

Prevalence of Antibody Titres and Hepatitis B Virus Infection among Healthcare Workers at a Tertiary Care Hospital in India

Kavitha Latha M. L.¹, Vidyadhar L.², Bogadi Sujatha³, Jyothi Lakshmi G.⁴

¹Associate Professor, Department of Microbiology, Osmania Medical College, Hyderabad, Telangana, India.

²Technical Officer, Department of Microbiology, Osmania Medical College, Hyderabad, Telangana, India.

³Assistant Professor, Department of Microbiology, Niloufer Hospital, Hyderabad, Telangana, India.

⁴Professor, Department of Microbiology, Osmania Medical College, Hyderabad, Telangana, India.

Received: 15-02-2024 / Revised: 11-03-2024 / Accepted: 18-04-2024

Corresponding Author: Dr. Jyothi Lakshmi G.

Conflict of interest: Nil

Abstract:

Background: The danger of occupational exposure to several blood-borne diseases, such as HIV, Hepatitis B, and Hepatitis C virus infections, is significant for healthcare workers (HCWs). Of these, the only infection that may be prevented with vaccine is hepatitis B, which is also the most contagious. Healthcare professionals in underdeveloped nations have very low vaccination rates against Hepatitis B due to a number of factors, including low risk assessment, ignorance, and low priority from the health administrations of both public and private hospitals. In India, 28% of healthcare workers are still unvaccinated, while 17% are unsure about their immunization status.

Objectives: The purpose of this study was to determine the vaccination status against Hepatitis B among healthcare personnel working at a tertiary care hospital in Hyderabad, Telangana, India, as well as the titres of Anti-HBs antibodies and the prevalence of Hepatitis B virus infection.

Methods: 164 healthcare professionals were divided into two groups based on their history of Hepatitis B immunization. Following the acquisition of informed consent, all healthcare professionals were given information about the study's purpose and requested to complete a standard questionnaire containing personal health information. The Enzyme Linked Immunosorbent Assay (ELISA) was used to assess the blood samples for Hepatitis B surface antigen and anti-HBs antibody titres.

Results and Conclusion: According to our statistics, healthcare professionals who have received the full dose of the hepatitis B immunization exhibit long-term protection against HBV infection. Of individuals who had received vaccinations, 95.12% had antibody titres greater than 10 mIU/mL. This indicates that it is imperative to adopt awareness efforts and that hepatitis B vaccination should be made mandatory for health care workers in India. There is rationale for providing HCWs in India with a booster dose of the vaccine ten years after their original vaccination, as anti-HBs titres fall proportionately.

Keywords: Hepatitis B, Healthcare Workers (HCWs), Hepatitis B Vaccines, Hepatitis B Immunoglobulin (HBIG), Hepatitis B Surface Antigen (HBsAg), and Anti-HBs Antibodies/Titres.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

A viral infection that targets the liver, hepatitis B can result in both acute and chronic illness. The virus is mostly spread by contact with blood or other body fluids, sexual intercourse with an infected partner, risky injections, sharp object exposure, and mother-to-child transmission in early childhood during delivery or childbirth. Other behaviours that were also linked to the prevalence of HBV included biting one's fingernails in tandem with scratching the backs of carriers, sharing dental cleaning supplies, sharing chewing gum or partially eaten candies, and sharing bath towels. [1] According to WHO estimates, 1.5 million new cases of chronic hepatitis B infection occur

annually, affecting 296 million people worldwide. An estimated 820,000 people died from hepatitis B in 2019, primarily from cirrhosis and hepatocellular carcinoma or primary liver cancer. [2] Health care workers (HCWs) are well aware of the potential risks of occupational exposure to HBV because of regular interactions with them in NABH programme. Millions of medical personnel, labor are there in hospitals around the globe, and it is believed that 600,000 to 800,000 of them sustain cuts and punctures annually, of which only 50% are reported. [3] The virus can spread even in the absence of visible blood and can survive for extended periods of time on environmental

surfaces. Healthcare workers generally fail to identify all blood or body fluid exposures that may be infectious, and even when they do, they frequently fail to seek post-exposure prophylactic therapy. [4] Blood is the most significant medium of transmission in medical settings since it has the highest HBV titres of any bodily fluid. [5] There have been reports of hepatitis B being spread from patients to healthcare professionals (HCWs) and from HCWs to patients. [6,7] Effective, widely accessible, and safe vaccinations are available to prevent hepatitis B. [8] The only readily quantifiable indicator of vaccination-induced protection is anti-HBs. A protective titre is defined as an anti-HBs titre of ≥ 10 mIU/mL attained three months following the completion of the initial immunization.

Therefore, the aim of the research was to determine the vaccination status for Hepatitis B among healthcare workers, as well as to estimate the titres of Anti-HBs antibodies and the prevalence of Hepatitis B virus infection.

Materials and Methods

From December 2023 to January of 2024, at Osmania General Hospital in Hyderabad, India, conducted this cross-sectional study. Following informed consent, all healthcare professionals were told of the study's purpose and their personal health information was collected using a questionnaire that included their demographics. The HCW's age, sex, and occupation were among the demographic characteristics of their personal health information. Additionally, a record of their previous blood donations or transfusions was made. The manner in which this mishap happened, exposure to blood or blood products, and the status of the Hepatitis B vaccination were all noted. The source patient's history of needle stick injuries was also recorded, and additional questions concerning HBsAg, HIV, and anti-HCV status were asked. Concerning the use of personal protective equipment, questions were posed to all healthcare professionals. There was a range of two months to ten years of time elapse between the last immunization dosage and the anti-HBs titre testing.

HCWs with ages ranging from 22 to 60 were split into two groups according to how well they had completed their immunization program. Group A is made up of those who finished their vaccinations within the last five years and Group B is made up of people who had vaccinations more than five years ago.

Inclusion Criteria

The study comprised healthcare workers who had received the full course of HBV vaccination—three doses of the 0,1,6 regimen or the partial course of HBV vaccine two months earlier and gave their permission to donate a blood sample.

Exclusion Criteria

HCWs with a history of HBsAg positivity, those who got the Hepatitis B vaccine within a month prior to testing, those whose samples were hemolyzed, and those who failed to provide informed consent were all excluded.

Serum was separated as per standard procedure and evaluated immediately. The samples were kept at -20°C until testing could take place within three weeks if a delay of more than three days was anticipated.

Assessment of Hepatitis B Infection: Enzyme Linked ImmunoSorbent Assay (ELISA) was used to detect HBsAg, and a commercial kit (HEPALISA manufactured by J.Mitra & Co.Pvt. Ltd.) was used. Every run had validation controls, and the testing procedure was carried out in compliance with the manufacturer's guidelines.

Assessment of Anti-HBs Antibody Titres: With the aid of an HBsAb ELISA kit (Dia.Pro. Diagnostic Bioprobes Srl, Italy), anti-HBs titres were quantitatively assessed. Every run contained controls for validation and standards for quantification. The testing procedure followed the guidelines provided by the manufacturer.

Subjects classified as responders to vaccination were those whose anti-HBs titre was greater than 10 mIU/mL, while non-responders were those whose titre was less than 10 mIU/mL.

Results

This study comprised samples of 165 healthcare workers (HCWs). One blood sample was removed after being hemolyzed. Therefore, using the Enzyme Linked Immunosorbent Assay (ELISA) method, 164 serum samples of healthcare workers—both vaccinated and non-vaccinated were analyzed for Anti-HBs titres. Two groups were created out of these 164 HCWs. Group A: Those who had finished vaccinations during the previous five years ($n=128$), Group B: Individuals who had gotten vaccinations more than five years prior ($n=34$) and Two HCWs ($n=2$) were not vaccinated against hepatitis B. Out of the 164 HCWs, 84 (51.21%) were female and 80 (48.78%) were male. [Table 1].

Table 1: Anti-HBs antibody titres among Group-A and Group-B

Groups	Total	>10 mIU/mL	<10 mIU/mL	Male	>10 mIU/mL	<10 mIU/mL	Female	>10 mIU/mL	<10 mIU/mL
Group A	128/164 (78.04%)	126	2	64	62	2	64	64	0
Group B	34/164 (20.73%)	30	4	16	12	4	18	18	0
No Vaccine	2/164 (1.21%)	0	2	0	-	-	2	0	2
Total	164	156 (95.12%)	8 (4.87%)	80	74	6	84	82	2

Among Group A, 126 HCWs (98.43%) were responders, whereas 2 HCWs (1.56%) were non responders. 30 HCWs (88.23%) and 4 HCWs (11.76%) Among Group B were responders and non-responders, respectively.

It was discovered that not one HCW was HBsAg positive. Fortunately, all 26 HCWs with needle stick injuries have protective levels of anti-HBs antibody titres. The source patient in this case tested negative for three viral markers.

According to the study, vaccinated HCWs had protective levels of anti-HBs antibody (>10 mIU/ml) significantly greater [95.12% (156 of 164)] than unvaccinated HCWs [0% (of 2 HCWs)], as Table 1 illustrates.

Of the 162 HCWs who had received vaccinations, 128 (78.04%) had done so within the previous five years (Group A), and 34 (20.73%) had done so more than five years prior (Group B). Table 1 displays the titres of the anti-HBs antibodies. Antibody titres in group A were notably greater than those in group B, as predicted. It was discovered that not one HCW was HBsAg positive.

Out of the 162 (98.78%) healthcare workers, 92 (56.09%) had received all recommended doses of vaccinations, while 70 (42.68%) had received only some of the doses of the Hepatitis B vaccine. Of these, the majority HCWs 37.8% had missed the third dosage, and two (1.21%) had received no vaccinations at all. (Table 2).

Table 2: Vaccination status of HCWs and their Anti-HBs titres

Age	Fully Vaccinated			Partially Vaccinated			Non-Vaccinated		
	N=92	>10 mIU/mL	<10 mIU/mL	N=70	>10 mIU/mL	<10 mIU/mL	N=2	>10 mIU/mL	<10 mIU/mL
20-40 years (n=121)	72	72	0	48	48	0	1	0	1
41-60 years (n=43)	20	18	2	22	18	4	1	0	1

Regarding the 20–40 age group, all health care workers (HCWs), both fully and partially vaccinated, were responders; however, among the 41–60 age group, 83.72% and 16.27% are responders and non-responders, respectively (Table 2).

Anti-HBs >10 mIU/mL, the measure of seroconversion against the Hepatitis B vaccine, was

95.12%. 122 participants (74.39%) had titres >250 mIU/mL, 16 subjects (9.75%) had titres between 100 and 250 mIU/mL, 18 subjects (10.97%) had titres between 10 and 100 mIU/mL that were hyporesponsive, and 8 subjects (4.87%) had no protective titres. [Table 3].

Table 3: Vaccine response levels

Response Level	No. of HCWs	Percentage
< 10 mIU/mL	8	4.87%
10-100 mIU/mL	18	10.97%
100-250 mIU/mL	16	84.14%
>250 mIU/mL	122	

Discussion

This investigation was carried out in a tertiary care hospital where healthcare workers are more susceptible to hepatitis B and other blood-borne illnesses.

95.12% of healthcare workers in our study responded to the hepatitis B immunization, whereas 4.87% did not. This is consistent with other earlier research. The Anti-HBs antibody titres of Basiredy P. et al. [9] Reyaz Nasir et al. [10] Rambhala Nagamani et al. [11] Varsha Singhal et al. [12] and Sharma T et al. [13] demonstrated protective values of 96.5%, 95.6%, 100%, 79%, and 92.5%, respectively. Our findings are consistent with those of Sharma T. et al.'s study, [13] since anti-HBs antibody titres remain persistent even after five years following vaccination. The vaccination response seen in our study was outstanding; among completely vaccinated HCWs, the prevalence rate of non-responsiveness to the initial 3-dose regimen was 1.21%, which is consistent with the findings of RJ Thomas et al. [14] In contrast to our data, some other investigations revealed a low proportion of immunological response against the Hepatitis B vaccination.

In line with RJ Thomas et al. [14] and Pavani et al. [15] the female gender had demonstrated a better immunological response to the Hepatitis B vaccination. The anti-HBs level dramatically decreases with the amount of time after vaccination, which is consistent with the findings of Varsha Singhal et al.'s study.^[12] Numerous studies have demonstrated a correlation between the anti-HBs antibody titres and the number of dosages administered, as well as between the age and gender of the subjects, which was also observed in our investigation. [16,17] Our study's responder and non-responder percentages, which are 83.72% and 16.27%, respectively, are associated with that of Kunal Das et al.'s study, [17] in which 85.3% of participants in the over 40 years age group had seroprotective levels of anti-HBs.

Among the 164 health care workers in our study, 84.14% had anti-HBs titres greater than 100 mIU/mL, whereas 10.97% and 4.87%, respectively, had anti-HBs titres between 10 and 100 mIU/mL and less than 10 mIU/mL. These results are consistent with cohort studies conducted by Nagamani et al. and Vishal Batra et al. [18] additionally, it nearly correlates with the research done by Indernath S. et al. [16]

Certain variables, including smoking, obesity, drug misuse, alcoholism, chronic diseases, and male gender, have been linked to non-responsiveness to the HBV vaccine. There is a genetic component to the non-responsiveness of HBV vaccination to some HLA antigens, primarily the DQ2 haplotype, which is also linked to autoimmunity. [19-23]

Conclusion

Due to the high contagiousness of blood and other body fluids, blood-borne viruses can spread through them. Improper handling of sharps is a major contributing factor to unintentional exposure to these infections. All locations related to health care must use standard precautions and infection control procedures. Vaccination is one of the key infection prevention measures against HBV. Every health care worker (HCW) needs to be immunized, and they also need to know about the immune response and their vaccination status. Notifying HICC right once of any exposure to body fluids or blood is required. Following three doses of the HBV vaccination, hospital staff members should be required to receive one booster dose of hepatitis B vaccination in all healthcare settings. It is also crucial to monitor the anti-HBs titre six to eight weeks post-immunization. This conclusion is reached after evaluating the seroconversion rate of HCWs. In the healthcare settings, this will not only guarantee worker safety but also lower the risk of transmission.

Educating HCWs about the inherent risks of occupational exposure and how to prevent them, utilizing safety devices and other personal protective equipment, adopting standard precautions, and being informed about safer procedures and appropriate vaccinations for all HCWs are some crucial steps in minimizing the risk of HBV infection. Additionally, hospital settings should implement post-exposure management so that it can be centrally initiated as soon as needed.

References

1. Martinson FE, Weigle KA, Royce RA, Weber DJ, Suchindran CM, Lemon SM. Risk factors for horizontal transmission of hepatitis B virus in a rural district in Ghana. *Am J Epidemiol* 1998;147(5):478-87.
2. World Health Organization. Home. News. Fact Sheets. Detail. Hepatitis B. Retrieved 18 July, 2023. <http://www.who.int/news-room/factsheets/detail/hepatitis-b>.
3. Preventing Needlestick Injuries in Health Care Settings, DHHS (NIOSH) Publication No. 2000-108 November 1999, Page No.2.
4. Morbidity and Mortality Weekly Report (MMWR), CDC Guidance for Evaluating Health-Care Personnel for Hepatitis B Virus Protection and for Administering Postexposure Management, December 20,2013/62(RR10);1-19.
5. US Public Health Service. Updated U.S. Public Health Service guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for postexposure prophylaxis. *MMWR* 2001; June 29/50 (No. R R-11).

6. R Harpaz, L Von Seidlein, F M Averhoff, M P Tormey, S D Sinha, K Kotsopoulou, S B Lambert, B H Robertson, J D Cherry, C N Shapiro; Transmission of hepatitis B virus to multiple patients from a surgeon without evidence of inadequate infection control, *The New England Journal of Medicine*, 1996.
7. James L. Rosenberg, Don P. Jones, Lance R. Lipitz, Viral Hepatitis: An Occupational Hazard to Surgeons; *JAMA*. 1973;223(4):395-400.
8. US Department of Health and Human services, Hepatitis B Basic Information, <http://www.hhs.gov/hepatitis/learn-about-viral-hepatitis/hepatitis-b-basics/index.html>
9. Basireddy P, Avileli S, Beldono N, Gundela SL. Evaluation of immune response to hepatitis B vaccine in healthcare workers at a tertiary care hospital. *Indian J Med Microbiol* 2018; 36:397-400.
10. Reyaz Nasir, Anjum Farhana, Danish Zahoor, Tawhida Fazili, Sanam Rasool Wani. Protective Antibody Titre against Hepatitis B in Healthcare Workers: A Cross-sectional Study from Tertiary Care Hospital of Kashmir.
11. Rambhala Nagamani, Anjali Naidu and Saraswati Jayanthi, R. Study of Hepatitis B Surface Antibodytitres In Female Medical Students Post Vaccination. *Int J Curr Microbiol App Sci* 2017;6(2):1053-9.
12. Singhal V, Bora D, 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; 2:118.
13. Sharma T, Mittal G, Charu K, Agarwal RK, Rawat BS. Status of Anti-HBs Antibodies over time in healthcare workers after Hepatitis B Vaccination. *Indian J Comm Health*. 2019; 31, 1: 144-149.
14. Thomas RJ, Fletcher GJ, Kirupakaran H, Chacko MP, Thenmozhi S, Eapen CE, Chandy G, Abraham P. Prevalence of non-responsiveness to an indigenous recombinant hepatitis B vaccine: A study among South Indian health care workers in a tertiary hospital. *Indian J Med Microbiol* 2015;33:S32-6.
15. Pavani K, Srinivas Rao MS, Samhitha M, Vinayaraj EV, S. Manick Dass, Ratna Rao. Immune Response to Hepatitis B Vaccine in Health Care Workers in Tertiary Care Hospital in South India, <http://www.innovative-publication.com/>, DOI: 10.5958/2394-5478.2015.00016.3
16. Indermath S, Sudha K, Shanmugavadivoo N, Usha B, Babu VS. A prospective study on the quantification of anti-HBs antibody titers of vaccinated health care workers in a tertiary care teaching hospital by using automated enzyme linked fluorescent assay. *Int J Community Med Public Health* 2023;10:250-3.
17. Das K, Gupta RK, Kumar V, Kar P. Immunogenicity and reactogenicity of a recombinant hepatitis B vaccine in subjects over age of forty years and response of a booster dose among nonresponders. *World J Gastroenterol* 2003;9(5):1132-4.
18. Vishal Batra, Amitava Goswami, Sunil Dadhich, Dinesh Kothari, and Narendra Bhargava. Hepatitis B immunization in healthcare workers. *Annals of Gastroenterology*, 2015.
19. Giovanna Zanoni, Giovanna Contreas, Enrico Valletta, Oretta Gabrielli, Carlo Mengoli, and Dino Veneri. Normal or defective immune response to hepatitis B vaccine in patients with diabetes and celiac disease. *Human Vaccines & Immunotherapeutics* 11:1, 58–62; January 2015.
20. Sukriti, Nirupma Trehan Pati, Ankur Sethi, Kireet Agrawal, Kamal Agrawal, Gollapudi Tharun Kumar, Manoj Kumar, Anjur Tupil Kaanan, Shiv Kumar Sarin; 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 Nov;23(11):1710-5.
21. Varsha Singhal, Dhrubajyoti Bora, and Sarman Singh. Hepatitis B in Health Care Workers: Indian Scenario. *Journal of Laboratory Physicians / Jul-Dec 2009 / Vol-1 / Issue-2*.
22. Immunization of Health-Care Workers: Recommendations of the Advisory Committee on Immunization Practices (ACIP) and the Hospital Infection Control Practices Advisory Committee (HICPAC): Recommendations and Reports/MMWR/CDC, December 26, 1997/46(RR-18);1-42.
23. Elke Leuridan and Pierre Van Damme; Hepatitis B and the need for a booster dose. *Clinical Infectious Diseases* 2011;53(1):68–75.