DOI: https://doi.org/10.54393/pjhs.v4i10.1043

PAKISTAN JOURNAL OF HEALTH SCIENCES

https://thejas.com.pk/index.php/pjhs

Volume 4, Issue 10 (October 2023)

Original Article

Severity of *Plasmodium vivax* Malaria among Patients Presenting at Tertiary Care Hospital after Flood in Sindh – Pakistan

Mona Humaira[1*], Naila Memon[1], Akbar Gohar Abro[1], Arshad Sattar Lakho[1], Tahir Hanif[2] and Shuaib Ansari[1]

[1]Liaquat University of Medical & Health Sciences, Jamshoro, Pakistan
[2]PNS Shifa, Karachi, Pakistan

ARTICLE INFO

Key Words:
Severe Malaria, Plasmodium vivax, ALOC, Anemia

How to Cite:
Humaira, M., Memon, N., Abro, A. G., Lakho, A. S., Hanif, T., & Ansari, S. (2023). Severity of Plasmodium vivax Malaria among Patients Presenting at Tertiary Care Hospital after Flood in Sindh – Pakistan: Severity of Plasmodium vivax Malaria. Pakistan Journal of Health Sciences, 4(10). https://doi.org/10.54393/pjhs.v4i10.1043

***Corresponding Author:**
Mona Humaira
Liaquat University of Medical & Health Sciences, Jamshoro, Pakistan
monaahmed2810@gmail.com

Received Date: 14th September, 2023
Acceptance Date: 4th October, 2023
Published Date: 31st October, 2023

ABSTRACT

Malaria is one of the widely spread vector bond infectious disease responsible for grave health issues. Pakistan is one of the adversely hit country by malaria. We conducted this study to access whether there was only increase in no of malaria patients after flood in Sindh patients or clinical variance is also there. **Objective:** To assess the severity of *Plasmodium vivax* infection at a tertiary care hospital, after flood situation in Sindh. **Methods:** This cross-sectional study was conducted at LUMHS, Jamshoro from November 2022 to April 2023. After taking inform written consent, adult patients of age 13 to 60 years, irrespective of gender, with positive report of *P. vivax* malaria were included in the study. Data were recorded on predesigned proforma. Severity of malaria was determined according to the classification criteria. Data were analyzed with the help of SPSS version 23. **Results:** Out of total 170 patients, 52.4% female, mean age was 26.6 year. 50.6% patients of *Plasmodium vivax* found to suffer from severe malaria. Severe anemia, ALOC and jaundice were present in 28.2%, 21.2% and 11.2% of patients respectively. **Conclusions:** Enormous number of severe malaria cases due to of *P. vivax* was detected after floods in Sindh. Young age people were affected more, irrespective of gender. Severe anemia was the most common complication of malaria. Thrombocytopenia found frequently in patients infected with *P. vivax*.

INTRODUCTION

Malaria is one of the highly prevalent parasitic infections with high number of fatal outcomes still in this era of scientific advancement and potentially being a treatable disease it is one of the leading causes of death [1]. According to the latest World malaria report, there were 247 million cases of malaria in 2021 compared to 245 million cases in 2020. The estimated number of malaria deaths stood at 619,000 in 2021 compared to 625,000 in 2020 [2]. Pakistan also bears major burden of disease, 305 million cases registered last year. It is one of the endemic countries for malaria, with very high risk of transmission almost every person is at risk for getting the disease [3, 4]. In our country, *Plasmodium vivax* is extensively common, ranged from 70% to 81% followed by *Plasmodium falciparum* and very little contribution from other *plasmodium* variants [5, 6]. Traditionally, *Plasmodium vivax* is thought to be a benign disease as parallel to falciparum but since last few years more troublesome and even lethal outcomes are being noted [7]. *Plasmodium* is affected by many factors including climate. In Pakistan, KPK is worst malaria affected area followed by Sindh [8]. Knowledge is required about genetic makeup, disease producing properties qualities clinical presentation and drug response of the locally prevalent *plasmodium* species for proper control of disease, unfortunately scanty literature is available [6]. Research on these parameters is the need of

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time. Recently Pakistan was hit by troublesome floods, apart from mass destruction and human losses it also became the reason for dramatic increase in infectious disease including malaria [9]. We conducted this study to access whether there was only increase in no of patients or clinical variance is also there.

METHODS

This cross-sectional study was conducted at a premier tertiary care hospital i.e. Liaquat University of Medical & Health Sciences, Jamshoro which is represented hospital of whole interior of Sindh. The study was approved from the Research Ethics Committee of Liaquat University of Medical & Health Sciences, Jamshoro (Letter No./REC/-174; Dated 08-11-2022). The patients were selected via non-probability convenience sampling. Sample size was calculated via WHO Open Epi software by taking prevalence of *P vivax* in patients with severe malaria as 12.7% with Margin of Error as 5% and Confidence Interval of 95% [6]. All patients of age more than 13 years, irrespective of gender differences who were either admitted in medical ward or seeking consultation from in Medical OPD with positive report of *P. vivax* malaria were included in the study. Patients who were co-infected with *Plasmodium falciparum*, dengue or ITP were excluded from the study. *Plasmodium vivax* was detected by Giemsa stain, thick and thin blood films or ICT Malaria. Data were recorded on predesigned proforma after taken written informed consent from participants. The proforma included demographic profile, history, general and systemic examination of the patients along with lab investigations. Complete blood count, random blood sugar, (BSR), liver function test, urea, creatinine, serum bicarbonate urine examination, other specific tests were done as per clinical judgment with an intent of treatment. Severity of malaria was determined according to the classification criteria established by CDC [10]. The duration of study lasted from November 2022 to April 2023 and the data were analyzed with the help of SPSS version 23.0.

RESULTS

Total 170 patients were enrolled both from medical wards and OPD, who fulfilled the inclusion and exclusion criteria. In our study male were 47.6% while female were 52.4%. Age ranged from 13 years to 85 years so mean age was 26.6 year. Out of these 170 patients 50.6% patients of *Plasmodium vivax* found to be suffered from severe malaria (Figure 1). Severe anemia, ALOC and jaundice were present in 28.2%, 21.2% and 11.2% of patients and the criteria of severe malaria present in selected patients showed in Table 1.

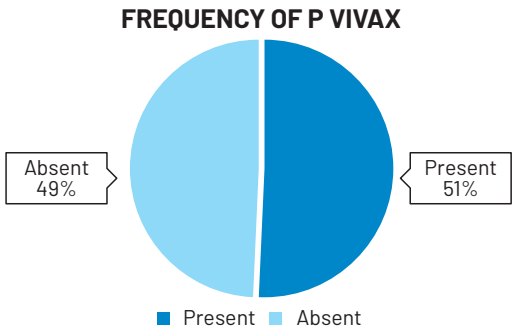

Figure 1: Frequency of *P. vivax* in patients with severe malaria

Table 1: Patient Clinical Profile

Criteria	Present	Absent
	N (%)	N (%)
Altered level of consciousness	36 (21.1)	134 (78.8)
Shock	11 (6.5)	159 (93.5)
Bilirubin (>than 3mg/dl)	19 (11.2)	151 (88.8)
Respiratory rate (> than30)	7 (4.1)	163 (95.9)
SpO2 Less than 92 %	7 (4.1)	163 (95.5)
Bleeding	13 (7.6)	157 (92.4)
Creatinine (>than 3mg/dl)	3 (1.8)	163 (95.9)
HCO3(< than 15 nmol/L)	3 (1.8)	163 (95.9)
Hemoglobin (Less than 7 g/dl)	48 (28.2)	122 (71.8)
BSR < 40 mg/dl	00 ()	170 (100)

Hemoglobin (g/dl) distribution and Platelet Count of the patients was shown in table 2. Minimum platelet count was 12×10^9/L and Maximum was 358×10^9/L while mean value was 64.6882×10^9/L (Table 2).S

Table 2: Hematological Parameters among patients of *P. vivax* Malaria

Hematological Parameters	
Hemoglobin (g/dL)	**N (%)**
Less than 7 g/dL	48 (28.2)
7.1 to 10 g/dL	69 (40.6)
Greater than 10 g/dL	53 (31.2)
Platelet Count (×10^9/L)	**N (%)**
10 – 50	62 (36.47)
51 – 100	67 (39.41)
101 – 200	33 (19.41)
201 – 360	8 (4.71)

DISCUSSION

Malaria is one of the widely spread, vector bond infectious disease responsible for grave health issues [11]. Malaria can manifest itself from inconspicuous infection to severe malaria which may be life threatening. Once assumed to be an innocent disease *P. vivax* is now increasingly being documented as an important cause of severe malaria [12, 13]. We conducted this study to access post flood situation of *vivax* malaria, whether there were only increases in the number of *P. vivax* malaria cases or variation in clinical spectrum of the disease was also there. In Pakistan, Sindh was tremendously hit province by floods. Apart from other

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destruction, health was affected immensely. Rapid escalation in no. of malaria cases were documented in Sindh and Baluchistan, contributed 78% of all cases of malaria from Pakistan. Situation was so worse that only in the month September 2022, 210,715 new cases were documented in badly hit 62 districts while the count was 178 657 cases in these areas in August 2022 [14]. Age ranged from 13 years to 85 years with mean age of 26.6 years. Majority of patients belong from younger age group. In a Pakistani study author urges importance of age in the occurrence of malaria and stated younger age groups were more prone for malaria [1]. Although *P. vivax* ratio is supposed to be more common in males [9]but in our study females were predominant with 52%. This is not very astonishing as some other authors also register the female predominance. Very scanty literature is available from Pakistan regarding severe *vivax* malaria. Study by Zubairi *et al.,* although old but worth mentioning as they assessed severe malaria cases. They noticed that 79.9% of cases of severe malaria were due to *P. vivax [15]*. Once thought to be benign disease increasingly being recognized as cause of severe malaria percentage of these cases was 24.1% in 2009 to 43.2% and 39.5% in 2011 [16]. We noted that 50.6% patients suffered from severe *vivax* malaria. In comparison to this an Indian author study also highlight approximately 50% of severe *vivax* malaria. This was comparable to a study by Mathews *et al.,* from India they found 42% severe malaria cases due to *P. vivax* [7] much lower than our study result. A systematic review and meta-analysis by another Indian author revealed that 29.3% patients suffered from severe *vivax* malaria [17]. Anemia is most commonly found blood related complication of malaria [18]. In our study most frequently noticed parameter of disease severity was severe anemia, present in 28.2% of patients. Kotepui *et al.,* teal also in favor that severe anemia was the most often found complication of *P. vivax* malaria [19]. Other commonly occurred pathologies were altered level of consciousness followed by bleeding. In this study we found that *Plasmodium vivax* is strongly linked with thrombocytopenia. On one hand platelets destroy *Plasmodium* by the action of platelet factor 4, on other hand platelets themselves are significant inflammatory mediators, leads to endothelial activation, resulting in worsening of the disease. *P. vivax* infections disease severity is strongly connected with the production of high levels of IL-10 which is also responsible for *P. vivax* - induced thrombocytopenia other important influencer of thrombocytopenia are HGF and IL-1Ra [20]. In contrast to our study, where we found no patient with significant hypoglycemia (i.e., less than 40 mg/dL), in one study authors found hypoglycemia in 48%, and liver and kidney failure in 30% [21].

CONCLUSIONS

It is noted that younger age people were affected more from *P. vivax* and an enormous number of *P. vivax* positive patients manifested as severe malaria cases with anemia and thrombocytopenia as common comorbid findings. Healthcare awareness regarding the elimination of the hypnozoite stage, and implement rigorous vector control measures for disease prevention should be promoted.

Authors Contribution

Conceptualization: MH
Methodology: NM
Formal Analysis: AGA
Writing-review and editing: TH, SA, MH, NM

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article.

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