Every veterinary professional knows the list of drugs related to anesthesia and pain management can seem overwhelming. By combining multiple drug classes in your anesthetic protocols, you can provide better pain control (by blocking more pain pathways) with less side effects (as most side effects are dose dependent). Many of us also realize that with tighter restrictions and less production, more practices have to be creative with their anesthetic and analgesic protocols.

Drug classes covered in this lecture will include, benzodiazepines, NMDA receptor antagonists, alpha two receptor agonists, induction agents, local anesthetics, and non-sterooidal anti-inflammatories (NSAIDs).

**Part 1: Benzodiazepines**

Benzodiazepines are a class of drugs used as tranquilizers for their calming and (sometimes) sedative effects. These drugs also provide some muscle relaxation. There are three benzodiazepines commonly used in veterinary medicine today. These are diazepam, midazolam, and zolazepam (the benzodiazepine component of the mixture telazol). Diazepam has been traditionally used as an anticonvulsant. Diazepam is not water soluble and is provided in a carrier solution of propylene glycol, therefore IM administration is not recommended due to pain on injection (Robbins, 2010). Diazepam is highly protein bound, and it should be used with caution in animals with low total protein levels. Midazolam is water soluble and can easily be combined with opioids in the pre-medications. It is important to note that these drugs DO NOT have analgesic properties. Benzodiazepines have minimal effects on both the cardiovascular and respiratory systems. Another attractive trait to benzodiazepines is their ability to be reversed via the administration of flumazenil.

**Part 2: NMDA receptor antagonists**

NMDA receptor antagonists are used in veterinary medicine as analgesic adjuncts and agents of chemical restraint. This drug class is extremely cost effective which makes it an attractive adjunct for many veterinary practices. By inhibiting NMDA receptors, ketamine has been shown to reduce the activity of neurons in the spinal cord in response to nociceptive stimuli and reduce sensitization of these neurons (Kerr, 2010). This helps to decrease the “wind-up” pain phenomenon from starting. NMDA receptor
antagonists include ketamine and tiletamine (the NMDA antagonist component of the mixture telazol). NMDA receptor antagonists cause an increased heart rate and blood pressure due to an indirect stimulation of the cardiovascular system (Robbins, 2010). Ketamine can be especially useful at decreasing inhalant gas anesthetic requirements when used as a constant rate infusion.

**Part 3: Alpha-2 adrenergic agonists**

Alpha 2 drugs such as medetomidine, xylazine and the newest form dexmedetomidine function as both sedatives and analgesics. Alpha-2s have analgesic properties that are primarily mediated via alpha-2 adrenergic receptors located in the dorsal horn of the spinal cord. These receptors modulate the release of neurotransmitters responsible for transmission of nociceptive signals to higher centers (Kerr, 2010) It is recommended that alpha-2s be used on only cardiac healthy patients as they can have significant cardiovascular side effects. Alpha-2 agonists cause increased systemic vascular resistance, peripheral vasoconstriction, and therefore increased systemic arterial blood pressure. Because of this increase in blood pressure, a decreased heart rate is often seen as the body’s normal response. Dexmedetomidine can be used as a premedication, and when combined with an opioid can sometimes be enough to preform minor surgical procedures (Shaffran, 2011). Dexmedetomdine can also be used as a constant rate infusion for overly anxious patients that require treatment and hospitalization.

**Part 4: Local Anesthetics**

Local anesthetics are used to block transmission of nerve endings or fibers. Local anesthetics inhibit the generation and propagation of nerve impulses by blockage of sodium channels in the nerve membrane (Mama, 2009) Bupivicaine and lidocaine are the two most commonly used local anesthetics in veterinary medicine. Local anesthetics can be administered intravenously, epidurally, and directly infiltrated. They can be especially useful as a part of multimodal analgesic plans.

**Part 5: Induction Medications**

Propofol can produce general anesthesia in animals, as a sole agent with continuous infusion for surgery, or as a pre-anesthetic for endotracheal intubation. It is valued for its fast recovery time, even after prolonged administration. Propofol has minimal analgesia at sub-anesthetic doses. It can be a profound respiratory depression, and may also cause hypotension. Because of its rapid elimination, it must be administered IV. Propofol can be used as a constant rate infusion for cases of total intravenous anesthesia.
Alfaxalone is another option for induction. Alfaxalone is a neurosteroid anesthetic and is similar to propofol in administration and use. Alfaxalone has been associated with less respiratory depression than propofol and less subsequent hypotension.

Another option for induction is a ketamine/diazepam combination. This combination works well for young healthy animals. The drug profiles for each of these drugs can be found above.

**Part 6: Non Steroidal Anti-inflammatory drugs**

The advent of newer, more potent, more specific anti-inflammatory agents has increased their usefulness in veterinary patients. NSAIDs are used to reduce fever, reduce inflammation, and provide varying degrees of analgesia. Carprofen, ketoprofen, ketorolac, and meloxicam may have duration of analgesic action up to 24 hours. They may be used concurrently with anesthetics, with opioid analgesics, and with local anesthetic/analgesics. Injectable NSAIDs are useful for accurate dosage and administration. NSAIDs may decrease clotting ability, of possible concern following surgery. Gastric upset and even ulceration may occur, especially with prolonged use. Prolonged use carries the risk of kidney or liver disease. Cats can be particularly susceptible to toxic effects of NSAIDs. Acetaminophen is never administered to cats; other NSAIDs should be used only at the dose and frequency recommended by your clinician.

References:


Further reading:

www.IVAPM.org