

# Routes of Drug Administration

VPT: Unit I; Lecture-9  
(Dated 21.10.2020)



**Dr. Nirbhay Kumar**

Asstt. Professor & Head



Deptt. of Veterinary Pharmacology & Toxicology  
Bihar Veterinary College, Bihar Animal Sciences University, Patna

# Routes of Drug Administration

## Local (Topical) Routes

1. Skin

2. Mucous Membranes

## Systemic

1. Oral

2. Sublingual

3. Rectal

4. Cutaneous

5. Inhalational

6. Nasal

7. Parenteral

(i) S.C.

(ii) I.M.

(iii) I.V.

(iv) I.D.

(v) I.P.

# Factors governing choice of route of administration of drugs

- ✓ Physical and chemical properties of drugs (solid/ liquid/ gas; solubility, stability, pH, irritancy).
- ✓ Site of desired action - localized or generalized.
- ✓ Rate and extent of absorption of the drug from different routes.
- ✓ Effect of digestive juices and first pass metabolism.
- ✓ Rapidity of response desired (routine or emergency).
- ✓ Accuracy of dosage required (i.v. and inhalational can provide fine tuning).
- ✓ Condition of the patient (unconscious, vomiting) etc.

# LOCAL ROUTES

- ✓ Systemic absorption from these routes is minimal.
- ✓ Systemic side effect is minimized.
- ✓ Desired localized action.
- ✓ High concentrations are attained at the desired site without exposing the rest of the body.

# Topical Routes

(A) **Skin** : Ointment, cream, lotion, paste, powder, dressings, spray etc.

(B) **Mucous membranes** :

- ✓ **Mouth & Pharynx** : Paint, mouth wash, gargles etc.
- ✓ **Eye, ear, nose** : Drops, ointment, nasal spray etc.
- ✓ **GI tract** : As non-absorbable drugs given orally, e.g.  $Mg(OH)_2$ , sucralfate, neomycin etc.
- ✓ **Bronchi and lungs** : As inhalations, aerosols (nebulized solution or fine powder), e.g. salbutamol, cromolyn sodium.
- ✓ **Urethra** : As jellys e.g lidocaine; irrigating solutions.
- ✓ **Vagina** : As pessaries (vaginal suppositories), vaginal tablets, inserts, cream, powders, douches.
- ✓ **Anal canal** : As ointment, suppositories.

# SYSTEMIC ROUTES

- ✓ Intended to be absorbed into blood and distributed all over through systemic circulation.

# Oral (Enteral) Route

- ✓ Oldest and commonest mode of drug administration.
- ✓ Safer and more convenient.
- ✓ Medicament need not be sterile, so cheaper.
- ✓ Solid dosage forms: Powders, tablets, boluses, capsules
- ✓ Liquid dosage forms: Elixirs, syrups, emulsions, mixtures etc.

# Limitations of Oral Route

- Action is slower - not suitable for emergencies.
- Unpalatable drugs are difficult to administer. Drugs may be filled in capsules to circumvent this.
- May cause nausea (tendency to vomit) and vomiting.
- Can't be used for uncooperative, unconscious or vomiting patient.
- Certain drugs are not absorbed by oral route (e.g. streptomycin).
- Some drugs are destroyed by gastric juices (e.g. Penicillin G).



# Sublingual or buccal Route

- ✓ Only lipid soluble and non-irritating drugs can be used.
- ✓ Absorption - rapid.
- ✓ The chief advantage is that the **liver is bypassed** and drugs with high first pass effect can be absorbed into systemic circulation directly. For example, Nitroglycerine, isoprenaline, clonidine, methyltestosterone.

# Rectal Route

- Certain irritant and unpleasant drugs can be put into rectum as suppositories for systemic effect.
- This route is used when the patient is having recurrent vomiting.
- Route is inconvenient and embarrassing.
- Absorption is slower, irregular and often unpredictable.
- Rectal inflammation can result from irritant drugs.
- Examples: Aminophylline, endomethacin, paraldehyde, diazepam etc. are sometimes given rectally.

# Cutaneous Route

- Highly lipid soluble drugs can be applied over the skin for slow and prolonged absorption.
- Liver is also bypassed.
- Example: Ointments.

# Inhalational Route

- Absorption takes place from the vast surface of alveoli - action is very rapid.
- When administration is discontinued, the drug diffuses back and is rapidly eliminated in expired air. Thus, controlled administration is possible.
- Examples: Volatile liquids and gases (General anaesthetics).

# Nasal Route

- The mucous membrane of the nose can readily absorb many drugs; digestive juices and **liver** are **bypassed**.
- Only certain drugs like GnRH agonists and desmopressin applied as spray or nebulized solution have been used by this route.

# Parenteral Routes

- It refers to injection of drug **directly into tissue fluid** or **blood** without having to cross the intestinal mucosa.
- The limitations of oral administration are circumvented.
- **Action is faster and surer** (valuable in emergencies).
- **Liver is bypassed.**
- **Disadvantage:** The preparation **has to be sterilized**, so **costlier**. The technique is **invasive and painful**, so assistance of other persons is required.

## (i) Subcutaneous Route (s.c.)

- The drug is deposited into the **loose subcutaneous connective tissue** which is **richly supplied by nerves** (so, **irritant drugs can't be injected**) but is **less vascular (absorption is slower)**.
- **Repository (depot) preparations** - oily solutions (like **vaccines**) or aqueous suspensions can be injected for prolonged action.



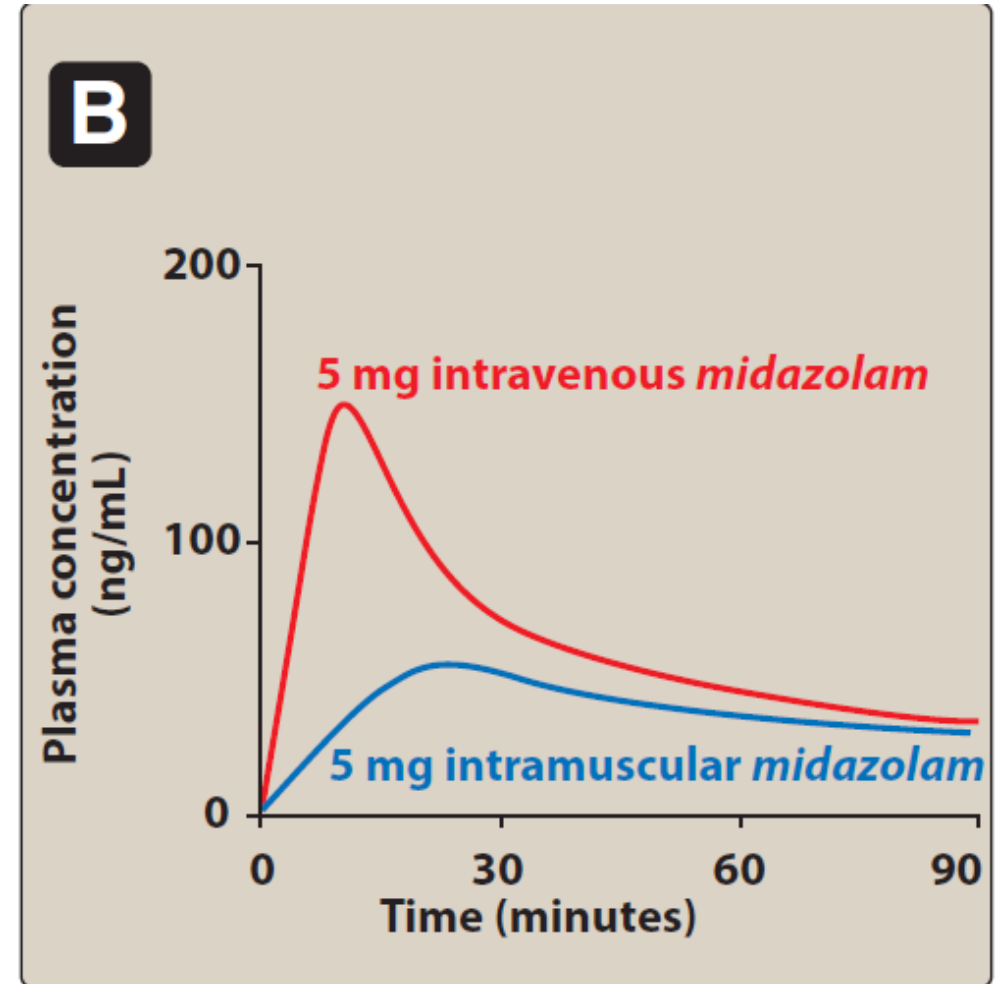
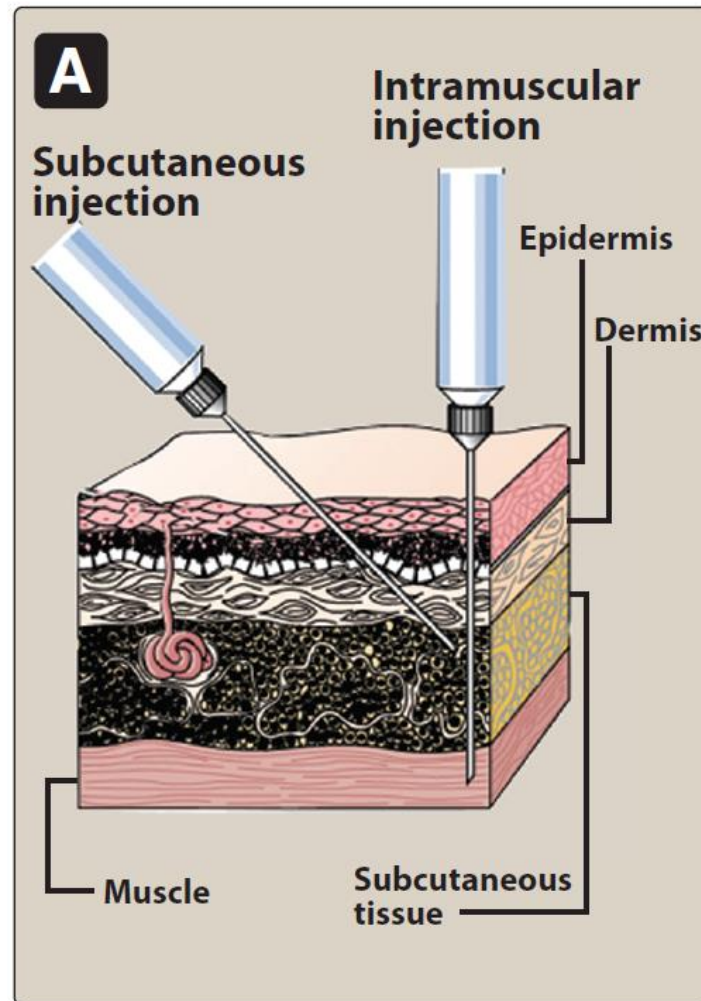
## (ii) Intramuscular Route (i.m.)

- The drug is **injected** in one of the **large skeletal muscles** (like **deltoid, triceps, gluteus maximus, rectus femoris** etc.).
- **Muscle is less richly supplied with sensory nerves (mild irritants can be injected) and more vascular (absorption is faster).**
- It is **less painful. Deep injection is needed.**
- **Depot preparations** can be injected by this route.



Fig.: [A] Schematic Representation of s.c. and i.m. injection  
[B] Plasma conc. Of a drug - Midazolam after i.v. and i.m. injection.

Source:  
Lippincott's  
Pharmacology  
(6<sup>th</sup> Edn.)



### (iii) Intravenous Route (i.v.)

- The drug is injected as a bolus or infused slowly after hours in one of the **superficial veins**.
- The drug directly reaches into the blood stream and **effects are produced immediately** (great value in emergencies).
- The **intima of veins is insensitive** and drug gets diluted with blood, therefore **even highly irritant drugs can be injected i.v.**, but hazards are - thrombophlebitis of the injected vein and necrosis of adjoining tissues if extravasation occurs.

## Intravenous Route (i.v.) contd...

- Only aqueous solutions are injected (not suspensions).
- Dose of the drug is smallest in this route and bioavailability is 100%.
- Response of the drug can be accurately measured.
- It is the most risky route - vital organs like heart, brain etc. get exposed to high concentrations of the drug.

## (iv) Intradermal Route

- The drug is injected **into the skin** by raising a bleb (e.g. BCG vaccine, sensitivity testing) or *scarring/ multiple puncture* of the epidermis through a drop of the drug (small pox vaccine) is done.
- This route is employed for **specific purposes only**.

## (v) Intraperitoneal Route

- This route is of importance in large animal practice for the administration of large volumes, because of great absorbing surface of the peritoneum and because the absorption rate is rapid.
- The injection is made via the sub-lumbar fossa, care being taken to avoid delivering the solution into an abdominal organ.
- The risk of causing peritoneal adhesions should also be borne in mind.

## (vi) Other Parenteral Routes

- Intrathoracic and intracardiac injections.
- Intrathecal injection.
- Epidural injection.
- Intra-articular injection.

# Order of absorption through various routes:

i.v. > inhalation > i.m. > i.p. > s.c. > oral



**Thank You**

