Incidence of $A_1$ & $A_2$ Sub Grouping among Blood 
Group A & AB in Blood Donors Attended at Blood 
Bank MGH, Jodhpur 

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Abstract: ABO groups and subgroups are medically important since these are responsible for transfusion reactions. Variation in A and AB subgroups are observed widely. The study was done in 1000 Blood group who had either A or AB blood group. In our study 711 blood donors had A blood group and 289 had AB blood group. 84.9% had $A_1$ subgroup and 15.1% had $A_2$ subgroup. Among AB blood group 81.6% had $A_1B$ and 18.4% had $A_2B$ subgroup.

Keywords: Blood groups, ABO group, Subgroup $A_1$, $A_2$

1. Introduction

Blood group is genetically predisposed. There are about 400 blood groups and the most common amongst them are ABO and Rh$^4$. The discovery of ABO blood groups by Karl Landsteiner was an important achievement in history of blood transfusion followed by discovery of Rh (D) antigen$^5$.

The bombardment of the red blood cells with A and/or B antigens occurs because of the action of the glycosyl transferase enzymes that add specific sugars to the precursor substance. A & AB Blood Group have been divided in to subgroup $A_1$, $A_2$, $A_1B$ & $A_2B$ depending upon the reaction with anti $A_1$ Lectin (Dolichous Bi Florous or Human anti $A$). About 80% blood group A & AB belong to sub group $A_1$ & $A_1B$ i.e. they react with Anti $A_1$ Lectin while 20% belongs to $A_2$ & $A_2B$ i.e. they fail to react with Anti-$A_1$ Lectin. At times the individual with sub group $A_2$ or $A_2B$ have anti $A_1$ in their serum. But this antibody is usually weak and most of the time no importance in selecting blood for transfusion. The difference between $A_1$ & $A_2$ is both quantitative & qualitative. $A_1$ red blood cell have about one million A antigen per cell. $A_2$ red cells have only 250,000 A antigen per cells or one fourth the amount that $A_1$ cells have$^3$.

A frequency of ABO blood group varies, till date only few studies have done on incidence of $A_1$, $A_2$, $A_1B$ & $A_2B$. Study was conducted to determine incidence of $A_1$, $A_2$, $A_1B$ & $A_2B$ in blood donors of Mahatma Gandhi Hospital Jodhpur.

Aim

The study was done to assess the prevalence of $A_1$, $A_2$, $A_1B$ and $A_2B$ subgroup in blood donors at Mahatma Gandhi Hospital Jodhpur, Western Rajasthan.

2. Material & Method

A total of one thousands blood donors with blood group A & AB were taken who attended Blood Bank MGH Jodhpur for donating blood voluntarily as well as on the replacement basis.

A and AB Blood groups are tested for their subgroups. On slide and tube a drop of Anti $A_1$ was placed and a drop of blood sample having blood group A & AB mixed on slide and test tubes were centrifuged, just after centrifugation result were recorded for agglutination. If agglutination was present then that blood group was recorded as $A_1$ & $A_1B$ respectively, and if no agglutination then $A_2$ & $A_2B$. Anti $A_1$ lectin is purified extract of the seeds of Dolicus biflorus containing phytoheamagglutinin (Lectin) which agglutinate human red cell only.

3. Observation

1000 blood donors who had either A or AB were taken for this study. 711 blood donors had A blood group and 289 had AB blood group.

Out of 711 ‘A’ blood group donor, 604 had $A_1$ subgroup while rest (107) had $A_2$ subgroup. (Table No. 1)

Out of 289 AB blood group, 236 had $A_1B$ subgroup and 53 had $A_2B$ subgroup (Table No. 1)

Hence in total 83% had $A_1$ subgroup while rest had $A_2$ subgroup. (Table No.1)

4. Discussion

The information of Blood Group is very essential as ABO blood groups system have a key role in evolutionary biology, anthropology, studying migration patterns, medical importance in diseases and organs transplantation, forensic pathology and medico legal issues such as mismatch pregnancy and disputed paternity$^4$.

ABO subgroups are distinguished by decreased amount of antigen in RBCs and in secretor, present in the Saliva.
The distribution of A & AB subgroups varies greatly among different population. Approximately 80% of Blood Group A or AB are classified as A₁ or A₁B the remaining 20% are either A₂ or A₂B. In 1911, Von Dungern described two different A antigens based on reaction between A, RBC, anti-A and anti-A₁. Classification into A₁ and A₂ phenotypes account for 99% of all group A individuals. The cells of approximately 80% of all group A (or AB) individuals are A₁ (or A₁B) and 20% remaining are A₂ (or A₂B) or weaker subgroups.

In our study 1000 blood samples were taken having blood group A and AB and has been tested for their subgroups i.e. A₁, A₂, A₁B, and A₂B. It was found that from total of 711 A group, 604 (84.9%) were A₁, 107 (15.1%) were A₂, and from 289 AB blood group, 236 (81.6%) were A₁B and 53 (18.4%) were A₂B. It is same as described by Von Dungern and by Prof. R.N. Makroo, Test Book of Transfusion Medicine.

The study done in Southern India shows 95.9% of A₁ and 4.1% of A₂ while among A₁B AB, it is 81.6% A₁B and 18.4% A₂B. Other studies done in India also shows, More than 90% of A₁ but among AB it ranged from 68.5% to 91.4% of A₁B and 31.5% to 8.6% of A₂B. (Table No. 2)

In the studies done at International level in Pakistan, Saudi Arab, Sudan and Japan, A₁ was 75.8% to 99.93% and A₂ was 0.17% to 24.2%. A₁B 79.8% to 98.9%, and A₂B was 1.12% to 20.2%.

All these studies had more number of A₁ and A₁B subgroup which is also seen in our study.

Table 1: Incidence of A and AB Subgroup in our Study

<table>
<thead>
<tr>
<th>Blood Group</th>
<th>No. of Donors</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A₁</td>
<td>604</td>
<td>84.9%</td>
</tr>
<tr>
<td>A₂</td>
<td>107</td>
<td>15.1%</td>
</tr>
<tr>
<td>A₁B</td>
<td>236</td>
<td>81.6%</td>
</tr>
<tr>
<td>A₂B</td>
<td>53</td>
<td>18.4%</td>
</tr>
</tbody>
</table>

Table 2: Incidence of A and AB Subgroup in Different Part of India

<table>
<thead>
<tr>
<th>Places in India</th>
<th>A₁</th>
<th>A₂</th>
<th>A₁B</th>
<th>A₂B</th>
</tr>
</thead>
<tbody>
<tr>
<td>North-West India (Rajasthan, Jodhpur)</td>
<td>84.9</td>
<td>15.1</td>
<td>81.6</td>
<td>18.4</td>
</tr>
<tr>
<td>Southern India (Tirupati)</td>
<td>95.9</td>
<td>4.1</td>
<td>80.8</td>
<td>19.2</td>
</tr>
<tr>
<td>Eastern India (Cuttack)</td>
<td>94.2</td>
<td>5.8</td>
<td>68.5</td>
<td>31.5</td>
</tr>
<tr>
<td>Central Part of India (Gwalior)</td>
<td>92.0</td>
<td>8.0</td>
<td>91.4</td>
<td>8.6</td>
</tr>
</tbody>
</table>

Table 3: Incidence of A and AB Subgroup in Various Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>A₁</th>
<th>A₂</th>
<th>A₁B</th>
<th>A₂B</th>
</tr>
</thead>
<tbody>
<tr>
<td>India (Our Study)</td>
<td>84.9</td>
<td>15.1</td>
<td>81.6</td>
<td>18.4</td>
</tr>
<tr>
<td>Saudi Arab</td>
<td>85.6</td>
<td>14.4</td>
<td>98.3</td>
<td>1.7</td>
</tr>
<tr>
<td>Pakistan</td>
<td>75.8</td>
<td>24.2</td>
<td>79.8</td>
<td>20.2</td>
</tr>
<tr>
<td>Sudan</td>
<td>93.4</td>
<td>6.5</td>
<td>91.6</td>
<td>8.3</td>
</tr>
<tr>
<td>Japan</td>
<td>99.83</td>
<td>0.17</td>
<td>98.86</td>
<td>1.14</td>
</tr>
</tbody>
</table>

5. Result

Variation in A & AB subgroups are observed widely. The common in all is that A₁ and A₁B are the commonest subgroup in A & AB subgroups. In our study incidence of A₁ is 84.9%, A₂ 15.1%, A₁B 81.6% and A₂B 18.4%.

The range of differences in A₂ in different places varies from 4-15% but range of differences in A₁B in difference places are wide i.e. 8-31.5%.

References

[10] Sharma Dharmesh Chandra, Rai Sunita, Iyenger Sudha, Jain Bharat: Prevalence and Distribution of ABO and Rh-D Antigens along with its subgroups & Rare Types in Greater Gwalior Region (3) OJBD 2013, 69-73.