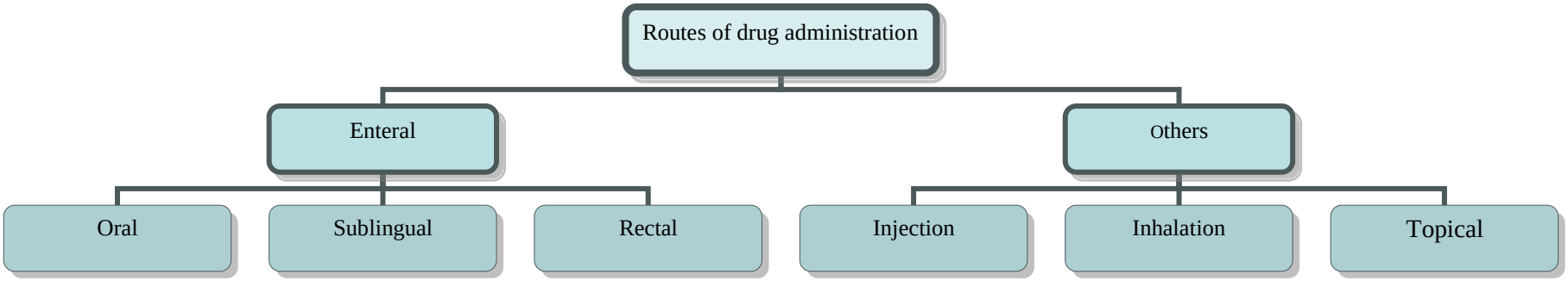


A)Enteral

	Oral	Sublingual	**Rectal**
Requirments	Suitable Small amount or volume Palatable(if not dilute with milk or fruits-use suger-coated dosage form) Non-irritant(if irritant take after meals or enteric-coated D.F.) Stable (Not affected by 1st pass metabolism) Absorbable(if used for systemic effect)	Suitable Small size. Palatable. Non-irritant. Stable & soluble. Absorbable(not cause vasoconstriction)	Not severely irritant.
Advantage	Convenient(Safe, easy,economic)	Rapid action. Bypass 1st pass metabolism. Can control the dose by spitting out the tablets.	Suitable for: Unconcious patients. Uncooperative patients. The patients has excessive vomiting or the drug is irritant. Large volume can be given.
Disadvantage	Not suitable in the following cases: Unconcious patients. Uncooperative patients. Emergencies. The patients has excessive vomiting or the drug is irritant. Some drugs are not absorbed or drugs destroyed in the gut(extensive 1st pass effect). Absorption is affected by food or other drugs.	Inconveniant if frequent. Excessive salivation which induce swallowing.	Rectal inflammation even anal polypi. Unreliable absorption especially if the rectum is full of faeces.

Dosage form
Enteral dosage form

A) Sublingual dosage form:
1-Sublingual pellets: small tablets dissolve under the tongue(e.g.nitroglycerine).
2-Oral spray.

B) Oral dosage form: Drugs taken by the mouth & swallowed for local or systemic effect.

1)Solid (most commonly used)	*2)Liquid*
More accurate dose Easy handling Smaller in size More stable No taste problem	***More homogenous*** ***Easier to swallow***

B)Solid oral dosage form: Tablets-capsule-powder-effervescrnt granules.

1)Tablets: is a solid dosage form of varying shape,size& weight in which the drug is compressed with inert substance(excipients).
-Simple tablets.
-Suger-coated tablets(Mask bad taste-improve appearance-protect against air & light but increase size & weight not less than 50%).
-Chocolate-coated tablets: rare nowdays.
-Enteric-coated tablets:remains intact in the stomach but dissolve in the intestine. Adv.:protect the stomach(Na Salicylate) or the drug(proton pump inhibitor).
-Controlled-release dosage form : Release the drug at a constant rate with invariant plasma concentration.:
Delayed-release D.F. : Release the drug at a later time; enteric- coated tablets, pulsatile- release capsules.:
Extended-release D.F. : Provide long Release time →Long duration-↓ frequency,improve patient compliance.
Repeat Action: Release the drug At intermittent intervals.
Sustained- Release D.F.: Initial Release of the drug with subsequent gradual Release over extended period.
Modified- Release D.F.: Time course or location.
a-Coated beads or granules(spansule.
b-Microencapsulation: solids,liquids or gases are inclused in microscopic capsules.
c-Matrix tablets:prepared by mixing the drug with the matrix matrial followed by compression of the matrial into tablets.The primary dose of the drug (the coat of the tablets) is relesed immediately then the rest of the dose is released slowly from the matrix.
-Chewable tablets.
-Dispersible tablets:disintegrate in water forming suspention then drink it.
Effervescent tablets: prepared by adding $NaHCO_3$ &tartaric acid or citric acid when added to water release CO_2 & improve palatability.-

2)Capsules:-
-Hard gelatin capsules.
-Soft gelatin capsule.
-Enteric coated capsule.
-Sustained release capsule.
3)Powders:in bottles or packets(ORS).
4)Effervescent granules: in bottles or packets.By adding $NaHCO_2$ & citric acid(or tartaric acid) ,when added to water ,CO_2 is librated.
b)Liquid oral dosage form:

Aquous	Alcoholic
*Mixture -Emulsion. -Suspention. -Syrup. -Decoction. -Infusion.	-Elixir. -Tincture.

1)Aquous :
*Mixture:> one drug in the preparation.
-Emulsion: 2 liquids in which one is dispersed through the other in the form of small droplets by emulsifying agents e.g. gum.
-Shake well before use.
Advantages: increase drug solubility,action & improve appearance.
-suspention: insoluble powder suspended in water by suspending agents.
-Shake well before use.
Advantages: increase drug stability & duration of action & improve taste.
-Syrup:Sweetened,coloured & flavoured aquous preparation.e.g.tolu.
-Decoction: Boiling dry plant in water. –Must be prepared fresh.
-Infusion: Soaking dry plant in cold or boiling water. -Must be prepared fresh.
2) Alcoholic:
-Elixir: Sweetened,coloured & flavoured hydroalcoholic preparation contain 5-40% alcohol.
-Tincture: Alcoholic or hydroalcoholic preparations of vegetable drugs e.g. tincture belladonna.

C) Rectal dosage form:

1-Solid: Suppository.
2-Liquid: Enema.
1-Suppository:
-Types:
Rectal supp.:usually cylindrical(bullet-like)When the rectum contracted,its shape facilitate its entry inward. For adult 2 gm,& less for infants & children.
Vaginal supp.(pessary=ovule): Oval,5gm.
Urethral supp.:long & tapered,60 mm long,5mm in diameter.N.B. PGE1 for erectile dysfunction ,micropellet(microsuppository) is 5mm long & 1.4mm in diameter.
-Supp. Bases:
Cocoa butter(theobroma oil): Solid at room temp. & melt at body temp. Disadv.: expensive,not suitable for vagainal Or urethral supp.,not suitable in hot countries,interfere with absorp. Of active ingredient(form a barrier).
Glycerin & Gelatin: Melt by rectal secretion & NOT affected by changes in body temperature.

2-Enema: fluid administered into the rectum & colon.

Types of enema:

	Retention enema	**Evacuant enema**
Aim	A mean of giving the drug (the drug retained in the colon)	Evacuate the colon from faeces.
Example	$MgSO_4$ (decrease ICT), Prednisolone in TTT of ulcerative colitis, Barium enema.	-TTT of constipation, -PRE-operative preparation of bowel. -Before colonoscopy.
Method	-Small volume. -Slow,at low head position. -At room temperature.	-Large volume. -Rapid,at high head position. -At 38^0 C temperature.

B) Others:

1)Parenteral route : Injections-subcutaneous implantation. –All drugs must be sterile & pyrogen free.

a**) subcutaneous implantation:**

A solid pellet is impanted under the skin & absorped slowly over weeks,months or years. E.g.Norgestrel provides 5-years contraception.

b)Injection:

	I.V.	*I.M.*	*S.C.*
Requirements	Aqueous only Given slowly with monitoring the patients. N.B. very irritant drugs can be given.	**A**queous or suspension or oily preparation. Non-irritant or mild irritant N.B.Depot preparation are suspension or oily preparation.(slow constant absorption).	Aqueous or suspension. Non-irritant drugs.
Advantages	100% Bioavailability. Suitable for Emergency (Rapid onse).t Suitable for irritant & large volume drugs.	Rapid action. Oily preparations can be given.	Self-administration**.** Accessible. Large surface.
Disadvantages	1. Most dangerous 2. Transmission of disease, e.g: AIDS & Hepatitis 3. If allergy → Anaphylactic shock. 4. If very irritant → phlebitis& thrombophlebitis 5. If Extravasation → Necrosis 6. Pyrogenic reaction 7. Nitroid reaction (flush & hypotention)nitroglycerine. 8. Velocity reaction eg.; Aminophylline 9. Once injected, No return Not suitable for oily preparation (fat embolism).	Some drugs are bound to muscle ptn→irregular absorption e.g. diazepam & phenytoin. Abscess formation. Painful.	Lipodystrophy(Hypertrophy or atrophy) . Less rapid absorption.

S.C absorption increase by:	*S.C absorption decrease by:*
1. Massage	1. Application of cold
2. Application of heat	2. Addition of V.C. e.g: adrenaline
3. Addition of hyaluronidase anzyme.	3. In cases of shock
4. solution	4. suspention

Other injection sites:

1-Intra dermal (0.1-0.2ml) sensitivity tests –local anaesthesia-some vaccines.

2-Intra-arterial - Diagnostic (Arteriography) -Therapeutic (Dissolution of coronary Thrombus by tPA)

3-Intra cardiac adrenaline in cardiac arrest

4-Intra-cameral in aqueous humour.

5-Intra-pleural injection of chemotherapy.

6-Intra peritoneal inject drug or fluid in peritoneal dialysis.

7- Intra thecal in subarachnoid space, e.g: (spinal anesthesia)-antibiotic in meningitis.

8-Intra articular cortisone in arthritis

9-Intra bone marrow (intra-osseous) in children < 6 years when I.V. line is not accessible.

N.B: I.V > I.M > S. C

Parenteral dosage form:

Available in the form of :

Solution-suspension-powder. In

Ampoule,vials& bottles.

inhalation

Drug may be given by inhalation in the following dosage forms:

- gas e.g. oxygen, and nitrous oxide (general anesthetic)
- volatile-liquid (vapour) e.g, halothane (general anesthetic)
- solution administered as AEROSOL (metered dose inhaler=MDI) by means of a nebulizer or atomizer e.g. salbutamol (bronchodilator). Aerosols provide high local concentration for action on bronchi, minimizing systemic effects.
- As a finely micronized powder e.g. disodium cromoglycate (Intal) used in prophylaxis of bronchial asthma given by a special inhaling device called "SPINHALER".

Advantages of inhalation route:Excellent & rapid absorptions
the large surface area ,thin porous membrane and rich blood supply of the alveoli.

Topical administration

A)For Local Effect on Mucous Membranes and skin:

Skin:

Ointment: A fatty base immiscible with water for dry lesion. May be absorbed& produce systemic effect. .(oil 80%,water 20%).

Cream: The base is miscible with water for oozing lesion.(oil 50%,water 50%).

Paste : as ointment but contain powder.(oil+water+powder).

Lotion: Suspension in small amount of water, Applied to the skin without rubbing. SHAKE well before use.

Dusting powder: Either for protection(form low friction film; decrease friction & evaporate ssweat) e.g. talc powder or medicated e.g.antiseptic.

Spray.

Mucous membrane:

Mouth: Mouth wash, gargle, lozenge, paint.

EYE: Eye drops, Eye Ointment, Eye lotion

-Preparation for eye should be STERILE

-Systemic absorption may occur e.g. bronchospasm in asthmatic patients using Timolol eye drops for glaucoma.

EAR : Ear drops, ointment, lotion

Nose: nasal drops, nasal spray, nasal inhaler.

VAGINA: Vaginal tablet, Vaginal ovule(pessary=suppository), Vaginal douche and Vaginal cream.

URETHRA:

Suppository as PGE_1 (alprostadil) in erectile dysfunction.

B) For systemic action: Transdermal delivery system

Adv.: -prolong blood level with minimal fluctuation. – Avoid 1^{st} pass effect.

e.g. Nitroglycerine ointment,,patch, nicotine, fentanyl, scopolamine.

Routes of drug administration

A)Enteral
1-Oral:
a-solid D.F.
Tablets,
Capsules
,powder
,effervescent powders.
b-Liquid D.F.:
a-Aqueous:
Mixture
Emulsion
Suspension
Syrup
Decoction
Infusion
b-Alcoholic:
Elixir
Tincture
2-Sublingual:
pellets; oral spray.
3- Rectal:
a-Solid:suppository:
cocoa butter-glycerin, gelatin.
b-Liquid:Enema:
Evacuant
Retention

B) Others:
Injection,inhalation,topical
Parenteral:
S.C. implantation.
Injection:
I.V.
I.M.
S.C.
In ampoule, vial, bottle
Solution,suspension,oil.

Inhalation:
-Gas
-Vapour
-Solution:
nebulizer, atomizer(M.D.I.).
-Powder.

Topial:
1) For local effect:
-Skin:
Ointment.
Cream.
Lotion.
Dusting powder.
Spray.
-Mucous membrane:
Mouth
Eye.
Ear.
Nose.
Vagina.
Urethra.
2) For systemic effect:
Trandermal delivery system:
Nitroglycerine,nicotine,fentanyl,
Scopolamine.

N.B.

1-Solid oral D.F.: taken in standing up,, with 150 ml of water.

2-I.M. :

Sites:Thigh (5 ml), Gluteal muscle , Deltoid (2 ml).

Disadvantage: Not suitable for large volume - Abscess formation.

Technique: 1- Direct: needle at 90º . and apply pressure to stop bleeding & leakage. 2- Z-track technique :slide the skin over the muscle .needle at 90^0 .

3-S.C.:

Volume: 0.5 -1 ml if more I.M.

Sites: upper arm, upper abdomen, upper back.

Technique : needle at 45^0 ,but if obese hold skin by 2 fingers & introduce needle at 90^0.

4-Intradermal:

Site: Medial aspect of forearm-upper back, provided no infection,no scar no pigment skin.

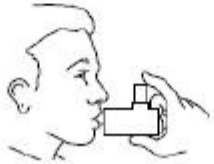
Technique: 0.1-0.2 ml with the bevel up at 15^0 angleat the upper layers of the skin without aspiration nor massage.Must produce wheal if not it is subcutaneous.

5- How to use MDI:

1. Remove the cap and hold the inhaler upright.
2. Shake the inhaler.
3. Tilt your head back slightly and breathe out slowly.
4. Hold your inhaler in one of the following ways. (See below.) Methods A and B are best, but C is acceptable if you have trouble with A and B. Method C must be used for breath-activated inhalers.
5. If you are not using a spacer, press down on your inhaler **one** time to release medication and breathe in slowly through your mouth at the same time. If you are using a spacer, first press down on the inhaler, then within 5 seconds, begin to breathe in slowly through your mouth.
6. Continue to breathe in slowly for 3 to 5 seconds.
7. Hold your breath for 10 seconds if you can to allow the medication to reach deeply into your lungs.
8. Repeat steps 3–7 until you have inhaled the number of puffs that your doctor prescribed. If you are using a quick-relief medication ($beta_2$ agonists), wait about 1 minute between puffs. There is no need to wait between puffs for other types of medication. Ask your doctor or pharmacist if you need to wait between puffs of your medication.

A. Hold inhaler 1 to 2 inches in front of your mouth (about the width of two fingers).

B. Use a spacer/holding chamber. These come in many shapes and can be useful to any patient.



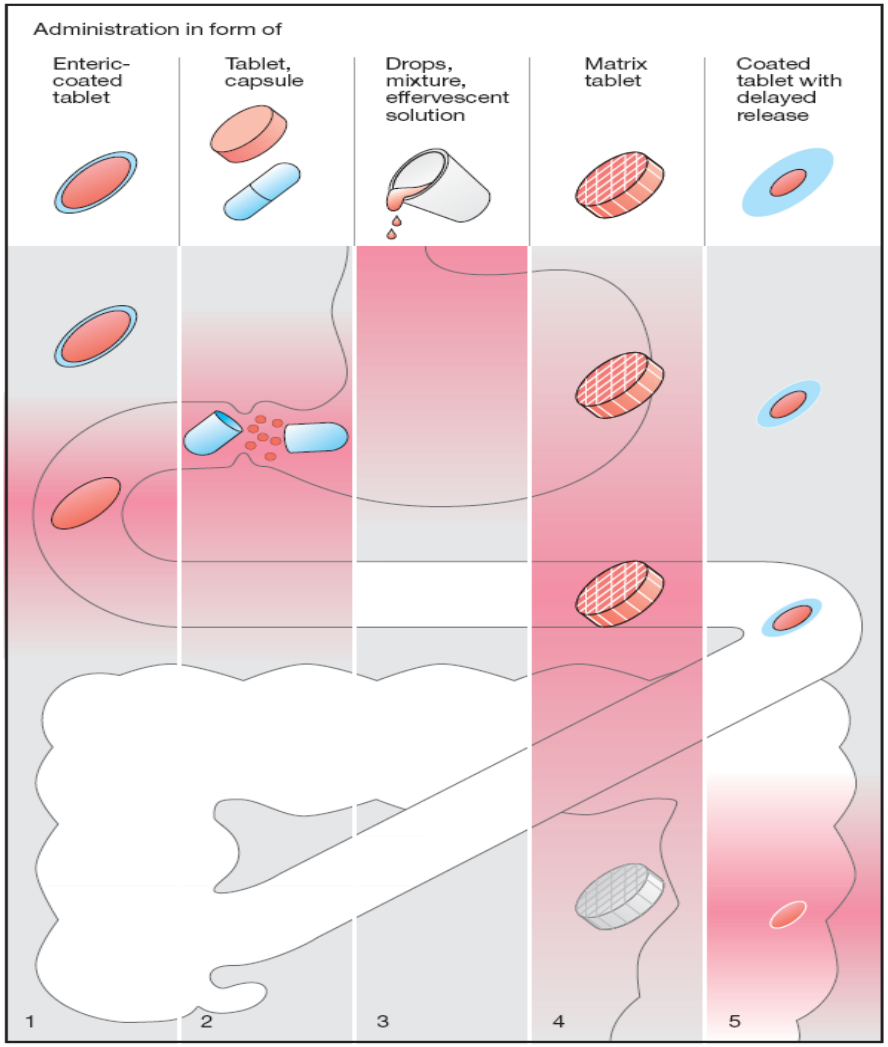
C. Put the inhaler in your mouth. Do not use for steroids.

7- **How to use nose drops**

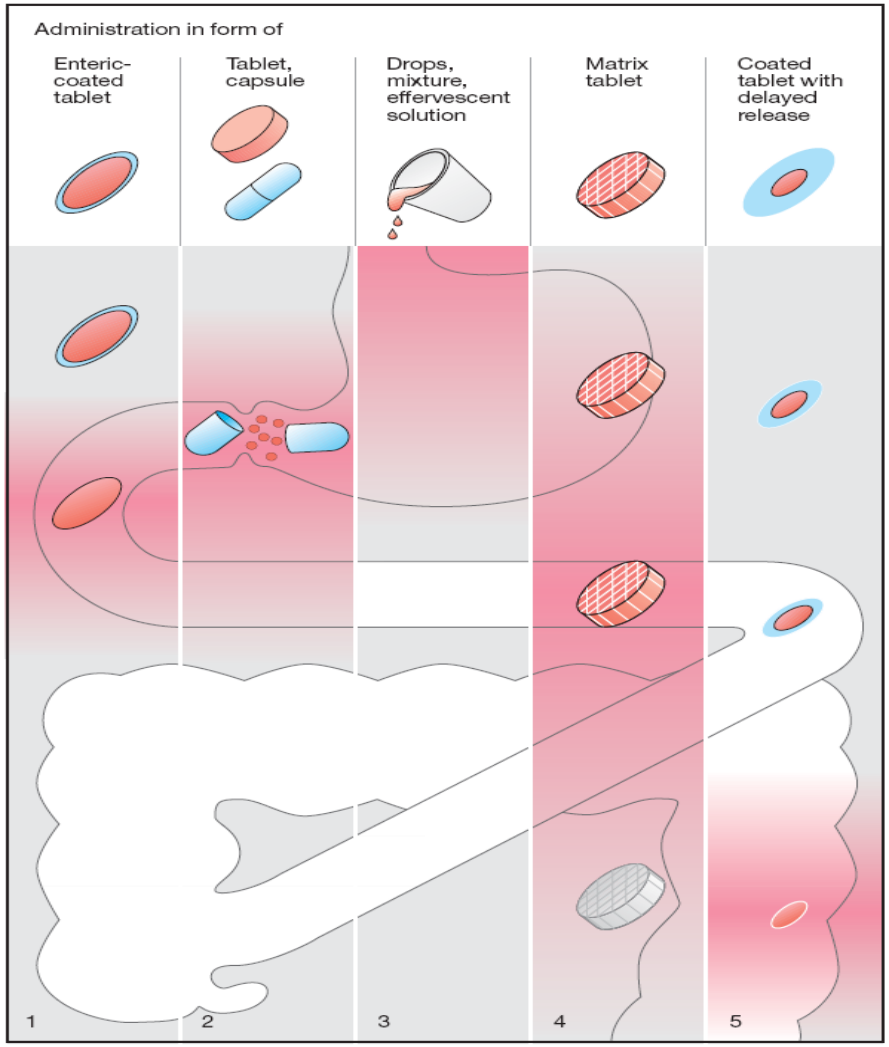
1. Gently blow your nose so that your nostrils are clear.
2. If your nose drops are a suspension, the label will remind you to shake the bottle before using the drops.
3. Wash your hands.
4. Take the lid off the bottle (for bottles with an integrated dropper, draw some liquid into the dropper).
5. Tip your head back.
6. Hold the bottle or dropper above your nostril and gently squeeze the correct number of drops into the nostril, taking care not to touch the nose with the bottle or dropper.
7. Keep your head tipped back for a few minutes to allow the drops to drain into the back of the nose.
8. Repeat this procedure for the other nostril if advised to do so by your doctor or pharmacist.
9. Replace the lid on the bottle.
10. Take care not to touch the tip of the bottle or dropper with your fingers. If the dropper is separate don't put it down on any surface.

8-How to use eye drope:
-Tilt the head back &look upward.
-Pull the lower eye lid out & put one drop into the space between lower lid & eye globe, without touching eye nor lid with the noozle.
-Close eye for 30 seconds.
9-How to use eye ointment:
-Look upward.
-Pull the lower eye lid & squeese a line of ointment 0.5 cm iside the space between lower lid & eye, without touching eye nor lid.
-Close eye for few miutes.take care from blurring of vision(not drive nor walking).
If eye drops & ointment are used at same time, use drops first,then after 5 minutes use ointment.

10-TDD:
Structure:
Backing layer: 1-increase hydration & skin temprature under the patch→++permeation of the drug through skin. 2- Maintain the drug within the patch.
Adhesive coat: keep the patch in place & protect from exessive sweat.
Drug reservoir.



A. Oral administration: drug release and absorption



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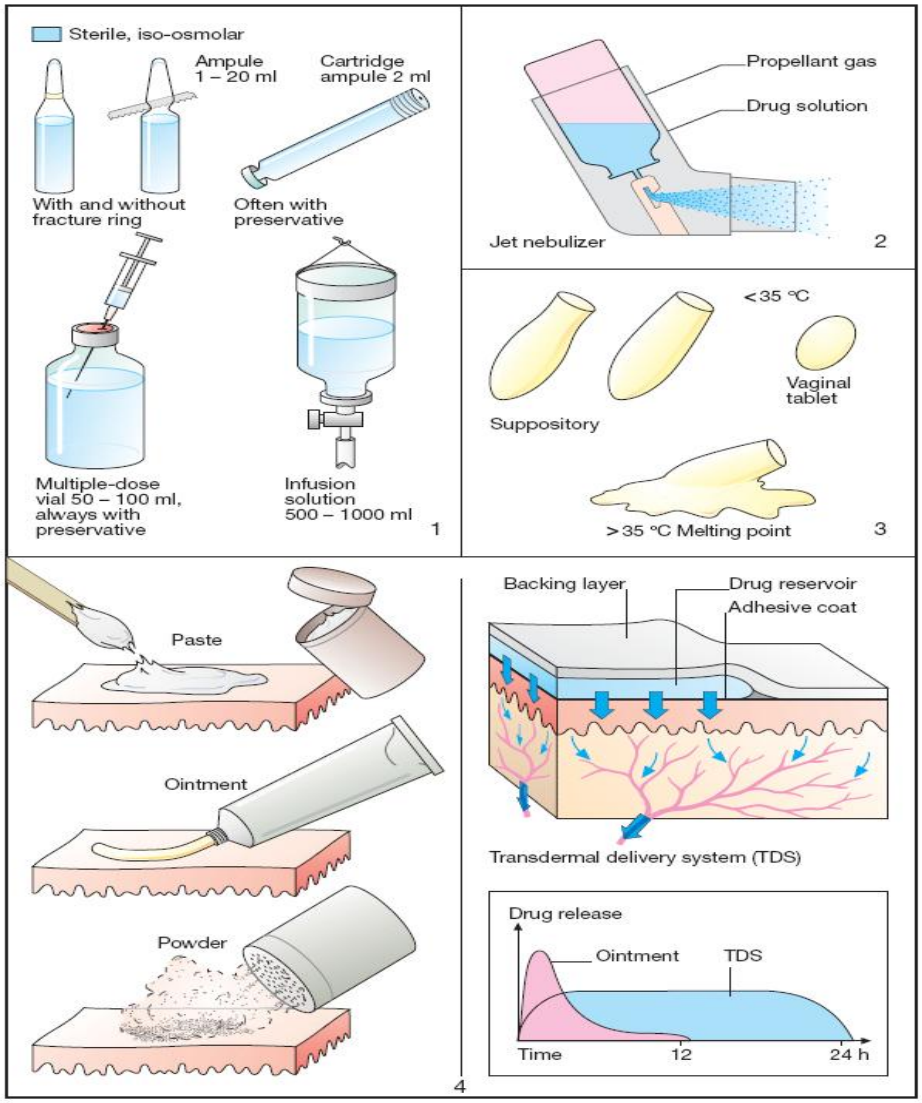
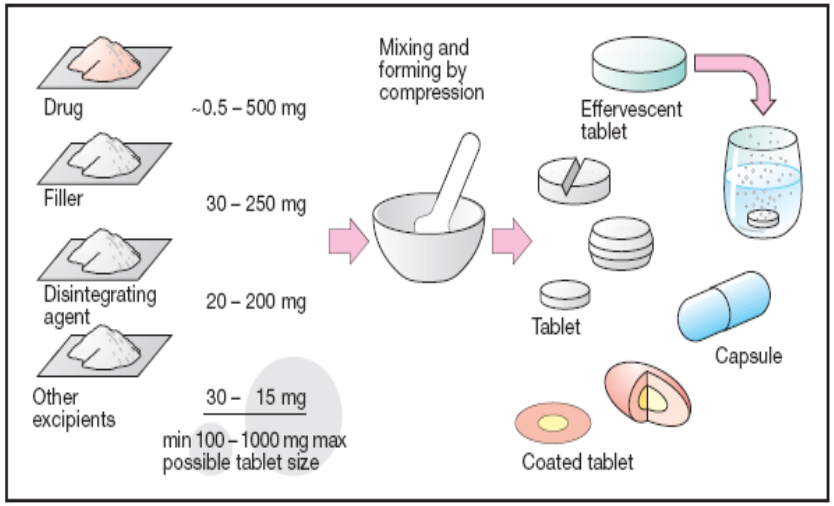


A. Preparations for parenteral (1), inhalational (2), rectal or vaginal (3), and percutaneous (4) application

A. Liquid preparations



B. Solid preparations for oral application