Pain Management in Veterinary Patients

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Abstract

The veterinary practitioner has an ethical obligation to help alleviate animal pain. Although most veterinarians accept the fact that animals feel pain, still, postoperative pain relief is not a routine practice in all veterinary hospitals and clinics today. Nociception is a physiological process which involves transduction, transmission, modulation and perception of the noxious stimuli. Chemical mediators are important components of the nociceptive reflex and offer a target of pharmacologic modulation. Assessment of pain in animals is the most important step in the successful management of pain. Choosing appropriate method of pain control would depend upon the type of procedure followed, severity of pain and economic considerations for each individual circumstance. Our understanding of the pain in its manifestation, mechanisms, assessment and alleviation in animals is still although improving, limited.

Keywords: Pain, Animal, Chemical Mediator, Nociception, Management to Pain.

Introduction

The International Association for Study of Pain (IASP) had defined pain as "an unpleasant sensory or emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (Mersky, 1979). The veterinarian has an ethical obligation to help alleviate animal pain. Although most veterinarians accept the fact that animals feel pain, still, postoperative pain relief is not a routine practice in all veterinary hospitals and clinics today (Flecknell, 1994). In many ways the issue of pain management in animals closely parallels that in human pediatrics whereby the patient is non-verbal and the clinician must rely on personal observations and the reports of the patient's advocate. Thus the physicians have long struggled with the critique of undermanaging pain in children (Schechter, 1989).

Patho-physiology of Pain

Nociception involves four physiological processes that are subject to pharmacological modulation. Transduction is the translation of physical energy (noxious stimuli) into electrical activity at the peripheral nociceptor. Transmission is the propagation of nerve impulses through the nervous system. Modulation occurs through the endogenous descending analgesic systems (endorphins) which modify nociceptive transmission. Perception is the final process resulting from successful transduction, transmission; modulation and integration of thalamocortical, reticular and limbic function to produce the final conscious subjective and emotional experience of pain. Nociceptors are specialized nerve fibers that have their dendritic endings in peripheral tissue, with several different subtypes identified. The fastest of the nerve fibers are the large diameter myelinated A-â sensory fibers which are involved the sensations of touch, pressure, etc. Somewhat slower are the thinly myelinated A-ä fibers which are involved in sharp physiologic and acute pain. C-fibers have small diameter, unmyelinated and, are very slow conductors of nociception and are involved in dull, aching chronic pain. Chemical modulation of pain transmission occurs via several neurotransmitter-receptor systems that have been shown to affect the spinal processing of nociceptive input. Excitatory neurotransmitters (e.g., substance P), are active in spinal cord and enhance pain transmission. The inhibitory elements are the opioids, the $á_2$adrenergic fibers, serotoninergic and adenosinergic receptors. Endogenous neurotransmitters work on dorsal horn neurons to inhibit excitatory transmitter release and consequently to decrease pain and perception (Tranquilli *et al.,* 2004).

Assessment of Pain

Assessment of pain in animals is the most

important step in the successful management of pain. Systems to consider in pain evaluation are: neurological, cardiovascular, respiratory, skeletal, digestive, urinary and endocrine. Behavioural parameters in?uencing pain scores are temperament, vocalization, posture, locomotion and other behavioural changes. Also, we have to consider that threshold and response to pain varies according to species, breed, health status and age. Ruminants are stoical animals, being prey species in which showing overt signs of pain would often threaten the individual's survival in the wild by identifying to a potential predator a potentially easy target for predation. It is probable that much pain in ruminants is not recognised and that, even when pain is recognized, too often inadequate efforts are made to alleviate it (Bourn and Broadman, 2004). For successful assessment, numbers of scales have been used such as Simple Descriptive Scale (SDS), Visual Analogue Scale (VAS), Numerical Rating Scale (NRS) and University of Melbourne Pain Scale (UMPS) (Bufalari *et al.,* 2007). Newer approaches have been developed in recent years for assessment of pain which includes, 'Power spectral analysis of electroence-phalogram' which is a quantified analysis of the electroencephalogram when animal is exposed to noxious stimuli (Johnson, 2007).

Medicinal/Pharmacological Managment of Pain

Current recommendations for pain management include the following:

1. Preemptive approach: Analgesic administration before, during and after a painful stimulus will minimize the effects of 'wind-up. It decrease's the intensity & duration of post-operative pain & minimizes the likelihood of chronic pain state being established (Hellyer, 1999).

2. Multimodal approach: Selecting drugs from different analgesic classes, that influence different portions of the pain pathway, results in a synergistic, rather than a mere additive, effect and optimizes analgesia while minimizing drug side effects (Gogny, 2000).

Opioids:

Opioids are frequently used for acute pain control in veterinary medicine, and are the mainstay of therapy in the perioperative period. Not only are opioids highly effective analgesics for moderate to severe pain, they may also be given pre-operatively to provide sedation and aid restraint. Opioids produce analgesia by their actions on specific opioid receptors namely mu (ì), kappa (ê) and delta (ä). Briefly however, of the pure ì agonists, morphine remains the prototype in widest use. It has no ceiling effect on analgesia or respiratory depression, elicits histamine release and causes vomiting at low doses. Oxymorphone does not elicit histamine release and other side effects may be less pronounced. Fentanyl in a transdermal patch remains useful in veterinary medicine. Buprenorphine is a partial agonist on the ì receptor though it has greater affinity than morphine. A great benefit of the drug in veterinary medicine is that its pKa (8.4) closely matches the pH of the feline oral mucosa (9.0), which allows for nearly complete absorption when given buccally in that species (Lascelles *et al.,*2002) and eliciting very little sedation. Butorphanol is a ì agonist and a ê antagonist. It's very short duration of action in the dog (approx. 30-40 min) makes it a poor choice for an analgesic in this species, though used parenterally it has utility as an adjunct with other medications such as $á_2$ agonists. Tramadol is a non-scheduled opioid with 1/100th of the affinity for the ì receptor as morphine but has a much better analgesic effect than this would predict.

Nonsteroidal Anti-inflammatory Drugs (NSAIDs):

NSAIDs inhibit the cyclooxygenase (COX) enzyme of arachidonic acid metabolism resulting in a number of anti-inflammatory, antipyretic and analgesic effects. The main limitation of all NSAID's revolves around the potential for adverse effects, since many of the drugs (ketoprofen, flunixin meglumine, etc.) do not selectively inhibit COX2 which is inducible prostaglandin. Inhibition of COX1 enzyme which is constitutive especially in the gastrointestinal tract and renal tubules leads to gastric erosion/ulceration and nephrotoxicity. Newer NSAIDs like meloxicam, carprofen, etc. selectively block COX2 thus avoids the undesirable side effects.

Ketamine:

The evidence is building for its pre-emptive and preventive effects when given at subanesthetic doses in an intravenous constant rate infusion. Ketamine binds to a phencyclidine receptor inside the NMDA receptors. Once bound, it decreases the calcium channel's opening time and frequency thus reducing Ca^+ ion. Hence it is unlikely to be truly analgesic in nature, rather it appears to be protective against hyperalgesia and central hypersensitization in the post-operative setting (Slingsby and Waterman-Pearson, 2000).

$á_2$ agonist:

$á_2$ agonists (xylazine, medetomidine) when given systemically, binds with $á_2$ adrenoreceptors that are located in several areas within the spinal cord and brain stem concerned with analgesia. Also, $á_2$ agonists given epidurally or intrathecally can provide analgesia with a decreased incidence of untoward side effects (McKelvey and Hollingshead, 2003).

Local Anesthetics:

Local anesthetics exert their action by binding to a hydrophilic site within Na^+ channels, thereby blocking

it and disallowing the Na^+ influx. Thus blocking depolarization of neurons and the effect can be complete anesthesia to a site rather than mere analgesia. Local analgesia can be induced by different modalalities. The effects of bupivacaine (4-8 hrs) are of longer duration than those of lidocaine (1.5-3 hrs) so it is preferred for postoperative analgesia (Sackman, 1997).

Non-Medicinal Management of Pain

No discussion of acute and chronic pain management is complete without strongly advocating the use of tools and techniques known to enhance comfort and recovery, outside the western-oriented construct of drugs and medications.

Cryotherapy:

Application of ice slows down of the nerve conduction of small caliber myelinated fibers (Aä and C). Also it causes peripheral vasoconstriction (and subsequent reduced blood flow) and slows down of local inflammation. Application of cryotherapy is indicated for acute attacks of arthritis or to relieve pain and prevent inflammation. The simplest way to apply cryotherapy is to massage with ice (5 to 10 minutes) for 3 to 6 times a day (Sawaya, 2007).

Thermotherapy:

Heat causes peripheral vasodilatation and stimulates numerous thermosensitive receptors that increase gate-control mechanisms causing local analgesia. Hot water bottles or hot-packs are simple methods for applying superficial heat. Tissue can be heated up to approximately 1 cm in depth and they are recommended particularly for distal joints. Superficial heat should be applied for 15 to 20 minutes, one to three times a day (Sawaya, 2007).

Actinotherapy:

Actinotherapy involves treatment of disease using infrared light. Infrared rays can heat up deep-seated tissues producing warmth and analgesia. It is mainly applied in joints affected with arthritis. The duration of exposure should be 15 minutes to one hour (Venugopalan, 2005).

Ultrasound Therapy:

Ultrasound waves can penetrate biological tissue up to 5 cm in depth. During application the temperature rise varies depending on the treated site by +1°C to +4°C (Draper *et al.,* 1995). High-frequency ultrasound is characterized by low-depth penetration (0.5-1 cm) but a powerful calorific effect which can be used only on distal joints of limbs. Low-frequency ultrasound (0.8-1 MHz) penetrates tissue more deeply (0.5-5 cm) which can be used to treat hip and shoulder joints and to reduce muscular spasm. In general, it should be applied for 5 to 10 minutes for two to three times a week (Sawaya, 2007).

Transcutaneous Electrical Neuro-Stimulation (TENS):

Two modalities of TENS currents are used on arthritic animals namely gate-control TENS and endorphinic TENS. Gate-control TENS works by causing peripheral hyperstimulation of large caliber sensitive fibers (Aâ) at high-frequency (80 or 100 Hz) thus inhibiting the transmission of nociceptive influxes conveyed by small-caliber fibers (Aä and C) in the dorsal horn of the spinal cord. This type of current generates rapid but short analgesia and is indicated mainly for acute pain. The endorphinic TENS works by causing stimulation of small-caliber fibers (Aä and C) at very low frequency (2 to 8 Hz) which favours the release of endorphins. Endorphinic TENS is indicated for subacute and chronic pain. To be effective, a TENS current should be applied for a minimum of 20 to 30 minutes. (Sawaya, 2007).

Extra-corporeal shock wave therapy (ESWT):

Based on lithotripsy techniques, ESWT has been used effectively since the 1990's to treat diverse rheumato-orthopaedic disorders in man (epicondylitis) and horses (desmitis of the suspensor ligament of the fetlock). It was observed that ESWT is effective in reducing pain rapidly and sustainably (pain relieved for several weeks or months) and in improving mobility and quality of life of arthritic dogs (Sawaya, 2007).

Acupuncture:

The analgesic action of acupuncture results from gate-control mechanisms when focal acupoints are treated and from stimulating the release of endogenous opioids when distal spots are treated to procure long term analgesia. Acupuncture can be used to treat acute as well as subacute and chronic attacks of arthritis. In the event of acute inflammatory attack, one session every two to three days is necessary until clinical signs resolve whereas for chronic pain, several sessions are required (Altman, 1998).

Low Level Laser Therapy (LLLT):

The localized and systemic increase in â-endorphins after LLLT irradiation has been clinically reported in multiple studies with subsequent pain reductions. Laser irradiation suppresses the excitation of these fibers in the afferent sensory pathway (Ohno, 1997). LLLT restores nerve cell action potential back to its normal value. It also helps to reduce levels of bradykinin which elicit pain by stimulating nociceptive afferents in the skin and viscera.

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