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**Original Research Article**

# A study of haematological profile of malaria in a tertiary care centre of western Uttar Pradesh, India

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## ABSTRACT

**Background:** Malaria is a major health problem in tropics with a high morbidity and mortality. Malaria causes wide spectrum of manifestation both clinical as well as hematological. A variety of haematological alterations like progressively increasing anaemia, thrombocytopenia, leucocytosis or leukopenia and rarely disseminated intravascular coagulopathy (DIC) have been reported in malaria. Though clinical manifestation has been widely studied but there is paucity of work in hematological abnormality.
**Methods:** The hospital based observational study was conducted in the Department of Paediatrics, Shri Rammurti Smarak Insitute of Medical Sciences (SRMSIMS), Bareilly. Ninety-eight cases were positive for malaria by peripheral smear or by rapid diagnostic test for malaria or by both.
**Results:** In the present study, prevalence of malaria found to be (11.6 %). Out of 98 cases, 60 were males, majority of cases belonged to 9-12 years of age, followed by 4-8 years of age. Male:Female ratio is 1.57:1. There was neutrophilic predominance and low monocyte count in cases positive for plasmodium falciparum malaria. All the patients had microcytic hypochromic anemia as per mean of MCV. In haematological profiles of malaria neutrophil and monocyte showed statistically significant variations (P value ≤0.001)
**Conclusions:** Anemia is the most common hematological abnormality. There was neutrophilic predominance and low monocyte count in cases positive for malaria which is highly significant. All the patients had microcytic hypochromic anemia as per mean of MCV. Profound thrombocytopenia is very common in malaria.

**Keywords:** Malaria, Microcytic anemia, Monocytopenia, Neutrophilia

## INTRODUCTION

Malaria continues to be one of the important public health problems in India. As per the World Health Organization (WHO) report 2015, Southeast Asian (SEA) region bears the second largest burden of malaria (10%), only being next to African region (88%). Among SEA region, India shares two-third of the burden (66%) followed by Myanmar (18%) and Indonesia (10%). The malaria situation remains a major problem in certain states and geographical pockets and is associated with high morbidity and mortality. The majority of malaria cases and death in India are being reported from Orissa, Rajasthan, Jharkhand, Chhattisgarh, Madhya Pradesh, Uttar Pradesh and the seven North Eastern States.[1]

Malaria is caused by protozoan parasite of genus plasmodium. Five species of the plasmodium such as *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium ovale*, *Plasmodium malariae*, and *Plasmodium knowlesi* causes malaria in humans which is transmitted by the bite of infected female anopheles mosquito. Malaria is associated with varied haematological abnormalities leading to clinical complication.

These changes involve the major cell types such as red blood cells (RBCs), leucocytes and thrombocytes. Hematological changes which are the most common systemic complication play a significant role in various other serious complication like coma, convulsions, renal and hepatic failure etc. Based on these haematological changes which are the measurable parameters of blood and can be easily ascertained by blood examination, suitable therapeutic intervention can be immediately started to avoid delay and consequent further complication. In this context the aim of this study was to focus on haematological profiles of malaria in patient admitted with malaria in this tertiary care hospital. Early diagnosis, anticipation of complication on the basis of haematological changes, close monitoring of vital parameters and combination therapy helps to curtail the morbidity and mortality.

## METHODS

This hospital based observational study was conducted in the Department of Paediatrics, Shri Rammurti Smarak Insitute of Medical Sciences (SRMSIMS), Bareilly. All patients were informed about the study and informed consent was obtained. Approval of Institutional Ethical Committee was taken.

Data from all indoor patients were filled and analysed on a preformed proforma. All children who satisfied the World Health Organization (WHO) criteria of malaria and severe malaria guidelines 2015, admitted in Paediatric Intensive Care Unit and ward were enrolled.[2] All cases underwent peripheral smear test and malarial antigen test to confirm malaria. Routine haematological and biochemical investigations were carried out. Patients were followed until discharge.

All the patients who proved positive for malaria by peripheral smear or by rapid test or by both, aged 1 month to 18 years admitted in indoor patients during one-year (December 2015 to December 2016) time period. Number of cases 98 positive for malaria out of total 840 paediatric patients admitted with fever in tertiary care hospital.

Following cases were excluded from study

- Only clinical diagnosis without peripheral smear study or rapid optimal test positive
- Known cases of bleeding disorder
- Patients who test positive for other infections like enteric fever, tuberculosis along with malaria.

Statistical analyses was performed using the Statistical Package for the Social Science (SPSS) version 20. The categorical variables were shown as numbers of cases with percentage, and the continuous variables were shown as mean±standard deviation (SD). P, value of ≤0.05 was considered statistically significant.

## RESULTS

98 cases fulfilled the criteria and were included in the study. Study showed prevalence of malaria to be 11.6%. Demographic characteristic of study is shown in which male children were predominant above 4 years of age (Table 1).

**Table 1: Demographic characteristic of study.**

| Age group | Male | | Female | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| ≤3 year | 6 | 6.1 | 5 | 5.1 | 11 | 11.22 |
| 4-8 year | 14 | 14.3 | 15 | 15.37 | 29 | 29.59 |
| 9-12 year | 27 | 27.5 | 10 | 10.20 | 37 | 37.76 |
| 13-16 year | 13 | 13.26 | 8 | 8.16 | 21 | 21.43 |
| Total | 60 | 61.22 | 38 | 38.77 | 98 | 100.0 |

**Table 2: Type of malaria.**

| Type of malaria | | | |
|---|---|---|---|
| **Malaria (n=98)** | **Simple malaria (n = 36)** | **Complicated malaria (n = 62)** | **Total** |
| *P. Vivax* | 30 (83.3%) | 21 (33.8%) | 51 (52.04%) |
| *P. Falciparum* | 3 (8.33%) | 33 (53.2%) | 36 (36.73%) |
| Mixed (vivax + falciparum) | 3 (8.33%) | 8 (12.9%) | 11 (11.22%) |
| Total | 36 | 62 | 98 |

98 cases fulfilled the criteria and were included in the study. Study showed prevalence of malaria to be 11.6%. Demographic characteristic of study is shown in which male children were predominant above 4 years of age (Table 1). Vivax malaria was more common than falciparum malaria, positive in approximately half of cases. Present study showed increasing trend of complicated malaria (62 cases) out of which 53.2% cases were due to plasmodium falciparum (Table 2). This study showed neutrophilic predominance in cases positive for plasmodium falciparum simple malaria which is highly significant (P<0.001). All the patients had microcytic hypochromic anemia as per mean corpuscular volume (MCV) (Table 3). Severe degree of pallor with mean Hb of 6.31±0.5 and 6.47±1.2 was recorded in plasmodium vivax and falciparum complicated malaria respectively.

**Table 3: Haematological parameters of simple malaria patients.**

| Hematological parameters | *P. Vivax* , (n=30) (Mean±SD) | *P. falciparum*, (n=3) (Mean±SD) | Mixed, (n=3) (Mean±SD) | P value |
|---|---|---|---|---|
| Hb (g/dl) | 8.7±1.51 | 8.80±1.58 | 8.58±1.97 | 0.909 |
| TLC (cu/mm) | 6526.35±3250.47 | 7230.56±3009.40 | 5216.67±3080.3 | 0.156 |
| Neutrophil | 47.67±17.66 | 84.47±21.62 | 52.0±16.30 | <0.001 |
| Lymphocyte | 43.09±15.6 | 43.0±15.7 | 37.66±18.3 | 0.549 |
| Eosinophil | 2.44±2.4 | 4.44±8.4 | 1.66±1.2 | 0.147 |
| Monocyte | 2.7±1.29 | 2.05±0.79 | 2.66±1.5 | 0.034 |
| Basophil | 1.92±0.95 | 1.55±0.65 | 1.75±0.45 | 0.108 |
| PCV (%) | 26.12±4.75 | 26.61±5.23 | 24.75±5.19 | 0.536 |
| MCV (FL) | 65.90±17.39 | 64.00±16.52 | 71.90±17.91 | 0.388 |
| MCH (PG) | 28.50±5.45 | 29.28±5.05 | 31.59±3.58 | 0.172 |
| MCHC(g/dl) | 31.23±5.17 | 31.76±3.56 | 32.53±4.50 | 0.644 |
| PC (lacs/mm) | 1.27±0.71 | 1.32±0.75 | 1.25±0.93 | 0.933 |
| PT/APTT (sec) | 0.69±0.23 | 0.63±0.23 | 0.69±0.23 | 0.429 |

**Table 4: Haematological parameters of complicated malarial patients.**

| Hematological Parameters | *P. Vivax* | *P. falciparum* | Mixed |
|---|---|---|---|
| | **(n = 21)** | **(n = 33)** | **(n = 8)** |
| Hb (g/dl) | 6.31±0.5 | 6.47±1.2 | 7.6±0.9 |
| TLC (cu/mm) | 6530±3442 | 6822±3012 | 6727±4886 |
| Neutrophil | 59±13.5 | 62.25±9.5 | 47.62±9.9 |
| Lymphocyte | 36.5±16.4 | 28.7±19.3 | 36±15.8 |
| Eosinophil | 1.5±1.1 | 1.75±1.2 | 1.75±1.5 |
| Monocyte | 2.07±0.3 | 2.0±0.0 | 2.25±0.5 |
| Basophil | 2.07±1.0 | 1.75±1.5 | 1.6±0.5 |
| PCV (%) | 26.30±6.1 | 21.75±4 | 27.6±3.2 |
| MCV (FL) | 55.9±20 | 62.35±19.6 | 64.9±17.3 |
| MCH (PG) | 31.4±4.8 | 28.6±5.9 | 32.05±3.1 |
| MCHC (g/dl) | 31.6±2.9 | 30.7±1.2 | 33.7±2.9 |
| PC (lacs/cumm) | 0.69±0.52 | 0.2±0.0 | 0.78±0.3 |
| PT/APTT(sec) | 0.61±5.4 | 0.61±0.1 | 0.47±0.3 |

Platelet count was decreased in all the cases of malaria. Mean platelet count recorded in Plasmodium falciaparum complicated malaria cases was 0.2±lacs per cumm. (Table 4).

## DISCUSSION

Malaria is still a major health problem in India. Poor sanitation and absence of protective majors is significantly leading to increased prevalence of the disease. We found a prevalence of 11.6% in the present study. Other studies have also reported prevalence rates ranging from 9.6% to 13.3%.

In 2005 it was reported to be 9.6% whereas in 2016, prevalence increased to 13.3%.[3,4] It appears that probably the adequate measures by society and the government is not enough to contain this infection rather, personal level preventive and protective measures are the need of time to check the infection.

Male female ratio in the present study was 1.57:1. Disease has been found to be more common amongst boys than girls. Venkateswar observed 76% male children in study and Kashinkunti observed male female ratio to be 3.76:1.[5,6] Possibly outdoor activities male children can be the reason for more boys to suffer from malaria.

The higher incidence of malaria is observed in children due to underdeveloped immune system. Clearing of parasite is more effective in adults than in children. 67% children belong 4-12 years age group and 11% children suffered from malaria in <3 years age group (Table 1). Amit et al also found 76% children <15 years age group whereas Sharma J et al found 58% less than 10 years of age in their study group.[7,8]

We found 63% cases of complicated malaria and 53% were caused by *Plasmodium falciparum*. *Plasmodium vivax* was the causative agents in 33.8% cases of complicated malaria and 83% cases of simple malaria (Table 2). Similarly, in Singh G et al also reported *Plasmodium vivax* in (54.76%), *Plasmodium falciparum* (17.80%), and mixed species (27.44%).[9] Another study from Aligarh district done by Umm-e Asma et al found *P. Vivax*, *P. falciparum*, and mixed infections as 64%, 34%, and 2%, respectively.[10]

Similar results were reported by Hadiya et al (*P. Vivax* 61.41%, *P. Falciparum* 38.56%). In contrast Karlekar et al reported *Plasmodium vivax* in 33.8% and *Plasmodium falciparum* 66.6% cases.[11,12] We reported severe degree of anemia in all patients of malaria but more lower hemoglobin levels in patients of complicated malaria with mean Hb level (6.31±0.5). Low haemoglobin levels correlated well with low PCV levels. There was no

significant difference in the incidence of anemia in *P. Vivax* and *P. Falciparum* groups (P = 0.909).

In our patients all the patients had microcytic hypochromic anemia as per mean of MCV (55.9±20 to 71.90±17.91). In contrast a study by Kotepui M et al reported a higher MCV in comparison to non-malarial infected patients. This can be attributed to acute hemolysis in complicated malarial patients.[13] Chaudhari PA and Chaudhari RJ did a comparative study of the hematological changes in malaria and they reported that there was no significant difference in the incidence of anemia in *Plasmodium vivax* and *Plasmodium falciparum* groups (34.68% vs 33.82%) with p value >0.05. However, lymphopenia was observed in 33.33% cases of *P. Vivax* as compared to 11.11% in *P. Falciparum* cases, p value <0.04. Eosinophilia was 12.16%. It was concluded that the *P. Falciparum* as well as *P. Vivax* can cause significant hematological changes with high incidence of thromboctopenia, anemia, lymphopenia and monocytosis.[14] Srivastava S et al observed that the commonest abnormality seen in the patients was thrombocytopenia in 97.5% patients; second common abnormality was anaemia seen in 44.3% patients.[15] Akhtar S et al who compared the hematological changes in malaria and observed that the 70% of the patient had thrombocytopenia, 94% anemia, 12% lymphopenia and 17% monocytosis, Eosinophilia was 12.16% and basophil count was normal in both groups.[16] Agravat AH and Dhruva GA reported that the *P. Falciparum* as the most common species specific malaria. Most of the infected cases showed anemia, elevated erythrocyte sedimentation rate (ESR), and thrombocytopenia as common hematological changes. These hematological values were decreased as compared to control (normal person) in *P. Falciparum* infection than in Plasmodium vivax (*P. Vivax*) infection.[17]

We reported neutrophilic predominance in cases positive for plasmodium simple malaria which is highly significant (P <0.001). But not many Indian studies have reported specifically about neutrophil count correlation with malaria. Similarly, Kotepui M et al observed significantly higher neutrophil count in patients of malaria.

A lower normal monocyte count was observed in the present study (2.0±0.0 to 2.66±1.5) which was significant with p value of 0.034. In contrast a study done by Kotepui M et al observed a higher neutrophil-lymphocyte ratio as well as a high monocyte lymphocyte ratio. Not many studies were encountered regarding monocyte count and its correlation with malaria. Present study as well as other authors concluded that there are significant haematological changes with varied manifestation in form of anemia; lymphocytopenia; thrombocytopenia; microcytic hypochromic anemia. Present study showed neutrophilic predominance and low monocyte count which is significant with p-value (<0.005).

## CONCLUSION

Anemia is the most common hematological abnormality. There was neutrophilic predominance and low monocyte count in cases positive for malaria which is highly significant. All the patients had microcytic hypochromic anemia as per mean of MCV. Profound thrombocytopenia is very common in malaria.

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## REFERENCES

1. Swati A, Piyush P, Shakuntala P. Study of clinical and hematological profile of Plasmodium vivax Malaria in tertiary care hospital in western Maharastra. IJSS. 2017:307.
2. World Health Organization. The guidelines for the treatment of malaria. 3rd Edn; 2015. Available at http://apps.who.int/iris/bitstream/handle/10665/162441/9789241549127_eng.pdf;jsessionid=9A15952A74DD1F2E143EABC983B53152?sequence=1
3. Amar T, Krishna V, Manish J. Clinico-haematological profile of cerebral malaria in a rural hospital. JIACM. 2006;7(4):308-12.
4. Mehta. Clinical pattern of epidemics in Rajasthan. J Phy India. 2001;48:211-5.
5. Rao VTM, Rao BB, Chikkala R. Clinical profile of plasmodium falciparum case presenting to a tertiary care teaching institution in south India: an observational study. IAIM. 2016;3(5):159-65.
6. Kashinkunti M, Alevoor S. Clinical, hematological and coagulation proflile in malaria. Sch J App. Med. Sci. 2014;2(2B):584-8.
7. Agravat AH, Dhruva GA, Babaria K, Rathod K. Clinico-hematological pattern of malaria. IJBAR. 2012;03(11):847-52.
8. Vinod P, Vas D, Sobhan P. Neglected Plasmodium vivax malaria in north eastern States of India. Indian J Med Res. 2015;141:546-55.
9. Singh G, Urhekar AD, Maheshwari U, Sharma S, Raksha. Prevalence of Malaria in a tertiary care hospital in Navi Mumbai, India. J Bacteriol Parasitol, 2015;6:2.
10. Asma U, Taufiq F, Khan W. Prevalence and clinical manifestations of malaria in Aligarh, India. Korean J Parasitol. 2014;52(6):621-9.
11. Jivabhai H, Kanubhaiv, Hariharbhai AA. Retrospective study of malaria cases attending at tertiary care level hospital in Rajkot city, Gujarat. Int J Current Res. 2014;6:6273-6.
12. Karlekar SR, Deshpande MM, Andrew RJ. Prevalence of asymptomatic Plasmodium vivax and Plasmodium falciparum infection in tribal population of village in Gadchiroli district of Maharastra state, India. Biological Forum. 2012;4(1):42-4.

13. Kotepui M, Bhukdee P, Nuoil P . Effect of malarial infection on haematological parameters in population near Thailand-Myanmar border. Malaria J. 2014;13:218.
14. Chaudhari PA, Chaudhari RJ. Hematological changes in malaria: a comparative study. Paripex Indian J Res. 2015;4(6):534-6.
15. Srivastava S, Jain P, Kuber D, Sharma GD. Haematological profile of vivax malaria patients. JIACM. 2015;16(3-4):209-12.
16. Akhtar S, Gumashta R, Mahore S, Maimoon S. Hematological changes in malaria: a comparative study. IOSR J Pharm Biol Sci. 2012;2(4):15-9.
17. Agravat AH, Dhruva GA. Hematological changes in patients of malaria. J Cell Tissue Res. 2010;10(3):2325-9.

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