International Journal of Research in Medical Sciences
Singh SP et al. Int J Res Med Sci. 2014 Feb;2(1):117-121
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: 10.5455/2320-6012.ijrms20140224

Research Article

A comparative study of complications of vivax and falciparum malaria in Dehradun, India

S. P. Singh*, Ragini Singh, Niaz Ahmad

Department of Medicine, SGRR Institute of Medical & Health Sciences, Patel Nagar, Dehradun, Uttarakhand, India

Received: 3 October 2013
Accepted: 16 October 2013

***Correspondence:**
Dr. S. P. Singh,
E-mail: drspsingh6@gmail.com

ABSTRACT

Background: Traditionally Plasmodium falciparum has been considered to cause severe malaria while Plasmodium vivax is known to cause benign malaria. However many recent studies have shown that Plasmodium vivax is also responsible for many cases of severe malaria. There is scarcity of data on this topic from this region. The present study was conducted to find out clinical and pathological manifestations of vivax and falciparum malaria in Dehradun.
Methods: The study period was of one and half years, from January 2012 to June 2013. Patients of 18 years of age or above it who were smear positive or antigen positive were included in the study.
Results: one hundred and thirty nine patients were found to be suffering from malaria. 90 (64.7%) had vivax malaria, while 49 (35.3%) patients suffered from falciparum. The study of morbidity profile showed that the complications related to severity, earlier attributed to only falciparum is equally seen in vivax case. Low platelet count was the commonest finding in both groups. Other complications seen in both groups were those of severe anemia, cerebral malaria, ARDS, renal failure, hepatitis, leucocytopenia, pancytopenia, and shock. Mortality in the two groups was of the same order.
Conclusions: Vivax malaria causes significant mortality and morbidity. The morbidity and patterns are almost similar in both vivax and falciparum malaria.

Keywords: Vivax malaria, Falciparum malaria, Dehradun

INTRODUCTION

Malaria is a major public health problem in India and contributes to significant mortality and morbidity. According to the world malaria report 2012 fact sheet, WHO estimated 219 million cases of malaria and 660 000 deaths in 2010.[1] With an estimated 24 million cases per year, India has the highest malaria burden in South East Asia.[1] Half of the total malaria cases in India are reported from Jharkhand, Orissa, Chhattisgarh, Madhya Pradesh and West Bengal.[2] Plasmodium vivax is the commonest among all the four human malaria species. Historically serious complications associated with falciparum malaria were not expected to be found in vivax malaria which was thought to run a benign course. However recent studies show that 21-27% of patients with severe malaria have P. vivax infection.[3,4] Factors like rapidly growing population, water logging and poor sanitation has resulted in the rise of malaria incidence in Dehradun. Malaria patients can be seen throughout the years but the maximum number of cases emerges during the rainy season. This study aims to compare the clinical features, complications, response to treatment and outcome in patients suffering from vivax and falciparum malaria.

METHODS

This prospective study was done at SGRR Institute of Medical & Health Sciences, Dehradun. This is a tertiary care and referral hospital of Uttarakhand. Patients reach here from Dehradun, neighbouring districts and bordering states. The study was performed for one and half years, from January 2012 to June 2013. All the admitted patients of 18 years of age or above it who were smear positive or antigen positive were included in the study. Patients with mixed infection were excluded from the study. A detailed history and clinical examination was done. Routine hematological and biochemical investigations were done in all cases. Additional investigations like CT scan of head and X- ray chest were done as when required. Patients who were smear negative or antigen negative but were treated empirically for malaria were excluded from the study. For statistical analysis p-value was calculated using Pearson chi-squire test

RESULTS

Total 139 patients were identified as suffering from malaria. Out of these 75 (54.0%) were male and 64 (46%) were female (Table 1). 90 (64.7%) patients were suffering from vivax and 49 (35.3%) from falciparum malaria. In both groups numbers of males were higher. There was clustering of cases in rainy season. All the patients presented with fever ranging from 2 day to 10 days with a mean duration of 3.5 ± 2.0 days.

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

	P. vivax n = 90 (64.7%)		P. falciparum n= 49 (35.3%)	
Age group	Male	Female	Male	Female
18-30	14 (15.6%)	13 (%)	7 (14.3%)	7 (14.3%)
31-40	13 (14.4%)	12 (%)	7 (14.3%)	5 (10.2%)
41-50	8 (8.9%)	7 (%)	5 (10.2%)	5 (10.2%)
51-60	6 (6.7%)	5 (%)	5 (10.2%)	4 (8.2%)
61-70	5 (5.6%)	4 (%)	3 (6.1%)	1 (2.0%)
71-80	2 (2.2%)	1 (%)	0 (0.0%)	0 (0.0%)
Total	48 (53.3%)	42 (%)	27 (55.1%)	22 (44.9%)

On examination all patients were febrile. Severe malaria was categorized according to the WHO classification).[5] In falciparum 26 (53.1%) cases were of severe malaria while in vivax group 40 (44.4%) patients suffered from severe malaria. When these results were compared statistically the p value was found to be 0.3 signifying no statistical difference between the falciparum and vivax (Table 2). Among vivax cases anemia was seen in 66 (73.3%) patients while in falciparum group it was in 38 (77.6%). 39 (43.3%) had altered sensorium in vivax group while it was 23 (46.9%) in falciparum group. Hepatosplenomegaly was seen in 18 (20.0%) of vivax group while it was in 5 (10.2%) of falciparum group. Petechiae was observed in 17 (18.9%) of vivax cases while it was in 9(18.4%) of falciparum group. Malaria hepatitis manifesting as jaundice was seen in 21(23.3%) of vivax group while it was in 12 (24.5%) of falciparum group.

Table 2: Clinical profile: comparison between vivax and falciparum.

Morbidity	Total	P. vivax	P. falciparum	p value
All patients	139	90 (100%)	49 (100%)	
Severe malaria	66	40 (44.4%)	26 (53.1%)	0.3
Fever	139	90 (100%)	49 (100%)	1.0
Pallor	104	66 (73.3%)	38 (77.6%)	0.6
Jaundice	33	21(23.3%)	12(24.5%)	0.8
Splenomegaly	44	28 (31.1%)	16 (32.7%)	0.9
Hepatomegaly	44	29 (32.2%)	15 (30.6%)	0.8
Hepatosplenomegaly	23	18 (20.0%)	5 (10.2%)	0.1
Headache	21	14 (15.6%)	7 (14.3%)	0.8
Seizure	13	8 (8.9%)	5 (10.2%)	0.8
Altered sensorium	62	39 (43.3%)	23 (46.9%)	0.7
Petechiae	26	17 (18.9%)	9 (18.4%)	0.9
Vomiting	23	16 (17.8%)	7 (14.3%)	0.6
Abdominal pain	22	15 (16.7%)	7 (14.3%)	0.7

Cerebral malaria was noted in 17 (18.9%) of vivax and in 11 (22.5%) of falciparum cases. Shock and circulatory collapse was noted in 7 (7.8%) of vivax and in 5 (10.2%) of falciparum cases. Severe anemia (Hb <5gm/dl) was noted in 6 (6.7%) of vivax and in 4 (8.2%) of falciparum cases. Severe Renal impairment (serum creatinine >3mg/dl) was observed in 5 (5.6%) of vivax and in 3 (6.1%) of falciparum group. 2 (2.2%) of vivax cases had ARDS while 2 (4.1%) of falciparum patients had this complication. Severe hypoglycaemia (blood sugar <40 mg/dl) was seen in 3 (3.3%) of vivax group and in 1 (2.0%) of falciparum group.

74 (82.2%) vivax cases and 40 (81.6%) of falciparum case were having thrombocytopenia. Bleeding in the form of epistaxis, petechiae, GI hemorrhage (malena or hematemesis) was associated with severe

thrombocytopenia (<50,000) in some cases. Leucopenia (TLC < 4,000) was found in 22 (24.4%) cases of vivax and 8 (16.3%) cases of falciparum (Table 3). SGOT and SGPT were raised in 29 (32.2%) vivax and 15 (30.6%) falciparum cases. 40 (44.4%) of total vivax cases and 26 (53.0%) of falciparum cases developed acute renal failure (S. creatinine > 1.5 mg/dl).

Table 3: Laboratory profile: comparison between vivax and falciparum.

Morbidity	Total	P. vivax	P. falciparum	P value
Thrombocytopenia <1.5 lakh	114	74 (82.2%)	40 (81.6%)	0.9
Thrombocytopenia <1 lakh	79	54 (60.0%)	25 (51.0%)	0.3
Thrombocytopenia <50,000	47	32 (35.6%)	15 (30.6%)	0.6
Leucocytopenia	30	22 (24.4%)	8 (16.3%)	0.3
Pancytopenia	72	42 (46.6%)	30 (61.2%)	0.1
Anemia (Hb <10 gm/dl)	104	66 (73.3%)	38 (77.6%)	0.6
Raised SGOT,SGPT	44	29 (32.2%)	15 (30.6%)	0.8
Acute renal failure (S. creatinine > 1.5 mg/dl)	66	40 (44.4%)	26 (53.0%)	0.3

Table 5: Mortality profile: comparison between vivax and falciparum.

Age group	P. vivax	P. falciparum	p value
18-30	1(1.1%)	1(2.0%)	1.0
31-40	2(2.2%)	1(2.0%)	0.9
41-50	2(2.2%)	2(4.1%)	0.5
51-60	1(1.1%)	1(0.0%)	1.0
61-70	2(2.2%)	1(2.0%)	0.9
71-80	1(1.1%)	1(2.0%)	1.0
Total	9(10.0%)	7(14.3%)	

Mortality in vivax malaria was 9(10.0%) while it was 7(14.3%) in falciparum group. causes of death were cerebral malaria, ARDS, shock, and multy organ failure.

Table 4: Severe malaria: comparison between vivax and falciparum.

Morbidity	Total	P. vivax	P. falciparum	P value
Cerebral malaria (Unarousable coma, repeated seizures)	28	17 (18.9%)	11 (22.5%)	0.6
Shock / circulatory collapse	12	7 (7.8%)	5 (10.2%)	0.6
Severe anemia (Hb <5 gm/dl)	10	6 (6.7%)	4 (8.2%)	0.7
Severe Renal impairment (serum creatinine >3mg/dl)	8	5 (5.6%)	3 (6.1%)	0.9
ARDS	4	2 (2.2%)	2 (4.1%)	0.9
Severe hypoglycaemia (blood sugar <40 mg/dl)	4	3 (3.3%)	1 (2.0%)	0.7
Total	66	40 (44.4%)	26 (53.1%)	

DISCUSSION

According to World Health Organization 2010 report, more than 50% cases of malaria in South East Asia are of vivax.[6] The belief that vivax malaria is rarely life threatening is increasingly being challenged.[7-12] Out of total malaria cases 64.7% cases were of vivax while only 35.3% cases were of falciparum. The incidence of severe malaria in vivax infection is 44.4% while in falciparum it is 53.1%. A statistical comparison of cases of severe malaria showed no significant difference between the two groups. The male patients due to malaria are more in number than females. This may be due to the increased probability of males having an outdoor exposure, although a genetic basis cannot be ruled out. Thrombocytopenia was the commonest hematological abnormality in both groups similar to the observations made in other studies.[13-17] The lowest platelet count here was 7000 cells which was in falciparum but many cases of platelets below 20000 were also seen in vivax group. The cause of thrombocytopenia in malaria may be due to lytic effect, immunological reactions, sequestration and oxidative stress.[18-20] Anemia and leukopenia are the other hematological abnormality in malaria.[26] Incidence of severe anemia was found to be 6.7% in vivax and 8.2% in falciparum (Table 4).

Pancytopenia was also significantly observed in both groups. Leukopenia resolved with treatment in most cases. Cerebral Malaria is the most lethal of all severe malaria cases.[22] Multisystem involvement was observed in all patients of falciparum group and in 55% of vivax cases. This finding was similar to what was observed in Bikaner study.[23] Acute respiratory distress syndrome (ARDS), acute pulmonary injury, and interstitial pneumonia are some of the respiratory complications reported in malaria. Small airway obstruction, gas exchange alteration, increased phagocytic activity, sequestration of vivax infected erythrocytes in pulmonary microvasculature, progressive alveolar capillary dysfunction after the start of treatment are the possible mechanisms in causation of lung injury.[24-26] In this study ARDS was seen in both the groups and it was the cause of death in 2 patents. Many patients developed ARDS after the treatment for severe malaria was started. Acute tubular necrosis is the predominant mechanism of renal failure. Hemolysis, cholestasis and hepatocellular injury are the causes of jaundice. 2 patients of malaria hepatitis had encephalopathy, of which 1 was in stage 3 who was falciparum positive. In all these complications it was remarkable to note that there was no statistical difference between the two groups i.e. vivax and falciparum. The morbidity profile established that the severe complication, earlier attributed to only falciparum was equally present in vivax group (Table 4).

Mortality in vivax 9 (10.0%) was found to be comparable to falciparum mortality 7 (14.3%) in this study Mortality pattern was equally distributed in both groups. The difference between the age specific mortality between vivax and falciparum were statistically insignificant.

CONCLUSION

P. vivax is an important cause of morbidity and mortality from malaria in Dehradun and neighbouring places. The prevalence of vivax malaria is higher than that of falciparum. The study also shows vivax malaria as an important cause of severe malaria. The mortality rate, when compared between vivax and falciparum showed no statistically significant difference.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. World Health Organization, World Malaria Report fact sheet. 2012. Available at: http://www.who.int Accessed 5 August 2013.
2. Basu S, Gupta P. Malaria. In: Ghai OP, Gupta P, editors. Text book of Social and Preventive Medicine. 3rd ed. New Delhi: CBS Publisher and distributors; 2010: 214-230.
3. Price RN, Douglas NM, Anstey NM. New developments in Plasmodium vivax malaria: severe disease and the rise of chloroquine resistance. Current Opin Infect Dis. 2009 Oct;22(5):430-5.
4. Li J et al. Geographic Subdivision of the Range of the Malaria Parasite, Plasmodium vivax. Emerging Infectious Diseases, Centers for Disease Control and Prevention. 2001 Jan-feb;7(1):35-42.
5. Severe falciparum malaria. World Health Organization, Communicable disease clusture. Trans R Soc Trop Med Hyg. 2000;94:S1-90.
6. World Health Organization, Regional Office of South East Region. Health topics: Malaria: World Malaria Report 2011. Available at: http://www.who.int Accessed 22 December 2012.
7. Nadkar MY, Huche AM, Singh Raminder, Pazare AR. Clinical profile of severe Plasmodium vivax malaria in a tertiary care centre in Mumbai. J Assoc physians India. 2012 October;6:11-3.
8. Mohapatra MK, Padhiary KN, Mishra DP, Sethy G. Atypical manifestations of plasmodium vivax malaria. Indian J Malariol. 2002;6:263-5.
9. Islam N, Qamruddin K. Unusual complicated in benign tertian malaria. Trop Geogr Med. 1995;47:141-3.
10. Mahgoub H, Gasim GI, Musa IR, Adam I. Severe Plasmosium vivax malaria among Sudanese children at New Halfa Hospital, Eastern Sudan. Parasites and Vectors. 2012, 5:154.
11. Shaikh S, Memon H, Iohamo B, Shaikh A, Ahmed I, Baird S. Severe disease in children hospitalized with a diagnosis of Plasmodium vivax in South eastern Pakistan. Malarial Journal. 2012;11:144.
12. Jat KR, Guglani V, Khairwa Anju. Severe and complicated Plasmodium vivax malaria in children. Trop Doct. 2012 Oct;42:185-7.
13. Kochar DK, Das A, Kochar SK, Saxena V, Sirohi P, Garg S et al. Severe Plasmodium vivax malaria: a report on serial cases from Bikaner in north-western India. Am J Trop Med Hyg. 2009;80:194-8.
14. Antinori S, Galimberti L, Erika G, Paola M, Anna R, Veronica A. Thrombocytopenia and Plasmodium vivax malaria. Clin Infect Dis. 2005;41(8):1210-2.
15. Makkar RP, Monga SM, Gupta AK. Plasmodium vivax malaria presenting with severe thrombocytopenia. Braz J Infect Dis. 2002;47:24-6.
16. Sharma A and Khanduri U. How benign is benign tertian malaria? J Vector Dis. June 2009;46:141-2.
17. Narang GS and Singh N. Thrombocytopenia and other complications of Plasmodium vivax malaria. Curr Pediatric Res. 2011;15 (2):117-9.
18. Yamaguchi S, Kubota T, Yamagishi T et al. Severe thrombocytopenia suggesting immunological mechanism in two cases of vivax malaria. Am J Hematol. 1997;56(3):183-6.
19. Fajarda LF, Tallent C. Malaria parasites within human platelets. JAMA. 1974;229:1205.
20. Rodriguez MAJ, Sanchez E, Varges M, Piccolo C, Colina R, Arria M et al. Occurrence of

Thrombocytopenia in plasmodium vivax malaria. Clin Infect dis. 2005;4:130-1.
21. Douglas NM, Anstey NM, Buffet PA, Poespoprodjo JR, Yeo TW, White NJ et al. The anemia of Plasmodium vivex malaria. Malar J. 2012;11:135.
22. Severe falciparum malaria. World Health Organization, Communicable Diseases Cluster. Trans R Soc Trop Med Hyg. 2000;94:S1-90.
23. Kochar DK, Tanwar GS, Khatri PC, Kochar SK, Sengar GS, Gupta A et al. Clinical features of children hospitalized with malaria - a study from Bikaner, Northwest India. Am J Trop Med Hyg. 2010;83(5):981-9.
24. Torres JR, Perez H, Postigo MM, Silva JR. Acute non cardiogenic lung injury in benign tertian malaria. Lancet. 1997;350:31-2.
25. Anstey NM; Handojo T, Pain MC, Kenangalem E, Tjitra E et al. Lung injury in vivax malaria: Patho physiological evidence for pulmonary vascular sequestration and post treatment alveolar - capillary inflammation. J Infect Dis. 2007;195:589-96.
26. Anstey NM, Jacups SP, Cain T, Pearson T, Zeising PJ, Fisher DA et al. Pulmonary manifestations of uncomplicated falciparum and vivax malaria: cough small airway obstruction, impaired gas transfer, and increased pulmonary phagocytic activity. J Infect Dis. 2002;185:1326-34.

DOI: 10.5455/2320-6012.ijrms20140224
Cite this article as: Singh SP, Singh R, Ahmad N. A comparative study of complications of vivax and falciparum malaria in Dehradun, India. Int J Res Med Sci 2014;2:117-21.