Original Article

Knowledge of vaccination status and Hepatitis B immunoprotection profile of hospital care workers

Conhecimento sobre situação vacinal e perfil de imunoproteção para hepatite B de trabalhadores da assistência hospitalar

Conocimiento sobre situación vacunal y perfil de inmunoprotección para Hepatitis B de trabajadores de la asistencia hospitalaria

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ABSTRACT

Background and Objectives: Hepatitis B is an universally prevalent viral infection, and it is considered the most important infectious occupational disease among health care workers, of which the nurse professional, for performingmany and frequent invasive actions, constitutes anextremely vulnerablegroup.The immunity obtained through vaccination is an effective preventive strategy; however, about 10% of vaccinees do not achieve protective antibody titers, requiring serological tests to confirm immunity. The aim of this study was to investigate the knowledge of the nursing staff about the vaccination status and immunoprotection profile for hepatitis B.**Methods**: This is an epidemiological, analytical study, carried out with 70 health care workers from a regional reference public hospital in the State of Paraíba. After giving their consent, they were submitted to the interview, blood collection and serological tests for the detection of HBsAg and anti-HBs markers, in duplicate, by electrochemiluminescence. The collected data were processed using the SPSS software, version 22.0 and analyzed using descriptive statistics. **Results**: Most participants were women (85.7%), with a mean age of 33.4 years and a high school degree (75.7%). About the vaccination status, 65.7% reported having completed the vaccination schedule and 73.9% had blood tests, with 18.2% of non-seroconversion among them. Regarding the test for immunological status verification, 25.7% reported not knowing about the existence of a specific test for such detection. There was a significant association between professional category and knowledge about Anti-HBs. **Conclusion**: There was a high percentage of non-seroconversion among nursing workers, which, concomitantly with the lack of knowledge about their immunological status, made them vulnerable to the disease.

KEYWORDS: Hepatitis B vaccine. Biomarkers.Occupational health.

RESUMO

Justificativa e objetivos: Hepatite B é infecção viral universalmente prevalente e considerada a doença ocupacional infecciosa mais importante entre os profissionais de saúde, e o trabalhador de Enfermagem, por desenvolver ações invasivas em quantidade e frequência intensas, constitui grupo de extrema vulnerabilidade. Imunidade obtida por vacinação constitui estratégia preventiva eficaz, entretanto, cerca de 10% dos vacinados não alcançam títulos protetores de anticorpos, sendo

necessário teste sorológico para confirmar imunidade. O objetivo deste estudo foi investigar o conhecimento da equipe de enfermagem sobre situação vacinale perfil deimunoproteção para hepatite B. **Métodos:** Estudo epidemiológico, analítico, com70trabalhadores de um hospital público de referência regional no Estado da Paraíba. Após consentimento, foram submetidos à entrevista, coleta de sangue e testes sorológicos para detecção dos marcadores HBsAg eanti-HBs,em duplicata, por Eletroquimioluminescência. Os dados coletados foram processados no SPSS versão 22.0 e analisados por estatística descritiva. **Resultados:** A maioria dos participantes é do sexo feminino (85,7%), com média de idade de 33,4 anos e nível médio de escolaridade (75,7%). Sobre a situação vacinal, 65,7% declararam possuírem esquema completo e 12,9% não lembravam/não sabiam se já haviam recebido imunobiológico.Sobre o teste para verificação do *status* imunológico, 25,7% informaram desconhecerem a existência de teste específico para tal detecção. Houve associação significativa entre categoria profissional e conhecimento sobre o Anti-HBs.**Conclusão:** O desconhecimento dos trabalhadores de enfermagem sobre seu *status* vacinal e imunológico os colocam em vulnerabilidade constante para a hepatite B, sinalizando a urgência de atitudes institucionais protetivas para este público.
DESCRITORES: Vacina contra hepatite B.Biomarcadores. Saúde do trabalhador.

RESUMEN

Justificación y objetivos: La Hepatitis B es una infección viral universalmente prevalente y considerada la enfermedad ocupacional infecciosa más importante entre los profesionales de la salud, y el trabajador de Enfermería, por desarrollar acciones invasivas en cantidad y frecuencia intensas, constituye un grupo de extrema vulnerabilidad. La inmunidad obtenida por vacunación constituye una estrategia preventiva eficaz, mientras que aproximadamente el 10% de los vacunados no alcanzan títulos protectores de anticuerpos, siendo necesario un análisis serológico para confirmar la inmunidad. El objetivo de este estudio fue investigar el conocimiento de personal del equipo de enfermería sobre situación vacunal y perfil de inmunoproteción contra lahepatitis B. **Métodos:** Estudio epidemiológico, analítico, con 70 trabajadores de un hospital público de referencia regional en el Estado de Paraíba. Después del consentimiento, fueron sometidos a la entrevista, recolección de sangre y pruebas serológicas para detección de los marcadores HBsAg y anti-HBs, en duplicado, por Electroquimioluminescencia. Los datos recopilados se procesaron en el SPSS versión 22.0 y se analizaron por estadística descriptiva. **Resultados:** La mayoría de los participantes es del sexo femenino (85,7%), con promedio de edad de 33,4 años y con nivel medio de escolaridad (75,7%). En cuanto a la situación vacunal, el 65,7% declaró poseer un esquema completo y el 73,9% hizo una prueba sanguínea, con un 18,2% de no seroconversión. Con respecto a la prueba para verificación del estado inmunológico, el 25,7% informó desconocer la existencia de una prueba específica para tal detección. Hubo asociación significativa entre categoría profesional y conocimiento sobre el antiHBs. **Conclusiones:** Se verificó alto porcentaje de no seroconversión entre los trabajadores de enfermería, situación que, concomitante al desconocimiento sobre su status inmunológico, los colocan vulnerables a la enfermedad.
PALABRAS-CLAVE: Vacunas contra Hepatitis B. Biomarcadores. Salud laboral.

INTRODUCTION

Hepatitis B is an infectious, viral disease considered to be universally prevalent, although it has a heterogeneous distribution. It can be symptomatic or asymptomatic, being accountable for the high rates of hepatic cirrhosis and liver cancer.[1]

In Brazil, the diagnosis of hepatitis B is based on the detection of the markers present in the blood, serum, or plasma of the infected individual through immunoassays, and/or viral nucleic acid detection, using molecular biology techniques.[2] Therefore, a person with one or more reactive

serological markers or the molecular biology test for the disease is considered a confirmed case of hepatitis B(positive or reactive HBsAg, anti-HBc IgM, HBeAg, detectable hepatitis B virus DNA), and virus transmission can occur through sexual intercourse without condom use, shared syringes, needles and other contaminated materials, breastfeeding, hospital use materials without adequate sterilization and accidents with sharp objects.[3]

Regarding the workers' health, hepatitis B is considered to be an incident, occupational infectious disease in health care professionals, being responsible for 30% of the risk for post-occupational exposure if there is a contaminated sharp instrument involved in the procedure, since exposure to the blood of patients with hepatitis B virus (HBV) represents the main source of occupational transmission and disposable syringes with hypodermic needles account for most accidents (30%), according to data from the National Surveillance System for Health Care Workers (NaSH).[4-6]

Although sharp objects can cause accidents anywhere in the health service, NaSH data show that 39% of accidents occur in hospitalization units, intensive care units and operating rooms, making these environments the most hazardous places for health professionals.

On the other hand, preventive mechanisms against the disease, such as the use of personal protective equipment, adequate disposal of sharp objects and correct sterilization of hospital equipment are effective universal measures, in addition to active immunization through pre-exposure vaccination.[6] The latter strategy is considered to be the safest and most effective prevention and control measure and the one with the greatest impact against hepatitis B by the Brazilian government health agencies.[2]

Therefore, the Brazilian Ministry of Health (MoH), through the National Immunization Program (PNI,*Programa Nacional de Imunizações*), recommends that the hepatitis B vaccine be administered in three doses (at 0, 1 and 6 months), with the complete vaccination schedule being necessary for full immunization. However, approximately 10% to 20% of vaccinated individuals do not reach protective antibody titers.[7] For health workers, the MoH also recommends that serological tests be performed 30 days after the administration of the last vaccine dose, aiming to control antibody titers.[5] Detection of anti-HBs antibodies ≥10 mIU / mL after the third vaccine dose confirms the immunity against the disease.[8]

In Brazil, hepatitis B vaccination throughout the country occurred in 1998, as established by the National Immunization Program (PNI) of the MoH, bringing advances in terms of disease control, since the target audience comprised children under 1 year, aiming to interrupt the epidemiological chain of hepatitis B among those born from that date onward.

In 2010, the PNI was able to expand its coverage, when it made the vaccine available in the basic units of the Unified Health System for groups considered to be more vulnerable, such as

pregnant women, after the first trimester of pregnancy; health care workers; individuals with sexually transmitted diseases (STDs);firefighters, civilian, military and road police officers; precinct and prison guards; hospital and household waste collectors; sexual partners of hepatitis B carriers; blood donors; men and women who have sex with individuals of the same sex; lesbians, gays, bisexuals, transvestites and transsexuals; inmates (prisons, psychiatric hospitals, juvenile institutions, armed forces, among others); manicurists, pedicurists and podiatrists; settlement and encampment populations; indigenous populations; potential recipients of multiple blood transfusions or polytrans fused individuals; sex workers; users of injectable, inhaled and smoked drugs, and trucker drivers.[9] The Hepatitis B vaccine is available as a three-dose regimen that induces antibody titers (anti-HBs ≥10 mIU / mL) in more than 90% of healthy adults and youngsters.[2]

With the increase in vaccination coverage for more vulnerable groups, which included health care workers, and considering that the specificities of hospitalization, emergency and ICU units may favor the occurrence of accidents with sharp objects, in which hepatitis B shows high rates of occupational transmissibility, it is considered important not only to provide the full vaccination schedule against hepatitis B to health professionals, but also to have proof of immunization through serological testing, since the knowledge of the vaccination status favors the rapid and correct evaluation of the conduct to be implemented in a possible post exposure prophylaxis, as the management of the post exposure situation depends on the outcome of this test.[10]

Considering the aforementioned facts, it is understood that the verification of the full vaccination status and antibody titration for hepatitis B should be routinely required during the hiring process of health professionals, as well as in their daily work activities, given that exposure to HBV is considered the most important occupational infection risk among health workers, since minute amounts of blood (0.0001 mL) are enough to transmit the infection. Moreover, the virus has high environmental resistance and can survive for more than a week in dry blood at room temperature and is resistant to common detergents and alcohol.[11]

Base on this information, the following questions are asked: are health professionals who provide direct care to patients admitted in the medical clinic, surgical clinic, emergency room and ICU clinic properly vaccinated and immunized against hepatitis B? Do these workers know about the anti-HBs test and its recommendation as a post-vaccination examination?

Aiming to answer these questions and considering it is urgent to know the vaccination and serological status of the health professionals who provide hospital care, in order to better plan preventive actions against the occupational transmission of HBV, this study was proposed, of which general objective was to investigate the knowledge about the vaccination status and immunoprotection profile for hepatitis B of these professionals, expecting this information will be

used as subsidy for occupational health and safety services to develop protective institutional strategies for this population, focusing on decreasing the vulnerability of these workers.

METHODS

This is an epidemiological, cross-sectional, analytical study with a quantitative approach, carried out in the medical clinic, surgical clinic, emergency and intensive care (ICU) units of a state public hospital located in the city of Cajazeiras, State of Paraíba, Brazil, which is a reference institution for the 15 municipalities that comprise the 9th State Health Management in the care of adult clinical and surgical patients.

The nursing professionals admitted to the aforementioned health institution, and were categorized according to the Brazilian Classification of Occupations (CBO) as nurses and nursing technicians, who spontaneously agreed to participate in the study and who met the following inclusion criteria were included in this study: a) To belong to the permanent staff of the institution; and b) to be included in the work schedule during the data collection period, to work in the following sectors: medical clinic, surgical clinic, emergency or ICU units. This study did not include professionals who, even though they met the inclusion criteria, were absent from work during the data collection period, which is the proposed exclusion criterion.

To calculate sample size, we considered a 5% sample error and a 95% confidence interval. We considered the total number of 127 nursing professionals and a proportion of non-seroconversion to hepatitis B of 10%, resulting in a sample of 67 professionals.

The investigated independent variables were: gender, age, professional qualification, years of graduation, time working at the institution, vaccination against hepatitis B, history of exposure to biological material, risk behaviors and situations concerning hepatitis B, knowledge of self-reported immunological status and serological test for hepatitis B, and as a dependent variable, the result of the anti-HBs serology test.

Data collection was carried out in two stages, with the first one being a meeting to answer the questionnaire, which consisted of two parts: Part I - comprised sociodemographic data, which allowed drawing a profile of the participating subjects and Part II - consisted of questions aimed at investigating risk behavior for hepatitis B and vaccination status.

This questionnaire was submitted to a pre-test in order to improve it regarding method and content. This step occurred during the month of February of 2015.

The second step aimed to evaluate the immune response to hepatitis B vaccination by collecting serological material for the determination of the antibodies against the hepatitis B surface antigen (anti-HBs). For this procedure, the blood was collected with disposable materials, with a

Vacutainer® brand device. Blood was collected aseptically in a vacuum collection tube containing serum separator gel.

The used materials were adequately packed and discarded in boxes for sharp objects. For the anti-HBs analysis, 8.5 mL of venous blood of each participant was collected by the researcher and two qualified undergraduate nursing students; after that 10 slow tube inversions were performed, and the tubes were placed in the vertical position and maintained at room temperature in a Styrofoam box. One hour after the end of each collection, the samples from that period were taken by the researchers to the Cajazeiras Clinical Analyses Laboratory (Central Lab), a laboratory that holds the highest quality certification obtained by the Brazilian Society of Clinical Analyses. The tubes were previously identified with code provided by Central Lab, followed by the list reported by the researchers.

The anti-HBs serologies were performed in duplicate using an electrochemiluminescence assay, which is considered the gold standard for this type of investigation. The serology results were considered reactive when the concentration of anti-HBs antibodies was ≥10 mIU / mL.

The results of the questionnaires and serology were typed and statistically analyzed using the software IBM Statistical Package for the Social Science (SPSS), version 22.0. Absolute, relative frequency and central tendency measurements were performed (mean and standard deviation). Pearson's chi-square test was used to investigate the association between categorical variables, with statistical significance when $p < 0.05$.

The study is part of the research entitled "Serological and vaccination profile for hepatitis B in hospital workers", linked to the Scientific Initiation Scholarship Program (PIBIC/CNPq) and submitted to the analysis of the Research Ethics Committee of Faculdade Santa Maria, registered at Plataforma Brasil under CAAE 33987114.9.0000.5180e, which received approval opinion under number 770,868, 09/29/2014.

After the conclusion of this study, the laboratory test results were handed to each participant by the researchers, so that he or she would be aware of their serological status for future action, if applicable. At that time, doubts arising after the test results were received and opened were clarified. The educational process occurred individually, during which the workers had the opportunity to be informed about the aspects involving vaccination against hepatitis B and the serological tests associatedwith the post-vaccination immunity assessment.

RESULTS

Among the 70 professionals interviewed, there was a predominance of female workers (85.7%), with age ranging from 30 to 39 years (45.7%) and amean age of 34.3 years, who were nursing technicians (75.7%) and nurses (24.3%), with a mean time of graduation of 8.9 years, with a mean

of 7.2 years working at that hospital institution. These professionals were distributed among the assessed workplaces, so that most worked in more than one sector, predominantly in the medical and surgical clinics (n = 42; 60%) (Table 1).

Table 1. Characterizationof the study participants - Cajazeiras, PB.

Variable	*n*	%
Gender		
Male	10	14.3
Female	60	85.7
Age		
20 – 29	22	31.4
30 – 39	32	45.7
40 – 49	11	17.2
50 +	04	5.7
Professional qualification		
Nurse	17	24.3
Nursing technician	53	75.7
Years ofgraduation (years)		
< 1	03	4.3
1 – 4	13	18.6
5 – 10	22	31.4
10 +	16	22.8
Not informed	16	22.9
Workplace		
Medical/Surgical Clinic	42	60.0
Emergency unit	17	24.3
Intensive CareUnit	11	15.7

In order to investigate the workers'hepatitis B vaccination status, theywere asked if they had been vaccinated and the number of doses received (Table 2). A total of 85.7% of the participantsdeclared they had been vaccinatedagainst hepatitis B, 65.7% of which had received the fullschedule, as recommended by the PNI; however, 20% reported having an incomplete vaccinationschedule, one professional reported not being vaccinated and 12.9% did not remember/did not know whether they had received immunobiological drugs for this condition.

Table 2. Vaccination status and immunological status for hepatitis B reported by the professionals.

Variable	Nurse	Nurse Technician
	N(%)	*N*(%)
Have you been vaccinated against Hepatitis B?		

Yes, 1 dose	0(0.0)	5(9.4)
Yes, 2 doses	3(17.6)	6(11.3)
Yes, 3 doses	13(76.5)	33(62.3)
I don't know/don't remember	1(5.9)	8(15.1)
No, I have not received any doses	0(0.0)	1(1.9)
Have you had any tests to verify your post-vaccination immunity status?		
Yes	7(41.2)	14(26.5)
No	10(58.8)	39(74.5)
If you have, what was the test result?		
Reactive	4(57.1)	2(14.2)
Non-reactive	3(42.9)	6(42.9)
Don't know/don't remember	0(0.0)	6(42.9)

Among the professionals who reported having completed the hepatitis B vaccination schedule, only one reported having undergone the test specifically to verify post-vaccination immunity, whereas 28.6% reported having undergone the serological test due to other reasons, of which 42.9% declared they had not been immunized against hepatitis B.

The reasons given for having undergone the serological test were: I considered it necessary (n = 3; 4.3%); I have donated blood (n = 3; 4.3%); the test is a mandatory prenatal screening test(n = 12, 17.1%); (n = 1, 1.4%) and for having had an accident with a sharp object (n = 1, 1.4%).

Among the reasons for not undergoing the serological test, the following were mentioned: I did not know there was a test for this purpose (n = 18, 25.7%); I did not consider it necessary, since the vaccination is enough (n = 10, 14.3%); because I am careless with my health (n = 21; 30.0%).

Of the 46 professionals that reported completing of the hepatitis B vaccination schedule, 71.7% agreed to perform the anti-HBs serology offered through this study, and 81.8% showed a protective response with the formation of antibodies against HBsAg. Therefore, for 18.2% of those who were vaccinated, there was no seroconversion.

Regarding the participants' knowledge about the testused to detect the immunological protection against HBV infection, 41.5% of the professionals correctly identified the marker used for such screening; however, 18.5% mistakenly mentioned the name of the biological marker, and 40% reported not knowing the name of the specific test for such detection. There was an association between professional training and knowledge about anti-HBs serology, with a higher degree of knowledge among nurses ($p < 0.05$) (Table 3).

Table 3. Professionals' knowledgeabout theanti-HBs test.

Variable	Nurse N(%)	Nursing technician N(%)	Total N(%)	*p*
What test is performed to detect immunity after a complete hepatitis B vaccination schedule?				
Anti-HBs	11 (64.7)	18 (34.0)	29 (41.5)	
HBsAg	5 (29.4)	5 (9.4)	10 (14.3)	
HBeAg	0 (0.0)	1 (1.9)	1 (1.4)	0.02
Anti-HBc	0 (0.0)	1 (1.9)	1 (1.4)	
Anti-HBe	0 (0.0)	1 (1.9)	1 (1.4)	
I don't know	1 (5.9)	27 (50.9)	28 (40.0)	

DISCUSSION

The hepatitis B virus is a constant threat of infection in health care workers' routine. Therefore, this study investigated the professionals' vaccination status and immunoprotection profile against hepatitis B, aiming to verify the knowledge of these workers about their protection / exposure status to the disease during their daily routines. The results of this study showed that most nurses/nursing technicians declared to have been fully vaccinated against hepatitis B; however, a significant portionremains unprotected, since even for some of those who declared themselves to be fully vaccinated, the serological status did not confirm immunity.

According to another study, approximately 350 million people are chronically infected with HBV worldwide, making the hepatitis B scenario a public health challenge.[12] Despite this fact, the percentage of health professionals with full vaccine coverage is not yet significant, corroborating the data found in this study.

Likewise, another study emphasizes that health professionals are constantly vulnerable to contracting diseases such as hepatitis B.[13] Considering the abovementioned facts, a broader vaccination coverage is necessary for these professionals, since an adequate vaccination coverage allows good immunity to the disease for a good period of time, since there is no relative decrease in post-vaccinal immunity rates over time. Although they hold a key position in society by assisting individuals and their communities, health workers constitute a group of workers that is vulnerable to unsafe working conditions. In the same study, 87.5% of the workers reported having been vaccinated, of which a smaller portion (84.3%) received the full vaccination schedule, data similar to those verified in this investigation, although some studies indicate that the vaccination coverage percentages in this group of workers vary according to the assessed country and, in the case of Brazil, according toits geographic regions.[14,17-19]

After identifying the professionals who declared they had received the three doses of vaccine against hepatitis B, these were invited to participate, and blood was collected for the serological test

of anti-HBs antibody count, aiming at knowing the prevalence of non-seroconversion among the vaccinated individuals.

The results showed that most professionals had a protective titer against HBV; however, a significant part of them (18%) did not reach the required titer for immunoprotection, a situation of concern, since the workers involved were unaware of their serological status, as well as the importance of laboratory verification of seroconversion after undergoing the vaccination schedule.

In this regard, a study found that, in workers who are non-reactive anti-HBs after a complete vaccination schedule, the first step is to check the interval between the last dose of hepatitis B vaccine and the serological test.[20] If it is longer than six months, a single dose of hepatitis B vaccine helps differentiate serology results regarding seroconversion. A booster vaccine dose induces a response in individuals with impaired immunity. Those presenting as non-reactive anti-HBs after the complete vaccination schedule are considered non-responders. Therefore, a fourth dose of the vaccine should be applied prior to the immunity test for workers who did not undergo this test within 30 to 90 days after completing the vaccination schedule. Some studies establish smoking and obesity as possible causes for non-seroconversion in individuals that are fully vaccinated against hepatitis B, conditions that are foundin the lifestyle of some health workers.[21,22] However, similar to the percentage of vaccination coverage, the percentage of professionals who check their post-vaccination serological conditions varies according to their country of origin.[23,24]

One study found that health workers often do not undergo the anti-HBs test after vaccination.[20] Although hepatitis B vaccination has been recommended for workers since the 1980s, and this vaccine is available free of charge at the Brazilian Public Health system (SUS), the routine of post-vaccination tests has not yet been incorporated into the care of workers in Brazil, a scenario also seen in the presentstudyand others.[25]

Hepatitis B vaccination is recommended for all health care workers who are likely to be exposed to blood or body fluids. Post-vaccination tests for anti-HBs are recommended for individuals whose subsequent clinical management depends on their knowledge of their immune status, such as health personnel. When recommended, post-vaccination immunity verification should be performed within 30 to 90 days of the last vaccine dose.[20]

Surprisingly, in addition to the factors that are already known in the scientific literature that expose professionals to the risk of HBV contamination, in the present study, the lack of knowledge about the existence of the anti-HBs test as a marker for confirmation of post-vaccinal immunity constituted a significant variable in protection against the virus / exposure to the virus, having a close association with higher education.Nurses, perhaps due to their additional studies in the scientific field of virology and, us, their knowledge about the serological markers related to HBV and their respective nomenclatures, seemed to be less vulnerable to contamination when compared

to nursing technicians, regardless of the work sector, years of graduation, age or any other investigated variable.

The importance of these professionals' knowledge about their immunological profile lies in the possibility of taking preventive measures to prevent accidents at work, in case the health professionals are not aware of the risks inherent to their profession, such as the issues related to contact with biological material. However, the training of health professionals remains particularly focused so that they acquire knowledge that is applied to the patients. Therefore, an educational support for this group of workers becomes of utmost importance, since this support can provide guidelines on the disease and its magnitude, prevention measures and a change in attitude regarding the quality of life in the work environment.

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