

SARCOSPORIDIA IN THE MYOCARDIUM OF
A PREMATURE INFANT *

REPORT OF A CASE

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REVIEW OF LITERATURE

Scott,¹ in a critical review of the sarcosporidia, summarizes our present knowledge of this group of parasites. The sarcosporidia are protozoa of unclassified position, found almost exclusively in the striated muscles of birds, reptiles and mammals, including man. Miescher² in 1843 first described the parasite in the muscles of the mouse. The genus *Sarcocystis* was created in 1882 by Lankester.³ Since then at least 43 species have been described from an almost equal number of hosts. Whether these are all true species or whether only one or a limited number of species exists is not known. Probably there are several species, since some are transmitted to other hosts with difficulty. Darling⁴ and others, however, have shown that at least two hosts may be parasitized by the same species, although in the transfer to a new host certain morphological changes occur in the parasite.

In the opinion of most investigators natural infection is through the digestive tract by means of contaminated food, although the exact details are not known. The first successful transmission by feeding was obtained by Theobald Smith⁵ in 1901, who was able to infect 63.6 per cent of gray and white mice by feeding them muscle from previously infected animals (mice). Nègre⁶ and Crawley⁷ have both shown that feces of infected mice are capable of causing the disease when ingested by other mice. The infective stage in this instance is a spore, resistant to heat and drying. Erdmann⁸ stated that in the intestinal tract the spore liberates a small ameboid form which penetrates the epithelium. It then multiplies within the various portions of the gut wall and surrounding lymphatics to ap-

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pear finally 28 to 30 days later in the striated muscles. The various stages within the striated muscle fibers are known largely from the works of Theobald Smith,⁵ Scott¹ and others.

HUMAN CASES

The first probable instance of infection with sarcosporidia in man was reported by Lindemann⁹ in 1868, as occurring in the heart valves and myocardium. These were interpreted as gregarines but Fantham, Stevens and Theobald¹⁰ consider them sarcosporidia. The latter authors doubt the authenticity of Rosenberg's case of sarcosporidia,¹¹ occurring in the mitral papillary muscles in the heart of a woman 40 years of age, dying with pleuritis and endocarditis. Fantham, Stevens and Theobald also cite 2 cases reported by Koch in 1887, and by Vuillemin in 1894, respectively. The location of the parasite in the case reported by Koch was not stated, while in the case reported by Vuillemin the parasite occurred in the voluntary muscles of a patient dying of tuberculosis. Cone's report¹² in 1922 of the parasites associated with yeasts in multiple bone cysts is a disputed case. The undoubted cases occurring in the human are best summarized in the accompanying table.

It is the purpose of this paper to report the incidental finding of a sarcosporidial infection in the myocardium of a premature infant.

REPORT OF CASE

Clinical History: A 10 day old, white, female infant, which was born 2 months prematurely, was brought to the hospital with a history of having had loose stools since birth and ulcerations of the buttocks for 2 days. Since birth it had been fed by a medicine dropper on a very weak, whole milk, dextrin-maltose and water formula. Physical examination revealed emaciation, and ulceration of the buttocks. On the 6th day after admission an omphalitis became apparent, with discharge of thick yellow purulent material from the umbilicus. The latter, along with the diarrhea, became progressively worse and the baby died 16 days after admission with signs of a terminal bronchopneumonia and cardiac dilatation.

POSTMORTEM EXAMINATION

Postmortem examination (A-32-163) revealed a poorly nourished premature infant measuring 40 cm. in length. Purulent exudate filled the proximal end of the umbilical vein. Multiple abscesses yielding *Staphylococcus aureus* and *Bacillus coli* occurred in the cortex

of both cerebral hemispheres, and to a less extent throughout the brain. The lungs showed a bilateral terminal bronchopneumonia with atelectasis and compensatory emphysema. Microscopic foci of necrosis were found in the myocardium, liver and spinal cord. Small

TABLE I
*Undoubted Cases of Sarcosporidiosis**

Author	Year	Age	Organ
Kartulis ¹³	1893	7rs. Adult	Abdominal muscles
Baraban and Saint-Remy ¹⁴	1894	Adult	Laryngeal muscles
Darling ¹⁵	1909	20	Biceps
Darling ¹⁶	1920	30	Tongue
Manifold ¹⁷	1924	Adult	Myocardium
Lambert ¹⁸	1927	32	Myocardium
** Vasudevan ¹⁹	1927	Adult	Pectoral muscles
** Naidu ²⁰	1928	55	Pectoral muscles
Bonne and Soewandi ²¹	1929	Adult	Cavernous hemangioma
Hewitt ²²	1933	Adult	Myocardium

* An additional human case of sarcosporidiosis, reported by Price, R. M., in the *J. Kansas M. Soc.*, 34, 132-135, has come to my attention since this paper was written.

** These two possibly represent reports of the same case.

TABLE II
Comparative Measurements of Parasite in μ made by Various Authors

Author	Cysts		Spores	
	Length	Diameter	Length	Diameter
Baraban and Saint-Remy ¹⁴	150-1600	77-168
Darling (Case 1) ¹⁵	84	27	4.0	1.0
Manifold ¹⁷	37-57	26-45	10.9	1.6
Lambert ¹⁸	82	31	7.2	2-2.5
Vasudevan ¹⁹	5.3 cm.	322	3.3	1.6
Naidu ²⁰	195-240	...	12.7	4.4
Hewitt ²²	190	50	5.0	2.0
Hertig	11.2-45	7.4-13	3.7	1.8

foci of purulent meningitis were found over the cerebral cortex, as well as a slight acute inflammatory reaction throughout the brain substance. The lungs, in addition to bronchopneumonia, gave microscopic evidence of aspirated amniotic sac contents. The pancreas showed slight, diffuse, acute inflammation with inspissation

of secretion in the finer ducts. Moderate numbers of sarcosporidia, including many in the early stages, were found microscopically in the myocardium. In no instance was there cellular infiltration in response to the presence of the parasite, although independent foci of necrosis were found. Examination of other striated muscle (diaphragm) revealed no parasites.

DESCRIPTION OF PARASITE

The lateral portion of the left ventricle, taken during a routine postmortem examination, was the source of the material. The parasites were identified by Professor S. B. Wolbach in studying the microscopic preparations. Sections stained by eosin and methylene blue, from material fixed in Zenker's fluid, gave the clearest histological detail, although hematoxylin and eosin, Giemsa, iron hematoxylin and Foot's reticulum stains were also made. The parasites were moderately numerous throughout the myocardium, averaging 1 per low power field. They lay within the myocardial fibers as sharply demarcated, oval bodies varying from 7.4 by 11.2 μ to 13 by 45 μ , with the long axis parallel to that of the surrounding fiber. The parasites, as seen in individual sections, were composed of closely packed, oval or spindle-shaped spores varying from 6 to 100 in number. No definite wall could be seen in the forms possessing less than 13 spores, although beyond that stage a hyaline wall or capsule averaging less than 1 μ in thickness was present. Occasionally, due to artifact, the cyst wall was pulled away from the surrounding muscle fiber and thus could readily be seen. No septa were seen in any of the forms studied. Slightly over 30 per cent of the parasites in this preparation contained from 6 to 13 spores, with the higher numbers predominating slightly, although approximately 10 per cent contained between 50 and 100 spores. The spores averaged 1.8 by 3.7 μ in size. The basophilic nuclear mass was irregular and occupied an eccentric position, often filling one end of the spore. No nuclear membrane could be made out, although the spore membrane was quite definite. Very rarely a suggestion of a minute extranuclear basophilic mass could be seen at the end of the spore opposite the nucleus. At no place in the myocardium was there any inflammatory response to the parasites. The remainder of the myocardium was essentially negative, except for foci of necrosis associated with the staphylococcus septicemia.

DISCUSSION

This case is of interest because of its occurrence in a premature infant and the early stage of development of the sarcosporidial cysts. Even in experimental studies it is uncommon to find sarcocysts with fewer than 8 spores, although moderate numbers of the forms studied here were of this type. The method of infection is unknown. However, since the infant was 26 days of age at death the infection could have been contracted shortly after birth, because the stage of development coincides very well with that seen in animals 26 to 29 days after ingestion of the infective spores. Theobald Smith²³ and Scott¹ state that intra-uterine infections do not occur in the lower animals, although this method cannot be ruled out in this case. Since mouse feces are known to be infective and since indigenous mouse infections may be common, this might have been a source of infection.

SUMMARY

A case of sarcosporidiosis involving the myocardium of a 26 day old premature infant is reported. This was an incidental finding in the routine microscopic study of postmortem material. The mode of entrance of the parasites into the body cannot be stated with certainty.

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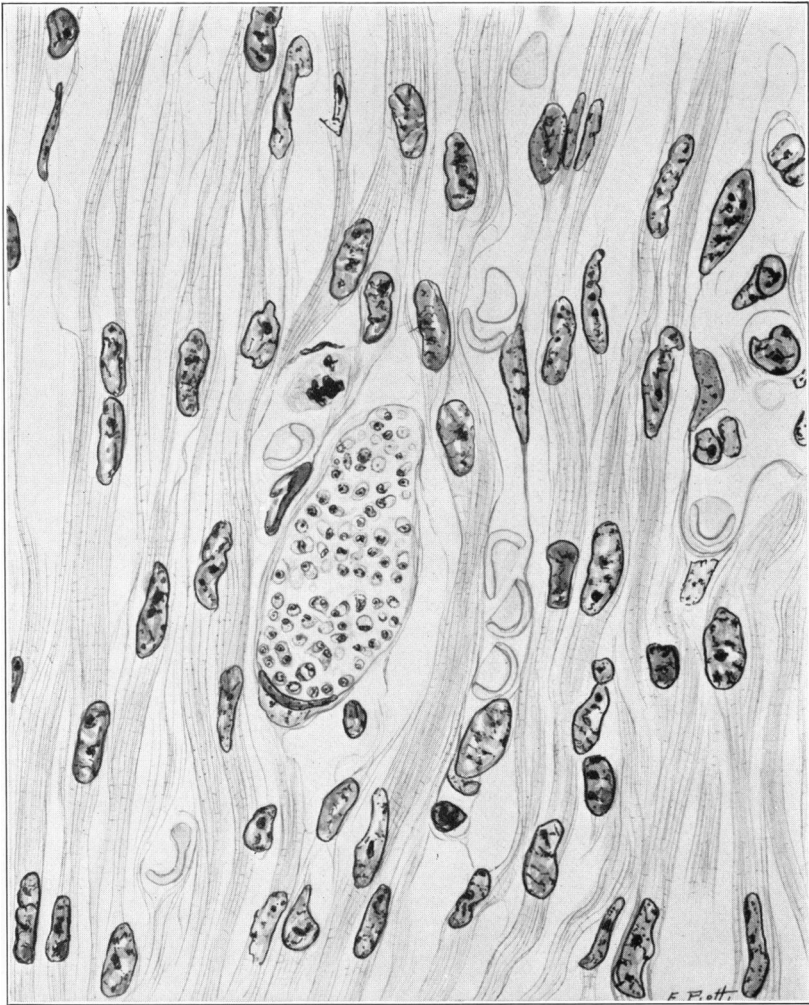
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DESCRIPTION OF PLATE

PLATE 107

FIG. 1. Sarcosporidial cyst in the myocardium of a premature infant. $\times 1300$.



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