Relationship between ABO blood groups and malaria*

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A total of 736 patients with fever was tested for malaria and classified according to ABO blood group. Of these, 476 cases had patent parasitaemia at the time of investigation. The distribution of blood groups in this group was significantly different from that in 1300 controls from the same area. While group A was found to be more common in malaria cases than in normals, the reverse situation was found for group O. Possible explanations for this are discussed.

A number of studies have shown that susceptibility to several infectious diseases is related to the patient's blood group. Clarke et al. (1) and Glynn et al. (2) found that rheumatic fever was more common in nongroup O individuals, while infection with influenza virus A2 was found more frequently in persons with group O blood (3). Some authors (4, 5) have found an antigenic similarity between group A antigen and vaccinia virus, and between Pasteurella pestis and group O antigen. Although the relationship between blood group and susceptibility to malaria has been studied by several workers, the results have been contradictory (6, 7). Since malaria has re-emerged as a major problem in India during the past few years, it would be useful to know whether there is any relationship between blood group and infection.

Blood grouping was performed according to the method of Dacie & Lewis (8). The baseline distribution of ABO groups in the normal population was established by taking blood samples from 1300 local inhabitants who were visiting patients at a nearby hospital. The distribution of blood groups in this population was not significantly different from that in neighbouring states (16) and hence was taken as the baseline.

RESULTS

A total of 736 patients was investigated, of whom 476 were found to have patent parasitaemia. Most of the patients were sedentary indoor workers. Most of them lived within a 2-km radius of the Institute and the patients therefore had similar home environments.

Plasmodium vivax was the predominant type of infection, being present in 472 cases. In one case, P. vivax was mixed with P. falciparum and in another with P. malariae; the other two were suffering from pure P. falciparum infection. About two-thirds (62.8%) of the cases were in the age group 10–30 years, and in all the age groups there were more infected males than females.

Table 1. Distribution of ABO blood groups in malaria cases and controls

<table>
<thead>
<tr>
<th>Blood group</th>
<th>Controls</th>
<th>Malaria cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>A</td>
<td>229</td>
<td>17.62</td>
</tr>
<tr>
<td>B</td>
<td>535</td>
<td>41.92</td>
</tr>
<tr>
<td>O</td>
<td>428</td>
<td>32.92</td>
</tr>
<tr>
<td>AB</td>
<td>98</td>
<td>7.54</td>
</tr>
<tr>
<td>Total</td>
<td>1300</td>
<td></td>
</tr>
</tbody>
</table>

* P < 0.01.

MATERIALS AND METHODS

The study was carried out on patients with fever who came to the malaria clinic at the National Institute of Communicable Diseases, Delhi, for a blood test. A relevant history was taken from every patient including name, age, duration and nature of fever, and medication taken so far. Cases who had undergone treatment before giving a blood sample were excluded from the study. The exact location of residence and the nature and place of their work were determined in order to assess any relevant environmental factors. Care was taken not to include the same case twice.

In every case, thick and thin blood smears were prepared, stained, and examined for malaria parasites.

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The comparison of the distribution of blood groups in the malaria patients with that in the control population shows that group A was found more frequently in malaria cases than in the controls, and vice versa for group O \((P<0.01)\) (Table 1). The proportions of groups B and AB were similar in both populations.

**DISCUSSION**

The resurgence of malaria is a serious public health problem in many parts of the world. It is, therefore, important to identify the factors which contribute to susceptibility of hosts.

The finding of more malaria cases in males than in females is in agreement with the findings of most malariologists. Studies by Miller and associates \((9-12)\) have indicated that Duffy-negative erythrocytes are resistant to invasion by *P. knowlesi* and Duffy-negative individuals were found to be refractory to *P. vivax* infection. The results of our studies suggest that subjects with different blood groups have different susceptibilities to malarial infection. The exact cause of this difference remains to be identified, but there are several possibilities. First, as suggested by Russell \((13)\), the genetic make up of individuals may cause a considerable variation in their reaction to malarial infection, and blood groups are merely an expression of genetic constitution.

Secondly, qualitative and/or quantitative variation in structure and chemical composition of the receptor sites on the erythrocytic membrane of the various groups may play an important role in determining susceptibility. This was suggested by Miller in relation to the Duffy blood group \((11)\). Recently, it has been shown (I. Kagan, personal communication, 1980) that malaria parasites share group A antigens and hence are better tolerated by the host's immune system—a situation similar to that in vaccinia \((4, 5)\).

The variation may also be ascribed to the feeding habits of the vector species. According to Boyd \((14)\) some people are more prone to mosquito bites than others. Wood et al. \((15)\) found that under laboratory conditions *Anopheles gambiae* seems to recognize blood groups and to feed preferentially on group O. The basis for this recognition is unknown although it may be related to the occurrence of ABO substances on skin cells and in sweat secretions \((15)\).

**ACKNOWLEDGEMENTS**

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**RÉSUMÉ**

**RELATION ENTRE LES GROUPES SANGUINS ABO ET LE PALUDISME**

Un total de 736 malades atteints d'une fièvre évoquant cliniquement le paludisme ont été étudiés. L'enquête a porté sur des facteurs appropriés de l'environnement, et l'on a recherché dans le sang de ces sujets les parasites du paludisme ainsi que le groupe sanguin ABO. Ce groupe a été également déterminé chez 1300 témoins de la même zone.

Une parasitémie patente, principalement à *P. vivax*, a été découverte chez 476 personnes. Parmi les cas positifs, 22,2% seulement étaient de sexe féminin et 62,8% appartenaien au groupe d'âge 10-30 ans. Si le groupe sanguin A était plus fréquent parmi les cas de paludisme que parmi les témoins, l'inverse a été observé en ce qui concerne le groupe O. Cela peut être dû à des différences dans les sites récepteurs des globules rouges appartenant aux différents groupes sanguins (comme le montre la résistance au paludisme des individus Duffy-négatifs) ou à quelque similitude antigénique entre le groupe A et les parasites du paludisme. D'autre part, des personnes peuvent avoir tendance à être plus ou moins piquées par les moustiques en fonction de leur groupe sanguin; en effet, il a été notamment montré que *A. gambiae* a une préférence trophique pour le sang de groupe O.

**REFERENCES**

RELATIONSHIP BETWEEN BLOOD GROUPS AND MALARIA