

# EFFECTS OF BENIGN AND MALIGNANT TERTIAN MALARIA ON HEMATOLOGICAL FINDINGS

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## ABSTRACT

**Objective:** To find out different changes in the peripheral blood of patients suffering from Malaria.

**Material and Methods:** It was a descriptive case series study conducted in pathology department of KMC/KTH from May 2013 to May 2014. A total of 200 Malarial patients were subjected to complete blood counts performed in automated Haematology analyzer, Sysmex KX 21 and thick and thin blood films stained with Giemsa to confirm Malarial parasite.

**Results:** Out of 200, 60% were male and 40% were female. Plasmodium Vivax was found in 68% and Plasmodium Falciparum in 32% cases. Automated Haematology Analyzer results showed that minimum total Leucocyte Count was 1100/cmm, maximum was 25,200/cmm, minimum haemoglobin was 2.50 g/dl, minimum platelet count was 10,000, maximum 4,03,00/cmm. Anemia was recorded in 51%; thrombocytopenia was recorded in 51% cases. TLC was normal in 82% of the cases while leukopenia was found in 08% and leucocytosis in 20% of the total patients. Pancytopenia observed in 03% cases.

**Conclusion:** Incidence of malaria is higher in plain areas, males were more prone than females. The Haematological findings in descending order was, Thrombocytopenia, leucopenia and pancytopenia.

**Key Words:** Malaria, Plasmodium, Vivax, Falciparum, blood smear.

## INTRODUCTION

Malaria which falls in the category of infectious diseases is caused by an organism, Plasmodia, which is a parasite of both blood and tissue. Female mosquito of the Anopheline group is responsible for the transmission of malaria and is a vector for malaria transmission.

Malaria ranks high amongst the existing health problems of Pakistan. In Pakistan, throughout the country, about 1.6 million cases of malaria are diagnosed and according to World Organization, 97% of the Pakistan population has very high chance of getting infected with Plasmodia parasite.<sup>1</sup> Malarial parasite has two phases of development. Sporogony, sexual phase that occurs in a mosquito and Schizogony, asexual phase that takes place in man.<sup>2</sup>

In humans, malaria begins after the bite of mosquito. All mosquitoes cannot cause malaria, but only the infected mosquitoes which inject Sporogony into human

body can cause malaria. The Sporogony that have been introduced, now travels towards the liver and infects the hepatic cells. After asexual replication in hepatic cells, thousands of merozoites are produced which then escape into the general circulation. These merozoites then get entry into the red blood cells and reproduce several times. Their number increases enormously and result in the breakdown of red blood cells. This lysis of the red blood cells results in increase parasite level of blood, which further infects the red blood cells.<sup>3</sup> A person infected with malarial parasite shows variety of hematological changes which vary, depending upon the level of malaria endemicity, haemoglobinopathies, malaria immunity, demographic factors and nutritional status.<sup>4</sup>

Although all the persons are at risk for malaria, burden of the disease is carried by children under age of 5 years and pregnant women.<sup>5</sup> Thrombocytopenia is directly related to level of parasitaemia and is a marker of poor prognosis in patients with malaria.<sup>6</sup> Red blood cells when infected by malarial parasite have altogether a different set of structural, biochemical and biophysical properties. These changes have drastic effects on the flow of oxygen carrying cells in our body.<sup>7</sup> Anaemia in

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malaria is mostly normocytic and normochromic and is due to increased red cell destruction.<sup>8,9</sup>

The Anaemia in malaria is attributable to different factors which may exist singly or in combination. These include increased RBC destruction, splenic removal of parasitized RBCs, and/or decreased RBC production. Malaria parasite infected erythrocytes are more fragile and carry less oxygen to the tissue. They become more rigid and tend to stick to endothelium of the capillaries.<sup>10</sup> Also they produce toxic substances and antigens and are thus, prone to destruction or lysis. The increased destruction of red blood cell is a very important factor in anaemia pathogenesis. Life span of erythrocyte is shortened. The erythrocyte infected with malaria parasite is less deformable and the membrane becomes more permeable due to alteration in the phospholipids content of the cell membrane. Inside the cell, malaria parasite rapidly digests the hemoglobin and uses it as a nutrient.<sup>11,12</sup>

Spleen plays an important role in platelet sequestration and destruction but splenomegaly itself is not the cause of thrombocytopenia, as most patients develop thrombocytopenia before any evidence of splenic enlargement. Thrombocytopenia is a constant feature of malaria which may be due to *P. Vivax* or *P. Falciparum*.<sup>13</sup>

In malaria, the coagulation activity is enhanced. This is associated with the level of parasitaemia. It has direct relation with the number of parasites in the blood. When the parasite level is high, coagulation mechanism is hyperactive.<sup>14</sup> Keeping in view of the above, this study is designed to evaluate the effects of benign tertian and malignant malaria on haematological findings in a tertiary care hospital of Peshawar.

## MATERIAL AND METHODS

It was a case series study, conducted in pathology department of KMC/KTH from May 2013 to May 2014. The study included 200 malarial parasites chosen on convenient sampling. Inclusion criteria: Only those patients who were found to be malarial parasite positive on peripheral blood examination were taken in. Those patients whose peripheral blood smear was negative for malarial parasite, patient on drugs causing thrombocytopenia, patients on radiotherapy, chemotherapy or agents causing myelosuppression were excluded from the study.

Patients with suspicion of malaria were studied. With signs and symptoms of malaria. Verbal consent of the patient was taken before the start of procedure. Clean glass slide and tubes containing anticoagulants were labeled. Puncture site was cleaned and venous

blood sample was taken. 3ml of blood was transferred to the tube containing anticoagulant and slide was made from a drop of blood. The slides were fixed, stained and studied for the presence or absence of malarial parasite. Blood counts were performed on Sysmex, automated Hematology analyzer.

Blood is aspirated from the sample probe. 6.0 ul of blood is transferred to the WBC transducer chamber along with 1.994ml of diluent. 1.0ml of WBC / Hb lyse is added to prepare 1:500 dilution sample. In 10 seconds, when the solution reacts, RBC is hemolysed and platelets shrink, with WBC membrane held as they are. Hemoglobin is converted into red colored methemoglobin. From this sample, 1 ml is transferred to the Hb flow cell. 500ul of the sample in WBC chamber is aspirated through the aperture. The pulses of the blood cells when passing through the aperture are counted by the DC detection method. In Hb flow cell, 655nm wavelength beam irradiated from the light emitting diode is applied to the sample. Absorbance is measured; and compared with that of the diluents alone, there by calculating the Hb. Platelets are counted by DC detection method. All the available information of the patient i.e. age, sex, area where he/she resides and the result of laboratory findings were documented on a Performa.

All the considered variables including demography, age and species of plasmodium were analyzed for percentages, age-wise distribution and gender wise distribution amongst the patients. Hemoglobin level, total leucocyte count, and platelet count were recorded. All the data was processed by computer software program.

## RESULTS

It is a hospital based descriptive case series study of 200 patients of malaria that were diagnosed on the presence of malaria parasite on peripheral smear examination. In this study it was found out that out of total 200 malaria positive patients, 120 (60%) were males and 80 (40%) were females with male to female ratio was 1.5: 1.

It was observed in this study that malaria was present in the age range of 0-5 years (10%) 20 cases, 6-10 year (06%) 12 cases, 11-15 years (10%) 20 cases, 16-20 years (18%) 36 cases, 21-25 years (09%) 18 cases, 26-30 years (09%) 18 cases, 31-35 years (10%) 20 cases, 51-60 years (11%) 22 cases and 61 years and above (02%) 4 cases. In this study minimum age of the malarial positives patient is 25 days and maximum age of the malaria positive patients is 86 years.

In this study it was noticed that malaria was more common amongst the patient living in plan areas as compared to dwellers of hilly areas. As the result indicated that out of total 200 malaria infected patients, 86 (43%) belonged to Peshawar, 14 (7%) belonged to Mardan, 14 (7%) belonged to Charasadda, 12 (6%) were from Kohat, 10(5%) were from Nowshera, 8 (4%) from each Bannu, Dir, Sawabi, and Khyber Agency, respectively. 6 (3%) each belonged to Malakand Agency, Hangu and Karak. Two (1%) and belonged to Haripur, Kurram Agency, Lakki Marwat, Parachinar and Waziristan Agency.

Two varieties of plasmodia parasite P-Vivax and P. Falciparum, were identified. Out of 200 malaria positive patients, 136, (68%) were infected with Plasmodium Vivax and 64 (32%) were found to be P. Falciparum positive. Trophozoite was found in majority of cases, 132, (66%) followed by gametocytes 42 (21%), trophozoites and gametocytes in 24 (12%) cases, trophozoites and schizont in two (1%) of total cases. From the results of the hematology analyzer it is noticed that total leucocyte count was also variable, ranging from minimum value of 1100/cmm to maximum value of 25, 200/ cmm.

Total leucocyte count was low in 16 (8%) of cases, in 128 (64%) it was within normal range and in 40 (20%) cases, it was raised than normal range. Minimum hemoglobin found was 2.5 g/dl and maximum hemoglobin recorded was 16.7g/dl. Out of total 200 patients 102 (51%) were found to be anemic and 98 (49%) were normal. Minimum platelet count recorded was 10,000/ cmm and maximum platelet count recorded was 4, 03, 000/ cmm. Thrombocytopenia was recorded in 102 (51%) cases, in 95 (47.5%) cases, it was within normal limits and 03 (1.5%) individual, had raised values than normal range. Pancytopenia was observed in 6 (3%) cases out of total 200 cases studied and presented with Anaemia, leukopenia and thrombocytopenia.

In this study it was also noted that total number of malarial patients during the month of July to September, were 120 (60% of total), during the month of October to December were 28 (10% of total) and during the month of January to March, 32 (16% of total) of cases were reported.

## DISCUSSION

Among blood infections, malaria is the most wide spread public health problem of the tropics with very high morbidity and mortality rates.<sup>15</sup> About half a million cases of malaria are reported each year in Pakistan.

Pakistan is a tropical and agricultural country with most of its population (>60%) living in rural area and urbanized population (>30%), are equally exposed to malaria infection. The unplanned organization with lack of proper drainage and sewerage system which resulted in stagnant water in ditches and drains, especially after rains provide favorable conditions for malarial parasite growth and proliferation. Annual floods in the rivers coupled with rains of monsoon and inadequate waste disposal all over the country, offer a suitable environment for malaria spread.

There is an increasing concern regarding the spread of malaria in all parts of country. Several reports show that malaria is re-emerging as a major challenge for the health system of the country.<sup>16</sup> In Pakistan, only 25% of the patients infected with malarial parasite approach to the hospital for treatment. The rest turn to quack and self medication.<sup>17</sup>

The common species of malaria parasite in Pakistan are Plasmodium Vivax and Plasmodium Falciparum.<sup>18</sup> Plasmodium Vivax was formally predominant species but now the incidence of P. Falciparum infection has increased considerably. According to the results of our study conducted on 200 malaria positive patients, 136 (68%) were found to be positive for Plasmodium Vivax and 64(32%) were carrying Plasmodium Falciparum in their blood. This finding is consistent with studies conducted in Multan,<sup>19</sup> and Larkana.<sup>20</sup> Similarly another study conducted in the urban and rural areas of Quetta district showed an incidence of Plasmodium Falciparum 44% and 35% respectively, and that of Plasmodium Vivax infection of 56% and 65% respectively<sup>21,22</sup>. A study conducted in Afghanistan revealed that the incidence of Plasmodium Vivax infection is around 70% and that of Plasmodium Falciparum is 30%<sup>23</sup>.

In this study males were more affected (60%) than females (40%) with males to females ratio of 1.5:1. Male predominance is also observed in other studies conducted in Multan<sup>19</sup> and Quetta<sup>23</sup>. Studies conducted in India<sup>20</sup> and Saudi Arabia<sup>24</sup> also showed that males are more prone to get malaria infection.

In this study anaemia is recorded in 51% of cases with 10-15% lying on border line, while rest were normal. Anaemia is present in both Plasmodium Vivax and P. Falciparum infection with slight predominance in case of Plasmodium Falciparum infection. According to the results of a study done in Military Hospital, Quetta,

anaemia was present in 61% of malarial patients.<sup>25</sup> In this study thrombocytopenia was found in 51% cases. In a study conducted at CMH Quetta, thrombocytopenia was found in 74%<sup>25</sup> In a study done in India, on 1565 subjects, 70% showed thrombocytopenia and about 30% were normal.<sup>26</sup>

In another study conducted at Liaquat Hospital, Hyderabad, out of 370 patients 33% showed normal platelet count.<sup>27</sup> The result of this study is slightly lower than the results of other studies. This might be due to the fact that our cases came to hospital earlier than development of aggressive phase of the disease. This argument is supported by the fact that anaemia in this study is also at a slightly lower range than (51%) some other studies.

In this study normal leucocyte count was found in 64% of the cases, while leucopenia was found in 16% and leukocytosis in 20% of the total cases. In a study conducted in Mumbai, India, leucocytes in normal range were present in 71% of the total cases while leukopenia was observed in 17% of cases, rest had leukocytosis. Malaria is a seasonal infection in endemic areas and mostly seen before and after the monsoon period, therefore, malaria control efforts should be more emphasized during this period. In our study it was observed that peak incidence of malaria occurred in the months of July to September and in October to December, coinciding with monsoon and post monsoon season. Although these basic hematologic changes in association with malaria are not new to the subject.

## CONCLUSION

In the light of results of this study, it is concluded that: malaria is still one of the major causes of morbidity and mortality in Pakistan. Plasmodium Vivax is the commonest parasite for malaria followed by Plasmodium Falciparum, Anaemia and thrombocytopenia are the commonest finding in malarial patients.

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### **AUTHOR'S CONTRIBUTION**

Following authors have made substantial contributions to the manuscript as under:

**Munir AH:** Idea and data collection.

**Nadeem S:** Manuscript writing.

**Amina:** Bibliography.

**Ashraf Z:** Statistics.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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