RESEARCH ARTICLE

Awareness Regarding Prevention of Hepatitis B and its Management Among Nurses

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Abstract

Background: Hepatitis B virus (HBV) infection is a substantial infectious hazard among nurses. The present study aimed to assess nurses' awareness regarding the prevention and care of HBV-positive patients.

Materials and methods: A total of 400 nurses were randomly enrolled in the study. The data was collected using a prevalidated questionnaire. Approval for the study was sought from the Institutional Ethics Committee.

Results: Mean age of the nurses was 30.6 ± 9.56 years. Female nurses outnumbered the males. The overall mean knowledge score was 25.7 ± 1.64 (56%). About 80% of nurses strongly agreed that they are at risk of getting HBV infection. Around 56% of nurses suggested that the patients positive for HBV should be isolated from other patients, whereas 70.2% of nurses felt that double gloves should be worn while providing care to these patients. A total of 78% of nurses opined that the patients should be tested for HBV at the time of admission to the hospital. All three doses of the HBV vaccine were taken by 57% of nurses. Only 22% had their immunoglobulin levels checked after getting vaccinated. Needlestick injuries (NSIs) were experienced by 44% of the nurses, and 56.5% knew about what should be done after getting NSI.

Conclusion: There is a need to organize in-service education programs for nurses on a regular basis to keep them abreast of HBV infection.

Keywords: Hepatitis B, Knowledge and Attitude, Nurses, Vaccination.

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Introduction

Hepatitis B is considered a major health hazard among healthcare workers (HCWs) and is significantly associated with higher morbidity and mortality.[1] Chronic liver disease, cirrhosis, and hepatocellular carcinoma are potentially fatal complications of hepatitis B virus (HBV) infection.[2] The main hurdles preventing the spread of infection among healthcare professionals are deficient knowledge and lack of clinical application of effective safety measures and evidence-based guidelines.

In healthcare settings, HBV is the commonly transmitted virus through blood and blood products through contaminated instruments, accidental needlestick, or sharps injuries.[3] Generally, transmission occurs from patients to the healthcare providers and vice versa. Among all HCWs, nurses sustain a high burden of needlestick injuries (NSI).[4] Nurses encounter the maximum risk of exposure to various hazards and activities liable to transmit blood-borne infections between patients and healthcare personnel.[5–9]

Improving the casual behavior of the HCWs concerning infection control practices is one of the main aspects of preventing the spread of HBV. Their knowledge about transmission and prevention of viral hepatitis can facilitate in achieving this goal. The Society of Gastroenterology Nurses and Associates believes that nurses have more contact with the patients, and one of their important roles is to provide health education to patients and their caregivers. The well-equipped and knowledgeable nurses can provide accurate information regarding the disease process to patients and their families to decrease the transmission of the disease in the community.[10]

Vaccination against HBV is another vital measure to decrease its incidence, which is considered to be safe, effective, and beneficial.[11] All healthcare personnel at risk of acquiring infection are expected to get themselves vaccinated against HBV. However, the attitude and viewpoint of HCWs toward its safety and effectiveness impact their decision to accept or reject it. The vaccination coverage among HCWs is meager, specifically in developing countries.[12] The various reasons documented for this are lack of awareness and low priority given by the hospital administration. One of the studies conducted

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in a tertiary care center (unpublished data) has reported that only 32% of nursing personnel had completed their vaccination protocol against HBV, irrespective of the free availability of the vaccine.[13] Another study has documented the status of vaccination as 49.0% among the HCWs and 42.2% among medical students.[14]

The current study was thus undertaken with the objectives to evaluate the awareness of nurses regarding hepatitis B to ascertain their attitude toward hepatitis B-positive patients and to find out the hepatitis B vaccination status among them.

Materials and Methods

The study was conducted in the emergency, medical and surgical wards, operation theater, intensive care unit, obstetrics areas, and dialysis unit of a tertiary care center. Bedside nurses, irrespective of gender, who consented to participate in the study were included. Using the list of nurses as a sampling frame, a proportionate random sample (50% of the total nurses in each study unit) was selected as participants. The list of nurses was obtained from the nursing administration of the institute and was adjusted to exclude those who were on leave. Sample size was calculated using the formula $N = 4\ pq/L^2$. Here, "*p*" is the prevalence of hepatitis B surface antigen (HBsAg) positivity and "*L*" is the allowable percentage of error. Assuming the prevalence of HBsAg of 40%[15] among HCWs and the desired level of precision of 5%, a sample size of 384 was calculated. Making it a round figure, a total of 400 bedside nurses were enrolled.

The data was collected using a validated questionnaire. Part one covered the information profile, including age, gender, qualification, years of experience, place of current posting, the experience of working with HBV-positive patients, whether they had participated in any training program regarding the disease, etc. Part two contained multiple choice questions (MCQs) and dichotomous (yes/no) type questions to assess the knowledge of nurses regarding various aspects of the disease. A total of 12 questions were regarding general information about hepatitis B, six each were related to the mode of transmission and management of hepatitis B, two each were regarding diagnosis and clinical symptoms of hepatitis B, three questions pertained to blood product screening, and 15 were regarding vaccination of hepatitis B. Score 1 was be given to each correct response. The maximum attainable score of 46 was further categorized as excellent, very good, good, average, and poor as per the scores obtained by the participants. Part three had a nine-item Likert-type scale, which was used to evaluate the attitude of the respondents regarding the care of hepatitis B-positive patients. Opinion of the participants regarding hepatitis B vaccination was also documented. It contained questions such as whether the hepatitis B vaccine should be made compulsory for HCWs, scared of getting vaccinated, not at risk for hepatitis B, do not trust vaccinations, and that vaccination is against traditional beliefs, etc.

Information was also obtained regarding the self-protection of the participants against hepatitis B, that is, their vaccination status against hepatitis B. They were also asked about NSI and its management. The respondents were asked to fill out the questionnaire in front of the investigator to avoid any kind of discussion among them. Approval to conduct the study was sought from the Institutional Ethics Committee. Permission was also obtained from the medical and nursing superintendent of the institute. Written consent was sought from each participant. They were assured of the confidentiality of their information. Statistical Package for the Social Sciences (SPSS) version 21 was used to analyze the data.

Results

Mean age of the nurses was 30.6 ± 9.56 years. Around one-third (39%) belonged to the age-group of 26–30 years. A majority (82.7%) of the nurses were females. Maximum were degree holders (67%), and around one-third each had 1–5 and 6–10 years of professional experience, respectively (Table 1).

The personal information of nurses regarding hepatitis B is depicted in Table 2. A majority (76%) of the nurses had learned about hepatitis B during their training period. Only 15% had attended some conferences on hepatitis B, and 83% had experience of attending patients with HBV infection. Four percent had suffered from hepatitis B. Currently, hepatitis B status was known to 63% of the nurses, whereas 27% responded that they were not aware of their hepatitis B status. The majority (95%) responded that they had written protocols available regarding handwashing in their wards.

The knowledge (mean and percentage score) of the subjects regarding various parameters of hepatitis B in descending order is shown in Table 3. The mean knowledge score of the subjects was 25.7 ± 1.64. The participants scored maximum (80%) regarding the diagnosis of hepatitis B. It was followed by the management of HBV infection and mode of transmission (71.7% and 70%), respectively. The awareness level was minimal regarding vaccination of hepatitis

Table 1: Identification data of the participants (*N* = 400)

Variables	*f (%)*
Age (years)	
Mean + SD	30.6 ± 9.56
Range	22–60
20–25	66 (16.5)
26–30	154 (38.5)
31–35	80 (20.0)
36–40	44 (11.0)
>41	56 (14.0)
Gender	
Male	69 (17.3)
Female	331 (82.7)
Professional qualification	
BSc nursing (degree)	260 (67.5)
General nursing and midwifery (diploma)	140 (32.5)
Total professional experience (years)	
Mean ± SD	**9.53 ± 7.10**
Range	01–28 years
<1	08 (2)
1–5	127 (31.7)
6–10	127 (31.7)
11–15	61 (15.3)
16–20	42 (10.5)
>21	35 (8.8)
Place of posting	
Emergency unit	96 (24.0)
Surgical unit	74 (18.5)
Operation theater	68 (17.0)
ICU unit	56 (14.0)
Obstetrics unit	48 (12.0)
Medicine unit	44 (11.0)
Dialysis unit	14 (3.5)

B and its clinical symptoms. The mean score of knowledge of hepatitis B according to the categorization of scores is shown in Table 4. Only 1% of the participants were in the excellent category of knowledge score. About half (48%) of the participants were in the good and average category of score. Only 3% were in the poor category of knowledge score.

The assessment of attitude regarding the care of HBV-positive patients is shown in Table 5. Around 80% of the participants agreed that they are at risk for hepatitis B, and 56.5% of them agreed that HBV-positive patients should be isolated from other patients. Majority of the nurses believed that double gloves should be worn while providing care to hepatitis B patients. The majority disagreed that one should avoid talking with hepatitis B-infected patients. Each patient should be tested for hepatitis B on admission to the hospital, which was agreed upon by the majority (78.7%) of the nurses.

Eighty percent of the nurses were vaccinated against HBV. Only 59% had taken all three doses of HBV vaccine. One and two doses were taken by 9 and 32%, respectively. Only 22% had their immunoglobulin levels checked after getting vaccinated (Table 6). The opinion about hepatitis B vaccination is shown in Table 7. Around 68% strongly agreed that vaccine for hepatitis B should be made compulsory for all the HCWs.

Table 2: Personal information regarding hepatitis B ($N = 400$)

Statements	*f (%)*
Source of knowledge about hepatitis B	
During training	304 (76.0)
During some conference/workshop	24 (06.0)
Both	57 (14.2)
NR*	15 (3.8)
Ever attended any conference/workshop on hepatitis B	
No	341 (85.3)
Yes	59 (14.7)
Ever attended/nursed any patient with hepatitis B	
No	66 (16.5)
Yes	334 (83.5)
Ever suffered from hepatitis B	
No	383 (95.8)
Yes	17 (4.2)
Current HBsAg status	
Positive	5 (1.2)
Negative	246 (61.5)
Don't know	149 (37.3)
Availability of any written protocol regarding care of hepatitis B patients in the ward	
No	314 (78.5)
Yes	86 (21.5)
Availability of written protocol regarding various infection control practices in the ward	
No	20 (5)
Yes	380 (95)
If yes, which guidelines	
Hand washing	380 (95)
NR	20 (5)

*NR, not replied

Discussion

Hepatitis B infection constitutes a significant healthcare hazard among HCWs. As understanding and information about a particular aspect forms the prime step toward modification of a desirable behavior, thus, awareness about the disease particularly among the nurses is very important for the prevention and control of the disease. In the current study, the mean knowledge score of nurses was 25.7 (56%). The score was higher regarding the diagnosis of hepatitis B, followed by its management and mode of transmission. The knowledge of nurses in the current study is more or less comparable to various other studies conducted on nurses. In one of the studies from Erbil, the mean knowledge score regarding hepatitis B has been reported to be 6.96 ± 1.6 of the maximum obtainable score of 10.[16] Similar findings have been documented in another study from Dhaka, wherein 67.3% of the nurses had adequate knowledge of hepatitis B and 49.3% had good level of preventive practices. In this study, the respondents who correctly answered >18 out of 28 questions were considered to have adequate knowledge, and the participants scoring less were categorized to have poor knowledge.[17] In the current study, around half the nurses were in the good category of knowledge score.

Hepatitis B is preventable with a safe, effective, and highly acceptable vaccine. Prevention of HBV transmission also depends on the effective immunization of HCWs. However, its adherence among HCWs is quite low. Though vaccination against HBV is recommended for all HCWs and is administered free of cost at the institution where the current study was conducted, all three doses of vaccine were taken only by 59% of the nurses. The knowledge score was minimum (9.2 ± 5.2, maximum being 15) regarding vaccination of hepatitis B of the other domains of knowledge assessed. Twenty-five years back, in the same institution, only 32%

Table 3: Knowledge score of the participants regarding various parameters of hepatitis B

Parameters of hepatitis B	*Mean ± SD, range*	*Max attainable score*	*Percentage score*
Diagnosis of hepatitis B	1.6 ± 0.48, 1–2	02	80
Management of hepatitis B	4.3 ± 1.5, 1–6	06	71.7
Mode of transmission	4.2 ± 1.7, 1–6	06	70
General information of hepatitis B	7.8 ± 3.8, 1–12	12	65
Blood product screening	1.9 ± 0.9, 1–3	03	63.3
Vaccination for hepatitis B	9.2 ± 5.2, 1–15	15	61.3
Clinical symptoms	1.2 ± 0.43, 1–2	02	60
Total mean (knowledge) ± SD	**25.7 ± 1.64**	**46**	**55.9**

Bold values indicate mean knowledge

Table 4: Mean score of knowledge as per category

Category	*Score*	*No of participants n (%)*	*Mean ± SD*	*Range*
Excellent	35–46 (>75%)	05 (1.25)	36.8 ± 0.8	36–38
Good	24–35 (51–75%)	192 (48)	26.9 ± 2.32	24–34
Average	12–23 (26–50%)	190 (47.5)	19.4 ± 4.55	12–23
Poor	1–11 (25%)	11 (2.75)	8.9 ± 2.42	07–11
NR*	–	02 (0.5)	–	
Total	46	400	25.7 ± 1.64	

*Not replied

Table 5: Attitude of the participants regarding care of hepatitis B-positive patients

Statements	*Strongly agree (1) f (%)*	*Neither agree nor disagree (2) f (%)*	*Disagree (3) f (%)*
Job puts me at risk for hepatitis B	323 (80.7)	59 (14.8)	18 (4.5)
Hepatitis B patients should be isolated from other patients	226 (56.5)	64 (16)	110 (27.5)
Should wear double gloves when providing care to hepatitis B patients	281 (70.2)	74 (18.5)	45 (11.2)
Should provide the same standard of care for HBV as for other patients	283 (70.7)	38 (9.5)	79 (19.7)
Should avoid talking to hepatitis B-infected patients	26 (6.5)	50 (12.5)	324 (81)
Should avoid touching fomites of HBV patients	129 (32.2)	60 (15)	211 (52.7)
Each patient should be tested for HBV at the time of admission to the hospital	315 (78.7)	43 (10.8)	42 (10.5)

Table 6: Hepatitis B vaccination status among the participants (*N* = 400)

Variables	*f (%)*
Vaccinated against HBV	
No	79 (19.7)
Yes	321 (80.3)
How many doses, if vaccinated (*n* = 321)	
One dose	30 (9.3)
Two doses	103 (32.1)
Three	188 (58.6)
Immunoglobulin levels checked after getting vaccination (*n* = 321)	
No	252 (78.5)
Yes	69 (21.5)

Table 7: Opinion about hepatitis B vaccination

Statement	*Strongly agree (1) f (%)*	*Neither agree nor disagree (2) f (%)*	*Disagree (3) f (%)*
Hepatitis B vaccine should be compulsory for all healthcare personnel	274 (68.5)	28 (07)	18 (4.5)
Scared of getting the vaccine as it hurts	57 (14.2)	55 (13.7)	288 (72)
Not at risk as I carefully take care of my patients	100 (25)	63 (15.7)	237 (59.2)
I am not at risk of HBV as I am a healthy person	34 (8.5)	48 (12)	318 (79.5)
I do not trust hepatitis B vaccination	10 (2.5)	38 (9.5)	352 (88)
Vaccination is against my religion/traditional beliefs	25 (6.2)	168 (42)	207 (51.7)

of the nurses were completely vaccinated against hepatitis B. At that time, six nurses discontinued after the first dose and 12 after taking the second dose.[13] This suggests that, over a period, nurses have become more aware of the preventive aspect of this infection. In various other studies, the completion rate of all three doses of vaccine has been reported to be low among nurses (39.7%) and doctors (40.3%) and more in nonclinical workers such as medical record personnel (76.3%) and engineering staff (69.5%) despite providing the vaccination free of cost.[17] In a few of the studies, the reported rate of vaccination is as low as 5.1%.[17–19] The various reasons for low vaccination coverage have been reported to be busy schedules, wastage of time, less awareness about disease severity and vaccine efficacy, and perception of low-risk status.[18–20] In the current study, though the majority strongly agreed that the hepatitis B vaccine should be made compulsory for all HCWs, they were scared of taking the vaccine as it hurts, they did not trust vaccination, and that vaccination is against their religion/traditional beliefs.

Healthcare workers (HCWs) are considered immune if they have documented proof that they were vaccinated before 13 years of age or if a positive anti-HBsAg antibody test is provided.[21] In the current study, only 22% got their immunoglobulin levels checked after vaccination. The age of vaccination of the participants was not confirmed. Nurses have higher chances of getting exposed to NSI or other infectious body fluids from patients. In the present study, 5/400 (1.25%) nurses were positive for hepatitis B. For others, serosurveillance for hepatitis B was not carried out. Had it been done, more could have been possibly detected as 44% of nurses reported having NSI, of which more than half experienced it 1–5 times, and 7% reported blood or body fluid splash in their eyes or mouth. In one of the studies, the maximum percentage of HBV positivity was found among laboratory technicians (4.1%), followed by nurses (1.7%).[22] These positive HCWs are more likely to transmit infection to the patients if they breach the health care practices. Many such episodes of transmission of infection have been reported.[23–25]

Periodical sensitization of the HCWs is very important to update their knowledge regarding various precautionary measures they should take while working with the patients. In the current study, only 4% of the nurses had ever attended any conference or workshop on hepatitis B or any other infection control program. In a study carried out by Elduma et al. in three hospitals in Sudan, it was reported that 15% had attended training courses in biosafety.[26]

This study has provided a sufficient base for organizing educational programs and proper preventive guidelines for nurses; however, it has a few limitations. The study design was cross-sectional, and therefore, causal relationships cannot be ascertained, and being a single group and single center study, comparison with other healthcare providers cannot be drawn. However, certain recommendations which can be made are as follows:

- There is a need to organize compulsory, ongoing in-service education programs for the nurses irrespective of their age and cadre.
- Module on the management of hepatitis B and probably also hepatitis C and HIV should be prepared and made available in all the units so that these can be consulted as and when required.
- The nurses should conduct weekly review clubs.
- Hepatitis B vaccine should be made compulsory for all nursing personnel before joining the service. Records regarding the vaccination of nurses should be maintained.
- There should be an abundant supply of personal protective equipments.
- Infection control guidelines should be prepared and made available in all the units.
- Infection control practices must be supervised regularly.
- Needlestick injury (NSI) protocol should be displayed at all workplaces.

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References

1. WHO. Department of Communicable Diseases Surveillance and Response. Hepatitis B. Available from: http://www.who.int/csr/disease/hepatitis/HepatitisB_whocdscsrlyo2002_2.pdf. Accessed on Oct 2019.
2. Gerberding JL. The infected health care provider. N Engl J Med 1996;334:594–595. DOI: 10.1056/NEJM199602293340909
3. Beltrami EM, Williams IT, Shapiro CN, et al. Risk and management of blood-borne infections in health care workers. Clin Microbiol Rev 2000;13(3):385–407. DOI: 10.1128/CMR.13.3.385
4. Smith DR, Choe MA, Jeong JS, et al. An GJ epidemiology of needle stick and sharps injuries among professional Korean nurses. J Prof Nurs 2006;22(6):359–366. DOI: 10.1016/j.profnurs.2006.10.003
5. Hsieh WB, Chiu NC, Lee CM, et al. Occupational blood and infectious body fluid exposures in a teaching hospital: a three-year review. J Microbiol Immunol Infect 2006;39(4):321–327.
6. Shiao JS, Mclaws ML, Huang KY, et al. Student nurses in Taiwan at high risk for needlestick injuries. Ann Epidemiol 2002;12(3):197–201. DOI: 10.1016/s1047-2797(01)00303-9
7. Ali NS, Jamal K, Qureshi R. Hepatitis B vaccination status and identification of risk factors for hepatitis B in health care workers. J Coll Physicians Surg Pak 2005;15(5):257–260.
8. Smith DR, Leggat PA. Needlestick and sharps injuries among nursing students. J Adv Nurs 2005;51(5):449–455. DOI: 10.1111/j.1365-2648.2005.03526.x
9. Smith DR, Smyth W, Leggat PA, et al. Needlestick and sharps injuries among nurses in a tropical Australian hospital. Int J Nurs Pract 2006;12(2):71–77. DOI: 10.1111/j.1440-172X.2006.00553.x
10. SGNA (. SGNA (Gastroenterology and Associates), 2001. Available at: http://www.sgna.org/. Accessed on Oct 2019.
11. Zanetti AR, Van Damme P, Shouval D. The global impact of vaccination against hepatitis B: a historical overview. Vaccine 2008;26(49):6266–6273. DOI: 10.1016/j.vaccine.2008.09.056
12. Aaron D, Nagu TJ, Rwegasha J, et al. Hepatitis B vaccination coverage among healthcare workers at national hospital in Tanzania: how much, who and why? BMC Infect Dis 2017;17(1):786. DOI: 10.1186/s12879-017-2893-8
13. Kaur S, Chawla Y, Joseph M. Assessment of knowledge of protective measures and practices adopted by nursing personnel caring for hepatitis patients. M.Sc. Nursing thesis 1995, NINE, PGIMER, Chandigarh (unpublished data).
14. Nasir K, Khan KA, Kadri WM, et al. Hepatitis B vaccination among health care workers and students of a medical college. J Pak Med Assoc 2000;50(7):239–243.
15. Ziraba AK, Bwogi J, Namale A, et al. Sero-prevalence and risk factors for hepatitis B virus infection among health care workers in a tertiary hospital in Uganda. BMC Infect Dis 2010;10:191. DOI: 10.1186/1471-2334-10-191
16. Abdulla SA, Abdulla Z. Effect of an educational program on nurses' knowledge and practices toward hepatitis B virus in emergency hospitals in Erbil City. Zanco J Med Sci 2014;18(1):618–624. DOI: 10.15218/zjms.2014.0005

17. Mehriban N, Ahsan GU, Islam T. Knowledge and preventive practices regarding hepatitis B among nurses in some selected hospitals of Dhaka city, Bangladesh. South East Asia J Public Health 2014;4(1):48–52. DOI: 10.3329/seajph.v4i1.21840
18. Fatusi AO, Fatusi OA, Onayade A, et al. Acceptance of hepatitis B vaccine by workers in a Nigerian teaching hospital. East Afr Med J 2000;77(11):608–612. DOI: 10.4314/eamj.v77i11.46734
19. Abdul RM, Munit AS, Salahyddin A. Hepatitis B vaccination status and knowledge, attitude, practices of health care workers (HCWs) regarding hepatitis B and C in a tertiary care centre of Karachi. Pak Med Net 2007;16(4):105–117.
20. Rea E, Upshur R. Semmelweis revisited: the ethics of infection prevention among health care workers. CMAJ 2001;164(10):1447–1448.
21. Calendrier vaccinal 2008. Avis du haut conseil de la santé publique. (In French.) Bull Epidemiol Hebd 2008;16–17:131-7.
22. Khakhkhar VM, Thangjam RC, Parchwani DN, et al. Prevalence of hepatitis B virus infection in health care workers of a tertiary care hospital. Natl J Med Res 2012;2(2):176–178.
23. Henderson DK. Patient-to-patient transmission of bloodborne pathogens in health care: the price and perils of progress? Infect Control Hosp Epidemiol 2008;29(4):294–296. DOI: 10.1086/587440
24. Perry JL, Pearson RD, Jagger J. Infected health care workers and patient safety: a double standard. Am J Infect Control 2006;34(5):313–319. DOI: 10.1016/j.ajic.2006.01.004
25. Poujol I, Floret N, Servant-Delmas A, et al. Hepatitis B virus transmission from a nurse to a patient, France, 2005. Euro Surveill 2008;13(21):18877. DOI: 10.2807/ese.13.21.18877-en
26. Elduma AH, Saeed NS. Hepatitis B virus infection among staff in three hospitals in Khartoum, Sudan, 2006–07. East Mediterr Health J 2011;17(6):474–478.