**Anaesthetic risk and nasogastric intubation**

**Introduction**

The case report in this issue by Monticelli and Adami describes two cases of aspiration pneumonitis (Monticelli and Adami, 2017). It is a condition well recognised in human patients (Engelhardt and Webster, 1999; Marik, 2001) and aspiration of gastro-oesophageal reflux associated with anaesthesia has been reported in other veterinary species (Kogen *et al* 2008; Obvey *er al*, 2014). It has not previously been reported in horses. This case report highlights another potential complication in anaesthetising the emergency colic case and discusses the best way to minimise respiratory complications secondary to the presence of nasogastric (NG) reflux in the perioperative period. Prompt recognition of hypoxaemia and the presence of reflux within the endotracheal tube are key events which should lead to a presumption of the likelihood of aspiration pneumonitis whilst under general anaesthesia. In the two reported cases, once aspiration of gastric contents had occurred, treatment was challenging and success was limited.Guidelines (BMK Best Practice Guidelines, 2017) for treating aspiration in humans includes suctioning of the oropharynx, tilting to a head up position, bronchoscopy and suctioning within a few hours of the incident. Positive end expiratory pressure and positive pressure ventilation are not recommended until endotracheal suctioning is performed**.** Many of these treatments are currently impractical in the horse. As this protocol would not be appropriate in horses, we need to consider methods of reducing the risk of aspiration. Clearly, prevention of aspiration pneumonitis caused by gastric contents is preferable to being faced with having to treat this complication.

It is well recognised that anaesthesia for colic surgery carries significant risk. CEPEF-1 and 2 showed anaesthesia for colic surgery had a greater mortality rate of approximately 7.9% compared to 0.9% for healthy horses (Johnstone et al, 2002). Smaller, single-centre studies have reported similar mortality rates for anaesthesia in colic cases (Hodgson and Dunlop, 1990; Young and Taylor, 1993; Mee *et al*, 1998; Bidwell *et al*, 2004;). Complications following general anaesthesia for colic surgery are varied but there is little data regarding respiratory complications in the perioperative period for colic cases.

Nasogastric intubation is technically easy to perform and is generally well tolerated by most horses. Reports regarding complications of NG intubation in horses are rare and are limited to trauma of the oesophagus and pharynx (Hardy *et al*, 1992). Epistaxis can occur secondary to NG intubation but is usually self-limiting. To our knowledge, this case report is the first report of aspiration pneumonitis in colic cases, although it may be that this condition is under-reported. The case report by Monticelli and Adami (2017) raises the question of how to best manage the risk of gastric reflux in the perioperative period to reduce morbidity and mortality due to aspiration in colic cases.

**Risk factors for aspiration**

The risk for aspiration of gastric contents in horses is generally considered to be lower than humans or many other veterinary species due to equine gastric anatomy (Budras and Henschel, 2008). The risk factors for aspiration hypothesised by Monticelli and Adami include gastric impaction, abdominal distension and the presence of an indwelling NG throughout the induction and maintenance phases of anaesthesia.

**Gastric impaction**

Transabdominal ultrasonography of the stomach may be useful in assessing gastric distension or impaction. It is, however subjective and there is conflicting evidence of the sensitivity and repeatability of this method (Lores *et al*, 2007, Le Jeune and Whitcomb, 2014). A rapid ultrasonographic scanning technique which can be employed during investigation, known as fast localised abdominal ultrasonography of horses (FLASH) scanning, also has potential to help identify cases where gastric distension is present while helping with decision making as to whether surgery may be required (Busoni *et al*, 2011, Naylor, 2015). This may also help quickly identify horses where passage of a NG tube is beneficial.

**Abdominal distention**

Abdominal distension is often assessed subjectively in cases with an acute abdominal emergency. Transabdominal ultrasonography has value in the diagnosis of tympany and gaseous distension of the small intestine (Freeman, 2003). Percutaneous trocharisation of the large colon or caecum can be undertaken to relieve gaseous distension in cases which have been identified on palpation per rectum. This is not without risk and should not be performed in cases where surgery is an option, whenever possible (Rowe, 2008).

**Presence of an indwelling NG tube through the induction and maintenance phases of anaesthesia**

Reflux, either spontaneous or a positive yield on the passage of a NG tube, occurs in 13% of the horses presented to the Philip Leverhulme Equine Hospital for investigation of acute colic (Philip Leverhulme Equine Hospital Colic Database). Proudman *et al* (2006) found that the presence of NG reflux was not associated with intraoperative death in colic cases. Such cases can provide challenges on how to best protect the airway during the perioperative period.

During induction of anaesthesia with ketamine, laryngeal and pharyngeal reflexes are usually maintained but the cough reflex is abolished (Lin *et al*, 2015), so it is challenging to know if aspiration has occurred immediately after anaesthesia is induced. Prompt intubation with an appropriate sized endotracheal tube and inflation of the cuff to provide an airtight seal is vital to protect the airway. Intubation of the horse’s trachea whilst the horse is in sternal recumbency is also advocated (Donaldson, 2009), but this can be challenging in many cases when inductions can be difficult to control, especially in painful horses or when practical or staffing limitations preclude.

Some authors advise maintaining a NG tube *in situ* throughout the induction and maintenance phase of anaesthesia to encourage passive drainage of gastric contents (Doherty and Valverde, 2006). Whether leaving a NG tube in place in a refluxing horse for anaesthesia is beneficial in protecting the airway is not clear. The premise is that an in situ NG tube may allow gastric fluid to drain via a low pressure outlet but we know of no evidence of this to date. In our experience, the presence of an *in situ* NG tube during induction and maintenance of anaesthesia promotes passage of gastric contents along the outside of the tube as well as, or instead of, down the lumen of the tube, as presumably the tube does not always form a seal with the oesophageal sphincter and so the low pressure outlet can be into the oesophagus itself. The other two options discussed in this case report are to remove the tube entirely prior to induction or partially withdraw the tube to sit proximal to the oesophageal sphincter. The advantage of complete removal of the NG tube is that there is no risk of the tube itself facilitating movement of gastric contents into the oesophagus. The disadvantage is that if it is subsequently considered necessary to place an NG tube, placement of an NG tube in a dorsally recumbent horse is difficult. Partially withdrawing a tube has the advantages of keeping the tube nearly in situ but avoids producing a poorly sealed low pressure release through the oesophageal sphincter. The disadvantages with partially withdrawing the NG tube are that it is difficult to be certain to the accuracy of the siting of the tube without the use of endoscopy and additionally, the NG tube may move distally through the oesophageal sphincter during induction or placing the horse on the operating table. Current practice in our clinic is to attempt to remove as much reflux from the stomach as possible prior to induction of a colic case with recognised reflux before removing the tube prior to induction of anaesthesia. The exceptions to this practice are those cases where it is anticipated that gastric lavage may be required during surgery e.g. gastric impactions.

To our knowledge, there is no recent evidence of the advantage of any one of the three NG tube approaches (NG tube in situ throughout anaesthesia, removed prior to induction or partially withdrawn prior to induction) to protecting against aspiration pneumonitis caused by gastric contents in a surgical colic case with recognised reflux, over any of the others. This case report might promote a discussion of which approach each clinician/ clinic adopts, but that discussion should at least now include the evidence of this case report that leaving NG tube *in situ* can still result in aspiration pneumonitis.

**Potential ways forward**

Reports focusing on the incidence of oesophageal reflux and aspiration of gastric contents are lacking in horses, therefore evidence informing the best course of action in dealing with potential NG reflux in the perianaesthetic period is needed. The options regarding NG intubation are to leave the tube in situ for anaesthesia, partially withdraw it into the oesophagus or to remove it entirely.

We have found that when NG tubes are left in situduring anaesthesia, it is common for reflux to drain around the tube. It is our opinion that this may increase the risk of aspiration. Partially withdrawing the tube into the oesophagus may reduce the risk of aspiration; however, it is difficult to determine exactly where the end of the tube is positioned in relation to the gastric cardia.

The challenges present when anaesthetising a colic case are numerous, but sudden onset hypoxaemia with the presence of gastric fluid within the endotracheal tubes and breathing system of the anaesthetic machine should highlight the possible diagnosis of aspiration pneumonitis in horses. Protecting the airway during induction of general anaesthesia and during intubation for the delivery of anaesthetic gases is key to preventing the condition developing and aggressive therapies to treat hypoxaemia should be undertaken without delay.

The case report suggests risk factors for the development of aspiration pneumonitis. Since gastric impaction or abdominal distension cannot be treated quickly prior to anaesthesia in the acute abdomen case, should we be more carefully selecting our cases where NG intubation is performed and should we be removing tubes for the anaesthetic period?

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