ARTICLE | BLOG

Hematological Alterations in Malaria: A Cross-Sectional Study of Anemia and Thrombocytopenia of Malarial patients in Swat

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Malaria is a life-threatening infectious disease that can lead to severe complications. In many cases, it presents with hematological changes like anemia and thrombocytopenia, which serve as important indicators of malaria. This study aimed to assess the frequency of these associated blood parameters in patients suffering from malaria. The study was conducted in 2023, in district Swat. A total of 156 patients visiting SGTH hospital Swat, both male and female, aged 10 to 70 years, with confirmed malaria through peripheral blood smears, were included. Data on age was presented as Mean±SD, while gender, hematocrit levels, and platelet counts were recorded as frequencies and percentages. The results showed that 61% of the patients were male, and 39% were female, with an average age of 28.29±13.70 years. Most of the patients were aged between 10 and 20 years, followed by 30% in the 21-30 age group. Thrombocytopenia was a common finding, with 23% of patients having a platelet count between 71,000 and 90,000, and 21% between 51,000 and 70,000. Hematocrit levels showed that 41% of patients had values between 36-45%, with 34% falling in the 26-35% range. Among males, 52.4% had a hematocrit level between 36-45%. In conclusion, anemia and thrombocytopenia were frequently observed in patients with malaria caused by *Plasmodium vivax*. The presence of these conditions in a febrile patient should raise suspicion of malaria, and further specific tests are recommended for confirmation.

Keywords: Anemia, thrombocytopenia, malaria fever, Plasmodium vivax.

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INTRODUCTION

Malaria is an important worldwide health dilemma with a significant disease encumbrance all over the world. In the year 2019, approximately 4,09000 deaths were occurred by 229 million cases of malaria, most of which were from African continent (WHO World Malaria Report 2020) (Menkin-Smith & Winders, 2022). Malaria is caused by single-celled parasites that belong to the Plasmodium genus. In humans, five species of Plasmodium cause malaria: P. vivax, P. ovale, P.falciparum,P. knowlesi and P. malariae (Antinori, Galimberti, Milazzo, & Corbellino, 2012). The most prevalent malaria species is P. vivax. P. vivax malaria can infect approximately 2.5 billion individuals worldwide. P. vivax can stay alive in cooler environment only owing to its latent liver phase rather than other species of malaria that possess extensive environmental range and can survive in tropics, subtropics and moderate environments. World Malaria Report in 2018 stated that P. vivax caused malaria in 74.1% of cases in the United States of America in 2017. Apart from P. vivax endemicity overlaps considerably with that of P. falciparum in many parts of the world, malaria infections are caused by P. vivax exclusively in many places of Southeast Asia for instance South Korea (Howes et al. 2016).Usually, the incubation period for vivax malaria is 12 - 17 days, however relapse can happen up to 2 years later from inactive hypnozoites (Baird, 2013). Therefore, the fever of P. vivax is occasionally regarded as “tertian fever.” Besides the classic clinical manifestations, malaria is often related to hematological changes such as hemolytic anemia, leukopenia, leukocytosis, neutropenia, neutrophilia, hemoglobinuria, and variation of thrombocytopenia (Prasasty, Prameswarie, Ramdja, & Handayani, 2018).

Clinically, anemia is the most frequent symptom observed in adults and children infected with P. vivax malarial parasite. In contrast to falciparum malaria, vivax malaria does not cause sequestration; consequently the failure of organ systems too is infrequent (Coelho et al. 2013). In case of unavailability of findings of parasitological examination, variations of the hematological profile in malaria helps physician to establish an effectual and timely therapeutic management to prevent death that may result from main complications. (Awoke & Arota, 2019) proposed guidelines that all cases of malaria should experience testing before commencing treatment. Clinically, two leading diagnostic modalities are applicable: Light microscopy and rapid diagnostic tests (RDTs). (Visser et al. 2015) Visualization of P. vivax parasites directly on Giemsa-stained blood smears using light microscopy is recognized as gold standard for the identification of vivax malaria. Subsequently, RDTs have become widely used diagnostic tool, particularly in situation of limited resources. RDTs identify one or more Plasmodium antigens in the blood. They are considered as a fast diagnostic tool with no need of a proficient laboratory technician to read blood smears (Abba et al. 1996).

As far as therapeutic management is concerned, Chloroquineis the main treatment for uncomplicated vivax malaria. Hypnozoite phase of P. vivax can be treated by addition of primaquine to the treatment regimens. However, primaquine is contraindicated in patients with G6PD deficiency and pregnant women. Hematological changes such as severe hemolytic anemia is caused by primaquine in case of G6PD deficiency (Recht, Ashley, & White, 2018) Furthermore, primaquine is not recommended in pregnancy due to the risk of fetal hemolysis. Consequently, primaquine treatment is delayed till after delivery. Globally, WHO suggested administration of intravenous artesunate (2.4mg/kg IV or IM at 0, 12hr, and 24hr then daily basis) for the management of severe malaria. Numerous researches have endorsed the effectiveness and safety of artesunate in the management of severe malaria against formerly administered IV quinidine (Kovacs. et al, 2015, Jones. et al, 2007, and Hess and Arguin, 2010).

Even though, many researches have shown thrombocytopenia in association with malaria as a frequent outcome, its relationship with the type of malaria and numerous hematological factors has not been assessed comprehensively in large researches.

Materials And Methods

Current study was conducted in SGTH Swat, A total of 156 patients who were diagnosed with positive malarial parasite on peripheral smears of both genders having age between 10 to 70 years were included in the study whereas patients diagnosed with dengue, congo, chikungunya and platelets less than 150,000 were excluded from the study. Samples of blood were drawn into a 3 ml tube with ethylenediaminetetra acetic acid (EDTA) through venipuncture by skilled staff for peripheral blood smear and were examined for malarial parasites using conventional microscopy. Hemoglobin (Hb), hematocrit (Hct) and platelet count were evaluated by using a hematology analyzer, Huma Reader Plus (HUMAN Diagnostic Worldwide, Wiesbaden, Germany). Clinically, patients were examined for identification of malarial fever. Blood peripheral smear was performed to investigate viral parasite. Examination of complete blood count, LFTs, RFTs, HbA1c, U/S abdomen and Pelvis, Hepatitis B/C status was performed. Malaria was detected with the help of clinical checkup and lab examination test. Data was analyzed by using Statistical packages for social sciences (SPSS) Version 20.0. Variables such as age was documented as Mean±SD. Frequencies and percentages were reported for gender, hematocrit and platelet count.

Results

A total of 156 patients diagnosed with Malarial Parasite plasmodium vivax on peripheral smear were included. Out of these, 96(61%) patients were males and 57(39%) were females with their observed mean age was 28.29±13.70 years. Age distribution among 156 patients revealed that (42%) patients were in the age between 10-20 years, (30%) were in between 21-30 years, (09%) patients were in between 31-40 years, (10%) were in between 41-50 years, (06%) were in between 51-60 years and (03%) were in 61-70 years. Furthermore, overall distribution of thrombocytopenia revealed that most of the patients (23%) had platelet count in the range of 71000-90000 while (21.0%) patients had platelet count in the range of 51000-70000. Additionally, hematocrit distribution revealed that (41%) patients had hematocrit values in the range of 36-45% followed by (34.0%) cases whose hematocrit values were in the range of 26- 35%, as depicted in Figure 1. Frequency of hematocrit with respect to gender revealed that (4.9%) males reported <15% hematocrit, (19.6%) reported 15-25% range of hematocrit, (21.3%) reported 26-35% range of hematocrit, (52.4%) males reported 36-45% range of hematocrit and only (1.63%) case of male reported 38.00% hematocrit. Furthermore, (23.0%) females had 15-25% hematocrit, (53.8%) females had 26-35% hematocrit, and (23.0%) females had 36-45% hematocrit, as depicted in figure 2. Distribution of thrombocytopenia with respect to age groups revealed that 10000-30000platelets were observed in (5.0%) cases between 10-20 years and (3.0%) cases between 21-30 years of age. Furthermore, 31000-50000platelets were observed in (13.0%) cases between 10-20 years and (3.0%) cases between 31-40 years of age. Moreover, 51000-

70000platelets were observed in (9.0%) cases between 21-30 years while equally distributed (3.0%) in all age groups except between 31-40 years of age. Additionally, 71000-90000 platelets were observed in (9.0%) cases between 21-30 years, as depicted in figure 2.

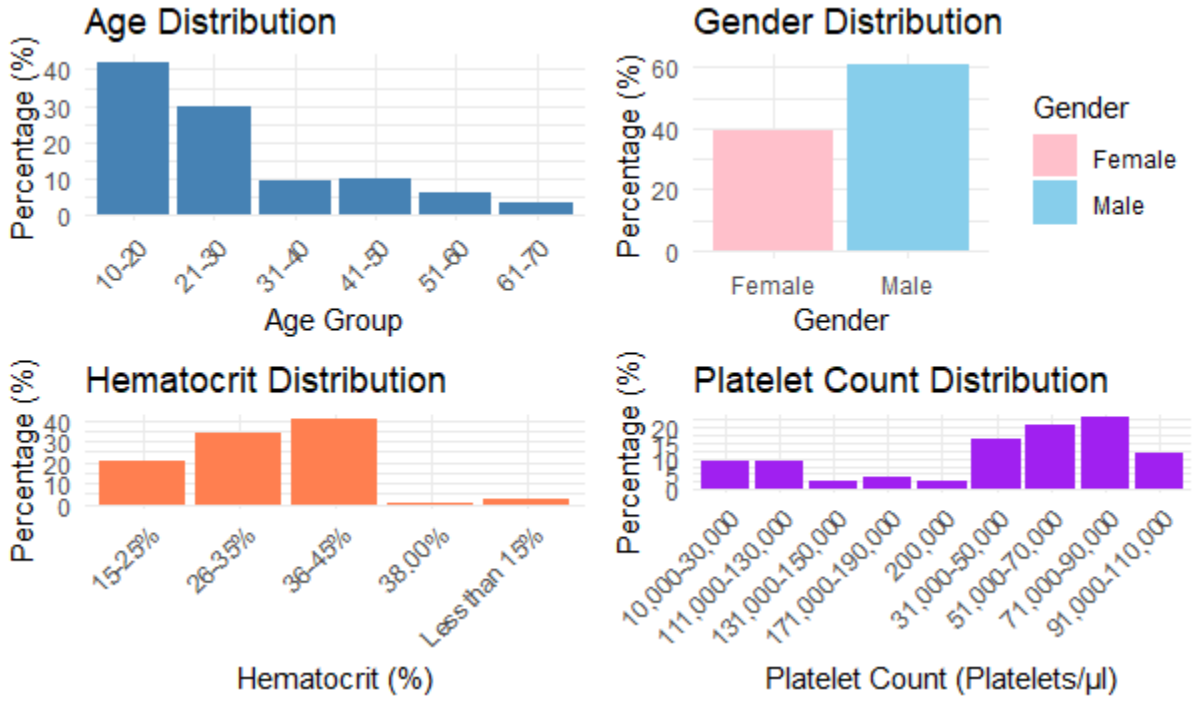

Figure 1: Distribution of malarial patients based on Age, Gender, Hematocrit and Platelet count

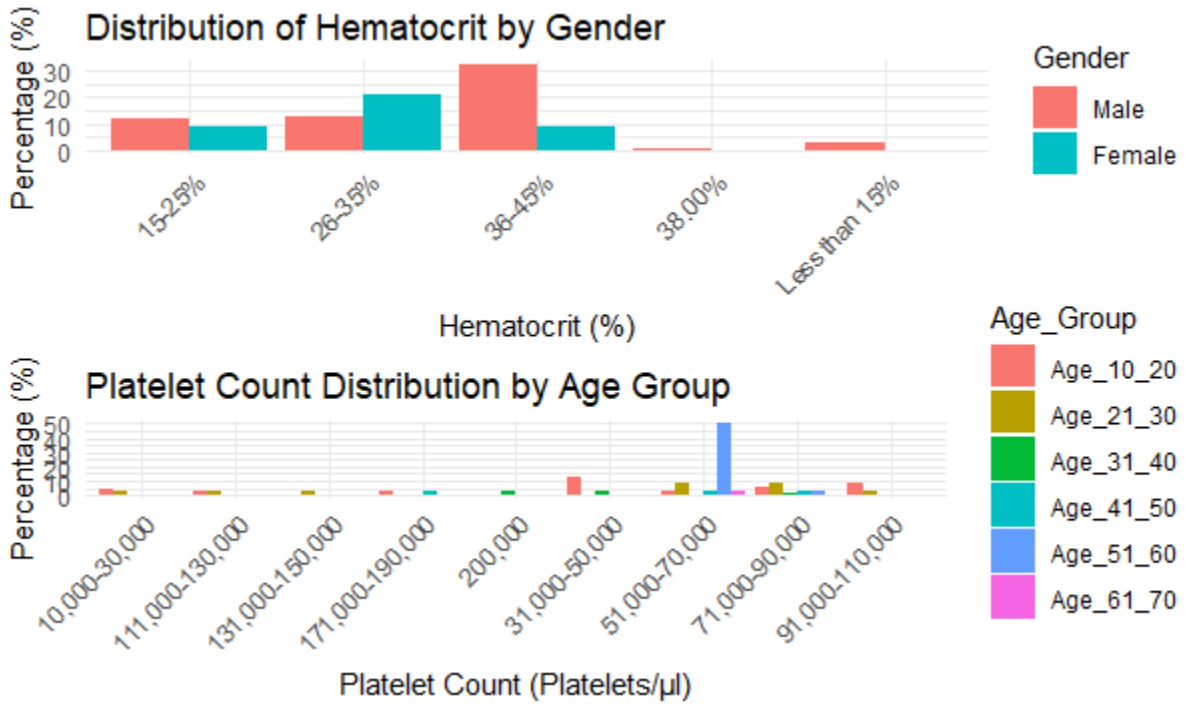

Figure 2: Gender and Age wise distribution of hematocrit and Platelet count respectively

DISCUSSION

Researches have revealed the peripheral deterioration of RBCs, unproductive hematopoiesis, and sequestration in the spleen as probable causes of anemia induced by malaria (Sajjanar, Dinesh, Kanbur, Mane, & Athanikar, 2013). The present study demonstrated the clinical outcomes associated with malaria. The present study showed the male predilection 61 (61%) in patients suffering from malaria fever. These findings were supported by another research wherein mostly patients were male (64.9%). (Lathia & Joshi, 2004) Likewise, one research by Manas et. al corroborated these findings and showed male predisposition (64,1%). This can be elucidated as males are more probable to work in malaria prevalent regions for instance mineworkers, fishermen and forest workers (Kotepui, Ratcha, & Uthaisar, 2017). The most observed complication of malaria infection is manifested as mild to severe thrombocytopenia. The present study revealed that thrombocytopenia was found in most of malarial patients. These findings were consistent with the research by Kochar et al. who showed the significant relationship of thrombocytopenia with malaria. Similarly, another research reported total, 54.4% of patients with malaria fever revealed thrombocytopenia. Their study revealed that thrombocytopenia associated with malaria was found in 71.4% patients. These facts were supported by additional researches presenting thrombocytopenia associated with malaria was observed in 63% cases by Khan et al. 82% cases in research by Srivastava et al, and 93.3% patients in research by George and Alexander. Multiple factors and mechanisms are suggested to be involved in development of anemia in malaria fever for example mechanical devastation of the parasitized red blood cells, decreased production of RBC in bone marrow, and phagocytosis of RBCs infected by parasites (Maina et al. 2010). The present study showed consistency with the above reported research and revealed that mostly patients 41(41%) reported 36-45% hematocrit indicating that the incidence of anemia was high. Timely recommendation by a health professional with the existence of symptoms may lessen more complications and its extent.

CONCLUSION

The study concluded that thrombocytopenia and anemia are frequently observed hematological abnormalities in patients with malaria. It suggests that the presence of thrombocytopenia and anemia in a patient with fever can be indicative of malaria, warranting further specific testing for confirmation. Therefore, thrombocytopenia can serve as a valuable diagnostic indicator for malaria, complementing clinical symptoms and additional laboratory tests.

CONFLICT OF INTEREST

The authors declared no conflict of interest

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