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Co-infection of blood borne viruses in blood donors: A cross-sectional study from North India

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ABSTRACT

Background: There are several studies on prevalence of individual infectious disease markers (mono-infection) in donors but none on prevalence of coinfection. Co-infection is significant as it leads to accelerated disease progression. We, therefore, evaluated the prevalence of co-infection among blood donors.
Materials and methods: The cross-sectional analysis was conducted in blood donors. All donors were tested for anti-HIV I and II, HBsAg, anti-HBC IgM, anti-HCV, Malaria and syphilis by chemiluminescence and ID-NAT assay. All reactive donor samples were confirmed by using confirmatory assays. Donors were grouped as mono-infected and co-infected. The student *t*-test was used for comparison.
Results: During the study period, a total of 106,238 blood donors were tested. Mean age of donors was 34.2 years and 94.2% of blood donors were males. 1776 (1.67%) donor samples were confirmed serologically reactive. 1714 (1.61%) samples were reactive for single marker (mono-infected) while 62 (0.05%) donors' samples exhibited co-infection. 18 donors were positive for HBV+HCV followed by HIV +syphilis (14).
Conclusion: We report for the first time the prevalence of different co-infection patterns in blood donors. Co-infection influence the disease progression; it would be important to investigate the co-infection prevalence in larger sample size.

1. Introduction

Human immunodeficiency virus (HIV), Hepatitis B virus (HBV) and hepatitis C virus (HCV) infection are important global public health problems. Regarding the disease burden, the World Health Organization estimates that more than 350 million and 170 million people are chronic carriers of HBV and HCV, respectively [1]. Chronic Hepatitis B (CHB) infection is a significant health problem all over world and India comes under intermediate zone of prevalence [1]. On an average, the estimated carrier rate of HBV carriers is around 5% in India [2]. This high prevalence of infection is thought to be due to horizontal transmission. Occasionally a person may harbor more than one infection; this is called co-infection.

Individuals with HBV, if co-infected with HIV are more prone to develop chronic hepatitis B which increases the risk for liver related mortality [3]. Hepatitis C virus is the major cause of non-A, non-B hepatitis worldwide [4]. HIV positive individuals are found to be infected commonly with hepatitis C infection (co-infection) and this association also tends to increase mortality and morbidity [5]. In US, HCV prevalence in HIV infected individuals is estimated to be approximately 50% [6]. Because of their shared modes of transmission, co-infection with HIV, HBV and HCV is a significant occurrence, particularly in areas where these viruses are endemic and even amongst apparently healthy subjects like blood donors.

There are several Indian studies on prevalence of individual infectious disease markers (IDM) in donors but none on prevalence of co-infection of hepatitis viruses (HBV and HCV) with HIV. Therefore, we evaluated the prevalence of co-infection among blood donors.

2. Materials and methods

2.1. Settings

This retrospective cross-sectional analysis was conducted at the department of Transfusion Medicine in a tertiary health-care

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Table 1
Prevalence of mono-infection and co-infection.

		Donations	Mono-infected	Co-infected	*p* value (Mono-infected versus co-infected)
Gender	*N* (%)	106,238	1714 (1.61)	62 (0.05)	–
	Male (%)	100,076 (94.2)	1695 (1.7)	61 (0.06)	**<0.0001***
	Female (%)	6162 (5.8)	19 (0.3)	1 (0.016)	**<0.0001***
	p value	–	**0.0001***	**0.049***	–
	First time donors (%)	83,821 (78.9)	1470 (1.75)	54 (0.06)	**<0.0001***
	Repeat donors (%)	22,416 (21.1)	244 (1.09)	8 (0.036)	**<0.0001***
	p value	–	**0.05***	**0.05***	**–**
Age group	Median age	34 (18–65)	39 (21–60)	36 (22–59)	**0.001***
	18–29	41,752 (39.3)	497 (1.19)	19 (3.82)	**<0.0001***
	30–39	46,851 (44.1)	558 (1.19)	21 (3.76)	**<0.0001***
	40–49	10,837 (10.2)	397 (3.66)	13 (3.27)	0.116
	50–59	4780 (4.5)	236 (4.94)	9 (3.81)	**0.007***
	≥60	2018 (1.9)	26 (1.29)	0 (0.0)	–

* *p*-value < 0.05, Statistically significant; 2 sample *Z* test, two-tailed.

hospital in the National Capital Region (NCR) of India, between January 2011 and July 2015.

2.2. Study population

Apparently healthy blood donors donating blood at the department. All blood donors were selected as per the departmental standard operating procedures (SOP).

Transfusion transmitted disease (TTD) testing of blood donors

All donors were tested for anti-HIV I and II, HBsAg, anti-HBC IgM and anti-HCV using enhanced chemiluminescence method on Vitros EciQ (Ortho Clinical Diagnostics, Johnson and Johnson, USA) using donors' serum sample. Simultaneously, EDTA blood sample of the all donors were tested by ID-NAT for HIV I, HCV RNA and HBV DNA. ID-NAT test was performed using the eSAS system Procleix Ultrio/Ultrio plus Assay (Novartis diagnostics, CA, US). Syphilis testing was done using immuno-chromatography by (Bio-Standard Diagnostics, India). Malarial antigen was tested using immuno-chromatography by Sure Test Malaria (Access Bio, Addis Ababa, Ethiopia).

2.3. Confirmation

All reactive donor samples were confirmed by using confirmatory assays. For HIV – western blot; HCV – Strip Immuno Blot Assay (RIBA)/HCV RNA; HBsAg – HBsAg ES confirmatory assay; Syphilis – TPHA was used as confirmatory assays. For malaria confirmatory assay was not available. Donor samples reactive for antibody/antigen test as well as reactive on NAT testing were considered confirmed reactive.

2.4. Data collection and analysis

Data were collected from the Hospital Information System (HIS). Parameters collected were number of blood donors confirmed reactive (for one of the TTD infections), age, type of donation (first time or repeat, replacement or voluntary) and gender. Confirmed reactive donors were grouped into Mono-infected (infected with single agent) and co-infected (infected with two or more agents). The analysis included profiling of donors on different demographic and number of infection parameters. Descriptive analysis of quantitative data was expressed as means and standard deviation. Categorical data were expressed as absolute number and percentage. The student *t*-test were used for comparison of quantitative parameters. Cross tables were generated and chi square test was used for testing of associations. *P*-value < 0.05 is considered statistically significant. SPSS software, version 24.0 was used for analysis.

3. Results

3.1. Demographics

During the study period from January 2011 to July 2015, a total of 106,238 blood donors were tested for transfusion transmitted viral infections. Mean age of the donors was 34.2 years and 94.2% (100,076) proportion of blood donors was male. Replacement donation by the family members and their relatives was the commonest mode of blood donation 91.5% (97,207). Total of 78.9% were first time donors while 21.1% were repeat blood donors. (Table 1)

3.2. Sero-prevalence

Of the 106,238 blood donor samples tested, 1776 (1.67%) donor samples were confirmed serologically reactive. 1714 (1.61%) samples were reactive for single marker while 62 (0.05%) donors' samples exhibited co-infection. Infections were predominant among males; 98.8% and 98.3% in mono-infected and co-infected donors were men, respectively. Mean age was similar; 38.7 years for mono-infected and 36.2 for co-infected donors. Out of 62 co-infected donors, 54 (87.1%) donors were first time donors while 8 (12.9%) were repeat donors. (Table 1)

3.3. Co-infection

From 62 co-infected donors, 18 (1.01%) were positive for HBV + HCV. Co- infection rate of HIV + HCV, HCV + Syphilis, HCV + malaria, HIV + HBV, HBV + syphilis and HIV + Syphilis was 0.5% (9), 0.7% (14), 0.05% (1), 0.05% (1), 0.3% (7) and 0.45% (8) respectively. 0.16% (3) donors were positive for HCV and Anti-Hbc IgM. One donor was positive for three infections (HCV + HIV + Syphilis). (Table 2; Fig. 1)

4. Discussion

We report for the first time a major cross-sectional study of the prevalence of different co-infection patterns in blood donors. To the best of our knowledge no systematic analysis has been conducted in India to study the prevalence of co-infection markers among blood donors.

In our study, sero-prevalence of HBV + HCV co-infection (1.01%) was higher than other co-infections followed by HCV + syphilis of 0.7%. HIV + HBV and HIV + HCV co-infection rate was 0.05% and 0.5% respectively. Only one case was malaria co-infection with HCV and this was expected, since our region is non-endemic for malaria. Study from Nigeria [7] reported a prevalence rate of 0.4% co-infection of HIV and HBV & 0% of HIV and HCV co-infection.