The influence of bed nets on Bancroftian Filariasis in Buhutu Valley, Papua New Guinea

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Abstract

A study was conducted to determine the microfilaria rate 50 years after the first documentation of bancroftian filariasis and to examine factors influencing the prevalence in Milne Bay Province. Finger prick blood smears were made from 75 persons aged between 5 and 70 years between 2300 to 0200 hours. The smears were examined and the microfilaria rate estimated to be 24%. This rate was lower than the 50% reported by Hopla in 1946. The mean mf density in positive carriers was 24.72 (SD=28.52) mf per 20mL blood and density ranged between 1 and 106 mf per 20 mL blood.

Significantly low microfilaria positive smears were observed in persons who reported using bed nets. The significant protection observed was stronger in females, with a higher proportion of females sleeping under the bed nets than males. The results also showed males were 1.75 times more likely to have positive smears for microfilariae than females.

We conclude that bed net is important in reducing the transmission of bancroftian filariasis. However, a combination of vector control and parasite chemotherapy will act synergistically to reduce the prevalence of the disease to significantly low levels than use of either method alone.

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Introduction

The only type of human filarial infection in Papua New Guinea (PNG) is bancroftian filariasis (BF) caused by *Wuchereria bancrofti.* BF is endemic in many coastal and offshore islands of PNG and the prevalence varies with altitude. In the Ok Tedi area of the Western Province where altitude ranges from 600m to 1000m the prevalence of BF is reported to range between 39% and 70%[1,2,3] and in coastal Madang Province the prevalence ranges between 30% and 51%[4]. BF has been reported in parts of PNG and a recent entomological study confirmed possible transmission[6].

The distribution of BF has not been fully investigated in PNG and previous epidemiological studies have been restricted to few areas [1,2,7,8,9] In the eastern part of the PNG the only study by Hopla in 1946 reported that the prevalence of BF ranged between 35 to 55% in Buhutu (Sagarai) valley of Milne Bay Province. The present survey was conducted in Buhutu Valley to investigate the prevalence of BF and examine possible factors that may influence it.

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Methods

Between 18 and 24 June 1994 all seven villages in the Buhutu Valley about 61 km from Alotau (capital town of Milne Bay Province) were visited to inform the village leaders of the purpose of the study. Ten households (HH) were selected using random number tables and heads of the selected HHs were informed of the study and verbal consent sought for family members to participate in the study.

The head of the HH was interviewed to identify any member of the family having "elephantiasis" or taking antifilarial drugs. Questions were asked about mosquito net(s) in the house and information on ownership, usage, and treatment with insecticide was noted.

Blood collection and microfilaria examination. Collection of blood samples for microfilaria examination was done between 2300 to 0200 hours and restricted to persons aged 5 years and above. Fingers were cleaned with alcohol swab (Mediswab, Australia) and pricked (Autoclix, Boehringer

Table 1. Microfilaria density by age group

Age group (years)	No. Tested	No. +ve (%)	Mean mf density/20ul (+ve only)	s.d.	Median mf density (+ve only)
5-19	22	3 (14)	5.33	2.08	6
20-39	30	10 (33)	28.6	23.01	25
40-59	16	4 (25)	35.00	47.89	16
60-79	7	1 (14)	3.00	-	-
Total	**75**	**18 (24)**	**24.72**	**28.52**	

Mannheim, Germany). 20 mL of blood was placed on clean pre-labeled glass slide and a thick near-oval smear was made and left to dry in a wooden slide carrying box. Blood smears were brought back to the main laboratory (Port Moresby) for staining and examination following the methods described by WHO[10]. The smears were stained in 20% Giemsa for about 40 minutes an examined under X40 power in a "zig-zag" manner to detect microfilaria. A slide was considered negative if no microfilaria were detected.

Results

The mean age for the 75 persons from whom blood samples were collected was 30.6 = 17.9 years (range 5 - 70 years). More persons were in the 20-39 years age group. These persons had lived in their villages all their lives. There were slightly more males (53%) than females (47%).

The overall (n=75) mean (arithmetic) mf density was 5.93 (SD=17.32) per 20 mL and the mf density ranged between 0 and 106 mf per 20 mL blood. The mean mf density in positive carriers (n=18) was 24.72 (SD=28.52) mf per 20 mL blood and density ranged between 1 and 106 mf per 20 mL blood. The calculated microfilaria positive rate (MFR) was 24%.

Categorization of mf densities to low (1-4 mf/20 mL or <200 mf/ml for finger-prick blood films) and heavy density groups[10] showed 28% (5/18) and 72% (13/18) of mf carriers in respective categories. Grouping age by 20 year intervals showed the 20-39 years age category had the highest prevalence of mf positive but the 40-59 years group had the highest mean mf density (Table 1). Male persons were more likely (RR=1.75) to be mf positive than females but the difference in the risk was not significant.

There was no filariasis control program in the area and no report of any person taking antifilarial drugs. Over 50% (43/75) of persons reported having mosquito nets in their houses but only 48% reported that all members of the family owned bed nets and used them every night. Over 70% of the women in the study reported having bed net and slept in it either by themselves or with their children every night. None of the bed nets had ever been treated with permethrin or any other form of insecticides since the nets were bought.

Those who reported bed nets in their houses were less likely to be mf positive (Table 2). This difference was significant (χ^2=5.58, p=0.02). The significant protective effect of bed net ownership was investigated for possible confounding by age and sex (Table 3). Stratifying by age indicated lack of confounding. Males were more likely (RR=1.73) to be mf positive than females but this association was not significant (χ^2=1.69, p>0.05).

Stratification by sex showed no significant association with bed net use in males (χ^2= 0.48, p=0.49) but females had a significantly (χ^2=7.73, p=0.005) lower risk (RR=0.10) for microfilarial infection associated with bed net use (Table 3). The effect noted here for females is believed to have caused the significant positive overall association between bed nets and microfilaria (Table 2).

The difference in the magnitude of the association between bed net use and mf positively for the two sexes was close to

Table 2. Distribution of MF positive and having bednets

	MF positive		
Have bednet	**Positive**	**Negative**	**Total**
Yes	6 (14%)	37 (86%)	43
No	12 (38%)	20 (62%)	32
Total	**18**	**57**	**75**

Table 3. Stratification for bednets with each sex for microfilariae

Have bednet	Males			Females		
	N	mf +ve	mf -ve	N	mf +ve	mf -ve
Yes	20	5	15	23	1	22
No	20	7	13	12	5	7
Total	**40**	**12 (30.0%)**	**28**	**35**	**6 (17.1%)**	**29**
	RR=0.714, X2=0.48, p=0.49			RR=0.104, X2=7.73, p=0.005, Fisher's Exact test p=0.012		

significance (Breslow-Day test χ^2=3.05, p=0.08) indicating a separate influence for females. This is evidence that bed nets are protective for females only.

Discussion

Results of this study shows that after 50 years the high prevalence of filariasis in Buhutu Valley reported by Hopla[11] has declined from 50% to 24%. The reduced microfilaria rate (MFR) in the population after 50 years is attributed to many factors perhaps predominantly vector related. If there was any protective influence of bed net since 1945 to present time it is impossible to authenticate. Other factors like the effects of DDT spraying during the National Malaria Control program (1960s to 1984) may have some influence on the transmission.

There was no significant variation in microfilaria positive rates with age. Perhaps immunological analysis would show such variation. However, no blood samples were collected for immunological analysis. The higher mf densities in the 40 to 59 years age group were unexpected because persons in this age group have had more exposure to the infection and are more likely to show light infections or negative results. It is conceivable from the results of this study that active adult worms survive longer and continue to release microfilariae on older persons with chronic infections.

The protective influence of untreated bed nets observed in this study is supported by protective influence of bed nets against malaria and filarial infection[4,12]. In the present study the protective influence of the bed net was only apparent in females. The lower risk of microfilaria positive in females is not suggestive of sex selection by the microfilarial worms but suggests that bed nets were specifically effective in reducing the human vector contact and filariasis transmission.

The high percentage of women (>70%) who reported sleeping under the bed nets is considered to contribute to the low proportion of females being mf positive. This was thought to be reflection of allocation of domestic assets to perceived important members in the family. On the contrary males without bed nets were mostly young adults and old males who would usually sit up until late at night. This social behaviour leave men unprotected from mosquito bites and contribute towards the transmission of filariasis.

The methods used to determine positive mf results could influence the results. The high proportion of individuals noted in this population with negative blood slides for microfilaria is plausible. There are fewer people in high prevalent areas with "light" infection who could easily be found to be negative using the smearing method. The results could have under reported the true prevalence of the infection compared with labour intensive and expensive but sensitive and specific tests like ELISA[13]. However the traditional slide method was controlled in this study and believed to generate reliable results observed here. In addition the study units were selected at random to represent the population, subjects lived in their villages and the methods for processing blood smears controlled.

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" The young have aspirations that never come to pass, the old have reminiscences of what never happened. "

Saki (H. H. Munro; 1870 - 1916)