

Original article

SEROPREVALENCE OF HEPATITIS B VIRUS AMONG PERSONNEL OF MAHARAJ NAKORN CHIANG MAI HOSPITAL, THAILAND

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Abstract

Objective and method From a personnel check-up project in 2003, 694 hospital personnel, 90 males and 604 females, aged 20-57 years, were tested for the presence of HBsAg and anti-HBs antibody. Data were analyzed in order to ascertain the status of hepatitis B virus (HBV) infection.

Results The overall HBV carrier rate among personnel of Maharaj Nakorn Chiang Mai Hospital was 8.6%. The mean age (\pm SD) of the HBsAg carriers was 35.7 \pm 7.6 years. Males had higher HBsAg prevalence (12.2%) than females (8.1%) ($p < 0.01$). A high prevalence of HBsAg was found in laboratory technicians (29.6%), especially those working in the Central Laboratory Section (40.0%). Two hundred and twenty six personnel (32.6%) were positive for anti-HBs antibody, and 408 (58.8%) seronegative for both HBsAg and anti-HBs antibody.

Conclusion The overall seroprevalence of HBsAg among Maharaj Nakorn Chiang Mai Hospital personnel (8.6%) was comparable with the seroprevalence among voluntary blood donors in northern Thailand (8.7%). A high prevalence was found among laboratory technicians (29.6%), especially those belonging to the Central Laboratory Section (40.0%). A high percentage of seronegativity for both HBsAg and anti-HBs antibody was observed in this hospital's personnel (58.8%). Hepatitis B vaccination was provided for these seronegative personnel by the hospital administration. **Chiang Mai Med Bull 2006;45(1):11-18.**

Keywords: Hepatitis B virus, HBsAg, anti-HBs antibody

Hepatitis B virus (HBV) infection is one of the most common infections in the world. According to the WHO annual report, a third of the world's population (2 billion people) has

been infected with HBV.⁽¹⁾ In adults suffering from primary HBV infection, 90-95% of the subjects can successfully clear the virus through self-limiting hepatitis and only 5-10%

become chronic HBV carriers. Of teen age subjects, who acquired HBV infection from either perinatal or horizontal transmission, more than 90% develop chronic infection.⁽²⁾ Worldwide, there are 400 million chronic HBV infections and 75% of them are living in Asia.⁽¹⁾ The natural course of HBV chronic infection is variable, ranging from an inactive hepatitis B surface antigen (HBsAg) carrier state to a more or less progressive chronic hepatitis, potentially evolving to cirrhosis and hepatocellular carcinoma.⁽²⁾ Fortunately, there are very effective vaccines against HBV infection, which are about 95% effective.⁽¹⁾ Southeast Asia has previously been classified as an area of high endemicity for HBV infection, with a 7-20% prevalence of HBsAg. Currently, Thailand is classified as having an intermediate endemicity (2-7.9%).^(3,4) Although the prevalence of HBV infection among children has been reduced since the infant vaccination program started, the virus is still circulating within the adult population. Therefore, the disease is now mainly observed in adults and adolescents, who were born before the initiation of the immunization program.⁽⁴⁾

Occupationally acquired HBV infection is a serious threat to healthcare workers and other hospital personnel who routinely come into contact with blood and body fluids. HBV is transmitted parenterally, with percutaneous exposure to infected blood such as medical mishaps, which are the most important mode of occupational transmission.⁽⁵⁾ In many countries with intermediate and low endemicity of HBV infection, the risk of infection with HBV among hospital personnel is higher than that for the general population.⁽⁶⁻⁸⁾ Previous studies in Thailand showed that the HBV prevalence in hospital personnel and other high risk groups is similar to that in the general popula-

tion.⁽⁹⁻¹⁴⁾ The purpose of this study was to determine a seroprevalence of HBV infection in medical personnel at Maharaj Nakorn Chiang Mai Hospital.

Materials and methods

The Faculty of Medicine, Chiang Mai University, which employs approximately 5,000 personnel, conducted a personnel check-up project in 2003. The Maharaj Nakorn Chiang Mai Hospital, which belongs to this Faculty of Medicine, has 1,800 beds and provides services for people in northern Thailand. Studied personnel are employed in 9 sections; including the Outpatient and Emergency Nursing Section, Operating Theater and Recovery Room Nursing Section, Surgical Nursing Section, Orthopedics Nursing Section, Medical Nursing Section, Obstetric and Gynecological Nursing Section, Pediatrics Nursing Section, Central Laboratory Section, and Blood Bank Section. These personnel were considered at high risk of acquiring HBV infection. Data related to the status of HBV infection in the personnel check-up project, performed during February to May 2003, were analyzed. There were 694 personnel from a total of 1,076 working in these sections who had a record of concurrent testing for the presence of HBsAg using SERODIA[®]-HBs test kits (Fujirebio Inc., Tokyo, Japan), based on reverse passive hemagglutination (R-PHA), and antibody to hepatitis B surface antigen (anti-HBs) using SERODIA[®]-Anti HBs test kits (Fujirebio Inc., Tokyo, Japan), based on passive hemagglutination (PHA). According to the manufacturer, the SERODIA[®]-HBs could perform detection of 60-80 ng/mL for subtype *ad* and 100-120 ng/mL for subtype *ay*. The sensitivity of the SERODIA[®]-Anti HBs was comparable to radioimmunoassay (95.5% consistency rate).

Cases of HBsAg positive and anti-HBs negative were defined as “HBsAg” and considered HBV carriers. The HBsAg negative and anti-HBs positive cases were defined as “anti-HBs”, and documented as evidence of previous seroprotective response, irrespective of whether the anti-HBs was acquired by vaccination or HBV infection. The negative cases for both HBsAg and anti-HBs were defined as “seronegative” and considered susceptible to HBV infection.

Each seroprevalence according to gender was tested for proportion, and these according to age groups were tested for independence using Chi-square tests. The results were considered statistically significant when p was < 0.01 .

Results

We studied 694 hospital personnel, consisting of 90 males and 604 females. There were 354 nurses, 207 practical nurses, 76 nursing aides, 44 technicians, 3 clerks and 10 manual workers. The range of age was 20-57 years

and the mean age was 34.5 years (SD = 8.7).

Table 1 shows the prevalence of serologic markers for HBV in these hospital personnel associated with gender, and Table 2 describes the comparison by age groups. The overall HBsAg positive rate among the hospital personnel was 8.6% (95% CI = 0.065-0.107), and the mean age of the HBsAg carriers was 35.7 years (SD = 7.6). Males had a higher HBsAg positive rate (12.2%) than females (8.1%). There was a significantly ($p < 0.01$) higher seropositivity in males than in females. The HBsAg positive rates were higher in the age groups of 30-39 (11.7%) and 40-49 years (9.3%) and lower in those of 20-29 (6.3%) and 50-57 years (5.9%). Two hundred and twenty six personnel (32.6%; 95% CI = 0.291-0.361) were positive for anti-HBs alone and 408 (58.8%; 95% CI = 0.551-0.625) were seronegative for both HBsAg and anti-HBs. Seroprevalence of anti-HBs positive increased with age ($p < 0.01$) from 25.8% in the 20-29 years age group to 47.0% in the 50-57 years one, while the prevalence of seronegative decreased

Table 1. Prevalence of HBV markers in hospital personnel according to gender.

	Number	HBsAg Number (%)	Anti-HBs Number (%)	Seronegative Number (%)
Male	90	11 (12.2%)	33 (36.7%)	46 (51.1%)
Female	604	49 (8.1%)	193 (32.0%)	362 (59.9%)
Total	694	60 (8.6%)	226 (32.6%)	408 (58.8%)

Table 2. Prevalence of HBV markers in hospital personnel according to age groups.

Age group	Number	HBsAg Number (%)	Anti-HBs Number (%)	Seronegative Number (%)
20-29	271	17 (6.3%)	70 (25.8%)	184 (67.9%)
30-39	206	24 (11.7%)	66 (32.0%)	116 (56.3%)
40-49	183	17 (9.3%)	74 (40.4%)	92 (50.3%)
50-59	34	2 (5.9%)	16 (47.0%)	16 (47.1%)

P -values < 0.01

with age ($p < 0.01$) from 67.9% in the 20-29 years age group to 47.1% in the 50-57 years one.

Table 3 shows the prevalence of serologic markers for HBV in hospital personnel according to professions, and Table 4 describes the prevalence according to service sections. The laboratory technicians had the highest prevalence of HBsAg (29.6%). The other professions had a prevalence of HBsAg no higher than that in the general population of this area. When focusing on places of work, personnel working in the Central Laboratory Section had the highest prevalence of HBsAg (40.0%), while those working in the Blood Bank Section had a prevalence of 10.3%. The

Orthopedics Nursing Section had an HBsAg prevalence of 16.7%, which was relatively higher than in the general population. Anti-HBs was found in 39.5% of nursing aides, and that was the highest prevalence compared to the other professions. Personnel in the Outpatient and Emergency Nursing Section, Obstetric and Gynecological Nursing Section, and Operating Theater and Recovery Room Nursing Section had a relatively high anti-HBs prevalence of 46.0%, 43.8%, and 40.3%, respectively. The highest prevalence of anti-HBs seronegative was found in manual workers (80.0%) and the lowest in the laboratory technicians (47.7%). When focusing on places of

Table 3. Prevalence of HBV markers in hospital personnel according to professions.

Profession	Number	HBsAg Number (%)	Anti-HBs Number (%)	Seronegative Number (%)
Registered nurses	354	27 (7.6%)	115 (32.5%)	212 (59.9%)
Practical nurses	207	10 (4.9%)	69 (33.3%)	128 (61.8%)
Nursing aides	76	9 (11.8%)	30 (39.5%)	37 (48.7%)
Laboratory technicians	44	13 (29.6%)	10 (22.7%)	21 (47.7%)
Clerks	3	0 (0.0%)	1 (33.3%)	2 (66.7%)
Manual workers	10	1 (10.0%)	1 (10.0%)	8 (80.0%)

Table 4. Prevalence of HBV markers in hospital personnel according to service sections.

Service section	Number	HBsAg Number (%)	Anti-HBs Number (%)	Seronegative Number (%)
Outpatient and Emergency Nursing Section	63	1 (1.6%)	29 (46.0%)	33 (52.4%)
Operating Theater and Recovery Nursing Room Section	119	8 (6.7%)	48 (40.3%)	63 (52.9%)
Surgical Nursing Section	111	8 (7.2%)	30 (27.0%)	73 (65.8%)
Orthopedics Nursing Section	18	3 (16.7%)	4 (22.2%)	11 (61.1%)
Medical Nursing Section	151	13 (8.6%)	46 (30.5%)	92 (60.9%)
Obstetric and Gynecological Nursing Section	89	8 (9.0%)	39 (43.8%)	42 (47.2%)
Pediatrics Nursing Section	89	6 (6.7%)	18 (20.2%)	65 (73.0%)
Central Laboratory Section	25	10 (40.0%)	2 (8.0%)	13 (52.0%)
Blood Bank Section	29	3 (10.3%)	10 (34.5%)	16 (55.2%)

work, the Pediatrics Nursing Section had the highest prevalence of anti-HBs seronegatives (73%), while the other service sections showed prevalence rates of 57.2% to 65.8%.

Discussion

In 1973, the prevalence of HBsAg carriers was 8.3% in the Thai general population. The hepatitis B vaccine, which was introduced to Thailand in 1985, showed its effectiveness by reducing the prevalence of hepatitis B carriers. In 1991, the prevalence of HBsAg in the Thai general population had decreased to 6.8%.⁽¹⁵⁾ In this study, the overall HBsAg positive rate among personnel of Maharaj Nakorn Chiang Mai Hospital (8.6%) was comparable with the seroprevalence among voluntary blood donors in northern Thailand (8.7%).⁽¹⁶⁾ Males had a higher HBsAg positive rate (12.2%) than females (8.1%). These rates were also comparable with previous reports, where 8-10% of males and 6-8% of females were positive.^(16,17) However, the comparative population of blood donors consisted of more males than females, while our subjects were mainly females (87%). In general, the HBV carrier rate among the hospital's personnel is similar to that in the general population of northern Thailand. However, a high prevalence was found among laboratory technicians (29.6%), especially in the personnel of the Central laboratory Section, who showed the highest prevalence rate of 40.0%. HBsAg in the personnel working in the Orthopedics Nursing Section (16.7%) was no different from that in a previous survey in 1990 (15.6% in Surgery and Orthopedics Sections).⁽⁹⁾ This result suggested that personnel, who work at risk of direct contact with a patient's blood or body fluids, or contaminated instruments, have a high potential of HBV infection.⁽¹⁰⁾ The high prevalence

in some service sections may have resulted from poor compliance with universal precautions.⁽¹⁸⁾ Other well known blood-borne pathogens are hepatitis C virus (HCV) and human immunodeficiency virus (HIV), therefore, strategies should be developed to motivate all hospital personnel to protect themselves by using appropriate infection control precautions for all patient (universal precautions).

Overall, anti-HBs were detected in 32.6% of hospital personnel with increasing by age ($p < .001$) from 25.8% in the age group of 20-29 to 47.0% in the 50-57 years. This prevalence rate was relatively lower than a previously report of 42.6% in voluntary blood donors of northern Thailand with increasing by age from 34.9% to 44.5% in the same age groups.⁽¹⁶⁾ The infection of HBV expresses in various pattern of serologic markers. Seroprevalence results in the development of anti-HBs and antibody to hepatitis core antigen (anti-HBc) with disappearance of HBsAg from the serum.⁽¹⁹⁾ The anti-HBs is a neutralizing antibody and capable for protecting against HBV infection. Natural infection with HBV produces a life-long detectable antibody in most individuals, whereas vaccine-induced antibodies decline over several years.⁽²⁰⁾ In clinical studies conducted in Taiwan and Thailand, a primary course of hepatitis B vaccination has been shown to result in protective levels of anti-HBs (10 mIU/mL or higher) in the great majority of vaccinees (83-99%). The HA was less sensitive than ELISA for detection of any HBV markers but not significantly difference for HBsAg and anti-HBc.⁽¹³⁾ Our study using the qualitative and low sensitivity of PHA technique, the seropositive for anti-HBs were presumably protective levels. The hospital personnel who had detectable level of anti-HBs do not need hepatitis B vaccine prophylaxis.

Prevention strategies against HBV infection include immunization, exposure avoidance by the use of universal precautions at all times, and post-exposure advice and prophylaxis. Vaccination of health care workers is highly effective in preventing occupationally acquired HBV infection, but the cost is a major factor impeding routine immunization programs. Pre-vaccination serological screening may be cost-beneficial if the prevalence of immunity is sufficiently high to offset its cost against the consequent reduction in vaccination needs.⁽²¹⁾ In this study, the prevalence of seronegative for both HBsAg and anti-HBs was 58.8% with decreasing by age ($p < .001$) from 67.9% in the age group of 20-29 to 47.1% in the 50-57 years. In areas with low and intermediate endemicity, many individuals were escaped from exposure to hepatitis B in early childhood and were not acquired natural immunity.⁽⁴⁾ The proportion of vaccinees with protective levels of antibody decreases to 75-87% after 5 years and 50-70% after 10-12 years.⁽²²⁾ It is now recognized that there are two subsets of memory B cells, with one having only a limited life span that results in a continuous decline in anti-HBs neutralizing antibodies, and the other a long life span, which can be rapidly reactivated to provide continuous protection against the disease even after loss of detectable antibodies.⁽²³⁾ In this study we used the PHA technique, which has relatively low sensitivity.⁽¹³⁾ Therefore it was suggested that low anti-HBs titers are undetectable.

The Steering Committee for the Prevention and Control of Infectious Diseases in Asia has developed guidelines for the physicians who choose to administer a hepatitis B vaccine booster in the region, as follows; time booster administration at approximately 10-15 years post primary vaccination; to boost rather than

not when monitoring antibody levels is not feasible; boost immunocompromised patients when the anti-HBs titer falls <10 mIU/mL; and boost healthcare workers.⁽²²⁾ The administrative body of the hospital decided to give prophylactic vaccinations for the seronegative personnel who had no history of HBV vaccination, and hepatitis B vaccine boosters to individuals who were vaccinated in the past, but carried undetectable anti-HBs.

Some of the anti-HBs-negative cases could come from naturally declining anti-HBs levels that are too low or at undetectably low levels for the technical low sensitivity test method. We did not test for evidence of subclinical infection with developed anti-HBc in this study. Detection of low level anti-HBs and the presence of anti-HBc can decrease unnecessary vaccination. The critical population prevalence can be calculated given the cost of vaccination and testing.

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อัตราการติดเชื้อและภาวะภูมิคุ้มกันต่อไวรัสตับอักเสบนชนิดบีของบุคลากร ที่ปฏิบัติงานในโรงพยาบาลมหาวิทยาลัยเชียงใหม่

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โรงพยาบาลมหาวิทยาลัยเชียงใหม่ คณะแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่

บทคัดย่อ

วัตถุประสงค์และวิธีการ จากโครงการตรวจสอบสุขภาพบุคลากรของโรงพยาบาลในปี พ.ศ. 2546 บุคลากรที่มีความเสี่ยงต่อการติดเชื้อไวรัสตับอักเสบนชนิดบีจากการปฏิบัติงานจำนวน 694 คน อายุ 20-57 ปี โดยเป็นชาย 90 คน และหญิง 604 คน ได้รับการตรวจหาแอนติเจนส่วนผิวของเชื้อไวรัสตับอักเสบนชนิดบี (HBsAg) และภูมิต้านทานต่อแอนติเจนส่วนผิวของเชื้อไวรัสตับอักเสบนชนิดบี (anti-HBs) จึงนำข้อมูลที่บันทึกไว้มามีวิเคราะห์หาภาวะติดเชื้อไวรัสตับอักเสบนชนิดบี

ผลการศึกษา อัตราการติดเชื้อเป็นพาหะของโรคไวรัสตับอักเสบนชนิดบีในบุคลากรของโรงพยาบาลมหาวิทยาลัยเชียงใหม่เป็นร้อยละ 8.6 อายุเฉลี่ย 35.7 ± 7.6 ปี อัตราการติดเชื้อเป็นพาหะของโรคไวรัสตับอักเสบนชนิดบีในผู้ชายเป็นร้อยละ 12.2 มากกว่าในผู้หญิงซึ่งพบว่ามีร้อยละ 8.1 อย่างมีนัยสำคัญทางสถิติ ($p < 0.01$) พบอัตราการติดเชื้อเป็นพาหะของโรคไวรัสตับอักเสบนชนิดบีสูงมากในบุคลากรที่ทำงานตรวจทางห้องปฏิบัติการ (ร้อยละ 29.6) โดยเฉพาะบุคลากรของงานปฏิบัติการกลางและชั้นสูตโรค (ร้อยละ 40.0) บุคลากรจำนวน 226 คน (ร้อยละ 32.6) มีภูมิต้านทานต่อแอนติเจนส่วนผิวของเชื้อไวรัสตับอักเสบนชนิดบี บุคลากรจำนวน 408 คน (ร้อยละ 58.8) ตรวจไม่พบแอนติเจนส่วนผิวของเชื้อไวรัสตับอักเสบนชนิดบีและไม่มีภูมิต้านทานต่อแอนติเจนส่วนผิวของเชื้อไวรัสตับอักเสบนชนิดบี

สรุปผล โดยเฉลี่ยอัตราการตรวจพบแอนติเจนส่วนผิวของเชื้อไวรัสตับอักเสบนชนิดบีในบุคลากรของโรงพยาบาลเป็นร้อยละ 8.6 ซึ่งใกล้เคียงกับอัตราที่พบในคู่มือโรคโลหิตทางภาคเหนือของประเทศไทยที่มีรายงานไว้ (8.7%) ในที่นี้พบอัตราการติดเชื้อเป็นพาหะของโรคไวรัสตับอักเสบนชนิดบีสูงถึงร้อยละ 29.6 ในบุคลากรที่ทำงานตรวจทางห้องปฏิบัติการ โดยเฉพาะบุคลากรของงานปฏิบัติการกลางและชั้นสูตโรค (ร้อยละ 40.0) บุคลากรที่ตรวจไม่พบแอนติเจนส่วนผิวของเชื้อไวรัสตับอักเสบนชนิดบีและไม่มีภูมิต้านทานต่อแอนติเจนส่วนผิวของเชื้อไวรัสตับอักเสบนชนิดบี มีสัดส่วนที่ค่อนข้างสูงถึงร้อยละ 58.8 ซึ่งเสี่ยงต่อการติดเชื้อโรคไวรัสตับอักเสบนชนิดบีจากการปฏิบัติงาน คณะผู้บริหารของคณะแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่ จึงได้ดำเนินการให้บุคลากรเหล่านี้ได้รับการฉีดวัคซีนป้องกันโรคไวรัสตับอักเสบนชนิดบี **เชียงใหม่เวชสาร 2549;45(1):11-18.**

คำสำคัญ: ไวรัสตับอักเสบนชนิดบี HBsAg, anti-HBs antibody