Original article:

Detection of weak RhD (D^u) phenotype among blood donors

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Abstract:

Introduction: The study on detection of weak RhD (D^u) antigen among 7019 healthy blood donors attended in SGMH blood bank associated with Shyam Shah Medical College Rewa from September 2014 to October 2015.

Method: Blood samples that were negative for RhD by immediate spin tube method were tested for weak D by indirect antiglobulin test.

Observation and results: Among 7019 healthy blood donors, 6787 (96.69%) were RhD factor positive while, 232 (3.30%) were RhD negative. Among these, 232 RhD factor negative individuals 1 (0.43%) were weak D positive.

Conclusion: Several research studies proved that weak D antigen is immunogenic and can produce alloimmunization if transfused to RhD negative subjects. Therefore, it is mandatory to also detect the weak D or partial D status of those individuals who are negative with saline anti-D.

Keywords: Weak D antigen, Rh blood group.

Introduction:

Following the discovery of the ABO blood group systems, the greatest breakthrough in transfusion medicine was the discovery of the Rh antigen by Levine and Stetson in 1939\(^{(1)}\). Subsequent to conflicting results in Rh grouping, a weakly reacting antigen was described by Stratton in 1946\(^{(2)}\). The Rh blood group system is clinically important because antibodies against Rh antigen involved in hemolytic disease of the newborn, transfusion reactions, and hemolytic anaemia\(^{(3)}\). Individuals are classified as Rh –positive and Rh-negative according to the presence or absence of the D antigen on the surface of their red blood cells which is the most immunogenic and therefore of critical importance for the blood transfusion strategy and proper management of Rh-negative gravid women\(^{(4)}\).

The RhD blood group antigen has been shown to be subject to many phenotypic variations \(^{(5)}\). There is one misconception that individuals with weak D phenotypes cannot make anti-D in contrast to partial D because they have low levels of complete D antigen\(^{(6)}\). Weak D phenotypic expression is known to arise from three mechanisms. In one of these mechanisms, referred to as gene interaction, there is a suppressive effect of the C gene when in trans to the D gene (e.g., D-ce/Ce). The second is when part of the D antigen is missing (partial D) thirdly, the presence of an aberrant form of D (e.g. at the molecular level) would result in weak phenotypic expression. The “weak D” actually refers to red cells with the aberrant Rh-D protein expressing reduced membrane surface D antigen\(^{(7)}\).

Aims and Objective:

This was undertaken with the studies the Rh-negative antigen and to detect the prevalence of weak RhD antigen in Rewa region of Madhya Pradesh.

Material and Method:

Routine Rh typing was done using the immediate spin tube technique. Blood samples, which were negative for agglutination by immediate spin tube method were further tested. Samples showing agglutination after incubation or addition of AHG ser-
um were considered to be weak D. Appropriate controls were used. Equal volumes each of anti D serum and 2-5% washed red cell suspension were placed in a clean glass test tube. They were mixed and incubated at 37°C in a water bath for 15-20 minutes. The tube was gently re-suspended and the cell button observed for agglutination. If the test red cells were agglutinated (but not in the negative control tube) the test was recorded as positive and there was need to proceed to the antiglobulin phase of the test. If the test cells were not agglutinated or the results were doubtful, the cells were washed three to four times with large volumes of normal saline. After the final wash, the saline was decanted and one to two drops of antiglobulin serum was added. Following this, the contents of the test tube were mixed and the tube was centrifuged at 1500 rpm for one minute. The cell button was then gently re-suspended and examined for agglutination. All negative results were confirmed under the microscope.

**Observation and Results:**

The results of the present study to detection of weak Rh D (Dw) phenotype among blood donors amongst 7019 healthy blood donors attending the blood bank of Sanjay Gandhi Memorial Hospital associated with S.S Medical College, Rewa (M.P.) from September 2014 to October 2015.

<table>
<thead>
<tr>
<th>Rh-negative</th>
<th>Rh-positive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>Percentage</td>
<td>Frequency</td>
</tr>
<tr>
<td>Male</td>
<td>180</td>
<td>2.56</td>
</tr>
<tr>
<td>Female</td>
<td>52</td>
<td>0.74</td>
</tr>
<tr>
<td>Total</td>
<td>232</td>
<td>3.30</td>
</tr>
</tbody>
</table>

Table 1 Prevalence of Rh-negative and Rh-positive among the whole blood donors. Shows that the 3.30% prevalence of Rh-negative among donors in this study. Low prevalence of Rh-negative and high prevalence of Rh-positive occurs in this study.

**Table 2**

<table>
<thead>
<tr>
<th>Rh-negative</th>
<th>False Rh-Negative (weak D Positive)</th>
<th>True Rh-negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>Percentage</td>
<td>Frequency</td>
</tr>
<tr>
<td>Male</td>
<td>180</td>
<td>77.58</td>
</tr>
<tr>
<td>Female</td>
<td>52</td>
<td>22.41</td>
</tr>
<tr>
<td>Total</td>
<td>232</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2 Prevalence of weak D phenotype among Rh-negative blood donors shows that the prevalence of weak D positive are 0.43% in this study. The prevalence rate of weak D antigens are very low in this study.
Fig-1 Prevalence of Rh-negative and Rh-positive among the whole blood donors populations.

![Graph showing prevalence of Rh-negative and Rh-positive among whole blood donors populations.]

Fig-2 Prevalence of True Rh negative and False Rh negative (weak D positive) among RhD negative blood donors.

**Discussion:**

The finding of 3.30% prevalence of Rh negative among donors in this study (Fig 1) is in keeping with available records of low prevalence of Rh-negative in other countries. Among Kenyans 3.9% has been reported and 1.6% among Nigerians. The low incidence of Rh-negativity contrast markedly with high figures obtained elsewhere, for example, about 15%-17% among Europeans and 15% in the USA population. Among Indians population 5%-12% Rh-negative positivity has been reported. This could be due to high RHD gene frequency among Indians population and for that matter, Rewa Madhya Pradesh. Weak D prevalence 0.43% in our study has been reported. The result of our study is similar to prevalence (0.4-%) among Moroccan population. This is however, a little below the 0.59% and 0.8%, 0.8% prevalence reported among the Europe and Brazil, Pakistan respectively. On the other hand, the 0.43% is little high, compared to those found in some other populations; for example, 0.14% prevalence in Albanias and among Indians 0.09%-0.189% prevalence has been reported. The results of our study have been contrast to other study due to various factors, the first and foremost is the difference in epidemiology i.e. demographic profile and social milieu of this region.

**Conclusion:**

Our study concluded that the incidence of Rh negative blood group was 3.30% in the Rewa region of Madhya Pradesh. There was no similar study from this region for comparison and this study can be used for future reference. We found a very low weak D positivity. Several research studies proved that weak D antigen is immunogenic and can produce alloimmunization if transfused to RhD negative subjects. Therefore, it is mandatory to also detect the Weak D or partial D status of those individuals who are negative with saline anti-D.

**References**

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