DOI: 10.7860/NJLM/2018/35142:2285

Original Article

Pathology Section

Analysis of Transfusion Transmitted Infections Among Blood Donors:To Prepare a Road Map for its Prevention and Control

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ABSTRACT

Introduction: Safe blood transfusion is the responsibility of all the blood banks and transfusion centres. Transfusion Transmitted Infections (TTI) is a major hurdle in achieving this goal.

Aim: To assess prevalence of TTI among blood donors and prepare guidelines for its prevention and control.

Materials and Methods: This retrospective study was carried out at Subharti Blood Bank, Meerut. All blood donors for a period of year 2011 to 2016 were included in this study. All donated units were screened by ELISA technique for HIV, HCV and HBSAg and rapid card techniques for syphilis and malaria.

Results: Total number of donors over a period of 06 years was 34342, with 96.50% male donors and 37.79% voluntary donors. Overall, seropositivity for HIV, HCV, HBV, syphilis and malaria were 0.1135%, 1.503%, 1.744%, 0.093% and 0.046% respectively. Out of 1200 female donors only 10 were seropositive for TTI, 07 for HCV and 03 for HBV. None of the female donor was seropositive for HIV, syphilis or malaria.

Conclusion: A downward trend was noticed in overall seropositivity over the years. It is concluded that initiatives be taken at each level to spread awareness about benefits of voluntary blood donation and to spread knowledge about prevention of TTIs, so that aim of providing 'Safe Blood' can be achieved.

Keywords: Hepatitis B, Hepatitis C, Malaria, Safe transfusion, Syphilis

INTRODUCTION

There is no doubt that blood and blood component therapy is an inescapable mode of treatment as a life saving measure in variety of routine and emergency patient's management. Though all possible measures are taken to ensure safe blood transfusion, yet it is a known fact that most deaths and disabilities related to blood transfusion worldwide is still caused by the transmission of infectious agents [1]. According to Blood transfusion safety and regulatory requirements it is the responsibility of blood bank to screen each donated blood unit for HIV, HCV, HBSAg, malaria and syphilis [2].

As the blood donors are part of general population of a particular geographic area, seropositivity of blood donors is a reflection of seropositivity for these infection markers in general population of that area [3].

This retrospective study was done to analyse the frequency of HIV, HCV and HBV, syphilis and malaria among the blood donors in a tertiary care hospital in Western Uttar Pradesh.

MATERIALS AND METHODS

A retrospective study was conducted at Subharti Blood Bank Meerut. Institutional Ethical committee clearance was obtained prior to the study. A total of 34342 blood donors including both voluntary and replacement were screened over a period of six years from January 2011 to December 2016 were analysed. Voluntary donors both at blood bank and blood donation camps were included, while replacement donors were patients relatives or friends.

All precautions were taken to eliminate professional donors by strict adherence on completion of questionnaire and proper history taking.

Samples for TTI screening were collected in sterile vacutainers immediately after blood donation. About 5 mL of whole blood sample was collected in EDTA and 5 mL into plain vacutainer. EDTA samples were used for malaria testing and serum separated from plain tubes by centrifugation was for detection of HIV, HCV, HBsAG and syphilis.

Third generation ELISA kits were used to detect seropositivity for HIV, HCV and HBV. All positive samples were retested by ELISA as well as rapid techniques for confirmation. For detection of syphilis, Rapid Plasma Reagin test kit (Arkray) and for malaria PAN-pLDH 2 band Sure test kit (Microgene) was used.

STATISTICAL ANALYSIS

Descriptive data analysis was done on SPSS version 19.0 to calculate the frequency of types of blood donors and its correlation with various TTIs.

RESULTS

Out of 34342 blood donors included in this study over a period of six years, 12977 (37.8%) voluntary donors whereas 21365 (62.2%) were replacement donors [Table/Fig-1].There were 33142 (96.50%) males, while 1200 (03.50%) were females [Table/Fig-2].

All donors were divided in three age groups i.e., 18 to 25 years, 26 to 40 years and more than 40 years. It is seen that there were almost equal number of donors from 18-25 years and 26-40 years groups i.e., 42.2% and 42.3% respectively while more than 40 years group had only 15.5% donors [Table/Fig-3].

Overall, average seropositivity was 3.47%, with 0.1135% for HIV, 1.503% for HCV and 1.744% for HBV, 0.093% for syphilis and 0.046% for malaria. On seeing year wise seropositivity it is seen that there is a trend of decrease in seropositivity, it being least (2.652%) in year 2016 from 4.327% in year 2012. Seropositivity in replacement donors was 1.7 times more as compared with voluntary donors. Out of 1191 seropositive donors, only 10 were females (0.84%).07 were positive for HCV and 03 for HBV. Out of these 03 were voluntary donors while 07 were replacement donors [Table/Fig-4]. 40.5% seropositive donors belonged to 18-25 years, 50.4% to 26-40 years and 8.9% belonged to more than 40 years group [Table/Fig-5].

Total 28 donors showed positivity for more than one infection marker [Table/Fig-5] in which 03 were positive for HIV also. All these cases of dual positivity were male donors, 10 were voluntary and 18 were replacement donors.

There were 39 HIV seropositive cases, all male donors. 13 donors belonged to 18-25 years and 26 to 26-40 years age group, and 13 were voluntary donors while 26 were replacement donors.

Year	Voluntary		Replacement		Total
	Number	%	Number	%	
2011	2007	41.6	2812	58.4	4819
2012	2466	46.2	2873	53.8	5339
2013	2083	37.8	3429	62.2	5512
2014	2126	37.6	3521	62.4	5647
2015	2306	34.1	4460	65.9	6766
2016	1989	31.8	4270	68.2	6259
Total	12977	37.8	21365	62.2	34342

[Table/Fig-1]: Distribution of donors-Voluntary and Replacement.

DISCUSSION

In our study 96.50% donors were male while 03.50% were female. Almost similar findings are noticed by Bobde V et al., 93.7% male donors [3], Fernandes H et al., 97.5% male donors [4], Giri PA et al., 95.28% male donors [5], Ahmed Z et al., 91.8% male donors [6], Makroo RN et al., 95.86% male donors [7], Shaikh M et al., 99.23% male donors [8], Yadav BS et al., 98.38% male donors [9], Shah et al., 97.12%

	Male			Female			Total		
Year	V	R	T	V	R	T	V	R	T
2011	1819	2768	4587	188	44	232	2007	2812	4819
2012	2281	2813	5094	185	60	245	2466	2873	5339
2013	1976	3385	5361	107	44	151	2083	3429	5512
2014	1991	3476	5467	135	45	180	2126	3521	5647
2015	2220	4402	6622	86	58	144	2306	4460	6766
2016	1816	4195	6011	173	75	248	1989	4270	6259
Total	12103	21039	33142	874	326	1200	12977	21365	34342
%	35.2	61.3	96.5	2.5	1.0	3.5	37.8	62.2	100

[Table/Fig-2]: Distribution of donors according to sex and type of donor (V-Voluntary, R-Replacement, T-Total).

Age	18-25 years			26-40 years			>40 years			Total
Year	Male	Female	Total	Male	Female	Total	Male	Female	Total	
2011	1698	170	1868	2226	56	2282	663	06	669	4819
2012	1973	187	2160	2374	49	2423	747	09	756	5339
2013	2031	52	2083	2733	80	2813	597	19	616	5512
2014	2355	103	2458	2040	54	2094	1072	23	1095	5647
2015	3126	88	3214	2459	39	2498	1037	17	1054	6766
2016	2540	160	2700	2362	69	2431	1110	18	1128	6259
Total	13723	760	14483	14194	347	14541	5226	92	5318	34342
%	40.0	2.2	42.2	41.3	1.0	42.3	15.2	0.3	15.5	100

[Table/Fig-3]: Distribution of all donors according to age and sex groups.

	Donor	2011	2012	2013	2014	2015	2016	Total	% TTI
HIV	V	01	02	06	02	01	02	14	.0408
	R	03	05	05	02	08	02	25	.0728
	Total	04	07	11	04	09	04	39	.1135
	%	.083	.131	.191	.070	.131	.064	.1135	
HCV	V	25	28	31 (01)	38 (01)	34	32	198 (02)	.577
	R	41	50	49 (04)	50	82 (01)	46	318 (05)	.926
	Total	66	78	80 (05)	88	116	78	516 (07)	1.50
	%	1.37	1.65	1.45	1.56	1.71	1.25	1.50	
HBsAg	V	36	44	28	42 (01)	28	35	213 (01)	.620
	R	47	74	61 (01)	75	81 (01)	48	386 (02)	1.12
	Total	83	118	89 (01)	117	109	83	599 (03)	1.74
	%	1.72	2.21	1.61	2.07	1.61	1.32	1.74	
Syphilis	V	01	06	01	0	0	0	20	.058
	R	03	06	03	0	0	0	12	.035
	Total	04	12	04	0	0	0	32	.093
	%	.082	.224	.072	0	0	0	.093	
Malaria	V	00	03	01	03	01	00	08	.023
	R	03	03	02	00	00	01	08	.023
	Total	03	06	03	03	01	01	16	.046
	%	.062	.112	.054	.053	.015	.016	.05	
Total Seropositivity	V	63	93	67 (01)	85 (02)	64	69	441 (03)	1.3
	R	97	138	120 (05)	127	171 (02)	97	750 (07)	2.2
	Total	160	231	187 (06)	212 (02)	234 (02)	166	1191(10)	3.5
	%	3.2	4.3	3.4	3.8	3.5	2.6	3.5	
Total donors	-	4891	5339	5512	5647	6766	6259	34342	

[Table/Fig-4]: Seropositivity for Transfusion Transmitted Infections among all donors.
(V-Voluntary, R-Replacement, T-Total) (Figures in parenthesis are female seropositive cases (total-10)

Age Group	18-25 years			26-40 years			>40 years			Total
Years	1 TTI	>1 TTI	%	1 TTI	>1 TTI	%	1 TTI	>1 TTI	%	
2011	58	1	36.9	83	1	52.5	17	0	10.6	160
2012	101	2	44.6	104	3	46.3	19	2	9.1	231
2013	77	3	42.8	97	1	52.4	09	0	4.8	187
2014	78	0	36.8	105	2	50.5	26	1	12.7	212
2015	85	4	37.9	125	3	54.4	17	1	7.7	235
2016	72	2	44.6	75	1	45.8	15	1	9.6	166
Total	471	12	40.5	589	11	50.4	103	5	8.9	1191

[Table/Fig-5]: Distribution of seropositive cases according to age groups.

male donors [10], Jassani J et al., 99.0% male donors [11], Dobariya GH et al., 97.16% male donors [12], and Leena MS et al., 96.0% male donors [13]. This reflects the general trend of male donors in our society. Female donors are few due to poor nutritional status and low haemoglobin levels leading to deferral from donation.

In present study 37.79% donors were voluntary donors while in literature there is a great variation in percentage of voluntary donors from 54.7% to as low as 0.8% [3,7,9,10,14,15]. This variation indicates level of awareness of general population of that area regarding voluntary blood donation. Lack of education and proper motivation might be the contributory factors for less number of voluntary donors in those areas. The level of motivation towards voluntary donation is a

matter of real concern as more developed and metropolitan cities also reveal, a figure of 66.7% from Chandigarh [14] and 03% from Delhi [7]. Only proper donor screening, sensitive screening tests and effective inactivation procedures can ensure the reduction and risk of acquiring TTIs [16].

In our study, number of donors belonging to age group (18-25 years) and age group (31-40 years) were almost equal, 42.2% and 42.3% respectively where as donors of more than 40 years of age were only 15.5%. Almost similar observation is noted by Fernandes H et al., [4] 18-30 years 68.5% [4], and Yadav BS et al., 18-30 years 69% [9].

In our study, average seropositivity for all five infection markers was 3.5%, highest 4.3% in year 2012 and lowest 2.6% in year 2016. Overall, seropositivity as noted by other workers has ranged from 0.6% Fernandes H et al., [3] to 4.0% Shaikh M et al., [8]. [Table/Fig-4] shows that seropositivity for all five infection markers has shown a general downward trend, lowest being in year 2016. Similar trend is noticed in other studies also, Jassani J et al., [11]. This downward trend over the years was due to stringent donor selection criteria, but we consider that along with stringent donor selection criteria, increased awareness towards voluntary blood donation and knowledge of transfusion transmissible diseases has also contributed towards this downward trend.

In our study overall seropositivity among replacement donors was 1.7 times more as compared to voluntary donors. Similar findings have been mentioned in other studies also [3,10].

About 40.5% seropositivity was seen in 18-25 years age group, while 50.4% in 26-40 years age group. Though, number of donors in both these groups was almost same i.e. 42.2% and 42.3% respectively but more incidence of seropositivity in 26-40 years age group shows more exposure to these infections in 26-40 year age group. This could be due to promiscuous sexual habits, unsafe injection as in IV drug user. This can be overcome by increasing general awareness regarding mode of acquiring these diseases and their consequence, by displaying posters and distributing pamphlets at hospital reception, waiting areas as well as at public places.

In our study, average seropositivity for HIV among the donors was 0.1135% (voluntary donors 0.0408% and replacement donors 0.0728%). A downward trend over the years is noticed thus lowest incidence of 0.064% seen in year 2016. Seropositivity for HIV as noted in other studies varies from 0.06% to 0.5% [4,8].

On analysing HIV positive donors' data, it is seen that all HIV positive donors were male. Out of 39 HIV seropositive cases, 13 were from age group 18-25 years, while 26 from age group 26-40 years and none from >40 years age group. As most important mode of HIV infection is by unsafe sex, this can be explained by more chances of promiscuous and unsafe sex in 26-40 years age group.

Among these HIV positive cases 14 were voluntary donors and 25 were replacement donors. This shows that possibility of HIV infection through transfusion was twice in cases of donations by replacement donors as compared to voluntary donors.

In our study average seroposivity for HCV was 1.503%, voluntary donors 0.577% and replacement donors 0.926%. There is an increasing trend in seropositivity for HCV from 1.369% in year 2011 to 1.714% in year 2015 but in year 2016 it has come down to 1.246%. Seroposivity for HCV as noted in other studies vary from 0.06% [4] to 1.11% [8]. Makroo RN et al., has also mentioned about increasing trend in HCV seroposivity [7].

Average seroposivity for HBV was 1.744%, voluntary donors 0.62% and replacement donors 1.124%. During our study period it has varied from 1.326% to 2.210%, lowest being in year 2016. Other studies have shown a variation in HBV seropositivity from 0.34% to 2.21% [4,8].

Positivity for syphilis RPR was 0.093%, voluntary donors 0.058% and replacement donors 0.035%. During the study period it has varied from 0.224% in year 2012 and 0.072% in year 2013. No donors were detected to be positive for syphilis in years 2015 and 2016. In review of literature seropositivity for syphilis in blood donors had varied from 0.04% to 0.9% [14,15].

Malaria was positive in 0.046%, voluntary donors 0.023% and replacement donors 0.023%. During study period malaria positivity has varied from maximum 0.062% in year 2011 to 0.015% in year 2015 and 0.016% in year 2016. During search in literature only three workers have included study of malaria positivity-0.01% by Fernandes H et al., [4], 0.024% by Dobariya GH et al., [12], and 0.1% by Leena MS et al., [13]. There were 28 donors who tested positive for more than one viral marker. Among these 03 donors were positive for HIV. Age group wise, among these 12 donors belonged to 18-25 years age group, 11 belonged to 26-40 years, and 05 belonged to more than 40 years age group. Out of them 10 were voluntary donors (2.35% of 425 all seropositive voluntary donors) and 18 were replacement donors (2.47% of 729 all seropositive replacement donors). Thus seropositivity for more than one marker was almost same in both the group, while Makroo RN et al., [7] has mentioned more than one marker positivity 2.1 times more among replacement donor than voluntary donors.

The seropositivity of various TTI's in different states of the country shows considerable variation [3,7,10,12,15,17-21] [Table/Fig-6]. The overall seroprevalance in Uttar Pradesh was highest for HBV (1.21%) followed by HCV (0.5%), HIV (0.1%), syphilis (0.84%) and malaria (0.04%) [17]. The above data signifies that healthy blood donors in Meerut district showed a higher seroprevalance for both HBV and HCV compared to national average. Steps should be taken to educate people at grass root level to prevent blood borne

Authors	Study Place	Duration	Total Donors	TTD (%)	HIV (%)	HBV(%)	HCV(%)	Syphilis(%)	Malaria (%)
Bobde V et al., [3]	Nagpur Maharashtra	2010-14 (4.5yrs)	43190	1.66	0.3	1.18	0.16	-	-
Makroo RN et al., [7]	New Delhi	2005-13 (9 yrs)	180477	2.099	0.24	1.18	0.43	0.23	-
Shah N et al., [10]	Ahmedabad, Gujrat	2006-13 (7.5 yr)	92778	1.48	0.18	0.98	0.108	0.23	-
Dobariya GH et al., [12]	Surat, Gujrat	2011-16 (5 yr)	40971	1.34	0.08	0.98	0.098	0.16	0.02
Vandana WV et al., [15]	Bangalore, Karnataka	2012-15 (4 yr)	4087	1.59	0.2	0.75	0.34	0.3	-
NACO [17]	India	2015 (1 yr)	6828055	1.622	0.136	0.939	0.326	0.182	0.039
Pallavi P et al., [18]	Mysore, Karnataka	2004-8 (5 yrs)	39060	2.22	0.44	1.27	0.23	0.28	-
Mandal R et al., [19]	Darjeeling, West Bengal	2010-12 (3 yrs)	28364	2.93	0.42	1.24	0.62	0.65	0.004
Chaurasia RK et al., [20]	Bhopal, Madhya Pradesh	2011-16 (5 yrs)	15060	4.19	0.14	2.13	0.62	1.30	-
Chaudhary V et al., [21]	Bareilly, Uttar Pradesh	2013 (1 yr)	28,395	3.3	0.27	1.93	1.02	0.16	-
Present Study	Meerut, Uttar Pradesh	2011-16 (6 yrs)	34342	3.5	0.11	1.74	1.50	0.09	0.046

[Table/Fig-6]: Comparative analysis of Transfusion transmitted infections in different parts of India.

transmission of these diseases.

LIMITATION

Root cause analyses of factors leading to increased prevelance of HBV and HCV in this era when TTI's are reducing is a cause of concern. As blood donors represent healthy population coming to hospitals, they reflect incidence of infection in the general population. Further, prospective studies should be undertaken after educating the people regarding safe blood transfusion and how they can prevent themselves for getting infected with these diseases.

CONCLUSION

Supply of safe blood is the prime duty of any blood bank or transfusion centre. All possible measures should be taken to select a disease free donor. Thus all steps beginning from history taking to screening of collected blood unit for TTIs is to be carried out very meticulously.

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FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Publishing: **Apr 01, 2018**