

LUNGWORM DISEASE (*Angiostrongylus cantonensis*) IN THE BROWN RAT (*Rattus norvegicus*) (CASE 548.37)

CASE HISTORY

Pest species (*Rattus norvegicus*) collected from zoo grounds for health surveillance during 1999.

GROSS PATHOLOGY

External examination: The pelage and teeth are in excellent condition. Small numbers of mites are evident within the fur.

Internal examination: There are multiple fine, white serpiginous tracts throughout the hepatic parenchyma. A squash preparation of the affected parenchyma revealed bipolar operculate, oval ova. Adult tapeworms are present within the jejunum. The stomach contains many large nematodes. A single nematode larva is evident within the outflow tract of the right ventricle. Eighty-two nematodes were removed from the pulmonary arteries. The pulmonary artery bears multiple linear, white, raised endothelial nodules. The pulmonary parenchyma is diffusely hepatized and friable. The pulmonary artery of the left caudal lung lobe is segmentally tortuous and distended, segmentally bulging out along the dorsal pleural surface.

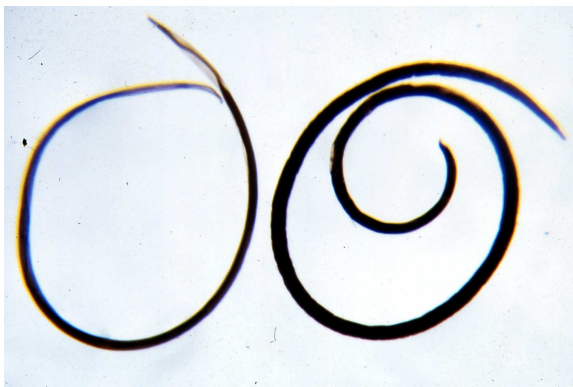


Fig 1. Adult male (left) and female (right) *Angiostrongylus cantonensis* nematodes.

HISTOPATHOLOGY

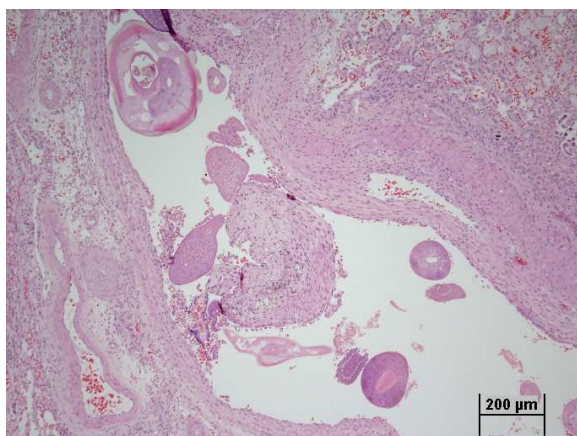
Lesions are not evident within the intestine, and pancreas.

Myocardium: The myocardial interstitium is moderately prominent due to the presence of patchy interstitial fibrosis and widespread mononuclear cell clusters. Mononuclear cell clusters are also scattered throughout the endocardium and epicardium. Scattered myocytes have hypereosinophilic cytoplasm and exhibit karyomegaly. There is a single focus of myocardial necrosis, where the myocytes are replaced with eosinophilic amorphous material. Fibroblasts and macrophages are prominent within this focus. Lymphocytes, plasma cells and Mott cells are scattered throughout the margin of the focus of necrosis.

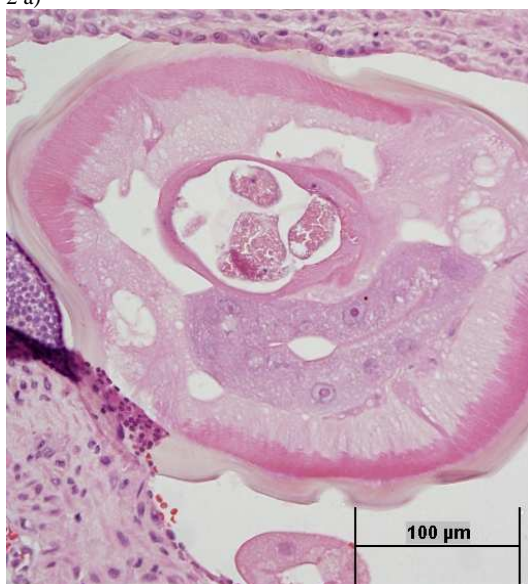
Lung: Cross sections of adult nematodes are present within the lumina of several pulmonary arteries (Fig 2). Pulmonary arteries diffusely have markedly thickened media. This thickening is primarily due to smooth muscle hyperplasia. Many pulmonary arteries have an intima thickened by the presence of mononuclear cells, multinucleate giant cells, and eosinophilic amorphous debris. The normal pulmonary parenchyma has largely been replaced due to the presence of multifocally extensive and coalescing granulomata (Fig 3). Granulomata are multiloculated, containing multiple oval embryonated or larvated ova, surrounded multinucleate giant cells and mature connective tissue. Free larvae are evident within multifocal alveoli and bronchi. Granulomata are also evident as thrombi within multifocal arteries. Occasionally, similar focal granulomata containing ova or larvae are evident within the arterial walls. Alveoli contain variable quantities of erythrocytes, and proteinaceous fluid, and alveolar macrophages. Alveolar macrophages contain moderate quantities of brown cytoplasmic pigment.

Liver: The hepatic parenchyma is multifocally and extensively replaced with clusters of oval, bipolar operculate ova. These ova have thick walls that bear radial striations. Many of these clusters are evident without any associated inflammation, however, there are also multiple inflammatory tracts that occur around or adjacent to cross-sections of adult nematodes. These inflammatory tracts are composed of central eosinophilic material that is surrounded with macrophages that have abundant foamy cytoplasm, and several cell layers of

connective tissue. Kupffer cells contain moderate quantities of waxy brown cytoplasmic pigment.

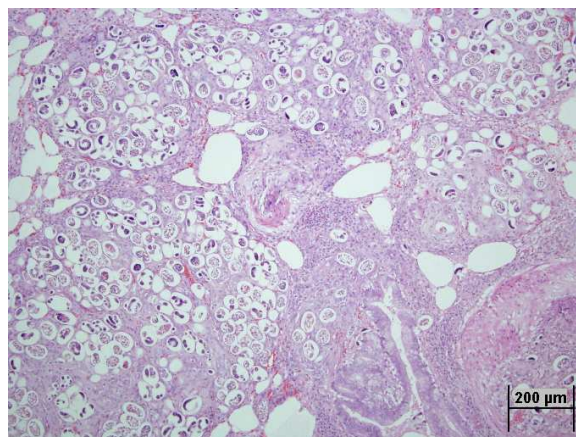


2 a)

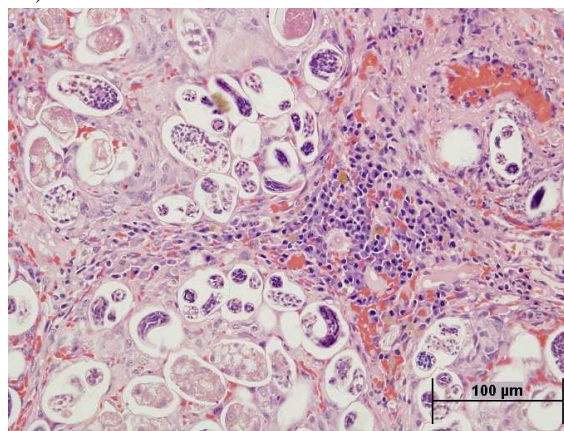


2 b)

Fig 2. Lung, pulmonary vessels H & E a) 100x, b) 400x



3 a)



3 b)

Fig 3. Sections of lung H & E a) 100x, b) 400x

Spleen: The splenic parenchyma contains scattered lymphoid follicles. The red pulp contains many polymorphonuclear

cells.

Stomach: There are multifocally extensive regions of mucosal ulceration. The ulcer beds are composed of a cellular exudate and eosinophilic amorphous material. The connective tissue underlying the ulcerated foci contains an intense cellular infiltrate that penetrates deep into the submucosa. The cellular exudate and infiltrates are composed of variable quantities of eosinophils, neutrophils, lymphocytes and plasma cells.

Small intestine: The intestinal lamina propria contains a mild infiltrate composed of lymphocytes, plasma cells and eosinophils.

Kidney: The renal interstitium contains a mild infiltrate of lymphocytes, and plasma cells. Scattered renal tubules contain luminal eosinophilic amorphous debris.

Lymph node: The node is very small. Lymph aggregates contain abundant pyknotic and karyorrhectic cell debris.

Brain: The meninges multifocally contain small aggregates of lymphocytes, plasma cells and reticuloendothelial cells that contain cytoplasmic brown pigment. There are several small foci where the meninges may contain an increased quantity of connective tissue. The meninges also contain a focal object that has a basophilic capsule and central eosinophilic amorphous material. This object is surrounded by a thin layer of connective tissue, and has the appearance of a degenerate nematode.

PARASITOLOGY

Cardiovascular and respiratory parasite identified as *Angiostrongylus cantonensis* by Dr. John Walker.

BACTERIOLOGY

Contents of small & large intestine: *Yersinia enterocolitica*

MORPHOLOGICAL DIAGNOSIS

Moderate non-suppurative myocarditis and focal subacute necrosis - *Angiostrongylus cantonensis*

Marked diffuse chronic granulomatous interstitial pneumonia and vasculitis - *Angiostrongylus cantonensis*

Gastric nematodiasis

Intestinal cestodiasis

Hepatic nematodiasis - *Capillaria* species

COMMENTS

The rat was suffering from severe diffuse granulomatous pneumonia resulting from a large burden of the rat lung worm *Angiostrongylus cantonensis*. The medial thickening of arteries is consistent with increased pulmonary hypertension reflecting clinical "heartworm disease". The heavy burden of nematodes within the pulmonary arteries is remarkable. Considering that experimental oral inoculation with more than 12 *Angiostrongylus cantonensis* larvae is most often fatal, this large parasite burden must have occurred as a result of repeated exposure to larvae over a prolonged period to allow the rats cardiovascular system time to adjust to reduced pulmonary blood flow. The small foci of inflammation within the meninges most likely represent migration of *Angiostrongylus cantonensis* larvae.

Most often *Angiostrongylus cantonensis* infection in rats is a subclinical infection. Nematode larvae are coughed up and shed in the faeces to then be ingested by snails and slugs, which act as intermediate hosts. Rats and other animals become infected with this lungworm by ingesting infected intermediate hosts. In hosts other than rats, the nematode travels through the spinal cord and brain rather than transiently migrating through the pia mater and then returning to the pulmonary arteries (as occurs in the rat).

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Case interpretation: Karrie Rose. Case construction: Damien Higgins

The Australian Registry
of **Wildlife Health**

