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Original Article

Seroprevalence of Anti-A1 antibody in Blood Group A and AB individuals

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Abstract

Objective: To determine the seroprevalence of Anti-A1 antibodies in blood group A and AB individuals and assess the distribution of A1/A2 and A1B/A2B subgroups in our population.

Methodology: This is a cross-sectional study conducted at Chughtai institute of pathology, Lahore from July to September 2024. A total of 375 A and AB individuals were tested for the presence of Anti A1 antibody. Individuals less than 6 months of age and those on chemotherapy were excluded from the study.

Results: A total of 340 blood groups were tested for anti-A1 antibodies. Out of these 340 bloods groups 280 (80.23%) were blood group A and 69 (19.77%) were blood group AB. Of the total blood group, A tested, 45 individuals had subgroup A2. only 12 individuals with blood group AB were labelled as blood group A2B. Of the total individuals with blood group A, 83.9 % were blood group A and 16.1% were A2. Likewise, in individuals with blood group AB, 82.6% were AB and 17.4% were A2B.

Conclusion: Although testing for anti-A1 antibodies is not routinely practiced in blood banks but we recommend that it's testing should be made an integral part of blood banking. Although rare but if occurs anti a1 antibody can induce severe hemolytic reaction specially in immunocompromised patients.

Key words: Anti A1 lectin, blood groups, subgroups.

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Introduction

There are 346 known blood group antigens, out of which 308 have been associated with 36 blood group systems while the remaining 38 are still not assigned to any blood group system. Among all these blood group systems ABO remains of utmost importance. The ABO antigens are not just present of the blood cells but are also present on endothelial cells and secretions like saliva, tears and milk.¹ These ABO antigens are product of ABO genes inheritance and have a codominant expression. The ABO system also has several weak subtypes which are characterized by decreased A/B antigens and a subsequent increase in H-antigen expression. Weak subtypes are often associated with blood discrepancies during reverse grouping due to the presence of unexpected anti-A or anti-B antibodies.²

Blood group A is divided into two major subgroups A1 and A2. Less frequent sub-groups include A₃, A_x, A_{end}, A_y and A_{el} which are characterized by a lesser number of

A antigenic sites on the red blood cells.³ The A1 and A2 subgroups can be differentiated by checking their reactivity with the lectin obtained from Dolichos biflorus seeds. The Dolichos biflorus lectin (Anti A1 lectin) reacts specifically with the cells of A1 subgroup and agglutinate A1, but not the A2 cells.⁴

Anti-A1 exist as naturally occurring IgM which reacts mainly when temperature is less than 25°C. However, cases of anti-A1 reacting at body temperature have also been reported worldwide. Anti-A1 can cause hemolytic transfusion reaction and its clinical manifestations have also been reported in hemopoietic stem cell and organ transplantation as well.^{1,5}

Although very rare but presence of anti-A1 in individuals carrying A1 antigens on red blood cells has also been reported. This antibody is labelled as "Auto-anti-A1. Rogers *et al.* detected auto-anti-A1 in a non-transfused patient while Castella *et al.* found auto-anti-A1 in a patient with metastatic carcinoma.⁶

Therefore, the aim of this study is to determine the frequency of anti-A1 antibodies in blood group A and AB individuals in our population so that we can develop guidelines regarding transfusion in patients with rare subgroups.

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Methodology

This is a cross-sectional study conducted at Chughtai institute of pathology, Lahore from July to September 2024 after taking approval from Institutional Review Board (IRB). A total of 375 A and AB blood group samples are tested in the blood bank of Chughtai Health Care center. The sample size was calculated using WHO sample size calculator keeping margin of error 5%, confidence interval 95% and prevalence of A and AB blood group 42% in Punjab.⁷ Sampling was done using a non-probability consecutive sampling technique. We enrolled subjects who came for blood group testing after taking their informed consent. Both male and females were included in the study. Individuals less than 6 months of age and those on chemotherapy were excluded from the study as their antibodies are diminished. 2ml of venous blood sample was taken from each subject in Ethylenediamine tetra acetic acid (EDTA) tube following standard sampling procedures. Blood grouping was performed using tube method. Both forward and reverse grouping were performed according to standard operating procedures (SOP) as per manufacturer's instruction. All A and AB blood groups were also be tested with Anti A1-Lectin to confirm the presence of Anti A1 antibody which enabled us to classify sub-blood groups A1 or A2. All the reactions noted while performing blood group were of good strength and any ambiguity was verified thoroughly.

Data were entered in the excel work sheets, checked manually and logically corrected where needed. The data was analyzed using Statistical Package for the Social Sciences (SPSS 20.0) and frequency and percentages were calculated for categorical variables.

Results

A total of 340 blood groups were tested for anti-A1 antibodies. Out of these 340 bloods groups 280 (80.23 %) were blood group A and 69 (19.77%) were blood

were Rh negative, all the others were Rh positive (Table I).

Of the total blood group, A tested, 45 individuals had no detectable reaction with Anti- A1 lectin antibody thus depicting that these individuals have subgroup A2. 12 individuals with blood group AB had no reaction with Anti- A1 lectin thereby they were labelled as blood group A2B (Table II).

Of the total individuals with blood group A, 83.9% were blood group A and 16.1% were A2. Likewise, in individuals with blood group AB, 82.6% were AB and 17.4% were A2B.

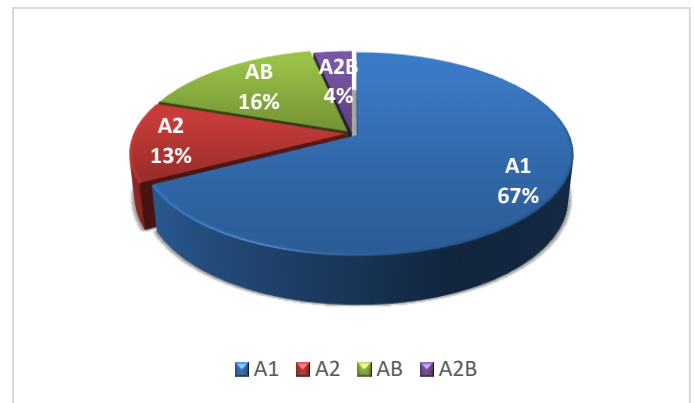


Figure 1: Pie chart showing frequency of blood groups and their subgroups.

Table II: Frequency of subgroups.

ABO Phenotypes	Subgroups	Frequency	Percentage
A	A ₁	235	67.3
	A ₂	45	12.9
AB	A ₁ B	57	16.3
	A ₂ B	12	3.4
Total		349	100

Discussion

Although ABO blood group system was discovered a century ago but detecting ABO subgroups and its weaker variants is a challenge for blood banks till date. Around 80% of blood group A and AB are subtyped as A1 and

Table I: Percentages and frequency of Blood group A and AB.

AB Phenotype	Rh phenotype Positive (n)	%	Rh phenotype Negative (n)	%	Total (n)	%
A	274	78.51	6	1.72	280	80.23
AB	66	18.91	3	0.86	69	19.77
Total	340	97.42	9	2.58	349	100

group AB. Only 9(2.59%) of the total blood group tested

A1B, respectively and the remaining 20% are subtyped as "A subgroup" most often A2 or A2B. A1 phenotyping

is generally not performed routinely in compatibility testing because Anti-A1 is clinically insignificant cold antibody which rarely causes transfusion reaction. Anti-A1 is significant, only if reacts at 37° C.⁸

Testing for Anti A1 is essential because it may cause hemolytic reactions. As Helmich et al reported a case of 96 years old female who had A2 blood group and developed severe hemolytic transfusion reaction and died shortly after transfusion. Her investigations revealed that she had high-titer of Anti A1 that induced complement deposition on A1 RBCs.⁹

In a study done on the Muslim population in Northern India by Hussain R et al., it was found that in a total of 724 samples analyzed, the prevalence of A1 and A1B was 26.52% and 19.34% and A2 and A2B was 2.90% and 1.24% respectively.¹⁰ Another study of Jammu and Kashmir, India showed that among A blood groups, frequency of A1 blood group was 94.09%, and A2 was 5.93%. Out of total AB blood groups, A1B was 85.5% and A2B was 14.48%. It was also observed that A2 in AB blood group was more frequent in occurrence than A2 in A blood group.¹¹ The same was observed in our study as well where the frequency of A2 was more in individuals with AB phenotype rather than those with A phenotype. In another study conducted by Giriyan et al the prevalence of A1 and A1B was 25.91% and 7.34% and A2 and A2B was 0.30% and 0.85% respectively in all donors in their blood bank.¹²

In a study conducted in Northern Pakistan, it was observed that the frequency of A2 was 13.8% and A1 was 86.9% which is quite similar to our study in which A1 was 83.9% and A2 16.1%. They also observed that blood group A2 individuals developed more Anti A1 as compared to those with A2B blood group.(3). This is contrary to the observation that A2B develops less Anti A1 as A2B have a smaller number of A antigens in comparison to A2 .¹³

In a study conducted in the Chinese population it was found out that only 134 individuals had A2 and A2B phenotypes among the total 11263 individuals that were tested. It was also observed that the proportion of A2B among AB samples was significantly higher than that of A2 in group A samples.¹⁴ These findings are similar to our findings where proportion of A2B among AB individual is slightly more than that of A2 in group A individuals.

Conclusion

Although testing for anti-A1 antibodies is not routinely practiced in blood banks but we recommend that it's testing should be made an integral part of blood banking. Although rare but if occurs anti a1 antibody can induce severe hemolytic reaction specially in immunocompromised patients. In time detection of this antibody in individual with rare subgroups can save their lives and make their journey towards recovery smooth and easy without the worry of hemolytic transfusion reactions.

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