

Anti-Hepatitis B surface antigen level amongst vaccinated health care workers in a tertiary care hospital

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Abstract

Context: Hepatitis B virus infection is a global health problem. Centre for Disease Control and prevention recommends vaccination for all health care workers. Protection statuses of vaccinees need to be assessed by measuring anti- Hepatitis B surface antigen level in the serum. *Aims:* This study aims to detect the serum levels of anti-Hepatitis B surface antigen level among vaccinated health care workers of our Institution. *Settings and Design:* Cross-sectional study *Methods and Material:* This study included 93 health care workers (surgeons, physicians, dentists, medical students, nurses, laboratory technicians, blood bank personnel and hospital attendants) of our tertiary care hospital for testing of anti-Hepatitis B surface antigen level; liver function tests were also done for the participants. *Statistical analysis:* Data analysis was done using statistical package for social sciences version 22. Percentages were calculated for categorical variables, Chi-square test was used for comparison of proportions. Logistic regression analysis was performed for studying the factors influencing response to vaccine. *Results:* In the present study, it was observed that about 9.7% were non-responders, 21.5% were poor responders and the rest (68.8%) were responders. *Conclusions:* All vaccinated individuals cannot be presumed to be fully protected. It is imperative to test the anti-Hepatitis B surface antigen level of the individual after completing the course to decide on appropriate measures to be taken.

Keywords: Hepatitis B Surface Antigen; Health Care Workers; Responders; Vaccinees.

Introduction

Hepatitis B is a viral infection of liver transmitted through blood or body fluids. About one-third of world's population have been infected with

Hepatitis B Virus (HBV) [1]. HBV is an important occupational hazard among health care workers (HCWs). Centre for Disease Control and Prevention (CDC) has recommended that all HCWs should be vaccinated against HBV. Protection statuses of

HBV vaccinees are determined by measuring anti-Hepatitis B surface (anti-HBs) antigen level in the serum. However, the immune response to HBV vaccine is variable and influenced by several factors. About 12-21% of HCWs are non-responsive to HBV vaccine.^[2] Although HBV infection is a major health care issue, studies assessing the immune response among vaccinated HCWs in India are lacking. Therefore, this study was conducted to assess the protection status of HBV vaccinated HCWs by determining their serum level of anti-HBs antigen.

Materials and Methods

A cross-sectional study was conducted among 93 HCWs (surgeons, physicians, dentists, medical students, nurses, laboratory technicians, blood bank personnel and hospital attendants) in our tertiary care hospital for testing of anti-HBs antigen level; biochemical parameters used in the assessment of liver function were also included in the study. HCWs not vaccinated against HBV and with positive history of HBV infection were excluded. Informed consent was obtained from all the participants and Institutional Human Ethics Committee (IHEC) approval has been obtained before commencement of the study.

1. Five ml of venous blood was collected and Enzyme-linked immunosorbent assay (ELISA) was performed for detecting anti-HBs antigen level. All vaccinated health care personnel with anti-HBs level ≥ 100 m IU/ml were considered to have a full response; those with anti-HBs level between 10 and 100 m IU/ml were considered to have a poor response, while those with anti-HBs level < 10 m IU/ml were regarded as non-responders.

2. Liver function test (LFT) - total serum protein, serum albumin, total bilirubin, direct bilirubin, Aspartate aminotransferase (AST), Alanine aminotransferase (ALT) and Alkaline Phosphatase (ALP) levels were determined as per standard protocol.
3. Based on the grades of protection, the HCWs with poor response to the vaccine (anti-HBs antigen level between 10 and 100 m IU/ml) were advised to receive a single booster vaccination and non-responders were advised to undergo tests to exclude current or past HBV infection, and given a repeat course of 3 vaccinations, followed by retesting after the second course of vaccination [3].
4. Data analysis was done using statistical package for social sciences (SPSS) version 22. Percentages were calculated for categorical variables, Chi-square test was used for comparison of proportions. Logistic regression analysis was performed for studying the factors influencing response to vaccine.

Observations & Results

A total of 93 HCWs who have been vaccinated for HBV were enrolled in the study. The demographic data of the 93 HCWs was summarized in table 1. Details regarding vaccination of HCWs were explained in table 2. The mean values of the anti-HBs antigen levels (m IU/ml) of our study participants were shown in table 3. We evaluated the various potential factors that might have contributed to the non-responsiveness of HCWs to the vaccine and were summarised in table 4. The comparison of liver function tests of the HCWs with varying responses to the HBV vaccine was shown in table 5.

Table 1: Demographic details of study participants

Categories	Value
Age (Mean \pm Standard deviation)	28.51 \pm 7.02 (range, 19 to 62)
Sex:	
Male	55(59.1%)
Female	38(40.9%)
Speciality:	
Surgeons	23(24.7%)
Physicians	27(29.04%)
Medical students	11(11.8%)
Lab-technicians	2(2.2%)
Hospital attendant	2(2.2%)
Dentists	16(17.2%)
Nurses	9 (9.7%)
Blood bank personnel	3 (3.2%)
Body Mass Index	24.21 \pm 3.85
Personal history:	
Smokers	7 (7.5%)
Chronic alcoholic	2 (2.2%)

Table 2: Vaccination details of study participants

Parameters	Value
No. of doses:	
One dose	8 (8.6%)
Two doses	16 (17.2%)
Three doses	51 (54.8%)
Three doses + booster	18 (19.4%)
Time interval between doses:	
1 st and 2 nd dose (n = 85) (Mean ± Standard deviation)	1.11± 0.98 months
2 nd and 3 rd dose (n = 69) (Mean ± Standard deviation)	6.00± 0.54 months
3 rd and booster dose (n = 18) (Mean ± Standard deviation)	3.72± 1.9 years
No. of years since the first dose (Median, 25 th and 75 th percentiles)	6 (4 and 10)

Table 3: Mean values of anti-Hepatitis B surface antigen levels (m IU/ ml)

Category of responders	Mean ± Standard deviation (range)
Non-responders (n = 9)	1.21 ± 1.94 (0 to 6)
Poor responders (n = 20)	47.05 ± 27.00 (10 to 98)
Full responders (n = 64)	754.19 ± 342.32 (100 to 1000)

Table 4: Factors contributing to non-responsiveness to Hepatitis B vaccine

Risk factor	Non-responders n = 9 (%)	Responders n = 84 (%)	Relative risk	p value
Female sex	4 (44.4%)	34 (40.5%)	1.16 (0.33 to 4.03)	1.0000
> 25 yrs at primary vaccination	5 (55.6%)	16 (19.0%)	4.29 (1.26 to 14.54)	0.0255
>5 yrs after last dose	5 (55.5%)	38 (45.2%)	1.45 (0.42 to 5.07)	0.7281
Single dose	2 (22.2%)	6 (7.1%)	3.04 (0.75 to 12.24)	0.1717
Smokers	2 (22.2%)	5 (6.0%)	3.51 (0.89 to 13.81)	0.1357

Table 5: Comparison of the liver function tests of participants

Parameter	Mean ± Standard deviation			p value
	Non responder (n = 9)	Poor responder (n = 20)	Full responder (n = 64)	
Total protein (g/ dl)	7.29 ± 0.62	7.51 ± 0.49	7.49 ± 0.45	0.4681
Albumin (g/ dl)	4.60 ± 0.31	4.74 ± 0.25	4.72 ± 0.33	0.5108
Globulin (g/ dl)	2.69 ± 0.63	2.77 ± 0.43	2.77 ± 0.46	0.8898
Total bilirubin (mg/ dl)	0.88 ± 0.68	0.60 ± 0.26	0.65 ± 0.34	0.1578
Direct bilirubin (mg/ dl)	0.37 ± 0.24	0.26 ± 0.09	0.27 ± 0.13	0.1037
AST* (units/ L)	29.89 ± 4.89	26.05 ± 7.25	29.36 ± 23.11	0.7919
ALT (units/ L)	21.56 ± 10.32	18.50 ± 10.08	24.70 ± 18.73	0.3373
Alkaline phosphatase (units/ L)	115.44 ± 39.96	110 ± 24.67	114.41 ± 29.83	0.8310

*AST-aspartate aminotransferases, ALT-alanine aminotransferases

Discussion

HBV vaccination is essential for all HCWs as they are at an increased risk of HBV infection. Although most HCWs receive the HBV vaccine as recommended by the CDC, many of them do not test their anti-HBs antigen level to know their protection status. We have assessed the immune response among 93 vaccinated HCWs of a tertiary care teaching hospital.

In our study, age of the participants ranged between 19 and 62 with the mean age of 29. Males

were predominating in our study population. Among the participants, physicians participated in higher numbers (29%) followed by surgeons (25%)(table 1). Least number of participants was seen in the category of laboratory technicians and hospital attendants.

Enquiry regarding the vaccination details showed that only 19% of our participants had received complete vaccination including booster dose. Among the HCWs of our study, 51% had received three doses of HBV vaccine, but failed to take the booster. Incomplete vaccination (single

dose and two doses) was seen among 25.8% of our study subjects (table 2). In a similar study done by Pathak R et al in North India showed that only 38.8 % were completely vaccinated against HBV. Incomplete vaccination was seen in 21.4% and 40% of HCWs did not receive HBV vaccine at all [4]. Since our study aimed at studying the anti-HBs antibody level among HCWs, unvaccinated individuals were not included in this study.

In the present study, it was observed that about 9.7% were non-responders and 21.5% were poor responders (table 3). This emphasizes the fact that all vaccinated individuals cannot be presumed to be fully protected. It is imperative to test the anti-HBs antigen level of the individual after completing the course to decide on appropriate measures to be taken. Mean value of anti-HBs antigen level seen among full responders, poor responders and non-responders were 754, 47 and 1 m IU/ ml respectively. In similar studies done among HCWs in Pakistan and Sri Lanka, the percentage of non-responsiveness to HBV vaccine was 14% and 9.9% respectively [2,5].

The immune response to HBV vaccine is variable and can be influenced by several factors. We found that the individuals who received the first dose of HBV vaccine after 25 years of age had 4 times increased risk of being non-responsive to the HBV vaccine (table 4). Logistic regression analysis also showed that age > 25 years at primary vaccination is an independent risk factor associated with poor responsiveness to the HBV vaccine. Also inadequate vaccination (i.e., a single dose) was associated with about 3 times increased risk of non-responsiveness to HBV vaccine, but it was not found to be statistically significant as majority of the study participants have received three doses and only a few had received a single dose. Similar studies from other parts of the world have reported that age > 25 years and inadequate vaccination schedule were associated with increased risk of non-responsiveness to HBV vaccine [6,7]. Female sex and more than 5 years post vaccination were not suggestive of reasons for non-responsiveness. Smokers had 3.5 times increased risk of being non-responsive to HBV vaccine. Statistical significance between smoking and poor response to HBV vaccine was not established as only a few of the recruited participants were smokers. In a study assessing the responsiveness of the public safety personnel to HBV vaccine, smokers were observed to show a poor response to the vaccine [8]. Elderly individuals, patients with chronic diseases

and immune defects are the common non-responders [9]. Age more than 40 years, male gender, obesity, smoking and presence of other illness are possible risk factors for non-responsiveness to HBV vaccine [10].

All the HCWs included in the study had normal serum total protein and albumin levels (i.e., none of them had hypoproteinemia, which might hinder the response to HBV vaccine) (table 5). Also, no association could be established between the routine biochemical parameters used in the assessment of liver function and serology.

Conclusion

About one-third of the HBV vaccinees were either non-responders or poor responders. It is therefore imperative to test the response to vaccine after completing the course, so that appropriate measures can be taken. Age > 25 years at primary vaccination is an independent risk factor associated with poor responsiveness to the HBV vaccine.

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Conflicts of interest: None to declare

Key Messages

About 10% and 20% of Hepatitis B vaccinated individuals were non responders and poor responders respectively, who need repeat vaccination of full course or single shot based on their anti-HBs antigen level.

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