

Immune Response of Hemodialysis Patients to Hepatitis B Vaccination

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Abstract

Objective: To determine the immune response of hemodialysis patients to hepatitis B vaccination at Shaikh Zayed Hospital, Lahore.

Method: It was a cross-sectional descriptive study done at the Microbiology Department of Shaikh Zayed Hospital, Lahore after approval from the Institutional Review Board. Two hundred hepatitis B surface antigen (HBsAg) negative patients were enrolled by convenient sampling technique. Their serum samples were taken and hepatitis B surface antibody (anti-HBs) and hepatitis B core antibody (anti-HBc) were done by enzyme-linked immunosorbent assay (ELISA) technique. The data entry and analysis were done using the Statistical Package for Social Sciences (SPSS) version 25.

Results: The majority of the patients (96.5%) were vaccinated. The anti-HBs antibody was positive in 141(70.5%) patients. Out of 141(70.5%) anti-HBs positive patients, 62.5% patients had antibody titer between 10-100 IU/ml whereas only 8% patients had antibody titer of greater than 100 IU/L.

Conclusion: The anti-HBs levels were protective in 70.5% of the hemodialysis patients. The majority of the patients (62.5%) had antibody titer ranging between 10-100 IU/L and only 8% of the patients had antibody titer greater than 100 IU/L. Forty percent of patients were isolated anti-HBs positive whereas, in 30.5% of patients, both anti-HBs and anti-HBc were positive.

Keywords: Immune response. Hepatitis B vaccination. Hemodialysis patients. Anti-HBs

How to cite: Aslam A, Izhar M, Khan FA, Qanber S, Satti KN, Aslam M. Immune Response of Hemodialysis Patients to Hepatitis B Vaccination. *Esculapio - JSIMS* 2021;18(02):209-213

DOI: <https://doi.org/10.51273/esc22.2518222>

Introduction

Hepatitis B is a frequent global disease caused by hepatitis B virus.^{1,2} Hepatitis B infects about two billion people worldwide, out of which chronic disease is present in 240 million individuals. Chronic disease causes cirrhosis and liver cancer. The annual mortality rate attributed to hepatitis B is 650,000 deaths per year

across the globe.³ Hepatitis B can manifest as asymptomatic, acute, fulminant, or chronic infection.⁴

Hemodialysis (HD) patients have greater chances of acquiring hepatitis B because of sharing of dialysis devices, need for repeated blood transfusions, and immunosuppression.^{5,6} In hemodialysis patients, the frequency of hepatitis B varies according to the disease prevalence in that area and implementation of infection control practices.⁴

The hepatitis B virus (HBV) has 3 important antigens: hepatitis B core antigen (HBcAg), hepatitis B surface antigen (HBsAg) and hepatitis B e antigen (HBeAg). HBsAg is present in incubation period, acute infection and chronic infection. It is the most important test for the diagnosis of the infection. HBeAg appears in incubation period and acute disease. In chronic disease, HBeAg may be present or absent. Its presence shows rapid multiplication of the virus and a highly infective

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Submission Date: 15/02/2022
1st Revision Date: 22/02/2022
Acceptance Date: 18/03/2022

state. HBcAg is a component of viral nucleocapsid. Three types of antibodies are produced against hepatitis B. Hepatitis B surface antibody (anti-HBs) shows either the patient has been previously infected or vaccinated against hepatitis B.^{4,7} If the patient has been previously infected with HBV, anti-HBc antibodies are also present in addition to anti-HBs.⁸ The presence of anti-HBs only shows patient has been vaccinated with HBV vaccine. The cut-off value for protective anti-HBs levels is higher than 10 IU/L. Anti-HBs levels higher than 100 IU/L show effective protection. Hepatitis B core antibodies (anti-HBc) are of two types:^{2,4} anti-HBc IgM in acute disease and anti-HBc IgG in chronic disease or after past infection.⁷ Anti-HBc IgG once positive remain positive for life. Hepatitis B e antibody (anti-HBe) shows a low likelihood of transmission.⁴

Hepatitis B is diagnosed by specific serological tests. HBsAg and anti-HBc IgM are detectable in the serum in acute infection. The patients are labeled as having chronic hepatitis B if the HBsAg persists in the serum for more than six months. In the recovery phase, liver function tests (LFTs) become normal, HBsAg is negative and anti-HBs & anti-HBc IgG appear in the serum.⁴

Immunization is an important measure for the prevention of the disease. Hemodialysis patients have impaired immunity and vaccine does not produce protective anti-HBs levels in these patients. Anti-HBs titer also declines more rapidly with time in HD patients as compared to healthy individuals.^{9,10} The vaccination schedule consists of 3 doses of 20µg vaccine given at 0,1 and 2 or 0,1 and 6 months. However, in HD patients, one additional dose of vaccine is given.² Anti-HBs levels should be monitored regularly in these patients and booster dose of vaccine administered in patients with low antibody titer.¹⁰

Hepatitis B is more prevalent in HD patients due to parenteral routes of the procedure in comparison to the general population. According to two studies conducted at hospitals in Lahore and Karachi, hepatitis B occurred in 10.6% and 10.2% of the hemodialysis patients, respectively.^{11,12} This study was planned to evaluate the levels of isolated anti-HBs in HD patients. It will determine the percentage of patients who had developed adequate anti-HBs levels after vaccination. It will also guide us in scaling up of strict infection control practices in HD patients to prevent the disease transmission and assess the effect of hepatitis B vaccine on the anti-HBs levels.

Material and Methods

It was a cross-sectional descriptive study done at the Microbiology Department of Shaikh Zayed Hospital, Lahore after ethical approval (Ref No. F-39/ NHRC/ Admn/IRB/88). All the patients gave written consent for participation in the study.

Two hundred HBsAg negative patients were included by the convenient sampling technique. Their relevant history was documented on a Proforma sheet. Using the aseptic technique, blood sample was collected from each patient through venipuncture and centrifuged for 5 minutes at 5000 rpm to separate serum. Enzyme-linked immunosorbent assay (ELISA) was done to determine HBsAg in serum samples. Anti-HBs and anti-HBc antibody levels were detected in the serum samples of 200 HBsAg negative patients by using the ELISA kits. There was a minimum period of 6 weeks between the last vaccine dose and the collection of the blood samples. The anti-HBs titer more than 10 IU/L shows immunity and greater than 100 IU/L indicates very effective protection.

The data was analyzed with the Statistical Package for Social Sciences (SPSS) version 25. Mean & standard deviation (SD) were used for quantitative variables such as age. For qualitative variables such as gender and anti-HBs levels, frequency and percentages were used.

Results:

The average age of hemodialysis patients was 47.05+ 14.33 years, with the range of 12 years to 80 years,

Table 1: Age, Gender and Vaccination Status of Hemodialysis Patients

Age Groups (years)	Frequency	Percentage (%)
11-20	7	3.5
21-30	31	15.5
31-40	27	13.5
41-50	47	23.5
51-60	56	28.0
61-70	25	12.5
71-80	7	3.5
Gender	Frequency	Percentage (%)
Female	79	39.5
Male	121	60.5
Vaccination status	Frequency	Percentage (%)
Unvaccinated	7	3.5
Vaccinated	193	96.5

et al, 73.8% of patients were vaccinated.¹⁶

In our study, 141(70.5%) patients were anti-HBs positive. with the antibody titer ranging from 10-100 IU/L in 62.5% of the patients and > 100 IU/L in 8% of the patients. In another study, the seroconversion rate was 100% in hemodialysis patients. All the patients were vaccinated. Sixty-four percent of the hemodialysis patients had anti-HBs levels ranging from 10-100 IU/L whereas, 36% of the patients had levels >100 IU/L.¹⁰ The anti-HBs levels were lower in other studies. A study conducted in Brazil enrolled 83 hemodialysis patients. All the patients had received a complete course of vaccination. Out of these, 59% patients were anti-HBs positive whereas, 41% of patients were non-responders i.e. their anti-HBs levels were less than 10 IU/L. Most of the anti-HBs positive patients (37.3%) had a level > 100 IU/L whereas, 21.7% of the patients had levels between 10 to 100 IU/L.¹⁶ In another study done in Theran, 100 hemodialysis patients were included. All the patients were vaccinated with a four-dose vaccination regime. Anti-HBs was positive in 56.7% of patients.¹⁷

Conclusion

The anti-HBs levels were protective in 70.5% of the hemodialysis patients. The majority of the patients (62.5%) had antibody titer ranging between 10-100 IU/L and only 8% of the patients had antibody titer greater than 100 IU/L. Forty percent of patients were isolated anti-HBs positive whereas, in 30.5% of patients, both anti-HBs and anti-HBc were positive.

Recommendations

- We recommend that hemodialysis patients should be tested for anti-HBc and then vaccinated accordingly. Anti-HBc negative patients should be vaccinated according to the regime with monitoring of anti-HBs levels.
- In anti-HBc positive patients, HBsAg should be done. If HBsAg is positive, patients should be assessed for the disease stage and management. In HBsAg negative patients, vaccination is not required as these patients are already protected from previous infection.
- The anti-HBs levels produced after vaccination are low and fall with time in hemodialysis patients. Regular monitoring of anti-HBs levels should be done in these patients and booster doses administered if required.

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Authors Contribution

AA: Conceptualization of Project

MI: Data Collection

FAK: Literature Search

SQ: Statistical Analysis

KNS: Drafting, Revision

MA: Writing of Manuscript