OSJ OPEN SCIENCE JOURNAL

RESEARCH ARTICLE

Spectrum of Transfusion Transmitted Infections Among Apparently Healthy Blood Donors in Blood Bank RIMS Ranchi From 2008 to 2014

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OPEN ACCESS

Citation: Sushma K., Ritesh K., Ramesh K. S. (2016) Spectrum of Transfusion Transmitted Infections Among Apparently Healthy Blood Donors in Blood Bank RIMS Ranchi From 2008 to 2014. Open Science Journal 1(2)

Received: 17th March 2016

Accepted: 1st June 2016

Published: 18th June 2016

Funding: The author(s) received no specific funding for this work.

Competing Interests: The author have declared that no competing interests exists.

Abstract

Context: Apparently healthy blood donors might carry out transfusion transmitted infections which might be fatal for the donor himself as well as the recipient later on.

Aim: To assess the seroprevalence of transfusion-transmitted infections (TTI) among apparently healthy blood donors in Ranchi, India.

Methods and Materials: All blood samples were screened for HIV-I and II, HBsAg, HCV (by using third generation enzyme-linked immunoadsorbent assay technique), Syphilis (by Rapid Plasma Reagin Kit), and Malaria antigen both for plasmodium falciparum and plasmodium vivax (by One step, rapid, immunochromatographic test).

Result: On screening of 106,306 blood units for TTIs, 1,462 (1.37 %) donors were found positive for one of the TTIs. Highest prevalence was for HBV (970 donors - 0.91%) ranging from 0.73% to 1.19%. This was followed by Malaria (272 donors - 0.25%) ranging from 0.08% to 0.48%, HCV (127 donors - 0.11%) ranging from 0.04% to 0.25%, HIV (72 donors - 0.06%) ranging from 0.03% to 0.10%, and syphilis (21 donors 0.01%) ranging from 0.00% to 0.09%.

Conclusions: Apparently healthy blood donors are not omitted from the danger of transfusion-transmitted infection.

Keywords: Transfusion-transmitted infections, Immunodeficiency virus, Hepatitis B, Hepatitis C, Syphilis, Malaria

Introduction

The goal of any transfusion service is to provide adequate and safe blood and blood products to the recipients. With every unit of blood transfusion, there is a 1% chance of transfusion related complications including transfusion-transmitted infections [1]. The process of preventing the transmission of transfusion-transmitted infections through blood transfusion presents one of the greatest challenges of transfusion medicine [2]. The Drug and Cosmetic Act, 1945 and its amendments require that all blood donations must be screened against the five major infections: HIV I & II, HBsAg, HCV, syphilis, and malaria [3][4]. Consequently, NACO recommended 3rd or 4th generation ELISA HIV I & II test kits with high sensitivity as the default test for use at blood banks for screening donated blood [5]. Blood transfusion departments not only screen TTI, but they also provide information about the prevalence of these infections in populations [6]. Blood safety interventions in the developed nations have greatly reduced the overall risk of transfusion-transmitted infections [7]. Globally, more than 81 million units of blood are donated each year [8]. More than 18 million units of blood are not screened for transfusion transmissible infections [9]. They are, therefore, unlikely to be totally free of the risk of the infections. The aim of our study is to investigate the prevalence of transfusion transmitted infections among apparently healthy donors in Ranchi, India, and to raise the awareness of infectious complications of blood transfusion

Materials and Methods

The present retrospective study was carried out at blood bank of tertiary care hospital, Rajendra Institute of Medical Sciences (RIMS), Ranchi, India from January 2008 to December 2014. The blood collections were carried out from the voluntary donors at outdoor blood donation camp and in-house blood bank as well as from replacement donors at blood bank. Physical examination and answers of donor's questionnaire were carefully screened by trained personnel. From the donor's blood unit, 5 mL blood samples were obtained for serological testing both in plain and EDTA vials at the time of bleeding. Blood samples were screened for hepatitis B surface antigen (HBsAG) by SD HBsAg Kit (Bio Standard Diagnostic), hepatitis C virus (HCV) antibodies by SD HCV Kit (Bio Standard Diagnostic), and human immunodeficiency virus (HIV-1 & HIV-2) antibodies by Span HIV kit (Span Diagnostic). These were third generation enzyme-linked immunoadsorbent assay technique. Syphilis was tested by RPR-Rapid Plasma Reagin Kit (modified slide test, Pathozyme Diagnostic) and Malaria was screened by SD Malaria Kit (One step, rapid,

immunochromatographic test for detection of plasmodium falciparum and plasmodium vivax antigen - Bio Standard Diagnostic).

Result

A total of 106,306 blood units (Voluntary and replacement) were received into our blood bank from January 2008 to December 2014 (Table 1). After the screening of the 106,306 blood units for TTIs, 1,462 (1.37 %) donors were found positive for one of the TTIs. Highest prevalence was for HBV (970 donors - 0.91%) ranging from 0.73% to 1.19%. This was followed by Malaria (272 donors - 0.25%) ranging from 0.08% to 0.48%, HCV (127 donors - 0.11%) ranging from 0.04% to 0.25%, HIV (72 donors -0.06%) ranging from 0.03% to 0.10%, and syphilis (21 donors 0.01%) ranging from 0.00% to 0.09 (Table 2 and Table 3).

Table 1. Total No of Blood Units Collection, Year Wise from 2008-2014. (Age of Donors, 18-60 Years)

S.N	Name of the year	No of collection
1	2008	11,685
2	2009	11,085
3	2010	11,805
4	2011	13,224
5	2012	16,767
6	2013	20,507
7	2014	21,233
	Grand Total	**106,306**

Table 2. Percentage of Transfusion Transmitted Infections among Blood Donors, Year wise (2008-2014)

S.N	Name of the year	Total no of HIV positive cases	% of HIV positive cases	Total no of HBSAg positive cases	% of HBSAg positive cases	Total no of HCV positive cases	% of HCV positive cases	Total no of Malarial Parasite Positive cases	% of Malarial Parasite positive cases	Total no of Syphilis positive cases	% of Syphilis positive cases
1	2008	04	0.03	110	0.94	14	0.11	50	0.42	03	0.02
2	2009	04	0.03	133	1.19	05	0.04	09	0.08	Nil	0.00
3	2010	12	0.10	95	0.80	12	0.10	23	0.19	Nil	0.00
4	2011	11	0.08	127	0.96	34	0.25	64	0.48	12	0.09
5	2012	14	0.08	166	0.99	17	0.10	66	0.39	05	0.02
6	2013	15	0.07	151	0.73	26	0.12	34	0.16	01	0.0048
7	2014	12	0.05	188	0.88	19	0.08	26	0.12	Nil	0.00

Table 3. Average Percentage of Transfusion Transmitted Infections among Blood Donors from 2008-2014

S.N	Total collection of blood units during 2008 to 2014	Transfusion transmitted infections	Total no of positive cases during 2008 to 2013	Average % of positive cases during 2008 to 2013
1	106,306	HIV	72	0.06
2		HBSAg	970	0.91
3		HCV	127	0.11
4		Malarial Parasite	272	0.25
5		Syphilis	21	0.01
		Grand Total	**1,462**	**1.37**

Discussion

The main blood borne viruses 'viz. hepatitis B virus (HBV), human immunodeficiency virus (HIV), and hepatitis C virus (HCV), are a major public health issue. Therefore, they represent the significant causes of morbidity and mortality which are associated with transfusion. Prevalence of Malaria is still higher in Jharkhand region ranging from 0.08-0.48%. This would, however, result to the wastage of many blood units every year. Most of the problems arise due to the prevalence of asymptomatic carriers in the society, as well as blood donations during the window period of infections [10]. The study of Gupta et al. states that accurate estimates of the risk of TTIs are essential for monitoring the safety of blood supply and in evaluating the efficacy of the currently employed screening procedures [11]. The prevalence of TTIs among blood donors in well-structured health care system with a well-organized blood establishment can be used as a reliable tool for statistical estimations of those infectious agents that can be transmitted through blood products; also, it can contribute to statistical estimation of these viruses in the general population as discussed by Gharehbaghian [12]. Khedmat et al. reported the results of serological screening tests for HBV, HCV, HIV, and syphilis infections in Iran performed by Tehran blood transfusion service between 2003 and 2005 in 1,004,889 subjects [13]. The result showed that the seroprevalence was 0.9% for HBsAg, 2.1% for anti-HCV, 0.2% for HIV Antibody 1 and 2, and 0.04% for VDRL [13]. Between 2003 and 2005, a decreasing trend was observed in the frequency of HbsAg as discussed by Khedmat et al. [13]. Jeremiah et al. reported HCV prevalence rates of 5.0% among donors in Port Harcourt, Nigeria [14]. Chandra et al. reported prevalence rates of replacement and voluntary donors for HIV (0.08 - 0.15%), HBV (0.24 - 1.67%), HCV (0.001 - 0.49%), VDRL (0.008 - 0.01%), and malaria (0.009–0.01%) in their study [10]. When compared to the study of Chandra et al., our study showed low prevalence rates of replacement and voluntary donors for HIV (0.03% to 0.10%), HBV (0.73 - 1.19%), and HCV (0.04% to 0.25%); on the other hand, it shows very high prevalence rate for malaria (0.08% to 0.48%) [10].

The reason for the high prevalence of malaria in Ranchi location is as a result of its geographically endemic zone for malarial parasite. Mollison et al. reported that the rate of transfusion transmitted malaria varies from less than 0.2 in nonendemic countries to 50 or more cases per million in endemic countries [15]. A study conducted at Agha Khan University Hospital showed that the rate of seropositivity of syphilis does not seem to be changing during the past several years. Thus, this is with an annual rate of less than 1%, which is similar with our study. Out of the 114,122 samples tested during the period mentioned, 252 donors were positive for syphilis antibodies which make an overall prevalence of 0.22% as discussed by Moiz et al. [16]. Blood Transfusion Center Nishtar Hospital Multan and Fatimid Blood Transfusion Center Multan tested for HbsAg, anti-HCV and HIV; and they noted that the prevalence of hepatitis B and C and HIV infection was 3.37%, 0.27%, and 0%, respectively, "as discussed by Mahmood et al. [17]." Furthermore, Chandra et al. reported that seropositivity was low both for Malaria (0.009%) and syphilis (0.01%) [10][18]. Seropositivity of VDRL infection has been constant (0.01%) in the last 12 years from 2001 - 2012. The data which provides a picture of TTI burden in India has come from various seroprevalence studies (Table 4 and Table 5) as shown by the studies of Pallavi et al. and Dogra et al. [19][37].

Table 4. Comparison of TTI prevalence rate in different parts of India [19]

Place	HIV (%)	HbsAg (%)	HCV (%)	Syphilis (%)
Delhi	0.56	2.23	0.66	
Southern Haryana	0.3	1.7	1.0	0.9
West Bengal	0.28	1.46	0.31	0.72
Bangalore, Karnataka	0.44	1.86	1.02	1.6
Mysore	0.44	1.27	0.23	0.28
Present study	0.06	0.91	0.11	0.01

Table 5. Comparison of prevalence of TTIs with various studies in India [36][37]

Author & Year	Place	Total TTIs	HIV	HBV	HCV	Syphilis
Gupta N et al (2001-2003)	Ludhiana	2.68 %	0.084 %	0.66 %	1.09 %	0.85%
Chadra et al (2001–2006)	Lucknow, U.P.	2.54 %	0.23 %	1.96 %	0.34 %	0.01%
Nilima Sawke et a (2006–2008)	Bhanpur, M.P.	4.21 %	0.51 %	2.90 %	0.57 %	0.23%
Bhawani et al (2004-2009)	Vikarabad, AP	2.72 %	0.39 %	1.41 %	0.84 %	0.08 %
Jasani et al (2004-2011) PIpARIA	Piparia, Gujarat	3.35 %	0.25 %	1.35 %	0.85 %	0.90 %
Dayal S 2006-2011	Etawah, UP	3.16 %	0.19 %	2.63 %	0.34 %	not done
Patel. A.et al (2005-2011)	Sola, Ahmedabad, Gujarat	0.53 %	0.08 %	0.30 %	0.09 %	0.06 %
Dogra Shruti et al (2009-2012)	New Delhi	4.3 %	0.72 %	2.4 %	0.7 %	0.48 %

Present study (2008-2014)	Ranchi, Jharkhand	1.37 %	0.06 %	0.91 %	0.11 %	0.01 %

For HIV, India is second only to South Africa in terms of the overall number of people living with HIV [19]. The Indian National AIDS Control Organization (NACO) suggested an overall prevalence of 0.91% (2005) in India with 0.25% in Delhi [21]. The prevalence of HIV in various parts of India is different with high rate in the western and southern parts [22]. Western India has reported an HIV seroprevalence of 0.47%, while that in Punjab is 0.26% [23][24]. Sonwane et al. have reported a prevalence of 1.83% in the rural population [20]. The present study showed a HIV prevalence of 0.06%, while Srikrishna et al. have noted 0.44%, Pahuja et al. have noted 0.56, and Singh et al. have noted 0.54% of HIV seroprevalence [2][21][22]. A WHO report states that the viral dose in HIV transmission through blood is so large that one HIV positive transfusion leads to death, on an average, after 2 years in children and after 3 to 5 years in adults [25]. Hence, safe transfusion practices like avoidance of single donors and practices of autologous blood transfusion should be encouraged [26].

India has been placed in the intermediate zone of the prevalence of hepatitis B by the World Health Organization (2 - 7% prevalence rates) [21]. Lodha et al. reported HbsAg prevalence rate of 1–2% in India [27]. Supporting this, HbsAg prevalence in Punjab blood donors was 1.7%, while Rajasthan had 3.44%, and Delhi had 2.23% [2][28][21]. In Karnataka, coastal area had 0.62% and Bangalore had 1.86% of HBV seropositivity [29][2]. Singh et al. have reported a HbsAg prevalence of 1.8%, whereas Joshi and Ghimere have reported a prevalence of 2.71% in healthy Nepalese males [21][22]. Prevalence of HbsAg in our blood donors was 0.77%. On the other hand, the prevalence of HBV infection is lower in the United States and Western Europe (0.1–0.5%), and is reported to be higher, 5–15% in South East Asia and China [21]. Bhattacharya explored a high rate of occult HBV infection prevalence among HbsAg negative/anti-HBC positive donors and, thus, emphasized the need for a more sensitive and stringent screening algorithm for blood donations [30]. Gupta et al. have also found more anti HCV positivity than HbsAg, suggesting the ability to detect hepatitis B virus (HBV) infection in window period [31]. India is still in the intermediate prevalence zone for HbsAg and has been estimated to be a home to over 40 million HbsAg carriers. Despite the fact that a safe and effective vaccine has been available since 1982, the HbsAg prevalence in India still remains high. This is because hepatitis B vaccination is not a part of our national immunization programme [21]. The wide variations of HCV seroprevalance in different studies in India might be due to the use of different generation of ELISA test kits, having different sensitivities and specificities [21]. Among the studies done, Garg et al. have reported an HCV prevalence of 0.28% in blood donors of Western India, and low prevalence of 0.11 % has been noted in our study [32]. Sri Krishna et al. have noted a prevalence of 1.02%, while Sood et al. and Pahuja et al. have reported a high prevalence of 2.2 and 2.23% in Delhi, respectively [2][21]. In addition to this, HCV prevalence by Kaur et al. was 0.78%, Singh et al. was 0.5%, and Jain et al. was 1.57% in New Delhi voluntary blood donors [24][21]. Internationally, various studies have reported an HCV prevalence range of 0.42–1.2% [21].

Sexually transmitted infections are widespread in developing countries, and it constitutes a major public health problem. The VDRL reactivity in our study was 0.01%. A comparatively very low value when compared to 1.6% was noted by SriKrishna et al. [2]. Also, 2.6% was recorded by Singh et al. [22] in Delhi. Arora et al. have reported a 0.9% of VDRL reactivity, while Bhattacharya found 0.72% reactivity [25][30]. Syphilis has also acquired a new potential for morbidity and mortality through association with increased risk of HIV infection, thus making safe blood more difficult to get. In studies related to this, Gupta et al., Otuonye et al., and Patil et al. observed a definite correlation between the positivity of HIV and syphilis [31][33][34]. Therefore, serological screening for syphilis serves as a surrogate test for HIV infected donors. Our study noted no correlation between HIV and other infections. A strict selection criteria for blood donors to exclude those with multiple sexual partners is recommended, and all the affected donors should be treated appropriately [35].

Conclusion

For safe blood transfusion, all blood units should be tested for Transfusion-transmitted infections with reduction in unnecessary blood transfusion. We have low total TTI burden and low prevalence of HIV, HBV, HCV, and Syphilis as comparable to other studies done in various parts of India (Table 4 and Table 5). This is with high prevalence of malaria as comparable to the study done by Chandra et al. that might be possible because Ranchi comes under endemic zone for malarial parasite. Implementation of strict donor selection criteria, the use of more sensitive screening tests, and the establishment of strict guidelines for blood transfusion would possibly help to reduce the incidence of TTI in the Indian scenario.

Acknowledgement

We are thankful to Dr. Kavita Deohgaria, counselor of the Blood Bank, RIMS, for her kind assistance during the data collection process.

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