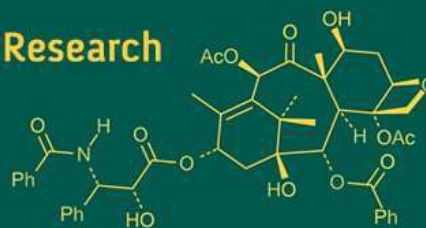


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; 8(9): 348-351
www.biochemjournal.com
Received: 22-06-2024
Accepted: 26-07-2024

Tushar Jain
Veterinary Surgeon,
Department of Animal
Husbandry and Dairying, Pet
Animal Medical Centre, Sector-
3, Panchkula, Government of
Haryana, Haryana, India

Manisha
Assistant Professor,
Department of Veterinary
Parasitology, Guru Angad Dev
Veterinary and Animal
Sciences University, Ludhiana,
Punjab, India

Shubham
M.Sc., Department of
Agricultural Economics,
CCSHAU, Hisar, Haryana,
India

Comparative efficacy of two treatment protocols in the management of canine spirocercosis: A randomized trial

Tushar Jain, Manisha and Shubham

DOI: <https://doi.org/10.33545/26174693.2024.v8.i9e.2164>

Abstract

This study aimed to compare treatment protocols for managing canine spirocercosis. This disease causes neoplastic changes in the oesophagus or sometimes stomach of carnivores, causing clinical symptoms such as odyphagia, inappetence, vomiting, regurgitation, and weight loss. In this study, 12 dogs aged between 7 months to 8 years were randomly divided into 2 groups. Group 1 was treated with doramectin at the dose rate of 0.2 mg/kg body weight (Subcutaneously, thrice at 14 days interval), while the dogs in group 2 were treated with ivermectin at the dose rate of 0.6 mg/kg body weight (Subcutaneously, thrice at 14 days interval) along with prednisolone at the dose rate of 0.5 mg/kg body weight (Orally, twice daily for 3 weeks and tapering the dose accordingly). Both groups were compared for the remission of disease symptoms after the end of treatment. It was found that all the dogs suffering from spirocercosis exhibited mild anaemia, leucocytosis and increased alkaline phosphatase levels. Furthermore, both treatment protocols were found to be equally effective in mitigating infestation of *Spirocerca lupi*.

Keywords: Canine spirocercosis, *Spirocerca lupi*, doramectin, ivermectin, prednisolone, neoplastic changes

Introduction

Spirocercosis, caused by the nematode *Spirocerca lupi*, is a severe and potentially fatal disease affecting dogs across tropical and subtropical regions worldwide (Rojas & Baneth, 2019) [1]. Despite its widespread distribution and significant impact on canine health, spirocercosis remains a neglected disease, often overlooked in veterinary practice. This parasitic infection presents a complex challenge due to its intricate life cycle, diverse clinical manifestations, and potential for malignant transformation.

S. lupi has a complex life cycle involving definitive hosts (Primarily dogs), intermediate hosts (Coprophagous beetles), and paratenic hosts (Small mammals and birds). Adult worms reside in nodules in the oesophageal wall of infected dogs, where they reproduce and release eggs that are passed in the faeces. These eggs are ingested by dung beetles (*Scarabaeus* spp.), where they develop into infective larvae. When dogs consume infected beetles or paratenic hosts, released larvae migrate through various tissues before reaching their final destination in the oesophagus (Rojas & Baneth, 2019) [1]. The hallmark of spirocercosis is the formation of oesophageal nodules. These nodules initially appear as inflammatory granulomas but can undergo neoplastic transformation in approximately 25% of cases (Dvir *et al.*, 2012) [2]. The mechanism underlying this transformation is not fully understood, but recent research suggests that the sustained inflammatory response to *S. lupi* excretory-secretory proteins (SI-ESP) may play a crucial role, similar to other carcinogenic helminths (Porrás-Silesky *et al.*, 2021) [3].

The most frequently observed clinical signs in dogs with spirocercosis include regurgitation, vomiting, and dyspnea (Merwe *et al.*, 2008) [4]. However, this disease can manifest in more severe forms due to aberrant larval migration. *S. lupi* larvae typically migrate through the gastric arteries to reach the esophagus, but aberrant migration through the mesenteric arteries can lead to severe complications, including necrotizing eosinophilic arteritis, thrombosis, and intestinal infarction (Brenner *et al.*, 2019) [5].

Corresponding Author:
Tushar Jain
Veterinary Surgeon,
Department of Animal
Husbandry and Dairying, Pet
Animal Medical Centre, Sector-
3, Panchkula, Government of
Haryana, Haryana, India

Moreover, aberrant migration into the spinal cord is an important cause of severe progressive neurological dysfunction in dogs, presenting a significant diagnostic challenge (Chai *et al.*, 2018) [6]. Diagnosis of spirocercosis is challenging due to the often-elusive clinical signs and the need for specific diagnostic techniques. The most sensitive method for diagnosing canine spirocercosis is NaNO₃ solution-based fecal examination, which utilizes a modified centrifugal flotation technique to yield the highest egg count compared with other methods (Christie *et al.*, 2011) [7]. Additionally, haematology often reveals hypochromic normocytic anaemia and severe thrombocytopenia, whereas blood biochemistry may depict elevated urea and creatinine levels, indicating renal impairment (Rodríguez-Alarcón *et al.*, 2016) [8]. Early and accurate diagnosis of spirocercosis is crucial for effective management, but remains a significant challenge in veterinary practice.

Radiography can reveal primary lesions such as oesophageal masses, spondylitis, and undulation of the aortic border (Merwe *et al.*, 2008) [4]. Advanced imaging modalities like contrast radiography, computed tomography, and oesophageal endoscopy provide additional diagnostic sensitivity. Ultrasonography, although not directly sensitive for diagnosing spirocercosis, can help identify aortic wall abnormalities that suggest *S. lupi* migration (Merhavi *et al.*, 2020) [9]. Recent advancements in molecular diagnostics, including PCR targeting the 18S rDNA of *S. lupi* in the cerebrospinal fluid, have shown promise for the ante-mortem diagnosis of canine intraspinal spirocercosis (Ruggeri *et al.*, 2019) [10].

The treatment of canine spirocercosis encompasses a multifaceted approach, primarily relying on antiparasitic therapy with macrocyclic lactones. Doramectin is currently considered the gold standard, administered at 200-400 µg/kg SC in various regimens (Merwe *et al.*, 2008 [4]; Asiag *et al.*, 2022 [11]). Milbemycin oxime is also effective, particularly in early cases (Kelly *et al.*, 2008 [12]). In complicated cases, surgical interventions, ranging from nodulectomy to partial esophagectomy, are necessary, with emerging minimally invasive techniques offering potential benefits (Sutton *et al.*, 2016) [13]. Supportive care, including anti-inflammatory medications and antibiotics, plays a crucial role in managing complications and improving outcomes. Novel approaches, such as targeted molecular therapies based on recent proteomics studies (Rojas & Baneth, 2019) [1] and immunomodulatory strategies addressing the role of inflammation in disease progression (Dvir *et al.*, 2012) [2], are under investigation. Regular monitoring through faecal examinations and imaging is essential for assessing treatment efficacy and detecting potential recurrence or neoplastic transformation. This study aimed to compare treatment protocols to enhance outcomes for affected dogs.

Material and Methods

The investigation was conducted on 12 dogs aged between 7 months to 8 years having similar history of odynophagia, inappetence, vomiting, regurgitation, and weight loss. Out of the 12 dogs, 4 also showed signs of dyspnoea and pain on palpating the neck region. The animals were randomly divided into two groups irrespective of age, sex, and breed. Radiography in right lateral recumbency was done to assess the oesophagus and trachea for any obstruction or deformity. Afterwards oesophagoscopy was performed to further assess the underlying issue. Blood samples were

collected in EDTA vials and serum vials from cephalic/saphenous veins. Haemato-biochemical analysis was performed using the auto-analyzer machine the hematological parameters assessed including haemoglobin (Hb), total leukocyte count (TLC), differential leukocyte count (DLC), total platelet count (Thrombocytes). The biochemical parameters included alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), blood urea nitrogen (BUN), creatinine, total plasma proteins. Faecal samples were collected for faecal floatation test using NaNO₃ solution and examined under a microscope for detecting any internal parasite eggs as per the methodology employed by Merwe *et al.* (2008) [4]. The animals in group 1 were treated with doramectin at a dose rate of 0.2 mg/kg body weight (Subcutaneously, thrice at 14 days interval) while the dogs in group 2 were treated with a combination of ivermectin at a dose rate of 0.6 mg/kg body weight (Subcutaneously, thrice at 14 days interval) along with prednisolone at a dose rate of 0.5 mg/kg body weight (Orally, twice daily for 3 weeks and tapering the dose accordingly). Both groups were compared for the remission of disease symptoms after the end of treatment.

Results and Discussion

Table 1: Estimated values of the hematological parameters of dogs under study

Parameters (Units)	Estimated values	Normal values
Hb (g/dL)	9.80±1.30	12.00-18.00
TLC (x10 ³ /mm ³)	14.40±3.80	4.00-15.50
Neutrophils (%)	72.00±9.00	60.00-75.00
Lymphocytes (%)	21.00±7.00	12.00-30.00
Eosinophils (%)	6.00±3.00	2.00-10.00
Basophils (%)	0.00±0.00	0.00-2.00
Monocytes (%)	7.00±4.00	3.00-9.00
Thrombocytes (x10 ³ /mm ³)	198.00±34.00	170.00-300.00

Table 2: Estimated values of the biochemical parameters of dogs under study

Parameters (Units)	Estimated values	Normal values
ALT (IU/L)	54.00±13.00	12.00-118.00
AST (IU/L)	39.00±8.00	15.00-66.00
ALP (IU/L)	141.00±22.00	5.00-131.00
BUN (mg/dL)	16.00±6.00	6.00-25.00
Creatinine (mg/dL)	0.90±0.30	0.50-1.60
Total plasma proteins (g/dL)	5.20±1.30	5.00-7.40

The haematology results are in correlation to the study done by Mylonakis *et al.*, 2006 [14] where they found macrocytic to microcytic hypochromic anaemia. The estimation of haematological values (Table 1) showed mild reduction in Hb (g/dl) concentration. Anaemia was likely a combination of inflammatory processes and blood loss from ulcerated areas in the mass. Also, the total leukocyte count of 12 dogs was found to be increased with neutrophilia as was depicted in study by Mazaki-Tovi *et al.*, 2002 [15]. Increase TLC is likely associated with the necrosis and inflammation of large neoplastic masses (Nivy *et al.*, 2014) [16]. There was mild increase in the ALP (Table 2) values while total plasma protein concentration was found to be decreased which can be due to decreased appetite, muscle degeneration and neoplastic changes as been discussed by Rodríguez-Alarcón *et al.*, 2016 [8]. All the remaining haemato-biochemical parameters were almost in the normal range.

In the radiographic assessment, 5 out of 12 dogs revealed increased opacity in the caudo-dorsal lung field and 2 out of 12 dogs exhibited mild to moderate spondylosis at the ventral border of thoraco-lumbar vertebrae. Plain radiography did not reveal any significant details and could be used only as a primary means of diagnosis and thus, plain x-ray is not a good diagnostic modality in cases of spirocercosis which is in concurrence with study by Mazaki-Tovi *et al.* 2002 ^[15].

Oesophageal endoscopy revealed variable sized nodules in all the dogs in middle to distal third of the extending while in 2 dogs, nodules were found at the level of fundus in the stomach. Esophagoscopy and gastroscopy are the diagnostic modalities of choice for direct visualization of *Spirocerca lupi* nodules. Although esophageal neoplastic masses tend to be cauliflower or pedunculated shape, with smooth outline, this is in agreement with Mazaki-Tovi *et al.* 2002 ^[15], Lefkaditis, 2002 ^[17] and Ranen *et al.* 2004 ^[18].

In all of the dogs, the faecal examination showed thick-walled eggs with larva inside suggestive of *S. lupi* infestation. Thus, faecal examination can be of great diagnostic value in *S. lupi* cases as was reported by Merwe *et al.* (2008) ^[4].

The treatment with doramectin in group 1 and combination of ivermectin and prednisolone in group 2 dogs were equally effective in the disappearance of clinical signs and nodular regression as also reported by Kelly *et al.* (2008) ^[12]. However, dogs in Group 2 starting eating earlier than dogs in Group 1. Clinical signs were gradually resolved within 3 months from the beginning of the treatment with doramectin in group 1 which is in concurrence with observations by Berry *et al.* (2000) ^[19]. In group 2 dogs, the clinical signs started disappearing within 2 months and the combination with prednisolone in group 2 dogs may have contributed to a faster nodular regression than the single use of ivermectin or even doramectin which was also reported by Mylonakis *et al.* 2004 ^[14]. Treatment with both the protocols was effective and without apparent side effects in the management of oesophageal spirocercosis of the dog.

Conclusion

Spirocercosis remains a significant threat to canine health worldwide, with potentially fatal consequences if left untreated. The complex life cycle of *S. lupi*, its ability to induce neoplastic transformation, and the challenges in early diagnosis all contribute to its status as a neglected yet deadly disease. Improved awareness among veterinarians, advancements in diagnostic techniques, and the development of more effective prophylactic measures are crucial for managing this disease effectively. Future research should focus on standardization of treatment protocols to improve consistency in outcomes for prevention and control in endemic areas. Various surgical (Oesophagotomy, nodulectomy, oesophagectomy, ethanol-induced chemical ablation etc.) and medicinal treatment protocols including drugs like ivermectin alone, ivermectin along with prednisolone, doramectin or milbemyacin oxime can be used in successful management of the disease keeping in mind the cost involved, time required and the inherent risks associated with the treatment. Prevention by proper disposal of dog faeces and controlling dung beetle populations, may help reduce transmission.

References

1. Rojas A, Baneth G. Secretome of the carcinogenic helminth *Spirocerca lupi* reveals specific parasite proteins associated with its different life stages. *Vet. Para.* 2019;275:10893-10895.
2. Dvir E, Mellanby R, Kjølgaard-Hansen M, Schoeman J. Plasma IL-8 concentrations are increased in dogs with spirocercosis. *Vet. Parasitol.* 2012;190(1-2):185-190.
3. Porras-Silesky C, Mejías-Alpizar M, Mora J, Baneth G, Rojas A. *Spirocerca lupi* Proteomics and Its Role in Cancer Development: An Overview of Spirocercosis-Induced Sarcomas and Revision of Helminth-Induced Carcinomas. *Pathogens.* 2021, 10.
4. Merwe L, Kirberger R, Clift S, Williams M, Keller N, Naidoo V. *Spirocerca lupi* infection in the dog: A review. *Vet. J.* 2008;176(3):294-309.
5. Brenner O, Botero-Anug A, Rojas A, Hahn S, Baneth G. Aberrant Mesenteric Migration of *Spirocerca lupi* Larvae Causing Necrotizing Eosinophilic Arteritis, Thrombosis, and Intestinal Infarction in Dogs. *Vet. Path.* 2019;57:281-285.
6. Chai O, Yas E, Brenner O, Rojas A, Konstantin L, Klainbart S, *et al.* Clinical characteristics of *Spirocerca lupi* migration in the spinal cord. *Vet. Parasitol.* 2018;253:16-21.
7. Christie J, Schwan E, Bodenstein L, Sommerville J, Merwe L. The sensitivity of direct faecal examination, direct faecal flotation, modified centrifugal faecal flotation and centrifugal sedimentation/flotation in the diagnosis of canine spirocercosis. *J. South Afr. Vet. Assoc.* 2011;82(2):71-5.
8. Rodríguez-Alarcón CA, López-Aguilar A, Pérez-Casío F, Rivera-Barreno R, Castillo-Luna O, Beristain-Ruiz DM. Dysphagia Secondary to *Spirocerca lupi* in a German Shepherd Dog. *Acta Scientiae Veterinariae.* 2016;44(1):171.
9. Merhavi N, Segev G, Dvir E, Peery D. Ultrasonography is insensitive but specific for detecting aortic wall abnormalities in dogs infected with *Spirocerca lupi*. *Vet. Rec.* 2020;187:59.
10. Ruggeri M, Rojas A, Chai O, Purzyc H, Hanael E, Rapoport K, *et al.* Detection of Intraspinal *Spirocerca lupi* in Canine Cerebrospinal Fluid by Polymerase Chain Reaction. *J. Comp. Path.* 2019;170:105-112.
11. Asiag N, Chai O, Yodovner S, Ruggeri M, Rapoport K, Baneth G, *et al.* Evaluation of a treatment protocol in dogs with intraspinal spirocercosis. *J. Amer. Vet. Med. Assoc.* c2022. p. 1-7.
12. Kelly P, Fisher M, Lucas H, Krecek R, Krecek R. Treatment of oesophageal spirocercosis with milbemyacin oxime. *Vet. Parasitol.* 2008;159(3-4):358-60.
13. Sutton J, Culp W, Scotti K, Seibert R, Lux C, Singh A, *et al.* Perioperative morbidity and outcome of esophageal surgery in dogs and cats: 72 cases (1993-2013). *J. Amer. Vet. Med. Assoc.* 2016;249(7):787-93.
14. Mylonakis ME, Rallis T, Koutinas AF, Leontides LS, Patsikas M, Florou M, *et al.* Clinical signs and clinicopathologic abnormalities in dogs with clinical spirocercosis: 39 cases (1996-2004). *J. Amer. Vet. Med. Assoc.* 2006;228:1063-1067.
15. Mazaki-Tovi M, Baneth G, Aroch I, Harrus S, Kass P, Ben-Ari T, *et al.* Canine spirocercosis: Clinical,

- diagnostic, pathologic, and epidemiologic characteristics. Vet. Parasitol. 2002;107(3):235-250.
16. Nivy R, Caldin M, Lavy E, Shaabon K, Segev G, Aroch I. Serum acute phase protein concentrations in dogs with spirocercosis and their association with esophageal neoplasia - a prospective cohort study. Vet. Parasitol. 2014;203(1-2):153-159.
 17. Lefkaditis MA. An important clinical case of *Spirocerca lupi* in dog and the way of treatment with the use of ivermectin. Presentation of the nematodes parasite *Spirocerca lupi* and also the drug, Ivermectin. Scientia parasitologica. 2002;2:102-106.
 18. Ranen E, Lavy E, Aizenberg I, Perl S, Harrus S. Spirocercosis-associated esophageal sarcomas in dogs. A retrospective study of 17 cases (1997-2003). Vet. Parasitol. 2004;119:209-221.
 19. Berry WL. *Spirocerca lupi* oesophageal granulomas in 7 dogs: Resolution after treatment with doramectin. J. Vet. Intern. Med. 2000;14:609-612.