ANALGESIA FOR WOUND MANAGEMENT

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KEY POINTS:

- Effective operative and postoperative analgesia is crucial for the patient and will also improve clinical outcome
- Understanding pain physiology is crucial for an effective treatment
- Different analgesic drugs and loco-regional anesthesia techniques are available to provide effective analgesia during wound management in dogs and cats
- What is new. Wound infusion catheters, TAP block, (LIPOSOMAL ENCAPSULATED BUPIVACAINE) Nocita®

The most widely recognized definition of pain comes from the International Association for the Study of Pain (IASP) and states that pain is a subjective unpleasant sensory or emotional experience associated with actual or potential tissue damage or described in terms of such damage.

Nociception is defined as the event of sensing mechanical, chemical and thermal stimuli, which have the ability or the potential ability to cause damage to the tissues, by neuronal structures known as nociceptors. Nociceptors are free nerve endings of the first order neurons that have the ability to encode physical insults into electrical signals and transduce them to the dorsal horn of the spinal cord.

In specific situations, nociceptors can lower their activation threshold following repeated stimulation, which results in peripheral sensitization. Conversely, nociceptors can also be desensitized as a consequence of excessive stimulation and activation.

Nociception is the physiologic process of sensing, encoding, and transducing a noxious stimulus, while pain is the global endpoint of the whole process that involves all structures of the central and peripheral nervous system and results in awareness of the sensation.

Typically, the perception of pain travels through three orders of neurons from the periphery to the brain cortex. First-order neurons carry information from the nociceptors to the macula densa in the dorsal horn of the spinal cord; second-order neurons relay this information from the spinal cord to the thalamus; and third-order neurons transmit the information from the thalamus to the primary sensory cortex, where the information is processed.

Pain is classified in two major categories: the first one is defined as physiologic pain and follows normal physiologic pathways, the second, known as neuropathic pain, is the consequence of pathology to nociceptors and conducting pathways.

The nervous system is capable of undergoing structural and functional changes in response to stimuli from the environment. This ability to change is known as plasticity and it is important to facilitate processes of learning and memory. However, it can also result in abnormal phenomenon such as hyperalgesia from high frequency stimulation that elicits long term potentiation of pre- and post-synaptic changes between 1st and 2nd order neurons at the level of the spinal cord.

All three orders of neurons (1st, 2nd, and 3rd) undergo plastic changes during central sensitization. It has
been shown in flexor motor neurons, lamina I and V neurons of the dorsal horn of the spinal cord, the thalamus) and the anterior cingulate cortex. With the aid of functional magnetic resonance researchers have demonstrated, in human subjects, changes during central sensitization also in the periaqueductal gray zone (PAG).

Central sensitization is characterized by a reduction in the stimulation threshold, an expansion of cutaneous receptive fields, and an increase in background activity of spinal neurons. It is usually a consequence of injury to peripheral tissues, but it can also be triggered by windup-inducing repetitive electrical stimulation. Numerous features characterize central sensitization: adaptation of nociceptive-specific neurons to wide dynamic range neurons that now respond to low threshold innocuous and high threshold noxious stimuli, cumulative increases in the responses generated by a normal series of repeated innocuous stimuli, a wider spatial range of their input, and by changes that continue even after the termination of the triggering event.

Windup is defined as a progressive, frequency dependent facilitation of the responses of a neuron after the application of repetitive (usually electrical) stimuli of constant intensity. Dorsal horn neurons are more easily excitable after the application of a windup-evoking stimulus. Windup occurs only if stimulation of the nerve or tissues is of sufficient intensity to activate C-fibers and delivered at frequencies greater than 0.3 Hz and this phenomenon can be inhibited by blockade of the NMDA receptors.

Windup and central sensitization are not equivalent; while windup may be sufficient to cause central sensitization, it is not necessary, meaning that the presence or absence of windup cannot by itself be a marker of the presence of central sensitization ³.

The treatment of operative and postoperative pain is crucial not only for ethical reasons. The activation of the sympatho-adrenal system during nociception triggers several physiologic mechanisms that if left untreated will impact the overall outcome of a patient. The increase in cardiac output will increase oxygen demand in patients that may have reduced cardio-vascular reserves. The vasoconstriction at the surgical site may impact healing by impeding cellular and molecular mechanisms that are crucial to tissue healing and protection from bacterial infection.

Also, immune function is negatively impacted by inappropriate operative and postoperative pain management. Decreased appetite and the development of chronic pain states are also other important consequences of ineffective pain management.

Numerous options are available in addition to conventional systemically administered analgesics (opioids, NSAIDs and alpha-2 agonists). Local and regional anesthesia for the analgesic management of cancer patients has become more and more indicated due to the increasing evidence that high doses of opioids having negative immunomodulatory effects thus increasing the metastatic rate of certain neoplasms.

Splash blocks have been proven less effective than specifically targeting nerves when using local anesthetics to treat surgical incisions. The use of nerve stimulators and ultrasounds to locate nerves is becoming the standard of care even in veterinary medicine. The main reason for the failure of splash blocks is the necessity for contact time, this may increase the surgery time and cause inefficiency. Also, large volumes of local anesthetics are necessary for splash blocks and can increase the chance of local anesthetic toxicity.

Wound soaker catheters are soft and flexible indwelling devices that are placed in proximity or inside surgical wounds. These are used to administer constant rate infusions or repeated boluses of local anesthetics with the goal to provide long lasting local analgesia at the surgical site.

Potential complications of soaker catheters include infection at surgery site, for this reason it is recommended to use closed systems when infusing local anesthetics through these devices in order to decrease bacterial contamination. The use of a bacterial filter may decrease the chance of bacterial
Nocita® is a bupivacaine liposome injectable suspension intended for local infiltration at the surgical site in dogs. Each milliliter of Nocita® contains 13.3 mg of bupivacaine. It is indicated for a single administration of 5.3 mg/kg injected into the tissue layers at the time of incisional closure, this will provide up to 72 hours of local analgesia (Fig 1). This drug may be used as is or diluted 1:1 with an isotonic crystalloid solution in order to increase the available volume. For a complete block all layers of the incisions need to be infiltrated with an adequate amount of volume. It is important to draw back with every injection making sure the drug is not administered by the intravenous route. As of now Nocita® is only labelled for use in knee surgery, however extra-label use is commonly done and this drug is widely used for the infiltration of surgical incisions in the dog.

Transversus abdominis plane (TAP) block for analgesia after midline abdominal incision (Fig 2). The TAP block consists of infiltrating with local anesthetics the fascial plane that overlies the transversus abdominis, this ensures sensory blockade to the abdominal wall and improving patient analgesia in the operative and post-operative period.

REFERENCES

