

Study of Prevalence of A₂, A₂B along with major ABO Blood Groups to minimize the transfusion reactions



Medical Science

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ABSTRACT

Research on ABO blood group system has been of immense interest, due to its medical importance in different diseases. The heterogeneity of A and B alleles results in weak variants of these antigens. Subgroups of A differ both quantitatively and qualitatively. The aim of the present study was to study the frequency of A subtypes and to study the prevalence of A₂ and A₂B along with other major blood groups in the healthy donors in eastern India. Blood samples from 3918 donors were typed into major ABO blood groups using standard tube technique. Anti-A₁ lectin studies were done for all patients with groups A and AB and they were classified into A₁/A₁B, A₂/A₂B. ABO blood groups detected in 3918 blood donors were 37.2% of 'O' blood group, 33.6% of 'B' blood group, 22.3% of 'A' blood group and 6.8% of 'AB' blood groups. The A and AB blood groups were subtyped into 88.1% A₁ and 11.9% A₂, 5.8% A₂ blood groups were found in A blood group and 31.5% A₂B were found in AB blood group. The result of our study show a significantly higher proportion of A₂B subtypes than A₂ subgroups. Patients should receive these compatible blood groups to minimise the reactions occurring due to blood transfusion.

INTRODUCTION:

ABO system remains the most important blood group system in transfusion and organ transplant medicine. It was initially discovered by Karl Landsteiner in 1900 On the basis of presence or absence of A or B antigen on RBC². Later De Casterlo & Struli discovered the fourth blood type (AB) in 1902.³Rh blood group, referred as Rhesus blood group, is the second important group in Transfusion Medicine. It was recognised in 1939 which was confirmed within few years. This system is highly polymorphic due to the presence or absence of Rh (D) antigen on red cells.

ABO subgroups are phenotypes which differ in amount of A and B antigens present on red cells and secretions. 'A' subgroup is more common than 'B' subgroup. Clinically the most common subgroups encountered are A₁ and A₂ constituting 80% and 20% respectively. Extremely weak A (and) B subgroups are infrequently encountered which can be recognized by the apparent discrepancies between red cell (forward) and serum (reverse) grouping results. The distinction between A₁ and A₂ subgroups can be made by observing reactivity with the lectin from Dolichos biflorus seeds. The Dolichos biflorus lectin reacts specifically with the cells of A₁ subgroup and agglutinate A₁, but not the A₂ cells. A₂ phenotype reflect the inefficient conversion of H → A antigen, A₂ red cells show increased reactivity with Anti-H lectin Ulex europaeus. Extremely weak A (and) B subgroups are infrequently encountered which can be recognized by the apparent discrepancies between red cell (forward) and serum (reverse) grouping results. "In weak sub-groups of A, erythrocytes give weaker reactions or are non-reactive serologically with anti-A antisera than the subjects with A₂ red blood cells. In the present study, we have first determined A₂ subgroup dissecting out A₂ and A₂B groups along with other major ABO subgroups in the healthy donors.

MATERIAL & METHODS:

From April to June 2015, blood samples from 3918 donors were typed & ABO blood group 'A', 'B', 'AB', 'O' were found in 873(22.2%), 1318(33.6%), 269(6.8%), 1458(37.2%) of donors respectively. Blood grouping was done by test tube technique.

Forward grouping was done using monoclonal antisera anti-A, anti-B, anti-AB, & anti-D (Tulip Diagnostic, Goa, India) & reverse grouping by in-house prepared pooled A cell, B cell, & O cell. Blood groups were interpreted based on agglutination pattern in both forward grouping and reverse grouping. In forward grouping, A or B antigen agglutination was observed with the corresponding antisera & circulating anti-A or anti-B were detected by reverse typing using pooled cells. The blood samples were classified as Rh-D positive or Rh-D negative according to the presence or absence of the antigen D.

For forward grouping, 1 ml of whole blood was washed thrice with saline, each time followed by centrifugation for five minutes. Finally 3% red cell suspension was prepared by transferring 0.3 ml of washed red cells to a test tube with 9.7 ml of saline. 1 drop of anti-A, anti-B & anti-AB were placed in labelled tubes. To each test tubes 1 drop of 3% suspension of the red cells were added. After mixing, centrifugation, red cell buttons were resuspended & examine for agglutination.

For reverse grouping, two drops of serum 1 drop of A₁, B, A₂ reagent cells are added to the labelled test tubes. After mixing, centrifugation, the serum was examined for agglutination. Agglutination was graded according to AABB guidelines. One solid agglutinate was graded 4+, several large agglutinates as 3+, medium size agglutinates with clear background as 2+ and small agglutinates with a turbid background as 1+, very small agglutinates with a turbid background were graded as weak reaction (wk) and mixtures of agglutinated and un-agglutinated red blood cells as mixed field (mf).⁴Samples of group A and AB were further tested with anti-A₁ lectin (Tulip Diagnostic, Goa, India) to classify them into A₁, A₂ subgroups. When the sample showed 4+ agglutinates with anti-A antisera but negative anti-A₁ lectin, the sample was considered as A₂ subgroup. A or AB blood group samples showing agglutination with pooled A cells were tested with A₁ cells to confirm presence of anti-A₁ antibodies.

RESULTS:

ABO Blood groups detected in 3918 blood donors were 1458 of

‘O’ group (37.2%), 1318 of ‘B’ group (33.6%), 873 of ‘A’ group (22.3%) and 269 of ‘AB’ group (6.86%).(FIGURE 1) All A & AB blood group donor’s blood samples were sub typed into 1006 number of A₁ (88.1%) and 136 number of A₂ (11.9%) respectively. Out of 873 A blood group donors, A₂ was found in 51 cases (5.8%)(FIGURE 2) and out of 269 cases of AB blood group, A₂B was found in 85 cases (31.5%)(FIGURE 3).

DISCUSSION:

ABO blood group system was the first system discovered, a century ago . The real challenge faced by immunohematologists was the occurrence of weaker variant heterogeneity of A and B alleles. ABH antigens are expressed by the addition of terminal monosaccharide immunodominant sugar to the precursor oligosaccharide H chain.

In 1911, von Dungern described two different A antigens based on reaction between A RBC, anti-A and anti-A₁.⁶Classification 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.

Inheritance of an A₁ gene elicits production of high concentration of 3-N-acetyl-galactosaminyltransferase converting all H precursor structure to A₁ antigens. A₁ creates 810,000 to 1,170,00 antigen sites on the adult RBC, where as 240,000 to 290,000 antigen sites are present on the adult A₂ RBC.⁷ Around 1% to 8% of A₂ individuals produce anti-A₁ in the serum and 22% to 35% of A₂B individuals produce anti-A₁.⁸ This antibody causes discrepancy between forward & reverse ABO testing and incompatibility when crossmatched with A₁ and A₁B cells. A₁ and A₂ phenotypes can be differentiated by anti-A₁ lectin which is prepared from the plant Dolichus biflorus .This reagent only agglutinate A₁ (or A₁B).

Our study is similar to those in Blacks and Japanese, who showed more prevalence of A₂B than A₂ subgroup.^{9,10} The presence of strong B gene would suppress A₁ antigen activity explaining to the high frequency of A₂B in Black populations.¹¹Our study showed prevalence of 5.8% of A₂ and 31.5% cases of A₂B. Present study show similar ABO blood group prevalence in Eastern India showing blood group O being the commonest (37.2%) followed blood group B (33.6%), A (22.2%) and AB (6.7%).¹²

After sub-typing of A and AB phenotypes to A₁, A₂ and A₁B, A₂B, further studies are required on the prevalence and classification of weak A subgroups. Though a molecular characterization of the subtypes would have been useful in this regard, but was not possible in this study. Although the presence of clinically anti-A₁ is rare, the testing for anti-A₁ in all patients with A and AB blood groups should be performed before transfusion for patients benefit by reducing the transfusion reactions.

FIGURE LEGENDS:

1. Prevalence of major ABO blood groups in healthy donors
2. Sub-typing of A blood group
3. Number of A₁B & A₂B

FIGURE 1

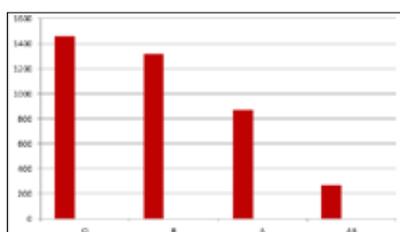
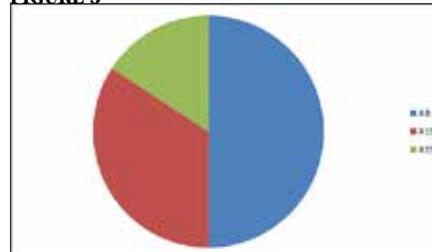


FIGURE 2



FIGURE 3



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