OCCUPATIONAL WORK EXPOSURE TO HEPATITIS B VIRUS INFECTION IN THE EMERGENCY COUNTY CLINICAL HOSPITAL, TIRGU MURES, ROMANIA

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ABSTRACT

***Introduction**: One of the ways of transmission of hepatitis B viral infection is occupational exposure and health care workers (HCWs) are exposed to the risk of acquiring HBV infection. The aim of our study is to assess the occupational exposure to HBV infection, in the HCWs of the Emergency County Clinical Hospital Tirgu Mures, Romania.*

***Materials and methods**: The study was conducted retrospectively on a sample of 524 HCWs, between January 2010 and December 2014, who accidentally came into contact with blood or other body fluids from patients admitted in the Emergency County Clinical Hospital Tirgu Mures, Romania. We persuaded the source patients for the following markers: HBsAg, HCVAb and the HCWs for the following markers: HBsAg, HBsAb, HCVAb, HIVAb. Depending on the tests results and after subjects has given their consent for vaccination and counseling, vaccination was planned at 1 month, 3 months and 6 months.*

***Results**: The annual rate of HBV infections occurring in health care workers ranged from 0.78% to 2.88%. The highest proportion of occupational work exposure occurred among physicians (41.6%) and nurses (32.44%). The HCWs working in surgical departments, reported the highest occupational work exposure (44.85%). The adherence to follow-up decreased significantly from the 1 month scheduled serological testing, to the 3 and 6 months testing ($p< 0.0001$).*

***Conclusion**: Educational programs, implementation and adherence to more safety precautions for HCWs will help to decrease the frequency of occupational work exposure. Administration of hepatitis B vaccine to HCWs early in their careers can prevent HBV infection associated with occupational work exposure.*

***Keywords**: hepatitis B viral infection, HBsAg, HBsAb, health care workers, occupational work exposure.*

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Introduction

Worldwide, approximately one third of the population has serological evidence of past or present infection with hepatitis B virus (HBV), around 350 million people being chronically infected[(1)]. The global prevalence of HBsAg varies and countries can be classified as having a high, intermediate and low prevalence of HBV infection based on a prevalence of HBsAg carriers of 8%, 2%-7.9%, and 2% respectively[(2, 3)].

Romania has been long recognized as having one of the highest burdens of hepatitis B and C in Europe[(4)]. The reported incidence of acute hepatitis B has declined from 12 per 100 000 population in 2000 to 2.4 per 100 000 in 2010. In 2010, the majority (59%) of cases were male and the incidence was higher in urban (2.6/100 000) than in rural populations (2.0/100 000)[(5)].

According to the results of Gheorghe et al. in 2013[(6)] Romania is a part of intermediate risk group for HBV infection, the overall prevalence rate of

HBV chronic infection among all the participants tested being 4.4%.

The natural history of HBV is very complex and is influenced by many factors: age at which the infection occurs, HBV genotype, viral mutations, the replication of HBV, immune status, gender, concomitant infection with other hepatotropic viruses, alcohol intake[7]. Persons with chronic HBV infection are at a lifelong risk of developing hepatocellular carcinoma (HCC), cirrhosis, or both. Globally, deaths due to cirrhosis and hepatocellular carcinoma were estimated at 310,000 and 340,000 per year, respectively[8].

According to the report of The European Association for the Study of the Liver in 2013[9] chronic hepatitis B affects between 0.5% and 0.7% of the European population, and the highest prevalence was recorded in Romania (5.6%).

One of the ways of transmission of HBV infection is occupational exposure and health care workers (HCWs) are exposed to the risk of acquiring HBV and hepatitis C virus (HCV) infection through mucosal-cutaneous exposure to potentially infectious blood or blood products or through percutaneous exposure to contaminated sharp objects[3].

Because of the burden of HBV infection in Romania, and because we found very little data about this particular way of transmission, the aim of our study is to assess the occupational exposure to HBV infection, in the HCWs of the Emergency County Clinical Hospital Tirgu Mures, Romania.

Materials and methods

The study was conducted retrospectively on a sample of 524 HCWs, between January 2010 and December 2014, who accidentally came into contact with blood or other body fluids from patients admitted in the Emergency County Clinical Hospital Tirgu Mures, Romania.

The Ethics Committee of University of Medicine and Pharmacy Tirgu Mures approved the study.

Data were collected from the Medical Register of the Department of Surveillance and Control of Nosocomial Infections of the Emergency County Hospital, Tirgu Mures, Romania. Testing for HBV infection was done by ELISA technique in the laboratory of the Department of Surveillance and Control of Nosocomial Infections, pursuing source patients for the following markers: HBsAg, HCV Ab and the HCWs for the following markers: HBsAg, HBsAb, HCVAb, HIVAb. Depending on the tests results and after subjects has given their consent for vaccination and counseling, vaccination was planned at 1 month, 3 months and 6 months.

The analyzed variables are: agreement to participate in the study, occupation, age, gender, department, number of days between exposure and occupational accident declaration, source patients and exposed HCWs medical tests, history of vaccination for HBV, consent for vaccination and counseling, follow-up (HBsAg, HBsAg) at 1 month, 3 months and 6 months.

Statistical analysis

We used MS Excel (educational license from of University of Medicine and Pharmacy Tirgu Mures) for the database and EpiInfo for Windows (free software from CDC Atlanta, www.cdc.gov) for statistical analysis. We used elements of descriptive statistics: frequencies, percentages, 95% confidence intervals. We used Chi Square test and Fisher exact test for determining statistically significant differences between the studied binary variables. A p value of less than 0.05 was considered significant.

Results

The annual rate of HBV infections occurring in HCWs ranged from 0.78% to 2.88% in our study group (Table 1).

Year	% (95%CI)
2010	1.01 (0.03-5.5)
2011	1.27 (0.03-6.85)
2012	2.88 (0.6-8.2)
2013	0.88 (0.02-4.83)
2014	0.78 (0.02-4.24)

Table 1: The annual rate of HBV infections occurring in health care workers.
CI: confidence interval

We notice an increase of the annual rate from 2010 to 2012, followed by a decrease in following years 2013 and 2014.

The characteristics of the study group are presented in Table 2. Women are more frequently affected than men (65.1% vs 34.9%). Depending on occupation, the physicians are most affected

and most occupational accidents were recorded in surgical departments. Unfortunately 40.5% of the subjects had no history of vaccination. The mean age in our study group was 31.8 years, and the number of days between exposure and the report of the occupational accident was 1, suggesting that HCWs presented immediately to the Department of Surveillance and Control of Nosocomial Infections, in order to report the injury.

Characteristics (n=524)	**% (95%CI)**
Gender	
Females, n=341 % (95%CI)	65.1 (60.8-69.1)
Males, n=183 % (95%CI)	34.9 (30.9-39.2)
Occupation	
Physicians, n=218 % (95%CI)	41.60 (37.37-45.97)
Nurses, n=170 % (95%CI)	32.44 (28.48-36.66)
Orderlies, n=76 % (95%CI)	14.50 (11.66-17.88)
Paramedics, n=13 % (95%CI)	2.48 (1.38-4.32)
Volunteers, n=39 % (95%CI)	7.44 (5.41-10.12)
Administrative staff, n=8 % (95%CI)	1.53 (0.71-3.11)
Departments	
Surgical departments, n=235 % (95%CI)	44.85 (40.55-49.22)
Emergency Department, n=113 % (95%CI)	21.56 (18.17-25.39)
Internal medicine departments, n=69 % (95%CI)	13.17 (10.45-16.44)
Intensive care units, n=67 % (95%CI)	12.79 (10.11-16.02)
Clinical laboratory, n=12 % (95%CI)	2.29 (1.25-4.08)
Dentistry, n=10	1.91 (0.97-3.60)
Morphopathology, n=10 % (95%CI)	1.91 (0.97-3.60)
Techical departments, n=7 % (95%CI)	1.34 (0.59-2.86)
Radiology, n=1 % (95%CI)	0.19 (0.01-1.23)
B hepatitis vaccination history	
No vaccination, n=212 % (95%CI)	40.5 (36.2-44.8)
Partial vaccination, n=129 % (95%CI)	24.6 (21.0-28.6)
Complete vaccination, n=183 % (95%CI)	34.9 (30.9-39.2)
Consent for vaccination	
Yes, n=511	97.5 (95.7-98.6)
No, n=13	2.5 (1.4-4.3)
Consent for counseling	
Yes, n=522	99.6 (98.5-99.9)
No, n=2	0.4 (0.1-1.5)
	Mean (min;max)
Age (years)	31.8 (19;55)
	Median (25th-75th)
Time between exposure and report of the occupational accident (days)	1 (1-1)

Table 2: Characteristics of the study group.
n = number of individuals; CI: confidence interval

HCWs and source patient's medical tests at presentation are presented in Table 3. At presentation only 7 subjects were HBsAg positive. We registered one subject positive for HIV infection and for HBsAg.

HCW medical tests (n=524)	% (95%CI)	Source patient medical tests (n=429)	% (95%CI)
HBsAg		HBsAg	
Positive, n=7	1.3 (0.6-2.9)	Positive, n=34	7.9 (5.6-11.0)
Negative, n=517	98.7 (97.1-99.4)	Negative, n=395	92.1 (89.0-94.4)
HBsAb		HCVAb	
Positive, n=323	61.6 (57.3-65.8)	Positive, n=36	8.4 (6.0-11.5)
Negative, n=201	38.4 (34.2-42.7)	Negative, n=393	91.6 (88.5-94.0)
HCVAb		HIVAb	
Positive, n=1	0.2 (0.0-1.2)	Positive, n=2	0.5 (0.1-1.9)
Negative, n=523	99.8 (98.8-100.0)	Negative, n=427	99.5 (98.1-99.9)
HIVAb			
Positive, n=1	0.2 (0.0-1.2)		
Negative, n=523	99.8 (98.8-100.0)		

Table 3: HCWs and source patient's medical tests at presentation.
n = number of individuals; CI: confidence interval

HCWs medical tests at 1, 3 and 6 months after the exposure are presented in Table 4. Even if in the beginning all 524 subjects accepted the testing and 511 of them agreed with vaccination (Table 1), only 187 subjects presented for 1 month testing.

The time between exposure and report of the occupational accident did not influence the serological results (see Table 2).

When comparing the groups with medical education (the physicians and the nurses), there was no significant statistical difference regarding the positivity of HBsAg between the two groups ($p=0.62$; Fisher exact test), but there was a significant difference regarding the positivity of HbsAb ($p=0.01$; Chi-square test).

Adherence to the serological testing was better at the evaluation scheduled for 1 month after the exposure than at those scheduled for 3 and 6 months after the exposure ($p< 0.0001$). The adherence to follow-up was not influenced by gender ($p=0.46$), nor by medical education ($p=0.29$).

HCWs medical tests at 1 month	% (95%CI)	HCWs medical tests at 3 months	% (95%CI)	HCWs medical tests at 6 months	% (95%CI)
HBsAg, n=187		n=91		n=46	
Positive,	4.3 (1.9-8.3)	n=6	6.6 (2.5-13.8)	n=5	10.9 (3.6-23.6)
n=8					
Negative, n=179	95.7 (91.7-98.1)	n=85	93.4 (86.2-97.5)	n=41	89.1 (76.4-96.4)
HBsAb, n=199		n=94		n=55	
Positive, n=143	71.9 (65.1-78.0)	n=81	82.6 (77.5-92.4)	n=41	74.5 (61.0-85.3)
Negative, n=56	28.1 (22.0-34.9)	n=13	13.8 (7.6-22.5)	n=14	25.5 (14.7-39.0)

Table 4: HCWs medical tests at 1, 3 and 6 months after the exposure.
n = number of individuals

Discussion

In Romania there is very little data on the prevalence of HBV infection among HCWs. The risk of infection and the post-exposure management depends on the HBV status of the source and of the healthcare worker. Occupational sharps injuries among HCWs cannot be ignored[10].

In our study group the annual rate of HBV infections occurring in HCWs ranged from 0.78% to 2.88%, comparable to an annual rate of HBV infections in HCWs reported by Minuk et al.[11] between 0.5 and 5%.

The risk for exposure varies by occupation and job duties[12]. Our results indicate that the highest proportion of occupational work exposure occurred among physicians (41.6%) and nurses (32.44%). According to CDC[13] nurses and physicians account for 41.9% and 22.8%, respectively, of HCWs reporting percutaneous exposures. Another study[14] shows that the highest proportion of needlesticks injuries among physicians (22%) and nurses (39%) was related to recapping of used needles. A cross-sectional study conducted in three university hospitals in Belgrade indicates that nurses had higher risk to experience needlestick injuries than doctors ($p = 0.05$) and the majority of the exposures occurred in the operating room ($p = 0.001$)[15].

According to their results based on an anonymous questionnaire only 41.2% of HCWs reported their injuries and 50.2% were vaccinated with three doses of hepatitis B vaccine. Our data show a lower adherence to vaccination, as only 35.68% of the HCWs (187 from the 524 HCWs) presented for the 1 month testing and vaccination.

One study performed by Homoud[16] which targeted only physicians, indicates inappropriate knowledge and attitude regarding the occupational risks of HBV, suggesting more education is needed.

In our study we obtained a significant difference regarding the positivity of HbsAb ($p=0.01$) between physicians and nurses, meaning a better understanding of the problem and compliance to vaccination amongst doctors. But, when looking to the adherence to follow up, there was no significant difference between doctors and nurses, indicating that more education, no matter the level of medical education, is still needed.

The HCWs working in surgical departments, reported the highest occupational work exposure (44.85%), followed by those working in emergency department (21.56%). This is similar with other studies results[11, 14, 15].

The adherence to follow-up decreased significantly from the 1 month scheduled serological testing, to the 3 and 6 months testing, which is similar with the results of Escudero et al[17]. Regarding to their findings, that adherence positively correlates with being female ($p=0.009$), we did not find gender to influence the adherence ($p=0.46$).

Transmission of HBV infection is influenced by vaccination. Administration of hepatitis B vaccine is included in the national immunization plan for children[18]. Although vaccination is strongly recommended among medical personnel, some employees bypass or refuse vaccination. Also, the low or non-responder status to the vaccine can cause the infection of these individuals.

Medical education has influenced the history of vaccination for HBV because more doctors than nurses received the vaccine, but it did not influence the adherence to follow-up after the occupational exposure.

As seen in Table 2, 34.9% HCWs were vaccinated, 40.5% HCWs were unvaccinated, and 24.6% HCWs were partially vaccinated. The findings of Batra et al show that 49.6% HCWs were vaccinated, 46.1% were unvaccinated, and 4.3% were par-

tially vaccinated[19]. Comparing our results with Batra's results, we have similar percentages regarding the unvaccinated HCWs, but an important difference regarding the partially vaccinated HCWs. We can put this difference to a lack of education and a lack of interest of the medical personnel, suggesting that a general screening for HBsAg should be made compulsory for HCWs. Frequent deviations from universal precautions, unprotected medical maneuvers, are extra conditions that may influence the occupational work exposure.

Conclusion

Educational programs, implementation and adherence to more safety precautions for HCWs will help to decrease the frequency of occupational work exposure. Administration of hepatitis B vaccine to HCWs early in their careers can prevent HBV infection associated with occupational work exposure.

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