

Seropositivity of hepatitis B surface antigen among first time voluntary blood donors in Magway Teaching Hospital

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Abstract

A cross-sectional descriptive study was conducted on 330 first time voluntary blood donors from Magway Teaching Hospital during 2016. The aim of this study was to detect the seropositivity of hepatitis B surface antigen (HBsAg) among first time blood donors from Magway Teaching Hospital. All 330 serum samples from first time blood donors were tested for HBsAg by both ICT (Immuno-chromatographic Test, Blue Cross Inc., China - HBsAg test) and ELISA (Enzyme Linked Immunosorbent Assay) (SD HBsAg ELISA Standard Diagnostics Inc., Korea). In this study, detection of seropositivity of HBsAg among first time blood donors by both ICT and ELISA showed the same result which was 4.55% (15/330). Out of 15 HBs positive blood donors, 13 (86.67%) were male blood donors and 2 (13.33%) were female blood donors. Among 15 HBsAg positive blood donors, 53.33% (n = 8) were between age 18-24 years, 26.67% (n = 4) were age 25-34 years, 20% (n = 3) were age between 35-44 years and there were no HBsAg positive blood donors in ≥ 45 years. The commonest blood group for HBsAg seropositivity is the blood group B accounted to be 9 out of 15 (7.25%) followed by the blood group A, 4 out of 15 (5.06%), blood group O, 2 out of 15 (1.96%). There is no HBsAg positive results found among AB blood group in this study. The objective of blood screening is to detect HBs antigen in order to prevent the transmission of infected blood and blood components for clinical use. The seroprevalence of hepatitis B surface antigen among first time blood donors was found to be 4.55% and the high seroprevalence was found in young age group and male gender. This information provides further management and prevention of hepatitis B infection among blood donors.

Introduction

Hepatitis B infection is a major public health problem worldwide caused by Hepatitis B virus. Chronic Hepatitis B virus (HBV) infection is the main cause of younger-onset complex liver disease including cirrhosis and hepatocellular carcinoma (HCC). An estimated 240 million people are chronically infected with hepatitis B and Over 686,000 people die every year due to its complications which can be prevented by currently available safe and effective vaccine¹. Hepatitis B virus can be transmitted through sexual contact, sharing needles, syringes, or other drug-injection equipment or from mother to baby at birth or blood transfusion of blood, blood products and organs². Transfusion-transmitted HBV played a major role in developing countries, where the prevalence of

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this infection is higher (> 8%) and the donor selection and screening procedures are less tight³. Screening for transfusion-transmissible infections (TTIs) to exclude blood donations at risk of transmitting infection from donors to recipients is a critical part of the process of ensuring that transfusion is as safe as possible⁴.

Myanmar is the area of high endemicity for hepatitis B with 35-60% infection rate and 10-15% carrier rate⁵. The seroprevalence of HBsAg among general population from Kawthaung Township in the southern part of Myanmar was 7.1% (27/380) and from Tachileik Township in the eastern part was 3.8% (19/503)⁶. Hepatitis B virus infection is significantly related to the blood group of donors. The higher frequency of seropositivity of Hepatitis B was found to be higher in young male blood donors in Iran⁷ and 7.28% in first-time blood donors representative of the urban adult population in Gabon⁸. Among different methods used for the diagnosis of hepatitis B virus, more sensitive methods, such as Enzyme Linked Immunosorbent Assay (ELISA), Radioimmunoassay (RIA) and Polymerase Chain Reaction (PCR) has been used globally⁹. Commercial rapid diagnostic test (RDT) kits with different sensitivity and specificity for detecting HBV markers are available¹⁰.

Studies on seroprevalence of HBV infection in first time blood donors from National Blood Bank, Yangon in Myanmar observed that HBsAg positivity was 2.9% in 2002, 4.3% in 2003, 5.1% in 2004, 4.23% in 2005 and 3.74% in 2006 from National Blood Bank¹¹. A study done in North Okkalapa General Hospital during 2004, HBsAg seropositivity rate was found to be 6.17% by ELISA method¹². In 2014, the seroprevalence of HBsAg by ELISA was found 4% among first time blood donors from Thingangyan Sanpya Hospital¹³.

In this study, screening of HBV infection among first time blood donors was performed by using both ICT and ELISA and to determine the diagnostic accuracy of ICT based on ELISA as an accepted gold standard technique. ELISA test is widely applicable, highly sensitive and specific screening method. It should be used for routine screening test for blood donors. Rapid test can be used as alternative test for screening of HBs antigen in limited resource area.

Detecting seropositivity of HBsAg among first time voluntary blood donors in this study could dictate prevention and control of transfusion-transmitted HBV infection by screening. Young age group and male donors were more frequently associated with HBs antigen positivity. These supporting information can enable infection prevention programme to consider further treatment for positive individuals.

Methods

A cross-sectional descriptive study among first time blood donors (n = 330) at Magway Teaching Hospital was conducted during the study period of 12 months from January to December 2016. Both genders fit for blood donation in compliance with the criteria of the National Blood Bank were included in this study following an informed consent after explaining the aims and detailed procedures of the study to each participant.

The study setting was the Blood Bank, Magway Teaching Hospital and Department of Microbiology, University of Medicine, Magway for HBsAg testing. Under sterile and aseptic conditions, three ml of venous blood was collected from each donor. Then, the collected blood was transferred into sterile plain test tube for the preparation of serum. Serum separation was done and stored at -20°C till analyzed. The HBsAg testing was performed at University of Medicine, Magway by using both ICT and ELISA. Blue Cross Inc., China HBsAg test strip is a rapid test is a visually read, qualitative immunoassay for in vitro detection of hepatitis B surface antigen in serum or plasma. The biological principle of the test is based on immunochromatographic, one step assay¹⁴. Enzyme Linked Immunosorbent Assay (SD HBsAg ELISA 3.0, Standard Diagnostics Inc., Korea) is double sandwich ELISA for the quantitative detection of HBsAg with high degree of sensitivity and specificity¹⁵. All data including patient's identity, clinical presentation and laboratory results were collected and saved in Microsoft Office Excel as a master sheet. Then data cleaning, data compilation, data processing and data analysis were done by using SPSS (Statistical Package for Social Science) version 16.0. Frequency distributions and percentages were computed. Diagnostic accuracy of tests was presented as kappa value.

Results

A total of 330 first time blood donors within the age range of 18-48 years from Magway Teaching Hospital were recruited for the study. All these 330 serum samples were tested for HBsAg by both ICT and ELISA. According to Table (1), the age distribution was highest among 18 to 24 years (58.18%; 192/330). Among 330 blood donors, 252 (76.36%) were male and 78 (23.64%) were female.

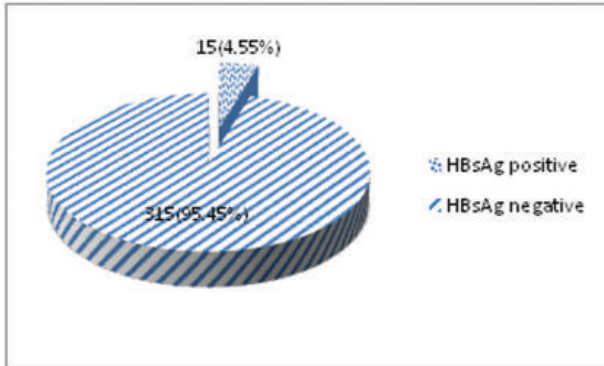
Table 1. Age and sex distribution of first time blood donors (n = 330)

Age (in years)	Total n (%)	Male (n = 252)	Female (n = 78)
18 - 24	192 (58.18%)	153 (60.71%)	39 (50.0%)
25 - 34	92 (27.88%)	67 (26.59%)	25 (32.05%)
35 - 44	37 (11.21%)	24 (9.52%)	13 (16.67%)
≥ 45	9 (2.73%)	8 (3.18%)	1 (1.28%)
Total	330 (100%)	252 (100%)	78 (100%)

In terms of blood groups, 37.58% (124/330) of first time blood donors were blood group "B" followed by blood group "O" (32.73%, 108/330), blood group "A" (23.94%, 79/330) and blood group "AB" 5.76% (n = 19).

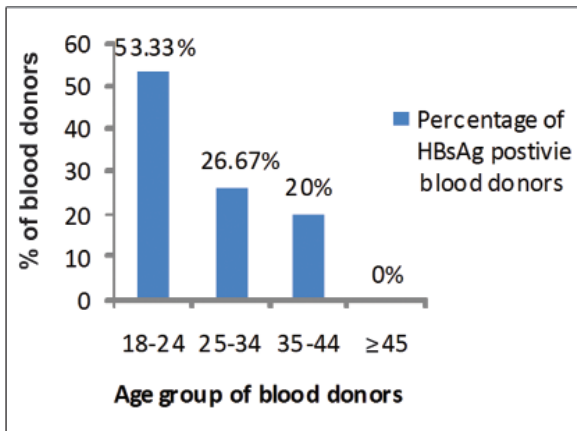
The seroprevalence of HBsAg among first time blood donors was 4.55% (15/330) (95%CI: 2.57% - 7.39%) (Figure 1).

Figure 1. Prevalence of HBsAg seropositivity among first time blood donors (n = 330)



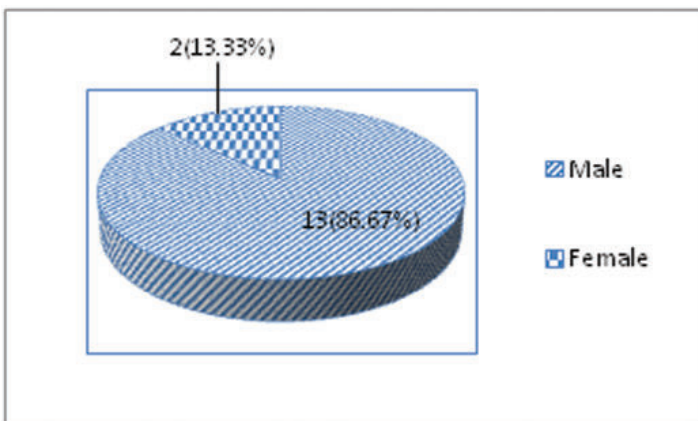
Out of 15 HBsAg positive blood donors, 8 (53.33%) were between age 18-24 years, 4 (26.67%) were age 25-34 years and 3 (20%) of blood donors were between 35-44 years. There were no HBsAg positive blood donors in ≥ 45 years (Figure 2).

Figure 2. Occurrence of HBsAg positivity by age group



Among 15 HBsAg positive blood donors, 13 (86.67%) were male blood donors and 2 (13.33%) were female blood donors (Figure 3).

Figure 3. Occurrence of HBsAg positivity by gender



Occurrence of HBsAg positivity by blood group

According to Table (2), the lowest frequency of HBsAg seropositivity of 1.96% (2/108) was found in blood donors of blood group O while those with blood group B accounted to be 7.25% (9/124) followed by blood group A (5.06%; 4/79).

Table 2. Distribution of HBsAg seropositivity by blood group

Blood Groups	First time blood donor (n)	HBsAg seropositivity (n)	Percentage	95% CI
A	79	4	5.06%	1.40% - 12.46%
B	124	9	7.25%	3.37% - 13.33%
O	108	2	1.96%	0.2% - 6.53%
AB	19	Nil	Nil	-
	330	15	4.55%	2.57% - 7.39%

The percentage seropositivity of HBsAg by ELISA based on ICT results was 100% (n = 15) of total 15 positive results by ICT. Among 315 negative ICT results from first time blood donors, it is also 100% (n = 315) negative by ELISA (Table 3). Sensitivity of the ICT results from the first time blood donors is 100% (15/15*100) and Specificity of the ICT results from the first time blood donors is 100% (315/315*100). Regarding Kappa agreement, Kappa value (k = 1) shows almost perfect agreement on diagnosis of seropositivity of HBsAg between ELISA and ICT result in study population.

Table 3. Percentage seropositivity of HBsAg by ELISA based on ICT results

		ELIISA		Total percentage
		HBsAg positive	HBsAg negative	
ICT	HBsAg positive	15	0	100%
	HBsAg negative	0	315	100%

Discussion

This study was undertaken on first time blood donors from Magway Teaching Hospital during the year of 2016 for detection of HBs antigen by using two different diagnostic tests, ICT and ELISA. This study observed that 15 out of 330 first time blood donors (4.55%) were HBsAg positive. Out of 15 HBsAg positive blood donors, 13 were male and 2 were female. Among 15 HBsAg positive blood samples, 5 were monks from the same monastery, 8 were general workers and 2 were university students who had the history of tattooing. The seroprevalence of HBV among voluntary blood donors at a tertiary care teaching hospital in rural area of India during 2009-2010 was 1.09%¹⁶. In Bangladesh during 2007-2009, the prevalence of confirmed positivity among blood donors was 0.62% for HBsAg¹⁷. The meta-analysis done in 2016 for the prevalence of HBsAg among blood donors of Eastern Mediterranean and Middle Eastern Countries was 2.03%¹⁸. By comparing these data, HBsAg positivity was found to be higher in this study among first time blood donors. The prevalence of HBsAg among blood donors at Gondar

University Teaching Hospital, Northwest Ethiopia from 2003-2007 was 4.7%¹⁹. This seroprevalence was the same result obtained from the present study. During 2002-2006 in National Blood Bank of Yangon, Myanmar, HBsAg positivity was 2.9% in 2002, 4.3% in 2003, 5.1% in 2004, 4.23% in 2005 and 3.74% in 2006¹⁶. A study done during 2004 in North Okkalapa General Hospital, HBsAg seropositivity rate was found to be 6.17% (65 in 1053 blood donors) by ELISA method¹⁸. Among first time blood donors from Thingangyun Sanpya General Hospital in 2014, the seroprevalence of HBsAg by ELISA was 4% of total 150 blood donors¹⁹. These results were not much difference with the result obtained from this study. The variation in seroprevalence rate of HBs antigen among blood donors might be probably due to different geographical regions, underlying socioeconomic status and uses of different diagnostic methods.

In a study done in 2014 in Nigeria for the seropositivity of HBsAg among blood donors, the prevalence was highest among younger donors in the 18-28 years age group 71.43% compared to 21.43% and 7.14% in the 29-38 and 39-48 years age groups respectively. No infection was observed among older blood donors in the 49-58 and 59-68 years age groups²⁰. Similarly, the risk of infection is high in young persons in the present study as 8 (53.33%) of 15 HBsAg positive blood donors were in the age of 18-24 years and 4 (26.67%) were between 25-34 years age groups. The same results were obtained from the study done in 2014 among first time blood donors from Thingangyun Sanpya Hospital and the study done in 2004 among asymptomatic voluntary blood donors from North Okkalapa General hospital in which the prevalence of HBV infections was more common in younger male persons^{12, 13}. These studies also support higher seroprevalence in male first time blood donors in the present study which noted that (86.67%) were male blood donors and 2 (13.33%) were female blood donors among 15 HBsAg positive blood donors. In a study done in Italy among first time blood donors during 2004-2005, out of 95 positive HBsAg cases, 80.9% were males and 19.1% were female⁴. The seropositivity of male first time blood donors is also higher than that of female first time blood donors in this study. Therefore, this study showed similar results with the present study. The higher rate of seropositivity was found in male gender and younger age group in this study. It might be due to the fact that majority of blood donors were males and of younger age group.

In a comparative study between enzyme linked immunosorbent assay and different rapid kits for detection of HIV, HBV and HCV infections in India during 2012, rapid kits were having high degree of sensitivity and specificity (100%) except that in HIV combo and HCV combo therefore ICTs were more efficient in specificity than ELISA in most cases. They were useful for further detection of false positive samples by ELISA²¹. A study done in Nigeria during 2013 the overall diagnostic accuracy of ICT was 84.7%²². The sensitivity and specificity of ICT is 94.12% and 97.61% respectively when compared to ELISA and overall sensitivity and specificity were 95% and 100%²³. The result of HBsAg from rapid test kits (various brands) agreed with the result from the ELISA test kit used in Thingangyun Sanpya General hospital among first time blood donors¹³. In the present study, 15 out of 330 serum samples were tested positive by ICT which were retested with ELISA and the

result was 15 (15) which is 100% same with the ICT results. HBs antigen can be detected by different serological tests. The choice of assay for blood screening should be highly sensitive and specific. Although the highly sensitive and specific serological method is ELISA, other alternative rapid test is also reliable test for screening.

Hepatitis B virus infection is significantly related to the blood group of donors, percentage of HBsAg was lower in donors who had blood group O and higher among Rh positive donors in the study done in Iran during 2005-2011⁷. Similarly, the lowest frequency of HBsAg seropositivity in the present study was found in the blood group O, 2 out of 15 in number. The commonest blood group for HBsAg seropositivity was the blood group B accounted to be 9 out of 15 followed by the blood group A, 4 out of 15. There was no HBsAg positive results found among AB blood group in this study. An earlier study done in 1991 for the HBV carrier rates in different blood groups of blood donors in Myanmar revealed 9.9%, 9.4%, 9.3% and 8.5% in the blood groups A, B, O and AB respectively which differed from the present study²⁴. Different studies yield different data on relationship between blood groups and HBs antigen positivity. This might be due to random genetic variation, the interaction between microorganisms and red blood cell membrane probably due to antigenic similarity and adhesion through specific receptors²⁵.

Conclusion

The seroprevalence rate (4.55%) in the first time blood donors from Magway Teaching Hospital further recommends comprehensive screening of blood donors. The higher seroprevalence was found in young male and therefore better education of donors, effective immunization and improved prophylactic measures at public level should be done to ensure safe blood donation for reducing the risk of transmission. The detection of HBs antigen in first time blood donors by both tests gave similar result which pointed out that rapid test can be used as an efficient alternative for screening.

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