**Sarcocystis spp. in Human Infections**

**Aims:** Intestinal *Sarcocystis* presents little health hazard to humans, cause acute diarrhea & low grade fever; The primary importance to humans of sarcocystosis is the loss of infected birds for food; the unesthetic appearance of parasitized muscle may prompt hunters to discard the carcass.

while muscular *sarcocystis* cause persistent myalgia and subcutaneous nodules.

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**Sarcocystis species**

Is a genus of *protozoa* which are heterogeneous coccidia with an obligate two-host cycle involving herbivorous animals as an intermediate (I.h.) and carnivorous animals as definitive host (d.h.). species in this genus infect reptiles, birds and mammals. *Sarcocystis* was first reported in 1843 by Miescher as white threadlike cysts in striated muscles of a house mouse, without a scientific name. For the following 20 years, the parasite was simply referred to as Miescher's tubules. The name is derived from Greek: *sarx* = flesh and *kystis* = bladder.

**In man Sarcocystis produces two distinct clinical types:**

1. **Intestinal sarcocystosis:** is caused by two known species namely *S. hominis* (from undercooked beef) or *S. suihominis* (from undercooked pork). humans and some primates are definitive hosts for *Sarcocystis hominis* and *S. suihominis* after eating raw meat from cattle and pigs, respectively.

2. **Muscular sarcocystosis:** The invasive forms were considered to belong to a single species - *S. lindemanni* where man act as (I.h.),while dog and cats act as are(d.h.). Man acquires infection by ingestion of drinks or foods contaminated with faeces of cat and dog containing the sporocysts.
Morphology: There are three distinct stages of this parasite:

1. **Oocyst**: contains a pair of sporocysts, the wall of oocysts rupture and the sporocysts are passed in the feces of human.

   ![Sarcocystis mature oocyst; Sporulated oocysts of Sarcocystis sp. in a wet mount viewed under UV microscopy, magnification 400x.](image)

2. **Sporocyst**: It is oval shaped, each sprocyst contains four banana-shaped sporozoites. Mature sporocysts are infective stage to other susceptible hosts.

3. **Sarcocyst or Miescher's tube**: This is spindle shaped structure with thick striated wall (are present in the bovine skeletal muscles). In the middle of the Miescher's tube there are large numbers of merozoites called *bradyzoites*, which are fusiform, elongated & cylindrical. The tube is divided into many compartment by septa. While in the periphery, there is usually a rounded fully developed cells called *metrocystes*.

   ![Miescher’s tube containing merozoites](image)

**Route of infection:**

**Intestinal Sarcocystosis**: Eating raw or undercooked beef and pork containing mature sarcocysts of *S. hominis* and *S. suihominis*, respectively, has resulted in humans acquiring intestinal sarcocystosis.

**Muscular Sarcocystosis**: *S. landimanni* causing muscular infection in humans in such cases, humans harbor the sarcocyst stage and therefore are the intermediate host, humans most probably become infected by eating food or drinking water contaminated with feces from of cat and dog containing the sporocysts.
**Symptoms:**

**Intestinal Sarcocystosis:** Signs that appeared 3 to 6 h after eating the beef included nausea, stomach ache, and diarrhea; these were transient and lasted about 36 h. In a second series symptoms - abdominal pain, distension, watery diarrhea and eosinophilia - appeared at 1 week and resolved after 3 weeks.

**Muscular Sarcocystosis:** painful swellings about 1 to 2 cm in diameter on extremities, subcutaneous masses associated with overlying erythema and subsided spontaneously about 2 weeks later.

**Life cycle:** **Intestinal Sarcocystosis:** After oocysts or free sporocysts from the definitive host are ingested by a susceptible intermediate host(I.h.), they pass to the small intestine, Motile sporozoites migrate through the gut epithelium, eventually entering endothelial cells in small arteries throughout the body. Here they undergo the first of four asexual generations (called schizogony or merogony), producing numerous merozoites (cells morphologically similar to sporozoites and bradyzoites) about 15 to 16 days after ingestion of sporocysts. Subsequent generations of merozoites develop downstream in the direction of blood flow to arterioles, capillaries, venules, and veins throughout the body and then develop the final asexual generation in muscles. Merozoites from this generation enter muscle cells, round up to form metrocytes (mother cells), and initiate sarcocyst formation. Sarcocysts begin as unicellular bodies containing a single metrocyte. Through repeated asexual multiplication, numerous metrocytes accumulate and the sarcocyst increases in size. As sarcocysts mature, the small, rounded, noninfectious metrocytes give rise to infectious, crescent-shaped bodies called bradyzoites (Greek: brady = slow, zoite = small animal). Maturation varies with each species and takes 2 months or more until bradyzoites form and sarcocysts become infectious for the definitive host. Sarcocysts can persist for months or years. Sarcocysts are found in virtually all striated muscles of the animal body including the tongue, esophagus, and diaphragm, as well as cardiac muscle and, to a lesser extent, smooth muscle.
In case of *S. landimann* is similar to that of life cycle of intestinal sarcocystosis, but different that asexual cycle is in the muscle of man (I.h.), while the sexual cycle is in the unknown final host & may be cat or dog (d.h.). Human has a blind end so the cycle will stop.

**Diagnosis : Intestinal sarcocystosis** : diagnoses in human is based on symptoms and a history of recently having eaten raw or undercooked meat. Definitive diagnosis, requiring identification of sporocysts in feces. Sporocysts can be seen by bright-field microscopy in a fecal flotation wet mount just beneath the cover slip. *Sarcocystis* can be detected in (beef or pork meat) by direct observation of
macroscopic sarcocysts or microscopic examination of histologic sections. Also, serological tests such as IHA, IFA, and ELISA have been found useful in the diagnosis.

**Intramuscular sarcocystosis** would be suspected based on various combinations of criteria including persistent myalgia, episodic weakness, subcutaneous nodules, dermatomyositis, eosinophilia, and elevated muscle creatinine kinase levels. *Sarcocystis* sarcocysts in muscle biopsy or autopsy specimens can be identified by microscopic examination of histologic sections stained with hematoxylin and eosin. Sporocysts are not excreted in the feces.

**Prevention:**

**Intestinal sarcocystosis** can be prevented by:

1. Thoroughly cooking or freezing meat to kill bradyzoites in the sarcocysts. Sarcocysts in pig muscles were rendered noninfectious for puppies after cooking meat at 60, 70, and 100°C for 20, 15, and 5 min, respectively.
2. To prevent infection of food animals, they must be prevented from ingesting the sporocyst stage from human feces in contaminated water, feed, and bedding.

**Muscular sarcocystosis:**

1. Prevent humans from becoming infected as intermediate hosts, ingestion of sporocysts must be prevented.
2. Boiling is the best method to ensure disinfection of water, contaminated foods
3. Washed or cooked before being eaten.