



Original Research

Prevalence and Risk Factors of Hepatitis B and C Viruses Among Hemodialysis Patients in Dhamar Governorate, Yemen

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Abstract

Background: Hemodialysis (HD) patients are at an increased risk of acquiring hepatitis B virus (HBV) and hepatitis C virus (HCV) infections due to high number of blood transfusion sessions, prolonged vascular access, high exposure to infected patients and contaminated equipment.

Aim: This study was aimed to determine the prevalence of HBV and HCV infections and the risk factors for transmission of viral hepatitis B and C among patients who attended dialysis center in Dhamar governorate, Yemen.

Methods: In this cross-sectional study, a total of 168 hemodialysis patients from hemodialysis center were interviewed. Information was collected by pretested questionnaire. The baseline and follow up data of HBV and HCV serology were gathered from medical records.

Results: The overall prevalence of HBV, HCV and HBV & HCV co-infection among the study sample was 29.17%, 10.12% and 0.6%, respectively. Duration of hemodialysis was found to be a statistically significant ($P < 0.05$) risk factor for HBV and HCV infections.

Conclusion: The prevalence of HBV and HCV infections in HD center in Dhamar governorate is still an important health issue in Yemen. Longer duration of dialysis is a major risk factor for HBV & HCV infections. However, further studies with a large number of cases and in different geographic places are needed to better determination of the prevalence and risk factors of HBV and HCV in HD patients.

Keywords: Prevalence, Risk factors, Hepatitis B virus, Hepatitis C virus, Hemodialysis, Yemen

1. Introduction

Infection with hepatitis B virus (HBV) and hepatitis C virus (HCV) affects the liver and results in a broad spectrum of disease outcomes [1]. HBV, a member of the *Hepadnaviridae* family, is a double-stranded DNA virus while HCV, a member of the *Flaviviridae* family, is RNA virus. HBV was discovered in 1966 whereas HCV was not identified until 1988 [2]. According to one global survey, about two billion people are infected with HBV and more

than 350 million of population is a carrier for HBV [3, 4, 5]. World health organization (WHO) estimated that 3% of the world's population is infected with HCV resulting in a total of 120 to 170 million people [6,7]. HCV and HBV can be transmitted parenterally, perinatally and sexually. Transfusion of infected blood or blood products, transplantation of organs from infected donors and sharing of contaminated needles [8,9]. Transmission by sexual activity and household contact occurs less frequently. In patients with end stage renal disease (ESRD), the compelling requirement for a vascular access site,

along with the extracorporeal circulation necessary to perform Hemodialysis (HD) adds to the risk of parenteral exposure to HBV and HCV infection within the HD unit. HBV and HCV infections are the most common causes of liver disease in HD patients [10].

The clinical presentation of HBV and HCV infection is usually the abdominal pain, malaise and appearance of jaundice [11]. HCV can also cause silent infection and can persist for 10 to 30 years without symptoms [12]. Complications of HBV and HCV are portal hypertension, cirrhosis, ascites and esophageal varices [13]. When patients with ESRD contract either HBV or HCV they regularly do not clear the virus and develop to chronic hepatitis. In a meta-analysis of previous clinical studies including 145,608 patients, anti-HCV seropositive status was a significant risk factor for death in patients on long-term dialysis [14].

Because of a high risk of infection during dialysis, it is essential to determine whether HBs Ag and anti-HCV negative sera contain HBV-DNA and HCV-RNA in order to prevent ongoing transmission [15,16]. Nurse understaffing in HD units may further increase the odds of HCV transmission since insufficient time to fully comply with disinfection requirements may facilitate cross-infection via blood-contaminated gloves and hands, dialysis equipment, dialyzer and blood line surfaces [14].

The introduction of HBV vaccination, isolation of HBV-positive patients, use of dedicated dialysis machines and regular surveillance for HBV infection dramatically reduced the spread of HBV in this setting [17]. In Yemen there are limited publications regarding the prevalence of HBV and HCV and their related risk factors among patients who undergo HD therefore this study focusing on this problem.

2. Methods

Study design

This study was carried out at Dialysis Center in General Dhamar Hospital Authority, Dhamar governorate, Yemen Study Design and Sample size. A cross-sectional study was conducted among HD patients at Dialysis Center in General Dhamar Hospital Authority. Patients were informed about objectives of this study. All patients had both a baseline HBV and HCV serology and a follow-up HBV and HCV serology. The baseline data was gathered from their medical records back to the beginning of dialysis in each patient. Follow up data was also gathered from their records. This study targeted 168 HD patients at Dialysis Center in General Dhamar Hospital Authority.

Data collection

The data was collected using questionnaire including information about sociodemographic characteristics of patients. These data included age, gender, duration of HD, as well as the associated risk factors of HBV and HCV infection (blood transfusions, organ transplantation,

surgical interventions, dental procedures, etc.) also were included. Questionnaire was completed by the researchers via patient interview to ensure proper data collection and prevent any misunderstanding.

Statistical analysis

Statistical analysis was carried out by using Statistical Package for the Social Science IBM SPSS, version 25.0. Data was presented as mean \pm standard deviation or number (percentages). Chi square and Fisher tests were used to evaluate the differences between variables.

Ethical consideration

Ethical approval was obtained from Tamar University Medical Ethics Committee (TUMEC-19019). Verbal consents were taken from the patients and the parents of children prior to questionnaire filling. All of the information was collected and kept strictly confidential.

3. Results

Patients' Characteristics

The study subjects consisted of 168 patients with ESRD who were attended the HD unit, 58.9% (99/168) were males and 41.1% (69/168) were females. Most of the patients were between 31- 60 years of age and mean age was 43.7 ± 15.1 years. In relation to marital status 76.2% (128/168) were married, 13.1% (22/168) were single, 7.1% (12/168) were widow, and the remaining 3.6% (6/168) were divorced. Regarding the educational status, 51.8% (87/168) were illiterates, 23.8% (40/168) had primary school education, 16.7% (28/168) had secondary school education, and 7.7 (13/168) had university or above education level (Table 1).

Table 1: Characteristics of the study subjects (n=168)

Variable	Frequency (n)	Percentage (%)
Age (Years)		
≤ 30	42	25.0%
31-45	52	31.0%
46-60	54	32.1%
> 60	20	11.9%
Sex		
Male	99	58.9%
Female	69	41.1%
Marital Status		
Single	22	13.1%
Married	128	76.2%
Divorced	6	3.6%
Widow	12	7.1%
Education Level		
Illiterate	87	51.8%
Primary School	40	23.8%
Secondary School	28	16.7%
University or above	13	7.7%

As shown in Figure1, of all the study subjects, 29.17% (49/168) were infected with HBV, 10.12% (17/168) were

infected with HCV and 0.6% (1/168) was infected with both HBV and HCV.

Of all the HBV infected patients, 2% (1/49) infected before HD and, the remaining 98% (48/49) were infected after HD. However, of all the HCV infected patients, 23.5% (4/17) infected before HD and the remaining 76.5% (13/17) were infected after HD (Table 2).

The results of this study showed that 61.2% (41/67) of all infected patients were males and 38.8% (26/67) were females. Prevalence of HBV, HCV and HBV&HCV infections among infected males were 70.7% (29/41), 26.8% (11/41) and 2.5% (1/41), respectively. While, the prevalence of HBV and HCV infections among infected females were 76.9% (20/26) and 23.1% (6/26), respectively. This association was not statistically significant ($P > 0.05$) (Table 3).

Table 4 shows that the age group of 31-45 (41.8%; 28/67) has the highest prevalence compared to the age group of > 60 which showed the lowest prevalence (7.5%; 5/67). The prevalence of HBV infected patients was more than HCV infected patients in all age groups.

Analysis of potential risk factors in HBV and HCV infected

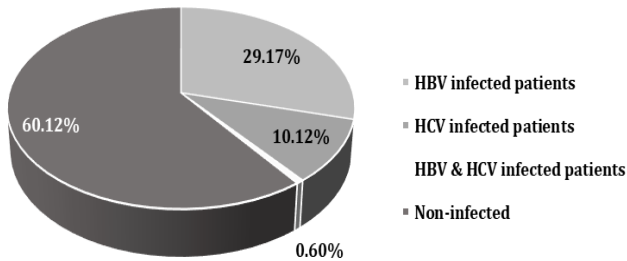


Figure 1: Prevalence of HBV and/or HCV infection among the study patients

patients showed that duration of HD was statistically significant ($P < 0.05$) risk factor. In patients with duration of HD for more than 3 years, the total prevalence of HBV,

HCV and coinfection was 55.2% (37/67) higher than those who were under HD for a shorter time period (Figure 2).

Analysis of other potential risk factors showed that there was no statistically significant relationship between HBV and/or HCV infections and blood transfusion, organ transplantation, surgical operations, dental procedures and Hegamh (cupping) ($P > 0.05$) (Table 4).

Table 2: Time of diagnosis of HBV and HCV infection

Variable	Total	Diagnosis of infection				X ²	P value
		Before HD		After HD			
		No.	%	No.	%		
HBV	49	1	2.0	48	98.0	193.3	< 0.001
HCV	17	4	33.5	13	76.5	102.8	< 0.001

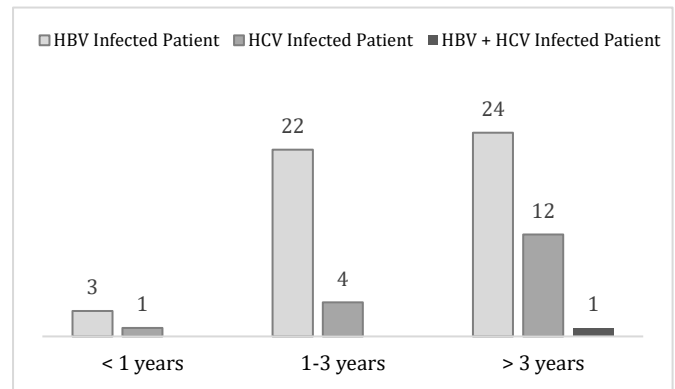


Figure 2: Correlation of duration of HD with prevalence of infection

Table 3: Distribution of HBV and/or HCV infection according to sex of the infected patients

Variable	Total	Male		Female		X ²	P value
		No.	%	No.	%		
HBV	49	29	70.7	20	76.9	0.034	0.854
HCV	17	11	26.8	6	23.1	0.499	0.480
HBV & HCV	1	1	2.5	0	0.0	0.701	0.589
Total*	67	41	61.2	26	38.8		

* No./Total of infected patients

Table 4: Distribution of HBV and HCV infections according to age of the infected patients

Variable	Total	Age group /Years								X ²	P value
		≤ 30		31-45		46-60		>60			
		No.	%	No.	%	No.	%	No.	%		
HBV	49	11	78.6	19	67.9	16	80	3	60	4.22	0.23
HCV	17	3	21.4	8	28.6	4	20	2	40	3.55	0.31
HBV & HCV	1	0	0	1	3.5	0	0	0	0	2.67	0.67
Total*	67	14	20.9	28	41.8	20	29.9	5	7.5		

* No./Total of infected patients

Table 5: Prevalence of HBV and HCV infections in relation to potential risk factors

Potential risk factors	Total	HBV				X ²	P value	HCV				X ²	P value
		Infected		Non infected				Infected		Non infected			
		No.	%	No.	%			No.	%	No.	%		
Blood transfusion	148	45	30.4	103	69.6	0.246	0.620	15	10.1	133	89.9	0.436	0.454
Organ transplantation	7	2	28.6	5	71.4	0.005	1.00	1	14.3	6	85.7	0.097	0.555
Surgical operation	72	21	29.2	51	70.8	0.021	0.884	7	9.7	65	90.3	0.130	0.719
Dental procedure	37	8	21.6	29	78.4	1.504	0.220	5	13.5	32	86.5	0.389	0.533
Hegamha (Cupping)	15	3	20	12	80	0.751	0.557	3	20	12	80	1.485	0.206

4. Discussion

In this study, the overall prevalence of HBV and HCV infection in HD patients were (29.17%) and (10.12%),

respectively. The prevalence of HBV and HCV Co-Infection was (0.60%). These results were lower than that reported in other studies from our country. In 2015 a similar study conducted in Zabid city has reported that the prevalence of HBV and HCV were 48.83% and 46.01%, respectively in

patients with HD [18]. Another study conducted in Aden has showed that the prevalence of HCV infection in HD patients was (40.2%) [19]. In Arabic countries, the prevalence of HBV infection ranges from 2% in Morocco to 11.8 % in Saudi Arabia. Moreover, the prevalence of HCV infection among HD patients has been reported to range from 27 % in Lebanon to 48.9 % in Syria [20-22]. Regarding other parts of the world, the prevalence of HBV infection among HD patients in Iran, Pakistan, Nigeria, and Argentina were 1.2%, 15.4%, 6%, and 8.7%, respectively. While the prevalence of HCV infections was 2.8%, 29.1%, 1.2%, and 9.9%, respectively [23-26].

The results of the present study showed no statistically significant relationship between HBV and HCV infections and sex of the patients. These results were in disagreement with the results of other studies in Yemen (Zabid city), Iran and Argentina which showed higher prevalence of HBV infection among males than females on HD patients [18,23,26].

In accordance with Joukar et al., Zahedi et al., and Kalantari et al., the present study did not reveal a statistically significant relationship between HBV and HCV infections and age of the patients [27-29]. On the other hand, Al-Hegami et al. and El-Ottol et al. reported a significant relationship between HBV infection and age of the patients in a way that patients < 40 years were reported to be more susceptible to HBV than older patients [18,30].

In this study a statistically significant relationship was found between HBV and HCV infections and time duration on HD, this finding was in agreement with the results of Zahedi et al. study [28]. Similar results were shown in previous study in Jordan but this was in contrast to another report in Iran, Gaza strip, and Moldavia [27,30,31]. The results of our study showed no statistically significant relationship between HBV and history of blood transfusion. These results were in agreement with the results of previous studies in Iran and Jordan which showed that the prevalence of HBV was not increased significantly by the history of blood transfusion [28,32]. But other studies in Gaza strip and Brazil do not support this relationship [30,33]. In addition, the results of this study showed no statistically significant relationship between HCV infection and history of blood transfusion which were in disagreement with the other studies which have done in Iran, Gaza strip, Brazil, and the USA [28,30,33,34].

5. Conclusion

The results of the present study showed that the prevalence of HBV and HCV infections in HD center in Dhamar governorate is lower than some other areas in Yemen but higher than some other countries in the region and the world. The results of the present study showed that longer duration of HD is a major risk factor for HBV and HCV infection. We recommend that further studies with a large number of cases within different geographic

places should be done, to better determination of the prevalence and risk factors of HBV and HCV infections in HD patients. Effective strategies to reduce the prevalence as well as nosocomial transmission of HCV and HBV infections among the HD patients should be implemented include infection control practices, effective follow up procedure, routine serological testing, immunization against HBV infection and training and education of health workers in HD center about infection control program. HBV and HCV PCR should be considered at baseline for persons with infection risk factors and for returning travelers receiving dialysis or renal transplant in HBV and HCV endemic countries to identify occult and newly acquired infections.

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Competing interests

The authors declare that they have no competing interests.

References

1. Lavanchy D. Hepatitis B, virus epidemiology, disease burden, treatment, and current and emerging prevention and control measures. *J Viral Hepat.* 2004;11:97–107.
2. Hayashmi J, Kishiharar Y, Yamaji K, Yoshimura E, Yawakami Y, Akazawa K, et al. Transmission of hepatitis C virus by health care workers in rural area of Japan. *Am J Gastroenterol.* 1995; 90:794-9
3. Stanaway JD, Flaxman AD, Naghavi M, Fitzmaurice C, Vos T, Abubakar I, et al. The global burden of viral hepatitis from 1990 to 2013: findings from the Global Burden of Disease Study 2013. *Lancet.* 2016 Sep 10;388 (10049) :1081-1088. doi: 10.1016/S0140-6736(16)30579-7. Epub 2016 Jul 7.
4. Lavanchy D. Public health measures in the control of viral hepatitis: A world health organization perspective for the next millennium. *J GastroenterolHepatol.* 2002;17S4: s452-s459.
5. Hayes PC, Sympton KJ, Garden OJ, editors. *Davidson's Principles and Practice of Medicine*; 19th ed. Philadelphia Churchill Livingstone; 2002.
6. Liu Z, Hou J. Hepatitis B virus (HBV) and hepatitis C virus (HCV) dual infection *Int J Med Sci.* 2006;3(2):57–62.
7. Huo TI, Huang YH, Hsia CY, Su CW, Lin HC, Hsu CY, et al. Characteristics and outcome of patients with dual hepatitis B and C-associated hepatocellular carcinoma: are they different from patients with single virus infection? *Liver Int* 2009, 5:767–773.
8. World Health Organization. Hepatitis C. Fact sheet no 164. Available at <http://www.who.int/mediacentre/factsheets/fs164/en/>. Updated: April 2017; Accessed: June 12, 2017
9. Centers for Disease Control and Prevention. Viral hepatitis. Available at <https://www.cdc.gov/hepatitis/abc/index.htm>. Updated: May 26, 2016; Accessed: June 13, 2017.
10. Saxena AK, Panhotra BR. The Impact of Nurse Understaffing on the Transmission of Hepatitis C Virus in a Hospital-Based Hemodialysis Unit. *MedPrincPract* 2004;13: 129–135.
11. Russel RCG, Williams NS, Bulstrode CJK, editors. *The Liver.* In: Bailey and Loves" Short Practise of Surgery, 24th ed. London: Chapman and Haal 2004;1076.
12. Seef LB. Natural history of hepatitis C. *Am J Med* 1999; 107:10-15.
13. Cuschieri SA, Steele RJC, Moosa AR, editors. *Essential surgical practice*, 4th ed. London: Arnold; 2002.

14. Fabrizi F, Dixit V, Messa P. Impact of hepatitis C on survival in dialysis patients: a link cardiovascular mortality? *J Viral Hepat.* 2012; <https://doi.org/10.1111/j.1365-2893.2012.01633.x> PMID:22863263 19(9):601-7.
15. Fabrizi F, Martin P, Dixit V, Brezina M, Russell J, Conrad A, et al. Detection of de novo hepatitis C virus infection by polymerase chain reaction in hemodialysis patients. *Am J Nephrol.* 1999;19(3):383-8. doi: 10.1159/000013482. PMID: 10393375.
16. Bukh J, Wantzin P, Krogsgaard K, Knudsen F, Purcell RH, Miller RH. High prevalence of hepatitis C virus (HCV) RNA in dialysis patients: failure of commercially available antibody tests to identify a significant number of patients with HCV infection. Copenhagen Dialysis HCV Study Group. *J Infect Dis.* 1993 Dec;168(6):1343-8. doi: 10.1093/infdis/168.6.1343.
17. Fabrizi F, Poordad F, Martin P. Hepatitis C infection and the patients with end-stage renal disease. *Hepatology.* 2002; 36:3-10
18. Al-Hegami MA, Al-Mamari A, Al-Kadasse AS, Al-Gasha'a FAS, Al-Hag S, Al-Hegami AAS. Prevalence and Risk Factors of Hepatitis B and Hepatitis C Virus Infections among Patients with Chronic Renal Failure in Zabeed City, Yemen Republic. *Open Journal of Medical Microbiology.* 2015;5:136-142. doi: 10.4236/ojmm.2015.53017.
19. Aman K, Al-Dubai SA, Aman R, Hawash A, Alshagga M, Kassim S. Prevalence and associated factors of hepatitis C virus infection among renal disease patients on maintenance hemodialysis in three health centers in Aden, Yemen: a cross sectional study. *Saudi J Kidney Dis Transpl.* 2015; 26: 380-385.
20. Almawi WY, Qadi AA, Tamim H, Ameen G, Bu-Ali A, Arrayid S, et al. Seroprevalence of hepatitis C virus and hepatitis B virus among dialysis patients in Bahrain and Saudi Arabia. *Transplant Proc.* 2004;36(6):1824-6.
21. Boulaajaj K, Elomari Y, Elmaliki B, Madkouri B, Zaid D, Benchems N. Prevalence of hepatitis C, hepatitis B and HIV infection among haemodialysis patients in Ibn-Rochd university hospital, Casablanca. *Nephrol Ther.* 2005;1(5):274-84.5.
22. Al Zabadi H, Rahal H, Fuqaha R. Hepatitis B and C prevalence among hemodialysis patients in the West Bank hospitals, Palestine. *BMC Infectious Diseases.* 2016;16:41 DOI 10.1186/s12879-016-1359-8
23. Morteza Alibakhshikenari. Prevalence of Hepatitis B and C Viruses' Infections among Hemodialysis Patients in Tehran, Iran. *Biomed J Sci & Tech Res.* 2018;11(2). BJSTR. MS.ID.002065. DOI: 10.26717/BJSTR.2018.11.002065.
24. Ali N, Hussain W, Hayat A, Shah T, Wen R, Zeb I, et al. Prevalence and risk factors of hepatitis B and C viruses among haemodialysis patients: a multicentric study. *Eur J Gastroenterol Hepatol.* 2019 Jan;31(1):29-33. doi: 10.1097/MEG.0000000000001220.
25. Amira CO, Lesi OA. Seroprevalence of hepatitis B and C infection among Nigerian subjects with chronic kidney disease. *J Clin Sci.* 2017;14:58-61.
26. Salvatierra K, Florez H. Prevalence of hepatitis B and C infections in hemodialysis patients. *F1000Research.* 2016;5:1910. <https://doi.org/10.12688/f1000research.9068.1>.
27. Joukar F, Besharati S, Mirpour H, Mansour-Ghanaei F. Hepatitis C and hepatitis B seroprevalence and associated risk factors in hemodialysis patients in Guilan province, north of Iran: HCV and HBV seroprevalence in hemodialysis patients. *Hepat Mon.* 2011;11:178-81.
28. 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;12:339-43.
29. Kalantari H, Ebadi S, Yaran M, Maracy MR, Shahshahan Z. Prevalence and risk factors of hepatitis B and C viruses among hemodialysis patients in Isfahan, Iran. *Adv Biomed Res.* 2014; 3:73.
30. Elkader Y, El Ottol A, Elmanama AA, Ayes BM. Prevalence and risk factors of hepatitis B and C viruses among haemodialysis patients in Gaza strip, Palestine. *Virol J.* 2010;7:210. doi: 10.1186/1743-422X-7-210.
31. Covic A, Iancu L, Apetrei C, Scripcaru D, Volovat C, Mititiuc I, et al. Hepatitis virus infection in haemodialysis patients from Moldavia. *Nephrol Dial Transplant.* 1999;14:40-5.
32. Al Hijazat M, Ajlouni Y. Hepatitis B infection among patients receiving chronic hemodialysis at the Royal Medical Services in Jordan. *Saudi J Kidney Dis Transpl.* 2008;19:260-7.
33. Silva LK, Silva MB, Rodart IF, Lopes GB, Costa FQ, Melo ME, et al. Prevalence of hepatitis C virus (HCV) infection and HCV genotypes of hemodialysis patients in Salvador, Northeastern Brazil. *Braz J Med Biol Res.* 2006;39:595-602.
34. de Medina M, Ashby M, Schlüter V, Hill M, Leclercq B, Pennell JP, et al. Prevalence of hepatitis C and G virus infection in chronic hemodialysis patients. *Am J Kidney Dis.* 1998;31:224-6.