Original Article

Hepatitis B seroprevalence in children and women and the impact of the hepatitis B vaccination program in the Black Sea Region of Turkey

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Abstract

Introduction: This study aimed to determine the seroprevalence of hepatitis B virus (HBV) infection in children and females in the middle Black Sea Region of Turkey and to assess the impact of the universal infant hepatitis B vaccination program started in 1998.

Methodology: The laboratory records of 12,057 patients who attended the Samsun Maternity and Children's Hospital between January 2007 and November 2009 were evaluated retrospectively. In this period, hepatitis B surface antigen (HBsAg), the antibody to hepatitis B surface antigen (anti-HBs), was studied from serum samples using the enzyme linked immunosorbent assay method.

Results: In the total population, HBsAg seropositivity was found to be 3.8% (456/12010); anti-HBs was 32.6% (3526/10800). HBsAg was 3.5%, in the 0-14 year age group, 8.2% in the 15-18 group, 3.3% in the 19-49 group, and 8.0% in the over 49 group. The seropositivity of HBsAg decreased by half in patients between zero and 14 years of age (4.2%) who were included in the universal vaccination program when compared with those in the 15-18 year group (8.2%) who were not included in the program. There was a significant difference in HBsAg seropositivity between boys (5.8%) and girls (3.9%) ($p < 0.05$).

Conclusions: According to the hepatitis B seroprevalence records of our region, HBsAg was 3.5% in the 0-14 year age group, 8.2% in the 15-18 year group. It may therefore be suggested that, since 1998, the vaccination program in our region has been successful.

Key words: hepatitis B; seroprevalence; children; women; vaccination

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Introduction

Hepatitis B virus (HBV) was first discovered in 1966. HBV is transmitted through the blood or bodily fluids of an infected person perinatally, through direct transmission, sexual contact, transfusion, or injection. Acute and chronic liver disease can develop and cause asymptomatic or fulminant hepatitis or cirrhosis and hepatocellular carcinoma as complications [1,2]. According to the World Health Organization (WHO), two billion people have been infected with the hepatitis B virus and more than 240 million people have chronic liver infections. About 600,000 people die every year due to the acute or chronic infections of hepatitis B [3]. It is still a major public health problem that can be prevented with vaccination. A plasma-derived vaccine was licensed in 1981 and a recombinant hepatitis B vaccine was licensed in the United States in 1986.

The endemicity of hepatitis B is revealed by the prevalence of HBsAg. Countries are classified according to the seroprevalence of hepatitis B. If HBsAg seroprevalence is < 2%, the country has low endemicity. If the seroprevalence is between 2% and 8% the country has intermediate endemicity, and if the seroprevalence is > 8%, the country has high endemicity [4]. In highly endemic areas, HBV is most commonly transmitted from mother to child at birth, or from person to person in early childhood.

Turkey is a country with intermediate endemicity. Hepatitis B seroprevalence of Turkey has decreased to between 2% and 8% from between 20% and 40% with the universal infant immunization program started in 1998 for the prevention of perinatal transmission. All infants are vaccinated at birth, at one month, and at six months of age in their follow-up. The prevalence of HBV decreased in the years after the vaccination program was implemented; the aim should be to

Figure 1: Distribution of HBsAg by age (%)

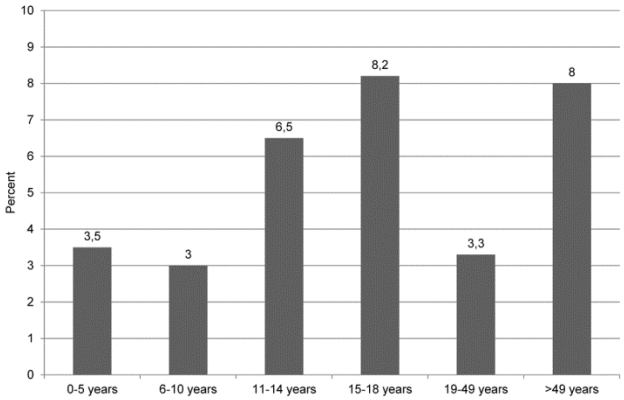
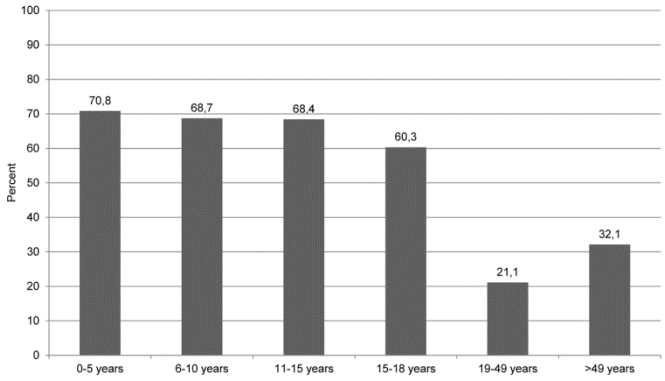


Figure 2: Distribution of anti-HBs by age (%)



decrease this ratio to below 2%. To reach the goal of the immunization programs, vaccination programs should be implemented timely and completely for each part of the population. The first dose of hepatitis B vaccine within 24 hours of birth should be a performance measure for hepatitis B immunization programs.

This study was conducted to determine the seroprevalence of hepatitis B in children and women and to evaluate the impact of the hepatitis B vaccination program in Samsun, Turkey.

Methodology

Study area and patients

Samsun is one of the metropolises in the Black Sea Region of Turkey. Its total population is about 1,250,000. Samsun Maternity and Children's Hospital is a second-step health center where the majority of the children and women of the city take health care.

The laboratory records of a total of 12,057 patients one year of age and older attending Samsun Maternity and Children's Hospital between January 2007 and November 2009 were evaluated retrospectively. Patients up to and including 18 years of age were considered children, and those 19 years and older were considered adults. Records were analyzed and grouped according to gender, age, and date of application. HBsAg and anti-HBs parameters in the laboratory records of the patients were included in the study.

Serological testing

The serological markers of hepatitis B surface antigen (HBsAg), the antibody to hepatitis B surface antigen (anti-HBs), were investigated in serum samples using the enzyme-linked immunosorbent assay (ELISA) E170 (Roche Diagnostics, Mannheim, Germany) method during the study period.

Statistics

Statistical analysis was conducted using SPSS software version 10.0. The Chi square test was used in the statistical analyses. A value of $p < 0.05$ was considered statistically significant.

Results

A total of 12,057 patients' laboratory records were evaluated. Of the 12,057 patients, 2,598 were 18 years of age and younger, and 9,459 of the patients were women over the age of 19.

HBsAg concentrations were studied in 2,551 of 2,598 children (1,258 male, 1,293 female). HbsAg seropositivity was found to be 4.86% (124/2,551) in the 0-18 age group. A total of 58.9% (73/124) of HBsAg seropositive children were boys, and 41.1% (51/124) were girls. HBsAg seropositivity was 5.8% (73/1,258) in boys, and 3.9% (51/1,293) in girls (Table 1). There was a significant difference in HbsAg seropositivity between boys and girls ($p < 0.05$).

Anti-HBs concentrations were studied in 2,598 children (1,267 male, 1,331 female). Anti-HBs seropositivity was found to be 67.8% (1,762/2,598) in the 0-18 age group. Anti-HBs seropositivity was 49.3% (869/1762) in boys and 50.7% (893/1,762) in girls. Anti-HBs seropositivity among genders was 68.6% (869/1,267) in boys, and 67.1% (893/1,331) in girls (Table 1). There was no significant difference in anti-HBs seropositivity between boys and girls ($p > 0.05$).

Table 1: Seropositivity of HBsAg and anti-HBs in children

	Male	Female	Total	p
	n/N (%)	n/N(%)	n/N (%)	p
HBsAg (+)	73/1258 (5.8)	51/1293 (3.9)	124/2551(4.86)	< 0.05
Anti-HBs (+)	869/1267 (68.6)	893/1331 (67.1)	1762/2598 (67.8)	> 0.05

Table 2: Seropositivity of HBsAg and anti-HBs in women

	n/N	%
HBsAg (+)	332/9459	3.5
Anti-HBs (+)	1764/8202	21.5

Table 3: Distribution of HBsAg and anti-HBs seropositivity by age

	0-5 y	6-10 y	11-14 y	15-18 y	19-49 y	> 49 y	Total
HBsAg (+)							
n/N	21/595	28/910	42/643	33/403	308/9161	24/298	456/12010
%	3.5	3.0	6.5	8.2	3.3	8.0	3.8
Anti-HBs (+) n/N	418/590	654/952	447/653	243/403	1675/7925	89/277	3526/10800
%	70.8	68.7	68.4	60.3	21.1	32.1	32.6

Table 4: Distribution of HBsAg and anti-HBs seropositivity in children and women

	Children		Women			Total	
	n/N	%	n/N	%	p	n/N	%
HBsAg (+)	124/2551	4.86	332/9459	3.5	< 0.05	456/12010	3.8
Anti-HBs (+)	1762/2598	67.8	1764/8202	21.5	< 0.05	3526/10800	32.6

HBsAg concentrations were examined in 9,459 women 20 years of age and older. HBsAg seropositivity was found to be 3.5% (332/9,459) (Table 2).

Anti-HBs seropositivity was found in 8,202 of the women; the seropositivity was found to be 21.5% (1,764/8,202) (Table 2).

In terms of seropositivity of HBsAg according to age group, two peaks were observed between the ages of 15 and 18 and over the age of 49 (Figure 1). The seropositivity of HBsAg in the 15 -18 age group (8.2%) was twice that of the 0-14 age group (4.2%).

A significant decrease was observed in anti-HBs titers with age (Figure 2).

The seropositivity of anti-HBs of patients 18 years of age and younger (67.8%) was three times higher than that of patients over the age of 19 (21.5%) (Table 3).

HBsAg seroprevalence of the whole patient population was 3.8% and anti-HBs was 32.8% (Table 4). There was a significant difference in the seropositivity of HBsAg (4.86%, 3.5%, $p < 0.05$) and anti-HBs (67.8%, 21.5%, $p < 0.05$) in children and women (Table 4).

Discussion

Hepatitis B seroprevalence in the general population of Turkey was reported to be between 2% and 8% in various regions in the European Centre for Disease Prevention and Control's (ECDC) September 2010 technical report about hepatitis B. According to this report, compared with European countries, Turkey is one of the countries with the highest prevalence of hepatitis B [5]. In Italy, the prevalence was found to have decreased from 5.1% in 1991 to 1.3% in 2005 after the vaccination program was implemented in 1999 [6]. In Greece, the prevalence was found to be low (0.6% in children, 3.4% in adults) after the vaccination program, but the prevalence was higher among immigrants (1.7% in children; 5.9% in adults) and different religions (5.1% in children; 9.9% in adults) [7]. Hepatitis B prevalence in Turkey varies by region. This prevalence is over 10% in the eastern regions [8].

In 1995, HBsAg seroprevalence in 1,316 patients 16 years of age and younger was found to be about 3.2%, and the anti-HBs prevalence rate was found to be 13.3% [9] in Samsun, Turkey. In this study, none of the patients were vaccinated. The seroprevalence of HBsAg among the 15-18 age group was 8.2%; this group of patients was not included in the universal vaccination program. This value decreased to 4.2% in the 0-14 age group whose members were included in the universal vaccination program. We found a very significant increase in seropositivity of anti-HBs (from 13.3% to 67.8%) in the child population by year. This shows that the universal infant hepatitis B immunization program, which was started in 1998 in Turkey, has had a substantial impact on children's immunities. In an epidemiological analysis of hepatitis B in the Republic of Moldova, it was found that the incidence decrease was significant in children under 15 years of age; the incidence dropped from 80.8 in 1989 to 2.0 per 100,000 in 2006 after the vaccination program was implemented [10].

In a 1998 study in Turkey, of 2,157 patients 30 years of age and younger, HBsAg and anti-HBs seropositivities were found to be 17% and 5.4%, respectively, with no age and sex differences [11]. The long-term effects of the universal vaccination program started in 1998 in Turkey are evident through lower HBsAg seropositivity and higher seropositivity in anti-HBs titers in all ages in the current study. In our study, HBsAg seropositivity was higher in boys than in girls (Table 1). Also, an increase in HBsAg titers was observed as age increased. Higher seropositivity of HbsAg in boys and older children may be due to different lifestyles between genders, or because of socio-demographic differences. Seropositivity of anti-HBs, however, did not differ between genders in children. This may be because the vaccination program succeeded in reaching each part of the population. Although HBsAg titers increased with increasing age (from 3.5% in the 0-5 age group to 8.2% in the 15-18 age group), anti-HBs titers decreased with increasing age (from 70.8% in the 0-5 age group to 21.5% in the 19-49 age group). There are two possible explanations for this situation. One is the decline of the protection effect of the vaccination over time [12]. The second and more likely reason is that the vaccination programs are more effective in younger populations. Anti-HBs titers may decline over time; it has been documented that anamnestic immunity protects against hepatitis B virus among immuncompromised people [13]. It has been suggested that some hepatitis B virus mutants that may cause immunization failure be studied for new vaccines [14]. Age-specific seroprevalence studies show that HBsAg seroprevalence increases with age and region [15,16].

Asian countries have high seropositivity of HBsAg. In China, the rate is 9.5% [17]; in French Guiana, 11% [18]; and in India, 4.2% [19]. In the fertility period of women, this ratio was found to be about 23.3% in South America [20] and 18.5% in South Africa [21]; lower rates were found in the Middle East (about 1%-4%) [22]. We found the HBsAg seropositivity to be about 3.3% in the 19 - 49 age group. Patients over the age of 49 had 8.0% of HBsAg seropositivity in our study. The group of patients over the age of 19 was not vaccinated because the vaccine was found in 1982; this seroprevalence, therefore, shows the exact value of seroprevalence of HBsAg for this age group in our region. A study about the differences in hepatitis B seroprevalence in urban and rural areas in Turkey showed a significant difference between rural (8.2%) and urban (6.2%) areas [23]. This also shows the effect of region, education, and age on the endemicitiy of hepatitis B. The distributions of the living areas of women in our study were varied, so we did not distinguish the difference in endemicity according to region.

In a systematic review of the 129 studies conducted in Turkey between 1999 and 2009 about the seroprevalence of HBsAg based on age and region, patients were grouped into seven age groups and three main regions according to geography, population size, and socioeconomic status. The overall population seroprevalence was found to be 4.57%. The seroprevalence of the Black Sea region was found to be 3.52%. Age-specific seroprevalence was the lowest in the 0-14 age group (2.84%) and the highest in the 24-34 age group (6.36%). Our results differed from these; we found the lowest seroprevalence in the 6-10 age group (3%) and the highest in the 15-18 age group (8.2%). The seroprevalence of the overall population of our region was 3.2%, lower than those from various regions and across the country [24].

Generally, studies about hepatitis B seroprevalence usually include healthy populations; the current study, however, focused on hospital patients. The seropositivity of the healthy population may be lower than our results in our region. Nevertheless, the low results of the seropositivity of HbsAg in our region may be the result of the importance placed on the universal vaccination program and its regular administration.

Our study included a large population and different age groups. We investigated patients 14 years of age and younger who were included in the universal vaccination program started in 1998, and patients between 15 and 18 years of age who were not included in this program. These results clearly demonstrate the effects of the universal vaccination program.

Anti-HBs titers of the patients in the 15-18 age group (60.3) was high; this may be because the information about the vaccination given to the public a few years prior to 1998 had been effective for this age group, and they might have been vaccinated during this period. The low values of anti-HBs found in the 19 years and older age group were from the population that was not vaccinated.

In our study, there was a lack of precise vaccination records of the study group, so the results of the seropositivity of hepatitis B in our region might not be exact.

Conclusion

Hepatitis B is still a major worldwide health problem with acute and chronic complications. Morbidity and complications can be prevented through universal vaccinations. The aim of Turkey's health policies should be to vaccinate everyone. Vaccination program in the Black Sea region of Turkey should aim to decrease the seroprevalence to below 2%.

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