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ORIGINAL ARTICLE

Post-Vaccination Immune Status Against the Hepatitis B Virus Amongst Doctors Working in a Tertiary Care Hospital

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ABSTRACT

Background*: Doctors face a high occupational risk of Hepatitis B. Vaccination provides protection, but the durability of this immunity is uncertain. This study assesses long-term vaccine-induced immunity in this vulnerable group.* ***Objective****: To assess the post-vaccination immune status against HBV among doctors in a tertiary care hospital and identify associated factors.* ***Methods & Materials****: This cross-sectional study was conducted at Sylhet MAG Osmani Medical College & Hospital from July to December 2018. Using simple random sampling, 75 doctors aged 23-59 years who were vaccinated against HBV ≥5 years prior were enrolled. Serum Anti-HBs antibody titers were measured using ELISA. Protective immunity was defined as an Anti-HBs titer ≥10 mIU/mL. Data were analyzed with SPSS v20; a p-value <0.05 was considered significant.* ***Results****: The mean age was 32.3±6.0 years; 64% were male. All 75 doctors received three vaccine doses. Time since vaccination exceeded five years for all: 36% at 6-10 years and 36% at 11-15 years. Protective Anti-HBs titers (≥10 mIU/mL) were found in 89.3% (64% >100 mIU/mL, 25.3% 10-100 mIU/mL), while 10.7% were non-protective (<10 mIU/mL). A significant association existed between titer and age (p = 0.032), but not with sex, BMI, time since vaccination, or booster history (p > 0.05).* ***Conclusion****: A decade after the primary series, most doctors maintain protective antibody levels, though 10.7% remain susceptible. These findings support the importance of post-vaccination testing and targeted booster strategies.*

Keywords: *Antibodies, Body Mass Index, Booster dose, Doctors, Hepatitis B vaccines, Immunity.*

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INTRODUCTION

Hepatitis B virus (HBV) infection remains a significant global health burden, with an estimated 240 million chronic carriers worldwide who are at risk of developing liver cirrhosis and hepatocellular carcinoma [1]. Healthcare workers, particularly doctors, face a substantially elevated occupational risk of contracting HBV infection through percutaneous injuries and mucocutaneous exposure to infected blood and body fluids [2,3]. Studies from various regions have demonstrated that physicians have up to a fourfold increased risk of acquiring HBV infection compared to the general population [4,5]. Vaccination represents the most effective strategy for preventing HBV infection among at-risk healthcare personnel [6]. The World Health Organization recommends universal hepatitis B vaccination for healthcare workers, and protective immunity is defined as an anti-HBs antibody titer of ≥10 mIU/mL following completion of the primary vaccine series [7,8]. However, concerns persist regarding the long-term durability of vaccine-induced immunity and the potential need for booster doses in high-risk populations [9]. Longitudinal studies have documented a progressive decline in anti-HBs antibody levels over time following vaccination [10]. In healthcare workers vaccinated as adults, the proportion maintaining protective antibody levels decreases significantly with increasing interval since primary immunization [11]. A study among Japanese healthcare personnel reported protective anti-HBs positivity rates ranging from 77.5% to 90.8% across different age groups, with significant variation by age and sex [12]. Furthermore, approximately 5-10% of vaccinated individuals may be primary non-responders who fail to develop protective antibodies even after complete vaccination [13]. In Bangladesh, data regarding the long-term immune status of doctors vaccinated against HBV remain limited. Given the high-risk nature of clinical practice and the potential consequences of occupational exposure, assessing post-vaccination immunity among this population is essential for informing vaccination policies and booster strategies. This study was therefore undertaken to evaluate the post-vaccination immune status against the hepatitis B virus among doctors working in a tertiary care hospital in Sylhet, Bangladesh.

METHODS & MATERIALS

This cross-sectional, observational study was conducted at Sylhet MAG Osmani Medical College & Hospital, Sylhet, Bangladesh, from July 2018 to December 2018. The study population comprised doctors working in various clinical departments of the hospital. Using simple random sampling from the hospital staffing list, a total of 75 doctors were enrolled as study participants.

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Inclusion criteria: Doctors who had been exposed to clinical settings, had received hepatitis B vaccination five or more years previously, were aged between 23 and 59 years, and provided informed consent were included. Both male and female doctors were eligible for participation.

Exclusion criteria: Doctors were excluded if they had a diagnosed HBV infection before joining services, any history of chronic liver disease, or a family history of HBV infection. Additional exclusion criteria included injectable drug abuse, immunocompromised states (such as diabetes mellitus, chronic kidney disease, or prolonged steroid therapy), and unwillingness to provide informed consent.

Study procedure: Data were collected through face-to-face interviews using a predesigned questionnaire to obtain demographic characteristics and hepatitis B vaccination history based on self-report. Five milliliters of venous blood were collected from each participant under universal precautions. Serum was separated and stored at -20°C until analysis. Anti-HBs antibody titers were measured using Enzyme-linked immunosorbent assay (ELISA) in the Department of Microbiology.

Data analysis: Data were analyzed using SPSS version 20. Qualitative data were expressed as frequencies and percentages, while quantitative data were expressed as means and standard deviation. The chi-square test or Fisher's Exact test was used to analyze associations, with a significance level set at $p<0.05$. Ethical clearance was obtained from the Institutional Ethical Committee before study commencement.

RESULT

A total of 75 doctors working at Sylhet MAG Osmani Medical College Hospital were included in this study. The mean age of participants was 32.26±6.04 years, with the largest age group being 31-40 years (56.0%).

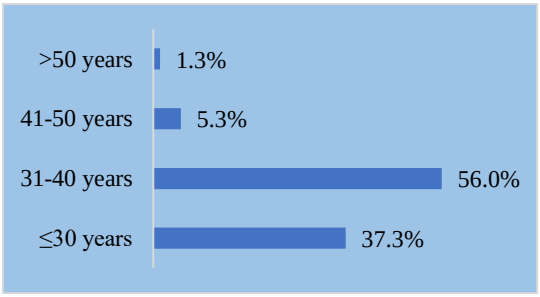

Figure 1: Age distribution of participants (*n*=75)

Males constituted 64.0% of the study population, while females comprised 36.0%.

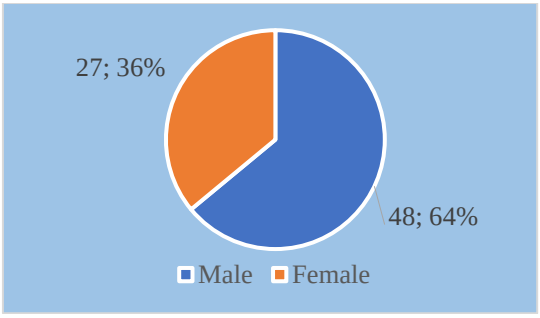

Figure 2: Gender distribution of participants

The majority of participants were Muslim (81.3%) and married (69.0%).

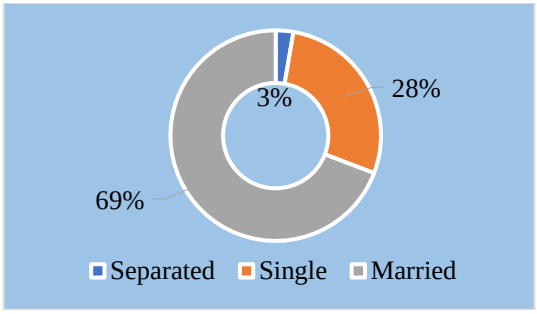

Figure 3: Marital status of participants

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Regarding professional characteristics, the participants held various designations, with Medical Officers (24.0%) and Intern Doctors (18.7%) being the most prevalent. The majority (82.5%) had a duration of employment of 10 years or less. Most doctors spent their maximum working hours in the wards (54.7%), followed by the operating theater (37.3%).

Table I: Professional characteristics of study subjects

Characteristics	n	%
Designation		
Medical Officer	18	24.0
Intern Doctor	14	18.7
Assistant Registrar	11	14.7
Resident	7	9.3
Registrar	6	8.0
Honorary Medical Officer	4	5.3
DDV Student	4	5.3
Associate Professor	3	4.0
MS Student	3	4.0
Consultant	3	4.0
Assistant Professor	1	1.3
OSD	1	1.3
Duration of employment (years)		
≤10	62	82.5
11-20	10	13.3
21-30	2	2.6
>30	1	1.3
Place of maximum working hour		
Ward	41	54.7
Operation theater	28	37.3
Outdoor	6	8.0

Assessment of body mass index revealed that 61.3% had normal BMI, while 28.0% were overweight and 9.3% were obese.

Table II: Body Mass Index distribution

BMI Category	n	%
Underweight	1	1.3
Normal	46	61.3
Overweight	21	28.0
Obese	7	9.3

All 75 doctors (100%) had received the complete three-dose hepatitis B vaccine series. The time since completion of vaccination exceeded five years for all participants: 36.0% were vaccinated 6-10 years ago, another 36.0% were vaccinated 11-15 years ago, 14.7% were vaccinated 16-20 years ago, and 2.7% were vaccinated more than 20 years ago. A booster dose had been received by 52.0% of participants. Although all doctors were aware of the anti-HBs test, only 9.3% had undergone testing previously.

Table III: Hepatitis B vaccination profile

Parameter	n	%
Completed 3-doses	75	100
Time since vaccination		
1-5 years	8	10.7
6-10 years	27	36.0
11-15 years	27	36.0
16-20 years	11	14.7
>20 years	2	2.7
Ever received a booster dose		
Yes	39	52.0
No	36	48.0
Had an anti-HBs test previously		
Yes	7	9.3
No	68	90.7

The anti-HBs antibody titer assessment revealed that 64.0% of doctors had high protective levels (>100 mIU/mL), while 25.3% had protective levels between 10-100 mIU/mL. Thus, overall protective immunity (≥10 mIU/mL) was observed in 89.3% of participants. Non-protective antibody levels (<10 mIU/mL) were found in 10.7% of doctors.

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Table IV: Distribution of anti-HBs antibody titer

Anti-HBs titer (mIU/mL)	n	%	Immunity status
<10	8	10.7	Non-protective
10-100	19	25.3	Protective
>100	48	64	High protective

Analysis of the relationship between anti-HBs titer and age demonstrated a statistically significant association (p=0.032). Among doctors aged 31-40 years, 5 (62.5%) had non-protective titers, while 29 (60.4%) had high protective levels. No significant association was found between anti-HBs titer and sex (p=0.654) or between anti-HBs titer and BMI (p=0.942). When examining the relationship with time since vaccination, no significant association was observed (p=0.479). Among those vaccinated ≤10 years ago, 2 (25.0%) had non-protective titers compared to 6 (75.0%) among those vaccinated >10 years ago. Similarly, no significant association was found between anti-HBs titer and history of receiving a booster dose (p=0.261), although a higher proportion of those with protective titers had received a booster.

Table V: Factors associated with anti-HBs antibody titer

Variable	<10 mIU/mL (n=8) n (%)	10-100 mIU/mL (n=19) n (%)	>100 mIU/mL (n=48) n (%)	P-value
Age Group				
≤30 years	1 (12.5)	9 (47.4)	18 (37.5)	0.032
31-40 years	5 (62.5)	8 (42.1)	29 (60.4)	
41-50 years	1 (12.5)	2 (10.5)	1 (2.1)	
51-60 years	1 (12.5)	0 (0.0)	0 (0.0)	
Sex				
Male	6 (75.0)	13 (68.4)	29 (60.4)	0.654
Female	2 (25.0)	6 (31.6)	19 (39.6)	
BMI Category				
Underweight	0 (0.0)	0 (0.0)	1 (2.1)	0.942
Normal	4 (50.0)	12 (63.2)	30 (62.5)	
Overweight	3 (37.5)	6 (31.6)	12 (25.0)	
Obese	1 (12.5)	1 (5.3)	5 (10.4)	
Time Since Vaccination				
≤10 years	2 (25.0)	8 (42.1)	25 (52.1)	0.479
>10 years	6 (75.0)	11 (57.9)	23 (47.9)	
Booster Dose Received				
Yes	2 (25.0)	10 (52.6)	27 (56.2)	0.261
No	6 (75.0)	9 (47.4)	21 (43.8)	

Chi-square test was used for all analyses; p<0.05 was considered statistically significant.

DISCUSSION

The present study assessed the post-vaccination immune status against the hepatitis B virus among 75 doctors working in a tertiary care hospital in Bangladesh. The findings reveal that 89.3% of participants maintained protective anti-HBs antibody levels (≥10 mIU/mL) five or more years after primary vaccination, while 10.7% had non-protective levels. This sero-protection rate is comparable to international studies examining long-term vaccine durability among healthcare workers. Gara and colleagues investigated anti-HBs durability in healthcare workers vaccinated as adults and found protective antibody levels in approximately 75-82% of participants 10-31 years post-vaccination, with 18-26% having levels below the protective threshold [14]. Their findings align closely with our observation that approximately one-tenth of vaccinated doctors lose protective antibodies over time. Similarly, a Japanese study among healthcare workers reported that only 2.0% of vaccinees who initially acquired low antibody levels (10-49 mIU/mL) maintained protective levels after five years, whereas 87.0% with high initial titers (≥400 mIU/mL) remained protected [15]. This highlights the importance of initial vaccine response strength in determining long-term immunity persistence. The significant association between age and anti-HBs titer observed in our study (p=0.032) corroborates existing evidence. Gara et al. identified older age at vaccination as the only significant predictor of inadequate anti-HBs levels (p=0.0005) in their logistic regression analysis [14]. Age-related immunosenescence likely contributes to declining vaccine responses, with studies demonstrating that individuals over 50 years exhibit lower seroprotection rates following vaccination [16,17]. In our study, the highest proportion of non-protective titers (62.5%) occurred in the 31-40 years age group, suggesting that waning immunity begins earlier than traditionally recognized. We found no significant association between anti-HBs titer and sex (p=0.654), consistent with some studies [14] but contrasting with others. A Chinese investigation identified male gender as a risk factor for non-response to hepatitis B vaccination [18], while another study reported that males had significantly lower seroprotection rates compared to females [19]. These discrepancies may reflect population differences or variations in study methodology. Regarding body mass index, we observed no significant association with anti-HBs levels (p=0.942), though 28.0% of our participants were overweight and 9.3% were obese. Previous research has identified obesity as a risk factor for poor vaccine response [18,19], with one study demonstrating that high BMI values were significantly associated with non-protective antibody levels [18]. The lack of association in our study may be attributable to the relatively small sample size or the predominance of normal-weight

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individuals (61.3%). The time since vaccination showed no significant association with antibody levels (p=0.479), although a higher proportion of non-protective titers (75.0%) occurred among those vaccinated >10 years previously compared to ≤10 years (25.0%). This trend, while not statistically significant, aligns with the progressive antibody decline documented in longitudinal studies [14,15]. The absence of statistical significance may reflect insufficient power to detect differences across time strata. Interestingly, we found no significant association between booster dose history and anti-HBs titer (p=0.261), despite 52.0% of participants reporting prior booster receipt. This observation warrants careful interpretation. While booster doses transiently elevate antibody levels, the rapid and robust anamnestic response to revaccination suggests that immunological memory persists even when circulating antibodies wane [14,20]. Studies demonstrate that 94% of individuals with inadequate anti-HBs levels develop protective titers within three weeks of booster administration, indicating intact immune memory [14]. The European Consensus Group has stated that routine boosters are unnecessary in immunocompetent individuals, as immune memory persists for more than 15 years [21]. However, in healthcare workers, ensuring protective antibody levels remains prudent given occupational exposure risks. The 10.7% seronegative rate in our study is clinically significant. These individuals remain susceptible to HBV infection despite prior vaccination. Primary non-response, occurring in approximately 5-10% of vaccinees [13], may account for some cases. Genetic factors, including HLA-DR alleles and cytokine gene polymorphisms, influence vaccine responsiveness. Additionally, waning immunity over time contributes to declining antibody levels. Notably, a study of healthcare workers vaccinated in infancy demonstrated that 51.1% had anti-HBs <10 mIU/mL 11-23 years later, compared to only 12.2% vaccinated during adolescence [21], highlighting the influence of age at primary vaccination on long-term immunity. Our findings have important implications for occupational health policy. Current guidelines recommend post-vaccination serologic testing for healthcare workers one to two months after vaccine completion [8]. However, our study demonstrates that periodic serologic monitoring remains valuable years after vaccination to identify individuals requiring booster doses. Among our participants, only 9.3% had previously undergone anti-HBs testing, representing a significant gap in occupational health surveillance. Implementing regular screening programs for healthcare workers would enable the timely identification of susceptible individuals and administration of booster doses where indicated. Several limitations warrant consideration. First, the cross-sectional design precludes assessment of antibody kinetics over time within individuals. Second, vaccination history relied on self-report, introducing potential recall bias. Third, the relatively small sample size may limit generalizability and statistical power for subgroup analyses. Fourth, we did not assess initial vaccine response, preventing differentiation between primary non-responders and those with waning immunity. Fifth, the study was conducted at a single tertiary center, limiting extrapolation to other healthcare settings.

LIMITATIONS

This single-center study with a small sample size relied on self-reported vaccination history, introducing potential recall bias. The cross-sectional design prevented assessment of individual antibody kinetics over time, and initial vaccine response data were unavailable to differentiate non-responders from those with waning immunity.

CONCLUSION

This study demonstrates that 89.3% of doctors maintain protective anti-HBs antibodies five or more years post-vaccination, while 10.7% remain susceptible to HBV infection. Age significantly influences antibody persistence, whereas sex, BMI, time since vaccination, and booster history do not. The findings underscore the need for routine post-vaccination serologic testing and periodic screening of healthcare workers to identify susceptible individuals requiring booster vaccination.

RECOMMENDATION

Regular anti-HBs screening should be implemented for all vaccinated healthcare workers, with booster doses administered to those with non-protective titers. Occupational health policies must mandate post-vaccination serologic testing and maintain comprehensive immunization records for effective long-term immunity surveillance.

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