ORIGINAL RESEARCH ARTICLE

# Correlation Between Haematological Parameters, Kidney Function Tests and Liver Function Tests in Plasmodium Falciparum and Vivax Malaria

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**Abstract:**

Malaria remains a major cause of morbidity and mortality in India. Plasmodium falciparum remains the main culprit although cases with vivax malaria are on the rise. Severe malaria as defined by the WHO criteria has high rate of complications and mortality. In our study we recruited microscopy positive falciparum and vivax malaria patients. Haematological and biochemical laboratory investigations were carried out in recruited patients. Both parameters were found to be significantly derailed in falciparum cases as compared to vivax. A direct correlation has been observed between kidney function tests (serum creatinine,serum urea) and direct bilirubin levels across all cases of malaria. Hence these parameters can be used to identify and monitor the progress of cases of severe malaria as significant proportion of patients fulfilled the criteria of severe malaria in the cohort.

**Keywords:**

Severe malaria, parasitaemia, falciparum, vivax

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## Introduction

Malaria continues to be a major public health issue in India. According to WHO report in 2016 around 1.09 million malaria cases and 331 deaths were reported at community levels in India[1]. Previous research suggests that the malaria incidence is between 9 and 50 times greater than reported, with approximate 13-fold under-estimation of malaria-related mortality[2].Many cases in the past and still being underreported and hence WHO estimated that there were 9-18 million malaria cases responsible for estimated 24000 deaths in India in 2016[1].

The natural course of malaria progresses from asymptomatic parasitaemia, uncomplicated illnessto recovery and in some cases to severe malaria and ultimately to death[3].As severe malaria is associated with high mortality,WHO defined the criteria for the diagnosis of severe malaria inyear 1990[4]. These criteria's were revised in year 2000 to include laboratory and clinical findings associated with poor prognosis in patients with malaria[5].

Progression to severe malaria depends upon several factors. In individuals infected with plasmodium falciparum, young children, pregnant women and immunocompromised individuals are particularly vulnerable[6,7].The laboratory findings indicating severe malaria includes severe anaemia, renal failure, hypoglycaemia, DIC, acidosis and hyperbilirubinemia[8].

Though the incidence of severe malaria is found more often with P.falciparum,more cases of severe malaria with P. vivax are being reported[9]. Among the laboratory indicators for severe malaria Deranged kidney function tests and hyperbilirubinemia (>3 mg/dl with hyperparasitemia) are the laboratory markers can be easily estimated in peripheral setting and can help to pick up the cases of severe malaria early. Development of severe malaria increases the probability of complications mortality in a patient, hence early identification of severe malaria and early aggressive intervention is likely to decrease the death due to malaria.

With this background, we tried to find out the proportion of deranged lab markers and comparison of deranged Kidney function tests and Liver function tests in admitted patients of malaria (Both vivax and falciparum).

## Material and Methods:

This study was carried out at Dhiraj General hospital, Vadodara. Which a is full-fledged post- graduate teaching hospital with many super-specialty departments. We

recruited patients of fever diagnosed as malaria on microscopy irrespective of their clinical severity.

Inclusion Criterion:

Acute fever diagnosed as Malaria on microscopy (Both P. Vivax and P. Falciparum) irrespective of severity of clinical condition.

**Tests performed on admission:**

1. Liver function tests (bilirubin, ALT, AST)
2. Kidney function tests (Creatinine/urea)
3. Hb and differential Blood count.

WHO criteria used to define severe malaria

1. Serum creatinine > 3mg/dl
2. Serum urea > 120 mg/dl
3. Severe anemia (Hb<7gm%)
4. Serum bilirubin > 3mg%

**Result and Analysis:**

**Table 1:** Comparative analysis of anthropological data and LFT and KFT in P. vivax and P. falciparum:

| | **P. Vivax (n=29)** | **P. falciparum(n=15)** | |
|---|---|---|---|
| **No. of Patients** | **Male:14 Female:15** | **Male:9 Female:6** | **p value** |
| **Age** | **35.31** | **35.42** | **0.98** |
| **Hb gm%** | **10.23** | **10.54** | **0.69** |
| **Platelets** | **1.68** | **0.55** | **0.008** |
| **Urea** | **35.06** | **46.14** | **0.31** |
| **Creatinine** | **1.24** | **1.82** | **0.002** |
| **Sr ALT** | **46.58** | **37.85** | **0.49** |
| **Total Bilirubin** | **2** | **4.2** | **0.000018** |
| **Direct Bilirubin** | **0.98** | **2.17** | **0.00001** |

Table 1 shows platelets, serum creatinine and serum bilirubin is affected more in falciparum infection.

Additionally, female patients affected with P. Vivax show severe anaemia as compared to Male patients of P.vivax. (MeanHb was lower by 3.3 mg% /p =0.00001). Rest of the parameters showed no gender difference. There is moderate correlation between KFT (creatinine and urea) with direct bilirubin across the cohort.

**Table 2:**

| | Sr. Direct bilirubin | p value |
|---|---|---|
| Sr Creatinine | r=0.46 | 0.001 |
| Sr Urea | r=0.35 | 0.02 |

In this study, we found following number of patients who fit into the criterion for the definition of severe Malaria according to WHO.

**Table 3**:

| Criteria | Number of patients | % |
|---|---|---|
| Severe anemia (Hb<7 gm%) | 7 | 16 |
| Total Bilirubin>3 | 4 | 9.1 |
| Creatinine>3 | 2 | 4.5 |
| Blood urea>120 | 3 | 6.8 |

**Discussion:**

The aim of the present study is to identify the proportion of patients showing derailment in LFT and KFT, differences in lab manifestations of falciparum and vivax infection and correlation between laboratory parameters in malaria cases. Thrombocytopenia was observed in both P.falciparum and P.vivaxmalaria as previously reported([10]).The decrease in platelet count was significant in P.falciparum as compared to P.vivax. The serum creatinine levels were higher in patients with falciparum infection denoting the derangement in creatinine secreting abilities of kidney in falciparum infection[(11)]. Hyperbilirubinemia was observed in both P.falciparum and in P.vivax infection indicating the active hemolysis because of malaria parasite. Total and direct bilirubin levels were significantly elevated in falciparum malaria. This hepatic dysfunction with hyperbilirubinemia is associated with high mortality and complications[(12)].

We did not find any significant difference in haemoglobin levels, serum urea and serum ALT in falciparum and vivax cases. Although the haemoglobin levels in females was significantly lower in P.vivax cases. Such gender difference has not been reported previously in vivax malaria.

We observed a moderate correlation between the kidney function tests (serum creatinine, serum urea) and direct bilirubin levels. These can be used as an indicator of

both degree of active hemolysis and degree of renal function deterioration. Both being criteria of severe malaria, these two parameters can be used for detection and monitoring the cases of severe malaria.

In our study the most common observation in severe malaria cases was that of decreased haemoglobin levels. Around 16% patients of severe malaria had severe anemia (Hb%<7). 9% of patients had hyperbilirubinemia (Total bilirubin >3mg/dl). Increased serum creatinine and serum urea was observed in 4.5% and 6.5% patients respectively. This pattern points towards the pathophysiology of severe malaria. In our cohort of patients it is likely that the intravascular hemolysis because of malaria parasite was responsible for severe anaemia, derailed liver function tests and kidney function tests.

**Conclusion:**

There is significant difference in laboratory parameters in cases of falciparum and vivax malaria. Falciparum malaria is more likely to cause severe derangement in haemoglobin levels, kidney function tests and liver function tests. There is a moderate correlation between kidney function test and direct bilirubin levels which can be exploited for early diagnosis and monitoring of severe malaria.

**Conflict of interest: None to declare**

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