DOI: 10.22037/jds.v39i3.36287
Original Article
ISSN 2645-4351

Safety Efficiency of General Vaccination Against Hepatitis B in Urmia Dental Students

Seyyed Amir Seyyedi[a], Afsoon Asadollahi[a], Mehdi Aghamohammadi[b], Saman Taram[c]

[a]Assistant Professor, Det. of Oral Medicine, Dental Faculty Urmia University of Medical Sciences, Urmia, Iran.
[b]Dentist, Private Practice, Urmia University of Medical Sciences, Urmia, Iran.
[c]Dental Student, Dental School, Urmia University of Medical Sciences, Urmia, Iran.
Correspondence to Saman Taram (email: taram.saman@umsu.ac.ir)
(*Submitted: 9 November 2021 – Revised version received: 12 June 2022 – Accepted: 14 June 2022– Published online: Summer 2022*)

Objectives Hepatitis B is a life-threatening disease that affects the liver. Despite the availability of vaccines and drugs, the disease remains a major human health problem worldwide. The aim of this study was to evaluate the serum level of anti-HBs in dental students of Urmia Dental School.
Methods This descriptive study was performed on 72 (38 males, 34 females) dental students vaccinated against hepatitis B. Totally, 5 cc of venous blood was taken from each student and sent to a laboratory. In the laboratory, after serum separation, HBs antibody titer was measured by Bind Mono kit by ELISA. Data were analyzed using SPSS 21 by the Chi-square test.
Results The minimum and maximum antibody titers were zero and 1000 IU/mg, respectively. Assessment of the frequency of HBs-Ab adequacy showed that 7 (9.7%) students had no immune response, 23 (31.9%) had low safety level, and 42 (58.3%) had good and acceptable safety levels. There was no significant difference between males and females in this regard (P>0.05)..
Conclusion Most of the students were immune to the virus, although about 32% of them showed low immunity, indicating the need for re-vaccination. Seven out of 72 students were not immune to the disease.
Keywords Hepatitis B; Vaccines; Students, Dental

Introduction

Acute hepatitis B infection and its chronic complications are among the most important health problems worldwide. More than 2 billion people worldwide have a history of past or current infection with the virus; of which, 350 million are chronic carriers of hepatitis B.[1] Approximately 25% to 30% of these patients expire earlier than patients with usual hepatic disease [2]. Hepatitis B is the most common infectious disease after tuberculosis and malaria.[1] Annually, about 50 million people are infected with hepatitis B. In Iran, the prevalence is 3% in the total population (about 2 million people); of which about 200-300 thousand people have chronic hepatitis B. Iran is one of the most prevalent regions for hepatitis B.[3]

Healthcare workers are 2 to 4 times more likely to develop hepatitis B than the general population due to occupational exposure to infected blood and injured mucosal surfaces. Dentists are at high risk of contracting the virus because of using sharp, small instruments contaminated with blood and other fluids. For this reason, in all societies, dentists are always strongly advised to be vaccinated against this virus.[4] The hepatitis B vaccine has a key role against hepatitis B virus infection and prevention of complications of chronic infections such as cirrhosis and hepatocellular carcinoma. There are several factors involved in the effectiveness of the hepatitis B vaccine, including prevalence of infection, age, genetics, immune status, underlying diseases, smoking, obesity, differences between vaccines, and place and method of vaccination. The vaccination strategy against hepatitis B is based on geographical differences and the epidemiology of hepatitis B. The World Health Organization recommends that people of countries with a moderate to high prevalence of infection need to be vaccinated against hepatitis B at birth as part of a national immunization program.[5]

Skin lesions are more common in dental students than in other medical students. [5] Various studies in different parts of the world have reported a higher prevalence of infection and consequently a higher risk of hepatitis B virus transmission among dentists. [6-9] Hepatitis B is transmitted by dermal pathway and mucosal exposure to contaminated fluids such as blood. Infected needles can infect people working in the medical field through accidental contact. Although there is no strong evidence for contamination through saliva and infected gingival crevicular fluid, some studies have reported hepatitis B virus antigen in these fluids. [10-12]

In addition to chronic liver disease, the major concern in hepatitis B infection is currently the subclinical process and the individual becoming a carrier of the virus. This transmits the disease from a seemingly healthy person in the medical staff to other staff and patients. Unsuccessful vaccination for any reason, including the use of substandard vaccines, failure to timely administer the triple doses, or assess the antibody titers in the long-term, and the need for a reminder dose are important issues to determine protection. Assessment of antibody titers against the HBs is the first step.[13]

Hepatitis B is among the most prevalent diseases in dental personnel, and the role of antibodies in prevention of this dilemma is undeniable. Since no similar study has been performed in Urmia so far, this study was performed to evaluate the serum level of anti-HBs in dental students of Urmia Dental School.

Methods and Materials

The study protocol was approved by the Research Ethics Committee of Urmia University of Medical Sciences (code

IR.UMSU.REC.1392.108). This descriptive study was conducted on 72 dental students who were vaccinated against hepatitis B at birth. The sample size was calculated according to a previous study with 95% confidence interval, 5% standard error rate and 47% prevalence of hepatitis B vaccination in China. [2]

The participants were asked to mention the date of their last hepatitis B vaccination, and participants who had been vaccinated in the past 5 years were excluded. All participants had been vaccinated with inactivated-type vaccines of viral surface proteins. Five milliliters of intravenous blood was taken from each student and sent to a laboratory. In the laboratory, after separation of serum, HBs antibody titer was measured by a Bind Mono kit (USA) by ELISA. Then, the test results of each student were divided into three groups based on the antibody titer obtained: antibody level more than 100 IU/L, antibody level between 10-100 IU/L and antibody level below 10 IU/L. A positive response indicated safety, low positive response indicated safety, and no response indicated no safety. [7]

The antibody titer evaluator was an expert, and the samples were evaluated by an ELISA kit (Bind Mono, USA) with three repetitions, and the mean value was reported. The ELISA kit is used to accurately evaluate antibodies worldwide, and therefore the results were comparable to the results of other studies.

The measures of central dispersion were reported for quantitative variables (mean and standard deviation), and the frequency and percentage were calculated for qualitative variables. Appropriate graphs and statistical tables were used to display the data as needed.

All statistical analyses were performed using IBM SPSS (IBM, Chicago, USA) version 21.0. Comparison of vaccination efficacy between males and females was conducted using the Chi-square test. $P<0.05$ was considered statistically significant.

Results

The present study was performed to evaluate the adequacy of hepatitis B vaccination in 72 dental students in Urmia. Of the total participants in the study, 38 (52.7%) were males, and 34 (47.2%) were females.

The mean level of HBs antigen serum level was 25.035 ± 25.842 mlU/mL. Table 1 shows the frequency of HBs-Ab adequacy of the dental students. According to the findings, 7 (9.7%) students had no immune response, 23 (31.9%) had low safety, and 42 (58.3%) had good and acceptable safety.

There was no statistically significant difference between males and females in terms of antibody adequacy ($P>0.05$).

Table 1: Frequency of different modes of immunity against hepatitis B in dental students

Variable	Antibody Efficiency	Males		Females	
		Number	Percentage	Number	Percentage
HBs-Ab	No safety	4	5.8	3	3.5
	Low safety	13	20.8	10	10.9
	Good safety	22	31.2	20	27.8
	Total	39	52.8	33	47.2

Discussion

Hepatitis B is one of the most serious medical conditions among dental students. Dental students are permanently exposed to this condition due to exposure to patients and injured mucosal surfaces. Compulsory vaccination against this virus has been carried out in Iran since 1993. Adequacy of hepatitis B vaccination was assessed in 72 students. Of the total participants in the study, 38 (52.7%) were males and 34 (47.2%) were females.

According to our findings, most of the students were immune to this virus, although about 32% of them showed low immunity, with no significant difference between males and females, indicating the need for re-vaccination. Seven people (4 males and 3 females) out of 72 students were not immune to this disease and there was no significant difference between males and females. Overall, there was no significant difference between males and females in terms of antibody adequacy in the present study. This can be very dangerous considering the profession of these students because they may be exposed to potentially contagious agents on a regular basis and the risk of infection will always be considerably high for them.

This finding shows that all healthcare workers who are exposed to infectious agents need to be safe before entering the workplace to protect their immune system against such infections. Izadpanah et al.[14] examined the antibody titer against HBV in nurses of Birjand University of Medical Sciences. The aim of their study was to determine the degree of immunization following complete hepatitis B vaccination in the nursing staff and the relationship between safety level and variables such as age, sex, body mass index, workplace and time elapsed since the last dose of vaccine. In their study, the antibody titer in 88.4% of the subjects was above 10 mlU/mL. The level of protective antibody was moderate in 12.5%, and appropriate in 75.9%. There was no significant relationship between antibody level and variables such as sex, age, hospitalization ward, and body mass index of patients. Similar to the results of the present study, in 11.6% of the subjects, the level of protective antibody was not measurable in their study, and therefore they recommended

measuring the level of HBs antibody in the nursing staff and revaccination of unsafe individuals. Absence of a significant difference between males and females in their study was similar to our results. In a similar study in a dental community in Brazil in 2013, Da Silva Sacchetto and colleagues at the University of Piau examined the vaccination status and immunity against hepatitis B in dental students. Of the students who received the three-stage vaccination, only 12.5% had adequate immunity against hepatitis B. The results of their study indicated that most people did not complete the three stages of their vaccination. However, serological analyses indicated that even people who had completed the three stages of vaccination did not develop complete immunity.[15] This finding highlights the importance of ensuring the safety and re-vaccination of high-risk individuals, such as students and healthcare workers.

In order to assess the serum level of anti-HBs in medical personnel vaccinated against hepatitis B, a study was conducted in 2005 in Shahid Beheshti Hospital in Kashan by Momen Heravi et al. [16] In their study, the effective antibody titer, i.e. above 10 IU/L was observed in 82.2% of subjects while ineffective level of antibody, i.e. less than 10 IU/L was noted in 17.2% of subjects.[17] The effectiveness of the vaccine has been reported differently in different studies. In 2002, in a study by Sharifi et al, in Yazd, which was performed on 272 medical personnel, the effectiveness of the vaccine was reported to be 58.8%.[18]

Several factors play a role in the effectiveness of hepatitis B vaccine, including the prevalence of infection, age, genetics, immune status, underlying diseases, smoking, obesity, differences between vaccines, location, and method of injection of the vaccine, which may explain the variations in the results reported in the literature. [13, 17] In a study on medical students in Germany, Schmid et al. examined the adequacy of childhood vaccinations. Seven of the 807 students studied had a history of previous hepatitis B infection, while no infection with hepatitis C and HIV was detected; 52% of students definitely needed a booster dose to be safe due to the low titer of antibodies against hepatitis B virus. The results of their study showed that vaccination against hepatitis B in childhood did not provide adequate protection against hepatitis B, and primary vaccination is considered as a suitable solution for this issue when medical students enter the medical wards.[13] The findings and conclusions of their study were similar to our results.

Some studies reported that 85% to 90% of those vaccinated as adults had serum levels of anti-HBs above 10 mlU/mL at 20 years after their vaccination, and only 40% to 60% of those had been vaccinated in infancy. [19, 20] The probable reason for this may be the small interaction of B and T cells in infants. In some other cases, presence of serum anti-HBs in mothers may affect the response to vaccination in infants.[17] This was consistent with the findings of Lamberti et al. In a cross-sectional descriptive study, they evaluated the long-term immunogenicity and effectiveness of hepatitis B vaccination in healthcare students at the University of Naples in Italy. A total of 994 students received a dose of 10 μg of neonate in the third, fifth and eleventh months of infancy. Of all, 1905 had received a dose of 20 micrograms of the vaccine at the age of 12 years. According to the results of their study, 87.7% of students who were vaccinated in adulthood had antibody titers above 10 IU/L, while this value was 77.4% in those who had been vaccinated in infancy. [20] A closer analysis of the results showed that healthcare students, who were predominantly female, had a higher percentage of antibody serum titers less than 10 IU/L; in other words, they were unsafe. In their study, 459 subjects had anti-HBs titers below 10 IU/L. Those with low titers were mostly younger and their fields of study were oral hygiene, nursing, pediatric nursing, and radiography. [21] The results of their study indicated that evaluation of antibody titers in people working in the healthcare system is important in two ways. The first is that non-vaccinated individuals are identified and referred for vaccination, and the second is that individuals with low antibody titers are referred for booster doses. [22] Healthcare workers and students are reported to have the highest occupational risk for hepatitis B virus infection in the world, with approximately 66,000 people being infected with hepatitis B worldwide every year. [23]

Therefore, considering that these individuals are the most common risk group, this group of students can be tested for serum levels of anti-HBs. [24] This is especially important in countries such as Iran where hepatitis B vaccination programs are performed for infants and adults but no post-vaccination tests and follow-ups are performed.[19]

Inability to check the antibody titers of all active students in the clinic is one of the limitations of this study, which can be overcome by using university-approved protocols to mandate students to check their antibody titers against hepatitis B regularly and undergo vaccination in case of presence of low titers.

Conclusion

Based on the findings of the present study, it may be concluded that the vaccination program performed in infancy and also in adulthood in Iran cannot guarantee the safety of individuals against hepatitis B.

Conflict of Interest

No Conflict of Interest Declared ■

References

1. André F. Hepatitis B epidemiology in Asia, the middle East and Africa. Vaccine. 2000;18; Suppl 1:S20-2.
2. Cortex F Nevot C Ramon J, Cuenca F. The Evolution of Dental Health in Dental Students at the University of Barcelona. J Dent Edu. 2002;66(10):1203-8.
3. Zhang FK. Interferon_alfa in the treatment of chronic hepatitis B. Hepatobiliary Pancreat Dis Int 2004; 3(3): 337-40.
4. Deisenhammer S, Radon K, Nowak D, Reichert J. Needlestick injuries during medical training. J Hosp Infect. 2006;63(3):263-7.
5. Sarker SA. Randomized, double blind placebo-controlled studies to evaluate the safety and tolerability of a novel Llama-derived anti-rotavirus VHH fragment in human volunteers (Part-I), and its therapeutic efficacy in children with rotavirus diarrhoea (Part-II). 2004.
6. Hu T, Li G, Zuo Y, Zhou X. Risk of hepatitis B virus transmission via dental handpieces and evaluation of an antisuction device for prevention of transmission. Infect Control Hosp Epidemiol. 2007;28(1):80-2.
7. Abbas Al Kasem MA, Al-Kebsi Abbas M, Madar Ebtihal M and Al-Shamahy Hassan A. Hepatitis B Virus among Dental Clinic Workers and the Risk Factors Contributing for its Infection. On J Dent & Oral Health. 2018;1(2):1-6.
8. KLEIN, R. S., et al. Occupational risk for hepatitis C virus infection among New York City dentists. The Lancet, 1991, 338.8782-8783: 1539-42.
9. Kamimura H, Watande J, Sigano T, Kuhisa J, Abe H, Kamimura K. et al. Relationship between detection of hepatitis B virus in saliva and periodontal disease in hepatitis B virus carriers in Japan. J Infect Chemother. 2021;27(3):492-6.
10.Villar LM, Bezerra CS, Cruz HM, Portilho MM, Flores GL. Applicability of Oral Fluid and Dried Blood Spot for Hepatitis B Virus Diagnosis. Can J Gastroenterol Hepatol. 2019;2019:5672795.
11.Hutse V, Verhaegen E, De Cock L, Quoilin S, Vandenberghe H, Horsmans Y, et al. Oral fluid as a medium for the detection of hepatitis B surface antigen. J.Med. Virol. 2005;77(1):53-6.
12.Klein RS, Phelan JA, Freeman K, Schable C, Friedland GH, Trieger N, et al. Low occupational risk of human immunodeficiency virus infection among dental professionals. N Engl J Med. 1988;318(2):86-90.
13.Franco E, Bagnato B, Marino MG, Meleleo C, Serino L, Zaratti L. Hepatitis B: Epidemiology and prevention in developing countries. World J Hepatol. 2012;4(3):74-80.
14.Izadpanah A, Moghadam HM, Ziaee M, Foadaldini M, Ebadian F, et al. Anti HBs level in nursing staff of Birjand University of Medical Sciences. J Birj Univ Med Sci.2008;15(2): 80-5.
15.da Silva Sacchetto MSL, Barros SSLV, de Alencar Araripe T, Silva AM, Faustino SKM, da Silva JMN. Hepatitis B: knowledge, vaccine situation and seroconversion of dentistry students of a public university. Hepat Mon. 2013;13(10):e13670.
16.Noubiap JJN, Nansseu JRN, Kengne KK, Ndoula ST, Agyingi LA. Occupational exposure to blood, hepatitis B vaccine knowledge and uptake among medical students in Cameroon. BMC Med Educ. 2013;13:148.
17.Zhang FK. Interferon_alfa in the treatment of chronic hepatitis B. Hepatobiliary Pancreat Dis Int. 2004;3(3): 337-40.
18.Salama II, Sami SM, Said ZN, El-Sayed MH, El Etreby LA, Rabah TM, Elmosalami DM, Abdel Hamid AT, Salama SI, Abdel Mohsen AM, Emam HM, Elserougy SM, Hassanain AI, Abd Alhalim NF, Shaaban FA, Hemeda SA, Ibrahim NA, Metwally AM. Effectiveness of hepatitis B virus vaccination program in Egypt: Multicenter national project. World J Hepatol. 2015 Oct 8;7(22):2418-26.
19.Schmid K, Wallaschofski H, Drexler H. Student health policy of a German medical school–results of a cross sectional study concerning students' immunity to vaccine-preventable diseases. Int J Hyg Environ Health. 2004;207(6):595-600.
20.Zhu C-L, Liu P, Chen T, Ni Z, Lu L-L, Huang F, et al. Presence of immune memory and immunity to hepatitis B virus in adults after neonatal hepatitis B vaccination. Vaccine. 2011;29(44):7835-41.
21.Chiara F, Bartolucci GB, Mongillo M, Ferretto L, Nicolli A, Trevisan A. Hepatitis B vaccination at three months of age: a successful strategy? Vaccine. 2013;31(13):1696-700.
22.Lamberti M, De Rosa A, Garzillo EM, Corvino AR, Sannolo N, De Pascalis S, et al. Vaccination against hepatitis b virus: are Italian medical students sufficiently protected after the public vaccination programme? J Occup Med Toxicol. 2015;10:41.
23.Carrozzo M, Scally K. Oral manifestations of hepatitis C virus infection.World J Gastroenterol. 2014;20(24):7534-43.
24.Caciari T, Casale T, Tomei G, Capozzella A, Trovè L, Lepanto R, et al. Biological risk among health workers.G Ital Med Lav Ergon. 2013;35(3):163-7.
25.De Schryver A, Claesen B, Meheus A, Hambach R, Van Sprundel M, François G. Hepatitis B vaccination policies for student healthcare workers in Europe. J Hosp Infect. 2014;86(2):147-50.

How to cite:
Seyyedi SA, Asadollahi A, Aghamohammadi M, Taram S. Safety Efficiency of General Vaccination Against Hepatitis B in Urmia Dental Students. J Dent Sch 2021;39(3):102-105.