Section: Pathology

Original Research Article

INCIDENCE OF HEPATITIS B AND HEPATITIS C AMONG BLOOD DONORS AT A TERTIARY CARE BLOOD CENTRE IN WESTERN UTTAR PRADESH REGION: AN INSTITUTIONAL ANALYSIS

Faiza Samin[1], Nikhil[2], Neeti[3], Seema Awasthi[4], Ashutosh Kumar[5]

[1]Assistant Professor Department of Pathology, India.
[2]Assistant Professor, Department of Pathology, India.
[3]Assistant Professor, Department of Pathology, India.
[4]Professor and Head, Department of Pathology, India.
[5]Professor, Department of Pathology, India.

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Corresponding Author:
Dr. Nikhil
Email: officialdrnikhilpatho@gmail.com

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ABSTRACT

Background: Hepatitis B virus (HBV) and Hepatitis C virus (HCV) are vital transfusion-transmissible infections. This research was carried out to assess prevalence of HBV and HCV seropositivity among blood donors at a tertiary care hospital–based blood centre in located in western Uttar Pradesh part of India. **Materials and Methods:** Blood donation records over 5 years (2021-2025) were reviewed retrospectively for prevalence and yearly trends of HBV and HCV seropositivity along with Age group, gender-wise prevalence. **Result:** A total of 20,967 donations were received. Overall number of HBV-seropositive donations was 300 and that for HCV was 731, with the prevalence rates of 1.43% for Hepatitis B surface antigen (HBsAg) and 3.48% for HCV. **Conclusions:** This research raises key concerns with regards to HBV and HCV prevalence in our nation. Although HBV showed less than HCV, it cannot be completely relied upon as donors were only screened HBsAg. Strict strategies are required on pressing basis that is inclusive of information spread, stringent screening protocol of blood & blood products, inclusion of nucleic acid amplification test, antibody to hepatitis B core antigen along with more efficacious donor recruitment, boosting voluntary donations.

INTRODUCTION

Blood donation act and blood transfusion services act as integral part of healthcare system. Various medical emergencies such as trauma, obstetric conditions and cases where blood transfusion is required is entirely dependent on safety of donated blood along with keeping in hindsight prevention of transfusion-transmitted infections. Hepatitis B, C are considered to be of substantial concern as they can affect safe blood transfusion. Prevention of transfusion-transmitted infections is challenging for blood centers as spread of these infections not only affects healthcare systems but it has its own social dimensions. Hepatitis B, C infections can result in chronic disorders imparting a significant health risk to both patients and donors affecting the entire healthcare system. [1,2] As BTS services are critical it is essential to know prevalence of hepatitis B virus (HBV), hepatitis C virus (HCV) among blood donors. Screening Blood donors for these infections is critical to prevent transmission to recipients and it will help in laying down strategies that can improve donor screening methods. Current research tries to inscript lack of knowledge by assessing prevalence of HBV and HCV among blood donors at a tertiary care blood center. Current research provides insights with regards to 'prevalence of HBV and HCV infections among blood donors further helping in chalking out approach for safe BTS and enhancing safe blood practices.

MATERIALS AND METHODS

Retrospective Research carried out at hospital-based blood center in Western Uttar Pradesh, India. Aim was to investigate incidence of Hepatitis B and Hepatitis C among blood donors over a duration of five years (2021-2025). Approval for research was granted by Institutional Review board with IRB no. IRB/124/2025. All blood donors voluntarily signed informed consent forms prior to sample collection, maintaining confidentiality and following ethical research guidelines. Blood donation records were reviewed retrospectively for a total of 20,967 donors, age varying from 18 to 60 years. As per NBTC (National blood transfusion council guidelines) hospital uses a blood donor screening questionnaire.

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All donors were required to complete a pre-donation screening questionnaire and donors with high-risk behavior (e.g., history of intravenous drug use, multiple transfusions or unprotected sex) were excluded from the study. Data collection: socio-demographic data: age, sex, jaundice history, hemoglobinopathies, hypertension, fever, any of late ailment or receiving of blood products, unsafe sexual practices were gathered from willing participants utilizing validated questionnaire adopted by blood transfusion services. Blood donations were categorized as: Voluntary Non-Remunerated Blood Donors (VNRBD), Replacement donors (family/friends of patients). Most blood units were donated by patient related individuals (family/friends: replacement donors) whereas remainder donations were made voluntarily by unrelated individuals. Suitable donors were evaluated for HIV, Hepatitis B and C virus, syphilis, malaria parasite in accordance with NBTC protocol. Detection of Hepatitis B surface antigen (HBsAg) and anti-HCV antibodies was performed utilizing validated ELISA kits. Specifically, HBsAg was identified utilizing HEPA LISA Microwell ELISA Kit provided by (Mitra Co. Pvt. Ltd.) in serum/plasma specimen. Detection of HCV antibodies in serum or plasma was performed utilizing third Generation HCV Microlisa Kit (Mitra Co. Pvt. Ltd.). Each run was inclusive of both manufacturer-provided positive and negative controls. Additionally, confirmed internal patient samples known to be positive and negative were utilized for internal quality assurance. Donor specimens that initially tested reactive for HBsAg or HCV were re-evaluated with a second test to confirm reactivity prior to final classification. All reactive donor blood units were discarded to prevent transfusion-transmitted infections as per the Standard Operating Procedure (SOP) with prior knowledge and permission from Blood Bank Officer (BBO) along with proper documentation mentioning the date, units involved and the cause of discard. Donor Notification and Follow-up: Blood donors who tested positive for HBsAg or HCV were notified confidentially through registered mail and were advised to visit hospital or to attend a local physician for counseling services for further evaluation and possible treatment. All gathered data were entered into Microsoft Excel for organization and preliminary handling. Statistical evaluations were carried out utilizing SPSS software (Version 17; SPSS Inc., Chicago, IL). Prevalence rates were determined and inferential statistical tests inclusive of Chi-square test, and Fisher's exact test (through cross-tabulation) were applied as appropriate. p-value <0.05 was considered of substantial statistical significance.

RESULTS

Over a five-year period (2021-2025), a total of 20,967 blood donors were screened for transfusion-transmissible infections at tertiary care blood center in Western Uttar Pradesh. The year-wise prevalence of Hepatitis B surface antigen (HBsAg), Hepatitis C virus (HCV) antibodies is summarized in [Table/Fig 1]. The overall prevalence of HBV among donors was 1.43%, with yearly rates ranging from 1.18% to 1.63%. Highest HBV positivity was observed in 2022 (1.63%), and lowest in 2025 (1.18%). Nevertheless, the year-wise variation in HBV prevalence was not statistically significant ($p = 0.325$), indicating a relatively stable trend during study period. In contrast, overall prevalence of HCV among donors was 3.48%. HCV seroprevalence showed a statistically significant variation across the years ($p = 0.027$), with rates ranging from 2.87% (2025) to a peak of 3.91% in 2021. This dynamic pattern may reflect regional epidemiological shifts, changes in donor profiles or variations in awareness and screening outreach. These findings underscore a persistent burden of HCV infection among blood donors, necessitating strengthened screening protocols, public health awareness initiatives and strategies to reduce transmission risk. Although HBV trends were relatively stable, ongoing vigilance is essential to ensure blood safety. Age-wise and year-wise prevalence of HBV and HCV is depicted in [Table/Fig 2]. Maximum number of HBV seropositive donors were noted in the age group of 18-30 years, Total number of Seropositive donors from age group 18-30 years noted were 175 , followed by 87 in the age group of 31-40 years, 27 were noted in the age group of 41-50 years and least 11 were noted in age group of 51-60 years. Similar trends were noted for HCV Seropositive donors with maximum number of HCV seropositive donors 379 were noted in age group 18-30 years and least number of seropositive donors 16 were noted in the age group of 51-60 years. HCV vs age group results were statistically significant (p value 0.038) whereas it was not significant for HBV vs age group. Higher HBV and HCV seropositivity in age group 18-30 can be attributed to increased exposure to risk factors such as unprotected sex, tattoos and unsterile medical practices. This age group forms majority of blood donors and may include undiagnosed chronic carriers. Cumulative sex wise prevalence is depicted in [Table/Fig-3]. HBV seropositivity was noted more in males as compared to females. Prevalence rate of 1.41% for HBV was noted in males and 3.64% prevalence was noted in males for HCV with substantial statistical association for HCV (p value 0.031). Higher prevalence in males can be attributed to sex based immunological differences and increased exposure to behavioral and occupational transmission links. Year-wise distribution of hypertensive donors is depicted in Table/Fig-4. Maximum number of Hypertensive donors were

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noted in year 2023(0.46%) and least in year 2021(0.32%). Only donors with hypertension controlled on medications were included for donation. Occupation-wise Distribution of Donors as Percentage of total Donors in demonstrated in Table/Fig 5. Maximum HBV and HCV seropositivity is noted in Manual laborers 2.18% and 4.41% respectively. HBV and HCV were more prevalent among manual laborers due to lower awareness, unsafe practices and poor vaccination coverage.

Table 1: Year-wise Prevalence of HBV, HCV, and HIV. Chi-square test for year-wise variation: HBV: p = 0.325 → Not statistically significant, HCV: p = 0.027→ Statistically significant

Year	Total Donors	HBV Positive	HBV (%)	HCV Positive	HCV (%)
2021	4654	66	1.42%	182	3.91%
2022	4244	69	1.63%	150	3.53%
2023	4549	56	1.23%	136	2.99%
2024	4735	76	1.61%	183	3.86%
2025	2785	33	1.18%	80	2.87%
Total Number of donors	20697	300	1.43%	731	3.48%

Table 2: Age-wise and Year-wise Prevalence of HBV and HCV. Chi-square test: HBV vs Age Group: Not statistically significant p value 0.076, HCV vs Age Group: p = 0.038 → Statistically significant

Age Group	Year	HBV Positive	HBV (%)	HCV Positive	HCV (%)
18–30	2021	39	59.1%	97	53.3%
	2022	41	59.4%	80	53.3%
	2023	33	58.9%	68	50.0%
	2024	42	55.3%	91	49.7%
	2025	20	60.6%	43	53.8%
31–40	2021	18	27.3%	62	34.1%
	2022	20	29.0%	48	32.0%
	2023	16	28.6%	46	33.8%
	2024	24	31.6%	71	38.8%
	2025	9	27.3%	29	36.2%
41–50	2021	6	9.1%	19	10.4%
	2022	6	8.7%	18	12.0%
	2023	5	8.9%	17	12.5%
	2024	7	9.2%	18	9.8%
	2025	3	9.1%	8	10.0%
51–60	2021	3	4.5%	4	2.2%
	2022	2	2.9%	4	2.7%
	2023	2	3.6%	5	3.7%
	2024	3	3.9%	3	1.6%
	2025	1	3.0%	0	0.0%

Table 3: Cumulative Sex-wise Prevalence of HBV and HCV. Fisher's exact test: HBV vs Sex: Not statistically significant (p = 0.35), HCV vs Sex: Statistically significant (p = 0.031)

Sex	HBV Positive	HBV Negative	HBV (%)	HCV Positive	HCV Negative	HCV (%)
Male	299	20461	1.41%	730	20030	3.64%
Female	1	206	0.48%	1	206	0.48%

Table 4: Year-wise Number and Percentage of Hypertensive Donors (2021–2025). Chi square test. Not statistically significant (p = 0.291)

Year	Hypertensive Donors	Total Donors	Percentage (%)
2021	15	4654	0.32%
2022	18	4244	0.42%
2023	21	4549	0.46%
2024	19	4735	0.40%
2025	23	2785	0.83%

Table 5: Occupation-wise Distribution of Donors as Percentage of Total Donors (2021–2025). Chi square test. not statistically significant (p = 0.204). Total number of donors depicted in this table are 10,350. Remainder of donors lacked occupation data

Occupation	Total donors	HBV Positive	HBV%	HCV Positive	HCV%	Total infection%
Students	2600	42	1.62%	75	2.88%	4.50%
IT Professionals	2100	33	1.57%	51	2.43%	4.00%
Healthcare workers	1800	26	1.44%	37	2.06%	3.50%
Manual laborers	2200	48	2.18%	97	4.41%	6.59%
Others	1650	22	1.33%	39	2.36%	3.64%

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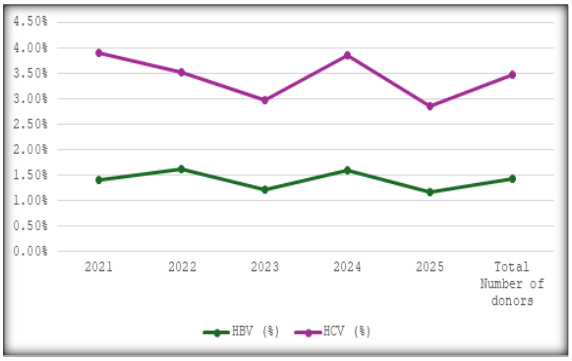

Figure 6: Year-wise Trends in HBV, HCV, and HIV Prevalence (2021–2025)

DISCUSSION

Each blood transfusion brings a plausible threat for transmissible diseases.[1,2] So it is mandatory to screening for infectious and transmissible markers in blood donations. Prevalence of infections among blood donors can be utilized as interim marker for detection of transmissible infections in a broader population. Nevertheless, few shortcomings such as exclusion of donors aged less than 18 years, aged more than 60 years along with paucity of female donors have been documented, however it persists as crucial measurement of overall disease impact. HBV, HCV are vital transfusion transmissible diseases. Australian antigen or HBsAg testing on donated blood has been performed from numerous years now, but in our nation, mandatory testing for HCV was implemented after year 2001.[3] World Health Organization advocates that to reduce risk of HBV infection via transfusion, screening should be conducted utilizing a extremely sensitive, HBsAg immunoassay either enzyme immunoassay or chemiluminescent immunoassay.[4] HBV is one of prominent key global health concern. HBV infection is 10th primary cause of mortality and HBV-related hepatocellular carcinoma is fifth chiefly observed carcinoma globally. Nearly 30% of global community has seropositivity reflecting prior or ongoing infection with HBV. India is classified as an intermediate HBV endemic zone, the number of HBV carriers is estimated to be 50 million, forming dominant global pool of chronic HBV infections.[5] HBV prevalence in India in global community ranges from 2% to 8% and 1% to 2% in blood donors in accordance with numerous researches conducted.[5-7] Panda and Kar,[7] conducted a research in Orissa and documented prevalence of HBsAg in blood donors to be 1.13%. Pahuja et al,[8] reported prevalence of 2.23% in Delhi. Garg et al,[9] documented prevalence as 3.44% on the higher side. In current research overall seropositivity for HBV over years was 1.43%. Overall prevalence rate in females was 0.48% whereas in males, it was 1.41%. prevalence range did not vary from year 2021 to 2025. HCV infection is an evolving public health global concern. HCV virus infects approximately 3% of global population, approximately 170 million population is more vulnerable for development HCV-related chronic liver disease.[10] Screening of blood for HCV should be conducted utilizing a extremely sensitive and specific HCV antibody immunoassay. Assay should also be able to detect genotypes specific to that nation or state.[4] Worldwide seroprevalence of HCV among blood donors varies from 0.4% to 19.2%. Nevertheless overall HCV prevalence in India has been documented as 2%. HCV Seroprevalence of voluntary blood donors in India ranges from 0.12 to 2.5%.[6-9,11] Research conducted by Pahuja et al prevalence of HCV in blood donors was documented as ranging from 0.66% to 2.5%.[8,11] Garg et al documented HCV prevalence in blood donors as 0.28%. In Orissa, HCV prevalence was documented as 1.98% by Panda et al.[7] In current research overall 5-year HCV seropositivity was 3.48% which was much higher as compared to research conducted by Meena M et al around 0.57%. Current research did not show variation among prevalence of HCV infection among blood donors in the past 5 years from year 2021 to 2025 but HCV was more prevalent than HBV depicted in Table/Fig 6. This can be attributed to ignorance, lower literacy rate and unawareness with regards to modes of transmission and prevention of the disease in this region of state in particular western Uttar Pradesh. Males were major affected in current research, overall prevalence rate in females was 0.48%% whereas in males, it was 3.64%. In conclusion, this research highlights critical issues with regards to HBV and HCV prevalence and also safety of blood supply in our nation. Moreover absence of HBsAg in blood of individuals without overt symptoms does not ensure lack of circulating HBV. HCV demonstrated notable upward trend in our research. With regards to huge population of our nation, even low prevalence accounts for larger number of infected people. Prevalence of mere 1% can affect millions of seropositive patients. Strict strategies are required on pressing basis that is inclusive of information spread, stringent screening protocol of blood & blood products, inclusion of nucleic acid amplification test, antibody to hepatitis B core antigen along with more efficacious donor recruitment, boosting voluntary donations, safe and protective sexual practices, adequate instruments sterilization, correct disposal of biohazardous material and vitally vaccination of vulnerable groups especially health care personnel.

CONCLUSION

Transfusion transmissible infections remain a persistent challenge, requiring sustained vigilance in blood safety. Stronger donor education, wider hepatitis B vaccination, and promotion of voluntary donations are vital for long-term control. Incorporating advanced screening tools such as nucleic acid testing and anti-HBc assays, alongside continued public health efforts, is essential to

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minimize transmission risks and safeguard the blood supply.

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