Veterinary Anaesthesia and Analgesia 2018, **xxx**, 1−9 https://doi.org/10.1016/j.vaa.2018.02.007

RESEARCH PAPER

Q8 Evaluation of the potential efficacy of an ultrasound-guided adductor canal block technique in dog cadavers

Q7 **Douglas S Castro[a], Fernando Garcia-Pereira[a] & Robson F Giglio[b]**

[a]Department of Large Animal Clinical Sciences, College of Veterinary Medicine, University of Florida, Gainesville, FL, USA

[b]Department of Small Animal Clinical Sciences, College of Veterinary Medicine, University of Florida, Gainesville, FL, USA

Correspondence: Fernando Garcia-Pereira, University of Florida College of Veterinary Medicine, 2015 Southwest 16th Avenue, Gainesville, FL 32608, USA. E-mail: garciaf@ufl.edu

Abstract

Objective To evaluate an ultrasound-guided technique for adductor canal (AC) block by describing the distribution of methylene blue around the AC, popliteal fossa, saphenous, tibial and common fibular nerves in dog cadavers.

Study design Prospective experimental trial.

Animals Ten mixed breed canine cadavers weighing 28.55 ± 3.94 kg.

Methods Ultrasound scans of the AC were performed bilaterally in 10 canine cadavers. A high-frequency linear transducer was placed on the long axis of the pectineus muscle and using an in-plane technique, an insulated needle was introduced at a proximal to distal direction into the AC. Methylene blue 0.1% (0.3 mL kg^{-1}) was administered followed by dissection. The presence of dye over the target nerves for ≥2 cm was considered successful distribution. Three of 10 cadavers were submitted to computed tomography (CT) and one of them to magnetic resonance (MR) evaluation.

Results Methylene blue reached the AC in 20 (100%) and the popliteal fossa in 17 (85%) pelvic limbs. Staining was successful in the saphenous nerve (4.0 ± 1.57 cm) in 11 (55%) limbs, tibial nerve (2.65 ± 0.8 cm) in six (30%) and common fibular nerve (2.7 ± 0.9 cm) in four (20%). There was no evidence of staining around the motor branches of the femoral nerve. No intraneural or intravascular dye spread was found during dissections. Contrast distribution to the popliteal fossa was observed in three limbs (50%) in CT and in one (50%) MR image.

Conclusions and clinical relevance Although the tibial and common fibular nerves were not stained as often as the saphenous nerve, dye was encountered throughout the popliteal fossa near the nerves. The AC block may be useful for intra and postoperative analgesia in stifle surgery with minimal femoral motor dysfunction. However, further study is required to confirm its efficacy and safety *in vivo*.

Keywords adductor canal, adductor canal block, dog, regional anesthesia, ultrasound-guided anesthesia.

Introduction Q1

Ultrasonography-guided techniques have been described in veterinary medicine and have become an important tool for regional anesthesia and pain management (Bagshaw et al. 2009; Campoy et al. 2010; Echeverry et al. 2010; Shilo et al. 2010; Costa-Farré et al. 2011; Graff et al. 2015). The ultrasound allows the operator to visualize the target nerves, accurately place the needle and watch the spread of local anesthetic solution during injection in real time, minimizing tissue damage or inadvertent intravascular administration (Gray 2006; Sites & Brull 2006). Furthermore, the use of an ultrasound-guided technique allows reduction of local anesthetic doses used in comparison with blind techniques, which increases safety by reducing the occurrence of adverse effects (Sandhu et al. 2006).

Cruciate ligament rupture is the most common orthopedic injury in dogs (Innes & Barr 1998; Wilke et al. 2005). Among the corrective surgeries used to treat this disease, tibial plateau leveling osteotomy is one of the most popular. This technique is considered to be very painful (Hoelzler et al. 2005). Of the human patients submitted to a total knee arthroplasty, 16–52% experienced moderate to severe postoperative pain (Andersen et al. 2009). To control the pain sensation in canine stifle surgeries, the femoral and sciatic nerves can be desensitized (Campoy et al. 2010, 2012; Echeverry et al. 2010; Costa-Farré et al. 2011; Trein et al. 2017). The femoral nerve supplies sensory innervation to the medial aspect of the limb and is also responsible for the quadriceps femoris motor function (Laurent et al. 2016). In humans, it is reported that more than 80% of the quadriceps femoris strength is affected after femoral nerve desensitization, and therefore ambulatory ability becomes compromised (Charous et al. 2011). The main postoperative concerns after femoral anesthetic blockade are potential falling and delayed rehabilitation (Muraskin et al. 2007; Sharma et al. 2010; Johnson et al. 2013). The sciatic nerve has two main branches, the common fibular and the tibial nerves. The posterior articular nerve, a branch of the tibial nerve, supplies the posteromedial aspect of the stifle. The lateral articular nerve, a branch of the common fibular nerve, innervates the lateral portion of the stifle joint and also the lateral collateral ligament (Evans & de Lahunta 2017). Therefore, both the femoral (or its sensory branch, the saphenous nerve) and the sciatic nerve should be desensitized if total anesthesia of the stifle joint is desired (Campoy & Mahler 2013).

Ultrasound-guided regional anesthesia of the adductor canal (AC) block is increasing in popularity to replace direct femoral and sciatic nerve desensitization in human patients submitted to a total knee arthroplasty (Jenstrup et al. 2012; Hanson et al. 2014; Gautier et al. 2016). In humans, the AC is a space medial to the adductor magnus muscle that begins at the femoral triangle and ends at the adductor hiatus, where the femoral artery becomes the popliteal artery. This intermuscular passage lies caudal to the sartorius muscle and provides a passageway for the neurovascular bundle from the femoral triangle to the popliteal fossa, being anatomically continuous between these two compartments (Laurent et al. 2016). Administration of local anesthetic solution into the AC may result in spread from the medial to the caudolateral part of the pelvic limb, reaching the saphenous nerve medially and the branches of sciatic nerve (tibial and common fibular nerves) caudolaterally (Davis et al. 2009). In one study, ultrasound imaging of the AC block was performed in the distal third of the thigh in eight fresh human cadavers (Goffin et al. 2016). A needle was inserted in a caudal–medial to cranial–lateral direction using an in-plane technique and 20 mL of methylene blue (0.01%) and ropivacaine (0.2%) were injected. The methylene blue reached the popliteal fossa and stained the sciatic nerve in all limbs (100%), the adductor magnus muscle in seven limbs (87.5%), above the sciatic bifurcation in five (62.5%), passed through the distal hiatus and coated the popliteal vessels in three (37.5%) and proximal hiatus in two limbs (25%; Goffin et al. 2016). A randomized placebo-controlled study of the AC block using ropivacaine identified a better degree of knee flexion, shorter time to return of ambulation and less opioid consumption than placebo during the first 24 hours postoperatively after total knee arthroplasty (Jenstrup et al. 2012). In another study with 17 patients undergoing knee surgery, the saphenous, common fibular and tibial nerve territories had markedly diminished or absent sensation after the AC block (Gautier et al. 2016).

The aim of this study was to evaluate the potential efficacy of an ultrasound-guided technique to provide the AC block by describing the distribution of methylene blue dye spread within the AC and popliteal fossa and staining of the saphenous, tibial and common fibular nerves in dog cadavers.

Materials and methods

Animals

The procedures used in this study were carried out in accordance with the University of Florida Institutional Animal Care and Use Committee (no. 201609545). Fresh intact mixed breed canine cadavers of either sex, approximately 2–4 years of age, weighing 20–30 kg and body condition scores ranging 3–6 of 9 were enrolled in this anatomical investigation. The dogs were euthanized for reasons unrelated to this study and were collected from the County Animal Services by our laboratory assistant as they became available. The study was performed in each dog within 7 days from cadaver collection. Animals in which ultrasound imaging was not possible (e.g., wounded or fractured limb) were excluded. Chondrodystrophic animals would be

