

## Comparative Studies on Prevalence of Hepatitis B Surface Antigen (HBsAg) Positivity Among Health Care Workers and Blood Donor

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### ABSTRACT

The study was conducted during the month of November 2017 to April 2018. The present study reveals that HBsAg infection was more prevalent among health care worker (9.21%) than voluntary donors (6.39%). In our study majority of health care workers and voluntary blood donors are in age group of (18–35) years. But most of reactive cases which include 3 (4.61%) health care workers among 65 health care workers and 2 (3.33%) voluntary blood donors among 210 donors are in a age group of 26–36 years. Among 65 health care workers highest reactivity 6.15% was found among 26 workers doing house keeping and lab attendant work, 1.54% was found among 26 lab technician and 1.54% was found among 10 nurses while no positive cases was found among doctors.

Among 210 voluntary blood donor student were 95 and among these 3 students (3.15%) were found HBsAg positive. Private and government workers were 62 among 1 (1.61%) was found HBsAg positive. Persons taken from general population 1 (2%) was found HBsAg reactive. Among 3 house wife no positive case of HBsAg infection was found.

**Keywords** Voluntary, Reactivity, Technician, Health care workers, Blood donors.

### INTRODUCTION

Hepatitis B virus (HBV) infection is a major public health concern with more than 240 million individuals chronically infected world-wide (Das et al. 2011). HBV infection could lead to acute and chronic hepatitis, cirrhosis and hepatocellular carcinoma, posing a tremendous public health burden (Lok and McMahon 2001).

HBV is a DNA virus classified in the virus family Hepadnaviridae. Humans are the only known natural host. HBV enters the liver via the blood stream and replication occurs only in liver tissue. The intact, infectious virus is 42–47 nm in diameter and circulates in the blood in concentrations as high as  $10^8$  virions per ml. The inner core of the virus contains Hepatitis B core antigen, Hepatitis Be antigen (HBeAg), a partially double-stranded 3,200-nucleotide DNA

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molecule and DNA polymerase with reverse transcriptase activity. Hepatitis B surface antigen (HBsAg) is found both on the surface of the virus and as self-assembling, non-infectious spherical or tubular particles (Repo et al. 2014).

Prevalence of HBV infection varies greatly in different parts of the world. The World Health Organization (WHO) has classified HBV prevalence into high (>8%), intermediate (2-7%) and low endemic (<2%) areas and India falls in the intermediate range with an estimated 1,00,000 deaths per year (Previsani and Lavanchy 2002).

The occupational exposure of HBV is well recognized risk factor for health care workers and voluntary blood donors. Throughout the world, million of the health care professionals work in the health institutions and is estimated that 60,000 to 80,000 accidental traumatic injuries occur while handling in hospital and related work, of which 50% are not registered cases. The prevalence of the infection in HCWs, a high risk group for acquiring infection with blood born pathogens due to occupational contact with infected body fluids like blood and saliva, tears, semen and vaginal secretions. Some advanced laboratories test for HBV, DNA in addition to the above seromarkers, using more sensitive, robust and specific nucleic acid tests (NATs) (Schmidt et al. 2016). Specific amplification and probe hybridization-based NATs are capable of detecting viral DNA even in the state of occult infection, thereby increasing screening efficiency and safety of the blood supply.

The study also aimed to analyze the sensitivity of the techniques applied for the detection of HBV. HBsAg tests remain the first-line of blood screening for HBV. Current HBsAg screening assays are enzyme immunoassays (EIAs), including enzyme-linked immunosorbent assays (ELISAs), chemiluminescence immunoassays (CLIAs) Nucleic Acid Amplification Technique. These different assays have sensitivity ranging between <0.1 and 0.62 ng of HBsAg per mL. (1 ng/ml corresponds to approximately 2 IU/mL) (Colin et al. 2006).

The study was conducted in the Department of Transfusion Transmissible Infection Laboratory

of IMA Blood Bank of Uttarakhand Dehradun with the following aims and objectives : To study the HBsAg positivity in various health care workers and voluntary blood donors. Analyzing the sensitivity of methods used to detect the HBV infection. To study the possible causes of Hepatitis in health care workers and voluntary blood donors.

## MATERIALS AND METHODS

This study was conducted in the Department of Transfusion Transmitted infections Lab of IMA Blood Bank of Uttarakhand Dehradun during the month of November 2017 to April 2018.

In this study Hepatitis B prevalence was studied by using following techniques among various health care workers and voluntary blood donors : Hepacard method, ELISA, Nucleic Acid Amplification Technique (NAAT).

The samples withdrawn from health care workers were grouped on the basis of their professional work. They were categorized into five groups, according to major activities performed by them : Doctors, Nursing staff, All technical staff (Lab technician), Lab Attendants and Sweepers doing general services, Voluntary blood donors.

To verify the prevalence of the infection of Hepatitis B virus and to identify the risk factor determining occupational infection of HBV with the hospital personnel of different categories. Our study contained among 65 health care workers and 150 voluntary blood donors (both male and female). Blood samples were collected over a period of 2 months from health care workers and voluntary blood donors of IMA Blood Bank of Uttarakhand for the detection of Hepatitis B virus and information was collected from them by asking them to fill up the donor requisition form and questionnaire given to them at the time of collecting blood samples. This information include detailed occupational history apart from general data like age, sex, socio-economic status, marital status, literate Illiterate, exposure to blood and/or blood products and the possible risk behavior and occupational hazards like needle-stick injury, blood transfusion and contact with infected

**Table 1.** Age specific HBsAg reactivity among health care workers.

| Age groups (years) | No. of health care workers | HBsAg positivity by Rapid Card method | HBsAg positivity by ELISA method | HBV positivity by NAAT (confirmatory) | Hepatitis positive (%) |
|--------------------|----------------------------|---------------------------------------|----------------------------------|---------------------------------------|------------------------|
| 18-25              | 22                         | 1                                     | 1                                | 2                                     | 3.07%                  |
| 26-35              | 18                         | 2                                     | 2                                | 3                                     | 4.61%                  |
| 36-45              | 15                         | 1                                     | 1                                | 1                                     | 1.53%                  |
| 46-55              | 3                          | 0                                     | 0                                | 0                                     | 0.0%                   |
| >55                | 2                          | 0                                     | 0                                | 0                                     | 0.0%                   |
| Total              | 65                         | 4                                     | 4                                | 6                                     | 9.21%                  |

person via i.v. drug user, sexual intercourse (specially multiple partners and homosexual), during handling and processing the infectious materials, vaccination status (complete, incomplete, without vaccination) and awareness towards hepatitis B all these are asked in the questionnaire.

## RESULTS AND DISCUSSION

This study was conducted in IMA Blood Bank of Uttarakhand Dehradun, Uttarakhand. Study done for a period of three months from 1 November 2017 to April 2018.

During this period 275 voluntary blood donors who donated in IMA Blood Bank of Uttarakhand and 65 health care workers of IMA Blood Bank included in present study. This denotes that HBsAg reactivity among health care worker was 9.23% and 6.39% among voluntary blood donors. HBsAg positivity in relations to age group shown in Tables 1 and 2. Sixtyfive health care workers included in this study,

**Table 2.** Age specific HBsAg reactivity among voluntary blood donor.

| Age groups (years) | No. of voluntary blood donor | HBsAg positivity by Rapid Card method | HBsAg positivity by ELISA method | HBV positivity by NAAT (confirmatory) | Hepatitis positive (%) |
|--------------------|------------------------------|---------------------------------------|----------------------------------|---------------------------------------|------------------------|
| 18-25              | 22                           | 1                                     | 1                                | 2                                     | 3.07%                  |
| 26-35              | 18                           | 2                                     | 2                                | 3                                     | 4.61%                  |
| 36-45              | 15                           | 1                                     | 1                                | 1                                     | 1.53%                  |
| 46-55              | 3                            | 0                                     | 0                                | 0                                     | 0.0%                   |
| >55                | 2                            | 0                                     | 0                                | 0                                     | 0.0%                   |
| Total              | 65                           | 4                                     | 4                                | 6                                     | 9.21%                  |

**Table 3.** HBsAg reactivity in relation to occupation of health care workers.

| Occupation                                                  | No. of health care workers | HBsAg positive | HBsAg positive (%) |
|-------------------------------------------------------------|----------------------------|----------------|--------------------|
| Doctors                                                     | 6                          | 0              | 0.0%               |
| Nurses                                                      | 10                         | 1              | 1.54%              |
| Lab technicians                                             | 23                         | 1              | 1.54%              |
| General services (House keeping workers and lab attendants) | 26                         | 4              | 6.15%              |
| Total                                                       | 65                         | 6              | (9.21%)            |

among which 9.21% found to be Hepatitis positive.

Table 1 shows age specific HBsAg reactivity among health care workers. Age group 26-35 found maximum reactive cases i.e. 4.61% and age group 45-55 and >55 are found less reactive i.e. 0%. Table 1 also shows that two health care workers with the same donor detail no. of age group 26-35 and 18-25 found to be non-reactive by Rapid Card method and ELISA method but found to be reactive by NAAT. Among 210 voluntary blood donors included in this study, 6.39% of them were found HBsAg reactive.

Table 2 shows the age specific HBsAg reactivity among voluntary blood donor. Age group 26-35 found maximum reactive cases (3.33%) while between 46-55 and >55 found to be non-reactive. It was also found that one of the non-reactive sample tested by the Rapid Card method give positive result when tested by the ELISA and NAAT. HBsAg positivity in relation to occupation shown in following Tables 3 and 4. Among 65 health care workers included in

**Table 4.** HBsAg positivity in relation to occupation of voluntary blood donors.

| Occupation                 | No. of voluntary blood donors | HBsAg positive | HBsAg positive (%) |
|----------------------------|-------------------------------|----------------|--------------------|
| Students                   | 95                            | 3              | 3.15%              |
| House wife                 | 3                             | 0              | 0%                 |
| Private and govt workers   | 62                            | 1              | 1.61%              |
| Other (General population) | 50                            | 1              | 2%                 |
| Total                      | 210                           | 5              | 6.39%              |

**Table 5.** Causes of HBsAg reactivity among health care workers.

| Sl. No. | Causes of reactivity among health care workers | HBsAg positive | HBsAg positive (%) |
|---------|------------------------------------------------|----------------|--------------------|
| 1       | History unknown                                | 2              | (3.0%)             |
| 2       | History of blood transfusion                   | 0              | -                  |
| 3       | Unprotected sex                                | 0              | -                  |
| 4       | Carrier (Family history)                       | 1              | (1.63%)            |
| 5       | Needle prick injury                            | 3              | (4.60%)            |
|         | Total                                          | 6              | (9.21%)            |

this study, 6 of them were found HBsAg reactive and remaining 59 were found to be non-reactive.

Total 65 health care workers included in this study. General services (House keeping workers and lab attendants) showed a relatively higher reactivity (6.15%) among other health care workers. One nurse found reactive among 10 nurses and 1 lab technician found reactive among 23 lab technicians. Among 210 voluntary blood donors included in this study, 5 of them were found HBsAg reactive and remaining 205 were found to be non-reactive.

Total 210 voluntary blood donors were included in this study. Among them students showed a relatively higher reactivity (3.15%). One private worker found reactive among 62 private and govt workers and 1 person found reactive among 50 persons of general population. Causes of HBsAg positivity among health care workers and voluntary blood donors shown in following Tables 5 and 6. Among 65 health care workers included in this study, 6 of them were found HBsAg reactive and remaining 59 were found to be non-reactive.

**Table 6.** Causes of HBsAg reactivity among voluntary blood donors.

| Sl. No. | Causes of reactivity among voluntary blood donors | HBsAg positive | HBsAg positive (%) |
|---------|---------------------------------------------------|----------------|--------------------|
| 1       | History unknown                                   | 1              | (1.25%)            |
| 2       | History of blood transfusion                      | 0              | -                  |
| 3       | Unprotected sex                                   | 1              | (0.2%)             |
| 4       | Carrier (Family history)                          | 2              | (3.33%)            |
| 5       | Needle prick injury                               | 3              | (4.60%)            |
|         | Total                                             | 6              | (9.21%)            |

**Table 7.** Results of Hepatitis test among health care workers and voluntary blood donors.

| Sl. No. | Method         | Total test | Reactive | Non-reactive |
|---------|----------------|------------|----------|--------------|
| 1       | Rapid Hepacard | 275        | 8        | 267          |
| 2.      | Hepalisa       | 275        | 9        | 266          |
| 3.      | NAAT           | 275        | 11       | 264          |

Among 65 health care workers total 6 were found HBsAg reactive. While re-evaluating these reactive cases (history taken) 3 (4.6%) had given history of needle pricking, one (1.63%) given family history of hepatitis infection and two cases (3.0%) could not reveal any relevant causes. Among 210 voluntary blood donors included in this study, 5 of them were found HBsAg reactive and remaining 205 were found to be non-reactive.

Among 210 voluntary blood donors total 5 donors were found HBsAg reactive. While re-evaluating these reactive cases (post donation counseling) 2 (3.33%) had given family history of Hepatitis infection, one (0.2%) given history of unprotected sex, one (1.81%) given history of needle pricking during needle sharing and one case can not reveal any relevant causes.

In our study all tests are performed by Rapid Hepacard (immune- chromatographic assay) and then by Hepalisa (ELISA method) and further confirmed with NAAT. Total 275 samples (210 voluntary blood donors and 65 health care workers) were included. Result of Hepatitis test done by Rapid Hepacard method, ELISA method and NAAT among voluntary blood donors and health care workers shown in following Table 7. Among 65 health care workers and 210 voluntary blood donors included in this study, 6 HCW and 5 voluntary blood donors were found HBsAg reactive.

The results from these test methods shows bit difference in their sensitivity. Among all Nucleic Acid Amplification Technique found to be more sensitive (4%) than ELISA (3.27%) and Rapid Card method (2.9%). NAAT is highly sensitive technique which reduces the window period for the HBV.

## CONCLUSION

HBsAg is one of the screening tests routinely done among blood donors as well as HBsAg infection is one of the known occupational hazards found among health care workers. According to India Drugs and Cosmetics act (1945) each blood unit has to be tested for Hepatitis B virus infection. All health care workers should be vaccinated against HBsAg infection.

Over all prevalence of HBsAg in India is 2 to 10%. In our study total 275 persons (210 voluntary donors and 65 health care workers) were included with seroprevalence of 4%. Among 210 voluntary blood donors sero prevalence of HBsAg was observed 6.39%. Similar study done by Singh et al. (2009) reveal sero prevalence of 0.62% among 960 voluntary blood donors of Coastal Karnataka reported 0.99% HBsAg sero reactivity among 1000 voluntary blood donors in Punjab during (1987-1992). In our study among 65 health care workers prevalence of HBsAg was observed to be 9.21%. Similar study done by Asok et al. (2000-04—2000-06) reveals 2.21% sero positivity among 208 health care workers in teaching hospital of Rea (MP). The present study reveals that HBsAg infection was more prevalent among health care worker (9.21%) than voluntary donors (6.39%). These results are in accordance with the results of Sonwane et al. (2003). Also, similar studies conducted in Western countries also shown 2-10 times higher prevalence of serological marker for Hepatitis B in health care workers in comparison of voluntary blood donors. The present study reveals that HBsAg infection seroprevalence was significantly high in health care workers as compared to voluntary blood donors. This can be explained by the factor that in our study most of the reactive cases were of health care workers and the possible reason behind this is that HCW are more exposed to the infectious material as compared to voluntary blood donors. In our study majority of health care workers and voluntary blood donors are in age group of (18–35) years. But most of reactive cases (Schmidt et al. (2016) which include 3 (4.61%) health care workers among 65 health care workers and 2 (3.33%) voluntary blood donors among 210 donors are in a age group of 26-36 years.

Among 65 health care workers highest reactivity 6.15% was found among 26 workers doing house keeping and lab attendant work, 1.54% was found

among 26 lab technician and 1.54% was found among 10 nurses while no positive cases was found among doctors. Lack of awareness seems to be the reason for this increase prevalence among these health care workers. Among 210 voluntary blood donor student were 95 and among these 3 students (3.15%) were found HBsAg positive. Private and government workers were 62 among 1 (1.61%) was found HBsAg positive. Persons taken from general population 1 (2%) was found HBsAg reactive. Among 3 house wife no positive case of HBsAg infection was found. While re-evaluating all 5 HBsAg positive cases among 210 voluntary blood donor it reveals that 2 among 3 students had family history of Hepatitis infection and one student was involved in drug abuse via needle sharing also one private worker had history of unprotected sex and remaining 1 reactive case from general population cannot reveals any significant history. Our study reveals that seropositivity is higher among carrier of HBsAg with positive family history as compared to other causes (unprotected sex and needle pricking via needle sharing). While re-evaluating all 6 HBsAg positive cases among 65 health care workers reveals that 3 among 4 person involves in general services (house keeping and lab attendant) had history of accidental needle prick but one HBsAg positive worker can not reveal any significant history. One reactive lab technician among 23 lab technicians reveals family history of Hepatitis infection. One reactive staff nurse among 10 nurses cannot reveal any relevant history. Thus our study reveal that among health care workers seropositivity is higher in person having history of needle pricking.

Other Western studies reveal less (1-4%) seroprevalence among health care workers and voluntary blood donors. This difference may be due to the fact that more and more health care workers and voluntary blood donors in Western countries are vaccinated nowadays. An increased awareness program and vaccination against Hepatitis B has become freely available in Western world. The most common mode of transmission of HBV to health care workers and voluntary blood donors in the work place is by accidental blood to blood by needle sticks or other contaminated sharps injuries. An unimmunized individual has a greater chance of transmission following a Hepatitis B positive needle stick injury. The annual

number of cases of Hepatitis B among health care workers and voluntary blood donors has been steadily decreasing due to the use of the HBV vaccine and improved medical follow up after an occupational exposure. There is a need for health education, awareness and training campaigns or programs for health workers and voluntary blood donors so that they can understand the risks of contamination or transmission of the infections, i.e. particularly, HBV infections with the fact of being exposed with the nature of their work.

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