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Short Communication

Occurrence and Clinical Significance of Thrombocytopenia in Plasmodium Falciparum and Plasmodium Vivax Malaria in Sinnar and Khartoum States, Sudan

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Abstract

Background: Malaria remains a major public health concern in Sudan, predominantly caused by Plasmodium falciparum, while Plasmodium vivax continues to emerge in several regions. Thrombocytopenia is frequently associated with malaria infection, yet its pattern and severity vary between species. This study investigated the occurrence of thrombocytopenia among malaria infected individuals in Sinnar and Khartoum States.

Methods: A cross sectional, hospital-based study was conducted between November and March 2020. A total of 160 EDTA blood samples were collected from malaria suspected patients. Malaria diagnosis was performed using Rapid Diagnostic Tests (RDTs) and Giemsa-stained blood films. Platelet counts were measured using an automated hematology analyzer (SYSMEX KX 21). Data were analyzed using SPSS version 22.

Results: Of the 160 malaria positive participants, P. falciparum accounted for 77.5% (n=124), while P. vivax represented 22.5% (n=36). Thrombocytopenia was more prevalent among P. falciparum cases, with 56.2% exhibiting abnormal platelet counts, compared to 8.8% in P. vivax cases. Males represented 60.6% of infected individuals. The highest infection rate occurred in the age group 1–25 years (47.5%). A statistically significant association was found between malaria species and platelet count abnormalities (p = 0.000).

Conclusion: Thrombocytopenia is a common hematological abnormality in malaria, particularly in P. falciparum infections. Its presence may assist clinicians in supporting malaria diagnosis, monitoring disease severity, and guiding management decisions.

Keywords: Malaria; Thrombocytopenia; Plasmodium falciparum; Plasmodium vivax; Sudan.

INTRODUCTION

Malaria is a disease of global importance. The World Health Organization (WHO) has reported a worldwide annual incidence of 247 million cases and malaria mortality of one million per year [1]. Malaria remains a pervasive infection affecting at least 91 different countries and approximately 300 million individuals annually [1]. Clinically, malaria presents with fever, shivering, headache, joint pain, and vomiting. Severe cases may progress to jaundice, kidney failure, anemia, coma, or death. Sub-Saharan Africa accounts for nearly 90% of global malaria cases [2], while India, Brazil, Afghanistan, Sri Lanka, Thailand, Indonesia, Vietnam, Cambodia, and China account for most of the remaining burden [3]. Hematological abnormalities, particularly anemia and thrombocytopenia, are common complications of malaria [4]. Thrombocytopenia has been reported in 60–80% of malaria cases, often more severe in Plasmodium falciparum infections than in Plasmodium vivax [5]. Proposed mechanisms include coagulation disturbances, splenic sequestration, oxidative stress, and immune-mediated platelet destruction [6]. Platelet–parasite interactions and shortened platelet lifespan also contribute to thrombocytopenia [6]. Given the high burden of malaria in Sudan and the coexistence of P. falciparum and P. vivax, understanding thrombocytopenia patterns is crucial. This study investigates the occurrence of thrombocytopenia in malaria patients in Sinnar and Khartoum States.

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MATERIALS AND METHODS

Study Design

This was a prospective, cross-sectional, and hospital-based study.

Duration of Study

This study lasted from November to March 2020.

Sample Size

A total of 160 samples were collected.

Study Population

Any individual with malaria in Sinnar and Khartoum states had the same chance to be chosen as the sample, considering their age, sex, and residence.

Methods

By using monoclonal antibodies to the Plasmodium species, histidine-rich proteins are highly sensitive and reliable. These tests employ an impregnated strip that gives a color change when blood-containing parasites are added, and these tests could be used at the primary healthcare level in malaria-endemic areas. One drop of blood is added to ICT in the wall (S), and 3-4 drops from the buffer are added to the wall (B) and then incubated for 10 minutes. In the slide, add 4 drops, 3 for thick and one drop for thin blood film, then fixation of thin by absolute methanol for 1 minute stain with Giemsa. 3 mL of blood in an EDTA container was analyzed by a hematological analyzer (SYSMEXKX21). Blood cells can be broadly divided into three categories. Red cells, White blood cells, and platelets. SYSMEX measures the number of cells and distinguishes between their types according to size using sheath flow Direct Current (DC) detection. Electrical current is passed through a solution; this method measures the change in electrical resistance that occurs when blood cells pass through the detection aperture.

Data Collection Tools

A questionnaire was used to obtain the primary information.

Data Analysis

Data collected in this study were analyzed using SPSS version 22.

Ethical Considerations

Patients undergoing the test were given explanations of the venous blood sample process. All participants were informed about the research objectives and procedures during the interview period. Written valid consent was obtained from all participants. All results were with high privacy and confidentiality.

RESULTS

This study explained Plasmodium injury and it is relationship with a decrease in platelet The result of statistical analysis showed that the rate of 77.55% that infected Plasmodium falciparum, and 22.5% of Plasmodium vivax decreased in platelet count. It was observed that the supreme injury rate in males increased by 60.6% and in females increased by 39.4%. It was also noted that the spread of infection was higher in the age group (1-25years) Plasmodium falciparum 40%, Plasmodium vivax 7.5% is higher than in another age group. The result showed that the prevalence of Plasmodium falciparum (124)-(77.5%) and Plasmodium vivax (36)-(22.5%) among that 160 individuals infected (Table 1). Prevalence of Plasmodium species according to sex, the rate of infection according to the sex of Plasmodium falciparum (48.8%) and Plasmodium vivax (11.9%) male. And Plasmodium falciparum (28.8%) and Plasmodium vivax (10%) female (Table 2). Prevalence of Plasmodium species according to normal and abnormal platelet counts the rate of infection according to normal Plasmodium falciparum (21.2%) and in Plasmodium vivax (13.8%) platelet counts, and abnormal Plasmodium falciparum (56.2%) and Plasmodium vivax (8.8%) platelet counts (Table 3).

DISCUSSION

The findings of this study confirm the predominance of P. falciparum malaria in Sinnar and Khartoum States, consistent with WHO regional data and previous reports indicating that P. falciparum is the leading cause of malaria morbidity in Sudan [1,2]. The significantly higher rate of thrombocytopenia among P. falciparum patients aligns with earlier studies suggesting that this species induces more severe hematological abnormalities compared to P. vivax [4,5]. Mechanisms such as splenic sequestration, immune-mediated destruction, oxidative stress, and platelet–parasite interactions have been proposed to explain the reduction in platelet count [6]. The predominance of infection in the younger age group (1–25 years) reflects increased exposure and lower acquired immunity, a pattern also observed in other endemic regions [3]. The higher infection rate among males may be attributed to occupational exposure and greater mobility, increasing contact with mosquito breeding sites (Table 4). Normal platelet counts in control samples confirm the reliability of laboratory measurements used in this study (Table 5). However, the absence of serial platelet monitoring limited the ability to correlate thrombocytopenia severity with disease progression or clinical outcomes. Larger, multi-center studies are required to assess platelet count as a prognostic marker for malaria severity, particularly in P. vivax infections where data remain scarce [7,8].

Table 1: Prevalence of Plasmodium species according to age group

Age group	*Plasmodium falciparum*		*Plasmodium vivax*	
	Frequency	*Percent %*	*Frequency*	*Percent %*
1-25	64	40%	12	7.5%
26-50	52	32.5%	24	15%
51-70	8	5%	0	0%
Total	77.5%		22.5%	
P. value	0.019			

Table 2: Prevalence of Plasmodium species according to sex

Sex	*Plasmodium falciparum*		*Plasmodium vivax*		*Total*	*P. value*
	Frequency	*Percent %*	*Frequency*	*Percent %*		
Male	78	48.8%	19	11.9%	**60.6%**	**0.087**
Female	46	28.8%	17	10%	**39.4%**	

Table 3: Prevalence of Plasmodium species according to normal and abnormal platelet count

Variables	*Plasmodium falciparum*		*Plasmodium vivax*		*Total*	*P. value*
	Frequency	*Percent %*	*Frequency*	*Percent %*		
Normal	34	21%	22	13.8%	**35%**	**0.000**
Abnormal	90	56.2%	14	8.8%	**65%**	

Table 4: Prevalence of Plasmodium species according to species

species	*Plasmodium falciparum*		*Plasmodium vivax*	
	Frequency	*Percent %*	*Frequency*	*Percent %*
Total	124	77.5%	36	22.5%

Table 5: The control platelet count

Blood sample	*Platelet counts*
1	153.000 *microliter*
2	359.000 *microliter*
3	322.000 *microliter*
4	205.000 *microliter*

CONCLUSION

Thrombocytopenia is a frequent hematological abnormality in malaria and is particularly associated with P. falciparum infection. Platelet count assessment may aid in diagnosing malaria and predicting disease severity.

Consent

Written informed consent was obtained from all participants.

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