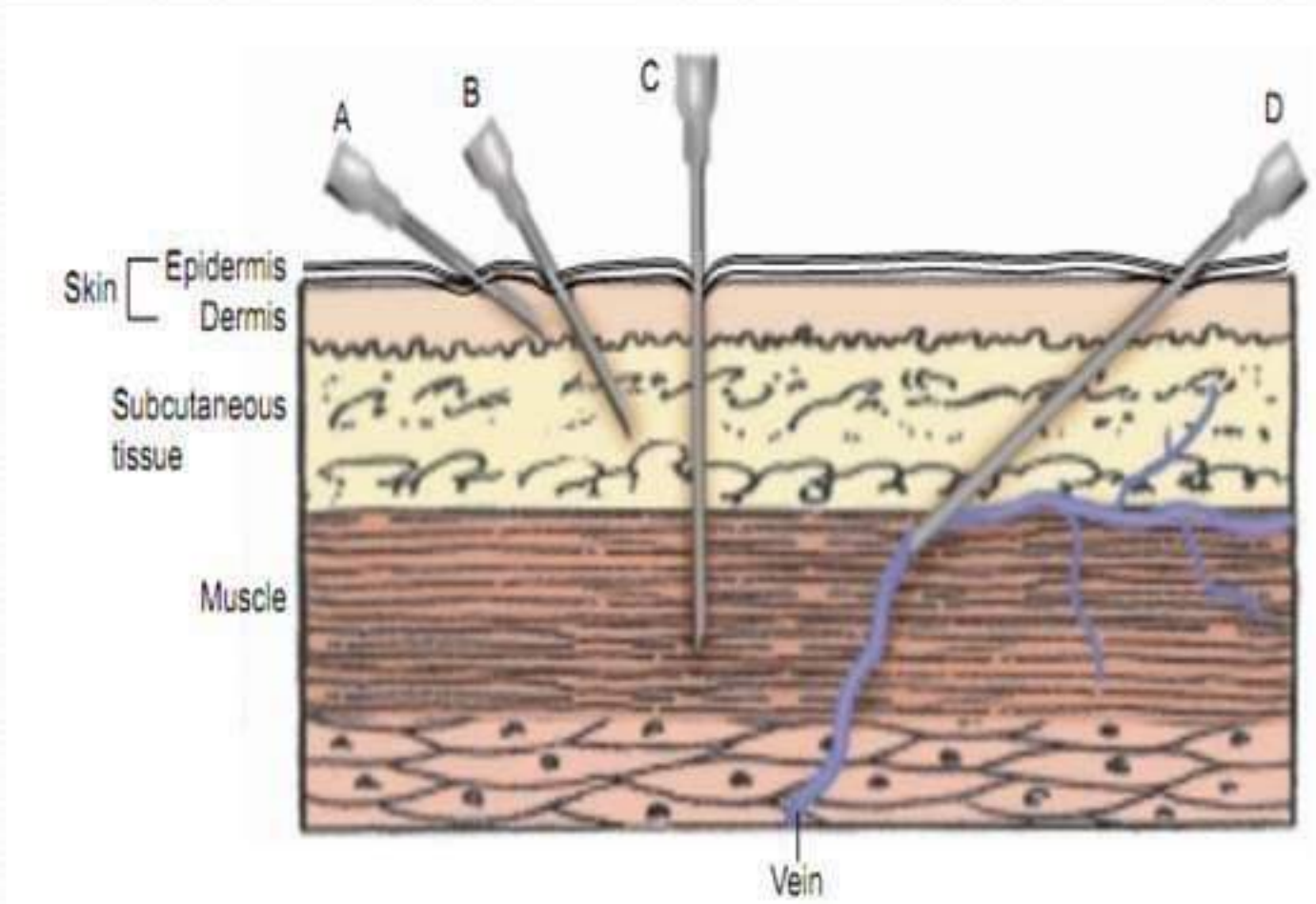
Intra - articular (Synovial fluids)

A) Intradermal – inj into skin

B) Subcutaneous - Absorption of drugs from the subcutaneous tissues

C) Intramuscular (IM) drug injected into skeletal muscle

D) Intravascular (IV)- placing a drug directly into the blood stream



First pass Metabolism

Metabolism of drug in the gut wall or portal circulation before reaching systemic circulation

- **so the amount reaching system circulation is less than the amount absorbed**

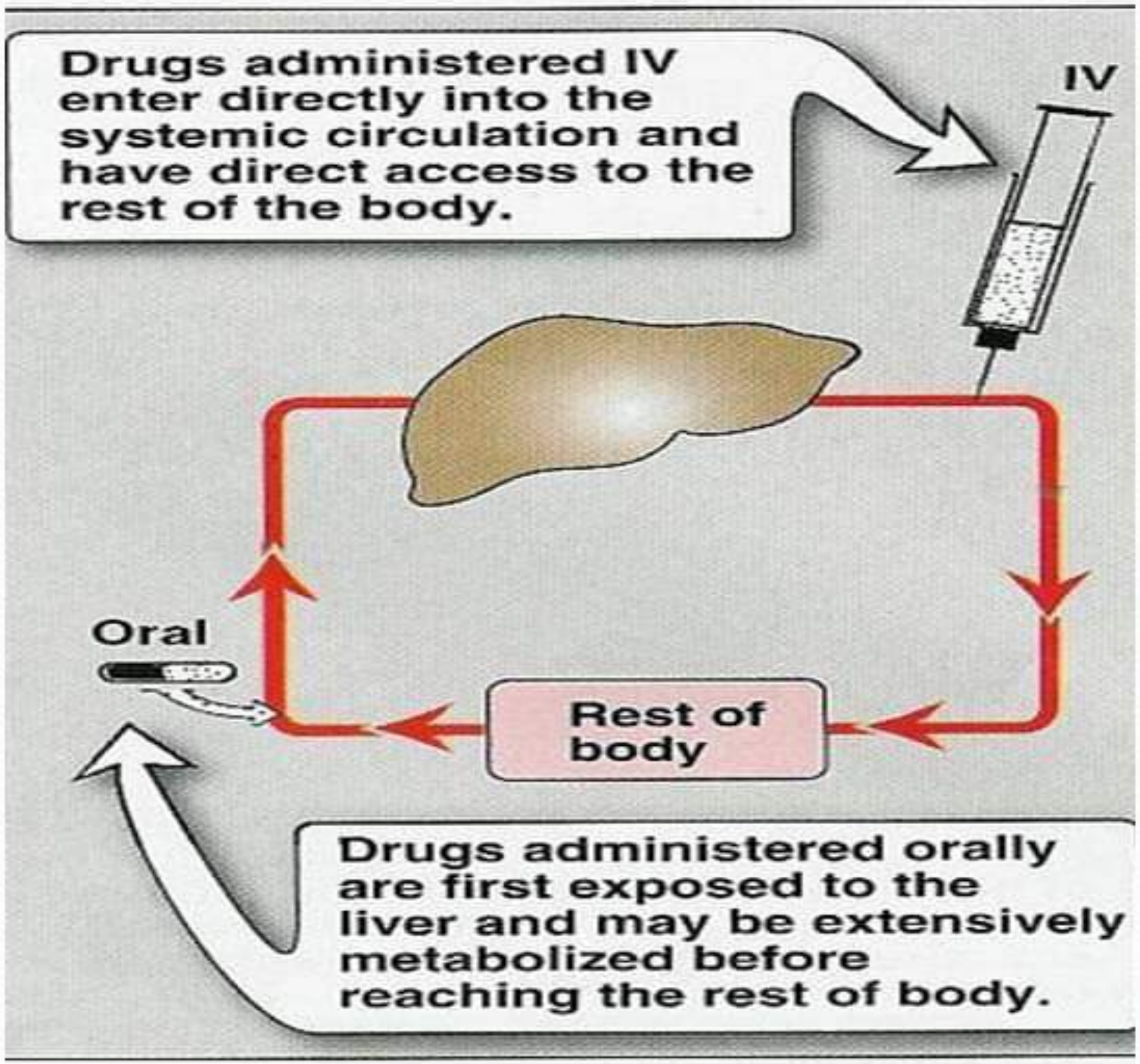
Where ?

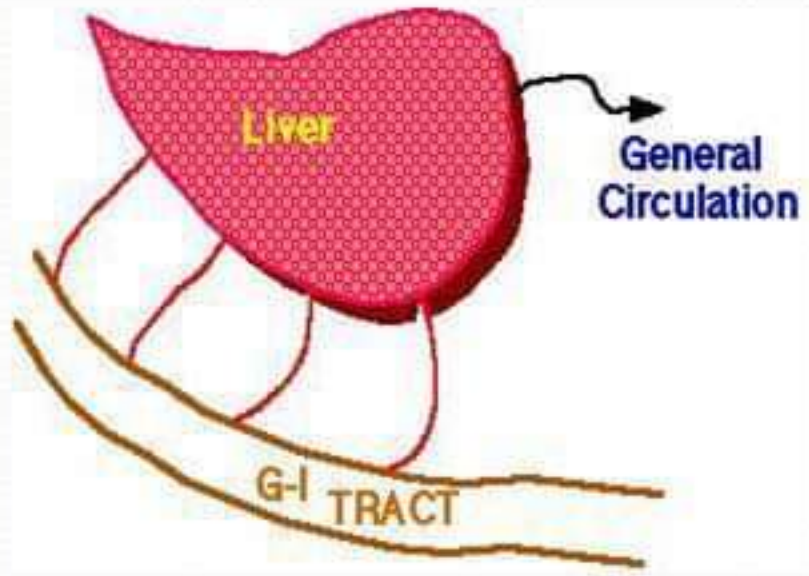
- **Liver**
- **Gut wall**
- **Gut Lumen**

Result ?

Low bioavailability.

Short duration of action (t ½).





First-pass metabolism can occur with orally administered drugs.

Parenteral administration

Advantages

- high bioavailability
- Rapid action (emergency)
- No first pass metabolism

Suitable for

–Vomiting &unconsciousness
– Irritant & Bad taste drugs.
– No gastric irritation
– No food-drug interaction

Dosage form:

Vial or ampoule

Disadvantages

– Infection
– Sterilization.
–Invasive assistance require
– Pain
– Needs skill
– Anaphylaxis
– Expensive.

Ampoule

iv infusion

Vial

INTRAVENOUS ROUTE

- ADVANTAGES

- IV is the most common parenteral route. For drugs that are not absorbed orally.
- Avoids first-pass metabolism by the liver.
- Intravenous delivery permits a rapid effect and a maximal degree of control over the circulating levels of the drug. Titration of dose with response.
- large quantities can be given, fairly pain free
- (100% bioavailability) Absorption phase is bypassed

- DISADVANTAGES

- However, unlike drugs in the GI tract, those that are injected cannot be recalled by strategies such as emesis or by binding to activated charcoal.
- IV injection may also induce hemolysis or cause other adverse reactions by the too-rapid delivery of high concentrations of drug to the plasma and tissues also vital organs like heart, brain etc.
- Thrombophlebitis of vein and necrosis of adjoining tissue if extravasation occurs

INTRAMUSULAR ROUTE

Large skeletal muscle- Deltoid, triceps, gluteus maximus, rectus femoris

ADVANTAGES

- Absorption reasonably uniform
- Rapid onset of action
- Mild irritants can be given
- First pass avoided
- Gastric factors can be avoided

DISADVANTAGES

- Only upto 10ml drug given
- Local pain and abcess
- Expensive
- Infection
- Nerve damage
- Local hematoma can occur in anticoagulant treated pt.

SUBCUTANEOUS ROUTE

- Drug is deposited in loose subcutaneous tissue – rich nerve supply- irritant drugs cannot be inj. Less vascular- slow absorption than im route
- Avoid in shock pt – vasoconstriction
- Only Small volume can be injected
- Subcutaneous injection minimizes the risks associated with intravascular injection
- Depot preparation can be injected- Dermojet, Pellet implantation, Sialistic and biodegradable implants

Intradermal Route

- Inj into skin raising bleb – BCG Vaccine, Sensitivity test

Intrathecal/intraventricular

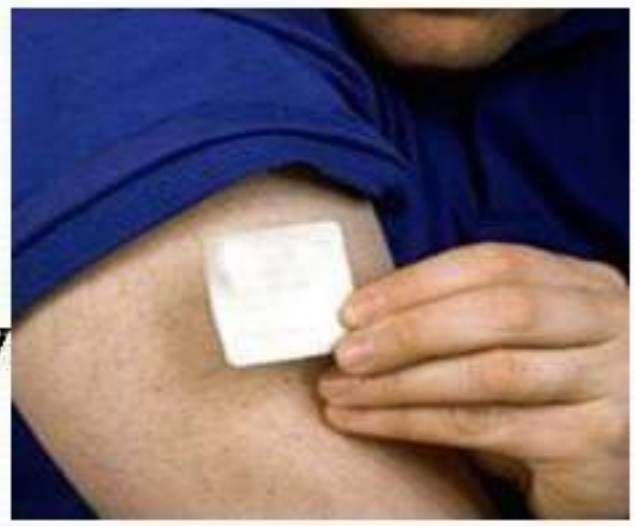
- It is sometimes necessary to introduce drugs directly into the cerebrospinal fluid. For example, amphotericin B is used in treating *Cryptococcal meningitis*

Transdermal

- This route of administration achieves systemic effects by application of drugs to the skin, usually via a transdermal medicated adhesive patch.
- The rate of absorption can vary markedly, depending on the physical characteristics of the drug (lipid soluble) and skin at the site of application.
- Slow effect (prolonged drug action)
- This route is most often used for the sustained delivery of drugs, such as the antianginal drug nitroglycerin, the antiemetic scopolamine.

the nicotine patches

- Site – Upper arm, chest, abdomen, mastoid region
- First pass effect avoided
- Absorption- increase by oily base, occlusive dressing, rubbing preparation



Transdermal therapeutic system

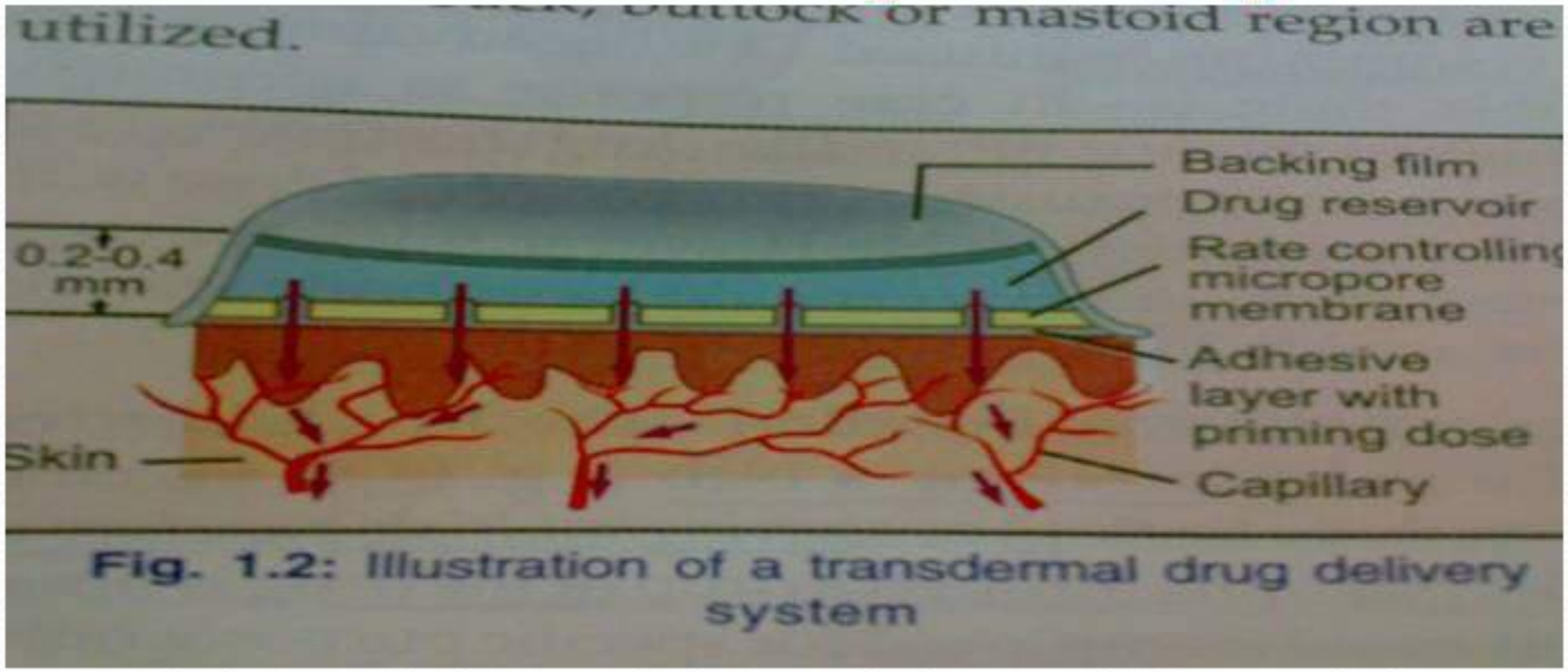


Fig. 1.2: Illustration of a transdermal drug delivery system

- Drug in solution or bound to a polymer is held in reservoir between occlusive backing film and rate controlling micropore membrane under surface of which is smeared with an adhesive impregnated with priming dose of drug. Adhesive layer protected with film which is peeled off just before application
- To provide smooth plasma conc without fluctuations
- More convinient pt compliance is better

Topical application

- **Produce local effect to**
- **Skin (percutaneous) e.g. allergy testing, topical local anesthesia**
- **Mucous membrane of respiratory tract (Inhalation) e.g. asthma**
- **Eye drops e.g. conjunctivitis**
- **Ear drops e.g. otitis externa**
- **Intranasal, e.g. decongestant nasal spray**

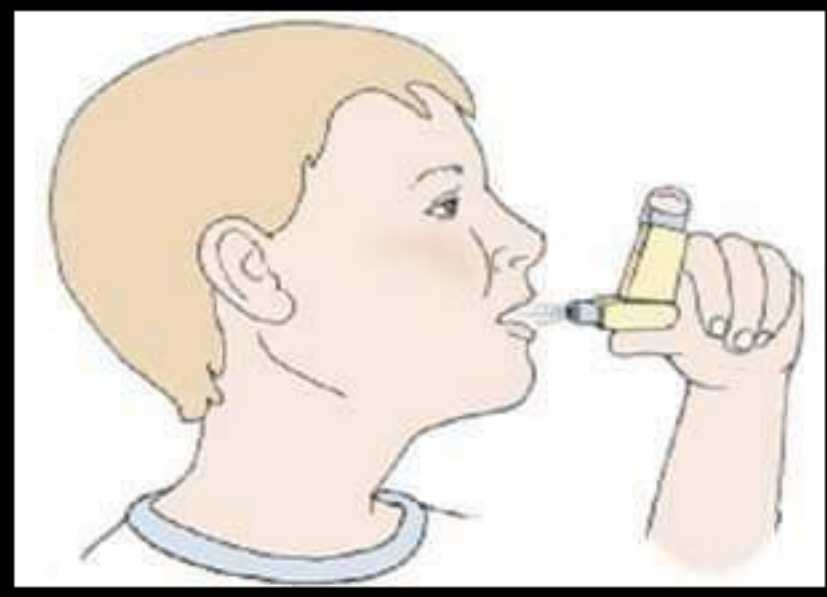
Inhalation

Advantages

- Mucous membrane of respiratory system
- Rapid absorption (large surface area)
- Provide local action
- Minor systemic effect
- Low bioavailability
- Less side effects.
- No first pass effect

Disadvantages

Only few drugs can be used



Dosage form: aerosol, nebulizer

Nebulizer

Atomizer

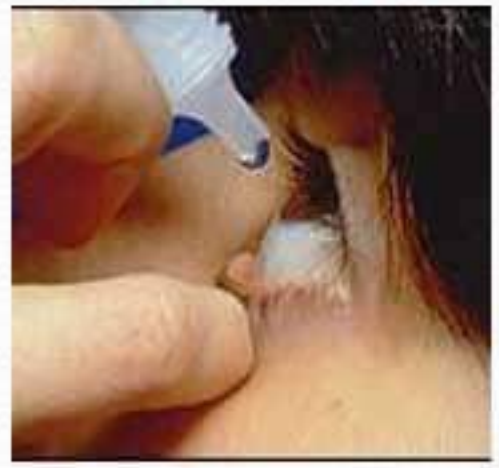
Inhalation

- Inhalation provides the rapid delivery of a drug across the large surface area of the mucous membranes of the respiratory tract and pulmonary epithelium, producing an effect almost as rapidly as with IV injection.
- This route of administration is used for drugs that are gases (for example, some anesthetics) or those that can be dispersed in an aerosol.
- This route is particularly effective and convenient for patients with respiratory complaints (such as asthma, or chronic obstructive pulmonary disease) because the drug is delivered directly to the site of action and systemic side effects are minimized.
- Examples of drugs administered via this route include albuterol, and corticosteroids, such as fluticasone.

Intranasal

- This route involves administration of drugs directly into the nose. Agents include nasal decongestants such as the anti-inflammatory corticosteroid.
- Desmopressin is administered intranasally in the treatment of diabetes insipidus; salmon calcitonin, a peptide hormone used in the treatment of osteoporosis, is also available as a nasal spray.
- The abused drug, cocaine, is generally taken by intranasal sniffing.

Eye drops



SKIN - Topical

- Dermal - Oil or ointment for local action
- Antiseptic cream and lotion
- Sunscreen lotion and powders

No <u>single</u> method of drug administration is ideal for all drugs in all circumstances

Thank You