Prevalence of Blood Group A2 in Northern Pakistan

Muhammad Sajid Yazdani, Zeeshan Khalid*, Muhammad Ali Rathore**, Sarah Fatimah***

Combined Military Hospital Abbottabad/National University of Medical Sciences (NUMS) Pakistan, *Armed Forces Post Graduate Medical Institute/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, **Armed Forces Institute of Transfusion/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, ***Armed Forces Institute of Pathology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan,

ABSTRACT

Objective: To determine the prevalence of A1 and A2 subgroups of blood group A in healthy blood donors of northern Pakistan.

Study Design: Cross sectional study.

Place and Duration of Study: Armed Forces Institute of Transfusion, Rawalpindi Pakistan, from Sep to Dec 2017.

Methodology: The blood samples of donors reported during the study period at Armed Forces Institute of Transfusion were collected. ABO typing was performed and those in group A and AB were further subtyped using anti-A1 lectin and thus the individuals were labelled as A1 (and A1B) or A2 (and A2B). The serum of individuals with groups A2 and A2B was tested for anti-A1 based on the reaction with A1 red cells.

Results: Out of total 4485 donors, 1116 (24.88%) were of blood group A and 422 (9.41%) individuals were of AB group. Out of 146 (13.08%) individuals among 1116 blood group A donors were of subgroup A2. While out of 422 of blood group AB, 80 (18.95%) were A2B. 21 (14.38%) out of 146 individuals of A2 blood group, had anti-A1 antibody while among 80 individuals with A2B blood group only 2 (2.50%) had anti-A1 antibody in their serum.

Conclusion: Blood group A2 is quite prevalent in our population. Although anti-A1 is present in significant fraction of A2 blood group individuals, the routine testing is not needed to identify the A2 group and cross match compatibility is the only requirement as anti-A1 is rarely active at 37° C.

Keywords: A2 blood group, A2B blood group, Subgroups of A blood group.

INTRODUCTION

It was noticed in early twentieth century that the serum of some individuals agglutinates the red blood cells of others. This important observation lead to blood group systems discovery, the first of which was ABO by Landsteiner, earning him a Nobel Prize.[1,2] In ABO blood group system, further sub groups are identified on the basis of decreasing amounts of antigens on red cell surface with or without some qualitative changes.

The varied expression of A antigen was recognized at the beginning of the 20th century and blood group A was divided into A1 and A2, the two major subgroups.[3,4] Less frequent sub groups of A2 (A3, Ax, Ael, Am, Afin, Aint and Ah) are characterized by a decreasing number of A antigen sites on the red cells and a corresponding increase in H antigen activity. The frequency of the subgroups of blood group A varies considerably between different populations. Generally almost 80% of blood group A or AB have subgroup A1 and the remaining 20% have A2.[5,6] Red cells from the people with subgroups A1 and A2 show a very strong reaction with monoclonal anti-A reagents in direct agglutination tests.[7,8] The reactivity of red cells with the lectin obtained from Dolichosbiflorus seeds differentiates between these two subgroups. The red cells of A1 subgroup, are specifically agglutinated by this Dolichos biflorus lectin. Now this Anti A1 lectin is commercially available thus making serological subgrouping easier.

It is not essential to identify these subgroups of blood group A routinely but the significance of identification of A2 group lies in the fact that not very in frequently Anti-A1 antibody appears as an atypical cold agglutinin in the sera of A2 or A2B individuals,[9,10] which is also active at 37°C in fewer cases, posing a potential risk of haemolytic transfusion reaction. The prevalence of A subgroups varies differently from place to place and with race. Thus, we planned this present study to determine the prevalence of A1 and A2 subgroups in healthy donors from Northern Pakistan.

METHODOLOGY

This cross-sectional study was carried out at Armed Forces Institute of Transfusion, Rawalpindi, from September to December 2017 after the approval

Correspondence: Dr Muhammad Sajid Yazdani, HOD Pathology, Combined Military Hospital, Abbottabad Pakistan

of Ethical Committee (Ref no. 106/Adm 8 Aug 2017). The data confidentiality was ensured. The sample size was calculated by using Word Health Organization (WHO) sample size calculator, keeping the population of 50,000 and confidence level of 95%. Non-probability consecutive sampling technique was used.

Inclusion Criteria: The blood donors of either gender who donated blood during the study period were included in this study.

Exclusion Criteria: The samples of donors with blood group O and B were excluded from the study.

Blood grouping for all the blood donors was performed on semi-automated analyser Qasar IV® in EDTA. The samples of donors with blood group A and AB were further tested using commercial anti-A1 lectin (tube method) according to the manufacturer's instructions. Based on reaction with anti-A1 lectin, the individual blood groups were classified as A1 or A2 subgroups. Reverse grouping with A1 cells was performed on the samples having A2 and A2B sub groups to detect anti-A1 antibody. The data were analysed and tabulated by using Microsoft Excel-2017.

RESULTS

A total of 4485 blood donors reported during the study period. Among them 4451 (99.2%) were males and rest 34 (0.8%) were females. Blood grouping of these 4485 blood donors revealed that 1116 (24.88%) individuals were of blood group A and 422 (9.41%) individuals were of AB blood group. Further analysis revealed that out of 1116 donors of blood group A, 970 (86.92%) individuals were of A1 and remaining 146 (13.08%) individuals of subgroup A2 (Figure-1).
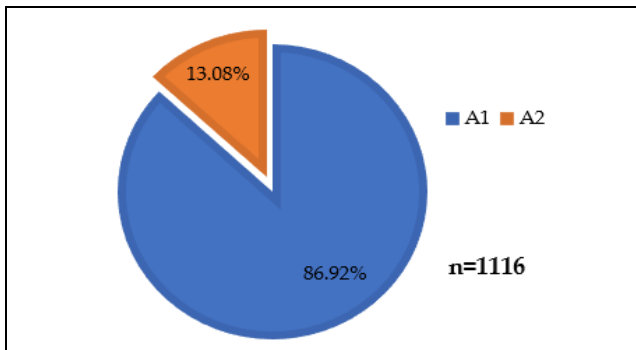

Figure-1: Frequency of A1 and A2 blood group.

While 342 (81.04%) individuals out of 422 of blood group AB were A1B and 80 (18.96%) individuals were A2B (Figure-2). These all results show the overall frequency of A1 as (970/4485) 21.63%, A2 as (146/4485) 3.26%, A1B as (342/4485) 7.63% and A2B as (80/4485)

1.78%. The serum of 23 (10.18%) samples belonging to blood group A2 and A2B individuals showed anti-A1. Out of 146 individuals of A2 blood group, 21 (14.38%) had anti-A1 antibody while among 80 individuals with A2 B blood group only 2 (2.5%) had anti-A1 antibody in their serum (Figure-3).
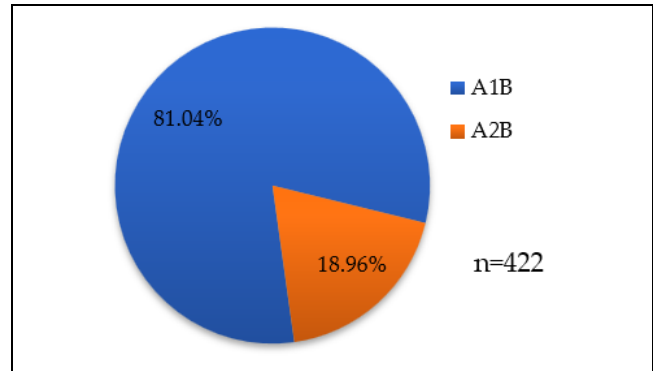

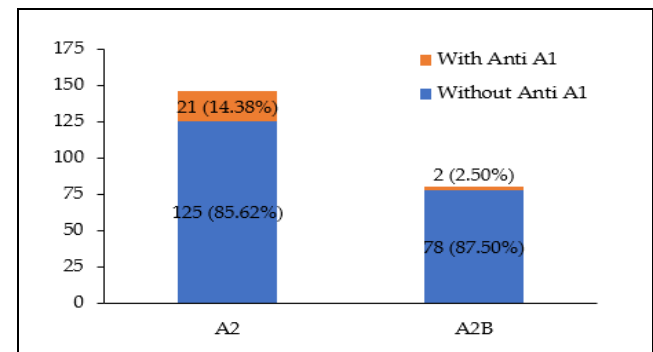**Figure- 2: Frequency of A1B and A2B blood group.**

Figure-3: Frequency of anti-A1 antibody in A2 and A2B blood groups.

DISCUSSION

Our study showed slightly higher frequency of A2 in blood group AB (18.96%) than A (13.08%). Anti-A1 was found far more prevalent in blood group A2 (14.38 %) than A2B (2.5 %). In contrast to our study, the blood groups A2 and A2B prevalence in a study of South India by Shastry *et al* and Bhatt *et al* was 1.85% and 10.50% respectively.[11] Another study conducted at North Karnataka region of India, showed that 98.90% individuals of blood group-A belonged to A1 sub-group and only 1.10% were of blood group A2.[12] Again, these results are in clear contrast to our present study.

Our findings of Northern Pakistan were similar to black population and Japanese, in whom the prevalence of A2 is significantly higher in blood group AB than A. To explain the high frequency of A2B in black populations, the presence of a strong B gene that would suppress A1 antigen activity has been postulated.[13] In a study conducted at Rayalseema area India by

Kumar *et al*, the prevalence of A2 and A2B in blood groups A and AB were 4.1% and 19.2 % respectively.[14]

The prevalence of A2 and A2B were 5.8% and 31.5% respectively in a similar study by Mahapatra *et al*.[15]

The prevalence of A2B subgroup in blood group AB was slightly higher in our study than that of A2 in A blood group, which is in agreement with Caucasian population study.[16] A study conducted in Lahore, Pakistan showed the prevalence of A1 as 18.4%, A2 as 5.8%, A1B as 6.7% and A2B as 1.7%[17] which was quite similar to our present study (21.63%, 3.26%, 7.63% and 1.78% respectively). Another study from Saudi Arabia showed prevalence of Al as 14.4% A2 as 4.7%, A1B as 9.3% and A2B as 1.7%,[18] which was also in agreement to our present study (Table).

Table: Frequency of blood groups A1, A2, A1B and A2B.

Previous Studies	Prevalence of A2 in Blood Group (%)		Overall Prevalence of Blood Groups (%)			
	A	AB	A1	A2	A1B	A2B
Shastry *et al*[11]	1.85	10.5	-	-	-	-
Giriyan *et al*[12]	1.1	-	-	-	-	-
Kumar *et al*[14]	4.4	19.2	-	-	-	-
Mahapatra *et al*[15]	5.8	31.5	-	-	-	-
Present	13.08	18.96	21.63	3.26	7.63	1.78
Parveen *et al*[16]	-	-	18.4	5.8	6.7	1.7
Maranjian *et al*[18]	-	-	14.4	4.7	9.3	1.7

The individuals with A2 and A2B may develop anti-A1 antibody which mostly causes red cell agglutination up to 25°C and thus of no clinical significance. However, if anti-A1 is reactive at 37°C, which may happen occasionally though, has a potential of causing hemolytic reactions. According to this study about 14.85% individuals of A2 and 2.5% individuals of A2B blood group, had anti-A1 antibodies, which is surprising and in clear contrast to other studies.[5,7,11] However, further studies in different other areas of Pakistan are suggested to confirm this finding. Our results also signify the importance of reverse blood group with A1 cells. Future genetic studies are suggested to confirm the serological findings and further separation of subgroups of blood group A.

Blood group A2 is quite prevalent subgroup in our population. It remains generally unnoticed, unless there is anti-A1 antibody active at 37°C, where it results in incompatible cross-match. Although anti-A1 is present in quite a significant fraction of A2 blood group individuals, there is no need, in routine testing, to identify the A2 blood group and cross match compatibility is the only requirement as anti-A1 is rarely active at 37°C. Based on the results of our study, it is recommended that the reverse blood grouping with A1 cells must be ensured in the routine blood grouping.

LIMITATIONS OF STUDY

The inability to distinguish between A2 and other weak subgroups of group A serologically was the main limitation of our study.

CONCLUSION

Blood group A2 is quite prevalent in our population. Although anti-A1 is present in significant fraction of A2 blood group individuals, the routine testing is not needed to identify the A2 group and cross match compatibility is the only requirement as anti-A1 is rarely active at 37° C.

Conflict of Interest: None.

Disclosure: The part of the data was presented in Haemcon 2018 as poster presentation.

Authors' Contribution

MSY: Idea conception, Supervised the study & Write the manuscript, ZK: Performed the tests, Data analysis, MAR: Technical support & Review the manuscript, SF: Review and help in final drafting.

REFERENCES

1. Coghlan G. The JR blood group system: genetic and molecular investigations. ISBT Sci Ser 2012; 7(1): 260-263.
2. Raja KA, Dobariya GH, Unagar CA, Pandya AN, Patel JN, Wadhwani SN. Frequency and distribution of ABO and Rh blood groups among blood donors in tertiary care hospital of South Gujarat, India. Int J Res Med Sci 2016; 4(12): 5377-5381.
3. Owusu EA. Prevalence of blood group A2 among Group A and AB donors who visit the Southern area blood centre (master's thesis). Legon, Ghana: University of Ghana; 2019 [Internet] Available from: http://ugspace.ug.edu.gh/bitstream/handle/123456789/34352/ (Accessed on December 20,2018)
4. Mathur N, Lamichaney R. A hospital based study to find the distribution of ABO and Rh blood group in the local population of Sikkim, North-Eastern India. J Med Res 2017; 3(6): 273-276.
5. Elnour MA, Ali NY, Mohammed HA, Hummeda SA, Alshazally WY, Elderdery AY, et al. Frequency of the A2-subgroup among blood group A and blood group AB among students of faculty of medicine and health sciences at AlimamAlmahadi university, White Nile, Sudan. Hematol Transfus Int J 2015; 1(4): 104-106.
6. Esmaili HA, Najafzadeh J, Elmdoost N. Investigating the frequency of anti-a1 antibody in individuals with a2 blood group. J Urmia Univ Med Sci 2015; 26(6): 476-481.
7. Hussain R, Fareed M, Shah A, Afzal M. Prevalence and gene frequencies of A1A2BO and Rh(D) blood group alleles among some Muslim populations of North India. Egypt J Med Hum Genet 2013; 14(1): 69-76.
8. Pradhan PK, Mishra SC, Patnaik BK, Mohanty D. Prevalence of ABO and RH Blood Group and Sub-Group A1 and A2 in Blood Donors of Odisha-Experience of One Tertiary Centre. J Blood Lymph 2019; 9(249): 2-5.
9. Chaudhari CN, Misra RN, Nagpal AK. Transfusion in Blood Group A2B with Anti A1 Recipient. Med J Armed For Ind 2008; 64(4): 371-372.
10. Chiewsilp P, Pinyopornpanich C, Makechay S, Tubrod J, Tingtoy U, Oota S. Subgroups of A in Thai Blood Donors. J Hematol Transf Med 2017; 27(4): 397-401.

11. Shastry S, Bhat S. Imbalance in A2 and A2B phenotype frequency of ABO group in South India. Blood Transfus 2010; 8(4): 267-270.

12. Giriyan SS, Agrawal A, Bajpai R, Nirala NK. A1 and A2 sub-types of blood Group 'A': a reflection of their prevalence in North Karnataka Region. J Clin Diagn Res 2017; 11(5): 40-42.

13. May RM, Du Toit ED. Blood group gene frequencies of four population groups in the western cape. S Afr Med J 1989; 76(12): 647–650.

14. Kumar ISC, Yashovardhan A, Suresh BB, Verma A, Babu KVS, Bai BSJ. The prevalence of A2 and A2B subgroups in blood donors at a tertiary care teaching hospital blood bank of Rayala-seema region: A pilot study. J Clin Sci Res 2012; 1(1): 50.

15. Mahapatra S, Mishra D, Sahoo D, Sahoo BB. Study of Prevalence of A2, A2B along with major ABO Blood Groups to minimize the transfusion reactions. Int J Sci Res 2016; 5(3): 189-190.

16. Voak D, Lodge TW, Stapleton RR, Fogg H, Roberts HE. The Incidence of H Deficient A2 and A2B Bloods and Family Studies on the AH/ABH Status of an Aint and Some New Variant Blood Types (Aint H↓A1, A2↑HwA1, A2↑BHA1B and A2↓BHA2B). Vox Sanguinis 1970; 19(1): 73-84.

17. Parveen N. ABO and sub-groups of group A in the Lahore Population. J Pak Med Assoc 1987; 37(8): 200-201.

18. Maranjian G, Lkin EW, Mourant AE,. The blood groups and haemoglobins of Saudi Arabians. Hum Bio 1966; 38(4): 394-420.

....