

THE PRESENT TREND OF MALARIAL INFECTION IN SINGAPORE

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Malaria, which at the height of its prevalence here was reported to have claimed as many as 127 lives in a week, Brook *et al* (1921), was considered to be non-existent by the mid 1950's. The occasional patient who presented with the disease then was always thought to have imported it from another country. This view was held until 1964 when an outbreak of locally transmitted malaria was reported following which the disease was made notifiable by law, Chew (1968). As a result, some 200 to 300 cases have been reported annually, giving an overall yearly incidence of approximately 1.0 per 10,000 population per year. In addition, there has also been evidence that local transmission of the disease is occurring on some of the smaller surrounding islands, Paul *et al* (1969).

In this paper, an analysis of 87 cases of the disease is made. It attempts to show, firstly, the current pattern of malarial infection in Singapore with respect to its distribution by ethnic groups, age and sex and its relationship to place of residence, occupation and travel. Secondly, that it is still a significant cause of obscure fevers. Thirdly, that the degree of diagnostic accuracy can be greatly enhanced through increased awareness of its presence here.

MATERIAL

In 1969, there were 302 reported cases of malaria in Singapore, Chan (1970), 146 (49%) of whom were diagnosed at the Outram Road General Hospital. The blood films of these were examined and confirmed by one of us (YKL). Staining was by the conventional Field's technique. Where a case had been first detected during routine examination of the peripheral blood film or while doing a differential white cell count, follow up studies of the thin and thick films stained specifically for malaria were always undertaken to confirm the diagnosis. 87 of the 146 cases were treated as in-patients in the hospital's five (3 adult and 2 paediatric) medical units. They form the material for our analysis. Fig. 1 shows the monthly distribution of cases seen in the hospital in 1969 as compared with the dis-

tribution of cases seen in the whole of Singapore for the same period.

RESULTS

Ethnic Group

Of the 87 patients, 39 (45%) were Chinese, 39 (45%) were Malays, 8 (9%) were Indians and 1 (1%) was of other race. Table I shows the distribution of malaria among the races as compared with that in the Fuyong Estate outbreak in 1964. There were as many Malay patients as Chinese.

TABLE I
DISTRIBUTION OF MALARIA BY RACE

	1964	1969
Chinese	16 (49%)	39 (45%)
Malay	13 (39%)	39 (45%)
Indian	4 (12%)	8 (9%)
Others	0 (0%)	1 (1%)

Age and Sex

Malaria was seen to have a predilection for the males and the young (Fig. 2). There were 70 male patients to 17 females, giving a sex ratio of 4:1. By age, those affected were largely from the first three decades of life. Only one case of malaria was seen in an infant.

Area of Residence

There are 28 postal districts in Singapore. These are purely administrative divisions rather than geographical, social or racial. The incidence of malaria in each postal district is given in (Table II), where the incidences calculated from the cases seen all over Singapore have been included for comparison. Our figures were derived from 75 cases only as the other 12 (11 Indonesian seamen and a Hungarian marine-biologist) were non-resident and had to be excluded. A high incidence of malaria was seen in postal districts 4, 5 and 17, which from the map in (Fig. 3) are seen to be included in two

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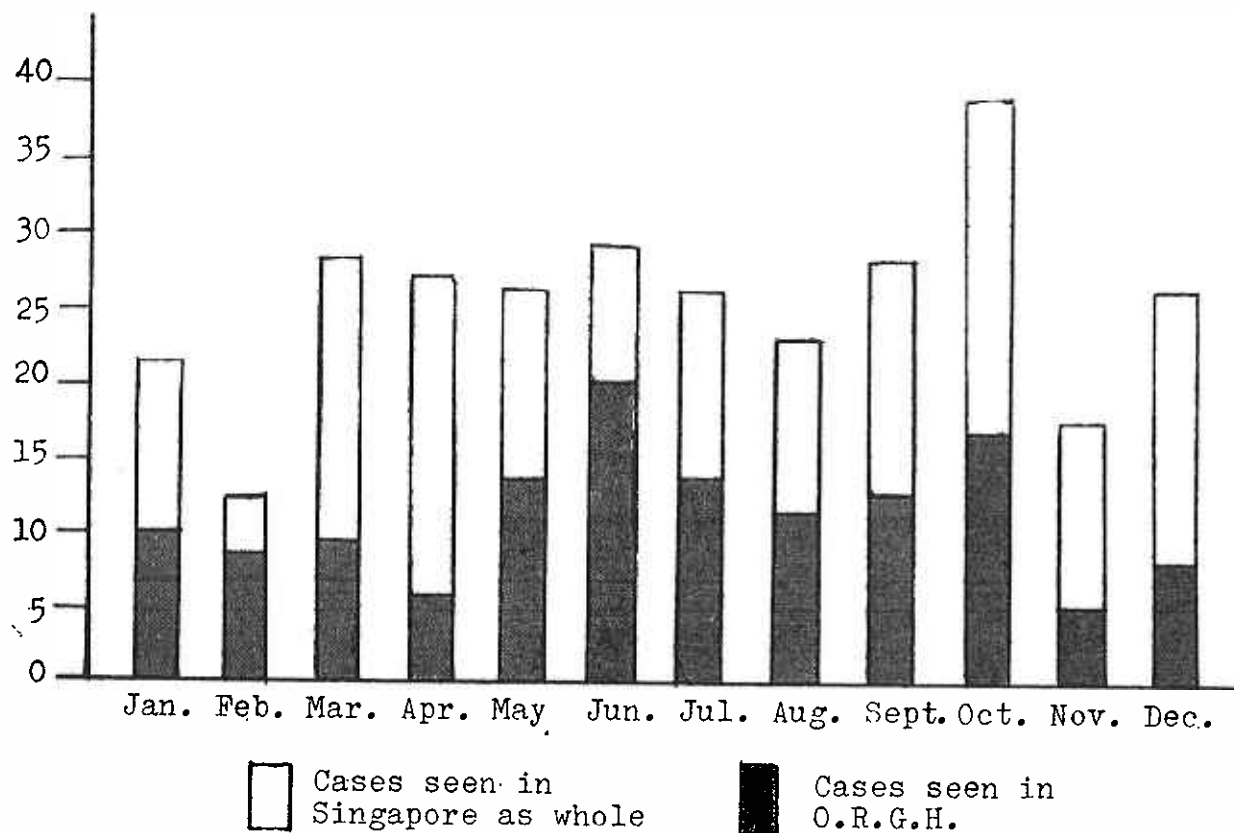


Fig. 1. The Monthly Distribution of Malaria 1969.

of the three areas in Singapore where the disease prevails. In these areas, an incidence rate of 2.0 or more per 10,000 was seen.

Occupation and Travel

The occupations of 42 patients were found to have a bearing on the development of the disease. All 42 gave a history of having been to malarious regions in their occupational pursuits or in recreational activities associated with them. There were 15 seamen, 12 labourers working in estates and plantations, 9 students, 4 soldiers and 2 school-teachers. The last three categories of patients had been involved in camping activities on some of the smaller surrounding islands. Of the remaining 45 patients, 8 were housewives, 15 non-schooling children and 22 people with unspecified occupations.

A history of travel to or from malarious regions just prior to development of the disease was given in 74 (85%) patients. 15 had come from Indonesia, 41 from Malaysia and 18 from the smaller islands surrounding Singapore, in particular Pulau Ubin and Pulau Tekong.

Clinical Features

The presenting symptoms in decreasing frequency were fever, chills, rigors, headaches

and sweats. These were followed by vomiting, the passing of dark urine, and non-specific complaints like bodyache and gastroenteric disturbances (Fig. 4). The main physical signs encountered were splenomegaly, hepatomegaly, jaundice, dark urine, drowsiness and skin flushes in decreasing order (Fig. 5). Beyond its presence being noted, the severity of each sign and or symptom was not assessed in any quantitative manner.

The parasite most commonly seen was *P. falciparum*, present in 46 cases (52.8%). This was followed by *P. vivax* in 36 (41.5%) and a double infection of vivax and falciparum in 5 (5.7%).

Diagnosis

A clinical diagnosis of malaria was made initially in only 42 (48%) of the patients. 24 others (28%) were treated as pyrexiae of unknown origin (P.U.O.) with malaria included among the probabilities to be proven or otherwise. In the remaining 21 (24%), the disease was not even considered as a possibility and these patients were treated as having diseases other than malaria until the inadvertent discovery of the parasite in blood films during routine haematological investigations, after a varying interval of time. 8 were thought to

have infective hepatitis, 5 viral fevers, 3 meningoencephalitis, 2 leptospirosis, 1 haemorrhagic fever, 1 haemolytic anaemia and the last acute bronchitis.

All 87 patients were subsequently proved to have malaria. In 85 (97%) the disease was found to be the main illness; while in the other 2, it was associated with and secondary to lepto-

spirosis. One of the 85 had E haemoglobinopathy which masked the clinical features, presenting as a haemolytic anaemia.

TABLE II
THE INCIDENCE OF MALARIA IN THE
VARIOUS POSTAL DISTRICTS
SINGAPORE 1969

District	No. of Cases	Population*	Incidence per 10,000
1	1 (8)	118,000	0.1 (0.8)
2	7 (16)	84,000	0.8 (2.0)
3	9 (41)	200,000	0.5 (2.0)
4	4 (8)	35,000	1.1 (2.2)
5	5 (37)	40,000	1.2 (8.4)
6	2 (2)	22,000	0.9 (0.9)
7	4 (6)	125,000	0.3 (0.4)
8	1 (3)	117,000	0.1 (0.3)
9	1 (3)	54,000	0.2 (0.6)
10	2 (9)	59,000	0.4 (1.2)
11	0 (4)	46,000	0.0 (0.8)
12	2 (1)	99,000	0.2 (0.1)
13	3 (4)	51,000	0.6 (0.8)
14	8 (10)	206,000	0.4 (0.5)
15	5 (4)	102,000	0.5 (0.4)
16	0 (1)	39,000	0.0 (0.2)
17	8 (48)	27,000	3.1 (18.6)
18	1 (1)	10,000	1.0 (1.0)
19	6 (12)	157,000	0.4 (0.8)
20	1 (0)	28,000	0.4 (0.0)
21	1 (4)	36,000	0.3 (1.2)
22	1 (2)	27,000	0.4 (0.8)
23	3 (4)	36,000	0.8 (1.0)
24	0 (2)	19,000	0.0 (1.0)
25	0 (5)	17,000	0.0 (3.0)
26	0 (8)	23,000	0.0 (3.5)
27	0 (31)	41,000	0.0 (7.7)
28	0 (1)	33,000	0.0 (0.3)
TOTAL	75 (302)	1,851,000	0.5 (1.6)

* 1968 Population estimates, derived from previous census figures and information based on housing development and as supplied by the Postmaster General to the Koro Study Team (cf. Singapore Medical Journal Vol. 10, No. 4, December, 1969), were used to calculate the incidence of malaria in 1969 as only minor changes in population distribution would have occurred during the year.

The figures in brackets were supplied by the Vector Control and Research Branch, Ministry of Health, Singapore, and were based on returns of notified cases during 1969.

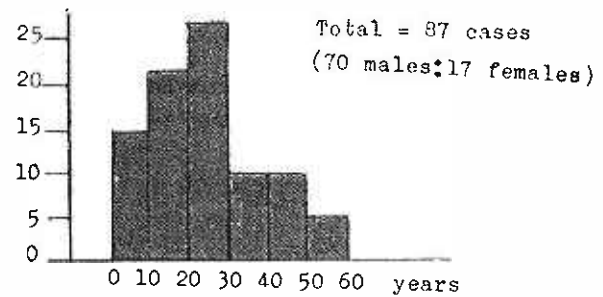


Fig. 2. Distribution by Age-groups Malaria 1969.

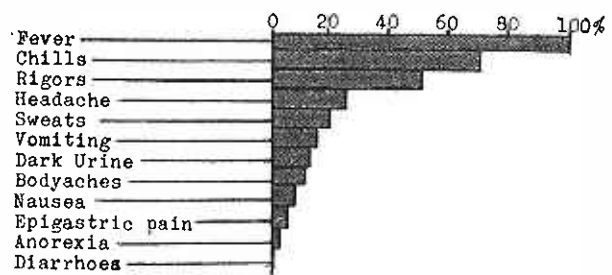


Fig. 4. Symptomatology.

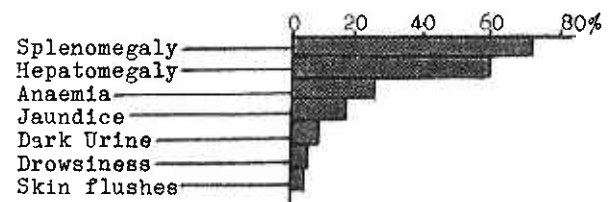


Fig. 5. Clinical Signs.

Laboratory findings of note were as shown:

TABLE IV

Haematological Findings		No. of Positive Cases		Percentage
		No. of Cases Investigated		
Anaemia	Hb <12.5 gm. %	54/86	63	
Leucopenia	TW <4,000	42/63	66	
Thrombocytopenia	Pl. <100,000	41/56	70	
Reticulocytosis	>5%	7/19	37	

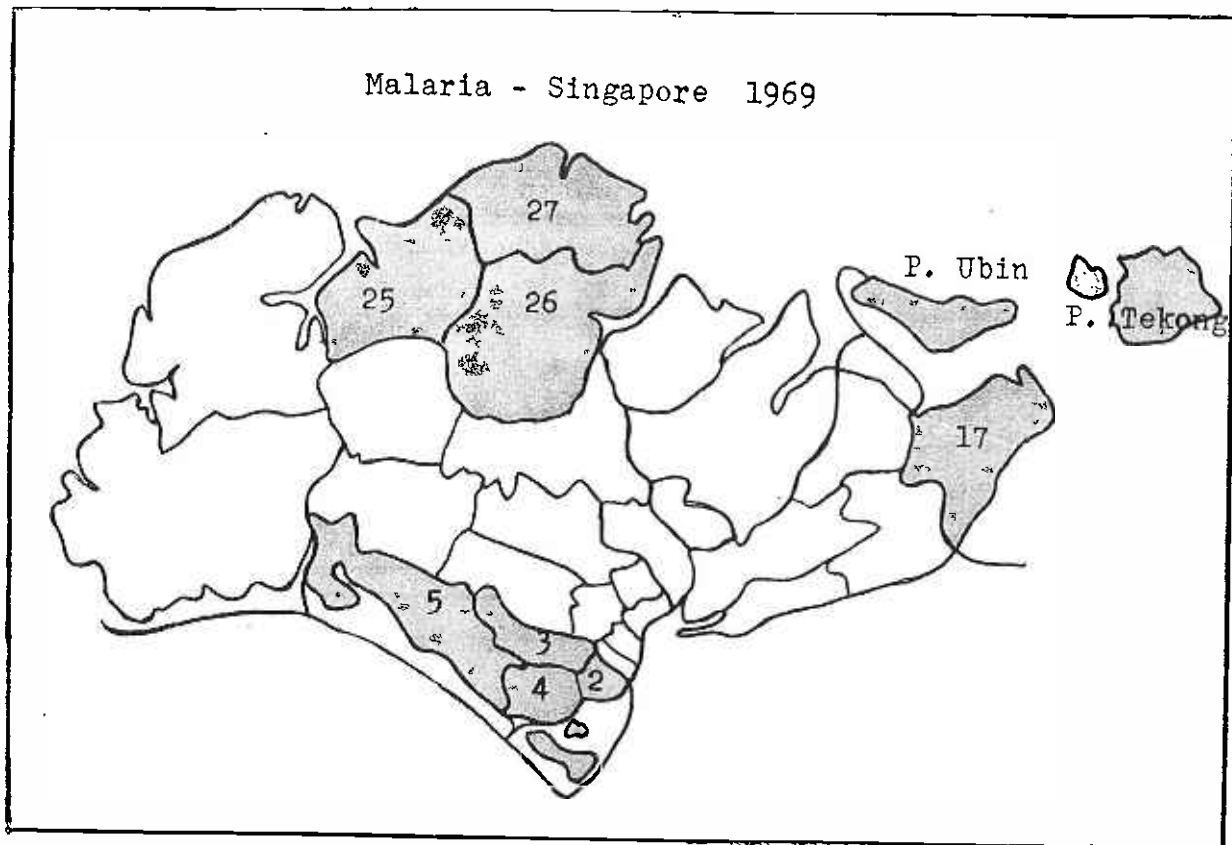


Fig. 3. Areas in Singapore with High Malaria Incidence.

DISCUSSION

There were 302 cases of malaria in Singapore in 1969, giving an incidence of 1.6 per 10,000 population which is slightly above the average of 1.0 per 10,000 per year. 87 of these cases, admitted to Outram Road General Hospital, were analysed.

There were equal numbers of Malay and Chinese patients, similar results of which were also seen in the Fuyong outbreak. Although the Malays form 14% and the Chinese 75% of the general population in Singapore, one may postulate a preponderance of the disease in the former ethnic group as the population breakdown by race for the age-groups susceptible to malaria are unavailable. Several reasons may account for this preponderance.

Generally, it is known that a significant proportion of the local Malay population derive a livelihood from the sea with a concomitant tendency to settle down in the coastal parts of certain postal districts, particularly 5, 15, 17 and 18, which have by tradition come to be known as "Malay settlements". In two of these, postal districts 5 and 17, a higher than average incidence of the disease was seen, (Table II). Furthermore, many Singapore Malays

have relatives in Malaysia and Indonesia and their chances of contracting the disease are enhanced through greater exposure by visits to these relatives in malarious regions or from relatives carrying the disease here. The map in (Fig. 3) shows two areas, to the north and south, of Singapore where a high concentration of malaria is noted. In these parts, respectively, are situated the landing points for travellers from Malaysia and Indonesia. Furthermore, the figures in (Table III) show that these cases are mainly of imported malaria, with scarcely any locally transmitted cases seen.

With regard to geographical distribution, three areas are seen to have high concentration of malaria. In addition to the two described above, a third to the east is noted. The area in the north consists of postal districts 25, 26 and 27 but the cases here have not been included in our analysis because of admission to another hospital.* In the south, the area includes postal districts 2, 3, 4 and 5. The significance of mainly imported malaria being seen here in these two areas has been pointed out previously.

In the east, the area consists of postal district 17 which includes the islands of P. Ubin and P. Tekong. These islands have been shown

*Thomson Road General Hospital, Singapore.

TABLE III
 DISTRIBUTION OF MALARIA BY POSTAL DISTRICTS
 SINGAPORE, 1969

Postal District	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	Total	
Local	—	3	—	—	5	—	—	—	—	—	—	1	—	1	1	42	—	1	—	1	—	1	—	2	—	—	2	—	60	
Unknown																													2	2
B/Transfusion																													1	1
S. Islands																													2	2
Imported	8	13	41	8	32	2	6	3	3	9	4	1	3	10	3	—	6	1	11	—	3	1	4	—	5	8	29	1	215	
Unknown																													18	18
S. Islands																													4	4
TOTAL	8	16	41	8	37	2	6	3	3	9	4	1	4	10	4	1	48	1	12	—	4	2	4	2	5	8	31	1	27	302
Incidence per 10,000 pop.	0.8	2.0	2.2	2.2	8.4	0.9	0.4	0.3	0.6	1.2	0.8	0.1	0.8	0.5	0.4	0.2	18.6	1.0	0.8	0	1.2	0.8	1.0	1.0	3.0	3.5	7.7	0.3	1.6	

Figures for the above table were obtained from the Vector Control and Research Branch, Public Health Division, Singapore.

to be reservoirs of local malaria, Chan (1970), and it is of interest to note that the malaria seen here is mainly of the locally transmitted variety (Table III). In our analysis, a concentration of cases was seen to have come from the high incidence areas in the south and east, from postal districts 5 and 17 respectively, showing a conformity to the general pattern in Singapore.

The clinical features were in the main typical. One exception was that fever, present in all cases, was noted to be periodic in only 4 (5%). 15% of the patients complained of passing dark urine, the nature of which was unfortunately not determined, beyond its presence being noted. It would have been of interest to determine how many were true black-water fever. Anaemia and leucopenia, well recognised in malaria, were seen in two thirds of the patients. 22% had a pancytopenia, the significance of which is left to be shown. It is of interest to note that Strickland *et al* (1969) have described a megaloblastic erythropoiesis with peripheral pancytopenia in patients with falciparum malaria in Vietnam.

Although the clinical diagnosis of malaria is not difficult, it was only done so initially in 42 (48%) patients. 24 (28%) patients were first diagnosed as P.U.O. and had malaria included in the list of differentials. In this category, specific investigations for malaria were carried out on all patients immediately, making the diagnosis definite with a minimum loss of time. This was not so in the last 21 (24%) patients. They were diagnosed as and treated for a variety of diseases other than malaria until the inadvertent discovery of the parasite during routine haematological investigations like differential white cell counts.

It can be seen that 1 in 5 cases of malaria diagnosed here may with legitimacy be considered as a chance discovery emphasizing the need for greater awareness of its occurrence in Singapore.

CONCLUSIONS

This study shows that malarial infection in Singapore as it is today is far from infrequent or non-existent. On the contrary, malaria has been diagnosed with recurring regularity, emphasizing the need for greater awareness of it as a cause of obscure fevers and the tremendous diagnostic value of simple investigations like a blood film for malaria parasite in all fevers. In addition, the disease is seen to prevail in three parts of Singapore, the distribution being influenced by race, age, sex, occupation, place of residence and travel.

ACKNOWLEDGEMENTS

We owe a special thanks to Dr. Kwa Soon Bee without whose advice this article would not have materialised. We would also like to thank the heads of the various medical units for access to the patients and case-notes.

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