



Prevalence of HBV, HCV, and HIV Infections among Patients Undergoing Hemodialysis in Fasa, Iran: A Six-Year Follow-up Study

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Abstract

Background:

Hemodialysis (HD) patients are at risk of viral infections such as hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency viruses (HIV). Current study aimed to determine the prevalence of HBV, HCV, and HIV among HD patients who attended the dialysis center in Fasa, Iran.

Methods:

Collectively, 2082 HD patients (1291 men, 791 women) took part in our 6-year follow-up study.

Results:

2082 HD patients with a mean age of 56.2 ± 17.8 were included in our study. One (0.09%) patient was HBsAg positive, two (0.18%) patients were anti-HCV positive, and one (0.09%) was anti-HIV positive. There was no significant correlation between the paraclinical parameters of men and women.

Conclusion:

The present study showed a reduction in the prevalence of HBV, HCV, and HIV infections during 6 years of follow-up in HD patients.

Keywords:

HBV, HCV, HIV, Hemodialysis patients, Prevalence rate

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Introduction

There is a general consensus among scientists that patients with chronic kidney diseases (CKD) are at risk of viral infections due to frequent hospital admissions and invasive hemodialysis (HD) procedures.¹ Moreover, the prevalence of CKD is rising due to the growing number of patients with diabetes mellitus and high blood pressure in the world.^{2,3} Accordingly, improving the management of patients with CKD should be considered in enhancing their quality of life.

In spite of strict hygienic criteria, it seems that infection with hepatitis C virus (HCV) is relatively common in HD patients and different countries show different prevalences of HCV infection in HD patients ranging from 5% to 60%.^{4,5} After national vaccination in Iran, the socioeconomic and sanitary changes, and expanded programs for immunization of infants and of all high-risk populations, the epidemiologic profile of hepatitis

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B virus (HBV) infection has changed.⁶ Furthermore, investigations show that Iranian HD patients are at risk of occult hepatitis C infection with the prevalence of 3.03%.⁷

Although immunization of a large number of people in Iran covered 94% of the population in 2005, prevalence of HBV is still estimated to be 2.14% ranging from 1.3% to 6.3% in different provinces.^{6,8} The statistics reveal that the positive rate of HBS Ag decreased from 3.8% in 1999 to 2.6% in 2006. On the other hand, end-stage renal disease shows an increasing prevalence.⁹ In contrast, HIV infection ranged from <0.2% in the general population to 17.25% in people who inject drugs in Iran.^{10,11} HIV infection is also considered another concerning health problem among HD patients ranging from 2.5% to 7.4%, depending on geographic distribution.¹² A prevalence of 0.0% to 1.5% is allocated to HIV among Iranian HD patients.¹³

To answer whether the HD procedure predisposes the patients to viral infections with HBV, HCV, and HIV in HD patients, we decided to evaluate the viral infection rate among HD patients in the city of Fasa, Iran, in a 6-year follow-up study.

Materials and Methods

It was a cross-sectional study on all HD patients who had been referred to the dialysis department of Shariati Hospital affiliated with Fasa University of Medical Sciences during 2014-2020. Moreover, we followed up on the frequency of HIV, HCV, and HBV infections among HD patients from Apr 2014 up to March 2020.

According to previous studies¹⁴⁻¹⁶ and taking into account a type one error of 0.05 and 90% statistical power, at the base of main outcome variables, using WINPEPI software (version 11.65) and to receive the maximum sample size (assumed proportion for HBV, HCV, and HIV equal to 10%, 10%, and 3% respectively, and acceptable difference of 0.02, the overall sample size needed was 1537 HD patients.

HD patients undergoing dialysis for more than 3 months were eligible to participate in this study. Patients with malignant diseases and/or those who were unwilling to give their blood samples were excluded from the study. After receiving consent forms from the patients, demographic information was extracted from their archived files. Doctors and hospital staff

completed the information during their next visit (Ethics approval number: IR.SUMS.REC.1398.1163).

Serologic Test

Blood samples (5 mL) were taken from 130 patients. Next, the samples were centrifuged at 3000 rpm for 20 min at 4°C, and the sera were separated and stored at -70°C to be checked for HCV infection, using an anti-HCV antibody assay through a third-generation indirect enzyme immunoassay HCV (Hepanostika, HCab, *bioMérieux*, the Netherlands). The screening tool was ELISA, and qualitative PCR was used as a confirmation test.

HIV screening was performed by the fourth generation of the ELISA kits (Vironostika, HIV Ag/Ab, *bioMérieux*, the Netherlands), and HBV screening was performed by an ELISA kit (Hepanostika, HBsAg ultra, *bioMérieux*, the Netherlands).

Sample Extraction and PCR

Total RNA extraction was performed using the RNA extraction method as follows:

One hundred microliter of the serum was mixed with 400 µL of the RNX reagent, and 100 µL of chloroform was added. Following centrifugation at 800 g, the upper layer containing RNA was precipitated by ethanol, and the pellets were washed and dissolved in free water and stored at -70°C to be used for PCR for HCV virus. Extraction RNA kit (Invitek Molecular, Robert-Roessle, Berlin, German).

DNA was extracted using a commercially available kit (DNA extraction kit (Cinna Gen, Tehran, Iran) following the manufacturer's instructions.

Statistical Analysis

The prevalence of HCV, HBV, and HIV among HD patients was calculated in two-time intervals. The comparison of these two frequencies was made by the chi-square test to find statistical significance. The first type of error (α) was set to 0.05. The calculation of prevalence and 95% CI and the comparison of prevalence in two-time intervals were performed with STATA software.

Results

Totally, 2082 HD patients, including 1291(62%) men

and 791(38%) women, were included in our study. The mean age of the patients was 56.2 ± 17.8 years.

Serological results showed that one (0.09%) patient was HBs Ag positive at the age of 18 years old. Two patients (0.18%) were positive for HCV Ab, the mean age of these patients were 57 ± 4.2 years, and one (0.09%) had positive HIV antibodies at the age of 60 years. The trend of seropositive patients from 2014 to 2019 is revealed in Figure 1.

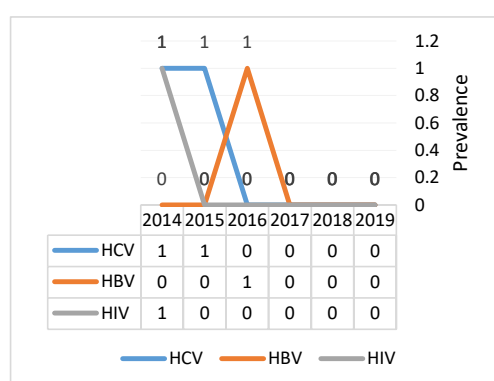


Figure 1. Trend of the prevalence of infected dialysis patients from 2014-2019.

The laboratory findings of HD patients in the first stage are summarized in Table 1. There were no significant differences between women and men in laboratory results.

Table 2 demonstrates the frequency of positive viral infection in HD patients referred to the dialysis department. According to the PCR results, HCV was positive in two male patients in the first and last sessions. Anti-HIV was also positive in male patients not only in the first session but also in the last session. Qualitative HBV PCR testing was positive in one (0.09%) of the HBV patients. She had a positive test in the last session. There was no significant difference between men and women in the first and last sessions.

The durations of dialysis in two patients with HCV infection were 18 and 36 months; also, in patients with HBV and HIV, they were 25 and 36 months, respectively. The duration of dialysis in patients was not significantly associated with the risk of viral infection [HBs Ag; $P=0.64$, anti-HIV; $P=0.64$, and anti HCV; $P=0.38$].

Table 1. The laboratory findings in patients at first-time hemodialysis

Characteristic	All Patients (N=2082)	Male Patients (n=1291)	Female Patients (n=791)
	Mean (SD)	Mean (SD)	Mean (SD)
Hb (gm/dL)	10.04 (1.48)	10.39 (1.45)	9.42 (1.37)
Hct (g/dL)	32.35 (4.63)	33.25 (4.37)	30.92 (4.80)
PLT (x1000/mm ³)	172.83 (62.31)	164.42 (58.33)	186.83 (67.80)
FBS (mg/dL)	130.89 (66.74)	123.07 (62.51)	144.71 (73.54)
BUN (mg/dL)	50.78 (12.88)	52.15 (14.10)	48.50 (10.53)
Cr (mg/dL)	7.50 (2.70)	7.91 (2.89)	6.81 (2.27)
Na (mEq/L)	140.82 (2.34)	141.25 (1.51)	140.12 (3.219)
K (mEq/L)	4.99 (0.69)	4.92 (0.74)	5.10 (0.62)
Ca (mg/dL)	8.31 (0.93)	8.22 (1.03)	8.47 (0.74)
ALP (U/L)	334.44 (266.60)	274.91 (232.53)	465.40 (301.55)
HbA1C	8.06 (1.43)	7.33 (1.31)	8.97 (1.02)
Chol (mg/dL)	123.81 (29.601)	112.82 (21.39)	144.56 (32.90)
TG (mg/dL)	125.15 (66.29)	108.41 (64.95)	156.78 (59.82)
Uric Acid (mg/dL)	5.69 (1.58)	5.96 (1.83)	5.16 (0.73)
Total bilirubin (mg/dL)	1.06 (1.9)	0.74 (0.26)	1.73 (3.4)
AST (U/L)	17.45 (11.34)	16.18 (10.72)	20.00 (12.64)
ALT (U/L)	19.58 (25.97)	21.14 (31.43)	16.45 (8.24)
Ferritin (ng/mL)	345.86 (441.01)	269.54 (331.73)	483.25 (577.71)
Alb (g/dL)	3.49 (0.33)	3.49 (0.27)	3.50 (0.44)
CRP	0.11 (0.312)	0.11 (0.31)	0.11 (0.32)

Hb: hemoglobin, HCT: hematocrit, PLT: platelets, FBS: fasting blood sugar, BUN: blood urea nitrogen, Cr: creatinine, Na: sodium, K: potassium, Ca: calcium, ALP: alkaline phosphatase, HbA1C: hemoglobin A1c, Chol: Cholesterol, TG: Triglyceride, AST: Aspartate transferase, ALT: alanine aminotransferase, Alb: albumin.

Table 2. The Frequency of positive viral infection in hemodialysis patients (first session and second session)

Viral Ab/Ag	HD		P value
	First session	Last session	
HBs Ag			
Male positive rate, No. (%)	0 (0)	0 (0)	0.22
Female positive rate, No. (%)	0 (0)	1 (0.24)	
HCV Ab			
Male positive rate, No. (%)	2 (0.28)	2 (0.28)	0.23
Female positive rate, No. (%)	0 (0)	0 (0)	
HIV Ab			
Male positive rate, No. (%)	1 (0.14)	1 (0.14)	0.41
Female positive rate, No. (%)	0 (0)	0 (0)	

HD: hemodialysis; HBsAg: hepatitis B surface antigen; HCV Ab: hepatitis C virus antibody;

HIV Ab: human immunodeficiency virus antibody

Discussion

The result of this study showed that the prevalences of HCV, HBV, and HIV in HD patients were 0.18%, 0.09%, and 0.09%, respectively.

HBV causes public health problems all around the world. According to the World Health Organization's reports, globally, it is estimated that 257 million people were infected with HBV in 2015.¹⁷ Moreover, 3.0% HBsAg seropositivity was reported in Iran by the Iranian Blood Transfusion Organization, which is considered an intermediate for HBV infection.¹⁸ As in other studies, HBV infection was also found in Tehran 2.8%,¹⁹ Guilan 1.4%,²⁰ Tabriz 5.8%,²¹ Kerman 7%,¹⁵ Isfahan 1.2%,²² Bandar abbas 5.9%,²³ and Mazandaran 2.1% of the HD patients.¹⁶ While the prevalence of HBV was 3.88% of the population in Turkey,²⁴ 4.5% in Sudan,²⁵ and 6.2% in Cameroon,¹⁴ our study showed that 0.09% of HD patients were positive for HBsAg. These results showed a decrease in the prevalence of the infection in the above patients compared with different geographical areas of the country. The reason for this decrease may be due to extensive vaccination in high-risk groups.

Moreover, HCV is considered a global health problem because not only can it be spread through interfamilial transmission, but also it can be spread through intravenous drug use, blood transfusion, and contamination during medical procedures.^{26,27} In this study, the rate of HCV infection was also seen

in 0.18% of the HD patients in Fasa, which is lower than studies in other areas of the country. In northern Iran, for example; Mazandaran 8.3%,¹⁶ Tabriz 8.1%,²⁸ Guilan 11.9%,^{20,29,30} and in southern Iran; Bandar abbas 3.36%,³¹ Kerman 7%,¹⁵ Khozestan province 7.9%³² of the HD patients had positive HCV antibody. Variation in the characteristics of the patients studied may be the reason for this difference.

Globally, HIV has infected 74.9 million people since 1983, and it is estimated that 37.9 million people are infected with HIV.³³ Accordingly, HIV infection was observed in 0.09% of HD patients in Fasa, which is less common than in similar patients in Tehran.¹⁹ However, in other parts of the country, the prevalence of HIV in HD patients has reached zero,^{15,16} which is similar to the results of the last 3 years of follow-up in Fasa. Probably the reason for the decrease in HIV in patients is the increase in public awareness about protective measures against the infection.

Several studies have shown that hepatitis is more common in men.^{34,35} Our study also found that men are more at risk for HCV and HIV infections.

However, no significant relationship was observed between HBV, HCV, and HIV infections with sex, age, and duration of dialysis. These results are similar to the study done by Zahedi and others.¹⁵ In the present study, the higher prevalence of viral infections in men than women may be due to occupational hazards.

Since HBV, HCV, and HIV were reported only in the first 3 years of our study, it seems that the reason for the decrease in the prevalence of viral infections in the studied dialysis patients and improved health standards in the country is social awareness about the complications of viral infections and protective measures against the infection in recent years. Given that HCV is more contagious than HBV and HIV, in the present study, the prevalence of hepatitis C compared with hepatitis B and HIV in HD patients was doubled.

Conclusion

It is concluded that proper management of HD centers, protective measures, and national vaccination during recent years has led to a significant reduction in the prevalence of HBV, HCV, and HIV viral infections among patients during a 6-year follow-up. The authors

strongly recommend the continuation of this design in the future.

Limitations

A limitation of this study is that in people who tested positive viral load was not determined.

Strengths

The retrospective cohort design and huge sample size are strengths of this study. For this reason, the results of the above study can be generalized to the larger population.

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Ethical Approval

This study was approved by Shiraz University of Medical Sciences (Ethics approval number: IR.SUMS.REC.1398.1163).

Conflict of Interest

The authors declare no conflict of interest related to this work.

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