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### **Wound Soaker Catheters:**

At the Foster Hospital for Small Animals and Tufts Veterinary Emergency Treatment and Specialties (Tufts VETS), we have been using wound soaker catheters routinely since 2004 for infusion of lidocaine (dogs) and intermittent bupivacaine injection in cats after a variety of procedures. These include limb amputation, ear canal ablation, intercostal and sternal thoracotomy, celiotomy, and soft tissue tumor excision.



*This dog, shown the evening after a thoracotomy, has a wound soaker catheter placed in a median sternotomy incision. Both the wound soaker (lowermost) and thoracic drain (uppermost) can be seen. He is ambulatory and comfortable.*

Two of our anesthesiology/pain medicine specialists, Dr. Emily McCobb and Dr. Cheryl Blaze, collaborated with experts at MILA International (Erlanger, KY) to develop the competitively priced veterinary catheters. Qualitatively, we find that the pain relief afforded to patients is excellent. Dogs recovering from an intercostal thoracotomy will lie on the side of the incision, which suggest that they are quite comfortable. Perhaps the most compelling application is the use of the wound soakers for limb amputation. In fact, the use of wound soaker catheters has become a common and preferred

amputation pain management technique in many hospitals. Patients are comfortable upon recovery from anesthesia, will stand, walk and eliminate with ease, and generally will eat the first postoperative night. It should be emphasized that we continue to use pre-, intra-, and postoperative multimodal analgesia, consisting of an intravenous opioid, ketamine or alpha 2 agonist infusion, and NSAIDS and/or epidural analgesia along with the wound soakers. However, we are able to reduce the amount of opioid medications and sedatives significantly. (See figures for views of patients managed with wound soaker catheters.)

In 2009, our group published a case series reviewing our experiences with the safety of the technique: Abelson AL, McCobb EC, Shaw S, Armitage-Chan A, Wetmore LA, Karas AZ and Blaze C. (2009) *Use of wound soaker catheters for the administration of local anesthetic for post-operative analgesia: 56 cases.* *Veterinary Anaesthesia and Analgesia.* 36:597–602. A study comparing recovery and rehabilitation pain in patients with and without wound infusion of local anesthetics is ongoing at the FHSA.



*The evening after forelimb amputation this dog is ambulatory and hungry. The infusion line seen in the foreground leads to her wound soaker and is labeled with a red lidocaine tag. She is slightly sedate from her anesthesia medications.*



*This dog, shown the day after a thoracotomy, has a wound soaker placed in the intercostal incision. She is interactive and comfortable.*

## Wound Soaker Catheters for Control of Post-Operative Pain in Dogs and Cats

Alicia Karas, Emily McCobb, Lois Wetmore, Cheryl Blaze

One of this decade's remarkable advances in managing post-surgical pain involves delivering local anesthetic directly to the wound, and is easily adopted for use in veterinary patients. Traditional nerve block techniques eliminate the pain of surgery but mastery can require significant expertise. In addition, commonly used local anesthetics have relatively short durations (lidocaine, 1 – 2 hours; bupivacaine, 4 – 6 hours). The availability of implantable infusion catheters makes it possible to use repeated dosing or continuous infusion of local anesthetics into surgical wounds, and improves pain control. FDA approved human use catheters are available, but costly. Modestly priced catheters are commercially available for veterinary use (see below). Basically, they consist of a pliable catheter with tiny holes along the implanted end, functioning somewhat like a garden "soaker hose" (See figure). The catheter is buried in the wound bed during surgical closure.



*MILA™ version catheter with 4 inch diffusion length*

Constant infusion of the local anesthetic can be used for patients staying in hospital. If electronic pumps are unavailable, or early discharge is planned, an elastomeric balloon pump can be used to achieve continuous infusion. Alternatively, intermittent injection of bupivacaine (every 4 – 6 hours) can be performed.

In humans, "wound soaker" catheters are used for cardiothoracic, abdominal, amputation and mastectomy surgeries, as well as for other major surgery types. Placement of the catheter is generally done at the end of surgery, and infusion duration is approximately 2 days. Benefits include reduction of mean pain scores at rest and with activity, reduction of daily consumption of opioids, and trends towards better patient satisfaction and reduced length of hospital stay.

To date, a small number of veterinary clinical studies of wound soaker catheters have been reported in the literature. The most studied surgical indication has been total ear canal ablation in dogs, but use for resection of fibrosarcomas in cats is also reported. We have published a review of clinical use of wound soaker catheters in our hospitals in 56 canine, feline and caprine patients. Collectively, studies reported to date have used either bupivacaine or lidocaine infusion. As with human studies, pain control was optimized, there was a reduced need for strong opioids, and the complication rate was low. Ancillary benefits include reduction in the level of sedation (or opioid side effects) and reduced hospital stay.

Concerns are sometimes raised about the effects of local anesthetics on wound healing, tissue integrity and infection. However, over the past decade it has become apparent that benefits of local anesthetics are not limited to simple inhibition of nerve conduction. They have been shown to have broad anti-inflammatory effects, including reduced production of eicosanoids, thromboxanes, leukotrienes, histamine, and inflammatory cytokines. They can also have antimicrobial effects.

Although vital to the overall immune response, inflammation can be responsible for severe morbidity in patients, in addition to its impact on the generation and maintenance of pain. Reported clinical complication rates for various methods of wound infusion of local anesthetics in humans are extremely low, with the exception of direct constant infusion into joints, which is not currently recommended. Therefore, it is time to re-examine the usefulness of peripheral local anesthetics in veterinary pain medicine.

### **Instructions for use of wound soaker catheters for surgeries with high potential for pain**

- Pre-, intra-, and post – operative analgesics are administered, generally starting with a strong opioid (e.g. hydromorphone, oxymorphone) +/- other adjunctive pain medications, and tapering to oral "go home" medications. Pain is assessed at regular intervals. Medications should be dosed according to patient evaluation, as weaker opioids (e.g. buprenorphine, tramadol) may be sufficient in conjunction with local anesthetic infusions.
- Prior to surgical closure, a soaker catheter is chosen so that the infusion holes will span the long axis of the wound, but be completely contained within it. The catheter is placed in the deepest layer of the wound, ideally with the injection port exiting dorsally. Deep placement helps assure that the catheter is close to major nerve trunks.
- The wound is closed over the catheter, which is fastened to the skin where it exits by means of a waterproof tape butterfly or other knotted suture technique. Care is taken not to occlude or kink the soft catheter. (See Innovation section for views of wound soaker catheters in place)
- A priming dose of bupivacaine (1.0 mg/kg) is injected slowly with the patient still under general anesthesia.
- Local anesthetic presence in the wound is continued by either:
  - o Continuous infusion of lidocaine (dog only)
  - o Intermittent bolus injection of bupivacaine (dog or cat)
- Administration of local anesthetic is continued for at least 24 hours, and up to 3 days. The catheter should remain in place for at least 6 hours after the last dose of local anesthetic to ensure that pain does not recur. If the patient is comfortable without the use of the local anesthetic drug the catheter may be removed. Note: the use of elastomeric "disposable" pumps requires that a flow controller of the appropriate rate be chosen.

### **DOSING**

#### **Dogs**

The lidocaine continuous infusion rate is 1.0 -2.0 mg/kg/hour. The dilution of lidocaine (from 1 – 2%) is adjusted so that the following approximate volumes are used:

30 – 40 kg, limb amputation wound	3 – 4 mls/hour
5 – 25 kg, limb amputation wound	1 – 3 mls/hour
30 – 40 kg, thoracotomy wound	2 – 3 mls/hour
5 – 25 kg, thoracotomy wound	0.75 – 2 mls/hour

The intermittent bupivacaine dose is 0.5 mg/kg every 4 – 6 hours. The 0.5% solution can be diluted to 0.25% with saline to increase coverage:

30 – 40 kg, limb amputation wound	4 – 8 mls/dose
5 – 25 kg, limb amputation wound	1.5 – 6 mls/dose
30 – 40 kg, thoracotomy wound	2 – 3.5 mls/dose
5 – 25 kg, thoracotomy wound	0.75 – 2 mls/dose

## ***Dosing - Cats***

Bupivacaine is diluted to 0.25%, with injection of 0.5 mg/kg every 4 – 6 hours.

The volume of drug used may be adjusted somewhat according to the size of the wound bed and the adequacy of pain control. Palpation of the entire wound, initially with the amount of pressure that you can comfortably apply over a closed eyelid and then slightly more, should elicit little reaction from the patient. Technical staff should be trained, and the catheter hub, syringes, pumps and lines should be clearly marked, to prevent accidental intravenous injection of local anesthetic – a significant hazard.

In our study, the most common complication was disconnection of the catheter from the infusion set. This can be avoided by the use of an intermittent injection technique or by securely attaching the infusion set to the catheter and using a tension loop.

## ***Anesthesia and Pain Case Challenge***

**History:** An 8 year old, 30 kg, mixed breed dog presents with recent onset of left hind leg lameness. Radiographs and subsequent biopsy reveal the presence of an osteosarcoma of the distal femur. The decision to amputate the limb is made. How would you manage this dog's acute perioperative pain using a wound soaker catheter? Calculate doses and volumes of local anesthetic needed to maintain pain control, and duration of treatment.

**Comments:** Limb amputation causes significant pain that is best managed by a multimodal analgesic strategy in the perioperative period and for several weeks after surgery. An excellent protocol would be to premedicate this dog with acepromazine, 0.025 mg/kg, and hydromorphone 0.1 mg/kg. Anesthesia is induced with ketamine-midazolam (0.5 ml of each drug per 9 kg IV, given to effect) and maintained with isoflurane. A lumbosacral epidural with 0.1 mg/kg sterile preservativefree morphine is placed preoperatively. Prior to closure, a wound soaker catheter with a diffusion area of 4 – 5 inches is placed in the deepest fascial layer of the wound, exiting towards the dorsal lumbar region. After wound closure, a dose of 6 mls of 0.5% bupivacaine ( $[30 \text{ kg} \times 1.0 \text{ mg/kg}] / 5 \text{ mg/ml}$ ) is injected through the catheter, which is secured to the skin. Postoperatively, the dog is given a 2.2 mg/kg dose of carprofen SQ and a continuous infusion of lidocaine through the wound soaker is started. His now lower bodyweight is taken into account (27 kg). The volume for this size wound is approximately 3 mls/hour, which at 2 mg/kg/hour is 2.7 mls per hour of 2% (20 mg/ml) lidocaine. Using a syringe pump, lidocaine is delivered to the wound for a total of 36 hours. During this time, intermittent IV buprenorphine (0.01 – 0.02 mg/kg q 6 hours) or hydromorphone (0.05 – 0.1mg/kg, q 6 hours) are given, if needed according to pain assessment. The dog may be discharged on oral carprofen plus tramadol +/- gabapentin, continuing for as much as 2 weeks.