



# Chapter 2

## Surgical approach in intestinal obstructive conditions caused by linear foreign body: a literature review

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### ABSTRACT

The cases of ingestion of foreign bodies (FBs) are routine in the veterinary medicine, being able to

evolve for pictures of urgency or emergency with need of surgical intervention, possessing clinical signs as emesis, apathy or restlessness, anorexia, diarrhea, pain to the palpation and shock. ECs are objects that cannot be digested, and may cause total or partial obstruction and evolve to death, and in most cases, are puppy patients of the breeds Dobermann, Pincher, Cocker Spaniel, and Rottweiler. When linear, they usually involve a loop, being free or anchored at some point, and may cause laceration of the mucosa and local or generalized peritonitis. The present study aimed to perform a literature review on linear foreign body obstruction in companion animals and to approach the surgical technique for correction of the condition. After the anamnesis, the patient should be taken to imaging exams such as ultrasonography and/or radiography, and endoscopy is required for visualization and removal of the FB, if the animal has ingested the FB at most 3 to 4 hours ago, ending in exploratory laparotomy, when it is not possible to establish the diagnosis. In case of confirmation and intestinal obstruction, an enterotomy is performed for removal. The prognosis is favorable if the surgical intervention occurs within a maximum of 14 hours, as well as in the absence of ischemia and necrosis of large intestinal portions and/or perforation and consequent septic peritonitis, which lead to an unfavorable prognosis for the reserved area.

**Keywords:** Enterotomy, jejunum, surgical technique.

### 1 INTRODUCTION

In the clinical-veterinary routine of dogs and cats are, routinely, cases of ingestion of foreign bodies (FBs), which, before possible complications and impossibility of expulsion of the object in most cases, can be considered urgencies or emergencies with need for surgical intervention (VIANA et al. 2020). The clinical signs vary according to the picture, its severity, structure affected, time of obstruction and are usually nonspecific, and the animal may present apathy or restlessness, emesis with possible frothy

yellowish-white content, diarrhea, anorexia, pain on palpation and shock in more severe and emergency pictures (LIMA et al. 2019).

After the anamnesis and suspicion of obstruction by a foreign body, the animal must be taken to complementary imaging exams such as ultrasound and/or radiography, and endoscopic analysis may be recommended for diagnostic confirmation in cases where ingestion occurred within 3 or 4 hours. After that, if the imaging exams do not allow a diagnosis to be made, exploratory laparotomy is recommended (DA SILVA et al. 2020).

In case of confirmation of intestinal obstruction by a foreign body, without the occurrence of ischemia and necrosis of the intestinal loop or other complications, pre-operative exams are performed and then the animal will be referred to enterotomy for removal of the FB (ROSA et al. 2020).

In view of the seriousness of the obstruction caused by ECs, and in order to contribute to the literature and knowledge of the technique of enterotomy, enterorrhaphy and anesthetic procedure, this study aimed to perform a literature review on the obstruction caused by linear foreign bodies in pets, and to approach the surgical technique for correction of this condition.

## **2 REVIEW OF LITERATURE**

### **2.1 ANATOMY OF THE SMALL INTESTINE**

The small intestine has three segments, these being the duodenum, jejunum, and ileum. The duodenum is a short, fixed segment and it is supported by the mesoduodenum. It begins in the pyloric of the stomach and extends to the jejunum, these limits are barely perceptible, being represented by the duodenojejunal fold (KONIG, 2016).

The jejunum is represented by the longest part of the small intestine, with highly mobile loops and supported by a long mesojejunum which suspends it from the abdominal roof along with the ileum. The ileum is represented by the final portion of the small intestine, which is attached to the ileocecal fold (FOSSUM, 2015).

The structure of the small intestine consists of four layers, namely: mucosa, submucosa, muscularis, and serosa. The mucosa has a single-layered epithelium with the primary function of absorbing nutrients and producing mucus. The submucosa is considered the strongest layer and is composed of connective tissue, lymphatic and blood vessels, and nerve plexus, which has the function of innervating the intramural glands, smooth muscle fibers, and vessel walls (KONIG, 2016). The muscle layer is composed of smooth muscle tissue, with the function of moving the intestinal loops. The serosa is composed of a thin peritoneal layer and is a source of mesothelial cells, in which it can provide rapid sealing in enterotomies and enterectomies. (SISSON, 2012)

According to Dyce (2010) and Konig (2016) the small intestine is vascularized mainly by the cranial and caudal mesenteric arteries. As for the vascularization of the proximal part of the duodenum, divergent authors Dyce (2010) states that the vascularization of the proximal duodenum is done by the

pancreaticoduodenal branch of the gastroduodenal artery and the hepatic branch of the celiac artery (LIMA, 2019).

## 2.2 PATHOPHYSIOLOGY OF INTESTINAL OBSTRUCTION CAUSED BY FOREIGN BODIES

Any object that cannot be digested by the animal such as rocks, plastic, or digests very slowly such as bones are considered foreign bodies (FB), and can lead to complete or partial intraluminal obstruction, with a potential risk of death (FOSSUM, 2015). In partial obstructions the passage of liquids or gases is still allowed, but there is a reduced rate of passage. Similarly to the complete obstruction, there is no way for the ingestion, liquids or gases to proceed through the intestine, resulting in a distension proximal to the foreign body (VIANA et al., 2020).

Dogs, especially puppies, tend to ingest frequently and indiscriminately foreign bodies such as stones, toys, socks, cloths, among others. Capak et al. (2001) reported a higher incidence in males and occurrence in breeds such as Dobermann Pincher, Cocker Spaniel and Rottweiler.

We can find two types of intestinal foreign bodies: linear and non-linear. The linear ones usually cover only one intestinal segment and can be free or anchored in some point. In this case its progression in the GIT is impeded, causing the bowel to move toward the point of fixation due to the repeated peristaltic activity, assuming a pleated aspect of cranial or central location in the abdomen (HAYES, 2009). Due to the occurrence of distension at the mesenteric border, this linear foreign body may lacerate the mucosa, with a possible complication of localized or generalized peritonitis. The most common location of this type of EC in the dog, is in the jejunum (LIMA, 2019).

Intestinal obstructions cause a hydroelectrolytic and acid-base imbalance, due to the low absorption that occurs in the intestinal lumen, and by hypersecretion. These occurrences are exacerbated by vomiting and low fluid and nutrient intake, as the animal is anorexic, leading to dehydration (LUMB, 2017). By raising the hydrostatic pressure, there is fluid extravasation into the interstitial space resulting in edema of the intestinal wall, which also accumulates in the peritoneal cavity. In addition, the tissue can become ischemic as there is interruption of local blood and lymph flow. Such events can evolve into necrosis and bowel perforation (SECOND et al., 2017).

The clinical signs of this disease can be non-specific and variable for each animal. Among them, we highlight the most observed: weight loss, vomiting, diarrhea, depression and anorexia. The main causes of death in affected animals are due to complications such as septic peritonitis and hypovolemic shock (MUDADO et al., 2012).

## 3.3 DIAGNOSTICS

To obtain the diagnosis of intestinal foreign body, it should be performed a physical and clinical examination, relying also on complementary exams to define the diagnosis, radiography, tomography,

endoscopy, and abdominal ultrasonography, an exploratory laparotomy can also be performed and blood count for evaluation of the animal's health status (VIANA et al., 2020).

Laboratory findings include an elevated hematocrit level due to dehydration, leukopenia and leukocytosis, and serum biochemistry shows hypoalbuminemia, hypokalemia, hyponatremia and hypochloremia. In the ventro-dorsal and latero-lateral radiographic exam, it presents segmental enteric dilation with abnormal presence of fluids and gases. Finally, ultrasonography revealed a hyperechoic mass, characterizing complete obstruction by a foreign body, confirming the diagnosis of a linear foreign body in the proximal portion of the jejunum (NYLAND et. al. 2004).

### 3.4 TREATMENT

#### 3.1.1 Surgical technique and anesthetic protocol

Faced with the diagnosis of the presence of a linear foreign body in the loop, the Veterinarian may monitor the intestinal transit for a few hours, and this is a conservative method in an attempt to avoid surgical intervention, which, because it is an invasive procedure of access to the abdominal cavity, has risks by the need for induction and maintenance of anesthesia (ADAMS et al., 2014). It is important that the limit of 14 hours for the removal of the EC is not exceeded, since the obstruction generates decreased blood flow in the loop, which may evolve to ischemia and necrosis with the need for partial enterectomy (NELSON, 2015).

Anesthesia is used during invasive procedures that cause pain to the animal, with the purpose of analgesia, unconsciousness, amnesia and promote muscle relaxation to facilitate surgical maneuvers (LUMB, 2017). The anesthetic protocol used in small animal surgeries varies according to the time and the surgical procedure performed, as well as the condition and physiological state in which the patient is, being

Previous laboratory exams are necessary to direct the veterinary anesthetist to the protocol that allows the induction of anesthesia with the greatest possible safety of vital parameters, and there are numerous drugs that can be used (SAESP, 2001).

In pre-anesthetic mediation (PAM), drugs are associated aiming at greater efficiency in sedation, helping induce the patient to anesthesia with the least volume of drugs. Therefore, one can combine anti-inflammatory drugs that have good analgesia, such as meloxicam, with opioids such as methadone, which has low side effects compared to morphine, for example, and can be reversed after the procedure with naloxone and xylazine, an adrenergic agonist drug that causes excellent muscle relaxation and analgesia, which are administered intramuscularly (MASSONE, 2017).

For anesthetic induction, propofol, a GABA receptor agonist, is widely used due to its high efficiency in inducing the patient to the anesthetic plane coupled with its short half-life time, being administered intravenously (IV) with the need for mechanical ventilation in longer procedures due to its adverse effect of respiratory depression (LUMB, 2017).

Inhalation anesthesia is considered the safest means of anesthetic maintenance in longer and more invasive surgeries, because it allows the patient to deepen or superficialize quickly if necessary, besides not accumulating in the animal's body and its elimination occurring basically by respiratory route, and isoflurane is widely used for ensuring good safety, especially for critical patients, with minimal adverse cardiovascular action, in addition to negligible effects on renal and hepatic flows and intracranial pressure (MASSONE, 2017).

After anesthetic induction, it is of utmost importance to prepare the surgical area, starting with the shearing of the abdominal hair and positioning the animal in dorsal decubitus. Afterwards, antisepsis and placement of the field cloth must be done in the surgical area (SAESP, 2001).

Enterotomy consists of accessing the lumen of one or more intestinal subdivisions. It should proceed with a midline alba incision in the skin, starting near the xiphoid process and extending to the pubis. Another incision must be made in the subcutaneous tissue until the external rectus abdominis fascia is exposed. The abdominal wall needs to be elevated with forceps, locating the linea alba and peritoneum to incise with a scalpel, extending the incision with scissors cranially or caudally (DA SILVA, et al. 2022). Subsequently, the affected intestine must be followed and the loop in which incision is desired must be exposed, isolating it with a field cloth or sterile compresses, accessing the lumen through an incision with a scalpel blade, longitudinal in antimesenteric region distal or caudal to the obstructed region in healthy-looking tissue, bypassing the serous, muscular, submucosal and mucosal layers, extending the incision with Metzenbaum blunt or blunt-thin scissors or blade (OLIVEIRA, 2012).

For the extraction of the EC, remove the chyme of the incised region facilitating access and avoiding further contamination, being able to seize the distal and proximal ends of the loop with atraumatic Doyen forceps or with the help of an assistant in a scissors type handle, proceeding with the removal of the foreign body with the help of tweezers, performing, subsequently, the enterorrhaphy in cases where there is tissue compromise in which requires partial excision (FOSSUM, 2015).

In the raphy of the intestinal lumen, the layers must be respected, with Gambee's suture being used in the third and second planes with absorbable thread such as poliglecaprone or polydioxanone and the first plan with continuous simple apposition suture that may be slowly or not absorbable such as nylon depending on the level of albumin of the animal, with both sutures being made with 4-0 or 3-0 monofilament thread, paying attention to possible leaks between sutures, adding them if necessary (GALERA, 2005). Proceed by washing the exposed loop, and warmed 0.9% saline solution can be used before repositioning it again in the abdominal cavity, proceeding with the myorrhaphy, which can be used Reverdin or Sultan suture and abdominal dermorrhaphy with Sultan or Simple Interrupted suture (FOSSUM, 2015).

The prognosis is favorable if the surgical intervention occurs within 12 to at most 14 hours, as well as in the absence of ischemia and necrosis of large intestinal portions and/or perforation and consequent septic peritonitis, which lead to unfavorable prognosis to the reserved (DA SILVA, et al. 2022).

#### **4 CONCLUSION**

The intestinal obstruction by linear bodies is an important affection and recurrent in the veterinary clinical routine, which can quickly evolve with serious complications and take the animal to death. Therefore, it should be included in the differential diagnoses for animals with the habit of chewing and ingesting objects, as well as in the exposure of signs of anorexia, hypodipsia, apathy, dyskinesia, emesis, and pain on palpation, despite being nonspecific signs. Therefore, it is clear that the disease needs a rapid diagnosis and appropriate surgical intervention in order to save the patient's life.



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