Antigens and their phenotypes among blood

Seroepidemiologic evaluation of Kell ØŒ Kidd, Duffy and Lutheran systems

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Abstract:

Background and Objectives:

30 blood group systems which include more than 302 antigens are detected. Some antigens are numerous and some are very rare. Exposure to mismatch erythrocyte antigens in transfusion, generate different Alloantibodies. It suggested reducing the risk of alloimunization by detecting minor blood group antigens. The purpose of this research is to determine the frequency of Kell ØŒ Kidd, Duffy and Lutheran blood group systems antigens in Mashhad blood donor, in order to use in antibody screening kit and identification donors with rare blood groups.

Material and method:

The study was carried out on 400 blood donors referring to Mashhad Blood Center. All donors blood group was O, and their viral screening tests (HIV, HTLV1, HBV, and HCV) were negative. Appropriate cell suspensions were incubated with several Kell ØŒ Kidd, Duffy and Lutheran antiserums; then,

based on the type of reactions observed and most probable genotypes identified

Results:

The most common phenotypes were Kp (a $^{-}$ b $^{+}$), K $^{-}$ k $^{+}$ in KellØŒ Fy(a+b+)in DuffyØŒ K(a+b+) in Kidd ÙˆLu(a-b+)in Lutheran system. Some phenotype such as Kp (a+b-)ØŒ Lu(a+b-) ØŒ Lu(a-b-)ØŒ JK(a-b-) were not seen in this population.

Conclusion:

In this study four donors with less common phenotypes were detected and their blood Packs were used for producing screening panel test cells. Their information was stored for blood donation in patient with reiterated mismatch cross match.

Key word: Phenotype – Antigen – Kell- Kidd – Duffy -Lutheran

Introduction:

Since the discovery of the ABO systems in 1901 by Karl land Steiner, blood groups introduce to the world (1). 30 blood group systems which include more than 302 antigens are identified (1. 2). Red cell antigens are classified in two system collections, low frequency and high frequency antigens (2). Compatible blood transfusion will survive the patient but the side effect of transfusion may threat patient’s life (3).

Compatible blood in ABO and Rh is necessary in transfusion and incompatible blood induces immunity stimulation and alloantibody production (4. 5).

Many blood groups antibodies are induced transfusion complication such as hemolytic disease of new born (HDN), hemolytic transfusion reaction (HTR), and hemolysis (6-10) and... that occur in 3. 5% of people who receive blood packs (3).

Preparing compatible and suitable blood are facilitate by laboratory techniques such as: cross match, antibody screening test, indirect combs and ... (11) . after the discovery of indirect combs a rapid increase was occur in transfusion medicine (12). Other erythrocyte antigens are not usually considered significant, but receiving fully typed blood will reduce the risk of alloimmunization (7). The most clinically significant minor blood groups are Rh, Kell, Kidd and Duffy (12). It’s further suggested that antibody screening test done with cross match, before transfusion as a routine test to reduce the risk of alloimmunization (13). Typing donors pack cell for antigenic systems and person who require transfusion in periods of time (14. 15) and store the data in information banks, help to prepare suitable blood for patient with several erythrocyte antibodies and to produce antibody screening cells. This process rapid the blood preparation procedure.

This study was done at Iranian blood transfusion organization, to determine the prevalence of red blood cell phenotype in Kell , Kidd, Duffy and Lutheran in Mashhad (northeast of Iran) donors.

Material and method:

This study was approved by research committee of Iranian blood transfusion organization in Mashhad.

A total number of 400 donors were included in this study, who attended to Iranian blood transfusion organization centers in Mashhad. All donors blood group was O and viral screening tests (HIV, HTLV1, HBV, and HCV) were negative. Samples that the viral screening tests were positive or don't belong to people who inhibited in Mashhad city were gotten out of this study. 5 Mili liter Peripheral bloods were collected in EDTA tube. Duffy(Fya, Fyb) and Kidd(Jka , Jkb) and k , K antigens in Kell system was typed for all samples, but because of limitation in amount of anti-sera, Lutheran antigens(Lua . Lub) and Kpa and Kpb antigens in Kell system typed just in 261samples. Cell suspension 3-5%in normal saline was prepared for each sample. The antigen typing of donor was performed, using cell suspension of samples and commercial antibodies (produced by Diagast and Immunodiastica Company, respectively). The test was performed as structure by the manufacture. The reactions were interpreted as result and erythrocyte phenotypes were reported.

Results:

The study of Lutheran systems showed that the expression of the Lu (a-b+) exceed 99% in the study group. None expression of the Lu (a+b-) and Lu (a-b-was seen in the population.

In the Duffy systems the Fy(a+b+) has been found to be the most common phenoytpes(38. 2%) in blood donors. Fy(a-b-) was found only in 0. 4% of donors.

Of the Kidd phenotypes, theJK (a+b+) was the commonest (50. 2%) in this population. However no donors had JK (a-b-) phenotype.

In the Kell system, the majority of the blood donors were K-k+ (95%) and Kp(a-b+)(99. 6%).

Some phenotype such as Kp(a+b-), Jk(a-b-) , Lut(a+b-), Lut(a-b-) were not seen in 400 donors.

Among 400 donors, 4 donors identified with low frequency phenotypes such as: K+k- , Lu (a+b+), Kp(a+b+). Their blood pack was used to prepare panel screening cells and the information was stored for blood preparation in patient with multi mismatch cross match.

Phenotypes frequencies in comparison to white are written below. Look at table1-4

Table 1. Phenotype frequency of Kell system.

Kp(a-b+)	Kp(a+b+)	Kp(a+b-)	K-k+	K+k+	K+k-	
99. 6%	0. 4%	0%	95%	4. 5%	0. 5%	Donors
97. 7%	2. 3%	Rare	91%	8.	0.	White

8% 2%

Table 2. Phenotype frequency of Duffy system

Fy(a-b-)	Fy(a-b+)	Fy(a+b+)	Fy(a+b-)	
0. 4%	28. 8%	38. 2%	33%	Donors
Very Rare	34%	49%	17%	White

Table 3. Phenotype frequency of Kidd system

JK(a-b-)	JK(a-b+)	JK(a+b+)	JK(a+b-)	
0%	21. 8%	50. 2%	28%	Donors
Very Rare	23%	49%	28%	White

Table 4. Phenotype frequency of Lutheran system

Lu(a-b-)	Lu(a-b+)	Lu(a+b+)	Lu(a+b-)	
0%	99. 6%	0. 4%	0%	Donors

Very Rare	93%	7%	0. 1%	White

Discussion:

Phenotype frequency blood group systems in Mashhad (northeast of Iran) are similar to white population in the world, and some little difference was seen in comparison to the world. A donor with rare phenotype Fy (a-b-) was an Arab-African emigrant that his ancestor had inhibited in Iran more than hundred years ago.

Musa’s study in National Blood Centre in Malaysia that detecting the prevalence of different antigenic phenotypes in Malaysian states detecting minor blood group in blood bank are very important, but just ABO and RH are typed in different center. Comparison the phenotypes frequency demonstrate that Fy(a+b-) is the most frequent phenotype of Duffy system in Malaysian but Fy(a+b+) phenotype was more common between our society. Another frequency does not reveal an important difference (16).

Makroo PN study in India demonstrates that the risk of alloimmunization after transfusion is 3-5% . people that develops alloantibody as a response to transfusion, May injury of complications. The survive rates in patient who receive fully match blood units increase (9).

Keramati’s study introduce Kp (a-b+), K-k+ in Kell and Lu (a-b+) in Lutheran systems as common phenotypes. These data accommodate the result of this study, but rare phenotypes frequencies such as Lu (a+b+) and Fy(a-b-) reveal a significant difference(2). Probably this difference is because of

donors’ blood group, which in this study all blood groups were O but Keramati’s study include different groups.

According to prevalence of haemoglobinopathy in southeast of Asia, a study was done to detect different alloantibodies in Thailand. Antigen Fya belongs to Duffy system is the most frequent antigen in Asian country. Nathalang et al. reported the common phenotype of Duffy , Lutheran and Kidd respectively : Fy(a+b-), Lu(a+b-) , Jk(a+b+)(13) . these results are similar to the phenotype frequency of northeast of Iran.

Presences of antibodies against some blood groups induce hemolytic reaction after transfusion. Chan and et al. Introduce k as a frequent antigen in Kell system (17) . our finding support this subject too.

Erythrocyte phenotyping and detecting antigenic frequency in patient who receive frequent blood packs, help to produce information blood banking of patient s and donors, and this process facilitate blood preparation in reiterated Mismatch cross match, and reduce the side effect of transfusion(18).

Another benefit of this process is identifying donors with particular phenotypes to provide screen panel cells.

Conclusion:

It seems that it’s necessary to identify erythrocyte phenotype in patients who receive frequent blood packs and in donors to prepare fully compatible blood and reduce transfusion complications.

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