

# PERIPHERAL BLOOD PICTURE OF MALARIA IN PATIENTS COMING TO A TERTIARY CARE HOSPITAL, PESHAWAR

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## ABSTRACT

**OBJECTIVE:** To determine the effect of malarial infection on hemoglobin, total leukocyte count (TLC) and platelet count of patients coming to a tertiary care hospital.

**METHODOLOGY:** This descriptive hospital based study was conducted in the Department of Pathology, Postgraduate Medical Institute, Hayatabad Medical Complex Peshawar and Department of Medicine, Khyber Teaching Hospital Peshawar from July 2009 to January 2010. Total of 100 confirmed patients suffering from malaria were selected through convenient non-probability sampling technique. Complete blood counts (CBC) were performed on automated hematology analyzer Sysmex KX 21. Thick and thin films stained with Giemsa stain were prepared to confirm malarial parasite. Statistical analysis was done by using SPSS version 14.

**RESULTS:** Out of 100 patients, 56% were males and 44% females. Mean age of the patients was 19.76+13.18 years and majority (39%) was in the age range of 1-10 years. *Plasmodium vivax* found in 54% and *plasmodium falciparum* in 46% of cases. Automated hematology analyzer results showed that mean total leukocyte count (TLC) was 7170.40+3919.11/mm<sup>3</sup> (minimum 700/mm<sup>3</sup> & maximum 22800/mm<sup>3</sup>), mean hemoglobin was 9.18+3.03g/dl (minimum 2.80 g/dl & maximum 16.40 g/dl) and mean platelet count was 143019+125497.83/mm<sup>3</sup> (minimum 4000/mm<sup>3</sup> & maximum 670000/mm<sup>3</sup>). These results were confirmed manually. Anemia was recorded in 66% of cases, leukopenia in 15% cases, leukocytosis in 12% cases, thrombocytopenia in 68% cases and pancytopenia was observed in 9% cases.

**CONCLUSION:** Thrombocytopenia was recorded in majority of the cases followed by anemia and leucopenia in patients suffering from *plasmodium vivax* and *plasmodium falciparum* malaria.

**KEY WORDS:** Malaria, *Plasmodium Vivax*, *Plasmodium Falciparum*, Blood Smear.

**THIS ARTICLE MAY BE CITED AS:** Khan K , Haider I, Khan Z, Raziq F, Khan I. Peripheral blood picture of malaria in patients coming to a tertiary care hospital, Peshawar. *Khyber Med Univ J* 2013;5(2): 91-94.

## INTRODUCTION

Malaria affects about 300 million people and causes more than a million deaths per year worldwide<sup>1</sup>. Malaria in humans is caused by intraerythrocytic

protozoa of the genus *Plasmodium* (*P. Falciparum*, *P. Vivax*, *P. Malariae*, *P. Ovale*). These parasites are transmitted to humans by the bite of an infective female *Anopheles* species mosquito<sup>2</sup>. Malaria kills approximately 1-2 million people

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Date Submitted: February 15, 2013

Date Revised: April 11, 2013

Date Accepted: April 20, 2013

every year, mostly in sub-Saharan Africa and in Asia<sup>3</sup>.

A variety of abnormalities in the number, morphology and function of blood and bone marrow cells may be found in *plasmodium falciparum* and *plasmodium vivax* malaria<sup>4</sup>. Hematologic changes associated with malarial infection are well recognized, but specific changes may vary with level of malaria endemicity, background hemoglobinopathy, nutritional status, demographic factors, and malarial immunity.<sup>5</sup> Major factors responsible for its morbidity and mortality are anemia and thrombocytopenia. Normochromic normocytic anemia is a common manifestation of malaria. This anemia has multiple etiologies. Red cells containing parasites are removed from the circulation by the reticuloendothelial systems. There is also accelerated destruction of non-parasitized cells. Both parasitized and non-parasitized red cells lose deformability leading to their destruction and removal by the spleen<sup>6</sup>.

Reported severe manifestations with *P. vivax* mono-infection are similar to those of severe *P. falciparum* infection and include cerebral malaria with generalized convulsions and status epilepticus<sup>7</sup>, severe anemia<sup>8</sup>, hepatic dysfunction and jaundice<sup>9</sup>, acute lung injury, acute respiratory distress syndrome (ARDS)/pulmonary edema<sup>10</sup>, shock<sup>11</sup>, splenic rupture<sup>12</sup>, acute renal failure and severe thrombocytopenia with or without bleeding from different parts of the body.<sup>8,13</sup>

The white blood cell count in malaria is usually normal but it may be raised in severe disease. Other white blood cell changes include a leucoerythroblastic response, monocytosis, eosinopenia and a reactive eosinophilia during recovery phase<sup>14</sup>. Thrombocytopenia is a well-known complication of malaria and has been present in 50-70% of adults and children in both endemic and non-endemic areas<sup>15</sup>. Local studies from Pakistan and India have documented thrombocytopenia in patients with of plasmodium falciparum and plasmodium vivax malaria.<sup>16-18</sup>

Keeping in view the importance of these changes in the peripheral blood of patients suffering from malarial infection, this study was conducted to determine the effect of malarial infection on hemoglobin, total leukocyte count (TLC) and platelet count of patients presenting to a tertiary care hospital. This study will help in early recognition and prompt treatment of hematological complications of malaria and thus reducing the morbidity and mortality of malaria.

## METHODOLOGY

This descriptive hospital based study was conducted in the Department of Pathology, Postgraduate Medical Institute, Hayatabad Medical Complex, Peshawar and Department of Medicine, Khyber Teaching Hospital, Peshawar from July 2009 to January 2010. Total of 100 con-

firmed patients of malarial infection with age ranging from 1-60 years, irrespective of gender, were included in the study. Convenient, non-probability sampling method was used for the collection of sample. All patients with acute febrile illness without localizing signs were considered for study. Patients suffering from other febrile illness with negative malarial parasite on blood film in three consecutive samples at intervals of twelve hours and patients with clinical history or finding suggestive of any condition which might have contributed in blood changes like chronic liver disease, bleeding disorder, thrombocytopenia, drug intake etc were excluded from the study. Informed consent was taken from all the patients taking part in study. At least 3-5 ml of blood was collected from the vein of patient (preferably from antecubital area) after cleaning properly with spirit swab. Both the slide and Ethylene diamine tetra acetic acid (EDTA) tube were prepared and labeled properly Thin and thick blood films were prepared with Field's staining and examined by clinical pathologist for plasmodium species through light microscopy using oil immersion lens 100. After confirmation of malaria on blood film, blood counts were performed on Sysmex automated Hematology analyzer KX 21. Data was collected on an especially designed structured proforma and consisted of patient demographics, plasmodium species, blood counts and complete blood counts. All the data was

processed and analyzed by computer program Statistical Program for Social Sciences (SPSS) version<sup>14</sup>.

## RESULTS

Out of 100 patients of malaria, 56(56%) patients were males and 44(44%) were females with male to female ratio of 1.27: 1. Minimum age in this study was 1 year and maximum was 60 years; mean age was 19.76+ 13.18 years.

Malaria was present more in the age range of 1-10 years (n=39/100; 39%). Among these 39 patients, 19 patients were admitted in hematology unit Hayatabad Medical Complex, Peshawar under supervision of pediatrician and pathologist while the rest of 20 cases (mostly in the age range 6-10 years) were admitted in Department of Medicine Khyber Teaching Hospital, Peshawar. These patients were admitted in medical unit because they were refused from admission in pediatric unit due to non-availability of female attendant. The rest of the age distribution is shown in Table I. Plasmodium vivax was found in 54(54%) cases and plasmodium falciparum in 46(46%) cases.

It was observed that malaria was documented in majority of the patients belonging to the plain areas as compared to hilly areas. Out of 100 patients, 39(39%) of the total malaria patients belonged

**TABLE I: AGE-WISE DISTRIBUTION OF PATIENTS**

Age range	No. of patients (n= 100)	Percentage
1-10 years	39	39%
11-20 years	22	22%
21-30 years	17	17%
31-40 years	13	13%
41-50 years	05	05%
51-60 years	04	04%

**TABLE II: RESULTS OF AUTOMATED HEMATOLOGY ANALYZER IN CONFIRMED CASES OF MALARIA (N= 100)**

	Reference range	Minimum	Maximum	Mean	Standard deviation
Total leukocyte count	7±3x 10 <sup>9</sup> /L	700/mm <sup>3</sup>	22800/mm <sup>3</sup>	7170.40/mm <sup>3</sup>	3919.11
Hemoglobin	15±2g/dL)	2.80 g/dl	16.40 g/dl	9.18	3.03
Platelet count	150-400x 10 <sup>9</sup> /L	4000/mm <sup>3</sup>	670000/mm <sup>3</sup>	143019/mm <sup>3</sup>	125497.83

**TABLE III: CHANGES OF HAEMOGLOBIN, TOTAL LEUKOCYTE COUNT & PLATELET COUNT LEVEL SEEN IN MALARIAL PATIENTS (N= 100)**

Hematological parameters		No. of Cases (n= 100)	Percentage
Hemoglobin Level	Low	66	66%
	Normal	34	34%
Total Leukocyte Count	Low	15	15%
	Normal	73	73%
	Raised	12	12%
Platelet Count Level	Low	68	68%
	Normal	29	29%
	Raised	03	03%

to Peshawar, 7(7%) cases belonged to Mardan, 7(7%) patients belonged to Charsadda, 6(6%) from Kohat, 5(5%) from Nowshera and 4(4%) patients each were from Bannu, Dir, Sawabi, and Khyber Agency respectively. Rest of the patients belonged to hilly areas of Malakand Agency, Bajur Agency, Hangu, Karak and Lakki Marwat.

Automated hematology analyzer results showed that mean total leukocyte count (TLC) 7170.40+3919.11/mm<sup>3</sup>, mean hemoglobin was 9.18+3.03g/dl and mean platelet count was 143019 + 125497.83/mm<sup>3</sup> (Table II).

Anemia was recorded in 66% of the cases and anemia in majority of the cases was of normochromic normocytic type. TLC and platelet count were found low in 15% and 68% cases respectively (Table III). Pancytopenia was observed in 9% patients of malaria.

## DISCUSSION

Malaria is the most widespread public health problem of the tropics among blood infections. Falciparum and vivax malarias are major health problems in Pakistan. In the last decade, there has been a six folds increase in falciparum malaria, which now comprises 42% of all malaria cases recorded by National Malaria Control Program, Pakistan<sup>19</sup>.

All cases of falciparum malaria are potentially severe and life threatening, especially when managed inappropriately. A major reason for progression from mild through complicated to severe disease is missed or delayed diagnosis. Once

diagnosed, the priority for treatment of complicated and severe disease is the parenteral administration of adequate, safe doses of an appropriate antimalarial, in the setting of highest possible level of clinical care<sup>20</sup>.

Plasmodium vivax is the most common prevalent malaria infection and is an important cause of morbidity in endemic areas of Asia, Oceania, Central and South America.<sup>21</sup> Infection due to plasmodium vivax is less severe than falciparum, and blood parasite levels are lower. Parasitized red blood cells do not develop knobs, therefore any microvascular obstruction with resultant brain, kidney, lung, or other organ complications rarely occur<sup>22</sup>.

In our study of 100 cases of malaria it was found that 54% of cases were positive for plasmodium vivax malaria and 46% were plasmodium falciparum. This finding is consistent with the studies conducted in Malaysia<sup>22</sup> and Karachi<sup>17</sup>, while it is higher as compared to a study conducted in Nawabshah, Pakistan<sup>10</sup>. A study conducted in the urban and rural areas of Quetta district showed an incidence of plasmodium falciparum 55.55% and 65.82% respectively.<sup>23,24</sup>

Males were more affected than females in our study. This male predominance was also evident in other studies conducted locally and abroad like Karachi<sup>17</sup>, Quetta<sup>23</sup>, Papua New Guinea<sup>25</sup> and Saudi Arabia.<sup>26</sup>

Majority (68%) of patients belonged to plain areas as compared to hilly areas of KPK, which is in contrast to another

study showing 24% of patients from plain areas of KPK<sup>27</sup>. This may be due to the fact that our place of study was Peshawar and most of the malarial patients included in this study were either from Peshawar or other nearby districts.

Anemia was recorded in sixty six (66%) patients cases. In a comparative study conducted by Jain M and Haur M<sup>18</sup> hematological changes were recorded and it was found that anemia was present in 66 (94.28%) patients. Thirty five (50%) cases showed normochromic normocytic anemia. In another study conducted in Al Rashid Hospital, Dubai, anemia was observed in 64%. These two studies coincide well with our studies.<sup>25,28</sup>

In our study, 68% of patients had thrombocytopenia. In a study conducted in Pakistan, thrombocytopenia was found in 109 (75%) cases of malaria.<sup>29</sup> Thrombocytopenia was also found in 83% of total cases in a study conducted in Dubai<sup>30</sup>. Our results are also consistent with few other local studies.<sup>15,16,31</sup> We observed Leukopenia in 15% and leukocytosis in 12% of the total patients. In a study conducted in Mumbai, India Leukopenia was observed in 14% and leukocytosis in 4.9% cases<sup>32</sup>. This study nearly coincides with our study.

## CONCLUSION

Incidence of malaria is higher in plain areas. Children aged 1-10 years were affected more than other age group. Males were more prone than females. Thrombocytopenia was recorded in majority (68%) of the cases followed by anemia (66%) and leucopenia (15%).

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## AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under

- KK:** Conception and design, Acquisition of data, drafting the manuscript, final approval of the version to be published
- IH, ZK:** Analysis and interpretation of data, drafting the manuscript, final approval of the version to be published
- FR:** Critical revision, supervision, final approval of the version to be published
- IK:** drafting the manuscript & final approval of the version to be published.