Original Article

PREVALENCE OF MALARIA CASES IN TEA GARDEN AREAS OF LAKHIMPUR DISTRICT, ASSAM

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ABSTRACT

Objective: After observing the increasing trend in numbers of fever cases from Joyhing and Koilamari tea estate, mass fever surveys were conducted to determine the prevalence of malaria cases in the affected areas.

Methods: Finger prick blood samples were collected from 368 patients having complained of fever and headache. Rapid malaria test kit was used for initial detection of malaria parasite. Further microscopic slide examination was also performed for confirmation. Taking microscopic examination as a gold standard method, the efficiency of rapid malaria test kit was determined by using statistical calculation.

Results: In rapid malaria test kit, *P. falciparum* malaria parasite was detected in 87 cases. Beside this, *P. vivax* infection was observed in 10 cases. Patients had no travel history. Females were more susceptible to malarial infection. Children's and adults were almost equally vulnerable to malaria infection. Among the positive samples, 88.66% cases were having symptoms of fever and remaining cases were asymptomatic. Taking macroscopic slide examination as a gold standard method, the sensitivity and specificity of SD malaria one step antigen rapid test was 100% and 97.83% respectively.

Conclusion: The disease prevalence was 24.73%. For active detection of malaria incidence, mass fever survey is needed in other tea garden areas where increasing trend of fever cases were observed.

Keywords: Assam, Lakhimpur, Malaria, *P. falciparum*, Tea garden.

INTRODUCTION

Malaria is the most widespread and serious parasitic disease in the world. Forty percent of the world's population (2.4 billion people) is exposed to the infection, especially people who live in tropical and subtropical countries [1]. Malaria is also considered as one of the major public health problems in our country. Around 1.5 million confirmed cases are reported annually by the National Vector Borne Disease Control Programme (NVBDCP), of which more than50% are due to *Plasmodium falciparum* (*P. falciparum*) infection [2]. The people of North eastern region are highly vulnerable to malarial infection, particularly in Assam where malaria becomes an epidemic form at any period of time. After the several intervention of health department, nowadays malaria burden is decreases to some extent in this region, but still now it is not eradicated and posing a serious hindrance in malaria control programme. It reemerges as a major problem in an outbreak form in several times and in different areas. In 2006, large epidemic of malaria has been taken place in Lakhimpur district of Assam where almost two hundred patients expired due to *falciparum* infection [3]. The Lakhimpur district is inhabited by Assamese belonging to Ahom, Kalita, Koch castes. There is also a significant population of Mising, Deori, Sonowal Kachari and Khamti. Forests are mainly tropical rain forest. The economy is agrarian, where tea industry is the backbone and provides employment to a large percentage of people in district. There are nine tea gardens in Lakhimpur district. These are named as Joyhing, Koilamari, Seajuli, Ananda, Cinataliah, Harmutty, Silanibari, Dirzoo and Dolohat tea estate (TE). Almost all tea gardens in Lakhimpur are situated in the fringe of thickly forested foot hills of Eastern Himalayan. As symptoms of fever are common cause among the people of tea garden labour so, a study was carried out in tea garden areas in Lakhimpur district of Assam for fever outbreak investigation and to determine the causative agent of fever.

Accurate and timely diagnosis plays a vital role to reduce the incident of malaria. In this aspect NVBDCP recommended rapid diagnostic test for initial diagnosis of malaria parasite so that clinicians are able to provide proper antimalarial during the early stage of development and multiplication of malaria parasite. Rapid test is useful in outbreak investigation and surveys of parasite prevalence. This test can also offer significant benefits in malaria management if a clear plan of action has been prepared to deal with the outcomes (i.e. drug treatment or appropriate further investigation). Taking in mind, nowadays rapid malaria diagnostic kit (NVBDCP supplied) are widely used in periphery levels by the malaria workers for initial diagnosis of malaria. As we know that the microscopic examination takes a long time for confirmation of malaria parasite, these rapid malaria test (RMT) kits are widely acceptable. Although there are few limitations like, RMT kits gives many false positive and false negative results, sometimes becomes confusing for health workers [7]. Keeping in mind with the vast application of RMT kits for malaria detection, to understand the diagnostic efficacy of this kit is required. So this study will also find out the diagnostic performance of RMT kits, assuming microscopic experiment as a gold standard method.

MATERIALS AND METHODS

Study area

Lakhimpur district occupies an area of 2277 km and has a population of 1,040,644 (as of 2011). The exact location of the district is 26.48' and 27.53' northern latitude and 93.42' and 94.20' east longitude (approx.).

Depending upon the constant increasing trend in numbers of fever cases from tea garden areas in Lakhimpur district of Assam, a mass fever survey was done in Joyhing TE and Koilamari TE which is nearly 20 km apart from Lakhimpur town. The study was conducted for a period of six month, from January to June, 2014. Any patients having complained of fever were included in our study irrespective of age and sex. Ethical permission was obtained from Joint director of health Services, Lakhimpur and other members in the board. Consent was taken from each participant before collecting blood samples. Finger prick blood samples were collected from a total of three hundred and sixty eight patients having complained of fever. In the field, the RMT kit namely standard diagnostic malaria one step antigen rapid test kit was done for initial detection of malaria parasite. Concurrently blood slide was also prepared for further confirmation of malaria parasite and species identification in the laboratory.

SD malaria one step antigen rapid test

The SD BIOLINE Malaria Ag *P.f/Pv* test is a rapid, qualitative and differential test for the detection of histidine-rich protein II (HRP-II) antigen of *P. falciparum* and *Plasmodium* lactate dehydrogenase (pLDH) of *Plasmodium vivax* in human whole blood.

Microscopic diagnosis

A drop of patient's blood, spread out as "blood smear" on a microscopic slide and the presence of malaria parasite was identified by examining under the microscope. Prior to examination, the specimen is stained with the Giemsa stain that gives the parasite to a distinctive appearance. This technique remains the gold standard for laboratory confirmation of malaria. After examining the malaria parasite by the above mention both methods, the sensitivity and specificity of SD malaria one step antigen rapid test was calculated by using the following statistical formula (16). Likewise, disease prevalence, positive likelihood ratio, negative likelihood ratio, positive predictive value and negative predictive value were also established.

❖ Sensitivity= True positive/True positive+ False negative
❖ Specificity= False positive /False positive+ True negative
❖ Positive Likelihood Ratio= Sensitivity/100-specificity
❖ Negative Likelihood Ratio=100-sensitivity/specificity
❖ Disease prevalence= True positive+ False negative/ True positive+ False positive+ False negative+ True negative
❖ Positive Predictive Value= True positive/ True positive+ False positive
❖ Negative Predictive Value=True negative/ False negative+ True negative

RESULT AND DISCUSSION

Out of total 368 (three hundred and sixty eight) sample tested, malaria parasite was detected from 97 (ninety seven) numbers of cases in RMT kit. *P. falciparum* mono infection was observed in 87 (eighty seven) cases and the remaining 10 (ten) cases had *P.vivax* infection. Instead of that, in microscopic examination 82 (eighty two) *P.falciparum* positive cases and 9 (nine) *P. vivax* cases were observed. Keeping microscopic observation as a gold standard method the sensitivity of SD malaria one step antigen rapid test was 100% (95% CI: 95.99 % to 100.00 %) and specificity was 97.83% (95% CI: 95.34 % to 99.20 %). Positive likelihood ratio and negative likelihood ratio was 46.17 (95% CI: 20.92 to 101.87) and 0 respectively. The disease prevalence was 24.73% (95% CI: 20.40% to 29.47%). There was 93.81% (95% CI: 87.01% to 97.68%) probability that the disease is present when the test is positive whereas 100.00 % (95% CI: 98.63% to 100.00 %) probability that the disease is not present when the test showed negative result.

Table 1: Demographic profile of malaria positive cases among the people of tea gardens in Lakhimpur district

Age groups (in years)	Malaria positive cases	Sex	
		Male	Female
1 to 10	22	7	15
11 to 20	27	11	16
21 to 30	24	15	9
31 to 40	21	10	11
41 to 50	1	-	1
51 above	2	1	1
Total	97	44	53

The overall incidence rate of malaria in Joyhing and Koilamari TE was 8.97 (per 1000 population). All the cases treated symptomatically. Complete dose of Artemisinin-based combination therapies were given to the *P. falciparum* positive cases whereas in *P. vivax* cases, Chloroquine for 3 days and Primaquine 0.25 mg/kg daily for 14 days were provided. Fever, chills and rigors, nausea and vomiting, and headache were the common symptoms seen in all types of malaria. Cases had no travel history indicating that the parasite might be circulating in the affected area. Among the malaria positive cases detected in RMT kit, 86 (eighty six) cases were symptomatic and the remaining 11 (eleven) cases had asymptomatic

infection. From these finding it was demonstrated that in high transmission areas, continuous exposures to *Plasmodium* parasites lead to partial immunity and consequently, create asymptomatic carriers in a given population [4, 5]. In addition, asymptomatic cases provide a fundamental reservoir of parasites and they might become gametocyte carriers, contributing in the persistence of malaria transmission [6]. Therefore, the presence of asymptomatic cases is a big challenge for the management of the elimination programme in any malaria endemic area. In order to achieve a successful elimination, detection of all parasite carriers by active case detection and then treatment of all cases must be considered to interrupt the malaria transmission in endemic areas.

The present study shows that females were more vulnerable to malaria infection which in opposing many previous findings [7-11]. Women are more susceptible to developing malaria due to a decreased immunity during pregnancy and an inequitable economic status that often results in delays to access health interventions [12]. Beside this, a significant number of malaria infections were also observed in young children's (Table 1). This is because they have not built up any immunity to the disease. This preponderance of males in case infection indicating the chance of outdoor work exposure in the case infection because males are more involved in outdoor works than females and they are less clothed than females and this promotes more chances of mosquito bite. Similarly, all age groups were found to be susceptible to malaria (Table 1). However, those in the age range between eleven to twenty years were more affected [7, 9, 13-15]. Similarly, other studies have reported that children were more susceptible than older age groups [8]. Beside this many studies have indicated that adult age groups were more vulnerable to malarial infection [7, 9, 13-15]. There are several factors which were found to be associated with high prevalence of malaria in tea gardens. During the consecutive supervision, coverage of dichlorodiphenyltrichloroethane (DDT) spraying was very poor due to refusal and also many houses were found locked. During the investigation period, incomplete treatment and lack of sanitary also observed within the participants. It was also seen that most of the garden labours were unaware about the risk of malaria. The movements of non immune tea labours from outside areas to these locality and that are engaged for tea work have led to a persistence transmission of malaria in the tea gardens. The knowledge of local malaria epidemiology in the tea gardens seems to be essential in taking up situation specific disease intervention strategies. During the study, information, education and communication (IEC) done regarding personal protection. During the analysis in first six month of the year, it was observed that another 20 (twenty) *P. falciparum* positive and 2 (two) *P. vivax* cases were reported from other tea gardens in Lakhimpur district. However the incidence of malaria is inconsiderable in these tea gardens as compared to Joyhing and Koilamari TE. It was believed that the tea garden labours have acquired relatively limited medical facility and are at higher risk of having malaria infection. So, special focus should be needed among the population in tea garden to prevent an impending large outbreak of malaria in Lakhimpur district of Assam.

CONFLICT OF INTERESTS

Declared None

CONCLUSION

Malaria is still prevalent among the people of tea gardens in Lakhimpur district of Assam. To avoid the burden, particular focus should be needed for screening out the asymptomatic cases. Prompt and accurate diagnosis also facilitate in early detection of malaria parasite which will help in taking initial steps for better management of malaria at an early stage.

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