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RESEARCH PAPER

Femoral nerve block: a novel psoas compartment lateral pre-iliac approach in dogs

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Abstract

Objective To describe a new approach to block the femoral nerve and to evaluate the distribution of a dye injected into the psoas compartment using a new femoral nerve block approach; to assess its clinical application, when combined with a sciatic nerve block, for surgical anaesthesia/analgesia of the pelvic limb in dogs.

Study design Prospective anatomical, research and clinical study.

Animals Two dog cadavers; two dogs that had to be euthanized for reasons unrelated to this study, and 15 dogs undergoing pelvic limb orthopaedic surgery.

Methods Phase 1: anatomical dissections were performed to determine a simple method to approach the femoral nerve within the psoas compartment. Phase 2: 0.1 mL kg^{-1} of a lidocaine-new methylene blue solution was injected bilaterally after successful electrolocation of the femoral nerve in two anaesthetized dogs. Colorant spread was evaluated through femoral nerve dissections after euthanasia. Phase 3: in 15 dogs undergoing pelvic limb orthopaedic surgery under light general anaesthesia with isoflurane, intra-operative analgesic effect (cardiovascular responses) and early post-operative pain score, of the novel femoral nerve block combined with a sciatic nerve block as the sole analgesic protocol, were evaluated.

Results Phase 1: a needle inserted from the lateral aspect of the lumbar muscles, cranially to the iliac crest and with a 30–45° caudo-medial direction, reaches the femoral nerve in the caudal portion of the psoas compartment. Phase 2: Four femoral nerves were stained >2 cm. Phase 3: this novel lateral pre-iliac approach, combined with the sciatic nerve block, blunted the intra-operative cardiovascular response to surgical stimulation in 13 out of 15 anaesthetized dogs. In addition, rescue analgesia was not required in the early post-operative 2-hour period.

Conclusion and clinical relevance The lateral pre-iliac femoral nerve block technique may provide adequate intra- and early post-operative pain relief in dogs undergoing pelvic limb surgery.

Keywords dog, femoral nerve block, lateral pre-iliac approach, peripheral nerve stimulation, psoas compartment, regional anaesthesia.

Introduction

Regional anaesthesia of the pelvic limbs achieved through peripheral or neuraxial nerve blocks has been investigated in several studies in veterinary medicine (Frank 1927; Mihelić et al. 1995; Duke

et al. 2000; Campoy 2006; Bergmann et al. 2007; Mahler & Adogwa 2008; Campoy et al. 2010; Vettorato et al. 2012). The increased interest in peripheral nerve blocks is because they produce an analgesic and anaesthetic effect comparable to neuraxial blockades, but with a lower incidence of complications (Caniglia et al. 2011; Campoy et al. 2012).

The femoral and sciatic nerves provide the main innervation of the pelvic limb (Evans & de Lahunta 2010). The skin sensory innervation of the pelvic limb is completed by the lateral cutaneous and the caudal cutaneous femoral nerves, which innervate the cranio-lateral aspect of the thigh and the proximal and caudo-lateral aspect of the thigh respectively (Ghoshal 1982). Peripheral regional anaesthesia of the pelvic limb can be achieved with the perineural administration of a local anaesthetic solution in proximity to the main nerves of the lumbosacral plexus: the femoral and the sciatic nerves (Lumb 1963; Campoy 2006).

The sciatic nerve can be approached using a peripheral nerve stimulator, by inserting the needle between the great trochanter of the femur and the ischiatic tuberosity (Campoy et al. 2008), in the gluteal region (Mahler & Adogwa 2008) or through a parasacral approach (Portela et al. 2010). The femoral nerve can be located by electrical stimulation and blocked at the level of the femoral triangle (Mahler & Adogwa 2008); through a single paramedian injection at the psoas compartment in the L_5–L_6 intervertebral space (Campoy et al. 2008); or by three paravertebral injections aiming at the spinal lumbar nerves (L_4, L_5 and L_6) that form the femoral nerve (Portela et al. 2010).

The aim of the present study was to describe, in dogs, a new electrolocation-guided approach to the femoral nerve at the psoas compartment. In addition, in cadavers, the distribution pattern of an injected solution (containing new methylene blue) in relation to the femoral nerve was evaluated. Finally, the clinical application of this new approach to provide surgical anaesthesia and analgesia of the pelvic limb was evaluated in a clinical study.

Materials and methods

This anatomical, experimental and clinical study was conducted in three phases: an anatomical dissection of cadavers (phase I), in dogs to be euthanized, an electro-location of the femoral nerves, and injection of new methylene blue evaluation (phase II), and finally, the clinical application of the nerve block as an analgesic technique in dogs submitted to orthopaedic surgery of the pelvic limb (phase III).

Phase I – Anatomical study

Two mongrel dog cadavers (11 and 23 kg) were used to characterize the approach to the femoral nerve in the lumbar region. With the dogs lying in dorsal recumbency, an anatomical dissection was performed in order to expose the femoral nerve from the thigh in the femoral triangle to its origins at the lumbar level. On the basis of these anatomical observations, the landmarks and the procedure needed to approach the femoral nerve with a stimulating needle were established, so as to locate the nerve at a point after the relevant lumbar nerves have joined and where the femoral nerve is completely formed, but before it emerges from the psoas compartment. In addition, the potential complications associated with the puncture, such as the possibility of damaging a major blood vessel, or abdominal and pelvic structures were evaluated by intentionally introducing the needle excessively deep or medial and with different inclinations.

Phase II – Nerve location and new methylene blue injection evaluation

This phase of the study was conducted at the Faculty of Veterinary Science, University of Buenos Aires, in accordance with the local legislation on animal experimentation and was approved by the Institutional Animal Care and Use Committee (CICUAL 2011/24).

It used the landmarks and the guidelines for needle placement as described in phase I, located the femoral nerve with a peripheral nerve stimulator, then 0.1 mL kg^{-1} of a lidocaine-new methylene blue solution (L-NMB) was injected.

Electrical nerve location

Two dogs (16 and 32 kg), which had to be euthanized for unrelated reasons were enrolled for this part of the study, owner consent having been obtained.

The dogs were anaesthetized, the hair of the entire dorsal and lumbar region then was clipped bilaterally and the dogs positioned in lateral recumbency with the side to be blocked uppermost and the leg in a neutral position.