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Seroprevalence and trends in transfusion transmitted infections in blood donors: a 6-year experience in a tertiary care hospital

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Introduction: Blood transfusion continues to be a possible source of pathogens in transfused patients. The pattern of transfusion-transmitted infections (TTI) varies between regions. Knowledge of prevalence of TTIs is essential to monitor safety of blood transfusion by ensuring better practices of collection and processing of blood components. The aim of the study was to determine the prevalence of TTI in blood donors in a tertiary care hospital in central India. **Materials and Methods:** A retrospective cross sectional study was performed from 2012 to 2017 in a tertiary care government hospital in central region of India. The study analyzes all voluntary and replacement blood donations received through the hospital in its blood bank and blood donation camps organized by the hospital. **Results:**A total of 54,831 units of blood was collected over a period of 6 years. Prevalence of TTI in the blood donors was 1.45%. Prevalence of seroprevalence of human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), syphilis and malaria were 0.31 %, 0.75%, 0.065%, 0.22% and 0.1% respectively. Among all the potential donors, the most common TTI prevalence was that of Hepatitis B followed by HIV and syphilis. **Conclusion:**Public awareness, careful donor selection,vigilant screening and adoption of newer techniques for inactivation of pathogens are needed to ensure safety of blood products and their transfusion.The public outreach programs such as blood donation camps could be used as a way of spreading awareness to improve the safety and efficacy of a blood donation program.

Keywords: Blood donor, Infection, Prevalence, Transfusion-transmitted infections

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Introduction

Transfusion-transmitted infections (TTI) are infections resulting from the introduction of a pathogen into a blood product recipient through blood transfusion. The goal of transfusion practices is to reduce the risk of TTIs to as low as possible. A wide variety of organisms, including bacteria, viruses, prions, and parasites can be transmitted through blood transfusions.Majority of post transfusion diseases are caused by hepatitis B virus (HBV), human immunodeficiency virus (HIV), hepatitis C virus(HCV), Treponema pallidum and malaria parasites. In order to achieve the desired zero risk of transmitted infection, many levels of safety practices are adopted including, donor selection criteria, donor deferral registries, laboratory testing and pathogen inactivation of the collected blood. Various challenges making it difficult to eliminate TTIs are immunological window period of early infectivity when the immunologic tests are unreactive, high cost of screening rarer pathogens, immunological variant of pathogens, non-seroconverting chronic or immune-silent carriers, inadvertent laboratory testing errors and cost of training and maintaining well equipped blood donation center. Post transfusion hepatitis B and C is a major problem in India because of low viral load and mutant strains undetectable by routine ELISA [1-3].

The magnitude of TTIs is proportional to the prevalence of the infection in the donor community. The important TTIs in India are HBV, HIV, Syphilis, HCV, Malaria, Hepatitis A, Hepatitis G, Epstein Barr Virus, Cytomegalo Virus (CMV), Parvo virus B-19, Human T Lymphocytic virus (HTLV-1 and HTLV-2) and bacterial infections. In standard practices however, for the cost and resource effectiveness, only common TTIs are tested and screened for. Thus, the risks of rare infections getting transmitted is always there [4]. The two aspects of preventing TTIs are the pre-donation screening of donors and post donation testing and modification of the blood. Even with many newer sensitive tests such as Nucleic Acid Tests (NAT) which are helpful in detecting infection with low pathogen load in the blood, in resource limited hospitals, where it is not practical to employ expensive tests to detect rare TTIs, nor can expensive sterilization techniques be employed; effective screening methods play important role in ensuring safe transfusion practices. The study aims to find out the prevalence of transfusion transmitted infection (TTI) in blood Donors in a government tertiary care hospital. Understanding the pattern of prevalence of the TTIs in the donor population is helpful in recruiting and retaining safe blood donors. The importance of public education in the outreach programs such as blood donation camps is reflected in by comparing the prevalence of various TTIs in a region. This study would serve as a guide to estimating and predicting patterns of prevalence of TTIs in rural hospitals of India helping policymakers implement necessary effort to improve safety of blood transfusion.

Materials and Method

Setting: This is a retrospective study of hospital-based blood bank and blood donation camps organized by the hospital.

Duration: Data from the study was collected from January 2012 to December 2017over a period of 6 years at Government Medical College, Rajnandgaon, Chhattisgarh.

Type of Study: This is a retrospective cross sectional study based on data collected from past voluntary and replacement donations in the hospital.

Sampling Method: All voluntary and replacement donors who arrived at the hospital or the blood donation scamps hosted by the hospital between the included time period were considered for the analysis.

Sample Size Calculation: Hospital records were accessed to calculate the total sample size. A total of 54,831 units of blood was collected from donors (voluntary and replacement) During this time period.

Inclusion Criteria: Standard donor selection criteria were employed through questionnaires.

Exclusion Criteria: Careful history taking and clinical examination was performed with the aim of eliminating professional donors and donors having received blood products within the last six months of donation. All the samples were screened for hepatitis B surface antigen (HBsAg), human immunodeficiency virus (HIV), hepatitis C virus (HCV), venereal disease research laboratory test (VDRL) and malaria. All the reactive sample were repeat tested before labeling them seropositive. The donated blood was discarded and donor was appropriately counselled whenever a donor sample

Was found positive for any TTI.

Data Collection Procedure: Basic demographic information regarding age, sex, occupation, number of previous donations along with the post donation testing data was compiled from the hospital records.

Data Analysis: Analysis of the collected data was performed using Microsoft excel.

Ethical Consideration: Consent were taken from the donors for using the collected data for research purposes. No individually identifiable information was conveyed in the research.

Permission: Permission was obtained from the hospital ethical committee for the conduct of the research and its publication.

Results

A total 54,831 blood donations were enlisted in the study which included both voluntary as well as replacement donors comprising of 12.43% and 87.57% of the total donation respectively (Table 1).

Table-1: Yearly distribution of voluntary and replacement donors.

Year	Voluntary Donors	Replacement Donors	Total
2012	1204 (17.90%)	5526 (82.10%)	6730
2013	960 (13.60%)	6112 (86.40%)	7072
2014	1086 (11.40%)	8457 (86.60%)	9543
2015	1010 (8.96%)	10266 (91.04%)	11276
2016	1218 (11.50%)	9400 (88.50%)	10618
2017	1340 (13.96%)	8252 (86.04%)	9592
Total	6818 (12.43%)	48013 (87.57%)	54831

Prevalence for HIV was 0.31%(172cases) in total donors. Seroprevalence of HBsAg in total donors was 0.75% (414cases). Seroprevalence of VDRL among all donors was 0.22% (120 cases). The seropositivity of HCV in total donors was 0.065% (36 cases) (Table 2).

Table-2: Yearly seroprevalence of TTI's in donors.

Year	HIV	HBV	HCV	VDRL	Malaria	Total TTIs
2012	25	54	02	20	13	114
2013	43	62	15	26	19	165
2014	41	65	11	43	13	173
2015	26	86	05	01	02	120
2016	19	73	01	01	03	97
2017	18	74	02	29	08	131
Total	172	414	36	120	58	800

Concurrent rates of seropositivity were highest for HBV followed by HIV, VDRL, malaria and HCV in descending order. Males constituted the majority of the donor pool with 53,764 (98.05%) donations. In all the five diseases the incidence of TTIs were observed at high prevalence in males (Table 3).

Table-3: Yearly gender distribution of donors.

Year	Male Donors	Female Donors	Total
2012	6537	193	6730
2013	6888	184	7072
2014	9433	110	9543
2015	11161	115	11276
2016	10421	197	10618
2017	9324	268	9592
Total	53764 (98.05%)	1067 (1.95%)	54831

The seropositivity rate of HBV stayed consistently highest amongst all the TTIs tested throughout the 6 years of study. The rate of syphilis seropositivity outnumbered the HIV positive donations on year 2014 and 2017 (Figure 1). Though the catchment region has a substantial prevalence of malaria, it did not reflect in the donor population, with total malaria positive samples being 58 in all 6 years combined.

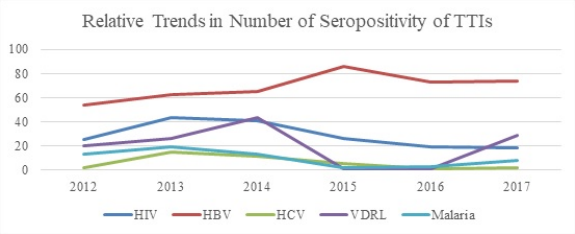

Fig-1: Relative Trend in Seropositivity of TTIs.

Discussion

In the 1930s, the only recognized TTI was syphilis. In 2009 the AABB (formerly known as the American Association of Blood Banks) published a list of 68 organisms, subsequently updated to 77, with the potential for transfusion-transmission (Stramer et al) [1]. Despite increasing identification of organisms involved in TTI, their relative prevalence and cost of detection prevents institutions from employing many of the screening tests.

The risk of TTI has declined dramatically in high income nations over the past two decades, primarily because of extraordinary success in preventing HIV and other established transfusion transmitted viruses entering the blood supply [2]. But this is not the true for the developing nation.

The nation policies here in our nation is originated recently and transfusion services are hospital based and fragmented [3]. Most of donors in the present study were male (98.05%) which is comparable to the studies done by others like Mallini Padma et al, Secundrabad [4], Rao and Annapurna, et al [5] in Pune, Rose, et al [6] in Vellore.

In the present study, replacement donors constitute 87.57%, the largest group of blood donors, which was similarly noted by Singh, et al. (82.4%) [7], Kakkar et al (94.7%) [8], Pahuja et al. (99.48%) [9]. Replacement donors (RD) are usually one-time blood donors who donate blood only when a relative is in need of blood whereason other hand, voluntary donors(VD) are motivated blood donors who donate blood at regular interval [10]. In contrast to our experience, a predominance of voluntary donors was noted by Mallini Padma et al, Secundrabad [4]. It is shown that the replacement donors constitute the largest blood donors in India [11].

It was found that the highest incidence of HBV (0.75%), followed by HIV (0.31%), VDRL (0.22%) and HCV (0.065%) in decreasing order. VDRL reactivity in the present study was 0.22% which is comparable to study by Mallini Padma et al, Secundrabad [4]. Awasthi et al [12] reported seropositivity for HIV was 0.1%, HBV 1.82%, HCV 0.83% and syphilis 0.13%. Agrawal et al [13] found overall seroprevalence of HBV and HCV was 1.5% and 0.8% respectively, while prevalence of syphilis and HIV was 0.07% and 0.1% respectively. The highest prevalence was observed for HBV followed by HCV, HIV and syphilis in decreasing order. Many of the Indian studies show prevalence rates for HIV 0.51-3.87%, HCV 0.12-4%, HBV(HBsAg) 1.2-3.5% and VDRL 0.3-0.82% [11,14,15,16,17-20]. A low prevalence rate in the present study may be attributed to increased number of donors donating at the blood bank with appropriate screening criteria. Hiding of the medical history by professional donors create a big threat to safety of blood supply. On the other hand, prevalence of HBV infection is lower in US and western Europe (0.1-0.5%) and is reported higher in south east Asia and China, which is 5-15% [10]. Though the study involves 6 years of data however it does not accurately reflect the population in the tribal area in the surrounding area because of the inaccessibility from those area. The study does not differentiate the donations received in the hospital that from the blood donation camps. Identifying the difference in pattern among these categories could have yielded Useful information regarding effectivity of public outreach through the blood donation campus.

Conclusion

Based on result it was understood that extensive donor selection criteria and screening procedures can improve the blood safety. Employing better screening technologies such as nucleic acid testing (NAT) could detect a greater number of window phase infective blood. The emphasis also should be given in raising awareness among people towards voluntary blood donations.Thus, a meticulous donor screening, counseling and use of highly sensitive tests can help in reducing the risk of TTIs.

What the study adds to the existing knowledge?

The study adds the unique perspective of central India to the other similar studies conducted in other parts of India. As the prevalence of TTIs vary from region to region, an estimate of the central India data which caters to a unique demography of population including tribal and poor rural population adds data to the other regional data for comparison and inference drawing. This information will help policy makers generalize public awareness efforts that needs to be done in the central India.

Author's contributions

Dr. Sadhna Bagde: Data analysis

Dr. Amit Kumar Tiwari: Data collection, manuscript writing

Dr. Tapas Ranjan Behera: Study concept and data analysis

Dr. Vikash Bombeshwar: Study concept and manuscript writing

Dr. Chandrashekhar Indoria: Data collection, manuscript writing

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