JIDC | THE JOURNAL OF INFECTION IN DEVELOPING COUNTRIES

Original Article

The prevalence of HBV, HCV, and HIV among hemodialysis patients in a tertiary care hospital in Mashhad, Iran

Mohammad-Bagher Khorrami[1 #], Arian Amali[2 #], Mahmood Sadeghi[3], Bamdad Riahi-Zanjani[4]

[1] *Social Security Organization, 17th Shahrivar Hospital, Mashhad, Iran*
[2] *Student Research Committee, Paramedical Department, Islamic Azad University, Mashhad Branch, Mashhad, Iran*
[3] *Medical Toxicology and Drug Abuse Research Center (MTDRC), Birjand University of Medical Sciences, Birjand, Iran*
[4] *Medical Toxicology Research Center (MTRC), Mashhad University of Medical Sciences, Mashhad, Iran*

# Authors contributed equally to this work.

Abstract

Introduction: Hepatitis and acquired immunodeficiency are major health concerns in high-risk patients with renal failure undergoing hemodialysis. This might be due to the number of blood transfusions, age, and dialysis duration. We aimed to investigate the prevalence of HBV, HCV, and HIV in hemodialysis patients to determine the effectiveness of preventive measures already in place and the possible correlation between various risk factors and viral infection in the Hemodialysis Center in Mashhad, Iran.

Methodology: Sixty-five patients were included in a retrospective cross-sectional study. The demographic information was collected. Hepatitis-B surface antigens, anti-HCV, and anti-HIV antibodies were screened using ELISA.

Results: Out of 65 patients, 34 (52.3%) were male, and 31 (47.7%) were female. Mean duration of dialysis was 30.68 ± 26.39 months, and the mean age was 64.95 ± 14.09 years. We found 9 (13.8%) patients that were HBV positive (HbsAg-positive), and 3 (4.6%) patients were HCV positive. Sex and the number of blood transfusions were found to be risk factors for HBV infection and had statistical significance ($p = 0.02$ and $p = 0.01$, respectively). No statistical significance was found between HBV- and HCV- positivity and the mean age of patients ($p = 0.84$ and $p = 0.76$, respectively). All patients were HIV-negative.

Conclusions: Prevalence of HBV was high and significant. More preventive measures need to be developed, and further studies should be conducted to examine the effectiveness of these measures. Moreover, evaluating the prevalence rates of HBV, HCV, and HIV in other hospitals and dialysis centers in Mashhad is recommended to minimize viral infections. Initial HBV vaccination for patients that require hemodialysis is crucial.

Key words: HIV; HBV; HCV; hemodialysis; prevalence; viral infection.

J Infect Dev Ctries 2023; 17(8):1146-1151. doi:10.3855/jidc.16874

(Received 21 May 2022 – Accepted 10 January 2023)

Introduction

HBV, HCV, and HIV infections threaten people's health around the world. According to World Health Organization (WHO), more than two billion people have evidence of a current or resolved HBV infection, with a prevalence rate of more than 7%. Furthermore, 150 million people are chronically infected with HCV [1]. It is also important to mention that according to the Joint United Nations Programme on HIV and AIDS (UNAIDS), there were approximately 38.4 million people across the globe with HIV as of 2021 [2].

The intriguing fact is that the aforementioned infections are more common in patients undergoing hemodialysis (HD) in comparison to the general population [3]. HD is used for the reatment of patients with end-stage renal disease (ESRD). The use of HD has increased in the past decades and significantly contributed to the normalcy of these patients' lives. Adversely, the process of HD provides a chance for blood-borne viruses to be transfered from one person to another. This might be due to the reuse of dialyzers as well as sharing of medications and supplies between HD patients. The duration and frequency of HD for each patient and the possible need for blood transfusions are also significant contributors [4]. Moreover, patients with renal failure develop certain immunological dysfunctions interfering their ability to eliminate these viruses [5].

On the other hand, there has been a decline in HBV prevalence in HD units, resulting from full compliance

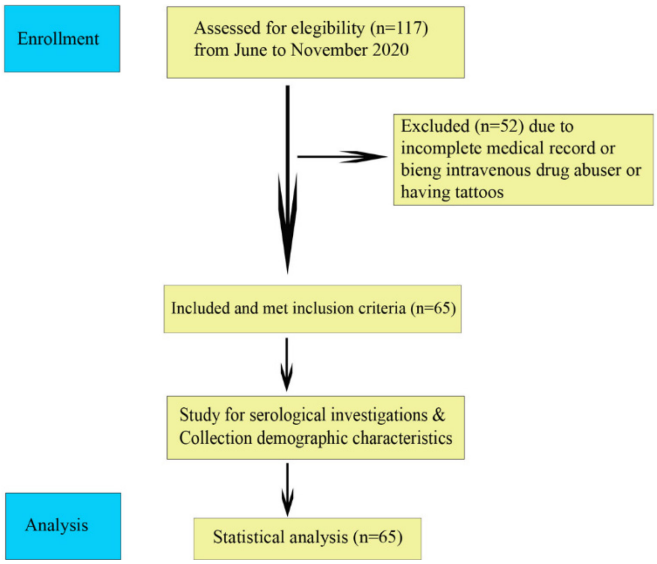
to control measures and guidelines provided for infection control. These measures include regular screening of anti-HBV antibodies, vaccination, and routine assessment of blood products [3]. On the other hand, because HCV patients are mostly asymptomatic, the lack of measures for infection control can easily result in the transmission of this virus, and since there is no effective vaccine for HCV, it has become the most common cause of chronic viral hepatitis in patients undergoing HD [6].

Previous systematic reviews regarding HCV, HBV, and HIV infection among HD patients in Iran reported prevalence rates of 1.30-14.40%, 2.1-18.2%, and 0-1.5%, for each of these viruses, respectively [7–9]. It seems that prevalence rates in developing countries are higher than those of developed countries. For instance, in a study conducted by Khattab (2008) [10], the prevalence rate of HCV was reported to be 7.1% in Iraq as of 2008. In another study conducted in Palestine in 2016, the prevalence of HBV and HCV were 3.8% and 7.4%, respectively [5]. In a similar study conducted in Cameroon, the prevalence rates were 9.3%, 20.6%, and 6.2% for HIV, HCV, and HBV, respectively [11]. However, this index for HCV was reported to be around 2.9-3.4% in the Netherlands and 5% in Switzerland [10], and in regards to HBV, the numbers were around 0.9% in the US and 1.63% in Switzerland [5].

A comparison of the prevalence of HBV, HCV, and HIV in the general population against HD patients in Iran along with a more profound awareness of the prevalence rates of these viruses helps authorities and especially healthcare workers improve necessary measures during HD, which includes disinfecting of instruments, surfaces, and surrounding equipment to reduce the rates of viral infections.

This study aimed to investigate the prevalence of HBV, HCV, and HIV among patients undergoing HD in the 17-Shahrivar Hospital Hemodialysis Center as previous studies in Mashhad, Iran are limited. Mashhad is considered as the second biggest and the most populous city in the country with a population of more than three million (2016 census). The hemodialysis center of 17-Shahrivar Hospital has been a referral center for HD patients for decades which is equipped with 30 dialysis units. Moreover, the effort of this study is to assess the effectiveness of the preventive measures in place and determine the risk factors of viral infections in HD patients in this specific area.

Figure 1. Population selection and study design.



Methodology

This retrospective cross-sectional study was conducted in the HD center of 17-Shahrivar Hospital in Mashhad. Serum samples of sixty-five patients, who were under HD treatment for at least three months, were included in this study. Sampling was performed for six months from June to November 2020, and the previous HD records were gathered and studied. None of the patients were intravenous drug abusers or had tattoos. The findings of the current research were from serum samples before the sera were discarded without specifying the information of the patients (Figure 1). The current study was carried out in accordance with the Declaration of Helsinki and the Guidelines on Good Clinical Practice. Our retrospective study including all experiments and practical steps was conducted after the approval of the Medical Research Ethics Committee of Mashhad University of Medical Sciences.

The HD Center provides service from Saturday to Thursday, runs two dialysis shifts per day, and offers three 4-hour sessions per week to each patient. Furthermore, the Center has 3 specialists, 15 nurses, and 22 machines (20 machines in one room for patients that are not infected with each HBV, HCV, or HIV and 2 in a separate room for patients who are infected). Standard precautionary measures such as constant disinfection of surfaces, use of disposables gloves, kits, and needles are followed. Dialysis machines are cleaned after each session and at the end of each day. These patients undergo a monthly check-up with a thorough check-up once every three months. The medical staff is checked for viral infections once a year.

Information such as gender, age, weight, address, education, marital status, and history of transplant were collected from patients. Patients' age ranged from 21 to 87 years, with a high rate of HD over 40 years.

To evaluate the prevalence of HBV, HCV, and HIV, 5 mL of blood was drawn from each of our subjects a total of six times (once every month) from the antecubital area of the arm. Hepatitis B surface antigen was considered as the marker for detection of HBV-positive sera, whilst for screening of HCV- and HIV-positive sera, the presence of related antibodies was identified. These tests were carried out based on Enzyme-Linked Immunosorbent Assay (ELISA) method and according to the manufacturer's protocols (Arya Mabna Tashkhis kits). Analyses were done in the central laboratory of the hospital.

Statistical Analysis

Statistical analysis was conducted using SPSS version 22 (SPSS Inc., Chicago, IL, USA). To compare parametric variables between the two groups, a Student's t-test was used, and to compare the non-parametric variables, the Chi-square test and Fisher's exact test were used. The Mann-Whitney U test was used to compare differences between two independent groups with non-normal distributions. A p value < 0.05 was considered to be a statistically significant level.

Results

A total of 65 patients participated in this study. Thirty-four (52.3%) patients were male, and thirty-one (47.7%) were female. The mean duration of dialysis was 30.68 ± 26.39 months, and that of age was 64.95 ± 14.09 years. It is noteworthy to mention that only two patients had undergone a renal transplant.

Based on immunoassay analysis, it was determined that nine (13.8%) patients were HBV-positive (HbsAg-positive). As demonstrated in Table 1, there was a significant correlation between HBV infection and sex as well as the number of blood transfusions (p = 0.02, p = 0.01, respectively). All HBV-positive patients included in the study were male. The mean age of those positive for HBV was 66.11 ± 12.21, and that of those negative for HBV was 64.76 ± 14.47, and therefore no statistical significance was found between HBV-positive patients and HBV-negative patients in regards to their mean age (p = 0.84). Moreover, three (4.6%) patients were HCV-positive. The mean age of HCV-positive patients was 65 ± 6.92, and it was 64.95 ± 14.39 for HCV-negative patients with no significant differences (p = 0.76) (Table 2). As for HIV, all patients were negative. As can be seen in Table 1, other variables were compared, and there were not any significant differences between the two groups.

Discussion

Patients undergoing HD are more susceptible to viral infections in comparison to the general population. In a previous study, the most critical factor for the acquisition of viruses in HD patients was claimed to be the number of blood transfusions [4]. Factors such as sharing of equipment, using common vials to prepare and inject drugs, and unstandardized cleaning routines are some of the other contributors to this matter [16]. Over the past decades, prevention and control measures have been enforced around the world, and therefore,

Table 1. A comparison of the demographic characteristics among patients that undergo HD regarding HBV infection.

Variable	HBV-Positive	HBV-Negative	p value
Access to veins			0.29
AV Fistula	4 (7.4%)	37 (63%)	
C.V.C	0 (0%)	11 (20.4%)	
Graft	1 (1.9%)	4 (7.4%)	
Sex			0.02*
Male	9 (13.8%)	25 (38.5%)	
Female	0 (0%)	31 (47.7%)	
Duration of dialysis (year)			0.53
≤ 1	2 (3.1%)	15 (23.1%)	
1-3	6 (9.2%)	25 (38.5%)	
≥ 3	1 (1.5%)	16 (24.6%)	
Blood transfusion			0.01*
Yes	2 (3.1%)	39 (60%)	
No	7 (10.8%)	17 (26.2%)	
Diabetes			0.12
Yes	5 (7.9%)	18 (28.6%)	
No	3 (4.8%)	37 (58.7%)	
Education			0.47
Less than diploma	5 (8.1%)	45 (72.6%)	
Diploma	2 (3.2%)	8 (12.4%)	
Higher education	0 (0%)	2 (3.2%)	

* p value < 0.05.

there has been a reduction in the prevalence of viral infections [17]. Despite that, viral infections are still obstacles to overcome.

In our study, the prevalence of HBV was 13.8%, which is considered to be a high number. In this regard, in our country, similar research have been conducted so far. In a study conducted in the southern parts of Iran by Bahri *et al.* (2016) [18], the prevalence of HBV was found to be 5.88%. They concluded that the parameters of the duration of HD, blood transfusion history, age, and sharing HD devices are the most important contributors to the acquisition of HBV in HD patients. Another study performed by Assarehzadegan *et al.* (2009) in Khuzestan, Iran, emboldened the duration of HD as one of the main contributors of viral infection among HD patients [19]. In a research carried out in Tehran, 360 patients from five HD centers were investigated [6]. This particular study determined that 1.39% of subjects were HBV-positive and 3.06% were HCV-positive, although they did not evaluate subjects for HIV. The prevalence of HCV was close to the number found in our study, yet the prevalence of HBV was considerably higher in our study. This may be because the demographic characteristics of Tehran are different from those of Mashhad. The results from similar studies performed in Iran have revealed that the number of blood transfusions was considered a significant risk factor for HCV infection [20,21].

From a comparative point of view, the results from other countries are somewhat controversial. For instance, in two studies conducted in Iraq and Palestine, which are in the same region as Iran, the prevalence of HBV in HD patients was 3.2% and 3.8%, respectively [5,22]. Neither of these studies found any relation between gender and infection of HBV among HD patients. On the contrary, all patients that were found to be positive for HBV in our study were men, which has apparent statistical significance ($p = 0.02$). Interestingly, we found no relation between gender and infection of HCV but in a study carried out by Khattab in Iraq, the opposite was found ($p < 0.05$) [10]. Concerning the mean age of HD patients and HCV positivity, our study found no correlation between those issues, which is consistent with the findings of a study conducted in Palestine by Abumwais in 2010 [23]. The prevalence of HCV among HD patients in developed countries such as Switzerland, the Netherlands, and the USA was 5%, 2.9-3.4%, and 8%, respectively [10,12], which are similar to our findings in regards to HCV (4.6%). On the other hand, the prevalence of HBV in our study (13.8%) was much higher than those of developed countries such as Belgium (0.97%) [24], Japan (2.6%) [25], and the USA (0.9%) [5].

Regarding HIV, hemodialysis is considered to be a low-risk setting if all precautions are carefully observed [4]. Our study showed this is true, as there were no HIV-positive patients among our subjects. Studies in the USA and European countries also showed low HIV prevalence (1.5% and 0.12%, respectively) [13].

Our study had some limitations. The sample size of the study was low and a small number of patients were included. The design of our study was another limitation. Because of the retrospective nature of this study, there was a failure for some of the medical

Table 2. A comparison of the demographic characteristics among patients that undergo HD regarding HCV infection.

Variable	HCV-Positive	HCV-Negative	p-value
Access to veins			0.21
AV Fistula	1 (1.9%)	37 (68.5%)	
C.V.C	0 (0%)	11 (20.4%)	
Graft	1 (1.9%)	4 (7.4%)	
Sex			0.9
Male	2 (3.1%)	32 (49.2%)	
Female	1 (1.5%)	30 (46.2%)	
Duration of dialysis (year)			0.43
≤1	0 (0%)	17 (26.2%)	
1-3	3 (4.6%)	28 (43.1%)	
≥ 3	0 (0%)	17 (26.2%)	
Blood transfusion			0.69
Yes	2 (3.1%)	39 (60%)	
No	1 (1.5%)	23 (35.4%)	
Diabetes			0.9
Yes	1 (1.6%)	22 (34.9%)	
No	2 (3.2%)	38 (60.3%)	
Education			0.35
Less than diploma	1 (1.6%)	49 (79%)	
Diploma	1 (1.6%)	9 (14.5%)	
Higher education	0 (0%)	2 (3.2%)	

records to be completely registered. This was a reason for the small sample size in the study.

Conclusions

The prevalence of HIV and HCV were found to be low in our study, yet HBV prevalence was high, which should not be overlooked. We found that gender and the number of blood transfusions of the patient were related to HBV infections. This study could be used as a baseline for future studies as the matter of viral infections remains an issue affecting HD patients. It also provides an overview of what can be done to lower prevalence rates. Finally, it is essential to mention that more preventive measures need to be developed, and further studies should be conducted in the future to examine the effectiveness of these measures. Initial HBV vaccination for patients that require hemodialysis, as well as evaluating the prevalence rates of HBV, HCV, and HIV in other hospitals and dialysis centers in Mashhad, Iran is highly recommended.

Authors' contributions

BRZ advised on the research project and revised the first and final drafts of the manuscript; MBK contributed to the design of research project, preparation of materials, in data analysis and performed the quantitative determination of samples; AA and MS contributed in writing the first and final drafts of the paper. All authors reviewed and approved the final draft.

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Corresponding authors
Dr Bamdad Riahi-Zanjani, MSc. PhD
Medical Toxicology Research Center,
Mashhad University of Medical Sciences
Tel: +985138002458
Email: riahib@mums.ac.ir

Mahmood Sadeghi
Medical Toxicology and Drug Abuse Research Center (MTDRC),
Birjand University of Medical Sciences,
Birjand, Iran
Email: sadeghi.mahmud@yahoo.com, sadeghim@bums.ac.ir

Conflict of interests: No conflict of interests is declared.