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HEPATITIS B VIRAL MARKERS AND VACCINATION STATUS AMONG HEALTH CARE PROVIDERS IN MENOUFIA GOVERNORATE

By

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Abstract:

Objectives: this study aimed at determinination of HBV viral markers, vaccination status of physicians and nurses acting in high risk departments and to estimate anti-HBs titer in vaccinated persons. **Subjects and methods:** A cross sectional study was done for doctors and nurses in high-risk departments in a district hospital in Menoufiya Governorate selected by simple random sampling. One hundred health care workers (HCWs) voluntarily participated in the study. A structured questionnaire was used to collect demographic data, HBV vaccination history and occupational risk factors. ELISA was used to test sera for HBsAg, Anti-HBs and total anti-HBc. **Results:** among the 100 participants, none of them tested positive for HBsAg, 49% had Anti-HBs, and 26% had Anti-HBc. Only 29% of the HCWs were immune after vaccination although 34% reported complete three doses HBV vaccine. Forty five of HCWs (45%) never vaccinated and were susceptible to HBV infection. The prevalence of life time exposure to HBV was 26%. All who reported complete vaccination had HBsAb, $p<0.001$. Significantly higher levels of anti-HBs titer was detected among HCWs less than 40 years (149.48± 43.67 vs. 97.47±29.25), in those who are free from chronic diseases (144.77± 45.70 vs. 102.08±31.01), and among those who had last dose of vaccine <3 years (155.56± 40.38 vs. 93.27±24.33). HCWs previously exposed to HBV were 4 times more likely to have needle stick injury in the previous year, (OR=3.92, 95% CI 1.29-12.42). **Conclusions:** None of the studied HCWs tested positive for HBV infection. The prevalence of life time exposure was high. Only one third of the HCWs were immune after vaccination. Needle stick injuries were the significant occupational exposure factor. There is a need to vaccinate all HCWs as a matter of policy.

Keywords: HBV, Vaccination, HCWs, Viral Markers, Occupational Exposure, Anti-HBs

Introduction:

Hepatitis B virus (HBV) infection and its sequelae, including chronic liver disease, cirrhosis and hepatocellular carcinoma are major global health problems. About 350 million chronic carriers worldwide constitute the primary reservoir of infection, (Kao and Chen, 2000). Exposure to blood and body fluids is a major risk factor for development of HBV infection and it is a well established fact that in an unvaccinated individual, the risk of acquisition of HBV infection after single exposure of HBV infected blood or body fluid ranges from 6%-30%. Therefore health care workers (HCWs) are at high risk of HBV infection due to repeated exposure, (Rosea et al., 1999) and (Talaat et al., 2003).

With the availability of HBV vaccine since 1982, the incidence of HBV infection and associated morbidity and mortality has been declining, (Gunson et al., 2003). Therefore, Centers for Disease Control (CDC) (1997), recommended that all HCWs should be vaccinated against HBV. Despite the recommendation and excellent protection profile among post vaccinated personnel, compliance to this recommendation remained poor in various health care settings, Shrestha and Bhattarai (2006) and (Dannetun et al., 2006).

Immune response to HBV vaccine is assessed by measuring antibody level after 6–8 weeks of completion of three doses. Hepatitis B surface antibody higher than10 mIU/ ml is generally taken to be protective, (Jack et al., 1999). Factors associated with decreased immune response include increasing age, smoking, obesity, gender and genetic factors, (Hollinger et al., 1989).

Hospital staff in contact with patients and especially patients' blood usually has a higher carrier rate than the general community. This applies to staff on renal dialysis or on oncology units. Patients are immunosuppressed and on contracting the disease become chronic carrier. The patient's attendant is infected from contact with blood parenterally such as from pricking or through skin abrasions, (Kashiwaga et al., 1990).

Aim of the work:

The aim of this study is to:

1- Determine the prevalence of Hepatitis B viral markers among health care providers in district hospitals of Menoufiya governorate.

2- Determine the vaccination coverage for physicians and nurses acting in high risk departments (surgery, obstetrics

and gynecology, medicine, clinical pathology and blood bank) in district hospitals of Menoufiya governorate.

3- Estimate anti-HBs titer in vaccinated persons in relation to the time of vaccination and the associated diseases.

Subjects and Methods:

Subjects:

A cross-sectional hospital based study was carried in the district hospitals of Menoufiya governorate. Menoufiya governorate has 10 district hospitals. Of the ten district hospitals, Quesina district hospital selected by simple random sampling. All doctors and nurses in selected high-risk departments (surgery, obstetric and gynecology, medicine, clinical pathology and blood bank) are invited to participate in the study after explaining objectives and methodology, risks and benefits. Only 36 doctors out of 51 (response rate 70%) and 54 nurses out of 67 (response rate 81%) voluntary agreed to participate in the study.

Methods:

Each individual under the study was subjected to:

I. Structured questionnaire: including personal data, present and past history of diseases specially viral hepatitis B and chronic diseases, history of HBV vaccination considering the schedule and the time past since the last dose, and occupational risk factors for HBV infection/ exposure .

II. Laboratory investigations:

Ten ml of venous blood were withdrawn from each studied subject and transferred slowly into a dry sterile centrifuge tube. The whole blood was allowed to clot at 37C°, and then centrifuged for 10 minutes at 1500 round per minute. The clear supernatant serum was separated and stored in a deep freeze at - 80C° till the time of testing.

Each serum sample was tested for hepatitis B viral markers including HBsAg, Anti-HBs and Anti-HBc Ig G by ELISA (Enzyme-Linked Immuno Sorbent Assay) by COBAS CORE auto analyzer – the kits were supplied by (Roche, USA). Results above 100% relative to the cutoff are considered positive and results below 100% relative to the cutoff are considered negative.

Anti-HBs titer was measured for the studied health care providers who completed three doses or more of hepatitis B vaccine.It was done by Elecsys auto analyzer; the kits were supplied by (Roche,

USA). Samples with concentrations < 10 mIU/mL are considered non-reactive in the Elecsys Anti-HBs test (negative)and samples with concentrations ≥ 10 mIU/mL are considered reactive in the Elecsys Anti-HBs test (positive).

Statistical Analysis:

Data were analyzed by SPSS version 16.0 statistical package. Quantitative data were expressed as mean and standard deviation (±SD) and analyzed by student t-test for comparison of the means of two groups.

Qualitative data were expressed as number and percentage and analyzed by Chi-square test ($\chi 2$). Yates's continuity correction or Fisher exact test were applied when appropriate.

Odds ratio (OR) was used to calculate the risk of exposure a long with 95% confidence Interval (CI).

Level of significance was set as P value <0.05.

Results:

One hundred health care workers (HCWs) voluntarily participated in the study from high risk departments at Quesina district hospital, Menoufiya Governorate. Their mean age was 35.40± 6.63. Seventy three percent were female, 60% were living in urban areas, and 64 % were nurses and 34% were physicians. Thirty percent of studied HCWs were working at the surgery department, 25% at the internal medicine department, 17% at the obstetrics and gynecology department, 12 % at the pediatric department, and 10% at intensive care unit and 6 % at the clinical pathology department. The mean duration of employment was 12.92±6.54 years. Three percent had a previous history of HCV infection, another 3% had HAV and only 1% had history of HBV infection.

Table 1, shows the seroprevalence of HBV markers in studied HCWs. None of the HCWs had positive HBsAg. Forty nine percent tested positive for anti-HBs. Anti-HBc were positive in 26%. There was no significant difference in the distribution of HBV viral markers between physicians and nurses, p >0.05.

On interpretation of the Hepatitis B viral makers, 45% of studied HCWs were susceptible for HBV infection, 20% were immune after infection, 29 immune after vaccination and 6% were indeterminate, table 2.

Regarding HBV vaccination, 34 HCWs (34%) reported having complete vaccination of three doses, 21 HCWs (21%)

had incomplete vaccination (less than three series) and 45 HCWs (45%) had never been vaccinated against HBV before.

Table 3, shows the relationship between status of vaccination and presence of protective level of anti-HBs. All of those who completed three doses of vaccine had protective level of anti-HBs, p <0.001, while 15% of those who did not completed vaccination or never vaccinated had anti-HBs in their blood.

The mean values of Anti-HBs titer were significantly higher among younger HCWs (<40 years) those who are free from chronic diseases and in those who had their last dose less than 3 years, p <0.01, table 4.

On studying occupational risk factors for HBV life time exposure, history of needle stick prick in the last year is associated with significant likelihood of having exposure to HBV (OR=3.92, 95% CI 1.29-12.42), table 5.

Table (1): Seroprevalence of HBV markers in the studied HCWs regarding their occupation

HBV markers	Occupation (n=100)				Total (n=100)		χ^2	P. value
	Physician (n=36)		Nurse (n=64)					
	No.	%	No.	%	No.	%		
HBsAg:								
· +ve	0	0.0	0	0.0	0	0.0		
· -ve	36	100.0	64	100.0	100	100.0		
Anti-HBs:								
· +ve	17	47.2	32	50.0	49	49.0	0.07	>0.05
· -ve	19	52.8	32	50.0	51	51.0		
Anti-HBc:								
· +ve	8	22.2	18	28.1	26	26.0	0.41	>0.05
· -ve	28	77.8	46	71.9	74	74.0		

Table (2): Distribution of interpretation of HBV serological markers .

HBsAg	Anti-HBs	Anti-HBc	Interpretation	No	(%)
Negative	Negative	Negative	Susceptible	45	(45%)
Negative	Positive	Positive	Immune after infection	20	(20%)
Negative	Positive	Negative	Immune after vaccination	29	(29%)
Negative	Negative	Positive	Indeterminate*	6	(6%)

*Indeterminate has four possibilities: i) Resolving infection (window phase),
ii) Remote resolving infection with low anti-HBs, iii) chronic infection with low levels of HBsAg,
iv)False positive anti-HBc, hence susceptible, Hollinger et al., (1989).

Table (3): Seroprevalence of HBV markers in the studied HCWs regarding status of hepatitis B vaccination.

Anti-HBs	HBV vaccination (n = 100)				Total (n=100)		Yates corrected χ^2	P-value
	Vaccinated (3doses or more) (n = 34)		Non-vaccinated /incomplete vaccination (n = 66)					
	No.	%	No.	%	No.	%		
Positive	34	100.0	15	22.7	49	49.0	50.57	<0.001*
Negative	0	0.0	51	77.3	51	51.0		

* Statistically significant

Table (4): Association of the level of Anti-HBs titer with some variables of the studied HCWs who completed hepatitis B vaccination (n=34).

Studied variables	n=34	Anti-HBs titer		t-test	P
		Mean ± SD	Range		
Age (years): <40 ≥40	 26 8	 149.48 ± 43.67 97.47 ± 29.25	 74.70 – 231.40 65.30 – 143.0	3.14	<0.01*
Sex: male female	 8 26	 141.68 ± 59.58 135.87 ± 42.50	 65.30 – 231.40 67.0 – 216.40	0.30	>0.05
Smoking: ever never	 4 30	 122.40 ± 71.19 139.22 ± 43.16	 65.30 – 220.50 67 -231.40	0.68	>0.05
Associated chronic diseases: yes no	 6 28	 102.08 ± 31.01 144.77 ± 45.70	 67 – 143 65.30 – 231.4	2.17	<0.05*
Duration since last dose (years): <3 ≥3	 24 10	 155.56 ± 40.38 93.27 ± 24.33	 74.7 – 231.40 65.3 – 143.0	4.52	<0.001*

* Statistically significant

Table (5): Occupational risk factors of HBV life time exposure among the studied HCWs.

Occupational risk factors	HBV exposure		Total (n=100)	(OR)	95% CI	χ^2	P- value
	+ve (n=26) No. %	-ve (n=74) No. %	No. %				
History of needle pricks last year:							
Yes	20 76.9	34 45.9	54 54.0	3.92	1.29-12.42	7.43	<0.01*
No	6 23.1	40 54.1	46 46.0				
Needle recapping practice:							
Yes	23 88.5	58 78.4	81 81.0	2.11	0.51-10.12	0.70**	>0.05
No	3 11.5	16 21.6	19 19.0				
Wearing of gloves in contact with blood:							
Yes	14 53.8	52 70.3	66 66.0				
No	12 46.2	22 29.7	34 34.0	2.02	0.57-7.74	2.31	>0.05

* Statistically significant

** Yates corrected Chi-square.

Discussion:

Hepatitis B virus is a global public health problem. In healthcare facilities, transmission generally occurs from patient to health care worker.

Hepatitis B virus is a recognized occupational hazard as non-immune health care workers stand a risk of being infected from their workplace, (Pruss-Ustun et al., 2005).

This is a hospital based cross sectional study, conducted on 100 voluntarily participated healthcare workers (36 physicians and 64 nurses) working in departments of high-risk exposure to blood born infections in a district hospital in Menoufiya governorate.

None of HCW under this study tested positive for HBsAg. This means that none of studied HCWs was a carrier of HBV. This is consistent with the prevalence of HBsAg among hospital personnel at the Clermont-Ferrad University Center in France, which was reported to be 0.0% by Djeriri et al., (1996). These results are also similar to that of Vivas et al., (1997), who conducted a study on 62 physicians working in "Hospital de Especialidades" in Spain to measure the prevalence of hepatitis B among them. All of them were negative for HBsAg.

Forty nine percent of HCWs had Anti-HBs, which could be due to immunity after infection or immunization. Twenty six percent of studied HCWs were tested positive for HBcAb, which indicates resolving infection or exposure to HBV. On interpretation of the viral markers combined, 45% of HCWs were susceptible for HBV infection, 20% were immune after infection, 29% were immune after vaccination and 6 % had indeterminate status. These results are close to that reported by Makram et al., (1994), who studied the prevalence of HBV markers among HCWs of the National Liver Institute, Menoufiya University, Egypt. They found that the prevalence of HBsAg was (3.2%), Anti-HBs (21%) and Anti-HBc (33%). Our results are also close to that of Nawar,(1990), who conducted a study on 82 medical and paramedical staff working in three different fever hospitals in Menoufiya governorate, Egypt, who are in close contact with patients suffering from viral hepatitis, to measure the prevalence of hepatitis B markers in them. 6.1% of the examined persons were HBsAg positive and 50% were HBcAb positive. In 1989, Goldsmith et al. conducted a study on 765 employees at 4 hospitals in Cairo, Egypt, to measure the prevalence of hepatitis B markers in them. Three percent (3%) of them were HBsAg positive and 28% of them were anti-HBs positive.

The prevalence of HBV viral markers were nearly similar in studied physicians and nurses, p >0.05. This is consistent with Goldsmith et al., (1989), who found no significant difference between physicians and nurses regarding the seroprevalence of HBV markers.

Only 34% of HCWs had complete vaccination series against HBV, 21 % had incomplete vaccination, and 45% did not receive any vaccination. Vaccination coverage did not differ significantly between physicians and nurses. The vaccination coverage was comparable to that reported by Talaat et al., (2003), of 38 % of professional HCWs in Egypt who reported receiving three doses of hepatitis B vaccine. However, hepatitis B vaccination coverage in the current study was far below reported by Murray and Skull (2002), in Australia of 95% of the studied HCWs were hepatitis B vaccinated. Lee et al., (1997), determined that hepatitis B vaccine coverage among HCWs in USA is 78%.

In the present study, we found that there was a significant association (P<0.001) between the status of vaccination and the seroprevalence of Anti-HBs, as the seropositivity of Anti-HBs in HCWs who completed HB vaccination was 100% (Anti-HBs level ≥ 10mIU/mL). Similar results have been obtained by Lozano et al., (2003), who reported 100% seroconvesion of Anti-HBs after the last dose of HB vaccine in all participants. Gandhoke et al., (2003), determined that seropositivity (Anti-HBs titer ≥10 mIU/mL) after 3 doses of HBV vaccine is 95.25%. Garcia et al., (2001), reported that more than 90% of healthy adults became immune after the third dose of the vaccine.

The anti-HBs titer was significantly higher among young HCWs less than 40 years. This finding was in agreement with Roome et al., (1993) and Zeeshan et al., (2007), who observed the inadequate levels of antibodies in relation to increasing age. The titer was also higher in those who are free from chronic diseases than of those with chronic diseases. In 2003, a study done by Keating and Noble, in New Zeeland, to assess the immunogenicity and protective efficacy of HBV vaccine against hepatitis B, the immunogenicity of HB vaccine was reduced in patients with medical conditions that may impair the immune system, e.g. diabetes mellitus and chronic renal failure.

HCWs who received their vaccination less than three years had significantly higher titers of Anti-HBs. Xu et al., (2000), in their study to evaluate the long-term efficacy of HBV vaccine reported that the protective

level of vaccine was still kept well 11 years after vaccination.

More than half of the HCWs had needle stick injury in the past year of study. HCWs with past exposure to HBV were four times more likely to have needle stick injury in the previous year, table 5. Talaat et al., (2003), reported a lower percentage of needlestick injury (35.6%) among Egyptian HCWs during the past 3 months of the study. Kosgeroglu et al., (2004), reported that 63.6% of Turkish nurses had suffered needle stick exposure. In Syria, about 77 % of HCWs had sustained at least one needle stick injury in 2008, Yacoub et al., (2010).

Conclusions:

None of the studied HCWs tested positive for HBV infection. The prevalence of life time exposure was high. Only one third of the HCWs were immune after vaccination. Needle stick injuries were the significant occupational exposure factor. There is a need to vaccinate all health care workers as a matter of policy and provide post exposure prophylaxis after having significant exposure to patient's blood.

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