

## A prospective study of comparison of clinical profile, complication and outcome of plasmodium vivax versus plasmodium falciparum in children

K. Visweswara Rao<sup>1</sup>, P. Suresh Babu<sup>2,\*</sup>, Anand Acharya<sup>3</sup>

<sup>1,2</sup>Associate Professor, <sup>3</sup>Professor and Head, <sup>1,2</sup>Dept. of Paediatrics, <sup>3</sup>Dept. of Pharmacology, Konaseema Institute of Medical Science, Amalapuram, Andhra Pradesh, India

\*Corresponding Author: P. Suresh Babu

Email: p.smitha@gmail.com

### Abstract

**Introduction:** Malaria is a life – threatening disease but is curable and preventable. As per data of WHO in 2017, there were an estimated 219 million cases of malaria in 90 countries. As plasmodium Vivax malaria has been considered to have a benign course with less mortality, most of the research is focussed on plasmodium falciparum. But in recent years there are number of studies conducted in India and other countries has highlighted that plasmodium vivax can cause severe and fatal malaria, in paediatric patients. Based on this background we have designed a prospective study to evaluate clinical profile, complication and outcome of plasmodium vivax and compare it with plasmodium falciparum malaria.

**Materials and Methods:** Present study is a prospective study conducted in the department of paediatrics Konaseema institute of medical science Amalapuram Andhra Pradesh during the period from Jan 2015 to October 2018. Data regarding patient age, sex clinical presentation, investigation, complication and outcome are recorded. Lab investigation like haemoglobin, total leukocyte count, platelet count, bleeding time, clotting time, blood sugar, blood urea, serum creatinine, serum Bilirubin, SGOT and SUPT were some for all these investigation standard laboratory procedure was followed.

**Result:** In present study 60 patient admitted with proven malaria to our hospital were analysed. Severe malaria was present in 4(11.12%) p. vivax infection patients and in 2(8.41) P. falciparum infection patient. 4 patients having bleeding manifestation in vivax group and 2 patient having bleeding manifestation in P. falciparum group. Jaundice was present in 4 p. vivax infection patients and 2 P. falciparum infection patients. 12 (33.33%) P .vivax patients were presented with shock, 8(33.33%) patient in falciparum group presented with shock. Renal failure was present in 4(11.12%) p value patient and 2 (8.4%) patients with P falciparum infection. Cerebral malaria was present in 3(8.33%) p. vivax infection patient and 2(8.4%) p. falciparum patients. 2(5.56%) patient in P.vivax infection and 1(11.1%) patient in p. falciparum developed ARDS/pulmonary edema.

**Discussion and Conclusion:** From present study we would like to conclude that both type of infection were presented with complication, organomegaly was common in Vivax infection but thrombocytopenia was common in falciparum infection. Hepatic and renal complications were more common in Vivax patients cerebral malaria was present in both groups.

**Keywords:** Plasmodium vivax, Plasmodium falciparum, Children, Complication and outcome.

### Introduction

Malaria is a life – threatening disease but is curable and preventable. As per data of WHO in 2017, there were an estimated 219 million cases of malaria in 90 countries. Death due to malaria has reached 435000 in 2017.<sup>1,2</sup> India and fifteen countries in sub- Saharan Africa carried almost 80% of the global burden of malaria. Malaria is an acute parasitic illness mainly caused by plasmodium Vivax and plasmodium falciparum in India.<sup>3</sup> falciparum malaria is considered to be associated with high morbidity and mortality and Vivax malaria is usually thought to be relatively benign condition. The proportion of P. Vivax and P. falciparum varies in different part of India.<sup>4</sup>

As plasmodium Vivax malaria has been considered to have a benign course with less mortality, most of the research is focussed on plasmodium falciparum.<sup>5</sup> But in recent years there are number of studies conducted in India and other countries has highlighted that plasmodium vivax can cause severe and fatal malaria, in paediatric patients. IVO Miller et al has reported that a widely accepted view of its inability to adhere to vascular endothelium and its preference to invade reticulates has now being challenged and it is able to produce complication resembled falciparum.<sup>6</sup> Dhanpat K. Kochar at al has reported that

jaundice and hepatic dysfunction was more common complication and renal complication was second most common complication, which is comparable to the observation reported in falciparum malaria. J. Kalvin Baird et al from his observation has use the word pernicious and threatening malaria for P. Value infection.<sup>8</sup>

Based on this background we have designed a prospective study to evaluate clinical profile, complication and outcome of plasmodium vivax and compare it with plasmodium falciparum malaria.

### Materials and Methods

Present study is a prospective study conducted in the department of paediatrics Konaseema institute of medical science Amalapuram Andhra Pradesh during the period from Jan 2015 to October 2018. During this period 60 patients below 18yrs of age with smear positive for plasmodium species or malarial antigen positive by Rapid diagnostic test (RDT) were included as per inclusion and exclusion criteria.

#### Inclusion Criteria:

1. Age below 18yrs
2. Both sex,
3. Availability of written and informed consent.

**Exclusion Criteria:**

1. No consent form Patient.
2. Mixed infection
3. Other complications like cardiac/renal complication

**Ethics:** present study is approved by institutional ethics committee and written informed consent was obtained from parent/garden of the patients.

**Diagnosis:** Diagnosis of the species of malaria was established by thick and thin film of peripheral blood smear, examined under oil emersion microscope with Giemsa stain and Rapid diagnostic test for malaria. Rapid diagnostic test was based on detection of specific malaria antigen, lactate dehydrogenase for plasmodium vivax and Histidine rich protein 2 for plasmodium falciparum. The severity of malaria was categorised on the basis of WHO guideline for severe malaria 2014.<sup>9</sup> Group 1 prostrate children (prostration is the inability to sit upright in a child normally able to do so or to drink in the case of children too young to sit). Three subgroups of increasing severity should be distinguished: Prostrate but fully conscious Prostrate with impaired consciousness but not in deep coma (the inability to localise a painful stimulus) Respiratory distress (acidotic breathing): Mild–sustained nasal flaring and/or mild intercostal indrawing (recession) Severe–the presence of either marked indrawing (recession) of the bony structure of the lower chest wall or deep (acidotic) breathing Shock compensated

or decompensated (see definition above) Group 2:-Children who, although able to be treated with oral antimalarials, require supervised management because of the risk of clinical deterioration but who show none of the features of group 1 (above)\*. These include children with any of the following: Haemoglobin <5 g/dl or haematocrit <15% 2 or more convulsions within a 24-h period Haemoglobinuria (black water) Jaundice. Group 3:-Children who require parenteral treatment because of persistent vomiting but who lack any specific clinical or laboratory features of groups 1 or 2 (above).

**Treatment:** All patients were treated according to WHO guidelines for malaria treatment.

**Data Collection and Analysis:** Data regarding patient age, sex clinical presentation, investigation, complication and outcome are recorded. Lab investigation like haemoglobin, total leukocyte count, platelet count, bleeding time, clotting time, blood sugar, blood urea, serum creatinine, serum Bilirubin, SGOT and SUPT were done for all these investigation standard laboratory procedure was followed.

All statistical data analysis was performed by using SPSS 19.0 window platform. Data was summarised, the interpretation of India.

**Result****Table 1: Baseline characteristic of the patients**

Variables	Plasmodium vivax (n=36)	Plasmodium falciparum(n=24)
Age (mean± SD)(yrs)	11.865±4.290.	10.7±7.03
Sex (male/female)	20/16	14/10
Severe malaria	13(36.11%)	10(41.66%)
Non severe malaria.	23(63.88%)	14(58.33%)

In present study total 60 cases of malaria among paediatric patients were enrolled for the study as per inclusion and exclusion criteria. Out of these 60 cases 36(60%) patients were having plasmodium vivax infection and 24 that are 40% patients had plasmodium falciparum infection. Mean age of the patients with vivax malaria was 11.865±4.290yrs and with falciparum was 10.73±7.03yrs.

Male to female ratio in vivax was 20/16 and in falciparum it was 14/10.

We have observed that both type of infection were presented with severe and non-severe malaria, 13 cases in vivax malaria were severe that is 36.11% and 10 cases in falciparum were severe that is 41.66%.

**Table 2: Comparison of various clinical profiles of patients**

Variables	Plasmodium vivax (n=36)	Plasmodium falciparum(n=24)
Anaemia(Hbless than 5 mg/dl)	4(11.12%)	2(8.33%)
splenomegaly	22(61.11%)	10(41.66%)
Thrombocytopenia	8(22.22%)	10.(41.66%)
Leukocytopenia	4(11.11%)	2(8.33%)
Hypoglycaemia	6(16.7%)	4(16.7%)
Raised SGOT	8(22.22%)	4(16.7%)
Raised SGPT	6(16.7%)	3(12.5%)
↑Blood urea	4(11.11%)	1(4.1%)
↑ Serum creatinine.	3(8.33%)	2(8.4%)

As per table -2 regarding various clinical profiles of patients, severe anaemia was found in 4 patients that is

11.12% of vivax infection and 2(8.33%) patients of falciparum infection.

Splenomegaly was present in 22 patients (61.1%) in vivax and 10(41.66%) in falciparum patients. 8 patients in P vivax group were presented with thrombocytopenia (22.11%) and in P. Falciparum group this number was 10 that is (41.67%), Leukocytopenia was observed in 4 (11.11%) patients with vivax malaria and in falciparum group 2 patients developed Leukocytopenia. Six patient developed hypoglycaemia in vivax infection group and 4 patients in falciparum infection have developed hypoglycaemia.

Raised SGOT was present in 8 patients with P. Vivax infection and 4(16.7%) patients with. P. falciparum infection, SGPT was elevated in 6(16.7%) pts. with P. Vivax infection and 3(12.5%) patients with P.falciparum infection. 4(11.12%) patient's blood urea was increased in vivax group and in falciparum group this number was 1(4.1%). Serum creatinine was elevated in 3(8.33%) patients, in vivax group and 2(8.4%) patients in falciparum infection.

**Table 3: Comparison of complication**

Variables	Plasmodium vivax (n=36)	Plasmodium falciparum(n=24)
Severe anaemia	4(11.11%)	2(8.4%)
Bleeding	4(11.11%)	2(8.4%)
Jaundice	12(33.35%)	8(33.33%)
Shock	2(5.5%)	1(4.1%)
Renal failure	4(11.11%)	2(8.4%)
Cerebral malaria	3(8.33%)	2(8.4%)
ARDS.(pulmonary edema)	2(5.56)	1(4.1%)

As per table 3 regarding comparison of complication between vivax and falciparum malaria, severe malaria was present in 4(11.12%) p. vivax infection patients and in 2(8.41) P. falciparum infection patient. 4 patients having bleeding manifestation vivax group and 2 patient having bleeding manifestation in P. falciparum group. Jaundice was present in 4 p. vivax infection patients and 2 P. falciparum infection patients. 12 (33.33%) P .vivax patients were prevented with shock, 8(33.33%) patient in falciparum group presented with shock. Renal failure was present in 4(11.12%) p value patient and 2 (8.4%) patients with P falciparum infection. Cerebral malaria was present in 3(8.33%) p. vivax infection patient and 2(8.4%) p. falciparum patients. 2(5.56%) patient in P.vivax infection and 1(11.1%) patient in p. falciparum developed ARDS/pulmonary edema.

not support study.<sup>12</sup> In our study there was male predominance and mean age of the patient with Vivax malaria 11.68yrs and with falciparum malaria was 10.7yrs. In the study of Jagadish Prasad Goyal et al the mean age was 5.2/5.6, with male predominance, but the study of Ragini Singh et al supports our observation.<sup>10,13</sup> In present study we have observed that severe malaria was little more common in falciparum patients than Vivax patients (41.66% vs 36.11%). which is supported by the work of Raginisingh et al.<sup>13</sup>

Regarding comparison of clinical profile of malaria, severe anaemia was more common in Vivax than falciparum that is (11.2% vs 8.33%), which corroborates with the finding of Vijay Baburao Sonawane et al,<sup>14</sup> but the study of Ragini Singh et al and Ravilala VK et al does but support our study.<sup>13,15</sup> Splenomegaly was common in Vivax patients than falciparum patients (61.11% vs. 41.66%) which is supported by the work of J.P. Goyal et al.<sup>10</sup>

**Table 4: Outcome of the treatment comparison between Vivax and falciparum**

Variables	P. vivax (n=36)	P. falciparum(n=24)
Recovered	36	24
Death	-	-

Thrombocytopenia was supposed to be present in P. falciparum infection but it is found in P vivax infection also, probable mechanism maybe IgG anti body mediated distraction of platelet. Which supported by the work of Arti Muley, Jitendra Lakhani et al and Naing C et al.<sup>16,17</sup> Leukocytopenia was more common in Vivax patient than falciparum, which corroborates with the finding of Kocher et al and Rasini et.<sup>7,13</sup> Hypoglycaemia was equally present in both group, which supported by the work of Ravilalav K et al.<sup>15</sup>

Abnormality and liver enzyme and serum urea and creatin was comparatively common in Vivax patient than falciparum, which is supported by the work of J.P. Goyal et al, Srivastava et al and Premaratana R et al.<sup>10,18,19</sup>

Regarding complication of malaria in two groups, Jaundice was more common complication which was equally prevalent in both groups which is followed by severe anaemia and bleeding which is slightly more common in P. Vivax patients.

All the patients enrolled in present study recovered and there was no death.

## Discussion

In present study 60 patient admitted with proven malaria to our hospital were analysed. Out of 60 cases, 60% of the patients have plasmodium Vivax malaria and 40% patients has P. falciparum malaria which is supported the finding of Jagadesh Prasad Goyal et al.<sup>10</sup> Poonam Singh et al has found that 55% and plasmodium falciparum was 34.9% which again corroborates with our finding.<sup>11</sup>

But Verma P et al study of central India has observed that P. falciparum cases are more than Vivax, which does

Which is supported by the work of Poonam Singh et al.<sup>11</sup> shock was equally found in both groups that (5.5% vs 4.1%), which corroborated with the finding of Ragini Singh et al.<sup>13</sup>

We have observed in our study that renal failure was more common in P. Vivax infection than P. falciparum. This is supported by the finding of Millind Y Nadkar et al. We have also observed that cerebral malaria and ARDS was present in both types of infection and there is no difference in the incidence, which is supported by the work of Jagdish Prasad Goyal et al but R. Singh et al has found that ARDS and cerebral malaria was more common in falciparum than Vivax.<sup>10,13</sup>

Out of 60 patients of proven malaria was audited in our hospital we have not recorded in death due to malaria in our hospital.

### Conclusion

From present study we would like to conclude that both types of infection were presented with complications, organomegaly was common in Vivax infection but thrombocytopenia was common in falciparum infection. Hepatic and renal complications were more common in Vivax patients cerebral malaria was present in both groups.

**Conflict of Interest:** Nil

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