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REVIEW ARTICLE

Analgesia for pelvic limb surgery. A review of peripheral nerve blocks and the extradural technique

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Abstract

Objectives To describe the anatomy and approaches reported for peripheral nerve blockade (PNB) of the pelvic limb in dogs and cats and to consider the role of PNB in relation to the extradural technique.

Databases used This review was conducted using the terms 'nerve block', 'extradural' 'dog' and 'cat' entered into Pubmed and Google. Results were filtered manually to narrow the field to pelvic limb nerve blocks. The reference lists of retrieved papers were scrutinized to identify further studies for inclusion.

Conclusions Successful PNB techniques require thorough anatomical knowledge for the establishment of reliable landmarks, puncture sites, the direction and depth of needle insertion, and relevant structures to be avoided.To date, clinical evaluations have been made in subjects undergoing stifle surgery where the sciatic nerve has been blocked in combination with various approaches to the femoral nerve. Currently the bulk of literature examines new approaches to these nerves and each of these is described. To date there are no veterinary studies directly comparing one approach *versus* another, and therefore one is unable to draw conclusions of superiority. The role of PNB's *versus* the extradural technique is discussed.

Keywords anaesthesia, cat, dog, analgesia, local anaesthesia.

Introduction

Regional anaesthesia (RA) is used widely in human anaesthesia in order to avoid general anaesthesia and associated risks, to improve intra-operative analgesia and increase patient comfort postoperatively (Roberts 2006). There has been a recent surge in interest in peripheral nerve blocks (PNB) in the veterinary literature, which has translated into these techniques being performed in veterinary practice. Pelvic limb PNB offers a comparable degree of analgesia to the extradural technique with fewer side effects in humans (Fowler et al. 2008). Such techniques have been facilitated by advances in technology such as electrical nerve location (ENL) and ultrasound guidance (USG), which offer more precise deposition of local anaesthetic solution compared to blind techniques. Although the will to prevent chronic post surgical pain is suggested as a valid rationale for RA, the weight of evidence for a positive effect is currently low (Andreae & Andreae 2013). This statement is based on a recent review in humans in which the authors conclude that extradural anaesthesia and paravertebral block, respectively, may prevent persistent (chronic) pain (PCP) after thoracotomy and breast cancer surgery in about one out of every four to five patients treated. The review by Andreae & Andreae did not include orthopaedic surgery, where the vast majority of RA is performed in veterinary practice.

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to narrow the field to pelvic limb nerve blocks. The reference lists of retrieved papers were scrutinized to identify further studies for inclusion.

Literature for PNBs utilizes a number of abbreviations not used otherwise in anaesthesia. Although in this review all are defined at first use, for ease of reference they are listed in Table 1.

Relevant anatomy

Successful PNB techniques require thorough anatomical knowledge for the establishment of reliable landmarks, puncture sites, the direction and depth of needle insertion, and relevant structures to be avoided.

The innervation of the canine pelvic limb has been examined in several cadaver studies with the aim of identifying appropriate landmarks and suitable approaches to perform PNBs, specifically the lumbar plexus (LP), the femoral/saphenous nerve (FN/SaN), the sacral plexus (SP) and the sciatic nerve (ScN). The lumbar and sacral plexuses provide the main innervation of the pelvic limb. Anaesthesia of the entire limb can be achieved with perineural administration of local anaesthetic solution in proximity to the main nerves of the lumbosacral plexus (L4–S2) which are the femoral (L4–L6) and the sciatic (L6–S2) nerves plus the lateral femoral cutaneous nerve (LFCN) (L3–L5), obturator (L4–L6) and the caudal cutaneous femoral nerve (L7-S2) (Bailey et al. 1988; Dyce et al. 1996; Portela et al. 2010; Echeverry et al. 2012b; Campoy & Mahler 2013). The LP is described as six nerves: the ileohypogastric, ileoinguinal, genitofemoral, lateral femoral cutaneous, femoral, and obturator nerve (Evans & De Lahunta 2010). The sacral plexus is composed of the pudendal, caudal cutaneous femoral, gluteal and sciatic nerves (Evans & De Lahunta 2010; Portela et al. 2010). In dogs the stifle is innervated by the medial articular nerve (SaN in origin), the caudal articular nerve and the lateral articular nerve (both ScN in origin). The medial articular nerve occasionally receives branches from the obturator nerve. In dogs the caudal articular nerve is often absent but by contrast this is the largest of the articular nerves in the cat (O'Connor & Woodbury 1982).

The paths of the FN and ScN have each been described in anatomical studies (Mahler & Adogwa 2008, Echeverry et al. 2010) in the dog as well as guides to dissection (Evans & De Lahunta 2010). The FN lies within the iliopsoas muscle then passes into the proximal pelvic limb where it enters the quadriceps femoris between the vastus medialis and the rectus femoris, splitting into branches to innervate quadriceps femoris. Before leaving the iliopsoas muscle, the SaN arises from the cranial side of the FN and a muscular branch splits off to innervate the cranial and caudal bellies of sartorius muscle. The femoral artery and vein run alongside and craniomedial to the FN. The SaN supplies skin on the medial side of the thigh, stifle, tarsus and paw as well as fibres to the medial articular nerve (O'Connor & Woodbury 1982).

The ScN exits the pelvis through the greater ischiatic notch and runs caudally towards the coxofemoral joint, passing caudal to the greater trochanter of the femur. It passes over the gluteus profundus muscle, deep to gluteus medius and gluteus superficialis muscles. It then travels distally between biceps femoris and the adductor muscles. With biceps femoris laterally and semitendinosus medially it divides into terminal branches, the tibial and peroneal nerves. The level at which this division occurs varies (Dyce et al. 1996).

Table 1 Abbreviations

PNB	Peripheral nerve blocks
ENL	Electrical nerve location
USG	Ultrasound guidance
RA	Regional anaesthesia
LP	Lumbar plexus
FN	Femoral nerve
SaN	Saphenous nerve
SP	Sacral plexus
ScN	Sciatic nerve
ON	Obturator nerve
LCFN	Lateral cutaneous femoral nerve

An overview of PNB approaches

The ScN nerve can be approached between the greater trochanter of the femur and the ischiatic tuberosity (Campoy 2008a), in the gluteal region (Mahler & Adogwa 2008) or through a parasacral approach (Portela et al. (2010). The FN can be blocked inguinally at the femoral triangle (Mahler & Adogwa 2008); through a single paramedian injection at the psoas compartment in the L5–L6 intervertebral space (Campoy 2008a); by three paravertebral injections aiming at the spinal lumbar nerves (L4, L5 and L6) (Portela et al. 2010), via a pre-iliac approach (Portela et al. 2013a) or using a suprainguinal approach (Echeverry et al. 2012a). These approaches are represented in Figs 1 & 2.