MOTTO AND VISION

- To impart evidence-based research-oriented medical education
- To provide the best possible patient care
- To inculcate the values of mutual respect and ethical practice of medicine

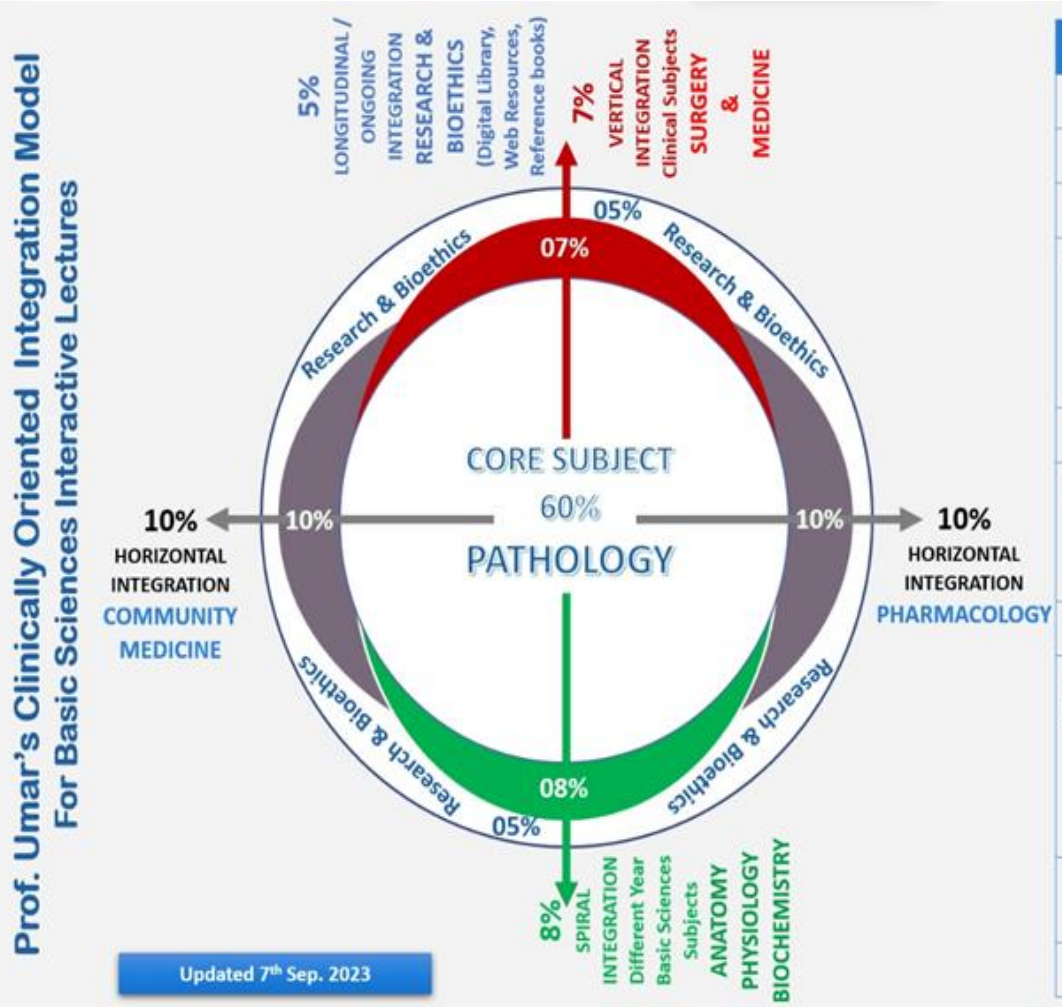
DOSAGE FORMS AND ROUTES OF ADMINISTRATION OF DRUGS

FOUNDATION MODULE

3rd year MBBS

SOURCE:

1) Bertram G. Katzung Basic & Clinical Pharmacology 15th Edition
2) Goodman and Gilman's The Pharmacological Basis of Therapeutics, 13th edition



Model 3rd Year Pathology LGIS (≈30 slides)	
Core Subject – 60% (≈ 18-20 slides)	
Pathology (≈ 18-20 slides)	
Horizontal Integration – 20% (≈ 5-6 slides)	
Same Year Subjects	• Pharmacology (10%) (≈ 2-3 slides) • Community Medicine (10%) (≈ 2-3 slides)
Vertical Integration – 07% (≈ 2-3 slides)	
Clinical Subjects	• Medicine (3-5%) (≈ 1-2 slides) • Surgery (3-5%) (≈ 1-2 slides)
Spiral Integration – 08% (≈ 2-3 slides)	
Different Year Basic Sciences Subjects	• Anatomy (1-3%) (≈ 1-2 slides) • Physiology (1-3%) (≈ 1-2 slides) • Biochemistry (1-3%) (≈ 1-2 slides)
Longitudinal / Ongoing Integration – 05% (≈ 1-2 slides)	
Research & Bioethics (≈ 1-2 slides)	

LEARNING OBJECTIVES

1. Enumerate different dosage forms
2. Discuss the utility of different dosage forms in different clinical situations
3. Enlist different routes of drug administration
4. Discuss the merits and demerits of each route of administration

DEFINITION

ROUTES OF DRUG ADMINISTRATION

The route of drug administration refers to “the method by which a drug is administered into the body”

DOSAGE FORM

The specific physical form in which a medication is presented for administration

ROUTES OF DRUG ADMINISTRATION

1. Enteral
2. Parenteral
3. Inhalational
4. Topical

ENTERAL ROUTE OF DRUG ADMINISTRATION

1. Oral
2. Sublingual
3. Rectal

Different dosage forms of drugs can be administered through each of the abovementioned routes

Oral route
General Characteristics

Advantages

1. Convenient route
2. Comparatively economical
3. Better patient compliance

Disadvantages

1. Absorption is slow and variable
2. Bioavailability is less due to 1st pass metabolism
3. Drug may cause GI irritation
4. Destruction of drugs by gastric enzymes
5. Cannot be administered to uncooperative or unconscious patients

Oral route
Dosage forms

Liquid preparations	Solid preparations
Mixture, Emulsion, Suspension, Droplet, linctus, Elixir, Syrup, Spirit, Tincture	Tablet, Capsule, Pill, Powder, Granule

Oral dosage forms
Liquid Preparations

Advantages

1. Easy to administer
2. The rate of absorption is faster as disintegration and dissolution time are not required
3. Suitable for pediatric patients and patients with dysphagia

Disadvantages

1. It is inconvenient to carry a drug in liquid form
2. Sometimes it is difficult to make the taste of a drug palatable in a mixture form

Oral dosage forms
Solid Forms

Advantages

1. Easy to carry
2. Can be given as enteric coated for drugs causing gastric irritation
3. Can be given as controlled release preparations to reduce numbers of daily dosing

Disadvantages

1. Absorption time is required as first disintegration and then dissolution occurs
2. Dose dumping can be a problem for the drugs that are given through controlled-release preparations
3. Cannot be given to pediatric or patients with dysphagia

Oral route
Activity

Activity:
Show different dosage forms like tablets, pills, capsules, syrup, suspension, etc. to the students and briefly discuss their advantages and disadvantages

Sublingual route
General Characteristics

Advantages

1. Rapid absorption of drugs from the sublingual and other blood vessels of the oral mucosa
2. More bioavailability as it bypasses the hepatic first-pass effect

Disadvantages

1. Cooperation and compliance of patient is required
2. Cannot be given to unconscious patient
3. Drugs can irritate oral mucosa
4. Suitable only for a few drugs

Rectal route
General Characteristics

Advantages

1. Route of choice in children for unpalatable and irritant drugs
2. Can be used for unconscious patients
3. More bioavailability as drugs bypass 50 % of the hepatic first-pass effect
4. Can be used for local effects

Disadvantages

1. Poor patient compliance
2. Unnatural and inconvenient to use
3. Drugs can irritate rectal mucosa

Rectal route
Dosage forms

Solid form	Liquid form
Suppository	Enema

Rectal route
Activity

Activity:
Show different dosage forms to the students and briefly discuss their advantages and disadvantages

PARENTERAL ROUTE OF DRUG ADMINISTRATION

1. Intra venous
2. Intramuscular
3. Subcutaneous
4. Intra-thecal
5. Intra-articular
6. Intradermal
7. Intra-arterial
8. Intra-cardiac
9. Intra pleural
10. Intraperitoneal
11. Intraosseous-into bone marrow

Intravenous route
General characteristics

Advantages

1. Action is rapid
2. Bioavailability is complete and rapid
3. Drug delivery is controlled
4. Certain irritating solutions can be given
5. The preferred route for emergency and unconscious patients

Disadvantages

1. Increased risk of adverse effects
2. Patency of vein is a pre-requisite
3. Pain and phlebitis might occur
4. Not suitable for oily and insoluble preparations
5. Expertise is required

Intramuscular route
General characteristics

Advantages

1. Absorption is rapid than subcutaneous route
2. Oily preparations can be given
3. Slow-releasing drugs can also be given by this route
4. Can be used in unconscious patients
5. First pass effect is avoided

Disadvantages

1. Using this route might cause nerve or vein damage
2. It might lead to abscess formation
3. Pain may accompany the injection
4. Less effective when blood flow is less e.g shock
5. Expertise are required
6. Asepsis must be maintained

Subcutaneous route
General characteristics

Advantages

1. Absorption is slow and constant
2. The duration for which the drug is absorbed can be altered.
3. Bioavailability is higher as compared to the oral route

Disadvantages

1. This might lead to abscess formation
2. Absorption is limited by blood flow
3. Large volumes of drugs cannot be given
4. Pain
5. Asepsis must be maintained

Subcutaneous route
Subcutaneous Implants

Advantages

1. It is a special form of subcutaneous administration

2. Absorption of drugs implanted under the skin in a solid pellet form occurs slowly over a period of weeks or months

3. some hormones (e.g., contraceptives) are administered effectively in this manner, can provide effective contraception for months.

Other parenteral routes
General characteristics

Intradermal route

i. Longest absorption time
ii. Used for sensitivity tests, like tuberculin and allergy tests

Intra arterial route

i. This method is used for chemotherapy in cases of malignant tumors and in angiography

Other parenteral routes
General characteristics

Intracardiac route

Injection can be applied to the left ventricle in case of cardiac arrest

Intra peritoneal route:

The intraperitoneal route may be used for peritoneal dialysis

Intra pleural route:

Penicillin may be injected in cases of lung empyema by intrapleural route

Other parenteral routes
General characteristics

Intra thecal route

i. Injection of drug into the subarachnoid space
ii. For lumbar puncture and spinal anaesthesia
iii. Need special precautions

Intra-articular route

Corticosteroids may be injected by this route in acute arthritis

Interosseous route

This route may be used for diagnostic or therapeutic purposes

Parenteral route
Dosage forms

Injections	Infusion
Vials Ampoules	Infusions

Parenteral route
Injections
Vials/Ampoules

Advantages

1. Easy to administer as a single shot
2. Separate for every patient

Disadvantages

1. There are chances of glass particle contamination
2. Mixing of ampoules as most have the same size and shape with chances of wrong administration of drugs

Parenteral route
Infusions

Advantages

1. For slow parenteral administration of drugs
2. For fluid replacement, large volume of fluids/drugs can be given
3. Infusion pumps are specialized time controlled delivery systems

Disadvantages

1. Associated pain, infection and phlebitis
2. Discomfort as patient had to bear it for longer period of time
3. Embolism and extravasation of fluid in neighboring tissues can be a problem

Parenteral route
Activity

Activity:

Show different dosage forms to the students and briefly discuss

1. How to use
2. Advantages and disadvantages

INHALATIONAL ROUTE
General characteristics

Advantages	Disadvantages
1. Immediate relief of symptoms	1. Special apparatus/ technique is required
2. Avoidance of hepatic first-pass metabolism	2. Irritation of the respiratory tract may occur
3. Effect of drug only at the desired site of action	3. Cooperation of the patient is required
	4. Airway must be patent

INHALATIONAL ROUTE
Dosage forms

Gases, Vapours, Steam inhalation, Nasal Spray, Nebulizer etc.

1. Aerosol Inhalation
2. Sprays

Inhalational route
Activity

Activity:

Show different dosage forms to the students and briefly discuss

1. How to use
2. Advantages and disadvantages.

TOPICAL ROUTE OF DRUG ADMINISTRATION

1. Enepidermic route
2. Epidermic route
3. Insufflation
4. Instillation
5. Irrigation or Douching
6. Painting or swabbing

Topical route

Advantages

1. Applied to a localized area of the body usually with lesser systemic side effects
2. Can be applied to unconscious /uncooperative patients
3. Can be used to get sustained drug levels over longer period of time systemically like Nitro-glycerine patch

Disadvantages

1. Sometimes systemic absorption with side effects can occur.
2. Ingredients can cause irritation to skin or mucous membrane

TOPICAL ROUTE
Dosage forms

1. Cream
2. Ointment (ophthalmic, dermal)
3. Lotion
4. Drops (ophthalmic, nasal, ear, etc.)
5. Passeries
6. Transdermal patches
7. Lozenges

Topical route
Activity

Activity:

Show different dosage forms to the students and briefly discuss

1. How to use
2. CLINICAL USES
3. Advantages and disadvantages.

Research Bioethics and Artificial Intelligence

1. Dougherty L, Lamb J, editors. Intravenous therapy in nursing practice. John Wiley & Sons; 2009 Mar 17.
2. He S, Leanse LG, Feng Y. Artificial intelligence and machine learning assisted drug delivery for effective treatment of infectious diseases. Advanced Drug Delivery Reviews. 2021 Nov 1;178:113922.

DOSAGE FORMS OF DRUGS

1. A dosage form that ensures titration of the drug into circulation is
   i. Infusion
   ii. Tablet
   iii. Syrup
   iv. Ointment

2. You are in an emergency department of a hospital. An unconscious patient is brought to you. Which dosage forms you would prefer to use for this patient.

ROUTES OF DRUG ADMINISTRATION

1. **Compared to the intramuscular route, enumerate the advantages of subcutaneous route of administration:**
2. **A patient is being administered a drug through a route that offers the most first-pass metabolism. Through which route is the drug most likely being administered?**
   i. Inhalation
   ii. Intramuscular
   iii. Oral
   iv. Rectal
   v. Sublingual