

Seroprevalence and Risk Factors for Hepatitis B Infection among Blood Donors at a Tertiary Care Centre in Kerala, South India

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ABSTRACT

BACKGROUND

Hepatitis B infection is a serious global public health problem and one among the transfusion transmitted infections (TTI). The prevalence of hepatitis varies across the world. There are several risk factors for HBV infection. We wanted to find out the prevalence of HBV infection among the blood donors and its relevant risk factors.

METHODS

This is a descriptive study conducted among healthy, voluntary and replacement blood donors. A total of 2400 blood donors were selected for the study by systemic random sampling method. Blood samples from these donors were tested for detection of HBsAg through enzyme linked immunosorbent assay (ELISA) to find out prevalence of infection. Various risk factors were compared among the blood donors for positive HBV infection. All statistical data were analysed using SPSS software version 16.

RESULTS

Total prevalence of HBV infection among the individuals of the study population was 0.45 %. When the risk factors for getting the HBV infection were analysed, unvaccinated blood donors gave a prevalence of 0.6 % (P value 0.001). Prevalence of HBV infection among blood donors with other risk factors were 0.63 % in first time donors (P value 0.04), 7.3 % in replacement blood donors (P value 0.01), 0.97 % in low socioeconomic status (0.03). Where as prevalence of infection among males was 0.49 % and females was 0.26 %. HBV infection among blood donors who were single was 0.34 % compared to married as 0.52 %. Hence the statistical analysis showed P value > 0.05, gender and marital status of the blood donors in the study is not significant for getting HBV infection.

CONCLUSIONS

Prevalence of HBV infection among blood donors was markedly less compared to prevalence in south India which shows that donor selection criteria was satisfactory to screen the blood donors during donor selection itself. In the study HBV unvaccinated blood donors, first time donors, replacement donors, and donors from low socioeconomic status were found to be significant risk factor to get HBV infection.

KEYWORDS

Transfusion Transmitted Infection, Enzyme Linked Immunosorbent Assay, HBsAg, Voluntary Blood Donors, Seroprevalence, HBV Vaccine

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BACKGROUND

Hepatitis B is one of the most common diseases in the world and has infected two billion people worldwide, with 400 million chronically infected cases and it is also the 10th leading cause of death worldwide.¹ In Asia and Africa, chronic HBV infection is common.² Chronic hepatitis B infection causing 500,000 to 1.2 million deaths per year due to chronic hepatitis, cirrhosis, hepatocellular carcinoma and other liver diseases.³

The Indian subcontinent is classified into intermediate HBV endemic (HbsAg carriage 2 - 7 %) zone and has the second largest global area for chronic HBV infection, hence causing serious morbidity and financial burden and is thus a major global health problem.⁴

Hepatitis B infection is caused by a DNA (deoxyribonucleic acid) virus of Hepadnaviridae family. HBV is transmitted through percutaneous or parenteral contact with infected blood and body fluid and by sexual intercourse, but never through cross intact skin or mucous membrane. During child birth there will be maternal-foetal haemorrhage and breaking of intact barrier leads to transmission of hepatitis B infection to foetus, otherwise HBV does not cross the placenta.⁵ Even though Kerala has high literacy rate, good public health care system and hepatitis B vaccine included in extended immunization programme prevalence among common population and blood donors are not diminishing.⁶

Objective

The study was conducted to evaluate the epidemiological features in blood donors in a tertiary care hospital in Kerala and to study the prevalence of hepatitis B infection among blood donors and importance of various risk factors to acquire the hepatitis infections among them.

METHODS

The study designed as cross-sectional type of descriptive study among 2400 blood donors over a period of one year from February 2015 to January 2016 after attaining the institutional human ethical clearance certificate dated 23 / 1 / 2015. The study was analysed and approved by Human Ethical Committee and review board of concerned hospital (IEC no: B6 / 79 / 2015 TDMCA). Subjects for this research were selected by systemic random sampling method. Sample size was calculated using formula $4pq/d^2$. Where P is prevalence of hepatitis B among blood donors in a study conducted in same epidemiological condition recently.⁷

Where q is 100 – p, and d is 20 % of p. Setting for the research was Department of Transfusion Medicine Government T D Medical College, Alappuzha. Inclusion criteria included both voluntary and replacement donors who came to the place of research setting, Exclusion criteria included blood donors who were positive for transfusion transmitted infection other than Hepatitis B and blood donors deferred due to other reasons.

Total sample size was 2400, so per month $2400 / 12 = 200$ samples, per day $200 / 30 = 6$ to 7 samples were analysed, since we got an average of 30 - 40 blood donation per day. Using systematic random sampling method every 5th donor was taken into study.

Data collected from 2400 samples by using routine questionnaire provided by the blood bank and self prepared semi structured questionnaire of investigator after translation into local language. Donation procedures were performed in accordance with blood drawing criteria in "National Blood and Blood Product Guide".⁸

People, who had hepatitis, surgery, tattoo, acupuncture, ear piercing, risky sexual intercourse, oral and intra venous narcotic addiction in their medical histories for the last one year were not accepted as donors. Socioeconomic status of the blood donors was assessed with revised modified B G Prasad classification scale January 2014.

We chose six risk factors for hepatitis B infection like blood donors who got vaccinated against HBV and non-vaccinated, socioeconomic status of blood donors, repeated altruistic blood donors and first time blood donation, voluntary and replacement blood donor, marital status of blood donor, blood donors from both gender dealt with hepatitis B infection and analysed whether it has same impact or more among blood donors.

Exclusion criteria included other risk factors like tattooing, recent surgery, history of blood transfusion, hepatitis other than hepatitis B, healthcare worker, history of dental extraction.

Post donation, blood samples were collected from the blood bag of the study population. The samples were centrifuged at 3500 x g for 4 minutes to separate the plasma. All samples were screened with 3rd generation HBsAg ELISA kit which provided an analytical sensitivity of 0.1ng / ml as per manufacture.

Statistical Analysis

All statistical data were analysed using SPSS software version 16. Continuous variables were expressed as mean + 2 standard deviation and qualitative data were being expressed as proportions and percentages. Risk estimated using odd's ratio with 95 % confidence interval. Independent t test was used for comparing qualitative data between groups. Categorical variables were compared using chi square test. All P values were two tailed and values of P < 0.05 were considered statistically significant.

RESULTS

Among 2400 blood donors involved in the study total 11 blood donors were positive for HBsAg by third generation ELISA, so total prevalence of hepatitis B among blood donors in this study was 0.45 %. Hepatitis B infection among blood donors with various risk factors were assessed in Table no: 1.

	Risk Factors	HBsAg n/N	HBsAg Percentage	P Value
Sex	Male	10 / 2019	0.49 %	Pearson Chi-square test 0.3
	Female	1 / 381	0.26 %	
Number of Donation	First time donors	10 / 1585	0.63 %	Pearson Chi-square test 0.04
	Repeated donors	1 / 815	0.12 %	
Type of Donors	Voluntary donor	2 / 2277	0.08 %	Fisher's exact test 0.01
	Replacement donors	9 / 123	7.3 %	
Vaccination Status	Vaccinated	0 / 563	0 %	Fisher's exact test 0.001
	Non vaccinated	11 / 1837	0.6 %	
Socioeconomic Status	Middle class	9 / 919	0.97 %	Pearson Chi-square test 0.03
	Upper class	2 / 1481	0.13 %	
Marital status	Married	8 / 1536	0.52 %	Pearson Chi-square test 0.3
	Unmarried	3 / 864	0.34 %	

Table 1. Comparison of Prevalence in HBV Infection among Donors with Different Demographic Patterns

Blood donor's hepatitis B vaccination has got significant impact on its prevalence. There was a single case of hepatitis B infection noted among the blood donors who had taken immunization against hepatitis B virus. In the study, a total of 1837 blood donors were not vaccinated against Hepatitis B virus and the prevalence of hepatitis B infection among HBV non vaccinated donors was 0.6 %, the difference was compared statistically using independent t test. Significant difference was observed with P value 0.001.

The blood donors were categorised into middle class and upper class depending upon their socioeconomic status using revised modified B G Prasad classification scale January 2014 for assessing the chance predilection for hepatitis B infection. There were 919 blood donors who came from middle class family and among them 9 (0.97 %) were detected with HBV infection using third generation ELISA when compared to upper class where only two blood donors out of total 1481 (0.13 %) were positive for HBV infection. The difference was statistically significant with P value of 0.03.

Another factor found to be relevant for HBV infection was the voluntary blood donors who were willing to donate repeatedly. 10 out of 1585 (0.63 %) blood donors who donated first time were positive for HBV infection compared to repeated blood donors which was only 0.12 % which was a significant difference since P value was 0.04.

In the study, voluntary blood donors were 2277. Among them 2 blood donors (0.08 %) were positive for HBV infection. Even though replacement blood donors were comparatively less with only 123 of them, yet their prevalence for HBV infection was 0.73 % which was statistically significant since it gave P value of 0.01.

DISCUSSION

A five-year study by M Keshvari, Heidar Sharafi and Seyed Moayed Alavian noted that prevalence of Hepatitis B Virus (HBV) was more compared to other transfusion transmitted infection (TTI).⁹

Study conducted in the same period by Harma et al. revealed a similar picture in which the seroprevalence of HBV was 3.51 %.¹⁰

HBV Infection burden was not different among south Indian blood donor population in recent times as described by Chandrasekaran S et al. which comes about 4 %.

Studies by Candotti D et al. and Niederhauser C et al. noted that the risk of transfusion transmitted HBV (TTHBV)

has been markedly reduced by the development of increasingly sensitive hepatitis B surface antigen (HBsAg) tests, the adoption of antibody against hepatitis B core antigen (anti-HBc) screening by some countries, the use of nucleic acid amplification tests (NAT), and improved screening of volunteer donors.¹¹

Jeremiah ZA et al. from their study had explained about blood screening procedures, which were dependent on HBV endemicity and economic conditions of each country. Some countries like Iran and India use HBsAg test for blood screening while others like Brazil use anti-HBc ELISA test to ensure blood safety.^{12,13}

It seems that in countries with high or intermediate prevalence of hepatitis B, anti-HBc test may lead to limited blood supply. Testing of core antibody IgM is better than total anti-HBc to screen donated blood units.¹⁴ This study has tried to compare seroprevalence of hepatitis B infection among blood donors as well as how the risk factors confer the chance of HBV infection among blood donors.

Total prevalence of hepatitis B infection among blood donors in the study was 0.45 %. Various risk factors for hepatitis B infection were analysed and vaccination and voluntary blood donation gave more statistically significant P value as 0.001 and 0.01 respectively to that of non-vaccinated and replacement blood donors.

Place	Prevalence	Reference Study
New Delhi	2.23 %	16
Dehradun	0.99 %	17
Kolkata	1.66 %	18
Kanpur	2.25 %	19
Bangalore	1.86 %	20
Madurai	4 %	7
Tamil nadu	1.37 %	21
Voluntary		
Replacement	2.96 %	22
Kerala	3.1 %	
Trivandrum		Present study
Kerala	0.5 %	
Alappuzha		

Table 2 Comparison of HBsAg Prevalence Rate in Different Parts of India

Similarly, socioeconomic status and repeated blood donation has also got influence on hepatitis B infection because we noted upper middle-class family and repeated blood donation gave P value of 0.03 and 0.04 when compared with to that of middle-class family and first-time blood donors. Hepatitis B infection among different gender has not much significance in our study because P value for HBV infection among males and female blood donors were 0.3.

Similar influence was noted among marital status in which hepatitis B infection among blood donors who were married was 0.52 % and unmarried 0.34 %. (P value 0.3)

Different studies in India had reported the prevalence of hepatitis B viral infection among healthy blood donors ranging from 0.34 % to 3.5 %.¹⁵⁻²¹ (Table 2) Prevalence of hepatitis B infection among the current analysis was in agreement with the above results.

World population also showed the prevalence of HBsAg in a wide range. A study by Wang et al. in china the prevalence was 2.32 %.²² Naglo BM et al. noted a high prevalence of 13.4 % among blood donors in Africa.²³ Prevalence of HBV in Iranian blood donors was only 0.6 % by M.Keshvari et al.. Highest prevalence of HBsAg positivity in voluntary blood donor described by Talib et al. in 1983 was 17.7 %.²⁴

According to S Gulia et al. the prevalence of HBsAg seropositivity between voluntary and replacement donors did not show a significant difference (2.45 % versus 2.54 % respectively (P > 0.05).²⁵ In our study replacement donors were 123 which was less compared to total of voluntary donors of 2277 and prevalence was 7.3 % and 0.08 % respectively the difference in was significant (p < 0.01). These findings are comparable to the study conducted by Chatteraj et al.

In the present study prevalence HBV infection was noted more in male (0.49 %) blood donors when compared to females (0.26 %). The majority of our study population were males, the statistical analysis (chi-square test) revealed the difference in the seroprevalence was not significant (P value 0.30). But significantly higher HBsAg seroprevalence in males than in females was reported in other studies also.^{15,19,26}

According to present study HBV vaccination showed valuable response in the prevalence of infection. All eleven HBsAg screening positive samples were from blood donors who were not vaccinated. Risk estimated also reflected the role of vaccination for preventing the hepatitis B infection, Odd's ratio was 1.09 (95 % Confidence Interval, 1.04 - 2.09). Study by Wuping Li et al. also proved the relevance of vaccination for prevention of HBV infection.²⁷ Protection of HBV infection using vaccination (87 %) was demonstrated among the participants of 22 years follow up study in Alaska by McMahon. BJ et al.²⁸ Haimanti Bhattacharya et al. studied the status of hepatitis B infection and the effect of hepatitis B vaccination in susceptible Nicobarese, an indigenous tribe of Andaman & Nicobar (A & N) islands with high hepatitis B endemicity evidenced among the 726 study subjects. HBsAg positivity was more among the vaccinated persons than non-vaccinated persons having statistical significance. That study showed that prevalence of HBV infection was declined after a decade of implementation of vaccination for hepatitis B in susceptible individual.

Han K et al. noted the potential causes of HBV infection in blood donors, particularly in vaccinated population that may originate due to three reasons noted. It may be due to low level or undetectable anti-HBc or HBV genotype A2 vaccine efficacy. Current hepatitis B Recombinant S protein vaccines are of genotype A2. Donors infected with non a2 /

mixed genotype bcf / b strains might not be fully effective with recombinant vaccine. Third reason for HBV infection among HBV vaccinated blood donors that which Han K et al. says that as age advances low level immune response were insufficiently protected when in contact with high HBV DNA load.²⁹

There are several confounding factors like donors who had history of tattooing, history of minor surgical procedure, health care worker, dental extraction and history of blood transfusion showed them having a risk of HBV infection in the form of occult infection. Any history of jaundice or hospitalization was not associated with higher incidence of seropositivity. Prevalence was high among the blood donors of specific occupation noted in the study conducted at Saudi Arabia by Kamel E et al. Among the blood donors 1536 were married and 864 were single, the prevalence was 0.52 % and 0.34 % respectively. There was no statistical significance (P = 0.30) noted in prevalence of HBV infection with respect to marital status of the study subject which contradicts the observance of Kamel E et al. that blood donors with positive HBV markers showed significant association with marital status.³⁰

Majority of the donors belonged to upper class and middle class of socioeconomic status, their prevalence was 0.13 % and 0.97 % respectively. In our study there was no statistical significance (P = 0.306) between the different socioeconomic groups which was agreed with study conducted by Puri P et al..³¹

In the present study prevalence of hepatitis B infection was noted more among first time (0.63 %) blood donors than repeated blood donor (0.73 %) (P value 0.04) which was comparable with study conducted by Hasan Boustani et al..³²

The strength of the study included prospective design and follow up of risk group blood donors since it was a hospital based study. This study could also show the burden of HBV infection in the locality because major part of donor population was from the area around the hospital premises through institutional blood donation and outreach blood donation camp. The study assessed the risk estimate of donor behavioural pattern and health care awareness that will help to modify the pre donation counselling and parameters to emphasize during donor deferral criteria. This study provides a helpful guide in reducing the residual risk of transfusion transmitted hepatitis not only in India but also in the other developing countries of the world. We recommend the government and private organizations involved in blood donation programmes to make common people aware of screening and donation of blood. Also to ensure donation according to international standards, proper treatment of infected persons and vaccination to every person to be done because prevention is better than treatment.

CONCLUSIONS

Prevalence of HBV infection was (0.45 %) low compared to endemicity of the infection of the area where study was conducted which shows the satisfactory donor selection

criteria to prevent transfusion transmitted infection (TTI). Vaccination against HBV infection was found to be a strong preventive method to decrease transfusion transmitted hepatitis B. Since altruistic repeated voluntary blood donors and donors from upper class socioeconomic status might be aware of importance of immunization and risk behaviours lead to various diseases including transfusion transmitted infection, that may be the reason why prevalence of HBV infection was less among them.

Limitation of Study

Assessment of the immune status of HBV vaccinated donors and anti-HBc level of the donors could not be evaluated to determine relevance of screening result and disease stage of occult blood infection (OBI) in donors.

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

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