



Hepatitis B Virus Infection among Resident Physicians and Nurses in Tertiary Hospitals in Sana'a City, Yemen

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Abstract

Health care workers (HCWs) represent one of the largest groups at risk for contracting hepatitis B virus (HBV) worldwide. This is due to the accidental occupational exposure to potentially infectious blood and other body fluids in the workplace. This cross-sectional study aimed to determine the rate of exposure to HBV infection and to identify potential occupational and non-occupational risk factors among doctors and nurses residing in tertiary hospitals in Sana'a city. This study included 169 physicians and nurses of whom 121 were physicians and 48 were nurses. Blood samples were collected from each one, then tested for serological markers of HBV infections. Also, data was collected in a pre-designed questionnaire including; demographic data, the potential occupational and non-occupational risk factors that contribute to HBV transmission. The results of the study showed that seropositive to hepatitis B surface antigen (HBsAg) among physicians and nurses was 5.3%, while the rate of exposure to hepatitis B virus infection (HBcAb) was 17.8%. The rate of exposure to HBV infection (anti-HBc + HBsAg) was higher in females (33.3%) than in males (21.4%).

The older age group was more susceptible to hepatitis B virus infection than the younger age group ($P < 0.05$). Only 11 participants (6.5%) said they attended training courses in biosafety. Just over 45.6% indicated that they had needle injuries and 40% of sharp tool injuries while working; 61 (26%) indicated they always followed bio-safety precautions, and 74 (43.8%) said they always wore gloves while their work. Only 32 (18.9%) of the participants received a full hepatitis B vaccination doses. Also, there was a statistically significant relationship between cut injuries and HBV infections ($P = 0.02$). In addition, the highest incidence of hepatitis B virus infection was 31.3% among nurses, while physicians had 19.8%. In conclusion, there was a high prevalence of hepatitis B virus among doctors and nurses. Unfortunately, most workers have not received training in biosafety, and fewer than half of the workers consistently use preventive measures such as wearing gloves during their work or taking vaccination. There is a need to make health care workers vaccination against hepatitis B infection a consistent policy and to ensure full and consistent compliance with standard safety procedures.

Keywords: HBV, resident, physicians, nurses, Yemen

Introduction

The hepatitis B virus (HBV) is the most dangerous type of viral hepatitis that causes a potentially life-threatening liver infection and leads to chronic liver disease and liver cancer [1]. HBV infection is a global public health problem and the tenth leading cause of death globally [2]. According to some estimates, nearly 2 billion

people are infected with the hepatitis B virus worldwide, resulting in 400 million people worldwide infected with this chronic disease. Besides, more than a million deaths due to liver disease occur in the end stage, such as cirrhosis and liver cancer (HCC) every year [3]. Hepatitis virus endemicity was estimated to be high in Yemen,

wherever positive HBsAg prevalence among adults was between 8% to 20%, among infants, 4.1%, and up to 50% of the population had serological evidence of hepatitis B virus infection in old reports [4-7]. On the other hand, recent studies have indicated a decrease in the rate of HBsAg as it ranges between 0.74-2% among the general population and blood donors as well as children [8-10]. When an occupational HBV was considered, the prevalence of hepatitis B virus among 388 public health center cleaners (PHCCs) was 8.2% [11].

HBV is carried in blood and other body fluids. Occupational exposure to blood and body fluids in hospitals leaves health care workers (HCWs) at risk of infection with blood-borne viruses including hepatitis B [8,12]. In 1992, the World Health Organization (WHO) recognized hepatitis B virus infection as an occupational disease for health sector workers [11]. Hospital residents, such as doctors and nurses, are at risk of infection with blood borne pathogens. This can be by a numerous procedure involving the use of sharp instruments on patients and injuries while learning new technical skill sets [11]. According to data provided by the World Health Organization, there are approximately 36 million health care workers worldwide, of whom about 3 million a year receive instrument injuries, and resulting to 2 million individuals infected with HBV, due to sharp injuries alone [13]. This cross-sectional study aimed to determine the rate of exposure to HBV infection and to identify potential occupational and non-occupational risk factors among doctors and nurses residing in tertiary hospitals in Sana'a city.

Subjects and Methods

This study included 169 randomly selected resident physician and nurses, of whom 121 were males and 48 were females and their age ranged from ≥ 22 to ≥ 38 years old with a mean age of 30 years. This study was conducted for a period of four months, starting in March 2018 and ending in June 2018 in Sana'a city. This study was performed at 3 tertiary hospitals in Sana'a city (Al-Jomhory, Al-Thorah, Al-Kuwait teaching hospitals). A consent form was done for each physicians and nurses in this study before withdrawing the blood specimens and the personal, occupational, and risk factors data were filled in a predesigned questionnaire.

About 4-5ml of venous blood was collected from each physicians and nurses in tubes containing separating gel and left to clot. Then all clotted samples were centrifuged at 3500 xg for 10 minutes. After that sera were divided in two labeled polypropylene screw – cap tubes and stored at -20 °C until tested for HBV markers. HBV markers were determined by using automatic sandwich electrochemiluminescence immunoassay (ECLIA) which intended for the use on the Elecsys 2010 analyzers machine, according to the manufacture information provided in the commercial kit manufactured by Rosh diagnostic GmbH, Mannheim.

Statistical Analysis

Personal data and risk factors data were obtained from each subject and recorded in a pre-designed questionnaire, then the data were statistically analyzed by software version Epi Info version 6, CDC, Atlanta, USA. From two-by-two tables, the odds ratios were calculated and the value of P value was determined using the uncorrected chi square test. Fisher's exact test was used for expected small cell sizes with a two-tailed probability value.

Results

Table 1 shows the demographic and occupational characteristics of the participants in the hepatitis B epidemiological survey, most of the individuals were physicians (121) and only 48 of the individuals tested were nurses. The number of males was 145 (85.8%) and 24 females (14.2%). Table 2 represents the prevalence and interpretation of serological markers of HBV, Susceptible HCWs in which they were negative for all markers counted 55%, immune after infection in which they are positive for anti-HB core and anti-HB surface antigen counted 17.8%, while immune after vaccination HCWs were 20.1% only in which anti-HBsAg were only positive. Current infections presented in 5.3% of total tested HCWs, while 1.8% was indeterminate. Table 3 shows the adjusted and odds ratio (risk) for contracting hepatitis B virus in various occupations, gender, and duration of work, when we considered positive against HBC + HBS-Ag (23.1%) as signs of contracting for hepatitis B virus, there was a high incidence of HBV infection among nurses (31.3%) with an OR value of 1.8, compared to 19.8% for physicians but this result was not statistically significant.

Table 1: Demographic and professional characteristics of the HBV survey participants, in tertiary hospitals, Sana'a city, Yemen.

Characteristics	Physicians		Nurses		Total	
	Number	%	Number	%	Number	%
Gender						
Male	110	90.9	35	72	145	85.8
Female	11	9.1	13	27.1	24	14.2
Age groups						
<22 years	18	14.9	12	25	30	17.8
23-27 years	21	17.4	9	18.8	30	17.8

28-32 years	27	22.3	10	20.8	37	21.9
33-37 years	21	17.4	11	22.9	32	18.9
≥38 years	34	28	6	12.5	40	23.7
Total	121	71.6	48	28.4	169	100

Table 2: Interpretation of serological markers of HBV among physicians and nurses in tertiary hospitals, Sana'a city, Yemen.

Serological markers			Interpretation	Number	%
HBs Ag	Anti-HBs	Anti-HBC			
Negative	Negative	Negative	Susceptible	93	55
Negative	Positive	Positive	Immune after infection (previous infection)	30	17.8
Negative	Positive	Negative	Immune after vaccination	34	20.1
Positive	Negative	Positive	Current infection	9	5.3
Negative	Negative	Positive	Indeterminate four possible	3	1.8
1-Resolving infection (window phase) 2-Remote resolved infection with low anti-HBs 3-Chronic infection with low level of HBsAg 4-False positive anti-HBC hence susceptible					

Table 3: The prevalent rate and odds ratio (risks) of contracting HBV for different occupations, gender, and duration of the work among physicians and nurses in tertiary hospitals, Sana'a city, Yemen.

Factors	Infection Anti-HBC+ HBS-Ag n=39 (23.1%) N (%)	Odds ratio	CI 95%	χ^2	p
Physicians n=121	24 (19.8)	0.54	0.2-1.15	2.5	0.11
Nurses n=48	15 (31.3)	1.8	0.86-3.9	2.5	0.11
Gender					
Male n=145	31 (21.4)	0.54	0.2-1.4	1.7	0.19
Female n=24	8 (33.3)	1.8	0.7-4.6	1.67	0.19
Duration of the practice					
>5 years n= 25 (14.8%)	3 (12)	Reference			
5-10 years n=78 (46.2%)	16 (20.5)	1.9	0.5-7.1	0.9	0.33
>10years n= 66 (39.1%)	20 (30.3)	3.2	1.0-11.8	3.5	0.05

χ^2 Chi-square ≥ 3.84 (significant)

p Probability value < 0.05 (significant)

There was a higher rate of infection with female (33.3%) with an OR value of 1.8, compared to 21.4% for males but this outcome was not statistically significant. When we considered the duration of practice, there was a higher rate of contracting HBV for >10 years period (30.3%) with significant OR equal to 3.2 times, CI=1.0-11.8 times, comparing with >5 years period. Table 4 shows the occupational possible risk factors for HBV, There was a high rate of needle stick injuries (45.6%) and cuts (40.8%) among physicians and nurses. There was a higher rate of contracting HBV from occupational cuts (31.9%) with significant OR equal to 2.3 times, CI=1.2 – 4.7 times with $X^2=5.1$ and $P=0.02$. There was a higher rate of contracting HBV from occupational needle

stick injuries (27.3%) with non- significant OR equal to 2.5 times ($P=0.23$). Only 11 participants (6.5%) said they attended training courses in biosafety. Just over 45.6% indicated they had injuries and 40% of sharp tool injuries while working; 61 (26%) indicated that they always followed biosafety precautions, and 74 (43.8%) said they always wore gloves while working. Only 32 (18.9%) of the participants received a full hepatitis B vaccination dose. Table 5 shows the general risk factors for hepatitis B virus infection, and the prevalence of hepatitis B virus among individuals with a history of blood transfusion (26.3%), (OR = 1.2, $p = 0.7$). When cupping was considered as a risk factor, the prevalence of hepatitis B virus was 33.3%, with the risk association factor for hepatitis B contracting was equal to 1.7 and this result was not significant ($p = 0.67$). The prevalence rate among individuals with a history of traveling

abroad was 23.9% with an OR = 1.13 (p = 0.74).

Table 4: Occupational possible risk factors for HBV among physicians and nurses in tertiary hospitals, Sana'a city, Yemen with previous and current HBV infection

Possible risk factors	Exposure N (%)	Infection n=39 (23.1%) N (%)	Odds ratio	CI 95%	χ^2	p
Needle stick injuries during works	77 (45.6)	21 (27.3)	1.5	0.8-32	1.4	0.23
Cuts injuries during works	69 (40.8)	22 (31.9)	2.3	1.2-4.7	5.1	0.02
Attended training courses in biosafety	11 (6.5)	2 (18.2)	0.7	0.15-3.5	0.1	0.69
Always followed the bio-safety precautions,	44 (26)	8 (18.2)	0.6	0.2-1.6	0.8	0.37
Always wore gloves during their work	74 (43.8)	9 (12.2)	0.28	0.12-0.6	9.8	0.001
Participants had received						
The full vaccination dose for hepatitis B	32 (18.9)	2 (6.2)	0.18	0.04-0.79	6.2	0.01
One or 2 doses for hepatitis B vaccine	83 (49.1)	6 (7.2)	0.12	0.04-0.3	23	<0.001
Non vaccinated	86 (50.9)	28 (32.6)	3.1	1.1-6.8	8.9	0.002

χ^2 Chi-square ≥ 3.84 (significant)

p Probability value < 0.05 (significant)

Table 5: General risk factors of contacting HBV among physicians and nurses in tertiary hospitals, Sana'a city, Yemen, with previous and current HBV infection.

	Exposure N (%)	Infection n=39 N (%)	Odds ratio	CI 95%	χ^2	p
Blood transfusion	19 (11.2%)	5 (26.3)	1.2	0.4-3.6	0.12	0.7
Cupping	3 (1.8%)	1(33.3)	1.7	0.14-19	0.18	0.67
Travel abroad	109 (64.5%)	26 (23.9)	1.13	0.5-2.4	0.104	0.74

χ^2 Chi-square ≥ 3.84 (significant)

p Probability value < 0.05 (significant)

Discussion

The crude rate of HBs Ag that indicates the current infection with the hepatitis B virus among our physicians and nurses is 5.3% (Table 2). This rate is similar to the rate of the general population in various regions in Yemen, including the city of Sana'a before 2004 [4-6]. However, our rate is five times higher than the rate that was recently reported in the general population in different regions of Yemen including adults and children, which ranges between 0.7-2% among the general population [10,14,15]. This rate is similar to the rate for dental clinics in the city of Sana'a, where the current serological prevalence of hepatitis B virus infection was 6.1% [16]. The high rate of hepatitis B among HCWs in our study is similar to the rate mentioned in previous epidemiological studies among HCWs and is higher than the rate in the general population, and this finding confirms that hepatitis B is an important occupational hazard for health care workers [17,18]. In some studies, it has been shown that HCWs have up to four times the risk of developing hepatitis B virus [19]. As the main risk factor for infection with hepatitis B virus for HCWs is direct contact with infectious

substances, especially blood infected with HBV or via a needle stick injury with body fluids contaminated with hepatitis B virus as described by Abbas et al. [16] In Yemen and Pellissier et al. [20] In Nigeria.

In particular, recapping of hollow-bore needles appears to increase the risk of needle stick injuries [21]. Other studies have reported a lack of awareness of HBV among HCWs; consequently, proper precautions (e.g., use of disposable gloves) against blood-borne infections are lacking in these workers [1]. This observation is consistent with other studies demonstrating that untrained individuals are more likely to be exposed to HBV infection [22]. The prevalence of current HBV infection among female health care workers in our study was 7.8%; prevalence of life time exposure to hepatitis B virus was 33.3%; higher than that of males as the current hepatitis B infection was 4.2%; the prevalence of a lifetime exposure was 21.4%. Also the associated odds ratio HBV infection in females was 1.8 times, compared to 0.54 for males (Table 3). This result differs from the common pattern of HBV among HCWs in most reports where the rate of HBV is almost the same in both sexes, [17,23] while this result is similar to that reported by Abbas et al. [16] in Yemen, where the infection rate is higher among female HCW than male HCWs. This result might be explained by that

female HCWs exposed more than male HCWs to the risk factors of contracting HBV [23,18].

The results of our study indicate that the prevalence of HBV depends on the period of practice in the profession, where rates increase with increasing duration of practice, for example the rate of antibodies to HBs + HBs Ag for > 5 years was 12% and this percentage increased for a period of 10 years to 33.3%, with significant associated OR equal to 3.2 times ($p=0.05$) (Table 3). This result is similar to studies that covered wider range of duration of practices in several risk HCW groups including physicians, nurses and dentists which indicated that the prevalence of HBV is duration practice dependent, in which it was increased with increasing duration of practice HCWs occupation age [16,17,21,23]. This relation could be explained by various reasons. One explanation could be that there is a more or less constant risk of exposure during life time and therefore the Hepatitis B prevalence increases with time of exposure. We cannot rule out, that the risk of transmission might have changed over time due to increased awareness and precautions like wearing of gloves and use of safety needles. On the other hand the finding, that long occupational exposure in healthcare services increases the risk of acquiring HBV infection, is consistent with other studies [17,23].

The risk of acquiring HBV from a needle stick injury ranges from 1% to 6% (source patient HBsAg-positive, HBeAg-negative) to 22% to 40% (source patient HBsAg-positive, HBeAg-positive) [24]. The risk of non-percutaneous exposure may account for a significant proportion of HBV transmission in the healthcare setting. Hepatitis B virus can survive in dried blood for up to a week and thus may be transmitted via discarded needles or fomites, even days after initial contamination. Indeed, many healthcare workers infected with HBV cannot recall an overt needle stick injury, but can remember caring for a patient with hepatitis B [25]. There was a significant risk of infection with hepatitis B virus in our HCWs with history of recent accident cut during practices where the OR was 2.3 times and this outcome was important where $p = 0.02$ (Table 4). This finding shows that our medical professionals may be more likely to get hepatitis B infection in hospitals because they are learning to do procedures and may be less cautious than other health workers in other countries. They are also less likely to practice universal precautions and are more likely to sustain needle stick injuries due to inexperience.

The present study showed that Medical workers (physicians and nurses) of face a high risk of blood-borne infections through blood exposures incidents. The prevalence rate needle stick was 45.6%. In a study conducted in Australia, an average of 3.0 percutaneous exposures (PCE) was reported among physicians annually [24]. Difference in exposure rates among different studies may be due to different subjects (job categories), sampling

methodologies. Medical workers in Yemen represent the most staff and less experienced, and hence longer working hours and greater probability of blood exposure. A study was conducted among Australian medical workers in whom 13.8% had suffered a total of 41 needle stick and sharps injuries (NSI) incidents [24]. In 2003 a study was conducted in Missouri, USA, in which 43 out of 224 HCWs (19.2 %) reported needle stick injuries [26]. Needle stick injuries during internship were reported by 61.9% (438/708) of Taiwanese nurses [27]. In the above-mentioned studies, it seems that in the more developed countries, the number of blood-exposure accidents tends to be lower. The overall socio-economic status and knowledge, and adoption of necessary precautions, and safety guidelines have led to lower exposure rates.

Presently in Yemen, efforts aimed at controlling hepatitis B viral infection remain feeble. There are no policies at both the National and Institutional levels on vaccination of high risk groups like health care workers and medical students. The present study was carried out also to determine the hepatitis B vaccination rate among medical workers in hospitals who could readily come in contact with infected body fluids from patients and hospital equipment during their clinical workers. This will generate information required to advocate for pre-vaccination policies for all high risk groups. Also, immunization against hepatitis B viral infection has assumed a primary role in the control of hepatitis B infection. Hepatitis B vaccine has been found to effectively reduce the prevalence of HBV infection [8,10]. Several studies [8,9,18] demonstrated that introduction of compulsory HBV vaccination contributes in decreasing HBV incidence rates. After a standard 3-dose vaccination regime at 0, 1, and 6 months, the rate of response on the basis of an anti-HBsAg titer of ≥ 10 mIU/mL is 90%–95% [18,28,29]. Unfortunately, a significant proportion of health care workers including physicians and nurses do not receive HBV immunization, and remain susceptible to HBV infection [28]. Vaccination coverage of the medical workers in the present work was 49.1% (one or more doses) against HBV and only 20.1% of the total were immune after vaccination (Table 4). Among Taiwanese nurses, vaccination against hepatitis B virus (HBV) was lacking in 47.6% [27]. However, the effectiveness of the vaccination is an important factor; also the completed doses should be strictly followed. In our study we found that the lowest vaccination rate (25%) (Table 4) was among the nurses while vaccination rate among physicians was higher (58.7%).

Also the study findings showed that 6.2% of all vaccinated individuals had full vaccine doses were regarded as infected with HBV infection (HBsAg+Anti-HBc positive) (Table 4). Different findings were reported in Iran among vaccinated adults, where a high protective anti-HBs response rate was found among vaccinated adults (97.4%) [29]. This difference in findings could be attributed to a different response in the primary course of vaccination, different

age groups, or to the different degrees of exposure to natural boosters and nutritional status and socioeconomic factors, race factors, or the type of vaccines used [30]. In this study, HB surface antigen was obtained among the whole studied HCWs (vaccinated and non-vaccinated), but due to the lack of serological data, either before or after vaccination, it was impossible to conclude whether these HCWs were already infected at the time of vaccination or infected subsequently. In the present study it was found that the frequency of HBsAg+anti-HBc positivity among the whole HCWs were 23.1% (Table 2), which was lower among full dose vaccinated (6.2%) when compared with the rate of the non-vaccinated HCWs (32.6%) (Table 4). This result indicate absent of HBV vaccine is risk factor for contracting HBV infection and vaccination for HBV is protective measures against HBV infection as described by most previous reports [9,10,18,31].

Also one of our aim was to determine the non-occupational risk factors of contracting hepatitis B virus among our HCWs. To achieve this aim, odds ratio of contracting HBV infection, and its confidence interval was calculated, and their significant also was determined by X2 and p value (Table 5). There was no significant association between HBV contract with history of blood transfusion, cupping and/or travel abroad, and this different with findings among different population groups in Yemen by Al-Shamahy et al. [4], and Scot et al. [6] that prior factors were significant risk factor for hepatitis virus infections. Our results were also different from those conducted in Syria, where the previous factors were the risk factors for hepatitis B virus infection among the general population and risk groups in Syria [32].

Conclusion

In conclusion high prevalence rates of HBV occurred among physicians and nurses. Unfortunately; most of the workers did not take training on biosafety, and less than half of the workers use protective measures consistently as always wore gloves during their work or vaccination. There is needed to make vaccination of health care workers against HBV infection a firm policy and ensure complete and consistent adherence to work standard safety measures. Also further research is needed to clarify the results of the current study.

Author's Contribution

This research work is part of a research work under the supervision of Hassan Al-Shamahy. The field, and laboratory works of the research was done by the corresponding author, and the forth author. The first, second, and third authors supervised the work and edited the manuscript.

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Conflict of Interest

"There is no conflict of interest related to this work."

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