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Prevalence of Hepatitis B Virus and Hepatitis C Virus and Associated Risk Factors among Hemodialysis Patients in Ibb City-Yemen

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Abstract:
The hepatitis B virus (HBV) and hepatitis C virus (HCV) infections are highly prevalent among patients undergoing hemodialysis (HD) and constitute the major threat that challenges the health system in developing countries. Therefore, the present work aimed to find out the prevalence rate of HBV and HCV infections and risk factors among patients attending the dialysis center in Al-Thawrah hospital in Ibb city, Yemen. One hundred (100) serum specimens were collected from HD patients from May 2013 to April 2016. Also, the data concerning risk factors were collected by using a designed questionnaire. The collected specimens were screened for hepatitis B surface antigen (HBsAg) and HCV antibodies by enzyme-linked immunosorbent assay (ELISA) techniques. The results revealed that the overall prevalence of HBV, HCV, and co-infection was 3%, 21%, and 2%, respectively, recorded in this study. The age group of 31-45 years, males, unmarried patients had the highest rate of HBV infection while HCV infection was highly recorded among age group >45 years, female, and married. Also, the patients living in the urban area and illiterate showed the highest infections with HBV and HCV. It can be concluded that the high prevalence of hepatitis infections among HD patients in Yemen represents a serious community health problem to become a nosocomial infection in dialysis units. So, strict adherence to proper and effective procedures for infection control may be reduced and prevented the prevalence of hepatitis infections.

Keywords: Hepatitis B, Hepatitis C, Hemodialysis, Ibb city, Yemen.

INTRODUCTION

Chronic viral hepatitis, primarily caused by the hepatitis B virus (HBV) and hepatitis C virus (HCV), poses a serious public health problem in the world. Globally, it was estimated that approximately 240 million individuals are chronically infected with HBV and about 180 million people are infected by the hepatitis C virus in the world and 3-4 million people are infected every year (Irfan *et al.,* 2016; WHO, 2016a,b).

HBV and HCV are highly infectious and transmitted from person to person by blood transfusions, sexual, and vertical routes. Recently, these types of viruses are common nosocomial problems and the cause of morbidity and mortality among hemodialysis (HD) patients because of the complications in the management of patients in the dialysis units (Iwasa *et al.,* 2008; Sinjari and Bakr, 2018).

The high prevalence of HBV and HCV in the hemodialysis units have been detected worldwide. The risk factors that include suppressed immunity of patients, prolonged vascular exposure, multiple blood transfusions, invasive medical procedures, and sharing of infected patients' environments are contributed to viral hepatitis B and C prevalent among hemodialysis patients (Elamin and Abu-Aisha, 2011; Bernieh, 2015). In general, the prevalence rates of HBV and HCV infections varied from country to country as well as from region to region of the world. HBV and HCV infections are ranging from 1% in the UK to more than 90% in Eastern Europe in hemodialysis patients (Reddy *et al*., 2005). Chronic infection of HCV leads to extra-hepatic disorders, hepatocellular carcinoma, renal disorders, hematologic diseases, and cirrhosis (Ali *et al.,* 2015; Hussien *et al.,* 2018).

The prevalence of chronic HBsAg infection among HD patients in Arab countries; 2% in Morocco (Elzouki *et al*., 2006) and 11.8% in Bahrain (Telaku *et al*., 2003). HCV antibodies prevalent among HD patients were recorded 27% in Lebanon (Naman *et al*., 1996), 75% in Syria (Abdulkarim *et al*., 1998), and in Saudi Arabia ranged from 49.9% (Al-Khattabi, 2019) to 62.7% (Al-Shohaib *et al*., 1995).

The frequency rates of HBV and HCV within dialysis units in developing countries are much higher than that reported in developed countries. Yemen is one of the developing countries and among the poorest countries in the world. The health system suffers from shortcomings in structure and organization, low staff, low quality of healthcare, shortages of essential medicines, and a lack of equality in the distribution of publicly funded facilities and human resources (WHO, 2010). A few epidemiological studies of viral hepatitis were conducted among HD patients in different cities in Yemen, the prevalence rates of HBsAg and HCV antibodies were recorded 31% and 62.7% in Aden (Bin Selm, 2010), 48.83% and 46.01% in Zabeed (Al-Hegami *et al*., 2015), and 20.7% and 47.2% in Sana'a (Al-Haj *et al.*, 2018).

Ibb city is located in the middle of Yemen east of Sana'a capital with an approximate population of 3.5 million and has one HD unit at Al-Thawrah hospital. Up to now, no previous study was conducted on the prevalence of viral hepatitis among HD patients in this city. Therefore, the present work aimed to determine the prevalence of HBV and HCV infections and risk factors among patients attending the dialysis center in Ibb city, Yemen.

MATERIAL AND METHODS

Study Design and Area

This work was conducted among all the ESRD patients attending the HD unit in Al-Thawrah hospital located at IBB city from May 2013 to April 2016.

Data Collection

A structured questionnaire that included age, gender, residency, level of education,

marital status, blood transfusion, surgical procedures, dentist visit, cupping, accidental inoculation, family history of jaundice, and duration on hemodialysis was filled for each patient via face-to-face interview by a researcher to confirm accurate collection of data properly and avoid any misunderstanding.

Specimens Collection and Examination

Five milliliters of blood was collected from each patient before dialysis. Specimen testing was performed at the laboratory of Al-Thawrah hospital by using an enzyme-linked immunosorbent assay (ELISA) for the quantitative determination of HBsAg (Equipar Sri, Italy) and HCV antibodies (In Tec Products, Inc.) and HBsAg (Equipar Sri, Italy) (Muhammad *et al.,* 2013; Dilshad *et al.,* 2016; Kalim *et al.,* 2017; Iqbal *et al.,* 2019).

Statistical Analysis

The obtained results were analyzed by SPSS version 18 (SPSS Inc., Chicago, IL, USA). The relative risk (RR >1), 95% confidence interval, Chi-square test, and *P* probability value <0.05 (significant) were used to examine the significance of the associations between the presence of HBsAg and HCV infections and potential risk factors.

RESULTS

A total of 100 patients were studied and their mean age range was 15–65 years. Most of the participants were male with 56(56%) while the female was 44(44%). The current results showed that the overall prevalence rates were 3% and 21%, respectively, recorded for HBV and HCV infection among patients undergoing HD as listed in Table (1).

Table 1. The prevalence of HBV and HCV among hemodialysis cases in Ibb city.

Serological results	HBV Ag*		HCV antibodies	
	No.	%	No.	%
Positive	3	3.0	21	21
Negative	97	97	79	79
Total	100	100	100	100

*All HBsAg positive cases were negative for HBeAg

Prevalence of HBV infection

The results regarding age between HD patients revealed that the highest prevalence of HBsAg was 5.6% among the age group 31-45 years followed by 2% of age >45 years old. While no recorded between the age group 31-45 years old. Also, regarding gender, only 5.4% of males were infected with HBV. The rate of infection in the urban area was more than in rural areas. The illiterate patients had the highest HBV infection (5.12%) with unmarried patients (2.35%) and blood transfusion (3.37%) (Table 2).

Prevalence of HCV infection

The highest prevalence rate of HCV infection was 22.5% among age group >45 years followed by 22.2% among the age group 15-30 years. The females had the highest rate (29.54%) of HCV infection than males (14.28%) as well as living in the urban area (25.80%). Also, according to education level high prevalence was 33.3% among illiterate among the married patients. Also, only one patient who used cupping treatment was infected with HCV as well as 33.3% of patients having history of surgical procedures and dentist visits were infected (Table 3).

Table 2. Prevalence of HBV infection among HD patients in relation to socio-demographic characteristics and relevant history.

Explanatory variables		Total No. (%)	Positive HBsAg No. (%)	RR	CI	X^2	P
Age in years	15-30	18 (18)	1 (5.6)	2.3	0.22-23	0.44	0.48
	31-45	42 (42)	0	ND	ND	2.24	0.13
	>45	40 (40)	2(5)	3	0.3-31	094	0.33
Gender	Male	56 (56)	3 (5.4)	ND	ND	2.43	0.1
	Female	44 (44)	0	ND	ND	2.43	0.1
Residence	Rural	69 (69)	2 (2.9)	0.9	0.1-9.5	0.01	0.92
	Urban	31(31)	1(3.2)	1.1	0.1-11.8	0.01	0.92
Education level	Illiterate	39(39)	2(5.12)	3.13	0.3-33.3	1.0	0.318
	Primary	10(10)	0	ND	ND	0.34	0.55
	Secondary	15(15)	1(6.7)	2.8	0.3-29.3	0.82	0.36
	University	36(36)	0	ND	ND	0.74	0.18
Marital state	Married	85(85)	2(2.35)	0.4	0.03-3.6	0.82	0.36
	Unmarried	15(15)	1(6.7)	2.8	0.3-2.9	0.82	0.36
History of	Blood transfusion	89	3(3.37)	ND	ND	0.38	0.53
	Surgical procedures	15	0	ND	ND	0.55	0.46
	Dentist Visit	15	0	ND	ND	0.55	0.46
	Cupping	1	0	ND	ND	0.03	0.85
	Accidental inoculation	21	1(4.76)	1.9	0.2-19	0.28	0.59
	Family history of jaundice	9	0	ND	ND	0.31	0.58

RR Relative risk >1 (at risk); CI Confidence intervals; X^2 Chi-square ≥3.84; *P* <0.05 (significant); ND Not defined.

Table 3. Prevalence of HCV infection among HD patients in relation to socio-demographic characteristics and relevant history.

Explanatory variables		Total No. (%)	Positive HCV No. (%)	RR	CI	X^2	P
Age in years	15-30	18 (18)	4(22.2)	1.07	0.4-2.8	0.02	0.88
	31-45	42 (42)	8(19.05)	0.85	04.-0.78	0.17	06.8
	>45	40 (40)	9(22.5)	1.13	0.5-2.4	0.09	0.76
Gender	Male	56 (56)	8(14.28)	0.85	0.3-2.3	0.7	0.78
	Female	44 (44)	13(29.54)	1.2	0.4-3.9	0.07	0.78
Residence	Rural	69 (69)	13(18.84)	0.73	0.34-1.6	0.63	0.42
	Urban	31(31)	8(25.80)	1.4	0.6-2.96	0.63	0.42
Education level	Illiterate	39(39)	13(33.3)	2.5	1.2-5.6	5.86	0.01
	Primary	10(10)	2(20)	0.95	0.3-3.5	0.01	0.93
	Secondary	15(15)	2(13.3)	0.61	0.2-2.3	0.63	0.42
	University	36(36)	4(11.1)	0.42	0.2-1.2	3.3	0.06
Marital status	Married	85(85)	18(21.18)	1.1	0.4-3.2	0.01	0.9
	Unmarried	15(15)	3(20)	094	0.3-2.8	0.01	0.9
History of	Blood transfusion	89	19(21.35)	1.2	0.3-4.4	0.06	0.8
	Surgical procedures	15	5(33.3)	1.8	0.8-4.1	1.62	0.2
	Dentist Visit	15	5(33.3)	1.8	0.8-4.1	1.62	0.2
	Cupping	1	1(100)	5	3.4-7.3	3.8	0.05
	Accidental inoculation	21	3(14.28)	0.63	0.2-1.9	0.72	0.39
	Family history of jaundice	9	1(11.1)	0.5	0.1-3.3	0.58	0.44

RR Relative risk >1 (at risk); CI Confidence intervals; X^2 Chi-square ≥3.84; *P* <0.05 (significant); ND Not defined.

The results showed that two patients who received a blood transfusion were infected by a co-infection for HBV and HCV infections, as well as these patients, who had a history of accidental inoculation (9.52%) and family history of jaundice (11.11%) summarized in Table (4).

The prevalence of HBV infection regarding the duration of hemodialysis revealed that the high rate was 6.7% among patients receiving hemodialysis from 1-2 years with statistically significant followed by more than 2 years with 3.08% (Table 5).

Table (6) shows the prevalence rate of HCV infection according to the duration of hemodialysis. The highest rate was (26.7%) found among patients who received hemodialysis from 1-2 years followed by more than 2 years with 24.6%. The statistical analysis showed there were no statistically significant between the prevalence of HCV infection and duration on hemodialysis as summarized in Table (6).

Table 4. The co-infection of both HBV and HCV infections according to risk factors

Variables	No. of examined		HBs Ag and Anti-HCV positive (co-infection)		*RR*	*CI*	x^2	*P*
	No.	%	No.	%				
Blood transfusion	89	89	2	2.24	1.07	0.3-3.9	0.01	0.91
Surgical procedures	15	15	0	0	ND	ND	4.4	0.03
Dentist Visit	15	15	0	0	ND	ND	4.4	0.03
Cupping	1	1	0	0	ND	ND	0.25	0.6
Accidental inoculation	21	21	2	9.52	0.42	0.1-1.7	0.82	0.17
Family history of jaundice	9	9	1	11.11	0.53	1.3-3.5	0.5	0.48

RR Relative risk >1 (at risk); CI Confidence intervals; x^2 Chi-square ≥3.84; P<0.05 (significant); ND Not defined.

Table 5. Prevalence of HBV infection according to the duration on hemodialysis

Duration in years	No. of examined		HBV positive		HBV negative		*RR*	*CI*	x^2	*P*
	No.	%	No.	%	No.	%				
<1	20	20	0	0	20	100	ND	ND	0.77	0.379
1-2	15	15	1	6.7	14	93.3	9.50	1.03-87.97	5.23	0.022
>2	65	65	2	3.08	63	96.92	1.08	0.10-11.46	0.00	0.950
Total	100	100	3	3	97	97	-	-	-	-

RR Relative risk >1 (at risk); CI Confidence intervals; x^2 Chi-square ≥3.84; P<0.05 (significant); ND Not defined.

Table 6. Prevalence of HCV infection according to the duration on hemodialysis

Duration in years	No. of examined		HCV positive		HCV negative		*RR*	*CI*	x^2	*P*
	No.	%	No.	%	No.	%				
<1	20	20	1	5.0	19	95	0.20	0.03-1.40	3.86	0.449
1-2	15	15	4	26.7	11	73.3	1.33	0.52-3.42	0.34	0.558
>2	65	65	16	24.6	49	75.38	1.88	0.75-4.71	1.98	0.158
Total	100	100	21	21	79	79	-	-	-	-

RR Relative risk >1 (at risk); CI Confidence intervals; x^2 Chi-square ≥3.84; *P* <0.05 (significant).

DISCUSSION

The hepatitis B and hepatitis C virus are considered global epidemics that cause a serious public health problem, particularly among hemodialysis patients. The prevalence of HBV and HCV infections among HD patients in developing countries within dialysis units seems higher (20%) according to several reports. The transmission routes of hepatitis viruses among patients in HD units due to lack of preventing measurement adherent during the dialysis process (Naman *et al*., 1996; Sinjari and Bakr, 2018).

The present study revealed that the overall prevalence of HBV and HCV infections were 3% and 21%, respectively, recorded among patients visiting dialysis units in Ibb city. These results are lower than the rates reported from many studies among HD patients in nearby cities of Yemen where the prevalence rates of HBsAg and HCV antibodies were recorded, respectively, 31% and 62.7% in Aden (Bin Selm, 2010), 48.83% and 46.01% in Zabeed (Al-Hegami *et al*., 2015), and 20.7% and 47.2% in Sana'a (Al-Haj *et al.*, 2018). Aman et al. (2015) revealed that 40.2% of HD patients attending dialysis units in Aden were infected with HCV. Also, in Sana'a city, Baghza (2014) reported that 22.5% of HD patients were infected with HCV.

The HBV transmission between the HD patients can be prevented by HBV vaccine that is currently available, appropriate screening of donated blood products, dedicating separate dialysis machines for HBV patients, and periodic examination for HBsAg and anti-HBV antibodies. Whereas strict adherence should be implemented to minimize and control of HCV infection transmitting within the dialysis environment (Elamin and Abu-Aisha, 2011). Generally, the high rates of hepatitis viruses prevalent in this study may be due to insufficient protection for patients admitted to the HD unit in Yemen. Additionally, sterilization, disinfection, and general standards of training and proficiency are generally lacking in most hospitals in Yemen.

The present work revealed the highest prevalence among the age group 31-45 years with HBV (5.6%) and more than 45 years with HCV (22.5%). A similar study by Al-Hegami et al. (2015) reported that the high prevalence of HBV and HCV infections was 52.08% and 51.11%, respectively, among the age group 15–39 years and 40–55 years. In contrast, Baghza (2014) observed the high prevalence of HCV infection was (13%) among the age group more than 65 years.

However, current work showed a high prevalence of HBV infection among male patients with 5.4% and females were non-infected. Whereas, the HCV infection was more among females (29.54%) than males (14.28%). These findings are similar to the study by Al-Hegami *et al*. (2015) indicating high rates of HBV infection among males having 55.41% of HBV and females 62.50% of HCV. Al-Hatheq et al. (2019) reported the overall prevalence of anti-HCV (2.8%) among blood donors and clinical visitors. In contrast, Al-Haj *et al*. (2018) showed that males revealed a significant higher level of HBV and HCV positivity. Also, Bin Selm (2010) observed that the higher rate of HCV was 39.2% among male patients. Similarly, Baghza (2014) found that 60% of infected patients with HCV were male. The difference in results between this study and other studies may be referred to as methods of specimen collection, processing, and type of techniques used for examination.

In this study, patients living in the urban area had the highest infections with HBV (3.2%) and HCV (25.80%) compared to the rural area and there was no statistically significant. The prevalence of HBV (5.12%) and HCV (9.2%) infections in the present study were remarkably higher among illiterate patients than other patients of education level. Also, there was a statistically significant relationship between HCV infection and the illiterate of the patients. This indicates that the education status influences the

prevalence of the hepatitis virus among the community.

The results regarding marital status showed that the high infection was among unmarried and married HD patients with HBV of 6.7% and HCV of 21.18%, respectively.

In this study, the overall rate of co-infection for both HBV and HCV infections was 2% among HD patients. This result is in agreement with a study by Al-Hegami *et al*. (2015) reported that 5.12% of HD patients were infected by mixed infection with HBV and HCV. Conversely, the high rate observed by Bin Selm (2010) showed the only 16 (31%) of patients having co-infection of both HBV and HCV infections.

The prevalence of hepatitis B was significantly higher among patients with a history of blood transfusion and lower among patients with a history of accidental inoculation. Whereas, the HCV infection was higher among patients with a history of cupping, surgical procedures, dentist visit, and lower among patients with a history of accidental inoculation and family history of jaundice. No significant relationship was found between the hepatitis virus and blood transfusion, surgical procedures, dentist visit, cupping, accidental inoculation, family history of jaundice ($P > 0.05$).

According to the duration of hemodialysis, the high prevalence rates of hepatitis B and hepatitis C were found among patients who received hemodialysis from 1-2 years and there was statistically significant only recorded between the prevalence of HBV infection and duration of hemodialysis (1-2 years). This finding is similar to the study by Baghza (2014) and (Al-Haj *et al*., 2018).

CONCLUSION

Form the present study, it was indicated that the high prevalence of HBV and HCV infections among HD patients in Yemen remains a serious community health problem that representing the continuous of acquiring the hepatitis virus as nosocomial infection during the dialysis process. Therefore, strict adherence to effective and proper procedures for controlling hepatitis infections will warrant preventing and reducing the prevalence of hepatitis infections.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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