ROUTES OF DRUG ADMINISTRATION

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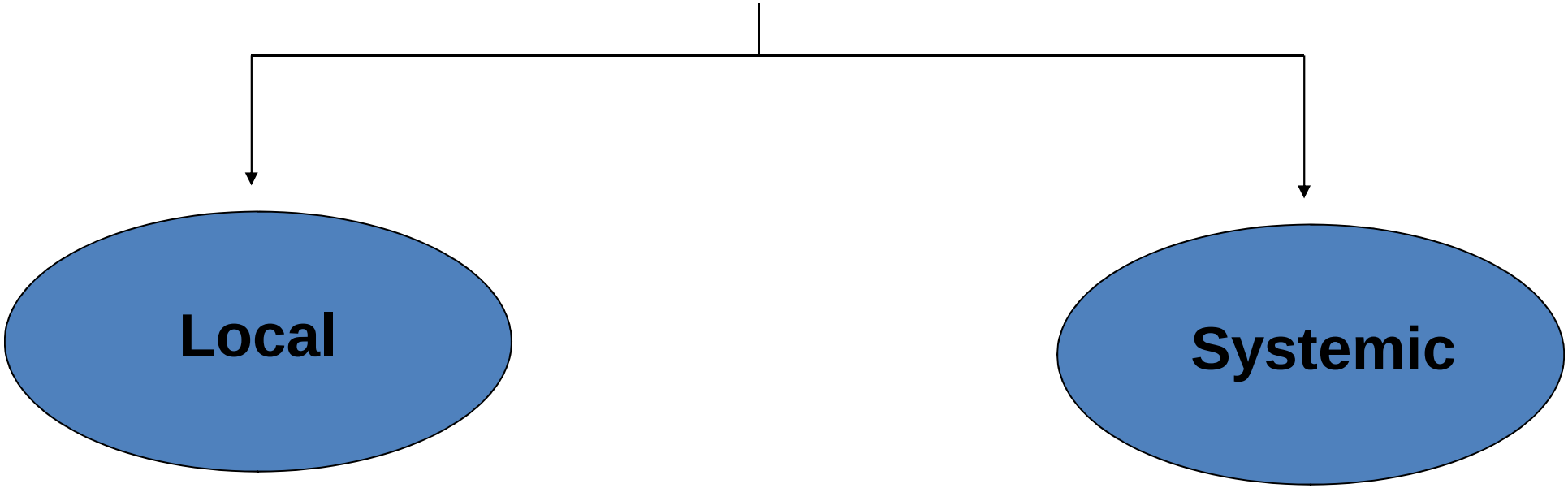
GOALS AND OBJECTIVE

1. TO UNDERSTAND THE UTILITY OF ROUTES OF DRUG ADMINISTRATION
2. DIFFERENCE BETWEEN VARIOUS TYPES OF ROUTES OF DRUG ADMINISTRATION
3. TO UNDERSTAND THE CONDITIONS WHICH REQUIRED FASTEST MEANS OF DRUG ADMINISTRATION

Factors affecting choice of route

1. Physical and chemical properties of the drug (solid/liquid/gas; solubility, stability, pH, irritancy).
2. Site of desired action (local or systemic).
3. Rate and extent of absorption of drug from different routes.
4. Effect of digestive juices and Ist pass metabolism on the drug.
5. Rapidity of tt. required (routine or emergency).
6. Accuracy of dose required.
7. Condition of the patient (vomiting, unconscious).

Routes of administration



Local routes of administration

1. **Topical –** external application of drug for localized action. It includes:

(a) Skin: ointment, cream, lotion, paste, powder, dressing, spray etc.

(b) Mucous membranes:

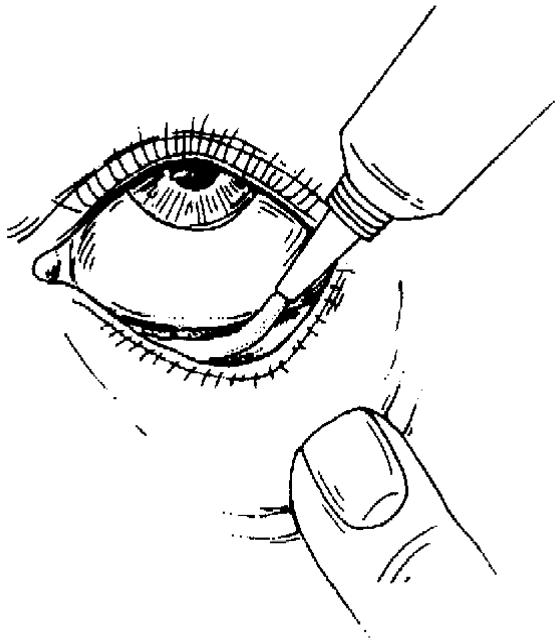
(i) Mouth and Pharynx: paints, lozenges, mouth washes, gargles.

(ii) Eyes, ears and nose: drops, ointment, irrigation, nasal spray.

(iii) GIT: non absorbable drugs-MgSO4, Sucralfate.

(iv) Urethra and vagina: jellies, irrigating solutions, pesseries, vaginal tablets, inserts, cream, powder, douches.

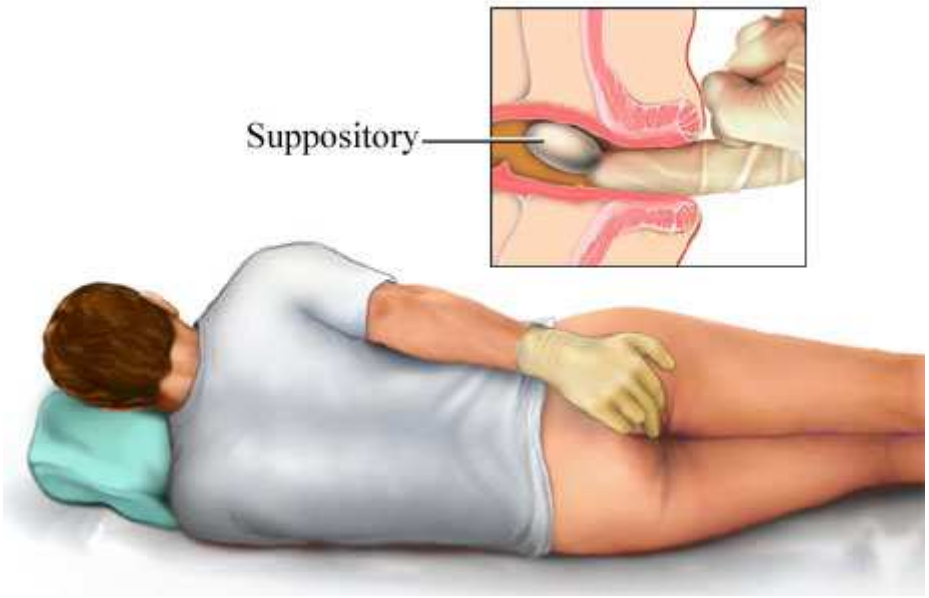
(v) Anal canal: ointment, suppositories.



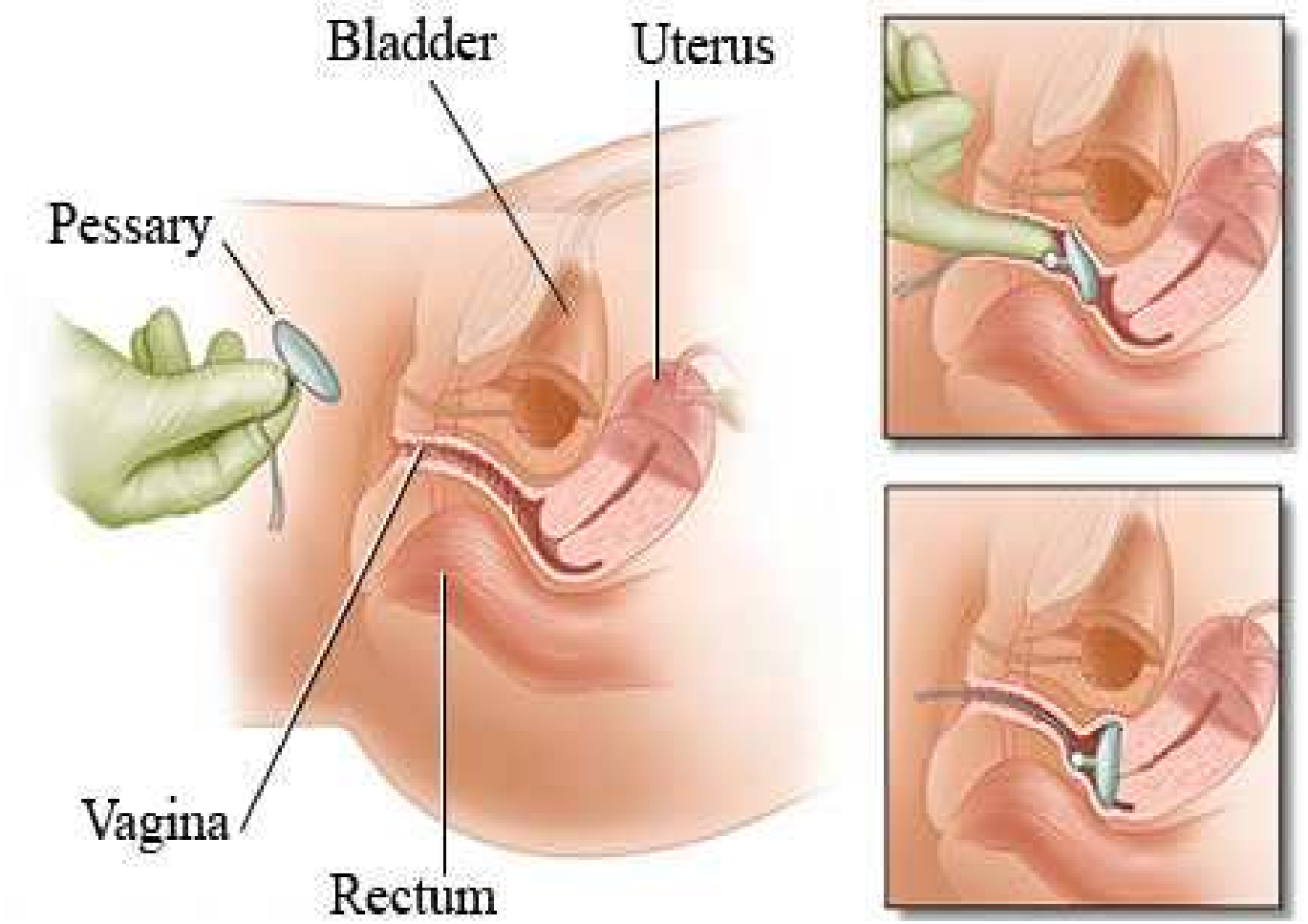
Ointment

Lozenges

Suppositories



How to insert suppository

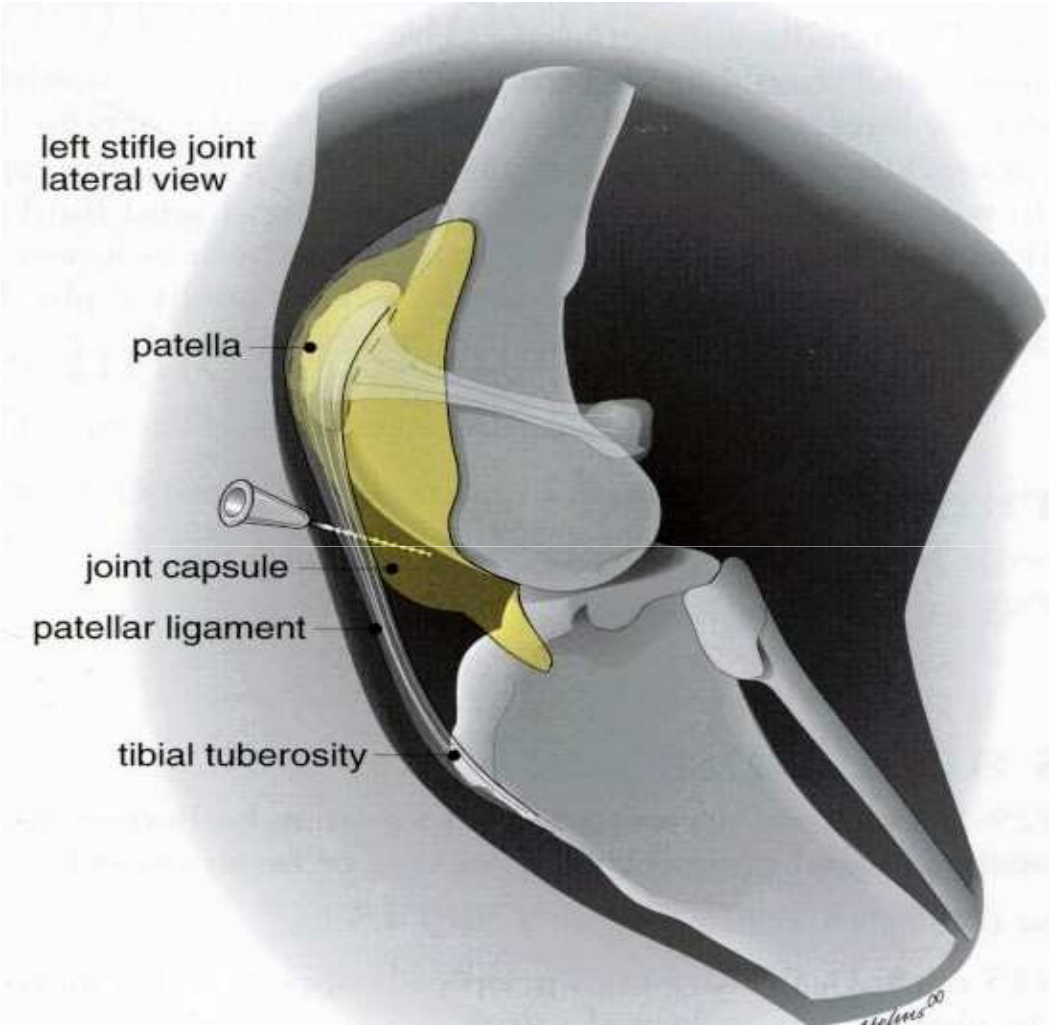


How to insert a vaginal Pessary

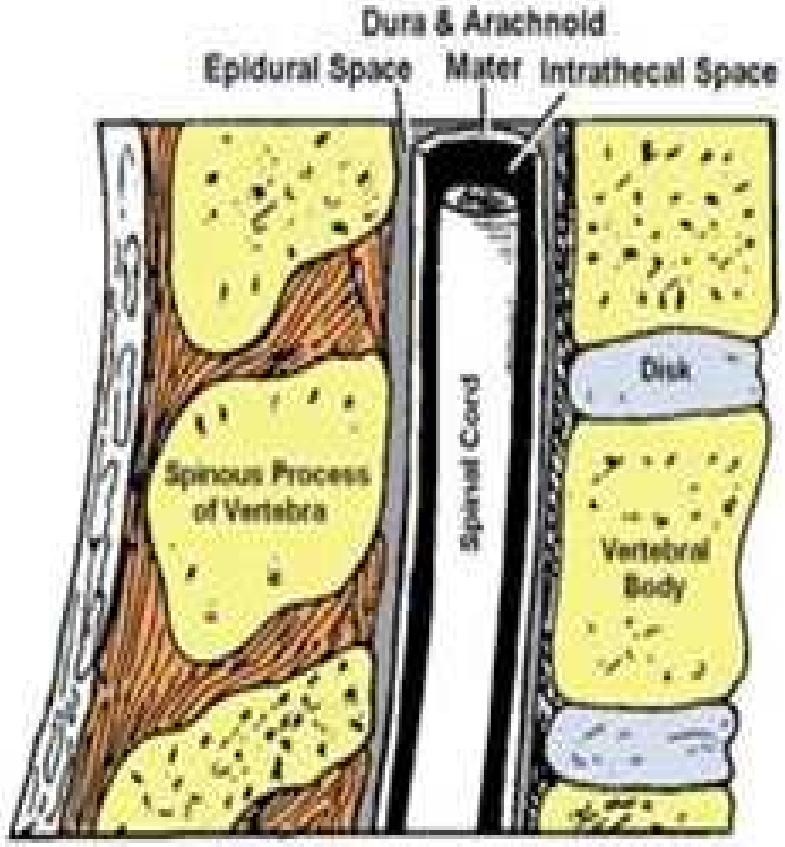
2. Deeper tissues: Intra - articular injections (in joint space - Hydrocortisone for Rh. Arthritis), Intrathecal injections (in subarachnoid space – spinal anesthesia, for myelography), Retrobulbar injections (for eye surgery).

3.Arterial supply: for contrast media in angiography, chemotherapy for localized effect.

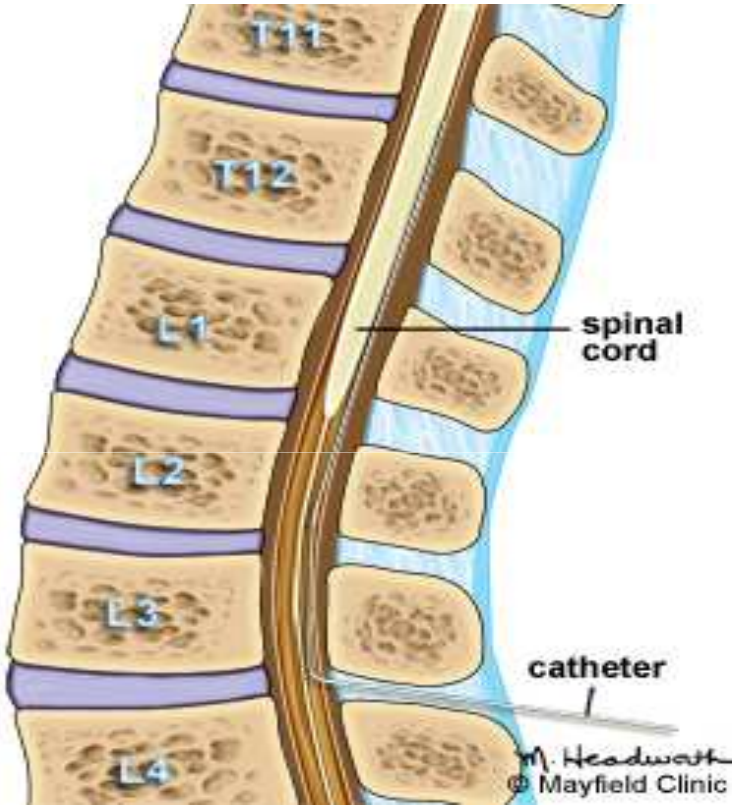
Retrobulbar Injection



Intra-articular Injection

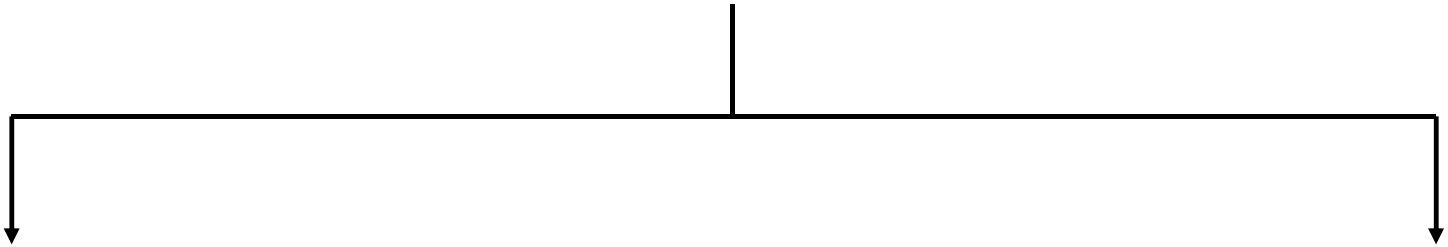


Intrathecal space



Lumbar Puncture

Systemic Routes



Enteral Routes

1. Oral
2. Sublingual
3. Rectal

Parenteral Routes

1. Intravenous
2. Intramuscular
3. Intraperitoneal
4. Inhalation
5. Subcutaneous
6. Nasal
7. Intradermal

Enteral Routes

- Administration of a drug directly into any part of the gastrointestinal tract is k/a Enteral administration.
- It is derived from a Greek word ‘ENTERON’ which means an intestine.

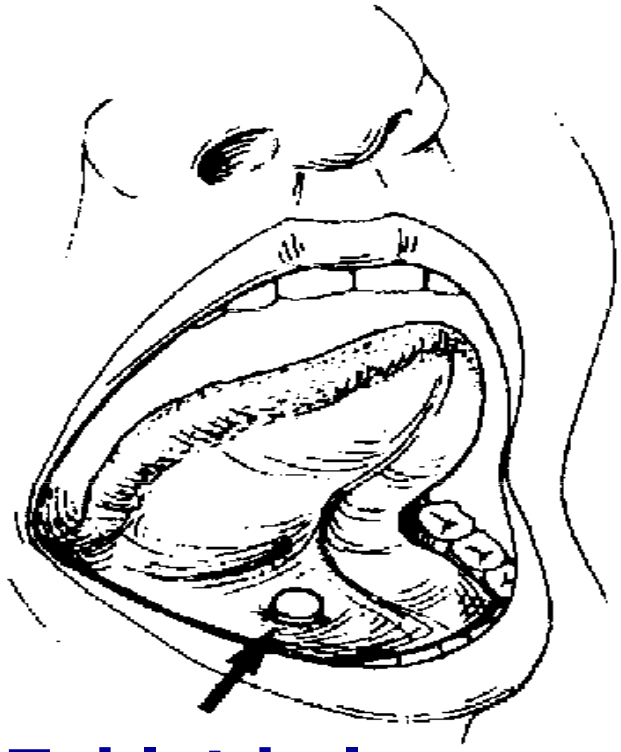
Oral administration

- ***Site:*** swallowing through mouth.
- ***Merits:*** most commonly used method as it is safe, convenient and painless procedure. Economical as no sterilization is needed.
- ***Demerits:*** slower onset of action, polar drugs are not absorbed, some drugs are destroyed by digestive juices, first pass effect, palatability is essential, not suitable for unconscious, uncooperative and patient having nausea, vomiting and diarrhoea.

Sublingual (and buccal) administration

- ***Site:*** drug is placed beneath tongue or crushed in mouth and spread over the buccal mucosa.
- ***Merits:*** quick onset of action (absorption through buccal mucosal membrane), no first pass metabolism (as drug reaches directly in systemic circulation, bypassing portal circulation), if side effects observed, drug can be spitted out.

- ***Demerits:*** distasteful, irritant drugs cannot be given, drugs of high molecular weight cannot be well absorbed through this route.
- ***Examples:*** Isosorbide Dinitrate (for Angina) , Isoprenaline (for Asthma), Nifedipine (for hypertension), Methyl Testosterone, Clonidine.



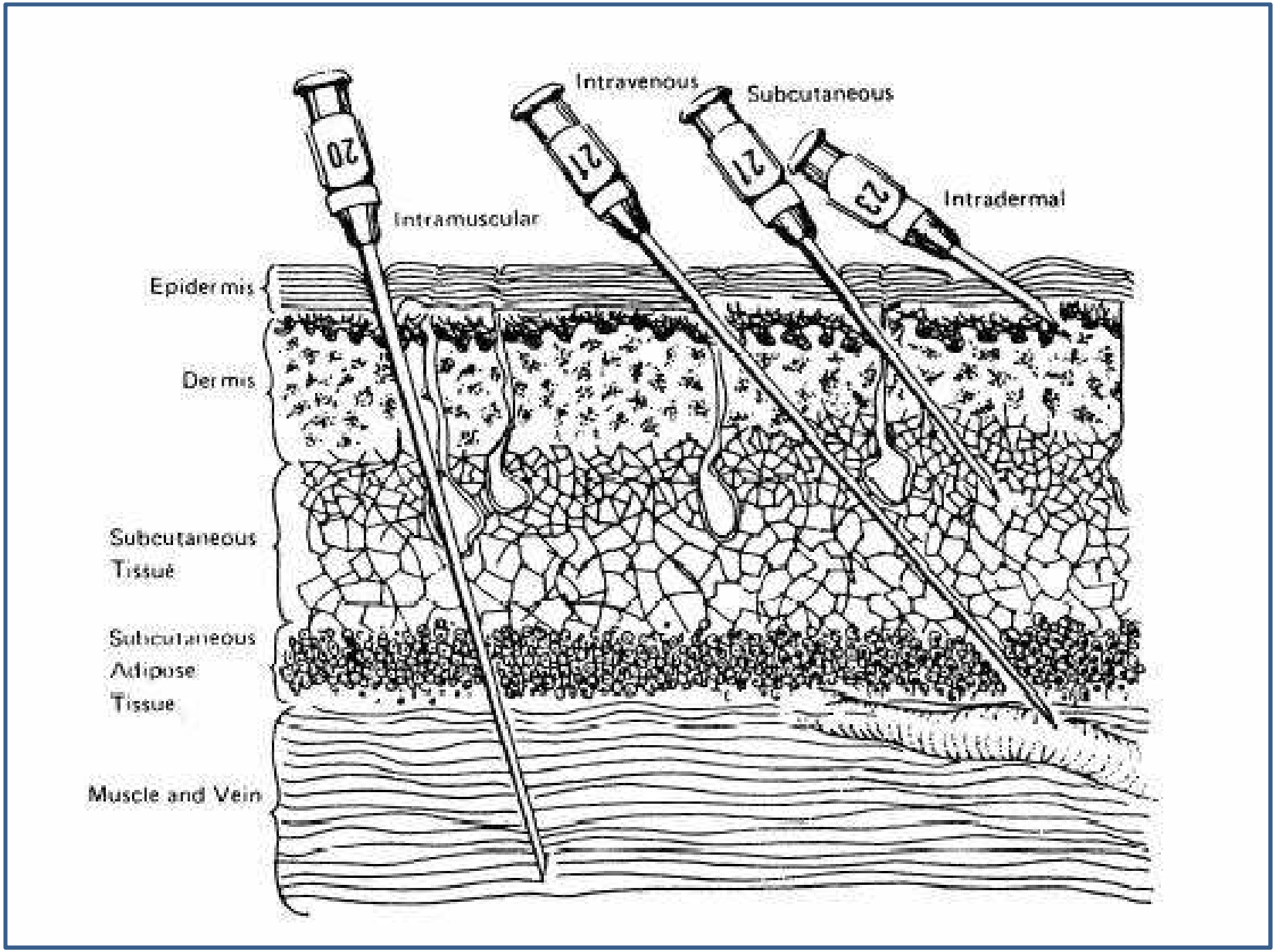
Tablet below tongue

Rectal Administration

- ***Site:*** through rectum.
- ***Merits:*** useful for gastric irritating drugs, no first pass metabolism as drug is absorbed through external haemorrhoidal veins, useful for nauseating and vomiting patients.
- ***Demerits:*** chances of rectal inflammation, absorption is unreliable, inconvenient and embarrassing to the patient.
- ***Examples:*** for local effects-Dulcolax and Glycerine suppositories, enemas; for systemic effects-Aminophylline and Indomethacin suppositories.

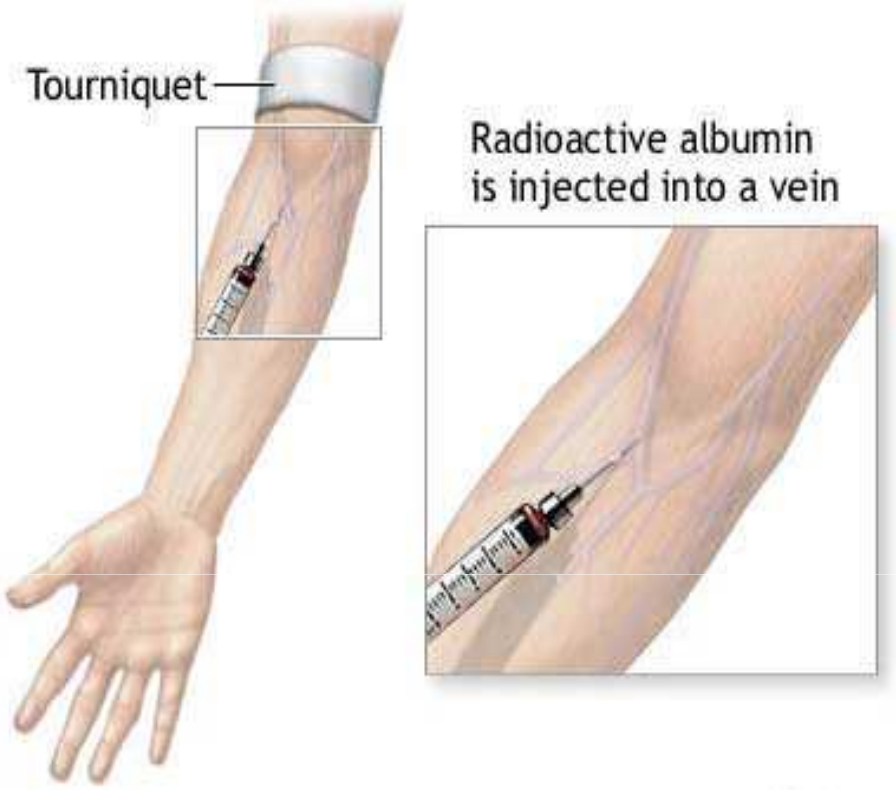
Parenteral Routes

- ‘PAR’ is a Greek word which means aside from.
- So, routes other than “enteral” are called as “Parenteral”.
- Parenteral routes can be systemic as well as topical.

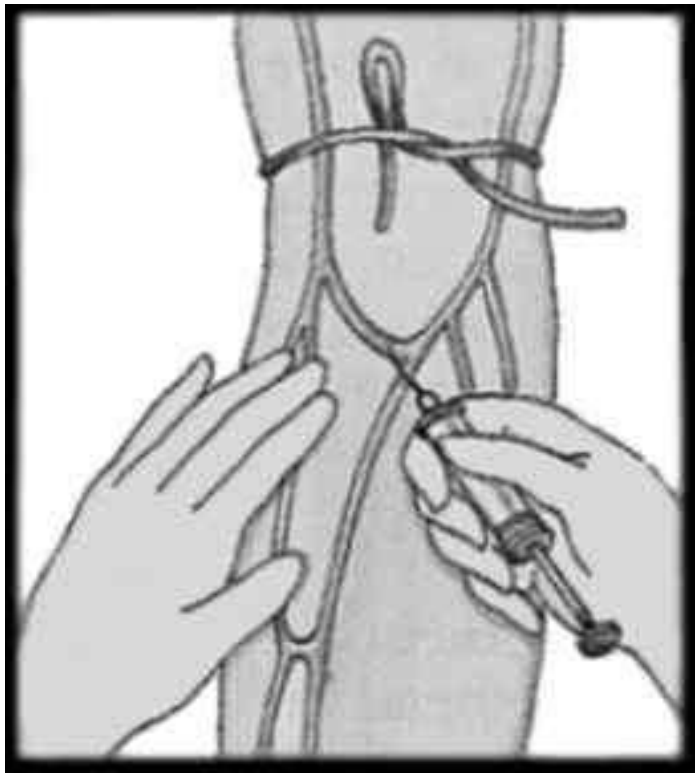

Intravenous
Subcutaneous
Intramuscular
Intradermal
20
21
21
23
Epidermis
Dermis
Subcutaneous
Tissue
Subcutaneous
Adipose
Tissue
Muscle and Vein

Intravenous administration

- ***Site:*** in the lumen of vein (Antecubital vein).
- ***Merits:*** quick onset of action, lesser dose is required, no first pass metabolism, useful for nauseating and vomiting, unconscious and uncooperative patients, concentration of drug can be controlled with accuracy, GIT irritant drugs can be administered.
- ***Demerits:*** strict aseptic conditions are mandatory, painful, irreversible, dependency, if extravasation occurs, venous thrombosis and Thrombophlebitis occur.



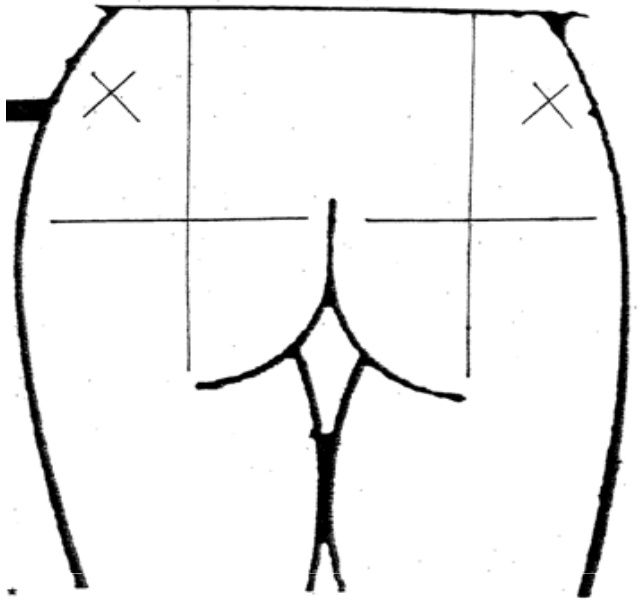
Intra Venous (i.v.) Injection

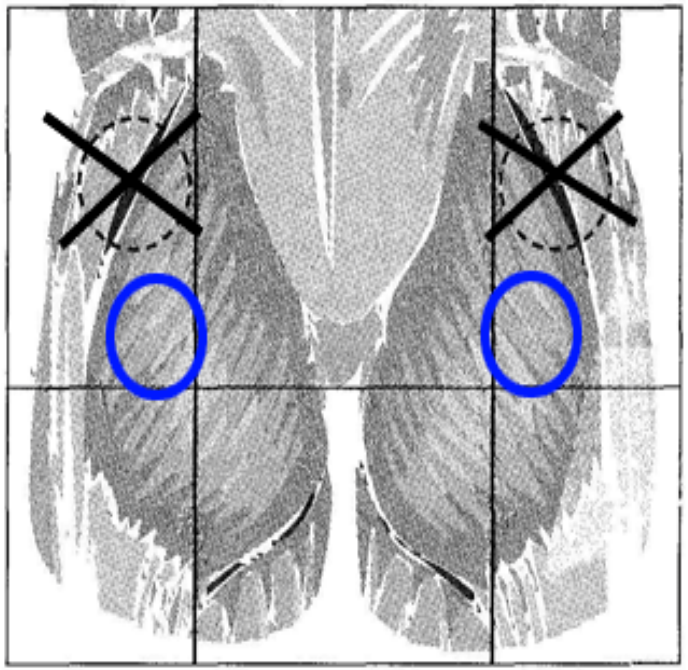


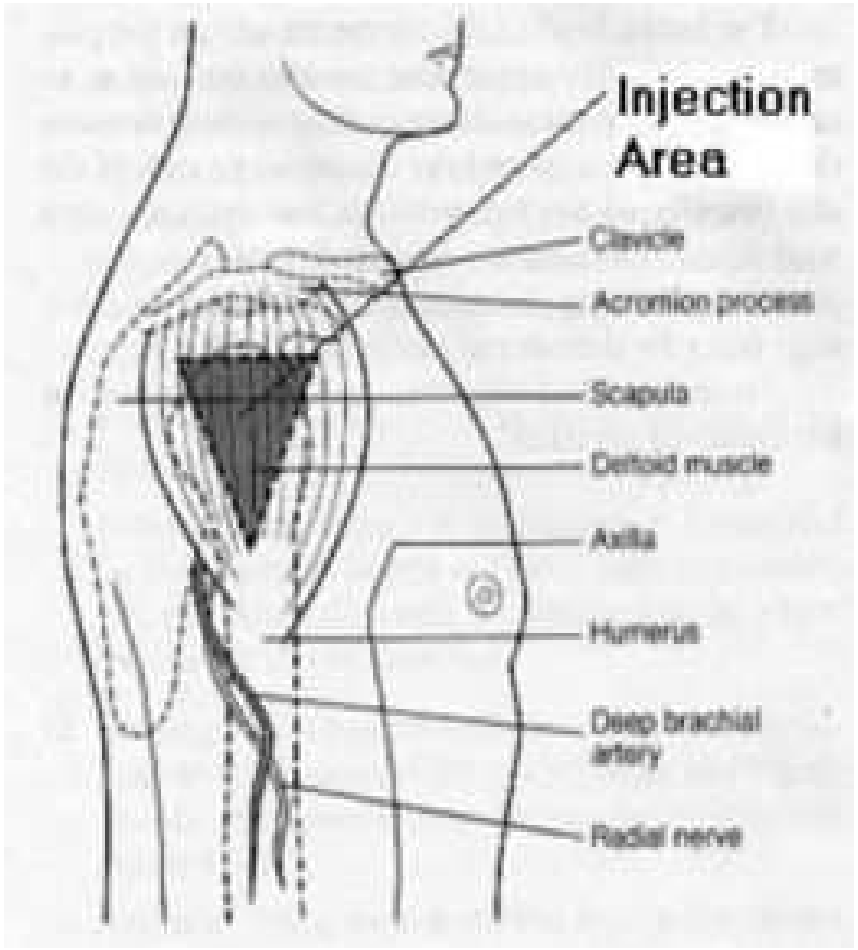
Antecubital Vein

Intramuscular Administration

- ***Site:*** upper 1/3rd of Deltoid or upper and outer quarter of Gluteal mass or lateral thigh (Vastus muscle).
- ***Merits:*** absorption is rapid, more predictable and less variable as compared to oral route, drugs in suspension or oily drugs (Depot injections) can be easily given.
- ***Demerits:*** strict aseptic conditions are mandatory, chances of nerve damage and abscess formation, large volumes cannot be administered (maximum is 5-10 ml).



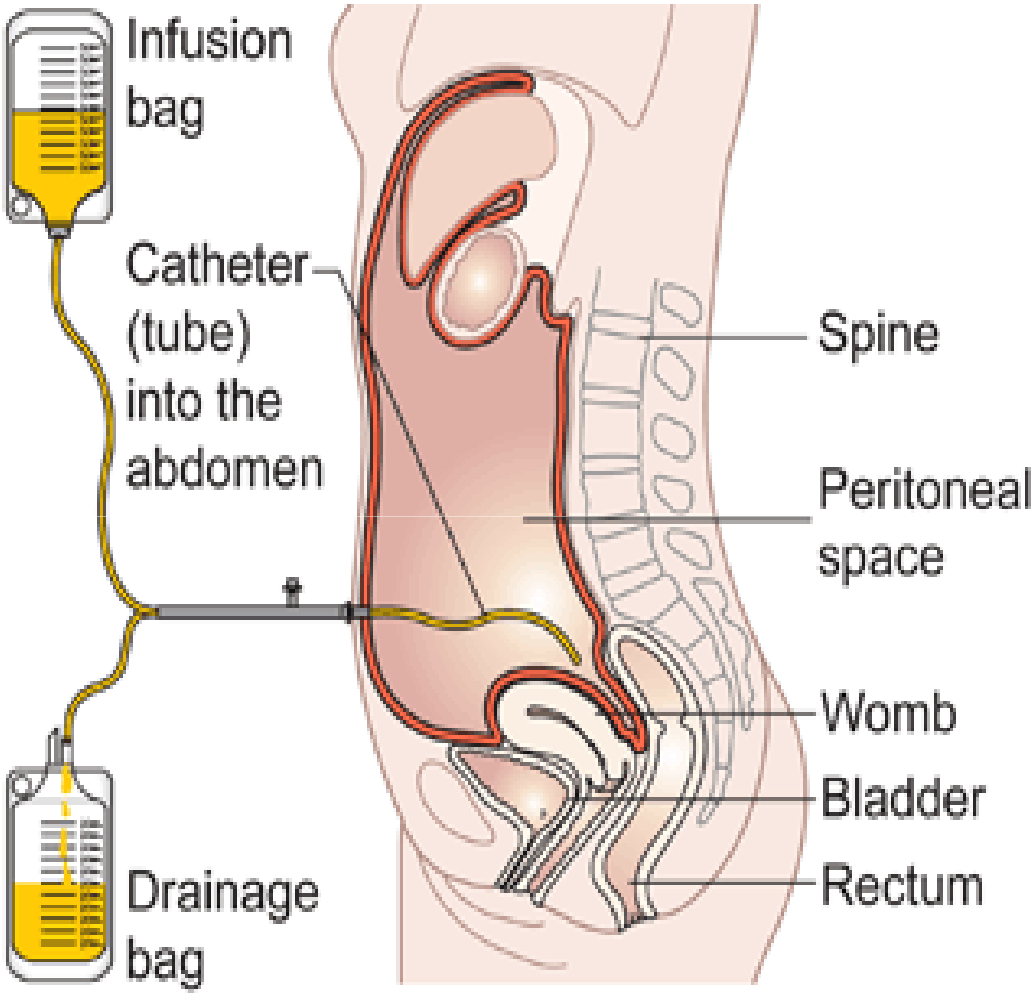




Intra Muscular Injection

Intraperitoneal Administration

- ***Site:*** into the peritoneal space.
- ***Merits:*** rapid absorption due to large surface area.
- ***Demerits:*** strict aseptic conditions are mandatory, painful, risky due to chances of adhesions and Peritonitis.
- Less in use, Peritoneal Dialysis for poisoning and Renal Failure, used for experimental purposes.



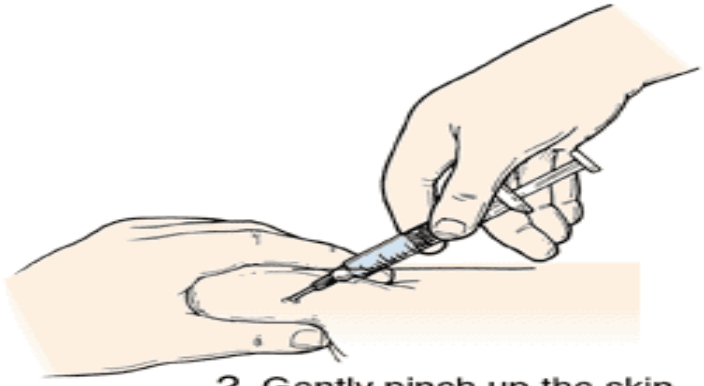
Intra Peritoneal Injection

Subcutaneous Administration

- ***Site:*** drug is administered under the skin.
- ***Merits:*** smooth, slower and prolonged absorption, Depot injections can be used.
- ***Demerits:*** only small volumes can be administered (<2 ml), irritant drugs cannot be given, not suitable in shock as reduced circulation decreases rate of absorption.
- Vaccines are administered preferably through this route as the active proteins reach lymphatics directly without destruction else where.

How to Give a Subcutaneous Injection

1. Use an alcohol swab to clean the skin where you will give yourself the shot.



2. Gently pinch up the skin and insert the needle into the skin at a 45° angle.

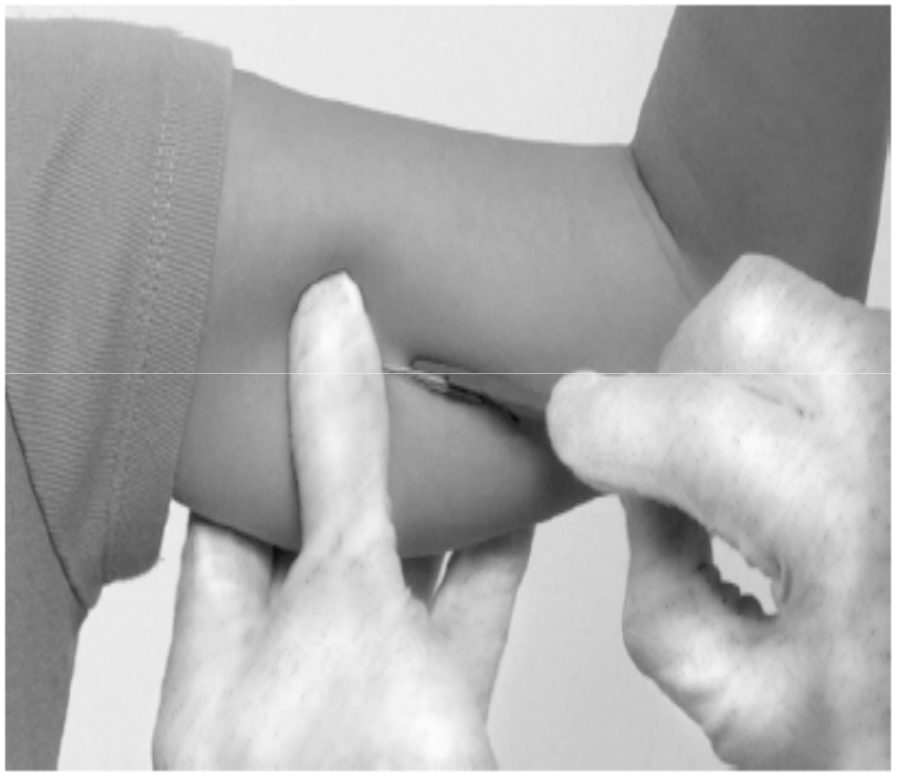
3. After you insert the needle completely, release your grasp of the skin.

4. Inject all of the solution by gently and steadily pushing down the plunger.

5. Withdraw the needle and syringe and press an alcohol swab on the spot where the shot was given.

Related routes

- **Intradermal (Intracutaneous) route:** drug is injected into outer layers of skin. BCG and allergic sensitization testing is done by this route.
- **Dermojet Injections:** subcutaneous needle less injection by high velocity jet projected through a microfined orifice.
- **Pellet or Biodegradable Implants:** implants (biodegradable or non-biodegradable) are placed under the skin to provide slow and uniform release of drug.



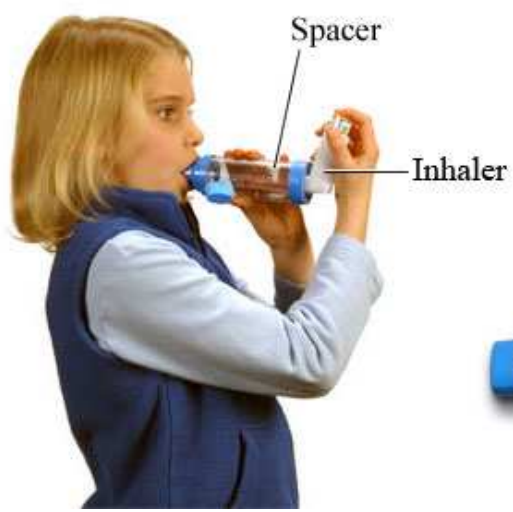
Subdermal Implants

Inhalation

- ***Site:*** inspiration through nose or mouth.
- ***Merits:*** self administration is possible , faster absorption (as large surface area), early onset of action.
- ***Demerits:*** bronchial irritation leading to cough, increased bronchial and salivary secretions.

Inhalation

Push down on the canister and breathe in slowly



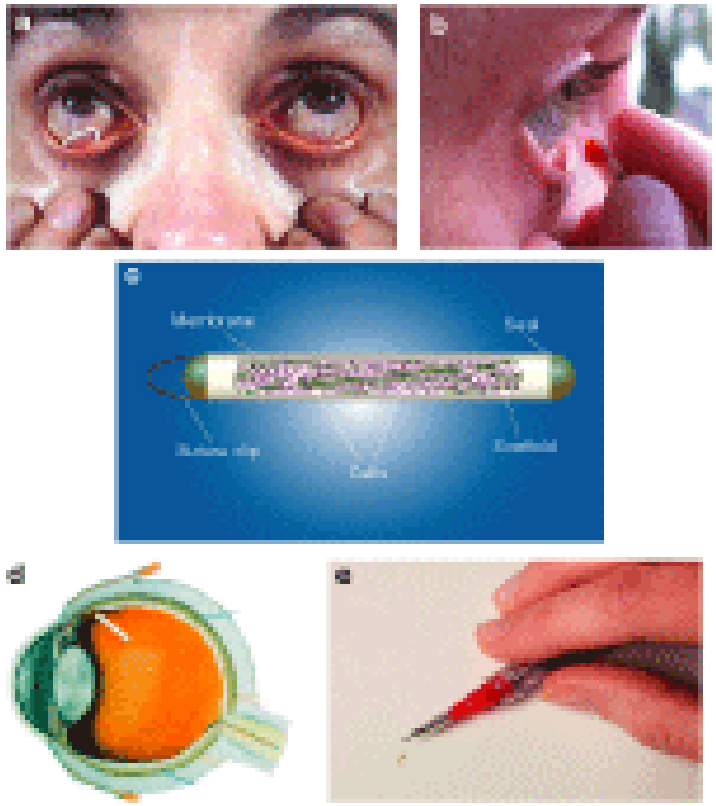
Inhaler

Spacer

New Drug Delivery Systems

1. Ocusert
2. Progestasert
3. Depot Injections
4. Liposomes
5. Transdermal Adhesive Patch
6. Prodrugs
7. Computerized Miniature Pumps
8. Monoclonal Antibodies.

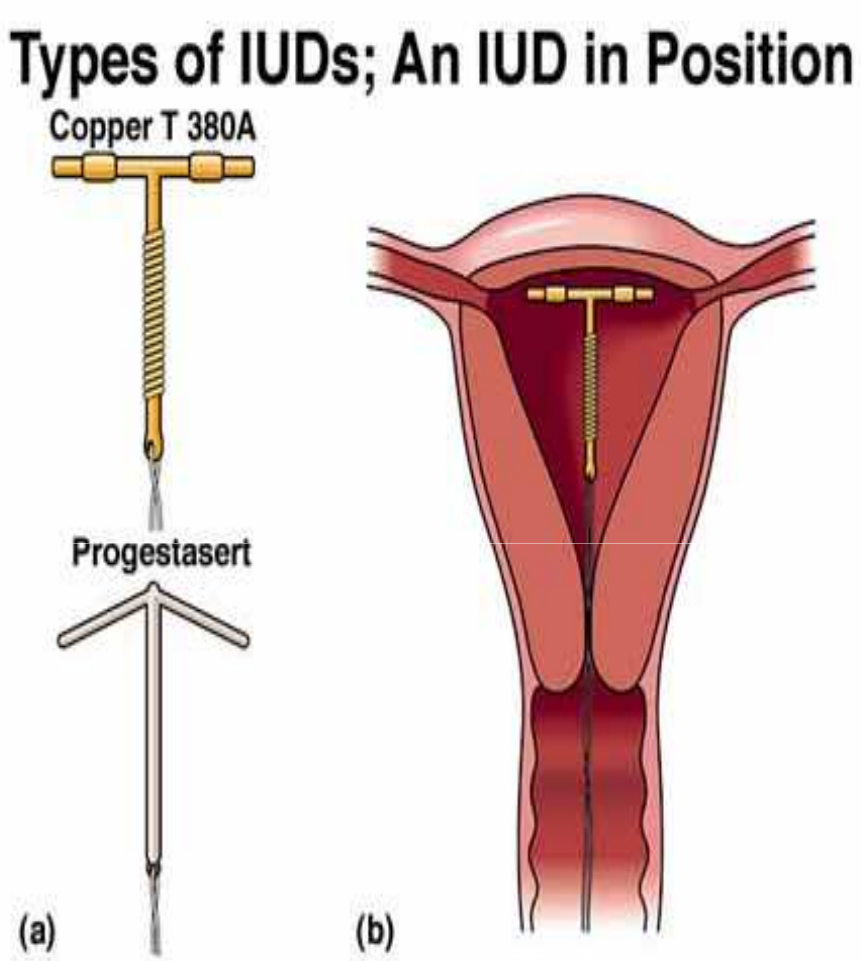
- **Ocusert:** these are thin elliptical microunits containing drug which is released slowly at a steady rate. Pilocarpine Ocusert is used in Glaucoma, placed under the eyelid, enough for 7 days, avoids daily administration of the drug.
- **Depot Injection:** longer acting injectable preparation, drug is dissolved in oily base from which it is slowly and steadily absorbed.



Ocusert

- **Progestasert:** IUD containing Progesterone, less side effects, more efficacious, useful for a period of 1 year.

Progestasert



- **Liposomes:** minute vesicles produced by sonication of an aqueous suspension of certain phospholipids. They can be filled by non-lipid soluble drugs, which are retained till liposomes are disrupted. Amphotericin B is used in Liposomes, it becomes less nephrotoxic and better tolerated.
- **Transdermal Adhesive Patch (Transdermal Therapeutic System):** the drug is held in a reservoir b/w an occlusive backing film and a rate controlling micropore membrane. The drug is delivered by diffusion for percutaneous absorption in to the circulation. These provide smooth and steady plasma concentration for a period of 1-7 days. Usual sites are chest, abdomen, upper arm, mastoid region, lower back and buttock. Drugs can be NTG, Fentanyl, Nicotine, Estradiol, Isosorbide Dinitrate, Hyoscine, Clonidine etc.

- **Prodrugs:** these are inactive forms of drug which get metabolized in the body to an active drug. These are used to overcome the pharmacokinetic disadvantages of the drug e.g. Dopamine is taken as LevoDopa.
- **Computerized Miniature Pumps:** these are programmed to release the drug at a definite rate, either continuously (Insulin) or intermittent in pulses (GnRH).
- **Monoclonal Antibodies:** a monoclonal antibody reacts with only single antigenic determinants (Epitope) of any antigen. They do not affect unnecessary other organs. Used against many cancers and also, to carry many anticancer drugs.

CONCLUSION

- ALL THE ROUTES OF DRUG ADMINISTRATION ARE EQUALLY IMPORTANT BUT JUDICIOUS USE OF VARIOUS ROUTES OF DRUG ADMINISTRATION IN DIFFERENT CONDITIONS MAY GIVE PROMPT RELIEF TO THE PATIENT

Explain why ?

- s/c route is used in angina pectoris
- 100% bioavailability in i/v route.
- Oral route is slower acting.

LONG QUESTION:-

1. DISCUSS THE ADVANTAGES AND DISADVANTAGES OF VARIOUS ROUTES OF DRUG ADMINISTRATION

REFERENCE

- ESSENTIALS OF MEDICAL PHARMACOLOGY:DR KD TRIPATHI