

Original Research Article

Seroprevalence and trends of markers of transfusion transmissible infections among blood donors: a 3-year hospital based-study

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ABSTRACT

Background: Evaluating the trends and rates of transfusion-transmitted infections (TTIs) among blood donors ensure that supplies of blood are safe and a proficient donor screening is in place. Hence, the study assessed the prevalence and trends of TTI markers among blood donors in Hail, Saudi Arabia.

Methods: A retrospective review was done using donor records in a 3-year period from January 2013 to December 2015. All samples underwent to mandatory serological screening. Descriptive and inferential statistics were used appropriately. Distribution tables were developed to discern the trends that exist and compare the prevalence rates among different age groups. Significant level was set at 5% ($p < 0.05$).

Results: Of the 11,162 blood donors evaluated, 1.5% was found positive for TTI markers. The overall prevalence of HBV, HCV, HTLV I/II, syphilis and malaria were 1.2, 0.04, 0.07, 0.2 and 0.02%, respectively. No blood donor showed positive for HIV markers. Majority of the infections were evident among replacement donors (57.3%). Greater number was observed from the age group of 30-39 years. Statistically, there was no significant difference among the various age groups.

Conclusions: The prevalence rate of TTIs in this study is comparably lower than in other regions of Saudi Arabia and some countries, with no significant variation among the different age groups. HBV continues to be the highest rate of infections inflicting blood donors. Methods to improve donor retention, encouragement and recruitment of new donors have to be identified.

Keywords: Transfusion-transmitted infections, Blood donors, Prevalence, Trends, Saudi Arabia

INTRODUCTION

One of the most essential procedures in the health care delivery at present scenario is the transfusion of blood and its components. However, unsafe donated bloods persist due to either unscreened blood unit from major transfusion-transmitted infections (TTIs) or quality system not in place in the screening.

The WHO Global Database on Blood Safety, according to the data given from 164 countries, shows an annual

collection of more than 92 million blood donations. Of these, discarded units reach approximately 1.6 million due to presence of infectious markers for TTIs.¹ In another data on blood safety indicators provided by ministries of health in 2007, only 71 from 155 countries that said to perform 100% HIV screening, screens in a quality-assured manner.²

In Saudi Arabia, prevalence of HBsAg among blood donors differs from each region with an average that ranges from 2.7% to 9.8%.³⁻⁷ For HCV, the overall

prevalence is 1.1%.⁸ In accordance with the national testing guidelines, screening for the markers of transfusion-transmitted diseases (TTDs), including HBsAg, anti-HBc, anti-HBs (for all anti-HBc positive samples), anti-HCV, HIV I/II, HIV p24 antigen, and the human T-lymphotropic virus (anti-HTLV I/II), in addition to using a serological test for syphilis and malaria, shall be performed in all blood units. Positive TTI test must be screened in duplicate.⁹

Assessing and evaluating the trends and rates of these infections among blood donors will ensure that supply of blood is safe and that donor screening are done proficiently. Thus, these data could show disease occurrences in the community and aid in estimating the dangers with blood transfusion and adapting alternative approaches to reduce the transmission of infections.¹⁰

Additionally, there is better understanding on the donor behavior and assessment of risk through epidemiological monitoring of infection rates among blood donors, including age and gender-specific prevalence rates in new and repeat donors.

Understanding the prevalence of TTI among blood donors provides firm support to government agencies and medical communities in managing disease burden; create policies to assess the safety of blood supply; and help in providing measures for the development of vaccination programs. Presently, current epidemiologic studies on the prevalence of TTIs among blood donors in the region are limited. Hence, the study aims to evaluate the trends in the prevalence of markers of TTI among screened blood donors in a government hospital-based blood bank in Hail, Saudi Arabia. This study will also aid in assessing major causes of TTIs that pose high risk to patients.

METHODS

A retrospective review of the donor records covering a 3-year period from 2013 to 2015 at the King Khaled Hospital Blood Bank serving Hail region in Saudi Arabia was carried out. Screening of HIV, HBV, HCV, HTLV, syphilis and malaria was done on all samples. All samples underwent to mandatory routine screening for serological tests and nucleic acid testing (NAT) for reactive or positive samples in reference laboratory and central blood bank. Serological assays for hepatitis virus markers were done using ARCHITEC Plus i1000SR. NAT for individual testing was done using Cobas TaqMan. VDRL test was done for syphilis, and microscopic examination of blood smears and immune-

chromatographic test (ICT) were used for the detection of malarial infection.

Descriptive statistics such as frequencies, percentages and means were used to measure demographic variables. Inferential statistics were used as appropriate. Distribution tables were formed to show the pattern that exist and compare the prevalence rates among different age groups. Significant level was set at 5% ($p < 0.05$).

RESULTS

A total of 11,162 apparently healthy adult donors were screened during the 3-year study period. Among them 10,689 (95.8%) were found to be fit for donation while 473 (4.2%) were deferred for various reasons. Of which, 171 (36.2%) from the deferred population were due to positive markers for TTIs or 1.5% from the entire donor population. The overall prevalence of HBV, HCV, HTLV I/II, syphilis and malaria were 1.2, 0.04, 0.07, 0.2 and 0.02%, respectively (Table 1). No blood donor showed positive for HIV. Among the donors positive for TTI markers, 73 (42.7%) were voluntary donors while 98 (57.3%) were replacement donors and majority were of age 30-39 years (35.1%). Consistently, higher number of positive TTI (37.8%) is noted on age 30-39 years among the replacement donors while younger age is observed among the voluntary donors on age 20-29 years with 37% positive TTI markers. Least number of positive TTI markers was observed among donors below 20 years (Table 2). There was no significant difference observed among different age groups ($p = 0.832$).

The seropositivity of HBV among the RD had consistently declined over the 3-year study period from 0.25% to 0.22% while the VD increases from 0.16% to 0.22% (Table 3). For the HCV seropositivity, both the VD and RD increased from 0 to 0.03% and 0.01% respectively. Noticeably, there was also an increased on Syphilis markers on both donors but most particularly to RD from 0.01% to 0.11%. On the other hand, positive markers for HTLV I/II and Malaria declined to both VD and RD over the study period. Overall, there was an increased rate of positive TTIs markers among the RDs as compared to the VD's. However, a declining trend was observed among the RDs while VD's were unstable. There was no significant difference observed between the RD and VD to all the TTI markers (HBV, HCV, HTLV, Syphilis, Malaria) as P values were 0.395, 1, 0.564, 0.099 and 1 respectively. HBV constitute the highest rate among the TTI's and lowest rate to malaria positive markers.

Table 1: Incidence of TTIs among the blood donors.

Year	Total donors	Total TTI positive N (%)	HBV N (%)	HCV N (%)	HTLV I/II N (%)	Syphilis N (%)	Malaria N (%)
2013	3584	55 (1.5)	46 (1.3)	0	4 (0.1)	3 (0.08)	2 (0.06)
2014	3656	46 (1.3)	43 (1.2)	0	3 (0.08)	0	0
2015	3922	70 (1.8)	50 (1.3)	4 (0.1)	1 (0.03)	15 (0.38)	0
Total	11162	171(1.5)	139(1.2)	4 (.04)	8(0.07)	18 (0.2)	2(0.02)

Table 2: Type of donors among the positive TTI population.

Year	TTI positive donors		Voluntary		Replacement	
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
Below 20	4	2.3	2	2.7	2	2
20-29	56	32.8	27	37	29	29.6
30-39	60	35.1	23	31.5	37	37.8
40-49	45	26.3	19	26	26	26.5
50 and above	6	3.5	2	2.7	4	4.1
Total	171		73		98	

Table 3: TTI incidence among voluntary donors (VD) and replacement donors (RD).

Year	HBV		HCV		HTLV		Syphilis		Malaria	
	VD	RD	VD	RD	VD	RD	VD	RD	VD	RD
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
2013	18 (0.16)	28 (0.25)	0	0	1 (0.01)	3 (0.03)	2 (0.02)	1 (0.01)	1 (0.01)	1 (0.01)
2014	16 (0.14)	27 (0.24)	0	0	0	3 (0.03)	0	0	0	0
2015	25 (0.22)	25 (0.22)	3 (0.03)	1 (0.01)	0	1 (0.01)	3 (0.03)	12 (0.11)	0	0
Ave.	19.7 (0.17)	26.7 (0.24)	1 (0.01)	0.3 (0.003)	0.3 (0.003)	2.3 (0.02)	0.7 (0.016)	4.3 (0.04)	0.3 (0.003)	0.3 (0.003)

DISCUSSION

Blood unit with even a low viral load may cause infection in the recipient as large volumes of blood or blood components are given during transfusion therapy. It is therefore crucial that effective screening systems is in place among transfusion services to detect, isolate and remove reactive blood units and all components derived from these donations from the quarantined useable stock.²

Almost all of the donor populations in this study were males (99.6%) and rarely were females. The majority of donors positive for TTI are classified as replacement donors (RD) accounting to 57.3%. These are one-time blood donors who donate blood only when a relative is in need. Motivated blood donors who donate blood at regular intervals are called voluntary donors (VD).² It is well established that replacement donors have a higher incidence and prevalence of TTIs among the recipients, a similar finding is noted in this study.¹¹⁻¹³ In the Kingdom of Saudi Arabia, most of the blood is provided from replacement donors instead of volunteer blood donors.¹⁴⁻¹⁶ This seems to be due to misconceptions on blood donation in the Saudi population.¹⁶ It is known that the safest source of blood worldwide is from voluntary donors.¹⁷⁻¹⁹ Thus, identifying new strategies to expand donor recruitment through retention programs for volunteers and encouragement of new donors is vital.

The study also shows that a greater number was observed among the age group of 30-39 years and least likely to age below 20 years. The result is consistent with the study of El Betalgy et al in Tabuk region.⁷ This could be attributed for the following: longer number of years of potential exposure among adults, no existing HB vaccination programs for adults and lack of awareness of TTI in earlier decades. Encouragement of young blood

donors to donate blood ensures a long-term increase in the blood supply without jeopardizing safety.

This study shows that the prevalence of transfusion transmitted infections among blood donors varies from each year reflecting unstable trend despite consistent increased from the number of donors. 1.5% of donated blood units had serological evidence of multiple infections with HBV having the highest rate. This result is lower as compared to the study conducted in the central region of Saudi Arabia with a prevalence rate of 1.9% for a period of 3 years and HBV as the most frequently noted TTI.⁶ Determining the prevalence of TTI through serosurveys is one of the key methods in identifying the safety of blood products and giving epidemiologic impression of these diseases in the community.¹¹

The prevalence of HBV during this study was 1.2%. The result is lower as compared to several studies in the Kingdom: Eastern region (6.7%), Southwestern region (5.4%) and Central region (1.5%). The estimated prevalence of HBV among blood donors in Saudi Arabia ranges from 3-6%.¹¹ Saudi Arabia was once considered a hyper-endemic for HBV with horizontal transmission early in life as primary mode of infection and less commonly by vertical transmission similar to what is observed in other HBV-endemic countries.²⁰⁻²³

Hepatitis C virus (HCV) is prevalent in numerous parts of the world though the prevalence and its incidence may be low in some regions. In Saudi Arabia, HCV infection rates from blood donor screening centers ranges from 0.4-1.1%.^{6,24,25} Our study found out a prevalence rate of 0.04% only. Although the rate is lower and very minimal as compared to other studies, the trend was escalating. According to WHO summary report, the prevalence of HCV infection is estimated to be 1.8% among persons

living in KSA.¹ Two decades ago, a more rigorous provision for HCV testing was implemented nationwide hence causing the reduction of transmissions acquired through transfusion-related means. Moreover, safer blood transfusion practices; surgical, dental, and procedural practices; better life standard and holistic sanitation improvement; and screening of all expatriate populations entering the country contributed to the major declines of HCV infection rates in the country.²⁶

For hepatitis markers and HIV, the reduction of prevalence can be attributed to the successful implementation of the vaccination program as well as to increased awareness among the public, particularly through the national premarital screening program (PMS) which was implemented in 2004 with testing for HBV, HIV and HCV included from 2008.^{27,28} HIV infection prevalence in this study accounted for 0% for 3 consecutive years. This means that none of the donors had a serologically reactive. Furthermore, a very low prevalence rate was also noted on HTLV infections with a rate of 0.07% found positive for anti-HTLV and with a decreasing trend each year. Saudi Arabia is a non-endemic region for HTLV I/II with a reported seroprevalence rate of 0-0.046% among the Saudi population. To date, very low seroprevalence of HTLV-I/II are reported. Based on 7 studies, HTLV screening results from 1997 to 2005 has a seroprevalence of 0.000028.²⁹

The safety of blood used for transfusion can be compromised from blood donors with high-risk behavior among with other risk factors may potentially acquire syphilis infection. *Treponema pallidum* infection in KSA is more common in men than in women (1.6:1) and predominated in the age group 20-39 years.³⁰ Similarly, the present study reveals that reactive syphilis donors were from age 21 to 39 years. In another study on sexually transmitted infections (STIs) in KSA, five-year surveillance was conducted and among 39,049 STIs, syphilis infections were 8.7% (3,385).³¹ Based on more recent study by Kilany et al. in Southern area, only 0.028% positive cases for anti-*Treponema pallidum* antibodies was reported.³² Our present study accounted 0.2% of reactive syphilis. Additionally, data on this study reflects that there was an unusual increase on the numbers of reactive syphilis on 2015. This needs further investigation.

Another serious complication that remains to pose risks in blood bank settings is the Transfusion-associated malaria. Saudi Arabia is a malaria endemic country and rejecting blood units with antibody-positive would result in too much wastage of blood units. In this present study, 0.02% was positive for malaria and both were male donors. The study of Alhassan and Roberts reported that males are 2.6 times more frequently affected than females.³³ Similarly, all the affected donors in this study were males.

CONCLUSION

The prevalence of TTIs in this study is comparably lower than in other regions of Saudi Arabia and some countries with no variation in age groups among the positive donors. HBV continues to be the highest rate of infections inflicting blood donors. Majority of infections is evident among the replacement donors, and greater number is observed among the young adult. Methods to improve donor retention and recruitment of new donors have to be identified. Continues educational programs should target both public and hospital personnel to increase awareness concerning these pathogens. So as to ensure the safety of blood supply, quality assessed and validated assays that are highly sensitive and specific should be used during the screening.

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