

Diffuse and Massive Endocardial Sarcocystosis in a Lamb

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Abstract

Sarcocystosis is a critical parasitic zoonosis caused by Sarcocystis species, an intracellular protozoan parasite of the Apicomplexa phylum and one of the most prevalent parasitic diseases among wild and domestic animals all around the world. Infection in the definitive host is mainly characterized by the formation of cysts in muscle tissue. In intermediate host skeletal muscles, the diaphragm and heart are the favored locations for Sarcocystis spp. While we were examining the heart of a three-month-old dead lamb, we incidentally observed striking, white, and discrete spots, measuring 2–3 mm, that were diffusely distributed in the endocardium. Microscopically, numerous Sarcocystis were seen within cardiomyocytes and Purkinje fibers. No different pathological modifications had been found in inflamed muscle fibers or the surrounding interstitium. To the best of our knowledge, there is no case report about diffuse involvement of endocardium by Sarcocystis spp., and this unique form of sarcocystosis prompted us to place the current case on record.

Keywords: endocardial sarcocystosis, lamb, Iran

Introduction

Sarcocystosis is a significant zoonotic disease caused by Apicomplexan protozoa [1, 2]. Infections by *Sarcocystis* can result in financial losses in animal farming, threatening food safety, and a public health issue [3]. The parasites typically develop in a heteroxenous predator-prey life-cycle involving final (carnivore) and intermediate (omnivore/herbivore) hosts [4]. *Sarcocystis* infections of sheep are common all around the world. The four most important species of *Sarcocystis*; (*S. arieticanis*, *S. gigantea*, *S. medusiformis*, and *S. tenella*) have been detected in sheep [5]. Of these, *S. tenella* and *S. arieticanis* are pathogenic species that form microscopic cysts and are transmitted *via* canids, whereas *S. gigantea* and *S. medusiformis*, non-pathogenic species, form macroscopic cysts and are transmitted *via* felids [6, 7]. *S. tenella*, *S. arieticanis*, and *S. gigantea* are spread globally, including in Iran. Though, *S. medusiformis* has only been reported in European and Asian nations [8]. Sarcocystosis causes weight reduction,

untimely birth, fetus removal, and even passing in sheep; these animals are typically infected by drinking water and hunting for feed contaminated with *Sarcocystis* sporocysts [9]. In the intermediate hosts, the sarcocysts are often found in the heart, tongue, esophagus, diaphragm, skeletal muscle, and rarely in the central nervous system [10]. This study aims to report an unusual form of diffuse endocardial sarcocystosis. To the best of our knowledge, there is no similar case in the world.

Case History, Clinical Observations, and Results

A three-month-old dead lamb was referred to the Veterinary Clinic at Shahrekord University, Shahrekord, Iran, with a history of mild fever, reduced feed intake for a few days, and sudden death. An autopsy of the carcass was performed, and gross pathologic lesions were registered. The carcass showed poor body condition, anemia, and pale and icteric mucosal membranes on necropsy examination. While examining the lamb's heart, we observed striking, white, and discrete spots, measuring 2–3 mm, that were diffusely distributed in the endocardium (Figure 1).

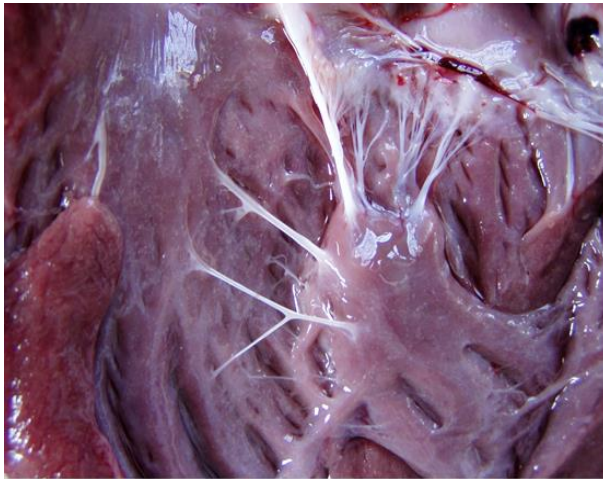


Figure 1: Note white spots in the opened left ventricle.

Mild pulmonary edema and congestion were also observed; other organs were normal. For histopathological examination of the spots on the heart, samples were taken and fixed in 10 percent buffered formalin and processed according to the standard histological techniques for paraffin embedding. Sections of 5 μm thickness were cut and stained with hematoxylin & eosin and then studied [11]. Microscopically, numerous thin-walled sarcocysts were seen within cardiomyocytes and Purkinje fibers (Figure 2).

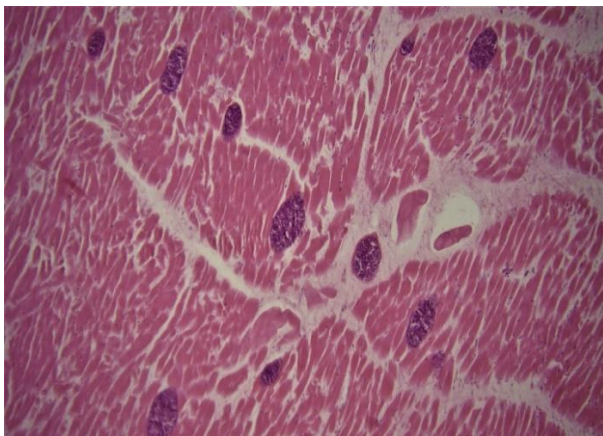


Figure 2: Severe cardiac sarcocystosis. The sections of sarcocysts are observed within cardiomyocytes (Hematoxylin and Eosin, $\times 10$).

The sarcocysts were full of basophilic bradyzoites that appeared as round, elongated, or crescent-like bodies depending on the cutting plane (Figure 3). No different pathological modifications had been found in inflamed muscle fibers or the surrounding interstitium.

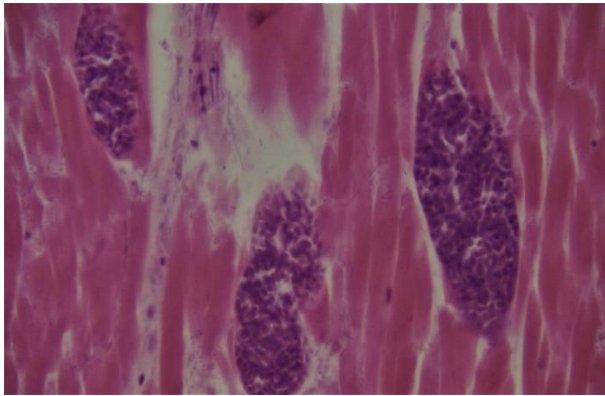


Figure 3: Higher magnification of three sarcocysts that basophilic bradyzoites are seen within the cysts (Hematoxylin and Eosin, $\times 40$).

Discussion

Muscular sarcocystosis is acquired by eating infected oocysts from the definitive host. Each oocyst releases four sporozoites, which invade the intestinal mucosa and transform into schizonts in the capillary endothelium. The first asexual reproduction occurs in the endothelium of small vessels of the mesenteric lymph nodes. Subsequent hematogenous spread results in merozoites entering the microcirculation of muscle tissue of intermediate hosts harboring sarcocysts or zoitocysts in their muscles [12]. Muscular sarcocystosis causes a broad spectrum of clinical manifestations, including myositis, myalgia, localized painful muscular swelling, low-grade fever, weakness, vasculitis, and eosinophilia [9, 13–15]. To the best of our knowledge, there is no report about diffuse involvement of endocardium by *Sarcocystis* spp. In intermediate hosts, sarcocysts are often found in the skeletal muscle, tongue, esophagus, diaphragm, and heart, and rarely in the central nervous system and gut [10, 16]. Still, these infections are not massive and diffuse. Sheep are the intermediate hosts of at least six species of *Sarcocystis*, including *S. gigantea* (syn. *S. ovifelis*), *S. tenella* (syn. *S. ovicanis*), *S. arieticanis*, *S. medusififormis*, *S. microps*, and *S. mihoensis* [17]. All species are morphologically distinguished based on their sarcocyst wall ultrastructure [18]. Electron microscopy and molecular methods must be used to identify *Sarcocystis* species [19]. In this study, *Sarcocystis* species was not identified. Still, the sarcocysts were macro-size, so it could be *S. gigantea* or *S. medusififormis* because these species produce macroscopic cysts and are transmitted by felids. In contrast, *S. arieticanis* and *S. tenella* have microscopic sarcocysts shared by canids [20].

Based on the results of this study, sarcocystosis should be taken as a differential diagnosis in cases with diffuse white-spotted endocardial lesions.

Author Contributions

Conceptualization: [Hossein Nourani]; Methodology: [Hossein Nourani/Soheil Sadr]; Formal analysis and investigation: [Hossein Nourani]; Writing - original draft preparation: [Hossein Nourani/Soheil Sadr]; Writing - review and editing: [Hossein Nourani/Soheil Sadr]; Supervision: [Hossein Nourani]

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Data Availability

The data sets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Compliance with Ethical Standards

Ethical approval: All applicable international, national, and/or institutional guidelines for the care and use of animals were followed.

Consent to Participate

Not applicable

Consent for Publication

Not applicable

Conflicts of Interest

The authors declare no conflict of interest.

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References

1. Lingappa HA, Krishnamurthy A, Puttaveerachary AK, et al. Foray of Cytologically Diagnosed Intramuscular Sarcocystosis- A Rarity. *J Clin Diagn Res.* 2015;9(5): ED11–ED12.
2. Mavi SA, Teimouri A, Mohebbali M, et al. *Sarcocystis* Infection in Beef and Industrial Raw Beef Burgers from Butcheries and Retail Stores: A Molecular Microscopic Study. *Heliyon.* 2020;6(6):e04171.
3. Ingole RS, Sonwane SR, Hedau M, et al. Sarcocystosis with thin Wall Cyst in Cardiac Muscle of Bullock: A Case Report. *Ind J Vet Sci Biotech.* 2018;13(4):72-73.
4. Bittencourt MV, Meneses ID, Ribeiro-Andrade M, et al. *Sarcocystis* spp. in sheep and goats: frequency of infection and species identification by morphological, ultrastructural, and molecular tests in Bahia, Brazil. *Parasitol Res.* 2016;115(4):1683-89.
5. Mirzaei M, Rezaei H. The Role of Sheep in the Epidemiology of *Sarcocystis* spp. in Tabriz Area Northwest of Iran. *J Parasit Dis.* 2016;40(2):285-88.
6. Adriana T, Mircean V, Blaga R, et al. Epidemiology and Etiology in Sheep Sarcocystosis. *Bull UASVM Vet Med.* 2008;65(2):49-54.
7. Beyazit A, Yazicioğlu Ö, Karaer Z. The Prevalence of Ovine *Sarcocystis* Species in Izmir Province. *Ankara Üniv Vet Fak Derg.* 2007;54(2):111-16.
8. Collins GH, Atkinson E, Charleston WA. Studies on *Sarcocystis* Species III: The Macrocystic Species of Sheep. *N Z Vet J.* 1979;27(10):204-06.
9. Fayer R. *Sarcocystis* spp. in Human Infections. *Clin Microbiol Rev.* 2004;17(4):894-902.

10. Prakas P, Butkauskas D. Protozoan Parasites from Genus *Sarcocystis* and their Investigations in Lithuania. *Ekologija*. 2012;58(1):45-58.
11. Luna LG. Manual of histologic staining methods of the Armed Forces Institute of Pathology. 3rd ed New York. McGraw-Hill. 1986.
12. Wong KT, Pathmanathan R. High Prevalence of Human Skeletal Muscle Sarcocystosis in South-East Asia. *Trans. R. Soc. Trop. Med. Hyg.* 1992;86(6):631-32.
13. Pamphlett R, O'Donoghue P. *Sarcocystis* Infection of Human Muscle. *Aust N Z J Med.* 1990;20(5):705-07.
14. Larbcharoensub N, Cheewaruangroj W, Nitiyanant P. Laryngeal Sarcocystosis Accompanying Laryngeal Squamous Cell Carcinoma: Case Report and Literature Review. *Southeast Asian J Trop Med Public Health.* 2011;42(5):1072-6.
15. Bunyaratvej S, Unpunyo P, Pongtippan A. The *Sarcocystis*-cyst Containing Beef and Pork as the Sources of Natural Intestinal Sarcocystosis in Thai People. *J Med Assoc Thai.* 2007;90(10):2128-35.
16. Dong H, Su R, Wang Y, et al. *Sarcocystis* Species in Wild and Domestic Sheep (*Ovis Ammon* and *Ovis Aries*) from China. *BMC Vet Res.* 2018;14(1):1-7.
17. Hu JJ, Huang S, Wen T, et al. *Sarcocystis* spp. in Domestic Sheep in Kunming City, China: Prevalence, Morphology, and Molecular Characteristics. *Parasite.* 2017;24:30.
18. Metwally DM, Al-Damigh MA, Al-Turaiki IM, et al. Molecular Characterization of *Sarcocystis* Species Isolated from Sheep and Goats in Riyadh, Saudi Arabia. *Animals.* 2019;9(5):256.
19. Al Quraishy S, Morsy K, Bashtar AR, et al. *Sarcocystis* *Arieticanis* (Apicomplexa: Sarcocystidae) Infecting the Heart Muscles of the Domestic Sheep, *Ovis Aries* (Artiodactyla: Bovidae), from K. S. A. on the Basis of Light and Electron Microscopic Data. *Parasitol Res.* 2014;113(10):3823-31.
20. Dubey JP. *Toxoplasmosis of Animals and Humans*. 2nd ed. Florida. CRC Press; 2016.