Routes of Drug Administration

Objectives

- Describe the pharmacokinetic implications of various Routes of Administration
- Understand the advantages and disadvantage of various Routes of Administration from a PK point of view

Routes of Administration

- Enteral
  - To do with Gastrointestinal (GI) tract
  - E.g. oral, buccal, rectal
- Parenteral
  - Not enteral
  - E.g. IV, IM, SC
- Other
  - E.g. topical, inhalation
- IV 'special'
  - No absorption step

Drug Administration

		Eye
Intramuscular		Nasal
Subcutaneous	Sampleable	Ear
Intravenous	Blood	Oral
Topical	Compartment	Intracardiac
Intrasynovial		Sublingual
Urethral		Rectal
		Vaginal

Oie, S. and Benet, L.Z., 1996 Chapter 5, Modern Pharmaceutics, 3rd., p 157

Oral Administration

- Advantages
  - Convenient - portable, painless, easy
  - Cheap - not sterile, compact
  - Variety - tablets capsules, fast, slow release
- Disadvantages
  - Maybe inefficient - high dose, low solubility
  - First-pass effect
  - Food Interaction
  - Local effect - GI flora
  - Unconscious patient - not able to swallow

First Pass Effect

General Circulation	Liver
Portal Circulation	Small and Large Intestine

First Pass Effect

Inferior Vena Cava
Hepatic Veins

Aortic Artery

Gall Bladder
Hepatic Portal Vein

Mesenteric Vein

Shargel L. and Yu, A.B.C., Applied Biopharmaceutics, 3rd. Ed., p 304

Buccal/Sublingual

- Held in mouth or under tongue
- Buccal - often harder - slower absorption
  - 4 hour disintegration (USP XX p 958)
- Sublingual - softer - faster release
  - 2 min disintegration (USP XX Nitroglycerin p552)
- Examples - nitroglycerin, steriods, nicotine (chewing gum)

Buccal/Sublingual

- Advantages
  - Avoid first pass effect
  - Rapid absorption
  - Drug stability
- Disadvantages
  - Inconvenience - advantages lost if swallowed
  - Small dose limit

Rectal

- By Suppository or Enema
  - E.g. aspirin, theophylline, chlorpromazine
- Advantages
  - By pass liver
  - Useful - children, non po
- Disadvantages
  - Erratic absorption
  - Not well accepted

Intravenous

- Injection into a peripheral vein over 1 to 2 minutes (bolus) or longer as an infusion
- Advantages
  - Rapid response, Total dose - larger doses by infusion, Veins relatively insensitive
- Disadvantages
  - Suitable vein, Rapid response - toxicity, Trained personnel, Expensive - sterility, solvent, transport

Subcutaneous

- Just under the skin
- Advantages
  - Can be given by the patient
  - Slow but generally complete absorption
    - Massage or heat, Vasoconstriction
- Disadvantages
  - Painful
  - Tissue damage from irritant drugs
  - Maximum of 2 ml injection

Intramuscular

- Advantages
  - Larger volume than SC
  - Depot or sustained effect is possible
- Disadvantages
  - Trained personnel
  - Site effects absorption - deltoid
  - Absorption may be erratic or incomplete

Inhalation

- Local effect - bronchodilator
- Systemic effect - general anaesthesia
- Advantages
  - By pass liver
  - Absorption of gases efficient and rapid
- Solids and liquids excluded if > 20 mincron and exhaled if < 0.5 micron

Topical

- Local effect - eye drops, antiseptic, sun-screen, callous removal
- Systemic effect - e.g. nitroglycerine ointment, scopolamine
- Toxicity from topical absorption
  - Burn patients
  - Children
  - Local areas of thin skin

Skin

Stratum Corneum

Hair

Dermis

Epidermis

Adipose Tissue

Nerve

Sweat Gland

Vein

Artery

Other ROA's

- Intra-nasal - small dose, avoid first pass
- Intra-arterial - cancer chemotherapy, localised delivery
- Intra-thecal - into the cerebrospinal fluid, avoid BBB

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