

Malaria Related Morbidity in Central Reserve Police Force Personnel Located in The North-eastern States of India

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INTRODUCTION

Malaria is endemic in most parts of the Northeastern States of India. *P. falciparum* (the killer parasite), is the predominant parasite species accounting for more than 60% of malarial infections, the remaining are *P. vivax* cases (Mohapatra et al., 1998; Dev et al., 2001a). Focal outbreaks of the diseases are of frequent occurrence particularly along forest fringe/ inter-border areas characterized by enhanced morbidity and mortality amidst public chaos and panic (Dev et al., 2001b). Although Northeastern region constitutes nearly 4% of country population, yet it contributes 10% to 12% of total malaria cases, 12% to 13% of *P. falciparum* cases, and 14% of deaths of those recorded in India annually. There are multiple vectors operating in this region namely *An. minimus*, *An. dirus* and *An. fluviatilis*; these are highly anthropophilic and are responsible for perennial and persistent transmission of malaria, despite regular anti-malaria measures conducted under National Anti Malaria Programme (Dev, 1996). This area is of strategic importance owing to an international border with China to North, Bhutan to the west, Myanmar to the East and Bangladesh to the South. The movements of defense personnel including Central Reserve Police Force (CRPF) is a regular feature along inter-border/ malaria infested areas, and thus are subject to risk of acquiring a malarial infection. The sole objective of this communication is to review the data retrospectively on account of morbidity and mortality attributable to malaria in the Central Reserve Police Force battalions operating in the northeastern states in relation to existing surveillance systems and control measures.

MATERIAL AND METHODS

Topography: The Northeast region of India (22° – 29° N; 89° – 97° E) comprises the seven states namely Assam, Arunachal Pradesh, Nagaland, Meghalaya, Mizoram, Manipur and Tripura. There are several hill ranges interspersed with

beautiful valleys, and is by and large sparsely populated. Each state is inhabited by number of ethnic tribes characterized by their native languages/ dialects, rituals, costumes and housing pattern. The valleys are marked by major river systems and are prone to floods during the monsoons. The terrain is difficult and communication is poor. The fauna and flora is rich and the evergreen rain forest covers nearly 40% of total geographical areas. Tea plantation is the major agricultural cash crop, and the other occupations included paddy (jhum) cultivation, handlooms and forest produce. Most people live under low socio-economic conditions. Large areas in this region get rainfall 2 meters or above during monsoon season (July to September) with pre-monsoon showers beginning in March/April. The relative humidity varies from 60% to 80%, and most part of the year is hot and humid (22° C to 33° C) in the foothill ranges except November to February which marked the winter season. Overall, the environment is conducive for mosquito proliferation, their survival and longevity, and is just right for active malaria transmission.

Data Acquisition: Data on malaria attributable morbidity were collected from the 41 CRPF battalions (population 38,417) located in the Northeastern States for the past 3 consecutive years (1999-2001). Each battalion has 1000 (approx.) personnel between the age group of 17 to 60 years, and most of these battalions (not all) have one medical officer to meet the medical services. Almost all of these battalions are located in very remote/inhospitable areas, and stand greater risk of acquiring a malarial infection. There being no microscopes and other diagnostic techniques, e.g. rapid test-kits, all those reporting fever are treated as clinical malaria cases. Patients with pre-existing malaria related complication, e.g. cerebral involvement, and those developing at a later stage are first referred to nearby civil hospital/ Primary Health Center, and later referred to Base Hospital CRPF and/or Govt. Medical College Hospital based on clinical judgment of attending Physicians. In many cases,

it takes time to reach nearby medical facility for immediate relief amounting to late diagnosis and delayed treatment. The data reported herein are those of 41 battalions responding to query and is reported as such. In addition, data from the CRPF Base Hospital, Guwahati, a referral Center (a largest set up with all possible medical facilities in Northeast Sector) is taken into account to measure disease burden due to malaria in relation to all other diseases.

Control Measures: In the CRPF establishments antivector measures are executed by the respective State/ District health authorities as per schedule. Indoor residual sprays with DDT are the main stay against the vector populations. Besides, one mosquito net per person is provided by the CRPF itself for personal protection, and these very nets are impregnated with synthetic pyrethroid, i.e. deltamethrin and/or cyfluthrin in the high risk areas for increased protection against the dreaded vectors as per guidelines. Insecticide Treated Mosquito Nets (ITMN's) are now being introduced in a phased manner especially in units located in remote/ inaccessible areas. During the period under review, 10 to 14 battalions were supplied with ITMN'S. Among anti-parasite measures, chemoprophylaxis (Chloroquine 300 mg weekly) was in practice in 28 to 35 battalions to reduce the risk of acquiring malarial infection. Clinical malaria cases and those confirmed positive were administered anti-malarial therapy as per NAMP drug policy. For capacity building, continuing medical education meetings are held annually for medical officers. Regular monthly meetings are held for paramedical staffs and jawans / young recruits with focus on malaria prevention and control aspects. In camp areas, thousands of larvivorous fishes (*Poecilia reticulata*) are being introduced in open drains and shallow water bodies as an environmental management method to check mosquito population and associated nuisance. In addition, there is a provision for Malathion fogging coupled with application of malarial oil to potential breeding habitats as and when situation warrants it.

OBSERVATIONS

Data on malaria related morbidity and mortality for the past 3 consecutive years, i.e., 1999 to 2001 in the CRPF personnel located in the Northeastern States are present in Table 1.

Clinical malaria cases were reported by all the battalions except the one located in Meghalaya for the year 1999. However, most cases were reported from Assam and Tripura corresponding to the strength of personnel posted in these States. Malaria related deaths were recorded for each year in the States of Assam, Tripura, Manipur and occasionally in Meghalaya, Arunachal Pradesh and Mizoram except Nagaland. However, most deaths were reported from Assam followed by Tripura corresponding to number of fever / clinical malaria cases.

Data based on hospital records on referral cases on account of malaria and associated deaths in relation to all other diseases are given in Table 2. Over the 3 years period, 4% to 9% of indoor cases were due to malaria. Among these, 84% to 93% were *P. falciparum* infections, and the remaining were *P. vivax* cases. Of the *P. falciparum* infected patients, 15% to 24% developed cerebral complications resulting in death of certain individuals. The death rate among *P. falciparum* cases ranged between 2% to 5% but it was nearly six times greater (12% to 33%) among those which developed serious complications. Of deaths recorded on account of all diseases, malaria contributed 8% to 21% of the deceased.

DISCUSSION

Malaria ranks among the major public health issue in the northeastern states of India, and accounts for much of the morbidity and mortality associated with the disease. This region in particular is considered as the nidus for spread of *P. falciparum* malaria particularly the multi-drug resistant varieties through human agency (Sharma, 2000). Currently, in India 2.5 to 3 million malaria cases along with 1000 deaths occur annually as per the Directorate of National Anti Malaria Program (NAMP) report. Taken together, these figures are considered only the trends on account of under reporting, poor surveillance and treatment seeking behaviour under existing health services. In fact, the World Health Organization estimate six times more cases and deaths manifold (WHO, 2000).

Most areas in the Northeast are considered high risk for acquiring malarial infection. The Assam state accounts for 70% of entire population, and over 50% of malaria cases of those reported from Northeast. Most of its

districts along inter-state and inter-country border areas categorized as high risk (source; State Health Directorate, Govt. of Assam). These very pockets are insurgent on account of ethnic conflicts, itinerant labor force, illegal migration across borders, and are subject to poor vector control and inadequate surveillance. Consequently, there is a heavy parasite load in the communities, and of these 8% to 33% of population groups are estimated to be the silent / asymptomatic carriers on account of herd immunity. The posting and out-posting of CRPF personnel and movement of other Defense Forces is a recurring phenomenon. Not surprisingly, most of the malaria cases and reported deaths were from battalions located in Assam corresponding to their strength and relative geographical location (Table 1). The latter factor has been proven to be of paramount importance in relation to vector breeding habitat / flight range (estimated 1.0 to 1.5 km) of vector mosquitoes (Carter et al., 2000). No claims are made here in for true incidence of malaria in the CRPF personnel, thus the present data may only be taken as trends. It is very likely that many cases would have been misdiagnosed and / or subject to under-treatment resulting in delayed treatment with a fatal outcome.

The CRPF personnel are highly mobile and often are non-immune population groups owing to their nature of assignments. Thus, malarial infection when acquired is often associated with severe clinical presentation. Despite the fact that every effort is made on the part of the management to meet the medical emergencies, certain individuals do succumb to the killer disease largely on account of late reporting and delayed treatment. While it is deemed necessary to ensure early diagnosis and prompt treatment in context of Roll Back Malaria (RBM) initiative of WHO, it takes a while to reach nearby Civil Hospital / Base Hospital due to geographical isolation and difficult terrain. Based on the hospital records, delayed reporting was the main cause of mortality associated with malaria (Table 2). All deaths were confirmed due to *P. falciparum* malaria and associated complications. Among its clinical manifestations, cerebral involvement was the main characteristic. *P. falciparum* was confirmed to be the major parasite species among cases those admitted / referred from field sites. There being no diagnostic facility at these locations, most

Table 1: Malaria attributable morbidity and mortality in Central Reserve Police Force Battalions located in the Northeastern States of India.

State	1999				2000				2001			
	No. of BN's (Population)	No. of fever cases	No. of malaria cases	No. of deaths	No. of BN's (Population)	No. of fever cases	No. of malaria cases	No. of deaths	No. of BN's (Population)	No. of fever cases	No. of malaria cases	No. of deaths
Assam	20 (18740)	415	152	05	19 (17803)	379	117	04	19 (17803)	517	187	10
Tripura	09 (8433)	327	48	04	10 (9370)	536	104	06	10 (9370)	554	152	01
Manipur	04 (3748)	19	04	03	04 (3748)	016	016	03	04 (3748)	29	13	01
Meghalaya	01 (937)	00	00	00	01 (937)	67	67	01	02 (1874)	168	63	00
Nagaland	05 (4833)	47	41	00	04 (3748)	20	14	00	04 (3748)	10	05	00
Mizoram	01 (937)	37	37	01	01 (937)	29	03	00	01 (937)	48	17	00
Arunachal Pradesh	01 (937)	12	06	00	02 (1874)	35	20	00	02 (1874)	17	06	02

Table 2: Relative disease burden due to malaria in the CRPF personnel based on the records of Base Hospital III, Guwahati, Assam

Year	No. of Indoor cases (all diseases)	No. of admissions/ referral cases due to malaria	No. Positives for		No. of <i>P. falciparum</i> cases with cerebral involvement	No. of deaths due to <i>P. falciparum</i>	Total deaths (all diseases)
			<i>P. falciparum</i>	<i>P. vivax</i>			
1999	945	90	84	06	16	2	15
2000	1064	43	40	03	06	2	25
2001	1177	89	75	14	18	4	19

fever cases were treated as clinical malaria cases subject to judgment of attending physicians. In practice, for treatment of malaria, chloroquine is the first drug of choice, followed by Sulfa-doxine-Pyrimethamine (S-P compound) and Quinine as per guideline of NAMP (Dhillon and Lal, 1997). Yet reduced therapeutic efficacy to chloroquine and S-P Compound has been documented in region since its first report in Karbi – Anglong district of Assam (Sehgal et al., 1973; Gogoi et al., 1995). No reports of resistance to quinine has been documented in this region, and fortunately so, alternative potent anti-malarials, i.e., artemisinin derivatives are now available for the treatment of severe / complicated malaria cases (Dev et al., 1998; Asthana et al., 2001). Besides, chemoprophylaxis (300 mg chloroquine weekly) is in practice in battalions located in the remote / inaccessible areas and was seemingly effective to reduce the relative risk of malarial episode. Besides saving lives of CRPF personnel, it is all the more important to check the spread of drug resistant varieties of *P. falciparum* malaria to rest of India (Northeast being the gateway) through effective vector control and strict vigilance. In this context, it is recommended that in the CRPF battalions:

1. At least one medical officer and a skilled technician be provided at each field site to ensure early case detection and prompt treatment / management of severe / complicated malaria cases. In so far as possible, rapid malaria test kits be provided for on the spot diagnosis. These test kits have been field evaluated across the world and are considered vital to the programme (Dev and Bhattacharyya, 2002).
2. All CRPF personnel be examined at entry / exit point from and to Northeast for malaria parasite, and radical cure be ensured, and

be briefed / educated on malaria with focus on prevention and control aspects.

3. In addition to all other anti malaria measures, Insecticide Treated Mosquito Nets (ITMN'S) be introduced as personal protection method and be made mandatory for enhanced compliance. This method of control is being incorporated in the health services in Northeastern region based on the proven success (Jana-Kara et al., 1995).
4. Ensure sufficient supply of anti malarial drugs and insecticides used for impregnation / re-impregnation of mosquito nets. The know how technology is available with the Malaria Research Center, Sonapur, Assam.
5. Chemoprophylaxis at the prescribed doses be continued in high risk areas two weeks prior to entry and four weeks after withdrawal, and ensure strict compliance.
6. Information, Education and Communication activities be regularly observed for up-gradation of skills for medical officer, technicians and the troops alike.

All these measure would help restore confidence, good health and high spirit in the troops in services to the nation and mankind. Along with these confidence building measures, efforts should be made to strengthen the health delivery system at the periphery, and promote better reporting system in order to forecast and possibly avert the onslaught of malaria epidemics (Najera et al., 1998).

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KEYWORDS Malaria. Defense Personnel. Morbidity. Mortality. North-east India. *P. falciparum*

ABSTRACT The data on morbidity and mortality attributable to malaria in the Central Reserve Police Force personnel located in the seven states of the Northeast are reviewed retrospectively for the years 1999 to 2001. Maximum number of malaria cases and associated deaths were recorded in Assam followed by Tripura and Manipur in relation to strength of the troops in the respective states. Based on the CRPF Base Hospital records, it was concluded that *P. falciparum* was the predominant parasite species (> 80% of cases) among indoor/ referral cases, and was responsible for much of the mortality associated with cerebral complications. In order to reduce the relative risk of acquiring a malarial infection in the region, the use of Insecticide Treated Mosquito Nets (ITMN's) were advocated in addition to the existing intervention strategies in practice.

REFERENCES

- Asthana, O.P., Srivastava, J. S., Pande, T. K., Vishwanathan, K. A, Dev, V., Mahapatra, K. M., Nayak, N. C., Balsara, A. B., Mandal, O.P., Gupta, N., Mishra, S. K., Mohanty, S., Sathpathy, S., Das, B.S., Patnaik, J.K., Sathpathy, S.K. and Dash, B.: Multicentric clinical trials for safety and efficiency evaluation of alpha-beta arteether in complicated *P. falciparum* malaria. *Journal of Association of Physicians of India*, **49**: 1155-1160 (2001).
- Carter, R., Mendis, K.N. and Roberts, D.: Spatial targeting of interventions against malaria. *Bulletin of the World Health Organization*, **78**: 1401-1411(2000).
- Dev, V.: *Anopheles minimus*: its bionomics and role in transmission of malaria in Assam, India. *Bulletin of the World Health Organization*, **74**: 61-66 (1996).
- Dev, V. and Bhattacharyya, P.C.: Rapid kits for diagnosis of malaria: An update. *Medicine update*, **10 (8) 12/02**: 83-87 (2002).
- Dev,V., Hira, C. R. and Rajkhowa, M.K.: Malaria – attributable morbidity in Assam , northeastern India . *Annals of Tropical Medicine & Parasitology*, **95**: 789 –796 (2001a).
- Dev, V., Ansari, M. A., Hira, C. R. and Barman, K.: An outbreak of *P. falciparum* malaria due to *Anopheles minimus* in Central Assam, India. *Indian Journal of Malariology*, **38**: 32-38 (2001b).
- Dev, V., Nayak, N. C., Mahapatra, K. M., Choudhary, D., Phukan, S., Srivastava, J. S., Asthana, O. P. and Sharma, V.P.: Alpha-beta arteether, a new anti- malarial. *Current Science*, **75**: 758-759 (1998).
- Dhillon, G.P.S and Lal, S.: Revised drug policy under the malaria eradication programme. *J. Commun. Dis.*, **29**: 209-217(1997).
- Gogoi, S.C., Dev, V., Choudhury, B. and Phookan, S.: Susceptibility of *P. falciparum* to chloroquine in tea garden tribes of Assam, India. *Southeast Asian J. Trop. Med. Public Health*, **26**: 228-230 (1995).
- Jana-kara, B. R., Wajihullah, Shahi, B., Dev, V., Curtis, C.F. and Sharma, V.P.: Deltamethrin impregnated bednets against *Anopheles minimus* transmitted malaria in Assam, India. *Journal of Tropical Medicine and Hygiene*, **98**: 73-83. (1995).
- Mohapatra, P. K., Prakash, A., Bhattacharya, D.R. and Mahanta, J.: Malaria situation in Northeastern region of India. *ICMR Bulletin*, **28**: 21-30 (1998).
- Najera, J. A., Kouznetzov, R.L. and Delacollette, C.: *Malaria Epidemics, Detection and Control, Forecasting and Prevention*, pp 81. WHO/MAL/ 98.1084. World Health Organization, Geneva (1998).
- Sehgal, P. N., Sharma, S.L. and Gogoi, S.: Resistance to chloroquine in falciparum malaria in Assam State, India. *J. Commun. Dis.*, **5**: 175-180 (1973).
- Sharma, V. P.: Status of drug resistance in malaria in India, pp: 191-202. In: *Multi-drug resistance in emerging and re-emerging diseases*. R.C.Mahajan (Ed.). Indian National Science Academy, Narosa Publications, Delhi (2000).
- World Health Organization. *Implementation of collaborative activities on Roll Back Malaria in the South-East Asia Region*. pp: 24, SEA-MAL-215(2000).

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