

Routes of Administration

OBJECTIVES/RATIONALE/OBJECTIVES

For pharmaceutical agents to be effective they must be absorbed. For absorption to take place the drug must be administered in the appropriate manner. The student will relate dosage forms to routes of administration and describe the advantages and disadvantages of each. The student will differentiate between solid, semi-solid, and liquid dosage forms, name forms in which drugs are manufactured, name routes of drug administration, describe the advantages and disadvantages of each administration of a drug, list the sites suitable for intramuscular injection, and define the special medical terms associated with intravenous administration of a drug.

TEKS: 121.25 1D, 5E

TAKS ELA 1, 3, 4, 5, 6

KEY POINTS

Routes of Administration PowerPoint Presentation

- I. Routes of Administration
 - A. appropriate administration route depends on
 - 1. the dosage form in which the drug is available
 - 2. the patient's age
 - 3. the patient's condition, e.g. level of consciousness, etc.
 - B. Each route of administration has distinct advantages and disadvantages. The same drug administered via a certain route
 - 1. may be therapeutic
 - 2. or the same drug may be
 - a. ineffective
 - b. harmful
 - c. sometimes even fatal
 - C. Some drugs are approved for use via more than one route and are manufactured in more than one dosage form appropriate for these routes, e.g. nitroglycerin
 - 1. sublingual tablets
 - 2. sublingual spray
 - 3. ointment for transdermal application
 - 4. intravenous solution for infusion
- II. oral – the most convenient and most commonly used route of administration
 - A. advantages
 - 1. examples are tablets, capsules, and liquids
 - 2. patients with dysphagia can usually swallow liquids without problems
 - 3. infants may be given drugs in liquid form mixed with some formula or juice in a nipple

4. unconscious patients can receive liquid medications via NG tube (nasogastric)
 5. oral route usually abbreviated as p.o. or PO (Latin *per os*, meaning *through the mouth*.)
- B. disadvantages
1. some drugs, especially certain penicillins, cannot be administered orally as they become inactivated by the stomach acid, therefore must be administered via intramuscular or intravenous injection.
 2. some drugs are so quickly metabolized by the liver after oral administration that as they pass through the portal circulation that therapeutic levels cannot be reached in the systemic circulation. These drugs must be administered via intravenous injection, e.g. lidocaine (Xylocaine) for cardiac dysrhythmias
 3. some drugs combine chemically with certain foods or beverages to form an insoluble complex or interact to produce adverse side effects, e.g. tetracycline cannot be taken with dairy products
- III. Parenteral - any route of administration other than the oral route
- A. intradermal – injection of a liquid into the dermis, just below the epidermis; when correctly administered the tip of the needle is still visible through the skin, e.g. Mantoux test for TB
- B. subcutaneous – injection of a liquid into the fatty layer of tissue just below the dermis of the skin but above the muscle layer
1. slower absorption of the drug because only few blood vessels in this layer as compared to intramuscular injection, e.g. insulin, heparin, allergy shots
 2. no official abbreviation but commonly accepted are: s.q., SQ, subQ, s.c., S.C., or subcu
- C. intramuscular – injection of liquid into the belly (area of greatest mass) of a large muscle
1. large muscles well supplied with blood vessels
 2. provides for more rapid absorption than via subcutaneous injection
 3. only five intramuscular injection sites that allow for administration with lowest risk of damage to adjacent nerves and blood vessels
 - a. deltoid – located on upper arm, lateral aspect
 - b. vastus lateralis – located on mid thigh, lateral aspect
 - c. rectus femoris – located on mid thigh, anterior aspect
 - d. . ventrogluteal – located on the side of the hip over gluteus muscle between anterior and superior spines of the iliac crest
 - e. dorsogluteal – located over gluteus minimus and edge of gluteus maximus muscles in upper outer quadrant
 4. some drugs are not water soluble and would precipitate out in muscular tissue, therefore are not acceptable to be administered intramuscularly, e.g. Valium, Librium
- D. intravenous – injection of drug directly into the vein
1. therapeutic effect can be seen immediately

2. drug does not need to be absorbed
 3. examples
 - a. Pantothal for induction of general anesthesia
 - b. Valium for control of continuous epileptic seizures
 - c. chemotherapy drugs for cancer treatment
 - d. antibiotics in high dosages
 4. i.v. or IV injection can be accomplished in three ways
 - a. I.V. push - the administration of a drug bolus by injecting a single dose of drug directly into the vein or through a port (rubber stopper) into an existing intravenous line in a very short time
 - b. I.V. drip - mixing the drug with fluid in an I.V. bag or bottle to be administered continuously over several hours
 - c. I.V. piggyback – mixing the drug in a very small I.V. bag or bottle connected through tubing to a port in the existing primary I.V
- E. sublingual – the drug, usually in tablet form, is placed under the tongue and allowed to dissolve slowly.
1. the tablet is NOT swallowed.
 2. the drug is absorbed quickly through oral mucous membranes into the large blood vessels under the tongue.
 3. sublingual application provides a faster therapeutic effect than the oral route, e.g. nitroglycerin tablets and spray for angina.
- F. rectal – reserved for certain clinical situations, such as a vomiting patient and medication not available in injectable form, e.g. Tylenol.
1. preferred route when drugs are administered to relieve constipation or hemorrhoids
 2. absorption via rectal route slow and often unpredictable in effectiveness
- G. vaginal – used to treat vaginal infections and vaginitis with creams and suppositories, e.g. Monistat suppositories, Premarin vaginal cream; also route of administration for vaginal contraceptive foams and gels
- H. topical – applied directly to the skin or the mucous membranes of the eye, ear, nose, or mouth
- effect usually local, not systemic, e.g. bacitracin antibiotic ointment, Sudafed nasal decongestant, Timoptic eye drops
- I. transdermal – applied to the skin via physical delivery through a porous membrane, e.g. nitroglycerin transdermal patch
1. therapeutic effects felt systemically
 2. usually releases drug slowly over time, providing sustained therapeutic blood levels
- J. inhalation – administration involves inhaling of a drug in gas or liquid form; drug is absorbed through alveoli of the lungs, e.g. nitrous oxide for general anesthesia, Proventil (albuterol) bronchodilator

ACTIVITIES

- I. Identify sample Pharmaceutical Agents as to dosage form and prescribe the correct route of administration for each.
- II. Write and perform a skit of a dosage form and its route of administration: “The Journey of a Pharmaceutical Agent”.
- III. Design posters depicting various routes of administration or produce a three-dimensional model with proper labeling

MATERIALS

Drug references, e.g. PDR, etc.

ROUTES of DRUG ADMINISTRATION

ASSESSMENT

Performance of skit

Project Rubric

ACCOMMODATIONS

For reinforcement, the student will design a comparative chart listing dosage forms, their appropriate route of administration, advantages and disadvantages of each, and examples of drugs for each.

For enrichment, the student will develop a teaching video demonstrating appropriate methods of pharmaceutical agent administration for the different routes of administration.

REFLECTIONS

ROUTES of DRUG ADMINISTRATION

ROUTE	APPROXIMATE ONSET OF ACTION	INDICATIONS	EXAMPLES
oral (PO, p.o.)	30 - 60 minutes	whenever possible, safest and most convenient route	most medications, e.g. analgesics, sedatives, hypnotics, antibiotics
sublingual (s.l.)	several minutes	when rapid effect is desired	NTG (nitroglycerin) in angina pectoris
buccal (bucc.)	several minutes	convenient dosage form for certain drugs; may be used in unconscious patients	androgenic drugs
rectal (p.r.)	15 - 30 minutes	when patients are unable to take oral medications and parenteral route is not indicated, also for local effect	analgesics, antiemetics, laxatives
transdermal	30 - 60 minutes	convenient dosage form, provides continuous absorption and systemic effects over extended time (hours, days, etc.)	nitroglycerin, estrogen, morphine
subcutaneous (sq, s.c., subq., subcu)	several minutes	for drugs that are inactivated in gastrointestinal tract	insulin
intramuscular (i.m., IM)	several minutes	for drugs with poor oral absorption, when high blood levels are required, when rapid effect is desired	narcotic analgesics antibiotics

intravenous (i.v., IV)	within 1 minute	in emergency situations, when immediate effect is desired, when large volumes need to be administered, e.g. infusion	IV fluids nutrient supplementation antibiotics resuscitative drugs
intraarterial (i.a.)	within 1 minute	for local effects within specific target organ	cancer drugs
intrathecal	several minutes	for local effects within the spinal cord	spinal anesthesia
inhalation	within 1 minute	for local effects within respiratory tract	antiasthmatics bronchodilators
topical	within 1 hour	for local effects on skin and mucous membrane of eye, ear, nose, mouth	creams, ointments, sprays, tinctures, lozenges
vaginal	15 - 30 minutes	for local effect	creams, foams, suppositories