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Seroconversion of Anti-HBs alone among certain high risk groups in Al-Ramadi City, Western Iraq

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ABSTRACT

Hepatitis B causes significant morbidity and mortality worldwide. Little is known about the existence of hepatitis B among high risk groups of the Ramadi population and the prevalence of anti-HBs alone or in combination with other markers. The present study was conducted to determine the magnitude of anti-HBs alone (a serologically confirmed past vaccination) in certain high risk groups, their comparison and its relation to age and other factors associated with serological marker positivity. This cross sectional study was carried out in Al-Ramadi city, Al-Anbar province, western Iraq, from January 2011 to July 2012. A screening of anti-HBs was performed on blood samples that were collected from five vulnerable or risky groups including hemodialysis patients, barbers, family contacts to a known hepatitis B patient, cuppers and health care workers (HCWs). Demographic information was recorded and the vaccination status was assessed by detailed interview. Analysis was conducted using the Epi info 7 software. A total of 789 subjects were screened. Of these, 294 individuals were reactive with anti-HBs alone. Most of the studied groups showed higher rate of findings with high significant statistically. In concern to age, being ≤ 19 years old age showed the highest rate (45.5) for testing positive for anti-HBs alone. Other age groups were of lower rates ranging from (25.4 to 40.1%). Males showed higher rate (38.7%) of positivity in contrast to females (33.8%). However, positive past history of jaundice showed lower rate (15.1%) than negative history (40.9%), regarding anti-HBs positive (alone) with high significance ($p < 0.001$). The vaccinated group showed the highest positivity for anti-HBs (alone) (55.8%) and the difference was statistically high significance ($p < 0.001$). Also, unknown history regarding vaccination status showed lower rate (31.1%) with statistical high significance ($p < 0.001$). For number of vaccine versus seropositivity of anti-HBs alone, highest rate (65.03%) was apparently among those with 3 doses followed by those with 2 doses and 1 dose (60 and 15.2%, respectively) with statistically significant (p value < 0.001). In concern to the duration of last dose effect on seropositivity of anti-HBs alone, those of last dose duration between 1 and 5 years showed the highest rate (57.89%), while those of less than one year duration was slightly lower (56.89%). On the other hand, those with more than 5 years duration were of rate (39.02%) and the difference was statistically significant ($p = 0.03$). The importance of the control of chronic hepatitis B in certain high risk groups was highlighted by this study, as these pools provide a trigger for the spread of disease in the community. Family contacts and HCWs showed the higher rate of anti-HBs positivity. Males were more affected than females with predominance of ≤ 19 years old age. Moreover, vaccinated group showed the significantly highest rate, particularly among those who received the 3rd dose of vaccine.

Keywords: Anti-HBs alone, hepatitis B, high risk groups, Ramadi City.

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INTRODUCTION

Hepatitis B is a common infection affecting the masses and is the leading cause of chronic liver disease. Hepatitis B affects 350 to 400 million people worldwide and accounts for 1 million deaths from cirrhosis, liver

failure and hepatocellular carcinoma (World Health organization, 2011). About two third of people suffering from hepatitis B are residing in the developing countries (Brown and Gaglio, 2003).

Iraq is in the low zone of hepatitis B prevalence areas (Ataallah et al., 2011). Higher prevalence of hepatitis B has been reported in certain areas of Iraq like Al-Anbar governorate. Al-Anbar governorate, west of Iraq, is the area with intermediate prevalence of HBV. In Al-Anbar governorate, the prevalence rate among general population was 5.23% and family contacts in 2011 was 2.68%. While prevalence rate in Basra governorate among HCWs was 2.3% and family contacts was 14.29%.

The reason for high prevalence is explained by several factors including transfusion of unscreened/improperly screened blood or blood products (Luby et al., 2000), use of injections by unsterilized syringes in general practice by quacks (Khan et al., 2000), nose prick or ear prick by unsterilized needles and frequent visits to barbers for shaving purposes (Bari et al., 2001; Khan et al., 2011).

Use of unsterilized syringes is a significant risk factor of Hepatitis B globally (Jittiwutikarn et al., 2006; Perez et al., 2005). Despite the inclusion of hepatitis B vaccine in National immunization program including vaccination of risk groups like dentists and family contacts since 1990s (CDC IRAQ, 2012), higher prevalence however have been reported in certain high risk groups and in family members of hepatitis B patients (CDC, 2011).

Data of prevalence of anti-HBs alone in high risk groups is sparse and a comparison of different risk groups is required to formulate national health policies and preventive strategies. Therefore, the present study was conducted to determine the prevalence of anti-HBs in serologically confirmed past vaccination in certain high risk groups, their comparison and the relationship of age and other factors to the positivity of this serological marker.

MATERIALS AND METHODS

The study was conducted from January 2012 to July 2012 as part of an effort to control and prevent viral hepatitis in the province. Five vulnerable or at risk population groups were identified for this cross-sectional study. These included hemodialysis (HD) patients, barbers, family contacts to a known hepatitis B patient, cuppers and health care workers (HCWs). Health care workers were included in high risk groups due to higher exposure to hepatitis patients, routinely reported needle prick injuries and low uptake of hepatitis vaccine. This group is of particular importance because, infected health care workers can transmit the infection to uninfected patients admitted to hospital, which can further spread the disease in society.

A total of 789 individuals were subjected to this study, we included health care workers of the two main hospitals in Ramadi city (Al-Ramadi General Teaching Hospitals and Children and Maternity Teaching Hospital), families of hepatitis B patients were registered by the Referral Laboratory of Public Health Section/Viral Hepatitis Department/Al-Anbar Health Directorate, almost all hemodialysis patients registered by hemodialysis centers in the city and barbers and cuppers working in Ramadi city. Among HCWs, only staff from exposure-prone procedures (EPP) were included in the study. These included operation and emergency units staff, surgeons, doctors, nurses dentists, midwives, health service workers and administratives. We categorized the age using 10-year groups from ≤19, 20 to 29, 30 to 39, 40 to 49 and ≥ 50 years old.

Convenient sample procedure was used to obtain study sample of the individuals included in this study. All identified individuals were then approached for a detailed interview and blood sample collection. Demographic information was recorded and the vaccination status was assessed by detailed interview.

A team of laboratory workers was deputed to collect samples from these groups. All samples were taken after obtaining the verbal consent. Consent was also obtained from the institutional heads with assurance of confidentiality and provision of treatment from the hepatitis control program. The study protocol was reviewed and approved by an independent ethics committee. Sample collection was carried out at different sites for the groups as indicated. Five milliliter of venous blood was collected in white tubes using aseptic technique. Blood samples were transported to the designated lab for further processing. Anti-HBs antibody test was performed at International Blood Bank Laboratory in Baghdad, Iraq, by using ARCHITIC I system. A chemiluminescent micropaticls (CMIA) for quantitative determination of antibody to hepatitis B surface antigen (anti-HBs) in human serum and plasma a level of ≥ 10 IU/ml was regarded positive.

Health-care worker group was taken as a reference category when investigating the relationship between risk groups and positivity for anti-HBs; as this group may have prevalence of hepatitis B vaccination that may be slightly higher than others. Data entry and analysis were done using Epi info 7 software chi-squared test using the Mantel-Haenszel test was computed. In this study, a total of 789 individuals were included in this analysis. The level of significance was set at 95% confidence ($p < 0.05$).

RESULTS

We screened 789 subjects for anti-HBs test. Out of these, 555 were males and 234 were females. Female participants were available to participate in all groups. The mean age of participants was 30.67 ± 12.7. Among risk groups, the highest rate was among health care workers 46.9%. For each group, the finding was statistically significant except for cuppers who were statistically non-significant ($p < 0.5980$).

With respect to age, being ≤ 19 years old age showed the highest rate (45.5%) for testing positive for anti-HBs alone. Other age groups were of lower rates ranging from 25.4 to 40.1%.

With respect to gender, male gender showed higher rate (38.7) of positively in contrast to female (33.8%); despite that, the difference was statistically not significant (p value < 0.18). As far as the history of jaundice is concerned, it is statistically highly significant ($p < 0.001$). However, positive history showed lower rate (15.1%) than negative history (40.9%) regarding anti-HBs positive (alone) (Table 1). With regard to effect of vaccination status, vaccinated group showed the highest positivity for anti-HBs (alone) (55.8%) and the difference was statistically highly significant ($p < 0.001$). Also, unknown history regarding vaccination status showed lower rate (31.1%) with statistically high significance ($p < 0.001$);

Table 1. Relationship of past history of jaundice with positivity of anti-HBs alone.

Past history of jaundice	Total	N	%	P value
Negative	680	278	40.9	Ref
Positive	106	16	15.1	<0.001
Unknown	3	0	.0	-
Total	789	294	37.3	

Table 2. Relationship of vaccination status with positivity of anti-HBs alone.

Vaccination status	Total	N	%	P value
Non-vaccinated	249	4	1.6	Ref
Vaccinated	495	276	55.8	<0.001
Unknown	45	14	31.1	<0.001
Total	789	294	37.3	
Number of vaccine doses				
1 dose	79	12	15.2	Ref
2 doses	130	78	60.0	<0.001
3 doses	286	186	65.03	<0.001
Total	495	276	55.7	
Duration of last dose				
Less than 1 years	283	161	56.89	Ref
1-5 years	171	99	57.89	0.8
More than 5 years	41	16	39.02	0.03
Total	495	276	55.7	

while those who were not vaccinated showed the lowest rate (1.6%). For number of vaccine versus sero-positivity of anti-HBs alone, highest rate (65.03%) was apparently among those with 3 doses followed by those with 2 doses and 1 dose (60 and 15.2%, respectively). The differences for the previous two categories (2 doses and 1 dose) were statistically highly significant ($p < 0.001$). Concerning the duration of last dose effect on sero-positivity of anti-HBs alone, those of last dose duration bet (1 to 5 years) showed the highest rate (57.89%) regarding positivity for anti-HBs alone, while those of less than one year duration was slightly lower (56.89%) and the difference was not statistically significant (p value < 0.8). On the other hand, those with more than 5 years duration were of rate (39.02%) and the difference was statistically significant ($p = 0.03$), as shown in Table 2.

DISCUSSION

This study was conducted in Al-Ramadi city of Al-Anbar governorate, western Iraq, about 110 km west of Baghdad, with an estimated 500,000 population, composed of low to moderate education level; most of them are farmers and workers. According to CDC/ Iraq, in 2012, the prevalence rate of HBV infection regarding some risk groups in Al-Anbar governorate was 0.39% for HCWs and 2.68% for family contacts to a known patients, but no exact rate for prevalence of the disease or vaccine coverage were published regarding general population or risk groups in Al-Ramadi city.

The presence of anti-HBs alone is a marker of vaccination (Vanessa and Benjamin, 2012; Ucmak et al., 2007). So, we defined anti-HBs-Ag antibody concentration of ≥10 as the seropositive threshold (Vanessa and Benjamin, 2012; Mast et al., 2006; Baghianimoghadam et al., 2011) (also as recommended by Archetic I 2000 kit instruction).

Among risk groups, the highest rate of anti-HBs positivity alone was among HCWs (46.9%) For each group, the finding was statistically significant except for cuppers which was statistically not significant but with the high rate (37.5%) (p value < 0.5980). These results reflect, in part, the effect of vaccine on anti-HBs seropositivity alone in each studied group also gave us a hint regarding vaccine coverage among different risk groups in our city. Furthermore, HCWs might be the best compliant with vaccination that could be related to higher awareness among this group than the others. Table 3 includes the patients or individuals belonging to each

Table 3. Anti-HBs positive among various individual subjects**.**

Epidemiological variables	Total	N	%	P value
Risk groups				
HD patients	45	3	6.7	<0.0001
Barbers	173	47	27.2	<0.0001
Family contacts	175	59	33.7	0.0034
Cuppers	8	3	37.5	0.5980
HCWs	388	182	46.9	Ref
Total	789	294	37.3	

N: number of participants; HD: hemodialysis; HCWs: health care workers.

group regardless to past vaccination status, number of vaccine doses or exposure status. All these factors could be causes for the lower rates of seroconverion (37.3%) for the overall studied individuals and for each group. However, the percentage of the seroconversion following hepatitis B vaccination is 90% in healthy individuals, while it is only 50 to 70% in End Stage Renal Disease (ESRD), especially in HD patients (Kara et al., 2004). Also, vaccination derived immunity (positive anti-HBs levels) decline more rapidly after immunization in HD patients compared to healthy individuals. So, booster doses are necessary to maintain protection against HBV (Matthew et al., 2010; Afsar et al., 2009). The insufficient antibody response following HBV vaccination is multifactorial in dialysis patients. According to previous studies, many variables such as gender, age, obesity, smoking, concurrent illness, albumin level and hepatitis C virus infection may influence the response of a patient to the hepatitis B vaccine (Sjogren, 2005; DaRoza et al., 2003; Lin et al., 2008; Wang and Lin, 2007; Liu et al., 2005; Unger and Peters, 2008). Also, a certain genetic predisposition has been recognized as a possible cause for none or low responsiveness (Sjogren, 2005; DaRoza et al., 2003; Lin et al., 2008; Wang and Lin, 2007). Moreover, the lowest rate among HD patients can be explained by the fact that antibody production following hepatitis B vaccination achieved in patients with chronic renal disease is suboptimal (Chow et al., 2006). For studied HD patient, they were with 1st, 2nd and 3rd dose vaccines and no fourth dose included yet. This might explain why they were of low seroconversion rates. Compared with healthy individuals, dialysis patients show a unique immune response to HBV vaccination. Among the general population, 90 to 100% of vaccinated subjects acquires protective immunity and maintains protection against HBV 10 to 20 years later (Zanetti et al., 2008; McMahon et al., 2005; Kotzee et al., 2006), even after vaccination in infancy (McMahon et al., 2005).

Regarding HCWs as a group, an overall anti-HBs rate of 46.9% was reported in our study. This was much lower than a study done in Iran among HCWs (including the same categories as our study also the same method) that revealed an overall anti-HBs rate of 82.7% (Mirza et al., 2010). Also, Shin et al. (2006) reported a higher prevalence of 76.9% for anti-HBs in Korea. Those higher rates of anti-HBs alone among HCWs in the different regions aforementioned could be due to higher prevalence rate of vaccination , less exposure rate or more adherence to prophylaxis and preventive measures (like glass wears, gloves, etc) as compared to our city, Ramadi. Additionally, the lower results of the current study might be due to sensitivity of our test that was of high detection so even low level of anti-HBc could be detected that lowered the rate of positivity for anti-HBs alone (Valente et al., 2010). Nevertheless, our result was in agreement with a study done among Morroccon HCWs (51%) (Djeriri et al., 2008) and was much lower than other societies. For example, in Vietnam, a country with a high prevalence (4 to 18%) of positivity for HBs-Ag among population, among farmers (5.2%) were positive for anti-HBs only, implying vaccination (Duong et al., 2009). In Angola, among 508 individuals, 4.3% individuals were positive for anti-HBs only (Valente et al., 2010). In South Africa, among nurses, 45.29% (77/170) were anti-HBs alone. In that study, the majority were females (Mosendane et al., 2012).

Considering age (Table 4), being ≤ 19 years old age showed the highest rate (45.5%). Other age groups were of lower rates ranging from 25.4 to 40.1%. This might reflect the impact of vaccination program which started in Iraq during 1990s, including vaccination of risk groups like dentists and family contacts (CDC IRAQ, 2012). However, exposure rate may affect rate of testing positive for anti-HBs alone even in vaccinated individuals if exposure occurred before or at time of vaccine administration (Bahmani et al., 2010). Also, these findings may be due to age-associated changes in immune status (Erkan et al., 2011). It is reported that increasing age is associated with a decline in humeral and cellular immunity to vaccines (Baghianimoghadam et al., 2011); this finding was the same with those in our study. However, the rate of seroconversion appeared to be lower as age increase except for age group of 30 to 39 years that was slightly higher than 20 to 29 years, with no statistical significance ($p < 0.31$). From all age groups, only 40 to 49 and ≥50 years were statistically significant

Table 4. Relationship of age with positivity of anti-HBs alone.

Age groups (years)	Total	N	%	P value
≤19	132	60	45.5	Ref
20-29	234	87	37.2	0.12
30-39	257	103	40.1	0.31
40-49	103	28	27.2	0.004
≥50	63	16	25.4	0.007
Total	789	294	37.3	

Table 5. Relationship of gender with positivity of anti-HBs alone.

Gender	Total	N	%	P value
Male	555	215	38.7	0.18
Female	234	79	33.8	Ref
Total	789	294	37.3	

($p < 0.004$ and $p < 0.007$, respectively).

Our results are in agreement with a study among HCWs in Iran regarding the rate in 30 to 39 years old. But ≥ 50 years old age group in that study showed higher rate than 40 to 49 years old age which was different from our study regarding the latter age groups**.** Generally, anti-HBs rate was decreased by increasing age, a fact that was similarly reported by Bahmani et al. However, the last mentioned study showed much higher rates than our study for all age groups reaching to about 3 times as in our study that could be explained by different rate of vaccination and different exposure rates and adherence to preventive measures (Bahmani et al., 2010). Our results disagreed with other studies that showed no significant effect of age (Ramezani et al., 2008; Elwell et al., 2003; Lin et al, 2011), confirming that no impact of age on the status of effective immunity against HBV after HBV vaccination. But regarding rates of seroconversion, Lin et al. (2011) were in agreement with our results showing the rate was higher among those of less than 40 years old age as compared to those of more than 40 years. In Morrocco, HCWs who had a poor immune response (anti-HBs < 10 IU/l) did not significantly differ in terms of age from those who had a good immune response (anti-HBs ≥ 10 IU/l) (Djeriri et al., 2008). However, contradictory findings also exist, which state that anti-HBs titers show no significant correlation with age (Ibrahim et al., 2006; Roozbeh et al., 2005).

When each gender (Table 5) was compared regarding anti-HBs positive (alone), the male gender showed higher rate (38.7) of positivity in contrast to female (33.8%) despite that the difference was statistically non-significant (p value < 0.18). Dissimilarly, it is suggested that women responded better than men (Lim et al., 1996). This could be due to a higher vaccine coverage among males than females or higher participant of males than females in the present study. However, other studies from Iran reported that positivity was higher in females than in males (84.3 and 79%, respectively) and other showed (71.1% vs. 61.2%, respectively) despite no significant difference was found in each study (Baghianimoghadam et al., 2011; Bahmani et al., 2010). Also, in Angola, females showed higher rate of positivity for anti-HBs only than males which might be due to large sample size of females than males, which is opposed to our study (Valente et al., 2010). Moreover, among nurses from South Africa, the results showed higher rate among females (the majority of participant were females) (Mosendane et al., 2012). Those results were different from our study, which could be due to larger number of male participants in our study compared to number of females. In Morocco, HCWs who had a poor immune response (anti-HBs < 10 IU/L) did not significantly differ in terms of sex from those who had a good immune response (anti-HBs ≥ 10 IU/L) (Djeriri et al., 2008).

Effect of vaccination status

As shown in Table 2, vaccinated group showed the highest (55.8%) and the difference was statistically highly significant (p value < 0.001). Also, unknown history regarding vaccination status showed lower rate (31.1%) with statistically high significance (p value < 0.001), while those who were not vaccinated showed the lowest rate (1.6%). A possible explanation for the last two findings could be that the participants were unable to recall their vaccination history because of a long duration of vaccination. For those unvaccinated with seroconversion, this condition could be explained by false positivity of test or waning of anti-HBc or false negativity for the latter marker or even mistaken by individuals reporting unvaccinated. The possibility that undetectable levels of anti-HBc may interfere with production of anti-HBs in fully

vaccinated individuals indicate the previous exposure to the virus making poor response to vaccination (Djeriri et al., 2008). Also, missing the 2nd and 3rd doses or no inclusion of the forth dose for HD patient might be causes for the low seroconversion of anti-HBs among vaccinated studied subjects. In the present study, the rate of vaccine protection (55.8%) might be underestimated because of the post-vaccine fall in anti-HBs (Djeriri et al., 2008; Wood et al., 1993). Also, this could be explained by low response to vaccine due to poor technique of administration or poor individual response for any cause or due to previous exposure to virus (that is, anti-HBc positive and anti-HBs positive). Therefore, those were excluded in this setting. In addition to the negative impact of old age and malnutrition on protective immunity after HBV vaccination, depression is closely related to antibody response following HBV vaccine especially in dialysis patients (Afsar et al., 2009). In a study among HCWs in Iran, of 299 vaccinated HCWs, 278 had negative serologic reaction for HBs-Ag and anti-HBc; of them, 48 (non-responders) so negative for all markers and the rate was 82.7% (251/299) for all 1st, 2nd and 3rd, while prevalence of 34% (16/47) for anti-HBs was among reported unvaccinated (Bahmani et al., 2010). However, our results were lower for vaccinated (55.8%) and 1.6% for non-vaccinated; so it was completely different from the previous study in Iran. But higher than what reported from Morocco among HCWs, in which the rate of vaccine protection was 51% (Djeriri et al., 2008). In comparison to our study, the overall seroconversion rate after primary vaccination was 70.5% among dialysis patients in a study carried out by Lin et al. (2011), were of a higher rate despite that the majority of our participants are immunocompetents.

Regarding number of vaccine, highest rate (65.03%) was apparently among those with 3 doses followed by those with 2 doses and 1 dose (60 and 15.2%, respectively). The difference for the previous two categories (2 doses and 1 dose) were statistically high significant (p value < 0.001). A full course or two doses of hepatitis B vaccination are sufficient to initiate anti-HBs production (Van Damme and Van Herck, 2007; Abe et al., 2006; Wang et al., 2004). However, 5 to 10% of normal subjects do not produce the anti-hepatitis B surface antibody (anti-HBs) after receiving a standard course of HBV vaccine (Zanetti et al., 2008; McMahon et al., 2005; Kotzee et al., 2006; Van Damme and Van Herck, 2007; Abe et al., 2006; Wang et al., 2004). In our study, the rate of seroconversion after receiving three doses was 65%, which much lower than what was expected. This might be due to variation of immune status on individual or environmental basis or previous exposure to virus among those who reported full vaccine series. In another study, the mean of immunity to HB vaccine in the second (59.5%) and the third (99.2%) vaccine administration was significant (p = 0.001) (Baghianimoghadam et al., 2011), that was of different rates as compared to our study. However, protective anti-HBs titers developed in over 67% of those ESRD patients who received the full schedule of HBV vaccination pre-transplant and only in 24% of those who had received two to three doses. Less than 10% of those who did not have protective levels at the time of transplant mounted responses to post-transplant vaccination (Potsangbam et al., 2011). Of 276 HCWs who completed the three-dose series of the hepatitis B vaccine, 232 (84%) became anti-HBs positive while 16% were negative. In our study, lower rate for seroconversion (65.03%) and the remainders were negative (34.97%). It is unclear whether these people are non-responders, have lost immunity, or retained anamnestic potential that need reassessment for revaccination (Bahmani et al., 2010). In fully vaccinated HCWs and other studied groups, the age at primo-vaccination was at adulthood. This might be too late for optimal protection since older HCWs or other individuals especially HD patients are more likely to be poor responders (Afsar et al., 2009; Sabido et al., 2007). We cannot exclude the possibility that refrigeration of some vaccine batches was suboptimal and that there were variations in shelf life of vaccines according to batches. Also, the mode of administration of the vaccine was not assessed (Djeriri et al., 2008).

Duration of last dose and its effect on seropositivity

Those of last dose duration bet (1 to 5 years) showed the highest rate (57.89%) regarding positivity for anti-HBs alone while those of less than one year duration was slightly lower (56.89%) and the difference was not statistically significant (p value < 0.8). On the other hand, those with more than 5 years duration were of rate (39.02%) and the difference was statistically significant (p value < 0.03). Anti-HBs levels decline after immunization even in healthy individuals but in HD patients more rapidly, so that the levels are undetectable at three years. Other reports suggest that in up to 42%, there are no detectable anti-HBs levels one year after vaccination (Matthew et al., 2010). However, those of duration bet (1 to 5 years) showed the highest rate and might receive 2 or 3 doses of vaccine for the majority of them. In contrast, those of less than one year duration showed slight decrease in rate. However, in morocco, of the fully vaccinated HCWs without anti-HBc, nearly one third (36%) had serological evidence of protection (anti-HBs ≥ 10 mIU/ml), as measured 6 years after initial vaccination (Djeriri et al., 2008). This was similar to our finding where approximately 39% of those reported more than 5 years after initial vaccination still seropositive for anti- HBs ≥ 10 mIU/ml. The compliance rate of HBV vaccine was decreased by increasing the duration (Bahmani et al., 2010). Other studies showed that 10% of patients who respond to vaccination may lose anti-HBs after 5 years and 50% after 10 years (Craig et al., 1999). In a study

conducted in Babol, northern Iran, 68.6% of vaccinated subjects had anti-HBsAb titer of >10 mIU/mL after 3.9 ± 1.98 years, and other 31.4% of health care personnel with a vaccination history had low titers of antibody. The authors suggested controlling the anti-HBsAb level every 5 to 7 years and reassessment for revaccination, if needed (Savadkoohi and Hosseinian, 2003).

Limitations

The unequal sizes of risk groups were regarded as limitation of this study. This was mainly due to the difficulty in approaching some groups like family contacts due to social barrier and cuppers due to the fact that most of them are working hidden without official authorization. Also, inability to reach some risk groups especially homosexuals, prostitutes, and intravenous drug users was a limitation. Similarly, we could not gain access to enough female groups in the rest of the four risk groups especially barbers due to social barriers.

RECOMMENDATIONS

Future studies should attempt to include females of high risk groups, and other vulnerable groups need to be examined like garbage collectors, immigrants especially from other countries and internally displaced people.

Although, our study showed a significantly higher prevalence of anti-HBs among HCWs, cuppers and family contacts, some groups had smaller number of participants like cuppers, so their findings may need further evaluations.

Conclusion

Our study highlights the importance of the control of chronic hepatitis B in certain high risk groups as these pools provide a trigger for the spread of disease in the community. The present study showed a higher prevalence of anti-HBs in HCWs, cuppers and family contacts groups. The prevalence is also significantly higher in HCWs than other groups except cuppers. Increase in age decreases the rate of anti-HBs in vulnerable groups; ≤ 19 years old age showed the highest rate, reflecting the impact of vaccination program which started in Iraq during 1990s including vaccination of risk groups like family contacts. The male gender showed higher rate of positively in contrast to female despite that the difference was statistically non-significant. Vaccinated group showed the highest and the difference was statistically high significant; while those who were not vaccinated showed the lowest rate (1.6%). Highest rate was apparently among those with 3 doses followed by those with 2 doses and 1 dose.

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