



2018 Learning Outcomes

I. Pain Physiology and Anatomy (20%)

- A. Describe the basic anatomy of the nervous system.
- B. Describe the physiological mechanisms of neuronal function (eg- action potentials).
- C. Review the nociceptive pathways.
 - 1. Define transduction, transmission, modulation, projection and perception.
 - 2. Identify the different types of nociceptors.
 - 3. Describe the different nerve fibers and their stimuli
 - 4. Identify the primary neurotransmitters involved in modulation of pain.
 - 5. Define the 'gate control theory'.
 - 6. Describe the anatomy and physiology of the inhibitory pathways in the spinal cord
- D. Define physiologic and pathologic pain and describe the differences between them
 - 1. Discuss, at a level of basic comprehension, the changes that occur in the spinal cord in association with chronic pain.
 - 2. Describe central sensitization at the cellular level.
 - 3. Describe peripheral sensitization at the cellular level.
 - 4. Describe how referred pain develops.
- E. Discuss the physiologic consequences of pain.
 - 1. Describe changes in the autonomic nervous system, neuroendocrine axis, metabolism, and immune system that are associated with pain.

II. Pharmacology (21%)

- A. Describe the basic principles of pharmacokinetics.
 - 1. Define the factors that affect drug bioavailability.
 - 2. Describe the basic mechanisms of drug elimination, metabolism and excretion.
 - 3. Define the 'first pass effect'.
 - 4. Define the mechanisms of drug excretion, including different mechanisms of renal excretion.
- B. Describe the basic principles of pharmacodynamics.
 - 1. Define agonist and antagonist receptor activity.
 - 2. Differentiate the terms full agonist and partial agonist
 - 2. Define the terms intrinsic activity, efficacy, potency, therapeutic index and affinity.



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C. List the mechanism of action, indications, adverse or side effects, routes of administration, duration of action, and available reversal drugs for the following classes of drugs (in dogs, cats, and horses):

1. Opioids
2. NSAIDs
3. Alpha-2 Adrenoceptor Agonists
4. Local Anesthetics

D. Regarding opioids specifically, define the following for dogs, cats, and horses:

1. Compare and contrast the receptor actions, potency, analgesic efficacy, and duration of action within a species.
2. Describe any species differences that may exist in those qualities.

E. Regarding the use of nonsteroidal anti-inflammatory drugs (NSAIDs) specifically, define the following for dogs, cats, and horses:

1. Discuss COX-2 selective versus non-selective COX inhibition.
2. Describe methods used to reduce the risk of adverse events associated with use of NSAIDs.
3. Compare and contrast the use of NSAIDs with respect to species.

F. Regarding the use of alpha-2 adrenoceptor agonists specifically, define the following for dogs, cats, and horses:

1. Discuss the use of this drug category for analgesia in each of the above-mentioned species.

G. Regarding the use of local anesthetics specifically, define the following for dogs, cats, and horses:

1. List the commonly used local anesthetics and compare and contrast their onset and duration of action when used as a peripheral nerve block.
2. Identify the factors that affect activity of local anesthetics.



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H. Regarding the following adjunctive analgesics, describe their mechanism of action, indications for use, potential side effects, potential drug interactions, routes of administration, and approximate durations of action for dogs, cats, and (where appropriate) horses:

1. NMDA antagonists
 - a. List available adjunctive analgesics that exhibit NMDA antagonism and define the factors in “H” for each drug
2. Gabapentin
3. Amitriptyline
4. Bisphosphonates
5. Tramadol
6. Capsaicin – Discuss the theoretical benefits of this agent with reference to the limited literature of its use in dogs

I. Distinguish how the type of pain (as discussed in section V letter E) affects pain management.

1. Define preemptive analgesia
2. Formulate appropriate drug choices for different types of pain, e.g. ketamine for somatic chronic nociceptive pain, and alpha 2 agonists for acute visceral nociceptive pain.
3. Summarize the drugs that are most effective for perioperative pain management in dogs, cats, and horses.
4. Describe strategies for treating neuropathic pain.

J. Recognize the limitations of different drug selection for various animals' breeds.

1. Define the approximate neonatal period for dogs, cats, and horses. Discuss any physiologic differences between neonates and adults in these species and consider the implications of neonatal physiology on analgesic choices in these species.
2. Describe the potential side-effects of opioid use during pregnancy.
3. Identify the interventions utilized for treatment of central sensitization.

III. Pharmacologic Delivery Techniques (21%)

A. Describe topical application of analgesics.

1. Compare the onset and duration of action of fentanyl patches in dogs and cats.
2. Identify topical analgesic creams commonly used in veterinary medicine.
3. Discuss the onset and duration of action of lidocaine patches in dogs and cats



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B. Regarding the use of local blocks:

1. Describe techniques for line blocks and incisional blocks.
2. Discuss the indications for the following locoregional nerve blocks: interpleural block, intercostal block, sciatic, femoral, brachial plexus, ring blocks, RUMM Block, and TAP block
3. Describe the techniques and identify the indications for dental nerve blocks (maxillary, mandibular, infraorbital, mental, palatine) in small animals.
4. Discuss the indications for and use of a fenestrated catheter for local anesthetic infusion
5. Define the indications and potential complications of a paravertebral block

C. Regarding the use of intra-articular drug administration:

1. List the drugs that are commonly used intra-articularly and define their proposed intra-articular mechanisms of action.
2. Discuss the use of intra-articular corticosteroids including a demonstrated knowledge of any specific indications and contra-indications of particular drugs

D. Regarding the use of epidural drug administration:

1. Contrast epidural versus spinal administration of drugs based on anatomy.
2. List the drugs that can be used for epidural analgesia in dogs, cats, and horses.
3. Describe the anatomical landmarks for performing an epidural in dogs, cats, and horses.
4. Describe the mechanisms of action of analgesic agents delivered by epidural with particular attention to local anesthetics and opioids
5. List the indications and contraindications for epidural analgesia.
6. List the potential side effects of epidural analgesia.

E. Discuss the various systemic routes of administration (IV, IM, SQ, OTM, intranasal, intrarectal, PO) for analgesic drugs.

1. List the analgesic drugs where there is literature support for transmucosal delivery.
2. Discuss species differences (dogs, cats, horses) where they exist.



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IV. Physical Medicine (15%)

A. With regards to the following physical modalities used in rehabilitation and identify the indications and expected effects for each: TENS, therapeutic ultrasound, LASER, thermo- and cryo-therapy, joint mobilizations, Shockwave therapy, hyperbaric oxygen, and aquatic therapy

1. Describe the set-up of TENS.
 2. Define the mechanism by which TENS modulates pain.
 3. Describe the effects of therapeutic ultrasound.
 4. Describe the application of therapeutic ultrasound.
 5. Describe the mechanism by which LASER modulates pain.
 6. List the indications for hot and cold therapy.
 7. Describe the mechanism by which joint mobilization modulates pain.
 8. Explain the use of shockwave therapy for pain
 9. Explain the basis for the use of hyperbaric oxygen therapy to treat pain
 10. Describe the physiologic basis of aquatic therapy
 11. Contrast TENS and NMES
12. Describe the use of therapeutic exercises use in pain management

B. Describe the use of passive and active stretching to modulate pain.

C. List and define the theoretical mechanisms for acupuncture use in pain management.

V. Pain Classification (8%)

A. Describe the classifications of pain, based on anatomic origin and/or physiologic significance.

B. Define the terms used to describe types of pain or altered sensation.

VI. Pain Scoring and Recognition (5%)

A. Discuss behaviors associated with pain in dogs, cats, and horses.

B. Describe the use of pain scales to assess and treat pain.

1. List common pain scales and current behavioral pain scales used in dogs, cats, horses, and laboratory species (including rabbits, rodents, pigs, etc.). Demonstrate familiarity with recent literature surrounding pain scales in these species.
2. Discuss the limitations of pain scoring with respect to subjectivity and types of pain (i.e.- ophthalmologic pain is more difficult to score than orthopedic pain).

C. Describe techniques used to differentiate pain from dysphoria.

D. Discuss guidelines for how frequently pain should be assessed in the following situations: acute injury/post-surgical, chronic with poor control, chronic with adequate control



VII. Nutrition (5%)

- A. Describe the importance of body condition scores and how to perform one.
- B. Describe the relationship between obesity and chronic pain.
- C. Define the role of nutrition in managing the chronic pain of arthritis.
- D. List common dietary supplements used to alleviate signs of osteoarthritis.

VIII. Hospice Care (5%)

- A. Describe basic hospice care with respect to pain and potentially painful conditions.
- B. Define the term 'quality of life' with respect to hospice care.
- C. Discuss methods for assessment of quality of life.