Original Article

Prevalence of human malaria parasite and its effects on patient blood chemistry in Pakistani population

Yar Muhammad Khan a, Sadia Nadir a, Shaista Parveen a, Shahnaz a, Rahmat Ali Khan b,*

a Department of Chemistry, University of Science and Technology, Bannu, Pakistan
b Department of Biotechnology, Faculty of Biological Sciences, University of Science and Technology, Bannu, KPK, Pakistan

ARTICLE INFO

Article history:
Received 2 April 2013
Accepted 3 May 2013
Available online 30 May 2013

Keywords:
Blood chemistry
Creatinine
Malaria
Pakistani population
Plasmodium falciparum

ABSTRACT

Background and aim: Malaria is a parasitic infection of global importance. Although relatively uncommon in developed countries, in endemic regions, malaria is significant cause of morbidity and mortality and creates enormous social and economic burdens. Plasmodium vivax and Plasmodium falciparum are the most common malaria parasite species in Pakistan. Present study concerned with prevalence of malarial parasites and their effect on patient blood Chemistry.

Methods and materials: For the prevalence study we have examined 3500 patients suspected to be suffering from malaria. The blood films of these patients were examined by graham staining.

Results: Slide positivity rate was 22 percent i.e. 767 were positive. Of the positive slides 767 shows 55 (7.2%) P. falciparum, while 712 (92.8%) show P. vivax. Among 767 patients 70 patients were selected to check the biochemical effect of these parasites on patient blood chemistry, such as to check Bilirubin, glucose, ALT and AST and creatinine. In present study bilirubin level increased significantly (P < 0.000013) in case of P. vivax and (P < 0.000008) in case P. falciparum. Hypoglycemia has been reported to occur in sever malaria but no significant change in glucose concentration was observed in present study i.e. P > 0.8060 in case of P. vivax and P > 0.8112 in case of P. falciparum. Similarly the AST and ALT level is reported to increase significantly in sever malaria but no such increase in present study i.e. AST and ALT value in case of P. vivax P > 0.29 and P > 0.47 respectively and in case of P. falciparum AST and ALT is non-significant i.e. P > 0.07425 and P > 0.837.

Conclusion: The creatinine level is significantly increased in both cases the values being P > 0.000312 in case of P. vivax and P > 0.000349 in case P. falciparum.

Copyright © 2013, JPR Solutions; Published by Reed Elsevier India Pvt. Ltd. All rights reserved.

1. Introduction

Malaria ranks among the major health problems in Pakistan. Endemic in ninety-one countries which consist of forty percent of the world population, malaria affects an estimated 300 million people per year worldwide causing more than a million deaths per year. Majority of the fatalities occur in children under five years of age. Pregnant women and non-immune people are at particular risk. Climate change is also expected to affect malaria indirectly by changing ecological relationships that are important to the organisms involved in malaria transmission (the vector, parasite and host). Examples of such
indirect forces are deforestation and habitat changes due to climate change that may affect which species of Anopheles are able to survive. The three main climate factors that affect malaria are temperature, precipitation, and relative humidity.\textsuperscript{2} Climate predicts, to a large degree, the natural distribution of malaria.\textsuperscript{3} Epidemics of malaria are caused by a disturbance in equilibrium between host, parasite and vector. Najera et al\textsuperscript{4} have defined three different types of epidemics. Type I epidemics are caused by meteorological conditions, which create temporary epidemics that eventually revert back to the previous condition. Type II epidemics are caused by landscape changes or colonization of sparsely populated areas that create a new equilibrium level of endemicity. Type III epidemics are caused by interruptions in measures that were controlling malaria. Plasmodium vivax and Plasmodium falciparum cause different types of epidemics. P. vivax epidemics occur mainly in areas with only seasonal transmission and show a bimodal peak, the second peak caused by relapses, whereas P. falciparum epidemics grow slowly and then explode causing only one peak of transmission.\textsuperscript{4} The aim of present study is to determine the prevalence of plasmodium falciparum and plasmodium vivax in a population of Bannu district (N.W.F.P), and also to evaluate the effect and extent on patient blood chemistry, such as bilirubin, Glucose, ALT and AST and creatinine, due to these parasites in severe case of malaria.

2. Matarials and methods

2.1. Study area and patients

In present study we have survey five different villages of Bannu district and take 2500 patients blood with ordinary symptoms such as temperature headache, throat infection, among these individuals, 767 malaria patients conformed by Giemsa staining methods, in these patients 53 were pregnant women, 215 children under five years and rest 599 patients above five years of both sex. Among these seventy patients (25 children under five years + 15 pregnant women + 30 adults both sexes were selected randomly for estimation of followings).

2.1.1. Determination of creatinine, serum bilirubin, aspartate transaminase (AST), alanine transaminase (ALT), glucose

Kits for the determination of the above mentioned parameters were purchased from Sigma.

2.1.2. Statistical analysis

Statistical analysis was carried out by means of computer software SPSS.

3. Results

In present study 2500 patients suspected to be suffering from malaria were examined. The blood films of these patients were seen for presence of malarial parasites. The data of these screening tests is summarized in Table 1. Table 2 shows the mean serum bilirubin, glucose, and ALT, AST and serum creatinine level of patients with P. vivax in comparison with normal healthy control subjects. With reference to serum ALT, the results show that the mean level of ALT in serum of normal healthy subjects is 15.12 μl while in malaria patients the mean value of ALT is 16.40 μl. The difference between ALT value in normal and patients of each of malaria patients is non-significant (P > 0.7425 μl). With reference to serum AST, the results show that the mean level of AST in serum of normal healthy subjects is 14.36 μl while in malaria patients the mean value of AST is 23.76 μl. The difference between AST value in normal and patients of each of malaria patients is non-significant (P > 0.29 μl). With reference to serum creatinine, the results show that the mean level of creatinine in serum of normal healthy subjects is 0.5033 mg/dl while in malaria patients the mean value of creatinine is 1.07 mg/dl. The difference between creatinine value in normal and patients of each of malaria patients was significant (P < 0.000312). Table 3 shows the mean serum bilirubin, glucose, ALT, AST and serum creatinine level of patients with P. falciparum in comparison with normal healthy control subjects. With reference to serum bilirubin, the results show that serum bilirubin level in healthy subjects is 0.567 mg/dl while in malaria patients the mean value of bilirubin 3.901 mg/dl. The difference between bilirubin value in normal and malaria patients is highly significant (P < 0.000008). With reference to serum glucose, the results show that the mean level of glucose in serum of normal healthy subjects is 70.97 mg/dl while in malaria patients the mean value of glucose is 68.3466 mg/dl. The difference between glucose value in normal and patients of each of malaria patients is non-significant (P > 0.8112). With reference to serum ALT, the results show that the mean level of ALT in serum of normal healthy subjects is 15.12 μl while in malaria patients the mean value of ALT is 16.40 μl. The difference between ALT value in normal and patients of each of malaria patients was non-significant (P > 0.7425 μl). With reference to serum AST, the results show that the mean level of AST in serum of normal healthy subjects is 14.36 μl while in malaria patients the mean value of AST 23.76 μl. The difference between AST value in normal and patients of each of malaria patients was non-significant (P > 0.47 μl). With reference to serum creatinine, the results show that the mean level of creatinine in serum of normal healthy subjects is 0.5033 mg/dl while in malaria patients the mean value of creatinine is 1.20 mg/dl. The difference between creatinine value in normal and patients of each of malaria patients was significant (P < 0.005).

### Table 1 – Prevalence of P. vivax and P. falciparum.

<table>
<thead>
<tr>
<th>Total slide</th>
<th>Malaria +ve slides</th>
<th>P. vivax</th>
<th>P. falciparum</th>
</tr>
</thead>
<tbody>
<tr>
<td>2500</td>
<td>767</td>
<td>712</td>
<td>55</td>
</tr>
</tbody>
</table>

### Table 2 – Effect of P. vivax on human blood biochemistry.

<table>
<thead>
<tr>
<th>Control subjects</th>
<th>Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bilirubin (mg/dl)</td>
<td>0.56 ± 0.25*</td>
</tr>
<tr>
<td>Glucose (mg/dl)</td>
<td>70.97 ± 2.76</td>
</tr>
<tr>
<td>ALT (U/l)</td>
<td>15.13 ± 1.71</td>
</tr>
<tr>
<td>AST (U/l)</td>
<td>14.36 ± 1.34</td>
</tr>
<tr>
<td>Creatinine (mg/dl)</td>
<td>0.50 ± 0.05*</td>
</tr>
</tbody>
</table>

*P < 0.05, **P < 0.005 as compared to control.
Table 3—Effect of P. falciparum on human blood biochemistry.

<table>
<thead>
<tr>
<th></th>
<th>Control subjects</th>
<th>Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bilirubin (mg/dl)</td>
<td>0.56 ± 0.05*</td>
<td>3.90 ± 0.19**</td>
</tr>
<tr>
<td>Glucose (mg/dl)</td>
<td>70.97 ± 3.76</td>
<td>68.34 ± 5.55</td>
</tr>
<tr>
<td>ALT (U/l)</td>
<td>15.12 ± 0.71</td>
<td>16.08 ± 1.40</td>
</tr>
<tr>
<td>AST (U/l)</td>
<td>14.6 ± 0.34</td>
<td>23.76 ± 1.50</td>
</tr>
<tr>
<td>Creatinine (mg/dl)</td>
<td>0.53 ± 0.05*</td>
<td>1.201 ± 0.08**</td>
</tr>
</tbody>
</table>

*P < 0.05, **P < 0.005 as compared to control.

4. Discussion

As presented in results the slide positivity rate in present study is 22%. In the light of results of present study it seems that the low slide positivity rate as presented above may have been under estimated. Due to rush of work and sometimes due to lack of adequate facilities in district hospitals and malaria control offices it is possible to miss many positive cases. Whereas a reduced slide positivity rate reflects a declining trend. The present study shows that the prominent species infecting the people in our situation is P. vivax (92.8%). This is consistent with the results of other similar studies conducted for different areas of Karachi (Pakistan). Rafi et al5 reported that in their studies P. vivax was the predominant species. A similar study was also made in Quetta, Pakistan, by Azeem et al6 In this study a total of 263018 subjects who were screened, the positive smears were 91679 (34.85%), of which 263018 subjects who were screened, the positive smears were 91679 (34.85%), of which 28166 (7.2%) and 55 (7.2%) P. falciparum was detected 28166 (30.72%) and P. vivax 61313 (66.87%), which show that malarial infection due to P. vivax is greater in Quetta, which is similar to our results. In our study we take 3500 malarial suspected patients of which 767 were positive slides showing 712 (92.8%). This is consistent with the results of other similar studies conducted for different areas of Pakistan. The occurrence of malaria in adults due to mal-absorption of glucose from intestine. Thai adults with severe malaria had greatly reduced absorption capacity for sugar transport both actively and passively. Most of our patients have hypoglycemia before quinine administration. This suggests that other causes may also be responsible for hypoglycemia.

Conflicts of interest

All authors have none to declare.

Acknowledgments

We are very thankful to Professor Dr. Salman Akbar Malik Chairman Department of Biochemistry, QAU Islamabad, Pakistan for his valuable suggestions.

References