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CAUDAL EPIDURAL ANESTHESIA IN CURRENT PRACTICE IN HORSES

ANESTEZIA EPIDURALĂ CAUDALĂ ÎN PRACTICA CURENTĂ LA CABALINE

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ABSTRACT | REZUMAT

Caudal epidural anesthesia provides desensitization of the tail, anus, rectum, perineum, vulva, vagina, urethra and bladder in obstetrical, standing surgical cases or pain therapy. There are two commonly used techniques to perform caudal epidural anesthesia in horses. First technique requires insertion of the needle perpendicular to the skin in the center of elected space (sacrococcygeal or intercoccygeal), the second demands the placement of the needle at the caudal aspect of intercoccygeal space at 30° angle to the horizontal plane. Substances that may be used in caudal epidural anesthesia include: local anesthetics, opioids, α2-agonists, ketamine and tramadol.

Keywords: caudal epidural anesthesia, horse

Anestezia epidurală caudală asigură desensibilizarea anusului, rectului, zonei perineale, vulvei, vaginului, uretrei și vezicii urinare în cazurile obstetricale, în proceduri efectuate pe pacienți în poziție patrupodală sau în terapia durerii. Există două tehnici utilizate în mod obișnuit pentru efectuarea anesteziei epidurale caudale la cabaline. Prima tehnică necesită introducerea acului perpendicular pe piele în centrul locului de elecție (sacrococcigian sau intercoccigian), a doua metodă necesită poziționarea acului în partea caudală a spațiului intercoccigian la 30° față de planul orizontal. Substanțele care pot fi utilizate în anestezia epidurală caudală includ anestezicele locale, opioidele, α2-agoniștii, ketamina, tramadolul.

Cuvinte cheie: anestezie epidurală caudală, cabaline

The risks associated with general anesthesia are well known by all those involved in the equestrian field. It is notorious that the mortality associated with general anesthesia in horses, in elective situations may reach 1%, but in emergency situations go up to 10% (10, 18). In general, the risk of mortality is the main factor taken into account when deciding whether the risks outweigh the benefits of achieving general anesthesia (27). In reality, the risks are greater, with non-lethal complications associated with the recovery period of general anesthesia. The respiratory and cardiovascular changes induced by anesthesia and the non-physiological decubitus position lead to a reduction in oxygenation and tissue perfusion, that causes the onset of myopathies and gastrointestinal dysfunctions (28). The use of anesthesia protocols that allow practitioners to perform diagnostic or surgical procedures on horses in a standing position would be of major clinical importance (27).

It is known that the blockage of sensitive fibers in the spinal cord produces anesthesia and analgesia.

The use of the epidural space for administration of drugs for analgesia and anesthesia became fairly common in the horse.

Caudal, sacrococcygeal or intercoccygeal epidural anesthesia and analgesia provide desensitization of the tail, anus, rectum, perineum, vulva, vagina, urethra, and bladder in conscious standing horses (24). An epidural injection can be administered easily in the field to assist with a variety of issues including but not limited to dystocia, rectal prolapse, uterine prolapse, surgery of the rectum, vagina, perineum and/or bladder/urethra and good adjunctive analgesia for painful conditions of the stifles and hocks (6, 8).

Additionally, caudal epidural anaesthesia can be used to provide perioperative analgesia or relief of inflammatory, traumatic and chronic pain (25). The epidural space is accessible at the lumbosacral articulation (cranial epidural) or caudal to the sacrum (caudal epidural). The caudal epidural (sacrococcygeal or intercoccygeal) is the preferred space to use, because it is easier and safer to perform in the field (6).

To avoid ataxia, the cranial epidural space (lumbosacral space) is less commonly used (1, 3, 15).

Accessing the cranial epidural space can be more difficult, particularly in well-muscled or obese horses. The procedure requires longer needles, and the landmarks are less obvious.

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Dural puncture and potential for acquiring cerebral spinal fluid is greater in the more cranial space.

The aim of this material is to describe the technique for quick and safe caudal epidural anesthesia, to give some examples of anesthetics substances that can be used.

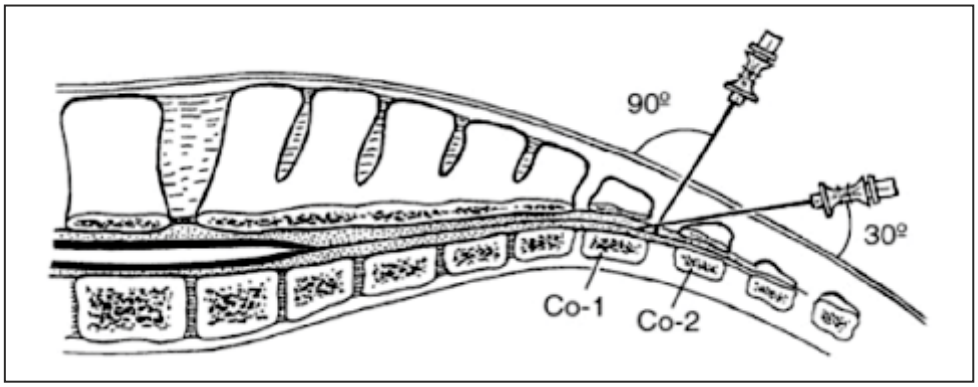

Fig. 1. Needle placement for caudal epidural anesthesia in horses (1)

ANATOMY RELEVANT FOR EPIDURAL ANESTHESIA

The spinal cord and meninges of horses generally terminate caudal side of the second sacral vertebrae. This is just caudal to the sacroiliac joint (6, 12).

In the horse, the perineal–inguinal region is innervated by the coccygeal roots of the pudendal and caudal rectal nerves and the ventral branches of lumbar nerves L1 to L3.

The sacral region is innervated by the caudal cutaneous femoral nerve originating from sacral nerves S1 and S2 and sacral nerves S1 to S5.

The lumbar region is innervated by lumbar nerves L1 to L6 and the thoracic area is innervated by thoracic nerves T8 to T18 (16).

There are studies showing that caudal epidural technique can provide analgesia up to the thoracic region (13). The epidural space is accessed via the intervertebral space between the first coccygeal vertebrae (Co1-Co2), although the sacro-coccygeal (S-C) and the second intercoccygeal (Co2-Co3) space can be used as alternative routes, without risk of entering the spinal canal. Either access site can be easily palpated when moving the tail up and down with the other hand (16).

In some horses, the last sacral and first coccygeal vertebrae are fused and the first moveable space may be the first coccygeal interspace (8).

The first intercoccygeal joint lies approximately 2.5-5 cm cranial to the origin of the tail hairs. This point is at the level of the caudal skin folds that can be seen at each side of the tail when it is raised (12).

The space between the two coccygeal vertebral arches, the interarcual space, can be relatively small in horses compared with bovines and sometimes difficult to locate with the needle. The epidural space at this level contains the nerves of caudal equina, venous sinuses, and epidural fat.

TECHNIQUE FOR CAUDAL EPIDURAL ANESTHESIA

The perpendicular depth from the skin to the first intercoccygeal space is approximately 3.5 to 8.0 cm. (17). The horse should be restrained adequately in stocks and after identifying the preferred site and the skin over the region is clipped and surgically prepared, 1 mL of 2% lidocaine may be injected to desensitize the skin if desired (8). This procedure can be performed on a patient sedated or not, depending on the specific situation. Horses that are strongly sedated have the tendency not to adopt a symmetrical position, which greatly hinders the operator's work.

For this technique, hypodermic needles or spinal needles 18-22G can be used, with a length of 3.8 to 7.5 cm depending on the size of the animal. There are two commonly used techniques for a one time administration into the caudal epidural space. In the first, the needle is inserted at the center of the chosen space, perpendicular to the skin with the bevel directed cranially and advanced in the median plane (Fig. 1). The „hanging drop" technique can be used where the hub of the needle is filled with sterile saline before advancing the needle and then when the needle enters the epidural space, the negative pressure will pull the drop into the epidural space. A slight popping may also be felt as the needle crosses the interarcuate ligament. When the needle is thought to be in the epidural space, aspiration will confirm lack of blood or cerebrospinal fluid and a test dose of air or saline may be made used to confirm "loss of resistance" to injection (8). In the second technique, a 12.7–19 cm 18 G spinal needle is inserted at the caudal part of the interspace, angling ventrocranially, approximately 30° parallel to the horizontal plane (Fig. 1). This technique can be useful for epidural injection if the horse previously had epidural injections which can result in development of fibrous tissue (8).

EPIDURAL MEDICATIONS

If the anesthetic substance to be administered has a small volume, it can be diluted in saline solution.

If the final volume is less than 10 ml, it can be given in one minute, but if the volume is greater than 10 ml, the administration is slow to avoid compression of the nerve endings at the epidural level, which can lead to loss of balance and the horse may become recumbent (4). Besides the fact that this technique can be used in the field conditions, has the advantage that can be used many *commonly* available *analgesic drugs* (6). Substances that may be used in caudal epidural anesthesia include: local anesthetics, opioids, α2-agonists, ketamine and tramadol (7, 9).

Local anesthetics induce blockade both on sensory and motor pathways. For this reason, but also to limit the cranial diffusion of anesthetics in epidural space, it is recommended to limit the total volume of local anesthetics administered to this route to 8-9 ml (17).

Lidocaine 2%, mepivacaine 2%, bupivacaine 0,5% and ropivacaine 0,5% produce analgesia by preventing depolarization of the nerve membrane and conduction of nerve impulses (2, 5, 23, 26). Epidural administrations of α2 adrenergic receptor agonists produce analgesia, reversible by intravenous administration of α2 adrenergic receptor antagonists (21).

Xylazine at a dose of 0.17 mg/kg diluted to 10 mL with 0.9% saline solution is a more desirable α2 adrenergic receptor agonist than detomidine for epidural use since it produces potent antinociceptive action, with minimal side effects (8, 20).

Detomidine it is used in caudal epidural anesthesia at a dose of 60 μg/kg diluted to 10 mL with sterile water, having the onset of action in about 5 min and the duration is approximately 3 h. Due to the systemic side effects, the debilitated horses should not receive more than 20 μg/kg (19). Other α2 adrenergic receptor agonists like romifidine and medetomidine appear to be less effective compared to xylazine and detomidine (11). The major benefits of opioids are the sensory blockade without affecting motor neurons and the possibility to be used alone or in combination with local anesthetics, α2 adrenergic receptor agonists, and/or ketamine. Morphine is usually used at a dose of 0.1 mg/kg diluted to a volume of 20 mL producing analgesia from the coccyx to the thoracic dermatomes for about 5 hours (14). The analgesia produced by hydromorphone at 0.04 mg/kg diluted to 20 mL with sterile saline solution or methadone 0.1 mg/kg, the last for about 4-5 hours. Meperidine is a synthetic opioid with local anesthetic proprieties capable to produce bilateral analgesia from perineal to sacral area for a period of 5 hours at a dose of 0,8 mg/kg (22).

Tramadol is a centrally acting opioid like analgesic drug with duration of epidural analgesia up to 4 hours at a dose of 1 mg/kg (14). Ketamine may be administered epidurally at doses between 0.5 and 2 mg / kg, but the quality of analgesia and the identification of side effects, especially neurotoxicity, require additional investigations on this subject (7).

There are numerous possible combinations of anesthetics to be administered epidurally in order to prolong and accentuate the efficacy of the same substances administered individually.

COMPLICATIONS OF EPIDURAL ANESTHESIA

Caudal epidural anesthesia is not a procedure without potential complications, accidents or side effects. Among the most important risks involved in performing this technique are: profound sedation, ataxia, CNS excitations, motor deficiency, decubitus, hypotension, hypertension, pruritus, neurotoxicity and infections. Inadequate analgesia or anesthesia may occur due to improper technique, anatomic abnormalities, fibrous changes from anterior epidural injections and can cause unsatisfactory results (12).

CONCLUSIONS

Applicability of anesthetic substances administered into the epidural space has been demonstrated over 90 years ago (17). Although this technique provides good analgesia for tail and perineal area in standing horses, it failed to become a method commonly used by practitioners. The need for very good contention, the difficulty of administering anesthetics compared to the same procedure in ruminants and the possible complications could explain the reluctance of colleagues to use more frequent caudal epidural anesthesia in horses.

With the development of new anesthetics molecules, abundance of scientific materials that demonstrate the utility of this technique for horses in field circumstances, superior working conditions in obstetrical, standing surgical cases or pain therapy, a great possibility of anesthetics combination, there are premises for more frequent use of caudal epidural anesthesia in the future. Many of the substances used in general anesthesia can have significant side effects, but they can be safely administered epidurally.

REFERENCES

1. *Auer J.A., Stick J.A.,* (2012), Equine Surgery, 4th edition, Elsevier/W.B. Saunders Co., Philadelphia, Pennsylvania, SUA, 1-3104
2. *DeRossi R., Breno F.B., Varela J.V., Junquieria A.L.*, (2004), Perineal analgesia and hemodynamic effects of the epidural administration of meperidine or hyperbaric bupivacaine in conscious horses. Can Vet J, 45:42-47
3. *Doherty T., Valverde A.,* (2006), Epidural analgesia and anesthesia. In: Manual of equine anesthesia and analagesia, (Eds.) T. Doherty T and A. Valverde, Blackwell Publishing, Ames, IA, SUA, 275-281
4. *Fikes L.W., Lin H.C., Thurman J.C.,* (1989), A preliminary comparison of lidocaine and xylazine as epidural analgesics in ponies. Vet Surg, 18:85-86
5. *Ganidalgi S., Cetin H., Biricik H.S., Cimtay I.,* (2004), Comparison of ropivacaine with a combination of ropivacaine and fentanyl for the caudal epidural anaesthesia of mares. Vet Rec, 154:329-332
6. *Gold J.R.,* (2008), How to use an epidural in a field situation for analgesia or local anesthesia. AAEP Proceedings, 54:290-294
7. *Gomez de Segura I.A., De Rossi R., Santos M., Lopez San-Roman J.,* (1998), Epidural injection of ketamine for perineal analgesia in the horse. Vet Surg, 27:384-391
8. *Grimm K.A., Lamont L.A., Tranquilli W.J., Greene S.A., Robertson S.A.,* (2015), Veterinary Anesthesia and Analgesia: The 5th Edition of Lumb and Jones, Wiley-Blackwell, Hoboken, NJ, SUA, 1-1072
9. *Grubb T.L., Riebold T.W., Huber M.J.,* (1992), Comparison of lidocaine, xylazine, and lidocaine/xylazine for caudal epidural analgesia in horses. J Am Vet Med Assoc, 201:1187-1190
10. *Johnston G.M., Eastment J.K., Wood J.L.,* (2002), The confidential enquiry into perioperative equine fatalities (CEPEF): mortality results of phases 1 and 2. Vet Anaesth Analg, 29:159-170
11. *Kariman A., Ghamsari S.M., Mokhber-Dezfooli M.R.,* (2001), Evaluation of analgesia induced by epidural administration of medetomdine in horses. J Fac Vet Med Tehran Univ, 56:49-51
12. *Natalini C.C., Driessen B.,* (2007), Epidural and Spinal Anesthesia and Analgesia in the Equine, Clinical Techniques in Equine Practice, 6(2):145-153
13. *Natalini C.C., Linardi R.L.,* (2006), Analgesic effects of subarachnoidally administered hyperbaric opioids in horses. Am J Vet Res, 67:941-946
14. *Natalini C.C., Robinson E.P.,* (2000), Evaluation of the effects of epidurally administered morphine, alfentanil, butorphanol, tramadol and U50488H in horses. Am J Vet Res, 61:1579-1586
15. *Oana L.I., Pestean C.P., Ober C.A.,* (2011), Ghid de anestezie si analgezie veterinara [Romanian], Ed. Risoprint, Cluj Napoca, Romania, 36
16. *Orsini J.A., Divers T.J.,* (2014), Equine Emergencies, 4th Edition, Elsevier/W.B. Saunders Co., Philadelphia, Pennsylvania, SUA, 1-912
17. *Robinson E.P., Natalini C.C.,* (2002), Epidural anesthesia and analgesia in horses. In: Pain management and anesthesia. Vet Clin North Am Equine Pract, (Eds.) A.S. Turner, M.R. Khursheed, and D.A. Hendrickson, Elsevier/W.B. Saunders Co., Philadelphia, Pennsylvania, SUA, 61-71
18. *Senior J.M.,* (2013), Morbidity, mortality, and risk of general anesthesia in horses. Vet Clin North Am Equine Pract, 29(1):1-18
19. *Skarda R.T., Muir W.W*., (1994), Caudal analgesia induced by epidural or subarachnoid administration of detomidine hydrochloride solution in mares. Am J Vet Res, 55:670-680
20. *Skarda R.T., Muir W.W.,* (1996), Comparison of antinociceptive, cardiovascular, and respiratory effects, head ptosis, and position of pelvic limbs in mares after caudal epidural administration of xylazine and detomidine hydrochloride solution. Am J Vet Res, 57:1338-1345
21. *Skarda R.T., Muir W.W.,* (1998), Influence of atipamezole on effects of midsacral subarachnoidally administered detomidine in mares. Am J Vet Res, 59:468-478
22. *Skarda R.T., Muir W.W.,* (2001), Analgesic, hemodynamic and respiratory effects of caudally epidurally administered ropivacaine hydrochloride in mares. Vet Anesth Analg, 28:61-74
23. *Skarda R.T., Muir W.W.,* (2001), Analgesic, hemodynamic and respiratory effects induced by caudally epidurally administered meperidine hydrochloride in mares. Am J Vet Res, 62:1001-1007
24. *Skarda R.T., Tranquilli W.J,* (2007), Local and regional anesthetic and analgesic techniques: horses. In: Lumb and Jones' veterinary anesthesia, 4th edition, (Eds.) W.J. Tranquilli, J.C. Thurmon, and K.A. Grimm, Blackwell Publishing, Ames, Iowa, SUA, 605-643
25. *Sysel A.M., Pleasant R.S., Jacobson J.D.,* Moll H.D., Modransky P.D., Warnick L.D., Sponenberg D.P., Eyre P., (1996), Efficacy of epidural combination of morphine and detomidine in 164 alleviating experimentally induced hind limb lameness in horses. Vet Surg, 25:511-518
26. *van Loon J.P.A.M., Menke E.S., Doornebal A.,* Back W., Hellebrekers L.J., (2012), Antinociceptive effects of low dose lumbosacral epidural ropivacaine in healthy ponies. Vet J, 193:240-245
27. *Vigani A., Garcia-Pereira F.L.,* (2014), Anesthesia and Analgesia for Standing Equine Surgery, Vet Clin North Am Equine Pract., 30(1):1-17
28. *Wagner A.E.,* (2008), Complications in equine anesthesia. Vet Clin North Am Equine Pract, 24(3): 735-752