

Oesophagogastric intussusception associated with spirocercosis in a dog

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An oesophagogastric intussusception was diagnosed in an intact Bull Terrier female aged 2 years and 7 months with a concurrent *Spirocerca lupi* infection. The dog was presented collapsed with a history of inappetence and lethargy of one day's duration. Anaemia and melaena were present on clinical examination. Thoracic radiographs did not reveal any significant findings. Abdominal ultrasound was suspicious for gastric pathology or a possible foreign body. The final diagnosis of an oesophagogastric intussusception with an *S. lupi* nodule at the cardia was made on post-mortem. Oesophageal intussusceptions are rare in dogs and often fatal. Gastro-oesophageal intussusceptions usually present with obvious radiographic signs in the caudal thorax, unlike an oesophagogastric intussusception, where the pathology lies within the abdomen and may not be readily diagnosed. Although spirocercosis often presents with a caudal oesophageal mass, this may not be seen radiographically. In this case, the two conditions were present together but the thoracic radiographs were normal.

Introduction

This case represents a very unusual occurrence of spirocercosis that presented as an oesophagogastric intussusception. The clinical signs reported in canine spirocercosis depend on the location and the severity of the lesions (Mazaki-Tovi *et al.* 2002). The clinical signs associated with spirocercosis include: vomiting or regurgitation, weight loss, pyrexia, respiratory abnormalities, enlarged salivary glands, melaena and locomotor deficits (Dvir *et al.* 2008; Fox, Burns & Hawkins 1988; Mazaki-Tovi *et al.* 2002). Apart from rare, sudden death due to aortic rupture, the presenting signs are normally slowly progressive (Van der Merwe *et al.* 2008). Diagnosis in the early stages of infection may be difficult and often animals are only presented when oesophageal involvement is seen. The non-specific clinical signs of infection make the diagnosis challenging; additional modalities such as radiology, endoscopy and computed tomography are often required. Initial diagnosis of a suspected *Spirocerca lupi* nodule is most commonly made radiographically (Dvir, Kirberger & Malleczek 2001). Radiological diagnosis is based on the presence of a caudal oesophageal mass with possible concurrent caudal thoracic spondylitis and aortic aneurysms (presented as aortic undulation) (Mazaki-Tovi *et al.* 2002). Whilst thoracic spondylitis and aortic undulation are considered to be pathognomonic for spirocercosis, a caudal oesophageal mass has a few differential diagnoses that include gastro-oesophageal intussusception.

Gastro-oesophageal intussusception is described as the invagination of the stomach into the lumen of the thoracic oesophagus (Rallis, Moraitou & Vlemmas 1995). It is an uncommon and often fatal condition in dogs and is defined as an acute emergency problem that requires immediate surgical reduction. It follows that an oesophagogastric intussusception is described as the invagination of the oesophagus into the stomach. Although cases of gastro-oesophageal and pylorogastric intussusceptions have been reported, to the best of the authors' knowledge, there is no published information on oesophagogastric intussusceptions in dogs. The clinical signs of gastro-oesophageal intussusception include: vomiting or regurgitation, dyspnoea, haematemesis and abdominal discomfort (Leib & Blass 1984; Von Werthern, Montavon & Fluckiger 1996). There is often a rapid deterioration of clinical signs and subsequent death (Von Werthern *et al.* 1996). Radiographic evidence of a gastro-oesophageal intussusception includes a large soft-tissue mass in the caudal mediastinum. Commonly, a gas-filled, dilated oesophagus is visible cranial to the herniation and the intussuscepted portion of the stomach appears as a mass within the oesophageal lumen. Rugal folds may be recognised on the surface of the mass, especially when barium is present within the oesophagus. A stomach silhouette may be absent from the cranial abdomen (Watrous 2007). Radiographic evidence of an oesophagogastric intussusception has not been described. Predisposing factors to the formation of gastro-oesophageal intussusception include: idiopathic megaesophagus, incompetency of the lower oesophageal sphincter and vomiting (Graham *et al.* 1998; Leib & Blass 1984; Rallis *et al.* 1995; Von Werthern *et al.* 1996).

One case of gastro-oesophageal intussusception due to *S. lupi* has previously been described (Rallis *et al.* 1995). An *S. lupi* nodule was found very close to the cardia in an intact 6-year-old

male German Shepherd dog. It was hypothesised that the nodule produced a mechanical or functional aberration of the lower oesophageal sphincter tone, which provoked lower oesophageal sphincter relaxation, resulting in invagination of the stomach and duodenum into the lumen of the oesophagus. It was thought that *S. lupi* provoked oesophageal neuromuscular degeneration resulting from chronic inflammation caused by the parasite and asynchronous relaxation of the lower oesophageal sphincter (Rallis *et al.* 1995).

This communication provides details of a case of oesophagogastric intussusception with a concurrent *S. lupi* nodule at the cardiac sphincter. The difficulties involved in the diagnosis of this case are discussed.

Case history

A 2-year-and-7-month-old intact female Bull Terrier presented at the Onderstepoort Veterinary Academic Hospital (OVAH); she collapsed on arrival. According to the owners, the dog had been lethargic and inappetent for a day. The owners thought that the dog may have eaten a blanket. There was no history of any vomiting or diarrhoea.

On clinical examination, the dog was tachycardic (160 bpm, reference range 80 bpm – 100 bpm), with pale mucous membranes and a tense abdomen on palpation. A rectal examination revealed soft melaena.

On initial presentation, the dog was severely anaemic (Ht of 12%) with mildly increased lactate (Table 1). Haematology revealed a severe normocytic, normochromic anaemia (Table 2). Although the reticulocytes were not counted, there was some evidence of regeneration, with a red cell distribution width of 16.5%, anisocytosis, polychromasia and a normoblast count of 8%. The dog had concurrent mild thrombocytopenia with marked leukocytosis due to marked regenerative left shift neutrophilia. Total protein was mildly decreased with moderate hypoalbuminaemia (Table 3). Sodium, potassium and total calcium were all mildly decreased. There was a mild increase in urea and the urine was haemoglobinuric. Faecal flotation revealed no sign of helminths.

Gastric ulceration was suspected and packed red cells were administered along with Ampicillin at 20.0 mg/kg three times a day, Omeprazole at 0.7 mg/kg once a day and Sucralfate at 1.0 g twice a day. The pack cell volume after the transfusion had increased to 17% and the dog's habitus and vital signs were mildly improved the next morning. Melaena and haemoglobinuria were still present.

On abdominal ultrasound, the spleen was slightly mottled, the bladder contained a moderate amount of hyperechoic sludge and the stomach was moderately distended with heterogeneously hyperechoic luminal content typical for ingesta. In the region of the cardia and extending into the

TABLE 1: Initial findings.

Test value	Patient values	Normal values
Pack cell volume	0.12	0.37 L/L – 0.55 L/L
Total serum protein	44.00	53 g/L – 75 g/L
Glucose	6.20	3.5 mmol/L – 5.5 mmol/L
Lactate	2.50	< 1.5 mmol/L
Creatinine	44.00	40 umol/L – 133 umol/L

TABLE 2: Haematological findings.

Test value	Patient values	Normal values
Haemoglobin	36.00	120 g/L – 180 g/L
Red cell count	1.55	5.50×10^6 e ¹² /L – 8.50×10^6 e ¹² /L
Haematocrit	0.10	0.37 L/L – 0.55 L/L
White cell count	24.50	6.0×10^9 e ⁹ /L – 15.0×10^9 e ⁹ /L
Neutrophils (mature) absolute	16.42	3.00×10^9 e ⁹ /L – 11.00×10^9 e ⁹ /L
Neutrophils (immature) absolute	5.15	0.00×10^9 e ⁹ /L – 0.50×10^9 e ⁹ /L
Lymphocytes absolute	1.72	1.00×10^9 e ⁹ /L – 4.80×10^9 e ⁹ /L
Monocytes absolute	1.23	0.15×10^9 e ⁹ /L – 1.35×10^9 e ⁹ /L
Eosinophils absolute	0.00	0.10×10^9 e ⁹ /L – 1.25×10^9 e ⁹ /L
Basophils absolute	0.00	0.0×10^9 e ⁹ /L – 0.1×10^9 e ⁹ /L
Platelets	114.00	200×10^9 e ⁹ /L – 500×10^9 e ⁹ /L
Anisocytosis	4+	-
Polychromasia	2+	-
Spherocytes	Few	-
Normoblast	8%	-
Red cell distribution width	16.50	< 16.25 indicates non-regenerative anaemia
Platelet smear	Platelet aggregation number low	-
Parasites	No parasites seen	-

TABLE 3: Biochemistry findings.

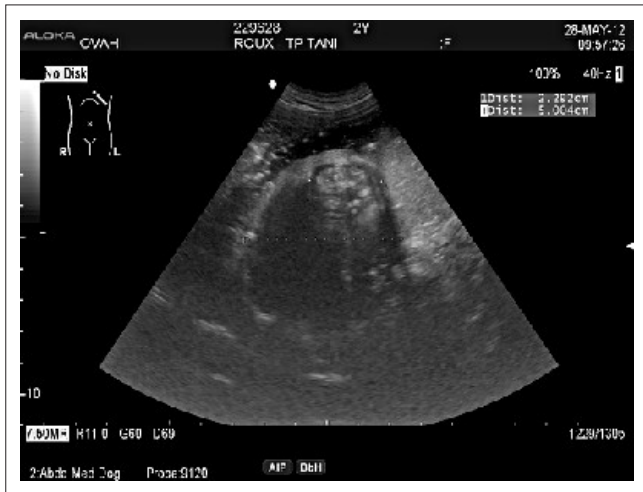
Test value	Patient values	Normal values
Total protein	48.30	(53.0 g/L – 75.0 g/L)
Albumin	18.30	(27.0 g/L – 35.0 g/L)
Globulin	29.90	(20.0 g/L – 37.0 g/L)
Albumin and Globulin ratio	0.61	(0.60–1.20)
Alanine transaminase	40.00	(9 U/L – 73 U/L)
Alkaline phosphatase	135.00	(65 U/L – 311 U/L)
Sodium	135.20	(140.0 U/L – 155.0 U/L)
Potassium	3.21	(3.60 mmol/L – 5.10 mmol/L)
Calcium	2.14	(2.20 mmol/L – 2.90 mmol/L)
Chloride	110.20	(105.0 mmol/L – 120.0 mmol/L)
Urea	10.00	(3.6 mmol/L – 8.9 mmol/L)
Creatinine	59.00	(40 umol/L – 133 umol/L)

Comments: Serum 5+ haemolysed.

fundic region there was a luminal, oval 2.9 cm heterogeneous structure surrounded by a 5 cm hyperechoic rim. This rim cast a distal acoustic shadow (Figure 1). The sagittal image showed an apparent layering within the previously described structure (Figure 2). The pyloric region was within normal limits and the rest of the gastrointestinal tract was empty. A gastric foreign body was strongly suspected. Oesophagogastric involvement could not be excluded. The stomach wall was within normal limits and no evidence of perforation or gastric wall necrosis was noted.

Survey thoracic radiographs (Figures 3 and 4) showed mild loss of cranial abdominal serosal detail with a focal soft tissue opacity in the left cranial abdominal cavity, assumed to be a fluid-filled stomach. No aortic aneurysms or thoracic

spondylitis were noted. It was concluded that a gastric foreign body was most likely, as the evidence on thoracic radiographs did not obviously indicate a gastro-oesophageal intussusception.



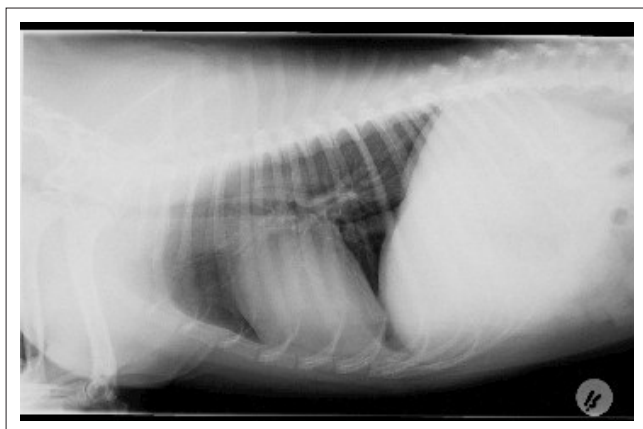
Source: Onderstepoort Veterinary Academic Hospital

FIGURE 1: Abdominal ultrasound – Cardiac region of stomach shows a luminal, oval structure, 2.9 cm in length with a heterogeneous appearance.



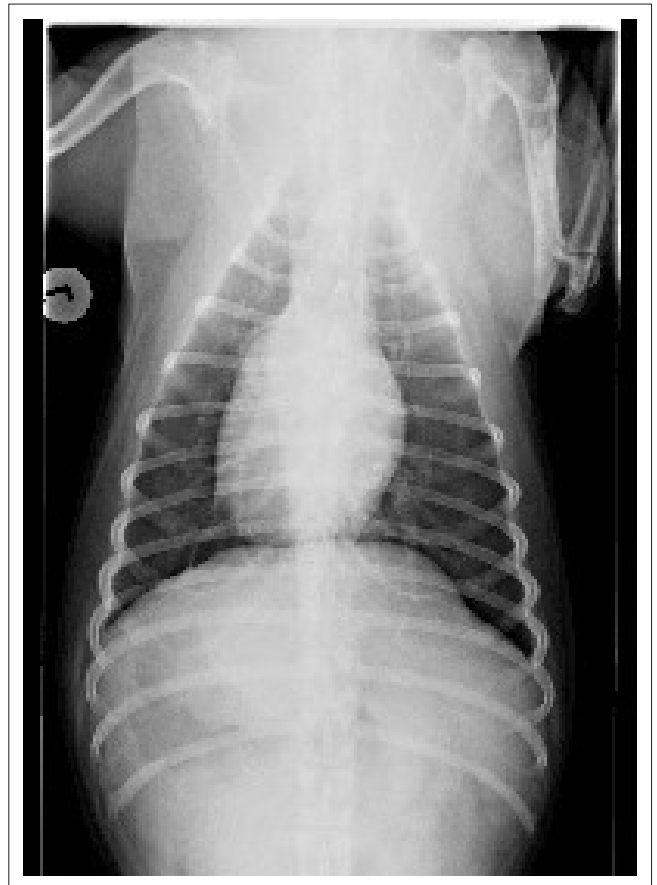
Source: Onderstepoort Veterinary Academic Hospital

FIGURE 2: Abdominal ultrasound – Sagittal view of stomach, shows a petal appearance and apparent layering of the stomach wall.



Source: Onderstepoort Veterinary Academic Hospital

FIGURE 3: Right lateral thoracic view – no signs of a caudal thoracic mass or spondylitis present.



Source: Onderstepoort Veterinary Academic Hospital

FIGURE 4: Ventro-dorsal thoracic radiograph – note that there are no signs of an undulating aorta.

A gastrotomy via a midline laparotomy incision was performed. The stomach was partially filled with digested bloody fluid; no foreign body was present. The cardiac sphincter appeared enlarged and thickened and there appeared to be a smooth mass surrounding the sphincter. The surgeon did not explore the cardiac region any further, given the poor prognosis of cardiac sphincter pathology and limited funds. The owners were contacted and the dog was euthanased on the table due to cost constraints.

A post-mortem examination was conducted and there was a focal *S. lupi* nodule at the oesophagogastric junction with approximately 2 cm invagination of the distal oesophagus into the stomach. There was melaena secondary to diffuse gastrorrhagia. No macroscopic evidence of gastric thrombi or infarcts was noted. The aorta contained multifocal aneurysms.

Microscopically, the nodule consisted of worms surrounded by degenerate neutrophils, lymphocytes, plasma cells, occasional macrophages and mast cells, as well as fibrous connective tissue with mature fibrocytes and plump fibroblasts, some of which appeared embryonal. The final diagnosis on post-mortem examination was an *S. lupi* non-neoplastic nodule in the caudal oesophagus with an oesophagogastric intussusception.

Ethical considerations

This article was written using data retrieved from the patient record system of the OVAH as a retrospective clinical case of a client-owned pet. The animal reported in this article was treated and housed according to the standard OVAH protocols for the management of client-owned pets. All diagnostic tests and treatments were performed as part of the treatment of the patient and routine work.

Discussion

This case was unique for a number of reasons: it was a spirocercosis case that presented as an emergency due to the presence of an oesophagogastric intussusception, which caused an obstruction and blood loss. To the best of the authors' knowledge, this is the first described case of an oesophagogastric intussusception in a dog. Gastro-oesophageal intussusceptions are rare in dogs but should be considered as a differential diagnosis in cases of unresponsive vomiting and regurgitation (Graham *et al.* 1998). Due to the same structures being involved in an oesophagogastric intussusception, similar presenting and clinical signs to a gastro-oesophageal intussusception could be expected, although there are obvious differences in the radiographic diagnosis. The rapid progression of clinical signs and deterioration of a patient with a gastro-oesophageal intussusception requires early diagnosis and surgical correction (Leib & Blass 1984). Some possible predisposing factors for gastro-oesophageal intussusception include: pre-existing megaesophagus, incompetency of the lower-oesophageal sphincter, oesophageal congenital abnormalities and vomiting (Graham *et al.* 1998; Leib & Blass 1984; Rallis *et al.* 1995). An *S. lupi* nodule so close to the cardia may have produced mechanical or functional aberration of lower oesophageal tone, thus provoking lower oesophageal relaxation and invagination of the stomach into the lumen of the oesophagus (Rallis *et al.* 1995). *Spirocerca lupi* has been described as producing oesophageal neuromuscular degeneration as a result of chronic inflammation caused by the presence of the parasite and asynchronous relaxation of the lower oesophageal sphincter (Rallis *et al.* 1995). It is possible in this case that the *S. lupi* nodule caused similar effects, but instead the oesophagus invaginated into the stomach.

The *S. lupi* nodule found at the cardia was not in a typical location for a mass to form. The typical location of the nodule is a few centimetres cranial to the diaphragm (Bailey 1972). In clinically affected patients, the typical oesophageal nodule will usually be seen on radiographs (Van der Merwe *et al.* 2008). In the majority of patients, the nodule is found in the caudal oesophagus (Dvir *et al.* 2001). It has been reported that 82% of the oesophageal masses were located in the caudal oesophagus (caudal to the heart base) and 18% of the cases were more cranially located (hilar region) (Dvir *et al.* 2001). Gastric nodules were found on necropsy in 5% of dogs (Van der Merwe *et al.* 2008). The present case provided a diagnostic challenge, as the typical radiological signs

of spirocercosis were not present. On examination of the thoracic radiographs, no obvious caudal oesophageal mass was present, nor was there evidence of aortic aneurysms or caudal thoracic spondylitis. Caudal thoracic vertebral spondylitis in spirocercosis is observed on radiographs in up to 53% of cases (Dvir *et al.* 2001; Mazaki-Tovi *et al.* 2002). Scarring of the thoracic aorta is a pathognomonic lesion of an *S. lupi* infection and aneurysms of various sizes are often present (Fox *et al.* 1988). Although the aneurysms, which are seen as undulations of the thoracic aorta, were not noted radiographically in this case, there was evidence of worm migration on post-mortem examination.

Faecal flotation per se is not a sensitive tool in confirming a diagnosis of spirocercosis (Christie *et al.* 2011; Fisher *et al.* 2009). Diagnosis by faecal analysis is only possible when eggs are being shed. This passage can occur for an unpredictable, relatively short period in adult worms (Fox *et al.* 1988). Egg shedding by *S. lupi*-infected dogs is variable and does not occur in all infected individuals (Christie *et al.* 2011). Eggs will only be present in the faeces when the female has a patent passage to the oesophageal lumen, thus, maturation of the nodule is essential (Van der Merwe *et al.* 2008). Faecal sedimentation has been found to be the most sensitive procedure for diagnosis of spirocercosis on faecal examination (Fox *et al.* 1988).

Endoscopy has been found to be the antemortal gold standard modality (Dvir *et al.* 2001; Kirberger *et al.* 2012). The mass can also be evaluated and biopsied during endoscopy (Dvir *et al.* 2008). Computed tomography (CT) has been found to accurately determine the exact size and shape of the mass, as well as changes to and involvement of the surrounding structures (Dvir *et al.* 2001). Both endoscopy and CT may have been helpful in this case, but were not deemed necessary as the thoracic radiographs were normal.

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Competing interests

The authors declare that they have no financial or personal relationship(s) which may have inappropriately influenced them in writing this article.

Authors' contributions

K.J.V. (University of Pretoria) was the primary author who was presented with the case, assisted with the work up and reviewed and researched the case. N.C. (University of Pretoria) was the primary radiologist on the case. E.D. (University of Pretoria) was the primary small animal internal medicine clinician on the case.

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