FREQUENCY OF KELL ANTIGENS (K & K) AMONG BLOOD DONORS OF NORTHERN PAKISTAN

Asad Mehmood, Maqbool Alam, Muhammad Sajid Yazdani, Muhammad Ali Rathore

Armed Forces Institute of Transfusion/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To determine the frequency of Kell blood group antigens (K and k) in blood donors from northern Pakistan.

Study Design: Cross sectional study.

Place and Duration of Study: The study was carried out at immunohaematology department of Armed Forces Institute of Transfusion (AFIT) Rawalpindi, Pakistan, from 1st Nov 2017 to 31st Dec 2017.

Methodology: After approval of Ethical Committee of Armed Forces Institute of Transfusion (AFIT) Rawalpindi, the blood samples of 2000 blood donors were collected. Samples were selected by non-probability consecutive sampling technique. After preliminary blood grouping for ABO and Rh D, these samples were phenotyped for K (kelleher) and k (celleno) antigens. Typing was performed on Biorad® automated blood grouping system by column agglutination technique (CAT), strictly following manufacturer's instructions.

Results: Out of 2000 blood donors, typed for K and k antigens, 1966 were males (98.30%) and 34 were females (1.70%). The frequency of K was 4.05% (81/2000) and that of k was 98.90% (1978/2000). The phenotype K-k+ (95.15%) was most prevalent followed by K+k+ (3.75%), K-k- (0.80%) and K+,k- (0.30%).

Conclusion: K antigen frequency is lower than as reported in Caucasions and Saudi Arabia but higher than Indian and African blood donors. This study confirmed that the k (celleno) blood group antigen was highly prevalent antigen in Pakistani population while the K (kelleher) antigen was present in a relatively lower frequency.

Keywords: Blood donors, Kell blood group, K & k antigens.

INTRODUCTION

Modern era of blood transfusion medicine started by great discovery of ABO blood group system by Karl Landsteiner in 1900[1]. Till this time, 36 blood group systems including their genes have been recognized by International Society of Blood Transfusion (ISBT)[2]. Kell is third most important blood group system after the ABO and Rh systems with a potential of causing hemolytic disease of fetus and newborn (HDFN) andhemolytic transfusion reaction[3,4]. It was discovered after discovery of Anti human globulin (AHG) in 1946 by Coombs, Mourant and Race[5]. They described an antibody in the serum of Mrs. Kelleher, which was responsible for HDFN. The name of antibody was given after the name of that lady as anti-Kellantibody[6]. After three year of this discovery, Levine and colleagues described anti-cellano antibody also called anti-k antibody. Later on so many other antigens were discovered. Presently Kell system consists of more than 30 antigens which reflecs the complexity of this system. The most important of these antigens are K & k, which are highly immunogenic and anti-K & anti-k antibodies are usually IgG type but can be IgM. These antibodies are immune and are not naturally occurring[7]. Technically Anti-K (IgG) antibodies react strongly with K positive cell by indirect Antiglobulin test (IAT) at 37°C and these are typically avid, react at same strength with K+k+ and K+k- red cells and show no dosage effect. This means it is not essential to have rare phenotype K+k- on red cell panel. Although Kell antigens are resistant to enzyme treatment, enzyme technique is not reliable for detection of kell antibodies[8].

Correspondence: Dr Muhammad Sajid Yazdani, Transfusion & Haematology Consultant, AFIT Rawalpindi Pakistan
Email: dryaz2000@yahoo.com
Received: 16 Aug 2018; revised received: 31 Dec 2018; accepted: 09 Jan 2019

Amongst Kell antigens, frequency of K ranges between 2-9% among different populations, while k antigen is highly frequent all around the world[8-10]. Because of lower frequency of K antigen it is easy to find K negative blood for allo immunized patients. On the other hand due to high prevalence of k antigen, probability of anti k alloantibodies is quite low although anti k antibodies have been reported. However, if an individual becomes alloimmunized with k antigen and develop anti-k antibodies, it becomes very difficult to find k negative blood due to high frequency of k antigen[8]. In pregnant women, transfusion history is strongly contributory to anti-K alloimmunization. About 80% of pregnant women with anti-K antibodies have a history of Red cell transfusion. Some studies suggest the administration of Kell negative blood to women during reproductive age so that alloimmuniza-tion could be avoided[11].

Present study was planned with an objective to determine the frequency of Kell blood group antigens (K,k) among blood donors from northern Pakistan.

METHODOLOGY

This cross-sectional study was carried out at Armed Forces Institute of Transfusion Rawalpindi, Pakistan from 1st November to 31st December 2017 after approval of Ethical Committee of the institute. Data were kept confidential and strictly for academic purpose. Samples of 2000 whole blood donors fulfilling the donor selection criteria were studied. Red blood cells from blood donor samples available after preliminary ABO and Rh D grouping were used for K and k typing. The phenotyping for K and k antigens was performed on fully automated blood grouping Biorad® system using column agglutination technique (CAT). The manufacturer instructions were followed in laboratory procedures for making cell suspensions and quality control. K antigen was detected by direct agglutination whereas indirect antiglobulin technique (IAT) was used for the detection of k antigen as described by manufacturer's instructions.

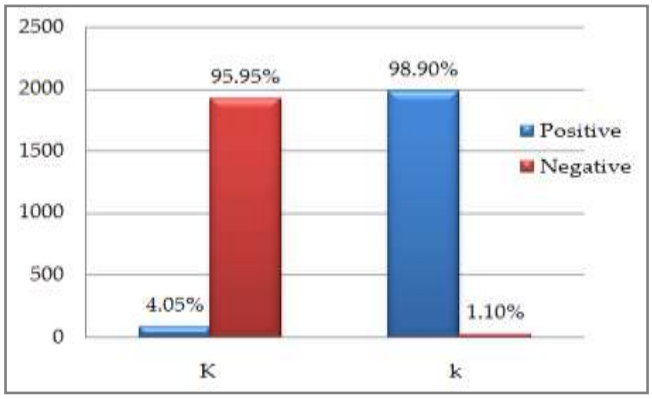

Figure-1: Frequency of Kell antigens.

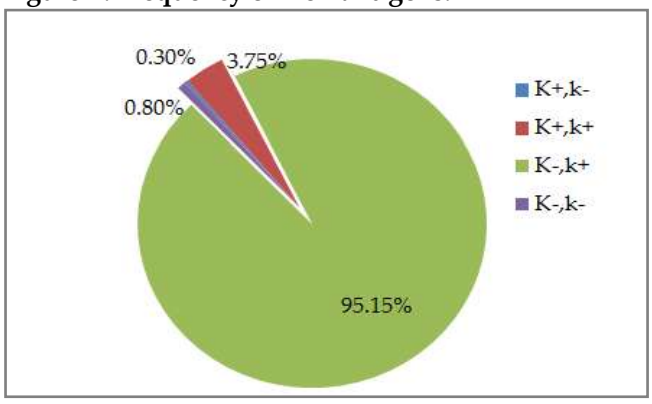

Figure-2: Frequency of Kell Phenotypes (n=200).

RESULTS

A total of 2000 samples were analyzed, 1966 were males (98.30%) and 34 were females (1.70%). The phenotyping showed 81 samples positive for K antigen and 1978 showed presence of k

Table: Antigen frequency of K and k antigens in different studies.

Antigens	Present Study n=2000	Agha Khan[13] n=100	India[9] n=3073	KSA[8] n=400	Nigeria[10] n=150	West Africa[11] n=651	Morocco[12] n=1286
K	4.05%	-	3.50%	18.2%	2%	0.77%	7%
k	98.90%	100%	99.97%	97.0%	N/A	99.94%	N/A

antigen. The frequency of K antigen was calculated as 4.05% and of k as 98.90% (fig-1).

Further analysis of results revealed that out of these 2000 samples, 6 exhibited homozygosity (0.30%) for K antigen and 75 showed heterozygosity (3.75%). Majority (95.15%) of these had double dose for k antigen (1903) and 16 were negative for both K and k antigens (0.80%). Thus the phenotype K-k+ (95.15%) came out to be most prevalent followed by K+, k+ (3.75%), K-k- (0.80%) and the least prevalent phenotype was K+, k- (0.30%) as depicted in fig-2.

DISCUSSION

Information regarding prevalence of blood group antigens in a population is useful for transfusion services for provision of safe blood and evidence based management of HDFN. It is also helpful in managing cases of alloimmunization. Multiply transfused patients such as those with thalassaemia, refractoryanemia, multiparous females etc are prone to develop antibodies against blood group antigens other than ABO system[12]. Practically it is difficult to match all these red cell antigens before transfusion to avoid alloimmunization. Finding compatible units for such patients without having any knowledge of prevalence of the implicated antigens in concerned population is difficult which is multiplied further, if the patient has developed more than one antibody[13].

Our observed K antigen frequency is 4.05 % as against 9% reported in Caucasions[5]. The study by Elsayid M and colleagues in Kingdom of Saudi Arabia showeda higher frequency of K antigen (18.2%) than our study (4.05%) and lowerfrequency of k (97%) than ours (98.90%)[14]. Frequency of K antigen in present study (4.05%) is onlyslightly higher than Indian blood donors (3.5%) as reported by Makroo and colleagues[15]. Prevalence of k antigen is higher in Indian study (99.97%) than ours (98.9%)[14]. The K antigen was more prevalent in our study (4.05%) as compared to Nigerian study (2%)[6] and in the healthy blood donor population of West Africa (0.77%)[16], while the prevalence of k antigen was comparatively less frequent in our study. A Moroccan studyon blood donors showed prevalence of K antigens as 7%, higher than ours[17] (table). Our study showed that the frequency of phenotype K-k+ is 95.15%, slightly lower than Indian population (96.5%) and K+k+ is 3.75%, slightly higher than Indian study (3.47%)[15]. A cross sectional study on blood donors at Agha Khan University hospital, Karachi revealed 100% positivity for k antigen and none (0%) of these showed presence of K antigen[18]. The result showed a significant difference as compared to other studies which are conducted in Asia, including our present study. But this difference could be possibly due to very small sample size.

CONCLUSION

The Kell blood group antigen k (celleno) was highly prevalent in Pakistani population, while the K (kelleher) was less frequent than Caucasians. These results will be helpful in establishing a local donor data bank for transfusion services planning and preparation of indigenous screening and identification cell panels for a nationwide usage. The phenotypic status of Kell blood group antigens should be determined, for phenotypically matched blood transfusions, along with ABO and Rh D typing in patients expected to require multiple transfusions.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

REFERENCES

1. Schwarz HP, Dorner F. Karl landsteiner and his major contributions to haematology. Br J Haematol 2003; 121(4): 556-65.
2. Daniels GL, Fletcher A, Garratty G, Henry S, Jorgensen J, Judd WJ et al. Blood group terminology from the International Society of Blood Transfusion committee on terminology for red cell surface antigens. Vox Sanguinis 2004; 87(4): 304-16.
3. Dajak S, Čulić S, Stefanović V, Lukačević J. Relationship between previous maternal transfusions and haemolytic disease of the foetus and newborn mediated by non-RhD antibodies. Blood Transfus 2013; 11(4): 528-32.
4. Manfroi S, Velati C. K-antigen blocking in a case of haemolytic disease of the foetus and newborn. Blood Transfus 2017; 15(6): 585-6.
5. Elmissbah T. Distribution of Kell Blood group system antigens Kpa, Kpb, and Phenotypes in Major Populations of Sudan. J Blood Disord Transfus 2013; 4(3): 140-42.

6. Osaro E, Ladan MA, Zama I, Ahmed Y, Mairo H. Distribution of Kell phenotype among pregnant women in Sokoto, North Western Nigeria. Pan African Med J 2015; 21(2): 301-10.
7. Harmening D. Modern blood banking & transfusion practices. 6th ed. Philadelphia: F.A. Davis; 2012; 191.
8. Qureshi R. Introduction to Transfusion Science Practice. 6th ed. Manchester: British Blood Transfusion Society; 2015; 199.
9. Mohamed S, Muna I. Characterisation of rh and other blood group systems amongst the maldivian blood donors. Med J Malaysia 2013; 68(5): 393-6.
10. Yu Y, Ma C, Sun X, Guan X, Zhang X, Saldanha J, et al. Frequencies of red blood cell major blood group antigens and phenotypes in the Chinese Han population from Mainland China. Int J Immunogenet 2016; 43(4): 226-35.
11. Royal College of Obstetricians & Gynaecologists. Blood Transfusion in Obstetrics. Green-top Guideline No. 47. London; 2015.
12. Bhuva DK, Vachhani JH. Red cell alloimmunization in repeatedly transfused patients. Asian J Transfus Sci 2017; 11(2): 115-20.
13. Hassan K, Younus M, Ikram N, Naseem L, Zaheer HA. Red Cell Alloimmunization in Repeatedly Transfused Thalassemia Major Patients. IntJ Pathol 2004; 2(1): 16-19.
14. Elsayid M, Alfaifi AM, Almutairi AK, Almajed F, Al Saqri F, Qureshi S. Phenotypic Profile of Kell blood group system among saudi donors at King Abdulaziz Medical City-Riyadh. J Med Sci Clin Res 2017; 5(1): 15654-57.
15. Makroo RN, Bhatia A, Gupta R, Phillip J. Prevalence of Rh, Duffy, Kell, Kidd & MNS blood group antigens in the Indian blood donor population. Indian J Med Res 2013; 137(3): 521-6.
16. Bogui LS, Dembele B, Sekongo Y, Abisse S, Konaté S, Sombo M. Phenotypic profile of Rh and Kell blood group systems among blood donors in Cote d'Ivoire, West Africa. J Blood Transfus 2014; 2014: 309817.
17. Zahid H, Yahyaoui A, Uwingabiye J, ElKhazraji A, Labrini F, Hadef R et al. Phenotype frequencies of Rh and Kell Blood Group Systems in Blood Transfusion department of Avicenna Military Hospital, Marrakech, Morocco. Intl J Medicine Health Res 2016; 2(1): 1-10.
18. Kareem F, Moiz B, Mohammad FJ, Ausat F, Khursheed M. Rhesus and kell phenotyping of voluntary blood donors: Foundation of a donor data bank. J Coll Physicians Surg Pak 2015; 25(10): 757-60.