

Course

Practicum in Health Science

Unit I

Preparation for Practicum

Essential Question

Why do healthcare workers need to know the route of administration of different medications?

TEKS

130.205 (c)
(c)(6)(A)
(c)(1)(A)
(c)(1)(B)
(c)(1)(C)
(c)(2)(A)

Prior Student Learning

none

Estimated time

2-4 hours

Rationale

For pharmaceutical agents to be effective they must be absorbed. For absorption to take place the drug must be administered in the appropriate manner.

Objectives

Upon completion of this lesson, the student will be able to:

- Relate dosage forms to routes of administration and describe the advantages and disadvantages of each
- 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
- Define the special medical terms associated with intravenous administration of a drug

Engage

A physician has standing orders for emergency medication for a patient in critical condition. He/she is intubated and has several peripheral IV's. If the patient codes, what would be the **fastest way/route** to give epinephrine?

Answers may include – 1) endotracheal tube, 2) IV, 3) injection intramuscular 4) intracardiac -- this route should only be used if there is insufficient time to establish an IV route and should only be administered by personnel well trained in this technique.

Key Points

- I. Routes of Administration
 - A. Appropriate administration route depends on
 1. the available dosage form of the drug
 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 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. Pentothal 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 I.V. 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
 - 1. 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

Activity

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

Assessment

Performance of skit

Project Rubric

Materials

Containers for Samples of OTC meds for students to identify dosage forms and routes

Drug references, e.g., PDR, etc.

Routes of Administration Worksheet

Accommodations for Learning Differences

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.

National and State Education Standards

National Health Care Foundation Standards

Foundation Standard 3: Systems

Healthcare professionals will understand how their role fits into their department, their organization and the overall healthcare environment. They will identify how key systems affect services they perform and quality of care.

Accountability Criteria

3.1 Healthcare Delivery Systems

3.11 Understand the healthcare delivery system (public, private, government, and non-profit).

3.13 Describe the responsibilities of consumers within the healthcare system.

3.14 Explain the impact of emerging issues such as technology, epidemiology, bioethics, and socioeconomics on healthcare delivery systems.

Foundation Standard 7: Safety Practices

Healthcare professionals will understand the existing and potential hazards to clients, co-workers, and self. They will prevent injury or illness through safe work practices and follow health and safety policies and procedures.

Accountability Criteria

7.3 Environmental Safety

7.31 Apply safety techniques in the work environment

TEKS

§130.205(c)(1)(A) interpret data from various sources in formulating conclusions;

§130.205(c) (1)(B) compile information from a variety of sources to create a technical report;

§130.205(c) (1)(C) plan, prepare, and deliver a presentation;

§130.205(c) (2)(A) accurately describe and report information, according to facility policy, observations, and procedures;

§130.205(c) (6)(A) integrate regulatory standards such as standard precautions and safe patient handling;

College and Career Readiness Standards

English Language Arts

I. Writing

2. Generate ideas and gather information relevant to the topic and purpose, keeping careful records of outside sources.

3. Evaluate relevance, quality, sufficiency, and depth of preliminary ideas and information, organize material generated, and formulate a thesis.

III. Speaking

A. Understand the elements of communication both in informal group discussions and formal presentations (e.g., accuracy, relevance, rhetorical

features, organization of information).

1. Understand how style and content of spoken language varies in different contexts and influences the listener's understanding.

2. Adjust presentation (delivery, vocabulary, length) to particular audiences and purposes

B. Develop effective speaking styles for both group and one-on-one situations.

1. Participate actively and effectively in one-on-one oral communication situations.

2. Participate actively and effectively in group discussions.

3. Plan and deliver focused and coherent presentations that convey clear and distinct perspectives and demonstrate solid reasoning.

IV. Listening

A. Apply listening skills as an individual and as a member of a group in a variety of settings (e.g., lectures, discussions, conversations, team projects, presentations, interviews).

1. Analyze and evaluate the effectiveness of a public presentation.

2. Interpret a speaker's message; identify the position taken and the evidence in support of that position.

3. Use a variety of strategies to enhance listening comprehension (e.g., focus attention on message, monitor message for clarity and understanding, provide verbal and nonverbal feedback, note cues such as change of pace or particular words that indicate a new point is about to be made, select and organize key information).

Cross Disciplinary Standards

I. Key Cognitive Skills

D. Academic behaviors

1. Self-monitor learning needs and seek assistance when needed.

2. Use study habits necessary to manage academic pursuits and requirements.

3. Strive for accuracy and precision.

4. Persevere to complete and master tasks.

E. Work habits

1. Work independently.

2. Work collaboratively.

ROUTES of DRUG ADMINISTRATION

ROUTE	APPROXIMATE ONSET OF ACTION	INDICATIONS	EXAMPLES
oral (PO, p.o.)		whenever possible, safest and most convenient route	most medications, e.g. analgesics, sedatives, hypnotics, antibiotics
	several minutes		NTG (nitroglycerin) in angina pectoris
buccal (bucc.)			androgenic drugs
rectal (p.r.)		when patients are unable to take oral medications and parenteral route is not indicated, also for local effect	
		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 with poor oral absorption, when high blood levels are required, when rapid effect is desired	narcotic analgesics antibiotics
intravenous (i.v., I.V.)			I.V. fluids nutrient supplementation antibiotics resuscitative drugs

intraarterial (i.a.)		for local effects within specific target organ	
	several minutes		spinal anesthesia
inhalation		for local effects within respiratory tract	
	within 1 hour		creams, ointments, sprays, tinctures, lozenges
vaginal			creams, foams, suppositories

Key - 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	cancer drugs

		target organ	
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

Project Rubric

Student: _____

Date: _____

Scoring criteria	4. Excellent	3. Good	2. Needs Some Improvement	1. Needs Much Improvement	N/A
Clearly/effectively communicates the main idea or theme.					
Reflects application of critical thinking.					
Information clearly provided in an organized and thoughtful manner.					
Strong examples used to describe the theme or objective.					
Illustrations follow a logical reasoning.					
Each image and font size is legible to entire audience.					
No spelling, grammatical or punctuation errors.					

NOTE: N/A represents a response to the performance which is "not appropriate."