

Seroprevalence of hepatitis B virus infection and vaccination compliance among health care workers in Fars Province, Iran

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ABSTRACT

Background: Health care workers (HCWs) are at high risk for acquisition of hepatitis B virus (HBV) infection due to occupational exposure to potentially infectious body fluids. This study was carried out to determine the prevalence of HBV markers and vaccination compliance among different categories of HCWs in Fars Province, Iran.

Patients and methods: A total of 346 HCWs working at Gerash and Evaz hospitals, were included. Serological HBV markers were detected in serum samples of HCWs by ELISA method. Statistical analysis was performed to determine the significant difference.

Results: The study population included 114 males and 232 females with their age ranged 20-59 years. Totally, 299 cases had received HBV vaccine. The overall prevalence of HBsAg, anti-HBs and anti-HBc among HCWs was 2.6%, 78.6% and 6.4%, respectively. The prevalence of HBsAg was higher in non-professional staff group (5%) but the anti-HBc rate was higher among aid-nurse group (12%). No significant difference was found for HBsAg and anti-HBc positivity between different variables including gender, age group and occupation. Significantly higher prevalence of compliance rate was observed among technician (96.8%) and nurses (88.4%) than non-professional staff (74.3%).

Conclusion: Results revealed that HCWs are at higher risk for acquiring HBV infection than general population, thus, an intense program for education, vaccination and post vaccination assessment is mandatory.

Keywords: *Health care worker, Hepatitis B, Iran, Prevalence.*
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INTRODUCTION

Health care workers (HCWs) are at increased risk of hepatitis B virus (HBV) infection worldwide (1). World Health Organization (WHO) has estimated annual global burden of 66000 cases and 261 deaths due to occupational HBV infection in HCW due to sharp injuries alone (2). Multiple factors influence the risk of HBV infection among HCWs, including prevalence of HBsAg-positivity in the general and patient populations, the

prevalence of immunity to HBV due to natural infection or immunization among HCWs, and the frequency with which HBsAg-positive exposures occur in the occupational setting. The relative contribution of these factors to HBV infection in HCWs differs between Asian and Western countries (3-6). Serologic studies conducted in low HBV prevalence countries during 1970s demonstrated that HCWs had a prevalence of HBV infection up to 10 times higher compared to the general population (7). Iran is an area of low endemicity for HBV in the Middle East (8). Several studies on HBV infection among different

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46 Hepatitis B virus markers among HCWs

populations were performed in Iran, but published studies on the HBV markers for HCWs are scanty. This study was conducted to determine the seroprevalence of HBsAg, anti-HBs and anti-HBc and vaccination compliance among different categories of HCWs in southwest Iran.

PATIENTS and METHODS

During November 2007 and June 2008, a total of 346 HCWs working at Gerash and Evaz hospitals, Fars province, Iran were included in a cross-sectional study. The participant distributions according to age, sex and occupations are listed in table 1. Four age groups and six categories of HCW according to occupation were defined. Cleaners, medical secretaries, sterilization workers and ambulance driver are categorized as non-professional staff group. Occupational and non-occupational information was obtained through a questionnaire. Two hundred and ninety nine of all cases had received a HBV vaccine. Blood samples of HCWs were collected in the sterile tubes at the working places, transferred to the Gerash HIV and Hepatitis Research Center (GHHRC), then sera were separated.

HBV serological markers including HBsAg, anti-HBs and anti-HBc were detected in sera of HCWs using commercially available standard enzyme immunoassay kits (Enzygnost, DADE BEHRING, Germany).

Samples with a result greater than or equal to cut-off value and less than or equal to cut-off value were considered positive for HBsAg and anti-HBc, respectively. Anti-HBs titer greater than or equal to 10mIU/mL was considered as a positive result for anti-HBs.

For analysis of vaccination compliance only cases were included in the study that had negative serologic reaction for HBsAg and anti-HBc markers.

All statistical analyses were achieved using SPSS for Window software(version 11.5, SPSS

Inc., USA). Chi square test was used to test the significance of difference in various groups.

Table 1. Distribution of health care workers according to age, gender and occupation

	Age group (years)				Total
	20-29	30-39	40-49	50-59	
Gender					
Male	37(32.5)	48(42.1)	20(17.5)	9(7.9)	114(100)
Female	122(52.6)	72(31)	36(15.5)	2(0.9)	232(100)
Occupation					
Physician	7(50)	6(42.9)	1(7.1)	0(0)	14(100)
Nurse	64(69.6)	23(25)	5(5.4)	0(0)	92(100)
Aid-nurse	2(8)	17(68)	6(24)	0(0)	25(100)
Midwife	7(38.9)	10(55.6)	1(5.6)	0(0)	18(100)
Technician	23(62.2)	11(29.7)	2(5.4)	1(2.7)	37(100)
Non-professional staff	56(35)	53(33.1)	41(25.6)	10(6.3)	160(100)
Total	159(46)	120(34.7)	56(16.2)	11(3.2)	346(100)

RESULTS

From November 2007 to June 2008, a total of 346 HCWs (114 males and 232 females) were investigated. Seroprevalence of HBV markers in different categories of HCWs according to gender, age and occupation is represented in table 2.

Table 2. Seroprevalence of HBV markers in health care workers according to gender, age and occupation

	HBsAg	Anti-HBs \geq 10	Anti-HBc	Total
	(mIU/mL)			
Gender				
Male	3(2.6)	80(70.2)	9(7.9)	114(100)
Female	6(2.6)	192(82.8)	13(5.6)	232(100)
Age				
20-29	7(4.4)	127(79.9)	9(5.3)	159(100)
30-39	1(0.8)	98(81.7)	8(6.7)	120(100)
40-49	1(1.8)	39(69.6)	3(5.4)	56(100)
50-59	0(0)	8(72.7)	2(18.2)	11(100)
Occupation				
Physician	0	12(85.7)	0(0)	14(100)
Nurse	1(1.1)	81(88)	4(4.3)	92(100)
Aid-nurse	0	21(84)	3(12)	25(100)
Midwife	0	17(94.4)	2(11.1)	18(100)
Technician	1(2.7)	33(89.2)	2(5.4)	37(100)
Non-professional staff	7(4.4)	108(67.5)	11(6.4)	160(100)
Total	9(2.6)	272(78.6)	22(6.4)	346(100)

The overall positive rate of HBsAg was 2.6% (9/346). The positive rate of HBsAg was the same in both genders (2.6%). Most of the HBsAg positive cases were 20-29 years old (4.4%) and HCWs who were in their fifties showed no positivity reaction for HBsAg.

With respect to occupation, the seropositive rate of HBsAg was higher in non-professional staff (4.4%). Physicians, aid-nurses and midwives were all HBs-Ag negative. There was no statistically significant difference in HBsAg-positivity among different variables including gender, age group and occupation.

The overall positive rate of anti-HBs among all categories of HCWs was 78.6%(272/346). Among 299 vaccinated HCWs, 278 had HBsAg(-)/anti-HBc(-) profile. The overall compliance rate was 82.7%(230/278) while the highest rates were found among midwives (93.8%) and technicians (93.5%). Table 3 represents compliance rates with respect to gender, age and occupation. Positivity was higher in females than in males (84.3% vs. 79%, NS). However, the majority of positive cases aged 20-29 years (87.8%) and the compliance rate was decreased by increasing age. HCWs aged 20-29 years were significantly more compliant than those aged 40-49 years ($p<0.005$). Nurses and technicians showed higher compliance rate when compared with non-professional staff ($p<0.003$).

Table 3. Compliance to HBV vaccine and anti-HBs status according to gender, age and occupation

	Positive anti-HBs	Odd's ratio (95% CI)	p-value
Gender			
Male	64(79)	1	-
Female	166(84.3)	1.4(0.7-2.7)	0.292
Age			
20-29	108(87.8)	1	-
30-39	82(83.7)	0.7(0.3-1.5)	0.380
40-49	35(70)	0.3(0.1-0.7)	0.005
50-59	5(71.4)	0.3(0.6-1.9)	0.228
Occupation			
Physician	12(85.7)	1	-
Nurse	76(88.4)	1.3(0.2-6.5)	0.528
Aid-nurse	17(81)	0.7(0.1-4.5)	0.544
Midwife	15(93.8)	2.5(0.2-30.9)	0.448
Technician	29(93.5)	2.4(0.3-19.2)	0.336
Non-professional staff	81(73.6)	0.5(0.9-2.2)	0.284

The overall seroprevalence of anti-HBc among HCWs was 6.4%(22/346) with the highest rate in aid-nurse group (12%). The positivity was 5.6% and 7.9% in males and females, respectively. The majority of positive cases aged 50-59 years (18.2%) while subjects aged 20-29 years demonstrated lower positivity (5.3%). No statistically significant difference in anti-HBc positivity was found with respect to gender, age and occupation. Results of HBsAg, anti-HBs and anti-HBc among vaccinated and non-vaccinated HCWs are shown in table 4. Among 299 vaccinated HCWs, 16(5.4%) were anti-HBc positive while 12.8%(6/47) of unvaccinated HCWs had positive reaction for anti-HBc. The positive rate of HBsAg among vaccinated and unvaccinated HCWs was 2%(6/299) and 6.4%(3/47), respectively. Furthermore, the seroprevalence of HBV markers in HCWs according to vaccination status and length of employment is shown in table 5. Totally, 299(86.4%) participants had received HBV vaccine, of whom 2(0.6%), 22(7.2%) and 276 (92.2%) were vaccinated once, twice, and thrice, respectively.

Table 5. Seroprevalence of HBV markers in health care workers according to vaccination status and employment duration (years)

	Anti-HBs \geq 10 (mIU/mL)	Anti-HBc	HBsAg
Vaccination			
Vaccinated	251(299)	16(72.7%)	6(66.7%)
Unvaccinated	21(47)	6(27.3%)	3(33.3%)
Total	272(346)	22(100%)	9(100%)
Dose of vaccine			
1 st	1(2)	0	0
2 nd	18(22)	1(4.5%)	1(4.5%)
3 rd	232(276)	16(5.8%)	5(1.8%)
Unvaccinated	21(46)	5(10.8%)	3(5.2%)
Total	272(346)	17	9
Length of employment (years)			
\leq 5	127(163)	6(3.7%)	5(3%)
6-10	73(87)	10(11.5%)	2(2.3%)
11-15	29(37)	2(5.4%)	0 (0)
16-20	40(49)	4(8.1%)	2(4%)
\geq 20	3(10)	0(0)	0(0)
Total	272(346)	22	9

Table 4. Results of HBsAg, anti-HBs and anti-HBc among vaccinated and non-vaccinated health care workers

	Anti-HBc(+)				Anti-HBc(-)				Total
	HBsAg(+)/ anti-HBs(+)	HBsAg(+)/ anti-HBs(-)	HBsAg(-)/ anti-HBs(+)	HBsAg(-)/ anti-HBs(-)	HBsAg(+)/ anti-HBs(+)	HBsAg(+)/ anti-HBs(-)	HBsAg(-)/ anti-HBs(+)	HBsAg(-)/ anti-HBs(-)	
Vaccinated	1(50)	0	14(77.8)	1(100)	5(83.3)	0	230(93.5)	48(66.7)	299(86.4)
Unvaccinated	1(50)	1(100)	4(22.2)	0	1(16.7)	0	16(6.5)	24(33.3)	47(13.6)
Total	2(100)	1(100)	18(100)	1(100)	6(100)	0	246(100)	72(100)	346(100)

HCWs were assigned in 5 groups according to the employment duration: ≤ 5 , 6-10, 11-15, 16-20 and ≥ 20 years. The compliance rate was decreased by increasing the employment duration ($p < 0.003$). There was no statistical significant difference between these groups with respect to anti-HBc ($p < 0.146$) and HBsAg ($p < 0.763$) status.

DISCUSSION

The prevalence of HBV infection among the general population in the Middle East differed from one country to another ranging between 2-7% (9). It had been estimated that in Iran over 35% of the population have been exposed to HBV and about 3% are chronic carriers (10). However, some studies showed that the prevalence of HBsAg carriers is less than that had been estimated; for example a study in Hamadan province indicated that the prevalence is 2.4% (11), and other studies showed that the prevalence of HBsAg ranged from 1.7% to over 5% in different provinces (9). There are few documented studies on HBV infection among HCWs in Iran. Data available from a study performed on the health workers of the National Iranian Oil Company (NIOC) showed that 23% had evidence of exposure to HBV and 1.8% had a positive HBsAg with the highest rate in the laboratory personnel (12).

This study showed that the prevalence of HBsAg positivity was 2.9% with the highest rate in non-professional staff group. This figure is higher among HCW when compared to blood donors in a study previously performed in Fars province (13). Most of the HBsAg positive cases had 20-29 years old (4.4%). This high seropositivity in younger

adults may be in part explained by few cases studied in the older age groups, nevertheless, chance of acquiring infection is higher since they are not well-experienced in their job. The seropositivity was similar in both genders (2.6%). This finding is in contrast with Hovig et al (14) and Elavia and Banker (15), but in agreement with Shin et al study (16).

Furthermore, non-professional staffs are at increased risk for acquisition of HBV infection (4.4%) than other HCWs. It seems as if lack of awareness could be the reason. Similarly, Kumar et al did not find statistically significant difference between different occupational categories (17).

An overall anti-HBs rate of 78.6% was reported in our setting. Similarly, Shin et al reported a prevalence of 76.9% for anti-HBs in Korea (16). Of 299 vaccinated HCWs, 278 had negative serologic reaction for HBsAg and anti-HBc and the compliance rate was 82.7%. A study carried out by Saberifiroozi et al in Shiraz showed a compliance rate of 83.9% (18). The obtained compliance rate in our study varied according to the occupation (73.6%-93.8%). Technicians and nurses had significantly higher compliance rate than non-professional staff. Results revealed that females may respond better to HBV vaccine than males (84.3% vs. 79%), but it was not statistically significant. When age is considered, the best compliance rate was observed among those aged 20-29 years (87.8%). The compliance rate was decreased by increasing age, a fact that was similarly reported by Krugman and Stevens (19).

The overall anti-HBc positivity rate was 6.4%, however, the rate of anti-HBc-alone positive cases was 0.28%. This study showed that the overall anti-

HBc rate was lower than the results observed in other societies (16,20). In Ciorlia et al study a frequency of 9.4% was reported for anti-HBc positive cases among HCWs in Brazil (21). The lower frequency of anti-HBc rate obtained in our study when compared to other studies, may be explained by the lower prevalence of HBV markers in Fars province (9).

The compliance rate of HBV vaccine was decreased by increasing the employment duration. Other studies showed that 10% of patients who respond to vaccination may lose anti-HBs after 5 years and 50% after 10 years (22). In a study conducted in Babol, northern Iran, 68.6% of vaccinated subjects had anti-HBsAb titer of $>10\text{mIU/mL}$ after 3.9 ± 1.98 years, and 31.4% of health care personnel with a vaccination history had low titers of antibody. The authors suggested controlling the anti-HBsAb level every 5–7 years and reassessment for revaccination, if needed (23).

Moreover, among vaccinated subjects those who received three doses of vaccine were significantly more compliant than others. Of 276 HCWs who completed the three-dose series of the hepatitis B vaccine, 232 (84%) became anti-HBs positive while 16% were negative. It is unclear whether these people are non-responders, have lost immunity, or retained anamnestic potential that need reassessment for revaccination. Some authors have argued against routine reassessment of subjects with low antibody titers, since the anamnestic response to viral particles and cellular immunity can prevent HBV infection (19).

Totally, 6 vaccinated HCWs were HBsAg positive. This indicates infection before vaccination or infection after unsuccessfully vaccination. Indeed, subjects who have been recently exposed to HBV before receiving the vaccine may go on to develop the disease in spite of immunization. HCWs who have already been infected with HBV will receive no benefit from vaccination.

In conclusion, the frequency of HBV infection in HCWs was lower in our study, however, they

are at increased risk for acquiring HBV infection due to occupational exposure to potentially infectious body fluids, hence, suitable education, vaccination and post vaccination assessment must be implemented.

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50 Hepatitis B virus markers among HCWs

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