**Angiostrongylus cantonensis** Eosinophilic Meningitis

Francis D. Pien, MD, MPH;* and Brian C. Pien, MS*

**ABSTRACT**

In the past 50 years, *Angiostrongylus cantonensis*, the most common cause of eosinophilic meningitis, has spread from Southeast Asia to the South Pacific, Africa, India, the Caribbean, and recently, to Australia and North America, mainly carried by cargo ship rats. Humans are accidental, "dead-end" hosts infected by eating larvae from snails, slugs, or contaminated, uncooked vegetables. These larvae migrate to the brain, spinal cord, and nerve roots, causing eosinophilia in both spinal fluid and peripheral blood. Infected patients present with severe headache, vomiting, paresthesias, weakness, and occasionally visual disturbances and extraocular muscular paralysis. Most patients have a full recovery; however, heavy infections can lead to chronic, relapsing disease and even death. There is no proven treatment for this disease. In the authors' experience, corticosteroids have been helpful in severe cases to relieve intracranial pressure as well as neurologic symptoms due to inflammatory responses to migrating and eventually dying worms.

Key Words: *Angiostrongylus cantonensis*, eosinophilic meningitis


*Angiostrongylus cantonensis* is the major cause of eosinophilic meningitis. This parasite was first described by Chen in 1935 in rat lungs, in Canton, China,1 and reported to cause human disease in 1945 by Nomura and Lin, in Taiwan.2 Since then, this parasite has been taken by shipboard rats throughout Southeast Asia, the South Pacific, Madagascar, Africa, the Caribbean, and most recently, to the continents of Australia and North America.3-7 Over 2500 cases of *A. cantonensis* meningitis have been reported in approximately 30 countries.8 The human case reports from Australia and North America occurred since publication of the authors' previous article 11 years ago,3 and make *A. cantonensis* an emerging infectious disease, worthy of an updated review.

**PARASITOLOGY**

*Angiostrongylus* is a genus of roundworms (nematodes) that infect mainly animals. The best known of these parasites is *Angiostrongylus costaricensis*, a rat lung worm that causes abdominal eosinophilic granulomas in Central and South America, although a case was recently reported from California.8 Clinical symptoms are abdominal pain, vomiting, bowel obstruction, and rarely, gastrointestinal bleeding.8,9

*Angiostrongylus cantonensis* also normally resides in rat lungs where it lays eggs in pulmonary arteries. Larvae subsequently hatch and migrate via the trachea and gastrointestinal tract into rat feces. First stage larvae are consumed by snails and slugs, then develop eventually into infectious third stage larvae, often in extremely high numbers. Rats and humans become infected by eating infected snails or contaminated uncooked vegetables, such as lettuce and watercress. In man, many larvae migrate to the brain where they cause abscesses, brain swelling, and hemorrhage.8 Additionally, worms can travel to the spinal cord where they also eventually die and degenerate.10

**CLINICAL PRESENTATION**

Clinical symptoms occur approximately 2 to 35 days after larvae ingestion. Patients present with severe headache, neck stiffness, and often, nausea and vomiting.5,11,12 Most patients do not have high fever, but may have severe muscular weakness, paresthesias, and extremity pain, which in chronic cases can cause wheelchair dependence. If not diagnosed promptly, clinical symptoms can progress to diplopia, blindness, ataxia, and in very heavy infections, coma and death due to hydrocephalus.12

**LABORATORY FINDINGS**

The most important diagnostic finding is eosinophilia. Two-thirds of patients have peripheral blood eosinophilia. It is important that spinal fluid be stained with Wright's stain, which reveals cerebrospinal fluid (CSF) eosinophilia in 15 to 95% of infections. Eosinophilia recently has been shown to be related to interleukin-5 stimulation and Th2-cytokine production.13
Cerebrospinal fluid protein is elevated, but CSF glucose is usually normal. In a small percentage of cases, worms can be recovered from spinal fluid. Magnetic resonance imaging (MRI) of the brain shows evidence of cerebral edema and infarction, with areas of enhancement due to vasculitis and meningitis; ventricular dilation can occur with hydrocephalus. Recently, Shih et al reported that chest radiographs may show dense opacities with ill-defined margins and segmental distribution in the lower lung fields, presumably due to either vascular thrombosis or larval track reactions.

Several serologic tests have been developed for the diagnosis of *A. cantonensis*, although none are commercially available. The most specific and sensitive test is the enzyme-linked immunosorbent assay (ELISA) method, which yields good results when testing either CSF or serum. This method uses antigens prepared from *A. cantonensis* rat larvae, and is available, on a limited basis, from the Centers for Disease Control and Prevention (Atlanta, Georgia).

Several recent publications have studied specific purified worm antigens to improve the sensitivity and especially the specificity of the ELISA test. These include a 204 kD antigen, 29 and 31 kD antigens, AW-3C2 antigen, 21-25 and excretory products in a coagglutination assay. With such experimental methods, cross-reaction with other nematodes can be greatly reduced.

**DIFFERENTIAL DIAGNOSIS**

Eosinophilic meningitis can be attributable by both allergic and infectious causes, as well as malignancies. Reactions to drugs (e.g., ibuprofen and ciprofloxacin) and foreign material (e.g., ventricular shunt, contrast dye), as well as Hodgkin disease and multiple sclerosis are the most common noninfectious causes, whereas nonparasitic infections include tuberculosis, coxsackie virus, rickettsial disease, coxiellidomycosis, and neurosyphilis. The main parasitic causes of eosinophilic meningitis, besides *A. cantonensis*, include cysticercosis, paragonimiasis, gnathostomiasis, and schistosomiasis. Neurocysticercosis produces characteristic lesions seen on computed tomography (CT) and MRI brain scan and can be diagnosed by commercially available serologic testing. Paragonimiasis is usually associated with cavitary lung disease and calcifications on brain scan. Gnathostomiasis is caused by subcutaneous larval migration of *Gnathostoma spinigerum* that usually appears first on extremities and later causes cerebral hemorrhages demonstrated by CT brain scan and by blood in the CSF. Similar to neurocysticercosis, schistosomiasis often presents with seizures, produces mass lesions on brain, and may have positive stool ova. Other nematodes, such as *Ascaris, Baylisascaris, Trichinella,* and *Toxocara* only rarely are associated with eosinophilic meningitis.

**REFERENCES**


