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Original Research

Assessment Of Haematological Parameters In Malaria Patients-A Case-Control Study

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ABSTRACT

Objectives: Malaria remains a major public health problem and leading cause of morbidity and mortality in tropical countries. A variety of direct and indirect effects on hematological alterations like anemia, leukocytosis or leukopenia, thrombocytopenia and rarely DIC have been reported in malaria.

Aim: The present study aimed to evaluate the alteration of hematological parameters in malaria and their probability to detect malaria in acute febrile illness cases.

Methods: This was a case-control study. A total of 40 patients' diagnosed of malaria as cases and 40 acute febrile illness malaria negative patients as control were enrolled and analysed. Diagnosis of malaria was made by microscopy of peripheral blood smear. Clinical presentation and hematological parameters were studied in all the malaria cases and controls.

Results: Out of total malaria cases 53%were infected with Plasmodium vivax (PV) and 47% were of Plasmodium falciparum (PF). Majority of the malaria cases (77.5%) were 18-30 years of age,predominantly male**.** Mean age±SD among cases was 28.46± 3.59 years. Among clinical presentation, most of the participants (75% cases & 65% control) were observed continuous fever. Splenomegaly was found in 60% of malaria cases and only 7.5% of non malaria control this was statistically significant ($p<0.05$). There was a statistically significant difference in hemoglobin, platelet counts, total leucocyte count and RDW ($p<0.05$) levels in patients with malaria compared to patients without malaria.

Conclusion: Anemia and thrombocytopenia was the most common hematological changes in malaria cases, canbehelpful in detecting early complications, to monitor and treat them effectivelylead to reduced mortality.

Keywords: Malaria, P. vivax, p. falciparum, fever, hematological parameters

INTRODUCTION

The intracellular parasite that causes malaria, a common and sometimes fatal disease in humans, is spread by the bite of an infected female Anopheles mosquito. Congenital transmission, sharing needles, and transfusion of contaminated blood are the other, less frequent ways that malaria is spread [1]. In tropical nations, malaria continues to be a serious public health concern. Numerous physiological and climatic risk factors influence the diverse distribution of malaria across the Indian subcontinent [2]. Plasmodium vivax and Plasmodium falciparum were the most prevalent of the five major species of malaria parasites, which are Plasmodium vivax, Plasmodium ovale, Plasmodium falciparum, Plasmodium malariae, and Plasmodium knowlesi. In India, P. falciparum causes the most deadly kind of malaria and contributes significantly to morbidity and mortality [3]. The clinical diagnosis of malaria becomes difficult because of the vast range of clinical manifestations that the malaria infection can induce, from very mild symptoms to severe disease [4]. Cerebral malaria, severe anemia, acute respiratory distress syndrome, circulatory collapse, hemoglobinuria, renal failure, thrombocytopenia, irregular bleeding, and disseminated intravascular coagulation are among the most frequent side effects of a falciparum malaria infection [5]. A more thorough search for malaria parasites is prompted by the hematological and biochemical changes that occur mostly during the asexual stage of the life cycle and are

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also believed to serve as an adjuvant aid in bolstering the suspicion of malaria [6]. In identifying the presence of malaria infection, a wide range of hematological changes, such as gradually worsening anemia, thrombocytopenia, declining RBC counts, atypical lymphocytosis, decreased red blood cell indices, and leukopenia, had comparatively high sensitivities and specificities [7].

Although microscopic analysis of peripheral blood smears is a valuable and gold standard method for diagnosing malaria, it requires skill and repeated testing to rule out the disease.

Modern molecular and serological diagnostic techniques for malaria offer higher sensitivity and specificity. Real-time polymerase chain reaction (rt-PCR), enzyme linked immunosorbent assay (ELISA), and rapid antigen detection test (RDT) are used to diagnose malaria [8].

For malaria to be effectively managed, a timely and accurate diagnosis is essential. The National Anti Malaria Program served as the basis for India's medication policy for treating malaria. To lower morbidity and minimize malarial mortality, any fever without any other apparent cause may be diagnosed as malaria, looked into, and treated appropriately [9–10].

AIMS & OBJECTIVES

The objective of this study is to evaluate the alteration of hematological parameters in malaria and their role as predictors of malaria in acute febrile illness.

MATERIAL & METHODS

This was a case control study conducted in the collaboration of Department of pathology in GMCH Aurangabad, India. Forty cases of malaria were identified by peripheral smear examination, and forty age-matched controls that tested negative for malarial parasites were also enrolled.

.Inclusion criteria

- Patients age ≥18 years with both gender
- Patients with fever of less than 7 days admitted to medical ward
- Participants who provides written informed consent for the study

Exclusion criteria

- Patients <18 years of age
- Patients who had no fever during hospital stay.
- Patients in whom a localizing skin or subcutaneous infections and systemic infection such as pneumonia or meningitis, etc.
- Patients who not willing for the study.

All the Information was collected through prepared proforma for each patient.

Age, socio-demographic status, and clinical signs and symptoms were among the information gathered. Fever, chills, rigors, and rashes were noted along with their duration, type, and pattern. To rule out any other potential causes of fever, a thorough clinical examination was conducted.

By using microscopy to examine peripheral blood smears, the malaria parasite was diagnosed. The gold standard for diagnosing malaria was a peripheral smear positive result.

Hemoglobin level (Hb%), complete blood counts, chest X-rays, urine microscopy, urine culture, serum biochemistry, blood culture, typhoid serology, and other pertinent tests were performed on each patient.

Both thick and thin peripheral blood smears were stained with JSB staining and inspected by knowledgeable epidemiology department staff. When any one of the smears tested positive for the malaria parasite, malaria was diagnosed.

Statistical analysis

The data were analysed using SPSS version 22 statistical software. Means, percentages, standard deviations, and ranges were calculated. Statistical analysis was performed using student T test. $P < 0.05$ was considered as significant.

RESULTS

Forty individuals with smear-positive diagnoses of malaria (cases) and forty with smear-negative diagnoses (control) were included for comparison.

Majority of the malaria cases (77.5%) were 18-30 years of age,Mean age±SD among cases was 28.46± 3.59 years and control were 29.37± 4.25 years. Most of the participants were male, 80% in malaria cases and 77.5% in control. Majority of the cases (67.5%) resided in rural area and belong to lower socio-economic class (42.5%). There were no statistically significant difference in age and gender among cases and control ($p>0.05$).

Table 1: Socio-demographic profile of malarial (cases) and non malarial (control)

Baseline characteristics		Cases (n=40)	Control (n=40)	P value
Age group (in years)	18-30	31 (77.5%)	29 (72.5%)	0.951
	31-40	6 (15%)	7 (17.5%)	
	41-50	2 (5%)	3 (7.5%)	
	>50	1 (2.5%)	1 (2.5%)	

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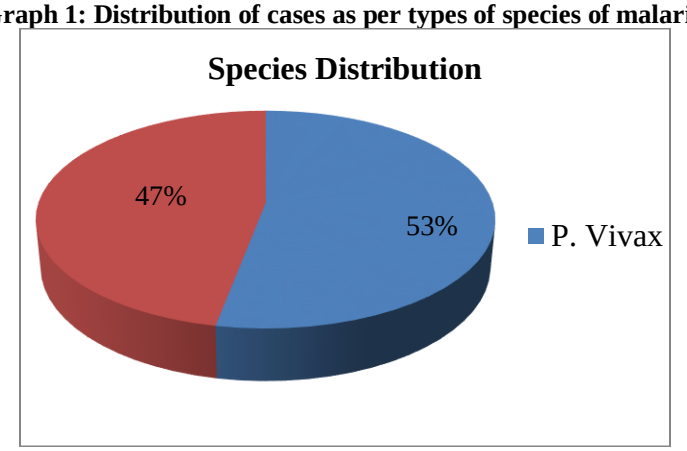
Mean age±SD (years)		28.46± 3.59	29.37± 4.25	
Gender	Male	32 (80%)	31 (77.5%)	0.784
	Female	8 (20%)	9 (22.5%)	
Residential status	Rural	27 (67.5%)	25 (62.5%)	0.639
	Urban	13 (32.5%)	15 (37.5%)	
Socio-economic class	Lower	17 (42.5%)	16 (40%)	0.956
	Middle	15 (37.5%)	15 (37.5%)	
	Upper	8 (20%)	9 (22.5%)	

It was revealed that Plasmodium vivax infection are slightly higher (53% case) than plasmodium falciparum (47% cases).

Graph 1: Distribution of cases as per types of species of malaria



Among clinical presentation, most of the participants (75% cases & 65% control) were observed continuous fever. Chills and rigors during the febrile episode occurred in 35% cases and 25% of the controls There are no significant difference between them (p>0.05). Splenomegaly was found in 60% of malaria cases and only 7.5% of non malaria control this was statistically significant (p<0.05).

Table 2: Clinical presentation among malarial (cases) and non malarial (control)

Clinical profile		Cases (n=40)	Control (n=40)	P value
Type of fever	Continuous	30 (75%)	26 (65%)	0.329
	Intermittent	10 (25%)	14 (35%)	
Fever with chills and rigors	Present	14 (35%)	10 (25%)	0.329
	Absent	26 (65%)	30 (75%)	
Fever with Splenomegaly	Present	24 (60%)	3 (7.5%)	< 0.001
	Absent	16 (40%)	37 (92.5%)	

Among malaria patients, 65% cases had anemia, 75% of thrombocytopenia, TLC counts between 4000-11000 in 67.5% of cases and 72.5% were RDW more than 15%. There was a statistically significant reduction in hemoglobin and platelet counts (p<0.05) levels in patients with malaria compared to patients without the disease. RDW was significantly increased in cases as compared to control. Statistically significant difference were seen in total leukocyte count of cases and control (p<0.05).

Table 3: Comparison of hematological parameters among malarial cases and non malarial control

Clinical profile		Cases (n=40)	Control (n=40)	P value
Hemoglobin (g %)	<10	26 (65%)	17 (42.5%)	0.043
	>10	14 (35%)	23 (57.5%)	
Mean ±SD (g%)		8.72±2.46	10.56±2.23	
Total Count cells/	<4000	11 (27.5%)	1 (2.5%)	0.006

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mm^3	4000-11000	27 (67.5%)	35 (87.5%)	
	>11000	2 (5%)	4 (10%)	
Mean ±SD **(cells/mm$^{3)}$**		7034±2409	8692±2894	
RDW	<15%	11 (27.5%)	25 (62.5%)	0.001
	>15%	29 (72.5%)	15 (37.5%)	
Mean ±SD **(%)**		18.63±4.23	15.52±3.24	
Platelet count	Thrombocytopenia	30 (75%)	1 (2.5%)	<0.001
	Normal count	10 (25%)	39 (97.5%)	
Mean ±SD (lakh)		1.13±0.57	2.57±0.95	

DISCUSSION

In India's temperate and tropical regions, malaria is a serious health concern. Hematological changes in malaria primarily serve as prognostic and follow-up indicators. Effective care of malaria depends on a timely and precise identification of the disease.

The incidence of Plasmodium vivax was marginally higher than that of Plasmodium falciparum in the current study, although this difference was not statistically significant. This finding was also reported by Malik AM et al. [11]. In contrast, numerous other Indian studies found significantly higher incidences of P. vivax, with Smita Chandra et al. [12] and RK Verma et al. [13] reporting P. vivax positive cases of 69.8% and 76.7%, respectively. Because P. vivax malaria usually has a lower parasitemia than P. falciparum, it is challenging to diagnose and treat.

Our study found that the highest proportion of malaria cases was seen in the younger adult (18-30) years of age group; with mean age was 25.98±10.2 years, similar results were obtained by Kumbhar SS et al [14] and Zeeba S et al [15]. Malaria was common amongst the younger population who are commonly exposed to mosquitoes by way occupation, travel, etc. The incidence of malaria in endemic areas falls as people grow older, suggesting that advancing age contributes to immunity.

In line with numerous other researchers, including Jiero et al. [16], and Sudheer B et al. [17], the current study found that males were more impacted by the malaria parasite than females. Male respondents may have a higher risk of contracting malaria since they engage in more outside activities.

Malaria was more common in rural areas, among people from lower socioeconomic backgrounds, and among daily wage workers or laborers who did not wear protective gear. The rainy (June–August) and post-rainy (September) seasons have higher chances of malaria. This may be because more water accumulates, which is ideal for female Anopheles mosquito breeding. Additionally, the hot, humid weather and warm stagnant water increase the rate of malaria parasite bites and transmission [18].

Depending on how severe the infection is, different patients will experience different clinical signs of malaria. Malaria signs and symptoms typically show up 10–15 days following an infectious insect bite. Fever with chills and rigors, headache, malaise, nausea, vomiting, abdominal pain, dyspnea, pallor, Splenomegaly, and bleeding symptoms were the most frequent clinical presentations. Continuous fever was seen in most of the patients in this study, in agreement with the Patel GI, et al [19].

We have also found that Splenomegaly was significantly higher among malaria cases as compared to control, our finding correlate with the P Khuraiya et al [20].

Hematological changes are well recognized in malarial infection and considered a hallmark of clinical suspicion of malaria. The primary hematological changes detected in this study were anemia and thrombocytopenia, which are also findings from a number of previous studies. For example, thrombocytopenia has been found to be a powerful predictor of malaria by Srivastava s. et al. [21] and Antwi B. et al. [22]. Disseminated intravascular coagulation or increased platelet clearance by the reticulo-endothelial system are two hypothesized causes of thrombocytopenia.

In line with Omarine N. et al. [23], we found a statistically significant decrease in hemoglobin levels (HGB<10g/dL) in malaria patients compared to those without the disease.

The current study has revealed that there were statistically significant differences in total leucocytes counts between malaria-infected and non infected patients, consistent with the earlier study performed by: Maina RN.et al. [24].

The population dispersion of red cell volume or the range of size changes of red blood cells, which typically seem larger following malarial invasion, is referred to as red cell distribution width (RDW). In line with previous research findings, the current study's RDW values showed that the malaria group had greater values than the non-malarial cases. Khan SJ, et al. [25] In our investigation, we found that the malaria group had lower mean values for hemoglobin, leukocyte count, and platelet count than the control group. This was consistent with a research conducted by Neha and colleagues [26].

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CONCLUSION

We came to the conclusion that there was a statistically significant link between malarial infection and hematological abnormalities such leucopenia, thrombocytopenia, anemia, and red cell distribution width. Each of these measures serves as a predictor of malaria and offers a diagnostic hint in a patient with an acute febrile sickness. In regions where malaria is endemic, anemia and thrombocytopenia can be utilized as prognostic indicators of infection.

REFERENCES

1. WHO. Malaria key facts - newsroom. Geneva, World Health Organization, 2022. https:// www. who. int/ news-room/ fact- sheets/ detail/ malaria
2. Sutherland CJ, Tanomsing N, Nolder D, Oguike M, Jennison C, Pukrittayakamee S, et al. Two nonrecombining sympatric forms of the human malaria parasite Plasmodium ovale occur globally. J Infect Dis. 2010; 201:1544–50.
3. World Health Organization. World Malaria Report. Geneva: WHO reports; Fact sheet Updated April 2017
4. S. Ogbodo, A. Okeke, H. Obu, E. Shu, and E. Chukwurah, "Nutritional status of parasitemic children from malaria endemic rural communities in Eastern Nigeria," Current Pediatric Research, vol. 14, no. 2, pp. 131–135, 2010
5. Roy P, Joshi M, Kumar A, Sonal GS, Dhariwal AC, Directorate of National Vector Borne Disease Control Program. Plasmodium vivax Malaria-Not so Benign Now: Caution for Clinicians, Vector-borne diseases special, Journal of the Indian Medical Association, 2015:13(12); 176-178
6. Sirak S, Fola A A, Worku L et al. Malaria parasitemia and its association with lipid and hematological parameters among malaria infected patients attending at Metema Hospital, Dove press. Pathology and Laboratory Medicine, International 2016:8; 43–50
7. Muwonge H, Kikomeko S, Sembajjwe L F and et al. How Reliable Are Hematological Parameters in Predicting Uncomplicated Plasmodium falciparum Malaria in an Endemic Region? Trop Med. 2013: 1–9.
8. Rodrigues-da-Silva RN, Lima-Junior JDC, Fonseca BDPF, Antas, PRZ, Baldez A, Storer FL, et al. Alterations in cytokines and haematological parameters during the acute and convalescent phases of Plasmodium falciparum and Plasmodium vivax infections. Mem Inst Oswaldo Cruz. 2014; 154–62.
9. Kotepui M, Piwkham D, PhunPhuech B, Phiwklam N, Chupeerach C, Duangmano S. Effects of malaria parasite density on blood cell param- eters. PLoS ONE. 2015;10: e0121057
10. L. Siahaan, Ed., Laboratory diagnostics of malaria IOP Conference Series: Earth and Environmental Science, IOP Publishing, Vol. 125, Bristol, UK, 2018.
11. Malik AM, Zaffar N, Ali Nadir, Malik AM, Khan R. Hematological Findings And Endemicity of Malaria In Gadap Region. Journal of the college of Physians and Surgeons 2010; 20:112-116.
12. Chandra S and Chandra H. Role of Haematological Parameters as an Indicator of Acute Malarial Infection in Uttarakhand State of India. Mediterr J Hematol Infect Dis 2013; 5(1)
13. Dr Rajendra kumar Verma, Dr Richa Giri, Dr Nirmala Singh, Dr Shivendra Verma, Dr Vaibhav Srivastav5 A Study ON Clinical Presentation and Outcome of Malaria from an Underreported, P.vivax Predominant Region of North India. Sch. J. App. Med. Sci., January 2016; 4(1C):233-243
14. Kumbhar SS, Kanetkar SR, Mane A. et al. Clinico-hematological profile of malaria cases in a tertiary care hospital. Galore International Journal of Health Sciences & Research. 2019; 4(3): 79-89
15. Zeeba Shamim Jairajpuri, SafiaRana, Mohd Jaseem Hassan, Farhat Nabi, and Sujata Jetley,An Analysis of Hematological Parameters as a Diagnostic test for Malaria in Patients with Acute Febrile Illness: An Institutional Experience,Oman Medical Journal (2014) Vol. 29, No. 1:12-17 DOI 10. 5001/omj.2014.04
16. Syilvia Jiero and Ayodhia Pitaloka Pasaribu,Haematological profile of children with malaria in Sorong, West Papua, Indonesia,Malar J (2021) 20:126 https://doi.org /10.1186/s12936-021-03638-w
17. Sudheer Babu Devineni, Obulapuram Suneetha, Nannam Harshavardhan. "Study of Platelet Count in Malaria Patients and the Correlation between the Presence and Severity of Platelet Count with Type of Malaria". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 67, August 20; Page: 11734-11746.
18. Karolina S. Akinosoglou, Elena E. Solomou & Charalambos A. Gogos (2012) Malaria: a haematological disease, Hematology, 17:2, 106-114, DOI: 10.1179/102453312 X1322 1316477336
19. Patel GI, Muley P, Vadher A, Suthar PP, Shah GV, Patel AB. A comparative study of clinical, biochemical and hematological profiles in smear positive malaria patients: at a tertiary care center located in rural part of Gujarat, India. Int J Res Med Sci 2015; 3:2561-6.
20. Khuraiya P, Sharma SS, Thakur AS, Pandey VP, Verma S. The study of clinical, biochemical and hematological profile in malaria patients. Int J Adv Med 2016; 3:209-17
21. Saurabh Srivastava, Payal Jain, Dheerendra Kuber, GD Sharma Haematological profile of vivax malaria patients. JIACM 2015; 16(3-4): 209-12
22. Samuel Antwi-Baffour*, Benjamin Tetteh Mensah, George Johnson, Dorinda Naa Okailey Armah, Samira Ali-Mustapha and Lawrence Annison,Haematological parameters and their correlation with the degree of malaria parasitaemia among outpatients attending a polyclinic, Malaria Journal (2023) 22:281
23. Nfor Omarine Nlinwe and Tang Bertilla Nange,Assessment of Hematological Parameters in Malaria, among Adult Patients Attending the Bamenda Regional Hospital,Anemia Volume 2020, Article ID 3814513, 8 pages
24. R. N. Maina, D. Walsh, C. Gaddy et al., "Impact of Plasmodium falciparum infection on haematological parameters inchildrenlivinginWesternKenya,"MalariaJournal,vol.9, no. 3, p. S4, 2010
25. Khan SJ, Abbass Y, Marwat MA. Thrombocytopenia as an Indicator of Malaria in Adult Population. Malaria

DOI: 10.69605/ijlbpr_13.10.2024.161

Research and Treatment 2012, www.hindawi com /journals/mrt/2012 Article ID 405981, 4 pages

26. Neha Chaudhary, Anjali Khare, Shradha Jain,et al.Comparison of Hematological Parameters in Various Acute Febrile Illnesses. National Journal of Laboratory Medicine. 2016 Jul, Vol-5(3): PO49-PO53