CLASSIFICATION

SYSTEMIC

Enteral
- Oral
- Sublingual
- Rectal

Parenteral
- Inhalational
- Injections
- Transdermal
  - Intravenous
  - Intramuscular
  - Subcutaneous
  - Intra-arterial
  - Intra-articular
  - Intrathecal
  - Intradermal

LOCAL

- Skin topical
- Intranasal
- Ocular drops
- Mucosal-throat, vagina, mouth, ear
- Inhalational
- Transdermal
PARENTERAL ROUTES

Direct delivery of drug into systemic circulation without involvement of intestinal mucosa

Subcutaneous (S.C.) (into subcutaneous tissue)
Intramuscular (I.M.) (into skeletal muscle)
Intravenous (I.V.) (into veins)
Intradermal (I.D.) (into skin)
Intra-arterial (I.A.) (into arteries)
Intrathecal (I.T.) (into the spinal canal)
Intraosseous (I.O.) (into the bone marrow)
Intraperitoneal (I.P.) (into the peritoneal cavity)
Intra-articular (into the joint synovial fluids)
Intracardiac (into the heart)
Intracavernous injection (into the base of the penis)
A) Intradermal – injected into skin

B) **Subcutaneous** -
Absorption of drugs from the subcutaneous tissues

C) Intramuscular (IM) - drug injected into skeletal muscle

D) Intravascular (IV) - placing a drug directly into the blood stream
## Parenteral administration

### Advantages

- high bioavailability
- **Rapid action (emergency)**
- No first pass metabolism

**Suitable for**
- Vomiting & unconsciousness
- Irritant & Bad taste drugs
- No gastric irritation
- No food-drug interaction

**Dosage form:**
Vial or ampoule

### Disadvantages

- Infection
- Sterilization
- Invasive assistance require
- Pain
- Needs skill
- Anaphylaxis
- Expensive
INTRAVENOUS ROUTE

□ ADVANTAGES

IV is the most common parenteral route.

□ For drugs that are not absorbed orally.
□ Avoids first-pass metabolism by the liver.
□ IV delivery permits a rapid effect and a maximal degree of control over the circulating levels of the drug. Titration of dose with response.
□ Large quantities can be given, fairly pain free
□ Absorption phase is bypassed (100% bioavailability)

□ DISADVANTAGES

□ However, unlike drugs in the GI tract, those that are injected cannot be recalled by strategies such as emesis or by binding to activated charcoal.
□ IV injection may also induce hemolysis or cause other adverse reactions by the too-rapid delivery of high concentrations of drug to the plasma and tissues also vital organs like heart, brain etc.
□ Thrombophlebitis of vein and necrosis of adjoining tissue if extravasation occurs.
INTRAMUSULAR ROUTE

Large skeletal muscles (deltoid, triceps, gluteus maximus, rectus femoris)

ADVANTAGES
- Absorption reasonably uniform
- Rapid onset of action
- Mild irritants can be given
- First pass avoided
- Gastric factors can be avoided

DISADVANTAGES
- Only upto 10ml drug given
- Local pain and abscess
- Expensive
- Infection
- Nerve damage
- Local hematoma can occur in anticoagulant treated patient
SUBCUTANEOUS ROUTE

- Drug is deposited in loose subcutaneous tissue – rich nerve supply - irritant drugs cannot be injected
- Less vascular - slow absorption than i.m. route
- Avoid in shock patient – vasoconstriction
- Only Small volume can be injected
- SC injection minimizes the risks associated with intravascular injection
- Depot preparation can be injected- Dermojet, Pellet implantation, Sialistic and biodegradable implants

Intradermal Route

- Injected into skin raising bleb – BCG Vaccine, Sensitivity test
Intrathecal

- Injection into the spinal canal, more specifically into the subarachnoid space so that it reaches the cerebrospinal fluid (CSF) and is useful in spinal anaesthesia, chemotherapy, or pain management applications.

- The drug needs to be given this way to avoid the blood brain barrier.

- Difficult dose calculation.

- They cannot contain any preservative or other potentially harmful inactive ingredients.

For example, amphotericin B is used in treating Cryptococcal meningitis.
The difference between an epidural and intrathecal is that an epidural is a catheter that sits down next to the spinal sack that holds the cerebral spinal fluid.

- Mainly used for anaesthesia and temporary or prolonged relief from pain or inflammation.
Intraperitoneal

- Generally restricted to peritoneal dialysis and in laboratory animals.

**Advantages:**

- Larger absorptive surface area than IM / Subcutaneous
- Greater blood flow

**Disadvantages:**

- Drugs or vehicles may cause peritonitis
- Damage to organs by needles
- Injection into organs

Intra-articular

- Direct delivery to site of action. High concentrations can be produced in the joint.
- It may be difficult to hit the joint space with irritation of joint surfaces/capsule (chemical effects, biochemical/physiologic effects.)
**Intraosseous infusion (IO)** is the process of injecting directly into the marrow of a bone to provide a non-collapsible entry point into the systemic venous system. This technique is used to provide fluids and medication when intravenous access is not available or not feasible.

High efficacy of IO administration of emergency medications in patients needing resuscitation in whom establishing intravenous (IV) access is difficult.
Transdermal

- This route of administration achieves systemic effects by application of drugs to the skin, usually via a transdermal medicated adhesive patch.
- The rate of absorption can vary markedly, depending on the physical characteristics of the drug (lipid soluble) and skin at the site of application.
- Slow effect (prolonged drug action)
- This route is most often used for the sustained delivery of drugs, such as the antianginal drug nitroglycerin, the antiemetic scopolamine.
- Site – Upper arm, chest, abdomen, mastoid region
- First pass effect avoided
- Absorption- increase by oily base, occlusive dressing, rubbing preparation
Transdermal therapeutic system

Drug in solution or bound to a polymer is held in reservoir between occlusive backing film and rate controlling micropore membrane under surface of which is smeared with an adhesive impregnated with priming dose of drug. Adhesive layer protected with film which is peeled off just before application.

To provide smooth plasma concentration without fluctuations.

More convenient and patient compliance is better.
Topical application

Produce local effect to

- Skin (percutaneous) e.g. anti-inflammatory, anti-infective, allergy testing, topical local anestheisa
- Mucous membrane of respiratory tract (Inhalation) e.g. asthma
- Eye drops e.g. conjunctivitis
- Ear drops e.g. otitis externa
- Intranasal, e.g. decongestant nasal spray
SKIN - Topical

- Dermal - Oil or ointment for local action
- Antiseptic cream and lotion
- Sunscreen lotion and powders
Inhalation

- Inhalation provides the rapid delivery of a drug across the large surface area of the mucous membranes of the respiratory tract and pulmonary epithelium, producing an effect almost as rapidly as with IV injection.

- This route of administration is used for drugs that are gases (for example, some anesthetics) or those that can be dispersed in an aerosol.

- This route is particularly effective and convenient for patients with respiratory complaints (such as asthma, or chronic obstructive pulmonary disease) because the drug is delivered directly to the site of action and systemic side effects are minimized.

- Examples of drugs administered via this route include albuterol and corticosteroids, such as fluticasone.
Inhalation

Advantages

- Mucous membrane of respiratory system
- Rapid absorption (large surface area)
- Provide local action
- Minor systemic effect
- Low bioavailability
- Less side effects.
- No first pass effect

Dosage form: aerosol, nebulizer

Disadvantages

Only few drugs can be used
Nebulizer

Atomizer
Intranasal

- This route involves administration of drugs directly into the nose. Agents include nasal decongestants such as the anti-inflammatory corticosteroid.

- Desmopressin is administered intranasally in the treatment of diabetes insipidus; salmon calcitonin, a peptide hormone used in the treatment of osteoporosis, is also available as a nasal spray.

- The abused drug, cocaine, is generally taken by intranasal sniffing.
Endotracheal drug therapy

- Instillation of a drug solution directly into an endotracheal tube for absorption into the circulation via the alveoli—may be used during CPR when venous access is limited.

- Used during cardiopulmonary resuscitation (CPR)

- Drugs that may be administered by the endotracheal route include epinephrine, atropine sulfate, lidocaine hydrochloride, naloxone hydrochloride, and metaraminol bitartrate
No single method of drug administration is ideal for all drugs in all circumstances.