Proceedings S.Z.P.G.M.I vol: 13(3-4) 1999, pp. 65-69.

Frequency of Duffy Blood Group in A Section of Lahore Population

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SUMMARY

The prevalence of Duffy blood group was studied among 310 healthy volunteers. Fy^{b-} was the most common blood group. Found in 91.29% cases while Fy^{b+} was only 8.71% Fy^{a-} was present in 54.19% and Fy^{a} in 45.81% individuals. When tested for both anti-Fy^{a+} and anti Fy^{b} the most common group was $Fy^{(a+b-)}$ in 46.12% individuals followed by $Fy^{(a-b)}$ in 45.16% cases. $Fy^{(a-b+)}$ was fond in 3.54% persons while only 1.61% individuals were $Fy^{(a-b+)}$. The prevalence of Duffy group differs markedly from Caucasian population, where the most common group was $Fy^{(a+b)}$ present among 47.85% cases. Followed by $Fy^{(a-b+)}$ among 35.56% individuals and $Fy^{(a+b-)}$ among 17.59% persons.

INTRODUCTION

Over 300 different antigens have been detected on human red cells, and a large proportion of them have been placed in the 21 blood group genetic systems currently considered to be established. The frequencies of their corresponding alleles vary greatly, but there are several million possible phenotypes. Thus, when a patient is transfused with serologically compatible blood selected only on the basis of ABO and Rh (D) phenotype, the probability that the blood contains one or more antigens foreign to the patients is very high, Fortunately, most red cell antigens are not very immunogenic, and only 12 antigens are responsible for stimulating most of the clinically significant antibodies occurring antibodies, anti-A and anti-B present a very serious transfusion hazard, but most others have little capability of destroying red cell[1].

Systems of blood groups apart from ABO and Rh are MNS, P, Lutheran, Kell, Lewis, Duffy, Kidd, Diego, Yt, Li, Xg, Dombrock and Colton. The most important systems of blood groups leading to transfusion reactions and hemolytic disease of the newborn (HNN) are still the ABO and Rh Systems. Since the advent of Rh prophylaxis and proper methodology of ABO and Rh grouping, some of the other minor groups have come in the forefront as being culprits to HND and transfusion reactions. These are Kell, Kidd and Duffy blood groups[2].

Of the fatal hemolytic reaction reported in USA, over a 3 years period, most of the reactions were immediate in type. Of these 75% were due to ABO incompatibility and the rest were due to a variety of other antigens like Rh and other minor groups. e.g. Kell, Kidd and Duffy[3,4].

It is, therefore, essential that the frequency of these blood groups be known in various populations. Since no such study existed in Pakistan, an attempt was made to fill in this gap. In a previous study[5], the frequency of Kell groups has been described. The present paper deals with the frequency of Duffy blood groups in a section of Lahore population.

MATERIALS AND METHODS

Three hundred and ten volunteers were studied, who were well aware of the objectives of the study and willingly participated. These volunteers came from various regions of the country and had different socioeconomic back-ground.

Two mls of venous blood was drawn from each invidual and immediately transferred to a glass tube containing EDTA. Each sample was tested for ABO, Rh and Duffy groups. The anti-sera for ABO

groups were from Biotest Diagnostic, Germany, while the anti-sera for Kell, Kidd, Duffy were from Lune Laboratory Ltd., England.

Rh grouping was done according to the technique of Dacie and Lewis[6]. Duffy groups, were determined by saline, albumin and Coombs method[7].

RESULTS

The distribution of Duffy blood groups is shown in Table 1. "Fy^{b-}" was the most common blood groups found in the Duffy blood groups systems with a frequency of 91.29%. The next most common groups were "Fy^{a-}" with a frequency of 54.19%. "Fy^{a+}" with a frequency of 45.81% and "Fy^{b+}" with frequency of 8.71%.

Table 1: Distribution of Duffy Blood Groups among 310 individuals.

Group	*No Observed*	*Percentage*
Fy^{a+}	142	45.81
Fy^{a-}	168	54.19
Fy^{b+}	27	8.71
Fy^{b-}	283	91.29

The distribution of the Duffy blood group system according to tests with both anti-Fy^a and anti-Fy^b is shown in Table 2. The commonest group encountered was $Fy^{(a+b-)}$ (45.16%) followed by $Fy^{(a-b+)}$ (3.54%), while the least common groups was $Fy^{(a+b+)}$ (1.61%).

Table 2: Distribution of Duffy Blood Groups according to tests with anti-Fy^a and anti-Fy^b (n=310).

Group	*No Observed*	*Percentage*
$Fy^{(a+b-)}$	143	46.12
$Fy^{(a-b+)}$	11	3.54
$Fy^{(a+b)}$	5	1.61
$Fy^{(a-b-)}$	140	45.16

The distribution of Duffy blood group according to sex is shown in Table 3. The most common Duffy blood groups in females was "Fy^{b-} "being 39.35%.The next common group was "Fy^{a-} " being 21.29% "Fy^{a+}" followed next being 20.96%. while the least common blood group of the Duffy blood group system in the females was "Fy^{b+}" with a frequency of 2.58%.

Table 3: Distribution of Duffy Blood according to sex (n=310).

Group	*Sex*	*No. of observed*	*Percentage*
Fy^{a+}	M	77	24.81
	F	65	20.96
Fy^{a-}	M	102	32.92
	F	66	21.29
Fy^{b+}	M	19	6.12
	F	8	2.58
Fy^{b-}	M	161	51.93
	F	122	39.35

Among males, again the most common blood group was "Fy^{b-}" being 51.93%. "Fy^{a-}" was the next most common being 32.9%. The third most common group was "Fy^{a+}" being 24.8% and the least common blood group like the females was found to be "Fy^{b+}" being 6.12% only.

Table 4: Distribution of Duffy Blood System according to sex and tests with anti-Fy^a and anti-Fy^b (n=310).

Group	*Sex*	*No. observed*	*Percentage*
$Fy^{(a-b-)}$	M	92	29.67
	F	58	18.7
$Fy^{(a+b-)}$	M	76	24.51
	F	67	21.61
$Fy^{(a-b+)}$	M	7	2.25
	F	3	0.96
$Fy^{(a+b+)}$	M	4	.29
	F	1	0.32

Table 5: Frequency of the Duffy phenotypes in England (tests with anti-Fy^a) (n=310).

Authors	*Year*	*No tested*	Fy^{a+}		Fy^{a-}	
			No.	*%*	*No.*	*%*
Cutbush & Mollison	1950	205	133	64.88	72	31.12
Race. Holt & Thompson	1951	255	167	65.49	88	34.51
Race & Sanger	1952	325	218	67.08	107	32.92
Race,Sanger & Thomson	1953	250	162	64.80	88	35.20
Cleghorn et al.	1961	909	613	67.44	296	32.56
Total		1,944	1,293	66.51	651	33.49

Table 6: Frequency of the Duffy Phenotypes among blood donors at a Blood Group Research Unit in England (tests with anti-Fy^a and anti-Fy^b) (n=310).

Year Of Study	*Total No.of cases*	$Fy^{(a+b)}$		$Fy^{(a+b)}$		$Fy^{(a-b+)}$		$Fy^{(a-b-)}$	
		No.	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
1958	103	22	21.36	40	38.83	41	39.81	0	0
1960	150	26	17.33	74	49.33	50	33.34	0	0
1961	656	130	19.82	321	48.93	205	31.25	0	0
Total	909	178	19.59	435	47.85	296	35.56	0	0

The distribution of the Duffy blood group system according to the test done by both anti-Fy^a and anti-Fy^b is shown in Table 4. Among females, the most common blood group observed was $Fy^{(a+b-)}$ being 21.61% The next most common group was $Fy^{(a+b-)}$ being 18.7%. $Fy^{(a-b+)}$ was 0.96%. while the rarest blood group encountered in the females (0.32%) was $Fy^{(a+b+)}$.

In the males the most common blood group encountered was $Fy^{(a-b)}$ being 29.67%. The next most common group was $Fy^{(a+b-)}$ being 24.51% $Fy^{(a-b+)}$ was 2.25%, while the rarest group in males was $Fy^{(a+b+)}$ was 2.25%, while the rarest group in males was $Fy^{(a+b+)}$ being 1.29% only.

DISCUSSION

The Duffy system is serologically complex. In white population, it is nearly always sufficient to consider two major antigens: Fy^a and Fyb, their respective alleles each having a frequency of about 0.50. The phenotypes are $Fy^{(a+b)}$ $Fy^{(a-b+)}$ Among blacks there is a very common phenotypes, $Fy^{(a-b-)}$ representing homozygosity for an allele not associated with production of Fy^a of Fy^b . The $Fy^{(a-b-)}$ phenotype protects red cells against parasitism by explanation for the prevalence of the phenotype in West Africans, who are unusually resistant to vivax malaria. The possibility that the Duffy antigenic

determents are the red cell receptors for P.vivax provides a good clue that blood group antigens are functional. It is possible, for example, that such carbohydrate-determined antigens as H,A, B,M, N, and P may act as cell recognition sites, initiating such processes as secretion, cell differentiation, and growth[1].

Table 5 shows the results of five different studies done on 1,944 English individuals with anti-Fy^a Fy^{a+} was mot common with a frequency of 66.51% while $Fy^{(a-)}$ was 33.49%. In another study carried by Nillson et al.[7] in Swedish men showed Fy^{a+} to be 68.30% a compared to Fy^{a-} which was 31.70% only.

The studies[10] done on 909 English individuals with anti-Fy^a and anti-Fy^b, (Table 6) reveal that the most common phenotype was $Fy^{(a+b)}$ with a frequency of 47.85%. The next common phenotype was $Fy^{(a-b+)}$ with a frequency of 35.56% $Fy^{(a+b-)}$ was 17.59% while they did not find any individual with the phenotype $Fy^{(a-b-)}$.

In the present study, the most common phenotype was $Fy^{(a-b-)}$ with a frequency of 48.37%. The next most common phenotype was $Fy^{(a+b-)}$ was 3.54% while $Fy^{(a+b+)}$ was 1.61% only. These figures are very different from those of the English population.

According to one study[9] 66% of English population are $Fy^{(a+)}$ belonging to the genotype Fy^a Fy^a or Fy^a Fy^b, the remaining being Fy^b Fy^b. In Whites, the genes Fy^a and Fy^b have frequencies of 0.425 and 0.557 respectively while Fy^a has a frequency of 0.16. another study[11] reported that among whites, the frequency of the gene Fy which produces neither Fy^b, is only 0.002 but in blacks in the U.S.A is about 0.7. Among American blacks the frequency of Fy is 1.0, all the natives having the phenotype $Fy^{(a-b-)}$[9]. In a study carried out on 1,207 Israeli jews and 509 Arabs by Sandler et al.[12], it was observed that the $Fy^{(a-b-)}$ phenotype was observed in Muslims, Christians and Druze Arabs and in Jewish Immigrants, but not in Sephardi or Askenal jews. According to the study of Moulds et al.[13] conducted in 1997, the most common genotype (83%) in blacks was $Fy^{(a+b)}$ Shimizu et al.[14] studied the sero-types Duffy groups among several Thai ethnic groups. High frequency of Fy^{a+} (917%) was observed, which is compatible with other Mongoloid.

Anti-Fy^a and Anti Fy^b are usually IgG, and some examples behave as treacherously as anti-Jka However the strength of their *in-vitro* reactions in the antiglobulin test tends to parallel their *in-vivo* hemolytic capability. Anti-Fy^a, like the antibodies in the Rh system is known to cause: delayed" transfusion reactions due to an anamnestic rise in antibody titer 1 to 4 weeks after transfusion of cells that were orginally compatible.

There remains a "gray area" of antibodies, which, in spite of being IgG, usually do not cause significant red cell destruction, perhaps because their corresponding antigens have fewer active sites or are "buried" by other membrane components. Although such antibodies are, in general, less dangerous than those discussed in the preceding paragraph, it is unsafe to make a blanket statement recommending that they be ignored, Caution, judgement, and experience are clearly necessary in making decision about transfusing, serologically incompatible blood, but, of course, the same pre-requisites apply to all transfusions, compatible or other wise[1].

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