Original Article

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# Hepatitis B and C Viral Infections among Dialysis Patients and Related Factors of Dialysis Centres in Saudi Arabia

Internal Medicine Section

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## ABSTRACT

**Introduction:** Viral Hepatitis is a global disease, affecting millions of patients around the world. Dialysis dependent patients use an artificial kidney (haemodialyser) to remove waste product from the blood in severe renal impairment patients. Hence, they are more vulnerable to viral hepatitis.

**Aim:** To investigate the prevalence of hepatitis B and C infections among dialysis patients and related factors of dialysis centres in the Qassim province, Saudi Arabia.

**Materials and Methods:** This cross-sectional study, reviewed the medical records of 707 patients from the data registry of 18 affiliated dialysis centres across Al Qassim region of Saudi Arabia, during August 2017 to August 2018. A detailed questionnaire regarding the general information about the dialysis centre, isolation and screen status, vaccination status, and vascular access was completed by the Dialysis Centre Manager of all the 18 affiliated centres. The details of Hepatitis B Surface Antigen (HBsAg) and Hepatitis C Virus (HCV) serology reports were extracted to establish the prevalence and epidemiological profile of these patients. Descriptive analysis was conducted, where numbers and percentages were used to summarise all categorical variables.

**Results:** The majority 14 (77.8%) of the centres were government entities and the rest were for profit centres. Out of the 18 centres, 10 (55.6%) were hospital based, 5 (27.8%) were free-standing and 3 (16.7%) were free-standing but owned by a hospital. The prevalence of HBsAg positive cases among incentre haemodialysis patients was 3.2% and the prevalence of Hepatitis C (HBC) antibody positive cases was 6.4% with 0.3% cases of the HBsAg and HBC converted to positive during the previous 12 months.

**Conclusion:** The incidence of hepatitis B and C positivity was common in patients receiving haemodialysis. The study found low prevalence of both Hepatitis B and C positive cases in comparison to several published articles. The decrease in HBV and HBC prevalence seen in the present study may be attributable to the development and implementation of preventive strategies, increased adherence by medical staff to aseptic measures, better infection management, immunisation, and isolation of affected patients. However, further studies are needed to generalise the outcome of the present study.

**Keywords:** Haemodialysis, Vaccination status, Vascular access

## INTRODUCTION

Viral hepatitis is caused by inflammation of the liver as a result of viral infection. Though five variants of Hepatitis viruses A, B, C, D, and E are responsible for its global spread, in majority of cases either Hepatitis B Virus (HBV) or Hepatitis C Virus (HCV) is responsible for the infection [1]. Millions of people are infected each year with viral hepatitis, which can lead to Hepatocellular Carcinoma (HCC), liver cirrhosis, and death [2].

According to the World Health Organisation (WHO), global hepatitis report, in 2015, an estimated 3.5% of the population were living with chronic HBV infection, and 1% of the population, with chronic HCV infection. The African and Western Pacific regions accounted for 68% of HBV infection while the European and Eastern Mediterranean regions were maximally affected by HCV infection. As per the report, the mortality from viral hepatitis has increased by 22% since 2000 and an estimated 1.34 million deaths are reported due to the viral hepatitis. Of these deaths, 96% were the result of complications of chronic HBV (66%) and HCV (30%) infections, while hepatitis A and hepatitis E accounted for 0.8% and 3.3% of deaths, respectively [3].

The HBV infections continue to be a major burden on the Saudi healthcare system, though its prevalence has declined considerably since the introduction of the HBV vaccine in the national immunisation program and, currently, it stands at 1.3% [4]. Hepatitis C virus endemicity is intermediate in Saudi Arabia with seroprevalence rates ranging from 0.9% to 5%, among children and adults, respectively [5].

Worldwide, the number of patients receiving Renal Replacement Therapy (RRT) is estimated at more than 1.4 million, with the incidence growing by approximately 8% annually [6]. The Saudi Centre for Organ Transplantation's 2019 statistics showed a total of 21,068 dialysis patients, 19,522 of them were treated by haemodialysis and the remaining 1,546 by peritoneal dialysis [7], as percutaneous or mucosal exposure to infected blood or other body fluids is the most common way for hepatitis to spread. Therefore, the patients with severe renal impairment who are on dialysis are at greater risk of acquiring these infections.

The prevalence rates of hepatitis B and hepatitis C infections vary widely around the world, from 1% in the United Kingdom to over 90% in Eastern Europe among haemodialysis patients [8]. In Saudi Arabia, many reports from different parts of the country had shown the HBV prevalence ranging from 1.5% to 75.7% [9-12] and HCV ranged between 15% and 80% [13-15]. A recent study by Almawi WY et al., had shown the prevalence of HBV and HCV infection in dialysis patient as 5.9% and 9.2%, respectively [11]. The sole study from the Qassim region has been done 20 years ago and showed a prevalence of 50% for the 96 included patients [14]. Only five centres participated in this study with no follow-up studies conducted in the province since then, to assess the prevalence of HBV and HCV infections among dialysis patients. Therefore, the aim of the present study was to investigate the prevalence of hepatitis B and C infections among dialysis patients and related factors of dialysis centres in the Qassim province, Saudi Arabia.

## MATERIALS AND METHODS

This cross-sectional study was conducted across Al-Qassim region of Saudi Arabia between August 2017 to August 2018. The present study was approved by the Regional Research Ethics Committee, Ministry of Health, Saudi Arabia (approved by Qassim Research Ethics Committee).

**Inclusion and Exclusion criteria:** A total of 623 patients monthly records, who reported regularly for haemodialysis, were included in the study and all the patients who underwent renal transplant, or moved to another region, or not reported for dialysis at the designated centres were excluded from the study.

### Study Procedure

The prevalence was calculated by dividing the number of patients with positive HBsAg or HCV serology to the total number of patients undergoing haemodialysis at these centres. A detailed questionnaire regarding the general information about the dialysis centre, isolation and screen status, vaccination status, and vascular access was completed by the Dialysis Centre Manager of all the 18 affiliated centres. Also the medical records of 707 patients from the data registry of 18 affiliated dialysis centres were reviewed for prevalence of hepatitis B and C infections among dialysis patients. All the data were stored in password protected laptop or desktop, which could only be accessed by the research team to ensure patients confidentiality for studies and data. A hard copy of the code and identification variable were maintained in a locked file cabinet.

## STATISTICAL ANALYSIS

After tabulating all the data in excel files, they were coded into numerical form for the purpose of analyses. It was then cleaned and verified, questionable data were validated and were excluded whenever necessary. Descriptive analysis was conducted, where numbers and percentages were used to summarise all categorical variables.

## RESULTS

### Prevelence of HBV AND HCV

As per the medical records a total of 707 non transient dialysis patients were admitted with 623 (88.1%) patients receiving in-centre haemodialysis. Of the 707 patients, 69% received atleast three doses of the hepatitis B vaccine and 76.9% in the patients receiving incentre dialysis. The prevalence of positive HBsAg among incentre haemodialysis patients was found to be 3.2% (2.9% were already positive when first admitted to the centre, while 0.3% was converted to HBsAg positive during the previous 12 months). The prevalence of positive hepatitis C antibody {Enzyme-linked Immunosorbent Assay (ELISA) based testing} was 6.4%, with 2 cases converted to positive during the previous 12 months [Table/Fig-1].

| Statement | Total cases N (%) |
|---|---|
| **How much maintenance, non transient dialysis patients were assigned?** | 707 (100%) |
| • Incentre haemodialysis | 623 (88.1%) |
| • Peritoneal dialysis | 2 (0.3%) |
| • Discontinued or not reported | 82 (11.6%) |
| **How many patient care staff worked in your centre?** | 227 (100%) |
| • Nurse/Nurse assistant | 114 (48.1%) |
| • Physician/Physician assistant | 44 (18.6%) |
| • Dialysis patient-care technician | 37 (15.6%) |
| • Social worker | 13 (5.5%) |
| • Dietician | 13 (5.5%) |
| • Dialysis biomedical technician | 6 (2.5%) |
| **Vaccines** | |
| A) Of the dialysis counted, how many received: | |
| • At least three doses of hepatitis B vaccine | 488 (69.0%) |
| • The influenza (flu) vaccine for the current/most recent flu season | 631 (89.3%) |
| • At least one dose of pneumococcal vaccine | 299 (42.3%) |
| B) Of the incentre haemodialysis patients counted, how many received: | |
| • At least three doses of hepatitis B vaccine | 479 (76.9%) |
| • The influenza (flu) vaccine for the current/most recent flu season | 591 (94.9%) |
| • At least one dose of pneumococcal vaccine | 216 (34.7%) |
| C) Of the patient care staff members counted, how many received: | |
| • At least three doses of hepatitis B vaccine | 190 (80.2%) |
| • The influenza (flu) vaccine for the current/most recent flu season | 170 (71.7%) |
| **Hepatitis status** | |
| A) Of the maintenance, non transient incentre haemodialysis patients: | |
| How many were HBsAg positive?† | 20 (3.2%) |
| • Of these patients who were HBsAg positive, how many were positive when first admitted to your centre? | 18 (2.9%) |
| • How many patients converted from HBsAg negative to positive during the prior 12 months? | 2 (0.3%) |
| B) Of the maintenance, non transient incentre haemodialysis patients counted: | |
| How many was hepatitis C antibody positive?‡ | 40 (6.4%) |
| • Of these patients who were hepatitis C antibody positive, how many were positive when first admitted to your centre? | 38 (6.0%) |
| • Patients converted from HC antibody negative to positive during the prior 12 months? | 2 (0.3%) |
| **Hepatitis C virus test** | |
| • Hepatitis C Virus Antibodies (HCVAb) | 3 (7.5%) |
| • Polymerase Chain Reaction (PCR) negative | 8 (20.1%) |
| • No PCR available | 29 (67.5%) |
| **General vascular access information** | |
| Of the maintenance, non transient haemodialysis patients, how many received haemodialysis through each of the following access types? | |
| • Arteriovenous (AV) fistula | 485 (77.8%) |
| • Tunnelled central line | 207 (33.2%) |
| • AV graft | 32 (5.1%) |
| • Non tunnelled central line | 22 (3.5%) |

**[Table/Fig-1]:** Patient, staff census, vaccine and Hepatitis B and C records.
†There were 20 cases of Hepatitis B positive out of 623 haemodialysis patients; ‡There were 40 cases of Hepatitis C positive out of 623 haemodialysis patients

### Factors of dialysis centres

The study included information from 18 dialysis centres, as presented in [Table/Fig-2]. The majority 14 (77.8%) of the centres were government entities and the rest were for profit centres. Out of the 18 centres, 55.5% were hospital based, 27.8% were free-standing and 16.7% were free-standing but owned by a hospital. Nearly, 94.4% of dialysis centres were incentre daytime haemodialysis. All the centres followed the same hygienic standard protocol from the Ministry of Health, including yearly Hepatitis B Surface Antigen (HBsAg) and Hepatitis C Virus Antibodies (HCVAb) testing.

| Parameters | n (%) (n=18) |
|---|---|
| **Dialysis centre** | |
| • Government | 14 (77.8%) |
| • For profit | 4 (22.2%) |
| **Hospital affiliation of dialysis centre** | |
| • Free-standing | 5 (27.8%) |
| • Hospital based | 10 (55.6%) |
| • Free-standing but owned by a hospital | 3 (16.7%) |
| **Types of dialysis services centre offered** | |
| • Incentre daytime haemodialysis | 17 (94.4%) |
| • Home dialysis | 1 (05.6%) |

| | |
|---|---|
| **Number of incentre haemodialysis stations (Total)** | 205 |
| • Median (min-max) | 6 (0-48) |
| **Is there someone at your dialysis centre incharge of infection centre?** | |
| • Yes | 16 (88.9%) |
| • No | 2 (11.1%) |
| If yes, which best describe this person† | |
| • Dialysis nurse or nurse manager | 13 (72.2%) |
| • Hospital affiliated or other infection control practitioner comes to our unit | 12 (66.7%) |
| • Dialysis centre administrator or director | 4 (22.2%) |
| • Dialysis education specialist | 2 (11.1%) |
| • Patient care technician | 2 (11.1%) |
| • Other | 1 (5.6%) |
| **Is there a dedicated vascular access nurse/coordinator at your centre?** | |
| • Yes | 2 (11.1%) |
| • No | 16 (88.9%) |

**[Table/Fig-2]:** General information of dialysis centre.
†Variable with multiple responses

Concerning routine isolation, 83.3% centres had hepatitis B isolation rooms and hepatitis C patients were routinely isolated 88.9%. Nearly 94.4% of the centres maintained records of the station where each patient received their haemodialysis treatment for every treatment session, while 83.3% of them maintained records of the machine used for each patient's haemodialysis treatment for every treatment session. The majority of centres were able to determine that a bloodstream infection contributed to their hospital admission and were able to obtain a patient's microbiology laboratory records from hospitalisation [Table/Fig-3].

| Statement | n (%) (n=18) |
|---|---|
| **Does your centre have capacity to isolate patients with hepatitis B?** | |
| • Yes, use hepatitis B isolation room | 15 (83.3%) |
| • Yes, use hepatitis B isolation area | 1 (5.6%) |
| • No hepatitis B isolation | 2 (11.1%) |
| **Is patients' routine isolated or cohorted for treatment within your centre for any of the following condition?†** | |
| • Hepatitis C | 16 (88.9%) |
| • Active Tuberculosis (TB disease) | 13 (72.2%) |
| • Methicillin-Resistant *Staphylococcus Aureus* (MRSA) | 13 (72.2%) |
| • Vancomycin-Resistant *Enterococcus* (VRE) | 11 (61.1%) |
| • *Clostridium difficile (C. diff.)* | 11 (61.1%) |
| • None | 2 (11.1%) |
| • Other | 12 (66.7%) |
| **Patient records** | |
| **Does your centre maintain records of the station, where each patient received their haemodialysis treatment for every treatment session?** | |
| • Yes | 17 (94.4%) |
| • No | 1 (5.6%) |
| **Does your centre maintain records of the machine used for each patient's haemodialysis treatment for every treatment session?** | |
| • Yes | 15 (83.3%) |
| • No | 3 (16.7%) |
| **If a patient from your centre was hospitalised, how often is your centre able to determine if a bloodstream infection contributed to their hospital admission?** | |
| • Always | 7 (38.9%) |
| • Often | 2 (11.1%) |
| • Sometimes | 3 (16.7%) |
| • Rarely | 3 (16.7%) |
| • Never | 2 (11.1%) |
| • N/A | 1 (5.6%) |
| **How often is your centre able to obtain a patient's microbiology lab records from hospitalisation?** | |
| • Always | 11 (61.1%) |
| • Often | 2 (11.1%) |
| • Sometimes | 2 (11.1%) |
| • Rarely | 2 (11.1%) |
| • Not applicable | 1 (5.6%) |

**[Table/Fig-3]:** Isolation and screening.
†Variable with multiple responses

## DISCUSSION

The prevalence of HBsAg positive cases among incentre haemodialysis patients in this study was 3.2% (n=20). This result was lower than the study by Alkhan AA [10], where he reported that the prevalence of HBsAg positive haemodialysis patients in Saudi Arabia was 14%. Another published study from the Najran region demonstrated a 4.4% prevalence of positive HBsAg cases which is higher than the prevalence reported in the present study [15]. Globally, the prevalence of HBsAg positive cases has differed in different locations [16-20]. In Iran, Roushan MRH et al., reported a very small percentage of HBsAg positive with 2.1% prevalence [18]. On the contrary, Noori S et al., reported a higher prevalence of 70.8%, which was the highest prevalence of HBsAg positive cases among national and international articles on the same subject [19]. Regionally, Rached AA et al., reported the least number of cases with HBsAg positivity with a prevalence of only 1.6% in Lebanon [20]. In Brazil, the incidence of positive HBsAg cases among haemodialysis patients had seen a decline in recent years, from 4% in 2001 to 0.8% in 2014-2015 [21].

The prevalence of Hepatitis C antibody positive in the present study was 40 (6.4%). Alkhan AA et al., reported that among the haemodialysis patients, 7% were found to be Hepatitis C positive which were slightly higher than the present study's findings [10]. Shaheen FA et al., reported a relatively high prevalence with 72.3% which we perceived as the highest number of cases here in Saudi Arabia [22]. In the present report, 38 of the incentre haemodialysis patients were already HCV positive before the admission and an incidence of two cases converting from HCV negative to positive during the course of treatment was reported. The present study had incidences of positive HCV findings before admission that can be attributed to different factors such as blood borne viruses and non human primates [23]. Cordeiro VM et al., reported the least number of positive cases of hepatitis C in Brazil with a prevalence of 2.8%, which was lower than the prevalence reported in the present study [21]. The previous studies have also reported a lower prevalence of HCV positive than the prevalence reported in the present study [20,21]. In accordance with results of the present study, Prakash S et al., reported similar incidence of HCV positive dialysis patients [24]. On the other hand, different international studies [Table/Fig-4] elaborated the high prevalence of HCV positivity [16-21,25-27]. A study conducted in Indonesia showed the highest prevalence of Hepatitis C positive with 61% [27]. Globally, the prevalence of HBsAg positive cases has differed in accordance to the location [Table/Fig-4] [16-21,25-27]. Though the prevalence of HBV and HCV infections among haemodialysis patients in private centres remains high [27] and, the low prevalence seen in the present study may be due to the fact that, majority of participating centres were Government owned, which followed a very strict hygienic standard protocol from the Saudi Ministry of Health.

| Author's name | Location | Prevalence of HBV/HCV |
|---|---|---|
| Elshafie S [16] | Gezira, Sudan | 17.3% of blood donors were found to be Hepatitis B Virus (HBV) carriers and 12.1% technical staff was also found to be carriers. |
| El Goulli N et al., [17] | Tunisia | Hepatitis B Surface Antigen (HBsAg) was detected in 6.5% of the young male adults. |
| Roushan MRH et al., [18] | Mazandaran, Iran | HBs Ag and anti-HCV prevalence was 2.1% and 8.27%, respectively. |
| Noori S et al., [19] | Iran | More than two-thirds of the diagnosed cases were infected with HBV. |
| Rached AA et al., [20] | Lebanon | The prevalence of Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) in haemodialysis patients across Lebanon was 1.6%, and 4.7%, respectively. |
| Cordeiro VM et al., [21] | Tocantin, Northern Brazil | There was a significant decline in HBsAg and anti-HCV prevalence from 4% and 13% in 2001 to 0.8% and 2.8% in 2014-2015, respectively. |
| El Ottol AE et al., [25] | Gaza Strip | The overall prevalence of HBV and HCV among the four HD centres was 8.1% and 22%, respectively. |
| Telaku S et al., [26] | Kosova | Among the haemodialysis patients HBsAg and anti-HCV antibody prevalence rate was 12% and 43%, respectively. |
| Utsumi T et al., [27] | Surabaya, Indonesia | The prevalence of hepatitis infections varied widely between the hemodialysis units, from 0% to 8.1% of patients positive for HBsAg and 0% to 60.6% of those positive for anti-HCV, respectively. |
| Present study | Qassim province, Saudi Arabia | The prevalence of HBsAg positive cases among incentre haemodialysis patients was 3.2%, while the prevalence of hepatitis C was 6.4%. |

**[Table/Fig-4]:** Summary of prevalence of Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) at various locations [16-21,25-27].

## Limitation(s)

As the present study included only limited number of centres from the Qassim Region, future study involving all the regions of Saudi Arabia with the random selection of participating centres may provide a better estimate of HBsAg and HCV prevalence and seroconversion.

# CONCLUSION(S)

The incidence of hepatitis B and C positivity was common in patients receiving haemodialysis. The study found low prevalence of both Hepatitis B and C positive cases in comparison to several published articles. However, further studies are needed to generalise the outcome of the present study.

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