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Hematological Changes in Children with Plasmodium Vivax Malaria Attending Elnihoud Teaching Hospital

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Abstract

Malaria is a major health problem in developing countries which is transmitted through female Anopheles mosquitoes and caused by various species of plasmodium parasite. The objective for this study was to assess the hematological changes in children with plasmodium vivax malaria attending Elnihoud Teaching Hospital. This was cross-sectional study; carried out in Elnihoud Teaching Hospital. A total of 170 patients were enrolled in this study, 120 plasmodium vivax positive males and females as cases and 50 malaria negative males and females as control, between the ages of 1 to 14 years. Patients suffering from hematological disease, liver or renal impairment and different infection producing sepsis, dengue infection, viral hepatitis, leptospirosis were excluded. We compared the levels of hemoglobin (Hb), mean corpuscular volume (MCV), total white blood cells (TWBCs), platelet, pancytopenia and lymphocytes count between plasmodium vivax malaria patients and controls. The study revealed an elevation in microcytosis MCV (p= 0.006), leucopenia (p= 0.006) and thrombocytopenia (p= 0.006) among Plasmodium vivax patients than the controls. The study findings indicate that Plasmodium vivax is one of the common causes of hematological changes among children.

Keywords

Plasmodium Vivax, Thrombocytopenia, Thrombocytosis, Leucopenia, Leucocytosis

1. Introduction

Malaria has been known to cause human disease for thousands of years and still remains one of the most common diseases affecting human population all over the world [1]. In addition to posing a key health problem it contributes as one of the major killers in pediatric population particularly in the developing world [2]. Vivax malaria was usually considered as a relatively benign illness, however over last decade or two, it is being increasingly realized that the vivax malaria is not a benign illness anymore and there have been number of reports and case series demonstrating severe hematological and clinical manifestations associated with vivax malaria mono-infection [3]. With almost three billion people living at risk of vivax malaria and at least 100 million clinical attacks annually, the frequency, character, and risks of life-threatening illness associated with a diagnosis of Plasmodium vivax represents a conspicuously important global health issue [4].

Plasmodium vivax (P. vivax) is the second most common cause of malaria in the world after Plasmodium falciparum, moreover, P. vivax has a wider geographical distribution, where more people are at risk of infection (2.85 billion) [5], and it is more difficult to control because of the hypnozoite forms of the parasite [6]. Recent reports on P. vivax infections suggest that this parasite may be evolving and adapting to new epidemiological contexts, becoming not only more virulent but also more frequent in countries where the incidence has traditionally been low [7]. Furthermore, it has

been shown that P. vivax is able to infect even Duffy-negative African patients [8].

This study aimed to assess the hematological changes in children with plasmodium vivax malaria attending Elnihoud Teaching Hospital.

2. Material and Method

This was cross sectional study; carried out in Elnihoud Teaching Hospital, Elnihoud Locality, West Kordufan State, Sudan. From December 2017 to December 2018. Elnihoud Teaching Hospital is tertiary referring hospital receiving approximately about 15,000 patients suffering from Malaria annually. Total of 170 patients were enrolled in this study, 120 plasmodium vivax positive males and females a cases and 50 malaria negative males and females as control, between the ages of 1 to 14 years. Institutional research and ethics approval was obtained before commencement of the study. All participants spoke sufficient Arabic to provide informed consent.

2.1. Inclusion Criteria

Males and females plasmodium vivax positive for the cases, and males and females negative malaria as control with symptoms and signs suggestive of malaria (fever with chills and rigor, headache, nausea with or without vomiting, arthralgia, diarrhea, weakness, drowsiness, confusion, stupor, anemia, jaundice, signs of dehydration, hepatomegaly, and splenomegaly and others), both groups between the ages of 1 to 14 years.

2.2. Exclusion Criteria

Patients with hematological disorders, liver or renal impairment, sepsis, dengue infection, viral hepatitis and leptospirosis were excluded.

3. Results

Figure 1 shows the ages of the study groups. For the P. vivax positive patients, (41.7%) of them their ages were under 5 years old, and (58.3%) their ages from 5 to 14 years old. For the control group (72%) of them their ages were under 5 years old and (28%) their ages from 5 to 14 years old.

Figure 2 shows the sex of the study groups. For patients with P. vivax, 50% were males and 50% were females. For the control group, 70% were males and 30% were females.

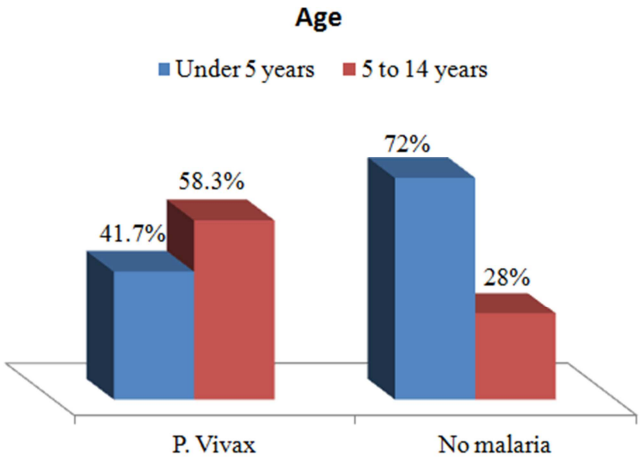

Figure 1. *Ages of study groups.*

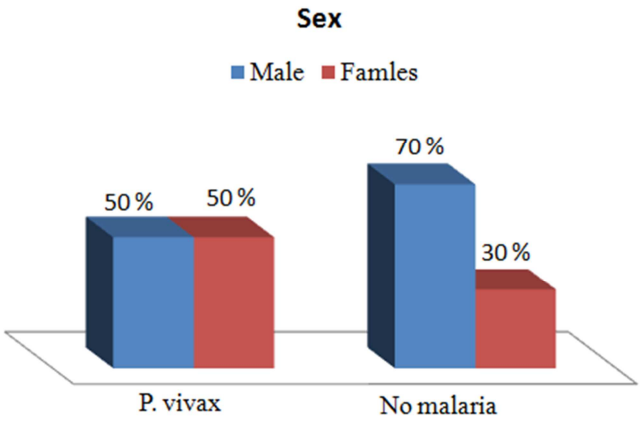

Figure 2. *Sex of study groups.*

Table 1. *Hematological parameters of the study groups.*

Parameter	P. Vivax	No malaria	Total	*P*-value
Hb				
Normal	101 (84.2%)	40 (80%)	141 (83%)	
Low (Anemia)	19 (15.8%)	10 (20%)	29 (17%)	0.509
Total	120 (100%)	50 (100%)	170 (100%)	
MCV				
Normal	46 (38.3%)	7 (14%)	53 (31.2%)	
Microcytic	73 (60.8%)	43 (86%)	116 (68.2%)	0.006
Macrocytic	1 (0.9%)	0 (0%)	1 (0.6%)	
Total	120 (100%)	50 (100%)	170 (100%)	
TWBCs				
Normal	93 (77.5%)	31 (62%)	124 (73%)	
Leucopenia	11 (9.2%)	2 (4%)	13 (7.6%)	0.006
Leucocytosis	16 (13.3%)	17 (34%)	33 (19.4%)	
Total	120 (100%)	50 (100%)	170 (100%)	
Platelet				
Normal	76 (63.3%)	40 (80%)	116 (68.2%)	0.006
Thrombocytopenia	39 (32.5%)	5 (10%)	44 (25.9%)	

Parameter	P. Vivax	No malaria	Total	*P*-value
Thrombocytosis	5 (4.2%)	5 (10%)	10 (5.9%)	
Total	120 (100%)	50 (100%)	170 (100%)	
Pancytopenia				
Present	10 (8.3%)	0 (0%)	10 (5.9%)	0.035
Absent	110 (91.7%)	50 (100%)	160 (94.1%)	
Total	120 (100%)	50 (100%)	170 (100%)	
Lymphocytes count				
Normal	57 (93.4%)	42 (85.7)	99 (90%)	
Decrease	3 (4.9%)	0 (0%)	3 (2.7%)	0.014
Increase	1 (1.7%)	7 (14.3	8 (7.3	
Total	120 (100%)	50 (100%)	170 (100%)	

Table 1 shows the hematological parameters of the study groups. For hemoglobin (Hb), there was an increased incidence of anemia in cases with P. vivax (65.5%) compared to control group but with no significant difference. Regarding mean corpuscular volume (MCV), the study revealed significant association between macrocytosis and cases with P. vivax (62.9%) with (*p*- value = 0.006). Concerning total white blood cells (TWBCs), there was significant association between patients with P. vivax and leucopenia (84.6%) with (*p*-value = 0.006), while there was decrease in the cases of P. vivax that had leucocytosis (48.5%) compared to the group with no malaria but with no significant value. For platelet, the results revealed significant association between cases with P. vivax and thrombocytopenia (88.6%) versus control group (*p*- value = 0.006), but for thrombocytosis the two groups were equal (50%). For pancytopenia, significant increase in the P. vivax cases with pancytopenia (100%) compared to control group was disclosed by current study (*p*-value = 0.035). Regarding lymphocytes, the results shows significant association between the study group and lymphocytopenia (100%) compared to the cases with no malaria (*p*- value = 0.014).

4. Discussion

Plasmodium vivax infection causing severe malaria is increasingly being reported. In present study, the participants that their ages under five years represent (50.6%) while those with ages from five to fourteen were (49.4%). For sex, (55.9%) of the participants were male and (44.1%) were female. The study revealed no significant difference between the participants that having P. vivax and the others with no malaria regarding anemia (low Hb level). Significant elevation in the number of cases with P. vivax that having microcytic MCV, leucopenia and thrombocytopenia compared to those with no malaria was showed by the current study. These findings were in consistence with similar results reported by Latif and Jamal who study the hematological changes in complete blood picture in pediatric patients of malaria caused by plasmodium vivax and falciparum [1]. Ankit *et al* stated that vivax malaria was increasingly associated with thrombocytopenia and anemia over last decade from their study titled changes in hematological manifestations in children with vivax malaria [3]. Similar findings disclosed by Hassan and Wisam and reported high prevalence of thrombocytopenia in vivax malaria patients [9]. Other study carried out by Katira and Shah and revealed similar result regarding the thrombocytopenia in children with P. vivax infection [10]. Study titled hematological changes in malaria-infected children in North-West Nigeria run by Momodu *et a* and stated that changes in hematological values in malaria-infected children were associated with anemia and thrombocytopenia *l* [11]. Similarly Subhasish and Dipkana disclosed that malaria can cause significant hematological changes with high incidence of anemia, thrombocytopenia [12]. From previous studies and the current one P. vivax infection in children can lead to remarkable effect on the different hematological parameters.

The current study shows that only few patients with P. vivax have pancytopenia, while there was no pancytopenia among the cases with no malaria. Significant increase in number of the patients with P. vivax having low lymphocytes account versus the cases with no malaria was revealed by the present study. Similar to the current result, Geleta and Ketema, and Momodu *et a*l reported decrease in lymphocytes account in malaria associated with P. vivax among children but with no significant value [13], [11].

5. Conclusion

Plasmodium vivax infection is one of the common causes of hematological changes among children beside the clinical manifestation of the malaria.

Thrombocytopenia is a clue for malaria diagnosis. In case of pancytopenia with plasmodium infection bone marrow examination should be deferred after malaria therapy and further complete blood count.

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