Practical Approach to Caudal Epidural Anaesthesia and sedation for flank and other surgeries in Ruminants

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Introduction

In practice, anaesthesia of cattle under field conditions involves the application of local anaesthetic techniques such as flank anaesthesia, regional limb perfusion and caudal epidural anaesthesia in order to obtain suitable operating conditions without having to perform general anaesthesia. Caudal epidural anaesthesia can be divided into 2 different categories: High dose and low dose. High epidural anaesthesia involves administration of a relatively large volume of local anaesthetic to provide analgesia to more cranial body regions and is therefore used for surgeries on the hind limb and flank. The more common method is low epidural analgesia which differs only in the volume of the local anaesthetic injected. This technique is inexpensive, effective and practical and requires no sophisticated equipment. It is therefore relatively easy to perform under field conditions.

Technique for epidural anaesthesia.

In ruminants, the end of the spinal cord extends from the lumbar region into the midsacral region and entrance into the spinal canal is achieved at the first coccygeal interspace (Co1-Co2). The other interspace that can be used is the sacrococcegeal space (S5-Co1), but this space calcifies in older cattle. To identify the correct location, the tail is moved up and down in a 'pump-like' fashion. The most proximal moving space palpable is the preferred location for injection. After identification of the space, the skin is clipped and disinfected and an 18 gauge needle is used to penetrate the interspace directly in the dorsal midline in the adult cow. The needle is directed in a slightly cranial direction and advanced until a 'popping' sensation is felt. This pop indicates entrance into the epidural space. If the needle is advanced too far it may contact the ventral floor of the spinal canal. If this occurs the needle should be withdrawn slightly to ensure correct placement in the epidural space. Correct positioning of the needle can be checked by placing a few drops of sterile water or lidocaine into the needle hub during insertion and observing aspiration of the drop into the epidural space, which has

negative pressure (‘hanging drop technique’). Prior to injection it is important to apply negative pressure to the syringe to ensure blood is not aspirated. If this occurs, the needle should be withdrawn slightly and the syringe re-aspirated. Injection into the epidural space should encounter no resistance.

Low dose epidural anaesthesia

Low dose epidural anaesthesia aims to desensitize the last three pairs of sacral nerves within the spinal canal without impairment of motor function to the pelvic limbs. The anaesthesia obtained by this low dose technique involves the tail and caudal reproductive tract and can therefore be used in surgery of the vagina, vulva, anus, rectum, caudal prepuce, scrotum and to perform urethrostomies. It can also be useful to control tenesmus and uterine contractions during repair of a prolapsed rectum or vulva, repositioning of a prolapsed uterus, dystocia with repositioning.

High dose epidural anaesthesia

High dose epidural anaesthesia aims to desensitise nerves further cranially and can lead to anaesthesia as far cranial as the diaphragm, depending on the amount of local anaesthetic used. This type of anaesthesia will lead to the animal becoming recumbent and it can, be used for surgery of the hind legs. It has also been used for umbilical surgery in calves. The technique and injection site are the same as for the low dose epidural, but the volumes are higher than with the low dose. The positioning after the administration of the epidural will determine the response of the animal as well as the distribution of the anaesthesia. Elevation of the front of the animal will mean that the local anaesthetic will not distribute further than the caudal end of the epidural space and elevation of the hind quarters will lead to the anaesthetic solution being distributed more cranially. With most local anaesthetic solutions, when the animal is positioned in lateral recumbency the anaesthetic will distribute better to the side the animal is positioned on (the lower side), whereas dorsal recumbency will lead to bilateral distribution of the anaesthetic solution. The major risk for this type of epidural is that incorrect positioning or a volume that is too high can lead to the anaesthetic travelling too far cranially with a chance of respiratory paralysis and death. Due to residual paralysis and muscle weakness, it is also advisable to hobble the hind legs of animals recovering from this type of anaesthesia as this will prevent abduction of the hind legs and as such unwanted damage or paralysis of the obturator nerve.

Drugs

The most commonly used drug for low dose epidural anaesthesia is 2% lidocaine at a dose rate of 0.2mg/kg (1ml/100 kg). Depending on the size of the animal cow the total volume that

is injected should be greater than 6 mls. There is a risk of paralysing the spinal nerves to the hind limbs when the dose is too large leading to unwanted recumbency. Anaesthesia using this technique usually occurs within 5 minutes and will last between 30 and 150 minutes depending on the dose. Mild ataxia can occur. No anaesthetic effect after 10 minutes usually indicates that the injection was not made into the epidural space. For high dose epidurals the drug of choice is 2% lidocaine on its own in a maximum dosage rate of 2mg/kg bodyweight (1ml/10kg).

Xylazine alone or added to lidocaine provides a longer duration of anaesthesia using the low dose epidural technique. The dose used for xylazine anaesthesia on its own is 0.05 mg/kg (2% xylazine) diluted into 5 ml sterile water. Onset of anaesthesia will be within 10 minutes and the anaesthesia will last between 3-4 hours. Xylazine in combination with lidocaine gives a longer lasting anaesthetic effect. The dose of the xylazine in this mixture is 0.03-0.05mg/kg made up to 5 ml with2% lidocaine. Onset of anaesthesia will be within 5 minutes and the duration of anaesthesia up to 6 hours. The use of xylazine in an epidural not only gives longer anaesthesia, but also gives mild to moderate sedation of the animal as well as mild ataxia with an increased risk of recumbency, decreased ruminal motility and bradycardia.

The effectiveness of all epidurals can vary between animals due to minor differences in distribution of the drugs in the epidural space. These differences in distribution are due to the degree of negative pressure in the epidural space as well as variations in epidural fat content between different animals; these factors can affect both the spread and pharmacokinetics of the drugs used.

Applications

Low dose epidural anaesthesia gives regional analgesia of the tail, anus, vulva, perineum, thighs and mid sacral region as well as relaxation of the anal sphincter and vagina and cessation of straining. The aim of the anaesthesia is to leave the motor function of the hind legs unaffected so that the animal remains standing. Applications for low dose epidural analgesia are shown in table 1. The choice of drug depends on the desired effect. In castrations analgesia is required, not only during the procedure but also during recovery. A combination of xylazine and lidocaine is therefore the best option. For caesarean sections and fetotomies it is necessary that the animal stops straining during the procedure. Lidocaine on its own can be sufficient in these cases depending on the length of the procedure. However, it is essential to ensure flank anaesthesia in addition to the epidural anaesthesia – epidurals do not fully anaesthetise the flank skin, muscles or peritoneum.

Sedation via epidural injection

As described above, the epidural use of xylazine on its own or with lidocaine gives mild to moderate sedation in animals. This knowledge was used by the authors to develop a method in which the animal is sedated by epidural injection. Most procedures, such as flank laparotomies and caesarean sections that are performed in the standing animal require the animal to stand quietly with appropriate restraint. Sedation of the animal by intramuscular injection can be helpful in this situation, but can be unpredictable also may have the undesired effect of the animal becoming recumbent and in the case of a caesarean section will sedate the calf. The use of xylazine administered into the epidural space for sedation purposes only requires a small dose of xylazine and results in an animal that is moderately sedated which will remain standing . Epidural xylazine also provides a degree of flank analgesia which makes injection of regional lignocaine less painful and therefore less difficult. The dose of xylazine that was used was 0.016-0.018 mg/kg (0.4-0.5 ml of 2% xylazine made up to 5 ml with 0.9% saline for a 600 kg animal). Compared with the intramuscular dose of 0.05 - 0.3 mg/kg this is a much lower dose. The authors have used this method effectively in caesarean sections, in combination with flank anaesthesia. All cows remained standing in all cases and were effectively sedated. The calf remained unaffected by the low doses of sedative used. This sedation method has also been used in castrations and - flank surgery - in fractious animals.

Table 1: Applications of low dose epidural anaesthesia in cattle and the most common drugs used for the different applications.

	Lidocaine	**Lidocaine/Xylazine**
Castration	Common	Most common
Vaginal prolapse	Common	Common
Uterine prolapse	Common	Common
Foetotomy	Most common	
Caesarian	Most common	

Epidurals in sheep and goats

Caudal epidural anaesthesia also has many applications in sheep and goats, but the main practical use for an epidural in these animals would be correction of dystocia and replacement/retention of a vaginal and/or rectal prolapse. However, since caesarean section in these animals is usually performed in lateral recumbency and it is not necessary for the animal

to remain standing, a higher dose epidural could also be used for this procedure as well as for surgery on the hind limbs. The epidural technique used is much the same as the one used in cattle, but as it is sometimes harder to find the first intercoccygeal space (Co1-Co2), the most common place used is the sacrococcegeal space (S5-Co1). Both these sites can be identified in standing animals as well as animals in lateral recumbency. After identifying the space by movement of the tail and palpation the area should be clipped and surgically prepared. With the tail held horizontally, a 20 gauge needle should then be inserted at an angle of approximately 20-30° towards the tail. The insertion should be done very gently as the 'pop' sensation that is felt in cattle is not as clear in small ruminants which could lead to penetration of the nerves in the epidural space. This has the effect of making the animal jump with movement of the needle and possible unwanted bleeding as a consequence. Anaesthetic solution should be injected slowly as in small ruminants the total volume of spinal fluid is a lot less than in cows and fast addition of extra fluid can lead to a dangerous increase of intracranial pressure followed by CNS and cardiovascular collapse. Again, the position of the animal after injection is important when dealing with the higher dose type of anaesthesia. Higher dose anaesthesia involves the administration of 1ml/7kg bodyweight of 2% lidocaine with or without adrenaline which will give flank analgesia for a maximum of 2 hours. With these high doses it will take at least 3.5 hours of recovery time before the animal has regained total control of its legs and is standing again.

For the correction of dystocia and retention of prolapses, the volume of the local anaesthetic is reduced but care should still be taken during injection and recovery. Drugs used for these procedures are again 2% lidocaine alone or a combination of 2% lidocaine with 2% xylazine. Dosage for the lidocaine alone is 0.5mg/kg with a maximum volume of 2 mls/animal. Dosage for the combination is 0.07mg/kg of 2% xylazine and dose of 0.5mg/kg of 2% lidocaine.

Additional reading

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