

Original Research Article

Comparison of clinical profile between *Plasmodium vivax* and *Plasmodium falciparum* malaria in children in tertiary care hospital

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ABSTRACT

Background: The high prevalence of uncomplicated malaria as seen in this study suggests the importance of timely diagnosis and effective treatment and encourages new activities to further decrease complicated malaria cases.

Methods: In this study, malaria was diagnosed by 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. The mode of presentations like fever, splenomegaly, vomiting, abdominal pain, laboratory investigations and complications were noted. Simple malaria was defined as *Plasmodium vivax* or *Plasmodium falciparum* malaria without any complications. All the statistical analysis was done by using SPSS 16 version and in MS Excel. Qualitative variables were expressed as frequencies and percentages. Chi-square was used for examining the categorical data.

Results: A total 100 cases of malaria diagnosed by rapid diagnostic test and/or peripheral smear were studied. 69% of the cases were falciparum malaria and 31% of the cases were vivax malaria. Males were more commonly affected than females. Vivax malaria was most common between 5-10 years of age and falciparum malaria was more common in 0-5 years of age. Uncomplicated malaria was seen in 73% of the cases and complicated malaria was seen in 27% of the cases. Incidence of complicated malaria was more common in case of falciparum malaria. Fever, pallor, hepatomegaly and splenomegaly were significant for clinical diagnosis of malaria. Severe anaemia was the most common presentation of complicated malaria followed by jaundice. Cerebral malaria was more common in case of falciparum malaria. Metabolic acidosis and renal failure were more common in falciparum malaria. Hypoglycemia, significant bleeding and shock were more common in falciparum malaria. ARDS was most common in vivax malaria.

Conclusions: This study emphasizes the importance of severity of *P. Vivax* malaria and recommends further studies to establish mortality and severity predictors specific to it.

Keywords: Clinical profile, Children, Malaria, *Plasmodium vivax*, *Plasmodium falciparum*, Tertiary care hospital

INTRODUCTION

India contributes to about 2/3rd of Malaria in the South East Asia region.¹ There exists heterogeneity and variability in the transmission between and within the states of the country as many ecotypes of Malaria have

been recognized. Among the four species of Plasmodium, *Plasmodium falciparum* and vivax are commonly found in India. Disease caused by Plasmodium vivax malaria used to be called benign tertian. In contrast Plasmodium falciparum causes severe malaria and often produces multi-organ failure unless treated early with multiple

drugs. Kochar et al in a study reported several cases of vivax Malaria with multi-organ dysfunction syndrome.² Profound thrombocytopenia is a common complication of falciparum malaria but recently there have been several reports of vivax malaria with thrombocytopenia.³ Acute respiratory distress syndrome, hepatic involvement and renal involvement are common in *Plasmodium falciparum* malaria; these complications also have been reported in *Plasmodium vivax* malaria⁴. Morbidity and mortality of *Plasmodium vivax* have increased recently due to the serious complications associated with it. The classic attack of malaria is recognized by its periodicity and pattern. However, today the classic clinical picture is more of an exception than the rule particularly with falciparum infection, which explains why it can easily be mistaken for other diseases with catastrophic results.

METHODS

This is a hospital based prospective observational study carried out at Niloufer hospital for women and children, Hyderabad from August 2016-July 2017 on 100 children admitted in Niloufer hospital.

Inclusion criteria

All the slide positive and/or rapid diagnostic test positive confirmed cases of malaria upto 12 years were included.

Exclusion criteria

- Patients presented with fever but empirically treated for malaria.
- Mixed infection of *Plasmodium vivax* and *Plasmodium falciparum* malaria.
- Patients presented with clinical features mimicking malaria like dengue fever, sepsis and meningitis.

In this study, malaria was diagnosed by 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. The mode of presentations like fever, splenomegaly, vomitings, abdominal pain, laboratory investigations and complications were noted. Simple malaria was defined as *Plasmodium vivax* or *Plasmodium falciparum* malaria without any complications.

Impaired consciousness/coma, Renal failure (serum creatinine >3 mg/dl), Jaundice (serum bilirubin >3 mg/dl), Severe anaemia (Hb <4 gm/dl), Metabolic acidosis, Circulatory collapse/shock (systolic BP <80mm Hg, 106 °F or >42°C), Hyperparasitemia (>5% parasitized RBCs), Hypoglycaemia, Significant bleeding. Thrombocytopenia in the study is defined as platelet count less than 1.5 Lakhs. In the study, reticulocyte count

is taken as low when <0.5 %, normal when 0.5 -2%, high when more than 2%. The clinical profile was compared between *Plasmodium vivax* and Falciparum malaria. All the statistical analysis was done by using SPSS 16 version and in MS Excel. Qualitative variables were expressed as frequencies and percentages. Chi-square was used for examining the categorical data.

RESULTS

The study was conducted in Niloufer hospital, Osmania medical college, Hyderabad, during the period of August 2016 to July 2017. 100 children with *P. vivax* or *P. falciparum* with smear positive and/or rapid diagnostic test were included in the study.

Results are tabulated as presence of variable as positive (P), absence of variable as negative (N).

Table 1: Classification based on types of malaria.

Group		No of cases	%	P Value
PV	Complicated malaria	4	12.9	0.03
	Uncomplicated malaria	27	87.1	
	Total	31	100	
PF	Complicated malaria	23	33.33	
	Uncomplicated malaria	46	67.7	
	Total	69	100	

Table 1 shows complicated malaria is more common in falciparum malaria when compared to the vivax malaria with a significant P value (<0.05). Total *Plasmodium vivax* cases were 31, Of which 4 were of complicated malaria and 27 of uncomplicated malaria and *Plasmodium falciparum* cases were 69 , out of which 23 cases were complicated malaria and 46 cases were uncomplicated malaria.

Table 2: Vomiting frequency in the study subjects.

Group		No of cases	Percent	P Value
PV	P	19	61.3	0.86
	N	12	38.7	
	Total	31	100	
PF	P	41	59.4	
	N	28	40.6	
	Total	69	100	

Table 2 shows all the cases in the present study has fever. Out of 31 cases of vivax malaria, vomiting was present in 19 cases (61.3%) and in falciparum malaria, vomiting was present in 41 cases (59.4%). The P value was found to be 0.86. Vomiting were more common in cases of vivax malaria.

Table 3: Abdominal pain reported in the study subjects.

Group		No. of cases	Percent	P value
PV	P	2	6.5	0.551
	N	29	93.5	
	Total	31	100	
PF	P	7	10.1	
	N	62	89.9	
	Total	69	100	

Table 3 shows out of 31 cases of vivax malaria, abdominal pain was present in 02 cases (6.5%) and in falciparum malaria, abdominal pain was present in 07 cases (10.1%). P value was calculated to be 0.551. Here the abdominal pain was more frequent in cases of falciparum malaria.

Table 4: Pallor frequency in the study subjects.

Group		No. of cases	Percent	P value
PV	P	22	70.9	0.87
	N	9	29.1	
	Total	31	100	
PF	P	50	72.4	
	N	19	27.6	
	Total	69	100	

Table 4 shows pallor is significant finding in both falciparum malaria (72.4%) and vivax malaria (70.9%). There is only a slight difference between the cases of vivax and falciparum. The P value here is 0.87.

Table 5: Hepatomegaly found in the study subjects.

Group		No. of cases	Percent	P value
PV	P	15	48.4	0.019
	N	16	51.6	
	Total	31	100	
PF	P	50	72.5	
	N	19	27.5	
	Total	69	100	

Table 5 shows hepatomegaly was present in 15 cases (48.4 %) out of 31 cases of vivax malaria and in 50 cases (72.5 %) out of 69 cases of falciparum malaria with significant P value (<0.05). Hepatomegaly is more common in subjects of vivax malaria, which is statistically significant.

Table 6 shows splenomegaly was present in 28 cases (90.4%) out of 31 cases of vivax malaria and in 66 cases (95.66%) out of 69 cases of falciparum malaria. P value was recorded to be 0.093. Only a slight variation of frequency of occurrence can be noted between the cases of vivax malaria and falciparum malaria.

Table 6: Splenomegaly found in the study subjects.

Group		No. of cases	Percent	P value
PV	P	28	90.4	0.093
	N	3	9.6%	
	Total	31	100	
PF	P	66	95.66	
	N	3	4.34	
	Total	69	100	

Table 7: Cerebral malaria found in the study subjects.

Group		No. of cases	Percent	P value
PV	P	1	3.2	0.791
	N	30	96.8	
	Total	31	100	
PF	P	3	4.3	
	N	66	95.7	
	Total	69	100	

Table 7 shows out of 31 cases of vivax malaria, cerebral malaria was present in 01 cases (3.2%) and in falciparum malaria, cerebral malaria was present in 03 cases (4.3%). The P value was calculated to be 0.791. There is no statistically significant difference in the incidence of cerebral malaria.

Table 8: Severe anaemia found in the study subjects.

Group		No. of cases	Percent	P value
PV	P	3	9.7	0.404
	N	28	90.3	
	Total	31	100	
PF	P	11	15.9	
	N	58	84.1	
	Total	69	100	

Table 8 shows out of 31 cases of vivax malaria, severe anaemia was present in 03 cases (9.7%) and in falciparum malaria, severe anaemia was present in 11 cases (15.9%).

P value was found to be 0.404. There is a considerable variation of frequency of severe anemia, however statistically not significant.

Table 9: Jaundice prevalence in the study subjects.

Group		No. of cases	Percent	P value
PV	P	2	6.5	0.252
	N	29	93.5	
	Total	31	100	
PF	P	10	14.5	
	N	59	85.5	
	Total	69	100	

Table 9 shows out of 31 cases of vivax malaria, jaundice was present in 02 cases (6.5%) and in falciparum malaria, jaundice was present in 10 cases (14.5%). P value was calculated to be 0.252. Jaundice was more common in the subjects of falciparum malaria as shown in the records, though statistically not significant.

Table 10: Thrombocytopenia found in the study subjects.

Group		No. of cases	Percent	P value
PV	P	16	51.6	0.373
	N	15	48.4	
	Total	31	100	
PF	P	29	42	
	N	40	58	
	Total	69	100	

Table 10 shows thrombocytopenia was present in 16 cases (51.6%) out of 31 cases of vivax malaria and in 29 cases (42%) out of 69 cases of falciparum malaria. P value was calculated to be 0.373. Thrombocytopenia was more prevalent among the cases of vivax malaria, though statistically not significant..

Table 11: Acidosis in the study subjects.

Group		No. of cases	Percent	P value
PV	N	31	100	0.338
	P	2	2.9	
PF	N	67	97.1	
	Total	69	100	

Table 11 shows acidosis was present in 02 cases (2.9%) out of 69 cases of falciparum malaria. P value was calculated to be 0.338. Acidosis was not at all observed in cases of vivax malaria. Whereas on the contrary, 2 cases were positive out of 67 cases of falciparum malaria.

Table 12: Hypoglycaemia in the study subjects.

Group		No. of cases	Percent	P Value
PV	N	31	100	0.501
	P	1	1.4	
PF	N	68	98.6	
	Total	69	100	

Table 12 shows hypoglycaemia was present in 01 cases (1.4%) out of 69 cases of falciparum malaria. P value was calculated to be 0.501. Vivax subjects showed no incidence of hypoglycemia whereas a single case out of 68 cases of falciparum malaria had hypoglycaemia.

Table 13 shows renal failure was present in 02 cases (2.9%) out of 69 cases of falciparum malaria. P value was calculated to be 0.338. All the cases of vivax malaria

were negative for renal failure, whereas only 2 cases of 67 cases were positive for renal failure investigation.

Table 13: Renal failure frequency in the study subjects.

Group		No. of cases	Percent	p value
PV	N	31	100	0.338
	P	2	2.9	
PF	N	67	97.1	
	Total	69	100	

Table 14 shows ARDS was present in 01 cases (3.2%) out of 31 cases of vivax malaria. Falciparum cases showed no incidence of ARDS where as a single case of vivax malaria had ARDS. P value was calculated to be 0.134.

Table 14: ARDS found in the study subjects.

Group		No. of cases	Percent	P value
PV	P	1	3.2	0.134
	N	30	96.8	
	Total	31	100	
PF	N	69	100	

Out of 69 cases of falciparum malaria, normal reticulocyte count was observed in 36 cases (52.19%), high reticulocyte count was observed in 21 cases (30.42%), low reticulocyte count was observed in 12 cases (17.39%). Out of 31 cases of vivax malaria, normal reticulocyte count was observed in 18 cases (58%), high reticulocyte count was observed in 4 cases (13%), low reticulocyte count was observed in 9 cases (29%).

Table 15: Reticulocyte count of the study subjects.

Group		No. of cases	Percent	P value
PV	0	9	29	0.125
	1	18	58	
	2	4	13	
	Total	31	100	
PF	0	12	17.39	
	1	36	52.19	
	2	21	30.42	
	Total	69	100	

0-Low Reticulocyte count (<0.5%), - Normal Reticulocyte count (0.5-2%), 2-High Reticulocyte count (>2%).

DISCUSSION

P. vivax malaria has been considered to be a benign form of malaria, with low mortality but studies from across the world now have shown that vivax is not benign but has been associated with complications and mortality similar to present study which also shown this trend. In the present study, the most common species to cause malaria

was *Plasmodium falciparum* (69%) followed by *Plasmodium vivax* (31%). In the study of Verma et al *falciparum* was most common form (53.6%), *vivax* (27.3%), followed by mixed parasitemia (18.9%) which is similar to present findings.⁴ In the study of Rao P done in southern india, *Plasmodium falciparum* is the most frequent implicating species accounting for 64% of cases which is similar to the present study.⁵ But, in the study of Sonawane VB et al, the most common species to cause malaria was *P. vivax* (63.20%) followed by *P. falciparum* (20.75%) and mixed parasitemia (1.88%) which is against to the present study.⁶ *Falciparum* malaria is more common than the *vivax* malaria in the present study because the incidence of *falciparum* malaria is more common in south india compared to north india as per NVBDCP.⁷

In *falciparum* 23 (33.33%) cases were of severe malaria while 46 (67.7%) were non-severe. In *vivax* group 4 (12.9%) patients suffered from severe malaria and rest 27 (87.9%) were non-severe. When these results were compared statistically the p value was found to be 0.3 signifying no statistical difference between the *falciparum* and *vivax*

Cerebral malaria has been observed in 3.2% of *P. vivax* and 4.3 % of *P. falciparum* cases in present study. Cerebral malaria is a very severe complication and leading to one of the most common causes of mortality of malaria. Though exact pathogenesis of cerebral malaria in *P. vivax* remains unknown, few studies suggested that it might be due to sequestration and cytokine mediated cerebral injuries. Severe anaemia is the most common presentation of complicated malaria in the present study. Severe anaemia is more common in *falciparum* malaria when compared to the *vivax* malaria which is similar to the study done by Sonawaneet VB et al.⁸ It has been well established that the primary target of human plasmodium species is the RBCs. *P. vivax* has a very strong predilection for RBCs, particularly reticulocytes, whereas *P. falciparum* has only a moderate predilection. Like in *P. falciparum*, the continued presence of *vivax* parasites may have been sufficient to infect and destroy most of the new reticulocytes, thereby hindering the timely restoration of the erythrocytes population and this could (partly) lead to extreme anaemia over a period of several months. Moreover, there could have been compounding factors like the impaired immune response of *P. vivax*-infected patients as a result of recrudescence, reinfection, and relapse.

Jaundice in malaria results from hemolysis of both parasitized and non-parasitized red cells as well as malarial hepatitis. Raised liver enzymes occur because of injury to hepatocyte and cholestasis. In the present study, a total bilirubin of more than 3 mg/dl was seen in 6.4% of *vivax* malaria and 14.5% of *falciparum* malaria which is similar to the study done by Sonawaneet VB.⁶ Whereas, in the study done by Verma et al, jaundice was most commonly seen in *vivax* malaria when compared to the

falciparum malaria.⁷ There is a scarcity of published literature on malarial hepatopathy in children. In acute malaria, hepatic dysfunction is reversible and patients respond favorably to antimalarial therapy with no residual effects. In the present study Thrombocytopenia is more common in *falciparum* malaria (14.4%) compared to *vivax* malaria (6.4%) which is similar to the study done by Sonawane VB and Goyal JP et al.^{6,8} In study done by Verma the incidence of thrombocytopenia is more common in *vivax* malaria (13.5%) compared to the *falciparum* malaria (13.5%). In the present study metabolic acidosis is more common in *falciparum* malaria (2.9%) when compared to the *vivax* malaria similar observation was noted verma. In the study done by Sonawane VB metabolic acidosis is more common in *vivax* malaria when compared to the *falciparum* malaria this variation in the result from the present study could be due *vivax* malaria is more common contributing to 67% of the cases.⁶

Hypoglycemia was more common in *falciparum* malaria (1.4%) when compared to the *vivax* malaria similar observation was noted in the study done by Verma et al.⁴ Renal failure is more common in *falciparum* malaria (2.9%) when compared to *vivax* malaria similar observation was noted in study done by Goyal JP, Sonawane VB and Singh et al.^{8,6,9} Whereas study done by verma renal failure is more common in *vivax* malaria when compared to the *falciparum* malaria the difference could be due epidemiological variations. ARDS is more common in *vivax* malaria (2.1%) when compared to the *falciparum* malaria similar observation was noted in the study done by Goyal and Singh R et al.^{8,9}

In the present study significant bleeding was seen in 2 cases (2.9%) of *falciparum* malaria which is in contrast to the study done by verma in which bleeding is more common in *vivax* malaria (13.3%). This difference could be due more severity and incidence of the *falciparum* malaria in the Telangana state when compared to the northern india in which *vivax* malaria is more common.¹² In the present study shock was seen in *falciparum* malaria when compared to the *vivax* malaria similar observation was noted in the study done by tarakeswara rao et al and verma.^{4,10} Out of 100 cases, 54% has shown normal reticulocyte count, 25% has shown high reticulocyte count and 21% has shown low reticulocyte count. 30.4% of the cases of *falciparum* malaria showed increased reticulocyte count, whereas, 29% of the cases of *vivax* malaria has low reticulocyte count which is similar to the observation done by Agrawal D et al.¹¹

CONCLUSION

A total 100 cases of malaria diagnosed by rapid diagnostic test and/or peripheral smear were studied. 69% of the cases were *falciparum* malaria and 31% of the cases were *vivax* malaria. Males were more commonly affected than females. *Vivax* malaria was most common between 5-10 years of age and *falciparum* malaria was

more common in 0-5 years of age. Uncomplicated malaria was seen in 73% of the cases and complicated malaria was seen in 27% of the cases. Incidence of complicated malaria was more common in case of falciparum malaria. Fever, pallor, hepatomegaly and splenomegaly were significant for clinical diagnosis of malaria. Severe anaemia was the most common presentation of complicated malaria followed by jaundice. Cerebral malaria was more common in case of falciparum malaria. Metabolic acidosis and renal failure were more common in falciparum malaria. Hypoglycaemia, significant bleeding and shock were more common in falciparum malaria. ARDS was most common in vivax malaria. In conclusion severe form of malaria is also seen in vivax malaria and should not be neglected.

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