STUDY OF WEAK D PHENOTYPE IN HETEROGENEOUS POPULATION

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ABSTRACT

Weak D is the current phenotypic term used to denote a weakened expression of Rhesus (Rh) D antigen on red cells due to a quantitative or qualitative difference in Rh antigen. The present study was undertaken from January 1986 to August 1997. Out of a total of 5042 Rh D confirmation tests 22 (0.43%) weak D phenotypes were detected. Fifteen (68.3%) weak D phenotypes were from blood group O. Five (22.7%) from blood group A and one (4.5%) each from blood group B and AB. There were 15 males and 7 females. There were no cases of haemolytic disease of the newborn or Rh incompatibility.

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KEY WORDS : Rhesus antigen; Red cells; Weak D.

Introduction

Wweak D is the current phenotypic term used to denote a weakened expression of Rhesus (Rh) D antigen on red cells due to a quantitative or qualitative difference in Rh D antigen [1]. It was described by Stratton in 1946 who named it Du phenotype. The weak D red cells have a relatively smaller number of D antigen sites and are evidently Rh D positive [2]. The frequency of weak D phenotype is relatively low, being less than 1% [3].

The present study was undertaken in Armed Forces Medical College, Pune to analyse the frequency of weak D Phenotype in the heterogenous population of blood donors reporting to the Department of Blood Transfusion.

Material and Methods

The present study was conducted in the Department of Transfusion Medicine, Armed Forces Medical College, Pune for the period from January 1986 to August 1997. Donor samples which showed no agglutination with Anti D (typing sera) are routinely put up for standard confirmatory procedure before labelling as Rh D negative. It is in these that some individuals may be weak D type and were tested by standard procedure and protocols using Bovine Albumin, anti Human Globulin sera and specific monoclonal typing sera [4]. Only anti-D sera recommended by the manufacturers for weak D testing were used for carrying out the test and the positive samples were labelled as weak D positive.

Results

Out of a total of 5042 Rh D confirmation tests received from January 1986 to August 1997, 22 weak D phenotype were detected (0.43%). Table-1 shows the blood groupwise distribution of weak D. Fifteen weak D phenotypes were from blood group O (68.3%). There were 15 males and 7 females. Table-2 shows the statewide distribution of weak D. There were 16 (72.70%) weak D pheno-

types from Maharashtra. Table-3 shows the ethnic distribution of weak D. There were 17 (77.2%) Hindu weak D phenotype.

TABLE 1
Blood groupwise distribution of weak D phenotype

Blood group	No.	Percentage
O	15	68.3
A	5	22.0
B	1	4.5
AB	1	4.5
Total	22	100

TABLE 2
Statewise distribution of weak D phenotype

State	No.	Percentage
Maharashtra	16	72.7
Kerala	2	9.1
Uttar Pradesh	2	9.1
Bihar	1	4.5
West Bengal	1	4.5
Total	22	100

TABLE 3
Ethnic distribution of weak D

Ethnic group	No.	Percentage
Hindus	17	77.2
Muslims	4	18.3
Christians	1	4.5
Total	22	100

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Discussion

Weak D phenotype involves a quantitative or qualitative variation in Rh D antigens located on red cells resulting in a weakened expression of the Rh D antigen. Normal D positive red cells of the R1r and R2R2 phenotypes bear about 10,000 and 30,000 Rh D antigen sites per cell respectively. In contrast, Rh D antigen sites number from 300-9000 per cell on weak D red cells [5]. Studies with both polyclonal and monoclonal anti D have been used to determine the number of Rh D antigen sites on the red cells, including automated methods.

The weak D phenotype may arise from three different genetic mechanisms. Firstly, a person may inherit a gene that encodes for a weakened quantitative expression of D. Secondly, one gene may interact with another to modify and weaken the expression of the D antigen; or thirdly a gene may not encode for all the epitopes that make up the complete D antigen [6].

Molecular cloning of Rh c DNA and subsequent studies by Colin et al, in 1991, revealed that individuals with Rh D positive red cells have two Rh genes, RHD and RHCE, while most of those with Rh D negative red cells have only one gene, RHCE [7]. RHCE is the name of the gene whose alleles include RHCE, RhcE, Rhce and RHCE, most individuals with Rh D negative red cells are homozygous for Rhce.

A small subset of individuals with Rh D positive red cells are able to make anti D antibodies but not against their own RBCs or with those of other individuals of the same unusual Rh D positive phenotype. Tippett, described these individuals as having partial D on their red cells [8]. In partial D phenotypes, one or more epitopes of D are missing, and such individuals can produce alloimmune anti D against the epitopes of Rh D that their red cells lack. The partial D phenotype always involves a qualitative difference in the Rh D antigen and sometimes leads to a quantitative difference (partial weak D or partial Du phenotype) as well. In tests using potent anti D typing reagents made from pools of human polyclonal anti-D, most partial D red cells type as unremarkable Rh D positive.

The incidence of weak Rh D in India is 0.3 to 0.5% [4]. The frequency in the present study is 0.43% which compares well with the Indian data. Sixteen cases belonged to Maharashtra which may be due to the fact that most of the civilian donors hail from Pune. Monoclonal anti D are ideal for testing weak D and partial Rh D antigen. The importance of weak D lies in the fact that it is much less antigenic as compared to Rh D and weak D red cells may be destroyed if transfused to a person having anti D. Hence, weak D donor units are currently labelled as Rh D positive. Weak D testing is not done for a recipient and they are labelled as Rh negative. The weak D positive infant can suffer from haemolytic disease of the newborn, if the mother possesses anti D antibodies. There were no cases of HDN or Rh incompatibility in the present study. Weak Rh D testing plays an important role in determining who should receive anti D immunoprophylaxis with Rh Immunoglobulin (Rh Ig). Newborns of Rh negative mothers are tested for Rh D and weak Rh D, and Rh Ig is recommended for mothers of Rh D positive or weak Rh positive in order to prevent immunisation.

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