An epidemiological study on clinical profile of malaria in Rampachodavaram and Maredumilli the tribal belt of east Godavari, Andhra Pradesh, India

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Objective: To observe the distribution of malaria infection in the tribal area of East Godavari District of Andhra Pradesh, India.

Methods: The data for the present study was collected from 6,342 and 765 patients who were admitted at tribal hospital and hill forest camps respectively during the study period. The data was collected from the malaria suspected patients admitted in paediatric and adult critical care wards of a tertiary hospital and in interior hill and forest camps in and around the Rampachodavaram. The detailed medical case sheet proforma were prepared and data has been analyzed. It was found that RDT’s can be helpful to screen Plasmodium falciparum (P. falciparum) in endemic areas and remote tribal belt.

Results: A total number of 6,342 and 765 patients were admitted at tribal hospital and hill forest camps respectively during the study period. Among 6,342 of individuals tested, 4,387 individuals were reported for malaria positive. Out of the 4,387 slides examined, 59.0% were positive P. falciparum infection, 19.4% slides showed positive Plasmodium vivax infection and 21.5% had mixed infection. The total P. falciparum burden was estimated as 80.5%. In hill forest camps, out of 765 admitted patients, 650 patients who had clinical history showed suggestive of malaria were examined for malaria parasites.

Conclusions: The maximum numbers of malaria infection (4,387) were reported from the tribal based hospital. Malaria is responsible for major health concern in this region, particularly in rainy season, P. falciparum was the major parasite type causing malaria, and most of the complications were due to Plasmodium vivax. Compared to rest of the hills and forest areas, where most of the tribal people reside has the heavy load of malaria mainly P. falciparum. One important finding from the present study was the sex-difference observed in the admission rate. The rate of malaria infection was significantly high for male (53.5%), followed by female (46.5%) and children (33%).

Keywords: Malaria, Plasmodium falciparum, Plasmodium vivax, RDT diagnosis

1. Introduction

Malaria is one of the foremost public health problems which impose great threat on humanity. About 36% of the world population is exposed to the risk of contracting malaria. World Health Organization (WHO) revealed that 300 to 500 million malaria cases annually recorded in about 100 countries[1,2]. Out of which the vast majority of cases have been reported from the Africa (85.5%)[3], followed by the Southeast Asia (10%) and the Eastern Mediterranean Regions.
been estimated that of Orissa, Jharkhand, Madhya Pradesh, Andhra Pradesh and forest areas. In continuation, the work has been carried out to understand the relatedness of seasonal pattern of malaria infected. Moreover, the treatment outlines are conducted in all cases of malaria at the clinical geographical setting.

2. Materials and methods

2.1. Study area and data source

This prospective study was conducted during one year from January to December, 2012. Observing the incidence of malaria, Rampachodavaram, Maredumilli area situated at Andhra Pradesh, India was selected as study area for conducting the survey. The data was collected from the malaria suspected patients admitted in paediatric and adult critical care wards of a tertiary hospital and in interior hill and forest camps in and around the Rampachodavaram. The detailed medical case sheet proforma were prepared and data has been analyzed.

2.2. Diagnosis of malaria parasite

Peripheral blood was collected from the group of male, female and children patients examined for malaria parasite who had short duration (<3 d) of fever (temperature>38 °C) associated with any localized symptoms such as fever with sweating and shaking chill, fatigue, headache, vomiting, abdominal cramps, dry cough, muscle and joint pain. Annual parasitic incidence was calculated using standard formula.

In this study, diagnosis of malaria has been done on the basis of malaria parasite on blood slide examination of thick and thin smears, and/or malaria antigen positivity with RDTs and Widal test. Widal test is of little clinical relevance due to the number of cross reacting infections. The systematic outline of the diagnosis process has been illustrated in Figure 1.

![Figure 1. Systematic diagram of the clinical diagnosis analysis for malaria.](image-url)
Both thick and thin blood films were prepared and stained by Ramnowski’s method. The species and the stages in which the parasite were seen also noted. The slide falciparum rate and percentage of \textit{P. falciparum} infection were calculated.

2.3. Treatment protocol for malaria infected individuals

Based on the clinical and laboratory parameters, male, female and children who has been categorized as severe malaria as per the guidelines of the WHO were included in the study[12].

Patients with uncomplicated \textit{P. falciparum} infected were treated with artemisinin combination therapy (ACT). Four different types of ACTs were reported such as, artemether plus lumefantrine, artesunate plus amodiaquine, artesunate plus mefloquine and artesunate plus sulfadoxine–pyrimethamine. WHO has now added a fifth ACT – dihydroartemisinin plus piperaquine. ACTs for first–line treatment in infants and young children with attention to accurate dosing and ensuring the administered dose is retained. The choice of ACT in a country or region will be based on the level of resistance of the partner medicine in the combination. In case of uncomplicated \textit{P. vivax} malaria infection, chloroquine combined with primaquine was used[13]. It was observed that at least a 14–day course of primaquine is required for the radical treatment of \textit{P. vivax}. However ACT (exception AS+SP) has been adopted as the first–line treatment for \textit{P. falciparum} malaria, is also be used for \textit{P. vivax} malaria in combination with Primaquine for radical cure.

In the treatment of severe malaria for adult individuals, artesunate \textit{i.v.} or \textit{i.m.}: 2.4 mg/kg body weight was given at the intervals of 0 h, 12 h and 24 h followed by once a day after wards[14]. Lactating women should receive standard antimalarial treatment (including ACTs) except primaquine and tetra–cyclines. Children with complicated malaria were treated with artesunate \textit{i.v.} or \textit{i.m.}; quinine \textit{i.v.} infusion or divided \textit{i.m.} injection should be used.

In pregnancy the infected female was treated with quinine plus clindamycin to be given for 7 d. ACT is applied if quinine plus clindamycin treatment fails or uncertainty of compliance found within 7 d treatment[15]. At the second and third trimesters, the patient was treated with artesunate plus clindamycin or quinine plus clindamycin for a week.

3. Results

A total number of 6342 and 765 patients were admitted at tribal hospital and hill forest camps respectively during the study period. Among 6342 of individuals tested, 4387 individuals were reported for malaria positive. Out of the 4387 slides examined, 59.0% were positive \textit{P. falciparum} infection, 19.4% slides showed positive \textit{P. vivax} infection and 21.5% had mixed infection. The total \textit{P. falciparum} burden was estimated as 80.5%.

In hill forest camps, out of 765 admitted patients, 650 patients who had clinical history suggestive of malaria were examined for malaria parasites. The parasitological parameters had showed that 60% of malaria occurred due to \textit{P. falciparum} infection, and \textit{P. vivax} was responsible for 15 % infection whereas, mixed infection were found in 25% cases (Table 1). The highest malarial cases from tribal hospital and hill forest camps were reported in month of August (Table 2).

| Table 1 | Parasitological parameters of malaria in hospital and hill forest camps. |
| Types of infection | No. of cases reported in hospital | No. of cases reported in hill forest camps |
| \textit{P. falciparum} | 2591 | 390 |
| \textit{P. vivax} | 855 | 98 |
| \textit{Plasmodium} mixed | 941 | 162 |
| Total | 4387 | 650 |

| Table 2 | Seasonal pattern of total parasitological infection in one year enrolled at hospital and hill forest camps. |
| Month | TNF | TNM | \textit{P. falciparum} | \textit{P. vivax} | Mixed | PF % |
| January | 146 | 144 | 65 | 27 | 52 | 81.0% |
| February | 168 | 157 | 83 | 39 | 35 | 75.0% |
| March | 182 | 174 | 93 | 38 | 43 | 78.0% |
| April | 179 | 170 | 75 | 50 | 45 | 70.0% |
| May | 411 | 303 | 142 | 89 | 72 | 70.0% |
| June | 662 | 433 | 238 | 110 | 85 | 74.0% |
| July | 704 | 607 | 322 | 114 | 171 | 81.0% |
| August | 1074 | 846 | 557 | 155 | 134 | 81.0% |
| September | 823 | 526 | 327 | 88 | 111 | 83.0% |
| October | 910 | 479 | 303 | 76 | 100 | 84.1% |
| November | 660 | 347 | 245 | 43 | 59 | 87.6% |
| December | 423 | 201 | 141 | 26 | 34 | 87.0% |
| Total | 6342 | 4387 | 2591 | 855 | 941 | 80.5% |

TNF: Total number of fever cases enrolled; TNM: Total number of malaria positive cases; PF: percentage of \textit{P. falciparum} infection.
4. Discussion

In the overall study, it was found that *P. falciparum* has been identified as the most common etiologic agent in both severe and non–severe malaria causing 80% of all malaria cases. Only 15% of malaria cases were caused by *P. vivax*, while 5% cases due to dual infection by both species of parasites. Therefore *P. falciparum* infection was more likely to cause severe malaria than *P. vivax* or mixed infection. Contrary to the present study, the high percentage of *P. falciparum* infections may be due to their prolonged illness and severity of the disease who were admitted to the hospital and camps from the adjoining areas. High number of *P. falciparum* infections may be due to their prolonged illness and severity of the disease who were admitted to the hospital and camps from the adjoining areas.

The present study also focused on the gender wise distribution of malaria positive patients. The total slide positivity rate was significantly high in male (53.5%). Interestingly the infections in female were recodes as 46.5% and followed by children (33%). The primary counseling revealed that in most cases males were acquiring malaria due to more exposed.

Malaria cases in India are reported throughout the year. During monsoon season (June to October) malaria cases were more reported as compared to winter season. During the rainy season more breeding grounds has been created. Almost every household are to be suffering from frequent bouts of malaria. The percentages of PF were found to be significantly higher at over the years. The study compares well with the study conducted by Talsania et al., 2010.

Chloroquine is remaining the drug of choice for treatment of malaria infection in this region. However, the major threat today is the potential for resistance to arise in *P. falciparum* against artesunate or its partner drug. For treatment, quinine or combination of sulfadoxine with pyrimethamine showed makeable result. However the doses were depending upon the clinical presentation of the patients. For *P. vivax* infection, chloroquine is highly susceptible to, and thus should always be the first line of treatment. Chloroquine combined with Primaquine has showed the fruitful effect on *P. vivax* infection. The pregnant women have been constituted an important risk group for malaria infection particularly in hyper and holoendemic situations. In the time of pregnancy artesunate plus clindamycin or quinine plus clindamycin has been shown the positive effect.

In this study an attempt has been made to find out the spectrum of clinical and parasitological features in severe malaria in and around of Rampachodavaram, Maredumilli area and to identify the factors which might be related with adverse outcome in malaria. When compared to rest of the hills and forest areas, where most of the tribal people reside has the heavy load of malaria mainly *P. falciparum* causing deaths and reemerging as threat to nation. It was found that RDT’s can be helpful to screen *P. falciparum* in endemic areas and remote tribal belt. In compare with the earlier guideline, the present WHO guidelines in the management of malaria (artemesunine combination therapy) has been showed much effective on both parasite infections.

The awareness towards the malaria infection by effective campaigning program targeted against the spread of malaria, careful search for malarial parasites in the peripheral blood film in clinical setting and urgent supply of anti malarial vaccine should be undertaken. The antilarval, anti adult mosquito and personal protection must be improved and implemented effectively. Various government and non–government organizations are involved in awareness campaigning programs but still there is a need to strengthen the counseling and media campaigning in rural areas to enhance malaria prevention activity. Treatment protocol for malaria infected individuals showed that ACT has been showed much effective on both parasite infections. The multidisciplinary approaches that include clinical and field studies with laboratory, molecular, and genomic methods would be provide a powerful combination for malaria control and prevention in India.

**Conflict of interest statement**

We declare that we have no conflict of interest.

**Comments**

**Background**

Malaria continues to pose a major public health threat in India. High prevalence has been reported among ethnic and tribal groups living in remote forested and border areas as well as among mobile and migrant population. Transmission is seasonal with increased intensity related to rain. Limited health infrastructure and lack of drugs at village level are the factors responsible for high morbidity and mortality due to malaria.

**Research frontiers**

The present study was conducted in the tribal belt of East
Godavari district i.e. Rampochodavaram and Maredumilli area. The population of tribal areas of Andhra Pradesh, Madhya Pradesh, Chhattisgarh, Gujarat, Maharastra, Bihar, Jharkhand, Rajasthan, Orissa and North Eastern states are contributing about 50% of \textit{P. falciparum} cases of the country.

\textbf{Related reports}

Muddaiah M. and Prakash PS (2006) have been reported a study of clinical profile of malaria in a tertiary referral centre in South Canara; Talsania NJ and Vani SN (2010): A study of malaria–related paediatric morbidity and mortality in Ahmedabad, Gujarat state, India.

\textbf{Innovations & breakthroughs}

\textit{P. falciparum} was causing 80% of all malaria cases. Cases are more in the month of August, mixed infection were also there in the 25% of cases. Comparatively males are more affected. Almost every household are suffering from frequent attacks of malaria.

\textbf{Applications}

\textit{P. falciparum} was more common which is dreadful with more complications. RDT immunological test found to be more useful in the community for early diagnosis in the resource poor setting.

\textbf{Peer review}

This is a good study in which the authors observed the epidemiological features of malaria in the tribal belt where the problem is more prevalent. Being hilly area transportation facilities are less and sometimes in accessible because of the bad weather. The observations are useful for the policy makers for evaluating the programme.

\textbf{References}


