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ASSOCIATION OF ABO AND RH BLOOD GROUP WITH TRANSFUSION TRANSMITTED INFECTIONS (TTI) AMONG VOLUNTARY NON-REMUNERATED BLOOD DONORS: A RETROSPECTIVE STUDY IN A TERTIARY CARE MEDICAL COLLEGE FROM NORTH INDIA

Pathology

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ABSTRACT

BACKGROUND: A total of thirty five (35) blood group systems has been discovered till date. It has been illustrated in the various transfusion literatures that particular disease is associated with particular type of blood group systems. The present study was conducted with the aim to determine the pattern of distribution and to detect any association of transfusion transmitted infections (TTI) with ABO and Rh blood groups.

MATERIALS AND METHODS: A retrospective study was done at the blood bank Shaheed Hasan Khan Mewati (SHKM) Government Medical College Nalhar Haryana, India over a period of 6 year 5 month (August 2013 to December 2019) . A total of 28,812 healthy donors were included in the study. All the donor blood unit were screened for HbsAg, HIV, HCV, Syphilis and Malaria.

RESULTS: The most common blood group was B (39.91%). The total seroreactivity of TTI was 3.8% (1096 out of 28,812). Out of the total, 2.88% (831 out of 28,812) cases were reactive for HBsAg, 0.29% (86 out of 28,812) for HIV, 0.565% (163 out of 28,812) for anti HCV, 0.0138% (4 out of 28,812) for syphilis and 0.0416% (12 out of 28,812) for Malaria. Maximum seroreactivity was seen in blood group B (5.0%) followed by A (3.6%) and O group (3.1 %) and then AB (1.1%). A significant association was seen between Rh positive blood group and HBsAg seropositivity (P value of 0.0459). There was significant association between syphilis infection and AB blood group with a p value of 0.0331 among syphilis positive donors.

CONCLUSION: This study provides the prevalence of ABO and Rh blood group and also their association with the transfusion transmitted infections (TTI). This study shows a significant association between Rh positive blood group and HBsAg and also significant association was seen between AB blood group and syphilis infection.

KEYWORDS

Abo, Rh, Blood Group, Blood Group Systems, Association, Study, Tti, Elisa

INTRODUCTION

Of the 35 Blood Group Systems (ABO, MNS, P1PK , Rh Lutheran , Kell, Lewis, Duffy, Kidd, Diego ,Yt, Xg , Scianna, Dombrock , Colton, LW, Chido-Rogers ,Bombay, Kx, Gerbich, Cromer, Knops, Indian, OK, Raph, JMH , I , Globoside , Gill , RHAG , FORS , JR , LAN, VEL, CD59) discovered till date and reported by the International Society of Blood Transfusion, ABO is the most important [1]. The distribution of ABO and Rh varies in different population groups and an understanding of their distribution helps in an efficient delivery of transfusion services [2]. Blood transfusion is an essential part of treatment plan of the clinicians. However, it carries the risk of transfusion transmitted infection. Some of these infection, like ABO and Rh incompatibilities of newborn, duodenal ulcer, gastric carcinoma, diabetes mellitus and venous thromboembolism shows an association with a particular type of blood group while others are directly transmitted as a result of transfusion [3]. These are mostly infectious infection and occur because blood group antigens function as a receptor for the attachment of microorganisms [4]. The receptor for plasmodium vivex is located on duffy blood group antigen on red cell membrane so in African black race who is duffy negative, malaria due to plasmodium vivex is not seen. The Transfusion Transmitted Infections can be broadly classified as viral, parasitic, bacterial, and spirochetal. Amongst the viral infections are those transmitted mainly by Hepatitis B virus (HBV), Human Immunodeficiency Virus (HIV 1 and 2), Hepatitis C virus (HCV) and Human T Cell Lymphoma virus (HTLV 1 and 2). Malaria, Filaria, Babesiosis, Chagas disease, Leishmaniasis and Toxoplasmosis form the main bulk of parasitic infections while spirochetal infections include Syphilis, Lymes disease and Leptospirosis. Among bacterial infections, Brucellosis is transmissible by blood [5]. The risk of transmission of transfusion transmitted infection (TTI) is 1% per transfusion [6]. According to NACO 2016-17 reports, the annual requirement of blood for transfusion is estimated to be 12.8 million units of blood. India ranks third in harbouring HIV infected individuals [7] HIV infection due to blood transfusion has been documented on many occasions. In a recent study conducted at a Regional Blood transfusion centre in North India, the prevalence of HIV was found to be 0.32% among blood donors while that of HBV, HCV, Malaria and Syphilis was 1.61%, 0.73%, 0.06% and 1.62% respectively [8]. In a study conducted to determine the relationship between blood groups and transfusion transmitted infection, it was found that the highest number of HBsAg positive cases were A positive, maximum number of HIV positive cases were O positive while seropositivity for HCV was equally high in blood groups O positive and B positive [9]. In view of ensuring safety in blood transfusions and reducing the risk of transfusion transmitted infection, it is pivotal that careful selection of donors must be done. The present study was undertaken with the aim of investigating the prevalence of TTIs among blood donors and also if possible to find any association of ABO and Rh blood groups with TTIs at the Blood Bank SHKM GMC Nalhar.

MATERIALS AND METHODS

STUDY DESIGN

This was a retrospective study conducted by Department of Blood Transfusion (Pathology) Shaheed Hasan Khan Mewati Government Medical college Nalhar, which is a tertiary care hospital from North India from August 2013 to December 2019.There is no ethical issue in this study. All technical support is provided by the staff posted.

DATA COLLECTION

This study used the data registered in donor register who came for the blood donation either in blood bank or at voluntary blood donation camp, Master blood donor record register and transfusion transmitted Infection testing record register and blood grouping record register. The data include the number of blood donors and number of transfusion transmitted infection positive cases and number of blood donors group wise from blood grouping record register from years 2013 (August) and 2019 (December). For this study details of parameter like age, sex, marital status, religion, Blood Group. were taken into consideration.

STATISTICAL (DATA) ANALYSIS

The statistical analysis was carried out using statistical package for social sciences (SPSS Inc, Chicago, IL,US;version 15.0 for Windows). Scores were presented as percentage. Qualitative or categorical variables (eg age and sex were described as frequencies and

proportions. Kruskal-Wallis test was applied to find if difference/ variance exists between scores. Then Mann-Whitney test was applied to check this for statistical significance. Proportions were compared using chi-square or Fisher's exact test as applicable. All statistical tests were two sided and were performed at a significance level of 0.05.

DESCRIPTIVE ANALYSIS

The study was conducted at a tertiary care centre, Shaheed Hasan Khan Mewati Government Medical College (SHKM) Nalhar Haryana, India over a period of 6 years 5 month (August 2013 to December 2019) India.. This was a retrospective study. All the donated blood units were screened for transfusion transmitted infections (TTI). Serological tests were performed for HBV surface antigen (HBsAg), HCV antibodies (anti-HCV), anti-HIV -1 and 2, RPR test for syphilis,and Malaria parasite (MP) antigen. The serum samples of donors were tested by Enzyme linked immunosorbent assay (ELISA) technique for the assessment of HBsAg, HCV antibodies and anti HIV 1&2.

For syphilis, rapid plasma reagin (RPR) card test was used whereas for malarial antigen rapid diagnostic kit was used..

RESULTS

Out of the total 28,812 donors, 28,057 were males (97.41%) and 755 were females (2.59%). 19,091 (66.3%) were first time blood donors and 9,721 (33.7%) were repeat blood donors. Among first time blood donors 18,474 (66.17% were male donor where as 6,17 (2.14%) were female. Among repeat blood donors 9,583 (33.27%) were male where as 138 (0.48%) were female (Table 1). The most common blood group was B (39.19%) (Table 2). The prevalence of Rh positive blood group was 91.94 % were as Rh negative blood group was only 8.06 % (Table 3). Overall seroreactivity of TTI was 3.80 % (1096 out of 28,812). Among the seroreactive donors, 831 (2.88%) cases were reactive for HBsAg, 86 cases (0.298%) for HIV, 163 cases (0.565 %) for anti HCV, 4 cases (0.0138 %) for Syphilis and 12 cases (0.0416 %) for Malarial antigen (Table 4). Overall maximum seroreactivity was seen blood group B (5.0%) followed by A (3.6 %) and then O group (3.1 %) and AB (1.1%). The prevalence of TTI in relation to ABO blood group including Rh is shown in (Table 5). On statistical analysis a significant association was seen between Rh positive blood group and HBsAg seropositivity (P value of 0.0459 also in syphilis positive donors, there was a significant association between syphilis infection and AB blood group with a p value of 0.0331 (Table 6). This final multivariate model incorporated all collected data (123 observations – 116 subjects from previously mentioned groups plus 4 additional control subjects). Variables were selected in a backward stepwise approach and maintained in the final model only if they presented statistical significance. Final model is detailed in Table 7.

Table 1: Year wise Blood collection 2013 (August) – 2019 (December)

Year	First time Blood Donor			Repeat Blood Donor			Total
	Male	Female	Total	Male	Female	Total	
2019	3757	139	3896	2369	59	2428	6324
2018	3846	48	3894	1923	25	1948	5842
2017	3499	86	3585	1656	19	1675	5260
2016	2307	48	2355	1632	30	1662	4017
2015	2101	109	2210	1425	5	1430	3640
2014	2047	151	2198	578	0	578	2776
2013	917	36	953	0	0	0	953
	18474	617	19091	9583	138	9721	28812

Table 2: Prevalence of different blood groups during 2013 (August) – 2019 (December)

Blood group	2013	2014	2015	2016	2017	2018	2019	Total	% of Total
A	217	601	807	916	1103	1327	1364	6335	21.98
B	358	1098	1375	1556	2103	2215	2584	11289	39.19
AB	85	241	408	383	509	581	582	2789	9.67
O	293	836	1050	1162	1545	1719	1794	8399	29.16
	953	2776	3640	4017	5260	5842	6324	28812	100

Table 3 : Distribution of Rh (positive) and Rh(negative)

Blood Group	Total Blood unit collected	%
Rh (positive)	26489	91.94
Rh(negative)	2323	8.06

Table 4: Year wise and total prevalence of transfusion Trans mitted infections (TTIs)

TTIs ↓	YEAR→	2013	2014	2015	2016	2017	2018	2019	Total (out of n=28,812 Donation)	% Prevalance
HIV (ELISA)		2	20	11	7	12	9	25	86	0.298
HBsAg (ELISA)		20	95	94	106	167	160	189	831	2.88
HCV (ELISA)		4	46	18	10	22	25	38	163	0.56
SYPHILIS (RPR)		0	1	1	2	0	0	0	4	0.013
MALARIA (RAPID CARD)		0	4	3	1	4	0	0	12	0.041

Table 5: Prevalence of TTI among different blood groups

Blood Group	Total Number of Blood unit	TTI Prevalance					Total no & %	
		HIV	HBsAg	HCV	Syphilis	Malaria	Total	%
A	6335	19	181	32	01	01	234	3.6
B	11289	44	435	79	02	08	568	5.0
AB	2789	02	14	14	0	01	31	1.1
O	8399	21	201	38	01	02	263	3.1
	28,812	86	831	163	4	12	1096	

Table 6: Significant association (p value) between TTI and blood groups

TTI	No. Of Reactive unit	P VALUE					
		A	B	AB	O	Rh+	Rh(neg)
HIV	86	0.1374	0.1831	0.1168	0.0791	0.0632	0.0963
HBsAg	831	0.1689	0.0572	0.8132	0.3777	0.0458	0.05482
HCV	163	0.8543	0.0957	0.0727	0.6913	0.1884	0.2251
SYPHILIS	04	0.7457	0.7108	0.0335	0.4659	0.647	0.4826
MALARIA	12	0.3075	0.6193	0.2091	0.2031	0.9526	0.9524

Table 7: Comparative % prevalence among different region of India with present study in the final model

Region	Place	HIV (%)	HBsAg (%	HCV (%)	Syphilis (%)	Malaria (%)
Present Study	South Haryana	0.298	2.88	0.56	0.013	0.041
North India	Delhi	0.56	2.23	0.66	--	--
South India	Karnataka	0.44	1.86	1.02	1.6	--
West India	Maharastra	0.07	1.09	0.74	0.07	--
East India	West Bengal	0.28	1.46	0.31	0.72	--

DISCUSSION

Association of Blood Group with various infection has been commonly observed. The aim of our study was to determine the prevalence of ABO and Rhesus blood groups among blood donors and their association with TTIs. There were a total of 28,812 donors, out of which 28,057 were males (97.41%) and 755 were females (2.59%). 19,091 (66.3%) were first time blood donors and 9,721 (33.7%) were repeat blood donors. Among first time blood donors 18,474 (66.17% were male donor whereas 617 (2.14%) were female. Among repeat blood donors 9,583 (33.27%) were male where as 138 (0.48%) were female. This result is comparable to the studies done by Chandekar et al., in which also the majority of donors were males [10-14]. The most common blood group in our study was B (39.19%), similar to the observation made by Anumanthan et al., Nigam et al. and Tyagi et al. where the most common blood group was also B positive [15-17]. However, the studies done by Talib, et al., Bashwari et al. and Abdullah found blood group O to be the most common [18-20]. The prevalence of Rh negative blood group in our study was 8.06 %. The least common blood group in our study was AB negative (0.41%) which was similar to the study by Ngassaki-Yoka et al.[21]. Overall seroreactivity of TTI was 3.80% which was slightly less than the study by Sharma et al. which showed 4.20% as the total percentage of TTIs [22]. Overall maximum seroreactivity was seen with blood group B (5.0 %), similar to the observation made by Sinha et al. followed by A (3.6 %) and then O (3.1 %) [23]. However, this finding differed from many studies that found a higher seroprevalence of TTI in blood group O positive [24]. The World Health Organization has placed India in the intermediate zone (2-7%) of prevalence of hepatitis B for HBsAg [25]. In our study, among the seroreactive donors, maximum cases (2.88%) were reactive for HBsAg. The same was observed by Sinha et al. in his study[23]. Several other studies by Tyagi and Nigam et al, Bobde et al. and Deshpande et al. also showed maximum seropositivity for HBsAg [16,17,26,27]. We also observed that the highest number of HBsAg positive cases were Rh positive. Sharma et al., Sreedhar et al. and Sinha et al. also showed a significant association between Rh positive blood group and HBsAg seropositivity [22,23,28]. However, the maximum seroreactive cases for HIV and HCV were seen in negative blood group which was in concordance with the study undertaken by Tyagi et al. that observed that negative blood groups were more prone to TTI [17]. In a study conducted by Sharma et al., AB negative blood group showed an increased seropositivity for hepatitis C (1.54%) which was again consistent with our study [22]. In the present study, 0.013% of the total donors tested positive for syphilis. Amongst RPR positive donors, there was a significant association between RPR infection and AB blood group with a P value of 0.0331. This value was lower than that observed by Chikwem et al. Where Treponema pallidum accounted for 3.57% of all TTIs [29]. However Garg et al. observed that the prevalence of syphilis among the donors was 0.22% [30]. In a study conducted by Chandra et al. and Bhawani et al., syphilis positive donors were 0.01% and 0.08 % respectively [31,32]. Compared with the above studies, the prevalence of syphilis was lower in our study. A total of 12 cases (0.041%) were positive for malarial parasite. However, this finding differed from many studies where there was not a single case of malarial parasite positivity [22,23]. This might be due to the fact that mewat region where the study was conducted falls under the endemic zone for malaria while most of the studies were done in the non-endemic zone of malaria.

CONCLUSION:

This study, therefore, reflects the correlation between blood group antigens and the transfusion transmitted infections and also highlights the importance of routine screening of blood and its components for safe transfusion and prevention of blood borne transmitted infection. This study shows a significant association between Rh blood group and HBsAg and also significant association was seen between AB blood group and syphilis infection.

CONFLICT OF INTEREST: None

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