Abo-Rhesus Blood Groups and Susceptibility to HIV Infection

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ABSTRACT

Erythrocyte surface antigens, particularly those governing blood group systems, are known to act as receptors for various etiological agents. It is for this reason that this study was conducted to determine the association between blood groups and the susceptibility to HIV infection in Cameroon. For this, data were collected from blood bank registers at the Yaounde University Teaching Hospital. Demographic data such as age and gender were collected on 1281 individuals who were recruited at the Blood Bank of the Yaounde University Teaching Hospital over a three-month period. Their HIV status and blood groups (Rhesus and ABO) were equally recorded. The analysis of the ABO Blood Group System of these individuals revealed that Blood Group O had the highest representation (48.6%) and Group AB the lowest (5.9%). The percentages of Rhesus positive and negative persons observed in this population were 96% and 4% respectively. The overall sero-prevalence of HIV infection was 5.5%. However, there was no significant difference in the prevalence of HIV among the different ABO (p=0.36>0.05) and Rhesus blood types (p=0.559>0.05). This study revealed no association between ABO and Rh blood groups and HIV infection.

Keyword: ABO, Rhesus, Blood Groups, Susceptibility, HIV, Infection

INTRODUCTION

The Acquired Immune Deficiency Syndrome (AIDS) is a disease of the human immune system caused by the Human Immunodeficiency Virus (HIV) [1]. Since its initial description in 1981, the number of people living with HIV worldwide has continued to increase. Estimates by the World Health Organization (WHO) indicated that globally, 34.0 million people were living with HIV at the end of 2011 [2]. Sub-Saharan Africa remains most severely affected, with nearly 1 in every 20 adults (4.9%) living with HIV and accounting...
for 69% of those in this condition HIV worldwide [2]. Cameroon is not excluded from the picture and shows an estimated average prevalence of 5.1% among the young adult population (15–49 years of age). The most affected areas are the North West, South West, East and Centre regions [3].

With the discovery of blood groups by Landsteiner at the beginning of the 20th century and the subsequent advancement in their study, many researchers have tried to link them with the prevalence and susceptibility to various diseases. To date many infectious diseases have been shown to be linked to the ABO Blood Group System; among which are malaria [4], filaria [5], and cholera [6], Chikungunya Fever [7].

Studies carried out in India revealed that the inheritance of blood groups and the consequent inheritance of certain immunological features may influence the development of the HIV infection [8]. Additionally, Ravi and collaborators [9] showed that patients of the Blood Group O who were Rh positive were most susceptible to the HIV infection. Scientific evidence showed that the level of natural antibodies resistant to viral antigens depends on the individual’s blood group and this is attributed to the main cause for natural resistance towards the infection. According to many other reports it was shown that no particular blood group type could be linked to the occurrence of this infection [10-13]. This contradict a study done in 2008 by Abdulazeez et al in Nigeria, where Blood group AB recorded the highest rate of HIV-2 infection and the least prevalence of HIV-1, and Rhesus positive participants were more susceptible to HIV infection [14].

It is on the basis of these controversial results that we carried out this study to determine if there is any such association in the Cameroonian population, since searching for and understanding the role of host factors are keys to discovering novel targets for the development of treatment and prevention strategies for HIV/AIDS.

**MATERIALS AND METHODS**

Ethical approval was obtained from the Cameroon Bioethics Initiative Ethics Review and Consultancy Committee (CAMBIN ERCC) and it reference number is: CBI/284/ERCC/CAMBIN. This was a retrospective study over a three-month period during which data from blood donors at the Blood Bank of the Yaoundé University Teaching Hospital was collected from archived registers. The following information was extracted for each case: ABO and Rhesus Blood Group, HIV status, gender and age. For each person, all data were entered into pre-established work sheets for analysis. The results were analyzed using the Statistical Package for Social Sciences Version 16 Software (SPSS 16). Chi-Square test ($\chi^2$ test) statistics were used to analyse the association between the blood groups and HIV infection. P values less than 0.05 were considered to be statistically significant.

**RESULTS**

Data were recorded on a total number of 1281 persons comprising of 294 (23%) females and 987 (77%) males. In the study population, the youngest subject was 18 and the oldest 63 years of age. The greater majority (97%) was between 18-49 years and only 3% were above 49 years. The total number of seronegative individuals was 1210, corresponding to 94.5%, and those that were seropositive were 71, representing 5.5% which is the overall prevalence of HIV in this study population. The highest number of participants was found to belong to Blood Group O (48.6%) and the fewest were of Blood Group AB (5.9%). Among the 1281 individuals, 1226 (96%) were Rhesus positive while 55 (4%) were Rhesus negative.
Table 1: Association between ABO Blood Groups and HIV status

<table>
<thead>
<tr>
<th>ABO Blood group</th>
<th>HIV status</th>
<th>Total per group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative N (%)</td>
<td>Positive N (%)</td>
</tr>
<tr>
<td>A</td>
<td>305 (23.8)</td>
<td>19 (1.5)</td>
</tr>
<tr>
<td>AB</td>
<td>73 (5.7)</td>
<td>2 (0.2)</td>
</tr>
<tr>
<td>B</td>
<td>241 (18.8)</td>
<td>19 (1.5)</td>
</tr>
<tr>
<td>O</td>
<td>591 (46.1)</td>
<td>31 (2.4)</td>
</tr>
<tr>
<td>Total</td>
<td>1210 (94.5)</td>
<td>71 (5.5)</td>
</tr>
</tbody>
</table>

P=0.36

Table 2: Association between Rhesus group and HIV Status

<table>
<thead>
<tr>
<th>Rhesus</th>
<th>HIV Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative N</td>
</tr>
<tr>
<td></td>
<td>52</td>
</tr>
<tr>
<td>Positive</td>
<td>1158</td>
</tr>
<tr>
<td>Total</td>
<td>1210</td>
</tr>
</tbody>
</table>

P =0.599

Table 3: Association between ABO group, Rhesus group and HIV status

<table>
<thead>
<tr>
<th>ABO group</th>
<th>Rhesus</th>
<th>HIV -</th>
<th>HIV+</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Rh-</td>
<td>14 (4.3%)</td>
<td>0 (0%)</td>
<td>0.34</td>
</tr>
<tr>
<td>A</td>
<td>Rh+</td>
<td>291 (89.8%)</td>
<td>19 (5.9%)</td>
<td></td>
</tr>
<tr>
<td>AB</td>
<td>Rh-</td>
<td>1 (1.3%)</td>
<td>0 (0%)</td>
<td>0.86</td>
</tr>
<tr>
<td>AB</td>
<td>Rh+</td>
<td>72 (96%)</td>
<td>2 (2.7%)</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Rh-</td>
<td>11 (4.2%)</td>
<td>0 (0%)</td>
<td>0.34</td>
</tr>
<tr>
<td>B</td>
<td>Rh+</td>
<td>230 (88.5%)</td>
<td>19 (7.3%)</td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>Rh-</td>
<td>26 (4.2%)</td>
<td>3 (0.5%)</td>
<td>0.17</td>
</tr>
<tr>
<td>O</td>
<td>Rh+</td>
<td>565 (90.8%)</td>
<td>28 (4.5%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 present the analysis of an association between the various blood groups and HIV infection in the study population. Chi-Square test results showed no significant difference in the distribution of HIV status among individuals of different ABO blood types (P=0.36). The cross tabulation of the Rhesus positive and negative individuals showed no association with HIV status (Table 2). Chi-Square test results showed no statistical significance as confirmed by P =0.599.

DISCUSSION

The results from this study showed that Blood Group O is the most predominant among all the others. This is in agreement with what was reported by Mbanya et al. [15], and Tagny and
The percentages of Rhesus positives and negatives observed in this population are once more similar to those reported by Tagny and collaborators [16]. Generally, only a small percentage of humans are Rhesus negative. The overall seroprevalence of HIV infection among blood donors in the study was 5.5%. Although this is comparable to the 4.3% noted in the Demographic Health Survey in Cameroon in 2011 [17], other studies on blood donors in the same institution have reported values ranging from 2.65% to 2.9% [18, 19].

The distribution of HIV infection among individuals of different ABO blood types showed no statistically significant difference (p=0.36), implying that there was no association between the two conditions. This result is similar to the findings of many others studies [10-13]. However, it is contradicted by the reports of Sayal et al. [8] and Ravizz and collaborators [9] which showed that patients with the blood group O and Rh positive were most susceptible to HIV infection. In addition, Abdulazeez et al. [14] reported that Blood Group AB individuals were more prone to HIV-1 than HIV-2; but our study did not distinguish the association with HIV types. Others contradictory results are the one of Onsten et al who reported a higher frequency of HIV infection in blood group B compared to non-B donors[20] and Mohammadali and Pourfathollah who instead reported that there was a significant association between HIV infection and Blood group A [21]. The χ² test results of the cross tabulation between the Rhesus positive and negative subjects and HIV status (Table 2) were not statistically significant (p = 0.599). This suggests that there is no association between the Rhesus status and the risk of acquiring HIV. Nneli et al. [9] also showed similar findings but which were in contrast to the Sayal et al. [7] and Ravi et al. [8]. Reports which showed that Rhesus negative individuals were less susceptible to HIV infection than Rhesus positive ones. The χ² test results of the cross tabulation between the Rh positive and negative subjects of different blood groups and HIV status (Table 3) showed no statistical significance at p > 0.05. This suggests that there is no association between the blood groups and the risk of acquiring HIV. This conclusion is still in agreement with the one reported by Nneli, et al. But contrast with the one reported by Sayal, et al saying that Rh-negative individuals are less susceptible to HIV infection than Rh+ ones.

The HIV virus infects nucleated cells because of its life cycle (integration of its genetic material into the cell’s genome). Since red blood cells are anucleated, any association between blood groups and HIV susceptibility will be an indirect one.

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CONFLICT OF INTEREST STATEMENT
The authors declare that they have no competing interests.

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