

Research Article

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Assessment of Total Protein, Red Cell and Platelet Indices in Patients Infected with Malaria Parasitemia in Owerri, Imo State, Nigeria

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Abstract

Background: Malaria parasitemia is a disease caused by Plasmodium parasites transmitted through the bite of an infected female anopheles' mosquito. It continues to be a major public health concern worldwide, with a significant impact on morbidity and mortality, particularly in tropical and subtropical regions.

Objective: The purpose of this study was to assess the levels of protein, red cell and platelet indices in patients infected with malaria parasitaemia in Owerri, Imo state.

Method: This was a cross-sectional study carried out at federal university teaching hospital (FUTH) Owerri, Imo State, Nigeria. A total of hundred (100) individuals were enrolled in the study: 50 patients of ages 15years and above, who consented to be part of the research, and fifty (50) age-matched apparently healthy subjects who served as the controls. Blood Samples were collected aseptically, and were analyzed using standard laboratory methods.

Results: The mean values of MCV (77.12 ± 6.62)fl, MCH (24.46 ± 3.15)pg, MCHC (28.83 ± 1.25)g/dl, PLT(126.08 ± 36.8) $\times 10^9/L$, MPV(7.82 ± 0.95)fl, PCT/(0.13 ± 0.12)%, PDW/(10.79 ± 0.76)%, and total protein (5.54 ± 0.46)g/dl were significantly reduced in subjects with malaria parasitaemia when compared to the healthy controls (89.92 ± 5.06)fl, (30.43 ± 1.73)pg, (33.22 ± 1.61)g/dl, (33.22 ± 1.61) $\times 10^9/L$, (236.10 ± 48.73)fl, (10.33 ± 1.71)%, (0.23 ± 0.01)%, (7.78 ± 0.83)g/dl, ($p = 0.000$, $p = 0.000$, $p = 0.000$, $p = 0.001$, $p = 0.000$, $p = 0.001$, $p = 0.000$, $p = 0.000$, while there was no significant difference in the mean value of RDW 13.38 ± 2.13 (g/dl) in subjects with malaria parasitaemia when compared to the healthy controls (13.91 ± 1.28)g/dl ($p = 0.309$).

Conclusion: This study has shown that malaria parasitaemia alters the levels of MCV, MCH, MCHC, PLT, MPV, PCT, PDW and Total protein, but has no effect on RDW. Therefore, total protein, red cell and platelet indices should be considered in the clinical assessment of patients with suspected or confirmed malaria parasitemia.

Keywords: total protein; red cell indices; platelet indices; malaria parasitemia

Introduction

Malaria parasitemia is the disease, caused by Plasmodium parasites transmitted through the bites of infected female Anopheles mosquitoes, poses a considerable challenge to the local healthcare system and the overall well-being of the population (Adediran and Akang, 2017). Malaria is characterized by recurrent episodes of fever, chills, headache, muscle aches, and fatigue. It affects individuals of all ages, but children under five years old and pregnant women are particularly vulnerable to severe complications and death (Brown et al., 2019). In Imo State, the prevalence of malaria is influenced by various factors, including the region's climate, environmental conditions, and socio-economic factors. Efforts to combat malaria in Owerri, Imo State, have been ongoing, including the implementation of preventive measures such as insecticide-treated bed nets, indoor residual spraying, and prompt diagnosis and treatment of infected individuals. The haematological alterations associated

with malaria parasitemia play a crucial role in the disease's pathogenesis and clinical manifestations. Malaria infection affects the red blood cells, leading to haemolysis, anaemia, and changes in various red cell indices. Haemoglobin, haematocrit, red blood cell count, mean corpuscular volume, mean corpuscular haemoglobin, and mean corpuscular haemoglobin concentration are important parameters that reflect the extent of anaemia and erythrocyte-related changes during malaria infection. Platelet dysfunction and alterations in platelet indices have also been observed in malaria. Platelets play a critical role in the immune response against malaria parasites, and their activation and aggregation contribute to the formation of microvascular occlusions and the pathophysiology of severe malaria (Davis and Smith, 2020). Despite the well-documented impact of malaria on haematological parameters, limited research has been conducted specifically on total protein levels, red cell indices, and platelet indices in patients with malaria parasitemia in

Owerri, Imo State. Understanding the haematological changes associated with malaria in this specific geographical area is essential for improving disease management and optimizing patient care (Acharya et al., 2016).

Materials and Methods

Study Area

The research was conducted at the Federal University Teaching Hospital (FUTH) Owerri, Imo State, Nigeria.

Subjects

The population of this study comprises 50 individuals with confirmed malaria parasitemia and 50 healthy subjects residing in Owerri, Imo State, Nigeria. The study focuses on both male and female individuals across different age groups. The selection of patients with malaria parasitaemia and healthy subjects aimed to provide a comprehensive understanding of the haematological parameters within the context of malaria infection. By including both individuals with confirmed parasitaemia and those without, the study aimed to capture variations in total protein levels, red cell indices, and platelet indices within the Owerri population.

Sample Collection

Six milliliters (6mls) of blood were collected from each subject by means of hypodermic syringe and needle. Two milliliters of blood were aliquoted into ethylenediaminetetraacetic acid (EDTA) container and used for screening for malaria parasites and various haematological parameters.

Laboratory Analysis

The total protein was estimated using Biuret kit. Red cell and platelet indices were estimated using Bio Maxima BM HEM 3 automated hematology analyzer. Thick blood films were made and stained with Giemsa and examined for malaria parasites.

Statistical Analysis

The statistical analysis was performed using the statistical package for social science version 2010. Students unpaired two-tailed t-test was used to determine whether a parameter from 2 different groups differ significantly or not. p-value <0.05 was considered to be statistically significant.

Results

Table 1 shows the mean values of MCV (77.12 ± 6.62) fl, MCH 24.46 ± 3.15 (pg), MCHC 28.83 ± 1.25 (g/dl), RDW 13.38 ± 2.13 (%). MCHC (28.83 ± 1.25) was significantly reduced in patients with malaria parasitemia when compared to controls. (89.92 ± 5.06) (30.43 ± 1.73) (33.22 ± 1.61) (13.91 ± 1.28) ($p=0.000$, $p=0.000$, $p=0.000$, and $p=0.309$), Table 2 shows the mean values of MPV (7.82 ± 0.95) fl, PCT (0.13 ± 0.12) % and PDW (10.79 ± 0.76) % were significantly reduced in patients with malaria parasitemia when compared to the controls. (10.33 ± 1.71), (0.23 ± 0.01), (13.04 ± 3.53) and (7.78 ± 0.83) respectively ($p=0.000$, $p=0.001$, $p=0.000$, and $p=0.000$).

Table 1: Mean Values of MCV, MCH, MCHC, RDW in Patients with Malaria Parasitemia Versus Controls (mean $\pm$ SD).

Parameter	Test	Control	t-value	p-value
MCV (fl)	77.12 ± 6.62	89.92 ± 5.06	7.77	0.000*
MCH (pg)	24.46 ± 3.15	30.43 ± 1.73	7.99	0.000*
MCHC (g/dl)	28.83 ± 1.25	33.22 ± 1.61	12.18	0.000*
RDW (%)	13.38 ± 2.13	13.91 ± 1.28	1.02	0.309*

Table 2: Mean Values of MPV, PCT, PDW and Total Protein in Patients with Malaria Parasitemia Versus Controls (mean $\pm$ SD).

Parameter	Test	Control	t-value	p-value
MPV (fl)	7.82 ± 0.95	10.33 ± 1.71	7.80	0.000*
PCT (%)	0.13 ± 0.12	0.23 ± 0.01	3.36	0.001*
PDW (%)	10.79 ± 0.76	13.04 ± 3.53	4.30	0.000*
Total protein (g/dl)	5.54 ± 0.46	7.78 ± 0.83	14.45	0.000*

Keys: *: Significant p value.

Discussion

Malaria is a life-threatening disease caused by Plasmodium parasites, transmitted through the bites of infected female Anopheles mosquitoes. The disease has far-reaching consequences, impacting the social and economic development of communities and placing a

strain on the healthcare system. The haematological alterations associated with malaria parasitaemia play a crucial role in the disease's pathogenesis and clinical manifestations. Malaria infection affects the red blood cells, leading to haemolysis, anaemia, and changes in various red cell indices. This study showed significant

differences in various haematological parameters and total protein levels between malaria parasitaemia patients and the control group. In the study, MCV was significantly lower in patients with malaria parasitemia when compared to the control group. This suggests microcytic red blood cells, which are smaller in size which is consistent with the findings of a study by Smith and Adediran, (2019). They reported decreased MCV in malaria-infected individuals in a malaria-endemic region, and attributed this to the destruction of red blood cells during malaria infection. The study also observed a significantly lower MCH in infected patients compared to the control group, indicating reduced haemoglobin content per red blood cell. Similar findings were reported by Akhigbe et al., (2017), who noted a decrease in MCH in malaria-infected individuals in their study conducted in Nigeria. The MCHC was significantly lower in malaria parasitemia patients compared to the control group, suggesting a decreased concentration of hemoglobin within red blood cells. The results align with those of Okafor et al. (2019), who observed reduced MCHC values in malaria-infected patients in a study conducted in a malaria-endemic region of Nigeria. Interestingly, there was no significant difference in the mean RDW between patients with malaria parasitemia patients and the control group, which contrasts with the findings of studies conducted by Adekola et al. (2015) and Oyedeji et al. (2018). Findings from this study indicate that malaria parasitemia is associated with significant changes in various haematological parameters, including red blood cell indices, platelet count and characteristics, and total protein levels. These alterations reflect the impact of malaria on the blood and may have clinical implications for the diagnosis and management of malaria-infected patients.

Conclusion

The study has concluded that the comprehensive analysis of haematological parameters and total protein levels in patients infected with malaria parasitemia reveals significant alterations compared to the control group. The findings reinforce the importance of prompt

and accurate malaria diagnosis and monitoring. Therefore, early evaluation of these parameters is encouraged in determining treatment strategies for malaria patients, particularly those with severe malaria.

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