Original Article

Seroprevalence of human immunodeficiency virus, hepatitis B virus, and hepatitis C virus among hemodialysis patients in a Tertiary Care Teaching Hospital in a developing country

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Abstract

Background: Human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV) prevalence in hemodialysis patients varies geographically, both within and between countries. High prevalence of these infections in dialysis patients reflects the increased presence of common risk factors for their acquisition, including transfusion, transplantation, history of drug abuse, plus susceptibility to nosocomial transmission during dialysis. **Objective:** The aim of this study is to investigate the seroprevalence and clinical profile of HIV, HBV, and HCV patient's on hemodialysis. **Materials and Methods:** Clinical and epidemiological data of patients undergoing maintenance hemodialysis in the dialysis unit of a teaching institution were obtained and analyzed over a 5 years' period. **Results:** A total of 127 males and 69 females were studied. Their mean age was 50.45 years. Out of the total 196 dialysis-dependent patients, 2 (1.02%) were seropositive for HIV antibodies, 6 (3.06%) were hepatitis B surface antigen positive, and 30 (15.30%) were anti-HCV antibody positive. There was no coexistence of HIV, HBV, and HCV markers. The major primary renal diseases in hemodialysis patients included diabetes mellitus (42%), hypertension (22%), chronic nephritis (15%), urologic diseases (6%), cystic renal diseases (4%), and others (11%). **Conclusion:** Prevalence of transfusion-transmissible viral infections was higher among hemodialysis patients, especially HCV infection which was an alarming situation and therefore strict adherence to infection control strategies, barrier precautions, and preventive measures, including routine hepatitis B vaccination and regular virological follow-up were recommended along with regular education and training programs of technical and nursing personnel's involved with dialysis patients.

Key words: Hemodialysis, nosocomial transmission, serconversion, seropositive

INTRODUCTION

Human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV) prevalence in hemodialysis patients varies geographically, both within and between countries. The high prevalence of these infections in dialysis patients reflects the increased presence of common risk factors for their acquisition, including a history of drug abuse, transfusion, and transplantation plus susceptibility to nosocomial transmission during dialysis.[1] Sharing

Access this article online

Quick Response Code:

Website: www.ijstd.org

DOI: 10.4103/ijstd.IJSTD_53_17

How to cite this article: Kansay S, Sekhon J, Rana S. Seroprevalence of human immunodeficiency virus, hepatitis B virus, and hepatitis C virus among hemodialysis patients in a tertiary care teaching hospital in a developing country. Indian J Sex Transm Dis 2019;40:120-5.

of supplies, instruments, or medications between hemodialysis patients and reuse of dialyzers increases the spread of these infections between patients.[2,3] Following a reduction in the transmission from blood products that have been screened for the presence of these viruses, nosocomial spread of these infection on account of failure to adhere to universal infection prevention measures has assumed more significance.[4] Although blood for transfusion is screened for these viruses, blood transfusion still remains a major risk factor for transmission of these infections as viruses in the blood could have been in the window period or there could have been contamination from the other positive patients within the dialysis unit.[5] HBV DNA has been detected in serum and peripheral blood mononuclear cells of hepatitis B surface antigen (HBsAg)-negative hemodialysis patients and staff, and they are, therefore, potentially infectious to other patients and staff.[6] The general prognosis of hepatitis in patients on maintenance dialysis is usually benign as most of these patients have no clinical symptoms except for episodic mild increases in serum aspartate aminotransferase and alanine aminotransferase, they, therefore, become carriers and potentially sources of infections.[5,7] Lack of implementation or breakdown in standard infection control practices like failure to appropriately change gloves between patients, sharing of dialysis equipment, sharing of a multi-dose heparin vial, and lack of disinfection of machines between treatments are usually thought to be responsible for most of the documented instances of transmission of these viral infections in hemodialysis units.[8] Therefore, strict observance of hemodialysis precautions including the cleaning and disinfecting of instruments, surfaces, and surrounding equipment etc., remains of paramount importance.

Study aim

The aim of the present study was to investigate the seroprevalence and clinical profile of HIV, HBV, and HCV patients on maintenance dialysis.

MATERIALS AND METHODS

Clinical and epidemiological data of patients undergoing maintenance hemodialysis in the dialysis unit of a teaching institution were obtained from January 2011 to December 2015. A total of 196 patients (127 males, 69 females) with end-stage renal disease (ESRD) and on maintenance dialysis were recruited into the study. This comprised all patients on maintenance dialysis at that time.

Age, sex, HBsAg, anti-HIV-1, 2, and anti-HCV antibody and the primary cause of end-stage kidney disease were examined. Serum samples were screened using rapid screening kits, that is, Hepacard; J. Mitra for HBsAg, HCV Tridot; J. Mitra for anti-HCV and HIV Tridot; J Mitra for anti HIV-1, 2 in Microbiology department of the hospital. Those samples found seropositive in rapid tests were examined using commercial third-generation enzyme-linked immunosorbent assays kits, that is, erbalisa hepatitis B; Transasia – Biomedicals Ltd., or Hepalisa; J Mitra for HBsAg, erbalisa hepatitis C Transasia - Biomedicals Ltd., or HCV Microlisa, J Mitra for Anti HCV and Erbalisa HIV 1 and 2; Transasia - Biomedicals Ltd., or HIV Microlisa; J. Mitra for anti HIV-1, 2.

Seropositivity status for these three viral markers for all the hemodialysis patients at the time of their first dialysis was not available; therefore, a number of new infections were not analyzed. Viral markers for all these patients were repeated after every 10 consecutive hemodialysis. The dialysis unit of this hospital had a strict policy of segregating HIV, HBV, and HCV-infected patients from uninfected patients. The infected patients were dialyzed in a geographically separate room. The dialysis machines used for infected patients were also separate from those used for dialyzing uninfected patients. Universal precautions were followed strictly and the technical or nursing staffs dealing with infected patients were not allowed to come in contact with uninfected patients or other staff members while they were taking care of the infected patients undergoing dialysis. The technical and nursing staff members were vaccinated against hepatitis B. Moreover, an attempt was also made to vaccinate all patients who were initially HBs Ag negative or are recruited new during the study period, but not all patients completed the vaccination mostly due to the fact that they either discontinued treatment or did not come to this center subsequently.

RESULTS

From 196 hemodialysis patients, 69 (35.2%) of them were female and 127 (64.7%) were male, and the age ranged from 18 to 82 years with mean age 50.45 years and median age 50 years. The mean age of these patients was 50.57 years for males and 50.23 years for females. 149 (76.0%) of the patients were between the age group of 40 and 69 years, 41 (20.9%) were between the age group of 18 and 39 years, and 6 (3.1%) were between 70 and 8 2 years of age [Figure 1].

In this study, 38 (19.38%) patients were seropositive for one of the three transfusion-transmissible viral

diseases, i.e., HIV, HBV, and HCV. 2 (1.02%) patients (2 males and 0 female) were HIV seropositive; 6 (3.06%) patients (4 males and 2 females) were HBsAg seropositive whereas 30 (15.30%) patients (21 males and 9 females) were anti-HCV seropositive [Figure 2]. There were no co-infections, i.e., seropositive for more than one of these viral infections.

The major primary renal diseases in these patients included diabetes mellitus (42%), hypertension (22%), chronic nephritis (15%), urologic diseases (6%), cystic renal diseases (4%), and others such as systemic lupus erythematosis, nonspecific chronic pyelonephritis, and those with unknown etiology (11%) [Figure 3].

Out of 196 patients enrolled in the study, 6 patients died during the study period, of which one was HIV seropositive.

After an average of 75.33 sessions of hemodialysis and an average of 33 months of initiation of hemodialysis seroconversion took place in those patients (16 patients) who were seronegative at the initial screening and became seropositive while on hemodialysis maintenance therapy.

DISCUSSION

As the parenteral exposure is a major route for transmission of viral infections, hemodialysis patients are at particular risk of acquiring them with a number of blood transfusions being the most important risk factor for their acquisition.[4,9] In a study from North India, 5.41% of hemodialysis patients were infected with HBV and 3.61% with HCV and 2 had co-infection with HBV and HCV.[4] In contrast to it, in the present study, the prevalence of HCV (15.30%) was quite higher than HBs Ag (3.06%) and HIV (1.02%). However, similar earlier studies from the present institute, also concluded that the prevalence of HCV infection was a little higher among the patient population (3.5%) and the healthy blood donors (1.42%) when compared to HBsAg (the patient population [1.38%] and the healthy blood donors [1.27%)]) and HIV (healthy blood donors 0.2%).[10,11] which indicates the overall high prevalence of HCV in the general population of this region. In a similar study from Morocco, the prevalence of anti-HCV and HBsAg was 60% and 6%, respectively in hemodialysis patients while for peritoneal dialysis patients, it was anti-HCV and HBsAg; 8% and 2.6%, respectively.[12] In an Italian multicentric cross-sectional study of HIV, HBV, and HCV markers among dialysis patients, 28% of patients were a potential source of infections for other patients and staff which emphasizes the need for stricter adherence to infection control, barrier

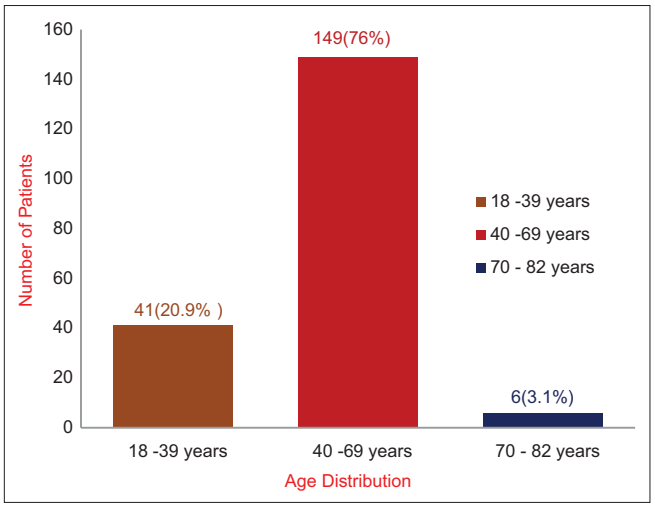

Figure 1: Distribution of hemodialysis patients between 3 different age groups

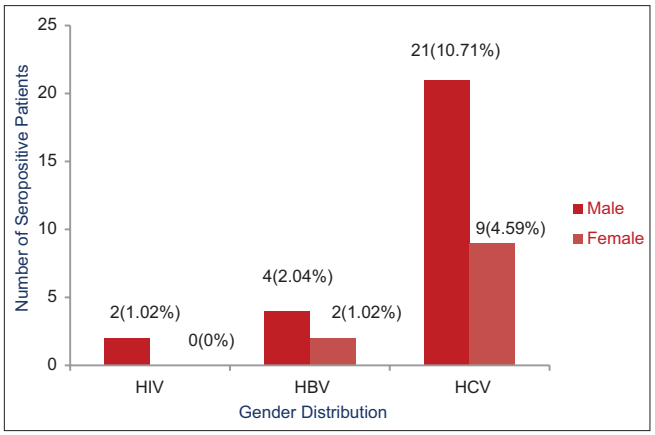

Figure 2: Gender distribution of seropositive patients

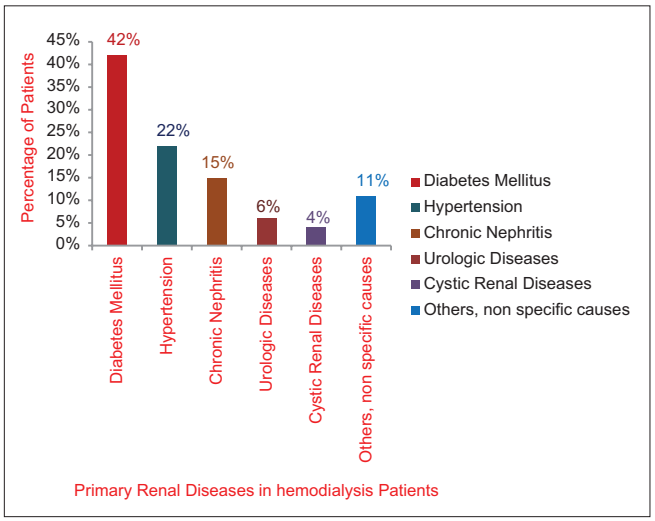

Figure 3: Distribution of primary renal diseases in hemodialysis patients

precautions and preventive behavior's with all patients.[13]

In a study from Tabriz, the median age for hemodialysis patients was 54.9 years (range: 13–90 years)[14] which was similar to the findings of the present study where the median age of patients undergoing dialysis was 50 years (range: 18–82 years).

Hemodialysis is considered a low-risk setting for the transmission of HIV infection, providing that dialysis unit precautions are carefully observed.[15] In the present study also the prevalence of HIV seropositivity (1.02%) was quite lower than that of HBs Ag and anti HCV but still it was higher than that of healthy blood donors (0.2%).[10]

The endemicity of HBV varies globally. Among hemodialysis patients from Japan, Tabriz, Iran, and Bangladesh, the seroprevalence of HBsAg was 2.6%, 3.2%, 3.5%, and 1.6%, respectively.[14,16,17] The present study also has similar findings, with prevalence of HBsAg being 3.06%. In contrary to these studies, China reported very high (37.5%) prevalence of HBV infection in their maintenance hemodialysis patients which was quite higher than that of their controls (9%).[2] As concluded by Shahin *et al*. in their study, lower prevalence of HBsAg (1.6%) in their hemodialysis patients probably was due to routine screening for HBsAg before selection of patients for dialysis. On the other hand, HBsAg was found in higher frequencies in their predialysis diabetic chronic kidney disease patients (16%) which was attributed to the fact that these patients had not undergone routine screening for HBsAg and vaccination.[17] Dialysis-related risk varies as varied HBsAg prevalence rates were observed among kidney transplant, hemodialysis, blood transfusion-dependent patients, and nonvaccinated healthcare workers: 29.4%, 17%, 22.5%, and 9.6%, respectively.[18] Multivariate analysis by Ferreira *et al*. revealed that among all risk factors studied, only gender, history of blood transfusion before 1993, and length of time on hemodialysis were significantly associated with HBV positivity; patients who received blood transfusion before 1993 had a 2.3-fold greater risk of HBV positivity compared to those that were transfused after.[19]

Patients on maintenance hemodialysis are also at greater risk of hepatitis C infection than the general population,[4-6,13,20] with seroprevalence rates across dialysis centers in Western Europe ranging from 3% in the UK to 30% in France.[21] High-HCV seropositivity were found in studies from Kosova (43%), Palestine (22%), and Taiwan (58.8%).[3,22,23] Even in the present study, prevalence of HCV (15.3%) was the highest of all the three viral infections. The prevalence of anti-HCV-positive patients on long-term dialysis in northern Europe was <5%, around 10% in most of southern Europe and the USA while it was between 10% and 70% in many countries of the developing world, including North Africa, Asia, and southern America.[9] A very high prevalence of HCV infection (71%) was observed among the hemodialysis patients in a study from Venezuela where nosocomial transmission of HCV was suspected to be major reason for the spread of HCV in their patients.[24] In a study by El-Kader *et al*., usually same staff were taking care of susceptible and infected patients in the same shift and they did not routinely discard gloves after use; that practice might had facilitated the dissemination of HCV RNA between their patients.[23] Fabrizi observed the persistence of an increased HCV-associated cardiovascular risk.[9] Furthermore, HCV plays a role in atherogenesis through the aggravation of metabolic syndrome and dyslipidemia resulting in the higher mortality rate of infected dialysis patients than noninfected patients.[25,26] HCV-infected dialysis patients, candidates for renal transplantation needs to be treated before transplantation, since HCV infection has a negative impact on graft and patient survival and interferon therapy remains contraindicated after transplantation because of the serious risk of graft rejection.[26] In addition, one study found that male dialysis patients infected with HCV had a significantly higher concentration of serum HCV RNA than females.[27,28] Since, prevalence of HCV infection in our study was more than that of HIV and HBV and its frequency is even higher in male patients (males vs. females i.e., 21 vs. 9), it is of prime concern to minimize the transmission of HCV infection among dialysis patients.

The main risk factors for high prevalence of these infections among hemodialysis patients were age, history of blood transfusions, treatment at various centers, tattooing or cupping, intravenous drug use, and history of kidney transplantation.[4,23,29,30] Multivariate analysis demonstrated that seropositive status was linked to the time on hemodialysis, previous kidney transplantation and the presence of anti-HBc antibodies and surrogate markers, whereas erythropoietin therapy and carrying out dialysis in dedicated spaces seem to protect against these infections.[1] According to Franco *et al*. study from Italy, vaccination against HBV did not influence

the diffusion of HBV in their dialysis units and it must be coupled with the implementation of long-standing infection control strategies.[31] The Taiwan Society of Nephrology had launched practice guidelines for hemodialysis and had proposed strict infection control measures and suggested beds/machines dedication for both HBsAg (+) and anti-HCV (+) patients which resulted in low annual seroconversion rate for HBsAg and anti-HCV.[23] Early vaccination against HBV to susceptible patients prior to ESRD was recommended as vaccine was less effective in patients already on dialysis and a protective anti-HBs level developed in only approximately 50%–60% even when double-dose regimen was used which was probably due to the advanced age and reduced immunity in these patients.[17,32] In contrary to all these studies, a study by Chang *et al*. from Taiwan, serological tests showed 13.7% of hemodialysis patients as HBsAg (+) and 17.3% as anti-HCV (+) while they were unable to detect HBV DNA in 42.2% of HBsAg (+) patients and HCV RNA in 26.2% anti-HCV (+) patients.[32,33] Their findings seem to be challenging the suggested principles of bed and machine dedication and the diagnosis of viral hepatitis in hemodialysis patients.

CONCLUSION

Prevalence of transfusion-transmissible viral infections is higher among hemodialysis patients especially HCV infection which is an alarming situation and therefore strict adherence to infection control strategies, barrier precautions and preventive measures are recommended along with regular education and training programs of technical and nursing personnel's involved with dialysis patients. Early and routine Hepatitis B vaccination and regular virological follow-up based on detecting the specific viral antigens and antibodies with sensitive, specific new-generation serological tests are required for dialysis units. However, new infections in hemodialysis units should be identified by determining the DNA/RNA status of seronegative patients using standardized real-time polymerase chain reaction assays.[1]

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

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