

Study on the Serum Titer of Anti-HBs Antibody of the Vaccinated Staffs of a Hospital in Three Consecutive Years

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| Article information | Abstract |
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| <p>Article history: Received: 16 July 2012 Accepted: 5 Oct 2012 Available online: 12 May 2013 ZJRMS 2013; 15(12): 23-27</p> <p>Keywords: Hepatitis B virus HBs antibody Hepatitis B vaccine</p> <p>*Corresponding author at: Gerash Research Center, Shiraz University of Medical Sciences, Shiraz, Iran E-mail: R_afkari78@yahoo.com</p> | <p>Background: Hepatitis B virus is one of the main factors causing acute and chronic hepatitis and hepatocellular carcinoma. Among others, healthcare workers are at the highest risk for exposure to hepatitis B virus. Vaccination against hepatitis B virus is one of the protective strategies but anti-HBs titer will be reduced in the sera of vaccinated people after some time. The aim of this study was to determine the titer of anti-HBs in the sera of vaccinated medical staffs in three consecutive years since administration of the last dose of hepatitis B vaccine.</p> <p>Materials and Methods: This study was carried out on 90 Omidvar Hospital (Lar, Iran) medical staffs that had passed 3-4 months since the administration of the last dose of hepatitis B vaccine. All sera samples were tested for anti-HBs in an ELISA method. Finally, statistical analysis was performed using SPSS-16 software.</p> <p>Results: This study was conducted in duration of 3 consecutive years on 90 medical staffs including 14.44% lab technicians, 10% obstetricians, 43.35% nurses, 6.665% specialists, 5.55% general practitioners and 20% maid staffs. While HBs Ab titer was measured as 87.7% (>100 mIU/ml) in the first year elapsed since the last dose of hepatitis B vaccination, it had been decreased to 55.4% after 3 years.</p> <p>Conclusion: The results showed that re-vaccination of the medical staffs is quite necessary as anti-HBs titer had been decreased after 3 years and the desired immune response was seen only in 55.4% of the medical staffs.</p> <p>Copyright © 2013 Zahedan University of Medical Sciences. All rights reserved.</p> |

Introduction

Hepatitis B infection as one of the major health problems is responsible for chronic hepatitis and hepatocellular carcinoma [1]. According to the World Health Organization (WHO), 367 million people worldwide are suffering from hepatitis B and 1 million people die each year because of the complications of this disease [1, 2].

According to the reports, 2-3% of the Iranian populations have been infected with hepatitis B virus, out of which 70-80% have been diagnosed as chronic hepatitis B [3, 4]. Those who are exposed to the blood samples are at high risk of acquiring infections to this virus. According to the reports of CDC (Center for Disease Control) every year 100-200 healthcare workers die as a result of hepatitis B infections [5]. Exposure of un-vaccinated medical staffs to the blood of infected patients through contaminated needles has caused 6-30% hepatitis B outbreak among these medical staffs. Medical staffs infection to the hepatitis B was reported as 0.4-1.6% in America, 0.2-1.2% in Europe and 0.6-1.6% in Iran per year [6-8].

With medical staffs being aware of hepatitis B transmission ways, destroying contaminated needles and most importantly by vaccination of those who are at increased risk of exposure to hepatitis B virus, the possibility of the occupational HBV transmission will be reduced dramatically. Administration of the hepatitis B

vaccine will result in the appearance of anti-HBs within the bloodstream at a titer of 79-90%. It should be noted that increasing anti-HBs titer up to >10 mIU/ml results in protection against hepatitis B for the whole life [9-11]. Recent studies on antibody production by medical staffs in response to hepatitis B vaccination showed increased titer of hepatitis B antibody among medical staffs of Mazandaran (64.5%) [8], Kermanshah (69.6%) [12], Shahr-e-Kord (86.3%) [13] and Tehran (70.6%) [14]. All over the world, the prevalence of hepatitis B is classified as low prevalence ($\leq 2\%$), intermediate prevalence (2-7%) and high prevalence ($\geq 7\%$). In Iran, the prevalence of hepatitis B is 1.5-6.5% which has placed this country among intermediate prevalence groups [15].

Despite several studies, the titer of antibody which is produced in response to hepatitis B vaccination is not enough to give the vaccinated individuals long-time protection against this disease, a feature that is quite necessary for the health workers who are at increased risk for exposure to hepatitis B. According to numerous studies, the variation of the antibody titer in different individuals depends on their age, sex, smoking and exposure to the individuals with hepatitis B or liver diseases [16-18]. The aim of this study was to determine the titer of serological anti-hepatitis B surface antigen (anti-HBs) in the vaccinated medical staffs in three consecutive years.

Materials and Methods

This study was conducted in a descriptive-analytic way on 90 Omidvar hospital (Lar, Iran) medical staffs who had passed three criteria for our study: completing the administration of hepatitis B, 3 dose series vaccine in 2008, 3-4 months passing since receiving the last dose of vaccine and availability of information regarding medical staffs srea anti-HBs titer since the last dose of vaccination in 3 consecutive years of 2009, 2020 and 2011. Questionnaires regarding demographic information, date of 3 dose series vaccination, diseases history (hepatitis, diabetes) and smoking and drinking status were filled out by all the cases of this study and the accuracy of their information was checked with their personnel files available in the hospital archives. This study was completed adhering to the ethical aspects form Helsinki convention and was approved by Shiraz University of Medical Science Ethics Committee.

All the cases were given the consent letter to be signed and patient information was kept private and secure. Five ml of venous blood were taken from each case, the sera was isolated, labeled with secret numbers and finally kept at -20 °C for the future analysis. The titer of anti-hepatitis B surface antigen (anti-HBs) was measured in an ELISA method making use of commercial hepatitis B ELISA kits (DiapulusInc, USA).

Descriptive statistical analysis was carried out using SPSS-16 software. Chi-square test, one way ANOVA test, Levene's test and Pearson's correlation coefficient were utilized for statistical analysis tests. p -value ≤ 0.05 was considered as significant level. To interpret the results according to the available sources, hepatitis B surface antibody titer of ≤ 10 mIU/ml was classified as weak response, antibody titer of 10-100 mIU/ml was considered as adequate response and antibody titer of ≥ 100 mIU/ml was grouped as desired response [18-20].

Results

This study was conducted in 3 consecutive years of 2009, 2020 and 2011 on the titer of anti-HBs in the sera of 90 medical staffs of Omidvar hospital (Lar, Iran) including 66 (73.33%) women and 24 (26.66%) men with the age range of 22-53 years old and the mean age of 34.90 ± 8.66 . No significant association was seen between the age and sex of the cases in an ANOVA test. The cases of this study included 14.44% (11 women, 2 men) lab technicians, 10% (5 women) obstetricians, 43.33% (34 women, 5 men) nurses, 6.66% (1 women, 5 men) specialist, 5.55% (2 women, 3 men) general practitioner and 20% (9 women, 9 men) maid staffs. There was a considerable association between age range and job

groups ($p=0.004$) (Table 1) and sex and job groups ($p=0.01$) in a chi-square test.

Measuring anti-HBs in 3 consecutive years in the cases of this study showed 3 individuals (3.3%) with the titer of ≤ 10 mIU/ml (weak response), 8 individuals (8.9%) with the titer of 10-100 mIU/ml (adequate response) and 79 individuals (87.8%) with the titer of ≥ 100 mIU/ml (desired response) in the first year of the study while it had been decreased to 22 individuals (24.4%) with the titer of ≤ 10 mIU/ml (weak response), 19 individuals (21.1%) with the titer of 10-100 mIU/ml (adequate response) and 49 individuals (54.4%) with the titer of ≥ 100 mIU/ml (desired response) in the third year of the study.

There was a significant association ($p=0.001$) between increasing the time elapsed since the last vaccination and decreasing anti-HBs titer in a t -test. Accordingly, there was a meaningful association ($p=0.002$) between decreasing anti-HBs titer and sex of the participants in an ANOVA test. The results showed more decline in desired immune response (≥ 100 mIU/ml) in women compared to the men so that it had been decreased from 86.36% to 46.96% in women group and from 91.46% to 75% in men group. There was a significant association ($p=0.001$) between decreasing the antibody titer and the age range of the individuals so that a prominent decline in antibody titer was observed by increasing the age of the participants. Desired immune response among individuals above 40 years old in the first and third years of the study was reported as 86.36% (19 individuals) and 45.45% (10 individuals), respectively, which shows a significant association ($p=0.002$) between increasing the age and decreasing anti-HBs titer.

According to the results, the level of desired response among different job groups of this hospital during 3 consecutive years had been decreased as follows: lab technicians (from 92.30% to 61.54%), obstetricians (from 100.0% to 44.44%), nurses (from 84.64% to 46.15%) and maid staffs (from 83.33% to 55.55%). As it is shown in tables 2-4, there was a decrease in the amount of desired titer (≥ 100 mIU/ml) during 3 consecutive years so that the titer amount of 87.77% in the first year since receiving the last dose of vaccination had been decreased to 55.55% in the third year of the study.

The desired antibody titer among participants of different age ranges during these 3 consecutive years of this study had been decreased as follows: individuals of 20-30 years old (from 28% to 21%), individuals of 31-40 years old (from 32% to 18%) and individuals of 41-50 years old (from 13% to 6%). A downturn change in desired antibody titer (≥ 100 mIU/ml) was seen among different sex groups by increasing the time elapsed since the last dose of vaccination, too.

Table 1. Absolute frequency and percentage of the age range in different job groups of the study population

| Age(year) | Lab technician(%) | Obstetrician(%) | Nurse(%) | Specian (%) | General practitioner(%) | Maid staff(%) | Total(%) |
|-----------|-------------------|-----------------|-----------|-------------|-------------------------|---------------|------------|
| 20-30 | 8(8.88) | 1(1.11) | 16(17.77) | 0(0) | 3(3.33) | 4(4.44) | 32 (35.55) |
| 31-40 | 3(3.33) | 7(7.78) | 15(16.66) | 4(4.44) | 1(1.11) | 6(6.66) | 29(32.22) |
| 41-50 | 2(2.22) | 1(1.11) | 7(7.77) | 1(1.11) | 0(0) | 4(4.44) | 15(16.66) |
| 50> | 0(0) | 0(0) | 1(1.11) | 1(1.11) | 1(1.11) | 4(4.44) | 7(7.77) |
| Total(%) | 13(14.44) | 9(10) | 39(43.33) | 6(6.66) | 5(5.55) | 18(20) | 90(100) |

Table 2. Absolute frequency and percentage of anti-HBs titer in different job groups of the study population (2009)

| Job group | Lab technician N(%) | Obstetrician N(%) | Nurse N(%) | Specian N(%) | General practitioner N(%) | Maid staff N(%) | Women N(%) | Men N(%) |
|--------------------------------|------------------------|----------------------|---------------|-----------------|------------------------------|--------------------|---------------|-------------|
| Ab titer of ≤ 10 mIU/ml | 1(7.69) | 0(0) | 2(5.12) | 0(0) | 0(0) | 0(0) | 3(4.45) | 0(0) |
| Ab titer between 10-100 mIU/ml | 0(0) | 0(0) | 4(10.24) | 0(0) | 1(20) | 3(16.66) | 6(9.09) | 2(8.33) |
| Ab titer of ≥ 100 mIU/ml | 12(92.30) | 9(100) | 33(84.63) | 6(100) | 4(80) | 15(83.33) | 57(86.66) | 22(91.66) |
| Total (%) | 13(100) | 9(100) | 39(100) | 6(100) | 5(100) | 18(100) | 66(100) | 24(100) |

Table 3. Absolute frequency and percentage of anti-HBs titer in different job groups of the study population (2010)

| Job group | Lab technician N(%) | Obstetrician N(%) | Nurse N(%) | Specian N(%) | General practitioner N(%) | Maid staff N(%) | Women N(%) | Men N(%) |
|--------------------------------|------------------------|----------------------|---------------|-----------------|------------------------------|--------------------|---------------|-------------|
| Ab titer of ≤ 10 mIU/ml | 4(30.76) | 3(33.34) | 10(25.64) | 1(16.66) | 1(20) | 0(0) | 17(25.75) | 2(8.33) |
| Ab titer between 10-100 mIU/ml | 0(0) | 2(22.22) | 7(17.94) | 1(16.66) | 3(60) | 5(27.77) | 12(18.18) | 6(25) |
| Ab titer of ≥ 100 mIU/ml | 9(69.23) | 4(44.44) | 22(56.41) | 4(66.66) | 1(20) | 13(72.22) | 37(56.06) | 16(66.66) |
| Total (%) | 13(100) | 9(100) | 39(100) | 6(100) | 5(100) | 18(100) | 66(100) | 24(100) |

Table 4. Absolute frequency and percentage of anti-HBs titer in different job groups of the study population (2011)

| Job group | Lab technician N(%) | Obstetrician N(%) | Nurse N(%) | Specian N(%) | General practitioner N(%) | Maid staff N(%) | Women N(%) | Men N(%) |
|--------------------------------|------------------------|----------------------|---------------|-----------------|------------------------------|--------------------|---------------|-------------|
| Ab titer of ≤ 10 mIU/ml | 2(15.38) | 4(44.44) | 11(28.20) | 1(16.66) | 1(20) | 3(16.66) | 19(28.87) | 3(12.5) |
| Ab titer between 10-100 mIU/ml | 3(23.07) | 1(11.11) | 10(25.64) | 0(0) | 0(0) | 5(27.77) | 16(24.24) | 3(12.5) |
| Ab titer of ≥ 100 mIU/ml | 8(61.54) | 4(44.44) | 18(46.15) | 5(83.33) | 4(80) | 10(55.55) | 31(46.96) | 18(75) |
| Total (%) | 13(100) | 9(100) | 39(100) | 6(100) | 5(100) | 18(100) | 66(100) | 24(100) |

Discussion

Dermal-mucosal infection in the individuals who are at high risk of exposure to the blood and body fluids is accounted for the transmission of many serious diseases such as hepatitis B, hepatitis C and HIV. In developing countries hepatitis B as a dangerous viral disease has been assigned a big portion of their health budget to itself. Vaccination of the individuals who are at high risk of blood infections, such as healthcare workers is considered as one of the most effective ways to prevent this disease. Several factors including sex, age, body mass, smoking and the time elapsed since receiving the last dose of vaccination can affect protection against this disease [12-13]. While in the first year since the last dose of vaccination antibody titer of ≤ 10 mIU/ml (weak response) was reported in 3.33% of the individuals, it had been increased to 23.33% of the individuals in the third year of the study. In fact 23.33% of the individuals were lacking the protective immune response in the third year of the study. According to our results, antibody titer of 77% is considered as the protective antibody titer which is consistent with the results of Jahanbakhsh et al. (Shahr-e-Kord), Averhoff et al. (America) and Savadkoobi et al. who had considered antibody titer of 76% as the protective antibody titer in their investigations [12, 21]. Studying on the medical staffs of Tohid hospital (Iran) in 2001, Rahimi et al. have found a significant association between the duration of the time elapsed since the last dose of vaccination and anti-HBs titer [23]. According to our results, there was a meaningful association between the titer of antibody and sex and age of the individuals so

that the titer of antibody had been decreased by increasing the participant's age. This result was consistent with those of other investigations [14, 21, 24, 25]. There was a significant difference in the amount of immune response between women and men groups. While the weak immune response was reported as 4.55% in women and 0.0% in men in the first year since the last dose of vaccination, it had been increased to 28.77% in women and 12.5% in men after 3 years. Our results were not consistent with the results of other studies in Tabriz and Yazd in which the amount of immune response in women was greater than men [26-27]. Getting more immune response in women in the above studies could be the result of involving more women cases including nurses and obstetricians who are at high risk of exposure to the blood. Unlike our investigation, the study results of Perera et al at university of Michigan and Azadi et al at University of Tehran showed no association between the sex of the participants and the amount of immune response [28-30]. The desired immune response in 3 consecutive years of 2009, 2010 and 2011 was reported as 86.36%, 56.06% and 46.97%, respectively; in women group of 66 individuals and as 91.67%, 66.67% and 75%, respectively, in men group of 24 individuals. The amount of immune response in individuals under 40 years old was greater than that of individuals above 40 years old. Statistically, there was a meaningful association between increasing the age of the individuals and decreasing the antibody titer so that the amount of the desired response had been decreased from 66.66% (60 individuals) to 43.33% (39 individuals) in the first year since the last dose of vaccination, which was in accordance with the

results of the other studies [31-33]. The result of monitoring immune responses in all 90 vaccinated participants in the first and third years of the study was as follows: weak immune response [3.33% (3 individuals) in the first year and 24.44% (22 individuals) in the third year]; adequate immune response [8.88% (8 individuals) in the first year and 21.11% (19 individuals) in the third year] and desired response [87.77% (79 individuals) in the first year and 54.44% (49 individuals) in the third year]. While comparing our results with those of Kordestan [34] Shahr-e-Kord [35] and America [36] showed a weaker immune response to HBs vaccine, our results were consistent with those of Gorgan [37] and Kermanshah [38] in which 27.3% of the participants showed weak immune response (Ab titer of ≤ 10 mIU/ml). While the titer of anti HBs in the vaccinated medical staffs of this study had been at desired level in the first year since the last dose of vaccination, it had been decreased to the adequate level in most of the cases after some time. Several factors including sex, age and the time elapsed since receiving the last dose of vaccination can affect this decline process. Passing more years since the vaccination, the titer of anti-HBs in most of the vaccinated medical staffs will be decreased to the weak

level, a time which makes re-vaccination quite requisite. This investigation underscores the importance of close monitoring of the performance of the infection control systems in health care facilities and further attention of the concerned authorities to the health of the medical staffs that are at the highest risk. Similar investigations regarding the effect of duration of the elapsed time on the titer of anti-HBs among medical staffs seems to be quite necessary.

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Authors' Contributions

All authors had equal role in design, work, statistical analysis and manuscript writing.

Conflict of Interest

The authors declare no conflict of interest.

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