

# AN ASSESSMENT OF FILARIASIS TRANSMISSION IN SINGAPORE

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## INTRODUCTION

The Pearson report (1969) gave the unjustifiable impression that communicable disease was rapidly disappearing from tropical countries. This is demonstrably untrue in rural areas and one disease at least, filariasis due to *Wuchereria bancrofti*, is increasing even in urban areas. Singh (1962, 1963, 1967) has shown that transmission is now taking place in two cities, Hyderabad and Bangalore, that were previously noted for their freedom from the vector *Culex fatigans*. Hairston and de Meillon (1968) have reported that in Rangoon, where there was no transmission of *W. bancrofti* before 1941, five to ten per cent of adults are now infected.

Two observations prompted an enquiry into the possibility of such an increase taking place in Singapore. During surveys of mosquitoes by Dr. K.L. Chan and ourselves as part of an investigation into the possibility of malaria transmission, it was noted that culicine adults were not infrequently infected with helminth larvae. During 1968 there was an unusual increase of *Culex fatigans* during a temporary breakdown of the cleansing services. Much earlier, in 1958, Danaraj, Schacher and Colless, while investigating eosinophilic lung, came to the conclusion that Bancroftian filariasis was being transmitted in Singapore.

This study records the results of an attempt to assess whether transmission was taking

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place and whether it was a problem of public health importance.

## MATERIALS AND METHODS

Three methods were used to obtain information: reports of hospital admissions diagnosed as filariasis, a survey of mosquitoes for infection with filariasis, and a survey of the human population to determine the amount of human infection.

### Hospital records

The method used was to extract from the records of the Outram Road and Thompson Road General Hospitals the details of those patients who had been diagnosed as suffering from filariasis, on the basis of a positive blood examination, between 1963 and 1967. These patients were then classified by ethnic groups, sex, age and address.

These figures are subject to considerable bias; night blood films were not taken as a routine; only when the suspicion of the clinician was aroused. One surgeon had been particularly interested in the possibility of filariasis in all patients presenting with hydrocoele and had examined night blood films.

With these qualifications the results were used as an indication for the planning of the later part of the investigation.

During these five years 129 cases were diagnosed (120 males and 9 females). 81 per cent of the cases occurred in the age group 20 - 60 (50% of the population of

Singapore was at that time below the age of 18) and 38 per cent between the ages of 35 and 50 years. No cases were detected under the age of 5 and only one under the age of 10. The rate amongst the Indians (53 cases) was highest - 41 per 100,000; amongst the Chinese (55 cases) it was 3.6 per 100,000; and amongst the Malays (20 cases) 8.6 per 100,000. There was no obvious difference in the age distribution of cases between the three groups.

It was possible to discover which districts of Singapore had an unexpectedly high rate based on the addresses from the hospital records. Unfortunately the population of these districts by ethnic group was not known.

Three areas were found where the number of cases were more than three times the number expected if the distribution had been random throughout Singapore. These were Anson, Geylang West and Joo Chiat. The first is known to be a predominantly Indian area and more cases in that area were Indian. In the other two predominantly Chinese areas the cases were mainly Chinese.

The mobility of the ethnic groups is different. The Indians travel more frequently to known endemic areas. The Chinese and Malays are more static.

Apart from the bias towards hydrocoele cases, the high proportion of male cases, which was marked in each ethnic group, cannot be explained.

These results did not give much information about the possibility of local transmission but they suggested the areas where it would be most likely that infected mosquitoes would be found.

#### Search for infected mosquitoes

The second stage of the investigation was the search for infected mosquitoes. Six

areas were chosen in Singapore: 3 in which the hospital case investigation had suggested a high rate of filariasis and 3 in which there was no such suggestion.

*Culex fatigans* were captured by sucking tube inside houses in the early morning and dissected for the presence of larvae in the thoracic muscles, head and abdomen. Search was carried out from July to September 1968 and in January and March 1969. A total of 2895 *C. fatigans* were dissected and 49 contained larvae.

The larvae were identified by the Department of Parasitology. All could be identified as *W. bancrofti*.

There was no indication that the infection rate was higher in the areas from which the hospital case had come (Joo Chiat, West Geylang and Sambau, which forms part of Anson). (Table 1)

These results show that 49 (1.7%) of the *C. fatigans* caught were infected with *W. bancrofti* but that only 2 had microfilariae in the head and might therefore pass on the infection. No exact calculation from such numbers can be made, but if we consider that 0.1 per cent of *C. fatigans* are potentially infectious and that each citizen of Singapore is bitten once a day by *C. fatigans* (a reasonable figure on the basis of the number of mosquitoes caught on this survey) then each individual would receive a bite from a mosquito with microfilariae in its head once every four years. Or 500,000 people in Singapore would receive a bite from an infected mosquito once a year.

It has long been known that the vast majority of such bites do not result in an infection with filariasis. Hairston and de Meillon have suggested that only one in 15,000 bites by an apparently infective

Table 1  
Examination of *C. fatigans* caught in Singapore from 25/7/68 to 12/2/69  
for infection with *W. bancrofti*.

Area	No. <i>C. fatigans</i> found positive				Total No. <i>C. fatigans</i> caught	% Positive
	Thoracic Muscle	Abdomen	Head	Total		
Sambau (Anson)	4	-	-	4	172	2.3%
Covent Garden	26	5	2	33	1,045	3.2%
West Geylang	6	-	-	6	366	1.6%
Kolam Ayer	4	1	-	5	522	0.96%
Geylang Serai	6	-	-	6	468	1.3%
Joo Chiat	1	-	-	1	322	0.31%
Total	47	6	2	55 (49 in Head and Thorax)	2,895	1.9% (or 1.7% if abdominal infections are ignored)

mosquito develops into a microfilaraemia. This would suggest something of the order of 30 new cases of Bancroftian filariasis in Singapore every year - a small but not a negligible number.

Although the number of new human infections is small, there must be a reservoir in the human population which would produce the not inconsiderable number of infected mosquitoes (49 out of 2895).

#### Undetected human cases of filariasis

It seemed clear that the 129 cases of filariasis detected would not be sufficient to produce this amount of filariasis in mosquitoes.

It was not considered practicable to carry out a midnight house to house survey at this stage of the investigation. An acceptable alternative was to examine the blood of all admissions to the General Hospital who were resident in West Geylang and Anson Road (two of the areas surveyed for mosquitoes). With the cooperation of the

admission office of the General Hospital this investigation was carried out between 17/3/69 and 30/3/69 and again 13/4/69 to 12/7/69.

Blood was examined from 146 patients from Anson and 2 were found positive; from 113 patients from West Geylang and 3 were found positive.

The method of blood collection and blood examination was as follows :-

Patients 10 years old and above were examined from the selected areas. Examinations were made between 2200 and 2300 hours. 20 c.mm blood were taken into a sterile pipette after finger puncture with a sterile disposable lancet. Two linear thick smears were made and the smears were dried overnight and stained next morning with Giemsa. They were examined by the laboratory technician in the Department of Social Medicine and Public Health and positive slides were confirmed as *W. bancrofti* by Professor

V. Zaman of the Department of Parasitology.

Recent work (Southgate and Desowitz, 1971) has suggested that this technique misses a proportion of light infections.

## RESULTS

The five patients in whom microfilariae were found had the following characteristics :-

Case	Age (years)	Sex	Ethnic Group	Diagnosis
1	69	M	Chinese	Malnutrition ? Cardiovascular accident
2	41	M	Chinese	Gastroenteritis
3	59	M	Chinese	Acute retention of urine
4	57	M	Indonesian	Congestive cardiac failure
5	10	M	Chinese	Concussion

It is likely that none of these patients would have been diagnosed as suffering from filariasis if this investigation had not been undertaken.

The Chinese boy's movements (Case 5) were not investigated and it cannot be said definitely that he was infected locally.

Thus of 259 patients examined five were found to be infected with filariasis (1.9%, standard error 1.4%). The population of Anson and West Geylang was about 61,000. These districts might well contain 1000 cases of unsuspected filariasis.

These figures are given as an indication of the size of the problem. Various factors introduce bias. The General Hospital admits patients of all ages, but the elderly are more likely to be admitted (and to be infected with filariasis). Only those of 10 years of age and over were examined. Of the 245 patients

examined 26 were below 20 years of age and 219 above. (In Singapore these two age groups are roughly equal in size.)

The older age group are also more likely to have been born outside Singapore and infected outside Singapore. But they still form the reservoir from which mosquitoes can be infected, even though they do not indicate the incidence of the disease in Singapore.

On these figures it is not possible to define the size of the reservoir of filariasis carriers but there can be no doubt that one exists.

## SUMMARY

This investigation has made some progress towards defining the problem of Bancroftian filariasis in Singapore. A human reservoir of several thousand, of whom many were probably infected outside the country. A considerable number of *C. fatigans* with about 1 per cent infected with *W. bancrofti*. New human infection occurring each year, but the number is uncertain. The detection and treatment of the individuals in the human reservoir should be quite easy if they are admitted to medical units. Their detection at home would be a difficult and time consuming procedure.

These results certainly emphasize the need for continuing and improving attacks on the breeding places of *C. fatigans*. It constitutes a small but definite risk to public health as well as a nuisance. The situation in Rangoon and Bangalore, where recently contracted filariasis is now widespread, shows what can happen if control is not maintained.

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#### REFERENCES

- DANARAJ, T.J., SCHACHER, J.F. and COLLESS, D.H., (1958). Filariasis in Singapore. *Med. J. Malaya*, 12 : 605.
- HAIRSTON, N.G. and DE MEILLON, B., (1968). On the inefficiency of transmission of *Wuchereria bancrofti* from mosquito to human host. *Bull. W.H.O.*, 38 : 935.
- PEARSON, L.S., (1969). *Partners in Development: Report of the Commission on International Development*. London, Pall Mall Press.
- SINGH, D., (1962). Annual Report of the National Institute of Communicable Diseases. *Delhi, 1962*.
- SINGH, D., (1963). Annual Report of the National Institute of Communicable Diseases. *Delhi, 1963*.
- SINGH, D., (1967). The *Culex pipiens fatigans* problem in South-East Asia with special reference to urbanization. *Bull. W.H.O.*, 37 : 239.
- SOUTHGATE, B.A. and DESOWITZ, R.S., (1971) Determination des taux et densités de Microfilaires: Efficacité comparée des techniques utilisant un étalement de sang après colaration, une cellule de numération ou la filtration sur membrane. *WHO-Fil-7191*. W.H.O., Geneva. (Roneod document.)