

Original Research Article

A prospective comparative study of clinical profile and severity of plasmodium falciparum and plasmodium vivax in coastal Andhra Pradesh, India

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ABSTRACT

Background: *Plasmodium falciparum* (*P. falciparum*) causes vital organ dysfunction. The manifestation of severe form of falciparum malaria includes cerebral malaria, acidosis, severe anaemia, renal failure, hypotension, shock, disseminated intravascular coagulation and convulsion. Death rate used to be high. But vivax malaria is not presented in severe form and there is tendency of recurrence. Present study has been designed to compare clinical profile and severity of *P. falciparum* and *Plasmodium vivax* (*P. vivax*) malaria in coastal district of Andhra Pradesh.

Methods: Present study is a prospective comparative randomized observational study conducted in the department of general medicine Rangaraya Medical College, Kakinada, Andhra Pradesh from February 2016 to May 2018. The study population include 260 patients diagnosed to have *P. falciparum* and *P. vivax* malaria and being admitted in the general medicine dept. Govt medical college Kakinada randomly selected based on exclusion and inclusion criteria.

Results: Out of 172 Falciparum malaria patients' anaemia was present in 39.53% patient and out of 88 *P. vivax* patients 43.18% patients have anaemia. Thrombocytopenia was present in 19.76% patients of falciparum malaria and 79.54% of *P. vivax*. Increased leucocyte count was seen in 29.65% *P. falciparum* and 4.54% *P. vivax* patients. Leukopenia was seen in 9.3% *P. falciparum* and 1.136% *P. vivax* patient. PT and APTT was increased in 12.79% patients of *P. falciparum* malaria and 6.8% patients of *P. vivax* malaria. Liver enzyme was elevated in 27.9% of *P. falciparum* patients and 47.72% patients of *P. vivax* patients. Raised serum urea and creatinine, was seen in 18.60% patients of *P. falciparum* and 18.18% patients of *P. vivax* malaria. Electrolyte imbalance was also found in both groups.

Conclusions: - In present study number of falciparum malaria cases were more than vivax with male predominance. Hepatomegaly was more common falciparum, but splenomegaly was more common in vivax malaria patients. Anaemia and thrombocytopenia were more common in *P. vivax* malaria patients. Elevated liver enzyme was more common in *P. vivax* patients but elevated serum urea and creatinine was almost same in both groups. Except hepatic dysfunction all other complication was more in falciparum than vivax infection. Death was only marginally high in falciparum than vivax malaria patients.

Keywords: Clinical profile, *Plasmodium falciparum*, *Plasmodium vivax*, Severity

INTRODUCTION

Malaria is a life-threatening disease caused by parasites *Plasmodium vivax* (*P. vivax*), *Plasmodium falciparum* (*P. falciparum*), plasmodium oval and plasmodium malaria.¹

As per the report of WHO, 91 countries had on going malaria transmission and really half of world's population were at risk of malaria. WHO has estimated that India accounts for 89% cases of malaria worldwide.² It is entirely preventable and curable. Both *P. vivax* and

P. falciparum are common in India with regional variability, out of this two species *P. falciparum* is associated with severe form of malaria but studies have been reported that vivax is also associated with severe form of malaria.³ *P. falciparum* causes vital organ dysfunction. The manifestation of severe form of falciparum malaria includes cerebral malaria, acidosis, severe anaemia, renal failure, hypotension, shock, disseminated intravascular coagulation and convulsion. Death rate used to be high.⁴ But vivax malaria is not presented in severe form and there is tendency of recurrence but from the study of Mahapatra et al, it is clear that vivax malaria has also presented with various complication like Jaundice, anaemia, thrombocytopenia and pancytopenia.^{5,6} Present study has been designed to compare clinical profile and severity of *P. falciparum* and *P. vivax* malaria in coastal district of Andhra Pradesh.

METHODS

Present study is a prospective comparative randomized observational study conducted in the department of general medicine Rangaraya medical science Kakinada AP from February 2016 to May 2018.

Study population

The study population include 260 patients diagnosed to have *P. falciparum* and *P. vivax* malaria and being admitted in the general medicine dept. Govt medical college Kakinada randomly selected based on exclusion and inclusion criteria.

Inclusion criteria

- Age above 15 years
- QBC both sex having
- Positive for malaria
- Thick and thin film demonstrate malaria parasite.

Exclusion criteria

- Fever of any other region
- Mixed parasitic infection
- Hepatic and renal dysfunction
- Chronic alcoholic.

Before start of this study approval has been taken from institutional ethics committee. A written informed consent was taken from patient as well.

A detail history of the patient was taken, and proper examination of the entire patient was done, and patients were followed till discharge or death. The data was collected and interpreted as per the history, clinical examination and investigational finding. Blood sample was collected from the entire patient before start of treatment and various parameters like, Hb%, RBC count, total leucocyte count, total platelet count, prothrombin

time, activated thromboplastin time, fast plasma glucose, serum urea and creatinine, liver function chest, X ray serum electrolyte ad arterial gas analysis test were done. All patients were treated according to the WHO guidelines for treatment of malaria. for estimation of various parameters fully automated Beckman counter AV 480 was used. Data was interpreted as number and percentage.

RESULTS

During the period of two and half year, total 260 patients of plasmodium infection were evaluated, out of 260 patients 172 (66.15%) patients were having *P. falciparum* infection and 88 (33.80%) patient having *P. vivax* infection. Among *P. falciparum* malaria patients 121 (59%) of total patients were between 15 to 45 years of age and 51 (29.63%) patients were above 45 years of age. Out of 88 *P. vivax* patients 59 (67.04%) patients were between 15-45 years of age and 29 (32.75%) patients were above 45 years of age. Male to female ratio was 106/66 in *P. falciparum* group of patients and 50/38 in *P. vivax* patients.

Table 1: Demography of the patients.

| Parameters | <i>P. falciparum</i> | | <i>P. vivax</i> | | |
|------------|----------------------|-------|-----------------|-------|-------|
| | No. | % | No. | % | |
| Number | 172 | 66.15 | 88 | 33.84 | |
| Age | 15-45 | 121 | 70.34 | 59 | 67.04 |
| | >45 | 51 | 29.63 | 29 | 32.95 |
| Sex | M | 106 | 61.62 | 50 | 56.81 |
| | F | 66 | 38.37 | 38 | 43.18 |

During the period of two and half years total 260 patients of plasmodium infection were evaluated, out of 260 patients 172 (66.15%) patients were having *P. falciparum* infection and 88 (33.80%) patient having *P. vivax* infection. Among *P. falciparum* malaria patients 121 (59%) of total patients were between 15 to 45yrs of age and 51 (29.63%) patients were above 45yrs of age. Out of 88 *P. vivax* patients 59 (67.04%) patients were between 15-45 yrs of age and 29 (32.75%) patients were above 45yrs of age. Male to female ratio was 106/66 in *P. falciparum* group of patient and 50/38 in *P. vivax* patients.

As per Table 2 regarding comparison of clinical presentation between *P. falciparum* and *P. vivax* fever was present in all patients. Out of 172 patients with falciparum malaria 90 (52.32%) presented with headache and in *P. vivax* group out of 88 patients 52(30.23%) having headache. Out of 172 falciparum malaria patients 52(30.23%) were having vomiting, but in vivax group 28 (31.81%) patients out of 88 patient having vomiting. Dyspnoea was present in 8(4.6%) patients out of 172 falciparum malaria patients similarly 6(6.8%) patient among 88 *P. vivax* malaria patients. Altered sensorium was present in 10(5.8%) having falciparum malaria but in only 1(1.1%) having vivax malaria. Pallor was found in

48(27.90%) patients of falciparum malaria but in vivax malaria group 28(31.81%) Patients were having pallor. Icterus of noted in 9.30% falciparum malaria patient but 29.54% of vivax malaria patients were having icterus. 18.02% of the patients in falciparum and 11.36% of the patients in vivax malaria group have hepatomegaly.

Table 2: Comparison of clinical presentation between *P. falciparum* and *P. vivax*.

| Parameters | <i>P. falciparum</i> | | <i>P. vivax</i> | |
|-------------------|----------------------|-------|-----------------|--------|
| | No. of cases | % | No. of cases | % |
| Fever | 172 | 100% | 88 | 100% |
| Headache | 90 | 52.32 | 62 | 70.454 |
| Vomiting | 52 | 30.23 | 28 | 31.81 |
| Dyspnoea | 8 | 4.6 | 6 | 6.8 |
| Altered sensorium | 10 | 5.81 | 1 | 1.1% |
| Pallor | 48 | 27.90 | 28 | 31.81 |
| icterus | 16 | 9.30 | 26 | 29.54 |
| Hepatomegaly | 31 | 18.02 | 10 | 11.36 |
| Splenomegaly | 42 | 24.41 | 36 | 40.9 |
| Pulmonary edema | 6 | 3.48 | 1 | 1.1 |

Splenomegaly was noted in 24.41% of falciparum malaria patient and 40.91% of vivax malaria patients. Pulmonary edema was noticed among 3.48% patients of *P. falciparum* malaria but 1.1% of vivax malaria patient also have pulmonary edema. From Table 3 it is clear that out of 172 falciparum malaria patients' anaemia was present in 39.53% patient and out of 88 *P. vivax* patients 43.18% patients have anaemia.

Table 3: Comparison of various laboratory parameters between *P. falciparum* and *P. vivax*.

| Parameters | <i>P. falciparum</i> | | <i>P. vivax</i> | |
|-------------------------------------|----------------------|-------|-----------------|-------|
| | No. | % | No. | % |
| Haemoglobin less than 5gm/dl | 68 | 39.53 | 38 | 43.18 |
| Thrombocytopenia less than one lakh | 34 | 19.76 | 70 | 79.54 |
| Leucocytosis | 51 | 29.65 | 4 | 4.54 |
| Leukopenia | 16 | 9.3 | 1 | 1.136 |
| Elevated PT and APTT | 22 | 12.79 | 6 | 6.8 |
| Elevated liver enzyme | 48 | 27.90 | 42 | 47.72 |
| Increased serum urea and creatinine | 32 | 18.60 | 16 | 18.18 |
| Hyponatremia | 38 | 22.09 | 9 | 10.22 |
| Hyperkalaemia | 18 | 10.46 | 4 | 4.54 |
| Hypokalaemia | 4 | 2.3 | 1 | 1.136 |
| Pulmonary edema | 8 | 4.6 | 6 | 6.8 |

Thrombocytopenia was present in 19.76% patients of falciparum malaria and 79.54% of *P. vivax*. Increased

leucocyte count was seen in 29.65% *P. falciparum* and 4.54% *P. vivax* patients. Leukopenia was seen in 9.3% *P. falciparum* and 1.136% *P. vivax* patient. PT and APTT was increased in 12.79% patients of *P. falciparum* malaria and 6.8% patients of *P. vivax* malaria. Liver enzyme was elevated in 27.9% of *P. falciparum* patients and 47.72% patients of *P. vivax* patients. Raised serum urea and creatinine, was seen in 18.60% patients of *P. falciparum* and 18.18% patients of *P. vivax* malaria. Electrolyte imbalance was also found in both groups. Hyponatremia was found in 10.46% *P. falciparum* patients and 4.54% *P. vivax* patients. Hypokalaemia was seen in 2.3% *P. falciparum* patients and 1.136% *P. vivax* patients. Pulmonary edema was present in 4.6% *P. falciparum* patients and 6.8% *P. vivax* patients.

Table 4: Comparisons of complication between *P. falciparum* and *P. vivax*.

| Parameters | <i>P. falciparum</i> (n=172) | | <i>P. vivax</i> (n=88) | |
|---------------------|------------------------------|-------|------------------------|-------|
| | No. | % | No. | % |
| Altered sensorium | 18 | 10.46 | 2 | 2.27 |
| Hypoglycaemia | 21 | 12.20 | 1 | 1.136 |
| Acidosis | 4 | 2.3 | 1 | 1.130 |
| Seizures | 16 | 9.3 | 0 | 0 |
| Pulmonary edema | 8 | 4.6 | 6 | 6.8 |
| Hypotension | 34 | 19.76 | 9 | 10.22 |
| Renal dys function | 17 | 9.88 | 8 | 9.09 |
| Hepatic dysfunction | 34 | 19.76 | 19 | 21.59 |

Regarding complication of *P. falciparum* and *P. vivax* malaria altered sensorium was seen in 10.46% patients of *P. falciparum* and 2.27% patients of *P. vivax*. 12.20% of falciparum infection has developed hypoglycaemia but only 1.136% of *P. vivax* patient has developed hypoglycaemia. Acidosis was seen in 2.3% of *P. falciparum* group but it was 1.136% in *P. vivax* group seizures was found in 9.3% falciparum infection patients but it was absent in *P. vivax* absent.

Hypotension was present in 19.76% patients of *P. falciparum* and 10.22% patients of *P. vivax*. Renal dysfunction was found in 9.88% *P. falciparum* patients and 9.09% patients of *P. vivax*. Hepatic dysfunction was present in 19.76% of *P. falciparum* patients and 21.59% of patients of *P. vivax* infection.

Table 5: Comparisons of outcome of treatment.

| Parameters | <i>P. falciparum</i> | | <i>P. vivax</i> | |
|------------|----------------------|-------|-----------------|-------|
| | No. | % | No. | % |
| Recovered | 168 | 97.67 | 86 | 97.72 |
| death | 4 | 2.32 | 2 | 2.22% |

As per table 5 out of 172 *P. falciparum* infection patients 168(97.67%) patient recovered and 4 patients died that is 2.32% similarly out of 88 cases of *P. vivax* malaria 86 patients recovered and 2.22% of the patient died.

DISCUSSION

In this prospective observational study authors have compared the clinical profile and severity of one hundred seventy-two *P. falciparum* and 88 *P. vivax* infected patients, during two and half years

In present study we have found that 66.15% cases malaria was due to *P. falciparum* and 33.80% of cases were due to *P. vivax*. As per national vector born disease control programme of India there is decrease trend in the plasmodium falciparum cases.⁷ In the study of Gupta S et al, the incidence of *P. falciparum* was more than *P. vivax* which support present study but the finding of Mitra S et al, does not support present study.^{8,9} There is male predominance in both group and both group of infections was common in patients with age below 45 years, which is supported by the work of Singh SP et al.¹⁰

Regarding various clinical parameter percentages of patients with clinical presentation like headache, vomiting, dyspnoea, pallor, icterus and splenomegaly was more in *P. vivax* group. But altered sensorium, hepatomegaly and pulmonary edema was more common clinical presentation in plasmodium falciparum patients. This finding corroborates with the work of Singh SP et al, and Barber BE et al.^{10,11}

Regarding comparison of laboratory parameters, anaemia was more common in *P. vivax* patient then *P. falciparum* that is (43.18% verse 39.53%) which is supported by the study of Singh R et al, and Dlouglasm et al.^{12,13} But is not corroborates with the finding of Limaye CS et al.¹⁴

In present study thrombocytopenia is common in *P. vivax* patient but leucocytosis and leukopenia is common in *P. falciparum* patients. Singh R et al, found that thrombocytopenia is more common in *P. falciparum* patients but leucocyte chances are common in *P. falciparum* which partially support present study but the study of Goyal JP et al, support present study.^{12,15} In present study authors have found that elevation of PT and APTT was high in *P. falciparum* patient in comparison to vivax. But in his study Ali E et al, did not find any significant difference in the PT and APTT level, but Mahapatra S et al, has found that disseminated intravascular coagulation has increased in plasmodium vivax malaria patients.^{16,17} Authors have also found that liver enzyme was elevated in both groups, but it was more in *P. vivax* and renal parameter changes same in both groups. This finding is partially supported by the study of Singh R et al.¹² But it is supported by the work of Singh SP et al.¹⁰ Electrolyte imbalance was more common in *P. falciparum* then *P. vivax* patients this finding is supported by the work of Rani A et al, and Jasani et al.^{18,19} pulmonary edema is more common in *P. vivax* patients. Pukrittayakamee S et al, and Nicholas M et al, reported that non-cardiogenic pulmonary edema is common in both type of infection which support present study.^{20,21}

Regarding comparison of severity and complication of both type of malaria except seizure all the complication like altered sensorium, hypoglycaemia, acidosis, pulmonary edema, hypotension hepatic and renal dysfunction are present in both type of plasmodium infection but the incidence was found more in *P. falciparum* infection than *P. vivax* but seizure was absent in *P. vivax* patients which is supported by the work of Saravu K et al, and Limaye et al.^{22,23}

Number of deaths was more in *P. falciparum* patient then *P. vivax* patients but the percentage death was marginally higher in *P. falciparum* then *P. vivax* infection which is supported by the work of Imtiaz S et al.²⁴

CONCLUSION

Authors would like to conclude that in present study number of falciparum malaria cases were more than vivax with male predominance. Hepatomegaly was more common falciparum but splenomegaly was more common in vivax malaria patients. Anaemia and thrombocytopenia was more common in *P. vivax* malaria patients. Elevated liver enzyme was more common in *P. vivax* patients but elevated serum urea and creatinine was almost same in both groups. Except hepatic dysfunction all other complication was more in falciparum then vivax infection. Death was only marginally high in falciparum then vivax malaria patients.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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