

SARCOCYSTIS AND SARCOCYSTOSIS IN INDIA

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Abstract. Sarcocystosis, in recent times has been recognized as a disease in animals and man. With the attention of scientists on this problem all over the world, work on prevalence, morphology, life cycle, transmission, pathogenesis, immunology, biochemistry and prophylaxis of this parasite has been initiated in domestic animals in India.

INTRODUCTION

Since the discovery of *Sarcocystis* cysts in the striated muscles of mice by Miescher in 1834, this protozoan parasite has been described in domestic and wild animals throughout the world. The earlier observations were based on the morphology of the sarcocysts. These were also known as Miescher's tube and recovered mainly from the striated muscles, rarely in heart, and brain of the hosts. Thereafter, was a big gap in the information on *Sarcocystis* and in spite of its wider prevalence in the animals, the disease was considered to be unimportant. This situation persisted until 1972, when a major break-through, by the way of the discovery of pattern of life cycle and mode of transmission of *Sarcocystis* was achieved (Fayer, 1972; Heydorn and Rommel, 1972a, b). It became clear for the first time that this parasite has an obligatory two host life cycle having pre-predator relationships. Herbivores and omnivores act as the intermediate hosts, acquire infection by ingesting the sporocysts which are shed in the feces of carnivores (dogs and cats), known to act as definitive hosts. On the other hand definitive hosts become infected with *Sarcocystis* by ingesting the sarcocysts in the muscles of intermediate hosts.

A vast literature has been accumulated on different aspects of *Sarcocystis* in recent years and a number of excellent reviews have been published (Dubey, 1976; Levine, 1977; Mehlhorn and Heydorn, 1978; Stalhein *et al*, 1980; Dubey,

1983; Tadros and Laarman, 1976; Dubey *et al*, 1989). These well written reviews have provided information on various aspects of *Sarcocystis*, ie, number of species, ultrastructure, life cycle, developmental stages, pathogenesis, biochemistry, immunology, treatment and control. The zoonotic significance has been recognized with the establishment of two species, ie, *S. hominis* (cattle origin) and *S. suis* (pig origin) as cause of disease in humans.

COMMENTS AND DISCUSSION

Prevalence

In India, statewide prevalences of sarcocystosis in domestic animals, have been determined and a variety of species of *Sarcocystis* have been found in cattle, buffaloes, sheep, goats, horses and pigs have been reported from various parts of the country (Table 1) (Shah, 1983). The distribution of *Sarcocystis* is recorded in various organs, ie, heart, oesophagus, diaphragm, tongue, ocular, thigh and tail muscles.

Definitive hosts

Dogs and cats are established as the main definitive hosts of *Sarcocystis* in domestic animals. Man is acting as the definitive host for *S. suis* and *S. hominis* but clinical disease in humans has not been reported in the country. Stray dogs play a main role in the transmission of the infection, as they can be easily seen eating meat offal outside the slaughter houses.

Table 1

A list of prevalent species of *Sarcocystis* in animals with their final host in India.

Sr No	Species	Intermediate host	Final host
1	<i>S. cruzi</i>	Cattle	Dog
2	<i>S. hirsuta</i>	Cattle	Cat
3	<i>S. hominis</i>	Cattle	Man (?)
4	<i>S. fusiformis</i>	Buffalo	Cat
5	<i>S. levinei</i>	Buffalo	Dog
6	<i>S. capracanis</i>	Goat	Dog
7	<i>S. hircicanis</i>	Goat	Dog
8	<i>S. ovis</i>	Sheep	Dog
9	<i>S. arieticanis</i>	Sheep	Dog
10	<i>S. miescheriana</i>	Pig	Dog
11	<i>S. suihominis</i>	Pig	Man (?)
12	<i>S. equicanis</i>	Horse	Dog
13	<i>Sarcocystis</i> sp.	Man	—

Experimental infection

Chauhan *et al* (1978) described the gametogenic development of Bubaline *Sarcocystis fusiformis* in pups in an experimental study. It appeared that oesophageal tissues fed to pups were infected with *S. fusiformis* (Macro) and *S. levinei* sarcocysts. Later speciation was done by various workers based upon the morphology of cyst, prepatent period in final host, and size of sporocysts in cattle, buffalos, sheep, goat, horse and pigs.

There are reports of experimentally induced sarcocystosis in animals (Pethkar and Shah, 1982; Juyal *et al*, 1989; Saleque, 1990; Solanki, 1988). There is no cross transmission of *Sarcocystis* sp., as they are strictly host specific.

Biochemistry

Some information is available on the biochemistry of sarcocysts of *S. fusiformis*. The protein and phospholipids constitute the major portion in the sarcocyst (Chaudhry *et al*, 1984). The glycogen content and activities of alkaline and acid phosphatases of *S. fusiformis* in the Indian water buffalos have been determined bio-

chemically and histochemically (Chaudhry *et al*, 1986).

Immunological studies

Little has been done on the immunology of *Sarcocystis* in India. Few immunodiagnostic tests ie double immuno-diffusion, radial-immuno diffusion and ELISA have been tried in experiments to detect antibodies against *S. fusiformis* in buffalos (Juyal *et al*, 1990a; Saleque, 1990). A cell mediated immune response (CMI) has been demonstrated in experimentally infected kids against *S. capracanis* (Juyal *et al*, 1990b).

Zoonotic importance

Sarcocystis cysts have been reported in two clinical reports in human beings at Lucknow (Uttar Pradesh) (Gupta *et al*, 1973; Aggarwal and Srivastava, 1983).

It is established that *S. suihominis* (pig origin) and *S. hominis* (bovine origin) cause digestive disturbances and at times life threatening symptoms in human beings who eat undercooked meat of these animals (Shah, 1984; Juyal and Bhatia, 1989). A possibility of cases of human

Sarcocystis cannot be ruled out in India due to the favorable conditions and also the presence of zoonotic species of *Sarcocystis* as reported by Shah (1987), Solanki (1989) and Saleque (1990).

The prevalence of *S. suis* is much more compared to *S. miescheriana* as reported by Shah (1990). It indicates that human exposure to *S. suis* was more frequent and wide spread as this is also associated with the human activities that might be facilitating a regular flow of infections between humans and pigs. The feeding habit in general is to eat the meat after proper cooking. But there is a possibility of infection if meat is not properly cooked. Moreover, there are other situations prevailing where the infection can be transmitted. It is known that pigs are mostly reared by the economically depressed class which mainly live under unhygienic and unsanitary conditions. Furthermore, the slaughtering of pigs is not held in regular abattoirs. They are slaughtered generally in the backyard of the slums/houses of the owners in many parts of the country. It has been my observation during the slaughter of a pig, small children do the job of sharpening the knife, holding the pigs and holding the bucket, etc. So after the slaughter or during the slaughter the children are rewarded with small pieces of ear, tail and other parts of the tissues which they consume after a little bit of roasting in the fire or they eat it raw. It is one of the principal sources of infection to man.

Another contributing factor is the manner in which the preparations of sausages are done. The general practice is that the tissues from oesophagus, tail, lung, etc., of slaughtered pigs is minced and are filled in the intestine of the same pig after removing the excreta and giving it a dip in warm water. These are consumed by the people in the same locality and also nearby the country liquor shop where they are sold indiscriminately. This process may not destroy the sarcocysts.

Control

Effective steps should be taken to control this infection in animals and man.

1. Avoid exposure of dogs and cats to raw meat and offals.

2. Avoid contamination of feed and water with the sporocysts.

3. Heating of the meat (70° C for 15 minutes) (Saleque *et al.*, 1990).

Research work needed

1. There is a need for exhaustive surveys to determine the magnitude of the disease in animals and man.

2. Definite information on economic losses incurred should be known.

3. Medical-veterinary coordination is required for research work as well as to educate the people on personal hygiene and public health importance of the disease.

4. There is a need for ante-mortem diagnosis of the infection in the food animals serologically or otherwise.

5. To ascertain the immunological status.

6. Devise proper methods of control.

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