

Original Research Article

Comparison of clinical profile and severity of *P. falciparum* and *P. vivax* malaria in a tertiary care hospital of Surat, India

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ABSTRACT

Background: Surat is an endemic area for malaria. There has been a change in the trend of clinical profile and severity of *P. vivax* and *P. falciparum* malaria. Initially, *P. falciparum* was considered notorious for its complications but now *P. vivax* also presents with similar pictures. Hence, vivax malaria, which was once thought to be a relatively benign condition, is appearing in its more malignant form, with severity gradually becoming a serious concern. This aim of the study is to compare the clinical profile severity of *P. vivax* and *P. falciparum* malaria in pediatrics age group in a tertiary care hospital in Surat, India.

Methods: A retrospective study was carried out at a tertiary care hospital of a medical college in Surat. This study was done for a period of 6 months from July 2014 to December 2014. Patients below 18 years of age who were smear positive for plasmodium species or malarial antigen positive were included in the study. Statistical analysis was done using chi square test for comparing proportions. P value < 0.05 was considered significant.

Results: Eighty-seven patients were found to be suffering from malaria detected by malarial antigen test or through blood smear. Out of this, 48 (55%) patients were found to have *P. vivax* while 31 (35.6%) patients were found to have *P. falciparum* and only 8 cases had mixed malaria. The common complications encountered were jaundice and severe anemia. Severe malaria was more common in patients having *vivax* malaria as compared to *falciparum*. Besides anaemia as a haematological manifestation, thrombocytopenia was the second common abnormality encountered more commonly in patients with *vivax* as compared to *falciparum* species. The detailed study morbidity profile clearly establishes that severe malaria, earlier attributed to only *falciparum* is equally seen in *vivax*.

Conclusions: Severe form of malaria is seen in *vivax* malaria and the age group affected by *vivax* also is younger. Profile of complications is different in different studies.

Keywords: Severe malaria, *Vivax*, *Falciparum*

INTRODUCTION

Malaria is endemic in the tropics and subtropics with highest prevalence in Africa followed by Southeast Asia. India contributes 80% of Southeast Asia malaria burden (24 million cases per year).¹ While *P. falciparum* is prevalent infection in Africa, *P. vivax* causes majority of burden in India.² The proportion of *P. vivax* and *P. falciparum* varies in different parts of India.² Most of

Indo Gangetic plains and northern hilly states, north western India and southern Tamil Nadu have less than 10% of *P. falciparum*. In the forested area inhabited by ethnic tribes, *P. falciparum* is recorded as much as 30% - 90%, while in the remaining area it ranges from 10% - 30%.²

Vivax malaria has long been considered to have a benign course with multiple relapses. The typical complications

seen in falciparum malaria were not usually found in vivax mono-infections. However, during the past few years, the trend in the clinical manifestations of vivax malaria has been changing.³ *P. vivax* is now also getting recognized as a major cause of severe and fatal malaria despite its low parasite biomass, increased deformability of infected RBC and an apparent paucity of parasite sequestration.⁴ Cases of malaria, as seen round the year, peak during monsoons from July to October.⁵ The classic triad of fever with chills and rigors is often masked by other symptoms like jaundice, renal failure, acidosis, hypoglycemia and electrolyte imbalance. Many patients with malaria present with especially renal and hepatic failure.⁶ This study was carried out to analyze the trends in clinical features and severity of disease in both *P. falciparum* and *P. vivax* infections in our hospital, which is a tertiary care center.

METHODS

This study was a retrospective study of children aged between 0-17 years admitted in SMIMER hospital Pediatric department from July 2014 to December 2014.

This study included patients with either a smear positive for plasmodium species and/ or malarial antigen positive by RDT (rapid diagnostic test).

*Categorization of severe malaria was according to WHO guidelines (2014).*⁷

- Impaired consciousness/coma
- Repeated generalised convulsions
- Renal failure (serum creatinine >3 mg/dl)
- Jaundice (serum bilirubin >3 mg/dl)
- Severe anaemia (Hb<5 gm/dl)
- Pulmonary edema/ acute respiratory distress syndrome
- Hypoglycaemia (plasma glucose < 40 mg/dl)
- Metabolic acidosis
- Circulatory collapse/shock (systolic BP < 80mm Hg, <50 mm Hg in children)
- Abnormal bleeding and disseminated intravascular coagulation (DIC)
- Hemoglobinuria
- Hyperpyrexia (temperature >106 °F or >42°C)
- Hyperparasitemia (>5% parasitized RBCs).

The study plan was approved by hospital research committee.

Diagnostic methods used were conventional thick and thin peripheral smear stained with Leishman stain, examined under oil immersion. The slide was considered negative when there were no parasites in 100 HPF. Rapid diagnostic tests were based on detection of specific plasmodium antigen, LDH (optimal test) for *Vivax* and HRP2 for *falciparum*.

Apart from peripheral blood film and rapid diagnostic test other lab investigations were undertaken like haemoglobin, total leucocyte count, platelet count, renal function tests, liver function test, blood sugar, blood urea, serum creatinine, other investigations needed for the patient. Other appropriate blood tests, CSF examination were done wherever needed.

Statistical analysis was done using chi square test for comparing proportions. P value < 0.05 was considered significant.

RESULTS

Total 87 cases of malaria from age group 0-17 years were detected by either malaria antigen study and/or through peripheral blood smear. Out of these, 48 (55.10%) patients were found to have *P. vivax* while 31 (35.60%) had *P. falciparum*. 8 (9.4%) cases had mixed infection.

Table 1: Age- sex wise distribution of malaria cases.

Gender	No (%)
Male	52 (59.77%)
Female	35 (40.23%)
Total	87 (100)
Age group (years)	Number (%)
0-5	20 (22.99%)
5 to 10	13 (14.94%)
>10	54 (62.07%)
Total	87 (100)

Male to female patient ratio recorded in our study turned out to be 3:2. The most common age group to be affected was >10years (62.2%) (Table 1).

It may be noted that the patients of both the plasmodium species had severe as well as non-severe malaria (severe being categorized according to the WHO classification).⁷ In *falciparum* 23 (74.19%) cases were of severe malaria while only 8 (25.81%) were non-severe. In *vivax* group 35 (72.9%) patients suffered from severe malaria and rest 13 (27.1%) were non-severe. While in mixed group, 7 (87.5%) cases were of severe malaria while only 1 (12.5%) was non-severe (Table 2).

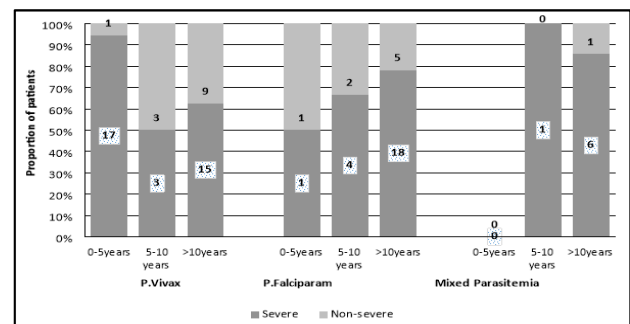


Figure 1: Distribution of cases according to age and species.

Severe malaria was noted in both species. In children less than 5 years, the predominant species to cause malaria were *vivax* (90%) as compared to *falciparum* in 10%. Older children had *falciparum* and mixed malaria. 65

/87(74.7%) patients had severe form of malaria. Of all patients with severe form of malaria, 53.8% were due to *vivax* and 35.3% due to *falciparum* (Table 2).

Table 2: Distribution according to age and species.

Category	0-5 years	5-10 years	>10 years	Total
Total malaria patients	20	13	54	87
<i>P. vivax</i>	18(90%)	06(46%)	24(44.4%)	48(55.1%)
<i>P. falciparum</i>	02(10%)	06(46%)	23(42.5%)	31(35.6%)
Mixed parasitemia	0	01(8%)	07(13.1)	08(9.4%)
Total severe malaria	18	08	39	65
Severe <i>P. vivax</i> monoinfection	17(94%)	03(38%)	15(38%)	35(53.8%)
Severe <i>P. falciparum</i> monoinfection	01(%)	04(50%)	18(46%)	23(35.2%)
Severe mixed parasitemia	0	01(12%)	06(16%)	07(10.00%)

Table 3: Severe malaria and hematologic profile.

Severity markers	<i>P. falciparum</i> Number (%)	<i>P. vivax</i> Number (%)	Mixed parasitemia Number (%)	Total Number (%)
All patients	23	35	07	65 (100%)
Jaundice	12 (52.17%)	18 (51.43%)	03 (42.86%)	33 (50.77%)
Severe anemia	09 (39.13%)	14 (40%)	04 (57.14%)	27 (41.54%)
AKI	01 (4.35%)	0	0	01 (1.54%)
Cerebral malaria	0	01 (2.86)	0	01 (1.54%)
ARDS	0	01 (2.86%)	0	01 (1.54%)
Thrombocytopenia (<1lakh)	15 (65.22%)	23 (65.71%)	05 (71.43%)	43 (66.15%)
Thrombocytopenia all patients	19 (82.61%)	33 (94.29%)	06 (85.71%)	58 (89.3%)

The commonest complication of malaria in our patients was jaundice (50.7%) followed by severe anaemia (32.3%). Acute kidney injury was seen in 1.54% patients followed by cerebral malaria and ARDS in 1.54% each. Of all the severe malaria cases, only 1 (2.86%) patients developed ARDS. This patient had *vivax* malaria. Liver involvement or malarial hepatitis was seen in 18/35 (51.43%) in *vivax* group, 12/23 (52.17%) in *falciparum* group and 3/7 (42.86%) in mixed variety. Hematologic profile showed that 23 (65.71%) *vivax* cases and 15(65.22%) of *falciparum*, 5 (71.43%) of mixed cases were having thrombocytopenia (platelets) <100000. Severe anemia was recorded in 9 (39.13%) cases of *vivax*, 14 (40%) cases of *falciparum* and 4 (57.14%) cases of mixed variety (Table 3).

A comparison of morbidity profile between *vivax* and *falciparum* shows there was no difference regardless of the complication involved (Table 3).

DISCUSSION

P. vivax malaria has been considered to be a benign form of malaria, with low mortality.¹⁰ Studies from across the

world now have shown that *vivax* is not benign but has been associated with complications and mortality.¹¹⁻¹⁴

India, Indonesia, New Guinea and Pakistan have reported that *vivax* is also associated with mortality and complications.¹⁵ This study was done to see whether Surat, India an endemic area for malaria also has shown this trend. We analyzed patients admitted with proven malaria (blood smear positive or RDT), admitted to our hospital. There were 87 patients admitted between time. 48 of them had *vivax* malaria, 31 had *falciparum* and 8 had mixed parasitemia.

The studies across India show a variable incidence of types of malaria, severity and mortality. In our study the age group most affected was children >10 years of age, prevalence being 62.07%. In the study by Manju et al it was commonest between ages of 0 to 5 years (33.9%).¹⁷ In study by Kochar et al the age group most affected was between 5 to 10 years (48.1%).¹⁶

The most common species to cause malaria in our study was *P. vivax* (55.1%) followed by *P. falciparum* (35.6%) and mixed parasitemia (9.1%). In the study by Singh R et al the prevalence of *vivax* was more, 71.8% versus

falciparum (28.2%).⁸ Verma et al reported falciparum most common form 53.6%, *vivax* 27.3%, followed by mixed parasitemia 18.9%.⁹ Age stratification study by Verma showed more preponderance of *vivax* in younger age group (0 to 5 years). Kochar also reported preponderance of *vivax* causing malaria for younger age group. Between 0 to 5 years in their study *vivax* was responsible for 42.3% infections, compared to in age group of >10 years where it was 30%. In present study also *vivax* was responsible for 90% infections in age group between 0 to 5 years in comparison to 44.44% in age group of > 10 years.

Male preponderance has been reported in study by Kocher 70.6% versus 29.4%. In present study it was 3:2. Severe form of malaria has been reported in 49.5%, 56.9% and 65.88% in various studies.^{8,9,16}

Proportion of severe malaria caused by different species is also reportedly different by various authors. Kochar et al found the relative frequencies for different species causing severe malaria to be *P. falciparum* 52.7%, *P. vivax* 43.3% and mixed parasitemia 4%.¹⁶ In our study most common organism was *P. vivax* 56.6%, followed by falciparum species in 34% and mixed parasitemia in 9.3% as a cause for severe malaria. Ragini et al also found *vivax* to be the predominant species for severe malaria.⁸ *P. vivax* in their study was responsible for 67.85% and falciparum for 32.15% cases of severe malaria.

The most common complication in our study was hepatic dysfunction (50.7%), followed by severe anemia (41.5%). The other complications were AKI, ARDS and cerebral malaria (1.5% each). Verma P et al found anemia as the most common complication (65.6%), followed by impaired consciousness (20.5%) and multiple convulsions (17.6%).⁹ Hepatic dysfunction was seen in 17.6% of their patients. Ragini et al reported CNS manifestations as the most common complication (18/56 patients i.e. 32.1%), followed by severe anemia (12/56, 21.4%).⁸ Hepatic dysfunction was seen in 9/56, 16% patients in their study. Kochar et al reported severe anemia in 37/150 (24.6%) patients, cerebral malaria in 8/150(5.3%), hepatic dysfunction alone and renal dysfunction alone in 7/150 patients a common complications. There was no mortality in our study during the study period so this profile has not been discussed.

CONCLUSION

In conclusion severe form of malaria is seen in *vivax* malaria and the age group affected by *vivax* also is younger. Profile of complications is different in different studies.

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