HEPATITIS B VIRUS SEROPREVALENCE AND RISK ASSESSMENT AMONG PERSONNEL OF A GOVERNMENTAL HOSPITAL IN BANGKOK

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Abstract. At present, the risk for acquiring hepatitis B virus (HBV) among hospital personnel is high. A cross-sectional analytic study of 380 hospital personnel was conducted in a governmental hospital in Bangkok to investigate HBV sero-prevalence and to assess risk factors in order to develop the risk assessment form for screening the occupational risk of HBV among this group. The studied personnel who had no histories of HBV vaccination and jaundice before working in the hospital were included by voluntary participation. All studied personnel were interviewed by using a structured questionnaire consisted of risk exposure factors and some medical histories. Blood specimens were collected for determining HBV sero-markers (HBsAg, Anti-HBs, and Anti-HBc) by an enzyme immunoassay. The risk factors were analyzed by using Odds ratio (OR), χ^2 -test, and multiple logistic regression. The results revealed that 48.68% were positive for any HBV markers. The HBsAg positive rate was 3.42%, anti-HBs ± anti-HBc was 43.16 and 2.11% were positive only anti-HBc. The significant risk factors from univariate analysis were: age over 30 years (OR=3.15, p<0.0001), marital status (OR=2.19, p=0.0002), working in risk ward (OR=2.89, p=0.0274), duration of working over 5 years, (OR=2.81, p<0.0001), a history of accident from working (OR=1.58, p=0.0354), and a history of needle stick (OR=1.83, p=0.0064). After multivariate analysis, the significant risk factors included age over 30 years (OR=2.99, p<0.0001), sex: male (OR=3.05, p=0.0020), working in risk ward (OR=2.81, p=0.0337), and a history of needle stick (OR=2.16, p=0.0030). The risk assessment form was developed by using risk scores. The validity was calculated by the Receiving Operating Curve. The sensitivity of this form was approximately 50% and the specificity was 80% when the cut-off score at risk ≥ 5 was used.

INTRODUCTION

Hepatitis B virus (HBV) infection is one of important infectious diseases attacking the liver. Although most infected individuals will develop immunity after infection, 6-10% will develop asymptomatic chronic carriers who are at risk for developing chronic active hepatitis, cirrhosis, and primary hepatocellular carcinoma (Hadler and Margolid, 1991). The virus resides primarily in a reservoir of chronic asymptomatic carriers estimated at over 350 million persons worldwide (World Health Organization, 1996). A prospective study in Taiwan showed that the relative risk of primary liver cancer for a HBV carrier compared to non-carrier was 223 (Beasley *et al*, 1981). In endemic areas including East Asia and Southeast Asia, the transmission of HBV from carrier mothers to their infants has been considered the most important route for HBV infection (Sobeslavsky, 1980; Gust, 1996). While the horizontal transmission including parenteral transmission, sexual contact and close contact with the carrier has been important as well as the mother-to-child transmission in the low and intermediate endemicity (Fay *et al*, 1985). Previous studies in Thailand showed that HBsAg carrier rate was 5-10% (Pramoolsinsap *et al*, 1986; Suwanggool *et al*, 1988). Since the beginning of HBV vaccination among newborn in the year of 1992 was established, the carrier rate has decreased to be 4.30-4.61% during the years 1995-1999 (Khowean *et al*, 1998;

Luksamijarulkul *et al*, 1995). At present, Thailand is an intermediate endemicity of HBV infection. In intermediate and low endemicity of HBV carrier rate, the risk for acquiring HBV among hospital personnel is higher than the risk for general population (Kane *et al*, 1993; Pruss *et al*, 1999). In Italy, the incidence of HBV infection among hospital personnel was 3.5 higher than that among general population (Stroffini *et al*, 1994). This study attempts to investigate HBV seroprevalence and to assess HBV risk factors among hospital personnel in order to develop the risk assessment form for screening the occupational risk of HBV among hospital personnel. It is valuable for preventing HBV infection among this group.

MATERIALS AND METHODS

Study design and population

The study design was a cross-sectional analytic study conducted during October 1997 to March 1998, in voluntary participation of hospital personnel who had no HBV vaccination and no history of illness of jaundice before working in Lerdsin Hospital, a large governmental hospital in Bangkok.

Sample size and study methods

The sample size was calculated by the formula: $n = Z_{\alpha}^2 PQN/Z_{\alpha}^2 PQ+d^2N$. With: N=1,460 hospital personnel, P = proportion of HBV infection rate in health personnel from the previous study = 0.55, Q = 1-P = 0.45, $Z_{\alpha} = 1.96$ at $\alpha = 0.05$, d = 0.05; the calculated sample size was 302.

The 380 studied hospital personnel who had no HBV vaccination and no history of illness of jaundice before working in the hospital were selected by voluntary participation from 1,460 hospital personnel. All studied personnel were interviewed by a structured questionnaire which was consisted of 3 parts including sociodemographic characteristics, risk exposure factors, and some medical histories. Blood specimens from 380 studied personnel were collected for detecting HBV seromarkers including HBsAg, anti-HBs, and anti-HBc by an enzyme immunoassay (EIA) of which the sensitivity and specificity were 100% and 99.83%, respectively.

Data analysis

From the laboratory results, studied personnel were divided into 2 groups; the first group was positive for any HBV seromarkers (HBV infected personnel) and the second group was negative for all HBV seromarkers (HBV non-infected personnel). The information from interviews between 2 groups were analyzed to search risk factors for HBV infection among studied hospital personnel by using Odds ratio (OR), 95% confidence interval of OR, chi-square test and multiple logistic regression analysis with SPSS for WINDOW version 6.0. A p-value less than 0.05 was considered to indicate statistic significance.

RESULTS

General characteristics

Among 380 studied hospital personnel, 38.95% were 18-30 years of age, 28.68% were 31-40 years and 20.26% were 41-50 years. The mean age was 35.61±10.75 years. About 88% were female. Almost 48% of studied personnel were married. A half of them have worked related to handling infectious wastes or exposing to patients' blood and secretion, this group included physicians, nurses, nurse aids, and laboratory personnel.

HBV seromarkers

It was found that 185 (48.68%) were positive for any HBV seromarkers. The HBsAg positive rate was 3.42%, anti-HBs ± anti-HBc was 43.16%, and 2.11% were positive only anti-HBc (Table 1). The age group of 31-40 years showed the highest prevalence of any HBV seromarkers (60.55%), and HBsAg positive (4.59%). The male personnel were relatively higher positive rates of any HBV seromarkers, HBsAg and anti-HBs ± anti-HBc

Table 1
HBV seromarker prevalence among studied hospital personnel divided by age group, sex, and type of hospital personnel.

Variables	No. tested	No. (%) of positive for seromarkers			
		HBsAg±Anti-HBc	Anti-HBs±Anti-HBc	Anti-HBc	Any HBV markers
Age (years)					
≤ 30	148	5 (3.38)	41 (27.70)	1 (0.68)	47 (31.76)
31-40	109	5 (4.59)	57 (52.29)	4 (3.67)	66 (60.55)
≥ 41	123	3 (2.44)	66 (53.66)	3 (2.44)	72 (58.54)
Sex					
Male	44	3 (6.82)	23 (52.27)	1 (2.27)	27 (61.36)
Female	336	10 (2.98)	141 (41.96)	7 (2.08)	158 (47.02)
Type of personnel					
Physician, nurse, laboratory personnel	169	7 (4.14)	75 (44.39)	2 (1.18)	84 (49.70)
Aids	99	2 (2.02)	37 (37.37)	2 (2.02)	41 (41.41)
Workers	73	3 (4.11)	34 (46.58)	1 (1.37)	38 (52.05)
Others	39	1 (2.56)	18 (46.15)	3 (7.69)	22 (56.41)
Total	380	13 (3.42)	164 (43.16)	8 (2.11)	185 (48.68)

Table 2
Risk factors for HBV infection among studied hospital personnel : Univariate analysis.

Studied factors	HBV-infected group	HBV-noninfected group	Odds ratio (95% CI)	p-value (chi-square)
Age				
> 30 years	138	94	3.15	<0.0001[a]
≤ 30 years	47	101	(2.04-4.87)	
Sex				
Male	27	17	1.79	0.1033
Female	158	178	(0.90-3.58)	
Marital status				
Married	107	75	2.19	0.0002[a]
Others	78	120	(1.43-3.38)	
Location of ward				
Risk ward[b]	18	7	2.89	0.0274[a]
Other wards	167	188	(1.11-7.85)	
Ward rotation				
Yes	49	39	1.28	0.3710
No	136	139	(0.77-2.14)	
Duration of working				
> 5 years	133	93	2.81	<0.0001[a]
≤ 5 years	52	102	(1.83-4.29)	
A history of accident in the ward				
Yes	90	73	1.58	0.0354[a]
No	95	122	(1.05-2.28)	
A history of needle stick				
Yes	84	61	1.83	0.0064[a]
No	101	134	(1.18-2.84)	

[a]Statistical significance at $\alpha = 0.05$.
[b]Risk ward including ICU, Hemodialysis, Laboratory, and Obs/Gyn.

than those in females (Table 1). When the prevalence of HBV seromakers was classified by types of hospital personnel, it was found that physicians, nurses, laboratory personnel and workers were relatively higher HBsAg positive rate than other groups. Details are shown in Table 1.

Risk factors for HBV infection

After univariate analysis, it was found that significant risk factors for HBV infection among studied hospital personnel were: (a) age group as over 30 years, OR=3.15 (p<0.0001), (b) marital status as married, OR=2.19 (p=0.0002), (c) location of ward as risk ward, OR=2.89 (p=0.0274), (d) duration of working over 5 years, OR=2.81 (p<0.0001), (e) a history of accident from working in the ward, OR=1.58 (p=0.0354), and (f) a history of needle stick, OR=1.83 (p=0.0064). Details are shown in Table 2.

Multiple logistic regression analysis was applied for controlling confounders and for evaluating the effects of risk variables on HBV infection among studied group. The order variables were entered into the logistic regression model to be as following: age (p<0.0001), sex (p=0.1033), marital status (p=0.0002), location of ward (p=0.0274), duration of working (p<0.0001), a history of accident in the ward (p=0.0354) and a history of needle stick (p=0.0064). After analysis, 4 variables directly related to HBV infection among studied samples included (a) age over 30 years, OR=2.99 (p<0.0001), (b) sex: male, OR=3.05 (p=0.0020), (c) location of ward: risk ward, OR=2.81 (p=0.0337) and (d) a history of needle stick, OR=2.16 (p=0.0030), shown in Table 3.

Validity of risk assessment form for screening HBV infection

The risk assessment form was developed by using risk scores from Table 3 as following: risk score = scores of age + sex + location of ward + a history of needle stick. Score of age = 3 when age over 30 years, and = 0 when other age group. Score of sex = 3 when sex as male, and = 0 when female. Score of location = 3 when location as risk ward, and = 0 when other wards. Score of a history of needle stick = 2 when having a history of needle stick, and = 0 when having no a history of needle stick. The calculation of risk scores was analyzed and a validity of this model used for predicting the risk for HBV infection among hospital personnel was calculated by the receiving operating curve (ROC). The sensitivity of this model was approximately 50% and the specificity was 80% when the cut-off score at risk ≥ 5 was used (Fig 1).

Table 3
Risk factors for HBV infection among studied hospital personnel analyzed by logistic regression analysis.

Risk factors	Adjusted Odds ratio (95% CI)	p-value
Age		
> 30 years	2.99 (1.90-4.71)	<0.0001
≤ 30 years	1.00	
Sex		
Male	3.05 (1.51-6.17)	0.0020
Female	1.00	
Location		
Risk wards[a]	2.81 (1.08-7.29)	0.0337
Other wards	1.00	
A history of needle stick		
Yes	2.16 (1.30-3.60)	0.0030
No	1.00	

[a]Risk wards including ICU, Hemodialysis, Laboratory and Obs/Gyn.

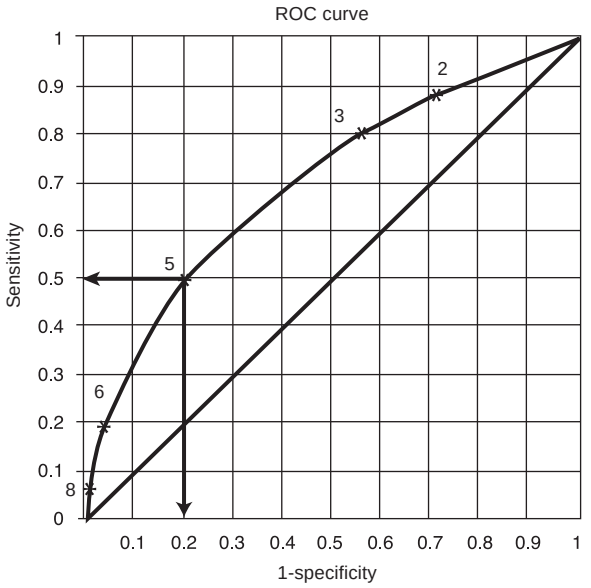

Fig 1–ROC curve for 4 predictors in the prediction of HBV infection among studied hospital personnel (When the cut-off point at risk score of ≥ 5 was used, the sensitivity was approximately 50% and the specificity was 80%) .

DISCUSSION

The HBV seroprevalence of studied hospital personnel was 48.68% and HBsAg positive rate was 3.42%. It was relatively lower than that reported by previous studies in Thailand (Wongpaittoon *et al*, 1986; Chainuvali, 1990). The lower infection rate may be affected from the current implementation of universal precaution in the hospital (Occupational Safety and Health Administration 1994,1997). However, the reports of Thai Red Cross Society and Phitsanulok Regional Blood Center in recent years showed 3.7-4.61% of HBsAg positive in blood donors (Tanprasert *et al*, 1993; Luksamijarulkul *et al*, in press). The HBV protection rate (anti-HBs and anti-HBc or anti-HBs only) of this study was 43.16% while the prevalence of anti-HBc only, which showed that those personnel have been infected with HBV, was 2.11%. The decreasing of HBV seropositive for any markers supported that HBV infection in Thailand should be changed from the high endemicity to the intermediate endemicity.

It is clear that not only vertical transmission but also horizontal transmission of HBV is an important route. The horizontal transmission may occur in a variety ways: sexually in some, through shared toothbrushes, close contact with HBsAg carrier, parenterally and contact non-intact skin or mucous membrane with patients' blood or body fluids (CDC, 1988; Polish *et al*, 1992; Luksamijarulkul *et al*, 1995). Among hospital personnel, the transmission usually occurs by exposure of mucous membrane or broken skin or an injury from a hypodermic needle or the sharp objects in the work-place (Occupational Safety and Health Administration 1994,1997).

There should be more than one factors contributed to increase the occupational risk of HBV infection among hospital personnel. In this study, data from the univariate analysis showed that age, marital status, location of ward (risk ward), duration of working in the hospital, a history of accident in the ward and a history of needle stick were associated with HBV infection ($p<0.05$). After multiple logistic regression analysis for controlling confounders has be done, only 4 factors including age over 30 years (OR=2.99), sex as male (OR=3.05), location of ward as risk ward (OR=2.81) and a history of needle stick (OR=2.16) were associated with HBV infection among studied hospital personnel ($p<0.05$). Age was a significant risk factor which agreed with previous studies (Taylor *et al*, 1989). Males were more likely to be HBV seropositive than females, as mentioned by some other studies. These may be due to the more risk behaviors reported in males than females (Kane *et al*, 1993; Luksamijarulkul *et al*, 1995). The occurrence of hepatocellular carcinoma associated with HBV infection was also reported in males more than females (Songsivilai *et al*, 1996). Hospital personnel who have worked at risk wards including ICU, hemodialysis unit, obstertric and gyncology ward and clinical laboratory unit, had more risk for HBV infection than other wards. In risk wards, hospital personnel may have the higher opportunity to expose the contaminated instruments and/or patients' blood and body fluids, as mentioned

by several studies (Polish *et al*, 1992; Stroffini *et al*, 1994). Surprisingly, this study showed no significant risk among studied hospital personnel who have worked in ER and OR units. The last risk factor, a history of needle stick during working (OR=2.16, p=0.003), was an important risk factor for blood-borne pathogens, especially HIV, HBV and HCV. Hospital personnel who had been punctured by the needle had higher risk for HBV infection than non-needle stick group. The result was supported by the studies of Weiss *et al* (1994) and Petrosillo *et al* (1995).

The HBV risk assessment form was developed by using predictors including age, sex, location of ward and a history of needle stick. The cut-off score was more than 5, which showed 80% of specificity and approximately 50% of sensitivity analyzed by ROC curve. The hospital personnel who had score more than 5 was considered as occupational risk for HBV infection. If he was negative for any HBV seromarkers, he should be vaccinated with HBV vaccine. For a new hospital personnel, he should be vaccinated with HBV vaccine when he has to work at the risk wards including ICU, hemodialysis unit, Obstretric and Gynecology ward and clinical laboratory room. These may be applied for HIV and HCV occupational risk but there is no vaccine for HIV and HCV infections. The universal precaution should be emphasized for preventing the occupational risk for HIV and HCV infections among hospital personnel.

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