



Prevalence and Risk Factors of Hepatitis B and C Virus Infections Among Patients Undergoing Hemodialysis in Kurdistan, Iraq

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Abstract

Background and Objectives: Hepatitis B and C viral (HBV, HCV) infections are major the health problems worldwide. Patients undergoing hemodialysis (HD) are more vulnerable to acquire such infections than the general population. The current study aimed at assessing the prevalence and risk factors of HBV and HCV infections among patients undergoing hemodialysis in Kurdistan, Iraq. **Methods:** The current cross sectional study was carried out at five governmental dialysis units in Kurdistan, Iraq; most of the current study patients were recruited from 10 August 2015 to 11 February 2016. All the participants were clinically evaluated and detailed history of blood transfusion, duration of HD, and all the other parameters were also noted. Hepatitis B surface antigens (HBsAg) and anti-HCV antibodies (anti-HCV Ab) were measured and seropositive HCV samples were subjected to polymerase chain reaction (PCR) for confirmation. Data regarding the serological status of such patients and potential risk factors were collected and analyzed. **Results:** A total of 510 patients undergoing HD were enrolled in the study. The overall prevalence of HBV, HCV, and coinfection in the studied subjects was 1.8%, 9.2%, and 0.2%, respectively. HBV and HCV infections were independently associated with age and history of HD ($P = 0.005$). HBV vaccination was a strong protective factor against HBV infection ($P = 0.001$), but the rate of fully vaccinated patients (77%) was still suboptimal. Other risk factors for HCV infection were the duration of HD, history of kidney transplantation, and history of dental and surgical procedures. **Conclusions:** The prevalence of HBV and HCV infections in the patients undergoing HD in the centers in Kurdistan was low to moderate. HBV vaccination was an efficient protective measure. The factors associated with viral hepatitis within HD units were highly suggestive for nosocomial transmission. Strict adherence to infection control measures and more effective follow-up procedures may reduce the prevalence of the studied infections.

Keywords: Hepatitis B, Hepatitis C, Hemodialysis, Chronic Renal Failure, Kurdistan, Iraq

1. Background

Hepatitis B virus (HBV) and hepatitis C virus (HCV) infections are the major health problems worldwide. An estimated, 240 million people are chronically infected with HBV and around 150 million people globally have chronic HCV infection (1, 2). The infections can lead to cirrhosis, hepatocellular carcinoma, and death (3, 4).

Hemodialysis (HD) is the main renal replacement therapy for patients with end-stage kidney disease (ESKD); it ameliorates many of the clinical manifestations of renal failure and postpones otherwise imminent death. This treatment modality carries high risk of transmitting blood born infections such as HBV and HCV to patients with renal failure, which could be explained by suppressed immunity of patients, prolonged vascular exposure, multiple blood

transfusions, contaminated devices and equipment, environmental surfaces, and attending personnel (5, 6).

HBV and HCV infections are the important causes of morbidity and mortality among patients undergoing HD and impose problems in the management of patients in the dialysis units. Since patients with renal failure do not clear such viral infections efficiently, identifications of the potential risk factors and introduction of measures to address these factors are a priority in HD units (3, 4).

Preventive measures for HBV infection include HBV vaccination, proper screening of donated blood products, separation of HBV dedicated dialysis machines, and periodic test for hepatitis B surface antigens (HBsAg) and anti-HBV antibodies, while HCV transmission within the dialysis environment can be minimized by strict adherence to infection control precautions recommended for HD pa-

tients (5).

The large country-to-country variability in HBV and HCV seroprevalence and even among centers within a single county may reflect a difference in baseline rates and the degree of implementation of infection control measures (5, 6). Results of a study by DOPP showed an HBV prevalence of 0% - 6.6% and HCV prevalence of 2.6% - 22.9% across HD facilities in Western Europe, Japan, and the USA (7, 8), while a registry study of Asian-Pacific countries found the prevalence of HBV ranged 1.3% to 14.6% and HCV prevalence 0.7% to 18.1% (9). In the Middle-East, an annual report from Saudi Arabia indicated the prevalence of HBV and HCV as 3.4% and 9.24%, respectively (10); on the other hand, a systemic review across Middle-East countries demonstrated an overall rate of 25.3% for HCV infection among the population undergoing HD (11).

Iraqi Kurdistan region is located in the Northern Iraq, with an approximate population of 5 million with Erbil, Sulaymania, and Duhok governorates. To the authors' best knowledge, no previous study was conducted on the prevalence of viral hepatitis among patients undergoing HD in this region.

2. Methods

Five governmental HD centers were included in the current cross sectional study, two from Erbil governorate (Hawler teaching hospital and Rozhawa emergency hospital), two from Sulaymania governorate (Shar hospital and Sulaymania's dialysis center) and one from Duhok governorate (Hevi hospital).

A total of 510 subjects out of 543 patients undergoing HD were investigated from 10 August 2015 to 11 February 2016. Those who had no interest to participate in the study or were difficult to trace were excluded. An informed consent was obtained from each patient. The study protocol was in accordance with the world medical association declaration of Helsinki medical research protocols and approved by the ethical committee of Kurdistan Board for Medical specialties.

All demographic information of the study subjects and results were dealt with in confidentiality. A close-ended multiple-choice questionnaire was completed by interview to ensure proper data collection and prevent misunderstandings.

2.1. Samples Collection

Blood samples were collected from each patient, in plain tube, prior to dialysis to prevent the interference of heparin with downstream applications. Serum was tested for HBsAg and anti-HCV antibodies (anti HCV Ab). For HCV

RNA polymerase chain reaction (PCR), a 4-6-mL blood was drained into an ethylenediaminetetraacetic acid (EDTA) tube.

2.2. Virology

All the samples were submitted to the 3rd generation enzyme-linked immunosorbent assay (ELISA) for testing.

For HBsAg determination, AxSYM HBsAg version 2.0 kit (Abbott, USA) was used. Non-reactive samples were considered negative for HBsAg and not tested further, while reactive samples were retested to confirm the result; repeatedly reactive samples were considered positive.

For anti-HCV Abs determination, AxSYM HCV version 3a.0 kit (Abbott, USA) was used. Non-reactive samples were considered negative for HCV, while reactive samples were retested and underwent confirmation by detecting HCV RNA via PCR assay (QIAGEN, Rotor-Gene Q-Pure Detection, Germany).

2.3. Statistical Analysis

Statistical analysis was performed with SPSS version 16 (SPSS Inc, Chicago, IL, USA). Chi-square was used to compare the differences between various categorical data frequencies and the Student t test was used to compare the differences between continuous numerical data. P value ≤ 0.05 was considered statistically significant.

3. Results

A total of 510 patients undergoing HD were included from five major governmental hospitals in order to cover almost all the patients in Kurdistan region; out of which 92 patients from Hawler Teaching hospital, 101 from Rozhawa dialysis center in Erbil governorate, 159 from Sulaymania dialysis center, 51 from Shar hospital in Sulaymania governorate, and 107 patients from Hevi Hospital in Duhok governorate were enrolled in the study.

There were 254 (49.8%) males and 256 (50.2%) females. The mean age of the participants was 48 ± 12 years (ranged 10 - 80). Duration of HD was 36 ± 9 months. Family history of viral hepatitis, injecting drug usage, and high-risk sexual behavior were not found in any patient. The review of participants medical records showed no history of HBV or HCV infection in the patients before starting the maintenance HD program.

The HBsAg was detected in the sera of nine participants (1.8%). Although anti-HCV Ab was found in the sera of 53 patients, only 47 (9.2%) subjects were also positive for HCV RNA. HBV and HCV coinfection was observed in one patient (0.2%) (Table 1).

Table 1. Demographic Characteristics and Medical History of Participants

| Variable | No. or Mean \pm SD | % |
|---------------------------------------|----------------------|------|
| Age, y | 48 \pm 12 | |
| Male | 254 | 49.8 |
| Female | 256 | 50.2 |
| Duration of dialysis, mo | 36 \pm 9 | |
| Blood transfusion | 494 | 96.7 |
| Family history of HBV | 0 | |
| Family history of HCV | 0 | |
| Renal transplant | 20 | 3.9 |
| History of dialysis in another center | 51 | 10 |
| Body tattooing | 7 | 1.4 |
| Dental procedures | 67 | 13.1 |
| Surgical procedures | 65 | 12.7 |
| Vaccination against HBV | 393 | 77.1 |
| Intravenous drug user | 0 | 0 |
| Prevalence of HBV infection | 9 | 1.8 |
| Prevalence of HCV infection | 47 | 9.2 |

Overall, 77% of the participants were fully vaccinated against HBV; the highest rate (93.3%) in Sulaymania Governorate, where no HBV infected patient was detected (Table 2).

No significant relationship was found between HBsAg positivity and gender, dialysis duration, blood transfusion, kidney transplantation, body tattooing, and dental and surgical procedures ($P > 0.05$). However, there was a significant relationship between HBsAg positivity and age ($P < 0.04$), since the infection is more common in relatively younger individuals (mean age: 39.2 ± 14.6 years). HBV acquisition was directly related to the history of HD ($P = 0.005$), and inversely related to hepatitis B vaccination; vaccination against hepatitis B was a strong protective factor ($P < 0.001$) (Table 3).

The current study reported HCV infection in 47 (9.2%) patients with various rates among the governorates; 10 (5.2%) from Erbil, 27 (12.9%) from Sulaymania, and 10 (9.3%) from Duhok.

The study revealed a significant relationship between HCV infection and relatively old ages (mean age: 55 ± 12 years), longer duration of dialysis (mean: 50 ± 12 months), renal transplantation, history of HD, and history of surgical and dental procedures ($P < 0.05$). Whereas gender, tattooing, and blood transfusion were not associated with increased risks of HCV infection ($P > 0.05$) (Table 4).

4. Discussion

HBV and HCV infections are important causes of morbidity and mortality among patients undergoing HD and cause problems to manage patients in the renal dialysis units (3, 4).

The prevalence of HBV and HCV infections among patients undergoing HD in Kurdistan was 1.8% and 9.2%, respectively, and the rate of coinfection for both viruses was 0.2%.

The current study showed a higher rate of HCV infection compared with that of HBV infection and variable rates among HD units were consistent with those of studies in other parts of the world (5, 6).

HBV infection rate in the current study was comparable with that of reported in general population in Iraq 1.6% (12), but it was much lower than that of observed in patients undergoing HD in Basra, south of Iraq 31.1% (13) and those of other countries, for example 5.9% in Jordan (14), 3.8% in Palestine (15), 7% in Kerman, Iran (16), 4.3% in Turkey (17) while it was in agreement with that of a study sample from the (DOPPS) including 8615 adult patients undergoing HD from 308 dialysis facilities in the developed countries, their mean HBV prevalence was 3% with a median of 1.9% (7).

This favorable HBV rate in the current study could be explained by lower rates among general population (12), successful hepatitis B vaccination program, effective screening of donated blood, dialyzing on dedicated machines, and adherence to infection control measures (5, 18).

In the current study, gender, blood transfusion, dialysis vintage, renal transplant, body tattooing, surgical and dental procedures were not associated with increased rate of HBV, this observation was inconsistent with those of several studies that related one or more of these potential risk factors to higher rates of HBV infection (5, 7, 19-21), but it was similar to that of a study from Iran (16).

The current study results showed that patients infected with HBV were significantly younger on average than non-infected patients, this observation was in agreement with that of a study conducted in Libya (19). On the other hand patients infected with HCV were older on average than non-infected congruent with other studies (8, 11) with no clear reason for that.

The current study data demonstrated that a history of hemodialysis in another center carried a high risk for HBV and HCV infections, same observation was reported by other authors (19, 20).

Vaccination against HBV is a potent protective factor to prevent HBV transmission among patients undergoing HD (3, 5, 7). The current study revealed the lowest HBV infection rate among the centers (Sulaymania) with high-

Table 2. Relationship Between HBV Infection and Vaccinated Patients in Each Governorate^a

| City | Numbers of Patients | Vaccinated Patients | HBsAg Positive Patients | P Value |
|--------------|---------------------|---------------------|-------------------------|-------------|
| Erbil | 193 | 116 (60.1) | 6 (3.1) | 0.04 |
| Sulaymania | 210 | 196 (93.3) | 0 | |
| Duhok | 107 | 81 (75.7) | 3 (2.8) | 0.03 |
| Total | 510 | 393 (77) | 9 (1.8) | 0.01 |

^aValues are expressed as No. (%).

Table 3. Variables Potentially Associated With HBV Infection in Patients Undergoing Hemodialysis^a

| Variable | HBV Positive | HBV Negative | P Value |
|-----------------------|--------------|--------------|---------|
| Age, y | 39.2 ± 14.6 | 48 ± 12 | 0.04 |
| Males | 5 (55.6) | 249 (48.8) | 0.81 |
| Females | 4 (44.4) | 252 (49.4) | 0.81 |
| Dialysis duration, mo | 41 ± 10 | 36 ± 9 | 0.4 |
| Dialysis history | 3 (33.3) | 48 (9.4) | 0.005 |
| Blood transfusion | 9 (100) | 485 (96.8) | 0.345 |
| Renal transplant | 0 | 20 (3.9) | |
| Intravenous drug user | 0 | 0 | |
| Body tattooing | 0 | 7 (1.4) | |
| Dental procedures | 1 (11.1) | 66 (12.9) | 0.94 |
| Surgical procedures | 1 (11.1) | 64 (12.5) | 0.98 |
| Vaccination | 2 (22.2) | 391 (76.9) | 0.001 |

^aValues are expressed as No. (%) or mean ± SD.

Table 4. Comparison of Variables in Patients Undergoing Hemodialysis with and Without HCV Infection^a

| Variable | HCV Positive | HCV Negative | P Value |
|-----------------------|--------------|--------------|---------|
| Age, y | 55 ± 12 | 48 ± 12 | 0.001 |
| Males | 25 (53.2) | 229 (44.9) | 0.35 |
| Females | 22 (42.6) | 234 (45.9) | 0.4 |
| Dialysis duration, mo | 50 ± 12 | 36 ± 9 | 0.001 |
| Blood transfusion | 45 (95.7) | 449 (96.6) | 0.21 |
| Renal transplant | 10 (21.3) | 10 (2) | 0.001 |
| Dialysis in history | 25 (53.2) | 26 (5.4) | 0.003 |
| Family history of HCV | 0 | 0 | |
| Intravenous drug user | 0 | 0 | |
| Body tattooing | 0 | 7 (1.5) | |
| Dental procedures | 12 (25.5) | 55 (11.1) | 0.025 |
| Surgical procedures | 19 (40.4) | 46 (9.4) | 0.015 |

^aValues are expressed as No. (%) or mean ± SD.

still suboptimal as reasonable numbers of patients started HD without being fully vaccinated and even vaccinated patients did not undergo regular antibody titer assessments.

The prevalence of HCV 9.2% in the current study was remarkably higher than that of general population in Iraq 0.4% (15), this difference of prevalence clearly points to the importance of nosocomial transmission among patients undergoing HD. However, it was lower than the ones reported in patients undergoing HD in Iraq 20% (11) and particularly in south of Iraq 42.6% (13). An overall prevalence of 25.3% of HCV infection was reported among patients undergoing HD in Middle-East region (11) with various rates in different countries such as 7.4% in Palestine (15), 31.1% in Libya (19), 51% in Egypt (21), 12% in Iran (11), and 7.9% in Turkey (17). In DOPPS study including 308 dialysis facilities in seven industrialized countries, the mean HCV prevalence was 13.5% and varied among countries from 2.6% to 22.9% (8).

Duration on HD was a statistically significant risk factor for HCV infection in HD population under investigation ($P < 0.001$), this explained that nosocomial transmission was related to dialysis, since longer duration of dialysis represented a longer period at risk of acquiring an infection. Similar observations are reported by other authors (8, 11, 19-21). In accordance with other studies (8, 11, 19), HCV infection was more prevalent in patients with a history of previous kidney transplant, which could be attributed to immunosuppressive drugs, making them more liable to acquiring infection.

Dental and surgical procedures were risk factors for HCV transmission. The unsafe medical procedures and tools were a well-recognized risk factor for HCV acquisition (4).

In the current study results, in agreement with those of others (16, 19-21), no association was observed between HCV prevalence and gender of the patients; it was inconsistent with those of DOPPS study (8).

Although blood transfusion was regarded a risk factor for HCV infection in some studies (11, 20), in the current study and several others (8, 21) no significant association was observed, which could be the result of effective blood

est vaccination rate, however, the vaccination program is

screening methods.

The authors noticed a suboptimal adherence to universal precautions in the studied HD units such as shortage of nursing staff and crowded units attributed to low resources and it may lead to breakdown in the infection control measures (6, 22).

A limitation to this study was that hepatitis B core antibodies or hepatitis B DNA were not studied, it is therefore possible that the study failed to detect cases of occult hepatitis B infection.

Testing for HCV relied on a third generation ELISA to detect anti-HCV antibodies and then confirmed by PCR for HCV-RNA. Partial immunosuppression in patients undergoing HD resulting in a poor antibody response to HCV infection underestimate serological screening of HCV (4).

4.1. Conclusion

The prevalence of HBV and HCV infection in HD centers in Kurdistan, Iraq was low to moderate. HBV vaccination was an efficient protective measure. The factors associated with viral hepatitis within HD units were highly suggestive of nosocomial transmission. Strict adherence to infection control measures and more effective follow-up procedures may reduce the prevalence of the disease.

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Footnotes

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References

- World Health Organization . *Hepatitis B fact sheet updated July 2016*. 2016. Available from: <http://www.who.int/mediacentre/factsheets/fs204/en/>.
- World Health Organization . *Hepatitis C fact sheet updated July 2016*. 2016. Available from: <http://www.who.int/mediacentre/factsheets/fs164/en/>.
- European Association For The Study Of The L. EASL clinical practice guidelines: Management of chronic hepatitis B virus infection. *J Hepatol*. 2012;57(1):167-85. doi: 10.1016/j.jhep.2012.02.010. [PubMed: 22436845].
- European Association for Study of L. EASL Clinical Practice Guidelines: management of hepatitis C virus infection. *J Hepatol*. 2014;60(2):392-420. doi:10.1016/j.jhep.2013.11.003. [PubMed: 24331294].
- Elamin S, Abu-Aisha H. Prevention of hepatitis B virus and hepatitis C virus transmission in hemodialysis centers: review of current international recommendations. *Arab J Nephrol Transplant*. 2011;4(1):35-47. doi: 10.4314/ajnt.v4i1.63154. [PubMed: 21469594].
- Bernieh B. Viral hepatitis in hemodialysis: An update. *J Transl Int Med*. 2015;3(3):93-105. doi: 10.1515/jtim-2015-0018. [PubMed: 27847896]. [PubMed Central: PMC4936461].
- Burdick RA, Bragg-Gresham JL, Woods JD, Hedderwick SA, Kurokawa K, Combe C, et al. Patterns of hepatitis B prevalence and seroconversion in hemodialysis units from three continents: the DOPPS. *Kidney Int*. 2003;63(6):2222-9. doi:10.1046/j.1523-1755.2003.00017.x. [PubMed: 12753311].
- Fissell RB, Bragg-Gresham JL, Woods JD, Jadoul M, Gillespie B, Hedderwick SA, et al. Patterns of hepatitis C prevalence and seroconversion in hemodialysis units from three continents: the DOPPS. *Kidney Int*. 2004;65(6):2335-42. doi: 10.1111/j.1523-1755.2004.00649.x. [PubMed: 15149347].
- Johnson DW, Dent H, Yao Q, Tranaeus A, Huang CC, Han DS, et al. Frequencies of hepatitis B and C infections among haemodialysis and peritoneal dialysis patients in Asia-Pacific countries: analysis of registry data. *Nephrol Dial Transplant*. 2009;24(5):1598-603. doi: 10.1093/ndt/gfn684. [PubMed: 19096083].
- SCOT . *Saudi center for organ transplantation- annual report 2015*, page 83. 2015. Available from: www.scot.org.sa/pages/Doc15.
- Ashkani-Esfahani S, Alavian SM, Salehi-Marzjafari M. Prevalence of hepatitis C virus infection among hemodialysis patients in the Middle-East: A systematic review and meta-analysis. *World J Gastroenterol*. 2017;23(1):151-66. doi: 10.3748/wjg.v23.i1.151. [PubMed: 28104991]. [PubMed Central: PMC5221279].
- Tarky AA, Akram W, Al-Naaimi A, Omer A. Epidemiology of viral hepatitis B and C in Iraq: a national survey 2005-2006. *Zanco J Med Sci*. 2013;17(1):370-80. doi: 10.15218/zjms.2013.0017.
- Shihab S, Al-Hmudi H, Aledani H, Mahdi K. Viral hepatitis infections in Basrah haemodialysis unit: Serological diagnosis and viral loading. *Euro J of Experimental Bio*. 2014;4(2):106-12.
- Al Hijazat M, Ajlouni YM. Hepatitis B infection among patients receiving chronic hemodialysis at the Royal Medical Services in Jordan. *Saudi J Kidney Dis Transpl*. 2008;19(2):260-7. [PubMed: 18310881].
- Al Zabadi H, Rahal H, Fuqaha R. Hepatitis B and C prevalence among hemodialysis patients in the West Bank hospitals, Palestine. *BMC Infect Dis*. 2016;16:41. doi:10.1186/s12879-016-1359-8. [PubMed: 26830673]. [PubMed Central: PMC4736137].
- Zahedi MJ, Darvish Moghaddam S, Alavian SM, Dalili M. Seroprevalence of Hepatitis Viruses B, C, D and HIV Infection Among Hemodialysis Patients in Kerman Province, South-East Iran. *Hepat Mon*. 2012;12(5):339-43. doi: 10.5812/hepatmon.5969. [PubMed: 22783346]. [PubMed Central: PMC3389360].
- Suleymanlar G, Altiparmak MR, Seyahi N. *National hemodialysis, transplant and nephrology registry report of Turkey, 2011*. Istanbul: Turkish Nephrology society: Pasific Press; 2012.
- Yuan J, Yang Y, Han F, Zhang P, Du XY, Jiang H, et al. Quality control measures for lowering the seroconversion rate of hemodialysis patients with hepatitis B or C virus. *Hepatobiliary Pancreat Dis Int*. 2012;11(3):302-6. doi: 10.1016/S1499-3872(12)60164-7. [PubMed: 22672825].
- Alashek WA, McIntyre CW, Taal MW. Hepatitis B and C infection in haemodialysis patients in Libya: prevalence, incidence and risk factors. *BMC Infect Dis*. 2012;12:265. doi: 10.1186/1471-2334-12-265. [PubMed: 23082935]. [PubMed Central: PMC3507892].

20. Su Y, Yan R, Duan Z, Norris JL, Wang L, Jiang Y, et al. Prevalence and risk factors of hepatitis C and B virus infections in hemodialysis patients and their spouses: a multicenter study in Beijing, China. *J Med Virol*. 2013;**85**(3):425-32. doi: [10.1002/jmv.23486](https://doi.org/10.1002/jmv.23486). [PubMed: [23341370](https://pubmed.ncbi.nlm.nih.gov/23341370/)].
21. Sarhan II, Kamel CR. Prevalence of hepatitis C virus seroconversion among hemodialysis patients in Egypt. *Egypt Liver J*. 2015;**5**(2):34-9. doi: [10.1097/01.elx.0000463167.48017.41](https://doi.org/10.1097/01.elx.0000463167.48017.41).
22. Girou E, Chevaliez S, Challine D, Thiessart M, Morice Y, Lesprit P, et al. Determinant roles of environmental contamination and noncompliance with standard precautions in the risk of hepatitis C virus transmission in a hemodialysis unit. *Clin Infect Dis*. 2008;**47**(5):627-33. doi: [10.1086/590564](https://doi.org/10.1086/590564). [PubMed: [18662134](https://pubmed.ncbi.nlm.nih.gov/18662134/)].