AN EPIDEMIOLOGICAL SURVEY OF MALARIA AT AN AIR FORCE STATION

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ABSTRACT

Increased incidence of malaria in an Air Force Station in western India in 1994 was investigated by means of an epidemiological survey. The survey was conducted from 17 October to 20 October 1994. It revealed that the station had ecological conditions and topography favouring mosquito breeding. For 1994 the annual parasite incidence was 3.29 and annual blood examination rate was 26.4 per cent. Active parasitological survey revealed 2 cases of asymptomatic parasitaemia. The survey also revealed that the outbreak was due to combination of natural forces and laxity in implementing existing anti-malaria activity.

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KEYWORDS : Epidemiology; Malaria; Prevention.

Introduction

Malaria has been a major health problem in India for several decades. Although the number of cases came down in 1965 because of the National Malaria Eradication Programme, the disease returned in a big way and the national incidence of malaria started increasing from 1970 onwards [1]. As a result of the modified plan operation, the number of malaria cases dropped to 2.1 million in 1984. Since then the epidemiological situation has not shown any great improvement. It has appeared to have reached a plateau which is causing concern [2]. Transmission of malaria has been persistent in southwestern sector in spite of regular rounds of indoor residual insecticide spray. An Air Force station in western India reported 21 cases of malaria during the third quarter of 1994. This paper describes the epidemiological study undertaken to identify the cause of increased incidence of malaria and to recommend suitable preventive measures.

Material and Methods

The Air Force station referred to has a population of approximately 8500 which includes civilians and their families. The station is peculiar in its layout as various units are located at 3 differ-

ent sites widely separated from each other. The main unit has a population of approximately 6200, and the other two smaller sites are 21 and 25 km away from the main unit. The administrative and health cover is given by the main unit.

The survey was carried out from 17 October to 20 October 1994. Collection of data and epidemiological study was performed on records available at the Air Force station and from the regional National Malaria Eradication Programme (NMEP) office for civil population. Environmental and other epidemiological variables like temperature, rainfall, relative humidity were studied. Five hundred children in the age group of 2 to 10 years were examined for spleen enlargement. Adult mosquito collection was done by suction-tube method from indoor and outdoor resting places. Spray sheet collection was also done to study qualitative and quantitative indoor resting population [3]. A total of 512 blood slides were randomly collected from the population under study. An attempt was made to include all age groups including infants.

Results

Epidemiological profile of malaria in the Air Force station for the period 1991-1994 is shown in

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TABLE 1

Malaria morbidity rate at Air Force Station (1991-1994)

Year	Population at risk	BSE*	ABER%**	Total +ve slide	Rate/100	<i>P. falciparum</i> +ve	<i>P. vivax</i> +ve	API***
1991	7749	1840	23.74	20	0.258	6	14	2.58
1992	7650	1860	23.31	18	0.235	6	12	2.35
1993	7800	1525	19.55	22	0.282	9	13	2.82
1994	8500	2240	26.35	28	0.329	4	24	3.29

*BSE - Blood slides examined; **ABER - Annual blood examination rate; *** API - Annual parasite incidence

TABLE 2

Seasonal distribution of malaria cases at Air Force Station (1991-1994)

Year	Jan	Feb (I Qtr)	Mar	Apr	May (II Qtr)	Jun	Jul	Aug (III Qtr)	Sep	Oct	Nov (IV Qtr)	Dec	Total
1991	—	—	2	—	2	2	2	—	6	4	6	—	24
1992	—	1	3	3	—	1	2	—	5	4	3	—	22
1993	—	—	1	—	4	1	5	3	2	2	3	1	22
1994	—	1	—	1	4	1	9	8	4	—	—	—	28
Total	—	2	6	4	10	5	18	11	17	10	12	1	96

Table 1. It is evident that malaria cases increased from 20 in 1991 to 28 in 1994. However, percentage of *P. falciparum* cases to total cases had been fluctuating during the same period. In 1994 percentage of *P. falciparum* cases had fallen as compared to previous years showing that increase was predominantly due to BT malaria. Annual parasite incidence (API) increased from 2.58 in 1991 to 3.29 in 1994. The monthwise distribution of malaria cases during 1991-94 is shown in Table 2. It shows that transmission occurred mainly between March and November with maximum incidence between July and October. Table 3 compares incidence of malaria amongst air force personnel and their families with the incidence in the civil population. During the period July to September 94 there was an increase in incidence of malaria cases in the Air Force and civil population in the city. There were fewer cases of MT malaria in Air Force population as compared to the civil population.

Of the 500 children in the age group of 2-10 years examined for spleen enlargement 8 were found to have a just palpable spleen. The spleen

TABLE 3

Comparison of malaria positive cases during 1994

	Air Force Station	Civil population
Population at risk	8500	12 lac
BSE*	2240	94829
Malaria positive blood slides	28	5170
Rate per 1000	3.29	4.31
<i>P. falciparum</i> positive	4	1142

*BSE - Blood slides examined in 1994

rate was 1.6 per cent. API was found out to be 3.29 and annual blood examination rate (ABER) was 26.35 per cent as shown in Table 1. Slide positivity rate was 1.25 per cent. In 2 of the 512 blood slides examined malaria parasites were found. One was *P. falciparum* and other was *P. vivax*. The subjects from whom these samples were drawn had not suffered from malaria earlier and this indicated asymptomatic parasitaemia.

Environmental and other epidemiological variables related to malaria were also studied in details. The Air Force Station has a village on one side and slum dwellings on the other, adjacent to

TABLE 4
Mosquito density per man hour at the Air Force Station

Place	Time spent in collection (Hours)	<i>A. stephensi</i>		<i>C. quinque fasciatus</i>	
		Total	PMH*	Total	PMH*
Main AF Station	2	8	4	40	20
Sub AF Station A	1	2	2	18	18
Sub AF Station B	1	3	3	21	21
Total	4	13	3.25	79	19.7

* PMH - per man hour

the perimeter fence. The Air Force Station itself is located in a low lying area and was waterlogged during August-September 94 due to continuous rain. All along the perimeter fence there is permanent accumulation of water in low lying area. During July-September 94, heavy rains and release of water from a local lake had created a flood like situation in the Station. There is a large open drain which is emerging from the adjacent city and passes through the Air Force campus causing collection of water and sewage. These two permanent water collections were the main source of mosquito breeding.

This station has grossly insufficient accommodation. Therefore, approximately 70 per cent of service personnel were staying outside, specially in the adjacent village. This village is not hygienic for living. It has rampant mosquito and fly menace and is full of cattle sheds. Inside the camp area, due to shortage of accommodation personnel often shared houses. There was over-crowding in billets and married quarters giving impetus to malaria spread. Due to shortage of accommodation some airmen were staying in tents and therefore exposed to greater malaria risk. The smaller detachments of the Air Force Station complex also had many low lying area, which filled up during monsoon and provided places for mosquito breeding.

The average rainfall from July to September is 240 mm. In 1994 it was 290 mm. The minimum and maximum temperatures during this period were 24°C and 32°C respectively with an average relative humidity of 65 per cent. This was highly conducive to mosquito breeding.

Out of 12 potential breeding sites studied, 8 were found positive for mosquito breeding and

anopheline breeding was found in 5 (41.6%) of these. Vegetation growth was also observed over many water collection. Baytex had been used for anti-larval treatment at this station. An mosquito survey was undertaken to assess density per man hour at 3 sites. Average adult mosquito density for *Anopheles stephensi* and *Culex quinque fasciatus* was 3.25 and 19.7 respectively as shown in Table 4. Total mosquito catch using pyrethrum was undertaken and a total of 33 mosquitoes were collected. Out of these 6 were anopheline and 27 were culex. Third round of malathion spray was in progress at the time of visit and spray coverage was found to be approximately 70 per cent. Personnel carrying out the spraying were interviewed and asked to demonstrate method of spray. It was found that spraying was not as per recommended procedure, thereby indicating that although coverage was 70 per cent, the effectiveness of the spray may have been very low. Moreover, breeding was also found at a location which was reportedly treated 24 hours earlier. The density of mosquito by space spray knock down method in a room of 30 cubic meter was 34, out of which 6 were anophelines.

Discussion

This Air Force station had topographical favouring water collection. The heavy monsoons during July-September 1994, suitable temperature and relative humidity favoured mosquito breeding throughout the year particularly so between March and October. The anti-larval activities being carried out at the station were inadequate as 8 out of 12 locations tested for presence of larvae showed breeding. This was a high density favouring rapid transmission. Main vector of malaria in this station

as *A. stephensi*. It is a well-known vector of malaria in urban India. It has been incriminated as a vector in Bihar, Gujrat, Maharashtra, Tamil Nadu, Karnataka, Punjab, Uttar Pradesh and West Bengal [4]. Local NMEP authorities reported carrying out insecticide sensitivity tests and found it to be sensitive to BHC and malathion. This had been done two years earlier and the status of sensitivity of vector needs to be re-assessed. API was 3.29 which was higher as compared to previous years but it was less as compared to local civil population. This was only by passive surveillance. No active surveillance was being carried out in the station. ABER was 26.35 per cent, which was considered adequate, because a minimum ABER of 10 per cent has been recommended based upon estimate of fever rate in India [5]. Active survey of 512 randomly selected persons including all age groups was carried out. Their blood slides showed 2 to be positive, one for *P. falciparum* and one for *P. vivax* which is an indicator for starting active surveillance in addition to passive surveillance.

In view of above findings the recommendations were: intensification of antilarval measures by mapping, locating and treating existing and potential breeding sites, proper use of anti-larval chemicals, follow-up and survey of effectiveness of anti-larval activity and adoption of source-reduction measures like filling ditches and low lying areas and channelling waste water. An extra round of malathion spray was recommended to cover adjacent villages, where majority of personnel stay. Three rounds of fogging in July, August and September recommended for abrupt reduction of adult mosquito density to interrupt disease transmission.

Use of DMP/Odomos may be encouraged along with strict implementation of personal protective measures. Regular training of anti-malaria squad must be done and spraying must be supervised by trained sanitary assistants. Regular liaison with local NMEP authorities and co-ordination of anti-malaria activities with these authorities is essential. An intensive health education drive to improve knowledge, attitude and practice of malaria control measures by all personnel and families is necessary.

To conclude, the epidemiological and entomological evidence confirms that increased incidence of malaria in the Air Force station studied was due to a combination of natural forces and laxity in control measures. It is felt that with intensive measures and proper utilization of available trained man power, incidence of malaria can easily be brought down without resorting to measures like suppressive treatment.

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