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SEROPREVALENCE OF TRANSFUSION TRANSMITTED INFECTIONS AMONG BLOOD DONORS IN TRANSFUSION MEDICINE DEPARTMENT OF A TERTIARY CARE HOSPITAL IN A RURAL SETUP IN NORTH INDIA

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ABSTRACT

Background: Transfusion transmitted infections (TTIs) are the major problems associated with blood transfusions.

Aim: Our aim is to estimate the prevalence of TTIs in blood donors in the unit of Transfusion Medicine and Immunohaematology working under department of Pathology of a rural tertiary care hospital, North India.

Materials: The study was conducted on 15,739 blood units of voluntary and replacement donors from August 2020 to July 2023. Serologic testing was done for Hepatitis B virus (HBV), Hepatitis C Virus (HCV) and Human immunodeficiency virus (HIV) by using the appropriate microwell Enzyme-linked immunosorbent assay (ELISA). Laboratory diagnosis for syphilis and Malaria was done using Rapid plasma reagin (RPR) and malaria antigen kit, respectively. The donated blood was discarded whenever the pilot donor sample was found positive for any TTIs.

Results: A total of 15,739 blood donors were screened, of which 15,484 (98.37%) were males and 255 (1.62%) were females. The mean age of the blood donors were 30 years with standard deviation of ±2.2. Of these, 14,165 were replacement (89.99%) and 1,574 voluntary donors (10%). The donor population was mostly in 26-35 years (52%) age group. The overall seroprevalence of HBV, HCV, HIV, Syphilis and Malaria was found to be 2.89%, 0.80%, 0.17%, 0.06% and 0.04% respectively. Hepatitis-B was the most common and Hepatitis-C was second most common infection.

Conclusion: TTIs are prevalent at high rates among blood donors in rural regions. Extensive donor selection and highly standard techniques are required to avoid transfusion of infectious blood products.

Keywords: Transfusion Transmitted Infections (TTIs), Blood (Voluntary and Replacement) Donors, Rural Region, Serologic Testing, Hepatitis B Virus (HBV), Hepatitis C Virus (HCV),

Human Immunodeficiency Virus (HIV), Enzyme-Linked immunosorbent Assay (ELISA), Rapid Plasma Reagin (RPR).

INTRODUCTION

Transfusion-transmitted infections (TTIs) hamper blood safety and cause a serious public health problem**.**[1] The Indian government mandate routine screening of blood and its components for five major transfusion transmissible infections i.e HIV, HBV, HCV, syphilis and malaria for all blood donors in all the blood banks.[2]

The present study was carried out with the aim of determining the seroprevalence of TTIs among apparently healthy blood donors in a tertiary care hospital in rural area and also to estimate seropositivity rates of TTIs in voluntary, replacement and different socioeconomic group donors in order to enhance the awareness about TTIs related risks.

MATERIALS & METHODS

A retrospective study was carried out for a period of 3 years from August 2020 to July 2023 in the blood bank of a rural tertiary care teaching hospital. Data was collected from records and registers of the blood bank. The blood bank is situated in the Village and is found 25 km from the city. The village has population of 7,141 peoples, of which 3,917 are males and 3,224 are females as per Population Census 2011. The hospital provides health care services to the local as well as for population coming from surrounding villages and urban regions also.

A total of 15,739 donors were enlisted and studied. Of these, 14,165 were replacement and 1,574 voluntary donors. Replacement donors were those who donated blood in exchange for receiving blood units for their ailing patients and were family members, close relatives or friends of the recipient. Voluntary blood donors donated blood without incentive for the cause. Replacement donors were the major contributors of blood units for this blood bank. All blood units in the present study were collected from remunerative donors. Most of the blood units were collected at the blood bank and also collected at blood donation campaigns organised in universities, banks, industrial setup and other institutions in order to increase the number of blood donation and in these campaigns 1,265 voluntary blood units were collected during the period. Remaining voluntary units came randomly from staff members and local population.

Registration and consent form were filled after interviewing the donor by a councellor. After proper consent and registration, detailed medical history regarding TTIs risk factors was taken through a panel of questions on previous illnesses and medical conditions i.e anemia, history of jaundice in past 1 year, malaria, asthma, medication, hypertension, fever, recent history of having undergone a surgical procedure, serious illness, previous blood transfusions, pregnant and lactating women, women with heavy and irregular menstrual bleed and people who engaged in high risk behavior (i.e. unsafe intercourse, drug abuse). After that, physical examination done by a medical officer for blood donation eligibility, according to blood donor's selection criteria (National blood safety) and guideline for NACO. The eligibility criteria for the donors, were age between 18 and 60 years, minimum weight of 50 kg, hemoglobin level more than 12.5 g%. Care was taken to eliminate professional and paid donors. After then, phlebotomy of selected healthy donors done by the nursing staff. After completion of phlebotomy, 5 ml donor sample was collected in a plain vacutainer tube from the donor unit for serological testing of these five major TTIs. After serologic testing, corresponding blood unit was discarded whenever the pilot sample was found positive for any TTI.

All the healthy appearing blood donors were also categorized in different socioeconomic groups with the use of most widely used scale, Kuppuswamy's socio-economic status scale - 2013-14, which is a composite score of education and occupation of the head of the family along with monthly income of the family.[3] The seroprevalence of TTIs and socio demographic variables were compared using the Chi-square test. Statistical significance was set at $p<0.05$.

Laboratory Tests

During the period, blood samples were collected and tested in the blood bank. Tests were performed by the trained technician with strict adherence to the kits manufacturer's instructions with positive and negative controls. Healthy blood donor sample was used as negative control. Pilot blood samples from donor bags were centrifuged and the sera were separated and tested. HBV, HCV and HIV were tested by generation-3 Microwell ELISA (Automated microplate processor, DSX machine). NACO (National Aids Control Organization) supplied kits were used in this third generation ELISA machine for HIV (Erba Lisa HIV Gen 3), HCV (Erba Lisa HCV Gen 3(v2)) and HBV (Erba Lisa SEN HBsAg Gen 3). Laboratory diagnosis for syphilis and Malaria was done using RPR kit (Beacon Diagnostics) and malaria antigen card (Pf- HRP-II/ Pan-p LDH antigen card supplied by Reckon diagnostics) respectively.

The pilot donor sample, on testing if found positive for any TTI infection, the repeat testing was done. If again, pilot sample was found positive then the donated blood was discarded. This study also had some limitations. Tested samples during the window period did not give positive serological results. So majority of the blood donors likely to be in the window period for TTI were deferred during detailed preliminary risk factors assessment made by trained health care professionals.

RESULTS

In this study, a total of 15,739 blood donors were enlisted (both voluntary and replacement donors). Of these, 14,165 were replacement and 1,574 voluntary donors. Replacement and voluntary blood donation was 89.99% and 10% respectively. Total male donation were 15,484(98.37%) and female 255(1.62%), with a mean age and standard deviation of 30 ± 2.2 years (range 18 to 60 years) **[Table-1]**. Of these, 8,210 (52%) donors aged from 26 to 35 years, 6119 (39%) aged from 18 to 25 years and 1410 (9%) were in the 35–60 years age group. In all the five TTIs, the seroprevalence infectivity rate was high in 26-35 years age group compared to other groups but the difference in TTI seropositivity was not found statistically significant (p>0.05) **[Table-2]**.

Age (Mean Age)		**30±2.2**
Sex	Male	15,484 (98.37%)
	Female	255 (1.62%)
Socioeconomic status	Lower	8,324 (52.88%)
	Middle	6,955 (44.18%)
	Upper	460 (2.92%)
Replacement donor		14,165 (89.99%)
Voluntary donor		1,574 (10%)
Total infective cases		622 (3.95%)

Table 1: Demographic profile of study population [n=15,739 blood donors]

Age Group	**Total Donor**	**Non-Reactive**	**Reactive**	**P Value**
18–25	6,119 (39%)	5,709	410 (2.60%)	P=0.133
26–35	8,210 (52%)	7,735	475 (3.01%)	
35- 60	1,410 (9%)	1,298	112 (0.71%)	

Table 2: Reactive and non-reactive case distribution in different age group

Of all donations, 622 (3.95%) were tested reactive in the screening tests for blood transmitted infections. Among them 22 (0.14%) were reactive in more than one test.

The seroprevalence of HBsAg (455 cases), HCV (126 cases), HIV(26 cases), syphilis (9cases) and malaria (6 cases) in our study population was 2.89%, 0.80%,0.17%,0.06% and 0.04% respectively. The seroreactivity rates were highest for HBsAg followed by HCV, HIV, Syphilis and malaria in descending order **[Table-3]**.

Infection Type	Total Infective Cases (Prevalence %)
Hepatitis B	455 (2.89%)
HCV	126 (0.80%)
HIV	26 (0.17%)
Syphilis	9 (0.06%)
Malaria	6 (0.04%)
Table 3: TTIs seroprevalence in total study population	

In all the five TTIs, the seroprevalence infectivity rate was high in males (3.85%) compared to females (0.09%), but the difference in seropositivity of TTI among males and females was not found statistically significant (p>0.05) **[Table-4].**

Gender	Total Donor	Non-Reactive	Reactive	P value
Male	15,484	14,877	607 (3.85%)	P=0.110
Female	255	240	15 (0.09%)	
Table 4: Gender wise distribution of reactive and non-reactive cases				

The TTI seroprevalence infectivity rate was also high in replacement donors (4.25%) compared to voluntary donors (1.2%) and the difference in TTI seropositivity among voluntary and replacement donors was found statistically significant (p<0.05) **[Table-5]**.

Donor Type	Total Cases	Non-Reactive Cases	Reactive Cases	P value
Replacement donors	14,165	13,562	603 (4.25%)	P=0.00001
Voluntary donors	1,574	1,555	19 (1.2%)	
Table 5: TTIs seroprevalence in voluntary and replacement donors				

Our study population mainly belong to lower socioeconomic group (52.88%) and middle group (44.18%). Upper socioeconomic group showed very less donation (2.92%). Seroprevalence infectivity rate was found highest in lower socioeconomic group (2.61%) as compared to middle (1.31%) and upper groups (0.02%) and the difference in TTI seropositivity of lower socioeconomic group was found significantly higher as compared to other groups (p<0.05) **[Table-6]**.

Socioeconomic Class	Total Donor	Infective Cases (prevalence %)	P value
Lower	8,324 (52.88%)	411 (2.61%)	P=0.00001
Middle	6,955 (44.18%)	207 (1.31%)	
Upper	460 (2.92%)	4 (0.02%)	
Table 6: TTIs seroprevalence in different socioeconomic groups			

DISCUSSION

Transfusion transmissible infections (TTIs) are the common serious hurdles of blood transfusion. TTIs like HIV, HBV, HCV and syphilis are the major public health problems in developing countries.[4]

In this study, analysis of blood donors regarding demographic profile, voluntary- replacement donation, socioeconomic profile and seroprevalence estimation of TTIs (HBV, HIV, HCV, Syphilis and Malaria) was done.

In our study, replacement donors constituted 89.99% as compared to 10% of voluntary donors. Disha Arora et al[5] from New Delhi reported replacement blood donors as 96.4% and voluntary donation as 3.52%, which supported our study. Study by Varsha Chaudhary et al [6] from western Uttar Pradesh (Bareilly) also reported, more replacement donation (60.43%) than voluntary donation

(39.57%), which again supported our study. Other studies with same results are Gita Negi et al[7] and Tulika Chandra et al.[8]

In the study, TTIs seroprevalence was found more in replacement donors (4.25%) as compared to voluntary donors (1.2%). Study done by Disha Arora et al[5] showed similar results that, 1.42% voluntary donors were found to be TTI positive as compared to 4.13% replacement donors. Tulika Chandra et al. [8], also concluded similar results that prevalence of transfusion transmitted infection (HIV, HBV, HCV, VDRL, and malaria) was more in replacement donors in comparison to voluntary donors. Similarly Chaurasia et al.[9] reported that overall TTIs incidence in voluntary donors and replacement donors was found to be 1.568% (66/4208) and 5.215% (5606/10852) respectively.

In the present study, majority of the donors were males (98%) compared to females (2%), similar to studies done by Varsha Chaudhary et al,[6] Anjali et al,[10] Pallavi et al,[11] Tessema et al,[12] Arora D et al[13] and Unnikrishnan B et al.[14]

Seroprevalence of TTIs in our study was found more in males (3.85%) as compared to females (0.09%). Gita Negi et al[7] reported that the male: female (M: F) ratio among the infected donors was 14.1:1, similar to our findings. However study from Pakistan (Mahmood et al.) showed approximately equal seroprevalence of TTIs in both males (10.8%) and females (10%).[15]

In the study, majority of blood donors (52%), were in the age group of 26-35 years. In the study of Karmakar PR et al,[16] among the donors, nearly 68.77% were in the age group of 21-40 years, similar to our findings. Other studies with the same conclusion are Kaur G et al[17] and Giri PA et al.[18]

In our study maximum donation came from lower socioeconomic group (52.88%) as compared to middle group (44.18%). Upper group showed the least donation (2.92%). The most probable reason for this is that our institute is present in rural area and it covers surrounding underdeveloped areas. Poor people form the bulk here due to lack of money and also this institute provide free services especially for the poor. Middle and especially upper group entertain themselves in private hospitals in order to save their time and to avoid rush. Study by Jyotsana Khattri et al [19], however shows maximum donation by middle socioeconomic group.

The seroprevalence of TTIs in different socioeconomic group was 2.61% in lower class, 1.31% in middle class and 0.02% in upper class. Lower class showed maximum and upper class showed minimum TTIs seroprevalence. This is probably due to lack of education, awareness and poor hygienic practices followed by the lower class. Jyotsana Khattri et al[19] concluded similar findings that maximum number of donors found positive for transfusion transmitted infections were in upper lower class (IV) (2.36%) followed by lower middle class (III) (0.92%). The positivity of TTIs infection was found minimum in Upper class (I) (0.009%).

In our study, overall seroprevalence of TTIs was 3.98% (622 reactive cases) which correlates well with the study of Disha Arora et al[5] showing 4.03% (1682 reactive cases out of 41,657 donations) TTIs seroprevalence. Other studies of Gupta PK et al[20], Garg S et al[21] and Sing B et al [22] also interpreted similar results to our study.

Out of 622 reactive cases in this study, the seroprevalence of hepatits B was 2.89% (455 cases), HCV- 0.80% (126 cases), HIV- 0.17% (26 cases), Syphilis-0.06% (9 cases) and malaria-0.04% (6 cases). Garg S et al,[21] Singh B et al[22] and Srikrishna A et al[23] show prevalence rates for HBV (HBsAg) 1.2–3.5%, HCV 0.12–4%, HIV-0.51–3.87%, and Syphilis 0.3–0.82%, similar to our study. Malaria seroprevalence (0.04%) in our study is similar to studies done by Bahadur et al[24] and Dubey et al[25] showing malaria seroprevalence of 0.03% and 0.09% respectively.

The seroreactivity rates were highest for HBsAg followed by HCV, HIV, Syphilis and malaria in descending order similar to the study of Varsha Chaudhary et al[6] showing highest seroprevalence rates for HBV 1.93% -, followed by HCV-1.02%, HIV0. 27% - and syphilis-0.16% in decreasing order.

In the present study, the hepatitis B (seroreactivity of 2.9%) was the most prevalent infection, similar to Indian study of Varsha Chaudhary et al[6] showing hepatitis B seroprevalence of 1.93%. Other Indian study done by Gupta PK et al,[20] also shows similar results.
Limitation of our study is that other TTI such as leishmaniasis, toxoplasmosis and viral infections like cytomegalovirus, Parvovirus B19 have not been covered.

CONCLUSION

Prevalence of TTIs is still higher in Indian scenario. Sensitive laboratory screening by highly standard techniques should be implemented for early detection of TTIs. Awareness about personal hygiene and healthy sexual practices should be spread in society especially in lower socioeconomic group who are the main culprit due to lack of education and money. It is also important to increase the number of repeated voluntary donors through different promotional activities of blood bank. Voluntary donation should be promoted as there is less chance of TTI among this group compared to replacement donors. By availing all these measures we can reduce the high prevalence rates of TTIs.

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