Nerve stimulation-guided femoral and sciatic blocks in an alpaca (Vicugna pacos) for the removal of a sequestrum from the distal femur

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AUTHORS AND AFFILIATIONS

Robert Ward (a,b) BSc BVM&S FHEA MRCVS
Eleonora Po (a) DVM MSc Dipl ACVIM(LA) MRCVS
Miguel Gozalo Marcilla (b) DVM PhD DipECVAA MRCVS

Affiliations:
(a) Queens Veterinary School Hospital, University of Cambridge, Madingley Road, Cambridge, CB3 0ES
(b) Royal (Dick) School of Veterinary Studies, Easter Bush Vet Centre, Edinburgh, EH25 9RG

Work conducted at Queens Veterinary School Hospital, University of Cambridge, Madingley Road, Cambridge, CB3 0ES. Author's present address is Royal (Dick) School of Veterinary Studies, Easter Bush Vet Centre, Edinburgh, EH25 9RG

TITLE OF CASE

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SUMMARY

A 2 year old female intact Huacaya Alpaca weighing 66.6 kg presented for the removal of a bone sequestrum from the distal femur. Nerve stimulator guided femoral and sciatic nerve blocks were applied to provide analgesia for distal femoral surgery. The blocks were simple to perform using existing equipment and current techniques translated from small animals. The techniques reported here for both femoral and sciatic nerve blocks in an alpaca can be used as an alternative to an ultrasound guided approach, especially in field situations where additional expensive equipment may not be available or desirable.

BACKGROUND

Loco-regional anaesthetic techniques provide intra- and post-operative analgesia as demonstrated in small animals (1), avoiding the systemic effects of parenteral drugs. These techniques also reduce the requirements of inhalant agents used to maintain general anaesthesia and therefore their side effects. Whereas many loco-regional techniques are described for dogs and cats (1) especially encouraged by the recent

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renaissance of ultrasound guided (USG) techniques (2), not many specific limb nerve blocks have been described in lamoids. Caudal epidural anaesthesia has been used for neutering in alpacas (3), and this approach may be seen as the most straightforward local anaesthetic technique for hindlimb surgery; however, there are reports of complications (4). As an alternative, more specific local anaesthetic techniques have been used in alpacas for limb-repair surgeries, such as USG radial, ulnar, median and musculocutaneous (RUMM) (5) and USG psoas compartment and sciatic nerve blocks (6). In this case report we describe the successful use of a nerve stimulator to block both femoral and sciatic nerves to provide perioperative analgesia to the distal femur.

CASE PRESENTATION

A 2 year old female intact Huacaya alpaca presented for removal of a sterile sequestrum localised in the distal medial right femur. The sequestrum was previously investigated with CT scan and ultrasonography as well as culture. The sequestrum was initially treated medically with the use of florfenicol (given at 20 mg/kg, IM, every 36 hours for 3 consecutive weeks). A recheck visit and repeated imaging (radiography) revealed lack of healing, necessitating surgical removal. On admission the alpaca had a weight of 66.6 kg, and presented with normal vital parameters, with a temperature of 38.2 °C, a heart rate (HR) of 50 beats per minute (bpm) and respiratory rate (RR) of 20 respirations per minute (rpm). Body condition was estimated to be at 4/10. There was a mild muscle atrophy on her right gluteal muscles, and pain was elicited on palpation of the distal femur. A 2/5 lameness was noticed on her right hind leg and the gait demonstrated a lateralisation (abduction) of the right leg at a walk. This was considered to be a learned, compensatory behaviour, secondary to the sequestrum.

INVESTIGATIONS

DIFFERENTIAL DIAGNOSIS

TREATMENT

Sequestrum removal was performed under general anaesthesia after fasting for 20 hours. The skin over the lower third of the right jugular vein was clipped and aseptically prepared. After administration of subcutaneous lidocaine (Lidocaine 2%, B. Braun GbH, Germany) a skin incision was made with a number 11 blade and a 14-gauge cannula (Intraflon, Vigon, France) was placed. Premedication with 0.1 mg/kg butorphanol (Torbugesic, 10 mg/ml, Zoetis, UK) followed by 0.02 mg/kg medetomidine (Sedator 1.0 mg/ml, Eurovet Animal Health BV, UK) was administered intravenously (IV) which provided sternal recumbency after 4 minutes.

Ten minutes after premedication, general anaesthesia was induced with a total of 2 mg/kg propofol (Propoflo Plus 10 mg/ml, Zoetis, UK) given to effect and the trachea intubated with a 10mm cuffed silicone endotracheal tube (Kruuse, Denmark) using a laryngoscope with a 300mm Miller blade and a blunt stylet. Induction of general anaesthesia was considered as T0 for a better description of the events. Once transported to the surgical table and placed in left lateral recumbency, anaesthesia was maintained with isoflurane (Isofane, 100% w/w, Piramal Healthcare UK limited, UK) in 100% oxygen delivered via a circle breathing system at approximately 2 L/min throughout the procedure, with end-tidal isoflurane remaining between 1.0 and 1.1%. Monitoring consisted of electrocardiography, capnography, pulse oximetry, oscillometric blood pressure, oesophageal temperature and end-tidal isoflurane concentration on a multiparameter monitor (Cardiocap/5, Datex Ohmeda, Helsinki, Finland). Mechanical ventilation was available; however it was not required as the patient was breathing spontaneously throughout the procedure and maintained normocapnia (39-46mmHg). Whilst the monitoring was being connected, the right pelvic limb was clipped and surgically prepared. Invasive blood pressure monitoring

was added at T30 via a 22-guage cannula (Intraflon, Vigon, France) placed in the left auricular artery.

The sciatic nerve block was administered at T25 using the lateral approach as described by Campoy & Mahler (1). With the animal in left lateral recumbency, a stimulating needle was inserted approximately one third of the distance from the greater trochanter to the ischiatic tuberosity (Figure 1) with a nerve stimulator (Stimuplex HNS 11, B. Braun GbH, Germany) initially set to deliver a current of 0.8 milliamperes (mA). Correct positioning of the needle was confirmed by dorsiflexion of the distal limb and foot, and the current was reduced to 0.4 mA in 0.1 mA steps with the dorsiflexion of the foot remaining constant with a cut off of 0.3 mA to avoid intraneural injection. Bupivacaine (25mg, Marcaine Polyamp Steripack, 0.5%, Astra Zeneca, UK) was injected once negative pressure confirmed extravascular needle placement.

The femoral nerve block was performed 8 minutes after the sciatic nerve block, with the animal remaining in left lateral recumbency, using the Campoy technique as described by Campoy & Mahler (1). The right hindlimb was abducted approximately 90° and the femoral artery was identified by manual palpation of the pulse. The needle was advanced cranial to the femoral artery and directed proximally towards the iliopsoas muscle at an angle of approximately 30° to the skin with an initial current of 0.8 mA (Figure 2). Correct positioning of the needle was confirmed by extension of the stifle, and the current was reduced to 0.4 mA in 0.1 mA steps with a cut off of 0.3 mA to avoid intraneural injection. Bupivacaine (25 mg, Marcaine Polyamp Steripack, 0.5%, Astra Zeneca, UK) was injected once negative pressure confirmed extravascular needle placement.

The animal was then positioned in right lateral recumbency and the exact location of the sequestrum was confirmed by ultrasonography and marked prior to initiating the surgical procedure. The first incision was made at T90 through skin and subsequently on the belly of the vastus lateralis, revealing the distal medial femur. The sequestrum could be palpated, its capsule incised, separated from adjacent bone and extracted. The surrounding bone was curetted to allow for new bone deposition. The fragment was sent for culture (negative). The muscle was closed in three layers and skin was closed with absorbable intradermal sutures (Coated Vicryl®, polyglactin 910, 2-0, Ethicon, US).

During surgery, HR and RR remained steady with a gradual increase in HR from 60 to 80 bpm over 15 minutes at approximately T120. This could be due to the waning effect of the medetomidine from the premedication, or potentially nociception as the limb was manipulated to extract the sequestrum. To exclude nociception, IV morphine (0.1 mg/kg, Morphine Sulfate 30 mg/ml, Wockhardt, UK) was administered which caused a transient reduction in HR to 68 bpm, returning to 80 bpm after 5 minutes. As the skin closure was performed at T150 there was another increase in HR from 80 to 120 bpm which was self-limiting to 3 minutes. This is potentially due to cutaneous innervation from the saphenous nerve, which branches off the femoral nerve. If the branch occurred proximally to the location of the block, then there would be a nociceptive stimulus as the skin was sutured. At time of skin closure, additional IV morphine (0.2 mg/kg) was administered to provide antinociception and to improve recovery.

The total anaesthetic duration was 190 minutes, after which the patient was moved to the recovery area and extubated 9 minutes later when swallowing. After a further 10 minutes in lateral recumbency the patient entered sternal recumbency.

Post-operatively, the alpaca received amoxicillin clavulanic acid (Synulox, Zoetis, UK ltd, 8.75 mg/kg, IM daily for 6 days), meloxicam (Metacam, Boehringer Ingelheim Vetmedica GmbH, Germany, 1 mg/kg, IV, every 48 hours, twice) and morphine sulphate (0.1 mg/kg, IV, every 4 hours, 4 consecutive doses).

OUTCOME AND FOLLOW-UP

Surgery was successful, and recovery from general anaesthesia was uneventful. Three hours after recovery the animal remained still in sternal recumbency and refused to stand even when prompted. This was hypothesised to be due to manipulation of nerves during the surgery, however damage due to the nerve blocks, e.g. due to nerve trauma from iatrogenic injury, could not be ruled out at this stage.

Overnight the animal progressed to standing and was assessed to be comfortable, with normal appetite. The distal right hindlimb (fetlock) demonstrated a degree of paresis which resolved over the next 48 hours. Gait was assessed three days post operatively, revealing the maintained abduction movement at a walk, hypothesised to be due to a learned behaviour. The alpaca was discharged to the owners seven days post operatively with instructions to restrict exercise in the following two weeks and to gradually increase the amount of pen space over a month before introducing back with the main herd. Prognosis for breeding and lactation were deemed optimal.

DISCUSSION

This case report demonstrates the use of the sciatic and femoral nerve blocks performed with a nerve stimulator in an alpaca for the removal of a sequestrum in a hindlimb, together with nonsteroidal anti-inflammatory and opioid therapies to improve pain management and patient care. Although these nerve blocks are commonly used in small animal practice, the reported use in alpacas and other farm animals is currently lacking for the majority of techniques. The NSG block used here appeared to provide analgesia for the majority of the procedure, however a rise in heart rate, which may or may not be due to nociception, lead to the use of a single

dose of rescue analgesia. The end-tidal isoflurane was maintained at the reported minimum alveolar concentration for lamoids, although there is limited/contradictory published data available with inhalational anaesthetic agents in these species (7-9).

There are numerous benefits seen from using locoregional anaesthesia techniques as part of a balanced anaesthetic protocol documented in both human and veterinary literature including improved intra-operative (10) and post-operative pain control (10-12), as well as an economic advantage in larger patients (10). The most commonly reported complication when using peripheral nerve blocks is failure of efficacy (13), with some self-limiting minor neurological deficits also being recorded, such as in this case. There are fewer studies examining severe complications from peripheral nerve blocks, and these are mainly limited to retrospective surveys.

With regards to the local anaesthetic techniques used, the blocks were simple to perform using existing equipment and current techniques translated from small animals. This case report is of importance as, first, it shows an alternative to the use of USG blocks in field situations where additional expensive equipment may not be available or desirable, however deep sedation may be required as the use of NSG blocks may be uncomfortable even when no C fibres are stimulated (1). Second, it demonstrates an alternative to the use of an epidural approach. In small animals, there is the current tendency for hind limb procedures to move from epidurals towards more specific local anaesthetic techniques such as sciatic or femoral blocks. Administration of local anaesthetics and morphine epidurally may result in potential side effects such as intraoperative hypotension and urinary retention respectively (1). A prior case report also describes delayed respiratory depression after unintended intrathecal injection of morphine and bupivacaine in an alpaca (4). The NSG techniques are not without risk however (13). The use of newer techniques such as

ultrasound guided nerve blocks which allow of direct visualisation of the nerve tissue and needle may reduce the incidence of these complications.

This case also demonstrates the use of a multimodal analgesic protocol for patient care and welfare as proposed in many other veterinary species with valuable outcomes (14, 15). There are 3 parts to the pain pathway that can be targeted using a multimodal approach; transduction, transmission and modulation (16). Indeed, transduction was treated with non-steroidal anti-inflammatory drugs, transmission of the painful stimulus with local blocks, and modulation of the pain response at the level of the spinal cord with opioids. This is of special importance in alpacas because inadequate pain management, together with stressful events such as transportation from their environment followed by surgeries and postoperative hospitalization, may predispose them to compartmental ulcers. Moreover, these animals are stoic animals which tend to hide pain, making pain recognition and management more difficult. Unlike other species, alpacas are not easily treated with medications such as proton pump inhibitors as they are often ineffective in these species (17).

Finally, when anaesthetising farm animals, including lamoids, it is important to consider the legislation regarding drug selection. In the UK a drug must be in the list of allowed substances for food producing animals with an established maximum residue limit (MRL), and then the cascade can be followed as there are currently no licensed products for alpacas. Although some of the drugs used here are not licensed for use in food producing animals in the UK, the animal was considered a pet and it was deemed necessary to use these medications for animal welfare. This was discussed with the owner prior to surgery and informed written consent was gained for off-license drug use. Moreover, the owner indicated the animal would never enter the food chain. In the UK, despite the majority of camelids are kept as pet or fibre producing animals, alpacas are classified as food producing. Compared to horses, it is

not possible to correctly identify camelids that received off-label (table 1; EC 37/2010 regulation) or drugs that are not allowed (table 2; EC 37/2010 regulation) in order to be removed from the food chain. This alpaca received off-label medications and a year-long withdrawal was arbitrarily established based on guidance on prescription of unauthorised medication under cascade (18). Efforts are being made in the veterinary community to improve pain management in food producing species which is restricted by the current legislation (19).

LEARNING POINTS/TAKE HOME MESSAGES

- Small animal nerve block techniques can be translated to farm animal procedures.
- Nerve blocks should be considered to improve multimodal pain control of orthopaedic surgeries in camelids to provide better post-operative care.
- This case report highlights the importance of a multimodal analgesic plan with the use of sciatic and femoral nerve blocks in an alpaca that may avoid the potential risks associated with an epidural approach.
- Analgesia is particular important in camelids as pain can predispose them to compartmental ulceration which is difficult to diagnose and treat.
- Drug legislation is an important consideration when working with food producing animals.

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FIGURE/VIDEO CAPTIONS

Figure 1 – Sciatic nerve block being performed with the stimulating needle inserted approximately one third of the distance from the greater trochanter to the ischiatic tuberosity.

Figure 2 – Femoral nerve block being performed with the stimulating needle inserted cranial to the femoral artery and directed proximally towards the iliopsoas muscle.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest with this manuscript.

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