Research Article

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Investigation of the Prevalence of HBV, HCV and HIV in Patients Receiving Hemodialysis Treatment for Chronic Renal Failure

Kronik Böbrek Yetmezliği Nedeniyle Hemodiyaliz Tedavisi Uygulanan Hastalarda HBV, HCV ve HIV Sıklığının Araştırılması

Ayşe Rüveyda Uğur[1], Burak Ezer[2], Bahadır Feyzioglu[3], Mehmet Özdemir[3]

[1]*Konya City Hospital, Clinic of Medical Virology, Konya, Türkiye*

[2]*University of Health Sciences Türkiye, Beyhekim Training and Research Hospital, Clinic of Medical Microbiology, Konya, Türkiye*

[3]*Necmettin Erbakan University Faculty of Medicine, Department of Medical Microbiology, Konya, Türkiye*

ABSTRACT

Objectives: Patients on hemodialysis (HD) are more vulnerable to infections than the general population due to immunosuppression caused by chronic renal failure. Hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) transmitted by blood are the most important causes of morbidity and mortality in these patients. The aim of this study is to investigate the prevalence of HBV, HCV and HIV in chronic renal failure patients undergoing HD treatment over a four-year period.

Materials and Methods: This study analyzed 3,799 patient records of persons receiving HD at Meram Medical Faculty and Konya City Hospitals from April 1, 2020, to December 31, 2023. Serum samples from all patients were analyzed for HB surface antigen (HBsAg), anti-HBs, anti-HCV, and anti-HIV markers. The serological parameters were assessed using the Architect I200 SR (Abbott, USA) or the Cobas 8000 immunoassay analyzer (Roche, Mannheim, Germany).

Results: After exclusion of duplicate data, 463 patients were eligible for the study. Of the patients, 52.4% were male, and 47.6% were female. The mean age was 54.5±16.1 years. All patients tested negative for anti-HIV. Seventeen patients (3.7%) were positive for anti-HCV, 11 patients (2.3%) were positive for HbsAg, and 423 patients (91.9%) were positive for anti-HBs.

Conclusion: Our results regarding the seroprevalence of HbsAg, anti-HCV, and anti-HIV in HD patients were consistent with existing literature from Türkiye. Conversely, we observed an

ÖZ

Amaç: Hemodiyaliz (HD) tedavisi uygulanan hastalar, kronik böbrek yetmezliği nedeniyle bağışıklıkları baskılandığı için enfeksiyonlara karşı normal popülasyona göre daha duyarlıdır. Kan yoluyla bulaşan hepatit B virüsü (HBV), hepatit C virüsü (HCV) ve insan immün yetmezlik virüsü (HIV) bu hastalarda en önemli morbidite ve mortalite nedenlerindendir. Bu çalışmanın amacı HD tedavisi gören kronik böbrek yetmezliği nedeniyle HD tedavisi alan hastalarda HBV, HCV ve HIV sıklığının incelenmesidir.

Gereç ve Yöntemler: Çalışmada 01.04.2020-31.12.2023 tarihleri arasında Meram Tıp Fakültesi ve Konya Şehir Hastanelerinde HD tedavisi gören 3.799 hasta kaydı değerlendirildi. Tüm hastaların serum örneklerinde hepatit B yüzey antijeni (HBsAg), anti-HBs, anti-HCV ve anti-HIV parametreleri araştırıldı. İlgili parametreler Architect I200 SR (Abbott, ABD) veya Cobas 8000 immünoanaliz analizör (Roche, Mannheim, Almanya) cihazları kullanılarak incelendi.

Bulgular: Tekrar veriler çıkarıldıktan sonra çalışmaya dahil edilen 463 hastanın yaş ortalaması 54,5±16 yıl olup, %52,4'ü erkekti. Serolojik belirteçler incelendiğinde hastaların tamamında anti-HIV negatif bulundu. Anti-HCV 17 (%3,7) hastada; HBsAg 11 (%2,3) hastada pozitif olarak saptanırken, anti-HBs ise 423 hastada (%91,9) hastada pozitif olarak belirlendi.

Sonuç: Çalışmamızda HD hastalarındaki HBsAg, anti-HCV, anti-HIV pozitiflik oranlarında, ülkemizde yapılmış olan çalışmalara benzer veriler elde edildi. Anti-HBs pozitifliği ise daha yüksek saptandı.

Address for Correspondence: Ayşe Rüveyda Uğur, MD, Konya City Hospital, Clinic of Medical Virology, Konya, Türkiye

E-mail: ayserugur@gmail.com **ORCID ID:** orcid.org/0000-0002-9622-6404

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elevated prevalence of anti-HBs positivity among HD patients. The vaccination procedures administered to dialysis patients receiving treatment in tertiary hospitals in Konya were deemed highly effective. We emphasize that those at risk for HBV infection must receive vaccination without exception, and that infection control protocols in dialysis units should adhere to established guidelines.
Keywords: Chronic renal failure, hemodialysis, HBV, HCV, HIV

Sonuç olarak, Konya ilinde bulunan üçüncü basamak hastanelerde tedavi gören diyaliz hastalarında uygulanan aşılama politikalarının başarılı olduğu belirlendi. Hepatit B'ye karşı duyarlı olan hastaların mutlaka aşılanması ve diyaliz ünitelerinde uygulanan enfeksiyon kontrol önlemlerinin standartlara uygun şekilde yürütülmesi gerektiği kanaatindeyiz.
Anahtar Kelimeler: Kronik böbrek yetmezliği, hemodiyaliz, HBV, HCV, HIV

Introduction

Hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) are significant public health concerns affecting millions of people worldwide. In 2022, it was reported that HBV affected 1.1 million people, while HCV infected 244,000 individuals. Without effective measures, it is estimated that viral hepatitis could cause 1.14 million deaths by 2034 (1,2). HIV, on the other hand, was responsible for 630,000 deaths in 2022, and the annual incidence of HIV exceeds 1.5 million (3). It is estimated that 80% of individuals infected with viral hepatitis and HIV are unaware of their condition and therefore lack access to treatment (3). HCV infection is a serious health problem that can progress to cirrhosis, end-stage liver disease, and hepatocellular carcinoma. Although there is currently no effective vaccine, HCV can be treated with highly effective antiviral agents, which can reduce complications. However, because HCV infection is often asymptomatic, it can easily go undiagnosed (4).

Chronic kidney disease (CKD), which impairs the kidneys' metabolic and endocrine functions, is a major health concern as it can lead to severe fluid and electrolyte imbalances due to decreased glomerular filtration rates (5). Hemodialysis (HD), which is used to improve life expectancy and quality in CKD patients, weakens the patients' cellular immune system, making them more susceptible to blood-borne viral infections (5). Factors such as percutaneous interventions, blood transfusions, patient age, dialysis duration, and the contamination of HD machines and other equipment increase the risk of HBV, HCV, and HIV transmission among HD patients (6,7). The World Health Organization and the Turkish Society of Nephrology (TSN) recommend vaccinating patients diagnosed with CKD against HBV, implementing infection control measures to prevent the transmission of HBV, HCV, and HIV in HD units, and routinely screening blood products for these pathogens (8). As a result of the implemented strategies, the prevalence of HBV and HCV in HD units has gradually decreased. For instance, with the initiation of HBV vaccination programs in the United States, HBV incidence among HD patients has decreased by 95% (9). This study aims to examine the seroprevalence of HBV, HCV, and HIV among CKD patients undergoing HD in the Konya region.

Materials and Methods

In this study, patient records of 3,799 individuals receiving HD treatment at Meram Medical Faculty and Konya City Hospitals between April 1, 2020, and December 31, 2023, were retrospectively reviewed. After removing duplicate records, 463 patients were included in the study.

Statistical Analysis

Serum samples from all patients were tested for hepatit B surface antigen (HBsAg), anti-HBs, anti-HCV, and anti-HIV parameters. These parameters were analyzed using chemiluminescent immunoassay on the Architect I2000 SR (Abbott, USA) or electrochemiluminescence on the Cobas 8000 immunoassay analyzer (Roche, Mannheim, Germany). HCV ribonucleic acid (RNA) levels were detected using a commercial kit (HCV-RNA QS-RGQ Kit, Hilden, Germany) through real-time polymerase chain reaction (PCR) analysis.

The obtained data were evaluated using descriptive statistical tests, percentage calculations, and mean ± standard deviation.

The protocol was reviewed and approved by Necmettin Erbakan University Drug and Non-Medical Device Research Ethics Committee (date: 16.06.2023, decision number: 2023/4385).

Results

The mean age of the 463 patients in the study was 54.5±16.1 years, with 52.4% being male. Upon the assessment of the serological markers, anti-HIV was found to be negative in all cases. Anti-HCV was found to be positive in 17 patients (3.7%), HBsAg in 11 patients (2.3%), and Anti-HBs in 423 patients (91.4%). HCV-RNA was undetectable in the plasma of 17 anti-HCV positive patients using the real-time PCR method. The mean anti-HCV value was 54.1±28.2 cut-off index (COI) [minimum (min): 0.935, maximum (max): 99.5]; the mean HBsAg value was 2,375.2±1,826.6 COI (min: 33, max: 7,531); and the mean anti-HBs value was 396.0±27 IU/mL (min: 10.7, max: 99.5), as represented in Table 1.

We observed that the serological tests were routinely performed every three months. Among the 423 anti-HBs-positive HD patients, 18.4% (78/423) were identified as seronegative at least once during the study duration. For these patients, the following situation was revealed when the study timeline was extended both forward and backward. Even though the patients had received prior vaccinations, they gradually lost their antibody titers and developed an anti-HBs negative status. It took a mean of 8.1 months for the anti-HBs titer to decline by 50%, and 32.1 months for it to decline to less than 10 IU/mL. Both HBsAg and anti-HBc were negative in those patients. Among those 78 patients, 24.4% (19/78) developed anti-HBs titers of <100 IU/mL after completing HBV vaccination, a condition defined as that of a low-responder. Non-responders to immunization were identified in 17 of the HD patients (3.8%).

Table 1. Seroprevalence of hepatitis markers in hemodialysis patients

	Percentage of seropositivity (n)	Mean value of serum levels	Mean age	Gender
HBsAg	%2.3 (11/463)	2,375.2±1,826.6 COI	54.5±16.1	52.4% (male) 47.6% (female)
Anti-HCV	%3.7 (17/463)	54.1±28.2 COI		
Anti-HBS	%91.4 (423/463)	396±27 IU/mL		
Anti-HIV	Not detected	-		

HBsAg: Hepatitis B surface antigen, Anti-HCV: Hepatitis C antibody, Anti-HBs: Hepatitis B surface antibody, Anti-HIV: Antibody against human immunodeficiency virus, COI: Cut-off index

Discussion

The prevalence of HBsAg positivity in dialysis patients correlates with the endemicity in the general population. Notwithstanding the availability of effective vaccinations since 1982, HBV infection remains widespread in numerous countries. Türkiye is classified as a medium-risk endemic area for HBV. Numerous studies indicate that the HBsAg positive rate among HD patients in Türkiye ranges from 3.6% to 8.7% (10,11,12,13,14). A systematic analysis of global research revealed HBsAg positivity rates among HD patients of 1% in the United States, 5.9% in Italy, 12% in Brazil, and between 1.3% and 14.6% in Asia Pacific nations (15). The HBsAg positive rate among HD patients in Türkiye was reported by the TSN as 3.8% in 2016 and 2.57% in 2019 (16). In our investigation, the HBsAg positivity rate was slightly lower than the national data reported by TSN. Individuals having an anti-HBs titer of ≥10 mIU/mL and a negative anti-HBc status are deemed to be immune against HBV via vaccination (17). Patients who are negative for anti-HBs, anti-HBc, and HBsAg and have not previously been exposed to the HBV are at risk of HBV infection during HD. HBV vaccinations must be promptly delivered to these patients (17). Research conducted in Türkiye indicates that the anti-HBs positivity ranges from 33.5% to 64% (18). Research in the Konya region found that the anti-HBs positivity rate among HD patients was 11.2% (19). We found that the anti-HBs positivity rate among HD patients in the Konya region was significantly higher than those reported in other local surveys (19). Strict adherence to HD patient follow-up requirements may be the cause of the high antibody positivity rate. We observed that serological tests were routinely performed every three months on HD patients. The patients whose antibody titers started to wane received the booster dose or vaccination in a timely manner. Another reason may be a meticulous analysis of the records we performed. We carefully avoided duplicate data. Furthermore, during the course of the three-year study period, we found that 18.4% (78/423) of HD patients who had been positive for anti-HBs developed seronegative status. The response of HD patients to vaccination varies depending on nutritional status and immunological factors (20). It has been reported that the general population and HD patients have inadequate seroconversion rates of 5-10% and 20%, respectively (20). An anti-HBs titer greater than 10 IU/mL is considered to indicate seroconversion. Indeed, an anti-HBs titer greater than 100 IU/mL is recommended. On the other hand, a low response is indicated if the anti-HBs titer is less than 100 IU/mL (20). We observed that 24.4% of HD patients had anti-HBs titers of less than 100 IU/mL five weeks after completion of the HBV immunization, while 3.8% were found to be non-responders.

The HBV vaccine's durability is not well established. While the general population and HD patients are known to experience a reduction in anti-HBs titer over time, patients on renal replacement therapy experience this decline much more frequently and more quickly (20). The majority of HD patients have undetectable anti-HBs titers at the end of the third year of vaccination (20). In our study, it took a mean of 8.1 months for the anti-HBs titer to decline by 50%, and 32.1 months for it to decline to less than 10 IU/mL. Furthermore, antibody titers in anti-HBs-positive HD patients should be assessed at regular intervals to evaluate potential declines in immune response and ascertain the necessity for a booster dose of the HBV vaccination (anti-HBs ≤10 mIU/mL) (20).

Nosocomial transmission constitutes a significant risk factor for HBV infection in HD patients. The preparation of medications for intravenous administration in the HD setting has been demonstrated to elevate the transmission risk of HBV infection (21). Although it has been demonstrated that HBV-DNA crosses the dialysis membrane during high-flux dialysis, the infectiousness of dialysate and ultrafiltrate remains an issue of debate. The Centers for Disease Control and Prevention states that dialyzers obtained from HBsAg positive patients must not be reused, and dialysis equipment should be segregated. HBsAg screening tests should be conducted every three months to identify new HBV infections in HD patients. Consequently, the dialysis units for these patients must be isolated, and specific infection control protocols should be implemented to mitigate the risk of HBV transmission. Patients diagnosed with chronic HBV infection should be evaluated for HBeAg, HBV-DNA levels, and the progression of cirrhosis. Despite the low rate of occult HBV infection in HD patients, those who are HBsAg negative and HBV-DNA positive must be dialyzed apart from those who are HBsAg positive to mitigate the risk of nosocomial transmission (21).

Despite the lower rate of HCV infection compared to HBV in Türkiye, it continues to be of importance among specific patient groups due to its severity and the absence of a vaccine. HCV infection is particularly critical due to its potential for nosocomial transmission among dialysis patients (22). The frequency and duration of dialysis, screening through antibody detection tests prior to blood transfusion and transplantation, and intravenous drug use are factors that increase the risk of HCV transmission (23). The anti-HCV positivity rate among HD patients in Türkiye ranges from 4.1% to 28% (24,25,26,27,28). The global anti-HCV positivity rate among HD patients ranges from 4% to 59% (29). The TSN reported an anti-HCV positivity rate of 5.2% in HD patients in 2016 (30). Our study revealed an anti-HCV positivity rate of 3.7% among

HD patients in Konya, which is slightly lower than the rate reported by the TSN.

The data concerning the rates of HIV infection in HD patients are limited. Reports show that the prevalence of anti-HIV antibodies in HD patients in Türkiye is 0.1% (30). HIV infection can be prevented by strict adherence to standard infection control protocols in dialysis facilities. Isolation of dialysis machines or patients is not advised. HIV transmission during HD has been documented in Argentina, Egypt, and Colombia (31,32,33). We found that anti-HIV antibodies were negative in all HD cases. Research conducted in various countries has shown similar findings (19).

To prevent viral hepatitis and HIV transmission in HD patients, it is essential to screen blood products for HBsAg and HBV core antibody (anti-HBc), anti-HCV, and anti-HIV; vaccinate staff and susceptible patients; implement infection-control strategies in dialysis units; use erythropoiesis-stimulating agents to decrease transfusion requirements; isolate dialysis machines for patients with viral hepatitis; and prevent shared use of equipment and medications among patients. Nevertheless, vaccination efforts and prevention measures implemented in HD units, healthcare staff, and patients remain at elevated risk of blood-borne viral agents (34).

In our study, the mean anti-HCV level was determined to be 54.1±28.2 (COI), the mean HBsAg level was 2,375.2±1,826.6 (COI), and the mean anti-HBs level was 396±27 mIU/mL. Our results defy the widespread knowledge that false positive results for HIV and HCV tests are common in HD patients. We did not observe false positives for anti-HIV. Additionally, in our study, low-titer anti-HCV positivity was very rare, and repetitive tests confirmed these results as negative.

Conclusion

Strict implementation of infection control measures, the separation of dialysis machines for patients with viral hepatitis, and the correct application and expansion of vaccination policies are essential to prevent viral transmission in HD patients. Serological screening tests should be regularly monitored. Moreover, HD patients susceptible to HBV should be vaccinated, and appropriate precautions should be implemented by monitoring anti-HBs levels post-vaccination.

Ethics

Ethics Committee Approval: The protocol was reviewed and approved by Necmettin Erbakan University Drug and Non-Medical Device Research Ethics Committee (date: 16.06.2023, decision number: 2023/4385).

Informed Consent: Informed consent was not obtained since it was a retrospective study.

Footnotes

Authorship Contributions

Concept: A.R.U., B.E., B.F., M.Ö., Design: A.R.U., B.E., B.F., M.Ö., Data Collection or Processing: A.R.U., B.E., B.F., M.Ö., Analysis or Interpretation: A.R.U., B.E., B.F., M.Ö., Literature Search: A.R.U., B.E., B.F., M.Ö., Writing: A.R.U., B.E., B.F., M.Ö.

Conflict of Interest: No conflict of interest was declared by the authors.

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