HBsAg, anti-HCV and anti-HIV seroprevalence among blood donors in Southeastern Anatolia, Turkey, 2011-2015

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SUMMARY

Transmission of infections through blood and blood product transfusion is a serious healthcare problem. There are insufficient up-to-date data about seroprevalence of HBsAg, anti-HCV and anti-HIV 1/2 among healthy blood donors in Turkey. We aimed to investigate the seroprevalence of HBsAg, anti-HCV and anti-HIV 1/2 in Southeastern Anatolia, Turkey. HBsAg, anti-HCV, and anti-HIV 1/2 analysis results among blood donors who applied to Dicle University Faculty of Medicine, Diyarbakir District Blood Centre, between January 1, 2011 and December 31, 2015 were retrospectively evaluated. HBsAg, anti-HCV, and anti-HIV 1/2 screenings were performed using a fully automated device with the microparticle enzyme immunoassay method (MEIA). The chi-square (χ^2) test was applied to variables. Among the donors, 1607 (1.73%) were HBsAg-positive, 255 (0.27%) were anti-HCV-positive and two (0.0021%) were positive for anti-HIV 1/2. HBsAg positivity rates by years were 2.50% in 2011, 1.92% in 2012, 1.74% in 2013, 1.53% in 2014 and 1.27% in 2015 ($p<0.001$). HBsAg-positivity was 0.78% for the donors between 18-24 years of age, 1.90% for those between 25-49 years of age and 3.92% for donors over the age of 49 ($p<0.001$). Anti-HCV positivity rates were as follows: 0.35% in 2011, 0.34% in 2012, 0.29% in 2013, 0.23% in 2014 and 0.16% in 2015 ($p<0.001$). Verified anti-HIV 1/2 positivity was observed for only two donors (0.0021%) within five years. HBsAg and anti-HCV positivity were observed to decrease significantly over the years and were significantly lower among younger donors.

Keywords: blood transfusion, blood donors, HBsAg, anti-HCV, anti-HIV.

INTRODUCTION

Transfusion of blood and blood products is a life-saving treatment method when performed for the right indication. However, like the majority of common treatment methods, blood transfusions are also associated with various complications. The most important complication of blood transfusion is transmission of infections. Various microorganisms including virus, protozoa, fungi or prions may lead to infectious complications on the host by blood transfusion.

Various methods are in use to prevent the transmission of infections through blood transfusion. In this respect, blood donors should be physically examined and questioned about the possible infections they may be carrying, while the blood and blood products to be transfused should be scanned for any infectious agents [1]. Since a number of infectious agents can be transmitted through transfusion, all the donated blood should be serologically scanned for the most commonly transmitted agents and the most difficult to be diagnosed infections to

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provide a safe blood supply. These serologic scans vary among the countries. In Turkey, blood centers routinely test for HBsAg, anti-HCV, anti-HIV 1/2 and syphilis [2]. In the USA, donor blood is also tested for human T-cell lymphotropic virus type 1 (HTLV-1) and human T-cell lymphotropic virus type 2 (HTLV-2) in addition to the HBsAg, anti-HCV, anti-HIV 1/2 and syphilis agents [3].

In order to minimize the risk of transmission of these viruses through transfusions, it may be beneficial to determine national and regional epidemiological data and seroprevalence of these agents. For this purpose, we have retrospectively investigated the HBsAg, anti-HCV and anti-HIV 1/2 prevalence and the epidemiological data during a five-year period among the individuals who have donated blood at the Dicle University Hospital District Blood Centre.

PATIENTS AND METHODS

Among 92393 donors who applied to Dicle University Faculty of Medicine, Diyarbakir District Blood Centre between 1 January 2011 and 31 December 2015 to be blood donors and were found eligible after the evaluation of blood donor questionnaire, HBsAg, anti-HCV and anti-HIV 1/2 test results were retrospectively evaluated. Variables were tested through Chi-square (χ^2) test. A P value <0.05 was considered to be statistically significant. HBsAg, anti-HCV and anti-HIV 1/2 (HIV 1/2 Combo Ag/Ab) tests were performed through chemiluminescence microparticle enzyme immunoassay (MEIA) method (Architect, Abbott, IL, USA). Positive results were verified using the same devices and kits. Samples tested positive for HIV were sent to the laboratories of the Turkish Public Health Agency Microbiology Reference Laboratories for Western Blot verification test.

Table 1 - HBsAg positivity in the donor blood according to the genders.

	Total	*HBsAg(+)*	
	n	*n*	%
Male	89353	1583	1.77
Female	3040	24	0.79

RESULTS

The number of the blood donors who applied during the specified period was 92393. Among donors, 1607 (1.73%) were positive for HBsAg, 255 (0.27%) were positive for anti-HCV and 2 (0.0021%) tested positive for anti-HIV. 89353 (96.71%) of the donors were male while 3040 (3.29%) were female. The number of HBsAg-positive male donors was 1583 (1.77%), while 24 (0.79%) female donors were HBsAg positive (Table 1). HBsAg positivity ratios by years were as follows: 2.50% in 2011, 1.92% in 2012, 1.74% in 2013, 1.53% in 2014, and 1.27% in 2015 (p<0.001) (Table 2). When the distribution of HBsAg positivity according to age groups was evaluated, HBsAg positivity among the donors between 18 and 24 was 0.78%, while it was 1.90% among the donors between 25 and 49 and 3.92% among the donors over 49 (p<0.001) (Table 3). Anti-HCV positivity ratios were 0.35% in 2011, 0.34% in 2012, 0.29% in 2013, 0.23% in 2014, and 0.16% in 2015 (p<0.001). Only two donors were confirmed as anti-HIV positive within the 5-year study period (0.0021%).

Table 2 - HBsAg, Anti-HCV, and Anti-HIV positivity in the donors according to the years.

Year	*Donor*	*HBsAg*		*Anti-HCV*		*Anti-HIV*	
	n	*n*	%	*n*	%	*n*	%
2011	17519	395	2.50	62	0.35	1	0.0057
2012	18405	354	1.92	64	0.34	ND*	ND
2013	18939	330	1.74	55	0.29	ND	ND
2014	19109	294	1.53	44	0.23	ND	ND
2015	18421	234	1.27	30	0.16	1	0.0054
Total	92393	1607	1.73	255	0.27	2	0.0021

*ND: not determined.

Table 3 - HBsAg positivity in the donors based on the age groups.

Year	18-24 years of age			25-49 years of age			>49 years of age		
	Donor	HBsAg(+)	%	Donor	HBsAg(+)	%	Donor	HBsAg(+)	%
2011	3936	29	0.73	12970	331	2.50	613	35	5.70
2012	4178	32	0.76	13555	282	2.08	672	40	5.95
2013	4074	29	0.71	14103	272	1.98	761	29	3.81
2014	4227	32	0.75	14037	236	1.68	845	26	3.07
2015	4106	39	0.94	13432	177	1.31	883	18	2.03
Total	20522	161	0.78	68097	1298	1.90	3774	148	3.92

DISCUSSION

Among the donors who applied to our centre, 96.71% were male and 3.29% were female. The rate of female donors between 2000 and 2010 was only 2.5%. Although this rate has shown a slight increase according to the data of last 5 years, it is still much lower than average of Turkey and Europe [4, 5]. The mean percentage of female blood donors is 49% in the USA, while it is 32% in Italy which is the lowest percentage in European countries [6, 7].

HBV infection is a global healthcare problem. The number of HBV carriers worldwide is estimated to be around 248 million [8, 9]. According to a meta-analysis conducted between 1999 and 2009 in Turkey, the prevalence of HBsAg was 4.57% [10]. In an epidemiological study conducted by the Turkish Viral Hepatitis Society and the Turkish Liver Research Association, prevalence of HBsAg between 2008 and 2011 was found as 2.4%, 1.9%, 3%, and 2.7%, respectively by years. The highest positivity rate in terms of HBsAg was observed in South-East Anatolia with 4.1%, while the lowest ratio was found in the Aegean region with 1.4% [11]. The risk of HBV transmission subsequent to blood transfusion varies according to HBV epidemiology of the countries. Incidence of post-transfusion hepatitis in the USA is 1 in 280,000 - 357,000 donations. However, this rate is 1 in 17.500 in China. This big difference is due to lower prevalence of HBsAg in the USA. In addition, the fact that anti-HBc is tested besides HBsAg to scan for HBV [12, 13]. It is impossible to diminish the risk

Table 4 - HBsAg, Anti-HCV and Anti-HIV seroprevalence among the blood donors in various geographical regions of Turkey.

Investigator	Study period	Province	Number of donors	HBsAg (%)	Anti-HCV (%)	Anti-HIV (%)
Dilsiz [27]	1996-2010	Ankara	220841	1.07	0.39	NRa
Uzun [31]	2004-2010	İzmir	80454	1.31	0.38	0.002
Tigen [32]	2004-2011	İstanbul	68393	1.54	0.38	0.01
Yıldız [33]	2007-2009	Adana	62461	1.66	0.05	0.003
Kaya [30]	2004-2007	Trabzon	12092	1.60	0.20	NR
Dayan [4]	2000-2010	Diyarbakır	266035	3.17	0.64	0.0004
Altındiş [18]	2001-2010	Afyon	37343	1.38	0.35	0.026
Güreser [19]	2008-2013	Çorum	13780	0.99	0.34	0.08
Turan [34]	2003-2009	Konya	17071	1.53	0.50	NR
Parlak [17]	2010-2015	Van	27365	0.41	0.06	0.020
Çelebi [28]	2000-2011	Erzurum	204000	3.14	0.92	1.06
Current study	2011-2015	Diyarbakır	92393	1.73	0.27	0.0021

aNR: Not reported

of viral infections to zero due to the donations which are made during the window period of the infection, laboratory errors, or variant viruses. In the USA, since the donor blood had started to be scanned using the Mini-Pool Nucleic Acid Testing (MP-NAT) in 2009, the risk of HBV transmission through transfusion has been reduced to 1 in 1 million donations [14]. In our study, a total of 92393 donated blood were scanned for HBV and HBsAg positivity rate was found as 1.77%. HBsAg positivity by years was 2.50% in 2011, 1.92% in 2012, 1.74% in 2013, 1.53% in 2014, and 1.27% in 2015. These data point out that HBsAg positivity has shown a significant decrease in this 5-year period. During an 11-year period between 2000 and 2010, 266035 donated blood were tested for HBsAg and a 3.17% positivity rate was detected in our District Blood Centre [4]. When we compare the period between 2000 and 2010 (3.17%) with the period between 2011 and 2015 (1.77%), we can safely claim that HBsAg positivity among the blood donors in our district has significantly diminished ($p<0.001$). HBsAg positivity among donors in Turkey varies among the geographical regions and years with ratios between 0.41% and 3.17% (Table 4). Despite the information mentioned above including a decline in HBsAg positivity, a recent study by Fiedler et al. comparing the effectiveness of HBV-NAT and HBsAg, and anti-HBc showed that NAT screening could detect infectious donations of 0.64 compared to 0.55 and 0.02 per million for anti-HBc and HBsAg, respectively [15]. Authors are suggested that these findings could be associated with the donations in an early viremic window period, where infectiousness may not be detected by anti-HBc analysis. However, they have also concluded that HBsAg analysis accompanying with anti-HBc is an effective testing strategy and provides detection of latent HBV infections in donors. In this context, these data confirmed that anti-HBc analysis should be added as a routine test along with HBsAg for HBV.

Similar studies conducted at the beginning of the 2000s in Turkey have shown HBsAg prevalence to be higher in Eastern and South-Eastern regions compared to other regions. Diyarbakir where our study was conducted is a city in the South-Eastern region of Turkey. The positivity rate in Van were 2.92%, while this rate was 3.17% in Diyarbakir [16]. However, the positivity rate of Van between 2000 and 2015 was 0.41%, where we detect a rate of 1.73% between 2011 and 2015 for Diyarbakir [17]. These results point out that the HBsAg prevalence in the Eastern and South-Eastern regions have reduced to the level of mean values of Turkey within the last years (Table 4). This development may be associated with the preventive healthcare measures, raised awareness in the public about viral hepatitis and the effective scanning of the donors. When gender distribution of HBsAg is examined in our study, it is observed significantly lower among females. Recent studies have also given similar results. In a study by Altindis et al., HBsAg positivity was found 1.43% for males and 0.9% for females; while in a study by Güreser et al., it was found 1.01% for males and 0.70% for females [18, 19]. Distribution of HBsAg positivity for the age groups was evaluated. The prevalence rates are as follows: 0.78% for the donors between 18-24 years of age, 1.90% for the donors between 25-49 years of age, and 3.92% for the donors over 49 years ($p<0.001$) (Table 3). These results indicate that HBsAg positivity in younger generation has significantly diminished, which can be associated with several actions, such as HBV vaccination programme established in 1998 in Turkey, improved hygiene and usage of disposable injectors. In Turkey, hepatitis B vaccine was included in Extended Immunisation Programme for the first time in 1998, although it had been accessible on an individual basis since 1988 [20, 21].

HCV is a virus leading widespread morbidity and mortality around the world. Its main routes of transmission are the transfusion of blood and blood products, hemodialysis, intravenous substance use and mother-to-child transmission [22]. HCV has the highest rate of chronic disease progression among hepatitis viruses. Moreover, at least 25% of all chronic cases develop cirrhosis or hepatocellular carcinoma [23, 24]. The global prevalence of anti-HCV is thought to be 1.6% and it is estimated that 150 million people are currently infected with HCV [25].

In Turkey, blood donors have been subjected to compulsory HCV testing since 1996 [26]. In a study conducted by Dilsiz et al., anti-HCV positivity among blood donors between 1996 and 2010 was found as 0.39%, while another study by Çelebi et al. which was conducted in Erzurum had demonstrated a 0.92% anti-HCV positivity among blood donors between 2000 and 2011 [27,

28]. Anti-HCV positivity among blood donors in Turkey has been presented by geographical regions and years in Table 4. In our study, anti-HCV positivity rate was 0.27%. Anti-HCV positivity by years were as follows: 0.35% in 2011, 0.34% in 2012, 0.29% in 2013, 0.23% in 2014, and 0.16% in 2016 ($p<0.001$). These results exhibit a significant decrease in anti-HCV positivity in this 5-year period ($p<0.001$). During an 11-year period between 2000 and 2010, 266035 blood donors were tested for anti-HCV and 0.64% positivity was detected in our Regional Blood Centre [4]. When we compare the period between 2000 and 2010 (0.64%) with the period between 2011 and 2015 (0.27%), we interpreted that anti-HCV positivity among the blood donors in our district has significantly diminished ($p<0.001$). Our results for anti-HCV rates are similar to other studies conducted in Turkey (Table 4).

According to the 2015 data of UNAIDS, the number of HIV-positive individuals in the world is around 36.7 million, the number of new cases infected with HIV in 2015 is 2.1 million, and the number of mortalities due to AIDS in 2015 is 1.1 million [29]. In Turkey, donor blood are being tested for HIV using the ELISA method since 1985 [30]. Any positive or suspicious results are being verified using the Western Blot (WB) test. HIV positivity among the donors in Turkey varies between 0-0.036% (Table 4). In our study spanning over a 5-year period, verified anti-HIV positivity was detected in only two donors (0.0021%). In recent years, the Turkish Red Crescent has started Nucleic Acid Testing (NAT) in addition to HBV, HCV and ELISA scans on all donated blood in order to provide greater safety to patients.

HBV, HCV and HIV prevalence among the blood donors in our region are similar to those in other regions of Turkey. When evaluated according to years, the HBsAg and anti-HCV positivity rates were found to have significantly diminished over the years. This development has been associated with vaccination programs, improved hygiene and greater awareness on hepatitis in the general public.

It is however still impossible to completely prevent the transmission of HBV, HCV, HIV and other infectious agents through transfusion in spite of the current scanning methods. Therefore, it is of utmost importance to use the NAT method in addition to ELISA, to conduct donor interview and examination with care, to create awareness in the public about the infections transmitted through transfusion, and to continue vaccination efforts specially to prevent HBV transmissions.

Disclosure: The authors have no conflict of interests.

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