Addicts and Ethics: Dealing with the Opioid Crisis from a Veterinary Perspective

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Local and regional (L&RA) anesthesia is the technique of applying or infiltrating tissues with a sodium channel blocking agent (most common in veterinary medicine: lidocaine, bupivacaine, ropivicaine) to completely numb a specific area. These techniques are one of the best ways to combat out inability to access opioids and in some cases a better technique for critical patients. We can literally take an animal in severe pain, such as broken ribs, and make them comfortable again within minutes. There are several adverse effects of continued pain, many of which delay healing and impact the patient psychologically. Local and regional blocking techniques are one of the few techniques we have to completely stop pain signaling to the spinal cord, further reducing sensitization, which in the worst-case scenario could lead to neuropathic pain. Local and regional blocking used for the anesthetized patient also shows a decrease in mobility and mortality and decrease complication in the post-operative period. There are multiple terms used for differing techniques of L&RA.

Topical or Surface Anesthesia is using sodium channel blocking agents in creams or solutions on the skin or mucous membrane providing some relief. Unfortunately, many of the agents we use are not readily absorbed through the skin surface unless left on for quite some time prior. The use of lidocaine patches over wounds or incisions has also been described but has not been found to alleviate the need for other analgesic medications.

Local Infiltration is a less precise means of infiltrating tissue with a blocking agent to achieve pain sensation loss. Basically, where the surgeon plans to incise, or tissues will be manipulated in a way that causes discomfort the local blocking agent should be used. There are many studies on the efficacy of using this technique for any stable surgical patient. The efficacy of this technique has even found its way into the Pain Management Guidelines published by AAHA.

Regional or Nerve Blocking techniques are a bit more precise using anatomical land marks, palpation or devices to infiltrate the blocking solution within millimeters of a nerve. A good knowledge of the nervous system anatomy is desirable before implementing such techniques. It is important we are not piercing the actual nerve or infiltrating the nerve, like commonly done during leg amputations. More recent research has shown the infiltration of the nerve, stretching the fibers can sensitive the remaining nerve component adversely.

Neuraxial Anesthesia is the technique of infiltrating blocking agents in the epidural space. This is a very effective technique for essentially anything on the caudal half of the animal and can be useful for such conditions as pancreatitis or thoracotomies when using opioids instead of a blocking agent.

There are a few basic tools one will need for local blocks.
Basic tools include: A variety of hypodermic and spinal needle gauges and lengths, preferably luer lock syringes.
Red rubber catheters with male end adapters for infiltration OR pre-made wound infusion catheters.
For more advanced techniques: A nerve stimulator and ultrasound

There are a few techniques in veterinary medicine used in practice to reduce the sting of blocking agents, as they are usually a weak base. Adding sodium bicarbonate to the blocking agent does alkalinize the agent for a less dramatic sting in awake patients. When adding sodium bicarbonate, the mixologist should keep in mind some proportional ratios as adding too much can cause precipitation and decrease efficacy. A 1 part sodium bicarbonate to 3 parts blocking agent solution is usually safe and still effective. If the patient is anesthetized you may forgo this technique altogether. If you need a greater volume of the blocking agent and have not added sodium bicarbonate you can add regular saline to the blocking agent at no greater ration than 1:1 or efficacy will be compromised. There is some evidence that adding saline to the mixture will better facilitate tissue distribution of the blocking agents.

The technique of mixing two different local blocking agents, having one agent with a quicker onset (Lidocaine) and one with a longer onset and lasting effect (bupivacaine), has largely been via summation. There is a larger body of evidence that shows when mixing the two agents the bupivacaine may be washed out of the system before any real beneficial effects. One more practical strategy is to provide the initial 60-90 minutes of anesthesia using a less irritating agent (lidocaine) and then reinject the anesthetized tissue with bupivacaine to provide analgesia well into the postoperative period.

Several adjunctive agents added to local blocking agents have been described and are a favorite technique of the author. Micro doses of opioids (0.005mg/kg buprenorphine or 0.01mg/kg morphine), steroids, and dexmedetomidine

(0.25mcg/kg) can dramatically prolonged the effects of local blocks from a couple of hours to 24-48 hours. Another more recent option is NOCITA by Aratana. This is a liposomal bupivacaine solution that last for 72 hours. Although labeled of canine CCL repair and feline fracture repair at this time the author has used it in many other procedures such as hemilaminectomies, general incision closures, dental work and much more. A poster describing the use of the human form of the medication showed analgesic effects last up to 96 hours in mice.

With the insertion of a needle into any tissue we can expect some risk and possible complications. From the needle insertion aspect, we can cause mechanical trauma to several different types of tissue depending on where you are inserting. Most commonly with peripheral blocking techniques we may see nerve injury. This occurs as the needle pierces through the nerve instead of adjacent to the nerve.
We can also cause trauma to the nerve by what is termed *injection pressure*. This is the rate at which the operator of delivering the blocking agent either intra or perineural. We can also see nerve injury what using advanced tools such as a nerve stimulator for electrolocation. In general, if the operator is near the nerve and feels resistance during injection of insertion, like going into a different type of tissue, they should stop and re-adjust the needle placement. Typical compilations from these types of injuries usually manifest 48 hours after the injury as motor loss, the patient biting or scratching at the site from a tingling sensation or injury to the tissue over time form chronic numbness and lack of self-awareness to injury.

Other complications we may see include neurotoxicity. Although evidence has shown that the efficacy of blocking agents (and other medications) used in epidurals with preservatives is the same the preservatives like EDTA has been associated with severe back pain in canine and human studies.

ADJUNCT CRIs FOR ADDITIONAL PAIN MANAGEMENT

Ketamine (100mg/mL)
- Classified as an NMDA receptor antagonist that effectively blocks central sensitization from occurring in the dorsal horn of the spinal cord and helps prevent hyperalgesia and allodynia.
- Ketamine does not have any direct analgesic effects but it is used as an adjunct to other analgesic drugs such as opioids. It may help improve opioid receptor sensitivity. DO NOT use ketamine as the sole analgesic agent.
- Dosages used for the CRI are given at sub-anesthetic levels so none of the dissociative effects are seen during CRI administration.
- Starting a ketamine CRI prior to a painful stimulus will provide the best means of preventing CNS sensitization but it is still effective in patient's that present with established pain.
- Loading dosage: 0.5mg/kg IV of ketamine should be given prior to starting the CRI in order to achieve initial therapeutic blood levels. Induction with ketamine/diazepam or Telazol® will provide an effective loading dose.
- CRI rate (intra-op): 10-20mcg/kg/min
- CRI rate (post-op): 2-10mcg/kg/min for at least 24 hours

Lidocaine (20mg/mL)
- MAC sparing and analgesic effects when administered as a CRI intra-op.
- Classified as a sodium channel blocker and a class IB antiarrhythmic.
- Displays free radial scavenging effects which may be helpful at preventing reperfusion injury.
- Acts as an inflammatory modulator by decreasing neutrophil chemotaxis and platelet aggregation.
- Acts as a prokinetic that enhances gut motility and helps prevent ileus.
- NOT recommended for use in cats due to its potential for toxicity. If used, do not exceed a dosage of 10mcg/kg/min and monitor closely for seizure activity and bradycardia.
- Commonly used as a first line treatment for ventricular premature complexes (VPC) or ventricular tachycardia.
- Some brands of lidocaine are sensitive to light. If lidocaine comes in a brown bottle the syringe or fluid bag containing the lidocaine should be covered when used as a CRI long term.
- Loading dosage: 1-2mg/kg IV of lidocaine should be given prior to starting the CRI in order to achieve an appropriate therapeutic level.
- CRI rate: 25-75mcg/kg/min

Dexmedetomidine (500mcg/mL or 100mcg/mL)
- Generally combined with an opioid CRI to enhance analgesia and sedation when an opioid CRI alone is not enough.

- Will greatly reduce MAC of inhalants when used intra-operatively.
- Commonly used during the post-operative period as a treatment for emergence delirium or when the patient would benefit from long term sedation during the post-operative period.
- Can be given in combination with ketamine, lidocaine and opioids
- Cardiovascular effects (significant bradycardia, biphasic effects on blood pressure) will likely be seen during CRI administration. Vital signs should be monitored closely. It is best to avoid a dexmedetomidine CRI if the patient has cardiovascular disease.
- Inhibits antidiuretic hormone (ADH) so an increase in urine production may be seen. The bladder should be expressed prior to recovery if used as an intra-operative CRI.
- Inhibits insulin release so a transitory hyperglycemia may be seen. Avoid a dexmedetomidine CRI if serial glucose values need to be obtained.
- Loading dosage: 0.5-1mcg/kg IV should be given prior to starting the CRI in order to achieve an appropriate therapeutic level.
- CRI rate: 0.5-3mcg/kg/hr

Medetomidine

- Used in the same manner as dexmedetomidine.
- Loading dosage: 1-2mcg/kg IV prior to starting the CRI.
- CRI rate: 1-2mcg/kg/hr

- References available upon request. Please email the author for a copy of the slides for needle insertion sites and techniques at www.stephencital.com