

Evaluation of transfusion transmitted infections and distribution of ABO and Rh blood groups in donors in Eastern Turkey

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Abstract

Aim: Knowledge of blood group distribution and blood serology in a given region is critical for the proper functioning of blood banks and also for delivering the blood products to need owners. We aimed to determine the distribution rates of ABO and Rh blood groups and the incidence of transfusion-transmitted infections in the healthy donors in our region.

Materials and Methods: A total of 108,368 healthy individuals were participated in this study. Incidence of HBsAg, anti-HCV, anti-HIV-1/2 and syphilis along with blood group distribution were evaluated retrospectively.

Results: Of the blood donors, 98,901 (% 91.24) were male and 9,467 (%8.76) were female. Frequency of O, A, B, and AB blood group distribution in the donor population were 31.2%, 44.0%, 16.2%, and 8.6%, respectively. Of the blood donors, 95,039 (87.7%) were Rh positive and 13,229 (12.3%) were Rh negative. A total of 1,685 donors (1.55%) tested positive for HBsAg, 102 (0.09%) for anti-HCV, 23 (0.022%) for anti-HIV-1/2, and 58 (0.05%) tested positive for syphilis.

Conclusion: The ABO and Rh blood antigens distribution rates found in our study were similar for male and female and resembled the overall rates for Turkey. When looking at the annual analysis of the donor group, we observed a significant decrease of HbsAg test positivity over a seven-year-period (p values for time periods 2008-2009, 2010-2011, 2012-2013, 2014-2015 were 0.016, 0.02, 0.001, and 0.003 respectively). We believe that our results will be useful for the creation of a database on blood group distribution and the seroprevalence of infectious agents.

Keywords: ABO and Rh blood group system; transfusion-transmitted infections.

INTRODUCTION

Transfusion of blood and blood products is extensively utilized to support and saves life. During transfusion, infectious agents can transmit to the recipient along with blood cells, and most of the infectious agents transmitted can engender a latent infection in the recipient, thus making the recipient a carrier (1). Although viruses are the main agent transmitted, parasites, bacteria, rickettsia and fungi can also spread to recipients via transfusion (2). In turn to minimize the high risk of infection, donor selection and screening of donated blood for infectious agents are of critical importance (3). The World Health Organization (WHO) recommends testing of donor blood for the surface antigen for hepatitis B virus (HBsAg), antibodies for hepatitis C virus (anti-HCV) and the human

immunodeficiency virus (anti-HIV-1/2), and screening for syphilis (4).

The first studies on blood group classification were carried out in the 1870's. Karl Landsteiner first defined ABO classification in 1901, and Rh (Rhesus) groups were defined in 1940(5). ABO and Rh are the most important classification system, especially for blood transfusion and organ transplantation. This system is based on antigens composed of protein, glycoprotein and glycolipids found in the erythrocyte membrane. The four main blood groups determined by antigen-antibody methods are A, B, AB, and O (6). Differences in ABO and Rh blood group dispersion can be observed in nations, racial communities, and even in different regions within the same country (7). Studies carried out in Turkey have shown variations in ABO and

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Rh blood group frequencies in different cities. Knowledge of the blood group frequencies in a given province or city can help in the acquisition of blood by those who work in blood banks, thus enabling the correct blood types to reach individuals in need.

The aim of this study is to describe the distribution values of ABO and Rh blood groups and the incidence of infectious microorganisms transmitted via transfusion in a composed of donors group who applied to our hospital during the last 12 years. The blood donors were from Van and the surrounding areas. We believe that these data will be accepted as a sample for eastern Turkey and will contribute to the epidemiological data.

MATERIAL and METHODS

In this study, a total of 108.368 healthy subjects aged between 18-65 who applied to Yuzuncu Yil University blood processing unit as volunteer donors between January 2004 and December 2015, were analyzed retrospectively. The trial protocol conforms to the ethical guidelines and it was confirmed by the ethics committee of faculty of medicine. The incidence of HBsAg, anti-HCV, anti-HIV-1/2, syphilis and the distribution of ABO and Rh blood groups has been evaluated retrospectively. The tests for surface antigen for hepatitis B virus, anti-HCV, anti-HIV-1/2, and syphilis were performed by using chemo-luminescence (ARCHITECT i1000 SR Immunoassay Analyzer, Abbott Diagnostics, and Germany). For HBsAg, anti-HCV, and anti-HIV-1/2, samples with a sample/cut-off ratio (S/

CO) ≥ 1 were evaluated as reactive. Samples with S/CO between 1-10 for HBsAg and anti-HCV and the samples positive for anti-HIV were retested with the same method. Samples that were seropositive for surface antigen for hepatitis B virus, anti-HCV and anti-HIV-1/2 were recorded and destroyed. Subjects who were positive for anti-HIV again were referred to Infectious Disease Department for verifying with Western Blot method and also for follow-up. Assay of ABO and Rh blood groups between the years 2004-2006 was performed using the tube agglutination method. Since 2007 the gel centrifuge method, utilizing Dia Med Micro Typing System kits (Dia Med AG, Switzerland), has been employed.

Statistical Analysis

Descriptive statistics for the studied variables were presented as percentage and count. The Chi-square test was utilized to determine relationship between categorical variables. In addition, the Z test was utilized for comparison of proportions. SPSS for windows (ver:16) statistical program was used for all statistical analyzes and p values less than 0.05 were considered statistically significant.

Results

Of the 108,368 subjects, 98,901 (91.24%) were male and 9,467 (8.76%) were female. The ages of the blood donors varied between 18 and 65. A total of 1,685 (1.55%) donors for HBsAg, 102 (0.09%) donors for anti-HCV, 23 (0.022%) donors for anti-HIV-1/2, and 58 (0.05%) donors for syphilis tested positive (Table 1).

Table 1. Frequency of test positivity for HBsAg, Anti-HCV, Anti-HIV-1/2 and Syphilis by years

Year	Donor (n)	HBsAg n (%)	Anti-HCV n (%)	Anti-HIV-1/2 n (%)	Syphilis n (%)
2004-2005	Female (1.812)	58	2	0	0
	Male (18.931)	324	25	2	2
	Total (20.743)	382 (1.84)	27 (0.13)	2 (0.01)	2 (0.01)
2006-2007	Female (1.655)	20	3	1	0
	Male (17.291)	289	31	7	6
	Total (18.946)	309 (1.63)	34 (0.18)	8 (0.04)	6 (0.03)
2008-2009	Female (1.774)	35	1	0	1
	Male (18.538)	311	15	6	15
	Total (20.312)	346 (1.70)	16 (0.08)	6 (0.03)	16 (0.08)
2010-2011	Female (1.373)	25	1	0	0
	Male (14.363)	199	7	2	3
	Total (15.736)	224 (1.42)	8 (0.03)	2 (0.01)	3 (0.02)
2012-2013	Female (1.467)	30	0	0	1
	Male (15.339)	201	11	8	17
	Total (16.806)	231 (1.37)	11 (0.07)	8 (0.04)	18 (0.01)
2014-2015	Female (1.386)	19	0	0	2
	Male (14.439)	174	11	2	11
	Total (15.825)	193 (1.22)	11 (0.04)	2 (0.01)	13 (0.08)
Total	Female (9.467)	187	7	1	4
	Male (98.901)	1.498	95	22	54
	Total (108.368)	1.685 (1.55)	102 (0.09)	23 (0.022)	58 (0.05)

HBsAg: hepatitis B surface antigen, Anti-HCV: hepatitis C virus antibody, Anti-HIV: HIV-1/2 antibody

The overall frequencies of O, A, B, and AB blood groups were 31.2%, 44.0%, 16.2%, and 8.6%, respectively. O, A, B, and AB frequencies were 31.3%, 44.0%, 16.1% and 8.6% for male subjects and 30.9%, 44.1%, 16.3%, and 8.7% for female subjects, respectively. Rh positivity were 88.1% for

males and 86.4% for females. There was no significant difference between males and females in terms of O, A, B, and AB blood groups distribution ($p = 0.542$, $p = 0.714$, $p = 0.452$, $p = 0.997$, respectively). ABO and Rh blood group distributions are shown in Table 2.

Table 2. Gender distribution of ABO and Rh blood groups

Region	O	A	B	AB	Rh+ (%)	Rh- (%)
Male	31.3%	44.0%	16.1%	8.6%		
Rh+	27.7%	38.7%	14.1%	7.6%	88.1%	11.9%
Rh-	3.6%	5.3%	2.0%	1.0%		
Female	30.9%	44.1%	16.3%	8.7%		
Rh+	26.9%	37.9%	14.1%	7.5%	86.4%	13.6%
Rh-	4.0%	6.2%	2.2%	1.2%		
Total	31.2%	44.0%	16.2%	8.6%		
Rh+	27.5%	38.6%	14.1%	7.5%	87.7%	12.3%
Rh-	3.7%	5.4%	2.1%	1.1%		

DISCUSSION

Thanks to current preventive measures, blood and blood products can now be used more reliably for the purposes of treatment compared to the past (8). Routine screening of blood donors for hepatitis B virus has decreased its transmission via transfusion (9,10). In Turkey, blood products were routinely screened for HBsAg (HBV), anti-HCV, anti-HIV and syphilis in order to confirm its safety.

The studies on blood donors carried out in the last ten years in Turkey shows that the HBsAg seropositivity rates varies by region between 1.31% and 3.6% (11,12). In this study, the HBsAg positivity was detected as 1.55% in donors; this rate decreased over time, reaching its lowest level in 2014-2015. There was no significant difference between male and female subjects in terms of HBsAg seropositivity rates ($p=0.413$). Between 2008 and 2015, a significant decrease in positive HBsAg tests was observed (p values for 2008-2009, 2010-2011, 2012-2013, 2014-2015 time periods were 0.016, 0.02, 0.001 and 0.003 respectively) in total donor group. We believe that the reason for this decrement in the positivity of HbsAg test results over the study period is due to increased awareness of HBV infections via national and international symposiums, campaigns, advertisements etc. and also regular and/or compulsory implementation of vaccination against HBV infection as a health policy.

Although hepatitis C virus incidence is lower than hepatitis B virus incidence, it carries greater risk of chronicity, development of cirrhosis and progress to hepatocellular carcinoma. The frequency of HCV in Turkey has been reported to be between 0.16% and 0.92% in healthy blood donors (13). In our study, HCV prevalence was found to be 0.09% lower than the national average. No comparative statistical analysis by sex could be carried out because

the number of female subjects who tested positive for anti-HCV positive was too low. Studies in Turkey have reported HIV seroprevalence between 0% and 0.2% (13). In our study, 23 (0.022%) HIV1/2 positive cases were detected with chemoluminescence method (ARCHITECT i1000SR Immunoassay Analyzer, Abbott Diagnostics, Germany) but only one of the 23 positive cases was confirmed with Western Blot validation test. The percentage of donors in this study testing positive for syphilis was found to be 0.05%, which correlates with the reported rates for Turkey of 0% to 2.33% (14, 15). The seroprevalence of HBsAg, HCV, HIV and syphilis in blood donors in different cities and regions of Turkey is shown in Table 3.

ABO and Rh blood groups distribution ratios vary by ethnicity and region. By the identification of ABO blood groups by Karl Landsteiner, numerous studies have shown that identification of blood groups is crucial for organ transplant and blood transfusion. Having information about the blood groups distribution ratio is vital for both blood transfusion and organ transplantation in humans (16,17). The overall distribution information of ABO and Rh blood groups in selected cities of Turkey is shown in Table 4. The ABO distribution ratios determined in the present study are generally aligned with the rates in Turkey as a whole. As in our study, the distribution of blood type A across Turkey is significantly higher than other blood groups. The frequencies of AB and B blood groups are significantly lower, exceptions are found in places where blood group O is predominant. When evaluated by city-based, the rates of O, A, B and AB blood groups in some cities are close to those cities represented in our study (Van and surrounding cities) (18). The highest value of blood group A was 45.06% , while the lowest value was 36.68%. In our study this rate is 44.0%. The highest value of blood group O detected was 44.07%,

the highest value for blood group B was found 21.25% in Turkey. In the present study, we found the rate of blood group B was 16.2% and that of blood group AB was 8.6%, the latter being the highest value in Turkey. The present study determined the Rh positivity rate to be 87.70%. The highest Rh positivity value in Turkey was 90.83% and the lowest value was 83.7%. In Turkey, the overall rate for Rh positivity is 88.54% (19).

In conclusion, as indicated by the data provided by the studies, the complete elimination of transfusion-transmitted infectious microorganisms such as hepatitis B, hepatitis C, HIV and syphilis from donated blood does not appear feasible at this time. In order to minimize the

risk of infection by transfusion, donor questionnaires must be completed honestly and accurately, the criteria for selecting donors must be carefully re-observed, and the selected donors must be subject to all necessary tests. Most importantly, unnecessary transfusion of blood and blood products must be avoided. Knowing distribution rates of blood groups is of considerable usefulness to the local blood banks in any region of the country. In the present study the distribution rates of blood groups that we identified are similar to those of Turkey in general and when examined by city minor differences can be observed. We believe that this study will provide an important addition to the database of blood group distributions in Turkey.

Table 3. The seroprevalence of HBsAg, HCV, HIV and syphilis in selected regions of Turkey

Region	Number	HBsAg	Anti-HCV	Anti-HIV-1/2	Syphilis
Diyarbakir	79.245	3.60	0.59	0	0.14
Hatay	12.313	2.02	0.52	0	0.03
Istanbul	220.401	2.39	0.35	0.003	0.19
Ankara	104.011	1.96	0.59	0.18	0.02
Erzurum	204.000	3.14	0.92	0.002	2.33
Izmir	80.454	1.31	0.38	0.002	0.04
Van (our study)	108.368	1.55	0.09	0.022	0.05

HBsAg: hepatitis B surface antigen, Anti-HCV: hepatitis C virus antibody, Anti-HIV: HIV-1/2 antibody

Table 4. Distribution of ABO and Rh blood groups in selected regions of Turkey

Region	O (%)	A (%)	B (%)	AB (%)	Rh+ (%)	Rh- (%)
Eskisehir	31.10	43.52	16.84	8.50	86.65	13.35
Istanbul	30.80	44.80	15.90	8.10	87.20	12.80
Sanliurfa	34.69	36.68	21.25	7.68	90.79	9.21
Konya	32.21	45.06	16.53	7.12	87.40	12.60
Rize	44.07	44.07	9.26	2.60	83.70	16.30
Denizli	33.30	42.60	16.80	7.40	89.90	10.10
Kayseri	33.30	44.00	16.20	7.50	88.20	11.80
Ankara	42.24	44.62	15.45	7.69	88.13	11.87
Yozgat	31.70	44.30	15.90	8.10	88.00	12.00
Gaziantep	35.09	40.01	18.10	7.80	90.83	9.17
Malatya	41.28	39.32	13.36	6.04	89.00	11.00
Diyarbakir	33.66	40.81	18.53	6.98	89.18	10.82
Van (our study)	31.20	44.00	16.20	8.60	87.70	12.30
Turkey (Total)	32.67	42.84	16.46	8.03	88.54	11.46

CONCLUSION

This study found that male and female participants were not negatively influenced by Ramadan fasting in terms of neuro performance. In general, when the results of studies above are taken into consideration, it can be seen that the disrupted concentration in the first week of Ramadan fasting and the increasing reaction time return to normal values in the second week of Ramadan fasting. Since all our measurements were conducted in the first week of Ramadan, the results of our study are in parallel with these studies. We believe that the study we conducted will be a resource for future studies.

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