Seroprevalence of transfusion transmissible infections among blood donors at a tertiary care hospital in urban area of Nepal

Bipin Nepal[1], MS; Sabindra Maharjan[1], MMLT; Sunil Bhasima[1], BMLT; Achyuta Adhikary[1], CMLT; Akriti Ghimire[2], MBBS; Prajwol Bhurtel[3], MD; Krijan Man Vaidya[4], BMLT

[1] Department of Transfusion Medicine, Grande International Hospital, Kathmandu, Nepal

[2] Department of Medicine, Nepal Medical College, Kathmandu, Nepal

[3] Department of Pediatrics, Grande City Hospital, Kathmandu, Nepal

[4] Department of Laboratory Medicine, Grande International Hospital, Kathmandu, Nepal

ABSTRACT

Background

Infection with hepatitis B virus (HBV), hepatitis C virus (HCV), human Immunodeficiency Virus (HIV) and syphilis are serious complications of blood transfusion. These infections are always screened by blood banks. Such tests are mandatory for transfusion safety in Nepal and the entire world. This study was aimed at determining the seroprevalence of HBV, HCV, syphilis and HIV.

Method

A retrospective analysis of blood donor data from June 2017 to May 2020 was conducted at Blood Bank of Grande International Hospital, Kathmandu, Nepal. Sera samples were screened for hepatitis B surface antigen (HBsAg), antibodies to hepatitis C virus (HCV), human immunodeficiency virus (HIV) 1 & 2 by Enhanced Chemiluminance Assay method, using diagnostic kit from Johnson & Johnson at Vitros 5600 machine and by Immunochromatography method for Treponema pallidum antibody, commercially available immunochromatography based kits from SD biosensor.

Result

Out of 8811 candidate blood donors, 133 (1.5%) donors were serologically reactive with either one of Transfusion Transmitted Infection. Seroprevalence of HIV, HBV, HCV and syphilis infection was 0.17%, 0.39%, 0.28% and 0.65% respectively. The prevalence of TTIs was 1.55% for male and 1.31 % for female in the donation population.

Conclusion

The prevalence of HIV, HBV, and HCV was higher in male donor whereas syphilis show high prevalence among the female donors. According to age group HIV prevalence was highest among blood donors of the age group 21 to 30 years of age.

Keywords: **blood; transfusion; transmissible infections; blood donor**

Introduction

Blood transfusion and component therapies are essential medical practices; however these medical practices are not without risks and may lead to the transmissions of infectious agents from donor to recipient. Common infectious agents include hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV) and syphilis[1] which are also included in our National Guidelines on Screening Donated Blood for Transfusion-Transmissible Infections[14]. HIV, hepatitis B, and hepatitis C are major public health problems in developing countries. They are transmitted parenterally, vertically, or through high-risk sexual behaviors and can cause fatal acute and chronic life-threatening disorders. With every unit of

Corresponding Author:
Bipin Nepal, MS
Email: nepalbipin@hotmail.com
Received: 3 March 2021
Accepted: 21 January 2022

blood, there is 1% chance of transfusion-associated problems including transfusion-transmitted diseases. Among all infections HIV and hepatitis are the most dreadful. The first case of transfusion-associated AIDS was described in an infant given transfusion for erythroblastofoetalis[6].In Nepal, HIV prevalence among 15-49 sexually active age group was 0.13%.On the other hand, the overall prevalence of hepatitis B in Nepal is estimated at 0.9%[2,3]. HCV seroprevalence among Nepalese general population and blood donors has been reported to range from 0.1 to 1.7%[2,4]. A high prevalence of Human Immune deficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV) and syphilis in blood donors poses an increased risk of window period transmission through blood transfusion. Due to cost limit and lack of Nucleic Acid Amplification Test(NAAT) in the Transfusion Transmitted Infection (TTI) screening blood units, the chance of detection of blood borne pathogens is limited in our developing country during window period that lead to high chance of infection among the Nepalese patients. So, this study aim at the finding prevalence rate of HIV, Hepatitis B, Hepatitis C and syphilis among the blood donors at the tertiary level hospital, Grande International Hospital, Dhapasi, Kathmandu, Nepal with high specific and sensitive test Enhanced CLIA to reduce the risk of infection transmission to the Nepalese patients.

Materials and metods

This cross-sectional study was performed at Grande International Hospital, Department of Transfusion Service, and Dhapasi Kathmandu. The total sample number included the number of blood donors donating blood only once during the study period from 2017 June to 2020 May. The sample site of the study was located in Kathmandu valley where there is high demand for the blood supply. All the replacement and non-remunerate volunteer healthy blood donors who have participated in blood donation program organized by different social organizations, private sectors, local government and individuals were first assigned unique donor donors and bag number. The donor went through the pre-donation screening asking some questionnaires as per the National guideline of transfusion service[14]. The donors were randomly selected for the sampling method. The information included in the guideline criteria of Donor Health Quarries (DHQ) includes Age limit, donor appearance and inspection, vital signs such as pulse, body temperature and pressure, hemoglobin screening, donor medical history about non communicable diseases such as anemia, coagulation disorder, cardiovascular disease, hypertension, thrombosis, Gastrointestinal disease, metabolic and endocrine disease diabetes and thyroid, immunological disease (allergy), central nervous system disease cardiovascular, epilepsy, dementia, multiple sclerosis, the donors were asked about immunization and vaccine, Blood transfusion and transplantation, medication diagnostic and surgical procedure and donor risk assessment such as viral infection HIV, Hepatitis B, Hepatitis C, Hepatitis A. The consent was taken for every blood donors during counseling who were eligible to donate the blood. The donor who was not eligible to donate blood as per the criteria was excluded from the study. About 350 -450 ml of blood units were collected in the mother bag and 3-4 ml of blood volume collected in labeled Ethylenediaminetetraacetic acid (EDTA)and Gel clot activator Tube as per Standard Operating Procedure (SOP) of National Guidelines. All samples were screened for hepatitis B surface antigen, anti-human immunodeficiency virus antibodies, hepatitis C virus and Venereal Diseases Research Laboratory (VDRL) reactivity. The date was entered in Microsoft Excel 2010 for the analysis. The total number of seroreactive cases and their distribution were noted. The seroreactive of the sample was repeated and confirmed with two different methods. Then the donors were concealed by the Transfusion Medicine specialist and referred to National Public Health Laboratory, Teku, Kathmandu for further confirmation with NAAT or other assay.

Table 1: Reagent and company used in donor screening

Kit	Method	Company
Diagnostic kit for Ab to HIV 1 and 2	ECI	J & J company, ortho-clinical diagnostics, UK
Diagnostic kit for Ab to HCV	ECI	J & J company, ortho-clinical diagnostics, UK
Diagnostic kit for Ab to HBV surface antigen	ECI	J & J company, ortho-clinical diagnostics, UK
Diagnostic kit for Ab to Treponema palladium	ICT	SD biosensor, standard Q syphilis Ab, Korea

Table 2: Seroprevalence of transfusion-transmissible infections : Total Reactive case n= 133 (1.50%) and Total population N= 8811

Gender	Total	HIV	HBV	HCV	Syphilis	Total Reactive TTI
Male	7334(83.24%)	13(0.17%)	31(0.42%)	22(0.29%)	48(0.58%)	114(1.55%)
Female	1447(16.42%)	2(0.13%)	4(0.27%)	3(0.20%)	10(1.03%)	19(1.31%)
Total	**8811(100%)**	**15(0.17%)**	**35(0.39%)**	**25(0.28%)**	**58(0.65%)**	**133(1.50%)**

Table3: Seroprevalence of Transfusion Transmissible Infections (Donor Type distribution)

Types of donor	Total	HIV	HBV	HCV	Syphilis	Total Reactive TTI
Volunteer	5730(65.03%)	10(0.17%)	25(0.43%)	17(0.29%)	41(0.71%)	93(1.6%)
Replacement	3081(34.96%)	5(0.16%)	10(0.32%)	8(0.25%)	17(0.55%)	40(1.29%)
Total	**8811(100%)**	**15(0.17%)**	**35(0.39%)**	**25(0.28%)**	**58(0.65)**	**133(1.50%)**

Table 4: Seroprevalence of Transfusion Transmissible Infections(Age group wise distribution)

Age Group	Total	HIV	HBV	HCV	Syphilis	Total Reactive TTI
18-20	1199(13.60%)	1(0.08%)	5(0.4%)	2(0.16%)	7(0.58%)	15(1.2%)
21-30	4938(56.04%)	5(0.10%)	17(0.34%)	12(0.24%)	20(0.40%)	54(5.7%)
31-40	1776(20.1%)	6(0.33%)	11(0.56%)	8(0.45%)	19(1.06%)	43(2.4%)
41-50	734(8.3%)	3(0.40%)	2(0.27%)	3(0.40%)	13(1.7%)	18(2.4%)
>50	164(1.8)	0	0	0	2(1.2%)	3(1.8%)
Total	8811	15	35	25	58	133

Results

1. Demographic Characteristics of the participant

The characteristics of the study population are shown in Table 2 where major group were male accounting 83.23 % and 16.42% were female donors. Their age group ranges from 18 to 65 years in which age group 21 to 30 years shows large participation in blood donation Table 3. Out of 8811 total donation, 65.03% were volunteer donor and 34.96% were replacement donors for their relatives. Majority of volunteer donor were from different social organization, colleges, private sectors, bank etc. and replacement donor were from the family member of admitted patient inside different wards of hospital.

2. Major TTI

Out of 8811candidate donors, 133 (1.5%) donors were serologically reactive with either one of Transmitted Transfusion Infection. Seroprevalence of HIV, HBV, HCV and syphilis infection was 0.17%, 0.39%, 0.28% and 0.65% respectively. The prevalence of TTIs was 1.55%for male and 1.31 % for female in the donation population. The prevalence of HIV, HBV, and HCV was higher in male donor whereas syphilis show high prevalence among the female donors. According to age group HIV prevalence was highest among blood donors of the age group 21 to 30 years of age. According to the type of donors high prevalence of positive case was found among the volunteer donors (1.6 %.)

Discussion

Total 133 individuals (1.33%) tested seropositive for at least one of the screened pathogens. A report by Misganaw Birhaneselassie shows 1.7%, Leena et al indicated a 1.35% and another report demonstrated a 3.8% positive rate in Eritrea[12].The prevalence of HIV, HBV HCV and Syphilis during our study on blood donors was 0.17%, 0.39%, 0.28% and 0.65% respectively. As comparison, this report is similar to the early study done in Nepal by Ashish Chandra etal 2009 at Tribhuwan University Kritipur in which HIV HBV

Table 5: Comparison of transfusion transmitted infections prevalence rate with other studies

Studies	HIV	HBV	HCV	Syphilis
Sushma A chandekaretal, 2011, Maharastra, India	0.26	1.30	0.25	0.28
Ashish Chandra etal, 2009, kritipur, Nepal	0.12	0.47	0.64	0.48
Yan Sang etal, 2010, Macau, China	0.87	0.86	0.31	0.70
MF Khattaketal, 2002. Pakistan	0.007	3.3	4.0	--
Arora D etal, 2010,south Haryana, India	0.3	1.7	1.0	0.9
	0.17	0.39	0.28	0.65
Tessema *et al*. (2010), Northwest Ethiopia	3.8	4.7	0.7	1.3
El-Hazmi MM etal, 2004, Saudi Arabia	0	1.5	0.4	---

HCV and syphilis was detected in 0.12%, 0.47%, 0.64% and 0.48%[2]. The study report is also similar to the earlier study performed in India Maharastra by Sushma A chandekar asseroprevalence rate of HIV, HBV, HCV and syphilis as 0.26, 1.30, 0.25 and 0.28 respectively. However, the seroprevalence report is higher in percentage of HIV, HBV and HCV to the study done by Yansangetal, and Arora D[6,8]. Another study done by El-Hazmi MM et al, 2004, Saudi Arabia also reveals higher prevalence of HBV and HCV. The differences in the prevalence between our study and other studies may be attributed to differences in the sensitivities of the assays used, the criteria of positivity, types of donors as well as in the degree to which individuals with risk factors for blood-borne viral infections may have been excluded. In our study a fourth generation ECI were used, which were more sensitive and more specific.

In our study seroprevalence of TTIs was higher among male donors (1.55%) compared to female donors (1.33%) as the study done Ashish chandraetal[2], sushma A chandekaretal[5] Arora D etal[6].The findings could indicate some risk behaviors of males, such as outside socialization, multiple sex relationships, etc. or it may not be valid due to less participation of female donor and not willing to donate the blood.

The prevalence rate of seropositive slightly higher among volunteer donors (1.6%) in our study than replacement donor (1.2%). This study is different from the study done by Misganaw Birhaneselassie in which prevalence rate of TTI reactive case is more in replacement donor(7.5%) than volunteer donors[12]. In a family/replacement blood donor system, a donor gives blood when it is required by a member of the family or community of a patient. This stricter screening of donated blood and implementation of more donor selection criteria, higher percentage of volunteer donors might affect the result value.

According to the prevalence of age group our study reveals the higher percentage (5.7%) of TTI positive was found at the age group of 21 years to 30 year. The find of this result was similar to the study done at Nepal, Tribhuwan University by Ashish Chandra etal 2009.The higher case reported in this age group reflect the high risk age group, sexually active group or high number of blood donor of this group.

Conclusion

Our study shows that there is high prevalence of reactive cases among the healthy donor. In our country, most of the regional blood bank depends upon rapid test for the screening of TTI. Therefore, selection of donors with low TTI risk and effective laboratory screening is very important part in blood bank processing which has reduced the risk of transmission to very low levels. To minimize this risk, we recommend to using high level of specific and sensitive method such as enhanced CLIA and NAAT method, report the result of the test and follow up counseling and promote the young donors who have no history of pervious blood transfusion to minimize the risk of TTI. The study reflects the seroprevalence of the general population in our area, which may be helpful in planning public health interventional strategies. The major limitation of the study is that there is no many study done and no sufficient article available for comparison and analysis of the trends. Hence, we hereby recommend for future studies to look into trends for TTIs from this area.

Reference

1. Schreiber GB, Busch MP, Kleinman SH, Korelitz JJ. The risk of transfusion-transmitted viral infections. The Retrovirus Epidemiology Donor Study. N Engl J Med. 1996;334(26):1685-90.
2. Shrestha AC, Ghimire P, Tiwari BR, Rajkarnikar M. Transfusion-transmissible infections among blood donors in Kathmandu, Nepal. J Infect Dev Ctries. 2009 ;3(10):794-7.
3. American Sociological Association 2006 "Country Progress Report NEPAL To Contribute to Global AIDS Monitoring Report", 2016
4. Naveira MCM, Badal K, Dhakal J, Mayer NA, Pokharel B, Del Prado RF. Seroprevalence of hepatitis B and C in Nepal: a systematic review (1973-2017). Hepatol Med Policy. 2018;3:10. doi: 10.1186/s41124-018-0039-2.
5. Chander A, Pahwa VK. Status of infectious disease markers among blood donors in a teaching hospital, Bhairahawa, western Nepal. J Commun Dis. 2003;35(3):188-97.
6. Arora D, Arora B, Khetarpal A. Seroprevalence of HIV, HBV, HCV and syphilis in blood donors in Southern Haryana. Indian J Pathol Microbiol. 2010;53(2):308-9.
7. El-Hazmi MM. Prevalence of HBV, HCV, HIV-1, 2 and HTLV-I/II infections among blood donors in a teaching hospital in the Central region of Saudi Arabia. Saudi Med J. 2004; 25(1):26-33.
8. Song Y, Bian Y, Petzold M, Ung CO. Prevalence and trend of major transfusion-transmissible infections among blood donors in Western China, 2005 through 2010. PLoS One. 2014;9(4):e94528. doi: 10.1371/journal.pone.0094528.
9. Tessema B, Yismaw G, Kassu A, Amsalu A, Mulu A, Emmrich F, et al. Seroprevalence of HIV, HBV, HCV and syphilis infections among blood donors at Gondar University Teaching Hospital, Northwest Ethiopia: declining trends over a period of five years. BMC Infect Dis. 2010;10:111. doi: 10.1186/1471-2334-10-111.
10. Giri PA, Deshpande JD, Phalke DB, Karle LB. Seroprevalence of transfusion transmissible infections among voluntary blood donors at a tertiary care teaching hospital in rural area of India. J Family Med Prim Care. 2012;1(1): 48-51.
11. Birhaneselassie M. Prevalence of Transfusion-Transmissible Infections in Donors to an Ethiopian Blood Bank Between 2009 and 2013 and Donation Factors That Would Improve the Safety of the Blood Supply in Underdeveloped Countries. Lab Med. 2016;47(2):134-9.
12. Leena MS. Trend and prevalence of transfusion transmitted infections among blood donors in rural teaching institute, South India. J Pathol Nepal 2012;2:203–206
13. Fessehaye N, Naik D, Fessehaye T. Transfusion transmitted infections - a retrospective analysis from the National Blood Transfusion Service in Eritrea. Pan Afr Med J. 2011;9:40. doi: 10.4314/pamj.v9i1.71219.
14. Public Health Update. National Blood Transfusion Policy. Nepal; Ministry of Health and Population. 2071. https://publichealthupdate.com/national-blood-transfusion-policy-2071