

## Survey of the incidence, diagnosis, clinical manifestations and treatment of *Spirocerca lupi* in South Africa

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### ABSTRACT

A questionnaire survey of 716 veterinary practices was undertaken to determine the incidence of *Spirocerca lupi* in dogs in South Africa. In total, 49 % of the questionnaires were returned, indicating a possible incidence of 28 %. Fewer than 4 cases per year were recorded by 82 % of the respondents; 4–12 by 14 %; 12–24 by 3 %; and more than 48 by only 1 %. No seasonal incidence was reported by 48 % of the respondents. Large breeds were considered to be at greater risk by 43 % of respondents. No specific age or sex was identified to be at higher risk. The most common complaints by owners and clinical findings were vomiting (46 %), weight loss (27 %), coughing (21 %) or regurgitation (20 %), although 14 % of respondents reported no abnormal clinical findings. Diagnostic methods used were radiology (74 %), endoscopy (27 %), *post mortem* examination (34 %) and faecal flotation (4 %). Complications associated with *S. lupi* were reported by 76 % of respondents, which included oesophageal neoplasia (41 %), hypertrophic osteopathy (38 %) and acute haemothorax (30 %). Specific treatments were used by 58 % of the respondents, whereas 42 % of the respondents either used no treatment (72 %) or recommended euthanasia (28 %). Of the treatment group, 52 % used ivermectin, 27 % doramectin, 13 % other deworming drugs (benzimidazoles, nitroscanate), and 8 % used disophenol. Sixty-three percent of the respondents considered their treatment ineffective, whereas 31 % considered it effective, and 6 % were unsure. The overall mortality rate was high.

**Key words:** dogs, incidence, South Africa, *Spirocerca lupi*, survey.

Lobetti R G Survey of the incidence, diagnosis, clinical manifestations and treatment of *Spirocerca lupi* in South Africa. *Journal of the South African Veterinary Association* (2000) 71(1): 43–46 (En.). Department of Companion Animal Medicine, Faculty of Veterinary Science, University of Pretoria, Private Bag X04, Onderstepoort, 0110 South Africa.

### INTRODUCTION

*Spirocerca lupi* is a nematode parasite of carnivores, found primarily in dogs but also reported in numerous wild carnivores<sup>5</sup>. Natural infections have been reported in a man, goat, pony and a donkey<sup>11</sup>. Spirocercosis occurs throughout the world, mainly in tropical and subtropical areas<sup>20</sup>, although there are colder regions with a high incidence<sup>11</sup>. Infection depends upon canine population density and the degree of contact between definitive, intermediate and transport hosts<sup>1</sup>. The adult parasite is most commonly found embedded in a nodule in the host's thoracic oesophagus, although it can occur in the thoracic aorta, stomach, vertebrae, pleura, lungs, kidneys, mediastinum and skin<sup>14</sup>. In the oesophagus the adult worm passes larvated eggs into the lumen that hatch only after having been ingested by an intermediate host (coprophagous beetles)<sup>8,14,18</sup>. A transport host (birds, amphibians, reptiles and small

mammals) can become infected if they ingest the intermediate host<sup>8</sup>.

The definitive host becomes infected by ingestion of either the intermediate or transport host. Once ingested, the larvae are liberated in the stomach, where they penetrate the stomach wall, enter an arteriole and then migrate in the wall of the gastric and gastric-epiploic arteries to the coeliac artery and then to the thoracic aorta. From the aorta, the larvae emerge and migrate to the adjacent oesophagus. This process takes approximately 6 months<sup>8,14,18</sup>. The pathology of spirocercosis results from larval migration, presence of adult worms in granulomas in the oesophagus and secondary bacterial infections<sup>8</sup>. In some cases, the oesophageal granuloma can undergo malignant transformation to form a sarcoma, with and without metastases<sup>10</sup>. Hypertrophic osteopathy and spondylitis of the thoracic vertebrae (T6–T12) may also be evident<sup>8,11,14</sup>.

Clinical signs of spirocercosis include vomiting, regurgitation, weight loss, salivation and dysphagia<sup>7,8</sup>. Aortic infection is asymptomatic, unless rupture

occurs, resulting in haemothorax and sudden death<sup>18</sup>. Diagnosis is based on survey and contrast radiographs<sup>7</sup>, oesophagoscopy<sup>1</sup> and finding larvated eggs on faecal flotation<sup>14,18</sup>. The latter is, however, not a common finding, as the adult female can only shed eggs if there is an opening in the granuloma and the eggs are also only shed for an unpredictable, short period<sup>8</sup>. As the eggs are heavier than other helminth eggs, a flotation fluid of higher specific gravity is also required<sup>18</sup>.

It has been suggested that in endemic areas the incidence of infection can be 100 %, which is probably associated with the many opportunities of acquiring infection from the various intermediate and transport hosts<sup>20</sup>.

As limited studies have been carried out on spirocercosis in South Africa, the purpose of this study was primarily to establish the incidence, importance and distribution of *S. lupi* in South Africa by means of a questionnaire.

### MATERIALS AND METHODS

A questionnaire (see Appendix 1) was sent to 716 veterinary practices throughout South Africa that were on the mailing list of Pfizer Animal Health, South Africa. The questionnaire covered 4 main interest areas: (1) presence or absence of *S. lupi*, and whether the presence was a new phenomenon or not; (2) if *S. lupi* was associated with time of year, breed, age and sex; (3) presenting features, clinical signs, diagnosis and presence of complications or asymptomatic cases; and (4) treatment(s) and its efficacy, and mortality associated with the disease.

### RESULTS

In total, 351 (49 %) questionnaires were returned. Of these, 97 (28 %) of the respondents indicated that *S. lupi* occurred in their area, whereas 254 (72 %) indicated that *S. lupi* did not. Reported occurrence in the various provinces of South Africa is shown in Table 1.

Seventy-six (78 %) of practitioners that responded positively considered *S. lupi* not to be a new phenomenon, whereas 21 (22 %) considered it a new phenomenon. Most new cases were recorded in the past

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Received: September 1999. Accepted: November 1999.

Table 1: Summary by province of the response to a questionnaire survey among veterinarians to determine the incidence of *Spirocerca lupi* in South Africa.

Province	Respondents who see <i>Spirocerca lupi</i> cases		Respondents who do not	
	Actual number	%	Actual number	%
Western Cape	2	2.1	60	23.6
Eastern Cape	4	4.1	21	8.3
Northern Cape	1	1	7	2.8
KwaZulu-Natal	34	35.1	31	12.2
Mpumalanga	5	5.2	10	3.9
Gauteng	45	46.3	80	31.5
Free State	1	1	22	8.7
North-West Province	3	3.1	15	5.9
Northern Province	2	2.1	8	3.1
Total	97	100	254	100

2 years (1996–1998). Fewer than 4 cases per year were recorded by 79 (82 %) respondents; between 4 and 12 by 14 (14 %); between 12 and 24 in 3 (3 %); and more than 48 by only 1 (1 %).

Forty-seven (48 %) of the respondents reported no seasonal incidence, whereas 50 (52 %) considered *S. lupi* to be seasonal. The reported seasonal incidence was as follows: all year occurrence in 2 (4 %), summer 29 (58 %), spring 6 (12 %), autumn 3 (6 %) and winter 10 (20 %).

No particular breed was reported by 55 (57 %) respondents, whereas 42 (43 %) considered large breeds to be at greater risk. Of these, the German shepherd dog was reported by 11 (11 %) of the respondents to be at greater risk. No particular age or sex was identified to be at higher risk for *S. lupi* infection.

The most common owner complaints were vomiting (46 %), weight loss (27 %), cough (21 %) or regurgitation (20 %). Reported clinical findings tended to mirror the clinical signs reported by the owners. Other clinical signs reported included fever, anaemia or dyspnoea. Fourteen (14 %) respondents reported no abnormal clinical findings. The most common diagnostic methods used were radiology (74 %), endoscopy (27 %) and *post mortem* examination (34 %). Only 4 % of cases were diagnosed on faecal flotation. Other diagnostic methods used were eosinophilia on blood smear examination, response to treatment, and history and clinical signs. Most respondents (71 %) did not report seeing asymptomatic cases, whereas 20 % reported asymptomatic cases and 9 % did not know. Complications associated with *S. lupi* were reported by 76 % of the respondents, which included oesophageal neoplasia (41 %), hypertrophic osteopathy (38 %) and acute haemothorax (30 %). Rarer complications were spondylosis, oesophagitis and aortic thrombosis.

Specific treatments were used by 56 (58 %) of the respondents, whereas 41 (42 %) either used no treatment (72 %) or recommended euthanasia (28 %). Of the treatment group of respondents, 52 % used ivermectin (Ivomec, Logos Agvet), 27 % doramectin (Dectomax, Pfizer Animal Health), 13 % used other deworming drugs (benzimidazoles, nitroscanate (Lopatul, Novartis Animal Health)), and 8 % used disophenol. Sixty-one (63 %) of the respondents considered their treatment ineffective, whereas 30 (31 %) considered it effective, and 6 (6 %) were unsure. It was also reported that treatment was more effective if the disease was diagnosed early enough and if there were no complications. Mortality rate was divided as follows: less than 10 % by 8 (8 %) of the respondents, between 20 and 40 % by 4 (4 %), between 40 and 60 % by 6 (6 %), between 60 and 80 % by 6 (6 %), and greater than 80 % by 42 (44 %). Thirty-one (32 %) respondents were unsure as to the outcome of their cases.

## DISCUSSION

This survey indicated that *S. lupi* is common in South Africa, having an apparent incidence of 28 %, with the highest incidence in the provinces of Gauteng and KwaZulu-Natal. Most respondents reported seeing only a few cases a year and that the disease was not a new phenomenon. From the survey, there was no obvious distinction between urban and rural areas. It has previously been reported that *S. lupi* is common in rural dogs in South Africa<sup>7,14</sup>; however, in 1063 dogs examined for helminths, *S. lupi* was reported in only 3 dogs<sup>21</sup>. Faecal examination is, however, unreliable, as only a small percentage of cases can be identified by this method. In a recent study, 18 of 132 (14 %) dogs that were autopsied in South Africa were positive for *S. lupi*. (N. Minnaar, Department of

Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, pers. comm., 1999). In a Kenyan study, 39 clinical cases and 206 of 1607 (13 %) dogs autopsied over a 10-year period were reported to be positive for *S. lupi*<sup>22</sup>. In other studies in Kenya, 78 % of dogs autopsied were positive for *S. lupi*, with the prevalence higher in rural than in urban dogs (85 vs 38 %)<sup>3</sup>. Rural dogs were closely associated with cattle, chickens and dung beetles. In an Iranian study, 76 % of sick or stray dogs were infected with *S. lupi*, with oesophageal lesions present in 58 %<sup>10</sup>. In Malaysia, 23 % of dogs autopsied were positive<sup>15</sup>. In India varying incidences of 20<sup>12</sup>, 58<sup>17</sup> and 78 %<sup>13</sup> have been reported. In Southern Texas the incidence ranged from 15–18 %<sup>19</sup>. In Auburn, Alabama, 8 % of dogs autopsied were positive<sup>1</sup>. It thus appears that the most significant factor in the prevalence of *S. lupi* infection is related to the proximity of the dogs to the intermediate and transport hosts.

This survey indicated a tendency towards a summer seasonal incidence, which has not been previously reported in the literature. However, as the pre-patent period of the parasite is 6 months, the reported seasonal incidence may not be accurate.

This survey indicated a tendency for large breeds to be at greater risk, with the German shepherd dog at highest risk. These findings are similar to those previously reported<sup>1,22</sup>. No particular age or sex was identified to be at higher risk for *S. lupi* infection; however, it has been reported that the age group most commonly affected with *S. lupi* is between 1 and 4 years of age<sup>5,6</sup>. In a report from West Africa, the age distribution ranged from 1 month to 12 years<sup>9</sup>. As this report was based on a faecal survey, the age distribution of dogs <6 months is questionable, as the development period of the parasite is

6 months<sup>8,14,18</sup>. In two reports, male dogs were considered to be more commonly affected<sup>12,17</sup>, which was not supported in this survey.

Owner complaints and clinical signs (vomition or regurgitation, weight loss, cough, fever, anaemia and dyspnoea) as well as associated complications (oesophageal neoplasia, hypertrophic osteopathy, acute haemothorax, spondylosis, oesophagitis and aortic thrombosis) were the same as those previously reported<sup>7,8,14,18</sup>. In this survey, no abnormal clinical findings were reported in a number of dogs.

The most common diagnostic methods used in the diagnosis of *S. lupi* were radiology (both survey and contrast), endoscopy and *post mortem* examination, as previously described<sup>7,8,14,18</sup>. Although faecal analyses have been used to determine the incidence of *S. lupi* in other studies, it was not a commonly used diagnostic method by respondents in this survey. This could be attributed to the poor sensitivity of the test as well as the need for special flotation fluid. In Sierra Leone (West Africa) a faecal survey of dogs showed an infestation rate of 3.5 %<sup>9</sup>, in Kenya 56 %<sup>3</sup>, in India 37 %<sup>5</sup>, in Malaysia 40 %<sup>14</sup>, in the rural areas of the southeastern states of America (Alabama and Mississippi) 33.5 %<sup>6</sup>, and in Auburn (Alabama) 47 %<sup>1</sup>. In a recent study, none of the dogs that were confirmed to have *S. lupi* on autopsy (18/132, 14 %) were positive on faecal analysis (N. Minnaar, Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, pers. comm., 1999). It has also been shown that the incidence of the disease can vary, as in a follow-up faecal study performed in the same area in Auburn, the number of positive cases on faecal examination decreased to 12.7 %<sup>2</sup>. This was attributed to shrinkage of rural areas with a concomitant decrease in rural dogs, and decreased dung beetle populations as a result of increased pesticide use.

Other questionable diagnostic methods that were reported in this survey in-

cluded eosinophilia on blood smear examination, response to treatment, history and clinical signs. Most respondents (71 %) did not report seeing asymptomatic cases, whereas 20 % reported asymptomatic cases and 9 % were uncertain. Mortality rate caused by spirocercosis in this survey was high and probably associated with late diagnosis, presence of complications and no available anthelmintic of proven efficacy.

The only anthelmintic that is effective against adult *S. lupi* is disophenol<sup>16</sup>, which is no longer available, although a number of respondents in this survey indicated that they had used it. Of the respondents that reported effective treatment, all had used either doramectin or ivermectin; however, doses and dosing intervals were as varied as the number of respondents. Doramectin has been effective in the therapy of a limited number of spirocercosis cases<sup>4</sup>.

#### ACKNOWLEDGEMENTS

I thank Pfizer South Africa for both sponsoring and distributing the questionnaire, Peter O' Farrell for data capture, Professor R C Krecek for her help, and all the veterinarians who made this survey possible.

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## ***Spirocerca lupi* questionnaire**

### **PRACTITIONER AND PRACTICE DETAILS**

Practitioner: .....

Practice name: .....

Physical address: .....

Postal address: .....

Province: ..... Postal code: .....

Tel: (.....) Fax: (.....) E-mail: .....

### **PLEASE CIRCLE THE APPROPRIATE RESPONSE OR ANSWER IN THE SPACE PROVIDED**

1. Do you see cases of *Spirocerca lupi* in your practice?  
YES / NO  
If the answer is no, **please stop here and return the questionnaire in the envelope provided. Negative responses are very important.**
2. Is *Spirocerca lupi* a new phenomenon in your practice?  
YES / NO  
If yes, when did you first see it? .....
3. How many cases do you see per year? (please circle)  
<4            4–12            12–24            24–48            >48
4. During which month(s) do you see most cases? (please circle)  
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
5. Do you diagnose *Spirocerca lupi* more commonly in certain:  
Breeds?            YES / NO            If yes, specify: .....
- Age groups?            YES / NO            If yes, specify: .....
- Sexes?            YES / NO            If yes, specify: .....
6. What are the most common owner complaints? .....
7. What are the most common clinical findings? .....
8. How do you diagnose *Spirocerca lupi*? .....
9. Do you see asymptomatic cases of *Spirocerca lupi*? .....
10. Do you see complications with *Spirocerca lupi*? (acute haemothorax, neoplasia, Marie's disease)  
YES / NO            If yes, specify: .....
11. Which drug(s) do you use to treat *Spirocerca lupi*? Please provide details (dose, frequency, and duration of treatment): .....
12. What other treatment(s) do you utilise? .....
13. Do you considered the drug(s) and/or treatments to be effective in the treatment of *Spirocerca lupi*?  
YES / NO            If no, specify: .....
14. What is the mortality figure (%)? .....
15. What was the source of information for this questionnaire?  
Computer records    Paper records    Memory    Combination
16. Would you be interested in being involved in future projects on *Spirocerca lupi*? .....