Galore International Journal of Health Sciences and Research
Vol.5; Issue: 1; Jan.-March 2020
Website: www.gijhsr.com
Original Research Article *P-ISSN: 2456-9321*

Seroprevalence of Transfusion Transmitted Infections among Blood Donors: A 8 Year Regional Blood Bank Experience

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ABSTRACT

Introduction: Transfusion transmissible infections (TTI) are the major problem which leads to the transmissions of infectious agents from donor to recipient which includes Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Human Immunodeficiency Virus (HIV) and Syphilis. The present study was carried out with the aim of determining the seroprevalence of TTI among healthy blood donors in a tertiary care hospital.

Material and methods: A retrospective study from January 2011 to December 2018 is carried out on 1,14,187 healthy donors.

Result: Out of total only 5.3% were female. 0.131% of donors were reactive for HIV, 1.027% were reactive for HBV, 0.1409% were reactive for HCV, 0.001% were reactive for VDRL while 0.01% were reactive for malarial parasite.79% of transfusion related disease is HBV, while HIV and HCV with 10% almost equally contributing to transfusion related disease. Out of total, 91.11% donors were voluntary while rest were replacement donors. Safe blood transfusion services are a cornerstone of an effective, high-quality healthcare system. However, contaminated blood transfusion is a potential source of TTIs and can be fatal instead of saving life.

Conclusion: Advanced and vigilance screening of donated blood should be there prior to transfusion.

Keywords: TTD, HIV, HBV, Blood bank

INTRODUCTION

Blood transfusion is an effective treatment for saving millions of lives worldwide each year. But this service doesn't come without risk. Transfusion transmissible infections (TTI) are the major problem which leads to the transmissions of infectious agents from donor to recipient. Common infectious agents include Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Human Immunodeficiency Virus (HIV) and Syphilis[1].

All these transfusion transmissible infections cause prolonged viremia and carrier or latent state. These infections also cause fatal, chronic, and life-threatening disorders[2].

Complications of blood transfusions may be mild or can be life-threatening and hence meticulous pre transfusion testing and screening for transfusion-transmissible infections is mandatory[3].About 12.5% of patients who receive blood transfusions are at risk of post-transfusion hepatitis. These infections are a threat to blood safety, and so blood transfusion services have to ensure safe, adequate, accessible, and efficient blood supply at all levels. The safety of blood therefore depends on proper screening for TTI. Also because of the window period risk of infectivity, stringent donor selection criteria are also crucial in-order to ensure blood safety. Unsafe blood transfusion proves very costly for both the recipient and society at large[4].

The economic costs of the failure to control the transmission of infection include increased requirement for medical care, higher levels of dependency and the loss of productive labor force, placing heavy burdens on already overstretched health and

social services and on the national economy. The present study was carried out with the aim of determining the seroprevalence of TTI among healthy blood donors in a tertiary care hospital.

MATERIAL AND METHODS

A retrospective study was carried out at our institution where data were analyzed over a period of 8 years from January 2011 to December 2018. Blood was collected from apparently healthy individuals after detail history and examination, aged 18-60 years with weight >45 kg with hemoglobin concentration >12.5 gm%. All blood donors samples were screened for HIV, hepatitis B surface antigen (HBsAg), HCV, and syphilis.

HIV, HBsAg, HCV tests were done by enzyme-linked immunosorbent assay (ELISA) procedure using the third generation kits. Syphilis was diagnosed by performing the venereal disease research laboratory (VDRL) test. Malaria testing was done by slide method using Leishman's staining.

Statistics

Data was analyzed using SPSS version 20. Results were calculated as frequencies, means, standard deviations, cross-tabulation, chi-square and Fisher's exact test. *P*-value was set at 0.05.Chi-square trend test was applied to examine the variation in trends. Logistic regression was employed to explore the association between dependent and independent variables.

Statistically, P values of below 0.05 were considered as statistically significant.

RESULT

Total number of donors from January 2011 to December 2018 were 1,14,187 with maximum were in 2015. (Table 1). Maximum female donors were in 2016.

Table 1. Total blood collection and sex distribution of donors

Year	Total donors	Male	Female
2011	11,044	10,694	350
2012	12,178	11,782	396
2013	13,042	12,711	311
2014	15,336	14,620	716
2015	16,260	15,320	940
2016	16,198	15,024	1,174
2017	14,605	13,596	1,009
2018	15,524	14,349	1,175
Total	1,14,187	1,08,116 (94.7%)	6,071 (5.3%)

Table 2. Prevalence of syphilis, Malaria, hepatitis B surface antigen, human immunodeficiency virus, and hepatitis C virus in blood donors

Year	No of donors	HIV reactive	HBV reactive	HCV reactive	Syphilis infected	Malaria positive
2011	11,044	13 (0.12%)	155 (1.40%)	19 (0.17%)		
2012	12,178	20 (0.16%)	176 (1.44%)	29 (0.24%)		
2013	13,042	22 (0.17%)	124 (0.95%)	26 (0.20%)	01	02 (0.015%)
2014	15,336	23 (0.15%)	148 (0.96%)	10 (0.06%)		08 (0.05%)
2015	16,260	18 (0.11%)	146 (0.90%)	20 (0.12%)		
2016	16,198	14 (0.09%)	170 (1%)	19 (0.12%)	01	
2017	14,605	27 (0.18%)	146 (1%)	25 (0.17%)		
2018	15,524	13 (0.08%)	107 (0.7%)	13 (0.083%)		02
Total	1,14,187	150 (0.131%)	1,173 (1.027%)	161 (0.1409%)	02 (0.001%)	12 (0.01%)
human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV)						

Table 3. Incidence of syphilis, Malaria, hepatitis B surface antigen, human immunodeficiency virus, and hepatitis C virus in blood donors

Year	Total reactive donor	HIV	HBV	HCV	Syphilis	Malaria
2011	187	13 (6.95%)	155 (82.88%)	19 (10.16%)		
2012	225	20 (8.89%)	176 (78.22%)	29(12.89%)		
2013	175	22 (12.79%)	124 (72.09%)	26 (15.11%)	01 (0.58%)	02 (1.16%)
2014	189	23 (12.70%)	148 (81.76%)	10 (5.52%)		08 (4.41%)
2015	184	18 (9.78%)	146 (79.34%)	20 (10.86%)		
2016	204	14 (6.90%)	170 (83.74%)	19 (9.35%)	01 (0.49%)	
2017	198	27 (13.63%)	146 (73.73%)	25 (12.62%)		
2018	135	13 (9.77%)	107 (80.45%)	13 (9.77%)		02 (1.50%)
Total	1,483	150 (10.11%)	1,172(79.09%)	161 (10.85%)	02 (0.13%)	12 (0.81%)

The overall seroprevalence of the HIV, HBV, HCV, syphilis and malaria were 0.131%, 1.027%, 0.1409%, 0.001% and 0.01%, respectively with maximum HIV prevalence 0.18% in 2017. Maximum HBV prevalence 1.44% in 2012. Maximum HCV prevalence 0.24% in 2012. (Table 2)

79% of transfusion related disease is HBV, while HIV and HCV with 10% almost equally contributing to transfusion related disease. (Table 3)

Table 4. Yearly distribution of voluntary and replacement donors

Year	Total donor	Voluntary donor	Replacement donor	Repeat donor
2011	11,044	9,409	1,635	1,127
2012	12,178	10,713	1,465	1,117
2013	13,042	11,586	1,456	1,236
2014	15,336	13,926	1,410	2,120
2015	16,260	14,905	1,355	4,701
2016	16,198	15,156	1,042	7,157
2017	14,605	13,823	782	1,182
2018	15,524	14,523	1,001	1,550
Total	1,14,187	1,04,041 (91.11%)	10,146 (8.89%)	20,190

Table 5 Comparison of transfusion transmitted infections prevalence rate with other studies

Studies	HIV reactive	HBV reactive	HCV reactive	Syphilis positive
Srikrishna *et al*. (1999), Bangalore, India	0.44	1.86	1.02	1.6
Pahuja *et al*. (2007), Delhi, India[10]	0.56	2.23	0.66	
Bhattacharya *et al*. (2007), West Bengal, India[11]	0.28	1.46	0.31	0.72
Adhikari *et al*. (2010), Sikkim, India[12]	0.32	0.78	0.27	0.27
Arora *et al*. (2010), Southern Haryana, India[13]	0.3	1.2	1.0	0.9
Anjali *et al*. (2012), Kerala, India[14]	0.6	1.5	0.4	0.1
Nagalo *et al*. (2011), Koudougou	2.21	14.96	8.69	3.96
Matee *et al*. (2006), Tanzania[9]	3.8	8.8	1.5	4.7
Fiekumo *et al*. (2009), Nigeria	3.1	18.6	6.0	1.1
Tafuri *et al*. (2010), Italy	1.5	8.3	4.5	1.5
Tessema *et al*. (2010), Northwest Ethiopia[2]	3.8	4.7	0.7	1.3
Stokx *et al*. (2011), Mozambique	8.5	10.6	1.2	
Present study	0.131%	1.027%	0.1409%	0.001%

DISCUSSION

The aim of this study was to determine the seroprevalence of HIV, HBV, HCV, and syphilis among healthy blood donors. Safe blood transfusion services are a cornerstone of an effective, high-quality healthcare system. However, contaminated blood transfusion is a potential source of TTIs and can be fatal instead of saving life[5-7].

Most of the donors in our study were males 1,08,116 (94.7%), aged between 18 and 60 years. This result is comparable with other studies of Buseri*et al*.[8].,Pallavi*et al*.[3], Tessema*et al*.[2], and Matee*et al*[9]. (Table 5) Also there is increase in female donors in recent years.

The overall seroprevalence of the HIV, HBV, HCV, syphilis and malaria were 0.131%, 1.027%, 0.1409%, 0.001% and 0.01%, respectively which is comparable with other studies

Present study shows downward trend of transfusion related disease as years advances. More awareness, new generation kits are leading cause of downward slope of transfusion related disease.

79% of transfusion related disease is HBV, while HIV and HCV with 10% almost equally contributing to transfusion related disease.

Out of total almost 91% donors are voluntary donor. (Table 4) Its very positive study with regard to mission of 100% voluntary donors from 2020. There is steady decrease in replacement donors as years advances with increase in repeat donors. Increases awareness, motivation and advertisements have contributed immensely voluntary repeat donors.

Fasola *et al* showed a significantly high prevalence of 13.2 per cent in Nigeria[15]. (Table 5)

HBV is highly contagious and easily transmitted from one individual to another

by transfusion during birth, by unprotected sex and by sharing needles. Syphilis can be spread by sexual contact, blood transfusion and by vertical transmission. Due to the nature of blood born virus, HCV is widely recognized as a major causative agent for posttransfusion non-A, non-B hepatitis. Other less common routes of transmission are sexual intercourse and mother to child transfer. In case of HIV, transmission during window period is possible even if each unit is tested for HIV antibodies. The possibility of window period transmission would be minimized if blood is collected from low risk targeted general public[16].

In general variation in the total sample size, donor recruitment (proportion of volunteer to replacement donors), time period, strength of preliminary screening of donors and factors related to test algorithms used for screening, the test kits on the market, storage and validation of the test kits might be the possible reason for the discrepancy in the total seroprevalence of TTI between various studies. The wide variations of HCV seroprevalence in different studies from India might be due to the use of different methods for testing and use of different generation of ELISA test kits, having different sensitivities and specificities. According to the current study unemployed blood donors were more likely to have HCV infection compared to student. This might be due to low socio-economic levels of unemployed donors, as they are most likely to indulge in risky sexual relationships that may expose them to TTIs. Moreover, as a consequence of economic problems, unemployed donors may experience risky practices, such as sharing of personal care items toothbrushes, sharing of sharp kitchen materials, and having sexual contact with a person infected with TTIs. Employed donors were also at higher risk of HIV-infection compared to student donors.

According to the WHO report, 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 3–5 years in adults. HBsAg seroprevalence in India is high in spite of a safe and effective vaccine has been available. High prevalence rate of 10% has been seen in Southern China, Korea, Melanesia, the Philippines, India, Indonesia, Japan, and Pakistan have intermediate rates of endemicity. However, these rates may be inaccurate and possible the tips of the iceberg as rates of occult HBV infection are not included in this[17].

Sexually transmitted infections constitute a major public health problem and are widespread in developing countries. Syphilis has also acquired a new potential for morbidly and mortality through association with increased risk of HIV infection, thus making safe blood more difficult to get. Jain *et al* used enhanced chemiluminescence immunoassay and nucleic acid amplification testing (NAT) and found that HBV NAT yield was much higher than studies done in Europe and the USA and emphasized that in a country like India where there are a significant number of window period donations, NAT must be judiciously introduced. In our study, HBV was the most prevalent life-threatening TTI indicating a need for an organized programme for hepatitis B vaccination and use of a highly sensitive technique for its detection like NAT. With this regard males are approximately 1.5 times more likely to develop chronic HBV infection than females as a result of the slower plasma disappearance rate for HBsAg in males compared to females [18]

CONCLUSION

Despite stringent donor screening and testing practices, safe blood free from TTIs remains an elusive goal since the prevalence of TTI is substantial increased overtime. This finding showed growing evidence in the burden of TTIs in blood donors which is directly related to the prevalence in the general population thus it requires community-based studies to identify societal risk factors. Age, sex, occupation and number of donation

significantly associated with different type of TTIs. Thus advanced and vigilance screening of donated blood should be there prior to transfusion. In additions, there should be strategies for monitoring the implementation of post donation counseling for recruitment and retention of safe regular donors is the need of the time.

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How to cite this article: Patil PU, Gawai S, Joshi A. Seroprevalence of transfusion transmitted infections among blood donors: a 8 year regional blood bank experience. Gal Int J Health Sci Res. 2020; 5(1): 150-154.

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