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Frequency of Kell Blood Group Antigen in Voluntary Blood Donors

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Abstract

Background: The data on incidence of antigens of various blood groups in the local donor population helps in routine blood transfusion practices of a blood transfusion centre. It is important to know the frequencies of the various antigens when dealing with patients who have developed multiple alloantibodies. This information is necessary to predict the availability of blood units that lack the corresponding antigen(s). The current practice of providing compatible blood to patients in such cases in India is still reliant upon random cross matching of available units in the inventory.

Aim: To study the prevalence of Kell antigen in the voluntary blood donors with a view to generate blood bank data for constitution of panel of blood donors for multipurpose utilities.

Materials and methods: A prospective study was carried out on 3014 healthy blood donors from April 2016 to Nov 2016 at our blood bank. Donors were grouped and typed for ABO and Kell antigen. Statistical analysis was carried out using Microsoft excel software. Incidence was given in proportion with 95% confidence interval.

Results: The frequency of K antigen was 2.92%. **Conclusion:** Database for antigen frequency in local donor population helps to provide antigen negative blood unit to patients with multiple alloantibodies, minimize alloimmunization rate, and thereby improve blood safety.

Keywords: Kell blood group antigen, prevalence, Alloimmunization.

Introduction

The data on incidence of antigens of various blood groups in the local donor population helps in routine blood transfusion practices of a blood transfusion centre [1]. In situations where clinically significant antibodies are identified in patient's serum antigen-negative donor units for such cases can be easily retrieved from the donor database of various blood groups available with a blood transfusion centre. For this particular reason, all blood banks should have the donor database on antigen frequency of other blood group systems in their local donor population.

RBCs transfusion may become complicated by immunizations. Although blood transfusion is a life saving remedy but not without risk. Blood transfusion can cause immediate or delayed immunological reactions, out of these most serious is the haemolytic transfusion reaction by antibody incompatibility.

A total of 308 RBC antigens are recognized till now by the International Society of Blood Transfusion (ISBT), 270 of which are clustered in 30 blood group systems [2].

The Kell blood group system (also known as Kell-Cellano system) was discovered in 1946 and was named after Mrs. Kellner. Kell locus is located at 7q34. The k antigen is a high frequency antigen that is present in more than 98% of whites and blacks. The K antigen is much less common but very immunogenic. These antigens are the third most potent, after those of the ABO and Rh blood groups, in triggering an immune reaction), Because of this, anti-K is often encountered [3].

The Kell blood group system is an interesting mix of high-frequency and low-frequency antigens. It consists of 25 antigens, which include six pairs of triplets of antithetical antigens. All of these polymorphisms represent Single Nucleotide Polymorphisms SNP's encoding amino acid substitutions on the Kell glycoprotein. The two antithetical antigens (K and k) remain the most common of the system. K has a frequency of about 9% in a Caucasian population, and about 3.6% in blacks. Despite the low quantity of K antigens on the Red Blood Cells (RBC) surface (3,500-6,000 K copies/cell), it is very much immunogenic. It can be detected on fetal RBC's as early as 10 weeks of gestation. Outside the ABO and Rh antibodies, anti-K is the most common antibody seen in the blood bank. It is usually made in response to antigen exposure through pregnancy or previous transfusion and can persist for many years. The antibody is therefore important in transfusion medicine, autoimmune hemolytic anemia (AIHA), and hemolytic disease of the newborn (HDN). People without Kell antigens (K0) must be transfused with blood donors who are also K0 to prevent hemolysis [4,5,6,7].

Alloantibodies against kell (K) also can impose serious clinical problems such as delayed haemolytic reactions and logistic problems, for example, to obtain timely and properly matched transfusion blood for patients in which new alloantibodies are detected [8]. Retrospective studies in the general population reported antibody frequencies after transfusion in less than 1 to 3 percent. However, in multi-transfused patients, alloimmunizaton occurs in up to 70% of patients [9,10].

There is wide variation in distribution and frequency of Kell antigens throughout the world and lack of study especially from west part of India i.e. in the population of Rajasthan, impelled us to identify the frequency of Kell antigens.

2. AIM

This study was carried out to determine the phenotypic frequency of Kell (K) antigen in healthy blood donors.

3. Material and Methods

This prospective, cross-sectional analytical study was conducted upon voluntary blood donors from camps organized by Dept. of IHBT, S.P Medical college, Bikaner, Rajasthan (India). Collected blood samples were from VBD camps organized in different areas so that we have representative samples in the study from urban and rural areas of different zones of Rajasthan, India. 3,014 subjects were included in the study over a period from April 2016 to Nov 2016. All donors were examined and were declared fit for donation as per guidelines of WHO. Written consent was taken at the time of donor screening. The antigen typing of donors was performed.

Reagents

K antigen was typed using monoclonal anti-K sera from Immucor derived from clone MS56.Before proceeding to Kell phenotyping, the donor's ABO grouping was done. For Kell (K) typing, red blood cells were tested against specific antisera to observe antigen-antibody reactions (haemagglutination) by the microplate haemagglutination method with IgM monoclonal antiserum on a fully automated system (Galileo, Neo, Immucor Inc., Norcross, GA, USA) as per instructions provided in the instrument operator manual. Conventional tube method was also done

using 1 drop of specific antisera with 1 drop of 3-4% suspension of red blood cells to be tested. No agglutination indicated its absence. Agglutination reactions in positive test results were recorded and graded as 1+ to 4+.

4. Results

During the study period, antigen typing was done on 3014 voluntary blood donors. ABO grouping in this study showed that "B" was the most common blood group (37.92%) followed by "O" (32.25%), "A" (20.97%) and "AB" was the least common (8.86%) type.

RhD typing along with other major Rh antigens was done on all the donors and out of the 3,014 donors 2,771(91.94%) were D positive and 243 (8.06%) were D negative.

Table 1. shows Prevalence of Kell Antigen (2.92%) in the study population. Blood group wise distribution of Kell antigen is shown in Table 2. p-value = 0.27 shows that relation of K antigen to the ABO antigens is not statistically significant. Prevalence of Kell Antigen in Rh D positive and Rh (D) negatives blood donors in the study population is shown in Table 3. The Kell antigen was 4.12% in D negative individuals while in D positive individuals it was 2.81%. p-value = 0.33 depicts that prevalence of K antigen with relation to Rh(D) positive and negative is also not statistically significant.

TABLE 1. Prevalence of Kell Antigen in the study population.

Antigen	K
No. (n=3014)	88
Percentage (%)	2.92
95% CI	2.32-3.52

TABLE 2. Prevalence of Kell Antigen in ABO blood group system in the study population.

Antigen	Blood Group							
	A (n=632)		B (n=1143)		O (n=972)		AB (n=267)	
	No.	%	No.	%	No.	%	No.	%
K	12	1.90	37	3.24	33	3.40	6	2.25
Chi-square = 3.93, df = 3								
p-value = 0.27								

TABLE 3. Prevalence of Kell Antigen in Rh D positive and Rh (D) negatives blood donors in the study population.

Antigen	D positive (n=2771)		D negative	
	No.	%	No.	%
K	78	2.81	10	4.12
Chi-square = 0.91, df = 1				
p-value = 0.33				

5. Discussion

In Kell system our study shows frequency of K antigen was 2.92%. The prevalence of K antigen among the study population was compared with that of other studies carried out in India at different regions [11,12,13,14] and with other populations [15,16,17] as presented in Table 4 and 5. The K (KEL 1) Antigen frequency was 2.92% in our study, which was similar to the study done by Divjot Singh Lamba et al (2.8%) [11] but lower than the studies done by Thakral et al (5.68%) [12], and Kahar et al (6.09%) [13]. This difference may be due to the fact that donor population in our study includes donors of all blood groups as compared to "O blood group" donors in their study. Thus there is a need to perform more studies with much larger sample size to know more accurately the antigen frequency of Kell antigen in the population of this region.

The expression of Kell antigen is different in different populations all over the world. There is racial and ethnic difference in expressing Kell antigen.

TABLE 4. Comparison of frequency of Kell Antigen in various Indian Studies.

Indian Study	(KEL1) Antigen (%)
D. Lamba et al [11]	2.8
Thakral et al [12]	5.68
Kahar et al [13]	6.09
Present Study	2.92

The maximum expression of Kell antigen on red cell surface is seen in Caucasians [14] with no antigen on RBC sample of Chinese populations [15] and Thai [16].

The prevalence of K antigen was found to be 2.92% in our study, which is comparable with the frequency in Black population. However frequency in whites and Caucasian are higher where 9% individuals express K antigen.

TABLE 5. The frequency of Kell Antigen Worldwide.

Population	KEL1 Antigen (%)
Caucasian [14]	9
Chinese [15]	0
Thai [16]	0
Present Study	2.92

6. Conclusion

Kell antigen testing was carried in random population from all rural and urban areas which encompassed a total of 3,014 subjects. Total no. of donors who were tested positive for K antigen was 88.

It has been reported that in the population of different ethnic and racial, the incidence of Kell antigen is reported to be rare to a maximum of 9% in Caucasians and up to 25% in arab population [17]. The genetic and environmental factor, previous transfusion, pregnancy and factors responsible for varying frequency needs to be probed further. Further studies need to be carried out a large sample size. Thus a multi-centric study in hospitals located in different regions, would be valuable to provide information regarding the frequency of the Kell antigen in different regions of India. Outcomes of such studies can be used to formulate a Rare Blood group Donor registry (donors lacking high frequency antigens) at national level, and patients with antibodies against high frequency antigens can be directed to such Rare Blood Group donor registry. Whenever any transfusion reaction, AIHA and pregnant women wherein chances of HDN are expected, the anti-Kell antigen screening is recommended. The third most immunogenic antibody is that of Kell. It is also advisable to test for anti-Kell in persons who are positive for unexpected antibodies. The person who have received multiple transfusion/multi-parity, also need to be tested for anti-Kell antibodies.

Though the sample size of this study was relatively small compared to the huge population of the country, it still gives an estimate of the frequency of Kell blood group antigen.

References

[1]. Brecher ME. 15th ed. Bethesda: American Association of Blood Banks; 2005. Technical manual; pp. 304–58.

[2]. Daniels G, Castilho L, Flegel WA, Fletcher A, Garratty G, et al. International Society of Blood Transfusion Committee of terminology for red blood cell surface antigens: Macao report. Vox Sang, (2009); 96: 153-156.

[3]. Kathryn E, Webert James W, Smith Donald M : Red Cell, Platelet, and White Cell Antigens Wintrobeâs Clinical Hematology. (12th edtn.). Lippincott Williams & Wilkins, 2009, 22: 631-638.

[4]. Coombs RR, Mourant AE, Race RR. A new test for the detection of weak and incomplete Rh agglutinins. Br J Exp Pathol 1945;26:255-66.

[5]. Lee S, Wu X, Reid M, Zelinski T, Redman C. Molecular basis of the Kell (K1) phenotype. Blood 1995;85:912-6.

[6]. Lee S, Lin M, Mele A, Cao Y, Farmar J, Russo D, *et al*. Proteolytic processing of big endothelin-3 by the kell blood group protein. Blood 1999;94:1440-50.

[7]. Yu LC, Twu YC, Chang CY, Lin M. Molecular basis of the Kell-null phenotype: A mutation at the splice site of human KEL gene abolishes the expression of Kell blood group antigens. J Biol Chem 2001;276:10247-52.

[8]. Daniels GL, Fletcher A, Garratty G et al. Blood group terminology 2004: from the International Society of Blood Transfusion committee on terminology for red cell surface antigens. Vox Sang 2004; 87:304-316.

[9]. Zalpuri S, Zwaginga JJ, Le Cessie S et al. Red-blood-cell alloimmunization and number of red-blood- cell transfusions. Vos Sanguinis 2012; 102:144-149.

[10]. Miller ST, Kim HY, Weiner DL, et al. Investigators of the Sickle Cell Disease Clinical Research Network (SCDCRN). Red blood cell alloimmunization in sickle cell disease: prevalence in 2010. Transfusion 2013; 53:704-709.

[11] .Divjot Singh Lamba, Ravneet Kaur, and Sabita Basu: Clinically Significant Minor Blood Group Antigens amongst North Indian Donor Population; Advances in Hematology, 2013, Volume 2013, Article ID 215454, 5 pages.

[12]. Thakral B, Saluja K, Sharma RR, Marwaha N. Phenotype frequencies of blood groups systems (Rh, Kell, Kidd, Duffy, MNS, P, Lewis, and Lutheran) in north Indian blood donors. Transfus Apher Sci.2010; 43:17–22.

[13]. Manoj A. Kahar and Rajnikant. D. Patel. Phenotype frequencies of blood group systems (Rh, Kell, Kidd, Duffy, MNS, P, Lewis, and Lutheran) in blood donors of south Gujarat, India Asian J Transfus Sci. 2014 Jan-Jun; 8(1): 51–55. PMCID: PMC3943149 doi: 10.4103/0973-6247.126693

[14]. Reid ME, Lomas-Francis C. 2nd ed. London: Elsevier Academic Press; 2004. The blood group antigen facts book; pp. 29–296.

[15]. Lin-Chu M, Broadberry RE, Chan FJ. The blood group antigens and alloantibodies among Chinese in Taiwan. Transfusion. 1988; 28:350-52.

[16]. Nathalang O, Kuvanont S, Punyaprasiddhi P, Tasaniyanonda C, Sriphaisal T. A preliminary study of the distribution of blood group systems in Thai blood donors determined by the gel test. Southeast Asian J Trop Med Public Health. 2001 Mar; 32(1): 204-7.

[17]. Abdelaal MA, Anyaegbu CC, al Sobhi EM, al Baz NM, Hodan K. Blood group phenotype distribution in Saudi Arabs. Afr J Med Med Sci. 1999 Sep-Dec; 28(3-4): 133-5.