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

<table>
<thead>
<tr>
<th>Intramuscular</th>
<th>Subcutaneous</th>
<th>Intravenous</th>
<th>Topical</th>
<th>Intrasyovial</th>
<th>Urethral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye</td>
<td>Sampleable Blood</td>
<td>Oral</td>
<td>Intracardiac</td>
<td>Sublingual</td>
<td>Rectal</td>
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<tr>
<td>Nasal</td>
<td>Eye</td>
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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

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<tr>
<th>General Circulation</th>
<th>Liver</th>
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<tbody>
<tr>
<td>Portal Circulation</td>
<td>Small and Large Intestine</td>
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</tbody>
</table>
First Pass Effect

- Inferior Vena Cava
- Hepatic Veins
- Gall Bladder
- Hepatic Portal Vein
- Mesenteric Vein
- Aortic Artery

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, steroids, 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 micron 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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