Routes of drug administration

Most drugs can be administered by a variety of routes. The choice of appropriate route in a given situation depends both on the drug as well as patient-related factors.

Factors governing choice of route:

? Physical and chemical properties of the drug (solid/liquid/gas; solubility, stability, ph, irritancy).
? Site of the desired action – localized and approachable or generalized and not approachable.
? Rate and extent of absorption of the drug from different routes.
? Effect of digestive juices and first-pass metabolism on the drug.
? The rapidity with which action is desired (emergency or routine treatment).
? Accuracy of the dose required (IV or inhalation can provide fine-tuning).
? Condition of the patient (unconscious, vomiting).

Routes are divided into:

1. Local routes
2. Systemic routes

Local routes

Local routes can only be used for localized lesions at accessible sites and for drugs whose systemic absorption from these sites are minimal or absent.

High concentrations are attained at the desired site without exposing the rest of the body. Systemic side effects or toxicity are consequently minimized.

Local routes include:

1. Topical – refers to external application of the drug to the surface for localized action. It is more convenient and encouraging to the patient. Drugs can be conveniently delivered to localized lesions on the skin, nasal mucosa, eyes, ear canal, anal canal, or vagina in form of lotion, ointment, cream, powder, paints, suppositories, or pessaries.

? Non- absorbable drugs given orally for action on g.i. mucosa (sucralfate, vancomycin),

? Inhalation of drugs for action on bronchi (salbutamol).

? Irrigating solutions/jelly (povidone-iodine, lidocaine)

2. Deeper tissues – certain deep areas can be approached by using a syringe and needle but the drug should be such that systemic absorption is slow e.g. intra-articular injection (hydrocortisone acetate or infiltration around a nerve.

3. Arterial supply – close intra-arterial injection is used for contrast media in angiography, anticancer drugs can be infused in the femoral or bronchial artery to localize the effect for limb malignancy.

Systemic routes

The drug is intended to be absorbed into the bloodstream and is distributed all over, including the site of action, through circulation.

1. Oral – oldest and commonest mode of drug administration.

Advantages

? Safer
? Convenient
? Does not need assistance
? Non-invasive
? Often painless
? Cheaper
? Medication does not need to be sterile.
? Both solid dosage forms (tablets, capsules, powders) and liquid dosage forms (elixirs, syrups, emulsion, mixtures) can be given orally.

Disadvantages

? The slower action of drugs – not suitable for emergencies.
? Unpalatable drugs (chloramphenicol) are difficult to administer. Drug administered in capsule form.
? May cause nausea and vomiting (emetine).
? Cannot be used in uncooperative / unconscious / vomiting patient.

? Variable and erratic absorption of certain drugs, certain drugs not absorbed (streptomycin). destruction of some drugs by digestive juices (penicillin G, insulin) or liver (GTN, testosterone, lidocaine).

2. Sublingual or buccal

? A tablet or pallet containing the drug is placed under the tongue or crushed in the mouth and spread over the buccal mucosa.
? Only lipid-soluble and non-irritating drugs can be administered.
? Absorption is relatively rapid – action can be produced within minutes.
? The liver is bypassed and drugs with high first-pass metabolism can be absorbed directly into the systemic circulation.
? Drugs given sublingually include GTN, desamino-oxytocin.

3. **Rectal**

? Certain irritant and unpleasant drugs can be put into the rectum as suppositories or retention enema for systemic effect.
? Can be used in a patient with recurrent vomiting or unconscious.
? Rather inconvenient and embarrassing and absorption slower, irregular and unpredictable, though diazepam solution is rapidly and dependably absorbed from the rectum in children.
? The drug is absorbed into the external haemorrhoidal veins (about 50% bypasses the liver), but not that absorbed into the internal hemorrhoidal veins.
? Rectal inflammation can result from irritant drugs.
? Diazepam, indomethacin, paraldehyde, ergotamine, and a few other drugs can be given rectally.

4. **Cutaneous**
? Highly lipid-soluble drugs can be applied over the skin for slow and prolonged absorption. The liver is bypassed.
? Absorption of the drug can be enhanced by rubbing the preparation or using an oily base.
? Examples include transdermal patches of GTN, fentanyl, nicotine, and estradiol.
? Most have been designed to last 1-7 days.
? Local irritation and erythema may occur but is generally mild and may be reduced rotation of the site of application.
? It avoids plasma concentration fluctuations and also bypasses the first-pass effect.
? Better patient compliance.

5. Inhalation
? Volatile liquids and gases are given by inhalation for systemic action e.g. general anesthetics.
? Absorption takes place from alveoli and action is very rapid.
? When administration is discontinued the drug diffuses back and is rapidly eliminated in expired air.

6. Nasal
The mucosal membrane can readily absorb many drugs; digestive juices and liver are bypassed.

Examples include desmopressin as a nasal spray or nebulized solution.

7. Parenteral (par – beyond; enteral – intestinal)

? Administration by injection takes the drug directly into the tissue's fluid or blood without having to cross the intestinal mucosa.

Advantages

? Overcomes limitations of oral administration.
? Faster and sure drug action.
? Can be used in unconscious, uncooperative, vomiting patient.
? Bypasses liver and digestive juices.

Disadvantages

? Preparation has to be sterile.
? Cost
? Painful
? Assistance by another person is needed, though self-injection is possible e.g. insulin.
? Chances of tissue injury.

i. Subcutaneous (s.c)

A drug injected into the loose subcutaneous tissue which is richly supplied by nerves (irritant drugs can not be administered)

? Absorption is slower than intramuscular injection.
? Only small volumes can be injected s.c.

ii. Intramuscular (i.m)

? A drug injected into one large skeletal muscle – deltoid, triceps, gluteus maximus.
? Self-injection is not possible but is less painful.

iii. Intravenous (i.v)

? A drug injected as a bolus or infused slowly over hours into one superficial vein.

Advantages

? The drug reaches directly into the bloodstream and action is produced immediately (useful in an emergency).
? Highly irritant drugs can be given.
? A small dose of a drug is required, bioavailability is 100%.
? Large volumes can be infused.

Disadvantages

? Only aqueous solutions can be given.