

Association between Blood Group and Hepatitis B Virus Infection in Blood Donors in West Bengal

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ABSTRACT

BACKGROUND

Blood donated by blood donors is collected in blood bags and the blood is screened for transfusion transmitted infections like Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Human Immunodeficiency Virus (HIV), and Syphilis in Blood Banks. Institution of Blood Transfusion Medicine (IBTMI) is a blood bank in Kolkata, West Bengal, collecting blood from a large area of Kolkata, and adjacent districts of West Bengal. The relation between HBV seropositivity, ABO blood group and Rh type is evaluated in this study.

METHODS

Records of blood collected by Institute of Blood Transfusion Medicine and Immunohaematology (IBTMI), Kolkata, West Bengal are studied. The data collected are used as secondary data. More than 2 lakh blood donors were recorded during this study. The collected blood undergoes testing for the Transfusion Transmitted Infections (TTI). All the blood bags that are collected are ABO grouped and Rh typed.

RESULTS

In three consecutive years of study, it is found that seropositivity of HBV infection is highest amongst blood donors having blood group AB Negative. 3.2 % of blood donors having AB Negative (AB-ve) blood group were found positive for Hepatitis B Virus (HBV) infection in the year 2007. 3.96 % and 2.42 % of blood donors with blood group AB-ve were found for positive for HBV infection in 2008 and 2009 respectively. While percentage was calculated with ABO group and Rh types taken separately, results were found to be different. Statistical analysis was done to compare the findings.

CONCLUSIONS

Following statistical analysis, we can conclude that the Hepatitis B Viral infections may have an association with a particular blood group and Rh type.

KEY WORDS

Blood Donor, ABO Blood Group and Rh Type, Transfusion Transmitted Infections (TTI), Hepatitis B Virus (HBV).

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BACKGROUND

Blood donors donate blood to help patients recover from diseases that require blood transfusion. Blood transfusion can save lives. Blood donors from around the world donate blood for helping patients who suffer from acute or chronic blood loss, due to injury or surgical procedures and diseases like thalassemia, sickle cell anaemia, malignancy. During blood transfusion the health care personnel should match the blood group of the donor and recipient. It is the blood bank where blood is ABO grouped and Rh typed and is screened for any transfusion transmitted infections. Otherwise, this infection can spread from a donor to a recipient. WHO recommends compulsory screening of all blood donors for HBV, HCV, HIV and Syphilis¹ The bags in which blood is collected from donors are stored in a blood bank. The blood bag undergoes ABO grouping and Rh typing and are screened for transfusion transmitted infections like Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Human Immunodeficiency Virus (HIV) at the blood banks.

It is noticeable in the Global Hepatitis B report in 2017, 257 million people are having this infection.^{2,3} The ABO blood group system is an erythrocyte antigen system and influences the host susceptibility to various diseases. These blood antigens are important receptors for immune and inflammatory process.⁴ Earlier, studies have revealed a relationship between blood groups and Hepatitis B, but with inconsistency. A particular blood group may be more susceptible to an infective agent whereas the same blood group may be less infected by some other disease-causing organism. Lao et al, found higher prevalence of of this infection in blood group O (10.2 %),⁵ but other authors⁶ found that Hepatitis B surface antigens were lower in blood group O. Szmuness et al^{7,8} and Behal et al⁹ failed to find any relationship with Hepatitis B and blood groups. In a retrospective study carried out by Sreedharbabu KV et al in Department of Transfusion Medicine at a tertiary teaching hospital blood bank, for 6 years found no association between Transfusion Transmitted infection seroprevalence and blood group.¹⁰ Tyagi et al found Rh negative blood group is more prone to transfusion transmitted infections.¹¹ Omar et al reported that HBsAg and Anti HCV antibody is found to be higher in donors with blood group O and lowest in donors with AB blood group. Distribution of Rh type in Hepatitis infection was higher amongst Rh +ve donors.¹² According to Das et al, the frequency of HBsAg and Anti HCV antibody among blood donors had maximum association with blood group O+ve.¹³ Kumar et al found highest prevalence of transfusion transmitted viral infections is seen in individuals with blood group O and Rh+ve.¹⁴ The present study determines the seroprevalence of Hepatitis B Virus and its relationship to different blood groups amongst blood donors recorded at this institution.

Aim of the study: The study intends to detect first the number of blood donors of each blood group and the number of blood donors of each group testing positive for HBV infection. Then to find out the percentage of donors of each ABO group and Rh type testing positive for HBV and then to evaluate any predilection of a blood group for Hepatitis B Viral infection.

METHODS

The study was conducted at Institute of Blood transfusion Medicine and Immunohaematology (IBTMI), Kolkata in association with Department of Anatomy and Department of Community Medicine, R G Kar Medical College, Kolkata. The study period was from 1st January 2007 to 10th October 2009. The design of the study is Institutional Record Based retrospective study. All blood donors donating blood to this institute and the blood camps organised by this Institute are recorded. All the registered donors were included for the study for whom the complete records were available. There was no inclusion or exclusion criteria. This is a census type of secondary data. Blood bags collected from each donor were ABO blood grouped and Rh typed. Microwell ELISA test is used for qualitative detection of Hepatitis B surface antigen (HBsAg) in plasma.

Statistical Analysis

Descriptive statistical analysis has been carried out in the present study. Significance is assessed at the level of 5 %. A 'p value' of < 0.05 was considered as statistically significant. The software used for calculation of significance between two proportions is MedCalc, Version 19.5. It uses 'N1' Chi-squared test as recommended by Campbell (2007) and Richardson (2011). Other software used in the study were PSPP, Version 3 (2007), Microsoft word (2007) and Microsoft Excel (2007).

RESULTS

The total number of blood donors were 2,97,725 in three years of study. The complete records were available for this population and they were analysed. In 2007, HBV was more prevalent in AB blood group (2.64 %), followed by B (2.22 %). (Table 1) The value of z is -2.496 and p value is 0.01242 when compared between these two groups. That suggests HBV was statistically more prevalent in group AB in 2007. But individual analysis of ABO with Rh showed the prevalence was most common in AB-ve (3.2 %), followed by AB+ve (2.62 %). The value of z was -0.6353 and p value was 0.52218. It suggests that the difference in prevalence between the two groups was not statistically significant.

Blood Group	Total No. of Donors	HBV Positive Donors	Percentage
A+ve	23281	429	1.84 %
A-ve	791	17	2.14
Total	24072	446	1.85
B+ve	37836	844	2.23
B-ve	1199	23	1.91
Total	39035	867	2.22
O+ve	32641	518	1.58
O-ve	1030	13	1.26
Total	33671	531	1.577
AB+ve	9362	246	2.62
AB-ve	311	10	3.2
Total	9673	256	2.64

Table 1. Seroprevalence of HBV According to Blood Group and Rh Type (Year 2007)
(Total Number of Donors = 106451)

No. of Blood Donors	No. of HBV Positive	Percentage of HBV +ve
Rh Positive 103120	2037	1.975
Rh Negative 3331	63	1.89

Table 2. Sero Prevalence of HBV According to Rh Type (2007)

Blood Group	Total No. of Donors	HBV Positive Donors	Percentage
A+ve	24997	512	2.04
A-ve	831	20	2.4
Total	25828	532	2.5097
B+ve	40624	899	2.21
B-ve	1206	35	2.9
Total	41830	934	2.23
O+ve	35167	642	1.82
O-ve	988	23	2.32
Total	36155	665	1.8393
AB+ve	10072	236	2.34
AB-ve	328	13	3.96
Total	10400	249	2.3942

Table 3. Seroprevalence of HBV According to Blood Group and Rh Type (Year 2008)

(Total Number of Donors = 114213)

No. of Blood Donors	No. of HBV +ve	Percentage of HBV +ve
Rh Positive 110860	2289	2.0647
Rh Negative 3353	91	2.7139

Table 4. Seroprevalence of HBV According to Rh Type (2008)

Blood Group	Total No. of Donors	HBV Positive Donors	Percentage
A+ve	16934	256	1.51
A-ve	573	06	1.04
Total	17507	262	1.4965
B+ve	27429	462	1.68
B-ve	850	15	1.76
Total	28279	477	1.6867
O+ve	23568	353	1.49
O-ve	645	12	1.86
Total	24213	365	1.5074
AB+ve	6856	107	1.56
AB-ve	206	05	2.42
Total	7062	112	1.5859

Table 5. Seroprevalence of HBV According to Blood Group and Rh Type (Year 2009)

(Total Number of Donors = 77061)

No. of Blood Donors	No. of HBV +ve	Percentage of HBV +ve
Rh Positive 77787	1178	1.5143 %
Rh Negative 2274	38	1.6710 %

Table 6. Sero Prevalence of HBV According to Rh Type (2009)

Hepatitis B Virus	1 st Pre-valence	2 nd Pre-valence	Statistical Significance	Year	The Common Factor
Individual blood group	AB negative	AB positive	No p=0.52218	2007	AB
ABO	AB	B	Yes p= 0.01242	2007	
Rh	+ve	-ve	No p=0.72786	2007	
Individual blood group	AB negative	B negative	No p=0.32708	2008	
ABO	A	AB	Yes p=0.0477	2008	
Rh	-ve	+ve	Yes p=0.0096	2008	-ve
Individual blood group	AB negative	O negative	No p=0.61006	2009	?AB
ABO	B	AB	No p=0.5552	2009	
Rh	-ve	+ve	No p=0.5485	2009	

Table 7. Comparative Analysis of Results of Three Consecutive Years

When analysis was carried out with respect to only Rh positive or negative status it was found that, the HBV was more

prevalent in Rh+ve (1.975 %), compared to Rh-ve (1.89 %). The significance of two proportions in two groups as: the value of z is 0.3433, with p is 0.72786. The result is not significant at $p < 0.05$. That suggests that the difference in proportions between two groups (Rh positive and Rh-negative blood donors) is not statistically significant. (Table 2).

In 2008, HBV was more prevalent in blood group A (2.5097), followed by AB (2.3942) (Table 3). The z value is -1.9829 and p value is 0.0477, when compared between these two groups. The result is significant at $p < 0.05$. So, group A had statistically significant higher prevalence in 2008. But individual analysis of ABO and Rh showed the prevalence was most common in AB-ve (3.96 %), followed by B-ve (2.9 %). The value of z was -0.9788 and p value was 0.32708. It suggests that the difference in prevalence between the two groups was not statistically significant.

The HBV was more prevalent in Rh-ve (2.7139 %), compared to Rh +ve (2.0647 %). The value of z is -2.5929. The value of p is 0.0096. That suggests HBV prevalence was statistically significant in Rh-ve in 2008. (Table 4)

The prevalence of HBV was highest in blood group B (1.6867 %), followed by AB (1.5859 %) in 2009. (Table 5) The z value was 0.592 and p value was 0.5552, when compared between these two groups. So, the difference of prevalence of HBV between B and AB is not statistically significant in 2009. But individual analysis of ABO and Rh showed the prevalence was most common in AB-ve (2.42 %), followed by O-ve (1.86 %). The value of z was -0.5061 and p value was 0.61006. It suggests that the difference in prevalence between the two groups was not statistically significant.

The prevalence of HBV was more in Rh-ve (1.6710 %), compared to Rh+ve (1.5143 %). The value of z is -0.6021 and p value was 0.5485. That suggests the difference of prevalence between two groups is not statistically significant. (Table 6). A comparative analysis of the results of three consecutive years is shown in Table 7.

DISCUSSION

The present study is not an exception to the worldwide researches going on to find out relationship between ABO blood group and Rh type and various infective agents affecting the human race. The present study is quite different from other studies. A huge population is involved in the study. As the number of donors ABO Grouped and Rh typed and tested for HBsAg are high, the relationship thus revealed is determined to be the strength of this study.

AB negative blood group was the commonest blood group associated with Hepatitis B infection for 3 consecutive years, as revealed in the present study. A subgroup analysis was performed to see the statistical correlation of ABO with Hepatitis B infection for each year. Apart from individual blood group, an analysis was done separately for ABO and Rh. This was done to corroborate or reconfirm the primary finding of this study, which is the association of AB negative blood group and increased chance of Hepatitis B infection. The subgroup analysis definitely revealed more chances of infection with Hepatitis B with AB blood group and Rh-negative status. The only weakness of the study is that it was done in a specialised population of blood donors, which may not be reflective of

general population, as this infection may be transmitted more frequently in blood donors.

Abdullah et al made a retrospective analysis of all blood bank records at Aseer Central Hospital, covering a total of 5174 blood donors during the period of one year starting from April, 2000. He found amongst 4664 Saudis and 510 non-Saudis screened, 17.9 % of Saudis and 34 % of Non-Saudis were HBV infected.¹⁵ Prabhakar K commented that at Apollo Hospital, Madras, they have been screening blood donors for HIV since 1988 along with HBsAg. HBsAg positivity rate was found to be 10.2 per 1000 donor. He also mentioned that high prevalence of HBsAg gets overshadowed by the current concern for AIDS.¹⁶ A G Kulkarni et al studied 1860 serum samples of blood donors from northern Nigeria, who were tested for HBsAg, 8.9 % were tested positive. Significant differences in frequency were observed amongst various ethnic groups as well as ABO blood groups.¹⁷

Joshi et al found in his study population, O positive was most common followed by A +ve, B +ve, AB +ve respectively. The analysis of relationship showed a tendency of high affinity of those diseases (HIV and HBV) in the subjects with O +ve blood group. However, no real relationship of those infection was found with the blood groups.¹⁸ C Odenigbo et al working at Nnamdi Azikwe Teaching Hospital from 2005 to 2009, tested 1229 blood donors (in Nnewi, South Eastern Nigeria) and found maximum seroprevalence of HCV in blood donors with blood group O+ve.¹⁹

M S Anwar et al, in department of pathology, Nawaz Sarif social security hospital, Lahore screened 16695 blood donors for Hepatitis B and Hepatitis C viral infection. HCV infection was most prevalent in blood group O positive (8.96 %). The study was carried out from January to December.²⁰

A retrospective study done by KV Sreedharbabu et al studied 41652 blood donors for 6 years, from January 2009 to December 2014. The commonest blood group that he found was O positive. Amongst total HBV positive donors 41.7 % were O Positive. This was followed by B (30.9 %), A (21.6 %) and AB (5.7 %). He concluded there is no association between blood group antigen and these infections.¹⁰ Omar AAA et al reported similar results¹² stating O blood group having higher seroprevalence of Hepatitis infections. Masoud Sabouri Ghannad et al, in a study conducted in Hamadan, Iran, amongst a number of 228409 people donating blood, found that A-ve, B+ve and A+ve were the most prevalent blood groups infected with HBsAg respectively.²¹ Mohammadali F et al studied blood donors in Tehran Blood Transfusion Centre from the year 2005 to 2011. 2031451 blood donors were studied. They found a significant association between blood group and Hepatitis B and HIV infection. According to them donors with blood group A had higher percentage of HIV whereas donors with blood group O had lower percentage of Hepatitis B.⁶ Nigam J S et al studied 4128 blood donors from January 2010 to April 2014.

They found highest percentage of HBsAg in blood group A-ve, followed by A+ve.²² Liu et al found in Chinese adult population of 3827125 participants, prevalence of HBsAg to be 5.34 % in blood group O, 5.55 % in A, 5.18 % in B and 5.06 % in AB. HBs Ag prevalence was 5.65 % in Rh D +ve and 3.96 % in Rh D-ve participants.²³ Memon F A et al found in their study, a high frequency of HBsAg, VDRL and malaria positivity among O-ve donors. Donors with B -ve blood group were commonly

infected with HCV as compared to other blood groups. HIV was most common in A+ve²⁴ Arif SH et al studied 36614 donors. Overall seroreactivity for TTI was 5.59 %. Maximum seroreactive donors were positive for HBsAg. Highest seroreactivity was found in B +ve. Statistical analysis showed significant association between Rh +ve group and HBsAg seropositive donor.²⁵

Here we have discussed about how researchers have established relationship between blood group and Rh type and transfusion transmitted infections. Thus, we find, although many of these previous studies had found blood group O having commonest association with Hepatitis B, but the present study revealed a different blood group (AB Negative) to be associated with Hepatitis B. Other studies mentioned above also found few other blood groups as commonest association with Hepatitis B. So, there was no unanimity of decision regarding the blood group association with Hepatitis B. Given the large sample size examined in the current study, it should give a pretty good accurate idea about this association.

CONCLUSIONS

A particular blood group may have more chances of contracting a particular infection. AB-ve is the blood group that shows maximum sero-positivity of Hepatitis B virus infection in three consecutive years in this particular population of blood donors.

Data sharing statement provided by the authors is available with the full text of this article at jemds.com.

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