

Original Article

Clinical Profile And Hematological Changes In Patients With Malaria In A Tertiary Care Hospital.

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ABSTRACT

Background: Malaria is prevalent worldwide within tropical and subtropical climates. Malaria parasites enter the human body through the bites of female Anopheles mosquitoes: blood cell irregularities and other tell-tale signs. Rapid identification of malaria requires screening for other hematological signs, which is essential for practitioners working in regions where febrile illnesses cluster.

Objectives: to analyze the clinical manifestations, blood cell alterations, and blood cell parameter correlations concerning various Plasmodium species among malaria patients at hospitals.

Methods: The study included patients with a confirmed diagnosis of malaria, as determined by peripheral smear and rapid diagnostic tests. Information was collected on demographics, clinical features, and hematological parameters, specifically hemoglobin, platelet, and leukocyte counts. Information was analyzed using SPSS version 25. Chi-square and t-test methods were the primary statistical tools employed, with a significance threshold set at $p < 0.05$.

Results: 100 patients of whom fifty-eight were males and forty-two were females. Participants had an average age of 32.4 years with an age span range of ± 12.6 years. The tests revealed Plasmodium vivax in 2% patients alongside P. falciparum, indicating a mixed Plasmodium infection. Each studied patient displayed fever symptoms and chills, along with vomiting and headache symptoms, which manifested in 85% and 38% of patients, respectively. The investigation found thrombocytopenia in 76% of the studied patients, anemia affected 62% of the participants, and leukopenia occurred in 28% of the study group. The association between P. falciparum infection and severe thrombocytopenia reached statistical significance based on the analysis ($p = 0.03$).

Conclusion: Fever and chills are symptoms of malaria, albeit thrombocytopenia and anemia are critical diagnostic markers. Recognition of these gets early diagnosis, species differentiation, and severity assessment in endemic areas.

Keywords: Malaria, Hematology, Thrombocytopenia, Falciparum

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INTRODUCTION

Malaria functions as a potentially fatal disorder, as its cause involves Plasmodium protozoan parasites spread by female Anopheles mosquitoes. These parasites transmit the disease to human beings through mosquito bites. Global public health experts remain worried about malaria because this disease continues to impact the tropical and subtropical regions of the world heavily. During 2021, the World Health Organization calculated that malaria caused 247 million cases, leading to 619,000 deaths across the globe, and almost all fatalities occurred in Africa [1]. Plasmodium vivax and Plasmodium falciparum are transmitted between humans through mosquito bites throughout India, although their transmission patterns differ by geographic area. The pathogen was initially considered harmless until recent medical studies revealed similar pathogenic effects matching those of P. falciparum illness patterns [2,3]. Malaria symptoms present in various ways among different individuals through generic indicators consisting of fever, chills, and myalgia, as well as vomiting and headache, and severe manifestations develop into coma alongside multiple organ dysfunction [4]. The confirmation of malaria infection utilizes both microscopy and rapid diagnostic tests, with healthcare providers adopting hematological parameters to facilitate prompt and early clinical diagnosis, as reported in the data [5,6]. Hematological parameters serve as essential indicators to evaluate diseases across locations where diagnostic abilities are limited or testing delays occur. Parasitic cell destruction, together with red blood cell hemolysis, immune damage, and blood cell sequestration within the spleen, drives various factors that create hematologic changes associated with malaria [7]. Thrombocytopenia has been consistently documented in patients infected with malaria, regardless of the case presentation, whether uncomplicated or otherwise [8]. Numerous patients presenting with malaria also develop anemia; the most recent studies indicate that various factors are implicated in the pathogenesis of this condition [9]. The evaluation of leukopenia in the process of disease diagnosis is significant because this hematological abnormality occurs in only specific cases. However, it is much less common than other hematological abnormalities. Consequently, in diagnosis, it is more frequently

overlooked. These findings, resulting from the changes, will provide an opportunity for early diagnosis of malaria and improve treatment approaches to deliver better clinical outcomes[10]. Study investigators examined malaria patients with verified clinical and hospital-based hematological changes and abnormal blood cell measurements. This also investigated the influence of various Plasmodium species on blood cell abnormalities to ascertain the extent of the disease.

Materials and Methods:

This observational cross-sectional study was conducted at Department of pathology Bannu Medical College Bannu from Jan 2023 to Jan 2024. 100 participants were those who met the criteria for malaria diagnosis through peripheral blood examination and were positive for the disease using a rapid test. After study members had obtained the patients' informed consent, the clinical features and demographic details were recorded. Laboratory methods involved complete blood counting and a peripheral smear examination for the identification of malaria parasites and species. Approval from the Institutional Review Board was obtained prior to the commencement of the study.

Inclusion Criteria

After obtaining consent, patients of all age groups were included following malaria testing, which was done via peripheral smears or RDT results.

Exclusion Criteria

Individuals with dengue or typhoid infections, as well as individuals with certain hematological disorders, were excluded from the study.

Data Collection

Clinical evaluations, which involved compiling the patient's medical history alongside the physical examination, were completed for the study participants. The study's execution followed two essential procedure steps. The first step involved drawing venous blood for subsequent automated analysis of the specified hematological parameters by an analyzer.

Statistical Analysis

Data entry and detailed processing were conducted through SPSS version 22.0. The results were described using frequency and percentage distributions. On the other hand, the continuous variables were displayed with mean and standard

deviation values; the analysis of variables used Chi-square tests, along with independent t-tests. The study was conducted with a statistical significance threshold of $P < 0.05$.

Results

Among the 100 surveyed patients, the mean age was 32.4 ± 12.6 years, with 58 subjects being males and 42 patients being females. The principal complaint experienced by patients was fever, with a 100% incidence rate, followed by chills and rigors

affecting 85% of patients, and vomiting and headache occurring in 42% and 38% of the same group, respectively. Among the evaluated patients, splenomegaly occurred in 28% of cases, while icterus manifested in 12% of patients. Most patients exhibited *Plasmodium vivax* infections, yet 34% had *P. falciparum*, and 4% patients displayed simultaneous infections of these parasites. The examined laboratory results indicated that *P. falciparum* infections led to severe platelet deficiency ($p = 0.03$) and diminished hemoglobin levels ($p = 0.04$), thus indicating that *P. falciparum* affected blood conditions to a greater extent.

Table 1: Demographic and Clinical Characteristics of Patients with Malaria (N=100)

Parameter	Frequency (n)	Percentage (%)
Age (Mean $\pm$ SD)	32.4 ± 12.6	—
Gender		
- Male	58	58%
- Female	42	42%
Clinical Symptoms		
- Fever	100	100%
- Chills & Rigors	85	85%
- Vomiting	42	42%
- Headache	38	38%
- Splenomegaly	28	28%
- Icterus	12	12%

Table 2: Distribution of *Plasmodium* Species (N=100)

<i>Plasmodium</i> Species	Frequency (n)	Percentage (%)
<i>P. vivax</i>	62	62%
<i>P. falciparum</i>	34	34%
Mixed Infection	4	4%

Table 3: Hematological Parameters in Malaria Patients (N=100)

Hematological Parameter	Normal Range	Abnormality Detected	Frequency (n)	Percentage (%)
Hemoglobin (Hob)	13–17 g/dl. (M), 12–15 g/dl. (F)	Anemia (<12 g/dl.)	62	62%
Total Leukocyte Count	4,000– 11,000/mm ³	Leukopenia (<4,000/mm ³)	28	28%
Platelet Count	150,000– 400,000/mm ³	Thrombocytopenia (<150,000/mm ³)	76	76%

DISCUSSION

Studies examined both clinical characteristics in full detail, along with laboratory blood tests, from patients diagnosed with malaria infections in the hospital. The study results demonstrate that malaria symptoms typically present as fever, accompanied by shaking movements, which make up the main clinical presentation. These study findings support the notion that thrombocytopenia and anemia affect blood cells, aiding malaria diagnosis, particularly in areas with high malaria prevalence. Survey findings revealed that every participant developed a fever, as Singh and colleagues observed, with fever most often appearing at the time of diagnosis [11]. The observation of rigors, together with chills, was reported in 85% of patients, according to data obtained from Mishra et al.'s study [12]. The long-lasting combination of malaria symptoms presents evidence that might lead to early malaria diagnosis by ruling out other infectious diseases. Thrombocytopenia affected 79% of patients in the study population studied by Lithia and Joshi [13]. 174 of 243 *P. falciparum* patients exhibited platelet counts below 150,000/mm³ according to Khan et al. [14]. Malaria-related thrombocytopenia develops from peripheral destruction events, splenic sequestration, and immune-mediated mechanisms, according to studies [15]. Our study confirmed that *P. vivax* patients developed thrombocytopenia similarly to a recent study, which does not support the previous assumption that *P. vivax* is a benign malaria strain [16]. Anemia affected 65% of malaria patients according to the findings reported by Sharma et al. It developed through the combined effects of hemolysis, dyserythropoiesis, and marrow suppression [17]. The aggressive nature of *P. falciparum* attacks red blood cells, resulting in decreased levels of hemoglobin, as evidenced by study findings [18]. According to Indian studies, leukopenia affects 25% to 30% of patients [19]. Some cases of leukopenia appear, but its frequency remains inconsistent relative to thrombocytopenia and anemia, as it develops either through immune deficiency or cell sequestration due to excessive parasitic inflammation. The assessment of *P. vivax* dominance in our study area showed a 62% prevalence rate, which is consistent with national public health records documenting *P. vivax*'s dominance across urban and peri-urban areas of India [20]. *P. falciparum* creates pathological damage to the

human body, leading to significant blood cell disorders, which produce established medical complications[21-24].

Limitations

Generalization of the findings remains limited due to the exclusive use of a single study center, combined with its restricted participant number. The study failed to analyze any changes in malaria incidence patterns that might occur throughout different seasons. The study did not contain information about how patients recovered their blood cell count following medical care.

Conclusion

Fever coupled with body chills stands as the primary symptom of Malaria, yet the bloodstream exhibits two main effects, which lead to thrombocytopenia and anemia. The detections enable faster diagnosis and prompt treatment procedures in areas where malaria cases are expanding across the population. Branches of clinical guidance and disease severity assessment rely on recognizing cell patterns that are distinct to each malaria species.

Future Findings

The current study outcomes need extensive verification based on increased facility participation scales. Future follow-up studies should incorporate the monitoring of recovery pertaining to the blood parameters post-therapy. Pathophysiological differences could be assessed molecularly to elucidate the impact of *P. vivax* and *P. falciparum* infections on the hematological outcomes. Research confirms that one of the core components for diagnosing malaria infections is the blood test. Incorporating these findings into routine clinical tests would streamline diagnostic processes and enhance the quality of care that can be provided in medically underserved regions.

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Authors Contribution

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