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# Hepatitis B Immunity Status Among Doctors: A Cross-Sectional Study

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**Abstract:** ***Background**: Hepatitis B virus (HBV) infection is a significant occupational hazard for healthcare workers, including doctors. Ensuring immunity against HBV is crucial to prevent transmission. Vaccine against HBV is widely popular and is included in the expanded program of universal immunization in infancy. **Objectives**: To assess the HBsAg and anti-HBs status among doctors and identify the proportion of non-immune individuals. **Methods**: A cross-sectional study was conducted among 100 doctors. Health care workers other than doctors were excluded. Blood samples were collected and tested for HBsAg and anti-HBs antibodies using CMIA (Chemiluminescent Microparticle Immunoassay). **Results**: Out of 100 doctors, 75% reported being vaccinated against HBV. However, 40% of those vaccinated did not receive the recommended booster dose. Serological testing revealed that 21% of the doctors were non-immune to HBV. **Conclusion**: This study highlights the need for improved vaccination strategies, regular serological testing, and enhanced infection control practices to protect doctors and patients from HBV transmission.*

**Keywords:** Hepatitis, Vaccination, HBsAg, Anti-HBs, HCW

## 1. Introduction

Hepatitis B virus related liver disease is a major health problem worldwide. There is an estimated population of more than 250 millions with HBV infection. Hepatitis B is one of the commonest causes of viral hepatitis in India. Carrier state of the virus ranges from 3-5% in the country, with a reduction in recent years in view of widespread usage of vaccination against HBV[1]. Medical and paramedical personnel carry a high risk of getting infected in view of exposure to contaminated blood and blood products during routine work. A meta analysis indicated that the prevalence rate of HBV infection in India is 1.46% with an estimated 17 million chronic carriers[2]. Hepatitis B can cause acute hepatitis, fulminant hepatitis, chronic hepatitis, cirrhosis of liver, hepatocellular carcinoma and carrier state. Based on the presence of HBeAg positivity or negativity, the disease is classified as 1. HBeAg positive chronic hepatitis, 2. HBeAg positive HBV infection, 3. HBeAg negative chronic hepatitis and 4. HBeAg negative HBV infection[3]. Once infected, the disease may have a chronic course leading to cirrhosis of liver. Vertical transmission is known to occur, if the maternal viral load is >2,00,000 IU/ml. Vertical transmission is to be prevented by antivirals during pregnancy and/or HBIG after birth to the newborn[4]. Vaccination is the way to prevent infection in children as well as adults[5]. Several vaccines are commercially available in India and successful vaccination prevents the disease when the anti HBs level is ≥ 10 mIU/ml. Vaccination has to be universal and is included in the expanded program of immunisation. There is no compulsory program of vaccination for adults in India. Medical professionals are required to be vaccinated in view of high rate of exposure to infected blood and blood products. So, there is a need to vaccinate all the persons involved in handling patients. There are various schedules of vaccinations, but the commonest ones are 0,1,6 months and 0,1,2,12 months with the recombinant HBV vaccination, 1 ml administered intramuscularly into the deltoid[3]. Antibody (anti HBs) development is an expected event after the administration of HBV vaccine, but not universal. There would be failure to develop adequate antibody titres and this could be a reason for development of HBV infection in apparently vaccinated individuals. There is no strict recommendation to undergo screening for protective antibodies in vaccinated individuals.

### Aim of the Study

The estimation of HBsAg and anti HBS titers in practicing doctors and to assess the vaccination status and booster administration in the study group.

**Table 1:** Characteristics among study population

| Category | Total | Vaccinated (%) | Unvaccinated (%) |
|---|---|---|---|
| N | 100 | 75 (75) | 25 (25) |
| Gender | | | |
| Male | 55 | 47 (85) | 8(15) |
| Female | 45 | 28 (62) | 17(38) |
| Age | | | |
| < 25 | 2 | 0 | 2(100) |
| 25-50 | 91 | 68 (75) | 23(25) |
| > 50 | 7 | 7 | 0 |
| AntiHBs≥10mIU/ml | 79 | 68 (86) | 11 (14) |
| AntiHBs<10mIU/ml | 21 | 7(33) | 14(67) |
| HBsAg Negative | 100 | 91(91) | 9(9) |
| HBsAg Positive | 0 | 0 | 0 |

| | | | |
|---|---|---|---|
| Booster dose | | | |
| Taken | 60 | 60 | 0 |
| Not taken | 40 | 15 (37) | 25 (63) |

## 2. Materials & Methods

This cross sectional study was conducted in a tertiary care hospital between 2023 & 2024. One hundred doctors were enrolled in the study and written consent was obtained. Blood samples were collected for HBsAg and antiHBs. Vaccination status was obtained by detailed questioning.

**Inclusion Criteria:**

- Health care professionals (doctors) working in tertiary hospital.

**Exclusion Criteria**

- Nurses, technicians and other paramedics working in the hospital.
- Procedure for collection of blood sample: Under strict aseptic precautions, 3 ml of venous blood was collected from all subjects. Serum separation was performed by centrifugation of the blood sample at 2000 rpm for 20 minutes and processed for HBsAg & anti HBs testing.
- HBsAg and Anti HBs testing was performed in department of clinical microbiology by CMIA method (Alinity i - Qualitative II and ARCHITECT Anti-HBs; Abbott Ireland, Sligo, Ireland)

**Table 2:** Factors for non- response to HBV Vaccine

| |
|---|
| Advanced age Obesity Smoking Chronic illness |
| Hereditary factors HCV infection* Vit D deficiency Celiac Disease |
| Occult HBV infection IBD* |
| DM* IDDM* |
| HIV* |
| Certain genetic polymorphism High mi-RNA 155* |
| SNP's of cytokine genes IL-1 beta, IL-4, IL4R, IL1, IL10* |

*HCV- Hepatitis C Virus, IBD - Inflammatory Bowel Disease, DM- Diabetes mellitus, IDDM - Insulin dependent diabetes mellitus, HIV- Human Immunodeficiency Virus, mi- RNA- MicroRNA 155, SNP - Single Nucleotide Polymorphism, IL - Interleukin.

**Table 3:** Non- Responders

| Factors for non- response to HBV Vaccine | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Advanced age | ✓ | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × |
| Obesity | × | ✓ | × | ✓ | × | × | × | × | ✓ | × | × | × | × | × | × | × | × | × | × | × | × |
| Smoking | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × |
| Chroni illness | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × |
| Hereditary factors | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × |
| HCV infection | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × |
| Vit D deficiency | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | ✓ | × | × | × |
| Celiac Disease | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × |
| Occult HBV | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × |
| IBD | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × |
| DM | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × |
| IDDM | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × |
| HIV | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × |

## 3. Results

In this study 100 doctors working in Yashoda hospital, Secunderabad, India were recruited after informed consent. All the subjects were screened for HBsAg and antiHBs. The study group had 55 males. The vaccination status was 75% overall; 85% of men and 62% of women had been vaccinated; but only 60% of the cohort had taken booster doses. The predominant age group was 25-50 (91) and 2 were below 25 and 7 over 50 years. All the subjects were negative for HBsAg; and anti HBs above 10 mIU/mL was noted in 79% and the remaining 21% showed lower titers. Among the 9 subjects who were not vaccinated, 5 had anti HBs titers >10mIU/mL and rest 4 had lower titers. The unvaccinated subjects with protective titers might have acquired the infection and developed natural immunity. Overall, the results suggest that 21% of health care professionals (doctors) did not have protective antibodies against HBV. The overall vaccination status was 75%, but the booster dose was received only by 60% of the cohort. (Table no 1). The software used was SPSS version 23 and Independent t-test. Confidence interval is 95%, hence P value <0.05 is considered significant.

**Table 4:** Antibodies vs Vaccination Status

| Booster dose | Anti-HBs (mIU/mL) | | | P value |
|---|---|---|---|---|
| | Minimum | Maximum | Mean± SD | |
| Vaccinated | 0.23 | 1000 | 612.2±405.1 | <0.0001 |
| Non-vaccinated | 0.22 | 1000 | 223.4±394 | |

Statistically significant difference found in the antibodies between vaccinated and non-vaccinated patients.

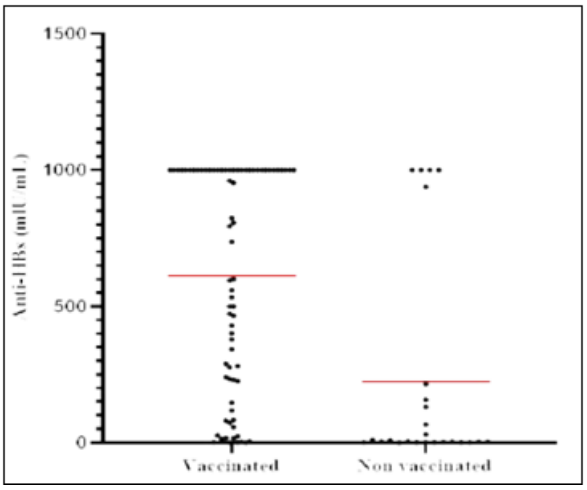


**Figure 1:** Antibodies vs Vaccination Status

**Table 5:** Antibodies vs booster dose status

| Booster dose | Anti-HBs (mIU/mL) | | | P value |
|---|---|---|---|---|
| | Minimum | Maximum | Mean± SD | |
| Taken | 0.3 | 1000 | 592.9±403.8 | 0.1158 |
| Not taken | 0.22 | 1000 | 452.9±450.2 | |

Statistically significant difference does not exist in the antibodies between booster dose taken and not taken patients.

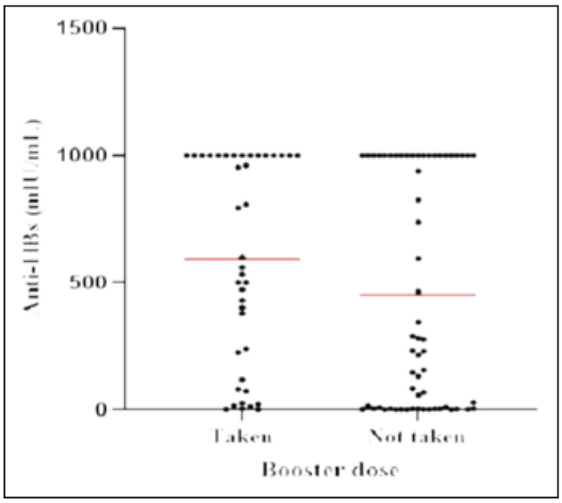


**Figure 2:** Antibodies vs booster dose status

## 4. Discussion

HBV infection is a worldwide problem and the prevalence rates are higher in asian countries. The prevalence rates in India ranges from 3-5%, with a tendency towards reduction, probably in view of increased awareness, patient education, effort of the medical professionals towards limiting the disease burden and the inclusion of HBV vaccine in the expanded program of universal immunization. Another factor that seems to be helping is the screening of patients before surgical procedures or major invasive techniques.All health care workers (HCW) are expected to receive the HBV vaccination as a precautionary measure against infection in view of high risk of exposure to blood and related products during the course of work[6]. Most of those vaccinated develop antibodies against HBV, but a small proportion of subjects may be non-responders and do not develop antibodies.

A hepatitis B vaccine 'non-responder' refers to a person who does not develop protective surface antibodies after completing two full schedules of hepatitis B vaccine and in whom an acute or chronic HBV infection has been ruled out.

Although the majority of persons vaccinated against HBV successfully respond to vaccination, an estimated 5-15% of persons may not respond due to various reasons. Any person not responding to vaccine may have been already infected with HBV and hence HBsAg testing is recommended before diagnosing a person as 'vaccine non-responder'.

The CDC recommends a second complete series of hepatitis B vaccine, especially by a different brand in subjects who have not responded to the first vaccine series. The revaccinated person should be retested for antibody response at the completion of second vaccine series, 1-2 months following the last dose. Persons who do not respond to the initial vaccine series have a 30-50% chance of responding to a second vaccine series. Newer vaccines may provide a greater antibody response [7].

Responders to the vaccine may have their antibodies reduced or lost over a period of time. 10% of people who respond to the vaccine lose anti-HBs after 5 years and 50% lose them after 10 years. However, the protection may last up to 10 years, even if antibody titer drops below 10 mIU/ml[8] . A single booster may increase the serological response to vaccine in most cases. A large proportion of children who receive the vaccine as neonate, experience waning of immunity after 15 years. This can lead to breakthrough infection [9].

Post vaccination testing is recommended 1-2 months after the last dose of vaccine, especially in a select group of patients. But this practice is usually not carried out, though it is essential especially in HCW[6]. A study from Africa showed that only 21.3% of vaccinated HCW were tested for anti-HBs[10].

In the present study, high percentage of absence of immunity in the vaccinated group could have been due to waning of antibodies over the period of years and a proportion of subjects may be non responders. There could be a few other reasons for the failure to respond to routine vaccination schedule. (Table 2)

The usual schedule of HBV vaccination followed in India, is the 3 dose schedule: 0,1,6 months; or the 4 dose schedule: 0, 1, 2,12 months. The two dose vaccine for adults - Heplisav-B, approved by the USA in 2018 is not yet popular or available in India[11].

## 5. Conclusion

This study highlights a significant concern regarding the immunity status of doctors against hepatitis B virus (HBV) infection. Despite being healthcare professionals, 21% of doctors in our study were found to be non-immune to HBV, as indicated by the absence of anti-HBs antibodies. This

finding underscores the need for:

- Improved vaccination strategies: Ensuring that all healthcare workers, including doctors, receive the complete HBV vaccination series and booster doses as recommended.
- Regular serological testing: Implementing regular testing for HBsAg and anti-HBs antibodies to identify non-immune individuals and provide targeted interventions9.
- Enhanced infection control practices: Strengthening infection control measures in healthcare settings to minimize the risk of HBV transmission to patients and healthcare workers.
- Occupational health programs: Developing and implementing comprehensive occupational health programs that include HBV vaccination, testing and counseling for healthcare workers.

By addressing these gaps, we can reduce the risk of HBV transmission in healthcare settings and protect both healthcare workers and patients[10].

Suggestions for Future Studies could include:

- Conducting longitudinal studies to assess durability of immunity and the need for booster doses.
- Evaluating the efficacy of different HBV vaccination schedules and booster doses in healthcare workers.
- Investigating the risk factors associated with non-immunity to HBV in healthcare workers.

By continuing to investigate in the proposed areas, strategies for preventing HBV transmission in healthcare settings can be strengthened[11].

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