

Prevalence of protective antibody levels against hepatitis B infection among healthcare workers in a tertiary care hospital in India



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ABSTRACT

Background: Hepatitis B virus (HBV) infection affects more than 2 billion individuals globally HBV. The chance of dying from liver cirrhosis, acute fulminant liver disease, or hepatocellular carcinoma (HCC) is present in 240 million of these chronic HBV carriers (HCC). **Aims and Objectives:** This study aims to assess the anti-HBs antibody titer level against various levels of healthcare workers (HCWs) and to assess the need for booster dose hepatitis B vaccination. **Materials and Methods:** This study was conducted at Melmaruvathur Adhiparasakthi Institute of Medical Sciences and Research, Melmaruvathur, Tamil Nadu, India, from July 2022 to December 2022. A total of 218 HCWs were divided into two groups: Group A (vaccinated ≥ 5 years ago) and Group B (vaccinated in past 5 years). The serum from 2 mL blood was separated and tested for anti HBs antibody titer by electrochemiluminescence immunoassay method. **Results:** The mean and standard deviation values of Anti-HBsAg titer between Group A and Group B was not statistically significant ($P=0.08467$). **Conclusion:** Our study demonstrates that people who have had vaccinations are unsure of whether they are responders or non-responders, and to determine this, they must have had their titer evaluated only 1–2 months after receiving their third dosage of hepatitis B vaccine. As a result, they still run the risk of contracting hepatitis B and strongly need a booster dose of the hepatitis B vaccine.

Key words: Hepatitis B; Hepatitis B vaccines; Healthcare workers

INTRODUCTION

Hepatitis B virus (HBV) infection affects more than 2 billion individuals globally HBV. The chance of dying from liver cirrhosis, acute fulminant liver disease, or hepatocellular carcinoma (HCC) is present in 240 million of these chronic HBV carriers (HCC). The highest rates of chronic hepatitis B infection, in which the World Health Organization (WHO) estimates to affect between 5% and 10% of the adult population in these regions, are found in sub-Saharan Africa and East Asia.¹

Health-care professionals have a significant risk of getting infected by hepatitis B. Acute infection from the HBV is typically self-limited; however, chronic infection can result in consequences such as cirrhosis, hepatocellular cancer, and

liver failure.² India being an intermediate endemic zone for HBV infection, every year about 115000 die of hepatitis B related complications. Healthcare workers (HCWs) are 3–5 times more prone to HBV than normal population due to needle stick injuries, exposure to the infected person's blood and bodily fluids.³ Hence, universal precaution should be followed among HCW to prevent the infection.

Hepatitis B vaccinations have reduced morbidity and mortality of the disease, but complete awareness about the vaccine among HCWs is doubtful. Vaccine is mandatory among HCW, and at least, three doses 0, 1, and 6 months are required.⁴ Sufficient protection is achieved with HBV vaccine plasma titer value of >10 m IU/ml.⁵ Some group of people remain as non-responders of the vaccine, whose plasma titer <10 m IU/ml. The effectiveness of a vaccine

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is impacted by many variables, including age, smoking, obesity, gender, host genetics, vaccine type, dose, location of injection, and time since the last vaccination. Hence, it is essential to measure the titer values in every vaccinated HCW to know the requirement of booster dose.

Aims and objectives

This study aims to assess the anti HBs antibody titer level against various levels of HCWs and to assess the need for booster dose hepatitis B vaccination.

MATERIALS AND METHODS

This study was conducted at Melmaruvathur Adhiparasakthi Institute of Medical Sciences and Research (MAPIMS), Melmaruvathur, Tamil Nadu, India, from July 2022 to December 2022. A total of 218 HCWs were recruited and divided into two groups: Group A (vaccinated ≥ 5 years ago) and Group B (vaccinated in past 5 years) after obtaining Ethical Committee Clearance.

Sample size was determined using the formula below for a confidence level at 95%.

$$\text{Sample size (n)} = \frac{DEFF * Np(1-p)}{[(d2/z21-\alpha*(N-1) + p*(1-p)]}$$

By applying stratified sampling method, the HCWs (doctors, post graduate students, staff nurses, laboratory technicians, and house holding staffs) working in MAPIMS hospital were included in the study.

Inclusion criteria

The following criteria were included in the study:

- All HCWs (doctors, staff nurses, postgraduates, laboratory technicians, and housekeeping staffs).

Exclusion criteria

The following criteria were excluded from the study:

- HCWs with history of hepatitis B infection
- Health workers with chronic liver disease
- History of taking immunosuppressive therapy.

Study methodology

2 mL of blood sample was collected after obtaining consent from the HCW. The serum was separated and tested for anti HBs antibody titer by electrochemiluminescence immunoassay method. Antibody titer level of >10 m IU/ml was considered protective and <10 m IU/ml was considered as non-responsive. Information such as sociodemographic profile, risk factors, hepatitis B vaccination status, booster dose status, and anti-HBs antibody titer level were collected in a pre-tested structured questionnaire in Google form developed by the principal investigator. Descriptive

statistics such as percentages, mean, median, and standard deviation (SD) was calculated. The association between variables was calculated by Chi-square test at 5% level of significance. All data were analyzed using SPSS version 24.0.

RESULTS

A total of 218 HCWs were included in the study, in which 127 (58.26%) were vaccinated over 5 years ago and 91 (41.74%) were vaccinated in the past 5 years. The mean and SD values of Anti-HBsAg titer between Groups A and B were 125.24 ± 80.96 and 158.27 ± 62.95 with $P=0.08467$ which was not statistically significant ($P>0.05$) (Table 1).

Out of the 218 HCWs included in the study, 65 were doctors, out of which 40 were vaccinated over 5 years ago and 25 were vaccinated in the past 5 years, 38 were nurses, out of which 25 were vaccinated over 5 years ago and 13 were vaccinated in the past 5 years, 20 were laboratory technicians out of which ten were vaccinated over 5 years ago and ten were vaccinated in the past 5 years, 48 were postgraduate students, out of which 28 were vaccinated over 5 years ago and 20 were vaccinated in the past 5 years, 47 were householding staff, out of which 24 were vaccinated over 5 years ago, and 23 were vaccinated in the past 5 years (Table 2).

A total of 91 HCW vaccinated in the past 1–5 years had a protective titer value of 76 (83.51%) mIU/ml and 127 HCW vaccinated over 5 years ago had a protective titer value of 89 (70.07%) mIU/ml (Table 3).

DISCUSSION

Health-care professionals are more likely to come into contact with different body fluids, putting them at danger of contracting diseases such as HIV and hepatitis B. The risk of occupational HBV infection is 3–5 times higher than the risk for the general public and is influenced by both age and length of employment.⁶ Adults are 90–95% protected against hepatitis B by immunization.⁷ The percentage of health-care professionals who have received the hepatitis B vaccine needs to be estimated to determine their susceptibility to HBV infection. Unfortunately, vaccination is still not widely acknowledged as a practice. According to the estimates of the WHO, hepatitis B vaccination rates in health-care professionals range from 18% in Africa, which is the lowest, to the highest at 77% in New Zealand and Australia.⁸

Two hundred and eighteen HCWs were fully immunized, according to our findings. A comparable study conducted in New Delhi revealed that 55.4% of HCWs had received their full HBV vaccination.⁹ In a research conducted at a sizable tertiary health-care facility in India, 224 out of 446

Table 1: Anti-HBsAg antibody titers

Parameters	Group A (vaccinated ≥ 5 years ago)	Group B (vaccinated in past 5 years)	P-value
n=218	127 (58.26%)	91 (41.74%)	
Age in years (mean)	35.16±3.14	34.29±2.98	
Anti-HBsAg titer mIU/ml (mean±SD)	125.24±80.96	158.27±62.95	0.08467

Table 2: Number of vaccinated HCWs

Groups	Group A (vaccinated ≥ 5 years ago) (%)	Group B (vaccinated in last 5 years) (%)
Doctors (n=65)	40 (61.54)	25 (38.46)
Nurses (n=38)	25 (65.79)	13 (34.21)
Laboratory technician (n=20)	10 (50)	10 (50)
Postgraduate student (n=48)	28 (58.33)	20 (41.66)
Householding staff (n=47)	24 (51.06)	23 (48.94)

Table 3: Anti-HB titers according to last vaccination

Last vaccination	Number of vaccinated HCWs	Protective titers (%) (>10 m IU/ml)
1–5 years	91	76 (83.51)
>5 years	127	89 (70.07)

(or 50%) health-care professionals had received the full course of immunization, whereas 28 (6%) had only received a portion of it.¹⁰ In the absence of statistics, the WHO extrapolated the average HBV vaccination rate for HCW in the SEAR-D region from the AFR-D region, where it is 18% in Nigeria.^{11,12} It is made clear by the fact that before these, there were relatively few trustworthy studies about the coverage of the hepatitis B vaccine among Indian health-care professionals. In addition, only North Indian data are being used here. This estimate is not indicative of the nation. Even in the majority of wealthy nations, the situation is not ideal.

According to one study, 75% of HCWs in the United States who were at risk had had three or more doses of the hepatitis B vaccine.¹³ In Sweden, just 40% of HCWs were reported to be completely immunized, despite the fact that 79% had gotten at least one dose of the vaccine.¹⁴ In Japan, dental professionals had a vaccination rate of 48.2%.¹⁵

Our study shows that the mean SD values of Anti-HBsAg titer for Groups A and B did not have statistical significance (P=0.08467). According to our study, while among 29.81% of doctors, 17.43% of Nurses, 9.17% of laboratory technician, 22.02% of postgraduate students, and 21.56% of householding staff were vaccinated. The disparity in vaccination coverage between the various groups can be accounted for by the level of education and awareness of those groups. Comparatively speaking, doctors, nurses, students, and technical staff were

more knowledgeable about hepatitis B and other blood-borne viruses, as well as how to prevent them.

Another intriguing finding in our study was that, of 91 HCWs who received their vaccinations within 5 years of the study, only 58.26% had protective anti-HBs titers. Although it has been shown in numerous studies that the level of protective antibodies declines over time,¹⁶ it is still up for debate whether or not this decline in anti-HBs level over time necessitates a booster shot every 5 years. This is because different studies have expressed conflicting opinions. Even if anti-HBs levels drop beneath detectable levels, initial immunization provides protection against HBV infection, according to long-term studies in select hyperendemic locations that show immunological memory stays persistent beyond 10 years following vaccination.^{17,18}

Limitations of the study

The small sample size could be considered as a limitation to this study.

CONCLUSION

Our study demonstrates that people who have had vaccinations are unsure if they are responders or non-responders, and to determine this, they must have had their titer evaluated only 1–2 months after receiving their third dose of hepatitis B vaccine. As a result, they still run the risk of contracting hepatitis B and strongly need a booster dosage of the hepatitis B vaccine.

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REFERENCES

1. World Health Organization. Hepatitis B. Available from: <https://www.who.int/news-room/fact-sheets/detail/hepatitis-b> [Last accessed on 2022 Dec 28].
2. Chan J, Burns MA, Wells BG, Schwinghammer TL, Malone PM, Kolesar JM, et al. Viral hepatitis. In: *Pharmacotherapy Principles and Practice*. New York, USA: McGraw Hill Medical; 2013. p. 435-441.

3. Ciorlia LA and Zanetta DM. Hepatitis B in healthcare workers: Prevalence, vaccination and relation to occupational factors. *Braz J Infect Dis*. 2005;9(5):384-389.
<https://doi.org/10.1590/s1413-86702005000500005>
4. Mast E, Mahoney F, Kane M, Margolis H, Plotkin SA, Orenstein WA, et al. A Hepatitis B vaccine. In: *Vaccines*. Philadelphia, Pennsylvania, Pa, USA: Elsevier; 2004. p. 299-337.
5. Chathuranga LS, Noordeen F and Abeykoon AM. Immune response to hepatitis B vaccine in a group of health care workers in Sri Lanka. *Int J Infect Dis*. 2013;17(11):e1078-e1079.
<https://doi.org/10.1016/j.ijid.2013.04.009>
6. Beltrami EM, Williams IT, Shapiro CN and Chamberland ME. Risk and management of blood-borne infections in health care workers. *Clin Microbiol Rev*. 2000;13(3):385-407.
<https://doi.org/10.1128/CMR.13.3.385>
7. Hessel L and West DJ. Antibody responses to recombinant hepatitis B vaccines. *Vaccine*. 2002;20(17-18):2164-2165.
[https://doi.org/10.1016/s0264-410x\(02\)00117-2](https://doi.org/10.1016/s0264-410x(02)00117-2)
8. Prüss-Ustün A, Rapiti E and Hutin Y. Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. *Am J Ind Med*. 2005;48(6):482-490.
<https://doi.org/10.1002/ajim.20230>
9. Sukriti, Pati NT, Sethi A, Agrawal K, Agrawal K, Kumar GT, et al. Low levels of awareness, vaccine coverage, and the need for boosters among health care workers in tertiary care hospitals in India. *J Gastroenterol Hepatol*. 2008;23(11):1710-1715.
<https://doi.org/10.1111/j.1440-1746.2008.05483.x>
10. Singhal V, Bora D and Singh S. Prevalence of hepatitis B virus infection in healthcare workers of a tertiary care Centre in India and their vaccination status. *J Vaccines Vaccin*. 2011;2(2):1-4.
<https://doi.org/10.4172/2157-7560.1000118>
11. Ganczak M, Ostrowski M, Szych Z and Korzeń M. A complete HBV vaccination coverage among Polish surgical nurses in the light of anti-HBc prevalence: A cross-sectional sero-prevalence study. *Vaccine*. 2010;28(23):3972-3976.
<https://doi.org/10.1016/j.vaccine.2010.03.042>
12. Adkins JC and Wagstaff AJ. Recombinant hepatitis B vaccine: A review of its immunogenicity and protective efficacy against hepatitis B. *BioDrugs*. 1998;10(2):137-158.
<https://doi.org/10.2165/00063030-199810020-00005>
13. Simard EP, Miller JT, George PA, Wasley A, Alter MJ, Bell BP, et al. Hepatitis B vaccination coverage levels among healthcare workers in the United States, 2002-2003. *Infect Control Hosp Epidemiol*. 2007;28(7):783-790.
<https://doi.org/10.1086/518730>
14. Dannetun E, Tegnell A, Torner A and Giesecke J. Coverage of hepatitis B vaccination in Swedish healthcare workers. *J Hosp Infect*. 2006;63(2):201-204.
<https://doi.org/10.1016/j.jhin.2006.01.014>
15. Nagao Y, Matsuoka H, Kawaguchi T, Ide T and Sata M. HBV and HCV infection in Japanese dental care workers. *Int J Mol Med*. 2008;21(6):791-799.
<https://doi.org/10.3892/ijmm.21.6.791>
16. Batra V, Goswami A, Dadhich S, Kothari D and Bhargava N. Hepatitis B immunization in healthcare workers. *Ann Gastroenterol*. 2015;28(2):276-280.
17. Ni YH, Chang MH, Huang LM, Chen HL, Hsu HY, Chiu TY, et al. Hepatitis B virus infection in children and adolescents in a hyperendemic area: 15 years after mass hepatitis B vaccination. *Ann Intern Med*. 2001;135(9):796-800.
<https://doi.org/10.7326/0003-4819-135-9-200111060-00009>
18. Durlach R, Laugas S, Freuler CB, Rodriguez VE and Costa M. Ten-year persistence of antibody to hepatitis B surface antigen in healthcare workers vaccinated against hepatitis B virus, and response to booster vaccination. *Infect Control Hosp Epidemiol*. 2003;24(10):773-776.
<https://doi.org/10.1086/502132>

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