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RESEARCH PAPER

A cadaver study comparing two approaches for performing maxillary nerve block in dogs

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Abstract

Objective To compare the success by inexperienced anaesthetists of using a modified infraorbital approach to the maxillary nerve with the traditional percutaneous approach.

Study design Prospective, randomized, blinded controlled study.

Animals Heads from 37 euthanized Beagle and Beagle cross dogs.

Methods Four anaesthetists were recruited to perform two different approaches to block the maxillary nerve of the cadavers. The infraorbital (I) approach advanced an intravenous catheter along the infraorbital canal. Earlier measurements from scans of similar heads were used to assess suitable catheter size. The percutaneous (P) approach introduced a needle percutaneously just below the ventral border of the zygomatic arch. The side of the head where the technique was to be performed was randomized. A total volume of 0.5 mL methylene blue was injected in each approach. After completion of injections, head dissections were performed by an investigator unaware of the approach used and staining of the maxillary and pterygopalatine nerves was evaluated. Chi squared analysis examined the relationship between the methods ($p < 0.05$). Complications related to the techniques, such as intravascular/intraneural injection and location of the dye, were evaluated macroscopically.

Results Maxillary nerve staining >6 mm was found in 64.9% (I) *versus* 21.6% (P) attempts; staining <6 mm was found in 27% (I) *versus* 21.6% (P); and no nerve staining 8.1% (I) *versus* 56.8% (M). Pterygopalatine nerve staining was found in 70% (I) *versus* 21% (P). The infraorbital approach demonstrated significantly higher maxillary and pterygopalatine nerve staining compared to the percutaneous approach ($p = 0.001$ for both nerves). No evidence of intravascular/intraneural injections was found.

Conclusion and clinical relevance The infraorbital approach was more successful than the percutaneous approach when performed by inexperienced anaesthetists. No macroscopic complications were observed.

Keywords dog, infraorbital approach, local anaesthesia, maxillary nerve.

Introduction

Local anaesthetic drugs prevent the generation and conduction of axonal action potentials by blocking voltage-gated sodium channels in neuronal membranes (Columb & MacLennan 2007). The use of local anaesthetic techniques has been shown to provide reliable analgesia in animals (Lantz 2003; Campoy et al. 2012); they aim to produce profound and complete analgesia to the targeted tissue and by so doing can decrease the concentration of volatile agents required to maintain anaesthesia. Therefore, regional anaesthesia is one component of overall

pain management in the oral/dental surgery patient (Lantz 2003; Beckman 2006).

For any peripheral nerve block, it is necessary to deliver the local anaesthetic drug close enough to the nerve for adequate contact in order for it to be successful and therefore achieve a good analgesic effect (Sites et al. 2009). Traditional approaches for performing such blocks are based on a detailed knowledge of the appropriate anatomical landmarks; in some cases, the difficulty of the technique itself and/or the low success rate have changed these approaches. Currently, the use of advanced tools such as neurostimulators or ultrasound has improved outcome of some local anaesthetic techniques (Campoy et al. 2008, 2010; Echeverry et al. 2012).

Several nerve blocks can be performed on the head in small animals, most of which have been widely described in the veterinary literature (Beckman & Legendre 2002; Rochette 2005; Lemke 2007; Woodward 2008; Dugdale 2010). The four most commonly used are mental, inferior alveolar, infraorbital and maxillary nerve blocks. The anatomical landmarks for all of them are relatively easy to locate and the probability of successful nerve blockade should therefore be relatively high. To the authors' knowledge, however, no studies have been performed to ascertain the true success rate with these techniques.

The maxillary nerve is a sensory branch of the fifth cranial (trigeminal) nerve, which traverses the wall of the pterygopalatine fossa ventral to the orbit. It then enters the infraorbital canal at the maxillary foramen, where it becomes known as the infraorbital nerve (Molenaar 2002). The pterygopalatine nerve arises from the ventral surface of the maxillary nerve, slightly rostral to the level of the pterygopalatine ganglion, and divides into three nerves: minor and major palatine nerves and the caudal nasal nerve of the nasal mucosa (Evans & Kitchell 1993; Evans & de Lahunta 2010). Blockade of the maxillary nerve and pterygopalatine nerve provides analgesia to the nose (nasal planum and most of bridge of nose), upper lip, upper teeth, palate and maxilla (König et al. 2009) and is therefore extremely useful for procedures involving the upper dental arcades, rhinoscopy and maxillectomy. To the authors' knowledge, only one study (Cremer et al. 2011) has evaluated its analgesic effects for rhinoscopy in dogs.

In the veterinary literature, several approaches to the maxillary nerve have been described. In the percutaneous approach, a needle is inserted percutaneously, perpendicular to the skin surface and in a medial direction, just below the ventral border of the zygomatic arch and, for medium-sized dogs, about 0.5 cm caudal to a vertical line drawn from the lateral canthus. The needle then is advanced into the pterygopalatine fossa, aiming slightly rostrally towards the maxillary foramen (Dugdale 2010). For the intra-oral approach, the mouth is opened wide, the lips retracted caudally at the lateral commissure and a needle directed dorsally, immediately caudal to the central portion of the maxillary second molar tooth. Advancement of the needle need not be more than 2–4 mm, depending on patient size (Beckman & Legendre 2002). Finally, another intra-oral route has been described as a deep infraorbital block (Rochette 2005; Tutt 2006); in this technique, a needle is advanced into the infraorbital canal to the level of the first maxillary molar. Once the needle is positioned, aspiration is performed to avoid intravascular injection and gentle digital pressure applied to the infraorbital foramen in order to restrict the local anaesthetic to the canal.

The purpose of this study was to investigate another method to block the maxillary nerve, using the second intra-oral approach described previously, but introducing a catheter (designed for intravenous use) from the infraorbital foramen and advancing it along the infraorbital canal until it reached a point level with the lateral canthus. We compared this approach with a traditional percutaneous approach performed ventral to the zygomatic arch. Injections of methylene blue and anatomical dissection were performed in each head in order to evaluate the degree of staining of the nerves achieved with each approach. Measurements of the infraorbital canal were performed using computed tomography (CT) scans to ensure catheters used during the study were suitable for the size of the heads in our study. Our hypothesis was that,when performed by inexperienced anaesthetists, a modified infraorbital approach for maxillary nerve block would be more successful and would not increase the incidence of complications, compared to the traditional percutaneous approach.

Materials and methods

Ten computed tomography (CT) scans from skulls of dogs were examined to determine measurements of the infraorbital canal. Inclusion criteria were: no brachycephalic breed dogs, body weight between 10