Seroprevalence and Trends of Transfusion Transmitted Coinfections among Blood Donors in North West Punjab - A Retrospective Study

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ABSTRACT

BACKGROUND
Blood transfusion has been a boon to medical science, but at the same time, it exposes millions of people to transfusion transmitted infections (TTI). TTI are the infections that are transmissible from one person to another through parenteral administration of blood / blood products. Various TTIs are hepatitis C (HCV), hepatitis B (HBV), syphilis, human immunodeficiency viruses (HIV) and malaria. With increasing use of blood transfusion, chances of transmission of TTIs is very common but proper screening of donor blood has reduced the chances of TTI. The present study was done to know the seroprevalence of HCV, HBV, HIV and syphilis and their coinfections.

METHODS
A retrospective study was conducted by reviewing the records from January 2015 to December 2019 at a blood bank of Guru Ram Das Institute of Medical Sciences and Research at Amritsar, Punjab. Number of donors included in the study were 43,037. All the donors who came to blood bank were tested for TTIs by enhanced chemiluminescent immunoassay.

RESULTS
Number of donors tested for TTI was 43,037. Out of 43037, 1739 patients had serological evidence of TTIs, out of which 1669 (96.19 %) had mono-infection and 70 (4.04 %) had coinfections. HCV & HBV (28 / 70) was the most common combination, followed by HCV & HIV (20 / 70), HCV & syphilis (9 / 70), HIV & syphilis (5 / 70), HBV & syphilis (3 / 70) and HBV & HIV (1 / 70). Two donors had HIV, HCV & syphilis coinfections and two donors had HIV, HBV & HCV coinfections.

CONCLUSIONS
The present study documents the high prevalence of TTI out of which hepatitis C is the most common followed by hepatitis B. Among coinfections, two most prevalent coinfections are HCV & HBV and HCV & HIV and it is important to screen for these coinfections due to their impact on the course of disease as well as quality of life. This shows the increasing evidence of transfusion transmissible infection in blood donors in spite of advanced and vigilant screening of donated blood prior to transfusion. So, strategies should be devised for monitoring the implementation of post donation counselling for recruitment of safe donors.

KEYWORDS
Coinfections, Transfusion Transmitted Infections, Seroprevalence

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DOI: 10.18410/jebmh/2021/164

How to Cite This Article:
Kaur H, Garg P, Kaur N, et al. Seroprevalence and trends of transfusion transmitted coinfections among blood donors in North West Punjab - a retrospective study. J Evid Based Med Healthc 2021;8(14):840-843. DOI: 10.18410/jebmh/2021/164

Submission 05-12-2020,
Peer Review 14-12-2020,
Acceptance 16-02-2021,
Published 05-04-2021.

BACKGROUND

According to WHO, approximately 117.4 million blood donations are made globally every year.[1] Provision of timely transfusion has often saved lives but at the same time exposed millions of people to transfusion transmissible infections (TTI). TTIs have infected all segments of population; be it young / old, rich / poor, male / female or of any race.[2] Therefore, maintaining the effectiveness of procedures conducted to ensure safe blood transfusions is a major concern.

Hepatitis C (HCV), hepatitis B (HBV), syphilis and HIV are the most common TTIs associated with systemic manifestations and share common routes of transmission including blood transfusion, sexual transmission, needle-stick injury, sharing of needles and organ transplantation.[3] It is very important to know that a healthy asymptomatic individual may be a carrier for these infections and transmit it further.

Various screening tests for these TTIs are routinely done. In emergencies, results of these screening tests should be provided as early as possible. This has been made easy with the use of enhanced chemiluminescence technology, electrochemiluminescence immunoassay analyser (ECLIA). Tests done by this technology are rapid, sensitive and specific.[4]

Individually, each of these infections cause high morbidity and mortality; however, the prevalence of coinfections of HCV, HBV, HIV and syphilis is of significant occurrence in a few endemic areas in India.[5] These coinfections alter the epidemiology and worsen the course of the disease. Coinfections like HCV / HIV and HBV / HCV facilitate the progression of disease to cirrhosis, liver failure, hepatocellular carcinoma and in some cases death.[6] Screening for individual infections is done commonly; however, coinfections such as (HBV and HCV) are usually not stressed on in our present healthcare system. Thus, a holistic approach to diagnose these coinfections early in the course of disease and providing appropriate treatment for the same is important.

Although extensive literature analysing the seroprevalence of individual TTIs is present, there remains a gap in our knowledge about coinfections. Our study was conducted to estimate the seroprevalence of HCV, HBV, HIV and syphilis and their coinfections amongst apparently healthy donor populations at a blood bank in a tertiary care center in Punjab over a period of 5 years (2015 - 2019).
This study was conducted to determine the seroprevalence of TTIs among the blood donors at a tertiary care hospital and to analyse the changing trend and coinfection rate of TTIs.

METHODS

This was a retrospective study conducted in the blood bank, of Sri Guru Ramdas Institute of Medical Sciences and Research, Amritsar, Punjab. A total of 43,037 apparently healthy donors were assessed for a period of five years (2015 - 2019). All donor registration forms were accompanied by a detailed pre-donation questionnaire containing information regarding past medical history, high risk behaviour, previous history of blood transfusion, history of vaccination, any episode of jaundice and occupation. The donors were selected according to the following inclusion and exclusion criteria.

Inclusion Criteria

Clinically healthy individuals between 18 and 65 years of age with a body weight of above 45 kg and haemoglobin more than 12.5 g / dl with no significant medical or surgical history were qualified for the donation process.

Exclusion Criteria

Persons belonging to high-risk groups such as patients with chronic diseases, intravenous drug users, dialysis patients, pregnant women, patients treated in thalassemia clinics, sexually transmitted disease clinics, and sex workers were excluded from the donation process.

All the donors who donated blood were subjected to various tests to detect TTIs. Three millilitres of blood was collected from every donor under aseptic conditions in a red coloured vacutainer. From this, we obtained serum for serology (HIV, HBV, HCV and syphilis). Each donor was tested for HBs antigen (Ag), anti-HCV, anti-HIV1 & 2 and syphilis by enhanced chemiluminescent immunoassay technique and for malaria by rapid card test.

Enhanced chemiluminescent immunoassay technique system used a revolutionary software as well as hardware which includes Intellicheck technology and chemiluminescence detection technology which processed samples and reported results at a faster rate. The Intellicheck technology was designed to detect critical errors and provided immediate operator notifications when exceptions were detected. The system used reagents and supplies that can be loaded, unloaded and replaced. The reagent inventory, levels and expiration date were continuously monitored. Calibrations is an important aspect of quality control for VITROS ECI / ECIQ. For each new reagent lot, a master calibration was done by carrying out multiple assays. Levey-Jennings (LJ) graphs which plot the result data points against mean and standard deviation were used for controls.

A total of 43,037 apparently healthy donors were assessed from a period of January 2015 to December 2019. All the donors who were positive for TTIs were calculated and percentage was derived. Then the donors with coinfections (donors with more than one transfusion transmitted infection) were calculated year wise from 2015 to 2019 and a total number was also calculated. This data was compared with other studies which were done till date. The data was also analysed to know the common and rare coinfections and the impact of these coinfections on health of the individual.

RESULTS

Data of 43037 donors was analysed. All donors included in our study were voluntary donors. Our study concluded that 1739 patients had serological evidence of TTIs, out of which 1669 (95.98 %) had monoinfection and 70 (4.02 %) had coinfections. [Table 1] Among coinfections HCV & HBV (28 / 70; 40 %) was the most common combination, followed by HCV & HIV (20 / 70; 28.57 %), HCV & syphilis (9 / 70; 12.86 %), HIV & syphilis (5 / 70; 7.14 %), HBV & syphilis (3 / 70; 4.28 %) and HBV & HIV (1 / 70; 1.43 %). Two donors had HIV, HCV & syphilis coinfections and two donors had HIV, HBV & HCV coinfections. [Table 2]

Total Number of Donors	**43,037**
Total donors with TTI	1739
Total donors with monoinfection	1669
Total donors with coinfections	70
Overall prevalence of TTI	4.04 %

Table 1. Trends of TTI along with Coinfections in Donors

	2015	**2016**	**2017**	**2018**	**2019**	**Total**
HCV & HIV	1	7	2	6	4	20
HCV & HBV	4	1	5	7	11	28
HBV & HIV	-	-	-	1	-	1
HIV & syphilis	1	-	-	2	2	5
HCV & syphilis	1	-	2	3	3	9
HBV & syphilis	-	-	-	2	1	3
HIV, HCV & syphilis	1	-	-	-	1	2
HIV, HBV & HCV	-	-	-	1	1	2
Total						**70**

Table 2. Year-Wise Distribution of Coinfections among Blood Donors (2015 - 2019)

DISCUSSION

Our study shows that 4.04 % (1739 / 43,037) donors had evidence of TTIs. This is in contrast to another study in which 1.12 % prevalence of TTIs was observed.[7] The main focus of this study was the prevalence of various coinfection patterns amongst blood donors. A very limited number of studies on the prevalence of coinfections have been conducted in India. Out of the 1739 donors who tested positive for TTIs, 70 donors (4.03 %) were confirmed to have more than one TTI. Most cases of coinfections were positive for HBV & HCV (28 / 70; 40 %). This was distinct from the findings of Kaur H et al.[5] who have observed the highest rate of coinfection with HBV & syphilis (29.62 %). The present study highlights that a significant rate of coinfection with HCV & HIV (20 / 70; 28.57 %) was seen in comparison to a previous study[8] that has shown a lesser rate for the same (11 / 73; 15.1 %). Our study showed 1.43 % (1 / 70) prevalence of HBV & HIV coinfection which is in concordance with the study done by Sellami A et al.[9] reporting a 2 % prevalence for the same. Interestingly, a previous study[5] recorded no cases with HBV & HIV coinfection.

Prevalence of more than 2 TTIs has not been widely studied and limited data exists on the same. A study by Bhattar S et al.[3] found 0.8 % prevalence and another study[10] found 2 % prevalence of a coinfection of HIV, HBV and syphilis. However, in our study none of the donors had HIV, HBV or syphilis coinfection. In our study, four of the patients with coinfections (4 / 70; 5.72 %) were infected with more than two TTIs; 2 HIV / HCV / syphilis and 2 HIV / HCV / HBV. This was in concordance to another study conducted in northern India[11] which observed 4.34 % prevalence of coinfection with more than 2 TTIs. Henceforth, this aspect of transfusion medicine must be researched accurately.

The findings of this study are consistent with the global estimates of the World Health Organization (WHO) which state that HIV-HCV coinfection affects 2.75 million people worldwide of whom 1.3 million are intravenous drug users (IVDU). In addition to that, HBV-HCV coinfection affects 2.6 million people. Africa and South East Asian countries bear the greatest burden for these coinfections.[12]

People infected with either HBV or HCV with HIV are at a higher risk of liver-related morbidity and mortality. A complete approach to diagnose these coinfections early in the course of disease and providing appropriate treatment for the same is important. Hence, physicians must be recommended to administer HBV vaccination in all HIV positive patients.[12]

Often, asymptomatic donors and carriers of TTIs escape detection from routine screening techniques due to the phenomenon of "window period".[5] Our study proposes that in case a donor is seropositive for anyone TTI, pre-donor counselling with screening for other TTIs (considering the window period) must be repeated. It is also important to continue application of strict measures for donor selection, especially considering their social conduct. Physicians must also be guided to carry out transfusions only as a last alternative.

Many factors favour coinfections including high degree of epidemiological similarity between HIV and hepatitis viruses with similar routes of transmission, risk factors and higher prevalence with other sexually transmitted diseases (STDs) such as syphilis. So, testing for syphilis is used as a surrogate marker for lifestyles known to be associated with a high risk of transmitting HIV and hepatitis. Compared to those who are only infected with HIV, coinfected individuals are at greater risk of hepatic toxicity following treatment with antiviral drugs, and their survival is also much lower. A study in India showed that one-third of deaths in HIV infection were directly or indirectly related to HCV infection.[6] Therefore, it is of utmost importance to screen the donors for all the TTIs and to know the rates of these coinfections among otherwise healthy blood donors at risk of transmitting these TTIs.

A major strength of this study is the large sample size. In our knowledge this is one of the few studies worldwide that focuses on prevalence of coinfections of TTIs and emphasises that the same needs to be studied extensively to better understand the clinical picture and treatment options. However, there are limitations to our study. Since all the patient data was collected from a single centre, the chance of coinfections might be higher.

CONCLUSIONS

Studies on prevalence of coinfections are limited. Hence, to understand the impact of coinfections on the clinical picture, extensive research on the same needs to be done. From the

study data, we derive that the two most prevalent coinfections are HCV & HBV and HCV & HIV, and it is important to screen for these coinfections due to their impact on the course of disease as well as quality of life. Strict measures for donor selection with importance on a comprehensive screening of donor blood for TTIs as well as their coinfections must be done.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
Financial or other competing interests: None.
Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

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