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Original Article

Proportion of Rh phenotypes in voluntary blood donors

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ARTICLE INFO

Article history:
Received 14 February 2012
Accepted 10 May 2013
Available online 24 September 2013

Keywords:
Rh blood group
Rh phenotypes
Alloimmunization
Multitransfused cases

ABSTRACT

Background: The Rh system is the major blood group system besides ABO system. Even after proper blood grouping and cross matching there is a possibility of alloimmunization and antibody production in the recipients against the Rh or minor blood group antigens like Kell, MNSs, Duffy etc. Keeping in view the heavy financial burden of complete phenotyping of blood; the determination of only Rh phenotypes can play a major role in preventing alloimmunization and adverse events in multitransfusion cases. To determine the proportion of Rh phenotypes in voluntary blood donors with a view to generate blood bank data for constitution of panel of blood donors for multipurpose utilities.

Method: Identification of Rhesus factors (Rh) was done by the antigen antibody agglutination test by the test tube method on 10,133 healthy voluntary donors.

Results: The phenotypic frequencies of Rh blood groups in the studied population were D-92.25%, C-87.55%, E-26.55%, c-51.06% and e-98.42%. Thus 'e' was the most common and E was the least common of all the Rh types. Phenotypically DCCee group was the most common phenotype and dccee was least common type.

Conclusion: Determination of Rh phenotypes can play a major role in preventing alloimmunization and avoiding adverse events in multitransfusion cases.

Introduction

The true genetic make-up of an individual is termed as genotype and effect of the genes can be clinically observed by the apparent outcome, known as the phenotype. The ABO and RhD grouping along with cross matching by Anti Human Globulin (AHG) technique is a mandatory requirement for safe transfusions. The Rh system currently is composed of 49 antigens expressed by the genes on chromosome 1. The important antigens of Rh system are: RhD, RhC, RhE, Rhc and Rhe. Even after proper blood grouping and cross matching there is a possibility of alloimmunization and antibody production in the recipients against the Rh or minor blood group antigens like Kell, MNSs, Duffy etc. Some developed countries have already made revolutionary changes in their cross match protocols and have started complete genotyping of their donors to make a huge database of donors for future usage and references. Some other countries have made extensive

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http://dx.doi.org/10.1016/j.mjafi.2013.05.004

phenotyping and complete cross matching compulsory for the category of patients who may require multiple transfusions in future. These procedures have added massively to the cost of blood banking in developed nations and thus its implementation in developing countries like India is way behind. Significantly the incidence of Kell is not so high in India as in the western countries.[1] Keeping in view the heavy financial burden of complete phenotyping the determination of only Rh phenotypes can therefore play a major role in preventing alloimmunization and avoiding adverse events in subsequent transfusions in multitransfusion cases. The present study was done to record the phenotypic frequency of various Rh antigens in blood donor population of Central Maharashtra. To determine the proportion of Rh phenotypes in voluntary blood donors of central Maharashtra with a view to generate data with multipurpose future utilities for health and prevention of alloimmunization. This study will also contribute to development of blood bank data for constitution of panel of blood donors, particularly, for multitransfused, alloimmunized patients.

Materials and methods

This study was carried out over a period of one and a half years from May 2010 to October 2011 on 10,133 Healthy Voluntary Donors reporting to the Blood Bank, Armed Forces Medical College, Pune. Determination of Rhesus factors (Rh) was done by the antigen antibody agglutination test by the test tube method. 5–10 cm segments of tubes were taken from blood bags by using tube sealers and stored at 2–4 °C. Five clean tubes were arranged and marked C, D, E, c and e & one drop of corresponding antisera and one drop of 2–5% of cell suspension was added, mixed and centrifuged at 1000 rpm for 01 min and the reaction was interpreted as agglutination +ve or −ve. Weak reaction or −ve reaction was confirmed by ID-Card "DiaClon Rh-subgroups" from Diamed AG, Switzerland by Gel method by antiglobulin test. Statistical analysis was done using Microsoft office Excel software.

Results

The Blood Bank of Armed Forces Medical College, Pune has an annual blood donation by 10,000 donors. A total of 10,133 (ten thousand one hundred and thirty-three) blood donor samples of all groups were typed for the presence of Rh (D, C, E, c, e) antigens. There were 9743 (96%) male donors and 390 (4%) female donors. The donors ranged from 18 to 60 years of age. Most of the donors were in the age group of 18–27 years. The donors were from all the districts of Maharashtra and majority of them were from Pune and army background.

ABO grouping in this study showed that "O" was the most common blood group (33%) and "AB" was the least common (9%) type. The trend was similar in male and female donor population. In Rh positive and negative males group "O" continued to be the most common type. While in Rh-positive females the result was similar to Rh-positive males, the expression of "O" and "A" groups was equal in the Rh-negative females. RhD typing along with other major Rh antigens was done on all the donors and out of the 10,133 donors 9348 (92.25%) were D+ and 785 (7.74%) were D−. The percentage of Rh − females was 0.42% whereas in males it was 7.32%.

Table 1 shows gender-wise distribution of Rh (D, C, E, c, e) antigens in the study population. The e antigen was found to have the highest frequency (98.42%), followed by D and C antigen (92.25% and 87.55%, respectively). Since genotyping was not done, the presumed Rh phenotype frequencies in our population are shown in Table 2. Nine probable phenotypes were found to be present in our population, the most common being DCe/DCe (R1R1; 35.2%). dce/dcE (rr″) (0.07%) was the most rare phenotype observed. The apparent homozygosity for CC, cc, EE and ee genes was found in 45.71%, 9.21%, 0.93% and 72.79% of donors tested, respectively. Table 3 shows antigen frequency (AF) of other Rh antigens (CcEe) in Rh (D) positive and Rh (D) negative blood donors in the study population. The maximum antigen frequency in Rh (D) positive donors was e (94.6%) followed by C (90%) and in Rh (D) negative donors e (99.5%) followed by c (97.8%).

Discussion

The aims of the study were to phenotype the 5 major types of Rh antigens in voluntary donors, to determine the Rh composition of the population in central Maharashtra to generate a database of donors for all future activities.

Prevalence of Rh (D) positive and Rh (D) negative blood donors in India

A total of 10,133 blood donors were tested for Rh (D) antigen by commercially available antisera where 92.25% of the donors were found to be Rh (D) positive and the remaining 7.74% Rh (D) negative. Comparison of the results of our study with the previous studies from India is shown in Table 4.

Our result of 92.25% Rh (D) positive blood donors is in agreement with earlier study from South India (92.25% vs. 94.53%).[2] Comparing our results with studies from different

Table 1 – Gender-wise distribution of Rh antigens in the study population.

Rh antigen type	Male	Female	Total	Percentage
Rh 'D' +ve	9001	347	9348	92.25%
Rh 'D' −ve	742	43	785	7.74%
Total	9743	390	10133	
Rh 'C' +ve	8534	338	8872	87.55%
Rh 'C' −ve	1209	52	1261	12.45%
Total	9743	390	10133	
Rh 'c' +ve	4965	209	5174	51.06%
Rh 'c' −ve	4778	181	4959	48.94%
Total	9743	390	10133	
Rh 'E' +ve	2577	114	2691	26.55%
Rh 'E' −ve	7166	276	7442	73.45%
Total	9743	390	10133	
Rh 'e' +ve	9587	386	9973	98.42%
Rh 'e' −ve	156	04	160	1.58%
Total	9743	390	10133	