A Study of changes in Hemoglobin, Red Blood Cells, Erythrocytes Sedimentation Rate and Platelet Count in Malaria Patients

Dr. Mayuri V Thaker[1], Dr. Seema Baxi[2], Dr. Vikas G Doshi[3] ,Dr. Vibha V Gosalia[4]

Abstracts:

Introduction: *Plasmodium Vivax (P.Vivex)* and *Plasmodium Falciparum (P.Falciparum)* are more common infections in the Indian subcontinent. Peripheral smear examination is the major diagnostic tool of malaria. Thrombocytopenia is also counted as a early sign of malarial infection. Moderate to severe hemolytic anemia, thrombocytopenia is commonly seen in *P.falciparum* malarial infection [5]. If early hematological changes are picked up in time, complications of malarial infection can be prevented. The present study was done to study changes in HB, RBC count, ESR and Platelet count in patients of malaria. **Objectives:** 1) to know prevalence of different species of malaria in Bhavnagar. 2) To study changes in HB, RBC count, ESR and Platelet count in patients of malaria. 3) To note, if any species specific changes in HB, RBC count, ESR and Platelet count in patients of malaria exist. **Materials & Method:** Hematological parameters in indoor and outdoor patients of malaria were studied in Central laboratory, Sir T. Hospital, Bhavnagar after taking appropriate history. Total 287 patients were studied for different haematological parameters. **Results & discussion:** Out of 287 patients, 204 (70.6%) were infected with *P. falciparum* whereas 83 (28.7%) had *P. vivax* infection. Majority of patient suffering from malaria had Anaemia 256 (89.2%). However severity of anemia is more in *P. falciparum* (25%). Majority 174(74.7 %) of the patients had low red cell count. Low red cell count was more in *P. falciparum* malaria (83.5%). 81.5% patients had thrombocytopenia, severe thrombocytopenia was found in *P. falciparum* (26.5%) whereas mild (31.3%) and moderate (38.6 %) thrombocytopenia was found in *P. vivax* malaria. **Conclusion:** Significant hematological changes like in hemoglobin level, platelet count, ESR and RBC count are affected more in *P. falciparum* malaria as compared to *P. vivax* malaria.

Key Words: Hematological changes, *P. falciparum*, *P. vivax*

[1]Assistant Professor, [2]Associate Professor , Department of Pathology, Govt. Medical College, Bhavnagar, Gujarat, India,

[3]Assistant Professor, Department of Preventive & social Medicine, Govt. Medical College, Baroda, Gujarat, India

[4]Assistant Professor, Department of Preventive & social Medicine, Govt. Medical College, Bhavnagar, Gujarat, India

Corresponding author mail: drmayuri_2881@yahoo.com

Introduction: Malaria is an acute, recurrent and sometimes chronic vector borne protozoal disease that has worldwide distribution in tropical and subtropical regions [1,2,3]. It is caused by infection with parasites of genus plasmodium and transmitted to man by the bite of female anopheles mosquito.[4] Genus plasmodium has four species- *P.vivax, P. falciparum, P.ovale, P.malariae. P.vivax* and *P. falciparum* are more common infections in the Indian subcontinent. *P.falciparum* produces the most serious form of disease.

In spite of worldwide efforts to reduce its transmission, malaria still remains a major cause of morbidity and mortality especially in children, in whom overall fatality rate is 10-30%.[5] Higher mortality rates are seen in rural and remote areas due to restricted access to diagnosis & treatment. Deaths occur principally in non-immune persons. [6]

Malaria can affect majority of the body organs including liver, spleen, brain, gastrointestinal tract, gall bladder, pancreas, blood vessels and placenta. So the clinical picture consists of a spectrum ranging from malaise and body ache to CNS symptoms like delirium and coma. Hyperparasitemia with sequestration in the internal organs, intravascular and immune mediated destruction of RBCs and platelets and cytokine-mediated injury are the various mechanisms by which the different organs are affected. [7]

The target of the malarial parasite is the red blood cell, though it produces a variety of changes in blood ranging from anemia, normoblastemia, bone marrow suppression, cytopenias to fulminant DIC. Peripheral smear examination is the major diagnostic tool of malaria. Some hematological changes are predominant in certain species of plasmodia. In recent years, it is seen that thrombocytopenia is a common and an early sign of malarial infection. [5] If early hematological changes are picked up in time, the path of the disease and hence the outcome of the disease can be modified.

The present study was done to study changes in HB, RBC count, ESR and Platelet count in patients of malaria.

Material and Methods:

The present study was conducted on the indoor and outdoor malaria positive cases over a period of six months, in Sir T Hospital Bhavnagar, and total 287 patients were included in our study to detect the hematological changes occurring in patients of malaria.

The details of patient including name, age, sex, date of admission, ward in

hospitalized patients and OPD unit in outdoor cases was noted. History elicited in all the cases included fever, jaundice, convulsion, nausea, vomiting, duration and progress and history of bleeding from any site. In addition, drug history, similar complaints in the past and family history were included.

The diagnosis of malaria was established on peripheral blood film. Further samples were collected in ethylene diamine tetra acetic acid and citrated tubes for complete blood count examination,& ESR. Thin film was stained with Leishman's stain. Thick film was stained with Giemsa stain and grading was done from thick film examination (Thin and thick films were made on different slides by method described in Practical Hematology - Dacie and Lewis, 10th Edition) [8].

Grading of parasitemia was done according to following method:

+ 1-10 parasites per 100 thick film High Power Field (HPF)

++ 11-100 parasites per 100 thick film HPF.

+++ 1-10 parasites per one thick film HPF.

++++ >10 parasites per one thick film HPF.

Initial 56 samples were estimated manually. Hemoglobin estimation was done colorimetrically, total WBC count and platelet count were done using Neubaer's chamber whereas 233 samples were tested on automated cell counter with complete profile including Hb, total WBC count, RBC count, & Platelet count. In 2 samples, the platelet indices could not be obtained due to instrumental error.

Erythrocyte sedimentation rate samples were collected in sodium citrate tubes and done by Westergren method.

Analysis: The data was entered in Microsoft Excel to evaluate the results. Statistical analysis was done using statistical package (SPSS).

Results:

Out of 287 patients, Hb, TC, DC, ESR count were done on all patients. RBC indices and platelet indices were performed only in 233 patients

Out of 287 patients, 204 (70.6%) were infected with *P. falciparum* whereas 83 (28.7%). had *P. vivax* infection.

Table 1: Severity of anemia in P. falciparum (PF) and P. vivax (PV) malaria

Hb	Species		Total (%)
	PF (%)	PV (%)	
Normal	14(6.9)	17(20.5)	31(10.8%)
Mild	53(26.0)	40(48.2)	93(32.4%)
Moderate	86(42.2)	24(28.9)	110(38.3%)
Severe	51(25.0)	02(2.4)	53(18.5%)
Total	204(100)	83(100)	287(100.0%)

Chi-square (χ^2) =38.11 (p<0.00)

Majority of patient suffering from malaria had Anemia 256 (89.2%). However severity of anemia is more in P. Falciparum (25%) as compared to P. Vivax (2.4%) The association was statistically significant. (Table 1)

Table 2: Relationship of RBC count in P.falciparum (PF) and P.vivax (PV) malaria

RBC	SPECIES		Total (%)
	PF (%)	PV (%)	
Normal	24(14.1)	27(42.9)	51(21.9)
Low	142(83.5)	32(50.8)	174(74.7)
High	04 (2.4)	04(6.3)	8(3.4)
Total	170(100)	63(100)	233(100)

Chi-square (χ^2) = 26.0 (p < 0.00)

In this study, 174(74.7 %) of the patients had low red cell count. In *P. falciparum* malaria, 142 (83.5%) had decreased red cell count. However in *P. vivax* malaria, there was almost equal number of cases of normal and low count. The association between RBC count and species was strongly significant. (Table 2)

Table 3: Relationship of ESR with P.falciparum (PF) and P.vivax (PV) malaria.

ESR	SPECIES		Total (%)
	PF (%)	PV (%)	
Normal	10(4.9)	5(6.0)	15(5.2)
Mild ↑	70(34.3)	31(37.3)	101(35.2)
Moderate ↑	88(43.1)	42(50.6)	130(45.3)
Severe ↑	36(17.6)	5(6.0)	41(14.3)
Total	204(100)	83(100)	287(100)

Chi-square (χ^2) = 6.6 ($p > 0.05$)

In *P. falciparum* malaria, markedly raised values were seen in 17.6% compared to only 6% cases in *P. vivax.* Most of the patients in both species had moderately raised ESR. However this difference was not statistically significant. (Table 3)

Table 4: Relationship of platelet count (PC) with P.falciparum (PF) and P.vivax (PV) malaria.

PC	SPECIES		TOTAL (%)
	PF (%)	PV (%)	
Normal	38(18.6%)	15(18.1%)	53(18.5%)
Mild ↓	49(24.0%)	26(31.3%)	75(26.1%)
Moderate ↓	57(27.9%)	32(38.6%)	89(31.0%)
Severe ↓	54(26.5%)	7(8.4%)	61(21.3%)
Profound ↓	6(2.9%)	3(3.6%)	9(3.1%)
Total	204(100.0%)	83(100.0%)	287(100.0%)

Chi-square (χ^2) = 12.4 ($p < 0.05$)

Overall 81.5% patients had thrombocytopenia. In P.vivax malaria, mild and moderate degree of thrombocytopenia was more common whereas in P.falciparum malaria severe thrombocytopenia was more commonly seen (Table 4). There was significant association between species of malaria and degree of thrombocytopenia.

Discussion: In this study, the prevalence rate of *P. Falciparum was* 204 (70.6%) and *P. vivax* was (28.7%).

High prevalence of P. Falciparum was found in different studies shah et al [9], Jatin et al [10],Bashwri et al[11] & Rihards et al[12] in spite of different geographical areas . *P.vivax* infection was higher in study of Jain et al and Bashawri et al in comparison to other studies.

In our study prevalence of anemia was 89.2% which is comparable to Shah et al and Jain et al whereas in the study of Bashawri et al and Richard et al % of anemia was lower. Anemia is a very common feature in malaria and prominent (moderate severity) especially in falciparum malaria.

In present study ESR was raised in 94.8% cases and equally in both *P.falciparum* and *P. vivax*; Eriksson B et al[13] found no major difference in ESR whereas increased ESR (46%) was found in study of Khan et al[14]. Platelet count was decreased in 81.7% cases which is comparable to shah et el[9], Jatin et el[10] ,Bashwri et al[11] & Rihards et al[12] with.

Thrombocytopenia is present equally in both P.falciparum and P. vivax. Mild to moderate decrease was more common among cases of vivax malaria whereas moderate to severe thrombocytopenia were more common among falciparum cases. Mechanisms of thrombocytopenia in this study could be immune mediated destruction of circulating platelets, decreased platelet survival in falciparum malaria, splenic uptake and sequestration and hypersensitive platelets.

Conclusion: *P. falciparum* was the predominant species detected in the patients of malaria. Moderate fall in the hemoglobin (Hb), moderately raised ESR, moderate to severe thrombocytopenia (decreased in platelet counts) were the significant hematological changes found in P. Falciparum malaria as compared to P.Vivex malaria.

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Acknowledgment: I am extremely thankful to Dr.Ajay Satnami, Dr.Samir Shah, Mrs.Hemaben Trivedi, Mr.Rajeshbhai Bhatt and all the technical staff of central pathology laboratory for their help.