



Seroprevalence, trend of transfusion transmittable infections and co-infections rate among blood donors at tertiary care hospital – 10 years study

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Abstract:

Background: Transfusion Transmittable Infections (TTIs) continue to be a major threat to safe blood transfusion practice. The WHO recommends universal and quality controlled screening of blood donors for major TTIs. **Aim:** We conducted a 10 years retrospective cross-sectional study to determine the seroprevalence of TTIs among the blood donors at Tertiary care Hospital. Also we analyzed the changing trend and co-infection rate of TTIs. **Material and methods:** A total of 38,237 blood units tested for TTIs, viz., anti HIV 1 and 2 antibodies, HBSAg, anti HCV antibody using ELISA. Test for syphilis was done by rapid plasma regain test and peripheral smear examination to detect malaria parasite. Malascan rapid test was introduced for malaria since January 2013. **Result:** In present study highest seroprevalence observed was for HBSAg 1.45% followed by HIV 0.39%, HCV 0.1% and syphilis 0.01%. Seroprevalence for hepatitis C was increased from 0.11% in 2011 to 0.14% in 2013. During study period decreasing trend for seropositivity of TTIs was seen. In 9 donors we found co-infection of TTI markers. Eight HCV positive donors were also showed positivity for a second TTI (5 for HIV and 3 for HBSAg). **Conclusion:** In present study Hepatitis B infection was most prevalent among TTI. Also HCV infection poses a threat to society due to its increasing trend. There is definite need to encourage voluntary donors, ongoing newer modes of screening test like enhance chemiluminisence and NAT testing which will improve blood safety further.

Key words: Blood donors; Co-infection; Hepatitis B; Hepatitis C; Seroprevalence; Transfusion transmittable infections

Introduction

Well organized blood transfusion service is a vital component of health care delivery system [1]. Everyday millions of people require blood transfusion. Safe transfusion of blood saves millions

of lives, but unsafe practice put millions of people at risk if the blood is contaminated by an infectious diseases. Frequency of transmission, per unit of blood transfused in USA, is estimated as 1 in million for HCV, 1 in 2 lakhs for HBV and 1 in 1.5 million

for HIV. Up to 5% of HIV infections in the developing world, may still be due to transfusion of contaminated blood [2]. Nothing could be worse than the fact that in an attempt to save life, blood and blood product having transmissible infectious agents may cause death or prolonged illness [3]. WHO recommends an integrated strategy to improve blood transfusion safety by establishment of well organized blood transfusion service, blood collection from voluntary non-remunerated donors, screening of blood for at least four major TTIs with quality assured system and rationale use of blood [1]. Blood is one of the major sources of transmission of infectious diseases, viz. HIV, HCV, HBV, syphilis and many other infections in India. India has the world's third largest population suffering from HIV/AIDS. The estimated adult HIV prevalence was 0.31% in 2009. As per the NACO 3.5% of HIV infection is attributed to blood transfusion [4]. India has intermediate endemicity of hepatitis B with HBsAg prevalence of 2-10% among study population. It has been estimated that up to 40 million people out of the 350 million hepatitis B chronic carriers worldwide arise in India. In India, there are about 12-13 million HCV carriers and modeling data predict that the burden of disease could soon increase substantially [5]. We aimed to study the prevalence of these diseases over the last ten years (2004-2013) in the Western part of Maharashtra.

Materials and Methods:

All the blood units collected from healthy donors in the blood bank & in the camps by Krishna Hospital blood bank, Karad were included from year January 2004 to December 2013 in this study. The records of blood donors from blood bank registers were analyzed retrospectively.

Inclusion Criteria: All the blood donors who donated in blood bank and camp were included during study period.

Exclusion Criteria: Rejected donors were excluded.

Diagnostic Methods:

The most sensitive and specific ELISA test protocol was used to establish the diagnosis. Every unit of blood was screened for presence of HBsAg and anti HCV antibodies by ELISA, for HIV 4th generation ELISA kit was used for detection of p24 antigen and antibodies was used. Syphilis was tested using rapid plasma regain test. Peripheral blood smear examination was done to detect malaria

parasite till 2012. Malascan rapid test was introduced for malaria detection since January 2013. If a single test is positive on the unit of blood remaining all other tests are performed as per regulations of Govt. of Maharashtra. For our project purpose any donor positive for more than one marker from the above five TTD is designated as having co-infection.

Statistical analysis:

Data were analyzed using Chi-square test to compare infection rates in consecutive 10 years. P-value ≤ 0.05 was considered statistically significant.

Results

Out of 38,237 blood donors, 34,971 (91.5 %) were voluntary and 3266 (8.5 %) were replacement donors difference was statistically significant ($\chi^2=1366.5$, $p < 0.0001^*$); The proportion of male donors were higher, 97.3% as compared to females, 2.7% and difference was statistically significant ($\chi^2=28.180$, $p < 0.0001^*$) (Table 1). Number of donations has increased from 2260 in year 2004 to 4442 in 2013 with the peak donations number were in 4939 in year 2010.

Present study estimated the prevalence of various infectious markers which was found to be 1.96% in total 739 donors. The mean prevalence of four major TTIs was observed as shown in Table no.2 in ten years. HBV infections prevalence observed was 1.45% followed by HIV 0.39%, HCV 0.1% and 0.01% for Syphilis. HBV showed relatively high prevalence in the initial 7 years (2004-2010) with lowest prevalence 0.86% being during 2013. At our centre mean prevalence of HIV was 0.39%. A decrease in the prevalence was seen from 2004 (0.58%) and decline from 2011-2013(0.23%). Present study reveals high prevalence for HIV and HBV in the initial years (till 2010) and has decreased during recent years.

The present study shows that over the last 10 years malarial infection has been negligible in the studied population. Prevalence of Malaria was low (0.002 %) with only one case being detected overall (in year 2013). No cases of Malaria were detected in other years (2004 to 2012).

Present study reveal prevalence for hepatitis C was 0.1% has shown lowest 0.03% in 2006. It was 0.11% in 2011 to 0.14% in 2013. There was increase in the prevalence for HCV seen $\chi^2=15.593$, $p =0.0188$. The present investigation reveals that among the five diseases that were studied, Hepatitis B infection was most prevalent among TTI. Thus, this

study results reveals that hepatitis infection needs to be taken much more seriously than HIV in this rural population.

In 9 donors we found co-infection of TTI markers. Of the 37 donors who were positive for HCV, 8 also showed positivity for a second TTI. Out of which 5 showed HCV and HIV positivity and 3 donors were positive for HCV and HBSAg. One donor showed combine positivity for HIV and Syphilis.

As shown in Table No. 2 there was no significant change in the prevalence of HIV, HBV, Syphilis and Malaria positivity over the study period. These changes in frequency rates were not statistically significant as $p > 0.0001$.

In the present study decreasing trend for all the markers was seen during study period and it was statistically significant as $p < 0.0001$. Seroprvalence of TTIs was decline from range 2.6% to 2.2% in year 2004 - 2010 to 1.6% to 1.2% in year 2011-2013.

Table 1: Year wise blood collection

Year	Total Donors	Voluntary	Replacement	Male	Female
2004	2260	2088	172	2187	73
2005	2679	2324	355	2556	123
2006	3370	2603	767	3290	80
2007	3702	2821	881	3558	144
2008	3503	3176	327	3403	100
2009	4569	4397	172	4497	72
2010	4939	4780	159	4828	111
2011	4457	4260	197	4317	140
2012	4316	4147	169	4198	118
2013	4442	4375	67	4361	81
Total	38,237	34971	3266	37195	1042
		91.50%	8.50%	97.30%	2.70%

(Voluntary: $\chi^2=1366.5$, $p < 0.0001^*$, Sex: $\chi^2=28.180$, $p < 0.0001^*$, $* < p$ is significant)

Figure 1: Prevalence of Infectious Markers in donors

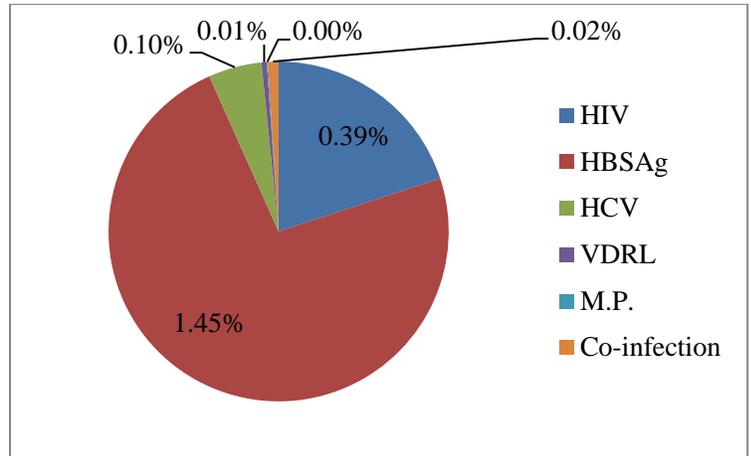
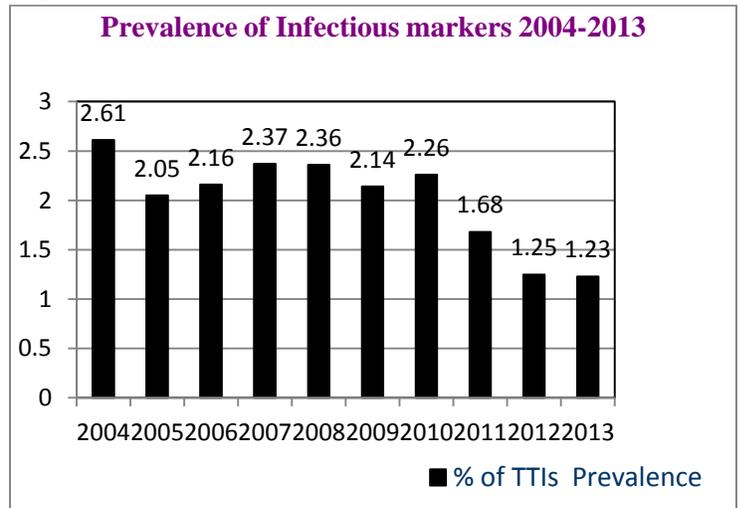


Figure 2:



(TTI trend: $\chi^2=26.578$, $p < 0.0001^*$, $* < p$ is significant)

Figure 3: Trend in the prevalence of Infectious Markers in donors: 2004-2013

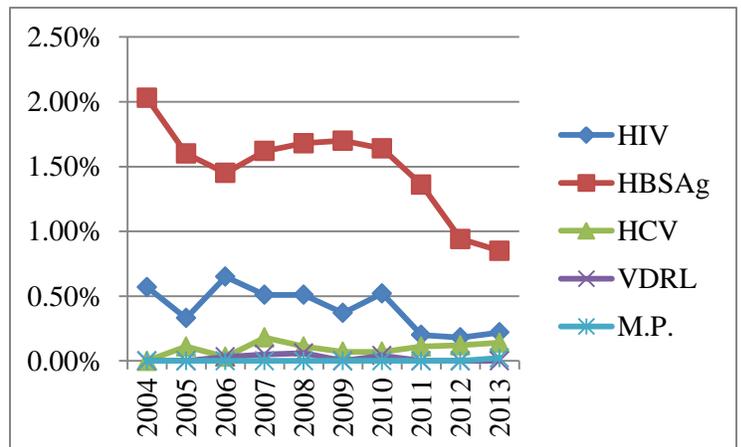


Table 2: Incidence of TTI among blood donors during 2004-2013

Year	Total collection	No. of HIV Ab%	HBSAg %	Anti HCV Ab %	VDRL %	M.P. %	Overall TTI Prevalence
2004	2260	13 (0.58%)	46 (2.04%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	59 (2.61 %)
2005	2679	9 (0.33%)	43 (1.61%)	3 (0.11%)	0 (0.00%)	0 (0.00%)	55 (2.05%)
2006	3370	22 (0.65%)	49 (1.45%)	1 (0.03%)	1 (0.03%)	0 (0.00%)	73 (2.16%)
2007	3702	19 (0.51%)	60 (1.62%)	7 (0.19%)	2 (0.05%)	0 (0.00%)	88 (2.37%)
2008	3503	18 (0.51%)	59 (1.68%)	4 (0.11%)	2 (0.06%)	0 (0.00%)	83 (2.36%)
2009	4569	17 (0.38%)	78 (1.71%)	3 (0.07%)	0 (0.00%)	0 (0.00%)	98 (2.14%)
2010	4939	26 (0.53%)	81 (1.64%)	3 (0.06%)	2 (0.04%)	0 (0.00%)	112 (2.26%)
2011	4457	9 (0.20%)	61 (1.37%)	5 (0.11%)	0 (0.00%)	0 (0.00%)	75 (1.68%)
2012	4316	8 (0.19%)	41 (0.95%)	5 (0.12%)	0 (0.00%)	0 (0.00%)	54 (1.25%)
2013	4442	10 (0.23%)	38 (0.86%)	6 (0.14%)	0 (0.00%)	1 (0.02%)	55 (1.23%)
Total	38237	151 (0.39%)	556 (1.45%)	37 (0.10%)	7 (0.01%)	1 (0.00%)	752 (1.96%)

Discussion

Transfusion transmitted infections (TTI) are a great concern of safety for patients. TTI was first observed in the process of blood transfusion in the late 1940s. The magnitude of the TTI varies from country to country depending on its loads in that particular population from where blood units are sourced. There is a risk of 1-2 per 1000 recipients receiving contaminated blood with viral, bacterial or parasitic agents [6]. This study was undertaken to find out the prevalence of infectious disease markers and the changing trends in donor population at tertiary care hospital.

In our study predominance of voluntary donors 91.5 % which is comparable to Bhattacharya P. et al [7] (94.6%) and Saghir et al [8] who

designated as semivoluntary (96%). Bulk of the donor population in our study were of males 97.3% and this finding is similar to other studies conducted in India, Kumari S. et al [9], Adhikari L. et al [10], H. Anjali et al [11], Pahuja et al [12]. There is need to increase awareness in females. Also rejection rate in female donors is more due to anemia and underweight. Also sero-positivity rate was more in male donors 732 (1.96%) than females 07(0.67%), similar findings were recorded in study by Kumari S. et al [9]. This might be attributed to more exposure of males to risk factors for TTI than females. Pattern of prevalence of TTI in our study was comparable to study from Hyderabad, India by Kumari S. et al [9]. Table no. 3 showing overall TTI prevalence 1.8%,

with rate of HBV 1.24%, HIV 0.42%, HCV 0.10% syphilis 0.02%.

In our study, overall seroprevalence of major blood borne pathogens was 1.96% and was in the range with other studies Kumari S. et al [9], Adhikari L. et al [10] and Chatterjee A. et al [13]. In present study overall decreasing trend in prevalence for TTI was seen 2004(2.61%) to 2013(1.23%). Similar finding was observed in study by Pahuja et al [12]. But the study by Bhattacharya P. et al [7] recorded significant increase in the prevalence TTI among voluntary blood donors in Kolkata. Our seropositive rates for HIV (0.39%), HBSAg (1.45%) were in the range given by Dr. Makroo R. et al [2] for Indian donors 0.1-0.9% and 0.86-2% but HCV (0.1%) it is lower for which range given was 0.28-0.53%. Overall seropositivity for HIV was 0.39% which was comparable to the similar study done by Adhikari L. et al [10] (0.32%), Gupta R. et al [14] (0.35%) and it was in the range 0.2% to 0.5% of similar studies conducted in India, Chatterjee A. et al [13], Phatak S. et al [5], Pahuja et al [12]. In our study decreasing trend in HIV prevalence in blood donors was seen since 2010(0.53%) to 2013(0.23%). Similar findings was also reported in study by Gupta R. et al [14] 1997(0.8%) to 2007(0.3%), Pahuja et al [12] 2002(0.70%) to 2005(0.44%), Chatterjee A. et al [13] 2000(0.56%) to 2009(0.22%). But the study by Prasad S. et al [15] recorded increasing trend for HIV 0.00% in 2006 to 0.36% in 2011 and Saghir et al [8] 0.10% in Nov. 2008-Oct. 2009 to 0.18% in Nov.2009- Oct. 2010.

India has been placed in the intermediate zone of prevalence of Hepatitis B by the World Health Organization. The comparison of Hepatitis B prevalence in different parts of India with our study showed high in Delhi of 2.23% but in present study it is 1.45% which is nearly similar to study by H. Anjali et al [11] (1.5%) & Kumari S. et al [9]. The seropositivity for HBV in present study is comparable to rates of 1.68-1.9% recorded in similar studies carried out by, Chatterjee A. et al [13], Gupta R. et al [14] and Pahuja et al [12]. HBSAg prevalence rate in our study is in range of 0.6 to 2.4% recorded by the similar studies carried out by Siddu M. et al [16], Gupta N. et al [17], Adhikari L. et al [10] and Pahuja et al [12] in which lowest rate of 0.6% was quoted by Siddu M. et al [16] and highest of 2.4% study by Pahuja et al [12]. In our study decreasing trend in HBV prevalence in blood donors was seen since 2004(2.04 %) to 2013(0.86%). Decreasing trend in HBV prevalence was also reported in similar study by Pahuja et al [12]

2002(2.42%) to 2005(1.97%) and Saghir et al [8] 2.40% in Nov. 2008-Oct. 2009 to 2.30% in Nov.2009- Oct. 2010. But the study by Prasad S. et al [15] and Bhattacharya P. et al [7] recorded increasing trend for HBV infections among blood donors. The present investigation reveals that among the five diseases that were studied, Hepatitis B infections was most prevalent among TTI, it appears to be more of a public health challenge than HIV in the population studied.

The seropositivity for HCV in our study is least of 0.1% which was comparable to the similar study carried out by Siddu M. et al [16], Adhikari L. et al [10] whereas it is high in Ludhiana and West Bengal 1.09%. Steady increase in seroprevalence was seen from 0.00 in 2004 to 0.14% in 2013. Increase in the prevalence for HCV was recorded by Chatterjee A. et al [13] and Gupta R. et al [14]. Mean seroprevalence for Syphilis is between 2004 and 2013 at our center was 0.01% which was comparable to the similar study carried out by Kumari S. et al [9]. This prevalence is low in our blood donors as compare to figures reported by other authors Gupta R. et al [14] (2.8%) Gupta N. et al [17] 0.85%, Saghir et al [8] 0.34% Chatterjee A. et al [13] recorded decreasing trend for Syphilis from 0.82% in 2005 to 0.22% in 2006 after 2006 to 2009 again increasing trend. In present study not a single case of Syphilis was detected in year 2011 to 2013. The present study shows that over the last 10 years malarial infections been negligible in the studied population. Similar findings also recorded in study by Chatterjee A. et al [13] (0.02%).

Comparison of TTI prevalence rate in different parts of India with present study is shown in Table 3: P. pallavi [18].

Table 3:

PLACE	HIV %	Hbs Ag %
HCV %	SYPHILIS %	
Ludhiana	0.084	0.66
1.09	0.85	
Delhi	0.56	2.23
0.66	-	
Lucknow	0.23	1.96
0.85	0.01	
Southern Haryana	0.3	1.7
1.0	0.9	
West Bengal	0.28	1.46
0.31	0.72	

Bangalore	0.44	1.86
1.02	1.6	
Hydrabad	0.42	1.24
0.10	0.02	
Present study	0.39	1.45
0.1	0.01	

Co-infection:

In present study number of positive donors was 739 and co-infection with more than one TTI marker was seen in nine (0.02%) donors which was slightly lower side than it was recorded in study by Kaur G et al. (0.05%) [19].

In Nine donors we found co-infection out of which five donors had co-infection by HIV and HCV but Kumari S. et al [9], found co-infection by HIV and HBV. One showed combined HIV and Syphilis reactivity which was comparable to findings by Saghir et al [8], who showed association of these markers in his study. In present study three donors had dual infection with HBV and HCV.

There is residual risk of TTI remains despite serological testing because of donors in window period, viral variants, immunosilent or delayed seroconverting carriers and laboratory errors. The risk of TTI has decline in developed country because of voluntary non-remunerated regular blood donors, incorporation of nucleic acid testing to narrow window period for HIV by 10-15 days, for HCV by 41-60 days and several week earlier than serological test in case of HBV [2].

Conclusion:

Our study showed predominance of male donors. Women can also be encouraged for voluntary blood donation. Hepatitis infections appear to be more of a public health challenge than HIV in the population studied.

Based on results of our study TTI can be reduced by encouragement of voluntary non-remunerated repeat blood donors, strict donor's selection and donor deferral policies. There is definite need for ongoing newer modes of screening test like enhance chemiluminisence and NAT, inclusion of anti HBC screening, viral inactivation procedures which will improve blood safety further. Motivational programmers with involvement of Government bodies for voluntary blood donations and education about the prevention of viral diseases can be implemented in blood centers all over India.

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Ethical consideration:

Institutional ethical clearance was obtained before starting the study.

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Conflicts of Interest: None

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