

Transfusion Transmitted Infections among Blood Donors at a Tertiary Care Hospital Blood Bank in Kumaon Region, Uttarakhand, India

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ABSTRACT

Introduction: Blood transfusion is one of the most important and integral intervention of the modern medicine but, simultaneously it carries the solemn risk of transmitting various life-threatening Transfusion-Transmissible Infectious (TTI) agents.

Aim: To study the serological profile of voluntary blood donors in a blood bank of tertiary healthcare centre in Kumaon region, Uttarakhand, India.

Materials and Methods: A hospital based prospective study was conducted from September 2018-September 2020. All the potential blood donors coming to the Department of Pathology and Blood Bank were included and after obtaining informed consent from the donor, venous blood was collected. Samples were tested for Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), syphilis, and malarial parasite. The data was

collected and tabulated in Microsoft Excel sheet and was analysed by calculating frequency and percentages.

Results: A total of 8874 donors were screened during the study period; of these 5.66% (503/8874) were found to be seropositive. Seroprevalence of HBV, HCV, HIV, syphilis and malaria was 1.87% (166/8874), 3.23% (287/8874), 0.15% (14/8874), 0.40% (35/8874) and 0.01% (01/8874) respectively. Highest prevalence of TTI (55.06%; 277/503) was within the age group of 18-28 years. Maximum seroreactivity was seen in blood group- B positive (32.60%; 164/503) followed by A positive (25.84%; 130/503).

Conclusion: Although, there has been a down-swing in the prevalence of TTI's but, there is still need for improvement in the quality of transfusion medicine services and implementation of strict donor criteria to further minimise the risk of TTI's.

Keywords: Hepatitis B virus, Hepatitis C virus, Human immunodeficiency virus, Malaria, Seropositive, Syphilis, Transmissible infections

INTRODUCTION

Blood transfusion, which is a fundamental part of our healthcare system, saves millions of lives. Having said that, Transfusion Transmitted Infections (TTIs) pose a solemn threat to blood safety and are a grave public health problem especially in developing countries like India, where only 20% of safe blood is accessible to 80% of population, according to World Health Organisation (WHO) global database on blood safety [1]. An area of major concern is ensuring safe blood transfusion to the recipient as, transfusion of blood and its products can lead to transmission of infections like Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Human Immunodeficiency Virus (HIV), Malaria, Syphilis and less frequently Epstein Bar Virus, Cytomegalovirus, Parvo virus B19, Toxoplasma, Brucellosis and many more [2].

There are more than 300 million people infected with HBV worldwide and majority of them are Asians. In India, prevalence of HIV infected adults is 0.31% according to National AIDS Control Organisation (NACO) [3]. The global prevalence of HCV is 3% and approximately 20 million people are infected with HCV in India [4]. As per the Drugs and Cosmetic Act 1940 Rules 1945 (SCH. F, Part XII B), every blood donation in India is to be screened against five infections- HBV, HCV, HIV, syphilis and malaria [5].

In view of ensuring safety in blood transfusions and reducing the risk of TTIs, careful selection of donors is essential along with setting up of dedicated and well organised transfusion services with quality control systems that are effectual [6]. The present study was undertaken with the aim of investigating the prevalence of major TTIs among blood donors in the hilly regions of Kumaon in Uttarakhand along with the objective to find the seroprevalence of HBV, HCV, HIV, Syphilis and Malarial Parasite in voluntary blood donors and to study the association of various socio-demographic factors with the seropositivity status of voluntary blood donors.

MATERIALS AND METHODS

A hospital based prospective study was carried out in the Blood bank of Government Medical College, Haldwani, Nainital from September 2018 to September 2020. Ethical clearance was obtained by the Institutional Ethics Committee. (Letter No.422/GMC/IEC/2018/Reg. No.435/IEC/R-08-10-2018).

Inclusion criteria: Healthy men and women aged 18-65 years, weight \geq 45 Kg and haemoglobin 12.5 gm/dL were included in the study.

Exclusion criteria: Pregnant and Lactating women, those subjects who have current history of taking any antibiotic, antiviral or antimalarial or antiretroviral therapy, those patients with history of major surgery or blood transfusion within one year, history of HBV, HCV, HIV, Syphilis and malaria, those having history of STD in sexual partners and with recent or past Radiotherapy or Chemotherapy were excluded from the study.

Study Procedure

All the potential blood donors coming to the Department of Pathology and Blood Bank were requested to fill a detailed pre-donation questionnaire prepared as per NACO guidelines for donor eligibility [7]. Weight, blood pressure, pulse and temperature were recorded. For donors who donate 350 mL blood, weight should be more than 45 kg and for donating 450 mL- more than 55 kg. Blood pressure should range between 100-140 mm Hg (systolic) and 60-90 mm Hg (diastolic)- with or without medications. Pulse should be regular and should range between 60-100 beats/minute. The patient should be afebrile and temperature must be below 37°C/98.4°F. Information regarding history of surgery-major or minor, hospitalisation, blood transfusion, occupation like- air crew member, long distance vehicle driver, emergency services, high-risk behaviour like- transgender, men who have sex with men, female sex workers, injectable drug

users, persons with multiple sexual partners, tattoo marks, socio-economic status and address were collected.

All the samples collected from apparently healthy donors were screened for Hepatitis B Surface Antigen (HBsAg), HIV, HCV by Enzyme Linked Immunosorbent Assay (ELISA) and syphilis by Rapid Plasma Reagin card test and malarial parasite by malaria card test. Tests were performed according to the manufacturer's instructions of commercially available kit.

STATISTICAL ANALYSIS

Data was collected and tabulated in Microsoft Excel sheet and was analysed by calculating frequency (n) and percentages (%).

RESULTS

Maximum donors (41.35%; 08/503) had weight in the range of 56-66 kg followed by 34.40% [173/503] donors with weight in the range of 66-75 kg. Least number of cases (0.20%; 11/503) had weight in the range of 86-95 kg. In the present study, 169 seropositive donors out of 503, had haemoglobin in the range of 14.6-15.5 gm/dL. 22.86% (115/503) donors had haemoglobin in the range of 13.6-14.5 gm/dL, closely followed by, 21.66% (109/503) donors with haemoglobin in the range of 15.6-16.5 gm/dL. Least number of donors (0.40%; 02/503) had haemoglobin in the range of 18.6-19.5 gm/dL. In the present

study, 385 out of 503 seropositive donors (71.18%) were literate and 145 out of 503 seropositive donors (28.82%) were illiterate. Maximum number of donors (34.20%; 172/503) had received primary education followed by 15.50% (78/503) having middle school education. Out of 503 seropositive donors, 501 (99.60%) were monogamous and 02 (0.40%) had multiple sexual partners.

A total of 8874 blood donors were studied for analysis, of which, 5.66% (503/8874) were seropositive. Sero-prevalence of HBsAg, HCV, HIV, syphilis and malaria was 1.87% (166/8874), 3.23% (287/8874), 0.15% (14/8874), 0.40% (35/8874) and 0.01% (01/8874) respectively. Out of 503 seropositive donors, 500 were males (99.40%) and only three were females (0.60%). The majority of the cases belonged to the age group of 18-28 years (55.06%; 277/503) followed by age group of 29-38 years (31.80%; 160/503). Age wise distribution of seropositive donors is depicted in [Table/Fig-1].

The seropositive donors were classified according to their profession and majority were skilled agriculture workers {22.26% (112/503)} [Table/Fig-2]. The donors were grouped according to their geographical distribution. Majority were from Udham Singh Nagar district (43.73%; 220/503), closely followed by Nainital district (38.56%; 194/503) [Table/Fig-3]. A 94.83% (477/503) donors were Rh positive and only 5.16% (26/503) were Rh negative. Maximum number of donors had B positive (32.60%; 164/503) blood group [Table/Fig-4].

Age group (years)	No. of donors (%)	HBV positive	HCV positive	HIV positive	Syphilis positive	Malaria positive	Total positive
18-28	4482 (50.5%)	103 (62.0%)	158 (55.0%)	06 (42.8%)	10 (28.5%)	0	277 (55.0%)
29-38	3176 (35.7%)	42 (25.3%)	103 (35.8%)	07 (50.0%)	08 (22.8%)	0	160 (31.8%)
39-48	953 (10.7%)	15 (9.0%)	21 (7.3%)	01 (7.1%)	13 (37.1%)	01 (100%)	51 (10.1%)
49-58	201 (2.26%)	05 (3.0%)	02 (0.69%)	0	04 (11.4%)	0	11 (2.1%)
59-65	62 (0.69%)	01 (0.6%)	03 (1.04%)	0	00 (0.00%)	0	04 (0.79%)
Total	8874 (100%)	166 (100%)	287 (100%)	14 (100%)	35 (100%)	01 (100%)	503 (100%)

[Table/Fig-1]: Seropositivity of different TTIs according to age group.

HBV: Hepatitis B virus; HCV: Hepatitis C virus; HIV: Human immunodeficiency virus; TTIs: Transfusion transmitted infections

Occupation	Number of seropositive blood donors	Percentage
Unemployed	78	15.50%
Elementary	83	16.50%
Plant, machine operators	43	8.54%
Craftsmen	71	14.12%
Skilled agriculture workers	112	22.26%
Skilled worker, shop, sales workers	81	16.10%
Clerks	08	1.60%
Technicians and associated workers	13	2.58%
Professionals	06	1.20%
Students	06	1.20%
Managers/Senior officers/Legislators	02	0.40%
Total	503	100%

[Table/Fig-2]: Distribution of seropositive donors according to occupation.

State	District	Number of seropositive blood donors	Percentage
Uttarakhand	Nainital	194	38.56%
	Udham Singh Nagar	220	43.73%
	Almora	21	4.20%
	Champawat	01	0.20%
	Pithoragarh	01	0.20%
Uttar Pradesh	Bareilly	20	3.97%
	Rampur	45	8.94%
	Bijnor	01	0.20%
Total	Total	503	100%

[Table/Fig-3]: Distribution of seropositive donors according to residence.

S. No.	Blood group	Number of seropositive blood donors	Percentage
1	A+	130	25.84%
2	B+	164	32.60%
3	AB+	81	16.10%
4	O+	102	20.27%
5	A-	05	1.00%
6	B-	10	2.00%
7	AB-	06	1.19%
8	O-	05	1.00%
	Total	503	100%

[Table/Fig-4]: Distribution of seropositive donors according to blood group.

DISCUSSION

Life saving measure like transfusion of blood and its components is a fundamental right of every individual, thus, necessitating the importance of safe blood transfusion [6]. Ninety million units of blood are collected every year across the globe and there is 1% risk of transfusion related problems like TTIs with each unit transfused [8]. A number of factors are responsible for unsafe blood transfusion- asymptomatic donors, false negative results, genetic variability of virus, atypical infections and technical errors [9]. Developed countries have observed a drastic reduction in TTIs but, that is not the scenario for developing nations because they are still facing problems like, lack of health education, poor health infrastructure, inadequate resources and lack of strict norms for screening [10].

A total of 8874 donors were screened during the study period; of these 5.66% (503/8874) were found to be seropositive, which is similar to studies conducted by Sul VG et al., (4.49%), Arif SH et al., (5.59%), Mittal G et al., (4.4%) [3,11,12]. However, Das BC and

Chaliha T, (1.3%), Jain C et al., (1.66%), Dhar G et al., (1.14%), Lathamani K et al., (0.82%) reported a lower value of TTIs [13-16]. Maximum number of seropositive donors had Hepatitis C infection, which was in discordance with most of the studies in various parts of India where Hepatitis B infection was the most common TTI. Koshy JM et al., reported higher prevalence of HCV (1.53%) than HBV (1.11%) or HIV (0.27%) and attributed this finding to high prevalence of Injectable Drug Users (IDU) in Punjab [8]. The prevalence of HCV infection, globally, is approximately 3%, with 170 million individuals infected chronically and 3-4 million individuals are newly infected every year [17]. As, HCV has a wide window period of 6 to 10 weeks during which its detection is not possible in blood and the donors are asymptomatic without any liver related disease, these infected donors escape the routine screening [4]. According to Mukhopadhyaya A, high prevalence of HCV is due to professional blood donors, IDU or by reusing improperly sterilised injections [18]. In Southeast Asia, an average person receives four injections per year, most of which are unnecessary and up to 75% are reused or unsafe [19].

Seropositivity of HBV was 1.87% in the present study, which was comparable to other studies. HBV is more infectious than HIV or HCV and can spread by intra-familial transmission as well as by unsafe injection practices, among other transmission routes. There is major variation in HBsAg prevalence in different states of India and the highest was seen in Arunachal Pradesh and Andamans [20].

A 0.15% of donors were positive for HIV in the present study, which is similar to studies conducted near this study region. India has the third largest number of HIV infected patients. The high prevalence areas of HIV are Maharashtra, Tamil Nadu, Karnataka, Andhra Pradesh, Manipur, Nagaland these areas show diverse social, cultural, religious, and sexual practices [21]. Seroprevalence of syphilis was observed to be 0.40% in the present study. Syphilis is a sexually transmitted infection but can also be transmitted by transfusing either red cell components stored for less than four days or by platelets stored at 22°C as *Treponemapallidum* does not survive at 4°C [22]. Even though the first ever reported TTI was malaria, its seroprevalence

was very low in this set up as the present study area is geographically a non endemic zone.

In the present study, majority of the donors were males (99.40%) as there is a general lack of participation in blood donation by females, especially in developing countries due to anaemia, multiple pregnancies, lack of motivation and beliefs. The present study was in discordance with study conducted by Dilek I et al., in Eastern Turkey, where 58% were male donors and 42% were female donors [23].

Most of the seropositive donors were between 18 and 28 years of age. Similar observation was made by Arora D et al., (66.9% cases in age group of 18-31 years), Yadav BS et al., (69.1% cases in age group of 18-30 years) and Sarah Y et al., (41.83% cases in age group of 20-29 years) [10,24,25]. Contrary to results of this study, study done by Prabhakar FP et al., shows maximum number of cases in age group 26-35 years (37.56%) [5]. Majority of the donors were skilled agriculture workers and elementary workers which was similar to study by Koshy JM et al., [8]. We evaluated the demographic profile of all the blood donors and found that maximum number of seropositive donors were from Udham Singh Nagar, which is an industrial area, closely followed by Nainital, which is a famous tourism spot. A significant association was found between seropositive donors with HCV and Syphilis and Nainital district. A significant association was found between seropositive donors with HBV and HIV and Udham Singh Nagar district.

The most common blood group in the present study was B positive (32.60%; 164/503), similar to the observation made by Arif SH et al., Nigam JS et al., and Tyagi S and Tyagi A [11,26,27]. However, Prabhakar FP et al., found blood group O to be the most common [5]. A significant association was present between Hepatitis C seropositivity and B positive blood group. The highest number of HBsAg positive donors were Rh positive, similar to studies conducted by Sreedhar KV et al., and Sinha RTK and Dey A, who also showed a significant association between Rh positive blood group and HBsAg seropositivity [28,29].

The published literature has been compared and tabulated with present study in [Table/Fig-5] [3,5,6,10,11,13,15,24,25,30-41].

Study	HBV (%)	HCV (%)	HIV (%)	Syphilis (%)	Malaria (%)
Arora D et al., [10] 2010, Haryana	1.70%	1.0%	0.30%	0.90%	-
Kaur G et al., [30] 2010, Chandigarh	1.70%	0.80%	0.60%	0.70%	-
Deshpande RH et al., [31] 2011, Maharashtra	2.02%	0.09%	0.21%	0.07%	-
Pallavi P et al., [32] 2011, Mysore	1.27%	0.23%	0.44%	0.28%	-
Dhar G et al., [15] 2013, West Bengal	0.80%	0.11%	0.10%	0.13%	-
Negi G and Gaur DS, [33] 2014, Dehradun	1.20%	0.90%	0.20%	0.30%	0.002%
Arya DR et al., [34] 2016, Rajasthan	1.60%	0.18%	0.10%	0.89%	0.04%
Sarah Y et al., [25] 2016, Saudi Arabia	8.60%	7.20%	0.80%	4.70%	-
Yadav BS et al., [24] 2016, Madhya Pradesh	1.77%	0.099%	0.14%	0.04%	-
Vandana WV and Rani KL, [6] 2017, Bangalore	0.75%	0.34%	0.20%	0.30%	-
Sul VG et al., [3] 2017, Maharashtra	3.20%	0.35%	0.90%	0.04%	-
Prabhakar FP et al., [5] 2017, Mumbai	1.80%	0.70%	0.60%	0.22%	0.017%
Das BC and Chaliha T, [13] 2017, Assam	0.75%	0.21%	0.16%	0.08%	0.14%
Sundarmurthy R et al., [35] 2018, Madurai	0.42%	0.56%	0.13%	-	0.01%
Singh P et al., [36] 2018, Delhi	0.70 %	0.50%	0.25 %	0.04%	0.01 %
Arif SH et al., [11] 2019, Aligarh	2.38%	1.27%	0.35%	1.29%	0.29%
Mukherjee S et al., [37] 2020, Odisha	0.62%	0.044%	0.073%	0.1%	0.12%
Bagde S et al., [38] 2020, Chhattisgarh	0.75%	0.065%	0.31%	0.22%	0.1%
Bindu Madhavi R et al., [39] 2020, Davangere	1.99 %	0.02%	0.25%	0.004%	-
Ram J et al., [40] 2021, Kanpur	1.4%	0.5%	0.1%	-	-
Chauhan SC and Solanki PK, [41] 2021, Gujarat	0.68%	0.11%	0.52%	0.81%	-
Present Study Nainital, Uttarakhand	1.87%	3.23%	0.15%	0.4%	0.01%

[Table/Fig-5]: Comparison of our study with other similar studies [3,5,6,10,11,13,15,24,25,30-41].

Limitation(s)

In the study, different TTIs were identified using testing kits. The test kits used to detect different infections have their own limitations and may not give accurate results. These inaccurate results may affect the final outcome of the present study.

CONCLUSION(S)

In this two year study period, we found that the overall seroprevalence of all the TTIs was comparable with other studies, but, a higher seroprevalence of HCV (3.23%) was noted. This finding necessitates the need for proper surveillance of HCV infection in blood donors so that imperative steps like implementation of strict donor selection criteria and sensitive screening tests are taken for providing safe blood to recipients. Encouraging female population as well as voluntary blood donors will result in increment in blood donations and safe blood transfusions. Also, for transmission prevention, donor notification and donor counseling are crucial.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]

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- Manual Googling: Jul 28, 2021
- iThenticate Software: Aug 18, 2021 (17%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
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