

Implementing hospital medicine for improving quality of healthcare in Ghaemshahr hospital staff by optimal vaccination

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Abstract

Objective and Background: In this paper, hepatitis B virus infection is considered as a serious public health problem worldwide. The prevalence of hepatitis B, caused by HBV infection, in Iran is 1.6% to 6.5%. Among the groups in which the risk of infection is high are those who work in hospitals as physicians as well as dialysis patients. One of the ways to prevent hepatitis B is HBV vaccination that is performed at 3 times (0, 1, and 6 months). In order to evaluate the efficacy of vaccination, determination of Hepatitis B surface antibody (HBsAb) titration was conducted in staffs working at the Valiasr Hospital of Ghaemshahr city, Iran.

Methods: In this study, vaccination program in hospital in priority for the health workers was developed, for this purpose, 210 individuals were recruited from staff of the Valiasr Hospital of Ghaemshahr city, Iran and HBsAb level was checked. Individuals identified as Non-immunized first received HBV vaccine, and were checked for HBsAb level one month later. If they were still non-immunized, the second- and third-time vaccination were conducted. Afterwards, one month after the third-time vaccination, HBsAb level was measured. If this time it was negative, the individual was considered Non-responder. The association of immunization based on the HBsAg levels was evaluated with baseline characteristic of the individuals.

Results: The optimal vaccine program for the efficient health care and patient outcome was proposed. Among the subjects, 20 cases were non-immunized (less than 10 IU/ml). The investigations indicated that 166 individuals (79.8%), 36 cases (17.3%), and 6 subjects (2.9%) were immunized, less-immunized, and non-immunized. There was no association between BMI, smoking, work experience, HBV vaccination numbers, duration since last vaccination, and gender.

Conclusions: To date, the immunization strategy has been implemented with considerable success. The immunization towards HBS vaccination is not dependent on the individual's status. Moreover, the hospital personnel should be screened for immunization for enhancing the staff health.

Keywords: Quality of Healthcare, Vaccination Program, Hospital Staff, Hospital Medicine

Objective and Background

The Sustainable Development Goals (SDGs) reaffirm a global commitment to achieve universal health coverage (UHC) by 2030. This means that all people and communities, everywhere in the world, should have access to the high-quality health services they need—promotive, preventive, curative, rehabilitative, or palliative—without facing financial hardship. Hepatitis is a systemic infection that mainly affects the liver. It is estimated that over 350 million virus carriers and 1.5-1 million deaths are occurred annually due to hepatitis B virus (HBV) or related chronic infection¹. Infection with the virus is one of the major health problems in the world as well as Iran². The cause of the disease dissemination is transmitting through exposure to any human secretions. Currently, there is no efficient cure for acute or chronic infections due to HBV, and existing therapies are costly and sometimes inefficient³.

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The most effective way to prevent the disease is exertion of a recombinant vaccine that will help all newborns and high-risk groups, such as health workers, injecting addicts, families with hepatitis B virus, hemodialysis patients, and those who have to do continuous blood transfusions and blood products⁴. In general, different parts of the world are divided into three groups: low prevalence below 2%, moderate prevalence of 2-7%, and high prevalence of over 7%. Iran is categorized as middle class with respect to positivity of Hepatitis B surface antigen (HBsAg)⁵.

Although the exact mechanism of hepatic injury during HBV infection is still unclear, studies on nucleocapsid proteins have established the mechanism of immediate immunological tolerance to HBV in children born to mothers with chronic HBV infection⁶. In transgenic mice expressing Hepatitis B envelop antigen (HBeAg), exposing to HBeAg in the uterus (small enough to cross the placenta) leads to tolerance in T cells toward both nucleocapsid proteins. This, in turn, may be able to explain why, when the infection is present in the early stages of life, no immunologic cleansing is carried out, leading to a long and lasting infection⁷.

In different clinical studies, antibody production after vaccine injection varies from 79 to 90% and high age has a negative effect on antibody response. An antibody titer is acceptable to prevent clinical hepatitis B above 10 IU / ml. However, Non-responders are those who are not immunized with the first series (the first three times) and the second series (the second three times) and the HBsAb level is less than 10 IU / ml⁸.

Given that hepatitis B vaccination was performed several times, we decided to test the level of HBsAb with respect to the

length of time since the last vaccine and the frequency of vaccination to determine whether hepatitis B vaccination was effective. This study was conducted on the staff of Valiasr Hospital in Ghaemshahr city, Iran. By detecting non-immunized staff in the hospitals, if they become needle stick, they will take necessary implements against virus⁹.

Method

Study subjects

Quality of care is the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge. This was a cross-sectional descriptive study with a practical purpose which was conducted on the staff of Valiasr Hospital in Ghaemshahr city, Iran. The study protocol was approved by ethical committee of Mazandaran University and written informed consent forms was obtained from all participants. After obtaining the necessary permits and continuing the research (anti-hepatitis B antibody level in vaccinated staff of Valiasr Hospital of Ghaemshahr in 2018), we identified individuals with antibody titers below 10 IU/ml. In personnel born after 1993, only titers were measured in case of lack of vaccination, and were vaccinated in case of less than 10 IU/ml titers. In personnel born before 1993, first they were evaluated if were given three doses of vaccine. Individuals who were titrated after 1-2 months after the third dose of the vaccine and reported as non-immunized, received one vaccine again because it was considered that it may have been due to a long interval. If the immunogenicity was also low 1-2 months after this time, the second and third times of vaccine were administered, and then HBsAb assay approximately 1-2 months after third

vaccination was conducted. If this time the titers were less than 10 IU/ml, they were considered as non-responders. Among the inclusion criteria were: formal employment or social security contract at Valiasr Hospital. However, exclusion criteria were: temporary personnel at Valiasr Hospital, and individuals other than nurse, assistant nurses, midwives and hospital services. Finally, 210 participants were included in the study.

Questionnaire form

A questionnaire was designed containing questions about susceptibility factors which possibly change the immunologic response. Moreover, data like age group, Body Mass Index (BMI), weight, height, job position, smoking, and HBV vaccination numbers were collected.

Preparation of serum samples and HBsAb measurement

From all subjects, 5 ml of peripheral blood was collected in the EDTA-anticoagulated tubes using venipuncture. Afterwards, serums were collected from blood samples through centrifugation at 3000 rpm. The serum samples were then sent to the paraclinical laboratory of Valiasr hospital in Ghaemshahr city for evaluation of HBsAg levels using enzyme-linked immunosorbent assay (ELISA) by a commercial ELISA kit and determination of optical density by ELISA reader device.

Statistical analysis

The data were coded and entered into SPSS v21 software (SPSS, Chicago, IL, USA) for statistical analysis. Descriptive statistics was conducted on the nominal data presentation. Pearson's chi-squared test was conducted to test for the association of BMI, HBV vaccination numbers, duration from last HBV vaccination, smoking, work

experience, and gender with the status of immunization in the individuals. In all tests, the significance level was set below 0.05. Scale data were expressed as mean \pm standard deviation (SD).

Result

Immunization report

Vaccination requirements is for the workforce (including students and contractors) before they start work in the organization. Among the 20 personnel with little than 10 IU/ml HBsAb titers in the first examination, 3 (15%) were finally non-responders. The first case was a 31-year-old female health worker with more than 10 years of work experience, and the time since last hepatitis B vaccination was over 5 years old with a BMI of 21. The second case was a female 38-year-old nurse with more than 10 years of work experience and the time since last hepatitis B vaccination was less than 5 years with a BMI of 31. Finally, the third case was a 28-year-old female nurse with less than 10 years of work experience and the time since last hepatitis B vaccination was less than 5 years with a BMI of 23. They received three doses of hepatitis B vaccine over two periods (0, 1, and 6 months) and remained in the non-immunized group (HBsAb level <10 IU/ml), which was considered as non-responders.

Study subjects

The demographic data and baseline characteristics of the study subjects are shown with more details in (Table 1). Specifically, 20 cases were non-immunized (less than 10 IU/ml). The investigations indicated that 166 individuals (79.8%), 36 cases (17.3%), and 6 subjects (2.9%) were immunized, less-immunized, and non-immunized.

Table 1. Normal characteristics and demographic data of the study participants.

| Characteristic | Value [N (%)/Mean ± SD] |
|--------------------------------|----------------------------|
| Gender | |
| Male | 66 (31.4%) |
| Female | 144 (68.6) |
| Age group | |
| 21-30 (Years) | 63 (30%) |
| 31-40 | 111 (52.9%) |
| 41-50 | 33 (15.7%) |
| 50 or more | 3 (1.4%) |
| Age | 35.18 ± 6.79 |
| BMI category | |
| Thin (less than 19) | 3 (1.4%) |
| Normal (19-25) | 97 (46.2%) |
| Overweight (25-30) | 85 (40.5%) |
| Obese (more than 30) | 25 (11.9%) |
| BMI (kg/m²) | 25.77 ± 4.04 |
| Weight (kg) | 73.28 ± 13.48 |
| Height (cm) | 168.50 ± 9.11 |
| Job position | |
| Nurse | 166 (79%) |
| Midwifery | 14 (6.7%) |
| Practical Nurse | 21 (10%) |
| Servicing | 4 (1.9%) |
| Other | 5 (2.4%) |
| Smoking | |
| Yes | 10 (4.8%) |
| No | 200 (95.2%) |
| HBV vaccination numbers | |
| One time | 127 (60.5%) |
| Two times | 16 (7.6%) |

| Characteristic | Value [N (%)/Mean ± SD] |
|-------------------------------|----------------------------|
| Three times | 55 (26.2%) |
| Four times | 8 (3.8%) |
| Five times | 1 (0.5%) |
| Six times | 3 (1.4%) |
| HBsAb status | |
| Immunized (>100 IU/ml) | 166 (79.8%) |
| Less-Immunized (10-100 IU/ml) | 36 (17.3%) |
| Non-Immunized (<10 IU/ml) | 6 (2.9%) |

BMI, Body mass index; HBV, Hepatitis B virus; HBsAb, Hepatitis B surface antibody

Association test

It was observed that BMI category of the subjects had not statistically significant difference in prevalence in the immunized, less-immunized, and non-immunized individuals ($P= 0.383$), (Table 2). Furthermore, HBV vaccination numbers was not associated with immunization, less-immunization, and non-immunization ($P= 0.953$). As such, duration from last HBV vaccination ($P= 0.716$), smoking ($P= 0.749$), work experience ($P= 0.668$), and gender ($P= 0.430$) were not associated with being immunized, less-immunized, and non-immunized in the individuals (Table 2).

Table 2. Distribution of HBsAb in accordance with normal characteristics of the study subjects.

| Category | Immunized N (%) | Less-immunized N (%) | Non-immunized N (%) | P value |
|---|--------------------|-------------------------|------------------------|---------|
| BMI | | | | |
| Thin (less than 19) | 3 (1.4%) | 0 (0%) | 0 (0%) | 0.383 |
| Normal (19-25) | 81 (38.9%) | 12 (5.8%) | 3 (1.4%) | |
| Overweight (25-30) | 61 (29.3%) | 21 (10.1%) | 2 (1%) | |
| Obese (more than 30) | 22 (10.1%) | 4 (1.4%) | 1 (0.5%) | |
| HBV vaccination numbers | | | | |
| One time | 0 (0%) | 0 (0%) | 0 (0%) | 0.953 |
| Two times | 0 (0%) | 0 (0%) | 0 (0%) | |
| Three times | 151 (72.6%) | 33 (15.4%) | 6 (2.9%) | |
| Four times | 12 (5.3%) | 4 (1.9%) | 0 (0%) | |
| Five times | 1 (0.5%) | 0 (0%) | 0 (0%) | |
| Six times | 3 (1.4%) | 0 (0%) | 0 (0%) | |
| Duration from last HBV vaccination | | | | |

| Category | Immunized N (%) | Less-immunized N (%) | Non-immunized N (%) | P value |
|------------------------|--------------------|-------------------------|------------------------|---------|
| More than 5 years | 125 (59.9%) | 26 (12.1%) | 4 (1.9%) | 0.716 |
| 5 years or less | 42 (19.8%) | 11 (5.3%) | 2 (1%) | |
| Smoking | | | | |
| Yes | 8 (3.8%) | 5 (2.3%) | 0 (0%) | 0.749 |
| No | 158 (76%) | 36 (16.8%) | 6 (2.9%) | |
| Work experience | | | | |
| More than 10 years | 86 (41.3%) | 18 (8.7%) | 3 (1%) | 0.668 |
| 10 years or less | 81 (38.5%) | 18 (8.7%) | 4 (1.9%) | |
| Gender | | | | |
| Male | 57 (26.9%) | 9 (4.3%) | 1 (0.5%) | 0.430 |
| Female | 5 (2.4%) | 27 (13%) | 111 (52.9%) | |

BMI, Body mass index; HBV, Hepatitis B virus

Systematic assessments of essential health services in high-mortality countries revealed major deficiencies in the quality of care received. In one such assessment across eight countries in sub-Saharan Africa, quality-adjusted (effective) coverage averaged 28% for antenatal care, 26% for family planning, and 21% for sick child care, and was substantially lower than crude service coverage⁶. This study was carried out on 210 personnel of Valiasr Hospital of Ghaemshahr city to determine the immunization status of HBV vaccination. Individuals were given checklists to record their age, sex, weight, height, occupation, smoking status, number of hepatitis B vaccine injections, and their HBsAb titration. Vaccination resulted in complete immunity in 79.8% and relative safety of 17.3% and lack of immunity in 2.9% of cases.

A similar study in Kashan by Habibian¹⁰ reported complete immunization after vaccination 48.4% cases, relative immunity in 37.9% subjects, and non-immunity in 13.7% individuals. It appears that the underlying reason for the difference in the rate of complete immunogenicity or lack of immunogenicity compared to the present study was the difference in the age of the subjects studied, that was higher in the current study. In Ayazi et al¹¹ performed a study in Tehran, Iran and identified that

34.4% of cases had complete immunization, while relative immunity and non-immunization was detected in 54.4% and 14.5% of subjects. In another study carried out by Kashifard and Hasanjani¹², 74.5% reported positive antibody and 25.4% reported negative antibody states, probably due to differences in the sample size of the subjects studied.

The current study reported that there was no significant relationship between sex and antibody titration, implying that a person's level of immunity after vaccination is not dependent on their gender. These results are consistent with previous studies by Ajmi and Abedian, Shokrgozar and Shokri, Moshrefian and Sharifinia, and Dehghanzadeh and Eslami¹³⁻¹⁶ but not with some studies, including study of Cleveland et al¹⁷. It is suggested that contradicting results may be due to differences in the sample size.

In this study, it was found that with age, vaccine immunogenicity did not decrease. As in some studies by Barash¹⁸, age was not reported as a factor influencing post-hepatitis B vaccination immunity, which is not in agreement with some results including Cleveland et al¹⁷, McDermott et al¹⁹, Westmoreland et al²⁰. In a study performed in US hospital evaluating the hepatitis B vaccination program, increasing age was the

only known risk of decreased level of immunity²¹. The reason for this discrepancy is probably due to differences in the studied population and the number of samples in different age groups.

The results of the present study showed that there was no significant relationship between smoking and vaccine-associated immunization, which is inconsistent with the results of studies by Havlichek et al²², which may be due to differences in the communities and the number of samples in different age groups studied.

Conclusion

A documented management process for vaccine refusal that includes reducing the risk to members of the workforce, and reducing the risk of a healthcare worker transmitting disease to vulnerable patients. Considering all the results, re-vaccination in the 20 subjects without immunity resulted in favorable immunity in 13 cases, who developed higher than 100 IU/ml HbsAb titration. However, and 4 subjected developed less-immunized titration of HBsAb (10-100 IU/ml) and 3 individuals had antibody titration less than 10 IU/ml. In this study, no relationship was found between BMI, HBV vaccination numbers, duration from last HBV vaccination, smoking, work experience, and gender and the status of immunization in the individuals. In this study, three non-responder subjects included two female nurses and one female assistant nurse. Because they are at high-risk groups, they need to be taken with serious implementations if they become needle-stick. However, it is suggested to follow the study with larger sample sizes in different hospitals of Iran.

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Abbreviation:

Hepatitis B, Hepatitis B Virus (HBV), Hepatitis B Surface Antigen (HBsAg), enzyme-linked immunosorbent assay (ELISA), standard deviation (SD).

Authors declare that there is no conflict of interests.

Authors contributed in writing, data collect, analysis and Translation of the paper.

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