

Hepatitis B Vaccination Coverage and Sharp Injuries Among Healthcare Workers in Hamadan, Iran

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Background: Hepatitis B virus (HBV) is one of the most common pathogens associated with needle stick and sharp injuries (NSSIs) among healthcare workers.

Objective: The aim of this study was to evaluate HBV vaccination coverage and NSSIs among healthcare workers in Hamadan.

Materials and Methods: This cross-sectional study was performed on teaching hospitals personnel in 2010. A two-part questionnaire was designed for data collection. All participants completed the first part, which concerned demographic data, history of HBV vaccination, and hepatitis B surface antibody (HBsAb) testing. If a history of NSSI during the preceding year was noted, the second part was completed that consisted of data about characteristics of injury including time, place, and method as well as the measures taken after the injuries.

Results: Out of 700 healthcare workers, 585 had a complete course of HBV vaccination and only 45.7% had checked the titer of HBsAb. A total of 294 participants (42%) had positive results for HBsAb titer. The rate of accidental NSSI was 24.1% during the preceding year and 48.5% of NSSIs were during blood sampling or intravenous catheter insertion.

Conclusion: Hepatitis B vaccination of all nonimmune healthcare workers and measuring HBsAb after vaccination can reduce the risk of nosocomial transmission of HBV to medical staff. Furthermore, the risk of blood-borne disease transmission can be reduced by educating medical personnel on effective methods of reducing the risk of NSSIs as well as taking appropriate measures when NSSIs occur.

Keywords: Injuries, Needle stick; Health Personnel; Infection Control; Hepatitis B Vaccines

1. Background

Healthcare workers (HCWs) are always at the risk of acquiring infection from their patients. Accidental needle stick and sharps injuries (NSSIs), which are common among HCWs, are high-risk conditions for blood-borne pathogens transmission (1). The incidence of NSSIs in the United States was reported between 14 and 839 per 1000 HCWs (2). Viral infections including hepatitis B virus (HBV), hepatitis C virus, and human immunodeficiency virus are the most common and dangerous pathogens among more than 20 NSSIs-associated blood-borne pathogens (3).

The HBV infection has a high worldwide prevalence and about 6% of HCWs are exposed to it annually (4). In developing countries NSSIs cause a high infection rate of 40% to 60% among HCWs; vaccination, however, has reduced the HBV infection rate to less than 10% in developed countries (5). Although HBV infection is a vaccine-preventable disease, the rate of immunization in high-risk groups is lower than the expected rate. On the other hand, HCWs should be informed about methods for preventing NSSIs as well as required measures in case of an accidental NSSI.

2. Objectives

Some studies in Iran indicated that the knowledge about prevention strategies in HCWs was not optimal (6) and some others showed a high rate of NSSIs; however, there are a few official report on exposure rate among Iranian HCWs (7, 8) and the incidence of NSSI and the rate of vaccination coverage in Iran have not been determined yet. Therefore, this study was designed to determine the rate of NSSIs among HCWs in an Iranian population.

3. Materials and Methods

This cross-sectional study was conducted in five teaching hospitals in Hamadan, Iran, including Farshchian, Ekbatan, Be'sat, Fatemiyeh, and Shahid-Beheshti hospitals. The study protocol was approved by the Ethics Committee of Hamadan University of Medical Sciences and all of the information remained confidential. Thus, all staff members that tended to participate in the study were enrolled. The staff were all HCWs including physicians, residents, interns, nurses, midwives, nurs-

ing students, midwifery students, laboratory and radiology staff, licensed practical nurses and nurse aids, and service workers.

Data was collected by a two-part questionnaire. All participants completed the first part that included demographic data, history of HBV vaccination, and hepatitis B surface antibody (HBsAb) testing. If a history of NSSI during the preceding year was noted, the second part was completed that consisted of data concerning characteristics of injury such as its time, place, and method as well as the measures taken after the injuries.

Data were analyzed using SPSS (version 15, SPSS Inc., Chicago, IL, USA) and a P value < 0.05 was considered statistically significant. The student's t test and Chi Square test were employed for analyzing quantitative and qualitative variables, respectively.

4. Results

Overall, 700 HCWs were included in the study. The mean age of participants was 31.9 ± 7.4 years (range, 21-54) and 68% of them were females. The mean years of work experience was 7.8 ± 6.9 years (range, 6 months to 29 years) and most of them were nurses (44.6%). Table 1 shows the characteristics of HCWs and incidence of NSSI in different job categories. The highest rates of NSSIs were seen in residents.

The course of vaccination was completed in 585 participants (83.6%). Of all the subjects, 294 (42%) had a positive results for HBsAb titer and 380 (54.3%) had not

checked the titer of HBsAb (Table 2).

The use of latex and disposable gloves during high-risk tasks was stated by 568 (81.1%) and 121 (17.3%) workers, respectively. Eleven subjects (1.6%) did not wear gloves during their tasks. Answers to the question "what would you do when you have a NSSI" were as follows: "referring to the infection control unit", "inducing bleeding by squeezing the area", and "washing the area with water and soap" in 393 (56.1%), 426 (60.9%), and 274 (39.1%) responses, respectively.

The incidence of NSSIs during the preceding year was 24.1% (169/700). The frequency of NSSI was once in 60.7% (134/169), twice in 14.8% (25/169), and thrice or more in 5.9% (10/169) of those with NSSIs (Table 3).

Majority of NSSI subjects were females with 30 to 34 years of age. The incidence of NSSIs differed significantly between the sexes (27.3% of females vs. 17.4% of males; $P = 0.004$) as well as age groups ($P = 0.009$). In addition, there was a significant difference in rate of NSSIs between the wards ($P = 0.002$); the higher rates were seen in ENT (36.8%), labor (35.8%), pediatrics (35%), and infectious disease (33.3%) wards, consecutively. However, there was no association between job and incidence of NSSI ($P = 0.1$) (Table 3).

The majority of NSSIs occurred during the morning shifts (50.3%) and venous catheter insertion was the most common activity (29%) leading to NSSI (Table 3). After needle stick injuries, only 32% of HCWs had sought medical attention and 26.6% had received hepatitis B immunoglobulin.

Table 1. Healthcare Workers Characteristic and Incidence of Needle Stick and Sharp Injuries in Different Job Categories

Job Category	No. (%)	Incidence of NSSIs ^a
Physician	29 (4.1)	4 (13.8)
Resident	46 (6.6)	14 (30.4)
Intern	49 (7)	13 (26.5)
Nurse	312 (44.6)	86 (27.6)
Nurse aid	51 (7.3)	13 (25.5)
Nursing student	54 (7.7)	12 (22.2)
Ward attendant	42 (6)	7 (16.7)
Midwife	20 (2.9)	6 (30)
Midwifery student	11 (1.6)	1 (9.1)
Laboratory staff	28 (4)	7 (25)
Radiology staff	21 (3)	-
Service worker	37 (5.3)	6 (16.2)
Total	700 (100)	169 (24.1)

^a Abbreviation: NSSIs, needle stick and sharp injuries.

Table 2. Hepatitis B Virus Vaccination and Immunity in Different Occupational Group of Healthcare Workers ^{a,b}

	HBV Vaccination			HBS Ab		
	Complete	Incomplete	None	Negative	Positive	Unchecked
Physician	25 (86.2)	2 (6.9)	2 (6.9)	-	22 (75.9)	7 (24.1)
Resident	46 (100)	-	-	2 (4.3)	23 (50)	21 (45.7)
Intern	37 (75.5)	9 (18.4)	3 (6.1)	2 (4.1)	17 (34.7)	30 (61.2)
Nurse	280 (89.7)	29 (9.3)	3 (1)	15 (4.8)	160 (51.3)	137 (43.9)
Nurse Aid	40 (78.4)	5 (9.8)	6 (11.8)	-	15 (29.4)	36 (70.6)
Nursing Student	33 (61.1)	16 (29.6)	5 (9.3)	2 (3.7)	10 (18.5)	42 (77.8)
Ward Attendant	28 (66.7)	7 (16.7)	7 (16.7)	1 (2.4)	11 (26.2)	30 (71.4)
Midwife	20 (100)	-	-	2 (10)	10 (50)	8 (40)
Midwifery Student	8 (72.7)	3 (27.3)	-	-	2 (18.2)	9 (81.8)
Laboratory Staff	20 (71.4)	8 (25)	1 (3.6)	2 (7.1)	8 (28.6)	18 (64.3)
Radiology Staff	17 (81)	3 (14.3)	1 (4.8)	-	6 (28.6)	15 (71.4)
Service Worker	31 (83.8)	4 (10.8)	2 (5.4)	-	10 (27)	27 (73)
Total	585 (83.6)	85 (12.1)	30 (4.3)	26 (3.7)	294 (42)	380 (54.3)

^a Data are presented as No. (%).^b Abbreviation: HBV, hepatitis B virus.**Table 3.** The Characteristic of Needle Stick and Sharp Injuries Among Healthcare Workers ^a

Category	Number	Incidence of NSSIs	
		Of total	Of subcategory
Sex			
Male	39	23.1	17.4
Female	130	76.9	27.3
Age Group			
<25	25	14.6	24.5
25-29	53	31.4	23.3
30-34	45	26.6	33.3
35-39	22	13	20.2
40 ≤	24	14.2	18.9
Ward			
ENT	6	3.6	31.6
Obstetrics and Labor	24	14.2	35.8
Pediatrics	21	12.4	35
Infectious Disease	7	4.1	33.3
Surgery	27	16	31.8
Operation Room	9	5.3	28.1
Urology	5	3	26.3
Emergency	18	10.7	23.1
Internal Medicine	33	19.5	22.1
CCU	3	1.8	21.4
Laboratory	5	3	16.7

ICU	6	3.6	18.2
Others	4	2.4	8.3
Frequency of NSSIs			
1	134	79.3	-
2	25	14.8	-
3	3	1.8	-
4 ≤	7	4.1	-
Incisor Vehicle			
Needle	102	60.7	-
Angiocatheter	45	26.8	-
Glass ampoule	8	4.7	-
Scalpel	2	1.2	-
Other Reasons	12	7.1	-
Task undertaken			
IV Catheter insertion	49	29	-
Blood Sampling	33	19.5	-
Injection	25	14.8	-
Recapping	23	13.6	-
Suturing	19	11.2	-
Medical Waste Disposal	11	6.5	-
Other tasks	9	5.3	-
Working Shift			
Morning	85	50.3	-
Evening	35	20.7	-
Night	49	29	-

^a Abbreviations: NSSIs, needle stick and sharp injuries; and IV, intravenous.

5. Discussion

About a quarter of HCWs at the five teaching hospitals in Hamadan, Iran, were at risk of infection with blood-borne pathogens through the NSSIs during the preceding year. This indicated that the NSSIs rate could be higher during the whole working life. Furthermore, some studies in Iran reported higher rates of NSSIs in medical personnel. Javadi et al. conducted a survey on 1350 HCWs in 11 hospitals of Isfahan Province and showed that the rate of NSSIs was 61.4% in 2003 (9). In a study of NSSI in the Fars Province in western Iran, Askarian et al. reported a rate of 49.6% among nurses (10). Several studies in different countries reported various incidences for NSSIs. In a study conducted in Uganda, 67.8% of participants in the survey had a NSSI (11); the rate was 17.9% in Oman (12) and 80.1% in India (13). Overall, the reports emphasize the high incidence of NSSIs among HCWs, which could be reduced by proper educational programs and prevention strategies.

Vaccination coverage rates vary greatly across countries and these dissimilarities might be justified by economic status or other characteristics of these countries. In a study from Uganda, only 6.2% of HCWs were vaccinated

for HBV and only 34.8% of the immunized group had completed the vaccination course (11). The authors concluded that the lack of public health facilities was the main reason for low coverage rate, which caused personnel to be vaccinated with their own costs. Another study in Poland reported that 75.7% of personnel had completed HBV vaccination course (14). In the United States, 72% of HCWs had received the primary vaccination and 68% had completed the course of vaccination (15). In a study conducted in hepatitis and STD clinic in Hamadan, only 64.5% of personnel with NSSIs had full HBV vaccination coverage (16), which was lower than the rate in our study. One reason for such discrepancy could be attributed to the fact that the aforementioned study had only examined the vaccination coverage in those with NSSIs, whereas we studied the vaccination coverage of the entire personnel. Although the population in our study had a rate of 83.6% for HBV vaccination, the high rate of unchecked HBsAb (54.3%) indicate the need for serological testing to detect unimmunized personnel.

The higher rate of NSSIs in some subgroups (sex, age, ward, etc) could be explained by higher exposure to the

high-risk activities, which indicated that these groups should be trained more for their high-risk task and prevention strategies. Considering our results and studies in the other countries, a large number of NSSIs can be prevented by developing appropriate educational programs regarding prophylactic tasks, disposal of medical wastes, and use of safe needle devices. Moreover, the reporting of such accidents as well as appropriate measures taken after them should be a goal of healthcare system. Conversely, HBV vaccination of all nonimmune HCWs and checking the HBsAb status after vaccination can reduce the risk of HBV transmission to medical staff.

Our study had some limitations that should be taken into account when interpreting the result. First, self-reports of the study participants may have an influence on the reported incidence of NSSI; a systematic reporting program to gather data from all HCWs and an active intervention based on active training and check-up can help to determine true rates of injuries as well as an active preventive approach. Second, the cross-sectional design of the study limited the conclusion for a specific causal direction. Finally, although the total sample size was appropriate to estimate the incidence in the whole population, the small sample size in some subgroup might result in an unrealistic estimation of injury incident.

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References

- Gabriel J. Reducing needlestick and sharps injuries among healthcare workers. *Nurs Stand*. 2009;**23**(22):41-4.
- Lee JM, Botteman MF, Xanthakos N, Nicklasson L. Needlestick injuries in the United States. Epidemiologic, economic, and quality of life issues. *AAOHN J*. 2005;**53**(3):117-33.
- MacCannell T, Laramie AK, Gomaa A, Perz JF. Occupational exposure of health care personnel to hepatitis B and hepatitis C: prevention and surveillance strategies. *Clin Liver Dis*. 2010;**14**(1):23-36.
- Attaullah S, Khan S, Ayaz S, Khan SN, Ali I, Naseemullah., et al. Prevalence of HBV and HBV vaccination coverage in health care workers of tertiary hospitals of Peshawar, Pakistan. *Viol J*. 2011;**8**:275.
- Hutin Y, Hauri A, Chiarello L, Catlin M, Stilwell B, Ghebrehwet T, et al. Best infection control practices for intradermal, subcutaneous, and intramuscular needle injections. *Bull World Health Organ*. 2003;**81**(7):491-500.
- Shiva F, Sanaei A, Shamshiri AR, Ghotbi F. Survey of needle-stick injuries in paediatric health personnel of 5 university hospitals in Tehran. *J Pak Med Assoc*. 2011;**61**(2):127-31.
- Azadi A, Anoosheh M, Delpisheh A. Frequency and barriers of underreported needlestick injuries amongst Iranian nurses, a questionnaire survey. *J Clin Nurs*. 2011;**20**(3-4):488-93.
- Askarian M, Shaghaghian S, Gillen M, Assadian O. Body fluid exposure in nurses of Fars province, Southern Iran. *Arch Iran Med*. 2008;**11**(5):515-21.
- Javadi AA, Mobasherizadeh S, Memarzadeh M, Mostafavizadeh K, Yazdani R, Tavakoli A. Evaluation of needle-stick injuries among health care workers in Isfahan province, Islamic Republic of Iran. *East Mediterr Health J*. 2007;**13**(1):209-10.
- Askarian M, Shaghaghian S, McLaws ML. Needlestick injuries among nurses of Fars province, Iran. *Ann Epidemiol*. 2007;**17**(12):988-92.
- Ziraba AK, Bwogi J, Namale A, Wainaina CW, Mayanja-Kizza H. 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.
- Al Awaidy S, Bawikar S, Duclos P. Safe injection practices in a primary health care setting in Oman. *East Mediterr Health J*. 2006;**12 Suppl 2**:S207-16.
- Muralidhar S, Singh PK, Jain RK, Malhotra M, Bala M. Needle stick injuries among health care workers in a tertiary care hospital of India. *Indian J Med Res*. 2010;**131**:405-10.
- Serafinska S, Smolinski P, Gladysz A. [Critical evaluation of reporting on postexposure skin damage incidents and its consequences for Polish health workers]. *Med Pr*. 2006;**57**(5):439-50.
- Gershon RR, Sherman M, Mitchell C, Vlahov D, Erwin MJ, Lears MK, et al. Prevalence and risk factors for bloodborne exposure and infection in correctional healthcare workers. *Infect Control Hosp Epidemiol*. 2007;**28**(1):24-30.
- Sabouri Ghannad MS, Majzoobi MM, Ghavimi M, Mirzaei M. Needlestick and sharp object injuries among health care workers in Hamadan Province, Iran. *J Emerg Nurs*. 2012;**38**(2):171-5.