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Frequency of Thrombocytopenia Among Adults with Malaria in Merowe City, Sudan, November 2021 to September 2022

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Abstract- ***Malaria is associated with haematological abnormalities, including thrombocytopenia. This study determined the frequency of thrombocytopenia among adults with malaria in Merowe City, Sudan, and compared its occurrence between Plasmodium falciparum and Plasmodium vivax infections. We conducted a retrospective cross-sectional study at Al-Gawda and Al-Ehsan Medical Centres in Merowe City, Northern State, Sudan, from November 2021 to September 2022. De-identified records of adults aged >18 years with confirmed malaria were reviewed. Complete blood count, malaria blood-film, and immunochromatographic test results were extracted. Thrombocytopenia was defined as a platelet count <150,000/mm³. Descriptive analyses were performed using SPSS version 16.0. Of 149 adults with malaria, 100 (67.1%) had P. falciparum and 49 (32.9%) had P. vivax. Thrombocytopenia was identified in 13 patients (8.7%). It occurred in 8/100 (8.0%) patients with P. falciparum and 5/49 (10.2%) patients with P. vivax. Minor bleeding was reported in one patient with P. vivax; no bleeding was reported among patients with P. falciparum. Thrombocytopenia occurred in approximately one in eleven adults with malaria and was slightly more frequent among patients with P. vivax than among those with P. falciparum. In patients presenting with acute febrile illness, thrombocytopenia may support clinical suspicion of malaria, although it should not be considered a stand-alone diagnostic test. Larger prospective studies are warranted.***

Index Terms: thrombocytopenia; malaria; Plasmodium falciparum; Plasmodium vivax; Sudan

I. INTRODUCTION

Malaria remains an important cause of morbidity and mortality in many endemic settings, particularly in sub-Saharan Africa. The World Health Organization estimated approximately 229 million malaria cases and more than 400,000 deaths globally in 2019, with the greatest burden occurring in Africa [1]. Sudan also has a substantial malaria burden, and malaria remains an important public-health problem [2,3].

Malaria is caused by Plasmodium parasites transmitted primarily through infected female Anopheles mosquitoes. Five Plasmodium species are recognized as causes of human malaria: P. falciparum, P. vivax, P. ovale, P. malariae, and P. knowlesi. P. falciparum and P. vivax account for most human malaria infections [4]. P. falciparum carries the greatest risk of severe disease, whereas P. vivax, although generally less virulent, can also cause severe illness and death [4–6].

Clinical manifestations commonly include fever, headache, nausea, vomiting, myalgia, anaemia, and jaundice [4]. Malaria is also associated with haematological abnormalities, including anaemia and thrombocytopenia [7]. The mechanisms of thrombocytopenia are multifactorial and may include increased platelet destruction or consumption, splenic sequestration, immune-mediated mechanisms, and reduced platelet survival [7].

Because thrombocytopenia can accompany acute febrile illnesses, it may provide a useful clinical clue in malaria-endemic settings. However, thrombocytopenia is not specific to malaria, and its diagnostic value depends on the clinical context and alternative causes. Previous studies have reported substantial variation in its frequency among malaria patients and differences between parasite species [8].

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Data from Merowe locality and Northern State remain limited.

This study therefore aimed to determine the frequency of thrombocytopenia among adults with confirmed malaria in Merowe City, Sudan, and to compare its occurrence between P. falciparum and P. vivax infections. We also describe the bleeding finding recorded in the available clinical records.
Malaria causes many haematological abnormalities, including anemia, low MCV, low MCH, low MCHC, and high RDW [7].

II. MATERIALS AND METHODS

Study design, area, and period
This retrospective cross-sectional study was conducted in Merowe City, Northern State, Sudan, approximately 400 km north of Khartoum. The study period was November 2021 to September 2022. Medical records were obtained from Al-Gawda and Al-Ehsan Medical Centres. The dataset consisted of coded, de-identified records supplied for the study.

Data collection
All available eligible malaria records from the two participating medical centres during the study period were included. Records were eligible if they belonged to adults aged >18 years with confirmed malaria during the study period. Individuals with a documented travel history to Eastern Sudan were excluded as dengue fever was considered an important alternative cause of thrombocytopenia in this epidemiological context.

Extracted information included demographic characteristics, medical history where available, clinical findings, and laboratory results variables, which included complete blood count, malaria blood-film findings, and immunochromatographic test results that was used to identify P. falciparum and P. vivax. Thrombocytopenia was defined as a platelet count <150,000/mm³. descriptive statistic analysis was performed using SPSS 16.0

Ethical considerations
Ethical approval was obtained from Al-Ehsan and Al-Gawda Medical Centres for record screening and data collection. The records were coded and de-identified. The source manuscript does not specify whether a formal waiver of informed consent was granted; this should be confirmed with the relevant ethics authority before submission.

III. RESULTS

A total of 149 adults with malaria were included. P. falciparum accounted for 100 cases (67.1%) and P. vivax for 49 cases (32.9%).

Table 1. Frequency of thrombocytopenia among adults with malaria

Platelets	Frequency	Percent
Less than 150000	13	9.0
more than 150000	136	91.0
Total	149	100.0

Overall, 13 of 149 patients had a platelet count <150,000/mm³, corresponding to 8.7% (approximately 9%). The remaining 136 patients (91.3%) had platelet counts ≥150,000/mm³.

Thrombocytopenia occurred in 8/100 (8.0%) patients with P. falciparum and 5/49 (10.2%) patients with P. vivax. It was therefore numerically more frequent in the P. vivax group, although the study was not designed or powered to establish a statistically significant difference between parasite species.

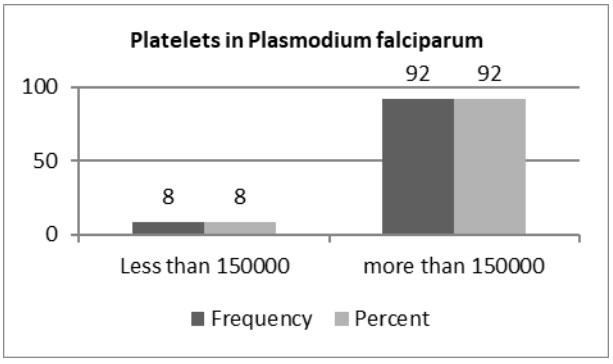

Fig. 1. Frequency of thrombocytopenia in Plasmodium falciparum

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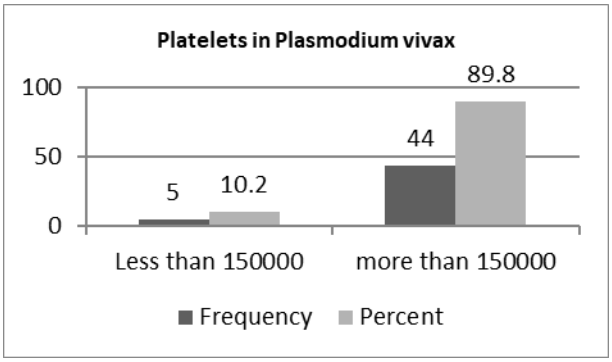

Fig. 2. Frequency of thrombocytopenia in Plasmodium vivax

Minor bleeding was documented in one patient with P. vivax, representing 2.0% of the 49 P. vivax cases. No bleeding was reported among patients with P. falciparum.

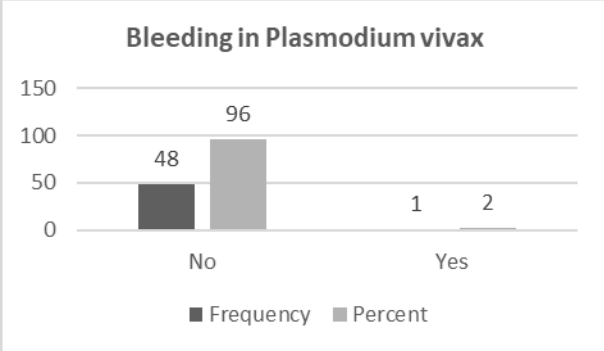

Fig. 3. Frequency of bleeding in Plasmodium vivax

IV. DISCUSSION

In this retrospective study of 149 adults with malaria in Merowe City, thrombocytopenia was present in 8.7% of patients. The frequency was 8.0% in P. falciparum infection and 10.2% in P. vivax infection. Thus, thrombocytopenia was present in a minority of patients in this cohort, with a small numerical excess among those with P. vivax.

The observed frequency differs substantially from that reported in several previous studies. Studies conducted in Kosti and Wad Medani, Sudan, reported thrombocytopenia as an important haematological manifestation of malaria, with higher frequencies than those observed here [8,9]. Studies from other malaria-endemic settings have also reported considerably higher frequencies [10–13]. Differences may reflect variation in study populations, malaria severity, parasite distribution, case ascertainment, platelet thresholds, timing of blood sampling, and inclusion or exclusion criteria.

The lower frequency observed in Merowe should not be interpreted as evidence that thrombocytopenia is uncommon in malaria generally. The present study was retrospective, involved two medical centres, and did not include detailed measures of disease severity, parasitaemia, splenomegaly, coexisting infection, medication exposure, or other conditions that can influence platelet counts. These factors may partly explain differences between studies.

Within this cohort, thrombocytopenia was slightly more frequent in P. vivax than in P. falciparum infection. This is consistent with findings from some previous studies, including Kochar et al. and Muley et al. [14,15]. In contrast, other observational studies and a systematic review have reported similar or different patterns between P. vivax and P. falciparum [16–18]. The present study cannot determine whether the observed difference is biologically meaningful because the number of thrombocytopenic patients was small and no inferential analysis was performed.
One patient with P. vivax had minor bleeding, whereas no bleeding was reported in the P. falciparum group. This observation should be interpreted cautiously because the study was not designed to estimate bleeding incidence and the number of events was very small. The available records also did not permit detailed assessment of bleeding severity, platelet nadir, coagulation parameters, or other potential contributors to bleeding.

Taken together, the findings suggest that thrombocytopenia may be a supportive finding when malaria is considered in an adult with acute febrile illness. However, thrombocytopenia is not specific to malaria and should not be used as a stand-alone diagnostic criterion. Laboratory confirmation of malaria remains essential when available.

Limitations
Several limitations should be considered. The sample size was modest and restricted to two medical centres

in one locality, limiting generalizability. The retrospective design limited the availability and consistency of clinical information. The study did not characterize thrombocytopenia severity or analyse platelet counts as a continuous variable. Potential confounders, including sepsis and other causes of thrombocytopenia, were not systematically excluded. Detailed measures of malaria parasitaemia and disease severity were also unavailable. Finally, because only descriptive statistics were reported, the study cannot establish whether the difference between parasite species is statistically significant.

Future studies should include larger prospective cohorts with standardized clinical assessment, serial platelet measurements, parasite density, disease-severity classification, and systematic assessment of alternative causes of thrombocytopenia. Such studies could determine whether platelet count adds diagnostic or prognostic information beyond conventional malaria testing.

V. CONCLUSION

Thrombocytopenia was identified in 8.7% of adults with malaria in this study from Merowe City, Sudan. It was slightly more frequent among patients with P. vivax than among those with P. falciparum. One patient with P. vivax had minor bleeding. These findings support thrombocytopenia as a possible supportive clue to malaria in acute febrile illness, but not as a substitute for parasitological or other validated diagnostic testing. Larger prospective studies are needed to assess severity, clinical significance, and potential confounding factors.

ABBREVIATIONS

MCV, mean corpuscular volume; MCH, mean corpuscular haemoglobin; MCHC, mean corpuscular haemoglobin concentration, RDW: Red Cell Distribution Width

STATEMENTS AND DECLARATIONS

Ethics approval and consent to participate

Ethical approval was obtained from Al-Ehsan and Al-Gawda Medical Centres for record screening and data collection. The records were coded and de-identified.

Consent for publication

Not applicable to this retrospective study using de-identified records, subject to confirmation by the responsible ethics authority and the authors' institutions.

Availability of data and materials

The data supporting the findings are held by Al-Gawda and Al-Ehsan Medical Centres. Because the data were provided under permission for the present study and are not publicly available, they may be available from the corresponding author on reasonable request and with permission from the relevant medical centres.

Competing interests

The authors declare that they have no competing interests.

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