Epidemiological Investigation of Forest Malaria among GREF and Army Personnel

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Abstract

Background: General Reserve Engineering Forces (GREF) engaged in road construction and military personnel camping in forest areas are at high risk of contracting malaria.

Method: All cases of malaria were confirmed by peripheral blood smear examination. Neighbouring civilian houses were visited, members interviewed and blood slides taken. Environmental survey included mosquito and larval collection. Epidemiological data on malaria in the state and the district was obtained from civil health authorities.

Results: During April-June 2001 there were 27 cases of malaria amongst GREF and army personnel out of 91 deployed giving an attack rate of 29.67%. The attack rate was significantly more in GREF personnel (45%) compared to army personnel (17.65%). All the cases were falciparum malaria. Out of 20 randomly collected blood slides from the civil laborers, 2 (10%) were positive for falciparum malaria.

Conclusion: For small patrols operating in hyperendemic malarious areas strict personnel protective measures besides chemoprophylaxis needs to be implemented.

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Key Words: Forest malaria; Falciparum; Army

Introduction

Malaria incidence is very high in the forest and forest fringes as compared to plains or urban areas [1]. *P falciparum* is the predominant infection. The problem of drug resistance, exophilic and exophagic vector behaviour and high efficiency of vectors of forest malaria aggravate the situation. Developmental projects, tribal concentration, population movement, transmigration and non-response of vectors to residual spraying contribute to transmission of malaria in the forests.

The paper describes outbreak of malaria among personnel of road construction force (GREF) deployed in the northeast and an infantry patrol giving security cover. Within a period of 2 months (March – April 2002), 45% of GREF personnel suffered falciparum malaria. Within two months (April-May 2002), 17.6% of the infantry patrol suffered falciparum malaria.

Material and Methods

Forty personnel of GREF engaged in road construction and a detachment of 51 infantry soldiers providing security cover were the subjects of a descriptive study. These personnel were on suppressive treatment with chloroquin 300 mg weekly.

Malaria Case Definition: Only laboratory confirmed cases of peripheral blood smears were included for the purpose of

study.

Blood slides were also collected from casual labour involved in road construction who gave history of fever in the past two weeks. Neighbouring civil houses were visited, members interviewed and examined. Environmental survey included mosquito and larval collection. Epidemiological and entomological data on malaria and its vectors in the state and the district were obtained from the records maintained by civil health authorities (secondary data analysis). Interviews were carried out among civil practitioners, villagers paramedics in the adjoining outposts and medical officers in the surrounding Primary Health Centres.

Meteorological and topographical features of working and camping sites of the personnel were also studied.

Results

The incidence of malaria among GREF and infantry soldiers is shown in Table 1. All cases were due to *P falciparum*. GREF personnel had significantly more malaria than army personnel (Chi sq = 8, df = 1, P = 0.0045, OR = 0.26 with 95% CI = 0.09 to 0.75).

Blood slides were taken from 20 casual labourers at random and 2 were found to be positive for falciparum malaria gametocytes. They were both asymptomatic. Epidemiological situation of malaria in Tripura is shown in Table 2. District wise incidence of malaria in Tripura is shown in Table 3. In spite of best efforts, adequate number of adult mosquitoes

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Table 1**Incidence of malaria among army and GREF personnel**

Category	Attacked	Not attacked	Total
Army personnel	9 (17.65%)	42 (82.35%)	51 (100%)
GREF personnel	18 (45%)	22 (55%)	40 (100%)
Total	27 (29.67%)	64 (70.33%)	91 (100%)

Chi Sq = 8, df = 1, P = 0.0045, OR = 0.26 with 95% CI 0.09 to 0.75)

could not be caught for identification/dissection purposes. A large number of larvae were collected in the streams and paddy fields nearby. Most of these larvae were anopheline. Prevalent vectors obtained from the civilian health authorities (Malaria Programme Office) were – *Anopheles fluviatilis*, *A. minimus* and *A. phillippisensis*.

Interview with medical officer at PHC revealed that approximately 50% of OPD attendance of 60 to 70 patients per day were fever cases. All cases were treated presumptively with quinine. Facilities for malaria microscopy were inadequate. Villagers reported that almost every house had fever cases which remits with treatment from the local medical stores which was found to be dispensing antimalarials such as chloroquin, quinine and Metakelfin. At the outposts paramedics were found to be treating fever cases with quinine including IV quinine for severe cases without facilities for peripheral smear examination. All fever cases in the civil population, as well as GREF personnel were subjected to quinine therapy. Treating medical officers and paramedics were apprehensive to treat with chloroquin, as several deaths had been reported among civil population and BSF personnel.

The army personnel were on chloroquin (300 mg weekly) whereas the GREF personnel were on chloroquin 300mg weekly plus proguanil 200mg daily prophylaxis. From May 2002, proguanil 200mg daily was added to the prophylaxis schedule of the army patrol.

The area was hilly with dense jungle and thick undergrowth. The area has predominantly tribal population. The work site was below raised features with numerous streams, cesspools and water collections. There were paddy fields in which breeding of anopheline larvae was noticed. The area had moderate to heavy rainfall. When cloud cover is present, it is comfortable around 23 – 28 °C, but humidity was high. During sunshine, the temperature is over 34-35°C. The men were mostly on the move, during which they use make shift accommodation. The personnel spent the day in the

Table 2**Epidemiological situation of malaria in Tripura 1996-2001**

Year	Blood slides examined	No positive	PF cases	ABER*	SPR	PF%	API	Deaths
1996	22119	9843	7112	7.19	4.40	72.20	-	16
1997	251903	18122	15491	7.90	7.20	85.40	5.70	10
1998	231487	12595	10507	7.00	4.50	84.00	3.80	5
1999	212056	14408	11889	6.40	6.80	82.50	4.30	11
2000	186153	12245	9623	6.10	6.00	78.60	3.60	6
2001	280715	17761	13831	8.80	6.30	77.80	5.50	9

Table 3**District wise incidence of malaria in Tripura 1999-2001**

Year	Slides examined	No positive	SPR	PF (No)	PF%	Deaths
West District						
1999	62635	694	1.11	462	66.57	03
2000	76533	713	0.93	553	77.56	02
2001	100888	3264	3.24	2479	75.95	01
South District						
1999	63686	10278	16.14	9023	87.79	05
2000	60104	12487	20.78	8836	70.76	02
2001	88132	11450	12.99	8984	78.46	05
North District						
1999	85735	3436	4.01	2484	72.29	03
2000	43961	1092	2.48	1072	98.17	02
2001	54364	1706	3.14	1608	94.26	02
Dhalai District						
2000	23724	718	3.03	330	45.96	01
2001	37331	1341	3.59	796	59.36	01

open and returned back to camp late at night. The bathing points and toilets were makeshift without protective wire-meshing. The persons were prone to mosquito bites during dusk and dawn while bathing or defecating.

Discussion

Tripura is hyperendemic for malaria with perennial transmission and having more than one vector operating [2-4]. Both *P. falciparum* and *P. vivax* are present, but the former predominates. The area is sub mountainous with rich flora and fauna covered by forests and crisscrossed by perennial hill streams. It is inhabited by tribal people and the density of population is low. In such an eco-system most locals are semi-immune and asymptomatic infections are common [5]. These form the reservoir for newly inducted susceptible personnel.

A study of labour in the northeastern region of India revealed that out of total of 253,000 labourers, 11.1% were positive for malaria, out of which 7.1% were falciparum malaria cases [1]. Forest malaria has been recognized as a separate entity in many parts of the world where they are major human migrant intrusions into forest areas [6-9]. Forest mosquitoes have different habits from those in endemic areas. They are outdoor biters and resters and bite during the day. Therefore,

residual household spray is not useful and collection of adult mosquitoes in outdoor places is difficult unless special techniques are used [10]. Singh et al [7] carried out surveys in forest villages in Central India and found more than 70% of the fever cases had malaria, with 87% of the cases of malaria being due to *P falciparum*. In the present study random sample of casual labourers showed 10% of blood smears to be positive for falciparum. The lower rate in the army personnel compared to GREF personnel (in spite of GREF personnel being on prophylaxis with chloroquin + proguanil, compared to army personnel who were only on chloroquin prior to May 2002) may be due to better malaria discipline in army. The outbreak could have been prevented if forest malaria had been considered before deployment of the susceptible GREF and military personnel, into a pocket of hyper endemic malaria by intensive health education and training in personal protective measures both before and throughout the deployment.

In view of lack of standardized treatment schedule among the local practitioners, paramedics, and chemists scientific studies of resistance status needs to be carried out and a uniform antimalaria drug policy formulated. Microscopy facilities, which were lacking in peripheral health centres need to be established for effective surveillance and rational drug treatment.

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