Research Article

Transfusion transmissible infections in blood donors at a tertiary care rural medical institute of Rohilkhand region, India

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Abstract

Background: Blood transfusion is an integral component of modern medicine; however, it is also associated with life-threatening complications and risks of transmitting blood borne infections like HIV, Hepatitis B and C, syphilis and many more.

Objective: The aim of this study was to observe the prevalence of transfusion transmissible infections in blood donors and their distribution among various socio demographic variables.

Material and Methods: Blood donor records of all sero-reactive cases were reviewed retrospectively from January 2014 to December 2015 at the blood bank of Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly, Uttar Pradesh. Distribution of sero-reactive donors among various socio-demographic variables was analyzed in terms of frequency, percentage, and ratio. Difference between proportions of sero-reactive donors was evaluated by *Z* test and *p* value of less than 0.05 was considered statistically significant at 95% confidence interval. Data was analyzed using MS Excel 2007.

Result: A total of 12,001 donors were selected for blood donation comprising 98.18% males and 1.82% females. Sero-prevalence of HIV, HBV, HCV, and syphilis was 0.09%, 1.44%, 1.11%and 0.53%, respectively and overall being 3.2%. Statistically, significant difference in proportion in gender was found only for HBV. Majority of sero-reactive donors were from rural areas (72.47%) and agriculture (39.22%) was the most common occupation. There was significant difference in proportions of donors sero-reactive for HBV and HCV from low and high education levels.

Conclusion: Transfusion transmissible infections were more common in males and those from rural background. There was a significant difference in proportions of donors sero-reactive for HBV and HCV in low and high education groups. Voluntary donors are safer than both family and replacement donors.

KEY WORDS: Sero-reactive blood donors, Sero-prevalence, Transfusion transmissible infections

Introduction

Blood transfusion constitutes an important treatment modality in the modern health care system for several medical and surgical ailments, however, it is also associated with the risks of transmitting infections like HIV, hepatitis B, hepatitis C, syphilis, and many more.[1] It is the moral responsibility of blood transfusion services to eliminate chances of transfusion-associated infections in the recipients of blood and blood products by adopting sensitive and specific assays and other methodologies for screening of transfusion transmissible infections (TTIs) in blood donors.

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At present 80% countries have identified hepatitis as an urgent public health problem. Around 500 million people are chronically infected with hepatitis B and C with one million deaths yearly contributing to 2.7% of all deaths from liver diseases including liver cancer; and millions of people are

unaware of their sero-reactive status, its consequences and risk of transmitting them to their families and partners.[2] The estimated number of people living with HIV in India is 21.17 lakhs with two-fifth of the total infections in females, and Andhra Pradesh and Telangana reporting highest number of cases.[3]

The Drugs and Cosmetic Acts and Rules in India advocated mandatory testing of blood donors for HIV in 1989, followed by hepatitis B surface antigen, malaria and syphilis in 1999, and hepatitis C in 2001,as a result of which several cases of sero-reactive for these diseases have been discovered with varying rates of prevalence in different parts of the country.[4,5–13] Despite sensitive and specific screening methodologies for viral markers, no transfusion is without risk because of the inability of the commonly employed methodologies to detect these sero-markers in the window period.

In view of the magnanimity of the disease burden for HIV, syphilis,hepatitis B and C infections, it is obligatory for every health organization to identify their magnitude, prevalence trends, and associated risk factors in the particular population they serve so that necessary actions and preventive strategies can be adopted. The present study was therefore undertaken to estimate the sero-prevalence of HIV, hepatitis B and C, syphilis, and malaria among blood donors donating blood at the blood bank of rural medical institute of Rohilkhand region, India. Distribution of such donors among various socio-demographic variables was the focus of interest in this study. Results of the study could be the basis of further developments in screening protocols and methodologies for transfusion transmissible infections in blood donors.

Materials and Methods

The present retrospective cross-sectional study was carried out at the blood bank of Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly, Uttar Pradesh, India. Deferral records from January, 2014 to December, 2015 were reviewed and demographic details of the donors deferred for TTIs were compiled. As a routine inclusion and exclusion criteria for blood donors stringently follow standard Indian FDA guidelines.[14] All donors who consented to blood donation were selected after thorough interrogation and medical examination. To have as insight on the prevalence patterns of transfusion transmissible infections in family donors as opposed to replacement (relatives and friends) and voluntary donors, they were classified into a third group of family donors that included recipients' first-degree blood relatives and husband/wife.

FDA approved kits based on enzyme linked immunosorbantassay or immuno-chromatographic method, with reasonably good sensitivity and specificity were used for TTI screening. HIV (Genscreen ULTRA HIV Ag–Ab, BIORAD), HBsAg (Monolisa HBsAg ULTRA, BIORAD), hepatitis C (Monolisa Anti- HCV PLUS version 2, BIORAD), syphilis (Modified TPHA, Rapid Test, Qualpro Diagnostics, India) and malaria (Rapid test For Pf/ Pan, Zephyr Biomedicals, India) were screened using fully automated EVOLIS TWIN PLUS system. All sero-reactive samples were tested in duplicate before labeling them as sero-reactive.

Socio-demographic variables such as age, gender, place of residence (rural or urban),occupation,educational level were tabulated and analyzed. Educational level of blood donors was classified according to the National Classification system of education;and occupation was classified as per national Classification of occupation-2004 by Directorate General of Employment and Training.[15,16] A group of employed was additionally incorporated in the list for those donors who did not clearly specify the type of job they were in.

Statistical analysis

Data was analyzed for the distribution of blood donors sero-reactive for HIV, HBV, HCV, and syphilis among various socio-demographic variables, donor category and expressed as frequency, percentage and ratios. To evaluate difference between proportions of sero-reactive cases among various variables, *Z* test for proportion was applied. *p* value less than 0.05 was considered statistically significant at 95% confidence interval. Data was analyzed using MS Excel 2007.

Result

Total number of blood donors selected for donation (Figure 1) during the study period was 12,001 comprising 11,782 (98.18 %) males and 219 (1.82%) females, male–female ratio being observed as 54:1. Replacement, family replacement, and voluntary donors comprised 7813(65.10%), 3955(32.96%) and 233(1.94%),respectively.

Out of total donors selected, 385 were found to be sero-reactive for HIV, HBV HCV, and syphilis, the rate of prevalence being observed as 3.2%.The distribution of the sero-reactive cases was as given in Table 1. Although, majority of donors were sero-reactive for only one serological marker, 4 presented with co-infection comprising 0.03%. Two were sero-reactive for HIV and HBV, 1 for HBV and HCV and 1 for HBV

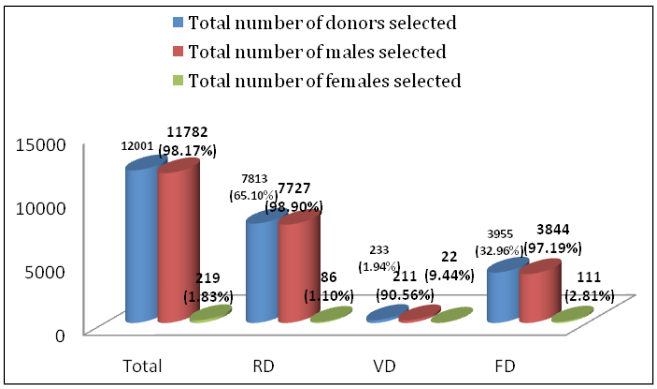

Figure 1: Total number, gender, and donor category distribution of selected blood donors

Table 1: Distribution of sero-reactive donors among various age categories

Age Category	HIV *N* (%)	HBV *N* (%)	HCV *N* (%)	Syphilis *N* (%)	Co-infection *N* (%)	Total *N* (%)
18–30	9 (2.34)	119 (30.91)	78 (20.26)	22 (5.71)	1 (0.26)	229 (59.48)
31–40	2 (0.52)	36 (9.35)	41 (10.65)	30 (7.79)	3 (1.78)	112 (29.09)
41–50	0 (0.00)	18 (4.68)	14 (3.64)	10 (2.60)	0 (0.00)	42 (10.91)
51–60	0 (0.00)	0 (0.00)	0 (0.00)	2 (0.52)	0 (0.00)	2 (0.52)
Total	11 (2.86)	173 (44.94)	133 (34.55)	64 (16.62)	4 (1.04)	385 (100.00)

Table 2: Gender and donor category distribution of sero-reactive donors

Variables		HIV *N* (%)	HBV *N* (%)	HCV *N* (%)	Syphilis *N* (%)	Co-infection *N* (%)	Total *N* (%)
Gender	Male	11 (2.86)	171 (44.42)	128 (33.25)	64 (16.62)	4 (1.04)	378 (98.18)
	Female	0 (0.00)	2 (0.52)	5 (1.30)	0 (0.00)	0 (0.00)	7 (1.82)
Donor Category	Replacement donor (RD)	7 (1.82)	106 (27.53)	84 (21.82)	47 (12.21)	1 (0.26)	245 (63.64)
	Family donor (FD)	4 (1.04)	63 (16.36)	48 (12.47)	17 (4.42)	3 (0.78)	135 (35.06)
	Voluntary donor (VD)	0 (0.00)	4 (1.04)	1 (0.26)	0 (0.00)	0 (0.00)	5 (1.30)

and syphilis. Prevalence of HIV, HBV, HCV, and syphilis alone was 0.09%, 1.44%, 1.11% and, 0.53%, respectively. No case positive for malaria was found. Sero-reactivity for HIV, HBV, and HCV was highest among blood donors between 18 and 30 years while no cases were reported in donors more than 50 years. Syphilis was more common in age group 31–40 (7.79%), however, 0.52% of them were also found in the age group 51–60 years.Proportion of HBV among the sero-reactive blood donors was significantly higher in those less than 30 years of age(p = 0.008) while that of syphilis was significantly higher in donors more than 30 years of age (p = 0.000).

Males outnumbered females among all sero-reactive cases, the ratios being 86:1 for hepatitis B and 26:1 for hepatitis C. No cases of HIV and syphilis were reported in females in this study. Difference in proportions of male and female sero-reactive donors was statistically significant for HBV (p = 0.008).Replacement donors contributed to the maximum number of sero-reactive cases (n = 245, 63.64%) followed by family donors (n = 135, 35.06%) and voluntary donors (n = 5, 1.30%). Co-infection cases were found in replacement (n = 1, 0.26%) in family donors (n = 3, 0.78%) (Table 2). In replacement donors, prevalence of HIV, HBV, HCV, and syphilis among the selected donors was 0.058%, 0.883%, 0.699%, and 0.392%, respectively. In family donors, the prevalence was 0.033%, 0.523% or, 0.399% and 0.142%, respectively. In voluntary donors, the prevalence for HBV and HCV was 0.033% and 0.008%, respectively. No cases of HIV and syphilis were observed among the voluntary donors. Overall prevalence in replacement, family, and voluntary donors was 2.04%, 1.12%, and 0.04%, respectively. Prevalence of co-infection was 0.008% and 0.25% in replacement and family donors, respectively.

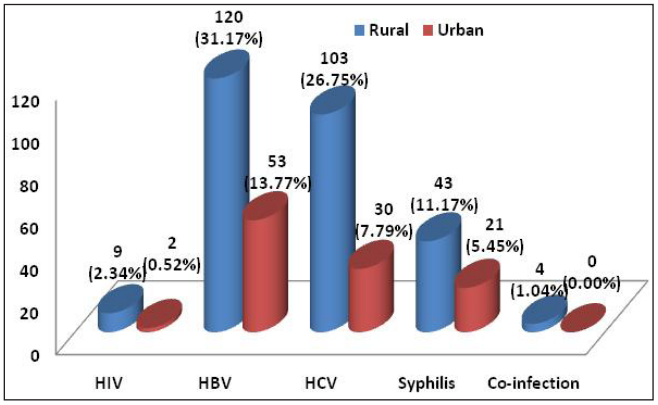

Figure 2: Distribution of sero-reactive donors with respect to place of residence(urban and rural)

The distribution of sero-reactive donors from urban and rural areas was as given in Figure 2. Donors from the rural area contributed 72.5% (n = 279) of the sero-reactive cases, while donors from urban areas contributed to 27.5% (n = 106) of the cases, ratio being observed as 4.5:1, 2.3:1, 3.4:1, and 2:1 for HIV, HBV, HCV, and syphilis, respectively although the difference in proportions were not statistically significant.

With respect to education (Table 3), HBV was significantly higher in donors with low education levels (nil and primary; p = 0.02), while HCV was more in donors with higher education levels (graduates and post graduates; p = 0.02). Difference was not significant for HIV and syphilis.

Among various occupation categories (Table 4) agriculture was the most common occupation comprising 39.22% (n = 151) followed by elementary occupation (n = 83, 21.56%).

Table 3: Distribution of sero-reactive donors with respect to educational status

Variables		HIV	HBV	HCV	Syphilis	Co-infection	Total
		N (%)	*N* (%)	*N* (%)	*N* (%)	*N* (%)	*N* (%)
Education	NIL	1 (0.26)	24 (6.23)	14 (3.64)	7 (1.82)	1 (0.26)	47 (12.21)
	Primary	1 (0.26)	23 (5.97)	6 (1.56)	3 (0.78)	0 (0.00)	33 (8.57)
	Upper Primary	2 (0.52)	23 (5.98)	23 (5.97)	18 (4.68)	0 (0.00)	66 (17.14)
	Secondary	3 (0.78)	37 (9.61)	37 (9.61)	17 (4.42)	1 (0.26)	95 (24.68)
	S. Secondary	1 (0.26)	29 (7.53)	22 (5.71)	8 (2.08)	2 (0.52)	62 (16.10)
	Under Graduate	0 (0.00)	9 (2.34)	1 (0.26)	2 (0.52)	0 (0.00)	12 (3.12)
	Graduate/diploma	3 (0.78)	25 (6.49)	26 (6.75)	6 (1.56)	0 (0.00)	60 (15.58)
	Post Graduate	0 (0.00)	3 (0.78)	4 (1.04)	3 (0.78)	0 (0.00)	10 (2.60)

Table 4: Distribution of sero-reactive donors with respect to occupation

Variables		HIV	HBV	HCV	Syphilis	Co-infection	Total
		N (%)	*N* (%)	*N* (%)	*N* (%)	*N* (%)	*N* (%)
Occupation	Agriculturist	4 (1.04)	63 (13.36)	56 (14.55)	26 (6.75)	2 (0.52)	151 (39.22)
	Associate professionals	0 (0.00)	0 (0.00)	3 (0.78)	1 (0.26)	0 (0.00)	4 (1.04)
	Craft and trade related workers	1 (0.26)	6 (1.56)	6 (1.56)	5 (1.30)	0 (0.00)	18 (4.68)
	Elementary occupation	4 (1.04)	39 (10.13)	26 (6.75)	13 (3.38)	1 (0.26)	83 (21.56)
	Professional	0 (0.00)	3 (0.78)	4 (1.04)	3 (0.78)	0 (0.00)	10 (2.60)
	Shop and market sales workers	1 (0.26)	24 (6.23)	17 (4.42)	11 (2.86)	1 (0.26)	54 (14.03)
	Unemployed	1 (0.26)	26 (6.75)	11 (2.86)	2 (0.52)	0 (0.00)	40 (10.39)
	Employed (nature of employment not specified)	0 (0.00)	12 (3.12)	10 (2.60)	3 (0.78)	0 (0.00)	25 (6.49)

Table 5: Prevalence of transfusion transmissible infections in blood donors reported by various authors in India

Place	State	Year	HIV (%)	HBV (%)	HCV (%)	Syphilis (%)	Author
Hisar	Haryana	2014	0.30	1.70	1.00	0.90	Arora et al.[9]
Rajkot	Gujrat	2014	0.07	0.68	0.07	0.07	Dhruva et al.[7]
Gandhi Nagar	Gujrat	2016	0.04 – 0.23	0.23– 0.65	0.03	0.04	Patel[12]
Pune	Maharastra	2014	0.28	1.23	0.41	0.01	Shastry et al.[11]
Kolkata	W. Bengal	2014	0.60	1.41	0.59	0.23	Karmakar et al.[5]
Aligarh	U.P.	2015	0.09	1.59	0.22		Afrose et al.[10]
ShriGanga Nagar	Rajasthan	2012	0.20 in 2010	1.37	1.37	0.63	Sabharwal etal.[6]
Kolkata	W. Bengal	2013	0.10	0.80	0.11	0.13	Dharet al.[8]
Bareilly	U.P.	2016	0.09	1.44	1.11	0.53	Present study

Overall TTIs were least common in the group of associate professionals (*n* = 4, 1.04%). No case of HIV was reported in associate professionals, professionals, and employed category. In most of the occupation categories HBV was more common than HCV, however in associate professionals, HCV was more common. No statistically significant difference was found among various occupation categories.

Discussion

Transfusion transmissible infections (TTIs) are widely prevalent globally and recipients of blood and blood components are always at a risk of acquiring these infections. In the present study, the overall prevalence rate in blood donors was highest for HBV (1.44%) similar to that reported by Karmakar et al.[5] from W. Bengal (1.41%) and Sabharwal et al.[6] from Rajasthan (1.37%). It was much higher than that reported by Dhruva et al.[7] from Gujrat (0.68%) and Dhar etal.[8]from Kolkata, West Bengal (0.8%) while it was lower than that reported by Arora et al.[9] from Harayana (1.7%) who reported the highest prevalence among all the studies, followed by Afrose et al.[10] (1.59 %) (Table 5).

The second most prevalent TTI observed was HCV (1.11%) almost similar to that reported by Arora et al.[9] Highest prevalence was reported by Sabharwal etal.[6] (1.37%) while lowest by Dhar et al.[8](0.11%).

Syphilis in this study was third in order of prevalence (0.53%) which was much higher than that reported by Shastry et al.[11] (0.008%) from Maharashtra which was least in prevalence among all the studies. A higher prevalence of 0.9% was reported by Arora et al.[9]

HIV was least common in this study with a prevalence rate of 0.09%. Highest prevalence was reported by Karmakar et al.[5] (0.6%).Patel[12] from Gujarat reported least prevalence not only for HIV (0.074%) but also for HBV and HCV.

Difference in the prevalence of TTIs may be due to the difference in the diagnostic kits with varying sensitivity and specificity used at different blood banks; hence standardization of the screening methods would eventually highlight the actual difference in their prevalence from region to region.

Prevalence pattern observed in this study, HBV > HCV > syphilis > HIV was similar to that reported by Arora et al.[9] and Giri et al.[13] while prevalence pattern of HBV > HCV = HIV > syphilis was reported from Gujarat. HBV > HCV > HIV > syphilis was observed in the study from Maharashtra while in West Bengal, Karmakar et al.[5]reported a sero-prevalence pattern of HBV > HIV > HCV > syphilis and Sabharwal et al.[6] from Rajasthan reported HBV = HCV > syphilis > HIV.

Sero-prevalence of donors with more than one marker (co-infection) was 0.03% which was almost similar to that observed by Dhar et al.[8] (0.02%) and the most common co-infection being HIV and HBV.

Most common age group with majority of donors sero-reactive for HBV, HCV, and HIV observed in this study was 18–30 years. An almost similar age group was reported by other authors.[5,10,11]

Males contributed to maximum number of sero-reactive cases for all transfusion transmissible infections as also seen in other studies.[5-13]The preponderance of males registering as blood donors at various places because of higher blood donation attitude score could be responsible for the increased proportion of males incidentally being discovered sero-reactive after donor screening and further males are subjected to the high risk factors associated with transfusion transmissible infections specially for HIV and syphilis.[17] Difference in proportion for HBV was significantly higher in males than females. No statistical significance in the difference in proportions of sero-reactive males and females was observed for HIV and syphilis as no female was found sero-reactive.

In the present study, HBV was significantly higher in donors with low education levels, while HCV was significantly more in donors with education levels graduate and post graduates compared to donors with nil and primary education because most of these donors were from rural areas and were either agriculturists by occupation or unemployed. Agriculture was the most common occupation among all sero-reactive blood donors followed by those with elementary occupation. These observations suggest that individuals irrespective of education, residing in rural area,with low earnings, in-formal occupation related to agriculture work or unemployed graduates,due financial constraints and lack of awareness,approach unregistered medical practitioners for health problems. Therapeutic use of unsterilized needles and syringes by these unregistered health care providers in rural areas are the greatest threat in transmission of blood borne infections.[18] In India, there are hardly any studies addressing prevalence patterns with respect to educational levels of donors and their occupations. Balderas et al.[19] from Mexico reported elementary level or lower education levels as risk factor for HCV sero-positivity although no significant association was found with HBsAg sero-positivity. They also reported significant association of HBsAg and HCV sero-positivity with various occupation variables, farmers, and employees being the most common. Hence, further studies are warranted to evaluate the association of education levels and occupation with the sero-reactvity status of blood donors for conclusive discussion.

In the present study, prevalence of all TTIs was highest in the replacement donors and least in voluntary donors. No cases sero-reactive for HIV and syphilis were reported in voluntary donors similar to that reported by Awasthi et al.[20] Prevalence rates in family donors were closer to those observed in replacement donors although the difference between proportions of various donor categories was not statistically significant. This could be due to extremely small number of voluntary donors in the present study comprising only 1.94% and family donors being comparable in number to replacement donors. Incidental discovery of sero-reactivity in first time donors, concealment of facts related to history of past infection or risky behavior of replacement or family donors, supported with patients' attendants for delivering false fabricated answers may be the possible reasons of higher prevalence rates of sero-reactivity in replacement or family donors.[4] High sero-prevalence rate of TTIs in family donors as compared to voluntary donors justifies that family donors should be treated as replacement donors and not voluntary donors as also reported by Jain and Gupta[21] Patel[12] also in their study comprising large number of voluntary donors reported less prevalence of TTI in voluntary donors (0.64%) compared to replacement donors (1.15%).

Conclusion

In conclusion, the present study supports the observations that TTIs are more common in males and those from rural background. Significant difference in proportions does exist for HBV and HCV among donors from low and high education levels. The study further supports the fact that voluntary donors are safer than replacement donors and family donors should not be treated as voluntary donors. Socio-demographic risk factors of TTIs need to be explored and monitored regularly to understand their prevalence pattern in blood donors.

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