SEATO MEDICAL RESEARCH STUDY ON EOSINOPHILIC MENINGOENCEPHALITIS IN THAILAND

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GENERAL INFORMATION

Completed studies on Eosinophilic Meningoencephalitis show that this disease is a major public health problem in Thailand both from the morbidity and mortality aspects. In the confirmed cases, 3.8% were active duty military personnel. With the very common eye involvement and sometimes motor paralysis, this disease could be of major significance to pilots and other personnal in critical military assignments. These studies also prove the significance of an improperly cooked local food product (snail) and the rat as a natural reservoir. Surveys of different areas of the country indicate that the militarily significant North, Northeast and Central portions of Thailand are the main infective areas. The significance of contaminated water and vegetables are aspects to be further evaluated.

Major Sompone and Captain Crook presented papers on their studies at the Second Medical Conference on Parasitic Diseases held in Bangkok on 7 March 1966. Each principal investigator had the opportunity to go to Honolulu, Hawaii, for orientation, observation and coordination of their research with the NIH Pacific Research Laboratory.

A critical aspect of this research study is the need for collection and study of the pathology of the central nervous system in more fatal human cases. Special attention needs to be made on the pathology in the spinal cord of cases with the myeloencephalitic form of the disease and the isolation and identification of the causative agent.

STUDY REPORTS

1. Title: Studies on the Animal-parasite Phase of Angiostrongylus cantonensis in Thailand. (Intermediate Host Studies; Definitive Host Studies)

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OBJECTIVE: The objectives of this study are to evaluate potential intermediate and definitive host species of A. cantonensis, seasonally, in distinct areas of Thailand with regard to frequency of natural infection, ecology, distribution and the possible methods of either direct or indirect passage of the parasite to man.

DESCRIPTION: The areas selected for study are Bangkok-Dhonburi near the mouth of the Chao Phya River; Nakornrajsrima (Korat), Ubol, and Udorn in the Northeast; Chiengmai and Sukothai in the North; and general collection in the South Peninsula. Plans call for inclusion of Nakhonsawan in the North due to recent findings by Sompone, Royal Thai Army Institute of Research. Average annual precipitation in the Bangkok areas is 1400 to 1600 mm, Nakornrajsrima (Korat) 1000-1200 mm, Ubon 1400-1600 mm, Udorn, Chiengmai and Sukothai 1200-1400 mm. South Peninsula precipitation varies from 1000-1200 mm. in the north portion to over 4000 mm. a year on the west central coast.

Average relative humidity in the Bangkok area is 75-80%, Nakornrajsrima, Ubon and Sukothai 70-75%, Udorn and Chiengmai 75-80%, and the South Peninsula varying between 80-85% in the central part and 75-80% on the extremes. Under the general classification of climates, all stations except the peninsula have a savana climate. The peninsula being largely tropical monsoon with a strip of the east coast, tropical rainforest climate.

PREVIOUS STUDY - The first study concerning natural A. cantonensis infection in Thailand was conducted by Dr. Pipat in March - April 1964. He examined ten rats from Amphur Nonghan, Udorn and found three infected with the worm. In December 1964, Professor Chamlong, Faculty of Tropical Medicine, Bangkok, reported examination of 309 rats from seven areas. Nine or 2.9% were positive. First intermediate host studies concerning this parasite in Thailand were reported in December 1964 by Sompone. He implicated the snail Pila ampullacea turbinis as a natural intermediate host. Professor Chamlong et al, December 1964, added the snails Achatino fulica and Pila scutata gracilis to the list of intermediate hosts known in Thailand.

PROGRESS: With the cooperation of Dr. Ophas, Assistant Director, Bangkok Municipality Bureau of Public Health, the study commenced using animals obtained from the Bangkok rat eradication program during the hot season, May-June 1965. A total of 1,817 mammals from 19 districts were examined, 138 or 7.5% were positive

Trapping during this hot season by Medical Zoology, in nine districts of Bangkok and two of Thonburi, yielded 398 rodents of which 16 or 6.5% were positive. The highest percentage of rodent infection, 21.1%, was in Paklongtalard district. The lowest with no parasites recovered was Klongtoey; however, the latter finding is questionable due to the small sample size of 8.
All remaining Bangkok districts exhibited some degree of rodent infection with a mean percentile of 8.5%. Klongsarn, Thonburi yielded 6 infections out of 57 rodents or 10.5% while no positives were found in 28 rodents from Bangkoknoi, Thonburi.

During this beginning phase of the study, gastropod examinations were restricted to species indicated by previous workers to be intermediate hosts for A. cantonensis. Areas in Bangkok and Thonburi which demonstrated near mean percentile rodent infections, approximately 8.5%, were collected with emphasis on A. fulica and P. ampullacea turbinis. Achatina fulica from Rajchawat, Bangkok, were 2.9% positive; however, many of the larvae which were Metastrongylid but could not be reared for specific identification due to insufficient numbers or dead larvae, probably were A. cantonensis. This assumption is based on the fact that all Metastrongylid larvae reared in this laboratory to date have proven to be A. cantonensis. If these were, in fact, A. cantonensis the percentage of infection would be 6.3%. The same snail species from Klongsarn, Thonburi showed 6.1% proven infection, with a possible 20.1% counting those which could not be reared. One Pila from Rajchawat was infected.

During the rainy season, July-Semtember 1965, 137 rats were obtained from the selected Bangkok "average" areas. Nine or 6.5% of the rats were positive. During the same period, 167 rodents were obtained from Klongsarn, Thonburi. Seven or 4.1% of these rats were positive.

Gastropod examinations during the 1965 rainy season included all species which could come in contact with infected fecal material. Nine hundred and seventy seven gastropods were examined. One positive, a slug (Veronicella sp.), was recovered along with one probable positive slug from the Bangkok collection sites. This was the first proven A. cantonensis slug infection in Thailand. This absence of gastropod infection is possibly attributable to the study areas having been generally flooded and most of the pulmonate snails drowned. Those pulmonate forms collected were young and had little opportunity for infection up to that time. The Thonburi area was well drained and most of the 1,169 specimens examined were at least 6 months old; therefore, carryovers from the preceeding hot season. A proven 7.7% and possible 17.5% of the A. fulica were infected, three Hemiplecta distincta and possibly the fourth were infected, and 3.2% to 5.3% of the slugs (Veronicella sp.).

During the Northeast hot season, May-June 1965, 174 gastropods were collected from the Udorn area and 336 from Korat. These collections were negative. No rat examination was accomplished in those areas during that hot season. First concentrated study in the Northeast was during the rainy season, August-September 1965. Difficult collection problems were encountered due to an unusually dry rainy season. Two of 54 rats from Korat, five of 92 from Ubol and 3 of 123 from Udorn were positive.

No positive gastropods were found among the 1,462 Korat specimens. Two Hemiplecta distincta were positive among the 562 Ubol specimens, and 22 positive and 53 possible positive Sarika resplendens were found among the 1,805 Udorn specimens.

Northeast cold season collections, January-February 1966, showed 7 of 123 rats positive from Korat, 4 of 158 from Ubol and 3 of 221 from Udorn; approximately the same as Northeast rainy season results. Gastropods examined from Ubol during this cold season, 112 P. polita were negative. Two of 329 P. polita were positive from Korat, and one of 216 P. polita from Udorn was positive. Eighty P. scutata gracilis, 33 H. distincta and 7 slugs from Udorn were negative. Conditions during the latter Northeast collection were extremely dry and obtaining land snails, such as collected during the rainy season, proved nearly impossible. The Pila which were collected, were dug from dried mud. The continued absence of A. fulica from Northeast gastropod collections indicates that the species has, as yet, failed to become established in that area and that the natural life cycle, with regard to intermediate hosts. is founded on such species as H. distincta, S. resplendens and possibly one more Pila species.

The North rainy season collection, October 1965, was restricted to Chiengmai. Of 75 rats examined, 14 were infected or 18.6%. From the same locations during the cold season, February 1966, 5 infections were found in 335 examinations, or 1.4%. This marked reduction could largely be due to

the extremely hot and dry period in that area which followed the rainy season and caused the depletion of A. fulica populations as much as 90% in some locations. The first verified A. cantonensis infection in Rattus exulans in Thailand was found during this cold season work in Chiengmai. Initial results from Sukothai show three positive among 236 rats examined, or 1.2%

One thousand thirty eight gastropods, of which 666 were A. fulica, were collected from Chiengmai during the rainy season, October 1965. Nine positive and two possible positive A. fulica were found. Results of the cold season gastropod collection from the North are not complete at the time of this writing.

Collections from the South Peninsula, October-December 1965, indicate an absence of natural infection from Chumphon in the north to Narathiwat in the south. The mammals collected from each area of the peninsula, a total of 1,101, were negative.

Gastropod collections from the peninsula demonstrated at least one suitable intermediate host for the parasite in each area studied; however, the 2,025 specimens examined were negative, corroborating the findings from rodent examinations.

It is too early in the study to speculate on the reason or reasons for this indicated void; however, it is interesting to note a pattern. Some degree of natural infection has been found in each location studied within the savana climate area of Thailand. No infection has been found in the tropical moonsoon-tropical rainforest areas which include the peninsula from Chumpun to the Malaysian border; this in spite of the presence of suitable hosts.

With regard to possible means of human infection, examination of 2,191 Pila spp. snails has revealed four harboring A. cantonensis. Some workers believe that Pila spp. are the important source of human infection. If the majority of eosinophilic meningitis cases reported, are in fact, caused by A. cantonensis, it seems that other routes of human infection must also apply. Recent observations in Chiengmai showed as many as 30 A. fulica falling into and contaminating a water well each day. This well served as the water source for a Wat with approximately 80 monks in residence. It has been demonstrated that soon after the drowning of an infected pulmonate snail, large numbers of larvae leave the snail and swim free in the water. These larvae are infective if they achieve third stage development before the hosts death. This possible method of human infection deserves consideration.

SUMMARY: These initial data indicate that natural A. cantonensis infection in Thailand is considerably lower than the reported prevalence in the Pacific island regions. The intermediate host phase of this parasites' life cycle in the Northeast appears to be based on gastropods other than A. fulica; perhaps H. distincta, S. resplendens or Pila spp. are such hosts. H. distincta and S. resplendens are new hosts for this parasite. Rainfall and temperature, affecting land snail populations, appear to have a marked effect on the life cycle and prevalence of the parasite, as evidenced when data from the Chiengmai rainy and cold seasons are compared. Absence of natural infection is indicated in the Thailand peninsula. Studies on the natural A. cantonensis population in this country are continuing, including efforts to explain the southern peninsula situation. Negotiations are in progress to have the North Malayan region studied to the Thai border to describe the southern extent of the natural infection void. Water contamination by infected pulmonate snails is presented for consideration as a route of humen infection.