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RESEARCH PAPER

Anatomical and ultrasonographic study of the femoral nerve within the iliopsoas muscle in beagle dogs and cats

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Abstract

Objectives An ultrasound (US)-guided ventral suprainguinal approach to block the femoral nerve (FN) within the iliopsoas muscle (IPM) has recently been described in dogs. The goal of the present study was to provide the operator with additional information to locate the FN within the IPM in dogs and cats using US.

Study design The study was carried out in three phases: a dissection of the FN (phase 1); an *in vivo* US-assisted nerve study (phase 2), and an anatomical cross-sectional study (phase 3).

Animals Nine healthy adult beagle dogs and nine healthy adult cats.

Methods Dissections were performed to investigate the anatomical characteristics of the FN and its related structures in one dog and one cat. Ultrasound scans of the left and right FN were performed in eight dogs and eight cats. The FN diameter and the distance between the FN and the external iliac artery (EIA) in US images and in anatomical cryosections were measured.

Results The median FN diameter did not differ significantly between cats and dogs (1.1 mm *versus* 1.0 mm) or between the two techniques (US *versus* anatomical cross-sectional study) (1.1 mm *versus* 1.1 mm in dogs; 1.0 mm *versus* 1.1 mm in cats). The US and anatomical measurements of the median distances between the FN and EIA differed significantly between dogs and cats (8.2 mm *versus* 5.8 mm by US; 5.7 mm *versus* 4.8 mm in the anatomical study).

Conclusions and clinical relevance The distance between the EIA and FN is reproducible in beagle dogs and cats and can be used in locating the FN within the IPM.

Keywords cats, dogs, femoral nerve, ultrasonography.

Introduction

Several studies indicate renewed interest in regional anaesthesia in dogs and cats (Campoy et al. 2012; Caniglia et al. 2012; Haro et al. 2012a). The introduction of peripheral nerve stimulators and, more recently, the development of ultrasound

(US)-based technology have improved the accuracy of location of the peripheral nerves.

Recent studies in dogs and cats have specifically described an US-guided technique to block the femoral nerve (FN) (Campoy et al. 2010; Echeverry et al. 2010; Haro et al. 2012a,b). The success of the FN block was not optimal (50.0–62.5%) when an inguinal approach was used (i.e. in the femoral triangle, cranial to the pectineus muscle) (Echeverry et al. 2010). Three recent studies in dogs have described the use of a US-guided ventral suprainguinal approach to localize the FN within the iliopsoas muscle (IPM) (Echeverry et al. 2012a,b; Mahler 2012). This US-guided approach may be clinically useful in the FN block and might provide a suitable alternative to the previously described inguinal approach. The inguinal nipple has been defined as the anatomical landmark with which to position the transducer and obtain optimal images of the FN (Echeverry et al. 2012a). Other parameters described as helpful in identifying the FN within the IPM include the distance between the transducer and the nerve (Echeverry et al. 2012a), the position of the nerve within the IPM (Mahler 2012) and the US appearance of the FN (Echeverry et al. 2012a,b; Mahler 2012). However, these parameters may vary from one animal to another (in the position of the nipple), from one operator to another (in the pressure applied to the transducer), and from one US machine to another (in settings allowing the differentiation of the FN from muscle fibres).

The goal of the present study was therefore to provide the operator with additional information with which to locate the FN within the IPM in dogs and cats using US. Because of its route near the FN, we hypothesized that the external iliac artery (EIA) might be a useful anatomical landmark.

Materials and methods

Animals

The procedures used in this experiment were carried out in accordance with the University of Toulouse Guidelines for the Care and Use of Laboratory Animals and with those of the French Agriculture Authority. They were reviewed and accepted by our local academic ethics committee. Eighteen animals acquired from an accredited experimental animal breeder (Avogadro, France) were used in this study. These included nine adult beagle dogs (five males, four females) and nine adult European cats (six males, three females). All animals were considered to be healthy on the basis of a complete physical examination. None of the animals had a clinical history of any pelvic limb, neurological or musculoskeletal disorders. One male cat and one male dog were used for the dissection of the FN. The remaining 16 animals were used for the *in vivo* US nerve study and for the anatomical cross-sectional study. The animals were destined for euthanasia for reasons unrelated to the present study.

Study design

The study was carried out in three phases: dissection of the FN (phase 1); an *in vivo* US-assisted nerve study (phase 2), and an anatomical cross-sectional study (phase 3).

Phase 1 (n = 2): dissection of the FN

One cat and one dog were embalmed directly after euthanasia. The left and right FNs were dissected to investigate the anatomical characteristics of the FN and its related structures. Skin incisions were made on the medial and proximal aspect of the thigh cranial to the pectineus muscle. The skin was reflected cranially and caudally from the vertical incision. The IPM was then located and split to expose the FN. The entire pathway of the FN within the IPM was dissected (Figs 1a & 2a).

Phase 2 (n = 6): *in vivo* US nerve study

The dogs and cats were sedated intravenously (IV) with 10 μg kg^{-1} metedomidine (Domitor; Janssen, France) and were placed in a dorsal recumbent position. The hair of the abdomen and inguinal area was clipped. All US scans of the left and right FNs were performed with an 18 MHz broad band linear array transducer (Imagic Agile; Kontron Medical, France) by the same experienced US practitioner (CL-L). Coupling gel was generously applied to the abdomen of the animal. Machine settings were optimized to give an image of the best possible quality of the FN.

For both dogs and cats, the transducer was placed in the inguinal region perpendicular to the long axis of the body in order to obtain a transverse image of the IPM (Fig. 3). The IPM has been identified in a previous study (Cannon & Puchalski 2008) as a

