Original Article

Prevalence of Hepatitis B and Hepatitis C in Patients undergoing hemodialysis at a teaching hospital in Uttarakhand

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Abstract

Introduction: Hemodialysis (HD) requires blood exposure to infectious materials through the extracorporeal circulation for a prolonged period, and exposure to risk factors for nosocomial infections is always there. **Aims and Objectives:** To determine the prevalence of hepatitis B and hepatitis C in patients undergoing hemodialysis and evaluate the various modes of transmission involved in the causation of the infection. **Materials and Methods:** A total of 60 patients with chronic kidney disease, admitted to our hospital for HD, were screened for hepatitis B surface antigen (HBsAg) and anti-HCV antibodies. A questionnaire was designed to evaluate risk factors and data were generated to evaluate the significance of the association. **Results:** Out of 60 subjects, an anti-HCV antibody was detected in 31.68% of patients and 11.66% of patients were positive for HBsAg. The maximum anti-HBV-positive patients were in >60 years of age group (11.53%), whereas the maximum HCV-positive patients were between 41 and 50 age group (23.07%). Most of the HCV-positive patients (54.54%), as well as HBV-positive patients (23.52%), received hemodialysis 50 to 100 times. The major primary disease-causing end-stage renal disease (ESRD) included chronic nephritis (35%). The duration of dialysis, multiple blood transfusions, drug addiction, and body piercing/tattooing were also observed as significant risk factors. **Conclusion:** In HD patients, viral hepatitis poses a significant health hazard, particularly in developing countries. HBV vaccination, strict adherence to the universal precautions, segregation of HBV-positive patients can control HBV infection in HD units. However, for HCV, the absence of a specific vaccine and the nosocomial transmission of the virus increase the peril more.

Keywords: HBsAg, HCV antibody, hemodialysis, immunocompromised, nosocomial

Introduction

In the renal dialysis units, hepatitis B (HBV) and hepatitis C (HCV) viral infections are significant causes of morbidity and mortality in hemodialysis (HD) patients, and management of such patients becomes complicated in lieu of these infections.[1] For patients with severe renal impairment, acute renal failure, and stage IV chronic renal failure, HD is a simulated way of maintaining hemostasis in the body. Most of the patients undergo dialysis for prolonged periods of time and are exposed to the various side effects occurring as a consequence of this procedure. The transmission of the virus to HD patients is generally nosocomial and potential risk factors include failure to disinfect devices between patients, sharing of single-use vials for infusion, improper aseptic techniques, contaminated dialysis equipment, and supplies and contamination by attending personnel. However, long-standing vascular exposure and manifold blood transfusions can also be major contributors.[2] Also, HD patients are already immune-compromised due to irrevocable renal compromise, which contributes to infection by these viruses.[3]

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In highly endemic areas, HBV/HCV co-infection is not uncommon, and also subjects with a high risk of parenteral transmission can have this dual infection as the modes of transmission for these two hepatotropic viruses are the same. The risk of progression to cirrhosis and decompensated liver disease is accentuated with an added risk of hepatocellular carcinoma (HCC) in these patients with dual HBV/HCV infections. The prevalence of HCV among dialysis patients in India is reported to range between 20% and 80% and that of HBV among dialysis patients in India is reported to range between 3.4 and 43%.[4] Chronic infections with HBV and HCV can have potential health risks due to the progression to hepatic cirrhosis and hepatocellular carcinoma.[5]

In HD units, HBV infection is less prevalent than HCV and this can be attributed to routine screening, vaccination programs, infection control measures for HBV, and higher rates of viral clearance.[6] In fact, the segregation of HBV-positive patients, utilization of devoted dialysis machines, and customary surveillance for HBV infection have considerably reduced the increase of HBV.[7] In HD settings, the guiding principles for preventing HCV infection are elemental infection control practices and customary screening of HD patients for HCV. The isolation of HCV-infected patients or the use of dedicated machines for such patients is not advocated, except when local outbreaks are reported. Adherence to universal precautions stringently plus the isolation of HBV- and HCV-infected dialysis patients might help control disease spread in HD units.[8,9]

This study aimed to determine the prevalence of hepatitis B surface antigen (HBSAg) and anti-HCV antibody in patients undergoing HD in our tertiary care hospital and evaluate various modes of transmission involved in the etiology of these infections.

Materials and Methods

A 6-month study from December 2019 to May 2019 was carried out in the Department of Microbiology and Immunology in association with the Department of Community Medicine at Shri Guru Ram Rai Institute of Medical and Health Sciences and Shri Mahant Indiresh Hospital, Dehradun. The study population included those patients who underwent HD in the hospital during the time of study. A patient was included for one time only. A total of 60 patients with chronic kidney disease, who were admitted to our hospital for HD, were screened for anti-HBsAg and anti-HCV antibodies. A study protocol was designed, and approval was sought by the ethics and research committee of the institution. Inclusion criteria included patients positive for anti-HBsAg or anti-HCV antibody for the first time during HD and the patients who were undergoing HD several times were included in this study. Exclusion criteria included patients positive for anti-HBsAg or anti-HCV antibody before HD and patients undergoing HD for the first time were excluded from this study.

A close-ended questionnaire was designed to ensure proper data collection. The collected data included age, sex, occupation, history of any comorbidity, duration of HD, number of blood units transfused, HBV vaccination status, and history of infection. All samples were identified for anti-HCV antibodies and HBs antigen by enhanced chemiluminescence assay (Vitros, Orthoclinical Diagnostics) according to the standard instructions of the assay. There are two Vitros HBs Ag controls and two VITROS anti-HCV controls (negative control and positive control). The recommendation is to run a negative and a positive control daily or after every 75 tests.

The dialysis unit has one machine dedicated for HBV-positive and four machines for HCV-positive patients. These five machines are placed away from the rest of the machines in an isolated room to avoid cross-contamination. Reprocessing of dialyzers of the patients having blood-borne virus infections is done in a separate room, away from the rest of the patients.

Data was entered and analyzed on Microsoft Excel and interpreted by descriptive methods in terms of frequency distribution in percentages, proportions, rates, and ratios. Non-parametric tests, i.e., Chi-square tests were applied to ascertain the significance of the association.

Results

Out of 60 study participants, the anti-HCV antibody was positive in 19 (31.68%) patients and 7 (11.66%) patients were positive for HBsAg. No HBV and HCV co-infection was found in the patients undergoing HD. All patients were between 15 and 71 years of age. The majority of patients receiving HD were in >60 years of age group. The maximum percentage of HBV-positive patients was in >60 years of age group (11.53%), whereas the maximum percentage of HCV-positive patients was between 41 and 50 (23.07%) age group. The mean age of HBV-infected patients was 50 and that for HCV-infected patients was 47. The majority of the patients (27 [61.66%]) had dialysis <50 times followed by 17 (28.33%) patients with dialysis 50 to 100 times; however, most of the HCV-positive patients (54.54%), as well as most HBV-positive patients (23.52%), received HD 50 to 100 times [Tables 1 and 2]. In the majority of patients (23 [38.33%]); the frequency of dialysis was "once a month," 22 patients (36.66%) were with the frequency of "thrice a week" and 10 patients (16.66%) were with frequency "once a week" [Table 3]. The mean duration of dialysis in HBV-infected cases was 27 months, whereas the mean duration of dialysis of HCV-infected cases was 30 months The duration of HD was a significant risk factor ($P < 0.05$) for both HBV and HCV infections [Table 4].

Table 1: Total number of dialysis (*n*=60)

Number of dialyses	Number of patients	Percentage
<50	27	61.66%
50-100	17	28.33%
100-200	11	18.33%
>200	5	8.33%
Total	60	100%

Table 2: Frequency of HCV, HBsAg in relation to the number of dialysis in enrolled subjects (*n*=60)

Number of dialyses	Screening results of anti-HCV		Total	Screening results of HBsAg		Total
	Positive	Negative		Positive	Negative	
<50	5 (18.51%)	22 (81.48%)	27 (45%)	3 (12%)	25 (92.59%)	27 (45%)
50-100	6 (54.54%)	11 (64.70%)	17 (28.33%)	4 (23.52%)	13 (76.47%)	17 (28.33%)
100-200	3 (27.27%)	8 (72.72%)	11 (18.33%)	0 (0%)	11 (100%)	11 (18.33%)
>200	5 (100%)	0 (0%)	5 (8.33%)	0 (0%)	5 (100%)	5 (8.33%)

Table 3: Frequency of dialysis (*n*=60)

Frequency of dialysis	Number of patients
Once a month	23 (38.33%)
Thrice a week	22 (36.66%)
Once a week	10 (16.66%)
Twice a week	5 (8.33%)

Table 4: Duration of dialysis (in months)

	Duration of dialysis in months (mean)	*P*
HBV-infected cases (*n*=7)	27	*P*<0.05
HBV non-infected cases (*n*=53)	20	
HCV-infected cases (*n*=19)	30	
HCV non-infected cases (*n*=41)	14	

The major primary diseases causing end-stage renal disease (ESRD) included chronic nephritis (35%) followed by hypertension (21.66%) and diabetes mellitus (15%) [Figure 1]. A comparative study on demographic characteristics of infected and non-infected patients showed that the duration of HD, history of blood transfusion were significant risk factors ($P < 0.05$) in both HBV- and HCV-infected patients. There was also a significance of drug addiction (*P*-value 0.00005) in HCV-infected patients; however, no significance of drug addiction was seen for HBV infection. Body piercing and tattooing in relation to HCV infection were found in a few patients, which was not significant ($P = 0.605841$), whereas it was found significantly associated with HBV infection ($P = 0.0119$) [Tables 5 and 6].

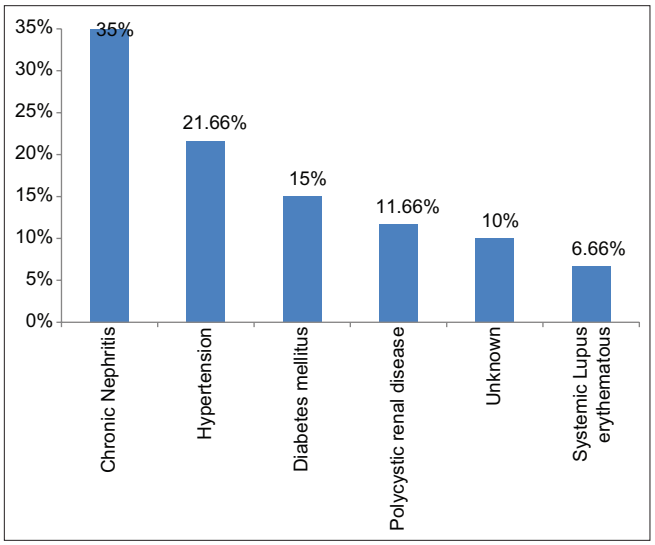

Figure 1: Major primary diseases causing end-stage renal disease (ESRD) (*n* = 6)

Discussion

Patients suffering from chronic kidney disease, acute renal failure, chronic renal failure, and other ESRDs have inadequate functioning kidney mechanisms for removing waste products from the blood. Hence, they require a continuous artificial mechanism for blood purification and removal of harmful nitrogenous wastes that can injure the body in diverse ways.[2] Patients with renal diseases undergo dialysis and such patients are at high risk of acquiring parentally transmitted infections not only because of the enormous numbers of received blood transfusions and invasive procedures but also because of their immunocompromised state. As a result of multiple dialysis procedures, these patients are more prone to HCV and HBsAg infections.[10]

Our study shows that the majority of HBsAg-positive cases were females (5/7) (71.43%), whereas the majority of cases positive for HCV markers were males (12/19) (63.15%). The results are in concurrence with Salvatierra's study, where the majority of HBsAg-positive cases were females 60%, whereas the majority of cases positive for HCV markers were males (82.35%).[11] The maximum percentage of HBV-positive patients was in the >60 years of age group (11.53%), whereas the maximum percentage of HCV-positive patients was between 41 and 50 (23.07%) years of age group. The mean age of HBV-infected patients was 50 and that of HCV-infected patients was 47. However, in a report by Bhaumik, 66.7% of HbsAg-positive patients were in the age group of 30 to 40 years and 83.33% anti-HCV-positive patients were between 21 and 40 years of age.[12]

In the current study, out of 60 participants, the anti-HCV antibody was positive in 19 (31.68%) patients and 7 (11.66%) patients were positive for HBsAg. Khashia *et al.*[10] from Pakistan have also reported 10.6% of HD patients to be positive for HBsAg, whereas 25.53% were positive for HCV. Bhaumik in his research work has reported that 7.3% of the HD patients were positive for HBsAg, whereas 12.1% were positive for HCV.[12] These variations depend mainly on the observance of standard infection control precautions. The adherence to strict infection control practices also will decrease the HBV and HCV prevalence rates among these patients.

Our research work shows that the maximum number of patients, i.e., 37 (61.66%) had dialysis <50 times, whereas the

Table 5: Comparison of demographic features and risk factors in patients on HD with and without HBV infection (*n*=60)

	HBV-infected cases *n*=7 (11.66%)	HBV non-infected cases *n*=53 (88.33%)	*P*
Male total *n*=33 (55%)	2 (6.06%)	31 (93.93%)	0.134796
Female total *n*=27 (45%)	5 (18.51%)	22 (81.48%)	*P*>0.05 (ns)
Age (in years)			
<20 *n*=2 (3.33%)	0	2	
20-50 *n*=28 (46.46%)	3	25	
>50 *n*=30 (50%)	4	26	
Duration of dialysis in months (mean)	27	20	0.035729 (s)
History of blood transfusion *n*=28 (46.66%)	6 (21.42%)	22 (78.57%)	0.027572 (s)
Positive history of body piercing/tattooing *n*=35 (58.33%)	1 (2.85%)	34 (97.14%)	0.0119 (s)
Positive history of drug addiction *n*=22 (36.66%)	2 (9.09%)	20 (90.09%)	0.636288 (ns)

*s: significant, ns: non-significant

Table 6: Comparison of demographic features and risk factors in patients on HD with and without HCV infection (*n*=60)

	HCV-infected cases *n*=19 (31.66%)	HCV non-infected cases *n*=41 (68.33%)	*P*
Male *n*=33 (55%)	12 (36.36%)	21 (63.63%)	0.387219 (ns)
Female total *n*=27 (45%)	7 (25.92%)	20 (74.07%)	
Age (years)			
<20 *n*=2 (3.03%)	0	2	
21-50 *n*=28 (46.66%)	13	15	
>50 *n*=30 (50%)	6	24	
Duration of dialysis in months (mean)	30	14	0.002267 (s)
History of blood transfusion *n*=28 (46.66%)	18 (64.28%)	10 (35.71%)	0.023804 (s)
Positive history of body piercing/tattooing *n*=35 (58.33%)	12 (63.15%)	23 (56.09%)	0.605841 (ns)
Positive history of drug addiction *n*=22 (36.66%)	14 (63.63%)	8 (36.36%)	0.000051 (s)

*s: significant, ns: non-significant

least, i.e., 5 patients (8.33%) were dialyzed >200 times. This is in concurrence with a study from Pakistan by Khashia *et al*.,[10] wherein 46.7% of patients were dialyzed <50 times and 4 patients (6.7%) were dialyzed >200 times. The maximum number of both HBV-positive patients (23.52%), as well as HCV-positive patients (54.54%), received HD 50 to 100 times. Khashia *et al*.[10] have also reported the maximum HCV positivity (22.72%) in patients dialyzed 50 to 100 times; however, the maximum HBsAg positivity (25%) was seen in patients dialyzed >200 times. In our study, 23 patients (38.3%) had frequency "once a week" and 22 patients (36.6%) were with a frequency of dialysis "thrice a week." In a study by Jamil, the majority of the population (69.82%) had once weekly dialysis, whereas 14.40% and 0.79% underwent dialysis on a twice-weekly or thrice-weekly basis.[13] The frequency of dialysis depends on the patient's requirement. Due to multiple practices of dialysis, these patients are more prone to HCV and HBsAg infection.

The mean duration of dialysis among HBV-positive patients was 27 months, whereas, in HCV-infected patients, the duration of dialysis was 30 months, which was statistically significant for both HBV and HCV infections ($P < 0.05$). In a study by Tajbakhsh, HBV-positive patients had a mean duration of dialysis of 29 months, whereas, in HCV-infected patients, it was 95.72 months and the difference was statistically significant ($P < 0.05$).[14] Thus, the duration of HD has a significant role in the acquisition of HBV and HCV infections. In the current study, the major primary diseases included chronic nephritis (35%) followed by hypertension (21.66%) and diabetes mellitus (15%). This is in concurrence with a study by Prakash *et al*.,[15] wherein the major primary diseases causing end-stage kidney disease (ESKD) included chronic nephritis (33.33%), diabetes mellitus (24.7%), and hypertension (22.58%). In a study by Badareen, diabetes mellitus (33.7%), hypertension (23.8%), and nephritis (6%) were reported to be the major primary diseases contributing to ESRD.[16]

In our study, risk factors, such as blood transfusion, were found to be significant ($P = 0.027572$) for HBV infection as well as for HCV infection ($P = 0.023804$). The majority of cases of blood transfusion were HCV positive (64.28%), which is similar to a report by Engle *et al*.,[17] which also showed more number of transfusions in HCV-infected patients. Another study by Prakash also reports anti-HCV antibody and HBsAg positivity to have a significant relationship with the frequency of blood transfusions ($P < 0.05$).[15] Bhaumik in his study observed that all anti-HCV-positive patients had a history of blood transfusion; none of the patients who had not received any blood transfusion were HBsAg- or anti-HCV positive.[12] Thus, blood transfusion can be implicated as a significant source of HBV/HCV in HD patients. Although blood to be transfused is mandatorily screened for HBV and HCV but probably the screening methods such as serology-based assays have their limitations and faltered to detect HBV- and HCV-positive blood samples. Hence, screening by PCR or nucleic acid testing should be considered in blood banks for better results although these methods are expensive.[6]

In the current study, there was significance (P = 0.0119) of body piercing and tattooing in relation to HBV infection, whereas there was no significance (P = 0.605841) of body piercing and tattooing in relation to HCV infection. However, in a report by Prakash, body piercing or tattooing was not found significantly associated with HBV and HCV infections.[15] According to a report by Alkhan, body piercing and tattooing are associated with a two-to three-fold increased risk of hepatitis C. This can be due to either improperly sterilized equipment or contamination of dyes used.[2] In our study, the history of drug addiction was found non-significant (P = 0.63) for HBV, whereas it was found significantly associated with HCV seropositivity (P = 0.000051). According to Duong and Prakash, drug addiction was not a significant factor for both HBV and HCV positivity.[15,18] However, in a report by Alkhan, intravenous drug use is the main method of transmission of HCV in developed countries.[2]

Because HBV and HCV infections are the major etiological agents of morbidity and mortality among patients undergoing HD and entail many challenging situations in the management of patients in the dialysis units, the identification of potential risk factors and proper counseling of such patients by the primary care physicians should be the priority when they attend such patients. Emphasis on implementation of preventive measures for HBV infection, such as HBV vaccination and periodic test for hepatitis B surface antigens (HBsAg) and anti-HBV antibodies, an understanding of significant risk factors involved imparted to these patients by primary care physicians can go a long way.

Conclusion

Among all risk factors studied, factors such as long duration of HD, history of multiple blood transfusions, body piercing/tattooing, and drug use were significantly associated with HBV and HCV positivity. The primary care physicians at the grass-root level may utilize this knowledge to educate patients in the community settings who are having regular dialysis treatments in various facilities. Thus, in HD patients, nosocomial transmission and noncompliance with the known universal infection control precautions could lead to a high prevalence. Screening facilities for blood transfusions need vigorous improvement to avoid contamination from this mode. Technical training of health care staff about stringent compliance to universal infection control measures can go a long way in the prevention of hepatitis transmission amongst patients undergoing maintenance HD. Additionally, two important strategies correspond to vital cornerstones in the deterrence of HBV infection in the dialysis setting: active vaccination and segregation of HBV carriers.

Ethics statement

The study was approved by the institutional research board and ethics committee.

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Conflicts of interest

There are no conflicts of interest.

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