

**HAEMATOLOGICAL CHANGES BEFORE AND AFTER
TREATMENT AMONG SUDANESE PATIENTS INFECTED BY
PLASMODIUM SPECIES IN KHARTOUM STATE, SUDAN**

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ABSTRACT

Malaria is a worldwide disease especially in tropical Africa with high rate of morbidity and mortality. This study aimed to evaluate the effect of malaria on three blood parameters among Sudanese patients. One hundred and eighteen specimens were collected from volunteered Sudanese malaria patients. All samples were diagnosed by Giemsa stained thick and thin blood films, and ICT (*P.f/P.v*). Complete blood counts were estimated by mindray blood counter. All cases were treated by antimalarial drugs and requested to check after two weeks. Forty one patients came back for check and the same investigations were done to make sure that they were cured. The study showed that *P. falciparum* was the most predominant species (n=115-97.5%). Mixed infection was 0.8% (n=1) and *P. vivax* was 1.7% (n=2). 85.6% of the

patients had mild anaemia. The majority of the patients had normal white blood count. Nineteen patients had leucopenia and five patients had leucocytosis. 42.4% of the participants had thrombocytopenia. 88% of them had platelets counts between 50,000 – 100,000/ μ l. Follow up of the forty one patients showed no significant changes in the level of haemoglobin and the white blood count (p=0.06 and 0.51 respectively). All patients with thrombocytopenia switched back to normal count (p=0.0003). As a conclusion anaemia and thrombocytopenia are common findings among Sudanese malaria patients. Detection of

thrombocytopenia is a valuable indicator of infection. Even more valuable is the reversal of thrombocytopenia to normal counts after treatment. This finding is a significant predictor of the cure of the patients.

KEYWORDS: Malaria, Anaemia, Thrombocytopenia, Sudan.

INTRODUCTION

Malaria is a protozoan disease transmitted by the bite of an infected female anopheles mosquito. Being, the most common and important of the parasitic diseases of human, it is transmitted in 108 countries inhabited by three billion people causing approximately one million deaths each year. Although, there are many promising new measures of control and research initiatives, malaria remains today as it has been for centuries, a heavy burden on tropical communities, a threat to non endemic countries and a danger to travellers. Five species of the genus *Plasmodium* are incriminated as the cause of all malarial infections in humans. These are *P. falciparum*, *P. vivax*, *P. ovale*, *P. malariae* and in the South East Asia, the monkey malaria parasite *P. knowlesi*. Almost all deaths are caused by *P. falciparum*.^[1] The mortality due to the other malaria parasites is rather low.^[2] Although haematological changes are common in severe malaria, the pathogenesis is particularly complex. It is thought to be due to combination of factors like the effect in parasitized red blood cells, depressed and ineffective erythropoiesis as well as other factors.^[3,4] In a prospective study in Moodabirdri, South India, Naik found that 15.8% of the malaria patients were anaemic.^[5] In South Korea Myoung *et al* found that 19.9% of the malaria patients having leucopenia.^[6] Memon has reported thrombocytopenia in malaria to be almost 70%.^[7] Earlier studies also confirmed the incidence of thrombocytopenia to be higher in *P. falciparum* infection. In the study by Nadeem *et al* thrombocytopenia was observed in 83% of *P. falciparum* patients and in 70% of *P. vivax* patients.^[8] The objective of this study was to demonstrate the impact of the common *Plasmodium species* infection on haematological parameters in malaria patients and the effect of treatment on these parameters.

MATERIAL AND METHODS

This is a comparative cross sectional study laboratory based conducted in different health centers in Khartoum North, Sudan during the period January to May 2018. Ethical clearance to carry out the study was approved by the ethical committee of the National Ribat University and the Sudan Medical Specialization Board. A voluntary signed informed consent form was obtained from each participant after explaining the objectives of the study. One hundred and

eighteen malaria positive patients of different ages and gender were included in the study. Thick and thin blood films and ICT test (All test TM malaria *P.f/P.v* rapid test cassettes) were used to diagnose malaria infection. Three milliliter of blood was taken in EDTA tubes to measure the blood parameters (Haemoglobin level, White Blood Cells count and Platelets count) using a full automated blood analyzer (BC-3000 plus mindray). The results were reported according to the standard normal values obtained from the WHO site on internet as follows; mild anaemia was defined as haemoglobin level less than 12.5 g/dl, moderate anaemia as haemoglobin level between 8 and 9.5 g/dl and severe anaemia less than 8 g/dl. Thrombocytopenia was described as platelets count less than 150,000 per microliter. Platelets count between 149,000 to 100,000, 99,000 to 50,000 and less than 50,000 per microliter were described as mild, moderate, and severe thrombocytopenia respectively. Leucopenia was described as white blood cells count less than $4000 \times 10^9/L$ and leucocytosis as counts more than $11,000 \times 10^9/L$. All malaria patients were treated by antimalarial drugs and requested to come back for follow up two weeks after finishing the treatment. Out of the total number of the patients only forty one candidate returned back for follow up. The same previous tests were done to make sure that they were cured and to look for the changes in the haematological parameters. Statistical analysis of the results were done by the statistical package for social sciences (SPSS version 25).

RESULTS AND DISCUSSION

Prompt and accurate diagnosis of malaria is the key for effective management. Changes in the diagnosis of malaria in the last three decades based on serology and molecular techniques which are costly in terms of equipments, reagents, infrastructure and expert personnel. This is rather inapplicable in sub-Saharan Africa where malaria is highly prevalent. In some hospitals people can afford to carry out complete blood count to detect the haematological parameters in malaria patients. This study was carried out to look for the changes in these parameters before and after treatment.

One hundred and eighteen patients with positive blood films and immunochromatography test (ICT) for malaria were included in this study. Sixty three of the participants were males and fifty five were females. Most of the participants were below 20 years of age. 97.5% of the patients were positive for *P. falciparum*, two (1.7%) were positive for *P. vivax* and only one patient (0.8%) had mixed infection of *P. falciparum* and *P. vivax*. 85.6% of the patients had normocytic normochromic anaemia (Fig. 1). This finding is consistent with the reports of

several researches. A similar study in Sudan by Shaza OK showed that the mean value of haemoglobin of malaria patients in Khartoum and Gazira states was significantly lower when compared to non infected individuals.^[9] In India Shamim *et al* stated that 84.6% of malaria patients had low level of haemoglobin.^[10] This effect on haemoglobin level could be due to accelerated red blood cells (RBCs) removal by the spleen, obligatory RBCs destruction during schizogony or as a result of inefficient erythropoiesis.

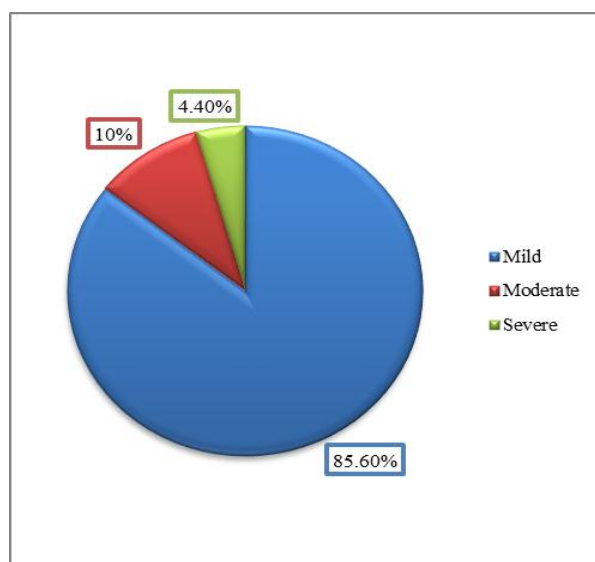


Fig. 1: Percentage of anaemia according to severity.

No significant change of the white blood cell count (WBCs) was detected in this study. Only 19 patients had leucopenia and 5 patients had leucocytosis. The presence of leucopenia in some of the patients was a common finding in other studies. Mayong *et al* in South Korea found that 19.9% of the patients had leucopenia, 2.9% had leucocytosis and 77.2% with normal values.^[6] Shamim *et al* in Maharashtra found that 7.4% of the patients had leucocytosis and 11.11% had leucopenia.^[10] Leucopenia is thought to be due to the localization of the leucocytes away from the peripheral circulation and splenic sequestration rather than actual depletion or stasis.

In this study 42.4% of the patients had thrombocytopenia. 88% of them had platelets count between 50,000 – 100,000/ μ L (Fig. 2). Memon reported that thrombocytopenia was about 70% in patients, suffering from malaria.^[7] Nadeem *et al* observed thrombocytopenia in 83% of *P. falciparum* patients.^[8] The mechanism of thrombocytopenia could be due to the generation of immune complexes leading to the sequestration of platelets by macrophages.

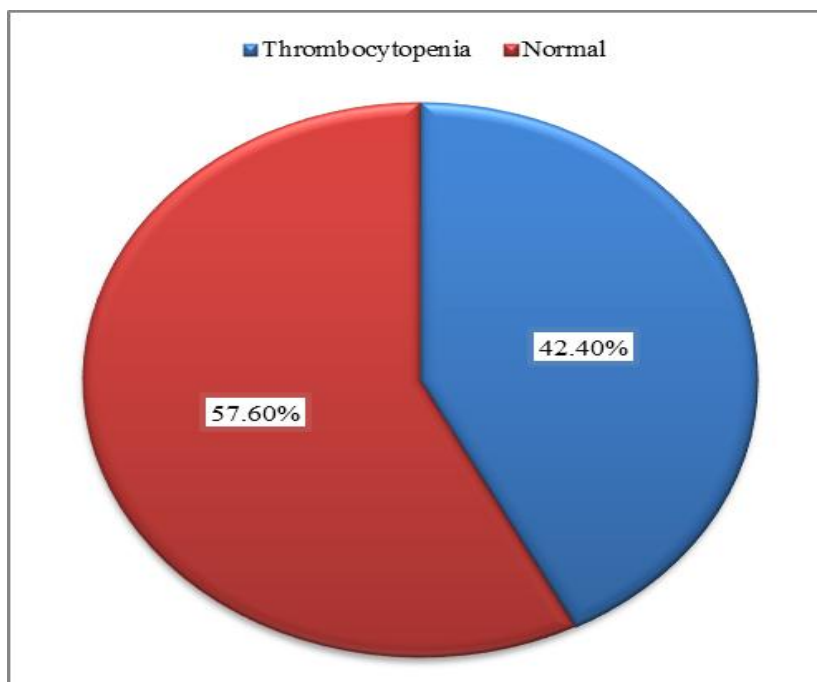


Fig. 2: Percentage of thrombocytopenia among the total number of patients.

Forty one patients came back for the follow up after finishing the treatment. All of them were negative for malaria parasite. Changes in haemoglobin level and the white blood cells count were insignificant ($p=0.06$, 0.51 respectively). There was a significant change in the platelets count after treatment. All of them reverted to normal count ($p=0.0003$). Similar results were obtained by Leowattana W *et al*, Lacerda MVG *et al*, and Ifeanyichukwu MO and Esan AJ.^[11-13] This finding is of great importance in the follow up of patients after treatment and can be taken as a predictor of the cure of the patient and the clearance of the parasite.

CONCLUSION

This study showed that anaemia and thrombocytopenia are common findings in patients suffering from malaria. The presence of thrombocytopenia is a good additive diagnostic finding in cases of malaria. A more important finding is the reversal of the thrombocytopenia to normal counts after treatment indicating the success of the treatment of the patient.

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