

Clinical Pharmacology Lesson IV

OBJECTIVES/RATIONALE

Veterinarians prescribe drugs as a means of preventing, diagnosing, or treating diseases in animals. The student will identify pharmaceuticals used in animal health care.

TEKS 121.5 1A, 1B, 1D, 3B, 7A

TAKS ELA 1, 3, 4, 5, 6
Mathematics 1, 2, 3, 8, 9, 10
Science 2

KEY POINTS

- I. Routes of Administration
 - A. Oral Administration – swallowing a tablet or capsule
 - 1. Methods
 - a. per os (by mouth)
 - b. enteral administration (by way of the intestine)
 - 2. Common forms
 - a. Tablets
 - b. Capsules
 - c. Liquids
 - d. Pastes
 - e. Food additives
 - f. Granules
 - g. Powders
 - 3. Advantages
 - a. Safe
 - b. Convenient
 - c. cost effective
 - d. Most drugs are readily absorbed in the stomach or small intestine
 - 4. Disadvantages
 - a. Dosing – absorption within the gut can vary from animal to animal depending on diet and disease state, thus making accurate dosing difficult
 - b. They may not take – many animals are not receptive to oral drugs due to the odor or taste
 - c. High Anxiety – oral administration can place undue stress on some animals and owners (owner compliance is very important)
 - d. Dosage size – oral administration requires larger doses than injection
 - B. Parenteral Administration – drugs are introduced without passing through the intestines and having to undergo digestion
 - 1. Injections
 - a. Intravenous (IV) – administered directly into the vein via a needle or indwelling catheter

- (1) Disadvantages
 - (a) Skill in locating veins- the person giving the drug must have the knowledge and skill to locate and inject into a vein
 - (b) Irritations – some drugs can be very irritating to the tissues if accidentally given perivascularly (outside of the vein)
 - (c) Length of effect – Medications given through an IV have a shorter duration of effect than those given via other routes
 - (d) Risky – some drugs, if accidentally given intra-articularly (IA), can lead to almost instant collapse or even death.
- b. Intramuscular (IM) – administered via needle into the muscle
 - (1) Have a slower onset to effect than IV drugs
 - (2) Faster than subcutaneous injections
 - (3) Can cause swelling and soreness in the muscle
 - (4) Frequent IM injections can cause animals to become needle shy
- c. Subcutaneous (SC) – administered beneath the skin
 - (1) Slower to onset and longer lasting than IM or IV injected medications
- C. Topical – application of drugs to the skin or mucous membranes
 - 1. Forms
 - a. Lotions
 - b. Sprays
 - c. Solutions
 - d. Ointments
 - e. Creams
 - 2. Easily administered and generally cause low stress for the animal
- II. Prescriptions and Drug Dispensing – Veterinary technicians may fill prescriptions and educate clients on the use of medications – any medication leaving clinic must have correct label
 - A. Essential Parts of a Prescription
 - 1. Heading
 - a. Name and address of doctor
 - b. Date issued
 - c. Name and address of client
 - d. Species of animal
 - 2. Superscription
 - a. Recipe (Rx)
 - 3. Inscription
 - a. Name of drugs and amounts
 - 4. Label (sig)
 - a. Direction to client (what the pharmacist puts on the label)
 - 5. Subscription
 - a. Direction to pharmacist (how to prepare)
 - B. Safety alert
 - 1. Females – if chance of pregnancy, alert supervisor – special cautions need to be used when dealing with
 - a. Steroids
 - b. Hormonal products

III. Drug Classification

- A. Analgesics – drugs that act upon the CNS to relieve pain and raise the pain threshold
 - 1. Narcotics
 - a. Morphine
 - b. Codeine
 - 2. Non-narcotic analgesics
 - a. Xylazine (Rompum)
 - b. Phenylbutazone (Bute)
- B. Antacids – drugs that counteract stomach acid
- C. Anesthetics – drugs that create an absence of sensation
 - 1. local anesthetics – the patient stays awake
 - 2. general anesthetics – the patient is rendered unconscious
- D. Anticonvulsants – drugs that inhibit seizures (phenobarbital and diazepam)
- E. Antibiotics – drugs created by microorganisms that kill or inhibit the growth of other microorganisms (penicillin and tetracycline)
- F. Antidiarrheal agents – drugs used to counteract diarrhea (loperamide and bismuth salicylate)
- G. Antiemetics – drugs that relieve vomiting (metoclopramide and haloperidol)
- H. Antifungals – drugs that destroy or inhibit the growth of fungi (miconazole and benzoic acid)
- I. Anthelmintics – drugs that are destructive to internal parasites (ivermectin and pyrantal)
- J. Anti-inflammatories – drugs that reduce inflammation (swelling) caused by infectious agents, trauma, surgical procedures, or musculoskeletal disease
 - 1. corticosteroids (hormones)
 - a. prednisolone
 - b. dexamethazone
 - 2. nonsteroidal anti-inflammatories (NSAID)
 - a. phenylbutazone
 - b. flunixin (Banamine)
- K. Antipyretics – drugs that relieve fever (aspirin and acetaminophen)
- L. Antiseptics – drugs applied to the skin to destroy bacterial and other organisms (Hydrogen peroxide and iodine)
- M. Cathartics – or laxatives are drugs that increase bowel motility or loosen stools (psyllium and emodin)
- N. Diuretics – drugs that increase the production of urine (Mannitol and furosemide)
- O. Emetics – drugs used to induce vomiting (ipecac syrup)
- P. Stimulants – drugs that excite the functional activity of an organ (caffeine and dopamine)
- Q. Tranquilizers – drugs that act upon the CNS to sedate or quiet an anxious patient
 - 1. major tranquilizers – antipsychotics (acepromazine)
 - 2. minor tranquilizers – antianxiety medications (diazepam (Valium))

IV. Pharmaceutical Arithmetic

- A. Prefixes and Numerical Equivalent
 - 1. kilo- 1000 (10^3)

- | | | |
|-----------|----------|---------------------|
| 2. deci- | 0.1 | (10 ⁻¹) |
| 3. centi- | .01 | (10 ⁻²) |
| 4. milli- | 0.001 | (10 ⁻³) |
| 5. micro- | 0.000001 | (10 ⁻⁶) |
- B. Commonly Used Conversions
- | | | |
|-----------------|--------------|---------|
| 1. 1 gallon | 128 ounces | 3785 ml |
| 2. 1 quart | 1 liter | 946 ml |
| 3. 1 pint | 16 ounces | 473 ml |
| 4. 1 cup | 8 ounces | 240 ml |
| 5. 1 tablespoon | 0.5 ounce | 15 ml |
| 6. 1 teaspoon | 1 fluid dram | 5 ml |
| 7. 1 ounce | 30 ml | |
| 8. 2.2 lbs | 1 kg | |
- C. Calculating Drug Dosages
1. drug dosages are generally expressed as units or mass of drug per body weight (BW) of the patient
 2. $BW \times \text{dosage} / \text{concentration of drug} = \text{volume of drug (dose)}$
- V. Drug Classes
- A. Over-the-counter drugs (OTC) – those that may be sold directly to clients without a prescription
- B. Prescription drugs – those medications deemed unsafe to be dispensed without regulation.
1. Ultimate responsibility of the veterinarian
 2. technicians may fill prescriptions and label dispensed medications
- C. Controlled Substances – certain group of drugs considered to have high abuse potential
1. Schedules of controlled substances
 - a. Schedule I—Research only; LSD, heroin
 - b. Schedule II—Requires written prescription, no refills; Oxymorphone, sodium pentobarbital injection
 - c. Schedule III—Oral or written, refills up to five times within 6 months; Hycodan, Tylenol with codeine, anabolic steroids
 - d. Schedule IV—Oral or written, refills up to five times within 6 months; Diazepam, Phenobarbital
 - e. Schedule V—No DEA limits; Lomotil, Robitussin AC
 2. Controlled Substances Act of 1970 - a practitioner who has controlled substances stored in his/her office must keep these drugs in a securely locked, substantially constructed cabinet or safe

ACTIVITIES

- I. Research and report on pharmaceuticals used in animal health care.
- II. Complete the Pharmaceutical Arithmetic Exercise.

MATERIALS NEEDED

Pharmacology Quiz Key

ASSESSMENT

Pharmacology Quiz

ACCOMMODATIONS

For reinforcement, the student will design a poster depicting commonly prescribed pharmaceuticals in a veterinary practice.

For enrichment, the student will investigate why some pharmaceuticals are appropriate only for use in animals.

REFLECTIONS

Common Abbreviations Found on Prescriptions

Abbreviation	Latin Root	English Meaning
a.c.	ante cibum	Before meals
ad lib	ad libitum	As desired
b.i.d.	bis in die	Twice a day
g.	gramma	Gram
VII.	hora	Hour
q.i.d.	quarter in die	Four times a day
sig. or S.	singa	Label
sol	solutio	Solution
tab	tabella	Tablet
t.i.d.	ter in die	Three times a day
s.i.d.	semel in die	Once a day
o.d.	omnie die	Daily
cap	-----	Capsule
q. 4 h	quaque 4 hora	Every four hours
os	os	Mouth
o.u.	oculo utro	Each eye
o.d.	oculus dexter	Right eye
o.s.	oculus sinister	Left eye
stat	statium	immediately

Common Conversions

	Tspn	Tbsn	Ounce	Cup	Pint	Quart	Gallon	Milliliter
1 Teaspoon	1	1/3	1/6	1/48	----	----	----	5
1 Tablespoon	3	1	1/2	1/16	1/32	----	----	15
1 Ounce	6	2	1	1/8	1/16	1/32	----	30
1 Cup	48	16	8	1	1/2	1/4	1/16	240
1 Pint	----	32	16	2	1	1/2	1/8	480
1 Quart	----	64	32	4	2	1	1/4	946
1 Gallon	----	----	128	16	8	4	1	3785

Pharmacology Quiz

Directions: Answer the following questions.

1. Give examples of drug forms.
2. List and define three routes of administration.
3. What factors must a veterinarian consider before choosing a route of administration?
4. What is the difference between *per os* administration and *enteral* administration?
5. List four disadvantages to oral administration.
7. What are the advantages and disadvantages of IV injections?
8. Give the Latin meaning and the English meaning of the abbreviations below.
 - b.i.d.
 - o.u.
 - stat
 - q.i.d.
 - q. 4 h

9. List the seven parts of a prescription.

10. Define the following:

Antibiotics

Analgesics

Antihelminthics

11. Describe the differences between anesthetic and analgesic drugs.

12. What does the abbreviation **NSAID** stand for?

13. Differentiate between stimulants and tranquilizers.

14. Name and define the three classes of drugs used in veterinary medicine.

15. List the five schedules of controlled substances with an example of each.

16. In your own words, discuss the Controlled Substances Act of 1970.

Pharmaceutical Arithmetic

Directions: Convert the following problems.

1. 1 L = _____ ml
2. 1,000 g = _____ kg
3. 1 g = _____ mg
4. 1 TBS = _____ tsp
5. 240 ml = _____ cups
6. 1 cup = _____ ml
7. 15 ml = _____ TBS
8. 1 tsp = _____ ml
9. 240 ml = _____ TBS
10. 1 pt = _____ ml
11. 1 fl oz. = _____ TBS
12. 1 qt. = _____ pt
13. How many kg are in 440 lbs.?

Pharmacology

Quiz - KEY

1. Give examples of drug forms.

Tablet and Liquid

2. List three routes of administration.

Oral, parenteral (injections), topical routes of administration

3. What factors must a veterinarian consider before choosing a route of administration?

1. Species of the animal
2. Size of the animal
3. Temperament of the animal
4. Cost and characteristics of the drug's formulation
5. Animal's disease state
6. Stress placed on the animal
7. Convenience of administration
8. Expertise of the individual administering the drug

4. What is the difference between per os administration and enteral administration?

Per os (by mouth), such as tablets or capsules

Enteral administration (by way of the intestine), such as through a feeding tube

5. List disadvantages to oral administration.

- a) Dosing—absorption within the gut can vary from animal to animal depending on diet and disease state, thus making accurate dosing difficult.
- b) They may not take it—many animals are not receptive to oral drugs due to the odor or taste.
- c) High anxiety—oral administration can place undue stress on some animals.
- d) Dosage size—oral administration requires larger doses than injections do.

6. What are the advantages and disadvantages of IV injections?

- a) Advantages: IV injections furnish the highest drug levels in the blood and the fastest onset of effect.
- b) Disadvantages:
 1. Skilled in locating veins—the person giving the drug must have the knowledge and skills to locate and inject into a vein.
 2. Irritations—some drugs can be very irritating to the tissues if accidentally given *perivascularly* (outside the vein).
 3. Length of effect—medications given by IV injection have a shorter duration of effect than those given via other routes do.
 4. Risky—some drugs, if accidentally given intra-articularly (IA), can lead to almost instant collapse or even death!

7. Give the Latin meaning and the English meaning of the abbreviations below.

b.i.d.—bis in die; twice a day

o.u.—oculo utro; each eye

stat—statim; immediately

q.i.d.—quater in die; four times a day

q. 4 h —quaque 4 hora; every four hours

8. List the parts of a prescription.

1. Heading
 - Name and address of doctor
 - Date issued
 - Name and address of client
 - Species of animal
2. Superscription
 - Recipe (Rx)
3. Inscription
 - Name of drugs and amounts
4. Label (sig)
 - Directions to client (what the pharmacist puts on the label)
5. Subscription
 - Directions to pharmacist (how to prepare)
6. DEA Number
7. Signature and Degree

9. Define the following:

Antibiotics—Antibiotics are drugs created by microorganisms that kill or inhibit the growth of other microorganisms.

Analgesics—Analgesics are drugs that act upon the CNS to relieve pain and raise the pain threshold.

Anthelmintics—Anthelmintics are drugs that are destructive to internal parasites (particularly parasitic worms). Examples include ivermectin and pyrantal.

10. Describe the differences between anesthetic and analgesic drugs.

Anesthetic drugs create an absence of sensation. Analgesic drugs act upon the CNS to relieve pain and raise the pain threshold.

11. What does the abbreviation NSAID stand for?

nonsteroidal anti-inflammatories

12. Differentiate between stimulants and tranquilizers.

Stimulants are drugs that excite the functional activity of an organ. Examples include caffeine and dopamine. Tranquilizers are drugs that act upon the CNS to sedate or quiet an anxious patient. There are two types of tranquilizers: (1) major tranquilizers, or antipsychotics, such as acepromazine, and (2) minor tranquilizers or anti-anxiety medications, such as diazepam (Valium).

13. Name and define the three classes of drugs used in veterinary medicine.

Over the counter drugs (OTC)—sold directly to clients without a prescription.

Prescription drugs—medications deemed unsafe to be dispensed without regulation, even when clearly labeled.

Controlled Substances—groups of drugs considered to have high abuse potential.

Regulated by the Drug Enforcement Agency (DEA)

14 List the five schedules of controlled substances with an example of each.

Schedule I—Research only; LSD, heroin

Schedule II—Requires written prescription, no refills; Oxymorphone, sodium pentobarbital injection

Schedule III—Oral or written, refills up to five times within 6 months; Hycodan, Tylenol with codeine, anabolic steroids

Schedule IV—Oral or written, refills up to five times within 6 months; Diazepam, phenobarbital

Schedule V—No DEA limits; Lomotil, Robitussin AC

16. In your own words, discuss the Controlled Substances Act of 1970.

States that a practitioner who has controlled substances stored in his/her office must keep these drugs in a securely locked, substantially constructed cabinet or safe.

Pharmaceutical Arithmetic
KEY

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12. 1 qt. = 2 pt
13. How many kg are in 440 lbs?
200 kg