

Effect of Malaria on Hematological Profile in Medical Unit-2 of Chandka Medical College Larkana

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ABSTRACT

Objective: To see effects of malaria on haematological profile and to see the difference of changes due to malaria on hematological profile in both males and females.

Study Design: Case control

Place and Duration of Study: Medical unit-2 Department of Chandka Medical College, Larkana from 1st June 2022 to 30th November 2022.

Methodology: Eighty seven patients of malaria and 80 without malaria were enrolled. A 3% Giemsa staining technique was applied for processing and staining of the films. Parasite density /ml blood was assessed. The blood samples taken from all participants were analyzed through proper quality assurances. The hematological profile included white blood cell counts (WBC), hemoglobin measurements (Hb), percentage of monocytes (MON%), percentage of lymphocytes (LYM%), percentage of neutrophils (NEUT%) as well as red blood cell distribution width (RDW-CV), and also the platelet counts (PLT).

Results: Malaria had an impact on the hemoglobin levels. Among our patients, 73.5% showed mild anemia, 9.1% had moderate anemia, and 14.9% were diagnosed with severe anemia. Females were found to be more affected than males. The sensitivity and specificity of the study was estimated for all the hematological profiling and it was found that White blood cells, monocytes as well as hemoglobin were very sensitive and specific predictors for malaria presence.

Conclusion: Hemoglobin levels, white blood cells count as well as platelets count are decreased significantly in malarial cases.

Keywords: Malaria, Anemia, Thrombocytopenia, Hematological profile, Rapid acting ICT method, Plasmodium

INTRODUCTION

Malaria is an illness that results from a parasite. The parasite is transmitted to humans by infected mosquitoes when they bite. Those who contract malaria typically experience severe symptoms, including high fevers and shaking chills. Although malaria is rare in regions with mild climates, it remains prevalent in tropical and subtropical areas. Approximately 290 million people are affected by malaria each year, with over 400,000 fatalities resulting from the disease.¹⁻⁴

Several studies have documented the number of severe cases and deaths caused by *P. vivax* malaria, and the median case fatality rate for *P. vivax* malaria among in patients with severe disease is around 3.1%.^{5,6} Anemia is a condition characterized by a reduction in hemoglobin levels (Hb), hematocrit values (Ht), and red blood cell (RBC) count. The severity of anemia can be classified as mild anemia: Hb levels between 10-12g/dL in women and between 10-13.5g/dL in men, moderate anemia: Hb levels between 8 to 9.9g/dL, severe anemia: Hb levels between 6.5 to 7.9g/dL and anemia that poses a threat to life: Hb levels less than 6.5g/dL.⁷⁻⁹

In adults, a typical platelet count ranges from 150,000 to 450,000 platelets per microliter of blood. Thrombocytopenia can be classified into different levels based on platelet count; mild thrombocytopenia: Platelet count ranging from 101,000 to 140,000 per microliter of blood. Moderate thrombocytopenia: Platelet count ranging from 51,000 to 100,000 per microliter of blood. Severe thrombocytopenia: Platelet count ranging from 21,000 to 50,000 per microliter of blood.¹⁰

The present study will assess the effect of malaria on hematological profile. The results of this study will assist in identifying the hematological markers involved in malaria disease and their changes which can be helpful in early detection of the disease. The results will also assist in timely identification of malaria by providing additional confirmatory tests results other than microscopic analysis.

MATERIALS AND METHODS

This was a case control study which was carried out on the patients with malaria who got admission in Medical unit-2 Department of Chandka Medical College, Larkana from 1st June 2022 to 30th November 2022. The study was performed after

ethical clearance through review committee of Shaheed Mohtarma Benazir Bhutto Medical University Larkana. There were 87 patients of malaria and 80 without malaria which were enrolled post gain of written informed consent and were confirmed of malaria through diagnosis by rapid acting ICT method. Undiagnosed patients, under age of 13 years, other co-morbidities, diseases that may affect haematological profile were excluded. The sample size of the patients was calculated using sample size calculator available online. The confidence of interval for the test was taken as 95% while 80% power pf test was applied. A 3% Giemsa staining technique was applied for processing and staining of the films. Parasite density /ml blood was assessed following the methods reported in a previous study. The cut-off level for mild parasitemia was <1,000 parasites/ μ L of blood, moderate parasitemia was 1,000 to 9,999 parasites/ μ L of blood, and severe parasitemia \geq 10,000 parasites/ μ L of blood. A 5cc whole blood was withdrawn and collected in EDTA anticoagulated test tubes from each patient and hematological profile was completed on each patient. The blood samples were analyzed through proper quality assurances. The hematological profile included white blood cell counts (WBC), hemoglobin measurements (Hb), percentage of monocytes (MON%), percentage of lymphocytes (LYM%), percentage of neutrophils (NEUT%) as well as red blood cell distribution width (RDW-CV), and also the platelet counts (PLT). Data was collected through pre-tested questionnaire and filled by investigator himself. Along with consent form, the Questionnaire contains three categories i.e. demographic questions, questions related to malaria diagnosis, and questions related laboratory reports of full blood count. Data was analyzed by IBM SPSS version 22 software.

RESULTS

Malaria had an impact on the hemoglobin levels. Among our patients, 73.5% showed mild anemia, 9.1% had moderate anemia, and 14.9% were diagnosed with severe anemia. The mean age of the patients with malaria was 15.5 \pm 3.6 years while that of without no malaria was 18 \pm 3.1 years. Females were found to be more affected than males, with 58.6% of females displaying anemia compared to 3.44% of males (Table 1).

The WBC count was much higher in the cases of malaria with mean value as 7.41 \pm 5.3 in compared with the non-malaria cases having a mean WBC value as 7.09–11.9. There was a mean

decrease of hemoglobin level in malarial cases in comparison with the non-malarial cases. A mean higher platelet as 238.5±113 as observed in the cases without malaria while it was 207.2 ±127.3 in malaria cases (Table 2).

The sensitivity and specificity of the study was estimated for all the hematological profiling and it was found that White blood

cells, monocytes as well as hemoglobin were very sensitive and specific predictors for malaria presence. The likelihood ratio also presented the similar analytes to be highly significant in predicting the presence of malarial disease through altered results (Table 3).

Table 1: Demographic details of patients in association with malarial parasitemia

Variable	Mild parasitemia	Moderate parasitemia	Severe parasitemia	Total cases
Age (years)	15.5±3.5	16±3.2	15±4.1	15.5±3.6
Gender				
Male	22 (25.2%)	3 (3.4%)	9 (10.3%)	34 (39%)
Female	42 (42.3%)	5 (5.7%)	4 (4.6%)	51 (58.6%)
Total cases	64 (73.5%)	8 (9.1%)	13 (14.9%)	87 (100%)

Table 2: Baseline features of hematological profile in cases with and without malaria.

Analytes	Normal range	With malaria (N = 87)		Without malaria (N = 80)		P value
		Mean±SD	95% CI	Mean±SD	95% CI	
WBC	4.0–10.0	7.42±5.5	6.58–8.23	9.52±11.01	7.08–11.9	<0.0001
LYM(%)	20.0–40.0	29.5±22.1	26.1–33.2	30.1±15.12	26.9–33.5	0.8930
MON(%)	1.0–15.0	6.5±2.4	6.05–6.74	7.02±3.0	6.31–7.56	0.1226
NEUT(%)	50.0–70.0	64.5±16.5	61.7–68	62.8±17.2	58.9–66.6	0.4156
HGB	12.0–16.0	11.2±2.49	10.91–11.71	12.2±3.12	11.5–12.8	0.0015
RDWCV	11.5–14.5	12.52±1.72	12.3–12.79	13.2±2.43	12.91–14.14	0.0783
PLT	100–300	207.1±127.4	188.4–227.6	238.6±114	214.6–263.4	0.0166

Table 3: Sensitivity, specificity and the predictive values of hematological analytes of cases with malaria

Variable	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)	LR (95% CI)	P value
Wbc < 4 × 10 ³ /μL	26.71%	94.95%	92.32%	36.13%	5.311	0.0003
	19.93-34.71	86.12-98.63	79.67-97.36	0.2895- 0.4395		
Lym% < 20%	38.29%	61.12%	70.01%	29.46%	0.9854	>0.9999
	30.32-46.93	47.81-72.98	58.45- 79.45	21.82-38.46		
Mon% < 1% > 15%	-	95.07%	-	32.51%	-	0.0122
	000-2.351	87.98-98.16	0 to 49.00	26.86- 38.70		
Neut% > 70%	54.94%	50.01%	71.57%	32.64%	1.098	0.5444
	46.73-62.88	37.91-62.08	62.48- 79.12	24.04-42.61		
Hb < 12 g/dL	68.13%	63.64%	77.04%	52.70%	1.874	<0.0001
	59.94-75.33	52.48-73.50	68.83-83.62	42.65-62.54		
RDW-CV < 11.5%	22.65%	71.24%	53.34%	38.82%	0.7872	0.3835
	15.72-31.49	59.98-80.36	39.07- 67.05	30.96-47.26		
Platelet < 100 × 10 ³ /μL	23.49%	90.64%	83.79%	36.49%	2.504	0.01945
	17.05-31.40	81.03-95.64	68.85- 92.36	29.41-44.21		

DISCUSSION

Our study reported that malaria affects the hematological profile, it causes mild to severe anemia and mild to severe thrombocytopenia. Our results also showed females were more affected those males. While there were no changes on number of granulocytes. The studies were performed in Nigeria by Adamu and Jigam¹¹⁻¹³, somewhat contradicts with our results that revealed that the general population of patients with malaria exhibited a significant reduction in haematocrit, neutrophils, and eosinophils, but there was no significant reduction in haemoglobin and monocytes. Another study in South Ethiopia agrees with our results that shows, Malaria patients showed significantly lower mean values of Hgb, Hct, platelet, WBC, RBC, and lymphocyte compared to those who were not diagnosed with malaria. The prevalence of thrombocytopenia and anemia among malaria patients was 84% and 67%, respectively. Additionally, there was a negative correlation observed between parasite density of P. falciparum and P. vivax and the counts of lymphocytes and platelets.¹⁴

The present study also agrees with a study conducted in Pakistan that reported that Overall, a large proportion of malaria patients in the study exhibited thrombocytopenia, anemia, lymphopenia, and monocytosis. The incidence of thrombocytopenia was slightly higher in P. Falciparum cases compared to P. Vivax cases, although the difference was not statistically significant. Additionally, there was no significant difference in the incidence of anemia between the two groups. However, lymphopenia was found to be more prevalent in P. Vivax

cases compared to P. Falciparum cases, and this difference was statistically significant. Normal eosinophil and basophil counts were observed in both groups.¹⁵⁻¹⁷

The positive test for malaria has a higher probability in altering hematological variables (Table 3). The likelihood of all WBC, platelets as well as of the hemoglobin was greater than one. Similar results have been reported in other studies where hematological parameters have specified changes in cases of malarial disease.¹⁸ Dhangadamajhi et al¹⁹ identified the presence of anemia as well as thrombocytopenia to be found in malarial patients and are predictors of the disease. The same findings were also highlighted in the current research.

In this study there is no significant variance within the value of LYM% within malarial and non-malarial cases. This is in contrary to the other previous studies results wherein mild atypical-lymphocytosis was identified to be observed accompanying malaria.^{20,21}

CONCLUSION

Hemoglobin levels, white blood cells count as well as platelets count are decreased significantly in malarial cases. There is a predomination of malarial parasitemia, anemia and thrombocytopenia as well as leukemia in cases suffering from malarial infection.

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