TITLE: Clinical spirocercosis in a dog in the UK

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Clinical spirocercosis in a dog in the UK

SUMMARY

A 2-year-old female neutered crossbreed dog was presented for evaluation of a three-day history of haematemesis, melaena and hyporexia. The dog had been imported from a rescue centre in Hungary four months prior to presentation. Abdominal computed tomography revealed the presence of a 3cm X 3cm X4cm diameter heterogenous intraluminal mass lesion in the gastric cardia, surrounding the ostium of the cardia and continuous with the distal oesophagus. The mass lesion was subsequently surgically resected. Histopathology of the gastric mass lesion was consistent with a *Spirocerca lupi* granuloma. The patient unfortunately developed a pyothorax and underwent cardiopulmonary arrest resulting in death two days post-operatively. To the authors' knowledge, this is the first reported case of clinical spirocercosis reported in a dog in the UK.

BACKGROUND

Spirocercosis is a serious disease of canids caused by the nematode *Spirocerca lupi.* Infection is associated with the development of granulomatous nodules in the oesophagus, which may later transform into sarcomas.[1,2] Spirocercosis has also been associated with other serious disease syndromes such as aortic aneurysm, spondylitis and pyothorax.[3,4]

Evidence of canine *S. lupi* infection was recently reported in the UK for the first time in a dog receiving food imported from Germany.[5] However, to the authors' knowledge, no cases of canine spirocercosis associated with clinical signs have been previously reported in the UK. We describe the first reported case of clinical spirocercosis in a dog in the UK.

CASE PRESENTATION

A 2-year-old female neutered crossbreed dog was presented to the Internal Medicine service of the Queen Mother Hospital for Animals (Royal Veterinary College) for investigation of a three-day history of lethargy, haematemesis, melaena and hyporexia. Diagnostics performed prior to referral included a packed cell volume (PCV) of 30% with total protein concentration of 48g/l, an *Angiostrongylus vasorum* SNAP test (negative) and measurement of prothrombin (PT) and activated partial thromboplastin (aPTT) times, both of which were within reference intervals.

The patient had been imported from a rescue centre in Hungary four months prior to presentation. The patient was receiving monthly endoparasite preventative treatment with oral milbemycin oxime and had no prior significant medical history to the owner's knowledge.

On physical examination the patient had pale pink mucus membranes with a normal capillary refill time. Heart rate, respiratory rate and rectal temperature were within normal limits. Melaena was detected on rectal examination. The patient's body condition score was 5/9. Examination was otherwise unremarkable.

INVESTIGATIONS

Significant haematological findings included a moderate regenerative anaemia [packed cell volume 25%, reference interval (RI) 37-55%, absolute reticulocyte concentration 146.7 $X10^9$/L, RI >60.0 $X10^9$/L] and mild mature neutrophilia [14.41 $X10^9$/L, RI 3.00-11.50 $X10^9$/L] with mild toxicity. Significant biochemical abnormalities included a moderate hypoalbuminemia [19.6g/l, RI 28.0-39.0g/l] with associated mild total hypocalcaemia [2.10 mmol/l, RI 2.13-2.70mmol/l]. Urinalysis (on a cystocentesis sample) revealed a urine specific gravity of 1.020 with an inactive sediment examination. Abdominal radiography was within normal limits with no evidence of a gastrointestinal foreign body or mechanical obstruction. Subsequent abdominal ultrasonography was also unremarkable. ACTH stimulation testing was not consistent with hypoadrenocorticism, serum cobalamin concentration was normal [653ng/l, RI >200ng/l] and SNAP4Dx serology was negative for *Ehrlichia, Anaplasma,*

Dirofilaria and *Borrelia burgdorferi*. Faecal Baermann and floatation examinations were negative for gastrointestinal parasites and a bile acid stimulation test showed no evidence of hepatic dysfunction. The patient was hospitalised and treated supportively for possible acute gastroenteritis with intravenous fluid therapy, anti-emetic therapy (maropitant 1mg/kg PO SID) and gastroprotectants (omeprazole 1mg/kg PO BID and sucralfate 500mg/dog PO TID). All clinical signs resolved within a few days and the patient was discharged with instructions to continue omeprazole and sucralfate, in addition to a 5-day course of fenbendazole (50mg/kg PO SID) to treat for possible occult gastrointestinal parasitism.

Upon re-examination three weeks later, the patient's clinical signs remained controlled, however repeat haematology revealed persistence of anaemia [haematocrit 30.5%, RI 37.0-55.0%], with a significant decrease in mean corpuscular volume (MCV) since previous haematology (decrease from 79.5fL to 62.0fL, RI 60.0-70.0fL). Repeat abdominal ultrasonography revealed a 3.3cm diameter hypoechoic mass lesion in the gastric fundus (figure 1). There was regional gastric wall thickening (up to 0.6cm diameter) with associated loss of normal wall layering. A connection between the mass lesion and the gastric wall could not be established.

Due to a high index of suspicion for gastric neoplasia, computed tomography (CT) of the thorax and abdomen was performed to further characterise the mass lesion and screen for evidence of metastasis. CT demonstrated the previously documented gastric mass lesion measured 3cm X 4cm x 4cm, was intramural and originated from the gastric cardia (figure 2). It was contiguous with the distal oesophagus which was eccentrically thickened. The thoracic oesophagus and remainder of the stomach appeared normal. The splenic lymph nodes were rounded and enlarged (up to 1.3cm diameter) while the sternal lymph nodes were mildly enlarged (up to 1cm diameter). The lungs were normal. The deep location of the gastric mass lesion and splenic lymph nodes precluded fine needle aspiration.

DIFFERENTIAL DIAGNOSIS

Differential diagnoses for the gastric mass lesion included benign (leiomyoma) and malignant (leiomyosarcoma, adenocarcinoma, lymphoma) gastric neoplasia. Non-neoplastic disease (e.g. granuloma) was considered unlikely.

TREATMENT

The patient underwent exploratory laparotomy to resect the gastric mass lesion. The mass lesion was challenging to remove due to it being contiguous with the distal oesophagus for several centimetres orally. It was resected via a partial gastrectomy and partial oesophagectomy (by submucosal resection). During resection multiple live worms were visualised emerging from the main body of the mass lesion, (figures 3 and 4). A gastrotomy tube was placed to facilitate post-operative enteral nutrition due to some narrowing of the distal oesophagus being created. No intra-operative or immediate post-operative complications were encountered.

OUTCOME AND FOLLOW-UP

Histopathology of the gastric mass lesion showed severe, transmural, chronic-active, eosinophilic, neutrophilic, and histiocytic gastritis with multiple granulomas associated with intralesional larvae (figure 5). The worms present within the mass lesion were examined by a diplomate of the European College of Veterinary Parasitology (MF), who concluded they were consistent with *Spirocerca* spp. Although it is not possible to grossly distinguish *S. lupi* from *S. arctica* (another *Spirocerca* spp. that has been detected in canids in Europe), the patient's clinical findings and travel history were consistent with *S. lupi* infection.

On diagnosis of spirocercosis, review of the patient's thoracic and abdominal CT was requested to screen for further lesions commonly associated with spirocercosis including thoracic spondylitis, aortic lesions and oesophageal nodules. Following review, a focal thickening of the oesophagus at the level of the left atrium, measuring approximately 1.1cm in width and extending approximately 4.1cm along the length of the oesophagus, was noted (figure 6). No additional thoracic or aortic lesions were detected. Given the presence of oesophageal thickening, possibly representing the presence of another *S. lupi* granuloma, it was decided to administer topical Advocate® (10% imidacloprid and 2.5% moxidectin).

The patient was hospitalised on intravenous fluid therapy and analgesia post-operatively. Unfortunately two days post-operatively, the patient became acutely dyspnoeic. Thoracic ultrasound revealed the development of a moderate volume of pleural effusion bilaterally. No peritoneal effusion was detected. Supplemental oxygen therapy was initiated and thoracocentesis performed for diagnostic and therapeutic purposes. Analysis of the pleural fluid was consistent with a septic exudate. Unfortunately, the patient underwent sudden cardiopulmonary arrest. Cardiopulmonary resuscitation was initiated, but subsequently discontinued following discussion with the patient's owner. Post-mortem examination was not performed per the owner's wishes.

DISCUSSION

To the authors' knowledge this is the first case of clinical spirocercosis to be reported in the UK. While evidence of canine *S. lupi* infection was recently reported in the UK for the first time in a dog receiving food imported from Germany,[5] this was based on the detection of *S. lupi* eggs on faecal examination and to the authors' knowledge was not associated with any clinical signs.

Due to the historically low prevalence of spirocercosis in parts of Europe frequented by UK holidaymakers, *S. lupi* has not previously been regarded as a significant pathogen for dogs travelling between the UK and continental Europe. Whilst traditionally regarded as a parasite of tropical and subtropical regions,[4,6] in recent years cases have been increasingly reported in continental Europe. The parasite appears to have a relatively high prevalence in Greece[7] and isolated cases have recently been reported from Spain, France and Italy.[8,9] The dog in this case was imported from a rescue centre in Hungary, a country where *S. lupi* has also increasingly been reported.[10] A similar case of *S. lupi* infection associated with importation of a dog from Hungary was recently reported in Germany.[11] Should cases of spirocercosis continue to be recorded in regions frequented by UK tourists and their dogs travelling on the Pet Travel Scheme (PETS), chemoprophylaxis and other preventative measures against *S.lupi* are advised. Additionally, in an era of widespread importation of dogs to the UK from parts of continental Europe with high or increasing prevalence of spirocercosis, clinicians in the UK must be vigilant for clinical signs of *S. lupi* infection in this population of dogs.

The dog in this case developed clinical spirocercosis 4 months after importation to the UK despite being on monthly oral milbemycin oxime therapy for endoparasite prevention. Clinical signs of spirocercosis are generally associated with the formation of oesophageal nodules caused by adult worms and the prepatent period of infection is generally 4-6 months.[12] It is therefore likely that this patient acquired the infection while in Hungary and was in the prepatent phase of infection at the time of importation to the UK. While milbemycin oxime has been demonstrated to have some efficacy against *S. lupi*,[13-15] milbemycin does not provide complete protection against infection or the development of disease.[15] Although various protocols of milbemycin oxime and doramectin administration to treat spirocercosis have been described,[3,13-17] we opted to treat our patient with Advocate® (10% imidacloprid and 2.5% moxidectin) post-operatively due to a combination of factors including lack of availability of doramectin, the patient's history of developing spirocercosis despite milbemycin oxime therapy and published efficacy of Advocate® for treating spirocercosis.[18,19]

The presentation of spirocercosis in this patient was unusual. Common clinical features associated with spirocercosis, including the presence of eggs on faecal floatation and thoracic vertebral lesions and aortic lesions on CT,[3,4] were not detected in this patient. *S. lupi* nodules that have not undergone neoplastic transformation may regress with appropriate medical treatment. Surgery is usually reserved for cases where nodules have undergone neoplastic transformation, due to the significant rates of post-surgical complications reported following resection of *S. lupi* oesophageal granulomas.[20,21] In this patient, the decision was made to proceed with surgery given the high index of suspicion for neoplasia and lack of other diagnostic abnormalities suggestive of spirocercosis. The option of pre-surgical upper gastrointestinal endoscopy was considered in this case, but ultimately not performed due to financial constraints. It is possible that upper gastrointestinal endoscopy could have obtained a diagnosis in this case, which may have changed the decision to pursue surgical versus medical treatment. However, it is also possible that a diagnosis may not have been obtained endoscopically or that endoscopic biopsies of the oesophageal and gastric lesions would not

have provided an accurate histopathologic representation of the tissue response (inflammatory versus neoplastic) to the parasite. Although thickening of the distal oesophagus was noted upon review of the patient's CT, the thickening was diffuse rather than nodular, and may have represented reactive changes rather than an additional *S. lupi* granuloma. Unfortunately post-mortem examination was not available to determine if this was the case. Given the non-specific nature of the distal oesophageal thickening on CT, the authors do not believe the clinical decision-making process would have been altered had this finding been available at the time of initial CT reporting.

The cause of cardiopulmonary arrest in this patient remains open. Analysis of the patient's pleural effusion was consistent with a septic exudate, raising concern for development of pyothorax. A possible explanation for the development of pyothorax in this patient is that the oesophageal lesion detected on CT represented a further *S. lupi* granuloma that spontaneously ruptured. However, the authors also acknowledge that the intracellular bacteria seen on cytology of the pleural effusion may have represented contamination rather than a primary pyothorax, as the intracellular bacteria were detected upon repeat analysis of the effusion, following a previous thoracocentesis. Ultimately, the authors cannot rule out another cause of cardiopulmonary arrest (e.g. pulmonary thromboembolism) in the absence of a post-mortem examination.

This case report is of epidemiological significance since we believe this to be the first reported case of clinical spirocercosis in a dog in the UK. It demonstrates that *S. lupi* should be considered as a differential diagnosis in dogs with compatible clinical signs if they have a history of travel from continental Europe, particularly from countries where cases are most frequently reported, such as Hungary and Greece.[7,10] In addition, this case is a reminder that not all cases of spirocercosis will exhibit characteristic or pathognomonic signs on diagnostic tests.

In conclusion, clinicians in the UK should be vigilant for cases of spirocercosis in dogs with a history of travel to continental Europe. Chemoprophylaxis and other preventative measures should be considered for dogs travelling to or from areas of high or increasing disease prevalence.

LEARNING POINTS/TAKE HOME MESSAGES

- Spirocercosis should be considered as a differential diagnosis in dogs with compatible clinical signs with a history of travel from continental Europe, especially from countries such as Hungary and Greece.
- Patients receiving monthly milbemycin oxime therapy can still develop clinical spirocercosis.
- In an era of increased foreign travel of dogs and increased importation of dogs to the UK, chemoprophylaxis and other preventative measures should be considered for dogs travelling to or from the parasite's range under the Pet Travel Scheme (PETS).

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FIGURE/VIDEO CAPTIONS

Figure 1: Abdominal ultrasound images. On longtitudinal (a) and transverse (b) views of the gastric fundus a mass lesion (indicated by arrows) is present. The lesion has a heteroechoic parenchymal texture. A connection to the gastric wall is not visible. (Photo credit: Mark Plested)

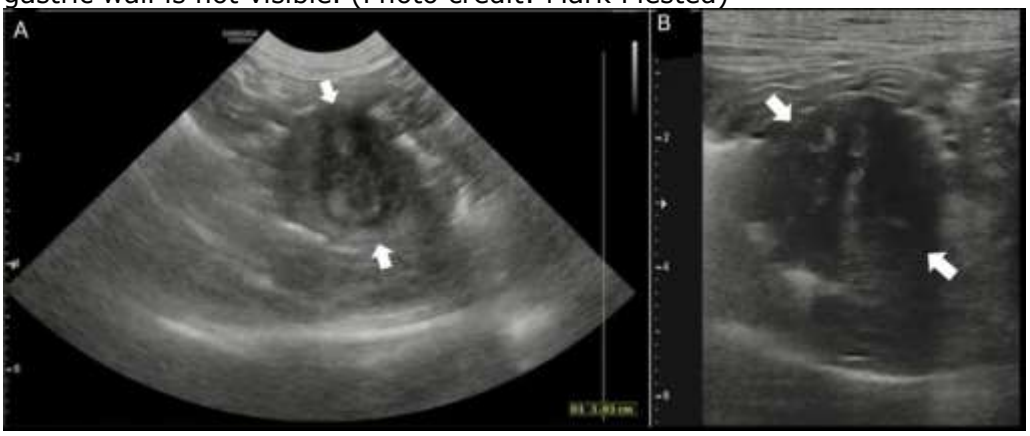

Figure 2: Abdominal CT, transverse view. An intramural mass lesion (highlighted with white asterix) surrounds the cardiac ostium and protrudes into the gastric lumen. (Photo credit: Mark Plested)

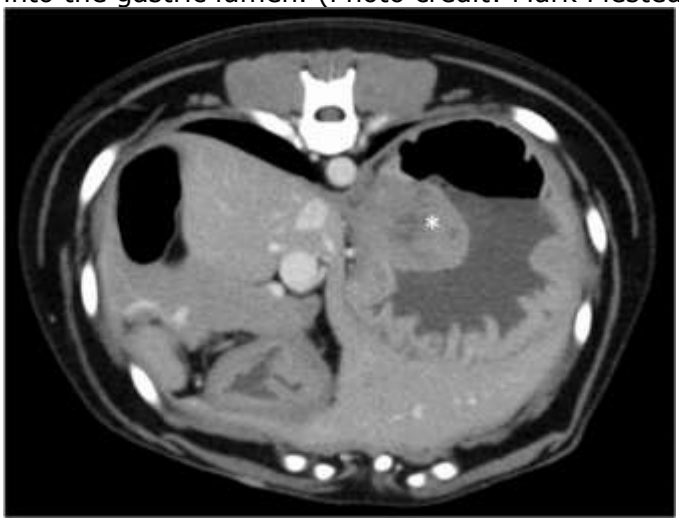

Figure 3: Photographs of the gastric mass lesion before (a) and after (b) resection. (Photo credit: Poppy Bristow)

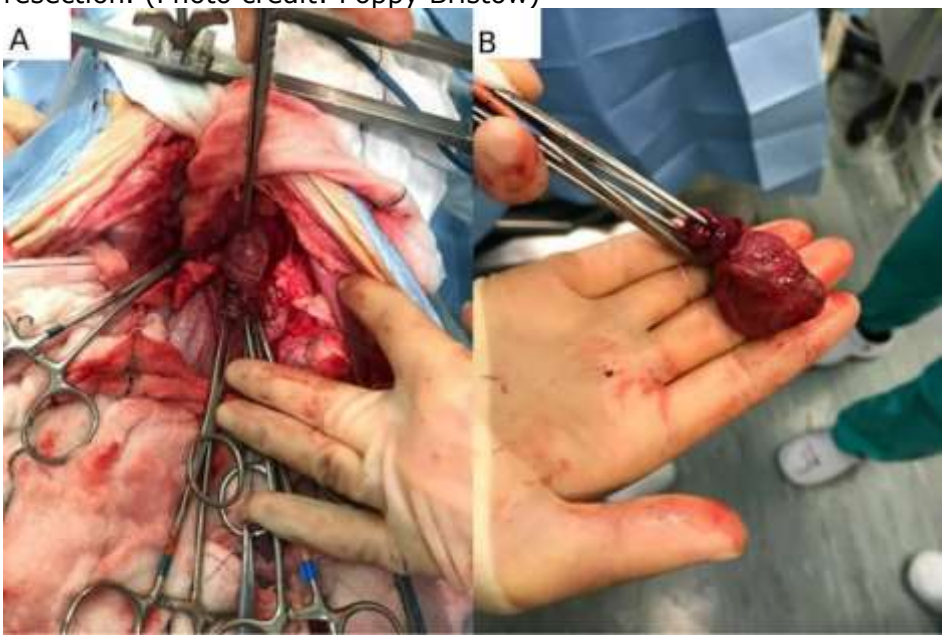

Figure 4: Multiple worms recovered from the gastric mass lesion following resection. (Photo credit: Doris Marmy)

Figure 5: Histopathology of the gastric mass lesion. The transit between the oesophagus (arrows) and the gastric mucosa is extensively ulcerated (arrowheads). The submucosa is expanded by fibrosis and exudative inflammation. *Inset*: Two nematode larvae (arrowhead) are surrounded by eosinophils (arrow) and macrophages. (Photo credit: Alejandro Suarez-Bonnet)

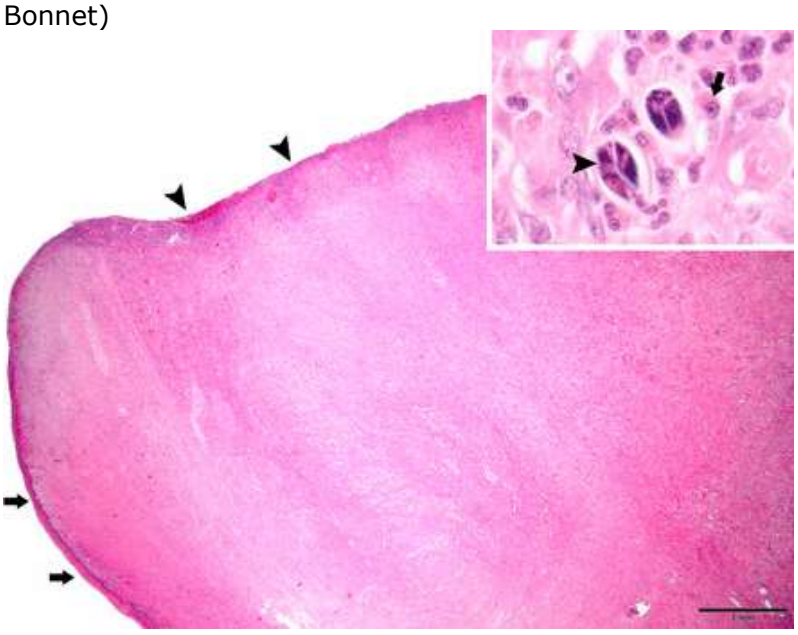

Figure 6: Thoracic CT, transverse view. A focal thickening of the oesophagus is present (highlighted with white asterix) at the level of the left atrium. (Photo credit: Mark Plested)

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