THE LONG-TERM IMMUNITY AMONG HEALTH CARE WORKERS VACCINATED AGAINST HEPATITIS B VIRUS IN A LARGE REFERRAL HOSPITAL IN SOUTHERN IRAN

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Background: Health care workers are at increased risk of occupational exposure to hepatitis B virus (HBV) infection. Reassessment for revaccination of such high-risk persons after 10 years may be appropriate if anti-HBs antibody titers declined below 10 mIU/mL. This study was conducted to evaluate the long-term efficacy of HBV vaccine in health care workers and the need for their reassessment for revaccination.

Methods: We interviewed 600 health care workers in a referral hospital in Shiraz, southern Iran. They were asked to complete a confidential questionnaire including information on their age, gender, vaccination date, number of doses of vaccine, their job description in hospital, previous history of needlestick injury, and educational level. Anti-HBs antibodies were determined by the ELISA method and titers of >10 mIU/mL were considered protective. Those with a positive HBsAg or anti-HBcAb were excluded from the study.

Results: Among 600 health care workers interviewed, 339 subjects who accepted to participate in the study, were vaccinated with three doses of HBV vaccine. Anti-HBsAb titers were >100 mlU/mL in 211 subjects (62.2%), 10 – 100 mlU/mL in 85 (25.1%), and <10 mIU/mL in 43 (12.7%) persons. Among 339 subjects who received three doses of vaccine, 273 were vaccinated less than 5 years, 47 cases between 5 – 10 years, and 19 cases were vaccinated more than 10 years before the study. The majority of them had an antibody concentration above the protective level (88.1%, 88.9%, and 60.9%, respectively, \( P = 0.001 \)).

Conclusion: Reassessment for revaccination in health care workers should be considered according to their anti-HBsAb levels 10 years after vaccination. In our health care workers, we think that due to the existence of low immunity against HBV, reassessment for revaccination after 10 years is mandatory.

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Keywords: Anti-HBs antibodies • health care workers (HCWs) • HBV vaccine • reassessment for revaccination

Introduction

Needlestick injuries among health care workers (HCWs) are a well-recognized health hazard that cause transmission of viral infections, especially hepatitis B virus (HBV). According to a report by WHO, between the years 1980 and 1985, 6 – 8% of all HBV-infected individuals were hospital personnel. This number decreased to 3 – 4% after a wide-scale vaccination effort of HCWs, that illustrates the importance of recognizing the most susceptible occupational groups and their prompt vaccination. After vaccination, anti-HBs antibody (Ab) develops in over 95% of vaccine recipients so that the attack rate of all HBV infections is only 3.2% in vaccine recipients as compared to 25.6% in placebo recipients.2

Long-term studies have demonstrated that vaccine-induced protection persists at least 11 years and booster doses are not needed at this time for adults who have responded to vaccination.3 Under certain circumstances, reassessment for...
revaccination of high-risk individuals for HBV infection is recommended. These include immunodeficient patients and high-risk persons, 5 – 10 years after vaccination. In some studies, reassessment for revaccination of such high-risk persons after 5 – 10 years is recommended if anti-HBsAb titers have declined <10 mIU/mL. In our country, long-term studies on the effect and need for HBV reassessment for revaccination in HCWs are scarce and inconclusive. However, in a recent study on students and residents being trained in a teaching hospital, it was suggested that antibody detection after 5 – 10 years is required. In this study, we determined the long-term efficacy of HBV vaccine in HCWs and the need for reassessment for revaccination. We determined the hepatitis B serologic immune status in HCWs at a large referral center in Shiraz, southern Iran.

Patients and Methods

Between February 2003 and March 2004, all HCWs in a large referral hospital in Shiraz, southern Iran, were included in this study. The HCWs of this hospital, as well as medical and nursing students being trained in this hospital who were previously vaccinated against HBV, based on the preventive measures set by the Ministry of Health, Education, and Treatment, were enrolled in this study. After explaining the objectives of the study and obtaining informed written consent from each person included in the study, all HCWs in the hospital were asked to complete a questionnaire consisting of their age, gender, duration of vaccination, complete or incomplete vaccination course, their job description, and educational level. Of 600 persons, 486 accepted blood sampling. The serum samples were tested for anti-HBsAb level (Hepanostika Anti-HBsAb B6 Kit) by ELISA. Titers >10 mIU/mL were considered protective. Those with positive HBsAg and anti-HBcAb were not included in this study.

Results

Of 486 subjects who accepted blood sampling, 284 (58.4%) had anti-HBsAb titers >100 mIU/mL, 124 (25.5%) had titers in the range of 10 – 100 mIU/mL, and 78 (16%) had titers <10 mIU/mL. Distribution of patients with complete vaccination, based on the categorized titers, is shown in Table 1. Our results showed that among 486 individuals who accepted blood sampling, 339 received three doses of vaccine against HBV. Among them, 273 were vaccinated 5 years before, 47 received vaccines between 5 – 10 years before, and 19 were vaccinated >10 years before the study. The majority of these people had an antibody level above the protective limit (88.1%, 88.9%, and 60.9%, respectively, P = 0.001). The mean ± SD of antibody concentration in the three former groups were 84.3 ± 38.9, 70.3 ± 44.1, and 51.4 ± 51.2 mIU/mL, respectively (P < 0.001; one way ANOVA). Furthermore, in 17 out of 118 persons who received incomplete vaccination, the anti-HBsAb was below the protective level of 10 mIU/mL; 82% were vaccinated <5 years before. In our HCWs, participation in the vaccination program had a significant correlation with the educational level (P < 0.001); there was no statistically significant difference between participation in this program and age, gender, or job description.

Discussion

HCWs are among high-risk groups for acquiring HBV, due to exposure to infected patients. Needlestick injuries among HCWs are a well-recognized health hazard, and nearly 400,000 needlesticks occur annually among the 4 million HCWs in the United States. Almost 60 – 90% of needlestick injuries in medical centers occur in nurses by use of syringes and intravenous cannulation equipment. Avoiding occupational blood exposure is the primary preventive means for transmission of HBV. Exposure to HBV in HCWs is, nonetheless, inevitable. Thereby, immunization and postexposure management are among integral components of a complete infection control program for this group. Some researchers have shown that three doses of vaccine provide more than 90% protection. Moreover, some studies have revealed that intramuscular injection of plasma-derived HBV vaccine, containing 10 µg of HBsAg protein, could produce good immune

Table 1. Long-term persistence of anti-HBsAb after complete vaccination against hepatitis B in Nemazee Hospital personnel, Shiraz, Iran.

<table>
<thead>
<tr>
<th>Vaccination time (yr last)</th>
<th>Anti-HBsAb titers (mIU/mL)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5</td>
<td>30</td>
<td>177</td>
</tr>
<tr>
<td>5 – 10</td>
<td>5</td>
<td>27</td>
</tr>
<tr>
<td>&gt;10</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>43</td>
<td>211</td>
</tr>
</tbody>
</table>
response in 75 – 100% of cases.10

Our study, as the largest one on Iranian HCWs (n = 339), revealed that in 87.3% of our HCWs who received complete vaccination course (three doses), the anti-HBsAb level was >10 mIU/mL. In our study, the rate of vaccination did not correlate with the age, gender, and job description but did significantly correlate with the grades of education. This suggests that HCWs should be educated more, with particular attention to those with lower educations.

Simo-Minana et al studied immunoresponsiveness to HBV vaccine in 427 healthy preadolescents after a three-dose schedule vaccination with recombinant Engerix B vaccine and found protective levels of antibody in 100% of vaccinees.11 Pongpipat et al studied 38 children and 61 adults and showed that three years after the first course of vaccination, 89% of children and 61 adults and showed that three years after the first course of vaccination, 89% of children and 83.4% of adults still have antibody levels above 10 mIU/mL.12 The results obtained from Ghaemshahr, northern Iran, showed that the protective antibody levels in 183 HCWs were 55%, 71%, and 86% after the first, second, and the third doses of vaccine; that is why the researchers thought that booster vaccination should be considered.13

In our study, in 43 of 339 (12.7%) participants who received three doses of HBV vaccine, the anti-HBsAb was <10 mIU/mL. It is unclear whether these people are nonresponders, have lost immunity, or retained anamnestic potential, and they need reassessment for revaccination. Some authors have argued against routine reassessment for revaccination of vaccines with low antibody titers, because the anamnestic response to viral particles and cellular immunity can prevent the HBV infection in these cases.14 – 15 In another study, 5 – 32% of cases had no response, with an unknown duration of immunity.15

It is, therefore, recommended that while the anti-HBsAb levels are <100 mIU/mL two months after the last dose of vaccine, reassessment for revaccination with a booster dose within the next six months is necessary. In those with anti-HBsAb levels >100 mIU/mL, anti-HBsAb should be checked up three years later; if it is <10 mIU/mL, a booster dose should be received.12

Some studies on HCWs protection against HBV have been performed but most of them have considered a small number of cases and conducted not more than five years after vaccination. While some think that there is no need for routine assay of antibody after complete vaccination, other studies recommend reassessment for revaccination, based on anti-HBsAb levels. In another cross-sectional study performed in Kermanshah, northwestern Iran, 69.9% of 138 HCWs developed a protective immune response. They concluded the existence of a low immunity in this group and suggested reassessment for revaccination of nonresponders and reevaluation of cost-effectiveness of the Heberbiovac HB vaccine in high-risk groups.5 The duration of protection against HBV is still uncertain, but many studies indicate that protection against clinical disease is well prolonged. It is believed that anti-HBsAb disappears from the serum of as many as 40% of vaccinated adults within 10 years.16

In our study, the protective antibody titer in 243 (89%) persons vaccinated against HBV for less than five years, was >10 mIU/mL in comparison to 58.5% of 272 personnel of Shaheed Sadoughi University of Medical Sciences.17 In 47 (13.9%) cases who had been vaccinated within 5 – 10 years before, the protective antibody titer was >10 mIU/mL (89.4%); in 19 (5.6%) HCWs who had been vaccinated >10 years before, 11 (57.9 %) had long-lasting immunity against HBV infection and did not require any booster doses. In another study carried out in Kerman, central Iran, on 150 healthy medical students and residents being trained in hospital, 98% of those who had received three standard doses of recombinant HBV vaccine one year before, 94% of those who had received vaccine 2 – 5 years before, and 84% of those who had received vaccine 5 – 10 years before, had protective levels of antibody (>10 mIU/mL). They suggested that anti-HBsAb detection 5 – 10 years after the primary vaccination and reassessment for revaccination is needed.7 Chadha and Arankalle studied the long-term persistence of anti-HBsAb in 34 HCWs, following three doses of vaccine. Injection of a booster dose after three years increased the protective antibody level of people from 19% to 40% after ten years of follow-up.18 Simo-Minana et al concluded that the central 50% of the sample would be protected during a period of 7.5 – 10.5 years. Therefore, they advocated a single booster dose ten years after the primary vaccination.11 In a study conducted in Babol, northern Iran, 68.6% of subjects vaccinated against HBV, had anti-HBsAb >10 mIU/mL after 3.9 ± 1.98 years, and 31.4% of health care personnel with a vaccination history had low titers of antibody. The authors suggested controlling the anti-HBsAb level every 5 – 7 years and
reassessment for revaccination, if needed.\textsuperscript{19}

HBV vaccination in HCWs, who are a major group at risk of acquiring HBV, should be encouraged and because the exact risk of acquiring infection in vaccinated subjects with antibody titers of <10 mIU/mL is not documented, those with unprotective anti-HBsAb titers need reassessment for revaccination.

Acknowledgment

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References