
Research Article

Evaluation of positive serological screening test rates in blood donors with ABO and Rh type blood groups

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Abstract:

Background: Blood transfusion is a life-saving method in emergencies. However, it also carries the risk of pathogen transmission, which is called transfusion transmitted infections (TTIs). All donated blood samples were screened for hepatitis B surface antigen (HBsAg), anti-hepatitis C virus antibody (anti-HCV), anti-human immunodeficiency virus antigens (anti-HIV^{1/2}) and syphilis using Venereal Disease Research Laboratory (VDRL) test.

This study was designed and carried out to determine the seroprevalences of TTIs among blood donors with different ABO and Rh blood groups. Identification of a relation between different blood groups and TTIs was anticipated.

Methods: All blood donors data obtained from the Blood Center of Marmara University Pendik Training and Research Hospital between January 2013 and October 2018 are analyzed retrospectively. Serum samples were examined for HBsAg, anti-HCV, anti-HIV^{1/2}, and VDRL.

Results: HBsAg and anti-HIV^{1/2} positivity rates were not statistically different according to ABO blood groups ($p>0.05$). Anti-HCV positivity rates are partially statistically significant ($p<0.05$). While the incidence of anti-HCV in patients with AB Rh (+) cases was significantly higher than that of O Rh (+), A Rh (+) and AB Rh (+) groups, no significant difference was found for the other analyzed blood groups ($p>0.05$). VDRL positivity rates did not differ significantly ($p>0.05$). Seropositive cases, as reported by Rh type blood group; HBsAg, anti-HCV, anti-HIV^{1/2}, and VDRL positivity rates were not statistically significant ($p>0.05$).

Conclusions: No significant relationship was found among TTIs and ABO and Rh type blood groups. For blood transfusion safety, screening tests should always and carefully be performed.

Key Words: ABO blood group, anti-HCV, anti-HIV, HBsAg, Rh blood group, VDRL

Introduction

Blood transfusion is currently the most frequently used therapeutic procedure. However, there is a possibility of transmission of viruses, bacteria, and parasitic microorganisms during this procedure. Acquiring infections due to blood transfusion is called transfusion transmitted infections (TTIs). Viral hepatitis, HIV, and syphilis are among the important TTIs. Blood and blood products should always be screened to reduce the risk of TTIs (1-6). For this reason, the World Health Organization (WHO) recommends that mandatory screening of all blood donations should be performed for HBV, HCV, HIV and *T. Pallidum* before use(1). Currently, screening is routinely performed in all blood transfusion centers to prevent the transmission of these infections (7). As an obligation of national blood banking procedures, all blood donations are screened for HBsAg, anti-HCV, anti-HIV^{1/2}, and VDRL.

Blood groups are divided into different groups according to the antigens on the surface of erythrocyte (RBC) and platelets. Another important factor in transfusion medicine is the D antigen. If a person has a D antigen, it is called Rh (+) and otherwise Rh (-). Therefore, ABO and Rh systems are the most important factors in blood transfusion and tissue

transplantation (4, 5).

Genetic and environmental factors may contribute to the formation of diseases (6). It is possible that genetically encoded polysaccharides in ABO blood groups may block the binding of pathogens to the cell surface but type O “non-secretors” lacking the antigens are more vulnerable to infections (8). The reverse is also possible that the risk of certain infections and malignancies were reported to be associated with the blood group antigens (9). The attachment of microorganism to the RBC membrane is probably due to adhesion through specific receptors, molecular mimicry, or regulation of antibody-antigen interactions (10).

There are a few studies analyzing blood donor screening test data according to blood groups. The number of donors examined in this study is at least 15-20 times higher than other studies in the literature. In this study, a total of 114,240 blood donor records were analyzed, which makes the study one of the studies with the highest number of analyzed blood samples in the literature.

The intention was to identify the prevalence of TTIs among blood donors in terms of ABO and Rh types. Thus, a statistical investigation of whether there is a relation between different blood groups and TTIs was performed.

Material and Methods

All blood donors data were obtained from the Blood Center of Marmara University Pendik Training and Research Hospital between January 2013 and October 2018. A total of 114,240 donor test results were scanned. The data were analyzed retrospectively.

Donor candidates were completing the donor inquiry form, and physical examination was performed by blood center doctor. Subsequently, serum samples of those who were eligible to donate blood were examined for HBsAg, anti-HCV, anti-HIV½, and VDRL. The study included 18-65 years old, >50 kg healthy male and female individuals. The minimum acceptable hemoglobin level was set to 12.5 gr/dl in females, and 13.5 gr/dl in males.

ABO and Rh blood groups of the people who applied to our blood center were determined by microplate agglutination, gel centrifugation, and column agglutination methods. Microparticle enzyme immunoassay (EIA) (Abbott Architect i2000 SR Combo diagnostic kits, USA) was used to screen serum samples for HBsAg, anti-HCV, and anti-HIV½. VDRL test was used for syphilis screening.

Statistical Analysis

The NCSS (Number Cruncher Statistical System) 2007 statistical software (Utah, USA) was used for statistical analysis. Pearson's chi-square test was used for comparative analysis of the qualitative data. The results were evaluated at a 95% confidence interval, and p-value lower than 0.05 was accepted as the limit of statistical significance.

Results

Total number of participants was 114,240 including 106,153 (92.9%) males and 8,087 (7.1%) females. Total HBsAg positivity rate was 0.5% (536/114,240). Anti-HCV positivity rate was 0.3% (37/114,240). The rate of positive anti HIV½ antigens was found to be 0.1% (101/114,240) in total. The rate of positive VDRL test was found 0.4% (403/114,240).

Evaluations of HBsAg, anti-HCV, anti-HIV½ and VDRL positivity by ABO blood groups

HBsAg positivity rates were not statistically different according to ABO blood groups (p>0.05). Anti-HCV positivity rates were partially statistically significant (p<0.05). While the incidence of anti-HCV in patients with AB Rh (+) cases was significantly higher than that of O Rh (+), A Rh (+) and AB Rh (+) groups (p:0,002; p:0,009; p:0,004 respectively), no significant difference was found among other blood groups (p>0.05).

Anti-HIV½ positivity rates did not differ significantly (p>0.05). VDRL positivity rates were not statistically significant (p> 0.05). All results were detailed in the table (Table 1).

Evaluation according to Rh type blood group

The evaluation of the seropositive cases according to Rh type system did not produce any significant relationship among Rh types and HBsAg, anti-HCV, anti-HIV½, and VDRL positivity rates (p>0.05) (Table 2).

Table 1. Evaluation of the distribution of seropositive cases according to blood groups

Blood groups	Total n (%)	HBsAg		p	Anti-HCV		p	Anti-HIV½		p	VDRL		p
		(+) n (%)	(-) n (%)		(+) n (%)	(-) n (%)		(+) n (%)	(-) n (%)		(+) n (%)	(-) n (%)	
0 Rh (-)	5731 (5.02)	31 (0.54)	5700 (99.46)	0.388	19 (0.33)	5712 (99.67)	0.041*	11 (0.19)	5720 (99.81)	0.128	15 (0.26)	5716 (99.74)	0.867
0 Rh (+)	32259 (28.24)	162 (0.5)	32097 (99.5)		93 (0.29)	32166 (99.71)		27 (0.08)	32232 (99.92)		112 (0.35)	32147 (99.65)	
A Rh (-)	6313 (5.53)	39 (0.62)	6274 (99.38)		23 (0.36)	6290 (99.64)		5 (0.08)	6308 (99.92)		23 (0.36)	6290 (99.64)	
A Rh (+)	43967 (38.49)	200 (0.45)	43767 (99.55)		141 (0.32)	43826 (99.68)		34 (0.08)	43933 (99.92)		171 (0.39)	43796 (99.61)	
ABRh(-)	959 (0.84)	3 (0.31)	956 (99.69)		4 (0.42)	955 (99.58)		0 (0)	959 (100)		3 (0.31)	956 (99.69)	
ABRh(+)	6920 (6.06)	31 (0.45)	6889 (99.55)		36 (0.52)	6884 (99.48)		8 (0.12)	6912 (99.88)		25 (0.36)	6895 (99.64)	
B Rh (-)	2197 (1.92)	8 (0.36)	2189 (99.64)		12 (0.55)	2185 (99.45)		0 (0)	2197 (100)		8 (0.36)	2189 (99.64)	
B Rh (+)	14025 (12.28)	55 (0.39)	13970 (99.61)		38 (0.27)	13987 (99.73)		13 (0.09)	14012 (99.91)		46 (0.33)	13979 (99.67)	
•Null	1869 (1.64)	7 (0.37)	1862 (99.63)		10 (0.54)	1859 (99.46)		3 (0.16)	1866 (99.84)		0 (0)	1869 (100)	
Total	114240 (100)	536 (0.47)	113704 (99.53)		376 (0.33)	113864 (99.67)		101 (0.09)	114139 (99.91)		403 (0.35)	113837 (99.65)	

^aPearson Chi-square Test, *p<0.05

•Blood group unknowns (null) were not included in the statistical evaluations.

HBsAg, hepatitis B surface antigen; Anti-HCV, anti-hepatitis C virus antibody; Anti-HIV^{1/2}, anti-human immunodeficiency virus antigens

Table 2. Evaluation of the distribution of seropositive cases according to RH type blood group

Blood groups	Total n (%)	HBsAg		p	Anti HCV		p	Anti-HIV ^{1/2}		p	VDRL		p
		(+)	(-)		(+)	(-)		(+)	(-)		(+)	(-)	
		n (%)	n (%)		n (%)	n (%)		n (%)	n (%)		n (%)	n (%)	
Rh (+)	97171 (85.06)	448 (0.46)	96723 (99.54)	0.229	308 (0.33)	96863 (99.67)	0.194	82 (0.1)	97089 (99.9)	0.432	354 (0.36)	96817 (99.64)	0.421
Rh (-)	15200 (13.30)	81 (0.53)	15119 (99.47)		58 (0.38)	15142 (99.62)		16 (0.1)	15184 (99.9)		49 (0.32)	15151 (99.68)	
•Null	1869 (1.64)	7 (0.37)	1862 (99.63)		10 (0.54)	1859 (99.46)		3 (0.16)	1866 (99.84)		0 (0)	1869 (100)	
Total	114240 (100)	536 (0.47)	113704 (99.53)		376 (0.33)	113864 (99.67)		101 (0.09)	114139 (99.91)		403 (0.35)	113837 (99.65)	

^aPearson Chi-square Test

•Blood group unknowns (null) were not included in the statistical evaluations.

HBsAg, hepatitis B surface antigen; Anti-HCV, anti-hepatitis C virus antibody; Anti-HIV^{1/2}, anti-human immunodeficiency virus antigens

Discussion

Providing a safe blood transfusion is essential, which is also the primary purpose of the blood centers. Detection of infectious diseases through transfusion in the blood of individuals who are possible donors would present a possible infection to the receiver.

More than 114,000 donors were studied in this study. The number of donors is at least 15-20 times higher than the ones reported in previous studies. In these studies, they deemed it appropriate to examine the topic in larger series (2, 3, 6). Using the series with a much higher number of samples in the analysis would provide more consistent and descriptive results.

Tyagi and co-workers reported that negative blood group people are more susceptible to TTIs. Furthermore, a higher number of blood group A negative patients were discovered to have HIV, HBsAg, and VDRL whereas blood group B negative patients were more prevalent in HCV-affected group (6). However, many studies reported that the prevalence of HBsAg, anti-HCV, HIV, and VDRL was higher in 0 positive groups (11-14).

In a study conducted in Hyderabad, Memon et al. reported that a high prevalence of HBsAg, VDRL and malaria positivity among blood group 0 negative donors (3.70%, 9.25%, 0.61%, respectively) (2). In comparison to all other blood group donors, blood group B negative donors showed a higher HCV infection rate of 12.5%. HIV frequency was reported to be higher among blood group A positive donors (2). In 0 positive blood group, Anwar et al. observed an elevated HBsAg and HCV seropositivity (7). Another study reported similar results that anti-HCV and HBsAg seroprevalence was higher among blood group 0 donors but the lowest was in blood group AB donors (11). Syphilis, which is also a serious TTI, did not show any association with any of the ABO blood groups (15).

In our study, blood group A positive (38.5%) and blood group 0 positive (28.2%) represented the highest blood groups

among blood donors (Table 1). It was found that HBsAg, anti-HIV^{1/2}, and VDRL positivity showed no significant difference compared to ABO blood groups (p>0.05). Anti-HCV positivity showed a difference from other ABO blood groups. The seroprevalence of anti-HCV in patients with AB positive was significantly higher than that of 0 positive, A positive and B positive groups. However, this result should not mean that the predisposition to anti-HCV positivity is higher in patients with AB positive group in general because there was no significant difference among the other 5 blood groups.

There are not many reports in the literature investigating the relations between with seroprevalence of TTIs and Rh antigen blood systems. It has been reported that Rh positive individuals have the highest prevalence of HIV and HBV infections (14). Certain infections in TTIs were reported to have preferences towards certain Rh types, especially to Rh negative group (6). Similarly, Nigam et al. reported that the infection rate of TTIs was higher among Rh negative individuals (3). In our study, we did not observe any significant relationship between Rh type system and HBsAg, anti-HCV, anti-HIV^{1/2}, and VDRL positivity rates. From these aspects, the results of our study differ from the aforementioned reports in the literature.

Conclusion

No significant relationship among TTIs and ABO and Rh type blood groups was found. Genetic-based studies should be conducted to clarify this issue in future. In order to reduce the risk of TTIs, in compliance with the WHO recommendations, prescreening tests for blood products should be mandatory and performed carefully around the world.

Acknowledgments

Ethics Statement: This study was approved by the Marmara University Faculty of Medicine Clinical Research Ethics Committee. Decision code:09.2018.358.

Conflict of Interests: The author declares no conflict of interest.

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