Association of Hemato-biochemical parameters with cases of types and severity of P.falciparum and P.vivex Malarial parasitic infection

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ABSTRACT
BACKGROUND AND OBJECTIVE: In india, malaria is a major public health problem in states having predominantly tribal population. The objective of present study is to find out correlation of haematology and biochemical parameters with the severity of malarial parasitic infection. The aim of this study is to compare haematological and biochemical parameters with the severity of malarial parasitic infection. METHODS: The complete blood count and serum billirubin, serum creatinine, serum SGPT (serum glutamic pyruvic transaminase) levels were analysed in 388 diagnosed cases of P.falciparum and P.vivax(241+147)malaria respectively, in a time period of June 2013 to June 2014 in V.S. General hospital, Ahmedabad, Gujarat, India. The patients were divided in two groups severe(209) and non severe(179) malaria. STATISTICAL ANALYSIS: The data from the study were analyzed separately by using the Statistical formula for Social Sciences. The results were presented as Mean ± SD. A p value of <0.05 were considered to be significant. RESULTS: The mean levels of serum billirubin, serum creatinine, serum SGPT and haemoglobin in the cases of P. Falciparum malaria were significantly changed as compared to those in the cases of P.vivax malaria. The levels of serum billirubin, serum creatinine ,serum SGPT and haemoglobin are significantly altered in the severe malaria cases as compared to those in the non severe malaria cases. CONCLUSION: Altered level of serum billirubin,serum creatinine,serum SGPT and blood haemoglobin level. They are associated with severe falciparum and vivax malaria. Correction of these imbalance in the severe cases is of great significance in the management of the patients.

Key words: Malaria, billirubin, creatinine, SGPT, haemoglobin.

INTRODUCTION
Malaria is a parasite infection and represents a medical emergency because it may rapidly progress to complications and death without prompt and appropriate treatment. Malaria accounts for an estimated 2-3 million deaths annually and it is also responsible for the untold morbidity and mortality in tropical and subtropical regions.¹ Four species of Plasmodium cause malaria in humans. These are P.falciparum, P.vivax, P.malariae and P.Ovale. P.falciparum is responsible for most of the deaths and most of the severe complications which result from malaria , which include cerebral malaria, anaemia and renal failure and hepatic dysfunction, hematopoietic systems.²,³ Malaria can affect single or multiple organs with different levels of severity which can be determined by different hematologic and biochemical parameters that could provide a credential clues in understanding of malarial pathogenesis, diagnosis and management.³,⁴ Malaria is a mosquito borne disease which spreads by the bite of the anopheles mosquito and rarely by blood transfusion. The species which are mainly prevalent in India are P.falciparum and P. vivax. Biochemical parameters (billirubin,creatinine,SGPT) disturbances are known to be common in severe complicated malaria and associated with disturbances in hepatic function.⁴

The aim of this study was to determine the prevalence of hematological imbalances and higher level of serum SGPT and billirubin and creatinine with the severity
Association of Hemato-biochemical parameters of malaria in a large cohort of patients with malaria which was caused by various Plasmodium species. \textsuperscript{5,6} Rise in serum bilirubin and serum SGPT in falciparum malaria patients is considered to be due to hemolysis of peripheral parasitized red blood cell, and impairment in billirubin transport because plasmodium falciparum hepatitis during malaria epidemics.\textsuperscript{1}

**MATERIALS AND METHODS**

This study was carried out over a period of 12 months in the Vadilal sarabhai general hospital, Ahmedabad, Gujarat, India. All the admitted patients with clinically suspected malaria (as per the WHO criteria) and who were willing to participate, were enrolled in this study. Before their enrolment in the study, the nature and purpose of the study were explained to all the participants. The diagnosis of malaria was made after the examination of the peripheral smears (thick and thin) and on the basis of the malarial antigen detection rapid card test. There were 388 diagnosed cases of P. falciparum and P. vivax malaria. The patients were divided into two groups of severe (207) and non severe (179) cases of malaria, based on the WHO guidelines and criteria.

**Severe Malaria**

- A Glasgow Coma Scale (GCS) score of < 11 in adult (which indicated cerebral malaria) and < 5 in children 
- Anaemia (haemoglobin < 5 g/dl in children and haemoglobin < 7 g/dl in adults with a parasite count of > 100000/μL) or 
- Jaundice (serum bilirubin -> 3 mg/dl with a parasite count of > 100000/μL) or 
- Renal impairment (urine output < 400 mL/24 hr. and serum creatinine -> 1.5 mg/dl) or 
- Hypoglycaemia (blood glucose -> 40 mg/dl) or 
- Hyperparasitaemia (> 10% parasitaemia) or 
- Shock (systolic blood pressure -> 80 mm Hg with cold extremities) or 
- Fulfilment of any one of the above criteria was considered as suggestive of severe malaria.

**Inclusion Criteria**

1. All the confirmed patients of malaria above 1 year of age.
2. Willingness in giving an informed consent.

**Exclusion Criteria**

1. Unwillingness in giving an informed consent.
2. Already enrolled in the study.

For all the patients who were willing to participate in the study, their demographic profile, their complete history with vitals and relevant system examination with relevant laboratory investigations was recorded in a preformed proforma and they were subjected to the following investigations:

- Complete Blood Count (CBC) : [Hb, TC and platelet]
- Peripheral Smear examination for the malaria parasite
- Serum bilirubin
- Serum Creatinine
- Serum SGPT

The methodology of the procedures to be followed:

1. CBC by using (“RUBY Five Part Differential Automated Haematology Analyser”).
2. PSMP by the thick and thin smear methods; staining with the Giemsa stain.

**Statistical Analysis**

The data from the study was analyzed separately by using the Statistical Package for Social Sciences. The results were presented as Mean ± SD (Standard deviation) and p value of < 0.05 was considered as significant.

**RESULTS**

**Table 1: P.Falciparum**

<table>
<thead>
<tr>
<th>Age/Sex</th>
<th>1-5 Year</th>
<th>6-15 Year</th>
<th>16-30 Year</th>
<th>31-45 Year</th>
<th>&gt;46 Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>32</td>
<td>29</td>
<td>47</td>
<td>28</td>
<td>3</td>
</tr>
<tr>
<td>Female</td>
<td>19</td>
<td>24</td>
<td>27</td>
<td>31</td>
<td>1</td>
</tr>
</tbody>
</table>

**Graph 1: Age and Sex wise distribution of P.falciparum malaria**
Table 2: P.Vivex

<table>
<thead>
<tr>
<th>Age/Sex</th>
<th>1-5 Year</th>
<th>6-15 Year</th>
<th>16-30 Year</th>
<th>31-45 Year</th>
<th>&gt;46 Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>13</td>
<td>20</td>
<td>26</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>Female</td>
<td>17</td>
<td>12</td>
<td>17</td>
<td>19</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 3: Biochemical and Hematological parameters in cases of P.falciparum and P.vivex Malaria.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Reference range</th>
<th>P.falciparum Mean ± SD</th>
<th>P.vivex Mean ± SD</th>
<th>Healthy subjects Mean ± SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haemoglobin%</td>
<td>12-14%</td>
<td>9.43±0.2</td>
<td>10.1±0.2</td>
<td>12.30±0.2</td>
<td>0.0011</td>
</tr>
<tr>
<td>S.creatinine</td>
<td>0.51-0.95 mg/dl</td>
<td>5.21±3.1</td>
<td>2.1±0.5</td>
<td>1.10±0.2</td>
<td>0.0389</td>
</tr>
<tr>
<td>S.bilirubin</td>
<td>0.3-1.2 mg/dl</td>
<td>7.24±3.01</td>
<td>3.9±2.5</td>
<td>1.59±0.2</td>
<td>0.0350</td>
</tr>
<tr>
<td>S.SGPT</td>
<td>Upto 55 IU/L</td>
<td>104.35±42.66</td>
<td>79.34±45.68</td>
<td>50±30</td>
<td>0.0250</td>
</tr>
</tbody>
</table>

DISCUSSION
Malarial parasite enters human body through bite of anopheles mosquito targeting liver cells and Red blood cells. It then multiply and develop morphologically in infected cells ultimately resulting in necrosis and rupture of infected cells. Hemolysis and liver cell necrosis result in anemia and jaundice. In case of P.falciparum other organs like liver, kidney and brain are also affected. In our study showed that the malarial infection affects more biochemical parameters in p.falciparum than p.vivax. A significant correlation found between liver enzymes, age, haemoglobin, bilirubin level. The most common age group affected in present study was 16 to 40 years. Young adults were more prone to infection due to their increased mobility. Present study noted higher serum creatinine is noted in patient with P.falciparum malaria. Out of 22 death 17 patient had renal failure and creatinine makedly raised in these cases. 209 cases have severe malaria, they shows altered level of hematological and biochemical parameters. Altered renal function test were more observed in P.falciparum cases compared to P.vivax cases. Male preponderance was noted compared to females in present study. The reason for this may be due to more exposure of the males to the bite of vector female Anopheles mosquito due to their clothing habits or outdoor activities. Maximum cases were noted from July to September in present study. July to September months corresponded to the monsoon season providing an environment favorable for the breeding of the vector female Anopheles mosquito. In present study jaundice was observed more in P.falciparum cases. Present study showed hepatomegaly in some of the cases. In Present study Hyperbilirubinemia was seen in patients which is comparable to study.

CONCLUSION
- Young adults male were affected maximum in present study.
- Fever with chills and rigor, bodyache, headache and nausea and vomiting are most common presenting features of malaria patients.
- Jaundice, hepatomegaly and splenomegaly were seen in addition to above with warning signs.
- Convulsion, shock, neurological involvement, liver, kidney and other organ failures were seen in severe malaria cases.
- Most patients showed Normocytic normocytic RBCs in malarial patients having anemia, hyperbilirubinemia, high serum creatinine was noted in most of the cases with severe malaria in present study.
- From the above finding we concluded that biochemical and haematological parameters are related to the severity and type of malaria cases. So, by these study we can diagnose early the severe cases of P.falciparum and P.vivex malaria and prevent the further complication related to infection.
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