DOI: https://doi.org/10.53350/pjmhs2023174717

ORIGINAL ARTICLE

The Clinical Laboratory Findings and Complications of Malaria at District Shaheed Benazir Abad

RAIZ AHMED QAZI[1], HIRA SAEED KHAN[2], MUHAMMAD MUQEEM MANGI[3], MAQBOOL AHMED MANGI[4], LUBNA SIDDIQUE[5], MUNZA NOOR MANGI[6]

[1]*MBBS M.Phil Hematology, Suleman Roshan Medical College (SRMC) Tando Adam*
[2]*Assistant Professor Physiology, Suleman Roshan Medical College (SRMC) Tando Adam*
[3]*Associate Professor Physiology, Suleman Roshan Medical College (SRMC) Tando Adam*
[4]*4th year MBBS Student, Laiquat National Medical College Hospital Karachi*
[5]*Associate Professor, Rawal Institute of Health Sciences*
[6]*3rd year MBBS Student, Liaquat College of Medical & Dentistry Karachi*
Corresponding author: Raiz Ahmed Qazi, Email: drraizahmedqazi@gmail.com, Cell: 0235572000

ABSTRACT

Objectives: To analyses the clinical as well as laboratory findings among patients with malaria. We also highlight the complications of malaria such as hypoglycemia and thrombocytopenia.

Material and Methods: An experimental and descriptive study was conducted from March 2021 to September 2021 at the pathology department of the diagnostic and research laboratory of Peoples University of health sciences (PUMHS) Nawabshah. The frequency of haematological complications including anaemia, leukocytosis and thrombocytopenia among 1230 patients with malaria visiting OPO were studied. Malaria and its haematological complications were diagnosed on the bases of clinical and laboratory findings.

Results: Out of 1230 patients, 820 (66.7%) were belonging to the suburbs and 410 (33.3%) were belonging to the city. The age range of the individuals in the study, comprising both children and adults, was from 5 - 65 years, with an average age of 35±30 years. The male-to-female ratio among these patients was 1.8:1. Malaria diagnosis was confirmed through both clinical observations and laboratory test results. The incidence of haematological complications, such as anaemia, leukocytosis, and thrombocytopenia, was evaluated using haematological measures, including the determination of Hemoglobin attentiveness and Complete Blood Count (CBC), in malaria patients.

Conclusion: Malaria often leads to urgent treatment is necessary due to common hematological complications such as anemia, leukocytosis, and thrombocytopenia.

Keywords: Malaria, frequency, hematological complications, hematological parameters

INTRODUCTION

Malaria remains a highly prevalent parasitic illness worldwide, causing approximately 500,000 fatalities globally. The majority of these deaths occur in Africa, shadowed by Southeast Asia and South America.[1] In 2018, there were around 228 million reported cases of malaria across the globe. Even though Falciparum was accountable for 50% of the malaria instances in Southeast Asia, the area also made a notable contribution to 53% of the P. vivax load that year, according to the World Health Organization (WHO).[2]

In Pakistan, the frequency of malaria in 2018 ranged from 1 to 10 occurrences per 1000 individuals who were at risk. The nation was among a group of seven countries in the WHO Eastern Mediterranean region that together accounted for 98% of the overall malaria burden in the region in 2018. Throughout that year, healthcare facilities reported a total of 374,513 malaria cases to federal directorates, with 16.4% (equivalent to 61,510 cases) originating from Baluchistan. Interestingly, 84% of all malaria cases were attributed to P. vivax. This high proportion of P. vivax cases in Baluchistan could be due to limited access to healthcare facilities and low rates of blood examination, which might have led to underreporting of malaria cases in the region.[3] The province of Baluchistan, like other regions in Pakistan, is prone to epidemic outbreaks, and the spread of malaria strains fluctuates throughout different seasons.[4] The clinical presentation of malaria can vary from asymptomatic infection to moderate/uncomplicated sickness and even severe/fatal cases, depending on factors associated with the individual and environment.[5] Despite the previous assumption that p.vivax only led to uncomplicated malaria, an extensive analysis of clinical studies on severe malaria has unveiled an increase in both severe instances and deaths linked to vivax within the past 15 years, particularly in Syria.[6,7] Studies have indicated that the clinical and laboratory characteristics of the disease differ from place to place, and malaria complications display significant variations globally. Some specific factors could be valuable for tracking the progression of the illness and evaluating the effectiveness of treatment.[8,9] The majority of research on the clinical characteristics of malaria focuses on regions with a high prevalence of the disease, such as Africa. However, studies conducted in areas with moderate prevalence, such as Pakistan, place emphasis on utilizing the existing data from coastal cities like Karachi, Thatta, Badin, Zhob, Larkana, and Nawabshah, which are regarded as highly endemic for malaria.[10] According to the data accessible for Balochistan, North Balochistan is moderately prevalent with malaria, while Ziarat and Kalat have a lower prevalence.[11] Some initial research has been carried out in Khuzdar, primarily focusing on the occurrence and incidence of different malaria types. Nevertheless, no data currently exists that compares the clinical and laboratory characteristics of severe and uncomplicated malaria cases in Khuzdar. Therefore, this upcoming study intends to gather data on the range of clinical and laboratory features observed in malaria cases (specifically vivax, falciparum, and mixed infections) that present at Combined Military Hospital Khuzdar. Severe instances were additionally characterized as possessing either a solitary complication or Multiple (>1 complication).

Laboratory tests: Malaria diagnosis involved the use of microscopy on traditional thick and thin blood slides, which were stained with Giemsa dye, in addition to rapid diagnostic tests (ROTs). The Tuber R Line Malaria Pf/Pv Rapid Test Cassette (Whole Blood) was utilized for this purpose. Blood samples from patients displaying clinical symptoms of malaria were examined for malarial parasites using both peripheral film analysis and RDT. The rapid diagnostic test (RDT), utilizing a sideways movement chromatographic immunoassay, enables the concurrent recognition and distinction of P. falciparum and P. vivax components in entire blood. The examination involves the interaction of whole blood with a pre-covered coloring compound linked to the test cassette, which subsequently ascends through capillary action.

MATERIAL AND METHODS

The descriptive and experimental study was conducted from April 2011 to September 2011 at pathology department and pediatric & medical out patient's departments. Total 1230 patients, children and adults including boys, girls, male and female visiting to OPD

during the study were included, any co-morbidity were not included in the study. The occurrence of malaria based on age, gender, residential areas, and clinical observations of all patients were recorded. To diagnose malaria and its blood-related complications, a volume of 2-3ml of venous blood specimens were collected from all patients and placed in tubes containing EDTA. These tubes were then sent to the pathology department. From the EDTA-mixed blood, blood smears were prepared on clean glass slides and examined under a microscope. This was done to identify different stages of malaria parasites using Giemas' stains. The concentration of hemoglobin, complete blood count (CBC) including red blood cell count, total leukocyte count (TLC), differential leukocyte count (DLC), and platelet count were determined using a hematology analyzer. The erythrocyte sedimentation rate (ESR) and malaria rapid diagnostic test were also performed using the same blood samples.

RESULTS

A comprehensive investigation involved examining 1230 cases, comprising 720 (58.3%) children and 510 (41.7%) adults. The age range of these individuals was among 5 and 65 years, with an average age of (35 ± 30). The male-to-female ratio was 1.8:1. Of the total 1230 patients, 410 (32.3%) hailed from urban locations, while 820 (66.7%) resided in rural areas. **Table I**

The patients' clinical observations, presented in table II, included the following symptoms: fever accompanied by chills, perspiration or sensation of cold and heat, paleness, bodily discomfort, and enlargement of the spleen.

The hematological complications are expressed in **Table III.**

The laboratory findings in these patients were showing in **table IV** such as mean values of hemoglobin, ESR, RBC, TLC. DLC, platelet counts, detection of malarial parasites and malaria antigens in serum of these patients were determined by examination of peripheral blood smears and malaria rapid diagnostic test. The average levels of hemoglobin, red blood cells (RBCs), and platelet counts experienced a significant decrease, while the count and proportion of neutrophils in white blood cells (WBCs) as well as the erythrocyte sedimentation rate (ESR) demonstrated a significant increase. The examination of stained blood smears, both thick and thin, from all these patients indicated the presence of Plasmodium vivax in 70.8% of cases and P. falciparum in 29.2% of cases. The ICT malaria test confirmed P. vivax in 70.8% of cases and P. falciparum in 29.2% of cases.

Table 1: The age. sex, area of residence and clinical findings in patients with malaria (n = 1200)

Age	Gender	Residence
Age in years 5 —65 years Mean age 35 ± 30	Male 770 (64 1%) Female 430 (35.9%) Male to Female ratio 1.7:1	Rural 800 (66.7%) Urban 400 (33.3)
Adults	Children	Total
500 (41.7%)	700 (58.3%)	1200 (100%)

n = Total number of patients

Table 2: Clinical findings in patients with malaria (n = 1200)

Clinical finding	Frequency	Percentage
Fever	1200	100%
Associated symptoms with fever like chills, sweating or feeling of coldness and hotness	980	81.7%
Bodyache	750	62.5%
Headache	600	50.0%
Pallor	800	66.6%
Splenomegally	300	25.0%

n = Total number of patients

Table 3: Hematological complications in patients with malaria (n=1230)

Hematological complications	Frequency	Percentage
Anemia	1200	100.0%
Leukocytosis with Neutrophilia	950	77.23%
Lymphocytosis	900	75.0%
Monocytosis	950	79.1%
Thrombocytopenia	750	62.5%

n = Total number of patients

Table 4: Laboratory findings in patients with malaria including hematological parameters for assessment of hematological complications (n=1230)

Laboratory findings	Frequency	Percentage
Hemoglobin concentration		
5.5 – 11.5 g/dl (8.5±3)	800	66.6%
ESR		
40 – 110 mn 37.5 ± 72.5	1200	100.0%
Total Leukocytes count		
6500 – 25000 /cumm (1625±8750)	900	75.0%
Red cells count		
2.5 – 4.5 m/cumm 3.5±1.0	700	58.3%
Platelet count		
40,000-110,000 /cumm (75000 ± 35000)	750	62.5%
Differential Leukocyte count		
Neutrophils 67-85% (80.5±5.5)	1000	83.3%
Lymphocytes 10-14% (11±3)	900	75.0%
Monocytes 10-18% (14±4)	950	79.1%
Eosinophils 2-4 % (3±1)	1200	100.0%
Microscopy		
PI: vivax	850	70.8%
PI: Falciparum	350	29.2%
Malaria diagnostic test Immunochromatography (IC) Technique		
+ve for PI: vivax	850	70.8%
+ve for PI: Falciparum	350	29.8%

n = Total number of patients

DISCUSSION

To the best of our understanding, this is the initial investigation conducted in Khuzdar concerning the clinical and laboratory characteristics of severe and mild malaria. Our findings indicate that specific clinical and laboratory factors are significantly linked to the severity of the disease and can serve as predictive indicators. In contrast to previous times, current literature provides ample substantiation for the involvement of P. vivax in the increased burden of severe malaria.[5–7,12] The results of our study showed similar outcomes. We discovered that P.vivax was the main cause of malaria (63.8%), followed by P.falciparum (29.5%) and mixed infections (6.7%). These results are in line with the Pakistan Annual Malaria report of 2019,[3] and correspond to the worldwide epidemiology of P.vivax.[6,13] However, according to Yasinzai's findings, P.falciparum was more prevalent in Barkhan and Kohlu, which are neighboring regions of East Balochistan.[14] In our investigation, males accounted for 90.5% of the cases, with a male to female ratio of 9.5:1. A similar male predominance was observed in Karachi, the FATA areas of Khyber Pukhtunkhwah, and Delhi, India.[6] All patients exhibited fever, but those with severe malaria displayed more frequent symptoms of vomiting, along with signs of paleness and jaundice.

The significant occurrence of uncomplicated instances observed in our research, possibly associated with enhanced understanding, mindset, and behavior among the participants, prompt availability of medical services, rapid identification, and efficient handling of malaria instances, corresponded with comparable investigations conducted in Khuzdar from 2003 to 2004 and Multann, as well as a study executed by Arevalo-Herrera M in Colombia.[5,15,16] Nevertheless, Mathews SM from Delhi recorded a significant percentage of severe malaria occurrences according to WHO criteria. In our research, P.vivax constituted 47.3% of severe malaria cases, while a tertiary hospital in Delhi documented 42% of severe vivax cases. The prevailing complications in our investigation were fever, jaundice, and pallor, reflecting results from a study conducted in Peshawar where fever (100%) and pallor (50%) were the primary symptoms observed in children suffering from severe malaria.[17] A research conducted at a specialized healthcare center in Delhi revealed that jaundice was the most common occurrence, with other recorded complications comprising of ARDS (20.6%), significant hemorrhaging (14.2%), metabolic acidosis (12.6%), acute renal failure, and cerebral malaria (7.9% each) among a total of 150 patients. However, our

research, in contrast, did not observe any instances of metabolic acidosis or acute kidney injury. In our study, we came across just one instance of cerebral malaria (5.3%), in contrast to the Delhi research which reported five occurrences (7.9%) of neurological symptoms. Our study revealed significant differences in hemoglobin levels, platelet count, total bilirubin, and prothrombin time between uncomplicated and severe malaria cases. Nevertheless, we discovered no significant connection between the type of malaria species and laboratory profiles. On the other hand, Zubairi and colleagues found a notable correlation between falciparum malaria and bilirubin, Hb (hemoglobin), and the count of platelets.

Although 47.4% of severe cases showed pallor, our study did not identify any cases of severe anemia according to the WHO criteria.[2] In contrast, a study conducted in Delhi found four cases (2.6%) of severe anemia. Thrombocytopenia, with platelet counts <100 x 10^9/1, was observed in 50.9% of all malaria cases in our study, and severe thrombocytopenia (platelet counts < 50 x 10^9/) occurred in only seven cases. Among these seven instances, six encountered severe malarias, whereas a single case manifested uncomplicated malaria. These results corroborated a study carried out in Columbia.[5] However, the study in Delhi[6] reported thrombocytopenia in 86.7% of all cases, using a threshold of plt count (< 150 x 10^9/1). In our research, out of the seven individuals who had a serious drop in platelet count, only two experienced unanticipated bleeding. It is worth mentioning that both low red blood cell count and paleness were the most commonly observed indications in children with severe malaria.[17] A study carried out in Delhi on advanced medical care also revealed that yellowing of the skin and eyes (jaundice) was the most prevalent complication. Other noted complications included acute respiratory distress syndrome (ARDS) with a prevalence of 20.6%, significant hemorrhaging with a prevalence of 14.2%, metabolic acidosis with a prevalence of 12.6%, acute kidney damage, and cerebral malaria, both occurring at a prevalence of 7.9%, among a total of 150 patients. Nevertheless, in our investigation, we did not observe any instances of metabolic acidosis or acute kidney damage. We only recorded a solitary occurrence (5.3%) of cerebral malaria, in contrast to the five occurrences (7.9%) of neurological symptoms observed in Delhi. We uncovered significant discrepancies in levels of hemoglobin, platelet count, total bilirubin, and prothrombin time between cases of uncomplicated and severe malaria. However, we did not identify any noteworthy association between the type of malaria species and the laboratory results. In contrast, Zubairi et al. reported a significant correlation between bilirubin, hemoglobin, and platelet count in cases of falciparum malaria.

Although 47.4% of severe cases showed a paleness of the skin, our study did not identify any instances of severe anemia according to the criteria established by the World Health Organization (WHO). In the Delhi study, four cases (2.6%) of severe anemia were observed. In our study, a reduction in platelet count (<100 x 109/1) was observed in 50.9% of all malaria cases, and only seven cases exhibited severe thrombocytopenia (50 x 109/1). Out of the seven instances examined, six individuals developed severe malaria, whereas a single case encountered uncomplicated malaria. These outcomes were consistent with the findings of a research conducted in Colombia, whereas the study in Delhi revealed thrombocytopenia in 80.7% of all cases using a platelet count threshold (<150 x 10^9/1). Out of the seven cases with severe thrombocytopenia, only two patients included in the study presented with spontaneous bleeding.

REFERENCES

1. Dayanand KK, Punnath K, Chandrashekar V, Achur RN, Kakkilaya SB, Ghosh SK, et al. Malaria prevalence in Mangaluru city area in the southwestern coastal region of India. Malar J [Internet]. 2017 Dec 19;16(1):492. Available from: https://malariajournal.biomedcentral.com/articles/10.1186/s12936-017-2141-0
2. Report W malaria. World Health Organization. 2019; Available from: https://www.who.int/publications/i/item/9789241565721
3. Khan M, Nisar H, Mushahid N. Clinical and Lab profile of severe and uncomplicated malaria: A prospective study from Khuzdar Balochistan. Pakistan J Med Sci [Internet]. 2021 Sep 9;37(7). Available from: https://pjms.org.pk/index.php/pjms/article/view/4210
4. Herekar F, Iftikhar S, Nazish A, Rehman S. Malaria and the climate in Karachi: An eight year review. Pakistan J Med Sci [Internet]. 2019 Nov 28;36(1). Available from: https://www.pjms.org.pk/index.php/pjms/article/view/1712
5. Arévalo-Herrera M, Lopez-Perez M, Medina L, Moreno A, Gutierrez JB, Herrera S. Clinical profile of Plasmodium falciparum and Plasmodium vivax infections in low and unstable malaria transmission settings of Colombia. Malar J [Internet]. 2015 Dec 11;14(1):154. Available from: https://malariajournal.biomedcentral.com/articles/10.1186/s12936-015-0678-3
6. Mathews S, Bhagwati M, Agnihotri V. Clinical spectrum of Plasmodium vivax infection, from benign to severe malaria: A tertiary care prospective study in adults from Delhi, India. Trop Parasitol [Internet]. 2019;9(2):88. Available from: http://www.tropicalparasitology.org/text.asp?2019/9/2/88/267133
7. Rahimi BA, Thakkinstian A, White NJ, Sirivichayakul C, Dondorp AM, Chokejindachai W. Severe vivax malaria: a systematic review and meta-analysis of clinical studies since 1900. Malar J [Internet]. 2014 Dec 8;13(1):481. Available from: https://malariajournal.biomedcentral.com/articles/10.1186/1475-2875-13-481
8. Alves-Junior ER, Gomes LT, Dombroski TCD, Nery AF, Vandresen-Filho S, Nakazato L, et al. New laboratory perspectives for evaluation of vivax malaria infected patients: a useful tool for infection monitoring. Brazilian J Infect Dis [Internet]. 2020 Mar;24(2):120–9. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1413867020300271
9. Khan1 M, Nisar2 H, Nuzhat Mushahid3. Clinical and Lab profile of severe and uncomplicated malaria: A prospective study from Khuzdar Balochistan. Pak J Med Sci [Internet]. 2021;37. Available from: file:///C:/Users/HP/Downloads/4210-Article Text-30900-2-10-20211005.pdf
10. Akram1 S, Khan2 MA, Hassan Bin Usman Shah3. FREQUENCY, SEASONAL VARIATION AND TREATMENT OUTCOME OF MALARIA IN PANJGUR, PAKISTAN. J Postgrad Med Inst [Internet]. 2020;34. Available from: file:///C:/Users/HP/Downloads/saadahmedmian,+2665-9 (1).pdf
11. Farooq, Muhammad Asif, Amjad Salamat MAI. Malaria--an experience at CMH Khuzdar (Balochistan). J Coll Physicians Surg [Internet]. 2008; Available from: https://www.researchgate.net/publication/5377766_Malaria--an_experience_at_CMH_Khuzdar_Balochistan
12. Chu CS, White NJ. The prevention and treatment of Plasmodium vivax malaria. PLOS Med [Internet]. 2021 Apr 23;18(4):e1003561. Available from: https://dx.plos.org/10.1371/journal.pmed.1003561
13. Qureshi NA, Fatima H, Afzal M, Khattak AA, Nawaz MA. Occurrence and seasonal variation of human Plasmodium infection in Punjab Province, Pakistan. BMC Infect Dis [Internet]. 2019 Dec 6;19(1):935. Available from: https://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-019-4590-2
14. Mohammad Iqbal Yasinzai1 JKK. Incidence of human malaria infection in Barkhan and Kohlu, bordering areas of East Balochistan. Pakistan J Med Heal Sci [Internet]. 2008;24:306–10. Available from: https://www.pjms.com.pk/issues/aprjun108/article/article24.html
15. Kader Maideen SF, Rashid A, Ahmad NI, Zahari SNA, Hamat RA. Sero-prevalence of malaria and the knowledge, attitudes and practices relating to the prevention of malaria among indigenous people living in the central forest spine in Peninsular Malaysia: a mixed-methods study. Malar J [Internet]. 2022 Oct 3;21(1):281. Available from: https://malariajournal.biomedcentral.com/articles/10.1186/s12936-022-04293-5
16. Kotepui KU, Kotepui M, Punsawad C. Knowledge, Attitude, and Practice Related to Malaria Diagnosis among Healthcare Workers in Hospitals: A Cross-Sectional Survey. J Trop Med [Internet]. 2019 Jun 11;2019:1–9. Available from: https://www.hindawi.com/journals/jtm/2019/1414079/
17. Khan1 M, Nisar2 H, Nuzhat Mushahid3. Fever, jaundice and pallor were the most frequent complications in our study which was similar to a study done at Peshawar, where fever (100%) and pallor (50%) were also the most common presenting symptoms of children with severe malaria. Pakistan J Med Heal Sci [Internet]. 2021; Available from: file:///C:/Users/HP/Downloads/4210-Article Text-30900-2-10-20211005 (5).pdf