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# PATHOLOGICAL CHANGES OF BLOOD IN MALARIAL PATIENTS

[1] Dr Sunnaan Amanat, [2] Dr Muhammad Hassaan Zafar, [3] Dr Rafia Masood

**[1]Rawalpindi Medical University, Pakistan**

**[2]Allama Iqbal Medical College Lahore, Pakistan**

**[3]Fatima Jinnah Medical University Lahore, Pakistan**

Abstract:

*Objectives*: ***The study was conducted to analyze pathological changes associated with different types of malaria among adults.***

*Methodology*: ***The observational method of analysis was conducted for 133 malaria patients at Infectious Diseases Unit of Mayo Hospital Lahore. The study was conducted from January 2015 to December 2017. The malarial parasites were tested by using Leishman's staining through thick and thin slides. The samples were examined by expert hematologist and full blood count was accomplished by using Beckman Coulter machine.***

*Results*: ***The sample consisted of thrombocytopenia (83%), anemia (64%), lymphopenia (24%) and monocytosis (10%). The parasites P. Falciparum was more prevalent as compared to P.Vivax which was (81%) in thrombocytopenia culture - p value >0.05. The percentage of anemia was (P. Falciparum 67% and P. Vivax 63% with a p value >0.05. Lymphopenia was slightly more different, 36% in Plasmodium. Vivaxcan and 15% in Plasmodium. Falciparum, with a p-value <0.04. Basophil and Eosinophil readings were normal for both parasites' groups.***

*Conclusions*: ***Malarial parasites (Plasmodium. Falciparum, Plasmodium. Vivaxcan) are responsible for significant changes in blood composition particularly in thromboctopenia, anemia lymphopenia and monocytosis.***

*Key Words*: ***Hematological, Plasmodium. Falciparum, Plasmodium.Vivax, Anemia, Lymphopenia, Thromboctopenia***

**Corresponding author:**

Dr. Sunnaan Amanat,

***Rawalpindi Medical University,***

***Pakistan***

QR code

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## INTRODUCTION:

Malaria is perhaps one of the oldest diseases faced by humans. It is common in all parts of the world and intense in some hot & humid places of Asia and Africa. The rate of mortality associated with the malarial parasites looks uncontrollable despite of all the advancements in medical science. Almost forty percent population of the world dwell in malaria infected places. Malarial patients' annual estimates range from 3-5 hundreds million cases causing roughly two million deaths per year [1]. The mortality rate associated with severe malarial is often as high as 20%. The hematological changes occurring due to malarial parasites are the leading causes for the worse outcome of the disease. Some common hematological changes occurring after malarial infection are anemia, thrombocytopenia, lymphocytosis, leukocytosis, neutropenia, neutrophilia, and monocytosis. In this study, the effects of malarial parasites on hematology (blood composition) were evaluated in the adult population of Lahore [2].

## METHODOLOGY:

The research was carried out Mayo Hospital Lahore. The study conducted within the period of two years from January 2015 to December 2017. The patients were selected on the basis of inclusion criteria. The diagnosis was done by Leishman's stain thick and thin blood stains for malarial infection. The study was premeditated according to the type of malarial parasite and clinical / demographic characteristics (age, sex, travel record etc.) of the subjects. Hematological changes were observed for different types of malaria. The sample excluded all the patients with the previous history of blood disorder, drug use, liver diseases and other possible conditions which might affect the composition of blood. Full Blood Count (FBC) was obtained for all the patients under discussion by using Beckman Coulter machine. White Blood Count (WBC) differences were also noted for all the patients. The results were seen by a worthy hematologist for identification of malarial parasites and their types. Platelets count and other hematological changes were noted for all the patients. The platelet count was further divided into three categories; Mild platelet group; Platelets Count (Plat50-150x$10^3$/ul), Moderate Platelet group; Platelet Count (Plat 20-50x$10^3$/ul) and Severe Platelet group; Platelet Count (Plat <20x$10^3$/ul). The anemia was tested according to WHO criteria, The Hemoglobin (red blood cell count) was <13gm/deci liter in men and <12gm/deci liter in women. The findings were statistically analyzed by using bivariate analysis, chi-square and ANOVA method (analysis of variance). All the results were considered statistically significant with a p value of <0.05.

## RESULTS:

From a total sample of a hundred and thirty-three subjects, plasmodium falciparum was more prevalent (72, 54%) than plasmodium vivax (59, 45%). The lowest occurrence was observed for plasmodium malaria (2, 2%). The age range of the sample was 14 to 76 years with a mean of 31.7 years. In our study, the men (123, 92%) dominated the women (10, 8%). Our sample consisted of emigrants with the exception of one UAE patient. The emigrants were from India (78, 59%), Pakistan (30, 23%), Africa (15, 11%) and other places (10, 8%). The patients who had travelled to malaria infected places were considerably high (81%). The patients showed up with indications like high fever with chills, nausea, vomiting, headache, low urge for appetite and bitter mouth etc. Most of the emigrants were employed as labors in agricultural or construction fields at UAE.

**Table-I: Hematological changes in P. Falciparum and P.Vivax malaria.**

| Hematological Parameters | P. Falciparum | | P.Vivax | |
|---|---|---|---|---|
| **Hb gm/dl (Ref.13-18)** | Anemia | 67%(48) | Anemia | 63%(37) |
| | Normal Hb | 33%(24) | Normal Hb | 37%(22) |
| **Platelets x$10^3$/ul (Ref.150-450x103)** | Thrombocytopenia | 87%(63) | Thrombocytopenia | 81%(48) |
| | Normal Platelet | 13%(9) | Normal Platelet | 9%(11) |
| **WBC x$10^3$/ul (Ref.3.6-11x103)** | Normal WBC | 86%(62) | Normal WBC | 85%(50) |
| | Leucopoenia | 10%(7) | Leucopoenia | 14%(8) |
| | Leukocytosis | 4%(3) | Leukocytosis | 2%(1) |

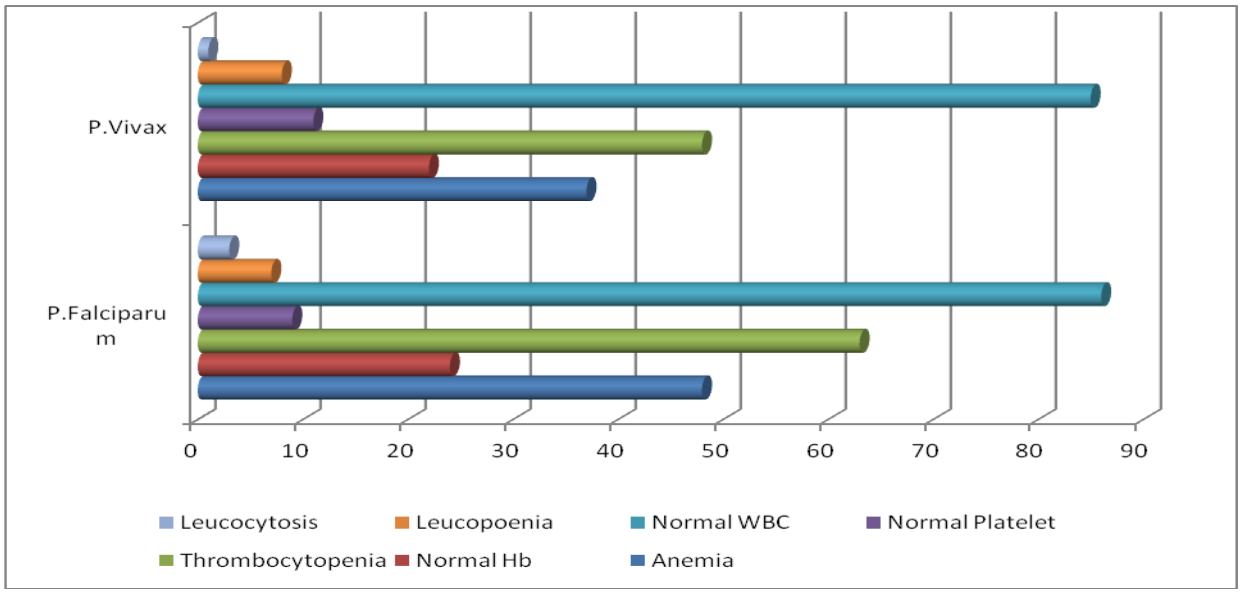


Figure 1 : Hematological changes in P. Falciparum and P.Vivax malaria.

Full Blood Count hematology findings revealed that neutrophil count was normal in 124 patients (93%), lymphocytes was normal in 101 cases (76%), monocytes in 117 (88%). Ninety-eight percent (131) cases were having normal readings for basophil and eosinophil. A slight increase was observed in monocyte & neutrophil bands (13, 10%). However, lymphopenia was prevalent in 32 patients (24%) - Table-II. The hematological results when seen in contrast with P. Falciparum and P.Vivax showed no major change in the prevalence of anemia (Plasmodium. Falciparum 48, 67%) and (Plasmodium. Vivax 37, 63%) cases with a p value>0.05 (Fig 1), thrombocytopenia (P. Falciparum 87%) and (P.Vivax 81%) with a p value >0.05 (Fig-2). However lymphocyte count was statistically significant and lymphopenia incidences were greater in P.Vivax 21 (36%) than in P. Falciparum 11 (15%) with a p value <0.04. Both the groups were indifferent in respect of monocyte, eosinophil and basophil count. Most of the patients 130 (97%) were discharged from the hospital in a stable condition. No blood transfusion was needed and no bleeding due to thrombocytopenia was noticed. The platelet count was tending to normal during 3 days stay at hospital. Different medications (Quinine sulphate, Chloroquine and Primaquine) were used for malarial infections caused by P. Falciparum and P.Vivax. Three P. Falciparum victims died during the research due to complicated infection.

**Table-II: Differential leukocyte changes in P. Falciparum and Vivax malaria.**

| Hematological Parameter | P. Falciparum | | P.Vivax | |
|---|---|---|---|---|
| **Absolute Neutrophils (Ref.1.4-8.3x103/ul)** | Normal Neut | 93%(67) | Normal Neut | 93%(55) |
| | Neutropenia | 4%(3) | Neutropenia | 3%(2) |
| | Neutrophilia | 3%(2) | Neutrophilia | 3%(2) |
| **Absolute Lymphocytes (Ref.7-5x103/ul)** | Normal Lymp | 85%(61) | Normal Lymp | 64%(38) |
| | Lymphopenia | 15%(11) | Lymphopenia | 36%(21) |
| **Absolute Monocytes (Ref.1-1.1x103/ul)** | Normal Mono | 89%(64) | Normal Mono | 86%(51) |
| | Monocytopenia | 1%(1) | Monocytopenia | 3 %( 2%) |
| | Monocytosis | 10%(7) | Monocytosis | 10%(6) |
| **Absolute Eosinophils (Ref.0-.5x10$^3$/ul)** | Normal Eoso | 100%(72) | Normal Eoso | 97%(57) |
| | Eosinophilia | 3%(2) | | |
| **Absolute Basophils (Ref.0-.1x10$^3$/ul)** | Normal Baso | 100%(72) | Normal Baso | 100%(59) |
| **Neutrophil Bands (Ref.0-3%)** | Normal | 92%(66) | Normal | 88%(55) |
| | Increased | 8%(6) | Increased | 12%(7) |

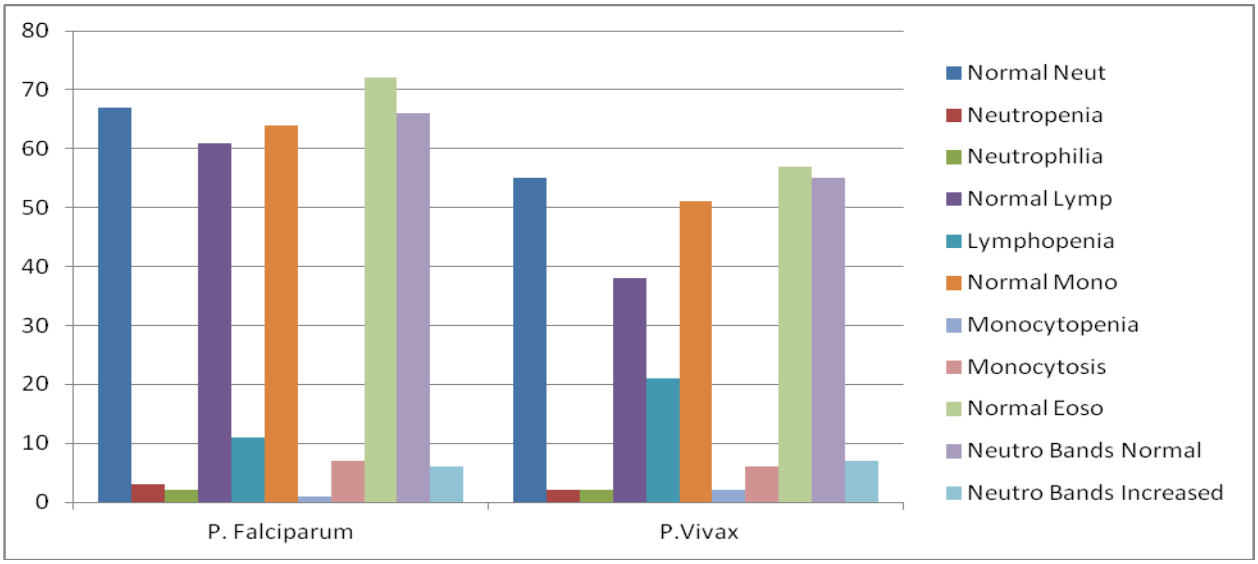


Figure 2 : Differential leukocyte changes in P.Falciparum and Vivax malaria.

## DISCUSSION:

Hematological problems caused by malarial parasites are well acknowledged and differ on the basis of type/level of malaria, nutritional factors, immune system and demographic characteristics. Hematological changes observed in the study include Hb, Plat count and WBC [3]. The prevalence of Anemia was 64% (normocytic) in our study which is in agreement with the study done by Facer and Beals. The deficiency of red blood cells and splenic phagocytosis are some other contributing factors in the existence of malaria related anemia [4].

Although platelet circulation is effected and continuously reported in malarial infections however, severe thrombocytopenia is rarely observed in malaria cases owing to P.Vivax. The study confirmed that 83% of malaria patients had established thrombocytopenia [5]. The percentage of thrombocytopenia is very high as compared to other studies done by Robinsons et al (71%) and Rodriguez et al (58.97%). However, no significant change was observed in the occurrence of thrombocytopenia in relation to Plasmodium Falciparum (87%) and Plasmodium. Vivax (81%) [6]. Severe thrombocytopenia observed in our study was greater when compared with other studies P. Falciparum (11%) and P.Vivax (3%). Bleeding disorders were not observed in these cases irrespective of the platelets count [7]. In typical malarial infections, the platelets are often oversensitive and develops particular protein like beta thromboglobulin (6TG), platelet factor IV. Thromboxane A2 and prostacyclin also increases during malarial infections [8]. The hypersensitive platelets are believed to enhance coagulation processes and responses. That is why no bleeding cases were observed in the current study despite of the low platelets count and dominant thrombocytopenia [9].

The normal white Blood Count (WBC) was observed in 86% cases contrary to some studies which argue leukopenia prevalence in non-immune and partial immune subjects [10]. Similarly, 93% cases were having normal readings for neutrophil count. The findings are not comparable to the other studies conducted on neutropenia or neutrophilia for malarial patients [11]. The prevalence of lymphopenia and monocytosis is however somewhat similar to the findings of other studies (24% and 10% respectively) [12]. Likewise, former studies also support the findings of our study on eosinophil and basophil count which was normal in 98% cases.

## CONCLUSIONS:

Malarial parasites (P. Falciparum, P.Vivaxcan) are responsible for significant changes in blood composition particularly in thromboctopenia, anemia lymphopenia and monocytosis. The hematological changes should be given due importance in the diagnosis and treatment of malaria on the basis of the outcomes of different researches available on the chronic malaria disease.

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