DIFFUSION CATHETER

The diffusion catheters are currently available in the sizes listed below (see chart below), each with a different length of catheter having micropores for drug administration.

Item Number:	Length of tubing having micropores:
DIFF2	2 inches
DIFF4	4 inches
DIFF6	6 inches
DIFF7	7.5 inches
DIFF9	9 inches

The distal tip of the catheter is sealed so that liquid exits only from the micropores, enabling saturation of a larger area of the wound bed. The black depth indicator marks a point one half inch (1.25 cm) from the first micropore.

Directions for Use:

1. The diffusion catheters are sterile and designed to be placed intra-operatively. To use the diffusion catheter properly it should be buried in the deepest layer of closure. For example, in a forelimb amputation the end of the catheter is curved over the nerve stumps and routed dorsally within the deeper muscle layer of the thoracic wall prior to closure of the muscle and subcutaneous tissue (Hansen, 2003).
2. The catheter should exit the wound dorsally and it is important that the micropores all be placed under the surface of the skin.
3. The end of the catheter can be secured to the skin using the catheter wings provided. The additional white suture wing can be placed anywhere along the catheter. To secure this wing, first suture the wing to the catheter using the top and bottom grooves, then suture the wings to the patient. Several stay sutures may be necessary to secure the catheter tubing in particularly agile patients.
4. The open end must be capped using an injection port or connected directly to an infusion set to allow constant rate infusion. An in line bacterial filter may be attached to help prevent contamination. A sterile dressing or Tegaderm® pad may be applied over the site where the catheter enters the wound if desired.

Protocol for Use:

Diffusion catheters can be used for intermittent administration of drug or can be attached to a syringe pump or fluid pump for constant rate infusion (CRI) delivery. It is best to administer 2 mg/kg (or less) of lidocaine or bupivacaine as a slow injection prior to extubation of the patient in order to “pre-load” the catheter. Post-operatively lidocaine can be continued as a continuous infusion at a dose of 2 mg/kg/hr, or bupivacaine may be given as an intermittent bolus every six hours at a dose of 0.5 to 2 mg/kg in dogs (Hansen, 2003). The concentration of local anesthetic should be adjusted to provide an appropriate volume depending upon the size of the patient. Catheters may be kept in place as long as they are needed if there is no evidence of infection (typically 1 to 2 days), with a maximum recommended time of 3 days. The patient should be observed for 12 to 24 hours off of the local anesthetic infusion before the catheter is pulled.

OPTIONAL ACCESSORIES:

Item #2420	**.2 Micron Filter**
Item #4206	**6 French Peel Away Introducer**
Item #7100	**Elastomeric Pump – 100ml - 0.5ml hr**

Instructions Written by:

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References - Hansen, B. Updated opinions on analgesic techniques, in: *Proceedings.* 21 st Annual American College of Internal Medicine Forum 2003; 810-813.

Follow this link for Sample Cases

SAMPLE PROTOCOLS – DIFFUSION CATHETER IN CANINE PATIENTS

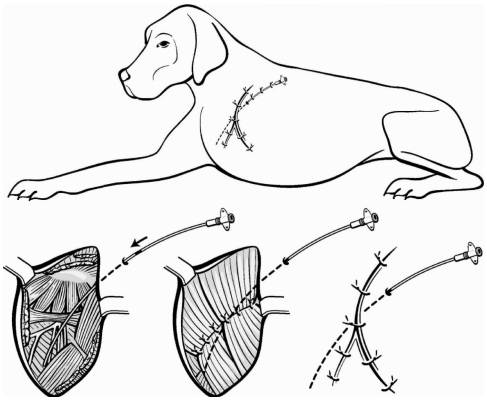
Typical dose rates for lidocaine are 2 mg/kg/hr (maximum dose). For bupivacaine a bolus dose of up to 1.5 mg/kg can be used every four to six hours. The goal is to achieve adequate analgesia with optimum volume. If the volume of local anesthetic is too small then the entire wound area will not be anesthetized. On the other hand, excess volume may contribute to seroma formation or cause fluid leaking around the catheter. The concentration of lidocaine can be adjusted by diluting lidocaine with saline from 2 to 1.5 or 1 % lidocaine in order to achieve the desired volume. In our experience 3 to 5 ml per hour is adequate, depending on the size of the wound. We recommend leaving the diffusion catheter in place for no more than 48 to 72 hours as it is unknown whether infection rate will increase if they are left in for longer periods of times. Some clinicians taper the dose of the lidocaine infusion over this period (for example by cutting back by 1 ml/hr every 12 hours).

If drains are also used they should be placed ventral to the diffusion catheter.

It is important to remember that since soaker catheters are not placed until the end of surgery, good pre-operative and intra-operative analgesic protocols, typically multi-modal, are essential. In the post operative period it is important to monitor the animal closely for pain level. Some patients will require additional pain medications if the analgesia from the diffusion catheter is not adequate. In contrast, when analgesia from the diffusion catheter is very good the patient may have a profound response to systemic opioids, requiring dramatically lower doses than patients who do not have a diffusion catheter in place.

CASE EXAMPLES:

1) Median Sternotomy, 9 year old German Shepherd (wt: 50 kg)



PreMed: Morphine 1 mg/kg IM
Midazalam 0.2 mg/kg IM

Induction: Ketamine/Midazalam

Maintenance: isoflurane in oxygen; Duramorph epidural; Morphine, Lidocaine, Ketamine CRI

Post-op: Intercostal block using bupivacaine at 1.5 mg/kg to block site of chest tube

Place DIFF6 (4 to 6 inch) along median sternotomy incision to provide local anesthesia to wound bed and ventral branches of intercostals nerves.
Lidocaine CRI at 2 ml/hr (note lower dose due to smaller area for administration).
Morphine CRI at 0.25-0.5 mg/kg/hr

2) Left sided TECABO in a 6 year old Cocker Spaniel (12.7 kg)

PreMed: Oxymorphone 0.1 mg/kg
Acepromazine 0.03 mg/kg
Induction: Propofol 4 mg/kg, to effect
Maintenance: Fentanyl CRI 0.3 µg/kg/min; Ketamine CRI 0.3 mg/kg/hr
Post op: Place DIFF4 into incision, taking care to avoid facial nerve
Load catheter with 1 mg/kg of bupivacaine or 3 ml of 5%
Lidocaine CRI at 2 mg/kg/hr (14 mg/hr, 1.5 ml/hr using 1% lidocaine in a syringe pump)
Carprofen at 2 mg/kg
Fentanyl Patch, 50 micrograms, placed 12 hours before surgery
Oxymorphone 0.05 mg/kg only if needed for break through pain

3) Forelimb amputation in a 10 year old Laborador Retriever (wt: 35 kg)

Pre-medication with standard doses of opioid and sedatives. Multi-modal analgesia provided peri-operatively including ketamine CRI, NSAIDs and additional opioids as appropriate.

A 6 inch or 7.5 inch diffusion catheter should be sufficient for the length of the incision. The catheter should be placed in the deepest layer of closure and exited through a separate exit incision. (see illustration).

The catheter can be loaded with 1 mg/kg of bupivacaine (35 mg or 7 ml of 5% bupivacaine) prior to extubation. A CRI of lidocaine can then be started once the animal is returned to its cage. At 2 mg/kg/hr the dog should receive 50 mg/hr. Using 1 % lidocaine the infusion rate can be set at 5 ml/hr. After 12 hours the infusion rate can be decreased to 3 ml/hr if the dog is comfortable.

With a diffusion catheter in place, dosages of systemic opioids can often be dramatically reduced. Forelimb amputations are typically given opioid pre and peri-operatively, however after the local anesthetic infusion is started, the dog may not require additional opioids after a single post-operative dose. Such patients typically are able to eat the evening of surgery and are usually waking by the next morning.

After 48 hours the local anesthetic infusion can be stopped and the patient observed for comfort level on discharge medications (i.e. an NSAID, potentially tramadol or gabapentin). If the patient is comfortable without the local anesthetic infusions then the catheter can be pulled and the patient discharged.

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