Correlation of hematological parameters in Malaria positive cases – A retrospective study in rural Melmaruvathur, South India

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Abstract

Background: Malarial infection is endemic in many countries of Asia, South Pacific, North Africa, Middle East and South and Central America. It is well known that it affects the haemopoietic physiology and induces changes in hematological parameters.
Objectives: This study was undertaken to know the prevalence of malarial infection in this rural area of Melmaruvathur, South India and to assess the changes in hematological parameters in malaria positive individuals.
Materials and Methods: This was a retrospective study carried out in Melmaruvathur Adhiparasakthi Institute of medical sciences hospital atMelmaruvathur. Hematological parameters of all malaria positive cases who visited the hospital during the year 2012-2015 were collected and statistically analyzed along with demographic data.
Results and Observations: A total of 60 cases were recorded during the year 2012-2015. Males were commonly affected in this rural area. The mean age of the patients was 33.57 with standard deviation 14.96. Out of these 60 cases, plasmodium vivax affected 55 cases and only five cases were found affected by Plasmodium falciparum infection. Thrombocytopenia was observed in 97% of infected individual and it was significant in Plasmodium vivax infection (p=0.017). Mild thrombocytopenia was noted in 75% of cases and moderate thrombocytopenia was observed in 21.7% of cases. Anemia was noted in 30% of affected individuals and significant anemia was observed in Plasmodium falciparum infection (p=0.003).
Conclusion: The frequency of malaria was found less common in this rural area. Thrombocytopenia was the common hematological finding and next to that was mild degree of anemia among malaria patients.

Keywords: Malaria- prevalence, Thrombocytopenia, Anemia, Hematological findings.

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Introduction

Malaria is a disease of tropical and subtropical countries particularly Africa and Asia[(1)]. It remains one of the major health problems in the tropics with increased morbidity and mortality[(2)]. Though Africa accounts for 90% of mortality burden of malaria, South east Asia also still suffers considerable mortality and morbidity[(3)]. Mortality rate is usually high in severe malaria and hematological changes which are the most common complication of malaria play an important role in these fatal complication. So, an understanding of hematological changes will help in diagnosis and treatment and also predict and prevent various complications[(4)]. This study was conducted to determine the frequency of malaria in this rural area of Melmaruvathur and also to find out the changes in the hematological parameters in malaria positive cases.

Materials and Methods

This was a retrospective study conducted in Melmaruvathur Adhiparasakthi Institute of medical sciences hospital, a tertiary health center at Melmaruvathur. All confirmed cases of malaria who presented to this hospital during the period of June 2012 to June 2015 were included in this study. Malaria was confirmed by identification of parasite by gold standard thin smear study stained with Leishman stain. All hematological parameters were performed in Benesphera hematology auto-analyzer. Hematological parameters include red blood cell(RBC) count, white blood cell (WBC) count, Differential count, Platelet count, Haemoglobin (Hb), Hematocrit (HCT), Mean corpuscular volume (MCV), Mean corpuscular hemoglobin (MCH), Mean corpuscular hemoglobin concentration (MCHC), Red cell distribution width (RDW). The demographic data of age, gender and hematological data along with type of malarial species of affected individuals were collected from the central laboratory registers of the hospital. The results were entered on a excel spread sheet and statistically analyzed.

Results and Observations

Only 60 cases were recorded as malaria during the year 2012-2015.The mean age of affected individual was 33.5 with standard deviation(SD) of 14.95 (Table 1). Males were predominantly affected 87% (n=52) than females 13%(Fig. 1). Among the malarial parasite, the common species identified in this area was Plasmodium vivax 92%(n=55) whereas Plasmodium falciparum was observed in 8% of cases (n=5) only.

Platelet count evaluation of affected individual showed mild thrombocytopenia (50,000-150,000/ul) in 75% of cases, Moderate thrombocytopenia (20,000-50,000/ul) in 21.7% of cases. Only 3% of cases showed normal platelet count (150,000-400,000/ul) and none of them showed severe thrombocytopenia (<20,000/ul). Mean platelet count in P. vivax infection was 78,890 with SD of 33,050 whereas 1,28,400 with SD of 1,10,540 was noted in Plasmodium falciparum infection. This reduction in platelet count was significant in Plasmodium vivax infection when compared to Plasmodium falciparum infection (p=0.017) in this area.(Table 2 & 3). Evaluation of hemoglobin count showed a normal reference range of 11-16g/dl in 70% of cases and least hemoglobin count of 4.5g/dl was noted in Plasmodium falciparum infection(Table 4). Mean hemoglobin count in Plasmodium vivax infection was 11.87 with SD of 1.95 whereas mean hemoglobin count in Plasmodium falciparum infection was 8.84 with SD of 3.20. This showed that anemia was significant in Plasmodium falciparum infection than Plasmodium vivax infection with a p value of 0.003 in this area (Table 5). It was also supported by other red cell parameters evaluation in both types of malaria cases (Fig. 2). Among the WBC parameters 85.45% of vivax infective cases and 80% of falciparum infected cases showed normal WBC count. All falciparum infected cases showed normal differential count distribution whereas vivax infection showed 20% neutrophilia and 11% lymphocytosis. (Table 6).

Results and observations

Table 1: Age Distribution

	No of cases	Minimum	Maximum	Mean	Std. Deviation
Age	60	2.00	80.00	33.57	14.96

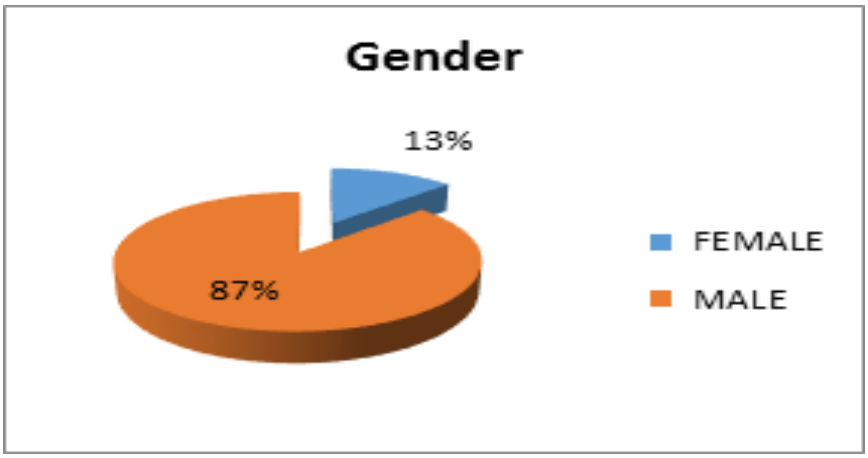

Fig. 1

Table 2: Platelet counts in malaria positive individuals

Platelet counts	P.Vivax (n=55)	P.Falciparum (n=5)	Total (n=60)
<20 ,000/ul	0	0	0
20,000-50,000/ul	12 (21.8%)	1(20%)	13(21.7%)
50,000-150,000/ul	42(76.4%)	3(60%)	45(75%)
150,000-400,000/ul	1(1.8%)	1(20%)	2(3.3%)

Table 3: Mean Platelet counts in two types of malaria

	No of cases	Mean	Std. Deviation	Std. Error Mean	
P. Vivax	55	78.890	33.050	4.460	P=0.017*
P. Falciparum	5	128.400	110.540	49.430	

Table 4: Hemoglobin counts in malaria positive individuals

Hemoglobin counts	P. Vivax (n=55)	P. Falciparum (n=5)	Total (n=60)
<6g/dl	0	1 (20%)	1 (1.7%)
6-8g/dl	3(5.5%)	1(20%)	4 (6.7%)
8-11g/dl	12(21.8%)	1(20%)	13(21.7%)
11-16g/dl	40(72.7%)	2(40%)	42(70%)

Table 5: Mean Hemoglobin counts in two types of malaria

	No of cases	Mean	Std. Deviation	Std. Error Mean	
P. Vivax	55	11.87	1.95	0.26	P=0.003*
P. Falciparum	5	8.84	3.20	1.43	

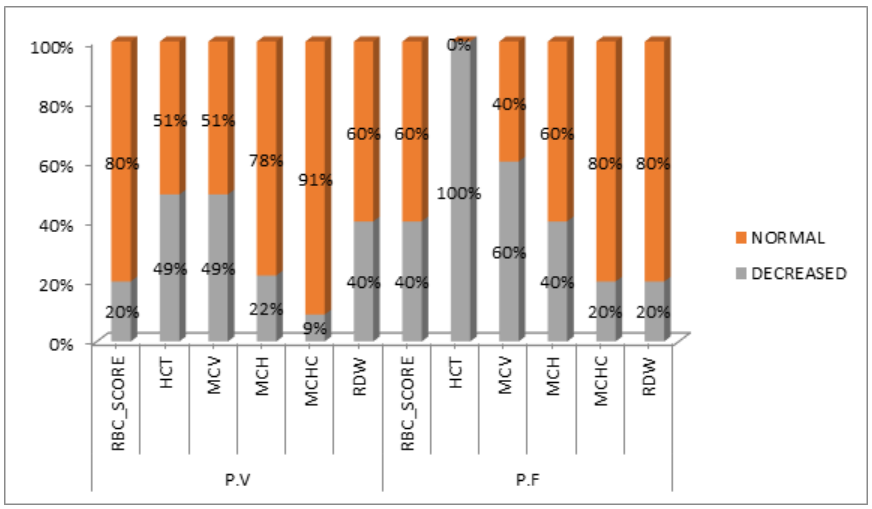

Fig. 2 Red blood cell parameters in two types of malaria

Table 6: WBC parameters in malaria positive individuals

Parameters	Decreased		Increased		Normal		Reference range
	P.V	P.F	P.V	P.F	P.V	P.F	
WBC	5(9%)	1(20%)	3(5.4%)	0	47(85.45%)	4(80%)	4000-11000/ul
Neutrophil	0	0	11(20%)	0	44(80%)	5 (100%)	50-70%
Lymphocyte	4(7.3%)	0	6(11%)	0	45(82%)	5(100%)	20-40%

P.V – Plasmodium vivax P.F – Plasmodium falciparum

Discussion

Malaria is a protozoal disease caused by the genus Plasmodium with four species pathogenic to man namely vivax, falciparum, ovale, malariae. In India, the prevalence of vivax and falciparum infection is 50% each, but proportion of cases in different region is variable[5,6]. In our study, 92% cases were of vivax infection and only 8% was falciparum infection. This is similar to studies done by Yasmeen et.al and UM Jadhav et.al who have reported 65.6% and 62% of vivax infection and 25.3% and 37% of falciparum infection respectively in Mumbai whereas higher incidence of falciparum infection was reported in studiesdone at Saudi and Dubai[1,7]. Similar to other studies[1,4,5,7,8,9] males were commonly affected in our study also whereas male predominance for vivax infection (60%) and female predominance (56%) for falciparum infection was observed in a study[3]. Hematological parameters are measurable indices of blood that serve as a marker for disease diagnosis. Hematological abnormalities are considered as a hallmark of malaria. Anemia and thrombocytopenia are the most frequently found abnormality in patients suffering from malaria.[10] The prevalence of thrombocytopenia was 97% of the cases in our study and highlights, the fact that normal platelet count is unlikely in the laboratory finding of malaria. Thrombocytopenia is common in vivax infection than falciparum which has also been observed in another study[7,11]. The finding of thrombocytopenia was significant in vivax infection with a p value of 0.017 in our study whereas there is no such association between two types of malaria was observed in a study[1]. Severe thrombocytopenia (<20,000/ul) was not observed in this study whereas Colonel et. al observed it in 26% of vivax infection and 23% of falciparum infection. The mechanism of thrombocytopenia could be due to peripheral destruction and consumption by DIC. A study showed that the production of IL-10 in malaria is responsible for thrombocytopenia by suppressing thrombopoiesis[12]. Oxidative stress damage of thrombocytes has also been implicated in the etiopathogenesis of thrombocytopenia based on the finding of low levels of platelet superoxide dismutase and glutathione peroxidase activity and high platelet peroxidation levels in malaria patients when compared to those of healthy subjects[13]. Presence of small fragmented platelets in the peripheral smear supported

this view .The second common hematological abnormality in malaria was anemia. In our study, 70% of affected individuals showed hemoglobin level within normal reference range which is in contrast with other studies where anemia was the common presentation[5,7,14]. The finding of anemia is significant in falciparum infection in our study (P value=0.003) which is similar to the study by Layla et. al(P value=0.0002). The pathogenesis of anemia in malaria is complex and multifactorial. It is thought to result from a combination of hemolysis of parasitized red cells, depressed erythropoiesis by TNF-Alfa, depletion of colony forming unit-Pluripotent stem cells as well as ineffective erythropoiesis with dyserythropoietic changes and anemia of chronic disease[15,16]. The feeding of iron by intra cellular malarial parasite may also contribute to anemia. WBC count was observed within normal reference range in 85% cases in our study which is also supported by a study[7]. Differential count distribution was normal in falciparum infection whereas neutrophilia (20%), lymphocytosis (11%), lymphopenia (7%) was observed in cases of vivaxinfection.

Conclusion

The Prevalence of malaria is less common in this rural part of South India. The prevalence of Plasmodium vivax infection (92%) is higher as compared to Plasmodium falciparum infection (8%). Mild degree of anemia and thrombocytopenia is observed in infected individuals. The finding of thrombocytopenia was significant in vivax infection and anemia in falciparum infection.

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