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RESEARCH PAPER

Gastro-oesophageal reflux in large-sized, deep-chested *versus* small-sized, barrel-chested dogs undergoing spinal surgery in sternal recumbency

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Abstract

Objective The aim of this study was to investigate whether an increased frequency of gastro-oesophageal reflux (GOR) is more common in large-sized, deep-chested dogs undergoing spinal surgery in sternal recumbency than in small-sized, barrel-chested dogs.

Study design Prospective, cohort study.

Animals Nineteen small-sized, barrel-chested dogs (group B) and 26 large-sized, deep-chested dogs (group D).

Methods All animals were premedicated with intramuscular (IM) acepromazine (0.05 mg kg^{-1}) and pethidine (3 mg kg^{-1}) IM. Anaesthesia was induced with intravenous sodium thiopental and maintained with halothane in oxygen. Lower oesophageal pH was monitored continuously after induction of anaesthesia. Gastro-oesophageal reflux was considered to have occurred whenever pH values > 7.5 or < 4 were recorded. If GOR was detected during anaesthesia, measures were taken to avoid aspiration of gastric contents into the lungs and to prevent the development of oesophagitis/oesophageal stricture.

Results The frequency of GOR during anaesthesia was significantly higher in group D (6/26 dogs; 23.07%) than in group B (0/19 dogs; 0%) ($p = 0.032$). Signs indicative of aspiration pneumonia, oesophagitis or oesophageal stricture were not reported in any of the GOR cases.

Conclusions and clinical relevance In large-sized, deep-chested dogs undergoing spinal surgery in sternal recumbency, it would seem prudent to consider measures aimed at preventing GOR and its potentially devastating consequences (oesophagitis/oesophageal stricture, aspiration pneumonia).

Keywords deep chest, dog, gastro-oesophageal reflux, oesophagitis, sternal recumbency.

Introduction

In anaesthetized dogs, both posterior oesophageal sphincter pressure (POSP) and barrier pressure (BrP, the difference between POSP and intragastric pressure) at the gastro-oesophageal junction are affected by the type of recumbency (Waterman et al. 1995; Pratschke et al. 2001). In particular, it has been reported that BrP for Greyhound dogs positioned in sternal recumbency (mean ± SEM, 1.10 ± 0.53 mmHg) was significantly less than BrP in right

lateral (5.41 ± 1.35 mmHg) or left lateral (9.07 ± 2.69 mmHg) recumbency (Pratschke et al. 2001). As a high BrP is important to prevent gastro-oesophageal reflux (GOR), reflux could logically be assumed to be more frequent in anaesthetized dogs placed in sternal recumbency for surgery (Pratschke et al. 2001). Nevertheless, in a relevant clinical study (Galatos & Raptopoulos 1995), surgery in sternal recumbency was not associated with an increased incidence of GOR compared with left lateral, right lateral or dorsal recumbency. However, the mean body weight of the dogs in which GOR was detected while in sternal recumbency (33.0 ± 5.7 kg) was significantly higher than that of the dogs placed in the same position in which GOR did not occur (20.1 ± 8.2 kg). Such an effect of body weight was not shown for any other type of recumbency.

Pratschke et al. (2001) suggested that reduced BrP in anaesthetized dogs in the sternal position could be explained by the distortion in thoracic anatomy caused as the weight of the dog presses downwards, distorting the diaphragm. Because the diaphragm is vital for maintenance of BrP, sternal recumbency may reduce BrP. It seems reasonable to assume that the distortion of normal thoracic anatomy and the potentially resultant decrease of BrP will be greater in dogs with a high body weight and a deep chest. It is possible that the effect of these factors contributed to the occurrence of GOR in those animals in the study by Galatos & Raptopoulos (1995) that exhibited reflux while in sternal recumbency.

The aim of this study was to investigate whether body weight (large-sized *versus* small-sized dogs) in combination with the conformation of the thorax (deep-chested *versus* barrel-chested dogs) affected the incidence of GOR in dogs submitted to surgery of the spinal column in sternal recumbency. We hypothesized that the incidence of GOR during surgery of the spinal column in sternal recumbency would be higher in large-sized, deep-chested dogs than in small-sized, barrel-chested dogs.

Materials and methods

This was a prospective cohort study, which was carried out at the Small Animals Clinic, School of Veterinary Medicine, Aristotle University of Thessaloniki, between 2007 and 2009. The protocol of the study was reviewed and approved by the Institution's Ethical Committee (no. 23/2006). Inclusion criteria were as follows: surgery (spinal column, sternal recumbency), age (> 6 months), American Society of Anaesthesiologists physical status (II or III), history (no reported previous diseases of the gastrointestinal system with the exception of dental disease), body weight and thorax conformation (≤ 9 kg and broad thorax, or ≥ 18 kg and deep thorax). Informed consent was obtained from all owners regarding participation of their animal in the study.

According to Galatos & Raptopoulos (1995), the incidence of reflux in dogs in sternal recumbency is 12.5%, with a standard deviation (SD) of 8.4%. In order to achieve a statistical power of at least 0.8, with an effect size of 0.9 (i.e. an anticipated increase in the incidence of reflux up to 20%), the minimum number of animals required was calculated to be 17 in each group.

All animals fitting the inclusion criteria between May 2007 and November 2009 were included in the study. Animals scheduled for surgery of the spinal column weighing between 9 and 18 kg were excluded. Radiographs were taken when animals underwent magnetic resonance imaging, computed tomography or myelography under general anaesthesia, usually a few days before the day of surgery and never on the same day as surgery. The conformation of the thorax was investigated using thoracic radiographs based on the methods described by Buchanan & Bücheler (1995). In brief, the distance from the cranial edge of the xiphoid process to the ventral border of the vertebral column along a line perpendicular to the vertebral column (thoracic depth) and the distance between the medial borders of the eighth ribs at their most lateral points (thoracic width) were measured from right lateral and dorsoventral or ventrodorsal thoracic radiographs, respectively, and the depth/width ratio was calculated. When the ratio was ≥ 1.25 the animal was deemed to be deep-chested and when it was ≤ 0.75 the animal was considered barrel-chested. Animals with a ratio between 0.75 and 1.25 were excluded. Dogs weighing ≤ 9 kg and with a barrel-shaped thorax were assigned to group B, while dogs weighing ≥ 18 kg and with a deep thorax were assigned to group D.

On the day of a study, the animal was fed a standardized meal of commercial tinned food offering half the daily energy requirements and then fasted for 3–4 hours before induction of anaesthesia. Animals that refused feed were excluded from the study. All animals had free access to water until

