Original Article

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Profile and predictors of hepatitis and HIV infection in patients on hemodialysis of Quetta, Pakistan

Ammara Lodhi[1], Ashif Sajjad[1,*], Khalid Mehmood[1], Ayesha Lodhi[2], Sabeena Rizwan[3], Ayesha Ubaid[3], Kulsoom Baloch[1], Sheikh Ahmed[1], Mohkam ud din[4], Zahid Mehmood[1]

[1] *Institute of Biochemistry, University of Balochistan, Sariab Road, Quetta, Pakistan;*
[2] *Chengde Medical University, Chengde, Hebei, China;*
[3] *Department of Chemistry, Sardar Bahadur Khan, Women's University, Quetta, Pakistan;*
[4] *Balochistan Institute of Nephrology and Urology, Quetta, Pakistan.*

Summary **Hemodialysis (HD) is the most commonly used treatment in patients with end-stage renal failure or disease (ESRD) worldwide. Blood-borne viral diseases are the major causes of mortality and morbidity in patients on HD. This study aims to analyze the prevalence and to concentrate on the key risk factors that are responsible for hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) infection in patients on HD visiting two dialysis centers in the city of Quetta in southwestern Pakistan. The overall incidence of HBV was found to be 16.1%, the overall incidence of HCV was found to be 43.2%, and two patients (1.6%) were found to be positive for both HBV and HCV. HIV was not found among patients seen at both hospitals during the study period. The main risk factors for development of a viral infection were the length of time on HD (p = 0.007), number of sessions (p = 0.001), and level of education (p = 0.092). Biochemical and hematological parameters including urea, creatinine, uric acid, and calcium levels, red blood cell count, white blood cell count, hemoglobin levels, and platelet count were also studied in patients on HD. HD is becoming one of the major factors causing a viral infection because a patient can possibly become infected during an HD session via a blood transfusion, dialysis machines, instruments and/or other contaminated equipment. In order to control the spread of viral infections, increased public awareness, vaccinations, and health education programs for both health care providers and patients are needed, and proper screening programs should be instituted before dialysis is performed.**

Keywords: Hemodialysis, hepatitis B, hepatitis C, HIV infection

1. Introduction

Hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) infections are becoming major public health problems. Patients with chronic kidney failure or end-stage renal disease usually undergo hemodialysis (HD) (*1*) and are at increased risk of developing a viral infection. The major reason for the high prevalence of HBV and HCV in patients on HD is related to vascular access. Patients on HD are at high risk of possible exposure to infected individuals due to the lack of standard preventive methods, effective vaccination, and contaminated and/or cross-contaminated dialysis machines (*2*).

HBV and HCV cause acute and chronic liver inflammation and damage, ranging from a minor liver disorder like cirrhosis to hepatocellular carcinoma, which is the main reason for the high mortality and morbidity rate in patients on HD (*3*). Measures to detect the incidence of HBV and HCV infections in HD units/centers and to address the risk factors for their spread help health care planners in a country to work more efficiently. The aim of the current study was to analyze the prevalence and to concentrate on the key risk factors causing HBV, HCV, and HIV viral infections

**Address correspondence to:*
Dr. Ashif Sajjad, Institute of Biochemistry, University of Balochistan, Sariab Road, Quetta, Pakistan 87300.
Email: ashif.sajjad@um.uob.edu.pk

in patients on HD in the Quetta District of Pakistan. The obtained information would be useful for health education programs, for patients on HD, and for health care personnel to control the further spread of viral infections in dialysis units.

2. Materials and Methods

2.1. *Study design*

A cross-sectional time-bounded study was conducted from June to September 2018 at two tertiary care public hospitals, Balochistan Institute of Nephrology and Urology, Quetta (BINUQ) and Sandeman Provincial Hospital (SPH), located in the Quetta District of Balochistan Province, Pakistan. BINUQ is a dedicated hospital for kidney diseases, and SPH is a general hospital. Both hospitals have two separate sections for HBV and HCV sero-positive and negative patients.

2.2. *Study sampling tools and procedures*

Subjects were a total of 118 patients who were diagnosed with either HBV or HCV. Written consent was obtained from each patient. Data were collected using a pre-tested structured questionnaire asking about socio-demographic data (age, gender, locality, marital status, level of education, occupation, and income), patient-related factors (cause of renal failure, co-morbidity, total years since the 1st session, and the length of time on HD), and clinical factors (family history of receiving dialysis, current status of HBV, HCV, and HIV, timing of initial onset, and laboratory results). Patient files were used to supplement information and clinical data. A blood sample of 5 mL was collected in an EDTA tube from each patient using the standard procedures for peripheral venipuncture before commencement of the HD session. The collected blood samples were stored at 4°C for analysis.

2.3. *Serological testing*

The collected blood samples were tested for HBV, HCV, and HIV with an immunochromatographic test (ICT) and/or chemiluminescence immunoassay (CLIA). Kits were used per the manufacturer's instructions to detect the presence of hepatitis B surface antigen (HBsAg) (HEXAGON HBsAg Immunochromatographic 1-Step test), anti-HCV antibodies (Onsite HCV Ab Plus Rapid Test), and anti-HIV antibodies (OneSite human immunodeficiency virus (HIV)-1/2 Ab Plus Combo Rapid Test). Non-reactive samples were considered to be negative and were not tested further. In the event of a positive or reactive result, the sample was tested again with an alternative testing method such as a CLIA per the manufacturer's instructions before a final diagnosis was made.

The collected blood samples were further tested for creatinine, urea, calcium, and uric acid levels. Commercial kits were used per the manufacturer's instructions. A complete blood count (CBC) was performed on a Medonic hematology analyzer (Stockholm, Sweden). The following parameters were included in the CBC: hemoglobin (HB) level, red blood cell (RBC) count, white blood cell (WBC) count, and platelet (PLTS) count. Controls were provided by the manufacturer and external controls were used.

2.4. *Statistical analysis*

Data were analyzed using SPSS v 22. Demographic characteristics were analyzed using a basic statistical tool (percentage and frequency for categorical variables and mean standard deviation SD for continuous variables). The presence of an infection was predicted with an inferential statistic using the chi-square test to determine the association between demographic characteristics and the presence of an infection.

3. Results

In the current study, 118 patients received HD at two government-run dialysis centers in the Quetta District. Of the patients studied, 93 were received dialysis at the BINUQ dialysis center and 25 received dialysis at the Civil Hospital in the Quetta District. All of the patients were on HD for more than one month, and a blood sample was collected during the first dialysis session. Of the 118 patients tested, 71 were male and 47 were female; 18 (15.3%) were positive for HBV, 52 (44.1%) were positive for HCV, 2 (1.69%) were positive for an HBV/HCV co-infection, and none were positive for HIV (Table 1). Patients ranged in age from 33-42 years. The mean age of HBV-positive patients on HD was 42.56 ± 16.80 years while the mean age of HBV-negative patients on HD was 43.36 ± 14.56 years. The incidence of HBV among the patients studied was found to be 16.1%. Positivity for HBV was higher among males than females (p = 0.929) (Table 2). An analysis of the obtained data revealed no significant association between HBV infection and patient age (p = 0.663). HBV infection was not significantly related to biochemical and/or hematological parameters such as

Table 1. Frequency distribution and percentage of several variables in patients on hemodialysis

Variable	Description	Frequency	%
Gender	Males	71	60.1
	Females	47	39.8
Viral Infection	HBV	18	15.3
	HCV	52	44.1
	HBV/HCV (co-infection)	02	1.69
	HIV	–	–

Table 2. Comparison between HBV, HCV, and HIV infection with risk factors in patients on hemodialysis

Variable	HBV Positive	HBV Negative	*P* value	HCV-positive	HCV-negative	*P* value
Age (Mean Age)	42.56 ± 16.80	43.36 ± 14.56	0.663	43.02 ± 13.69	43.41 ± 15.84	0.993
Gender						
Male	11 (61.1%)	60 (60.0%)	0.929	30 (57.7%)	41 (62.1%)	0.626
Female	7 (38.9%)	40 (40.0%)		22 (42.3%)	25 (37.9%)	
Marital Status						
Married	15 (83.3%)	87 (87.0%)	0.676	47 (90.4%)	55 (83.3%)	0.267
Single	3 (16.7%)	13 (13.0%)		5 (9.6%)	11 (16.7%)	
Locality						
Rural	5 (27.8%)	34 (34.0%)	0.605	17 (32.7%)	22 (33.3%)	0.941
Urban	13 (72.2%)	66 (66.0%)		35 (67.3%)	44 (66.7%)	
Education						
Illiterate	10 (55.6%)	35 (35.0%)	0.431	25 (48.1%)	20 (30.3%)	0.092
Religious	0 (0.0%)	7 (7.0%)		4 (7.7%)	3 (4.5%)	
Primary school	1 (5.6%)	9 (9.0%)		5 (9.6%)	5 (7.6%)	
Middle school	2 (11.1%)	8 (8.0%)		4 (7.7%)	6 (9.1%)	
Matriculated	4 (22.2%)	18 (18.0%)		6 (11.5%)	16 (24.2%)	
Intermediate	0 (0.0%)	8 (8.0%)		5 (9.6%)	3 (4.5%)	
Graduate	1 (5.6%)	15 (15.0%)		3 (5.8%)	13 (19.7%)	
Occupation						
Unemployed	6 (33.3%)	18 (18.0%)	0.520	9 (17.3%)	15 (22.7%)	0.702
Working part-time while studying	1 (5.6%)	11 (11.0%)		4 (7.7%)	8 (12.1%)	
Employee of private firm	2 (11.1%)	5 (5.0%)		2 (3.8%)	5 (7.6%)	
Government employee	3 (16.7%)	15 (15.0%)		8 (15.4%)	10 (15.2%0	
Self-employed	1 (5.6%)	20 (20.0%)		11 (21.2%0	10 (15.2%)	
Housewife	5 (27.8%)	30 (30.0%)		17 (32.7%)	18 (27.3%)	
Retired	0 (0.0%)	1 (1.0%)		1 (1.9%)	0 (0.0%)	
Income per month in USD						
Less than 50 USD	4 (22.2%)	21 (21.0%)	0.427	11 (21.2%)	14 (21.2%)	0.211
From 50-100	5 (27.8%)	17 (17.0%)		13 (25.0%)	9 (13.6%)	
More than 100	7 (38.9%)	34 (34.0%)		19 (36.5%)	22 (33.3%)	
No income	2 (11.1%)	28 (28.0%)		9 (17.3%)	21 (31.8%)	
Length of Time on Hemodialysis						
Less than 3 Months	0 (0.0%)	5 (5.0%)	0.007	2 (3.8%)	3 (4.5%)	0.409
3-6 months	5 (27.8%)	8 (8.0%)		4 (7.7%)	9 (13.6%)	
7-12 months	3 (16.7%)	15 (15.0%)		7 (13.5%)	11 (16.7%)	
1-3 years	3 (16.7%)	55 (55.0%)		29 (55.8%)	29 (43.9%)	
4-6 years	7 (38.9%)	15 (15.0%)		8 (15.4%)	14 (21.2%)	
7-9 years	0 (0.0%0	2 (2.0%)		2 (3.8%)	0 (0.0%)	
Frequency of Hemodialysis Sessions						
Twice weekly	18 (100.0%)	75 (75.0%)	0.017	51 (98.1%)	42 (63.6%)	0.001
Thrice weekly	0 (0.0%)	25 (25.0%)		1 (1.9%)	24 (36.4%)	

urea, creatinine, uric acid, and calcium levels, the RBC count, WBC count, HB level, and platelet count. HBV-positive patients had a mean blood urea level of 145.60 ± 48.45 mg/dL while HBV-negative patients had a mean blood urea level of 144.98 ± 56.60 mg/dL (p = 0.818). HBV-positive patients had a mean creatinine level of 7.46 ± 2.33 mg/dL while HBV-negative patients had a mean creatinine level of 7.50 ± 1.74 mg/dL (p = 0.817). HBV-positive patients had a mean uric acid level of 7.26 ± 2.21 mg/dL while HBV-negative patients had a mean uric acid level of 6.97 ± 1.74 mg/dL (p = 0.99). HBV-positive patients had a mean calcium level of 8.12 ± 0.26 mg/dL while HBV-negative patients had a mean calcium level of 7.36 ± 1.90 mg/dL (p = 0.446). HBV-positive patients had a mean RBC count of 3.11 ± 0.32 million cells/mcL while HBV-negative patients had a mean RBC count of 13.51 ± 20.41 million cells/mcL (p = 0.218). HBV-positive patients had a mean WBC count of 7.45 ± 4.12 thousand cells/mcL while HBV-negative patients had a mean WBC count of 11.30 ± 15.63 thousand cells/mcL (p = 0.767). HBV-positive patients had a mean HB level of 8.60 ± 1.49 gm/dL while HBV-negative patients had a mean HB level of 13.51 ± 20.41 gm/dL (p = 0.530). HBV-positive patients had a mean platelet count of 179.80 ± 65.15 platelets/mcL while HBV-negative patients had a mean platelet count of 208.55 ± 87.89 platelets/mcL (p = 0.408) (Table 3). HBV infection was significantly related to the length of time on HD (p = 0.007) and the frequency of HD sessions (p = 0.017) (Table 2).

The overall prevalence of HCV was 43.2% among patients on HD the two dialysis centers in the Quetta District. HBV infection was not significantly related to patient age (p = 0.993). The mean age of HCV-positive patients on HD was 43.02 ± 13.69 years while the mean age of HCV-negative patients on HD was 43.41 ± 15.84 years (Table 2). Positivity for HCV was higher among males than females (p = 0.626) (Table 2). HCV

Table 3. Comparison between HBV and HCV infection and biochemical and hematological parameters in patients on hemodialysis.

Variable (mean values)	HBV Positive	HBV Negative	*P* value	HCV-positive	HCV-negative	*P* value
Urea (mg/dL)	145.60 ± 48.45	144.98 ± 56.60	0.818	144.98 ± 56.60	145.60 ± 48.45	0.916
Creatinine (mg/dL)	7.46 ± 2.33	7.50 ± 1.74	0.817	7.50 ± 1.74	7.40 ± 2.33	0.88
Uric Acid (mg/dL)	7.26 ± 2.21	6.97 ± 1.74	0.99	6.97 ± 1.64	7.26 ± 2.21	0.99
Calcium (mg/dL)	8.12 ± 0.26	7.36 ± 1.90	0.446	7.36 ± 1.90	8.12 ± 0.26	0.446
WBC (thousand cells/mcL)	7.45 ± 4.12	11.30 ± 15.63	0.767	11.30 ± 15.63	7.45 ± 4.12	0.766
RBC (million cells/mcL)	3.11 ± 0.32	13.51 ± 20.41	0.218	3.60 ± 0.69	3.11 ± 0.32	0.218
HB (g/dL)	8.60 ± 1.49	13.51 ± 20.41	0.530	13.51 ± 20.41	8.60 ± 1.49	0.530
Platelets (platelets/mcL)	179.80 ± 65.15	208.55 ± 87.89	0.408	208.55 ± 87.89	178.80 ± 65.15	0.408

positivity was not significantly related to patient gender (p = 0.626) (Table 2). The incidence of HCV infection and level of education were significantly related (p = 0.092). Most of the patients with an HCV infection were illiterate (48.1%) or had matriculated (11.5%). Additional risk factors for HCV positivity included the frequency of HD sessions (p = 0.001) (Table 2). HCV was not significantly related to serum levels of urea, creatinine, uric acid, calcium, or HB or to RBC, WBC, or platelet counts. HCV-positive patients had a mean urea level of 144.98 ± 56.60 mg/dL while HCV-negative patients had a mean urea level of 145.60 ± 48.45 mg/dL (p = 0.916). HCV-positive patients had a mean creatinine level of 7.50 ± 1.74 mg/dL while HCV-negative patients had a mean creatinine level of 7.40 ± 2.33 mg/dL (p = 0.88). HCV-positive patients had a mean uric acid level of 6.97 ± 1.64 of mg/dL while HCV-negative patients had a mean uric acid level of 7.26 ± 2.21 mg/dL (p = 0.99). HCV-positive patients had a mean calcium level of 7.36 ± 1.90 mg/dL while HCV-negative patients had a mean calcium level of 8.12 ± 0.26 mg/dL (p = 0.44). HCV-positive patients had a mean RBC count of 3.60 ± 0.69 million cells/mcL while HCV-negative patients had a mean RBC count of 3.11 ± 0.32 million cells/mcL (p = 0.218). HCV-positive patients had a mean WBC count of 11.30 ± 15.63 thousand cells/mcL while HCV-negative patients had a mean WBC count of 7.45 ± 4.12 thousand cells/mcL (p = 0.766). Patients positive for HCV had a mean HB level of 13.51 ± 20.41 g/dL while patients negative for HCV had a mean HB level of 8.60 ± 1.49 g/dL (p = 0.53). HCV-positive patients had a mean platelet count of 208.55 ± 87.89 platelets/mcL, while HCV-negative patients had a mean platelet count of 178.80 ± 65.15 platelets/mcL (p = 0.408) (Table 3). The obtained values were compared with normal reference ranges, but a direct relationship between the studied parameters and both HBV and HCV infection was not noted.

4. Discussion

An HBV, HCV, or HIV viral infection is considered to be a major health hazard for patients on HD and the medical staff of dialysis units/centers (*4*). Among the patients studied, the prevalence of HBV was 16.1%. The observed prevalence is quite high compared to that in other studies conducted in different countries and regions like Jordan (5.9%), Gaza (8.1%), Saudi Arabia (10%), and Bahrain (11.8%) (*5*). This observed difference in prevalence of infection might remain because of the variation in the extent of the implementation of universal safety measures in order to prevent the nosocomial spread of viral diseases. In the current study, there was a significant association between HBV and the frequency of HD sessions and the years on HD, and this finding agrees with the results of a study conducted in Jordan (*6*). In general, most of the patients with a chronic kidney disease in the Quetta District and those who need major surgery are treated in different hospitals in different cities in Pakistan. Some of the patients had undergone HD during treatment in another city. A previous study in India reported that traveling to other cities is also associated with an increased risk of becoming infected with the hepatitis virus and/or HIV, and this risk would presumably increase when traveling to distant areas (*4*). As mentioned above, the observed difference between the incidence of HBV and the length of time on HD and the frequency of HD sessions might be due to variation in the type of surgical procedure, the medical facility, and associated factors in countries where surgery is performed. An HBV infection was not significantly related to patient age or income. Patients younger than 42 years of age had a greater risk of infection with HBV than older patients. Among the patients undergoing HD in the Quetta District in the current study, those 33 to 42 years of age had the highest incidence of HBV infection. Males had a higher risk of HBV infection than females. This might be related to the fact that males are more socially active and exposed to risk factors for development of an HBV infection (*e.g.* hair dressing, contaminated razors for shaving, blood donation, unsterilized instruments, and needles used in different types of surgery) than females. These findings are in accordance with the results of a previous study of the general population in the Karachi District of Pakistan (*7*). The reported incidence of HCV among patients on HD in Karachi was 43.2%, indicating that the observed prevalence of HCV in the current study was higher than that in Tunisia (19.1%),

Lebanon (27%), and Jordan (34.6%) and lower than that in Syria (75%) (*8,9*). The prevalence of HCV differed among HD units/centers; as stated earlier, the difference in prevalence of infection was due to different types of universal safety measures that are implemented in different units. Similar results were reported in previous studies conducted in Jordan and Lebanon (*8,10*). The current study noted no relationship between the incidence of HCV and patient gender, age, or income. This finding agrees with the results of a previous study (*11*), but HCV was significantly related to the frequency of HD sessions and conditions for HD, indicating that the risk factors for development of an HCV in patients on HD increased with a longer time on HD. Previous studies in different regions around the world have reported similar results (*12,13*). In the current study, most of the HCV-positive patients were illiterate or had matriculated (10 years of schooling). This finding agrees with the results of a previous large-scale study reporting that less educated people had a higher prevalence of HCV infection than educated people (*14*). Two patients in the current study (1.6%) were positive for both HBV and HCV, which is quite low when compared to the results of a study conducted in Moldavia that reported co-infection at a rate of 17% (*6*). Laboratory results were not significantly related to HBV, HCV, or HIV. In Pakistan, the prevalence of HBV and HCV is quite high, and nationwide efforts are required to identify people who are infected. In the current study, none of the patients studied were infected with HIV. This finding is similar to the results of a previous study conducted in Baghdad, Iraq (*15*). The prevalence of HIV among patients on HD was 0% in the Jenin District of Palestine, 6% in Nigeria, and 7% in the US; these rates are much lower than 33% in Kosovo, 39% in Morocco, 50% in France, and 51% in Spain (*16*).

5. Conclusion

To the extent known, the prevalence of HBV, HCV, and HIV among patients on HD has never been examined in the Quetta District of Balochistan. This study of viral infections among patients on HD was conducted to obtain baseline information for medical personnel. In the current study, HBV and HCV infections were prevalent among patients on HD in the Quetta District. None of the patients studied had HIV, which could be due to socio-cultural beliefs and practices. HD is becoming one of the major factors causing viral infections like HBV, HCV, or HIV because a patient on HD can contract an infection *via* blood transfusion, dialysis machines, instruments or other contaminated equipment. In order to control the spread of viral infections, increased public awareness, vaccinations, and health education programs for both health care providers and patients are needed, and proper screening programs should be instituted before dialysis is performed.

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