How to Alleviate Acute and Chronic Hindlimb Pain in Horses  

L. R. Goodrich and A. J. Nixon  

Cornell University, College of Veterinary Medicine, Ithaca, NY, 14850, USA.

1. Introduction  
Musculoskeletal pain associated with acute and chronic hindlimb injuries is common in equine practice. Unabated pain can result in complications such as gastrointestinal disorders and support limb laminitis. Pain management is critical to decrease suffering, to decrease peri-surgical stress responses, to promote early ambulation, and to minimize the devastating effects of contralateral limb laminitis [1]. Non-steroidal anti-inflammatories are the most commonly used conventional therapy to treat post-operative musculoskeletal pain such as osteochondrosis, joint sepsis, lacerations, fractures, and tendon injuries. However, the analgesia that these drugs provide is often inadequate, and their deleterious side effects are well known. Epidural opioids have been used successfully in humans and animals to provide analgesia for various causes, including post-operative pain, chronic pain, and pain-related complications [2-4]. However, the effectiveness of this analgesia varies depending on the patient and may not be adequate for intense pain [5]. Various studies have combined opioids with local anesthetics, which can result in sympathetic blockade and, most importantly, motor nerve paralysis in horses [6,7]. Recent studies in humans, dogs, and horses indicate that there is a synergistic effect from combining morphine with alpha-2 agonists, which results in prolonged and profound analgesia [8]. Most importantly, motor function is not affected. In a study by Sysel et al. [9], combination of morphine and detomidine was administered epidurally to evaluate analgesia after induced chemical synovitis of the tibiotarsal joint. Profound analgesia resulted. The same combination of morphine and detomidine was also used pre-operatively by Goodrich et al., [1] to evaluate post-operative analgesia after bilateral hindlimb arthroscopy, where large subchondral bone defects were made. Significant improvements in lameness scores and heart rates were reported. Administering epidural morphine and detomidine for hindlimb analgesia through an epidurally-placed catheter ensures proper administration of the drug and ease of repeated administration. Furthermore, the catheter may allow drugs to reach farther cranially into the epidural space, which provides analgesia to the upper limits of the hindlimbs. Long-term epidural catheterization is also not associated with any adverse systemic effects [10]. We have used this method of providing profound analgesia in our patients pre-operatively as well as after painful traumatic incidents and hindlimb diseases. This technique and drug combination has resulted in profound analgesia and abated support limb laminitis; additionally it has not been associated with any negative systemic effects.

2. Materials and Methods  
The materials needed include a Continuous Epidural Tray [a], an injection cap, materials for sterile prep, a #15 scalp knife blade, drugs for sedation, a non-absorbable suture on a straight needle, white adhesive tape, elastikon [b], and a stapling device. Epidural drugs include preservative-free morphine [c] and detomidine [d].  
The horse should be sedated to a level consistent with good analgesia but without incurring excessive swaying. The tail should be grasped with one hand and moved up and down several times, while the forefinger of the opposite hand palpates above the tail head to determine the most palpable and cranial joint space caudal to the sacrum (Fig.1). The hair over the sacrocudal and caudal vertebral areas should be clipped, and the area should be aseptically prepared for epidural catheter placement. Two milliliters of 1% lidocaine (provided in kit) should be deposited subcutaneously over the joint space (Fig. 2). A small stab incision should be made through the skin using a #15 blade (Fig. 3). An 18-gauge, 3.5-in Tuohy needle with stylet (provided in kit) should then be inserted through the stab incision at an angle approximately 45° to the horizontal plane (Fig. 4).
Figure 1. The tail head should be palpated, while elevating the tail, to determine the most palpable joint space caudal to the sacrum. - To view this image in full size go to the IVIS website at www.ivis.org.

Figure 2. Two milliliters of 1% lidocaine should be deposited sub-cutaneously as a visible bleb over the joint space. - To view this image in full size go to the IVIS website at www.ivis.org.

Figure 3. A small stab incision should be made using a #15 blade through the dermal layer of skin. - To view this image in full size go to the IVIS website at www.ivis.org.

Figure 4. An 18-gauge Touhy needle should be inserted through the stab incision at an angle 45° to the horizontal plane. - To view this image in full size go to the IVIS website at www.ivis.org.

The beveled end of the needle should be pointing cranially. Placement of the needle into the epidural space is confirmed by palpable penetration of the ligamentum flavum as well as ease of catheter advancement. The stylet is taken out of the Tuohy needle and the 21-gauge nylon catheter (provided in kit) is fed through the needle into the epidural space (Fig. 5).

Figure 5. The epidural catheter is fed through the Touhy needle into the epidural space. Very little resistance should be encountered at this point. - To view this image in full size go to the IVIS website at www.ivis.org.

A small amount of resistance is sometimes felt initially, but the catheter should advance with gentle manipulation if the Tuohy needle is appropriately placed. The catheter is advanced approximately 5 - 6 cm to the lumbosacral region. The distance between the sacrocaudal vertebral space and the lumbosacral region can be measured to ensure that the catheter is advanced to the correct distance. A 14-gauge, 1.5-in needle is passed into the skin approximately 2 cm away from the needle and exits out of the stab incision next to the Tuohy needle (Fig. 6). The Tuohy needle is then backed out over the catheter (Fig. 7). The epidural catheter is passed through the 14-gauge needle before it is backed out of the skin. The catheter exits the skin in a different location from the epidural space exit which may reduce the risk of ascending infection. The excess catheter length is cut to leave 12 cm external to the skin. A catheter connection device (provided in kit) is placed on the end of the catheter (Fig. 8).

Figure 6. A 14-gauge, 1.5-in needle is passed through the skin to exit out of the stab incision. This is done with the Touhy needle in place so as not to transect the catheter with the needle. - To view this image in full size go to the IVIS website at www.ivis.org.
The ends of the device are rotated counterclockwise to one another, the catheter is placed into the small end, and the device ends are rotated clockwise so that the device is screwed onto the catheter end. An injection cap can then replace the plastic cap. A butterfly piece of white adhesive tape is secured to the epidural catheter at the junction of the catheter and skin, and at least 2 sutures of 2-0 nylon are used to secure the catheter to the skin (Fig. 9). Two pieces of 10-cm-long elastikon should be placed over the catheter, and the edges should be stapled to the skin (Fig. 10). The catheter should then be flushed with 1 - 2 ml of heparinized saline [e].

**Research Horses**

Twenty-six horses were sedated and had epidural catheters placed 2 - 24 h pre-operatively. One h pre-operatively, the horses were administered a combination of morphine sulfate (0.2 mg/kg) and detomidine hydrochloride (30 µg/kg) using the epidural catheter with the volume of the drug increased with saline to 0.044 ml/kg body weight. Xylazine hydrochloride (1 mg/kg, IV) was administered 10 min before induction with ketamine sulfate (2 mg/kg, IV) and maintenance anesthesia using halothane. All horses were positioned in dorsal recumbency; they had bilateral arthroscopic debridement of a 15-mm cartilage and subchondral bone defect on the lateral trochlear ridge of the femur. Each defect was subsequently filled with a chondrocyte allograft test material in one stifle and chondrocyte allograft control product in the opposite stifle. Horses were assisted through recovery and walked to a recovery stall where phenylbutazone (4.4 mg/kg, orally) was administered. No other drugs were administered during anesthesia or recovery other than those reported. After surgery, horses were re-administered the morphine and detomidine combination 0 - 3 times as deemed necessary by monitoring the clinical signs of pain and discomfort.

**Clinical Cases**

Thirty-five clinical horses ranging in age from 3 mo - 25 yr were presented to the large animal hospital between 1996 and 2003 with various hindlimb pathologies including septic joints (fetlock, tibiotalar, femoral patellar, or coxofemoral), septic tendon sheaths, calcaneal bursitis/osteomyelitis, large lacerations, cellulitis, fractures (metatarsal or proximal phalangeal),
annular ligament desmitis, and sole abscesses. These horses were sedated and had epidural catheters placed peri-operatively as described above. Treatments were repeated as deemed necessary by clinical signs of lameness and elevation in heart rate and/or respiratory rate. Catheters were maintained by flushing once daily with 1 ml heparinized saline.

3. Results

Research Horses
When the morphine and detomidine combination was administered, horses remained sedated for approximately 20 - 30 min as visualized by head droop, drop in heart rate, and swaying. However, this did not interfere with their ability to walk. After recovery from anesthesia, analgesic effects of the epidural administration of the morphine and detomidine lasted a minimum of 6 h post-recovery. Many of the horses did not need to be re-dosed post-operatively. A few of the horses were re-dosed one time, which took place 6 - 14 h after recovery. Two horses were re-dosed two times.

Clinical Cases
Analgesia was considered good to excellent for all clinical cases. Catheters were maintained for 24 h - 3 wk. Catheters were placed with ease and efficiency. Average duration of catheter placement from prepping the site to administration of the drug was 10 - 30 min. Efficacy of the morphine and detomidine combination depended on severity of the pain, duration of pain before presentation to the hospital, and progression of the disease processes. The average duration of effective pain alleviation was 18 - 24 h. In cases with mild pain, the morphine and detomidine combination provided an analgesic effect up to 48 h. Conversely, severe and unrelenting pain needed re-dosing every 6 - 8 h. Most cases had a marked improvement in lameness after administration of the drug combination and went from a 4/5 - 5/5 lameness to a 1/5 lameness. Many times, the heart rate and respiration rate would remain normal until 1 - 2 h before re-dosing was deemed necessary. Clinical signs of infection, rejection, or irritation to the catheter were not detected. One catheter became kinked, necessitating its removal, and one catheter pulled out when the horse rolled in its stall.

4. Discussion

This method of providing analgesia has been invaluable in our hospital. When research horses undergoing the same surgical technique were treated with the morphine and detomidine combination and compared with horses treated with saline, a significant improvement in lameness score and a significant decrease in heart rate was detected up to 8 - 10 h after treatment. The benefits of administering this drug combination through an epidural catheter is twofold: drug delivery to the epidural space is ensured, and repeat drug doses can easily be administered for several weeks, if necessary. The pain induced in the research surgery described is most likely similar to pain induced when horses are operated on for bilateral osteochondritis dissecans (OCD) in the femoropatellar joints. We often place epidural catheters and administer this drug combination preemptively before proceeding with surgery on clinical cases. Treating pain before it occurs has been shown to effectively abolish the sensitization effect that often arises in response to pain [11].

Sysel et al., [9] reported the use of this drug combination before causing a chemical synovitis in the tibiotarsal joint. Profound analgesia was produced for several hours. In that study, results of long-term catheterization were also evaluated, and no adverse systemic effects were noted [9]. We did not detect any adverse effects to catheterization in either the research or clinical group of horses.

When placed pre-operatively, epidural catheters stayed secure throughout all recoveries from general anesthesia. The techniques, exiting the catheter through the skin 1 cm from where it enters the epidural space, suturing the catheter in place, and stapling elastic wrap over the catheter, seemed to hold the catheter in place quite well. Catheters remained secure even if the elastikon became wet and/or the horses had a rough recovery from general anesthesia.

We believe that placing the drug combination in the volume of .044 ml/kg is important in extending the drug to lumbar 4, because innervation to the upper hindlimb (stifle and higher) is derived from that region of the spinal cord. We base this on dye studies evaluating the cranial migration of fluid [12-14].

The analgesic effects on clinical cases were profound. We feel that support limb laminitis was abated in many cases: the horses were able to bear weight on the painful limb during the resolution of the disease process. The length of time that epidural catheters remained in place was between 24 h - 4 wk. Some of the horses were released from the hospital with the catheter in place so that drugs could be administered by the referring veterinarian.

The administration of epidural drugs did not seem to mask any important clinical signs. If on-going disease was still present, the horse began to show signs of discomfort when the analgesia began to subside and repeat dosing was deemed necessary. In summary, we feel that epidural catheterization and administration of a morphine adenoid combination profoundly alleviates hindlimb pain caused by many different disease processes. We have been able to more successfully treat clinical patients preemptively and post-operatively by alleviating pain and abating the devastating effects of support-limb laminitis.
Footnotes

[a] SIMS Portex Inc., Keene, NH 03431.
[b] Elastikon, Johnson & Johnson, Sommerville, NJ, 08876.
[c] Preservative-free morphine, PCCA, Houston, TX, 77005.
[d] Dormosedan, Pfizer Animal Health, West Chester, PA, 19380.
[e] 0.9% sodium chloride injection, Abbott Laboratories, North Chicago, IL, 60064.

References


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