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Eosinophilic Meningitis Due to *Angiostrongylus cantonensis*

During the period June-September 1985, two outbreaks of eosinophilic meningitis and eosinophilic meningoencephalitis occurred in the Taiwan Area:

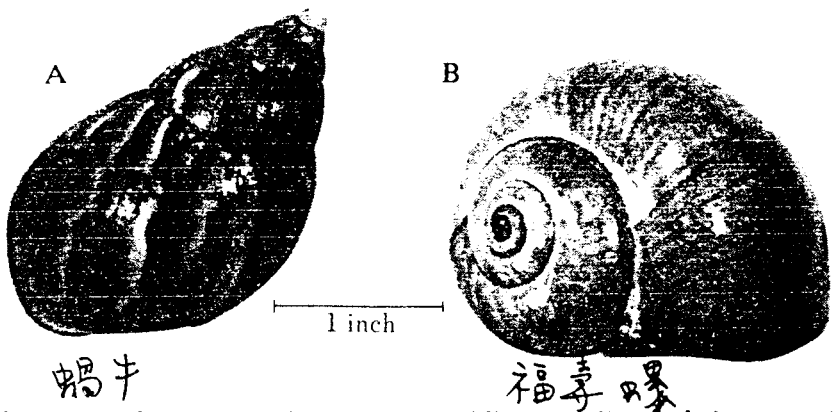
First Outbreak

From June 27 to July 29, eight adults and one child from an extended family in Taoyuan County were admitted to Kaohsiung Medical College Hospital with headache, fever, diplopia, and myalgias. Findings on physical examination included nuchal rigidity (8), positive Kernig's sign (3), anisocoria (1), and papilledema (1). Laboratory findings included eosinophilia (≥5%) in the cerebral spinal fluid (CSF) (9) and peripheral blood (6). A worm of the species *Angiostrongylus cantonensis* was recovered from the CSF of one patient. Four of the nine died, including one who developed unilateral blindness. The remainder recovered with supportive therapy. All affected family members had eaten raw snails of the species *Achatina fulica* (Figure 1A) 1-3 weeks before onset of symptoms. The family cultivated and ate raw snails of this particular species because they were told by a Japanese friend this would benefit their health.

Second Outbreak

During the period September 13-17, four children <6 years of age were admitted to a Kaohsiung City hospital with fever, headache, vomiting, and lethargy. All four were playmates from the same township in Kaohsiung County. Complete blood counts (CBC) revealed eosinophilia ranging from 8-31% in three of the four children. Elevated eosinophil counts of 36% and 45% were found in the CSF of two children. A worm of the species *A. cantonensis* was recovered from the CSF of one child. All four children re-

Figure 1. Snails of the species *Achatina fulica* (A) and *Ampullarium canaliculatus* (B)



covered with supportive therapy, however, one child was still lethargic at the time of discharge. In late August, approximately 1-2 weeks before onset of symptoms, the children collected snails of the species *Ampullarium canaliculatus* (Figure 1B) while playing in a field near their home. The children roasted the snails in their shells over an open fire and ate them. The number of snails consumed by each child was unknown. A fifth playmate who did not become ill, tasted, but did not swallow, the snail meat.

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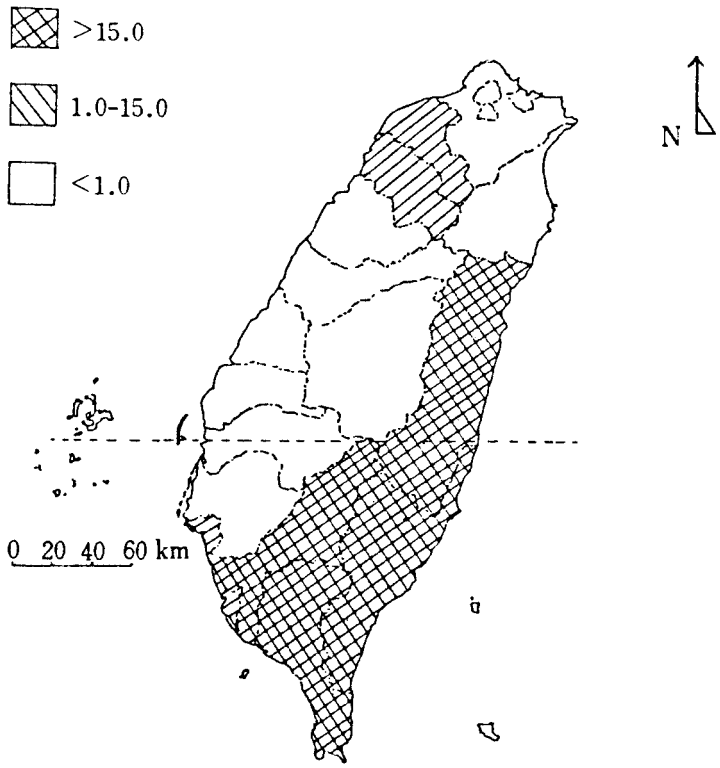
Editorial note: Angiostrongyliasis results from ingestion of the third-stage larvae of the rat lung worm, *A cantonensis* The adult worms live in the pulmonary arteries of rodents and lay eggs which hatch in the lung, migrate to the bowel, and are passed as first-stage larvae in the feces. The larvae enter natural molluscan intermediate hosts which include at least six species of snails and slugs in Taiwan[1], and develop into infective third-stage larvae. When a rodent eats infected molluscs, the larvae penetrate the gut, migrate to the brain, and finally to the pulmonary arteries where they develop into adult worms, completing the life-cycle. Man is an accidental dead-end host and becomes infected by eating raw or under-cooked molluscs containing the third-stage larvae of *A. cantonensis*. The ingested larvae migrate to the brain, spinal cord, eyes, and lungs, and die. The dead worms provoke a marked inflammatory response often accompanied by eosinophilia in the CSF. Clinical manifestations vary depending on the number and location of the worms. Extensive tissue damage can occur as the adult worms migrate through the brain or eyes. The case-fatality rate is low (<5%); blindness is one of the most common sequelae[1]. The efficacy of anthelmintic therapy is still under investigation, although some authors recommend anthelmintics should not be given since the simultaneous death of many worms might provoke a severe inflammatory reaction[2].

In Taiwan, the most important molluscan host associated with human illness is the giant African snail, *Achatina fulica*. Snails of this species are considered a delicacy, and are sometimes sold by street vendors. Infective *A. cantonensis* larvae have been recovered from *A. fulica* snail meat served at food stands[3]. This snail is not native to Taiwan, and is believed to have been imported from Singapore in 1932[1]. Up to 65% of *A. fulica* snails have been found infected with *A cantonenesis* larvae in certain areas in southern Taiwan[1].

Figure 2. Average annual incidence (per 100,000 population) of eosinophilic meningitis by county for the 12-year period 1974-1985, Taiwan, R.O.C.



Both the infection rate and the intensity of larval infection increase with the size of the snail[1]. Eosinophilic meningitis shows a distinct seasonal pattern associated with the summer breeding season of the molluscan intermediate hosts. In a review of 330 cases of eosinophilic meningitis in Taiwan from 1944 to 1985, Hwang and Chen showed the peak incidence occurs from June to August[4]. Although infected molluscan hosts have been found throughout the Taiwan Area[1], the counties with the highest incidence of eosinophilic meningitis are located in the southern and eastern parts of the island (Figure 2)[4]. In Taiwan, this disease is mostly confined to the pediatric age group. Most cases occur in children 2-8 years of age and >80% of cases occur in children ≤15 years of age[3]. In contrast, >70% of cases in Thailand occur in persons 20-39 years of age[5]. The reasons for these differences may be related to unequal exposure to snails among different age groups in the two cultures[3,5].

To reduce the risk of angiostrongyliasis in Taiwan, personnel at all levels of the public health and education systems should promote health education activities which warn of the risks associated with eating snails. Parents and young children are important targets for these activities, especially those in counties with a high incidence of the disease.

Reference

1. Chen ER. Angiostrongyliasis and eosinophilic meningitis on Taiwan - a review. In: Cross JH, ed., *Studies on angiostrongyliasis in eastern Asia and Australia* Taipei, R.O C., U.S. Navy Medical Research Unit No. 2, 1979, pp. 57-73.

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