How to Place an Epidural Catheter Easily and Maximize Its Clinical Effects

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1. Introduction
Epidural anesthesia is a beneficial mode of pain management in the equine practice.\textsuperscript{1,2} It is an easy technique that can have profound effects on acute and chronic pain.\textsuperscript{1–3} Using the epidural space allows for direct analgesic effects in the dorsal horn of the spinal cord, which minimizes systemic effects. A smaller dose of a drug can be used in epidural anesthesia, and it will oftentimes have a longer duration of action than when used systemically.\textsuperscript{4} Epidural anesthesia and analgesia have long been used primarily for orthopedic and soft tissue conditions affecting the hindlimbs and perineal region.\textsuperscript{1–5} However, there are reports of infused volumes that provide similar effects for the forelimbs, abdomen, or thoracic structures.\textsuperscript{2} Epidural catheters can be easily maintained in hospital settings and result in few complications with long-term use.\textsuperscript{2}

2. Materials and Methods
Locating the site for epidural catheter placement can easily be determined by palpating the junction between the first and second coccygeal vertebrae. The space can be palpated while the tail is moved in an up-and-down motion. An area \( \sim 15 \times 15 \text{ cm} \) is clipped and steriley prepared (Fig. 1). Lidocaine (1.0–1.5 ml) should be injected into the skin and dermis at the site (Fig. 2). After sterile preparation of the region, the horse should be sedated as needed to ensure that movement is minimized. Sterile gloves are used when placing the catheter. There are several epidural catheter kits commercially available.\textsuperscript{a,b} While allowing adequate time for thorough sedation of the horse, the clinician should open the catheter kit and become familiar with all of the components (Fig. 3). The catheter is wrapped in a coil, and when removed from the package, it can unravel quickly. Therefore, it is important to ensure that it does not get contaminated. There is a wire stylet in the catheter that makes it more rigid for easier placement. The catheter length in centimeters is shown with black gradation marks and should be noted to determine the distance that the catheter will be inserted (Fig. 4). Some techniques have discussed performing a stab incision with a #15 blade or creating a pilot hole with a 14-gauge needle. The site should be palpated again by having an assistant move the tail vertically or wrapping the tail with a sterile cloth drape to allow manipulation of the tail by the individual placing the catheter.
The tuohy needle should be inserted just cranial to the caudal vertebrae. This position in the intervertebral space will help when advancing the catheter, because the catheter makes the bend into the space as it is advanced forward. The needle will be tilted caudally at an angle of \(75–80^\circ\) to a line from the croup to the tail head (Fig. 5). The bevel of the needle end should be directed cranially. After going through the skin, there will be resistance created when advancing through the dorsal spinal ligament. After the catheter has been advanced through this structure, the stylet of the needle can be removed, and a drop of saline is placed in the hub of the needle. The needle is advanced until the saline in the hub is drawn into the epidural space by negative pressure. This will not always happen, especially if the space has been used before for catheter placement. If the drop is not drawn into the epidural space, saline can be gently injected into the space with a 3-ml syringe. When the space has been reached, the saline will inject easily. After the space has been reached, advancement of the needle 1 mm farther will aid in placing the catheter so that it does not back out of the space. The catheter is then inserted into the needle hub with the aid of the small catheter guide and advanced into the space \(8–10\) cm; this depth should be measured on the catheter with gradation marks before catheter placement (Fig. 6). Some resistance may be felt when the catheter enters the space and makes the bend cranially at the end of the needle. After the catheter is advanced to the desired distance, the stylet is removed, and the tuohy needle is removed carefully to avoid cutting the catheter. The needle is backed out of the skin by moving the hub cranially as the angle of the needle comes out of the skin to...
minimize the chances of cutting the catheter at the skin entrance site (Fig. 7). The catheter should be cut with a scalpel blade so that there is ~10–12 cm of catheter that extends beyond the skin surface. There is a butterfly piece that is attached to the catheter and then sutured in place (Fig. 8). The catheter is sutured with 2–0 nylon close to the insertion site, being careful to not kink the catheter. Some techniques describe covering the catheter with elasticon" or an ioban.d Our experience has shown that bandaging the site is not well tolerated by the horse.

3. Results

Medical records from horses with an epidural catheter placed that were examined at Oregon State University Lois Bates Acheson Veterinary Teaching Hospital between January 2007 and March 2009 were included in this paper. Information collected included breed, gender, age, condition being treated, number of days that the catheter was in place, and complications encountered.

Results are from 12 cases. There was one American Paint Horse, one Morgan, one Friesian, one Warmblood, one Pony of America, two Arabians, two Quarter Horses, and two Thoroughbreds. Six mares and six geldings were identified. The average age was 12 yr (range = 3–27 yr). Conditions included laminitis in all four limbs because of re-
Table 1. Medications Including Dose and Frequency Administered in the Epidural Space

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detomidine (10 mg/ml)</td>
<td>3–6 μg/kg</td>
<td>q 4–12 h</td>
</tr>
<tr>
<td>Morphine (25 mg/ml)</td>
<td>0.1–0.2 mg/kg</td>
<td>q 6–12 h</td>
</tr>
<tr>
<td>Ketamine (100 mg/ml)</td>
<td>0.5–2 mg/kg</td>
<td>q 6 h</td>
</tr>
<tr>
<td>Fentanyl (0.05 mg/ml)</td>
<td>2–4 μg/kg</td>
<td>q 4 h</td>
</tr>
<tr>
<td>Xylazine (100 mg/ml)</td>
<td>0.17–0.2 mg/kg</td>
<td>q 4–12 h</td>
</tr>
<tr>
<td>Lidocaine (20 mg/ml)</td>
<td>0.2–0.4 mg/kg</td>
<td>q 6–12 h</td>
</tr>
</tbody>
</table>

Complications encountered included profound sedation when the upper dose range of detomidine was used, ataxia from the use of ketamine in the epidural space, and generalized pruritis after using a combination of morphine and detomidine. Three patients had bandages placed over the catheter that consisted of elasticon or an ioban placed over gauze. All had rubbed the first catheter out within 6 h. Nine horses did not have the catheters bandaged, and this did not cause complications. One patient developed dermatitis from the betadine scrub used for sterile preparation. The catheter was removed, and a second catheter was placed 24 h later. Chlorhexidine solution was used during the subsequent catheter placement, and the dermatitis resolved within 4 days with topical hydrocortisone cream.

Medications administered through the catheter are listed in Table 1. Combinations included morphine with detomidine and xylazine with lidocaine. All other medications were administered separately at different time intervals. Medications were mixed with volumes of 0.9% saline ranging from 10 to 70 ml, depending on the involvement of forelimbs or hindlimbs in the clinical condition being treated. To obtain pain control of the forelimbs, a volume of saline ranging from 50 to 70 ml was used in horses from 450 to 550 kg.

All patients responded favorably to the epidural injections. Laminitis is a very painful condition, and patients will be tachypneic, tachycardic, shifting weight, and displaying reluctance to move. These patients showed profound improvement with decreases in heart and respiratory rates, willingness to move around the stall or more importantly, lie down comfortably, and less shifting of weight. Patients with laminitis included two mares with retained fetal membranes and signs of laminitis before referral. Both mares were euthanized after sinking in all four limbs. Two patients had colitis caused by Neorickettsia risticii and foundered soon after presentation. Both were euthanized because of continued deterioration in the face of aggressive medical treatment. Epidural injections made them more comfortable during treatment, but they did not reverse the underlying cause of the laminitis that resulted in death. The mare with the broad ligament hematoma was extremely painful and showed persistent colic signs with no resolution in clinical signs with constant rate infusions of lidocaine, butorphanol, and ketamine. After epidural catheter placement, she received two doses of xylazine (0.17 mg/kg) and lidocaine (0.2 mg/kg) that made her significantly more comfortable, and the catheter was removed after the resolution of the pain. She was discharged the following day with no further complications. Using an epidural catheter for cellulitis and lymphangitis has been very beneficial. These horses are often very painful and will bear excessive weight on the opposite limb, which raises concern for support limb laminitis. After the horses are appropriately analgesed, they are willing to walk, which aids their treatment and improves their overall clinical status and general wellbeing.

Of the twelve horses treated with epidural catheters, 5 of 12 (42%) were discharged from the hospital, and 7 of 12 (58%) were euthanized. Use of an epidural catheter aided in treatment of the individuals by making them more comfortable while their underlying condition was treated. The numbers in this paper would suggest that use of an epidural catheter was detrimental to the patient outcome; however, there are too few numbers to come to such a conclusion. The horses in which euthanasia was the end result had a poor prognosis when admitted to the hospital.

Contraindications for use of an epidural catheter may include cases in which the patient has had reactions in the past to drugs used in the epidural space. The drugs’ effects may be exacerbated with direct administration into the epidural space. Inflammation and fibrosis have been identified as potential long-term effects of epidural catheterization, and therefore, if there is inflammation present (i.e., meningoencephalitis), using an epidural catheter may create more problems locally. Cases in which there is a wound or dermatitis over the site of epidural catheter placement may impede the use of a catheter.

Another concern with using an epidural catheter pertains to managing the laminitic horse. Although complete resolution of pain is unlikely, making them comfortable to the point where they are standing more frequently could potentially predispose them to ventral displacement or rotation of the third phalanx. However, the overall detrimental effects of pain and the inciting cause must also be considered when treating a horse with laminitis.

4. Discussion

Placing an epidural catheter is a simple procedure that can be used in practice for various conditions.
Entrance into the caudal aspect of the epidural space and utilization of a 75–80 degree angle to the line from the croup to the tail head when entering the space can make placement of the catheter easier as it is guided into the space. Removal of the needle from the space by rocking the hub cranially as the needle exits the skin can decrease the risk of cutting the catheter prematurely. Larger volumes of diluent can be used to provide analgesia to the forelimbs and abdominal and thoracic structures. Larger volumes have been documented to cause complications such as collapse during administration which was not seen in these cases. Epidural catheters can be used for cases that require multiple injections, such as cellulitis or lymphangitis, fractures of the pelvis or hindlimbs as long as the fracture is properly stabilized, dystocias requiring manipulation of the fetus or fetotomy, laminitis affecting all four limbs, severe wounds, septic arthritis, and other conditions affecting the hindlimbs and perineal region, to maintain an even plane of analgesia. The epidural catheter is not a treatment for the underlying condition but can aid in recovery of difficult clinical conditions. There are few complications associated with its use, and using an epidural catheter can negate systemic side effects of other drugs commonly used for analgesia. The clinical efficacy and ease of this procedure were documented in these cases but further research with larger numbers of cases with various conditions would be beneficial.

References and Footnotes

*Epidural Catheter Trays, ReCathCo, Allison Park, PA 15101.
+Elasticon, Johnson and Johnson Healthcare, Allamuchy, NJ 07820.
+Ioan, 3M Health Care Professionals, St. Paul, MN 55144.