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Multimodal Pain Management in Veterinary Medicine: The Physiologic Basis of Pharmacologic Therapies 1173
Leigh A. Lamont

Multimodal analgesia refers to the practice of combining multiple analgesic drug classes or techniques to target different points along the pain pathway in an effort to improve analgesia. This strategy requires an understanding of pain physiology and pathophysiology so pharmacologic interventions can be tailored to meet the needs of the patient. This article reviews the physiologic basis of pain as it relates to analgesic treatments and also introduces new developments in molecular biology that may guide analgesic drug development in the future.

Adjunctive Analgesic Therapy in Veterinary Medicine 1187
Leigh A. Lamont

Adjunctive analgesic therapies are interventions for pain that involve agents or techniques other than the traditional analgesics (opioids, nonsteroidal anti-inflammatory drugs, and local anesthetics). Adjunctive therapies may be pharmacologic or nonpharmacologic in nature. The focus of this article is on pharmacologic interventions with potential utility as adjunctive analgesics in veterinary medicine. Pharmacology of selected agents, including medetomidine, ketamine, amantadine, gabapentin, systemic lidocaine, and pamidronate, is discussed in addition to evidence for their safety and efficacy and guidelines for their use in veterinary patients.

Epidural Analgesia and Anesthesia in Dogs and Cats 1205
Alexander Valverde

Current knowledge of drugs administered epidurally has allowed an effective way of providing analgesia for a wide variety of conditions in veterinary patients. Proper selection of drugs and dosages can result in analgesia of specific segments of the spinal cord with minimal side effects. Epidural anesthesia is an alternative to general anesthesia with inhalation anesthetics, although the combination of both techniques is more common and allows for reduced doses of drugs used with each technique. Epidural anesthesia and intravenous anesthetics can also be used without inhalation anesthetics in surgical procedures caudal to the diaphragm.
Paravertebral Blockade of the Brachial Plexus in Dogs 1231
Kip A. Lemke and Catherine M. Creighton

Local anesthetic techniques have the unique ability to block peripheral nociceptive input associated with surgical trauma and inflammation and to prevent sensitization of central nociceptive pathways and the development of pathologic pain. Complete neural blockade of the canine brachial plexus is difficult to achieve using the traditional axillary technique. This article describes paravertebral blockade of the brachial plexus in dogs and a new modified paravertebral technique. Both techniques are relatively easy to perform and produce complete blockade of the forelimb, including the shoulder. A review of relevant clinical anatomy and guidelines for using electrical nerve locators are also included.

An Update on Nonsteroidal Anti-Inflammatory Drugs (NSAIDs) in Small Animals 1243
Mark G. Papich

There are several choices of nonsteroidal anti-inflammatory drugs (NSAIDs) for treating dogs that have osteoarthritis. However, fewer drugs are available for cats. Like people, there may be greater differences among individuals in their response than there are differences among the drugs. In past practice, veterinarians often selected aspirin or phenylbutazone as an initial drug, and then progressed to off-label human drugs or other agents as an alternative. Now we have the advantage of several approved NSAIDs for which there are excellent published studies and US Food and Drug Administration or foreign approval to guide clinical use and safe dosages.

Managing Pain in Feline Patients 1267
Sheilah A. Robertson

This article reviews the current knowledge of pain assessment in cats and the most effective methods for its alleviation. Excellent acute pain management is achievable in cats by using opioids, nonsteroidal anti-inflammatory drugs (NSAIDs), \( \alpha_2 \)-agonists, and local anesthetics. A multimodal approach using agents that work at different places in the pain pathway is encouraged because this can have added benefits. Management of chronic pain in cats can be challenging, but there is now an approved NSAID for long-term use. As we gain experience with less traditional analgesics, such as gabapentin, and critically evaluate complimentary therapies, our ability to provide comfort to this population of cats should improve.

Pain Management for the Pregnant, Lactating, and Neonatal to Pediatric Cat and Dog 1291
Karol A. Mathews

Little information on the approach to analgesia in pregnant, nursing, or extremely young animals is available in the veterinary literature. Various analgesics and analgesic modalities are discussed, with emphasis placed on preference and caution for each group. Management of pain is extremely important in all animals but especially in the extremely young, in which a permanent hyperalgesic response to pain may exist with inadequate therapy. Inappropriate analgesic selection in pregnant and nursing mothers may result in congenital abnormalities of the fetus or neonate.
Inadequate analgesia in nursing mothers may cause aggressive behavior toward the young. Review of the human and veterinary literature on the various analgesics available for use in this group of patients is discussed.

**Perioperative Pain Management in Veterinary Patients**  
Doris H. Dyson

Pain exists; however, we can prevent it, and we can treat it. The fallacy that pain is protective and must be allowed to avoid risk for damage after surgery needs to be eradicated. Preoperative and postoperative analgesia is directed at aching pain, whereas sharp pain associated with inappropriate movements persists. Analgesia provides much more benefit than concern. This article provides suggestions for development of an analgesic plan from the point of admission to discharge. These guidelines can then be adjusted according to the patient’s needs and responses.

**Analgesia and Chemical Restraint for the Emergent Veterinary Patient**  
Doris H. Dyson

Frequently, analgesics are withheld in the emergent patient based on common misconceptions. Concerns expressed are that analgesics “mask” physiologic indicators of patient deterioration or that potential toxicity and adverse reactions associated with drug administration outweigh the benefits gained. Appropriate selection of drugs and doses as described in this article allow the veterinarian to achieve analgesia, in addition to sedation or restraint when needed, without unwarranted fears. Guidelines are provided for typical situations encountered in trauma patients to provide a safe starting point for providing analgesia. Caution required in these cases is also discussed, with emphasis on individualization of the approach to analgesia and chemical restraint.

**Analgesia for the Critically Ill Dog or Cat: An Update**  
Bernie Hansen

Acute pain reliably accompanies severe illness and injury, and when sufficiently severe, it can complicate the recovery of critically ill patients. Because acute pain is closely tied to the neurologic process of nociception, pharmacologic therapy is often essential and effective. This update focuses on two methods of treatment of acute pain—local anesthetic infusion and continuous intravenous infusion of multimodal agents—that can be layered on top of standard care with other drugs.

**Neuropathic Pain in Dogs and Cats: If Only They Could Tell Us If They Hurt**  
Karol A. Mathews

Neuropathic pain is difficult to diagnose in veterinary patients because they are unable to verbalize their pain. By assuming that neuropathic pain may exist based on the history of events that each patient has experienced, a focused client history and neurologic examination may identify a lesion resulting in persistent or spontaneous pain. Once neuropathic pain is diagnosed, a trial analgesic or acupuncture session(s) should be prescribed with instructions for owners to observe behavior. Dosing of the analgesic can be titrated to the patient’s needs while avoiding adverse
effects. When a particular analgesic may be ineffectual, an alternate class should be tried. As research into the neurobiologic mechanisms of neuropathic pain continues, specific therapies for its management should eventually appear in the human clinical setting and subsequently be investigated for veterinary clinical use.

Pain Management: The Veterinary Technician's Perspective 1415
Nancy Shaffran

In veterinary medicine, technicians provide primary nursing care and function as patient advocates. In this role, veterinary technicians have great influence over animal pain management. This article focuses on assessing patients for comfort, providing appropriate nonpharmacologic and pharmacologic therapy, and general concepts of providing optimal analgesia. The communication necessary for successful implementation of pain management strategies is discussed in detail.

Control of Cancer Pain in Veterinary Patients 1429
James S. Gaynor

Control of cancer pain is within the capabilities of most veterinarians and is achievable in most animal patients that have cancer with techniques that are currently available. Great satisfaction can be derived from not only treating the pet’s cancer but its pain. Incorporating pain management into oncology practice is good for the well-being of the pet, the owner, the staff, the veterinarians, and the practice.

Nonsurgical Management of Osteoarthritis in Dogs 1449
Spencer A. Johnston, Ronald M. McLaughlin, and Steven C. Budsberg

Osteoarthritis (OA), although superficially considered to be deterioration of the joint associated with pain and dysfunction, is actually quite a complex condition. When considering treatment of OA, a multitude of biochemical, physical, and pathologic alterations must be recognized. This article presents a review of the published material regarding various nonsurgical treatments for OA. When there are no data regarding a specific treatment or when a statement is the opinion of the authors, such a deficiency is identified.