The evaluation of retrospective pathological lesions on spirocercosis (*Spirocerca lupi*) in dogs

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Abstract From 1998 to 2012, 42 dogs with spirocercosis referred to pathology Department of Veterinary Faculty, Tehran University. Frequency of spirocercosis was higher in October, November, December, January, February, March months. Averagely, the cases were 4.73 years old of age, so that 59.3 % of them were male. The major pathological findings were located in distal part of esophagus (57 %, $n = 24$), stomach (24 %, $n = 10$), and aorta (9.5 %, $n = 4$), respectively. In addition, 7 % ($n = 3$) were in esophagus and stomach, 2 % ($n = 1$) in esophagus and aorta, 42 % ($n = 18$) indicated pulmonary lesions with hyperemia, atelectasis, edema and pneumonia. In 35 % ($n = 15$) of cases were with hepatic lesions hyperemia and fatty change. However, 26 % ($n = 11$) cases demonstrated renal lesions with hyperemia, interstitial nephritis, and 24 % ($n = 10$) encompassed urinary bladder lesions with hyperemia and adhesive cystitis. Furthermore, sudden death occurred in 7 % ($n = 3$) as well as cachexia in 7 % ($n = 3$) cases. Some spirocercosis cases (12 %, $n = 5$) were accompanied by distemper disease, mixed mammary gland tumor (2 %, $n = 1$) and parasitic dermatitis due to demodicosis (9.5 %, $n = 4$). Presumably

some of pathological findings were related or emerged by other sort of diseases such as distemper.

Keywords Spirocercosis · Dog · Pathology findings · Pulmonary · Esophagus

Introduction

Spirocercosis is a nematode of worldwide distribution but is commonly found in tropical and subtropical areas (McGavin and Zachary 2007). The majority of reports are from Israel (Mazaki-Tovi et al. 2002), the southern United States (Dixon and McCue 1967), Brazil (Oliviera-Sequeira et al. 2002), Kenya (Wandera 1976; Brodey et al. 1977; Kagira and Kanyari 2001), India (Ramachandran et al. 1984), and South Africa (Lobetti 2000). In the West Indies, a coprological and radiographic survey in seemingly healthy owned dogs revealed a prevalence of 24 % in St. Kitts (Fisher et al. 2009). Spirocercosis induces a few pathognomonic lesions including: aortic scarring with aneurysm formation, thoracic vertebral spondylitis and caudal oesophageal nodule formation. The typical clinical signs associated with spirocercosis are related to the presence of oesophageal nodules and include regurgitation, vomiting, dysphagia and weight loss, together with non-specific signs like pyrexia (Dvir et al. 2001; Mazaki-Tovi et al. 2002). It is characterized by formation of granulomas in the thoracic esophagus and aneurysms and/or mineralized plaques in the aorta. The lesions are as a result of migration and persistent presence of the parasite in the tissues (Mazaki-Tovi et al. 2002). Aberrant migration of larvae is fairly common and granulomas of the parasite have been found in several sites including the stomach and intestines, lumbar fascia, lung, thymus, trachea, interdigital tissue, diaphragm, heart, kidney, subcutis and urinary bladder

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(Dvir et al. 2007; Vander Merwe et al. 2008). In advanced cases, lesions of spondylitis of the caudal thoracic vertebrae and neoplastic transformation to fibrosarcoma, osteosarcoma and undifferentiated sarcoma may be seen (Ranen et al. 2004). Aortic thrombosis due to *Spirocerca lupi* has also been reported (Gal et al. 2005). Esophageal lesions are the most common findings in dogs exhibiting clinical signs and the search for *S. lupi* eggs is not rewarding (Evans 1983; Fox et al. 1988; Dvir et al. 2001). There are many stray dogs, and concomitant environmental problems in this area. Little is known about the prevalence of *S. lupi* and its pathologic changes in Tehran province of Iran. This study was undertaken, in order to find the prevalence and pathologic changes due to this nematode which has veterinary and public health importance in this area.

Materials and methods

In this retrospective study carried out from 2001 to 2012, necropsy records from the Pathobiology diagnostic. Serum samples from 42 dogs naturally infected by *S. lupi*, admitted to the Companion Animal Clinic, Tehran University of Tehran, Iran, between September 1998 and June 2010, were retrospectively examined. Several of these dogs had been participated in previously published studies (Mylonakis et al. 2004, 2006). The animal population consisted of 24 (59.3 %) intact males and 18 (24.7 %) intact females, with an age ranging from 1.5 to 10.5 years (median: 3 years) and included different ages and different breeds with spirocercosis. All dogs were examined through necropsy and necessary tissue specimens were taken. In order to histopathological study, tissue samples were fixed in 10 % of neutral buffered formalin, embedded in paraffin and sectioned at 5 micron pieces. Subsequently, the sections stained with hematoxylin and eosin method.

Results

The present research demonstrated that the frequency of spirocercosis was much higher in October, November, December, January, February, March. The major pathological findings were situated in distal part of esophagus; however, there were pathological findings in stomach, aorta, lungs, liver, kidney and urinary bladder as well. Apparently, Chart 1 represents the major pathological findings which were located in distal part of esophagus (57 %, $n = 24$), in stomach (24 %, $n = 10$), and in aorta (9.5 %, $n = 4$). In addition, 7 % ($n = 3$) were recorded in esophagus and stomach and 2 % ($n = 2$) in esophagus and aorta renal lesions such as hyperemia, interstitial nephritis were found in 26 % ($n = 11$), and 24 % ($n = 10$) indicated urinary

bladder lesions with hyperemia and adhesive cystitis, although sudden death took place in 7 % ($n = 3$) of cases as well as cachexia in 7 % ($n = 3$). Overall, 12 % ($n = 5$) of spirocercosis cases were accompanied with distemper disease, whereas some were concurrent with mixed mammary gland tumor and dermatitis due to demodicosis as 2 % ($n = 1$) and 9.5 % ($n = 4$), respectively. According to Chart 2, 42 % ($n = 18$) developed pulmonary lesions such as hyperemia, atelectasis, edema, and According to Chart 3: large breed dogs appear to be predisposed. In these 42 cases, 47 % ($n = 20$) were Mixed, 4 % ($n = 2$) Boxer, 2 % ($n = 1$) German shepherd and 2 % ($n = 1$) Pointer. Different types of pneumonia, the hepatic lesions were observed in 35 % ($n = 15$) of cases with hyperemia and fatty change. Average age of cases was 4.73 years old and solely one case was less than 1 year old. 59.3 % of cases were male and 40.7 % female (Charts 1, 2, 3).

Discussion

Spirocerca lupi is a nematode parasite of carnivores affecting mainly the canine esophagus (Bailey 1972). Although *S. lupi* infection is often subclinical, various conditions associated with it such as esophageal granulomas and sarcomas, aortic aneurysms, thoracic discospondylitis or spondylosis, hypertrophic osteopathy and salivary gland necrosis have been occasionally reported (Fox et al. 1988; Schroeder and Berry 1998). When spirocercosis turns

Chart 1 Anatomic position of lesions induced by spirocercosis

Chart 2 Clinicopathological findings in dogs with spirocercosis

Chart 3 Breed distribution in dogs with spirocercosis

symptomatic, however, regurgitation, repeated attempts to swallow (odynophagia), vomiting, and melena are the most common clinical manifestations (Dvir et al. 2001; Mazaki-Tovi et al. 2002). In areas where spirocercosis does not exist, oesophageal neoplasia is extremely rare (Ridgway and Suter 1979), making spirocercosis the major cause of oesophageal neo-plasia in the dog, and therefore a potential natural model for carcinogenesis. The fact that nematodes can induce cancer is documented in human medicine as well (Mostafa et al. 1999), and the idea that spirocercosis can serve as a model for nematode-induced cancer has also been proposed by others (Herrera et al. 2005; Melendez and Suarez-Pellin 2001). *S. lupi* is a nematode with a worldwide distribution in regions with a warm climate. The majority of reports are from Greece (Mylonakis et al. 2001), Turkey, India (Kumar et al. 1981; Ramachandran et al. 1984), Pakistan (Anataraman and Krishna 1966), Israel (Mazaki-Tovi et al. 2002), the southern United States (Dixon and McCue 1967), Brazil (Oliviera-Sequeira et al. 2002), Kenya (Brodey et al. 1977) and South Africa (Lobetti 2000). The prevalence of spirocercosis of dogs in these endemic regions varies from 10 to 85 %. Based on necropsy results of stray dogs prevalence rates of 23.5 % in India (Ramachandran et al. 1984),

3–78 % in Kenya, 13 % in South Africa (Minnaar et al. 2002) and 85 % in Kenya (Brodey et al. 1977) is previously reported. In a survey on the incidence of intestinal helminths and protozoa in house-dogs in Teheran, Iran, *Toxocara canis*, *Taenia multiceps* and *S. lupi* were the most common helminths in dogs (Mirzayans et al. 1972). In another study in North of Iran, a total of 65.2 % of the dogs were infected with *S. lupi* (Sadighian 1969). *S. lupi* is a nematode with a worldwide distribution in warm climate regions. Dogs less than 1 year old has low risk of affection (MacKenzie et al. 1995; Mazaki-Tovi et al. 2002). In present study only one case under 1 year old was involved. It is believed that upon infection, long period lasts to burden the esophageal wall by the nematode and initiate a granulomatous reaction. It is demonstrated that the infected dogs below 6 months of age, have not developed esophageal lesions and clinical signs (Fox et al. 1988). Spirocercosis is more common in males than females (Pandey et al. 1987). In current study 54.5 % of cases were male; however, some other studies showed no sex predilection for infection (Wandera 1976; Fox et al. 1988). Large breed dogs appear to be predisposed, and various studies indicated the frequency of sarcoma in Hond, Seter, Pointer and Labrador breeds is dramatically high (Soulsby 1986). In this study, all cases were stray local breed dogs, which were mixed, and it was impossible to study the prevalence of disease based on different breeds. In addition, spirocercosis may cause sudden death due to aortic tissue failure, leading to aneurysm, and vascular resistant reduces in that area, hence vascular rupture in aortic wall happens. Thus, patient dies following hypovolemic shock (Oryan et al. 2008). This study was undertaken, in order to find the prevalence and pathologic changes due to this nematode which has veterinary and public health importance in this area.

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