

Prevalence of Hepatitis B infection in nurses in the Gampaha district and some associated risk factors

E. Padmasiri¹, Lalini C. Rajapaksa², Wimal Jayakuru³ and Nalini Withana⁴

Journal of College of Community Physicians of Sri Lanka 1996; 1 : 19 -24.

Abstract

Objective:

To estimate prevalence of antibody against hepatitis B core antigen (HBcAb) and surface antigen (HBsAg) in nurses in Gampaha district and identify risk factors associated with hepatitis B infection.

Methodology:

In 300 nurses selected using a stratified random sampling procedure, blood was examined for the presence of HBcAb and HBsAg. Information on risk factors was obtained using an interviewer administered questionnaire. Risk of disease associated with each exposure was determined by comparing nurses who were found to be HBcAb positive with those who were negative. Relative importance of risk factors was examined using logistic regression analysis.

Results:

Prevalence of hepatitis B infection as indicated by the presence of HBcAb was estimated to be 11.6%. Hepatitis B carrier status as determined by a positive HBsAg was 2%. Age, duration of employment, a history of needle stick injury, past history of jaundice and illness with jaundice in the spouse were identified as significant risk factors after controlling for

confounding effects. There was no increase in risk of infection in association with given work settings or with non-occupational exposures.

Conclusions:

HBV infection is an occupational hazard among nurses that necessitates prevention programmes. Vaccination should ideally be offered at recruitment or early in their career.

Key words: nurses, Hepatitis B, biological hazard

Introduction

Hepatitis B virus (HBV) infection is a well known occupational hazard of health care personnel exposed to blood and body fluids (1). Medical and auxiliary hospital staff in general have been found to have 3-6 times higher prevalence of HBV than workers in other occupations (2). The risk has been shown to be particularly high in nursing personnel who care for children needing frequent transfusions, patients with malignant disease and the mentally handicapped (3).

Although occasional outbreaks of viral hepatitis in nurses working in government hospitals have been reported and investigated, the prevalence of HBV infection among health care workers has not been studied in Sri Lanka. The present study aims at determining the prevalence of HBcAb and HBsAg in nurses in the Gampaha district and identifying risk factors associated with infection.

Methodology

The Gampaha district has one teaching hospital, three base hospitals, four district hospitals and three peripheral units, representing all categories of government hospitals where nurses are usually required to work. A total of 907 nurses were working in these institutions at the time of the study. Sample size was calculated using the prevalence rate of HBV infection in

¹ Assistant Epidemiologist, Ministry of Health

² Senior Lecturer, Department of Community Medicine, Faculty of Medicine, Colombo

³ Epidemiologist, Ministry of Health

⁴ Virologist, Medical Research Institute, Ministry of Health.

the general population to be 10%, as reported in a previous survey (4). Relative risk to be detected was taken as 3. Ten percent was added to the calculated figure to guard against non response and a further 30% added for confounding variables. The final sample size corrected to the closest round figure was 300.

A stratified random sampling procedure was used, the stratification being based on the type of hospital. The sample was allocated proportional to the number of nurses found serving in each stratum. Thus, 240 nurses serving in large hospitals (teaching, general and base hospitals) and 60 serving in the smaller institutions were identified by name and institution. In instances where the individuals identified were absent, the institution was re-visited once in an attempt to interview them. If this failed, each absentee was replaced with another matched on age and selected randomly from the same stratum. There were only six such nurses in the sample.

An interviewer administered structured questionnaire was used to collect information on risk factors. The respondents were unaware of their disease status at time of interview thus eliminating possible recall bias. The objectives of the study were explained to the individuals and informed consent was obtained. Doctors trained in using the study questionnaire were used as interviewers. These measures helped to minimize non response.

Ethical clearance was obtained from the ethical review committee of the Faculty of Medicine, University of Colombo.

Serological tests

A sample of 3-5 ml. of blood was collected from each respondent and transported in ice to the Medical Research Institute where the tests were carried out. The presence of antibody against the core antigen (HBcAb) and the hepatitis B surface antigen (HBsAg) were determined using Enzygnost ELISA test kits and a semi

automated ELISA processor. The positives were re-tested with the same ELISA tests according to the manufacturer's guidelines and those positive for HBsAg on both occasions were confirmed using the manufacturer's confirmatory tests. As no confirmatory test kits were commercially available for HBcAb, a third series of ELISA tests were carried out.

Data analysis

For the study of risk factors, the presence of HBcAb was considered as evidence of disease and those who were negative were taken as controls. HBsAg positivity was considered as an indication of carrier status.

Odds ratios (ORs) which indicate the risk of developing the disease in the presence of a given risk factor were calculated for each co-variate separately, comparing those who were found to be HBcAb positive with those who were found to be negative. Where appropriate, the variables were factored using the mean of the study population as the cut off.

The relative importance of the variables was examined using logistic regression analysis. A stepwise procedure was carried out and after fitting several possible models, the best fitting model was identified as the one which minimized the deviance in relation to the degrees of freedom. EPI - INFO and EGRET soft ware were used in data analysis.

Results

The ages of the three hundred nurses ranged from 21 years to 64 years, with 50.7% of them being over 40 years. The mean age was 42.1 years with a standard deviation of 9.1 years. The duration of employment varied from 1 - 39 years, the mean was 15.8 years and standard deviation 10.6 years. There were only six (2%) males in the sample while the percentage of male nurses in the Gampaha district was three. Six (2%) of the sample gave a history of Hepatitis B vaccination.

Table 1: Relationship between age, duration of employment

Exposure	HbcAb +ve	HBcAb -ve	OR (95% CI)
Age in yrs.			
> 40	30	122	7.03
<= 40	5	143	(2.6-23.8)
Employment			
> 15 yrs	29	128	5.02
<= 15 yrs	6	137	(2.0-13.2)

Table 2: Occupational exposures and risk of hepatitis B infection in nurses

Exposure	HbcAb +ve	HBcAb -ve	OR (95% CI)
Blood bank			
Yes	1	14	0.53
No	34	251	(0.01-3.7)
Psychiatric Unit			
>= 1yr	4	38	0.77
< 1yr	31	227	(0.2-2.4)
Labour room			
>= 2yrs	14	80	1.54
< 2yrs	21	185	(0.7-3.4)
Surgical ward			
>= 4yrs	23	166	1.14
< 4yrs	12	99	(0.5-2.6)
Operating theatre			
Yes	11	72	1.23
No	24	193	(0.5-2.8)
Needle stick past 6 months.			
Yes	32	184	4.7
No	3	1	(1.4-24.6)
Jaundice patients past 6 months			
>= 3 persons	27	115	4.4
< 3 persons	8	150	(1.8-10.9)

Hepatitis B disease status

Of the 300 samples tested, 40 were found to be HBcAb positive in the first round of tests. Of these, 35 remained positive on re-testing and this was considered as evidence of infection, giving a prevalence rate of 11.6% among the nursing personnel. All 35 were females.

Seven of the blood samples were found to be positive for HBsAg on the first round of tests and six were confirmed at re-test and verified using the confirmatory test. All six thus identified were females who were also found to be positive for HBcAb. The hepatitis B carrier status was thus estimated as 2 percent.

Risk factors

Employment and personal characteristics of nurses who were HbcAb positive were compared with those who were negative, to compute odds ratios. Results of this univariate analysis are shown in Tables 1-3. Being over 40 years of age and a period of employment of over 15 years were both associated with significantly increased risk of being HBcAb positive (Table 1).

Risks associated with different occupational settings (Table 2) and possible exposures in the respondent's personal histories were examined (Table 3). The study did not identify any work setting that increased the risk of infection. A history of needle stick injury, nursing three or more jaundiced patients within the past six months, jaundice in the respondent, in the spouse and jaundice in a member of the family, were found to be associated with a statistically significant increase in risk.

As it was difficult to draw conclusions about the relative importance of occupational and non occupational exposures from the univariate analysis, a logistic regression analysis was carried out. The factor levels, parameter estimates and the adjusted odds ratios of the variables in the best fit model are given in Table 4. The model estimates that the probability of having hepatitis B increases with age over 40 years and duration of employment over 15 years as a nurse. A threefold increase

in risk is observed with the report of a needle stick injury. A past history of jaundice in the respondent and spouse were both associated with high ORs suggesting the increased probability of such an illness being due to hepatitis B virus.

Table 3: Non-occupational exposures and risk of hepatitis B infection in nurses

Exposure	HbcAb +ve	HBcAb -ve	OR (95% CI)
Hospitalization with invasive care			
Yes	16	105	1.3
No	19	160	(0.6-2.8)
Previous blood transfusions			
Yes	06	27	1.8
No	29	238	(0.6-5.0)
Dental extractions			
>= 3	3	43	0.5
< 3	32	222	(0.1-1.7)
Jaundice in 5 years;			
Yes	9	23	3.6
No	26	242	(1.4-9.4)
Jaundice in spouse			
Yes	7	16	3.6
No	27	219	(1.2-10.3)
Jaundice in family			
Yes	11	36	2.9
No	24	229	(1.3-4.7)
Married	34	235	4.3
Unmarried	1	30	(0.7-89.7)
>2 children	5	55	0.6
<=2 children	29	180	(0.2-1.6)
Child birth			
assisted	12	68	1.1
not assisted	17	109	(0.6-2.20)

Table 4: Adjusted odds ratios from logistic regression best fit model

Exposure	Coefficient	OR (95% CI)
Age in yrs. > 40 .	0.076	1.08 (1.0-1.2)
Employment >15yrs.	0.718	2.05 (4.0- 16.9)
Needle stick injury in past 6 months	1.204	3.33 (1.1-10.3)
Jaundice in past 5 years	1.731	5.65 (1.9-16.7)
Jaundice in spouse	0.89	2.44 (1.1-62)

Discussion

The estimated prevalence rate of 11.6% for hepatitis B infection among nurses in the Gampaha district is much higher than prevalence rates reported among nurses in developed countries such as Canada 2-5% (5), USA 3% (2) and UK 4.2% (6), although less than the reported figures from countries such as Egypt 28% (7) and Yugoslavia 17% (8). It is important to note that the study estimates that one in every nine nurses is affected.

The prevalence rates of infectious agents among population groups in the health care environment are generally higher than in the community (9). The HbsAg carrier rate found in the present study was 2%. This is in fact lower than the 2.5% reported in a community survey in the same district by the authors (10). However, the hepatitis B surface antigen carrier rate among females in the general population as reported by Padmasiri et al was 0.86% (10). The present sample of nurses consisted of 98% females and thus the prevalence among female nursing officers is 2.3 times higher than the

prevalence among the females in the general population. None of the males in the sample was found to be positive.

The logistic regression identified both age and duration of employment as being associated with an increased risk, the latter having a higher adjusted odds ratio. The association of increasing age and duration of employment found in the present study is very similar to findings from other countries (6, 7).

Marmion and Tonkin studying health care workers in a stable population, reported that risk of infection varied in different work settings (6). The present study did not demonstrate such a relationship probably because of the small number of cases in some of the work settings and the changes in work settings that an individual nurse will experience during a working lifetime. The increased risk associated with needle stick injury demonstrated in the study is well documented (6, 7). Reports indicate that injuries and associated infections are common even in developed countries despite the use of sophisticated techniques and transmission is known to occur with minute volumes of infected serum (12).

The association of a past illness with jaundice and hepatitis B has been described by other

authors (8). This highlights the increased probability of an illness with jaundice in a nurse being due to hepatitis B infection. This taken together with the fact that illness with jaundice in the spouse was seen to be associated with HBV infection, suggests that the nurse may have transmitted the infection to the spouse.

Conclusions

Female nurses in the Gampaha district had a high hepatitis B infection rate (11.6%) compared to those in developed countries. The hepatitis B surface antigen carrier rate was two to three times higher than in females in the general population.

Occupational exposures seem to play a more important role than non occupational exposures in causing disease. The implementation of programmes for prevention and management of needle stick injuries appear important. The findings justify the initiation of a vaccination program for nurses and highlights the importance of offering it to them at recruitment or very early in their career.

Acknowledgments

We acknowledge the National Health System Research Project for funding this study.

References

1. Deinhardt F, Abb J, Assaad F. Viral hepatitis. WHO Chronicle 1983; 37: 203-7.
2. World Health Organization. Technical Report Series 1973; 512: 7-52.
3. Astbury C, Baxter PJ. Infection risks in hospital staff from blood: hazardous injury rates and acceptance of hepatitis B immunization. Journal of Social and Occupational Epidemiology 1990; 40: 92-3.
4. Vitarana T. Viral hepatitis in Sri Lanka. Ceylon Medical Journal 1989; 34: 163-77.
5. De Lane S. Risk reduction through testing, screening and infection control precautions with special emphasis on needle stick injuries. Infection Control and Hospital Epidemiology 1990; 11: 563-5.
6. Marmion BP, Tonkin RW. Control of hepatitis in dialysis units. British Medical Bulletin 1972; 28: 169-78.
7. Dienstag J, Ryan DM. Occupational exposure to hepatitis B virus in hospital personnel; infection or immunization? American Journal of Epidemiology 1982; 115: 26-29.
8. Puvacic Z, Simic S, Karlovac M, Visnjec V, Simic M, Nikulin B. Evaluation of the epidemiology of hepatitis B virus cross infection

in a maternity hospital. *Infection Control and Hospital Epidemiology* 1991; 12: 669-71.

9. Hu DJ, Kane MA, Heymann DL. Transmission of HIV, hepatitis B virus and other blood borne pathogens in health care settings: a review of risk factors and guidelines for prevention. *Bulletin of the World Health Organization* 1991; 69: 623-30.

10. Padmasiri E, Rajapaksa L, Jayakuru W, Withana N. The prevalence of hepatitis surface antigen in the Gampaha district. *Ceylon Medical Journal* 1995; 40 (1): 10-13.

11. King SM, Jarvis DA, Shaw J. Prevalence of hepatitis B surface antigen and antibody (hepatitis b virus markers) in personnel at a children's hospital. *American Journal of Epidemiology* 1987; 126: 480-83.

12. Cossart YE. Epidemiology of serum hepatitis. *British Medical Bulletin* 1972; 28: 156-62.