

A COMPLETE OVERVIEW ON SPIROCERCOSIS IN DOGS

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ABSTRACT

Spirocercosis in dogs is mostly associated with the presence of oesophageal granulomas that may transform to sarcomas; aortic aneurysms; mid- thoracic spondylitis and pyothorax. This disease is manifested by regurgitation, odyphagia but often subclinical. Oesophageal dysphagia may be worsened by concomitant salivary gland necrosis associated with *Spirocerca lupi* infection. In endemic areas, regularly and properly disposing of fecal material, controlling stray dog populations, avoiding feeding dogs offal from transport host, and appropriately treating infecting animals may eventually reduce the incidence of Spirocercosis. Doramectin and ivermectin have been effective in the treatment of canine Spirocercosis, resulting in clinical regression of oesophageal granulomas.

INTRODUCTION

Spirocercosis is a parasitic disease caused by the spirurid nematode *Spirocerca lupi*. It has a worldwide distribution and endemic in warm climates. The major epidemiologic causes of the disease include canine population density areas and environmental conditions such as soil type, pH, temperature, rainfall and solar radiation (Jyothi Sree and Hafeez, 2013). Caprophageous beetles play an important role as intermediate hosts while lizards, snakes, frogs, birds, rodents and rabbits act as paratenic hosts in this disease. This nematode is infective for many species including human beings, but affects mostly carnivores (fox, wolf, coyote and jackal). In this migrating larval stages of L3 and L4 through gastroepiploic arteries and induce nodule formation in caudal oesophagus and thoracic aorta (Dvir *et al.*, 2010; Joubert *et al.*, 2005).

Pathogenesis

Study has revealed that *S. lupi* larvae-infected coprophagous beetles are small and dogs probably become infected through coprophagia rather than by catching the beetle. After ingestion beetle by dogs, the larvae are liberated in the gastric lumen and then migrate through the gastric mucosa via the gastric arteries, and reach the caudal thoracic aorta within 10 days. Later they migrate through the thoracic aortic wall to the caudal oesophagus within 90 to 109 days. The *S. lupi* larvae settle within the oesophageal wall, mature to adults and promote nodule formation (Figure 1).

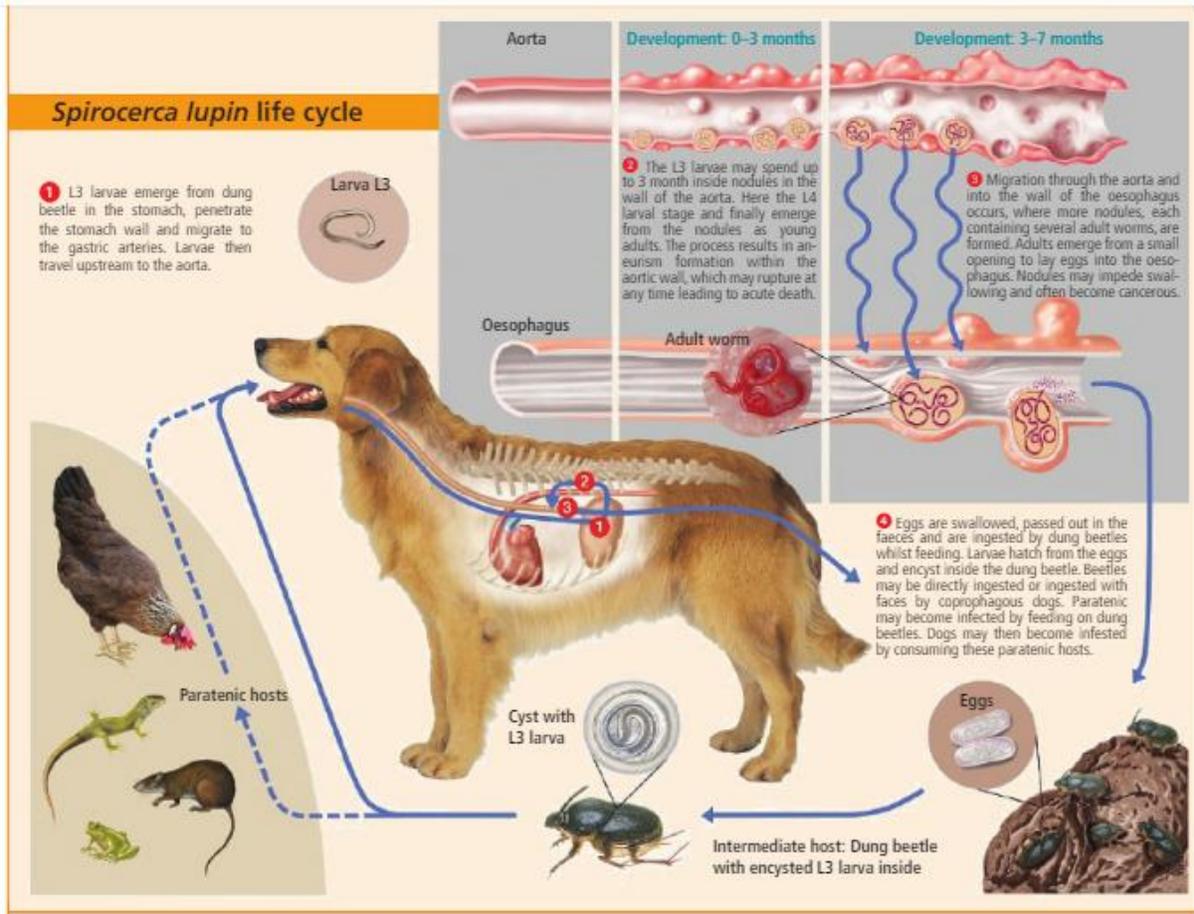
The early nodule is however composed predominantly of fibrocytes and then transformed into actively dividing fibroblasts that are located between numerous immature capillaries, immediately peripheral to the worms and their migratory tracts (Ziyet Yildirim *et al.*, 2007; Mylonakis *et al.*, 2008; Lee *et al.*, 2007). Lymphoplasmacytic infiltration with pockets of neutrophils specifically associated with the necrotic content along with the worms migratory tract. Spirocercosis induces some pathognomonic lesions; aortic scarring with or without osseous metaplasia and/or dystrophic calcification as well as aneurysm formation, caudal thoracic vertebral spondylitis and a characteristic caudal esophageal nodule.

Aberrant migration of *S. lupi* is not uncommon, and has been reported in most thoracic organs including pleura, mediastinum, diaphragm, lung, trachea, bronchi, thymus and heart. Non-thoracic aberrant migration was reported in the gastrointestinal and urinary tracts and subcutaneous tissue (Mylonakis *et al.*, 2008, Clinton *et al.*, 2013). Recently reported that such migration can lead to paraparesis and paraplegia, clinically mimicking disc extrusion and fibrocartilaginous embolism.

Aortic aneurysms are considered rare findings in veterinary medicine cases in living animals have been described as asymptomatic with the exception of Spirocercosis and a case with posterior paresis (Lee *et*

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al., 2007; Clinton *et al.*, 2013; Rinasa *et al.*, 2013; Berry, 2000). Acute rupture of the aorta as a cause of sudden death has been described in dogs with Spirocercosis.



Schematic representation of the life cycle of the *Spirocerca lupi*
 (Photo Courtesy: Clinton *et al.*, *Parasitology Res* (2013) 112: S91-S108)



Figure 1: Oesophageal Nodule



Figure 2: *S. Lupi* in Histo Section of the Spinal Cord

(Photo courtesy: Roshini *et al.*, *Indian Journal of Canine Practice* Vol. 5(1):2013)

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Whereas Intramedullary spinal cord migration presents a distinct neurological syndrome of an acute, progressive asymmetric, mostly painful paresis progressing to paralysis (Roshini *et al.*, 2013). Neurological examination may suggest a focal spinal cord lesion between T3 and S1, but the pathological lesions might be far more extensive due to progressing larval spinal migration (Figure 2).

RESULTS AND DISCUSSION

Clinical Findings

S. lupi infection is usually subclinical. Clinical signs are usually seen in dogs of more than 6 months of age. Clinical signs associated with oesophageal lesions include vomiting, regurgitation, pyrexia, weakness, anorexia, weight loss, salivation and melena. In endemic areas it has been suggested that dyspnoea, chronic cough and hypertrophic osteopathy should be considered as signs of Spirocercosis. Sudden death has been reported following rupture of aortic aneurysms (Joubert *et al.*, 2005). A definitive diagnosis can be made based on the finding of *S. lupi* eggs in a faecal float (Figure 3).

The clinical signs of Spirocercosis are variable; depends on the location and severity of the lesions. Signs related to aortic lesions occur when an aneurysm ruptures. Oesophageal lesions often interfere with swallowing. Affected dogs make repeated attempts to swallow (odynophagia) or have regurgitation (Jyothi Sree and Hafeez, 2013; Dvir *et al.*, 2010; Joubert *et al.*, 2005). Dogs with oesophageal lesions may be presented for ptyalism and symmetrical enlargement of mandibular or parotid salivary glands, mimicking the clinical appearance of salivary gland necrosis.

The most common lesions created are oesophageal masses, oesophageal granulomas, aortic scars and aortic aneurysms (Rinasa *et al.*, 2013). Young adult and large-breed dogs are apparently more prone to develop clinical spirocercosis, with Labrador retrievers, German shepherds, and Hellenic hounds being over represented.

Spondylitis of the thoracic vertebrae is commonly seen. Oesophageal masses can transform to neoplastic lesions (fibro sarcomas or osteo-sarcomas) (Ziyet Yildirim *et al.*, 2007; Lee *et al.*, 2007). Hypertrophic osteopathy can be seen as a result of thoracic masses. Granulomatous masses have been reported in the heart, lungs, gastrointestinal tract, urinary system and subcutaneous tissues. Normocytic, normochromic, non regenerative anemia, neutrophilic leukocytosis, hyperproteinemia, and increased alkaline phosphatase and creatine kinase activities have been recently proposed as useful indicators with dogs showing lameness, paraparesis, swollen distal limbs, along esophageal dysphagia in Spirocercosis (Oryan *et al.*, 2008).

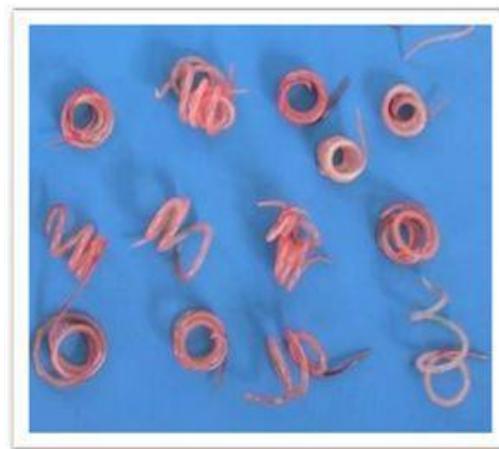


Figure 3: A Typical, Elongated, Oval, Thick-Shelled

Figure 4: *S. Lupi* Parasites of Dogs *Spirocerca Lupi* Egg

(Photo courtesy: Dvir *et al.*, (2010) in the Review: challenges in diagnosis and treatment of canine Spirocercosis Vol. 65 p.91)

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Diagnosis

Positive faecal flotation tests show numerous, characteristic, small, thick-shelled, larvated eggs (Figure 4). However, the sensitivity of faecal flotation is limited because eggs are shed intermittently by the female worms and the eggs are relatively heavy and may require special techniques and solutions such as sodium nitrate solution, supersaturated 33% zinc sulfate solution and super saturated sugar solution (Boulineau *et al.*, 2005). Nowadays, the FLOTAC technique was reported to improve the sensitivity and increase the number of microscopically detected eggs. This method seems to be superior to the previously described techniques and solutions. Repeated fecal analysis was found to increase the sensitivity of the test. Recently a PCR assay was developed to detect faecal *S. Lupi*. (Lavy *et al.*, 2002).

Survey thoracic radiography is less sensitive and specific than fecal analysis or esophagoscopy, but it frequently allows the detection of parasite-induced lesions or their secondary complications. The prominent radiographic features associated with *S. lupi*-induced lesions are caudal.

Thoracic spondylitis and a caudo dorsal mediastinal mass. The presence of both features is strongly suggestive of Spirocercosis in areas where the disease is endemic (Dvir *et al.*, 2010; Joubert *et al.*, 2005; Ziyet Yildirim *et al.*, 2007; Mylonakis *et al.*, 2008; Lee *et al.*, 2007; Clinton *et al.*, 2013). Intra luminal air accumulation, anterior mediastinal masses, ventral displacement of the trachea or main stem bronchi, an alveolar pattern in the cranial lung lobes, pleural effusion due to hemothorax or pyothorax, pulmonary metastatic disease, pneumothorax, mineralization of the aorta, and cranial Mediastinal masses are less common radiographic findings.

Esophagoscopy and gastroscopy are the diagnostic modalities of choice for direct visualization of *S. lupi* nodules (Figure 5). These nodules typically appear as broad based protuberances with a nipple-like orifice (Mylonakis *et al.*, 2006). Endoscopic pinch biopsies may also be misleading because they usually detect superficial inflammation rather than a deep-seated neoplastic process. Surgically obtained esophageal biopsies are essential for reliable histopathologic evaluation of the tissue response.



Figure 5: Oesophageal Endoscopic Benign Nodules

(Photo courtesy: Dvir *et al.*, (2010) in the Review: challenges in diagnosis and treatment of canine Spirocercosis Vol.65:91)

Treatment

Doramectin and ivermectin have been emerged as the most promising agents in the treatment of naturally acquired and experimental spirocercosis, although their use for this disease is currently off-label. In seven cases of natural infection, administration of doramectin (200µg/kg SC) at 14-day intervals for three treatments was effective in achieving clinical remission (Joubert *et al.*, 2005). Ivermectin (600µg/kgSC), administered twice at 14-day intervals, combined with oral prednisolone (0.5mg/kg) given q12h for 2 weeks and then once daily for an additional week, led to negative results of faecal testing and complete nodular regression in Spirocercosis (Clinton *et al.*, 2013). Surgical removal of oesophageal nodules or

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tumours has been largely unsuccessful due to the frequently extensive nature of the lesions and the postsurgical complications.

It is difficult to treat the aberrant migration cases. In these cases conventional doramectin treatment is not always effective. When the dogs presented with pyothorax, conservative medical treatment, including drainage and antibiotics together with doramectin treatment, was found relatively successful (Lavy *et al.*, 2002). In the cases of extradural spinal cord migration, removal of the worm was successful, while in intra medullary spinal cord migration, the prognosis was always grave (Jyothi Sree and Hafeez, 2013). If the dogs showing symptoms like severe intractable dysphagia, with firm mandibular salivary adenomegally then these dogs were all treated symptomatically and with doramectin and phenobarbitone (2 mg/kg q12h). They showed marked improvement within 48 hours from initiating phenobarbitone treatment.

Conflict of Interests

The author declares no conflict of interests.

REFERENCES

- Berry WL (2000).** *Spirocerca lupi* Oesophageal Granulomas in 7 Dogs: Resolution after Treatment with Doramectin. *Journal of Veterinary Internal Medicine* **14**(6) 609–612.
- Boulineau TM, Andrews-Jones L and Van Alstine W (2005).** Spontaneous aortic dissecting hematoma in two dogs. *Journal of Veterinary Diagnostic Investigation* **17**(5) 492–497.
- Clinton MA, Dawie JK, Dionne C and Schaper R (2013).** The Efficacy of a Topically Applied Imidacloprid 10 % / Moxidectin 2.5 % Formulation (Advocate ®, Advantage ® Multi, Bayer) against Immature and Adult *Spirocerca lupi* Worms in Experimentally Infected Dogs. *Parasitology Research* **112** S91–S108.
- Dvir E, Kirberger RM, Clift SJ and Van Der Merwe LL (2010).** Review: challenges in diagnosis and treatment of canine Spirocercosis. *Israel Veterinary Medical Association* **65**(1) 5-10.
- Joubert KE, McReynolds M J and Strydom F (2005).** Acute aortic rupture in a dog with spirocercosis following the administration of medetomidine. *Journal of the South African Veterinary Association* **76**(3) 159–162.
- Jyothi Sree Ch and Hafeez Md (2013).** A study on prevalence of spirocercosis in dogs in certain parts of Andhra Pradesh, India. *International Journal of Agricultural Sciences and Veterinary Medicine* **1**(3) 59-66.
- Lavy E, Aroch I and Bark H (2002).** Evaluation of doramectin for the treatment of experimental canine spirocercosis. *Veterinary Parasitology* **109**(1-2) 65-73.
- Lee ND, Danoff Kim, Dipl S and Rush JE (2007).** Cranial vena cava aneurysm in a dog. *Journal of Veterinary Cardiology* **9** 47-51.
- Mylonakis ME, Rallis T and Koutinas AF (2006).** Clinical signs and clinic pathologic abnormalities in dogs with clinical spirocercosis: 39 cases (1996-2004). *Journal of the American Veterinary Medical Association* **228**(7) 1063-1067.
- Mylonakis ME, Rallis T and Koutinas AF (2008).** Canine Spirocercosis. *Compendium* **30**(2) 111-116.
- Oryan A, Sadjjadi SM, Mehrabani D and Kargar M (2008).** Spirocercosis and its complications in stray dogs in Shiraz, southern Iran. *Veterinarni Medicina* **53**(11) 617–624.
- Rinasa MA, Nesnek R, Kinsella JM and DeMatteo KE (2013).** Fatal aortic aneurysm and rupture in a neotropical bush dog (*Speothos venaticus*) caused by *Spirocerca lupi*. *Veterinary Parasitology* **164** 347–349.
- Roshini S, Sawale GK, Patil GN, Mustare AK, Mhase AK, Moregaonkar SD, Kadam DP, Rohi RR and Bharkad GP (2013).** *Spirocerca lupi* associated granuloma in a stray dog: a case report. *Indian Journal of Canine Practice* **5**(1) 81-84.
- Ziynet Yildirim M, Kutsal O and Avcioglu H (2007).** Spirocercosis in a dog. *Ankara Üniversitesi Veteriner Fakültesi Dergisi* **54** 61-64.