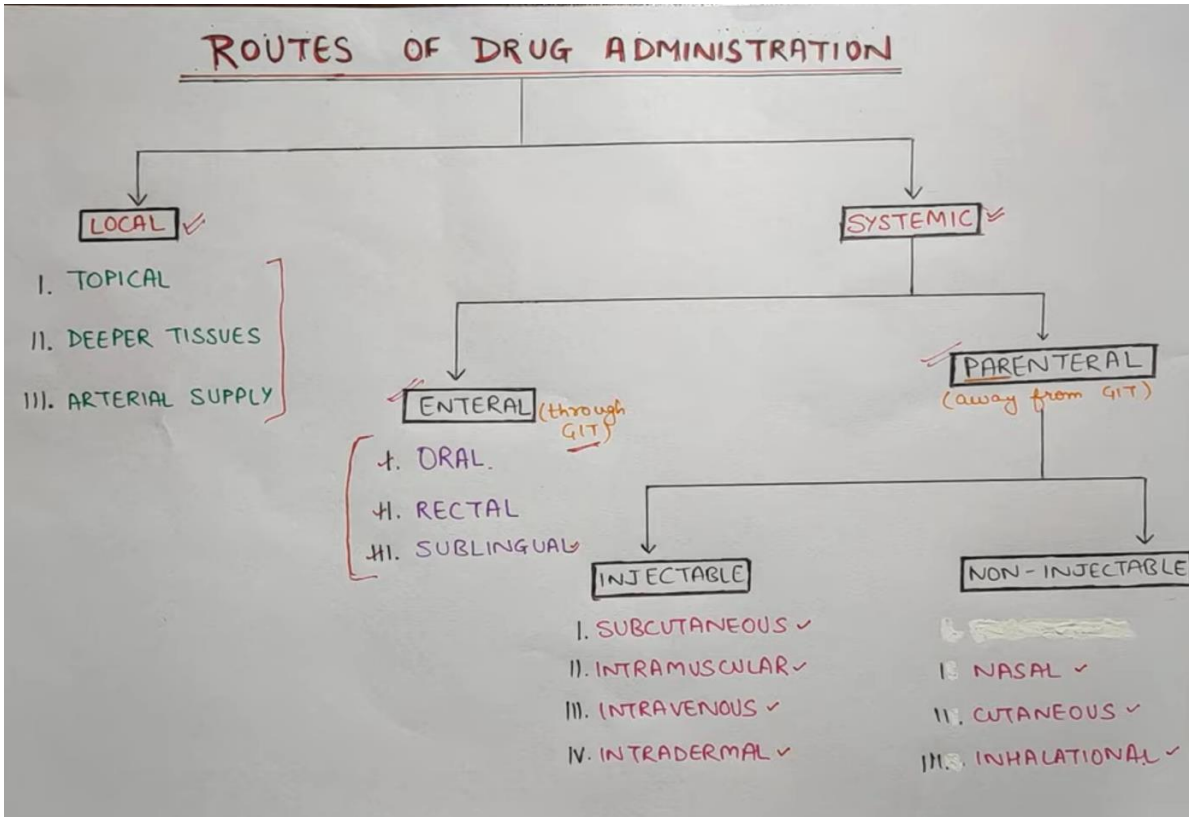
ROUTES OF ADMINISTRATION OF DRUGS

- A route of administration in pharmacology and toxicology is the path by which a drug, fluid, poison, or other substance is taken into the body.
- Most of the drugs can be administered by different routes.
- Drug and patient related factors determine the selection of routes for drug administration.

The factors are:

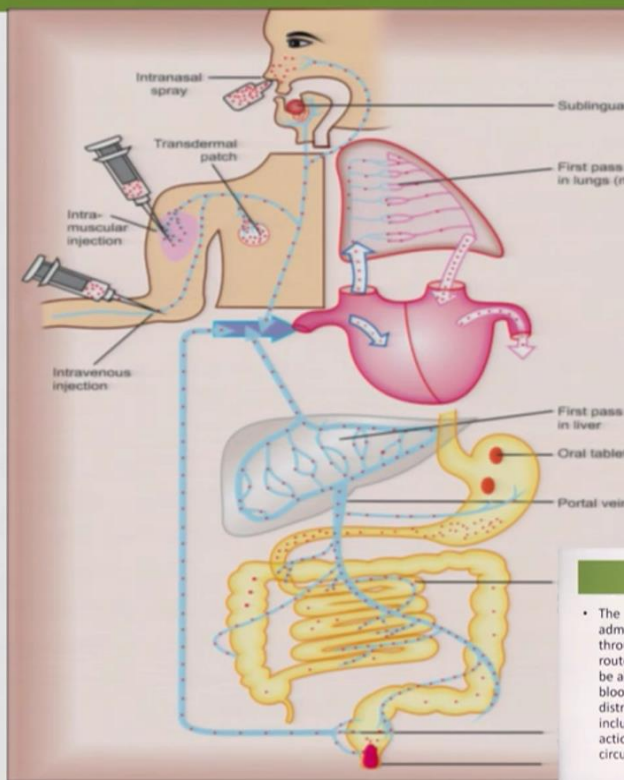
1. Characteristics of the drug.
2. Emergency/routine use.
3. Site of action of the drug—local or systemic.
4. Condition of the patient (unconscious, vomiting, diarrhoea).
5. Age of the patient.
6. Effect of gastric pH, digestive enzymes and first-pass metabolism.
7. Patient's/doctor's choice (sometimes).



Topical	Deeper tissues	Arterial supply
Drug is applied to the skin or mucous membrane at various sites for local action.	Deep areas can be approached by using a syringe and needle, but the drug should be in such a form that systemic absorption is slow,	Close intra-arterial injection
lotion, ointment, cream, powder, rinse, paints, drops, spray, lozengens, suppositories	intra-articular injection (hydrocortisone acetate in knee joint), infiltration around a nerve or intrathecal injection (lidocaine).	anticancer drugs can be infused in femoral or brachial arte localise the eff limb malignancies

SYSTEMIC ROUTES

- The drug administered through systemic routes is intended to be absorbed into the blood stream and distributed all over, including the site of action, through circulation.



SYSTEMIC ROUTES

[DRUG IS ABSORBED IN BLOOD STREAM & DISTRIBUTED ALL OVER, INCLUDING SITE OF ACTION THROUGH CIRCULATION]

① ORAL → OLDEST & COMMONEST MODE.

→ BOTH SOLID & LIQUID DOSAGE FORMS CAN BE GIVEN ORALLY.

ADVANTAGES :
- SAFER
- MORE CONVENIENT
- DOES NOT NEED ASSISTANCE
- NON-INVASIVE
- OFTEN PAINLESS
- CHEAPER

LIMITATIONS :
- ACTION IS SLOW ∴ NOT SUITABLE IN EMERGENCIES.
- MAY CAUSE NAUSEA & VOMITING
- CAN'T BE USED FOR UNCOOPERATIVE / UNCONSCIOUS / VOMITING PATIENT
- ABSORPTION OF DRUG IS VARIABLE (e.g. STREPTOMYCIN IS NOT ABSORBED)
- SOME ARE DESTROYED BY DIGESTIVE JUICES (e.g. INSULIN) OR IN LIVER (e.g. GTN; TESTOSTERONE)

FIRST PASS METABOLISM [redacted] OCCURS.
∴ BIOAVAILABILITY VARIES.

(i) ORAL → i) MOST COMMON MODE

ii) ABSORBED MAINLY THROUGH SMALL INTESTINE

iii) DRUG UNDERGOES FIRST PASS METABOLISM IN LIVER & INTESTINE.
↳ Reduces Bioavailability of drug.

ORAL DRUG → GIT → PORTAL VEIN → LIVER → IVC → HEART → BODY

100mg 70mg 50mg 50mg.

② RECTAL → CERTAIN IRRITANT & UNPLEASANT DRUGS CAN BE PUT INTO RECTUM AS SUPPOSITORIES OR RETENTION ENEMA FOR SYSTEMIC EFFECT.

→ CAN BE USED IN PATIENT HAVING RECURRENT VOMITING OR IS UNCONSCIOUS.

→ DRUG ABSORBED INTO EXTERNAL HAEMORRHOIDAL VEINS (about 50%) BYPASS LIVER BUT NOT THAT ABSORBED INTO INTERNAL HAEMORRHOIDAL VEINS.

→ DIAZEPAM SOLUTION & PARACETAMOL SUPPOSITORY ARE RAPIDLY ABSORBED FROM RECTUM IN CHILDREN

LIMITATIONS:
- ABSORPTION IS SLOW & IRREGULAR; OFTEN UNPREDICTABLE
- INCONVENIENT & EMBARASSING
- RECTAL INFLAMMATION FROM IRRITANT DRUGS

→ DIAZEPAM
INDOMETHACIN
PARACETAMOL
ERGOTAMINE
— Can be given RECTALLY.

③ SUBLINGUAL (BUCCAL) → TABLET / PELLET CONTAINING DRUG IS PLACED UNDER TONGUE OR CRUSHED IN THE MOUTH & SPREAD OVER BUCCAL MUCOSA

→ ONLY LIPID SOLUBLE & NON-IRRITATING DRUGS CAN BE ADMINISTERED BY THIS ROUTE.

→ ABSORPTION IS RELATIVELY RAPID.

→ ONE CAN SPIT THE DRUG AFTER DESIRED EFFECT IS OBTAINED.

ADVANTAGE: • LIVER IS BYPASSED
∴ DRUGS WITH HIGH FIRST PASS METABOLISM CAN BE ABSORBED DIRECTLY INTO SYSTEMIC CIRCULATION.

EXAMPLES: • GTN
• BUPRENORPHINE
• DESAMINO-OXYTOCIN

NON-INJECTABLE PARENTERAL DRUGS

(1) **NASAL** → MUCOUS MEMBRANE OF NOSE CAN READILY ABSORB MANY DRUGS.

→ DIGESTIVE JUICES & LIVER ARE BYPASSED

ONLY CERTAIN DRUGS CAN BE USED BY THIS ROUTE.

Examples :
- GnRH AGONISTS
- CALCITONIN
- DESMOPRESSIN

(2) **INHALATION** → VOLATILE LIQUIDS & GASES ARE GIVEN BY THIS ROUTE FOR SYSTEMIC ACTION

→ ABSORPTION TAKES PLACE FROM VAST SURFACE OF ALVEOLI
∴ ACTION IS VERY RAPID.

→ WHEN ADMINISTRATION IS DISCONTINUED DRUG DIFFUSES BACK & RAPIDLY ELIMINATED IN EXPIRED AIR.

→ IRRITANT VAPOURS CAUSES INFLAMMATION OF RESPIRATORY TRACT & INCREASE SECRETION

→ EXAMPLE : GENERAL ANAESTHETICS.

3. CUTANEOUS → HIGHLY LIPID SOLUBLE DRUGS GIVEN BY THIS ROUTE

→ DRUG IS APPLIED OVER SKIN FOR SLOW & PROLONGED ABSORPTION

→ LIVER IS BYPASSED.

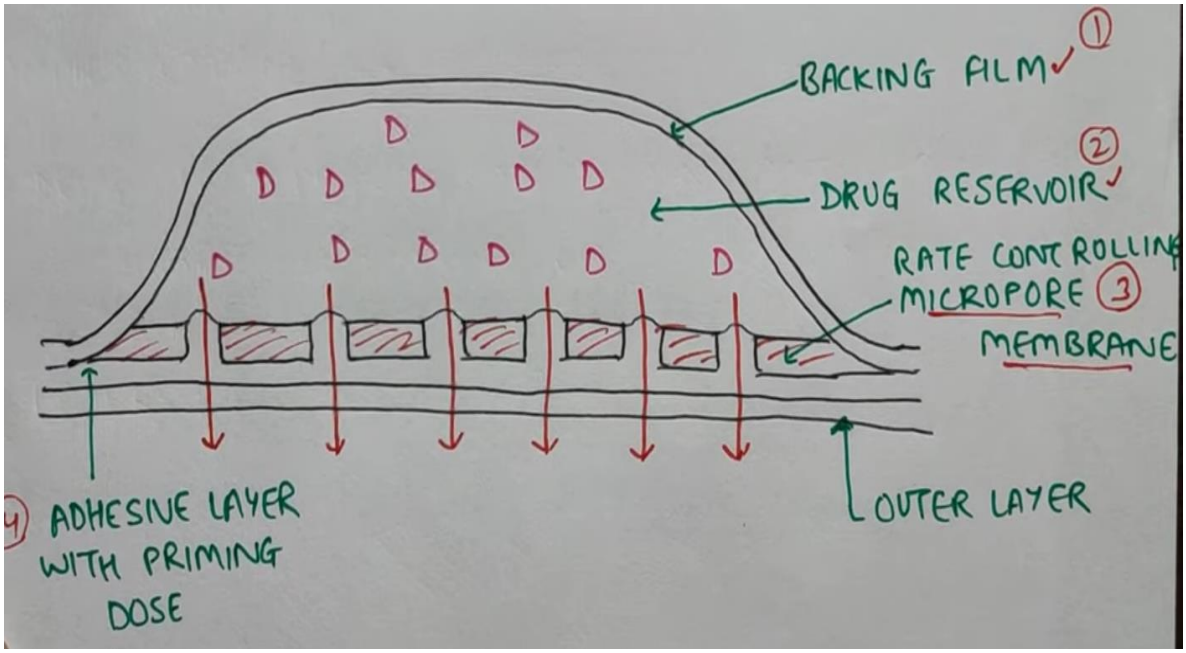
→ ABSORPTION OF DRUG CAN BE ENHANCED BY RUBBING THE PREPARATION.

TRANSDERMAL THERAPUTIC SYSTEM (TTS) :

I. DRUG IS ADMINISTERED IN THE FORM OF A PATCH OR OINTMENT THAT DELIVERS THE DRUG INTO CIRCULATION FOR SYSTEMIC EFFECT.

II. DRUG IS DELIVERED AT A CONSTANT RATE INTO SYSTEMIC CIRCULATION VIA STRATUM CORNEUM.

III. LAYERS :
- BACKING FILM
- DRUG RESERVOIR
- RATE CONTROLLING MICROPORE MEMBRANE.
- ADHESIVE LAYER [WITH PRIMING DOSE]
- OUTER LAYER [PEELED OFF BEFORE APPLYING ON SKIN]



IV. DRUG IS DELIVERED AT SKIN SURFACE BY DIFFUSION FOR PERCUTANEOUS ABSORPTION INTO CIRCULATION.

V. MICROPORE MEMBRANE IS SUCH THAT RATE OF DRUG DELIVERY TO SKIN SURFACE IS LESS THAN SLOWEST RATE OF ABSORPTION FROM SKIN.

∴ DRUG IS DELIVERED AT A CONSTANT & PREDICTABLE RATE IRRESPECTIVE OF SITE OF APPLICATION.

VI. COMMON SITES OF APPLICATION: CHEST, ABDOMEN, UPPER ARM, LOWER BACK, BUTTOCK OR MASTOID REGION

VII. EXAMPLES:
- SCOPOLAMINE PATCH FOR SIALORRHOEA & MOTION SICKNESS.
- GTN PATCH FOR PROPHYLAXIS OF ANGINA
- OESTROGEN PATCH FOR HRT.
- CLONIDINE PATCH FOR HYPERTENSION

VIII. ADVANTAGES :
- SELF-ADMINISTRATION POSSIBLE
- PATIENT COMPLIANCE IS BETTER
- SYSTEMIC SIDE EFFECTS ARE LESS
- FIRST PASS METABOLISM IS BYPASSED
- DURATION OF ACTION IS PROLONGED
- PROVIDES A CONSTANT PLASMA CONCENTRATION OF DRUG.

IX. DISADVANTAGES :
- EXPENSIVE
- LOCAL IRRITATION MAY CAUSE ITCHING
- PATCH MAY FALL OFF UNNOTICED

INJECTABLE
PARENTERAL ROUTES

SUBCUTANEOUS (S.C) → DRUG IS INJECTED INTO THE ~~SUB~~ SUBCUTANEOUS TISSUE OF THIGH, ABDOMEN, ARM.

EXAMPLE - ADRENALINE ; INSULIN etc.

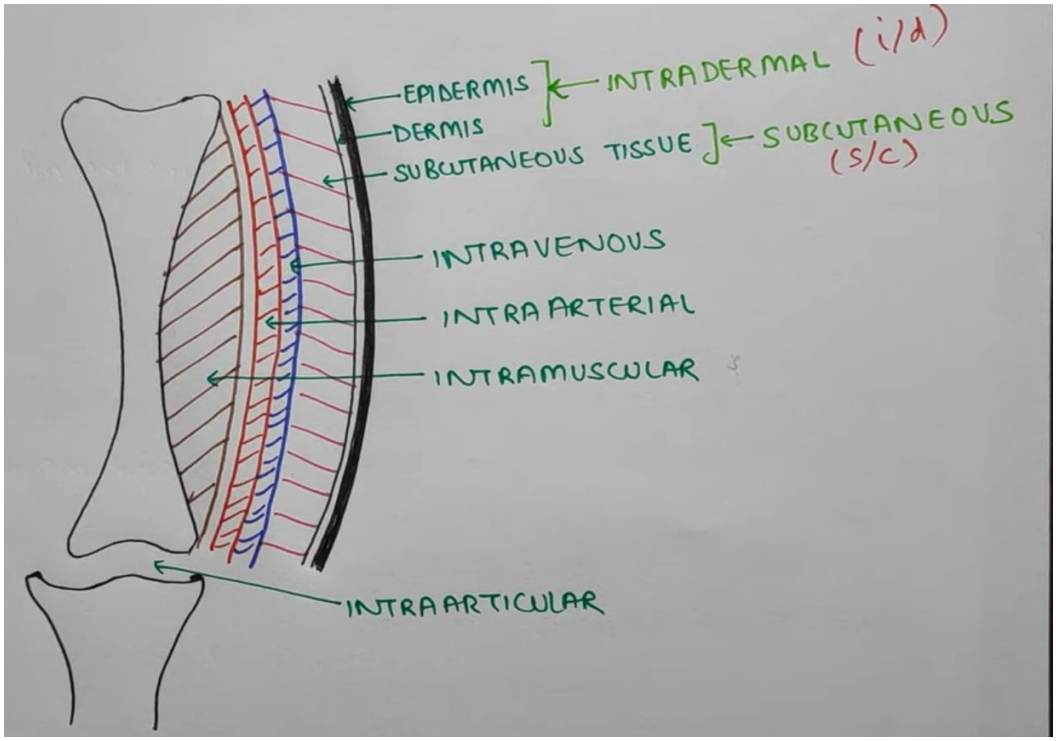
→ ADVANTAGES :
- SELF ADMINISTRATION IS POSSIBLE
- DEPOT PREPARATIONS CAN BE INSERTED INTO SUBCUTANEOUS TISSUE. FOR PROLONGED ACTION.
  eg. NORPLANT FOR CONTRACEPTION.

→ DISADVANTAGES :
- IRRITANT DRUGS CAN NOT BE INJECTED.
- DRUG ABSORPTION IS SLOW
  ∴ CAN'T BE GIVEN IN EMERGENCY.

INTRADERMAL → DRUG IS INJECTED INTO LAYERS OF SKIN RAISING A BLEB.

→ PAINFUL & A SMALL AMOUNT OF DRUG CAN BE ADMINISTERED.

Example, BCG VACCINATION.
&
DRUG SENSITIVITY TESTS.



INTRAVENOUS (i/v) → DRUG IS INJECTED AS A BOLUS OR INFUSED SLOWLY OVER HOURS INTO A SUPERFICIAL VEIN.

→ DRUG REACHES DIRECTLY INTO BLOOD STREAM & EFFECTS ARE PRODUCED IMMEDIATELY.
∴ USED IN EMERGENCY.

→ ADVANTAGES :
- 100 % BIOAVAILABILITY.
- HIGLY IRRITANT DRUGS CAN BE ADMINISTERED.
  ∵ THEY GET DILUTED IN BLOOD
- QUICK ONSET OF ACTION
- LARGE VOLUME OF FLUID CAN BE ADMINISTERED
  Eg. i/v FLUIDS IN SEVERE DEHYDRATION.
- CONSTANT PLASMA LEVEL OF DRUG CAN BE MAINTAINED BY i/v INFUSION.

→ DISADVANTAGES :
- LOCAL IRRITATION CAN CAUSE THROMBOPHLEBITIS.
- SELF ADMINISTRATION NOT POSSIBLE USUALLY.
- DEPOT PREPARATIONS CAN NOT BE GIVEN.
- EXTRAVASATION OF SOME DRUGS (Eg. Adrenaline) CAN CAUSE INJURY, NECROSIS & SLOUGHING OF TISSUES.

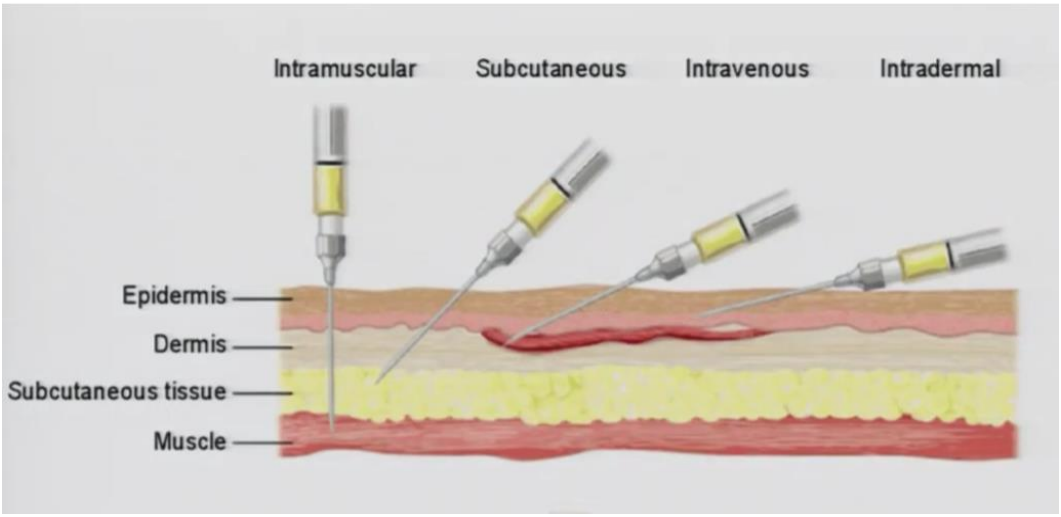
→ PRECAUTIONS :
- DRUG SHOULD BE INJECTED SLOWLY.
- BEFORE INJECTING, MAKE SURE THAT TIP OF NEEDLE IS IN VEIN.

INTRAMUSCULAR (i/m) → DRUGS ARE INJECTED INTO LARGE MUSCLES.

Eg. DELTOID, GLUTEUS MAXIMUS & VASTUS LATERALIS.

→ ADVANTAGES :
- MILD IRRITANTS CAN BE INJECTED ∵ MUSCLE IS LESS RICHLY SUPPLIED WITH SENSORY NERVES.
- LESS PAINFUL
- DEPOT INJECTIONS CAN BE GIVEN.

→ DISADVANTAGES :
- ABCESS FORMATION CAN OCCUR.
- SELF ADMINISTRATION NOT POSSIBLE ∵ DEEP PENETRATION IS NEEDED.
- SHOULD BE AVOIDED IN ANTICOAGULANT TREATED PATIENTS ∵ IT CAN PRODUCE LOCAL HEMATOMA.


Intramuscular
Subcutaneous
Intravenous
Intradermal
Epidermis
Dermis
Subcutaneous tissue
Muscle