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# Observational Study of Complications of *Plasmodium falciparum* in Central Rural India

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## Abstract

**Aims and Objectives:** The present study aims to understand the clinical course of the disease, complications, their response to treatment and outcomes in patients with *Plasmodium falciparum* malaria infection.
**Method:** Total 201 patients of age more than 12 year were recruited for the study. Rapid diagnostic test or peripheral smears positive for *falciparum* malaria were considered diagnostic. Out of total cases 99 were *falciparum* positive. Detailed history, physical and clinical examination and required investigations were done in all cases. Patient had been started on standard treatment of malaria and reviewed for any complication developed. Course of the disease in hospital and response to the antimalarial had been noted.
**Results:** Majority of our cases were males of more than twelve years. Fever was most common presenting symptom in 98% of patients. Thrombocytopenia was the commonest complication of malaria followed by cerebral malaria, jaundice, acute renal failure, anaemia, algid malaria, metabolic acidosis, respiratory distress and hypoglycaemia. Total 91 (91.92%) patients were treated with ACT but 8 (8.08%) patients have resistant to ACT and they were treated with Arthemeter plus lumifantrine. The most common cause of death was found to be cerebral malaria which was observed in 100 % of death. Other causes were algid malaria, severe thrombocytopenia, metabolic acidosis, jaundice, acute renal failure and respiratory distress.
**Conclusion:** Early diagnosis, early recognition of risk factors and complications, prompt treatment form the backbone of malaria management to reduce the morbidity and associated mortality.
**Keywords:** *Plasmodium falciparum*, Smears, Antimalarial, Cerebral malaria, Algid malaria.

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## 1. Introduction

Malaria is one of the oldest recorded diseases of world; it has infected humans since last 50,000 years. It continues to create menace in developing countries especially Indian subcontinent. India contributes about 70% of malaria cases in South East Asia region [1]. However, the regional differences in India in terms of weather, socioeconomic status and infrastructural irregularities make certain regions particularly important for burden of malaria. This huge burden of disease and malaria is responsible for increased mortality and morbidity.

Five species of *Plasmodium* (*P. falciparum, P. vivax, P. malariae, P. ovale,* and *P. knowlesi*) cause naturally acquired malaria in humans. Most often, severe malaria is caused by *P. falciparum*. The clinical features range from no or mild symptoms to severe disease and death as observed in many parts of the world [2]. Estimates indicate that around 150 returning travellers die each year from imported malaria and are manifested by severe anemia, renal failure, acute respiratory failure, hypoglycemia, shock, and / or central nervous system involvement [2-4]. The considerable mortality and morbidity in *falciparum* malaria is due to its protean manifestation, multi-organ involvement and delay in diagnosis and failure of administration of treatment Promptly [5,6]. All cases of *falciparum* malaria are potentially severe and life threatening medical emergency.

Maharashtra is one of the worst affected states by Malaria. Despite a substantial disease burden in this area, little is known about the natural history of complicated *falciparum* malaria. Therefore, this prospective observational study was undertaken in tertiary care centre of Central India, Maharashtra, to assess the clinical course, complications, their response to treatment and outcome in patients with *P. Falciparum* malaria infection.

## 2. Material and Method

This was a prospective observational study conducted on 201 patients of age more than 12 year, out of which 99 patients positive for *falciparum* malaria either by rapid diagnostic test or peripheral smear. Before starting the study, ethical clearance was obtained from Institutional Ethics Committee and written informed consent taken from the participants. Subjects who were not willing to participate were excluded from the study. Detailed demographic and clinical evaluation was done. Baseline investigation on admission had done as compete blood count, serum creatinine, urea, serum bilirubin and liver enzymes and urine protein was recorded. Patient had been started on standard treatment of malaria as per the treating physician. Over the period in hospital he/she had been reviewed for any complication developing and response to the treatment. Investigations had repeated after three days, if any complication was seen on the baseline investigation. Course of the disease in hospital and response to the antimalarial had been noted. The statistical analysis was done using SPSS statistical software version 15 and p value of$< 0.05$ was taken as significant.

## 3. Observations and Results

Total 99 cases were found positive to *falciparum* infection, of which majority of patients were between 12-30 years of age. Males were 66 (32.80%) outnumbered females 33 (16.40%). 54 (26.9%) patients were found positive by peripheral smear examination but 100% (99) of patients were found positive by rapid diagnostic test (RDT). Fever was most common presenting symptom in 98% of patients. Most of the patients were a febrile during admission were of the elderly age group, presented with altered behaviour, loose stool, rash and weakness.

The commonest complications observed was thrombocytopenia and severe thrombocytopenia followed by cerebral malaria, jaundice, acute renal failure, anaemia, algid malaria, metabolic acidosis, respiratory distress and hypoglycaemia as summarized in table 1. Many patients had more than one complication.

**Table 1: Complications of *Plasmodium falciparum* malaria**

| Complications | No. of patients | % |
|---|---|---|
| Anaemia | 8 | 8.08 |
| Thrombocytopenia | 36 | 36.36 |
| Severe Thrombocytopenia | 29 | 29.29 |
| Respiratory Distress | 4 | 4.04 |
| Cerebral Malaria | 20 | 20.20 |
| Acute renal Failure | 9 | 9.09 |
| Jaundice | 14 | 14.14 |
| Algid Malaria | 6 | 6.06 |
| Metabolic Acidosis | 6 | 6.06 |
| Hypoglycaemia | 1 | 1.01 |

The maximum number of patients [91 (91.92%)] were treated with ACT but 8 (8.08%) patients have resistant to ACT and they were treated with Arthemeter plus lumifantrine. Total 92.93% patients were discharge after successful treatment on *falciparum* malaria whereas 7.07 % patients' outcome was in the form of death and cause of death was multifactorial, (Table 2).

**Table 2: Show treatment response and treatment outcome of patient**

| Treatment Response | *falciparum* Malaria | |
|---|---|---|
| | No. of patients | Percentage |
| Response | 91 | 91.92% |
| Resistance | 8 | 8.08% |
| **Treatment Outcome** | | |
| Discharged | 92 | 92.93% |
| Death | 7 | 7.07% |

## 4. Discussion

Since 1977, there is a consistently declining trend in the annual malaria incidence in our country. During 2005 about 1.8 million cases were reported with 940 deaths. There were 0.79 million cases of *falciparum* malaria. In 2013, more than a million patients were affected by this

disease causing more than five hundred deaths [7]. The prevalence of complicated malaria has significantly increased in the last decade. Resistance of mosquitoes to insecticide and chloroquine resistance has lead to an increase in complicated malaria. Over the last many years, jaundice and acute renal failure have been increasingly noticed in patients with malaria. Severe malaria has been defined by WHO as presence of one or more pernicious syndromes in a patient with asexual forms of *Plasmodium* species in his blood [8]. According to annual report of Government of India, 38.6% of all cases from different parts of the country were due to *Plasmodium falciparum*, [9].

In current study, the maximum study subjects were in the second and third decade (age group of 12 – 30 years) followed by other age groups. That mean productive age group is more susceptible to virulence of the disease. This was consistent with the observation that malaria incidence was higher in young adults because of their outdoor activities and mobility [10]. *Falciparum* malaria was profound in males than female similar to the findings of other studies [11,12]. The reasons put forward for this difference is higher exposure of adult males to risk of malaria, because of the outdoor activities of the males and females are better clothed than males.

Total 99 patients were positive by RDT comparing with microscopy in which only 54 were positive by microscopy; this may be due to subjectivity of the microscopic test. This shows the need to train laboratory workers and microbiologist. Our observation was similar to previous studies [13,14]. Majority of (98%) patients presented with fever which reflects the fever was a single most denominatory symptom. Most of the patients was a febrile during admission were of the elderly age group, presented with altered behaviour, loose stool, rash and icterus. This reflects decreased immunity in elderly. The characteristic intermittent fever (tertian and quartan) may not be observed because of the antimalarial and/or antipyretic. The fever is considered, a symptoms almost always part of presentation of malaria. Our findings were similar to other studies [11,15,16].

The severe anemias were observed in 8 (8.08 %) patients. It is also observed that anaemia per se was not associated with any mortality. This observation was compared with study of Wasnik *et al* [15]. Thrombocytopenia and severe thrombocytopenia was observed in 36 (36.36%) and 29 (29.29%) patients respectively and was significantly associated with death (85.72%). Out of total 7 deaths 6 deaths were associated with thrombocytopenia from which 5 patients were associated with severe thrombocytopenia.

Murthy *et al* [11] and Wasnik *et al* [15] reported nearly similar incidence of thrombocytopenia in their study but it was not associated with mortality which was reverse of our study. The cerebral malaria was present in 20 (20.20%) patients. Though it was not commonest presentation in our study but was most dreaded complication and was the most common complication leading to death. So any degree of impaired consciousness and any other signs of cerebral dysfunction should be treated with utmost urgency as cerebral malaria. Our study correlated with other studies [11,17,18]. Jaundice was observed in 14 (14.14%) patients and was predominantly haemolytic type, most of time it was associated with anaemia and death. Renal failure was associated with death in 9.09% of cases and was significantly less in compare to earlier studies [11,15,17]. The respiratory distress was present in 4 (4.04%) patients and algid malaria in 6 (6.06%) patients and it (Algid malaria) was associated with deaths. So it is a good marker of severity and if it is observed aggressive management should start immediately. We observed metabolic acidosis in 6 (6.06%) patients and hypoglycemia in only one case (1.01%).

Early malaria case detection and prompt treatment with safe and effective antimalarial drugs still remains the mainstay of malaria case management [19]. As per mentioned in methodology treatment given according to treating physician. We used ACT with doxycycline for *falciparum* positive malaria. In our study we did not do the parasite counts, we consider the patients resistant to treatment in which fever was persistent on day three. Out of 99 patients 91 were responded to treatment which they received, while 8 patients were resistant to ACT, therefore we had given intravenous Artemether plus Clindamycine but results were not satisfactory. We did not find any study mentioning fever as criteria for resistance. Seven patients could not survive and cause of death in those patients was multifactorial. The cerebral malaria was present in 100 % patients of death followed by algid malaria, severe thrombocytopenia, metabolic acidosis, jaundice, acute renal failure, respiratory distress and Hypoglycemia. Our study compared with study of Wasnik *et al* [15].

## 5. Conclusion

In present study, most of the death was due to delayed presentation, delayed diagnosis, delayed recognition of complications and multi-organ failure. So early clinical judgment, early diagnosis, early recognition of risk factors and complications and prompt treatment form the backbone of malaria management to reduce the morbidity and associated mortality.

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