

Factors Affecting Intraoperative Gastro-Oesophageal Reflux in Dogs/Cats

Subjects: **Veterinary Sciences**

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Gastro-oesophageal reflux (GOR) is an anaesthetic complication that causes oesophageal inflammation and stricture in animals. There are many factors affecting the development of GOR during anaesthesia in dogs. Evidence in cats is even more scarce. More studies are necessary for safer conclusions.

anaesthesia

cat

dog

gastro-oesophageal reflux

1. Introduction

Gastro-oesophageal reflux (GOR) is the “silent” movement of gastric and/or duodenal contents into the oesophagus without associated eructation or vomiting, and can lead to oesophageal mucosal injury and oesophagitis in dogs and cats ^{[1][2]}. Anaesthetic agents seem to reduce the lower oesophageal sphincter (LOS) tone and this is a major factor involved in the pathogenesis of reflux ^{[3][4][5]}. The refluxate in the oesophagus can originate only from the stomach (acid reflux) or can be a mixture of gastric and duodenal contents (non-acid reflux) ^[6]. The incidence of GOR during anaesthesia has been investigated by the measurement of oesophageal pH. GOR occurs when the effectiveness of LOS is decreased by anaesthetic agents, gastric acidity and food withholding ^{[3][4][5][7]}.

As GOR is thought to be the main cause of oesophageal inflammation and stricture in animals, it can lead to death or euthanasia ^{[8][9]}. During general anaesthesia, GOR is a common complication that occurs in 4.8% to 66.7% of dogs ^{[6][10][11][12][13][14][15][16]}. According to the literature, there are many factors that contribute to the development of GOR, such as preoperative food withholding, volume and acidity of the gastric contents, age, type of the surgical procedure, positioning of the patient and anaesthetic agents ^{[6][10][15][17][18][19][20][21][22]}.

In humans, pulmonary aspiration following GOR is one of the most common causes of death related to anaesthesia. Over the years, a lot of research has been conducted to establish fasting guidelines prior to anaesthesia to reduce the risk of GOR. The traditional guideline was nil by mouth (NPO) from midnight if the surgery was scheduled for the morning, and toast with a tea (light breakfast) for the patients who were scheduled for the afternoon ^{[23][24][25]}.

Thirteen years ago, the American Society of Anesthesiologists (ASA) adopted the guideline of a 6 h fast from solids and 2 h fast from clear liquids prior to an anaesthetic procedure ^{[26][27]}. Moreover, the Canadian Anaesthetists’

Society recommends a total fast of no less than five hours and suggests that policies be constructed within individual departments [28].

In human medical literature, there are two large systematic reviews with meta-analyses in the Cochrane Collaboration on preoperative fasting. According to the first one, there is no evidence that a shortened fluid fast can increase the risk of aspiration, regurgitation, or mortality compared to the standard NPO fasting practice in adults [29]. In the second one on preoperative fasting in children, no evidence was found that children who do not receive any fluids for more than 6 h preoperatively benefit compared to the children who had free access to fluids for up to 2 h preoperatively [30].

Another factor that seems to affect the development of GOR in humans is the volume and acidity of gastric content (GC), and several reports have investigated a potential correlation between them [31][32][33][34][35][36][37][38]. According to Hardy et al. [37], there is no correlation between the GC volume and the incidence of reflux at induction of anaesthesia. Moreover, it has been reported that a prolonged duration of fasting does not guarantee a decrease in the volume of GC, and a light breakfast 2–3 h before surgery does not change the pH and the volume of GC [31].

In dogs, although there are no clearly proposed fasting guidelines before induction of anaesthesia, there is evidence that an increased duration of preoperative fasting may cause a high incidence of GOR [10][15][18]. Other suggested guidelines are withholding of food and water for approximately 12 h before surgery [10][12][13][21][39][40][41][42] or overnight [6][22][43]. Furthermore, the effect of various types of food given on two different preoperative fasting times, 3 or 10 h beforehand, on GC volume and acidity has been studied in dogs. It suggests that feeding dogs with canned food at a half daily rate 3 h before anaesthesia nonsignificantly increased the GC volume, while the GC acidity decreased significantly [18].

On the other hand, in a recent study by Viskjer et al. [14], a 3 h fasting period was associated with significantly greater odds for reflux compared to an 18 h fasting period. However, the pH of the refluxate was significantly higher in the 3 h fasting group. Another study in which the dogs were fed with canned food at half daily rate 12 h before the induction of anaesthesia reported an overall incidence (44.1%) of GOR in dogs [16].

A factor that seems to affect the incidence of GOR in dogs is the different types of drugs (anaesthetic/nonanaesthetic agents). Studies have investigated the effect of opioids such as morphine [6] and pethidine [21], injectable anaesthetic agents, (propofol and thiopentone) [42], inhalant anaesthetic agents, (halothane, isoflurane and sevoflurane) [22] on the incidence of GOR. Except for these agents, other drugs have also been investigated for their impact on GOR in dogs, such as D2 receptor antagonists [13][43], antiemetics [41] and antacids [12][39][40].

In anaesthetized cats, there is little evidence about the effect of different drugs on the LOS and on the incidence of GOR. There are studies investigating the effect of acepromazine, atropine, pethidine [4], propofol, thiopentone,

alphaxalone, ketamine and xylazine [3] on LOS, and other studies about the action of induction agents [20] and antacids [44] on GOR.

2. Factors Affecting Intraoperative Gastro-Oesophageal Reflux in Dogs/Cats

The fasting duration before anaesthesia seems to be an important factor that influences the incidence of GOR, and there is a lot of discussion about the proper fasting guidelines in humans and animals. In the study by Galatos et al. [10], an increased duration of preoperative fasting was associated with a high incidence of reflux. The clinical study by Savvas et al. [15] is also in favour of fasting duration less than 5 h. These findings are in agreement with the GOR incidence discussed in another study, investigating the effect of fasting on GC volume and pH, in which the administration of canned food at half daily rate 3 h before anaesthesia increased the risk of GOR in dogs, but this would be an effect of chance alone (nonsignificant effect) [18].

In contrast, two other studies (Viskjer et al. [14] and Tsompanidou et al. [45]) revealed a totally different outcome. A light meal 3 h before anaesthesia was associated with a significantly higher incidence of GOR in comparison with overnight food withholding. The authors of the first study (Viskjer et al. [14]) gave some explanations as to why their results differed from other studies. The large volume of the meal and the different composition of food (the amount of proteins and fibres were higher in comparison with the food in the study by Savvas et al. [18]) may have been responsible for the different findings in comparison with the other two studies. Moreover, the administration of an opioid as preanaesthetic medication in combination with the amount and type of food may influence gastric motor function. Another important point in the design is that the dogs that underwent pelvic limb surgery received an additional dose of morphine epidurally prior to surgery. All these limitations could explain the different findings in that study regarding the appropriate duration of fasting. Likewise, in the other study (Tsompanidou et al. [45]) pethidine was used to premedicate the dogs. From the subgroup analysis, it seems that the use of opioids in the anaesthetic protocol may lead to a threefold increase in the risk of GOR. It has been shown that opioids can induce GOR [6][21], so clinicians must always bear in mind this effect when they use opioids.

Not only antacids but also antiemetics, such as maropitant, and D2 receptor antagonists, such as metoclopramide, influence the incidence of GOR. The findings on the effect of metoclopramide on GOR during anaesthesia are different between the two relevant studies by Favarato et al. [13] and Wilson et al. [43]. The lack of a beneficial effect of metoclopramide alone or with ranitidine in preventing GOR in the study by Favarato et al. [13] may be due to the anaesthetic protocol used, which was not anticipated to contribute to a high occurrence of GOR, as an opioid was not included. Their findings are in contrast to the results of the study by Wilson et al. [43], which showed a reduced risk of GOR after the administration of metoclopramide, however morphine was part of the anaesthetic protocol as preanaesthetic medication in the study by Wilson et al. [43].

Different induction agents, thiopentone and propofol [42], or different inhalant agents for the maintenance of anaesthesia halothane, isoflurane and sevoflurane [22], seem to affect GOR differently, but a definite conclusion cannot be drawn.

Regarding the opioids, contradictory results have been reported by different studies. There is little evidence on the effect of opioids on GOR. Only two studies have been published on the effect of morphine [6] and pethidine [21] on GOR in dogs. Morphine increases the incidence of GOR during anaesthesia, while the use of pethidine decreases the incidence of GOR when compared to morphine premedication [21]. In the study on morphine, a prolonged period of food withholding (10–30 h) was implemented, and this may have contributed to the high incidence of GOR [6]. The food was withheld from the dogs for a mean of 18 h prior to anaesthesia and this is in agreement with other studies [10][19]. However, no animal that had a fasting duration between 2–4 h, had an episode of GOR. So, it seems that the association between fasting duration and the effect of morphine on GOR is a subject that requires further investigation.

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