



## Original Research Article

## Study of haematological and coagulation profile of Malaria in Tertiary level care centre in Ghaziabad

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## ABSTRACT

**Objective:** To study some hematological parameters in patients with complicated severe malaria and their relations to clinical outcome.**Materials and Methods:** This was a cross sectional observational study, including 100 patients from a tertiary care centre in Ghaziabad patients who were diagnosed to have malaria by peripheral smear examination (both thick and thin smear) or Malaria Rapid Antigen. Blood sample for haematological and coagulation study were taken.**Results:** Out of 100 patients 62 patients had Hb % less than 10 gm percentage in which 14 patients had Hb < 6 gm % (severe anaemia). Leucocytosis was seen in 12% of patients and Leucopenia was seen in 19% of the total patients. Packed cell volume was decreased in about 86% of the patients. ESR increase was seen in 73% of the patient. Thrombocytopenia was observed in 63% of the patients and 25% of the patients with mixed infection had severe thrombocytopenia. PT and APTT was increased in 22% and 14% of the total cases. Bleeding time was increased in 5% of the total case and no any patients with vivax malaria had increased bleeding time. Mixed infection shows as falciparum malaria. Sever anemia, thrombocytopenia, increase BT, PT and APTT associated to severity and complication of malaria.**Conclusion:** This study concluded that hematological changes are common complications encountered in severe malaria, but they are not related to the clinical outcome.© 2020 Published by Innovative Publication. This is an open access article under the CC BY-NC license (<https://creativecommons.org/licenses/by-nc/4.0/>)

## 1. Introduction

Malaria is a common protozoal disease transmitted by the bite of infected female Anopheles mosquitoes. It is prevalent in 108 countries containing 3 billion peoples and causes nearly 1 million deaths each year.<sup>1</sup> Malaria affects mainly poor, underserved and marginalized populations in remote rural area with limited access to health care and inadequate control measures.

In India, about 21.98% population lives in malaria high transmission localities.<sup>2</sup> The clinical presentation of malaria varies from mild to complicated according to species involved, the patients status of immunity, intensity of infection and presence of concomitant condition. In manifestation of severe *P. falciparum* malaria the signs

may include severe anemia, thrombocytopenia, renal failure, acidosis, hemoglobinuria, jaundice, convulsions and DIC. Haematological, hepatic and renal are some of the common systems involved in complicated malaria. India has taken steps to control malaria such as National Malaria Control Programme in 1953. After this government came out with National Malaria Eradication Programme (NMEP) in 1958. Malaria re-emerged in 1960. Later government came with Modified Plan of Operation in 1977.<sup>1</sup> The most severe forms of deaths from malaria are caused by *Plasmodium falciparum*, with other species rarely producing serious complications and debilitating relapses. Hematological abnormalities are considered a hallmark of malaria, bearing an impact on final outcome and representing indices of prognostic and follow up value. These include severe anemia, coagulation disturbances, leucocyte numerical or functional changes and spleen involvement.

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## 2. Materials and Methods

A cross sectional observational study was done in tertiary level health care institute Santosh Medical College and Hospital, Ghaziabad from Dec. 2017 to Nov. 2019. A total of 100 patients who were diagnosed to have malaria over a period of two years admitted in Santosh medical college and hospital, Ghaziabad were included in the study. Those cases having or suffered from chronic liver diseases, fever of any other causes, patients with inborn error of coagulation were excluded from study.

All the patients in this study were proved to be cases of malaria either by peripheral smear examination (both thick and thin smear) or Malaria Rapid Antigen Tests. The blood smears were stained with leishman stain. The following investigations for haematological and coagulation parameters were carried out- Haemoglobin estimation, RBC count, Total and Differential counts of leucocytes, Total platelet count, Whole blood clotting time, Prothrombin time and Activated partial thromboplastin time by automated blood analyzer. ESR estimation by Westergren's method. PCV by Wintrobe method'

A detailed history regarding age, sex, nature and duration of illness, blood transfusion and history of anti-malarial therapy were taken & Clinical examination findings were noted. Blood sample for haematological and coagulation study were taken. Statistical analysis was done using the excel and with appropriate statistical methods.

## 3. Result

In the study the predominant age group affected was the age group <40 year. The number of patients above the age of 60 year were very less i.e. 2%. There were no patients above the age of 70 years recorded in this study. The mean age of our study was 34.7 (Table 1).

**Table 1:** Showing age wise distribution

S. No.	Age group	No.	Percentage
1	<30	40	40
2	31-40	35	35
3	41-50	13	13
4	51-60	10	10
5	>60	2	2
<b>Total</b>		100	100

Out of the 100 patients included in the study 68 were males and 32 were females. Number of males affected in our study were more compared to females. The male to female ratio was 2.12 : 1.

In this study the majority of the population was from rural areas. About 63% of the patients were from rural areas. The M:F distribution in rural areas was 1.35:1 even in urban patients the M:F ratio was 1.4:1 (Table 2).

### 3.1. Investigations

On examination of peripheral smears 57% of the patients had normocytic normochromic blood picture, 25% of the patients had microcytic hypochromic blood picture and prevalence of dimorphic anaemia was seen in 18% of the cases.

### 3.2. Species

Out of 100 cases, *Pl falciparum* was the most frequently observed species. It was seen in more than half the cases i.e. 56%. Next common was *Pl vivax* seen in 40% of cases. Mixed infection consisting of both *P. vivex* and *P. falciparum* was observed in 4% case.

### 3.3. Hemoglobin level (Hb%)

Out of 100 patients, 62 patients had Hb % less than 10 gm percentage. This was than categorised into mild, moderate and severe anemia.

22 patients had Hb 8%-10% gm (mild anaemic), 26 patients had moderate anemia (6%-8% gms), and 14 patients had Hb < 6 gm % (severe anaemia).

### 3.4. Leucocytes abnormalities

Leucocytosis i.e. leukocyte count >11,000/ cmm was seen in 12% of patients. It was seen in 3 patients with mixed infection i.e. 50% of mixed infection patients. It was seen in 17.85% of falciparum malaria patients and in 2.5% of vivax malaria patients. Leucopenia was seen in 19% of the total patients. It was observed that, in 25% patients with falciparum malaria and 12.5% of the patients with vivax malaria. Leucopenia was not seen in any of the patients with mixed infection. (Table 3) Monocytosis was observed in 14% of the total cases. It was seen in 12.5% patient with falciparum infection. It was also noted in 15% with vivax malaria and 25% patient with mixed infection.

### 3.5. Thrombocytopenia

In present study thrombocytopenia was observed in 63% of the patients. Out of these 63 patients only 5 patients had severe thrombocytopenia less than 50,000/cmm. 5% of the patients with vivax malaria had severe Thrombocytopenia. 25% of the patients with mixed infection had severe thrombocytopenia.

### 3.6. PCV

Packed cell volume was decreased in about 86% of the patients included in the study. PCV was decreased in 89.28% of the patients with falciparum malaria. It was decreased in 80% and 100% of the cases with vivax malaria and mixed infection. Hematocrit of <20 was seen in 13% of the cases.

**Table 2:** Showing sex and urban - rural distribution

S. No.	Area	Male	Female	Total
1	Urban	23	14	37
2	Rural	45	18	63
<b>Total</b>		68	32	100

**Table 3:** Showing WBC abnormalities in malaria

S. No.	Leucocyte Abnormality	Falciparum N (%)	Vivax N (%)	Mixed N (%)	Total N (%)
1	Lymphocytosis	24 (42.85)	13 (32.5)	2 (50)	39 (39)
2	lymphopenia	11 (19.64)	1 (2.5)	2 (50)	14 (14)
3	Neutrophilia	15 (26.78)	6 (15)	2 (50)	23 (23)
4	Neutropenia	11 (19.64)	5 (12.5)	0	16 (16)
5	Eosinophilia	0	5 (12.5)	1 (25)	6 (6)
6	Monocytosis	7 (12.5)	6 (15)	1 (25)	14 (14)

**Table 4:** Thrombocytopenia in different species of Malaria

Thrombocytopenia	Pl. falciparum N=56(%)	Pl. vivax N=40(%)	Mixed N=4(%)	Total N=100
Present	39(69.64%)	21(52.5%)	3(75%)	63(63%)
Absent	17(30.28%)	19 (47.5%)	1(25%)	37(37%)
<b>Total</b>	56	40	4	100

Increase ESR, which is an indicator infection was seen in 73% of the patients. It was seen in 76.78% of the patients falciparum malaria and in 70% of the patients with vivax malaria. It was increased in 50% of the patients with mixed infection. Very high ESR >60 mm/hr was seen in 15% of the total patients. 12 out of 56 patients with falciparum malaria had very high ESR. 2 out of 4 with mixed infection had very high ESR. Only 1 out of 40 patients had very high ESR among vivax malaria.

### 3.7. Activated partial thromboplastin time (aPTT)

It was increased in 14% of the total cases. It was found to be increased in 14.28% of patients with falciparum malaria. 7.5% of the vivax malaria patients had elevated aPTT and 75% of the mixed infection patients had elevated aPTT.

### 3.8. Thrombin time

It was found increased in 22% of the total cases. In all these cases it was increased by >2 seconds. The increase was noted in 26.78% of the patients with falciparum malaria. It was increased in 15% of patients with vivax malaria and 25% of the patients with mixed infection.

### 3.9. Bleeding time

Bleeding time was increased in 5% of the total cases. Bleeding time was increased in 5.35% of the falciparum case. It was increased in 50% of the case of mixed infection and no any patients with vivax malaria had increased bleeding time.

## 4. Discussion

### 4.1. Age distribution of cases

In the present study the working age group is more affected (Table 1), because this age group is exposed to the mosquito bites especially in the fields and outdoors. Also this study follows the age pyramid in the country where the base is formed by young people and apex by the older age who constitute lesser percentage of the population.<sup>3</sup>

The mean age in our study was 34.7. In study done by Malhotra B. et al.<sup>4</sup> and Jadhav UM. et al.<sup>5</sup> mean age are 25.8 and 37.4. Most other studies have mean age groups between 25 and 40. The adult age group have more risk of exposure due to more outdoor activity.<sup>3</sup>

### 4.2. Male female ratio

In this study, the male to female ratio was 2.1:1 and was comparable to study done by Erhart et al.<sup>6</sup> This of malaria could be due to the different working pattern of males and females (men worked more in outdoor comparison to female so men are exposed more than female with mosquito).<sup>3</sup>

### 4.3. Peripheral blood smear

In present study, 57% of the patients had normocytic normochromic blood picture. It was similar in comparison to a study by Sen et al.<sup>7</sup> where half of the patients had normocytic normochromic blood picture. In our study, 25% of the patients had microcytic hypochromic blood picture.

In this study, dimorphic anaemia was seen in 18% of the cases similar results were also observed by Sen et al.<sup>7</sup> where the dimorphic anaemia was found in 20% in their study.

#### 4.4. Species

In the present study, the falciparum malaria was found in 56% cases and the vivax and mixed infection was seen in 40% and 4% respectively. In a study done by Bashwari et al.<sup>8</sup> the falciparum was found in 54.1% cases where vivax malaria was just seen in 39% cases.

In another study conducted by Malhotra B. et al.<sup>4</sup> the found falciparum, vivax and mixed infection in 60%, 35% and 5% respectively. This study by Malhotra B. et al. was similar to present study. From these observation it can conclude that the infection of particular species varies with geographical area, in the area where this study conducted have more falciparum case.

#### 4.5. Hematological parameters

Anaemia was present in 62% of patients in study and the severe anaemia (Hb <6gm%) was seen in 14% of the cases. The overall incidence of anaemia was at par with similar studies done earlier like Bashwari et al.<sup>8</sup> where the incidence was 59.2%.

#### 4.6. Leucocyte abnormalities

Leucocytosis was seen in 12% of the total patients in our study. In a study conducted by Bashwari et al.<sup>8</sup> the incidence of leucocytosis was 7.2%. Increase in case of leucocytosis in the present study could be due to cases of malaria associated with secondary bacterial infections.<sup>3</sup>

Leucopenia was seen in 19% of the overall cases in our study. Sharma SK. et al.<sup>9</sup> in their study had observation that 6.6% of their patients had leucopenia. Malhotra B. et al.<sup>4</sup> in their study observed that 13.7% of the patients had leucopenia. Leucopenia occurred in severe anaemia with septicemia.<sup>3</sup>

Monocytosis was observed in 14% of the patients in our study. Monocytosis could be due to anti-malarial drug.<sup>3</sup>

#### 4.7. Thrombocytopenia

Thrombocytopenia was present in 63% of the cases in the present study. In a similar study by Bhaswari et al. (8) 59.9% of the patients had thrombocytopenia which is comparable to the present study. It is common to all 4 type of human malaria<sup>10</sup> and could be due to increase macrophage colony factor, which stimulate macrophage activity and increase platelet destruction.<sup>11</sup>

#### 5. Hematocrit

Pack cell volume was decreased in about 86% of patients in our study PCV was decreased in 89.28% of the patients

with falciparum malaria this could be due to the decrease red cell mass in cases of falciparum. Hematocrit of less than 20 was seen in 13% of the patients. The percentage of patients with PCV <20 was 16.07% among falciparum malaria, 7.5% vivax malaria and 25% with mixed infection, this indicates the degree of anemia and its higher rate of destruction associated with falciparum malaria.<sup>3</sup>

#### 6. Erythrocyte Sedimentation Rate

Increase ESR was seen in 73% of the patients in our study. This was near similar to the study by Malhotra B. et al.<sup>4</sup> who had an incidence of 75% cases with elevated ESR. Malaria being an acute illness, a mild to moderate increase in ESR values occurs in the patients.

#### 7. Coagulation

##### 7.1. Prothrombin time

It was increased in 22% of the total case. In the study conducted by R. Clemens et al.<sup>11</sup> PT was prolonged in 22.7% of the cases this was similar to the observations in our study. Increased prothrombin time is usually due to the hepatic involvement which commonly occurs in the severe falciparum malaria.

##### 7.2. Activated partial thromboplastin time

In the present study APTT was increase in 14% of the patients and in a study conducted by S. Roy et al.<sup>12</sup> APTT was increased in 16.6% of the patients this was near similar to what we observed in this study. It could be due to the hepatic involvement associated with falciparum malaria.

##### 7.3. Bleeding time

In the study, 5 patients had increase in bleeding time all the cases were falciparum and mixed infection. In a study by Sharma SK. et al.<sup>9</sup> 6.7% of patients had increased bleeding time. In a study by S Roy et al.<sup>12</sup> on falciparum malaria cases 5% of the patients had increased bleeding time. Observations of this study were comparable to both these studies. It is most commonly occur in severe falciparum malaria due to thrombocytopenia, decrease clotting factor synthesis and consumptive coagulopathy.<sup>13</sup>

#### 8. Conclusion

In this study, falciparum had higher incidence. The incidence in our area was found higher in males than females with peak incidence in 20-40 years. In most of the cases, fever was the chief complaint. Splenomegaly seemed to be an important sign in malaria, but absence of this did not rule out malaria. Anemia was seen as the most common hematological abnormality. Most commonly, normocytic normochromic anaemia was seen but some

cases of microcytic hypochromic and dimorphic anaemia were also seen.

This study concluded that hematological changes are common complications encountered in any patient with severe malaria. Hemoglobin concentration is associated with significant changes in relation to the type of complications of severe malaria; however, it is not associated with the clinical outcome after severe malaria. The total WBC count can not be used as a predictor for severity. Thrombocytopenia can implicate complications, but it is usually asymptomatic and platelet transfusions are generally not required because patients recover quickly. It is recommended that physicians should rely on the clinical presentations and complaints of the patients with severe malaria and not hurry to conduct transfusion of blood or blood components based on findings of hematological parameters of interest.

## 9. Source of Funding

Nil.

## 10. Conflict of Interest

The authors of this paper have no conflicts of interest.

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