The European Journal of Biomedical and Life Sciences 2024, No 1–2
ISSN 2310-5674

PREMIER Publishing
ppublishing.org

Section 3. Preventive Medicine

DOI:10.29013/EJBLS-24-1.2-46-50

TO STUDY THE EFFECTIVENESS OF IMMUNE PROTECTION AFTER VACCINATION AGAINST VIRAL HEPATITIS B

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Cite: *Tadjiyev B.M., Matyakubov M.B. (2024). To study the effectiveness of immune protection after vaccination against viral hepatitis B. The European Journal of Biomedical and Life Sciences 2024, No 1–2.* https://doi.org/10.29013/EJBLS-24-1.2-46-50

Abstract

The aim of the study was to assess the immunity of vaccinated children against hepatitis B. Vaccinated children have a high level of protection against hepatitis B, which confirms the importance of vaccination in the prevention of infectious diseases among children. Further research will deepen our understanding of the effectiveness of vaccination and its role in ensuring public health.

Keywords: *viral hepatitis B, gender differences, immunity, vaccine*

Introduction

Infectious liver infections are a serious global public health problem, having a significant negative impact on the health of the population and the health system as a whole (Nelson N. P. et al,. 2016).

Hepatitis B is caused by the hepatitis B virus (HBV), which affects the liver, causes inflammation and death of its cells. HBV infection can be acute or chronic, and the severity of the disease varies from asymptomatic (no symptoms) to severe.

According to statistics provided by the World Health Organization (WHO), 820 thousand people die every year from complications caused by viral hepatitis B. Of this number, more than 650 thousand are associated with the development of cirrhosis or hepatocellular carcinoma, and approximately 130 thousand cases are associated with acute viral hepatitis (Nayagam S. et al,. 2016 and Wang H. et al,. 2018). In the world today, 296 million people are infected with chronic viral hepatitis, while 1.5 million new cases are infected annually. Mortality from hepatocellular carcinoma ranks third among oncological diseases in the world (Sung H et al,. 2020).

The vaccine contains a modified hepatitis B virus surface antigen (HBsAg), which is artificially created using a special yeast culture. This antigen cannot cause disease, but the human immune system perceives it as a pathogen and reacts by producing protective antibodies (AHBs).

The protective efficacy of hepatitis B vaccination is associated with the induction of anti-HBs antibodies, but also includes stimulation of T cell memory.3 The level of anti-HBs equal to 10 mMU per ml, determined 1–3 months after the last dose of the initial course of vaccinations, is considered as a reliable marker of protection against infection.

Method

A thorough study of 280 blood samples using enzyme immunoassay was conducted at the Republican Center for Epidemiology, Microbiology, Infectious and Parasitic Diseases. Various methods have been used for this purpose, including clinical, diagnostic and statistical approaches. In Tashkent, the capital of Uzbekistan, 280 children aged 0 to 8 years were tested for hepatitis B antigen and a special enzyme immunoassay. The first screening of the film in Russian was dedicated to 280 films, including «Express Test» and «Concise Translation». Let's do it with a brief analysis. It was very important to draw attention to HBs. The main group consisted of children who had been vaccinated against hepatitis B and who had vaccination data, after which an additional statistical analysis was carried out.

For the rapid distribution of HBsAg, a test system «COMBINED RAPID TEST for HBs» was created by the American manufacturer Aria (CTK Biotech, Inc., publication date 2025–01–29). After the proclamation of the Republic of Belarus, a concise analytical center was created to create an antigen using the v – HBS antigen test system in Vectohep from vector-the best.

To measure the level of protection against hepatitis B, enzyme immunoassay (ELISA) was used using the Vector-Best reagent kit, whose certification complies with ISO 13485 and is valid until May 12, 2024, to detect the concentration of antibodies to HBs. The blood for the study was delivered to the laboratory in a specialized refrigerated container, and then the serum was stored at –20 °C. Before the rapid analysis and enzyme immunoassay for antigens and antibodies, the serum was left to approach room temperature for 60 minutes.

Results

As part of the laboratory study, the blood of 280 children from birth to 8 years old from Tashkent was analyzed. 280 serum tests were performed for the presence of HBs antigen (using the express method and ELISA). Next, we tested these samples for antibodies to HBs through enzyme immunoassay. The main group for analysis included children who had been vaccinated against hepatitis B, and due to the availability of vaccination cards, we conducted an additional statistical analysis of these cards.

According to the results of our study, it was revealed that 21 children (7.5%) did not have vaccination documents, 15 children (5.4%) were vaccinated once, 7 children (2.5%) received two vaccinations, 28 children (10%) went through three vaccinations, and the vast majority, 209 children (74.6%), were vaccinated four times.

Table 1. *Percentage of children surveyed by gender*

	categories	abs.	%	95% DI
gender	boys	145	518	458–578
	girls	135	482	422–542

Note. total N=280

There were more boys in the study group (52%, or 145 young participants) compared to girls (48%, or 135 participants) (Table 1).

During the analysis of children with the absence of HBs antigen for antibodies to it, it was revealed that antibodies are present in 62% of the tested, which is 280 people.

Table 2. *Data analysis of vaccination cards for children (taking vaccines)*

categories	abs.	%	95% DI
no vaccination card	21	75	47–112

categories	abs.	%	95% DI
received 1 vaccine	15	54	30–87
received 2 vaccine	7	25	10–51
received 3 vaccine	25	89	59–129
received 4 vaccine	212	757	703–806

Note. total N=280

Hepatitis B virus in vaccines accounts for 100% of the total amount of emlangan, 3 and 91.5% of the total number of vaccines taken (Table 2).

Table 3. *Distribution of the presence of antibodies to the HBs antigen and the antigen itself among the studied children.*

gender	Anti-HBs antitelo positive	Anti-HBs antitelo negative
boys	94 (65%)	49 (34%)
girls	74 (55%)	56 (41%)

Note. total N=280

Gender-based data indicate a higher level of immunity among boys compared to girls (Table 3).

Additionally, in the remaining sera without HBs antigen, a quantitative analysis was performed for the presence of antibodies to Hbsag by enzyme immunoassay, which affected 273 samples.

Of the remaining 273 children who participated in our study, all were vaccinated against hepatitis B, and then tested for antibodies to the HBs antigen. Antibodies to HBs were found in 47% of children who received 1 vaccine, in 86% of children who received 2 vaccines, in 81% of children who received 3 vaccines, in 60% of children who received 4 vaccines, and in 57% of children for whom there was no information about vaccination. This indicates that not all children have an immune response to the antigen, but most vaccinated children still have an immune response.

When analyzing the immune status of children participating in the study, it was found that 74% of children under the age of one year, 67% of children aged 1 year, 56% of children aged 2 years, 76% of children aged 3 years, 55% of children aged 4 years, 40% of children aged 5 years old, 62% of children aged 6 years, 50% of children aged 7 years had antibodies to the anti-HBs antigen. From this it can be concluded that most children aged 0 to 3 years have a stable immune status, which begins to weaken from the age of 4, however, there are cases of maintaining immunity without loss of effectiveness.

Table 4.*Detection of anti HBS titration in children's blood serum*

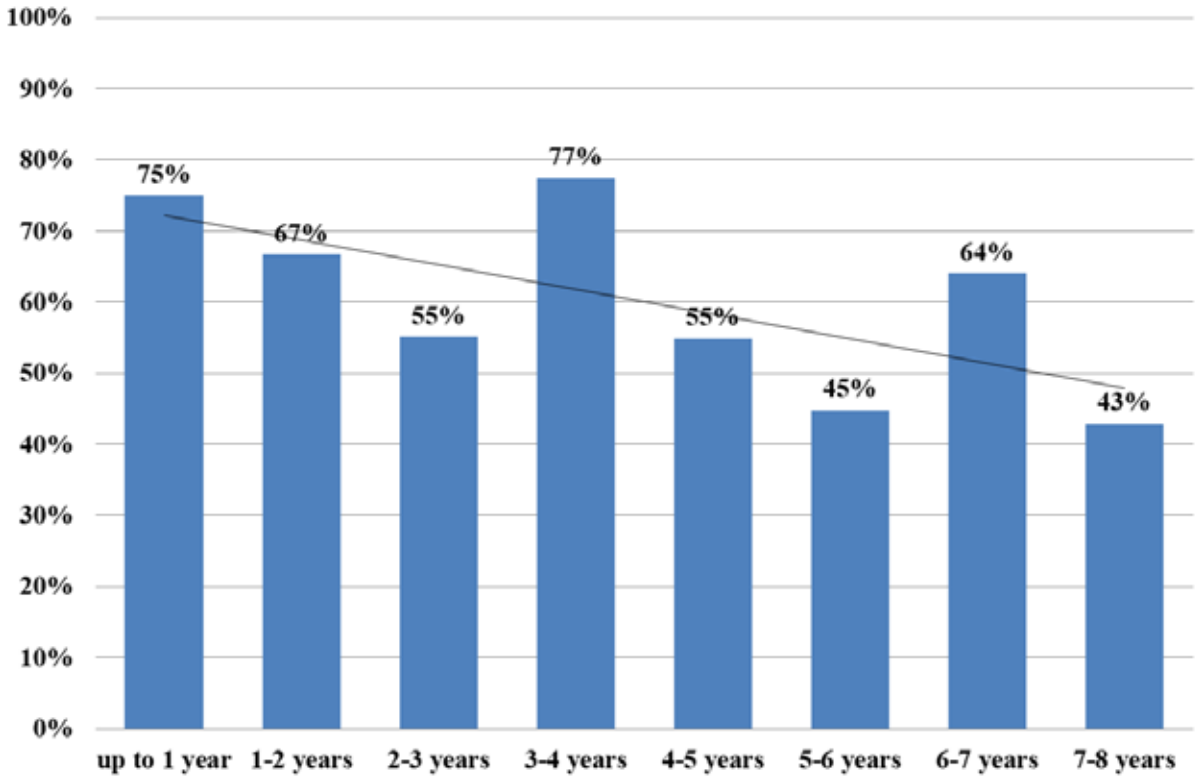
AntiHBS titre	abs	%	95% DI
<10 MMU/ml	105	375	318–435
10–100 MMU/ml	131	468	408–528
100–200 MMU/ml	17	61	36–95
200–300 MMU/ml	12	43	22–74
300–400 MMU/ml	12	43	22–74
400 MMU/ml <	3	11	02–31

Note. total N=280

When evaluating the titers of antibodies to HBs in the blood of 37.5% (105) children, it was found that the titers of antibodies to HBs did not exceed 10 MMU/ml, in children 46.8% (131) titers of 10–100 MMU/ml, in 15.7% (44) children titers above 100 MMU/ml were detected, in including 100–200 MMU/ml in 6.1% (17 out

of 12) children and 4.3% (12) children, antibody titers of 200–300 MMU/ml, 300–400 MMU/ml were detected in the blood/4.3% (12) and 1.1% (3) of children had antibodies in amounts exceeding 400 MMU/ml (Table 4).

Figure 1. *Determination of AntiHBs for children's age (%)*



Note. total N=280

The assumption of the detection of anti-HBs in relation to the age of children (Figure 1.) showed that the percentage of detection of antibodies decreases as children age. In 75% of children under one year of age, we can see that by the age of 7 this figure was 43%.

Discussion

The conducted study did not find positive results for the viral hepatitis B antigen, which is proof of the effectiveness of the immunity acquired as a result of vaccination. It is important to note that over time, this immunity may begin to weaken due to lack of contact with the antigen. This underlines the need for regular monitoring of the condition and, if necessary, additional vaccination to maintain the protective functions of the body.

It is important to understand that the immunity acquired as a result of vaccination is an essential element for protecting the body from viruses and diseases. However, like any system, it needs support and care. Regular monitoring and monitoring of the state of immunity will help to identify possible problems in a timely manner and take the necessary measures to eliminate them.

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submitted 14.05.2024;
accepted for publication 28.05.2024;
published 22.07.2024

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