Section: Microbiology

Original Research Article

SEROPREVALANCE OF HEPATITIS B VIRUS AMONG PEDIATRIC POPULATION RESIDING IN THE CATCHMENT AREA OF A TERTIARY CARE HOSPITAL OF BIHAR

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Abstract

Background: We aim to generate evidence on the sero-prevalence of Hepatitis B among under-five children to gather evidence on the sero-prevalence of HBV infection which could further be used to strengthen the course of vaccination programme. **Materials and Methods:** An observational cross-sectional study was carried out by the Department of Microbiology SKMCH, Muzaffarpur, Bihar. Children aged 1–10 years admitted in the pediatric ward of our hospital who had documented evidence of complete vaccination against HBV were included in our study. Children born to HBsAg-positive mother and children admitted with jaundice or any other liver disease were excluded from the study. Three ml blood sample was obtained simultaneously whenever the child was subjected to any laboratory investigation, and a separate needle prick to the participant was not given for this study. Sera were separated and stored at −80 °C till analysis. Serum specimens were tested for HBsAg and anti-HBs using automated enzyme-linked immunoassays. The assay principle combined an enzyme immunoassay sandwich method with a final fluorescent detection. **Result:** A total of 193 children participated in this study. In our study, 71.5% (138 out of 193) of the children showed protective antibody titers after vaccination, while remaining children had titers less than 10 IU/L (Figure 1). In the 07 children who received three doses of the vaccine, 04 children had titers less than 10IU/L and the remaining had protective antibody levels. The mean antibody titers reduced with age, and children aged younger than one year had mean titers of 487.3 IU/L and the titers kept reducing, to the lowest level at 5–6 years of age. **Conclusion:** A high percentage of children in our study were detected to have protective antibody levels after childhood vaccination with Hep B vaccine.

INTRODUCTION

Hepatitis B, a potentially life-threatening liver infection caused by the Hepatitis B virus is a major global health problem and a leading cause of chronic Hepatitis, liver cirrhosis, and hepatocellular carcinoma. World Health Organization (WHO) estimates that globally 296 million people were living with chronic Hepatitis B infection in 2019, with 1.5 million new infections each year.[1] According to a meta-analysis, incidence of chronic HB infection is 1.46% in India, with an estimated 17 million chronic carriers.[2]

The World Health Organization (WHO) aims to eliminate Hepatitis B as a global public health challenge by 2030. Following this, the World Health Assembly adopted its first global health sector plan in May 2016 that calls for a 90% decrease in new infections and a 65% decrease in mortality by 2030. However to achieve this goal, innovations for Hepatitis B diagnosis and treatment, along with a sustained and regionally targeted scale-up of the birth dose of the HB vaccine, and screening and treatment of pregnant mothers to halt mother to foetus transmission are required.[3] Furthermore, WHO advises that HB vaccine should be administered to all new born babies as soon as possible after delivery, ideally within 24 h, and then have second or third doses spaced at least 4 weeks apart.

Although, India has a low endemicity of Hepatitis B, still certain population remains at a higher risk of infection. However, a recent nation-wide study revealed that the children born after the introduction of Hepatitis B vaccination had a lower prevalence of past HBV infection.[4]

Hepatitis B vaccine was introduced in Universal Immunization Program (UIP) of India in 2002 on a pilot basis and later covered the entire nation by

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2012.[5] Currently the new born is given a birth dosage followed by three doses scheduled at 6, 10, and 14 weeks. In India, 83.9% of children between the ages of 12 and 23 months received 3 doses of the Penta or hepatitis B vaccine in 2019.[6] In order to evaluate the success of hepatitis B vaccination programmes, serological surveys measuring the prevalence of several HBV markers, such as hepatitis B surface antigen (HBs-Ag), antibodies to core antigen (anti-HBc) and surface antigen (anti-HBs) and hepatitis B envelope antigen (HBeAg) are advised.[7] We aim to generate evidence on the sero-prevalence of Hepatitis B among under-five children to gather evidence on the sero-prevalence of HBV infection which could further be used to strengthen the course of vaccination programme.

MATERIALS AND METHODS

An observational cross-sectional study was carried out by the Department of Microbiology SKMCH, Muzaffarpur, Bihar. Children aged 1–10 years admitted in the pediatric ward of our hospital who had documented evidence of complete vaccination against HBV were included in our study. Children born to HBsAg-positive mother and children admitted with jaundice or any other liver disease were excluded from the study. We included participants whose parents agreed to participate and provided informed consent. Participants who were ill or unable to provide required information were excluded from the study. The study duration was November 2022 to October 2023. During this period, based on inclusion and exclusion criteria, 193 participants were enrolled for the study. Basic demographic data, vaccination history and HBsAg status of the mother were recorded. All the enrolled children were evaluated for HBsAg and anti-HBS titres. Three ml blood sample was obtained simultaneously whenever the child was subjected to any laboratory investigation, and a separate needle prick to the participant was not given for this study. Sera were separated and stored at −80 °C till analysis. Serum specimens were tested for HBsAg and anti-HBs using automated enzyme-linked immunoassays. The assay principle combined an enzyme immunoassay sandwich method with a final fluorescent detection. The solid-phase receptacle (SPR) in VIDAS (VITEK Immunodiagnostic Assay System) had ad and ay HB surface antigens coated on the interior of the SPR. Antibodies in the serum bind to the antigen coated on the SPR leading to antigen–antibody complex formation which in turn will bind to biotinylated antigens in the diluent. Later, biotin is bound to the antibiotin–alkaline phosphatase conjugate. The alkaline phosphatase catalyses the hydrolysis of the substrate (4-methylumbelliferyl phosphate) into a fluorescent product (4-methyl umbelliferone), the fluorescence of which was measured at 450 nm. The intensity of fluorescence is proportional to the quantity of anti-HB antibody in the sample. At the end of the assay, results are automatically calculated by the instrument with the calibration curve stored in the memory and then printed out. The coefficient of variance of the assay was 10%. HBsAg status was evaluated by an ELISA-based rapid test.

RESULTS

A total of 193 children participated in this study. The baseline characteristics of the children are described in Table 1. The male to female ratio was 1.25. The mean age of the boys and girls was 66.4 months and 75.7 months, respectively. A higher percentage of boys showed protective antibody titers as compared with the girls. Most children had 4 doses of Hep B vaccine. Only 05 boys and 02 girls had been administered 03 doses of the vaccine. None of the mothers were found to be positive for Hep B surface antigen. None of the children included in the study were HBsAg positive.

In our study, 71.5% (138 out of 193) of the children showed protective antibody titers after vaccination, while remaining children had titers less than 10 IU/L [Figure 1]. In the 07 children who received three doses of the vaccine, 04 children had titers less than 10IU/L and the remaining had protective antibody levels. The mean antibody titers reduced with age, and children aged younger than one year had mean titers of 487.3 IU/L and the titers kept reducing, to the lowest level at 5–6 years of age. The proportion of children with protective antibody titers kept decreasing with age consistently till 5–6 years of age. While 100% of children between birth to three years of age had titers >10 IU/L, this proportion kept declining with age, and at 09–10 years of age, one-third of the children had titers less than 10 IU/L.

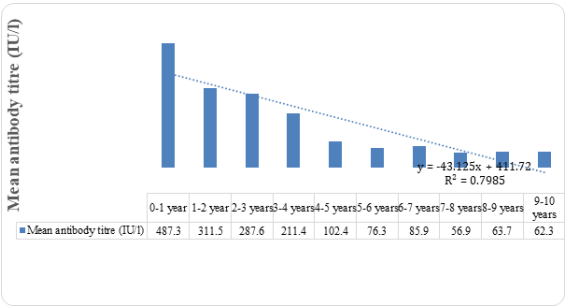

Figure 1: Mean antibody titers in various age groups

Table 1: Baseline characteristics of the study population

Characteristics	Gender	
	Male (107)	Female (86)
Mean age (months)	66.4 (35.6)	75.7 (31.9)
Mean weight (Kg)	19.2 (11.4)	17.8 (9.3)
Mean titre (IU/l)	121.9 (211.1)	119.4 (193.5)

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Antibody titer >10 IU/l <10 IU/l	 85 (79.4%) 22 (20.6%)	 53 (61.6%) 33 (38.4%)

DISCUSSION

We studied the protective antibody titers in 193 children who were vaccinated during infancy against hepatitis B. In our study, 71.5% of the children showed protective antibody titers after vaccination, while 28.5% of the children had titers less than 10 IU/L. The percentage of children showing protective titers fell with age, while 100% had protective levels till 03 years of age; this percentage fell to 35% for children aged between 09 and 10 years. A recent multicentric study by Puliyel et al. in India carried out in 2671 children reported protective antibody titers in 70% of the vaccinated children; the authors also reported that the levels waned from 82% in the first year to 47% by the age of 5 years.[8] In a study from rural Andhra Pradesh, 53% of the immunized children in the age group of 5–11 years were detected to have protective levels; however, the proportion of children with protective levels decreased with age.[9] In a similar study carried out in South Korea, the authors observed an average decline of around 18 IU/L for each year of age.[10] A study from China reported protective titers in 45.29–63.33% of the children aged between 7 and 14 years; however, similar to our findings, the authors also described a reducing level of protection with increasing age.[11] In a similar study from Iran, authors reported protective antibody titers in 88% of the children aged younger than 5 years, which declined to 74% at 10 years of age.[12]

In our study, the mean antibody titer was 112.4 IU/L. The titers reduced with age, and children aged younger than 01 years had the highest titers, and a steadily declining trend was observed thereafter. In a study from China, He et al,[13] reported the mean antibody titers of 23 mIU/L in a sample of 1526 children aged 15 years and younger who had undergone Hep B immunization during infancy. The authors also documented similar declining antibody levels with children aged one year having 147.8 IU/L and those at 15 years showing levels as low as 30.7 IU/L.[13] A study from Palestine reported 60% of children aged 1–15 years showing protective antibody levels, and similar to our study, while 92% of children aged one year had protective titers, this percentage fell to 39% for children aged between 7 and 19 years.[14]

Our study showed that a higher percentage of boys had protective antibody titers as compared with the girls; this is similar to the finding reported by Lee et al,[10] from South Korea. Other studies from China and Iran also reported higher rate of protective levels of anti-HBS in female children than in male children and infants.[12,13]

There is no clarity on the period of protection conferred by childhood hepatitis B vaccination.[15,16] This issue is especially important in countries with high or intermediate prevalence as risk of HBV is greatest during childhood through horizontal transmission.[17] Lao has convincingly argued the case to reexamine the claims of persistence of immune protection provided by childhood vaccination programmes and the possible need for booster dose in children.[16] Without knowledge about this important aspect, control of HBV infection through childhood vaccination programmes may not be completely effective.

CONCLUSION

A high percentage of children in our study were detected to have protective antibody levels after childhood vaccination with Hep B vaccine. These figures are comparable and also higher than those reported by authors from other developed countries. The protective titers, however, continued to decrease with age, and further studies may be required to assess the clinical and larger public health implications of the same.

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