

Immune response to hepatitis B vaccine in health care workers in Hong Kong

WL Lim, DA Wong, KC Cheng

The hepatitis B virus is hyperendemic in Hong Kong. Health care workers are at increased risk of acquiring hepatitis B because of frequent exposure and are therefore advised to receive hepatitis B vaccination. Immune response rates among 1102 female and 567 male health care workers in Hong Kong were examined and analysed. There was a good overall response rate of 93.8%, with women responding better than men. Among female health care workers, the proportion with an inadequate antibody response increased from 3.5% in those younger than 35 years old to 6.5% in those aged 35 years and older. Post-vaccination testing should be recommended to identify non-responders and to guide post-exposure management.

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Introduction

Hepatitis B virus (HBV) infection has been recognised as a significant occupational hazard for health care workers (HCWs). In Hong Kong, the prevalence of hepatitis B surface antigen (HB_s) in the general population has been reported to be 9.5% with HB_s detectable in up to 20% of random samples received from hospital wards.¹ In 1983, the government Medical and Health Department in Hong Kong recommended that hepatitis B vaccination be given to HCWs who are at risk of frequent exposure to blood and body fluids. Although HBV vaccine has been reported to elicit a protective immune response in a high proportion of those immunised, immune response rates vary in different populations.² There have been published reports on the immune responses to HBV vaccine among infants and children in Hong Kong. We report here the immune responses of HCWs to recombinant HBV vaccine (B-HEPAVAC II) [Merck Sharp & Dohme/Singapore Biotech, Singapore] in Hong Kong.

Materials and methods

Serum samples were screened for HB_s and antibody to HB_s (anti-HB_s) using commercially available enzyme immunoassay kits. Enzygnost-HB_sAg micro (Behringwerke AG, Marburg, Germany) and the Auszyme Monoclonal kit (Abbott Laboratories, Illinois, US) were used to screen for HB_s, while Ausab kits (Abbott Laboratories, Illinois, US) were used to detect anti-HB_s. Health care workers who were negative for both HB_s and anti-HB_s were advised to have HBV vaccine 10 mg intramuscularly in the deltoid area at months 0, 1, and 6. Those who received vaccination were reminded to return two to three months after completion of vaccination for anti-HB_s testing.

Anti-HB_s levels equal to or greater than 10 mIU/ml were classified as an adequate response. Health care workers who had anti-HB_s levels of less than 10 mIU/ml were tested for antibody to hepatitis B core antigen (anti-HB_c) by radioimmunoassay (Corab) [Abbott Laboratories, Illinois, US]. Those positive for anti-HB_c were excluded from the analysis. Data of HCWs who returned in 1992 and 1993 for post-vaccination anti-HB_s testing after completion of a course of vaccine were entered into a microcomputer. Based on the names registered, 1714 of 1721 who returned for anti-HB_s testing were Chinese. Results were analysed by sex and age for immune response to hepatitis B vaccine. Statistical tests were performed by the Chi-square test.

Government Virus Unit, Department of Health, Queen Mary Hospital, Pokfulam, Hong Kong

WL Lim, MRCPATH, FRCPA

DA Wong, MB, ChB, MSc

KC Cheng, AIMLS

Correspondence to: Dr WL Lim

Results

In 1992 and 1993, 5825 newly recruited and existing HCWs were screened for HB_s and anti-HB_s. Two hundred and fifty-five (4.7%) were positive for HB_s, 2223 (38.2%) were positive for anti-HB_s and 3347 (57.5%) lacked both HBV markers and were thus eligible for HBV vaccination.

Of those who received vaccination, 1721 returned for anti-HB_s testing in 1992 and 1993. Fifty-two were positive for anti-HB_c alone. This is consistent with a previous study in Hong Kong that showed 3.0% of HCWs to be positive for anti-HB_c alone at pre-vaccination screening.³ These HCWs were presumed to have had exposure to HBV prior to vaccination and were thus excluded from the analysis.⁴ Of 1669 HCWs included in the analysis, 93.8% had adequate immune responses to HBV vaccine. Overall, female HCWs had significantly better responses than did male HCWs ($P < 0.05$). However, analysis stratified by age group and gender demonstrated that the gender difference in immune response was only significant in the 15 to 24 year age group ($P < 0.01$). Although the frequency of inadequate responses increased with age, this was not significant statistically. It could be shown, however, that among female HCWs, the proportion with inadequate antibody response increased from 3.5% in those younger than 35 years to 6.5% in those aged 35 and older. This difference was statistically significant ($0.02 < P < 0.05$) [Table]. Among male HCWs, the difference was not statistically significant.

Discussion

It has been shown that 6% to 30% of at-risk HCWs may contract HBV after a needle-stick injury involving an HBV carrier's blood.⁵ Considering the high prevalence of HBV infection in Hong Kong and the evidence that the prevalence of HBV markers increases with increasing number of years of service among HCWs,³ the main aim of all concerned must be to achieve high immunisation coverage. In the past decade, many HCWs have been vaccinated as a result of the health policy promulgated by the Department of Health and the Hospital Authority in Hong Kong. Our study of 1669 HCWs shows that the response to HBV vaccine among HCWs in Hong Kong is good. Hence, it is the failure to vaccinate, rather than vaccine failure, that poses the greater risk of HBV infection.

In our study, the proportion of HCWs found to have HBV markers at pre-vaccination screening was comparable to that found in the general population. However, only 4.7% were HB_s carriers, a figure much lower than in the general population. We concede that there may have been bias in our screening as HCWs who are known to be HB_s carriers are less likely to volunteer for HB_s screening. Results of antenatal HB_s screening in recent years have consistently shown a carrier rate of 10% to 11% (Department of Health, unpublished data).

Our results indicate that there may be a difference in the immune response to HBV vaccine among HCWs in different parts of the world. The overall antibody response rate of HCWs given recombinant HBV vac-

Table. Immune response to hepatitis B vaccine in health care workers in Hong Kong

Age group (y)	n	Male		Female		Total
		No. (%)	n	No. (%)	n	
		Anti-HB _s <10 mIU/ml*		Anti-HB _s <10 mIU/ml		Anti-HB _s <10mIU/ml
15 - 24	217	19 (8.8)	235	7 (3.0) [‡]	452	26 (5.8)
25 - 34	151	10 (6.6)	343	13 (3.8) [‡]	494	23 (4.7)
35 - 44	125	13 (10.4)	382	24 (6.3) [‡]	507	37 (7.3)
≥ 45	74	8 (10.8)	142	10 (7.0) [‡]	216	18 (8.3)
Total	567	50 (8.8) [†]	1102	54 (4.9) [†]	1669	104 (6.2)

* An anti-HB_s level below 10 mIU/ml was classified as an inadequate response; [†] $P = 0.002$, $\chi^2 = 9.8$;
[‡] $P = 0.02$, $\chi^2 = 5.4$

cine was 95.8% in our study in Hong Kong. In the United States, Roome et al⁶ report an overall response rate of 88.1% and Wood et al⁷ report a similar response rate of 88.0%. In both of these studies, as in ours, female HCWs responded better than did male HCWs. However, although we could confirm that antibody response rate decreased relative to increased age in female HCWs, as in the American studies, the same could not be demonstrated in male HCWs. Male HCWs aged 35 years and older in Hong Kong appeared to respond better to HBV vaccine than their counterparts in the United States. Further study is required to determine whether this is due to the effect of smoking, body mass, or other host factors.^{6,7}

Needle-stick injury is still a relatively common occurrence in health care settings. In the United States, it is estimated that 800 000 needle-stick injuries occur each year.⁸ In Hong Kong, working on the premise that 20% of patients in hospitals are HB_s carriers and using the lowest 6% risk of contracting HBV infection from a needle-stick injury involving HBV-infected blood, for an at-risk HCW, the risk of contracting HBV infection from one needle-stick injury would be not less than 1%. Post-vaccination anti-HB_s testing should be encouraged so that non-responders can be given a second complete course of vaccine, after which 50% of cases are expected to respond, and appropriate therapy could be instituted promptly when exposure to contaminated blood occurs. Persistent non-responders should be treated with hepatitis B immunoglobulin after exposure. For the majority of HCWs who have responded to vaccination, they can rest assured that immune memory following HBV vaccination remains intact for at least a decade and that protection persists even after anti-HB_s responses have declined to undetectable levels.⁹ Knowledge of their anti-HB_s sta-

tus would eliminate any unnecessary anxiety among HCWs, particularly in a situation where counselling and testing are not always immediately available.

Vaccines aside, one should continue to emphasise the importance of universal precautions to prevent other blood-borne pathogen infections. Health care workers should also be constantly reminded to report occupational needle-stick injuries or mucosal contacts with blood or body fluids to the relevant authority so that procedures during which injuries occur can be examined and, whenever appropriate, remedial measures recommended.

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