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RESEARCH PAPER

Effect of intravenous lidocaine on cough response to endotracheal intubation in propofol-anaesthetized dogs

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Abstract

Objective To determine whether the administration of intravenous (IV) lidocaine before the induction of anaesthesia in premedicated dogs reduces the cough response associated with endotracheal intubation and the propofol dose required.

Study design Prospective, randomized, blinded clinical study.

Animals A total of 84 client-owned dogs, with American Society of Anesthesiology physical status I and II.

Methods Dogs received intramuscular (IM) acepromazine 0.02 mg kg^{-1} and methadone 0.3 mg kg^{-1} and were randomly allocated to one of two groups: saline (group S) and lidocaine (group L). Five minutes before the induction of anaesthesia and 40–50 minutes after premedication, group L received lidocaine (1.5 mg kg^{-1}) and group S received an equal volume of saline solution, each administered slowly IV. Anaesthesia was induced with propofol, initially 2 mg kg^{-1} IV over 40 seconds, and then in increments of 0.5 mg kg^{-1} every 15 seconds to effect. The same investigator anaesthetized all cases, unaware of group allocation. The following parameters were recorded: pulse rate (PR), mean arterial pressure (MAP, oscillometry), respiratory rate (f_R), sedation score immediately before and 5 minutes after treatment, and total dose of propofol required. Differences in pulse rate, MAP and propofol dose were analysed using the two-sample *t*-test, coughing incidence was analysed with the chi-square test, and differences in sedation score were analysed with the Mann–Whitney test.

Results After treatment, the incidence of coughing at endotracheal intubation was significantly reduced in group L compared with group S (21% *versus* 45%; $p = 0.022$). There was no significant difference between the groups with regard to propofol dose required for endotracheal intubation ($p = 0.122$), PR ($p = 0.611$), MAP ($p = 0.508$) or sedation score ($p = 0.051$).

Conclusions and clinical relevance IV lidocaine can decrease the incidence of cough during endotracheal intubation in dogs premedicated with acepromazine and methadone, but does not appear to have a sparing effect on the dose of propofol required for endotracheal intubation. Use of IV lidocaine, prior to induction of anaesthesia with propofol may be beneficial in dogs where coughing at intubation would be detrimental.

Keywords cough, dogs, endotracheal intubation, lidocaine, propofol.

Introduction

It is known that visualization of the larynx via laryngoscopy and placement of an endotracheal tube can cause a reflex sympathetic response with an

increase in heart rate (HR) and blood pressure (BP), as well as stimulation of the cough reflex (White et al. 1982; Drenger et al. 1985; Lev & Rosen 1994), contributing to increased intracranial pressure (ICP) and intraocular pressure (IOP) (Leech et al. 1974; Bidwai et al. 1979; Hofmeister et al. 2006). While this is of little clinical significance in healthy patients, and there is not enough proof of the relevance of transient elevations in ICP in patients with brain injury, there is clear evidence that, in patients with penetrating eye injuries, even a brief rise in IOP is associated with morbidity (Monaghan 2000).

Many human studies show contradictory results regarding the benefits of using lidocaine as a prophylactic treatment to reduce the cough reflex and the sympathetic response during tracheal, laryngeal or upper airway manipulation (Yukioka et al. 1985; Davidson & Gillespie 1993; Singh et al. 1995; Erb et al. 2013). Most studies that support the use of lidocaine at induction of anaesthesia involve premedicated patients or a dose that is near the upper limit of the reported range, suggesting that lidocaine doses >1 mg kg^{-1}, in combination with premedication, could be beneficial and more likely to result in the desired effect. A clinical study in dogs using 1 mg kg^{-1} lidocaine in unpremedicated patients anaesthetized with propofol showed no beneficial effect (Jolliffe et al. 2007).

The main objectives of this study were to determine if the administration of 1.5 mg kg^{-1} of intravenous (IV) lidocaine as a co-induction agent, 5 minutes before propofol administration in dogs premedicated with acepromazine and methadone, suppressed the cough reflex and had a sparing effect on the propofol dose required to allow endotracheal intubation.

The hypothesis was that IV lidocaine as a co-induction agent suppresses the cough reflex and has a sparing effect on the dose of propofol required for endotracheal intubation.

Materials and methods

The study was approved prospectively by the Ethical Review Committee of the School of Veterinary Medicine and Science (SVMS), Nottingham University, and informed owner consent was obtained in all cases. In all, 84 client-owned dogs, with American Society of Anesthesiology physical status I and II, undergoing elective surgery or diagnostic imaging between April and October 2013, were enrolled in the study.

To avoid confounding factors and bias, patients with pre-existing or suspected systemic diseases based on physical examination, history and diagnostic test results were excluded, as well as patients on cardiac medications, including antiarrhythmics, those with suspected pharyngeal or laryngeal dysfunction, or megaesophagus, and those with other risk factors for airway obstruction or regurgitation.

The primary outcome measure of the study was cough at endotracheal intubation. Based on previously reported data, it was anticipated that up to two-thirds of dogs would cough at endotracheal intubation (Jolliffe et al. 2007). A treatment effect reducing cough at endotracheal intubation to 25–33% of cases was considered clinically significant. A prospective power calculation revealed that 27–41 dogs per treatment group would be required to give the study a power of 80% to detect a statistically significant ($p < 0.05$) difference of this magnitude. Therefore it was decided to recruit a minimum of 80 cases to the study. Each dog meeting the inclusion criteria was randomly allocated at the time of recruitment to one of two groups, a lidocaine group (group L) or a saline group (group S), using a random number generator (www.Random.org).

The primary investigator (I.C.) allocated each dog to one of the two groups and subsequently prepared the syringe containing either saline or lidocaine. The second investigator (A.P.), unaware of group allocation, was responsible for the induction of anaesthesia, measurements of physiological variables and assessment of patient response.

All dogs received acepromazine 0.02 mg kg^{-1} (ACP, 2 mg mL^{-1} injection; Novartis Animal Health, UK) and methadone 0.3 mg kg^{-1} (Comfortan injection, 10 mg mL^{-1}; Dechra Veterinary Products, UK) as premedication, administered intramuscularly (IM) at least 30 minutes prior to induction of anaesthesia. An IV cannula was placed in a cephalic or lateral saphenous vein. Respiratory rate (f_R), pulse rate (PR) and arterial BP were recorded after premedication and immediately before lidocaine or saline administration (T0), after lidocaine or saline administration (T1), and post-intubation (T2). f_R was obtained by counting thoracic excursions. PR was determined by metatarsal arterial pulse palpation, and an automated oscillometric device (S/5; Datex-Ohmeda, UK) was used to measure BP with a cuff placed on the antebrachium. The cuff selected was one with the width closest to 40% of the