Veterinary
Anaesthesia and Analgesia
Formerly the Journal of Veterinary Anaesthesia

Veterinary Anaesthesia and Analgesia, 2016, **43**, 453–456 doi:10.1111/vaa.12322

SHORT COMMUNICATION

A description of a technique for ultrasound-guided lumbar plexus catheter in dogs: cadaveric study

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Abstract

Objective To describe an ultrasound-guided approach for lumbar plexus catheter placement in dogs.

Study design Prospective experimental cadaveric study.

Animals Eleven thawed canine cadavers (13 ± 2 kg).

Material and methods A technique to place a catheter in the psoas compartment at the level of the lumbar plexus under ultrasound guidance was described. Ultrasonographic landmarks for the placement of a lumbar plexus catheter were identified as the body of the sixth lumbar vertebrae, the psoas muscle and the femoral nerve. All catheters were placed by the principal investigator using epidural sets with an 18-G Tuohy needle. The procedure was carried out twice in each cadaver, with the aim of placing a catheter at the point of the left and right lumbar plexuses. A total volume of 0.4 mL kg^{-1} of 1% methylene blue solution was injected into the psoas compartment after which the catheter was removed. After performing the injection in four cadavers, the technique was modified, altering the angle of needle placement and length of catheter insertion. Staining of the femoral and obturator nerves was assessed. Success was recorded if both nerves were stained over a length >1 cm. The spreading of the dye into the abdomen or to the nerve roots was also recorded.

Results The success rate after the first four cadavers was four out of eight, and dye was found in the abdomen of two of the cadavers. When the modified technique was used in the subsequent seven cadavers, the success rate was 12 out of 14, and no dye was found in the abdomens.

Conclusions and clinical relevance This technique has shown a high percentage of success and low rate of complications. The only complication investigated in this study was the spread to the abdomen or epidural space. To establish safety, clinical studies will be needed.

Keywords continuous, dog, lumbar plexus, technique, ultrasound.

Introduction

Continuous peripheral nerve blocks can be performed by administering local anaesthetics via percutaneous catheters placed adjacent to the peripheral nerves. A continuous lumbar plexus block (CLPB) is a local anaesthesia technique that allows the administration of local anaesthetics into the caudal portion of the psoas muscle to block the main nerves in this plexus. In human anaesthesia, CLPB has been shown to decrease post-operative bleeding, increase the patient's post-operative passive range of motion and reduce the incidence of serious post-operative complications when compared with the parenteral use of morphine in

patients undergoing a total knee arthroplasty (Chelly et al. 2001). CLPB has also been used as an alternative to epidural catheters to provide adequate analgesia while reducing systemic side effects.

In veterinary anaesthesia, the lumbar plexus block has been described using different approaches with either electrolocation (Campoy 2008; Portela et al. 2013) or ultrasound (US)-guided techniques (Echeverry et al. 2012; Graff et al. 2015). All of these studies describe a 'single injection technique' to provide perioperative analgesia, the duration of which will depend on the local anaesthetic used. According to the authors' knowledge, the placement of a lumbar plexus catheter has not previously been described in the veterinary literature. The aim of this study was to describe a US-guided approach to the lumbar plexus to place an epidural catheter in the psoas muscle, in the space adjacent to the femoral and obturator nerves.

Material and methods

Ethical approval (URN 2015 1316) was obtained from the Royal Veterinary College. Eleven thawed cadavers (13 ± 2 kg) of dogs euthanized for reasons unrelated to the present study, with a body condition score between 3 and 4 out of 9 on the WSAVA (World Small Animal Veterinary Association) Global Nutrition Committee scale, were used. All of the CLPBs were performed using the same ultrasound machine (S9v; Sonoscape, China) with a 25-mm linear probe (10–6 MHz) and epidural catheters introduced via a 18-G Tuohy needle (Pebax catheter; Vygon, France).

The procedure was carried out twice in each cadaver (on the right and the left side) and was performed by the same investigator. A total volume of 0.4 mL kg^{-1} of 1% methylene blue (Methylthionium Chloride Injection 1% w/v; Martindale Pharma, UK) was injected, and the catheter was removed after dye administration. A second investigator performed a dissection of the lumbar area to assess the staining of the femoral and obturator nerves. A staining length of more than 1 cm on both target nerves was considered as a success. Spreading of the dye to the abdomen or nerve roots was recorded as a complication.

Description of the technique

Dogs were positioned in lateral recumbency with the targeted lumbar plexus positioned uppermost. The hair of the lumbar region was clipped, and the ultrasonographic gel was applied to the skin. The US transducer was placed perpendicularly to the long axis of the spine at the level of the lateroventral aspect of the 6th lumbar vertebra (L6). With the transducer in this position, the body of L6, the iliopsoas muscle and the femoral nerve (FN) were visualized. These anatomical structures represent the initial sonographic landmarks. The body of L6 was identified as a semicircular hyperechoic surface with distal acoustic shadowing. The belly of the ileopsoas muscle was hypoechoic with fine hyperechoic speckles, located in the space between the skin surface and the bony landmarks. The femoral nerve was identified in its short axis as a small (approximately 1.5 mm) circular structure with a hyperechoic peripheral rim and an anechoic/hypoechoic centre located within the ileopsoas muscle adjacent to the body of L6. The transducer was angled slightly caudally, with the probe pointing towards the ipsilateral iliac wing, and then moved dorsally from the ventrolateral to the lateral aspect of the lumbar area, maintaining the ileopsoas muscle and the femoral nerve within the field of view. With the transducer in this position it is possible to identify the obturator nerve which appears as a circular structure with a hyperechoic peripheral rim and an anechoic/hypoechoic centre adjacent to the femoral nerve, within the belly of the ileopsoas muscle (Fig. 1).

At this stage, the tip of the Tuohy needle was inserted through the skin of the dorsal lumbar area, 1–2 cm lateral to the spinous process of the 5th lumbar vertebra. The needle was inserted 2 cm cranial to the transducer in a caudoventral direction with an approximate angle of 45° in relation to the skin surface. Maintaining the position of the transducer, the needle was advanced through the ileopsoas muscle until the tip of the needle was seen as a hyperechoic focus on the image. When the tip of the Tuohy needle was located immediately adjacent to the femoral nerve, 0.2 mL kg^{-1} methylene-blue was injected and a collection of hypoechoic fluid was seen forming in the area surrounding the femoral nerve. After this, the US probe was removed, and the epidural catheter was advanced blindly through the Tuohy needle. When the operator considered the catheter to be successfully placed, the needle was withdrawn over the catheter and a further 0.2 mL kg^{-1} dye was injected through the catheter. After injection, the catheter was removed and dissection was carried out by another investigator.

After completing the procedure on four cadavers, the technique was modified slightly. This involved reducing the angle of the needle with