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Original Article

Hepatitis B Virus Vaccination Status and Anti Hepatitis B Surface Antibody Titer among the Health Care Workers of a Hemodialysis Unit

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Abstract

Background

Health care workers are in high risk of getting infected with hepatitis B virus. A large proportion of them do not receive a 3-dose series of hepatitis B vaccination and have anti hepatitis B surface antibody titer <10 mIU/ml.

Materials and Methods

Health care workers of the hemodialysis unit were included from March 2019 to March 2020 and were interviewed about hepatitis B vaccination status. Serum samples of the participants were analyzed for anti hepatitis B surface antibody titer. Participants with antibody titer of <10mIU/ml were given a 3-dose series of hepatitis B vaccination and antibody titer was again measured 1-2 months after the last dose.

Results

Among 30 participants, 19 (63.3%) had 3-dose series of hepatitis B vaccination, and all of them had anti hepatitis B antibody titer of >10 mIU/ml. Remaining 11 participants (36.7%), with either partial (6) or no hepatitis B vaccination (5), had antibody titer of <10mIU/ml. The mean ranks of antibody titer was significantly associated with the hepatitis B vaccination status (P<0.001). All 11 participants with antibody titer of <10 mIU/ml received a 3-dose series of hepatitis B vaccine and all of them achieved antibody titer >10 mIU/ml.

Conclusion

Our study shows that a large proportion of health care workers of hemodialysis unit were either partially or not vaccinated with hepatitis B vaccination and were having anti hepatitis B antibody titer of <10 mIU/ml. However, with complete 3-dose series of hepatitis B vaccination all of them achieved a protective antibody titer of ≥10 mIU/ml.

Keywords: *Hepatitis B, Renal Dialysis, Vaccination*

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Introduction

Hepatitis B virus (HBV) and hepatitis C virus (HCV) infections are common blood borne infections in hemodialysis unit [1-7]. According to World Health Organization (WHO) about 5.9 % of the health care workers (HCWs) worldwide are exposed to HBV infection each year [8-10]. Center for Disease Control (CDC) and WHO has recommended that all HCWs who have a reasonable expectation of being exposed to blood on the job should be offered HBV vaccine [11, 12].

HCWs like general healthy population should receive a 3-dose series of HBV vaccine, 20 mcg intramuscular (im) into deltoid muscle at 0, 1 and 6 months [11]. An immunological response following the vaccination generates anti-hepatitis B surface antibodies (Anti-HBs). Anti-HBs titer of ≥10 mIU/ml is considered protective whereas an Anti-HBs titer of <10 mIU/ml is considered non-protective [11-13].

HBV vaccination status and titer of Anti-HBs in HCWs of the hemodialysis units in Nepal is largely unknown. Hence the present study was carried out to assess the HBV vaccination status and Anti-HBs titer among the HCWs of the hemodialysis unit of a tertiary care teaching hospital in eastern Nepal. We also looked for the association of sex, age, duration of working in the hemodialysis unit and HBV vaccination status with Anti-HBs titer among the participants.

Materials and Methods

This was a prospective cross sectional study and was carried at the hemodialysis unit of Nobel Medical College Teaching Hospital, Biratnagar, Nepal, which is a tertiary care teaching hospital in Eastern Nepal. The hospital provides 24 hours acute as well as maintenance hemodialysis (MHD) services. MHD services to Nepalese citizens are provided free of cost to patients under government reimbursement scheme since 2017. Convenient sampling method was used and all the HCWs working in the hemodialysis unit, which included doctors, nurses, technicians and cleaners, were included from March 2019 to March 2020. Written informed consent was taken from all the participants and HCWs who refused to give consent were excluded. The study was approved by the institutional review committee (IRC).

Baseline characteristics of the participants i.e. age, sex, professional job description, duration of working in the hemodialysis unit were digitally recorded. All participants were screened for hepatitis B surface antigen (HBsAg), antihepatitis C antibody, and human immunodeficiency virus (HIV) by rapid tests. They were then interviewed about the history of HBV vaccination: whether or not HBV vaccination taken, if taken whether a complete or partial series was taken? Participants were asked to provide the documented evidence of their HBV vaccination series, whenever possible. All the participants, irrespective of their HBV vaccination history, were asked to provide blood samples; serum samples were analyzed in National Reference Laboratory, Lals Path, Lab, New Delhi, India for Anti-HBs titer. An Anti-HBs titer of <10 mIU/ml was considered as non-protective, whereas a titer of ≥10mIU/ml was considered as protective. In the second part of the study, all HCWs with Anti-HBs titer of <10 mIU/ml were given a complete 3-dose series of HBV vaccination (injection shanvac-B), 20 mcg, intramuscular (im) into deltoid muscle at 0, 1 and 6 months and Anti-HBs was measured 1-2 months after the last dose.

Statistical Analysis: For descriptive statistics, frequency, mean ± standard deviation were calculated. Age of the participants were further grouped into <30 years and ≥30 years, duration of working in the hemodialysis unit was classified into <24 months and ≥24 months. Study participants were categorized into three groups according to their HBV vaccination status: complete vaccination series taken, partial vaccination series taken and not a single dose taken. Since the variable "Anti HBs titer" was not normally distributed, the non-parametric test, Mann-Whitney test was used to examine significance between two mean ranks and Kruskal-Wallis test was used for comparison of three mean ranks. Probability of significance was set at 5% level of significance. SPSS version 26 was used for statistical analysis.

Results

There were 30 HCWs of the hemodialysis unit who were included in the study. All the participants on initial screening tests were negative for HBs Ag, anti-hepatitis C antibody and HIV. Mean age of the participants was 28.2 ± 7.0 years (range 20 to 45) and 17 (56.7%) of them were female. Baseline characteristics of the participants are shown in table 1.

There were 19 (63.3%) HCWs who had compete 3-dose series of HBV vaccination, 6 (20%) and 5 (16.7%) HCWs had partial series and not a single dose of HBV vaccination respectively. All 19 (63.3%) HCWs who had complete series of HBV vaccination status had Anti-HBs titer of >10 mIU/ml. All 11 HCWs (36.7%), who had either-partial (6 HCWs) or no hepatitis B vaccination status (5 HCWs), had Anti-HBs titer of <10mIU/ml.

Among 8 HCWs who had recently joined the hemodialysis unit (working for ≤1 month), 4 had complete series of HBV vaccination and all of them had Anti-HBs titer of >10mIU/ml. Three out of 8 recently joined HCWS had partial series of HBV vaccination and 1 had not even a single dose; all these 4 HCWs had Anti-HBs titer of <10 mIU/ml. The inferential analysis (Mann –Whitney test) suggested that there was no significant difference of mean ranks of anti-HBs titer with sex of the participants, age groups (<30 years versus ≥30 years) and duration of working in the hemodialysis unit (<24 months versus ≥24 months), P>0.05, as shown in Table 2.

Due to small sample size, we did not apply Chi-Square test to see the association of HBV vaccination status with Anti-HBs titer by making Anit-HBs titer categories as non-protective (<10 mIU/ml) and protective (≥10 mIU/ml) groups. Three cells contained zero frequency. Hence Anti-HBs titer was treated as continuous variable for further analysis. As shown in Table 3, Kruskal-Wallis test showed that the mean ranks of Anti-HBs titer was significantly associated with the HBV vaccination status (P<0.001).Since the other variables were not significantly associated with the Anti-HBs titer, it was not necessary to go for the multivariate analysis. Hence, we found that Anti-HBs titer value was independently associated only with the HBV vaccination status of the participants.

Second part of the study was to give HBV vaccination to HCWs who had Anti-HBs titer of <10 mIU/ml. All 11 HCWs who had Anti-HBs titer of <10 mIU/ml received complete 3-dose series of HBV vaccine, 20 mcg, im into deltoid area at 0, 1, and 6 months. All of them achieved protective immunity (Anti-HBs titer >10 mIU/ml) following the HBV vaccination series, mean Anti-HBs measured 1-2 months after the last dose was 877.4 ± 155.1 mIU/ml.

Table 1: Baseline characteristics of the study participants.

Varaibles	N (%), mean ± SD
Sex: Male/Female 13/17 (43.3/56.7)	
Age	28.2± 7.0 years (range 20 to 45)
<30 years	20 (66.7)
≥30 years	10 (33.3)
Professional description of the participants	
doctors	8 (26.6)
staff nurses	17 (56.6)
technicians	2 (6.6)
cleaners	3 (9.9)
Duration of working in HD[1] unit	30.2 ± 33.5 months (range 1 to 96)
< 24 months	17 (56.7)
≥ 24 months	13 (43.3)
Recently joined staff (worked for ≤1 month)	8 (26.6)
Hepatitis B vaccination status	
complete series taken	19 (63.3)
partial series taken	6 (20)
not a single dose taken	5 (16.7)
Anti-HBs[2] antibody titer	
<10 mIU/ml	11 (36.7)
>10 mIU/ml	19 (63.3)

[1] HD, hemodialysis; [2]Anti-HBs, anti hepatitis B surface antibody

Table 2: Mann-Whitney test showing the relation of mean ranks of anti-HBs[1] titer with sex, age groups and duration of working in the hemodialysis unit.

Variable	Anti-HBs titer Median, IQR[2] (mean ± SD)	Mean rank	P value
Sex of the participants:			
Male	509.3, 865.3 (544.1 ± 417.1)	18.0	0.168
Female	4.8, 998.9 (309.5 ± 460.7)	13.5	
Age group of the participants:			
<30 years	57.2, 966.7 (341.1 ± 444.2)	14.1	0.212
≥30 years	621.2, 926.2 (551.3 ± 452.8)	18.3	
Duration of working in the hemodialysis unit:			
<24 months	81.5, 999.2 (346.0 ± 452.2)	14.1	0.340
≥24 months	427.8, 983.0 (496.4 ± 451.8)	17.2	

[1]Anti-HBs, anti hepatitis B surface antibody; [2] IQR, interquartile range

Table 3: Kruskal-Wallis test showing the relation of mean rank of Anti-HBs[1] titer with the HBV[2] vaccination status.

HBV vaccination status	Anti-HBs titer Median, IQR[2] (mean ± SD)	Mean rank	P value
Complete series taken	871.3, 828.7 (648.4 ± 406.4)	21.0	<0.001
Partial series taken	1.0, 4.1 (1.8 ± 2.0)	6.1	
Not a single dose taken	0.7, 0.8 (0.7 ± 0.4)	5.8	

[1]Anti-HBs, anti hepatitis B surface antibody; [2]HBV, hepatitis B virus

Discussion

HBV vaccination effectively prevents about 90-95% of normal healthy individuals against HBV infection [13]. Unfortunately, though the vaccine has been in clinical use since 1980s and though HCWs are at increased risk of getting the infection, a large proportion of HCWs around the world are not vaccinated with HBV vaccine. HBV vaccination coverage is only about 18% in Africa, as compared to 75% in United States and 77% in Australia and New Zealand [9, 14]. Few old studies from India report that about 16-60% of the HCWs had complete HBV vaccination series [15, 16]. In a recently published (2015) study from India, about 50% of HCWs were vaccinated, 46% were unvaccinated, and 4 % were partially vaccinated. Thirty percent of the vaccinated HCWs had Anti-HBs titer of <10 mIU/ml [17].

We could found only a single study from Nepal on HBV vaccination status among HCWs; study done in Bir Hospital, Kathmandu in 2006 showed that about 48.9% of the HCWs had complete

series of HBV vaccination [18]. In the study, evidence of past or present HBV infection were present in about 21% of non-professional staff, 19% of nurses, 5% of laboratory workers and 3% of doctors. Lack of hepatitis B vaccination ($p<0.05$) and two HCW categories, nurses ($p<0.05$) and non-professional staff, who clean the used instruments ($p<0.05$) were significantly associated with the present or past HBV infection [18].

To the best of our knowledge, our study is the first study in Nepal looking for the HBV vaccination status and Anti-HBs titer specifically among the HCWs of a hemodialysis unit. In our study 63.3% of the HCWs of the hemodialysis unit had received complete 3-dose series of HBV vaccination and 36.7% had either partial or no vaccination at all. Interestingly all completely vaccinated HCWs had protective titer of Anti-HBs (>10 mIU/ml) and all partially or unvaccinated HCWs had non-protective titer of <10 mIU/ml. There was no significant association of Anti-HBs titer among the different sex, age group distribution and duration of working in the hemodialysis unit. Anti-HBs titer was significantly associated only with the HBV vaccination status of the HCWs.

Out of total 30 HCWs of our hemodialysis unit, 36.7 % had partial or no HBV vaccination and all of them had Anti-HBs titer of <10 mIU/ml. Four out of 8 new staff had partial or no HBV vaccination and with Anti-HBs titer <10 mIU/ml. These HCWs pose a risk of getting infected with HBV and could potentially transmit the infection to others. Hence we provided them with complete 3-dose series of HBV vaccination and achieved Anti-HBs titer of >10 mIU/ml. We strongly recommend that other hemodialysis centers should also strictly follow this.

Furthermore, it is in general suggested that at the time of entry into the medical, paramedical and nursing schools students should receive a complete 3-dose series of HBV vaccination followed by measurement of the Anti-HBs titer. Before employment in the health care settings, documented evidence of HBV vaccination and Anti-HBs titer should be checked. If not available then HBV vaccination and measurement of Anti-HBs titer should be made mandatory [19].

Conclusion

In conclusion present study demonstrates that a large proportion of HCWs of our hemodialysis unit had partial or no hepatitis B vaccination status; and had non-protective Anti-HBs titer of <10 mIU/ml. However, all of them achieved a protective Anti-HBs titer of ≥10 mIU/ml with a complete 3-dose series of HBV vaccination.

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Conflicts of interests: None

References

[1] Johnson DW, Dent H, Yao Q, Tranaeus A, Huang CC, Han DS et al, Frequencies of hepatitis B and C infections among haemodialysis and peritoneal dialysis patients in Asia-Pacific countries: analysis of registry data. Nephrol Dial Transplant. 24:5 (2009) 1598-1603. DOI:10.1093/ndt/gfn684 [PubMed]

[2] Bernieh B. Viral hepatitis in hemodialysis: An update. J Transl Int Med. 3:3 (2015) 93-105. DOI: 10.1515/jtim-2015-0018. PMCID: PMC4936461. PMID: 27847896 [PubMed]

[3] Burdick RA, Bragg-Gresham JL, Woods JD, Hedderwick SA, Kurokawa K, Combe C et al. Patterns of hepatitis B prevalence and seroconversion in hemodialysis units from three continents: the DOPPS. Kidney Int. 63:6 (2003) 2222-2229. DOI:10.1046/j. 1523-1755.2003.00017.x. PMID: 12753311 [PubMed]

[4] Guidelines for vaccination in patients with chronic kidney disease. Indian J Nephrol. 26:1 (2016) S15-S18. PMICD: PMC4928524 [PubMed]

[5] Unger JK, Peters H. Hepatitis B in chronic kidney disease: moving toward effective prevention. Kidney Int. 73:7 (2008) 799-801. DOI:10.1038/ki.2008.57. PMID: 18340351 [PubMed]

[6] Centers for Disease Control and Prevention (CDC). Outbreaks of hepatitis B virus infection among hemodialysis patients-- California, Nebraska, and Texas, 1994. MMWR Morb Mortal Wkly Rep. 45:14(1996) 285-289 URL accessed date: 07/12/2020 [FullText]

[7] Fabrizi F, Dixit V, Messa P, Martin P. Transmission of hepatitis B virus in dialysis units: A systematic review of reports on outbreaks. International Journal of Artificial Organs. 38:1 (2015) 1-7. DOI: 10.5301/ijao.5000376. PMID: 25633894 [PubMed]

[8] Singhal V, Bora D, Singh S. Hepatitis B in health care workers: Indian scenario. J Lab Physicians. 1:2 (2009) 41-48. DOI:10.4103/0974-2727.59697. PMCID: PMC-3167966. PMID: 21938248 [PubMed]

[9] Prüss-Ustün A, Rapiti E, Hutin Y. Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. Am J Ind Med. 48:6 (2005) 482-490. DOI:10.1002/ajim.20230. PMID: 16299710 [PubMed]

[10] WHO. Global policy report on the prevention and control of viral hepatitis in WHO member states. World Health organisation; 2013. URL accessed date: 07/12/2020 [FullText]

[11] https://www.who.int/occupational_health/activities/3hepatiti.pdf. URL accessed date: 07/12/2020.

[12] Schillie S, Vellozzi C, Reingold A, Harris A, Haber P, Ward JW et al. Prevention of Hepatitis B Virus Infection in the United States: Recommendations of the Advisory Committee on Immunization Practices. MMWR Recomm Rep 67: RR-1(2018) 1-31. DOI: http://dx.doi.org/10.15585/mmwr.rr6701a1external icon [FullText]

[13] https://www.who.int/en/news-room/fact-sheets/detail/hepatitis-b. URL accessed date: 07/12/2020.
[14] Simard EP, Miller JT, George PA, Wasley A, Alter MJ, Beth BP et al. Hepatitis B vaccination coverage levels among healthcare workers in the United States, 2002-2003. Infection Control and Hospital Epidemiology. 28:7 (2007) 783-790. DOI: 10.1086/518730. PMID: 17564979 [PubMed]
[15] Sukriti, Pati NT, Sethi A, Agrawal K, Agrawal K, Kumar GT et al. Low level of awareness, vaccine coverage, and the need for booster among health care workers in tertiary care hospitals in India. J Gastroenterol Hepatol 23 (2008) 1710-1715. DOI:10.1111/j.1440-1746.2008. 05483. PMID: 18761556 [PubMed]
[16] Duseja A, Arora L, Masih B, Singh H, Gupta A, Behera D et al. Hepatitis B and C Virus- prevalence and prevention in health care workers. Trop Gastroenterol 23 (2002) 125-126. PMID: 12693154 [PubMed]
[17] Batra V, Goswami A, Dadhich S, Kothari D, Bhargava N. Hepatitis B immunization in healthcare workers. Annals of Gastroenterology. 28:2 (2015) 276-280. PMCID: PMC4367220. PMID: 25830669 [PubMed]
[18] Shrestha SK, Bhattarai MD. Study of hepatitis B among different categories of health care workers. J Coll Physicians Surg Pak. 16:2 (2006) 108-111. PMID: 16499802 [PubMed]
[19] Averhoff F, Mahoney F, Coleman P, Schatz G, Hurwitz E, Margolis H. Immunogenicity of hepatitis B Vaccines. Implications for persons at occupational risk of hepatitis B virus infection. Am J Prev Med. 15:1(1998) 1-8. DOI: 10.1016/s0749-3797(98)00003-8. PMID: 9651632 [PubMed]