SHORT COMMUNICATION

Thromboembolism in Abdominal Aorta due to *Spirocerca lupi* in a Doberman Dog

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Abstract

An eight year old female Doberman dog, presented with left limb fracture and paraplegia revealed a mass in abdominal aorta on ultrasound examination. On worsening of the dog's clinical condition during the course of clinical intervention, the dog was euthanized on the request of the pet owner . In post mortem examination, nodules measuring around 2 cm diameters were observed in the caudal esophagus. Aortic thromboembolism of 3-4 cm with live *S. lupi* worms were observed along with multiple aneurysms. Nodular lesions were also observed on different organs in mediastinal lobe of lung, spleen and urinary bladder due to erratic migration of *S. lupi* parasites. Histopathologically, aorta revealed multiple necrotizing granuloma extending from tunica intima to tunica media and blood vessels dilatation with thickening of aorta. Muscular layer of esophagus also revealed multiple granuloma containing the L_3 stage larvae of *S. lupi*.

Key words: Aortic thromboembolism, Dog, Esophageal nodules, Granuloma, *Spirocerca lupi*.

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Introduction

Spirocerca lupi is one of the most pathogenic gastrointestinal parasites that affect dogs and causes the disease spirocercosis with worldwide distribution and greatest prevalence has been described in tropical and subtropical regions (Mc Gavin and Zachary, 2007). For *S. lupi* parasites to complete the life cycle, coprophagus beetle act as the intermediate host and canids act as the definitive host. Further, various paratenic hosts including rodents, reptiles, hedgehogs, rabbits, poultry and birds get *S. lupi* infection by ingestion of coprophagus beetle containing larvae stage of *S. lupi* (Rojas *et al*., 2020a). The lesions in spirocercosis are attributed mostly to the migration of the larvae and persistence of the adult parasites in the infected tissue (Mazaki-Tovi *et al*., 2002).

The most common presentation of spirocercosis in dogs are the esophageal nodules which are classified as non-neoplastic or neoplastic according to the inflammatory cell infiltrate, differentiation of tissue resident cell and external appearance of the nodules (Rojas *et al*., 2020b). The association between spirocercosis and neoplasia was first reported by Seibold *et al.* (1955). Though, esophageal wall is the typical target for Spirocerca parasites, aortic lesions are considered pathognomonic for spirocercosis (Chai *et al*., 2018). Aortic thrombosis due to *S. lupi* in dogs has been reported by Gal *et al*. (2005). Aortic scarring with aneurysm formation and thoracic spondylitis have also been reported in canine spirocercosis (Van der Merwe *et al*., 2008). Lavy *et al*. (2002) have stated that control of spirocerca parasites is very difficult due to the ubiquitous nature of the intermediate host. The present paper reports the identification of *S. lupi* worms along with major pathological changes such as thromboembolism in abdominal aorta at necropsy of a Doberman dog.

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Materials and Methods

An eight year old female Doberman dog, weighing 18 kg was presented to the Madras Veterinary College Teaching Hospital, Chennai - 600 007 with the history of injury in left hind limb. Physical and clinical examination of the dog revealed complete fracture of left hind limb distal to the hock joint and paraplegia. Radiography of the left limb and

ultrasound examination of the abdomen and thorax were performed. Blood samples collected for haematological investigation were analysed in Vet Auto Hematology Analyzer BC 2800 (Mindray Medical Instrumentation, China). Serum samples were analysed in automated biochemical analyzer (A-15 Biosystem Random Access Analyzer, Biosystem, Barcelona, Spain). During the process of clinical investigation, the condition of the dog deteriorated and it was euthanized on the request of the pet owner . Necropsy examination was done. Physical appearance of the carcass and gross changes of internal organs were recorded during necropsy. Samples were collected from organs which showed pathological changes, fixed in 10 % Neutral Buffered Formalin for 48 h, dehydrated in alcohol and cleared in xylene and then embedded in paraffin. Sections were cut at 3-5 µm thickness, stained by Haematoxylin and Eosin and screened for pathological findings.

Results and Discussion

Radiography of the left hind limb revealed mid shaft transverse fracture of tibia along with formation of callus around the fracture site. Ultrasound examination of the animal revealed a predominantly hypoechoic mass with heterogeneous parenchyma seen in the retroperitoneal space adjacent to aorta (Fig.1) and dilated abdominal aorta with mass occluding the aortic lumen (Fig. 2). Multiple echogenic masses in retroperitoneal area were also observed. Kidney showed irregularity in contour and increased echogenicity of cortex suggestive of early chronic kidney disease.

Complete blood count revealed neutrophilia, other parameters were within the reference ranges. Biochemical parameters were also within the reference ranges, except serum alkaline phosphatase (ALP), which was elevated.

In necropsy, live *S. lupi* worm (Fig. 3), aortic thromboembolism extending to the size of 3-4 cm and transmural orifices of 1-2 cm diameter with irregular borders were observed (Fig. 4). The general guarded prognosis in cases of aortic thromboembolism is related to the anoxic damage to the muscles and nervous system innervating the hind limbs which becomes rapidly irreversible if blood perfusion does not return to the affected tissues (Rodriguez and Harpster, 2002; Smith *et al*., 2003). Boswood *et al*. (2000) found that repeated thrombosis was uncommon for the few dogs that survived longer than one month after an acute episode of aortic thromboembolism.

Most of the aneurysms associated with *S. lupi* documented so far were in the thoracic aorta (Fox *et al*., 1988). However, in the present case, thrombus formation and aneurysms were observed in an abdominal aorta and the thrombus that occluded the aortic trifurcation causing paraplegia probably also originated from the abdominal/caudal aorta.

Esophageal nodules measuring 1-2 cm in diameter were observed at thoracic part of esophagus (Fig. 5). Clinical signs such as regurgitation, vomiting, limb edema which are commonly encountered in dogs with spirocercosis are related to esophageal nodules causing obstruction of the lumen or aortic thromboembolism (Van Der Merwe *et al*., 2008; Mazaki-Tovi *et al*., 2002; Klainbart *et al*., 2007). An interesting finding during necropsy was the observation of nodules in lung, spleen and lymph node due to atypical migration of parasites to different organs. Pulmonary nodules of 2 cm in diameter were observed on mediastinal lobe of lung (Fig. 6). Spleen was enlarged and showed multiple irregularly shaped nodules with 2-5 cm in diameter.

Kidneys revealed loss of cortex and irregular borders. Cut section of kidney revealed edematous renal pelvis with the presence of clotted blood and cone shaped area of dark red colour infarction extending from cortex to medulla. Urinary bladder had dark red clotted blood and a mass measuring 5-7 cm in diameter. Extensive muscular necrosis was observed in left hind limb which could be due to the injury and inadequate blood supply due to aortic thromboemboli. The lesions in kidney and urinary bladder could also be attributed to aortic thromboembolism.

Histopathologically aorta revealed dilation of blood vessels (Fig. 7), thickening, necrosis of tunica media elastic fibers (Fig. 8) and necrotising granuloma (Fig. 9) extending from tunica intima to tunica media layer. Variable sized cholesterol clefts with yellow pigments were also observed. Granuloma consisting of central necrotic area with mineralization (Fig. 10) surrounded by epitheloid cells, inflammatory cells of mononuclear cells, eosinophils and pigments were seen (Fig. 11). Heart revealed myocardial degeneration, necrosis with fat cells and mononuclear cell infiltration.

Histopathologically, esophageal duct revealed cellular exudates, haemorrhage in the sub-mucosal layer and mononuclear cells infiltration. Muscular layer revealed multiple granuloma consisting of L_3 stage larvae of *S. lupi* (Fig. 12) surrounded by inflammatory cells of eosinophils and mononuclear cells (Fig. 13). Rojas *et al*. (2020a) stated that cell infiltrate composed of neutrophils, macrophages and lymphocytes is a typical finding observed during early inflammatory stages of esophageal nodules in canine spirocercosis.

Histopathological examination of lungs revealed pulmonary edema and multifocal granuloma with calcification (Fig. 14). The granuloma consisted of central necrotic area with infiltration of epitheloid cells, lymphocytes and eosinophils surrounded by fibrous tissue capsule. Bronchiolar lumen contained detached epithelial cells with eosinophilic fluid. Liver revealed multifocal hepatocytic degeneration, sinusoidal congestion, bile duct hyperplasia with periductular fibrosis and mononuclear cell infiltration. Urinary bladder revealed mineralization, degeneration and necrosis of mucosal epithelium.

Histopathological examination of the kidneys revealed partial to complete loss of glomerular tuft, congestion, haemorrhage and tubular epithelial cell degeneration.

Spleen revealed congestion of trabeculae with pigment and necrotizing granuloma. Pancreas revealed mild degeneration of acinar and islet cells with pancreatic duct hyperplasia. Intestine revealed mononuclear cell infiltration in the lamina propria and submucosa. Stomach revealed mild degeneration of epithelial cells. Lymph nodes revealed lymphoid cell depletion along with multifocal mononuclear cell infiltration in the medulla.

Spirocercosis is associated with life threatening clinical signs such as metastasis of sarcoma, aberrant migration to other anatomical cavities and sudden death due to hemothorax and aortic thromboembolism in dogs (Aroch *et al*., 2015). In accordance to the literature perusal, in the present case, the dog infected with spirocercosis revealed pathological changes in multiple organs such as the heart, lungs, kidneys etc which would have been the reasons for the deteriorating state of the dog prior to euthanasia.

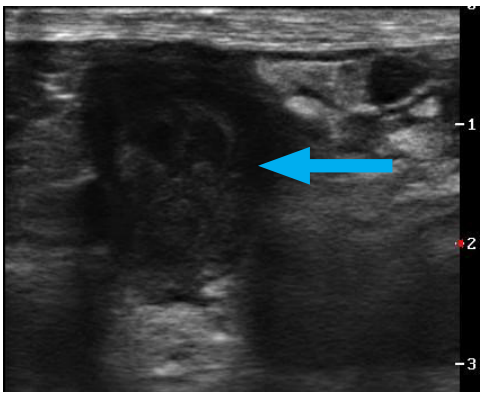

Fig. 1: Predominantly hypoechoic mass with heterogeneous parenchyma seen in the retroperitoneal space adjacent to aorta (arrow).

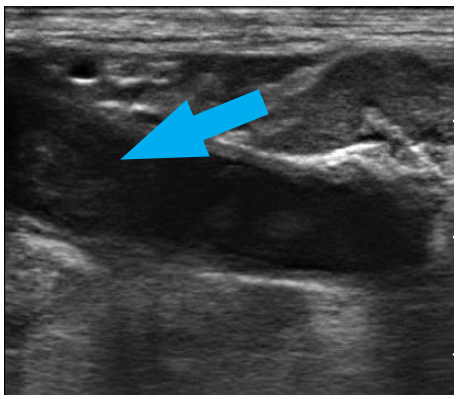

Fig. 2: Dilated abdominal aorta with mass occluding the aortic lumen (arrow).

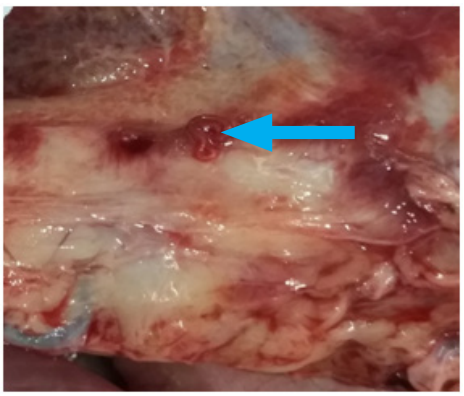

Fig. 3: Live *S. lupi* worm (arrow) observed on abdominal aortic nodule

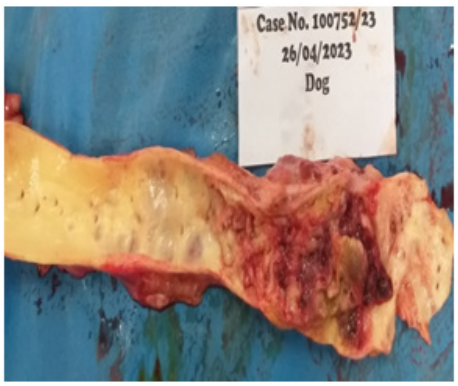

Fig. 4: Aortic thromboembolism and transmural orifices of 1-2 cm diameter with irregular border

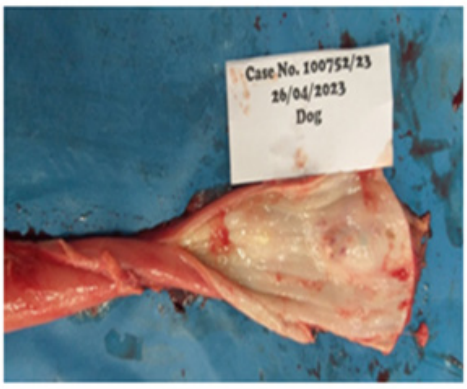

Fig. 5: Esophageal nodules measuring 1-2 cm in diameter observed at thoracic part esophagus

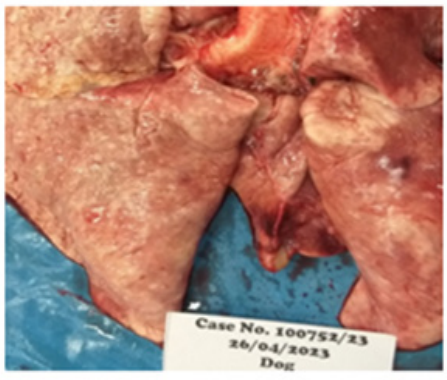

Fig. 6: Pulmonary nodule 2 cm in diameter were observed on mediastinal lobe of lung

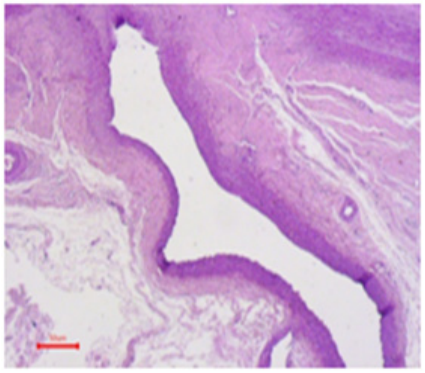

Fig. 7: Aorta-Dilated blood vessels. H&E stain 100X.

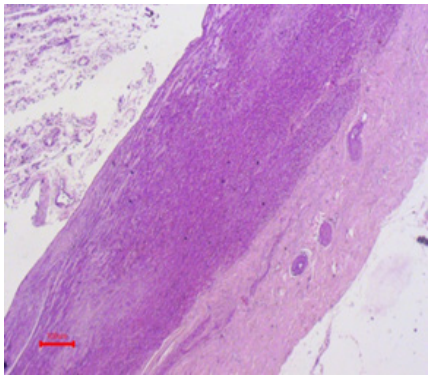

Fig. 8: Aorta - Thickening of T. media and T. intima. H&E stain 40X.

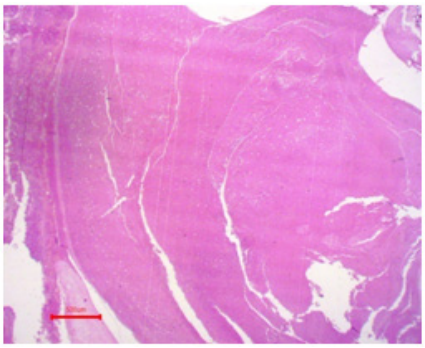

Fig. 9: Aorta - Necrotizing granuloma H&E stain 12.5X.

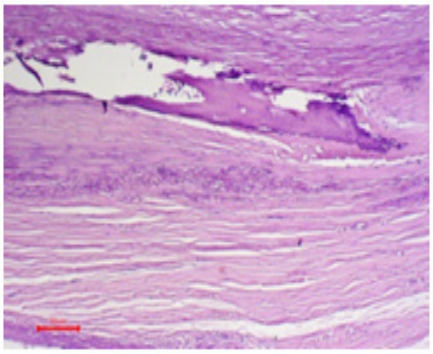

Fig. 10: Aorta - Mineralized areas. H&E stain 100X.

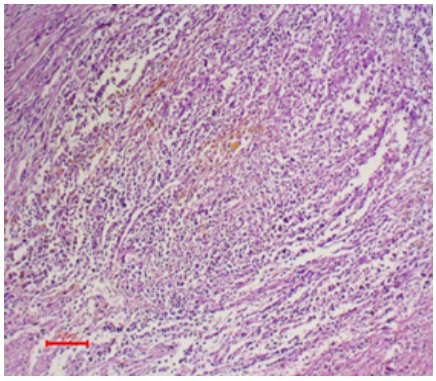

Fig. 11: Aorta - Infiltration of mononuclear cell. H&E stain 100X.

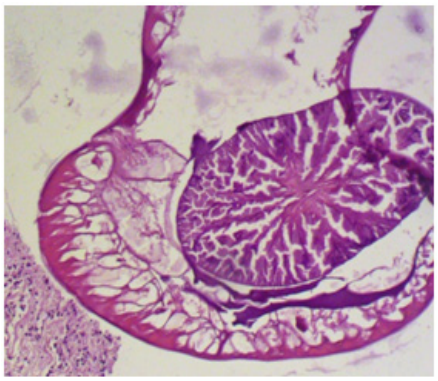

Fig. 12: Cut section of L3 stage larvae of *S.lupi.* H&E stain 1000X.

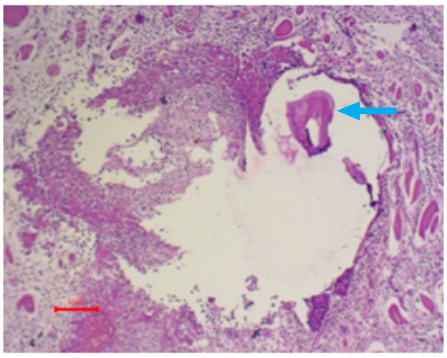

Fig. 13: Esophagus - Muscular layer revealed multiple granuloma, consisting of L_3 stage larvae of *S. lupi* (arrow) surrounded by inflammatory cells of eosinophils and mononuclear cell. H&E stain 40X.

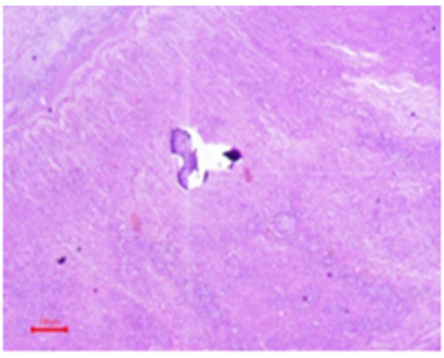

Fig. 14: Lung - Calcifying granuloma. H&E stain 40X.

Conclusion

The present case report depicted the findings of *Spirocerca lupi* parasites during necropsy examination of an euthanized dog and associated gross and histopathological changes. Spirocercosis cause life threatening complications in dogs if diagnosis and treatment are not done in early phase of the disease. Hence, regular deworming practices and periodic laboratory investigation including coprology analysis for pet dogs will serve at large to diagnose and to aid in early therapeutic intervention to mitigate mortality in dogs due to spirocercosis.

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References

Aroch, I., Markovics, A., Mazaki-Tovi, M., Kuzi, S., Harrus, S., Yas, E., Baneth, G., Bar-El, M., Bdolah-Abram, T., Segev, G., & Lavy, E. (2015). Spirocercosis in dogs in Israel: A retrospective case-control study (2004-2009). *Veterinary Parasitology*, *211*(3-4), 234-240.

Boswood, A., Lamb, C.R., & White, R.N. (2000). Aortic and iliac thrombosis in six dogs. *Journal of Small Animal Practice*, *41*(3), 109-114.

Chai, O., Yas, E., Brenner, O., Rojas, A., Konstantin, L., Klainbart, S., & Shamir, M.H. (2018). Clinical characteristics of *Spirocerca lupi* migration in the spinal cord. *Veterinary Parasitology*, *253*, 16-21.

Fox, S.M., Burns, J., & Hawkins, J. (1988). Spirocercosis in dogs. *Compendium Small Animal, 10,* 807-822.

Gal, A., Kleinbart, S., Aizenberg, Z., & Baneth, G. (2005). Aortic thromboembolism associated with *Spirocerca lupi* infection. *Veterinary Parasitology*, *130*(3-4), 331-335.

Klainbart, S., Mazaki-Tovi, M., Auerbach, N., Aizenberg, I., Bruchim, Y., Dank, G., Lavy, E., Aroch, I., & Harrus, S. (2007). Spirocercosis-associated pyothorax in dogs. *The Veterinary Journal*, *173*(1), 209-214.

Lavy, E., Aroch, I., Bark, H., Markovics, A., Aizenberg, I., Mazaki-Tovi, M., Hagag, A., & Harrus, S. (2002). Evaluation of doramectin for the treatment of experimental canine spirocercosis. *Veterinary Parasitology*, *109*(1-2), 65-73.

Mazaki-Tovi, M., Baneth, G., Aroch, I., Harrus, S., Kass, P.H., Ben-Ari, T., Zur, G., Aizenberg, I., Bark, H., & Lavy, E. (2002). Canine spirocercosis: Clinical, diagnostic, pathologic, and epidemiologic characteristics. *Veterinary Parasitology*, *107*(3), 235-250.

Mc Gavin, M.D., & Zachary, J.F. (2007). *Pathologic Basis of Veterinary Disease*. 4th ed. Louis: Mosby, pp. 1476.

Rodriguez, D.B., & Harpster, N. (2002). Treatment of feline hypertrophic cardiomyopathy. *Compendium*, *24*(6), 470-476.

Rojas, A., Deplazes, P., & Baneth, G. (2020b). Unravelling *Spirocerca vulpis* from red foxes from Switzerland: A 20-year-old record. *Parasitology Research*, *119*(9), 3105-3108.

Rojas, A., Dvir, E. & Baneth, G.(2020a). Insights on *Spirocerca lupi*, the carcinogenic dog nematode. *Trends in Parasitology*, *36*(1), 52-63.

Seibold, H.R., Bailey, W.S., Hoerlein, B.F., Jordan, E.M., & Schwabe, C.W. (1955). Observations on the possible relation of malignant esopbageal tumors and *Spirocerca lupi* lesions in the dog. *American Journal of Veterinary Research*, *18*(58), 5-14.

Smith, S.A., Tobias, A.H., Jacob, K.A., Fine, D.M., & Grumbles, P.L. (2003). Arterial thromboembolism in cats: Acute crisis in 127 cases (1992–2001) and long-term management with low dose aspirin in 24 cases. *Journal of Veterinary Internal Medicine*, *17*(1), 73-83.

Van der Merwe, L.L., Kirberger, R.M., Clift, S., Williams, M., Keller, N., & Naidoo, V.(2008). *Spirocerca lupi* infection in the dog: A review. *The Veterinary Journal*, *176*(3), 294-309.