

Prevalence and Risk Factors for Hepatitis C and B Viruses Infection among Hemodialysis Patients in Holy Karbala, Iraq

عوامل الخطر والانتشار للإصابة بالتهاب الكبد الفيروسي نوع (C) ونوع (B) بين مرضى الإنفاذ الدموي في كربلاء المقدسة، العراق

Hassan Abdullah Athbi, Ass. Instructor, Adult Nursing Department/ College of Nursing / University of Kerbala.

Nabeel Abdulrazaq Jasim, Academic Nurse, Kerbala health directorate/ Imam Hussein medical city.

E mail: hassan.nursing@gmail.com

الخلاصة:

خلفية البحث: تعد العدوى بالتهاب الكبد الفيروسي من الأسباب المهمة للمرضية والوفيات بين المرضى الخاضعين للمعالجة بالإنفاذ الدموي، وان انتشار العدوى يختلف إلى حد كبير في أماكن مختلفة من العالم. ويعد المرضى الخاضعين للإنفاذ الدموي في خطر عالي لانتقال فيروس التهاب الكبد الفيروسي نوع (C) و نوع (B) مقارنة بالأشخاص الآخرين.

الهدف: التعرف على مدى انتشار فيروس التهاب الكبد الفيروسي نوع (C) ونوع (B) بين المرضى الخاضعين للمعالجة بالإنفاذ الدموي في مدينة كربلاء المقدسة، وكذلك تحديد عوامل الخطر المرتبطة بانتقال تلك الفيروسات بين المرضى.

المنهجية: أجريت دراسة مستعرضة في مركز الإنفاذ الدموي في مدينة الإمام الحسين (ع) الطبية في كربلاء المقدسة، العراق. وتم شمول ١٦٥ مريض مصاب بالفشل الكلوي النهائي من الذين يتلقون المعالجة بالإنفاذ الدموي للفترة من حزيران ٢٠١٤ ولغاية آذار ٢٠١٥ بهدف التحقق من انتشار العدوى بفيروس التهاب الكبد الفيروسي نوع (C) ونوع (B) وكذلك التعرف على عوامل الخطر المرتبطة بانتقالهما بين المرضى مثل مدة المعالجة بالإنفاذ الدموي، التاريخ العائلي للإصابة بفيروس التهاب الكبد، التاريخ السابق لنقل الدم، التاريخ السابق للمعالجة في مراكز أخرى للإنفاذ الدموي، التاريخ السابق للتطعيم ضد التهاب الكبد الفيروسي نوع (B)، التاريخ السابق لإصابات الحروب والحوادث، التاريخ السابق للحجامة و الوشم، التاريخ السابق لزراعة الكلى والعمليات الجراحية. حيث تم سحب نماذج الدم من المرضى ومن ثم تم فحصها للتأكد من وجود المستضد السطحي لالتهاب الكبد الفيروسي نوع (B) والأجسام المضادة لالتهاب الكبد الفيروسي نوع (C). وتم تشخيص المرضى اعتماداً على النتيجة الموجبة لتلك الفحوصات. وتم استخدام البرنامج الإحصائي SPSS النسخة ١٦ في تحليل البيانات وقد اعتبرت النتائج ذات دلالة إحصائية عند مستوى $p \leq 0.05$.

النتائج: أظهرت نتائج الدراسة أن مريض واحد فقط (٠.٦%) كان مصاباً بالتهاب الكبد الفيروسي نوع (B)، و واحد عشر مريض (٦.٦%) كانوا مصابين بفيروس التهاب الكبد نوع (C) من بين ١٦٥ مريض. وأشارت نتائج الدراسة إن مدة المعالجة بالإنفاذ الدموي، التاريخ السابق لنقل الدم، وكذلك المعالجة في مراكز أخرى للإنفاذ الدموي كانت ذات دلالة معنوية في انتقال العدوى. وكانت الإناث، الأعمار بين ٤١-٦٠ سنة، المتزوجين، سكان المدينة، الغير متعلمين، وريبات البيوت لديهم نسبة إصابة عالية بالتهاب الكبد الفيروسي نوع (C).

الاستنتاج: أظهرت نتائج الدراسة أن هناك انخفاض في مدى انتشار العدوى بفيروس التهاب الكبد نوع (C) ونوع (B). وأشارت الدراسة إلى أن خطر انتقال فيروس التهاب الكبد نوع (C) ونوع (B) يرتبط بعوامل عديدة مثل طول مدة المعالجة بالإنفاذ الدموي، التاريخ السابق لنقل الدم، وكذلك المعالجة بالإنفاذ الدموي في مراكز أخرى.

التوصيات: أوصت الدراسة بأن العدوى بفيروس التهاب الكبد نوع (C) ونوع (B) ممكن أن ينخفض من خلال الالتزام الصارم بإجراءات السيطرة على العدوى في وحدات الإنفاذ الدموي، الفحص الدوري لمدى انتشار العدوى بفيروس التهاب الكبد نوع (C) ونوع (B) بين المرضى، كذلك استخدام erythropoietin بدلاً من إعطاء الدم لمعالجة حالات فقر الدم الناتجة عن الإنفاذ الدموي، وكذلك تقليل الاعتماد على المعالجة بالإنفاذ الدموي في مراكز أخرى، بالإضافة إلى الرصد الدقيق لإجراءات السيطرة على العدوى بين المرضى الخاضعين للمعالجة بالإنفاذ الدموي.

الكلمات المفتاحية: الإنفاذ الدموي، فيروس التهاب الكبد نوع (C)، فيروس التهاب الكبد نوع (B)، انتشار، عوامل الخطر.

ABSTRACT:

Background: Viral hepatitis infections are important cause of morbidity and mortality in hemodialysis (HD) patients, and its prevalence varies considerably among different areas of the world. Patients receiving maintenance HD are at higher risk for acquiring hepatitis B virus (HBV) and hepatitis C virus (HCV) infections than the general population.

Objectives: The aim of this study was to investigate the prevalence of the HBV and HCV among HD population in Holy Kerbala, as well as to identify the risk factors associated with their transmission.

Methods & Materials: A cross-sectional study was carried out in HD center at Imam Hussein medical city in Holy Kerbala, Iraq. A total of 165 patients with end-stage renal failure who have been receiving HD therapy were involved in this study from the period of June 2014 to March 2015 in order to investigate the prevalence of HBV and HCV infection also to detect the presence of risk factors associated with their transmission among HD patients such as duration on HD therapy; family history of hepatitis, blood transfusion history; previous dialysis in another HD center; history of HBV vaccination; history of war and traumatic injury; tattoos, cupping and injecting drug user history, history of kidney transplantation and previous surgery. Blood samples were taken from all patients, then tested for the presence of both hepatitis B surface antigen (HBsAg) and antibodies of hepatitis C virus (anti-HCV). Patients were considered to be HCV positive if they had a positive test result for the presence of antibody by serologic testing (anti-HCV-positive), and patients were considered HBV positive if they had HBsAg-positive in their serum. Statistical analysis was done using SPSS version 16. $p \leq 0.05$ was considered statistically significant.

Results: Out of one hundred and sixty five patients, one (0.6%) patient were HBsAg positive and eleven (6.6%) patients were anti-HCV sero-positive, none of the patients were infected by both HBV and HCV, this results suggest that there is a low prevalence of HCV and HBV among our patients. Longer duration of HD have a significant association with anti-HCV and HBsAg positivity at P value (0.005), history of blood transfusions, and previous dialysis in another center were significantly associated with HCV and HBV positivity at P value (0.000). Female gender, age between 41-60 years, married, urban residency, illiterate, and housewives patients were having highest prevalence of anti-HCV, and HBsAg positivity

Conclusions: Considering the outcome of this study, there is a low prevalence of HCV and HBV in HD patients in our center. The risk of acquiring HCV infection is significantly associated with increasing duration of dialysis, history of blood transfusion, and previous dialysis in another center.

Recommendations: The study recommended that the rate of viral infection can be decreased by strictly adherence to infection control measures in HD unit, regular HCV and HBV screening, also erythropoietin should be replace blood transfusion for the treatment of anemia, and reduce the dependence for the treatment outside patients center. Careful observation of preventive measures is required to improve infection control in HD center.

Keywords: Hemodialysis, Hepatitis (B) Viruses, Hepatitis (C) Viruses, Prevalence, Risk Factors.

INTRODUCTION:

Hemodialysis (HD) is the most frequent mode of renal replacement therapy in end-stage renal disease (ESRD)⁽¹⁾. Patients undergoing HD potentially have an increased risk of exposure to infections especially blood borne viruses (BBV) infections. Viral hepatitis such as HBV and HCV is the most frequent disease resulting in a complication of HD treatment⁽²⁾. Infections with HBV and HCV are well-known and important causes of liver disease in ESRD patients on HD^(3,4). HD patients are at high risk for viral hepatitis infections due to a history of blood transfusion, the high number of blood transfusion sessions, the potential for exposure to infected patients and contaminated equipment⁽³⁾. The duration of HD therapy is also considered as a risk factor for viral hepatitis infections transmission^(5,6).

HBV and HCV infections are important causes of morbidity and mortality among HD patients and pose problems in the management of patients in the renal dialysis units⁽⁷⁾. The prevalence of viral hepatitis in hemodialyzed patients is far higher than the prevalence of these diseases in the general population⁽²⁾. HBV infection is less prevalent than HCV in HD units⁽⁸⁾. The prevalence of HBV infection within HD units in developing countries range from 2% to 20%⁽⁹⁾, and HCV prevalence among HD patients varies from 4% to 70% in different countries⁽¹⁰⁾. The prevalence of HCV infections among HD patients is high and varies from (2% to 60%) between different countries, and between different dialysis centers within a single country⁽²⁾. In Arab countries, the prevalence of HBV among HD patients ranged from 2% in Morocco, to 11.8% in Bahrain, and the prevalence of HCV among HD patients has been reported to range from 27% in Lebanon to 75% in Syria^(2,7). In USA, and Taiwan the prevalence of HBV infection among patients undergoing long-term HD was 0.9% and 16.8% respectively⁽¹¹⁾. In Brazil, HBV infection in HD centers varies from 7.5 to 28.0 %⁽¹²⁾. Within India, a very wide range of prevalence rates for HBV (3.4-45%), and HCV (4.3-45.2%) in the dialysis population. These prevalence rates are higher than the average prevalence rates estimated for the general population in India (4.7% and 1.85% for HBV and HCV respectively)⁽¹³⁾. In Iraq the prevalence of HCV infections varies from (7.1 %) in Iraqi renal transplant center at Baghdad⁽¹⁴⁾, and 26.7%, 11.7 % in sulaimani dialysis unit and Al-Anbar governorate respectively⁽¹⁵⁾.

Investigating the prevalence and possible risk factors for HBV and HCV infections among HD patients is fundamentals to develop the evidence base necessary before prevention, treatment, and control plans can be introduced and adopted by both care providers and decision makers to reduce disease prevalence and recirculation, and ultimately reduce rates of morbidity and mortality⁽⁶⁾. No documented data or previous studies have been reported on the prevalence of hepatitis viruses' infection among HD patients in Holy Kerbala, this study is the first to address this issue.

OBJECTIVES OF THE STUDY:

The current study was conducted to investigate the seroprevalence and possible risk factors for HBsAg and anti-HCV among HD patients at the Kerbala HD unit in Imam Hussein medical city.

MATERIAL AND METHODS:

A cross-sectional study was carried out at HD center, in Holy Kerbala, Iraq. A total of one hundred and sixty five patients with ESRD who were undergoing maintenance HD therapy at Imam Hussein medical city, were evaluated in order to investigate the prevalence of HBV and HCV infection and detecting the main risk factors associated with their transmission among HD patients. The participants were 74 females (44.8%) and 91 males (55.2%). Blood samples were taken from all patients, and then tested for the presence of both hepatitis B surface antigen (HBsAg) and antibodies of HCV (anti-HCV). Patients were considered to be HCV positive if they had a positive test result for the presence of antibody by serologic testing (anti-HCV-positive), and patients were considered HBV positive if they had the presence of hepatitis B surface antigen (HBsAg-positive) in their serum.

Patients at any age and sex who were undergoing HD therapy were eligible in this study from the period of June 2014 to March 2015. The participating patients were explained about and informed of the purposes of the study and verbal consent was obtained from each participant, and a closed ended questionnaire was completed by the researcher via patient interview to ensure proper data collection and prevent any misunderstanding. The data requested included socio-demographic characteristics (age, gender, marital status, residence, educational level, and occupation), and possible risk factors for HCV and HBV infection including; duration on HD, family history of hepatitis, history of blood transfusion, history of hepatitis B virus vaccination, previous surgery, history of any trauma in the past, history of tattoos, injecting drug user, previous dialysis in another center, and history of kidney transplantation. Statistical analysis was done using SPSS version 16 using crosstabs and Chi-square test. P-value ≤ 0.05 was considered as statistically significant.

RESULTS:

Table 1: Prevalence of HBV and HCV infection among HD patients (n=165).

Type of hepatitis infection	Frequency	Percentage
Hepatitis B viruses positive patients	1	0.6%
Hepatitis C viruses positive patients	11	6.6%
Hepatitis C and B viruses negative patients	153	92.8 %
Total	165	100 %

Table 1 shows that Of the 165 patients enrolled in the study, anti-HCV and HBsAg was detected in 11 (6.6%) and 1 (0.6%) patients, respectively as shown in table (1). None of the patients were infected by both HBV and HCV.

Table 2: Sociodemographic characteristics of HBsAg, and anti-HCV positive patients.

Characteristics	Groups	All patients(n=165)		HBs Ag sero-positive (n=1)		Anti-HCV sero-positive (n=11)	
		F	%	F	%	F	%
Age groups (Years)	≥ 20	1	2.4	0	0	1	9
	21-40	35	21.3	0	0	3	27.2
	41-60	74	44.8	1	100	5	45.4
	≤ 61	52	31.5	0	0	2	18
Gender	Female	74	44.8	0	0	0	63.5
	Male	91	55.2	1	100	11	36.5
Marital Status	Single	16	9.7	0	0	2	18.2
	Married	141	85.5	1	100	8	72.7
	Divorced/Widowed	8	4.8	0	0	1	9.1
Residence	Urban	112	67.9	0	0	10	90.9
	Rural	53	32.1	1	100	1	9.1
Occupation	Student	4	2.4	0	0	1	9.1
	Employee	26	15.8	0	0	2	18.2
	Retired	27	16.4	1	100	1	9.1
	Gainer	29	17.6	0	0	1	9.1
	Housewife	67	40.6	0	0	6	54.5
	Unemployed	12	7.3	0	0	0	0

As shown in table 2 a total of 165 patients, 91 (55.2%) were males and 74 (44.8%) females were enrolled in the study. 74 (44.8%) were at age group of (41-60) years, and the majority were married, housewives, urban residency, and their educational level primary school. Age between (41-60) years, and female gender having the highest prevalence of HCV infection.

Table 3: Prevalence of HBsAg, and anti-HCV sero-positive in relation to risk factors.

Risk Factors	Groups	All patients (n=165)	HBs Ag sero-positive (n=1)	Anti-HCV sero-positive (n=11)
Duration of hemodialysis therapy	>2 years	71(43%)	1(100%)	0 (0%)
	≤ 2 years to >4	38(23%)	0 (0%)	5(45.5%)
	≤ 4 years	56(34%)	0 (0%)	6(54.5%)
	Total	156 (100%)	1(100%)	11(100%)
	P value		0.5	0.005
History of blood transfusion	Positive history	25(15.2%)	1(100%)	10 (90.9%)
	Negative history	140(84.8%)	0 (0%)	1 (9.1%)
	Total	156 (100%)	1(100%)	11(100%)
	P value		0.01	0.00
Previous dialysis in another center.	Positive history	25(15.2%)	1(100%)	10 (90.9%)
	Negative history	140(84.8%)	0 (0%)	1 (9.1%)
	Total	156 (100%)	1(100%)	11(100%)
	P value		0.06	0.00
History of previous surgery.	Positive history	76(46.1%)	1(100%)	6 (54.5%)
	Negative history	89(53.9%)	0 (0%)	5 (45.5%)
	Total	156 (100%)	1(100%)	11(100%)
	P value		0.2	0.5
History of kidney transplantation.	Positive history	5(3%)	0 (0%)	1 (9.1%)
	Negative history	160(79%)	1(100%)	10 (90.9%)
	Total	156 (100%)	1(100%)	11(100%)
	P value		0.8	0.2

Table 3 Indicate that the duration of hemodialysis therapy, history of blood transfusion, and previous dialysis in another center there were found to be a significant risk factor associated with HCV and HBV infection at p value (< 0.05).

Table 4: Characteristics of hemodialysis patients according to HBsAg, and anti-HCV sero-positive in relation to other associated factors.

Associated Factors	Groups	All patients (n=165)		HBs Ag sero-positive (n=1)		Anti-HCV sero-positive (n=11)	
		F	%	F	%	F	%
Family history of viral hepatitis	Positive history	2	1.2	0	0	0	0
	Negative history	163	98.8	1	100	11	100
Hepatitis B vaccination	Vaccinated	123	74.5	0	0		---
	Non vaccinated	42	25.5	1	100		---
Blood borne viruses infection history	Positive history	1	0.6	0	0	1	9.1
	Negative history	164	99.4	1	100	10	90.9
History of DM	Positive history	46	27.9	0	0	2	18.2
	Negative history	119	72.1	1	100	9	81.8
History of needle stick injuries exposure.	Positive history	1	0.6	0	0	0	0
	Negative history	164	99.4	1	100	11	100
History of war injury and RTA	Positive history	19	11.5	1	100	3	27.3
	Negative history	146	88.5	0	0	8	72.7
History of cupping.	Positive history	28	17	0	0	4	36.4
	Negative history	137	83	1	100	7	63.6
History of Tattooing/Piercing	Positive history	23	13.9	0	0	3	27.2
	Negative history	142	86.1	1	100	8	72.8
History of injection of illicit drug use.	Positive history	2	1.8	0	0	0	0
	Negative history	163	98.8	1	100	11	100

Table 4 shows history of factor associated with the hemodialysis patients according to HBsAg, and anti-HCV sero-positive

DISCUSSION:

The prevalence of viral hepatitis is greater in patients on HD than in general population that's affecting quality of life and mortality rate among patients. According to our results as shown in table one, out of 165 patients enrolled in this study; (6.6%) were positive for anti HCV, and (0.6%) patients were positive for HBsAg, none of the patients were infected by both HBV and HCV. This finding was in agreement to the result of the study which was done by Kalantari, et. al. (2014) to assess the prevalence of HBV and HCV infection among HD patients in Isfahan, Iran, reported that the prevalence of HBV positive and HCV positive among study population was 1.2% and 5.2%, respectively⁽¹⁶⁾. Different prevalence of anti-HCV was reported by similar studies. In our study, seroprevalence of HBsAg, and anti HCV among HD patients was lower, that is in contrast to the findings of other studies such as in Gaza the prevalence of HBV among HD patients was 8.1%, and 22% infected with HCV⁽⁷⁾, in Basrah-Iraq of 122 patients HBV infections seroprevalence were (50%) positive, whereas HCV seroprevalence were (42.6%)⁽⁵⁾, in Kosova out of 583 of HD patients HBsAg and anti-HCV prevalence rate was (12%), and (43%) respectively⁽⁹⁾, in state of Tocantins, Brazil of 100 HD patients HBsAg and anti-HCV were detected in (4%), and (13%) of patients respectively⁽¹⁷⁾, and in Amman, Jordan the prevalence of HBV and HCV positivity in HD patients was 5.9%, 36% respectively⁽¹⁸⁾. A retrospective study which was performed by Boulaajaj, et. al. (2005) on 186 patients in HD unit in Casablanca, reported a high prevalence of HCV infection (76%) and the prevalence of HBV infection was at 2%⁽¹⁹⁾. In conclusion the prevalence of HCV and HBV infection among our HD patients is really low but still a high prevalence in patients undergoing HD worldwide.

As shown in table 2 a total of 165 patients, (55.2%) were males and (44.8%) females were enrolled in this study. The majority of them (44.8%) were at age group of (41-60) years, and most of them were married, housewife, urban residency, and their educational level were primary school with their frequency and percentage was (85.5%), (40.6%), (67.9%), and (40.6%) respectively. The age-specific prevalence for HCV and HBV markers are presented in table 2, the highest prevalence of patients infected with HCV (45.4%) and HBV (100%) occurred in the age group of (41-60) years. The sex related distribution of hepatitis patients revealed that the highest prevalence (63.5%) were found in female having HCV infection, while in males there was relatively low prevalence of HCV infection (36.5%). Regarding the marital status, residence, educational level, and occupation the highest (72.7%) prevalence of HCV were found in married patients, urban residency patients (90.9%), illiterate (36.5%), and for housewives (54.5%) patients.

Associated risk factors for the prevalence of HCV and HBV infection in HD patients as indicated in table 3 and 4 that's include history of blood transfusions, duration of HD, previous dialysis in another center, history of previous surgery and kidney transplantation, family history of viral hepatitis, intravenous drug use and other factors. Among all risk factors studied, only history of blood transfusions, previous dialysis in another center, and duration on HD were significantly associated with HCV and HBV positivity, respectively. The result analysis showed that long duration on HD was a significant risk factor for HCV and HBV positivity at p value of (0.005). The majority of patients (54.5%) infected with HCV were having more than four years duration on HD and most of them (45.5%) were having 2-4 years duration on HD. Our data was similarly to the previous studies, revealed that the duration on HD therapy was significantly associated with HCV and HBV positivity^(5,17). Sekkat, et al, reported a seroprevalence rate of HCV was associated with longer duration on HD⁽⁵⁾. The difference in the prevalence rate for HCV positivity in HD patients reported in various studies might be due to different lengths of time on HD of the different populations⁽²⁾. Another study which was done by Hamissi, & Hamissi (2011) reported that the presence of HCV infection among HD patients was associated with the duration on HD, and the risk of getting HCV infection was significantly associated with increasing years of HD⁽¹⁰⁾.

Risk factors analysis for HCV and HBV infection among patients under HD therapy revealed a significant association between previous dialysis in another center and the history of blood transfusion at p value of (0.000). This result emphasized the finding of the study which was done by Reddy, et. al. (2005) shows that the HD patients are at high risk for viral hepatitis infections due to the high number of blood transfusions⁽⁸⁾. Galperim, et. al. (2010) showed a positive HCV independently associated to being on HD for more than five years; and previous blood transfusion⁽²⁰⁾. Zaki, et. al. (2014) revealed significant association between duration of HD and the numbers of transfused blood⁽²¹⁾. Su, et. al. (2013); and Ramzi, et. al. (2010) demonstrated that the factors for HCV infection were dialysis duration, blood transfusion, and attending more than one dialysis unit^(22,15). In other studies reported that the dialysis for more than two years was noted to be a significant risk factor for acquiring viral hepatitis infections^(18,23). Furthermore Surendra, et. al. (2011) confirmed that the duration of HD and getting the dialysis done at more than one center were the important risk factors for acquiring HCV infection in these patients⁽²⁴⁾. That's findings was in agreement with the result of our study. Finally our result indicates that there was no significant relationships was observed between the infected patients with HCV and HBV and the other risk factors as shown in table 4.

CONCLUSIONS:

There is a low prevalence of HCV and HBV among hemodialysis patients, the longer duration of HD; history of blood transfusions; and previous dialysis in another center were significantly associated with HCV and HBV positivity.

RECOMMENDATIONS:

1. Decrease the dependence on blood product in treatment and use of erythropoietin to correct anemia.
2. Reduce the dependence for the treatment outside patients center, and when needed should be restricted to centers with low hepatitis virus endemicity.
3. Strictly adherence with infection control measures, and regular HCV and HBV screening, are needed to decrease the prevalence of HCV and HBV infection among HD patients.

REFERENCES:

1. Halle M, Luma H, Temfack E, Tchamago V, Kaze F, Ashuntantang G, and Biwolé S.; Prevalence of Hepatitis B Surface Antigen and Anti-HIV Antibodies among Patients on Maintenance Hemodialysis in Douala – Cameroon; *Journal of Health Sci. Dis*; 2013; 14 (3): 1-5.
2. Toosil M, Larti F, Seifei S, and Abdollahi A.; Prevalence of viral hepatitis in hemodialysis patients in Tehran, Iran; *Journal of Gastrointestinal and Liver Disease*; 2008, 17(2): 233.
3. Zahedi M, Moghaddam S, Alavian S, Dalili M, and Mon H.; Seroprevalence of Hepatitis Viruses B, C, D and HIV Infection Among Hemodialysis Patients in Kerman Province, South-East Iran; *Hepatitis Monthly*, 2012; 12(5): 339-343.
4. Mina P, Georgiadou S, Rizos Ch, Dalekos G, and Rigopoulou E.; Prevalence of occult hepatitis B virus infection in haemodialysis patients from central Greece; *World Journal of Gastroenterol*; 2010; 16(2): 225-231.
5. Shihab S, Al-Hmudi H, Al-Edani H, and Mahdi K.; Viral hepatitis infections in Basrah hemodialysis unit: Serological diagnosis and viral loading; *European Journal of Experimental Biology*, 2014, 4(2): 106-112.
6. Gasim G, Hamdan H, and Adam I.; Epidemiology of Hepatitis B and Hepatitis C Virus Infections Among Hemodialysis Patients in Khartoum, Sudan; *Journal of Medical Virology*; 2012; 84: 52–55.
7. El-Ottol A, Elmanama A, and Ayesh B.; Prevalence and risk factors of hepatitis B and C viruses among hemodialysis patients in Gaza strip, Palestine; *Virology Journal*; 2010, 7 (210): 1-7.
8. Reddy G, Dakshinamurthy K, Neelaprasad P, Gangadhar T, and Lakshmi V.; Prevalence of HBV And HCV dual Infection in Patients on Hemodialysis; *Indian Journal of Medical Microbiology*; 2005; 23 (1): 41-43.
9. Telaku S, Fejza H, Elezi Y, and Bicaj T.; Hepatitis B and C in dialysis units in Kosova; *Virology Journal*; 2009, 6 (72): 1-4.
10. Hamissi J, and Hamissi H.; Occurrence of hepatitis B and C infection among hemodialyzed patients with chronic renal failure in Qazvin, Iran: A preliminary study. *International Journal of Collaborative Research on Internal Medicine & Public Health*; 2011; 3(1): 89-96.
11. Idrees M, Batool S, and Ahmed E.; Hepatitis B virus among maintenance hemodialysis patients: A report from Karachi, Pakistan; *J Pak Med Assoc*; 2011; 61(12): 1210-1214.
12. Carrilho F, Moraes C, Pinho J, Mello I, Bertolini D, Lemos M, Moreira R, Bassit L, Cardoso R, Santos G, and Silva L.; Hepatitis B virus infection in Hemodialysis Centres from Santa Catarina State, Southern Brazil. Predictive risk factors for infection and molecular epidemiology; *BMC Public Health*; 2004, 4(13): 1-11.
13. Chawla N, Sajiv C, Pawar G, and Pawar P.; Hepatitis B and C Virus infections associated with renal replacement therapy in patients with end stage renal disease in a tertiary care

- hospital in India – prevalence, risk factors and outcome; *Indian J Nephrol*; 2005;**15**: 205-213.
- 14.**KhatabO.; Prevalence and Risk Factors for Hepatitis C Virus Infection in Hemodialysis Patients in an Iraqi Renal Transplant Center, Saudi Center for Organ Transplantation, *Saudi Journal of Kidney Diseases and Transplantation*; 2008; 19(1): 110-115.
 - 15.**Ramzi z, Abdulla A, AL-Hadithi T, and Al-TawilN.; Prevalence and Risk Factors for Hepatitis C Virus Infection in Hemodialysis Pateints in Sulaimani;*Zanco J. Med. Sci.*; 2010; 14(1): 44-50.
 - 16.**Kalantari H, EbadiSh, Yaran M, Maracy M, and ShahshahanZ.; Prevalence and risk factors of hepatitis B and C viruses among hemodialysis patients in Isfahan, Iran; *PMC Journals*; 2014; 3(73).
 - 17.**Souza k, Luz J,TelesSh,CarneiroM, Oliveira L, Gomes A, Dias M,Gomes S, Yoshida C, and Martins R.; Hepatitis B and C in the Hemodialysis Unit of Tocantins, Brazil: Serological and Molecular Profiles; *MemInstOswaldo Cruz, Rio de Janeiro*; 2003; 98(5): 599-603.
 - 18.**Al Hijazat M, and AjlouniY.; Hepatitis B Infection among Patients Receiving Chronic Hemodialysis at the Royal Medical Services in Jordan; *Saudi J Kidney Dis Transpl*; 2008; 19(2): 260-267.
 - 19.**Boulaajaj K,ElomariY,ElmalikiB,MadkouriB,ZaidD, and BenchemsiN.; Prevalence of hepatitis C, hepatitis B and HIV infection among haemodialysis patients in Ibn-Rochd university hospital, Casablanca; *NephrolTher.*; 2005; 1(5): 274-84.
 - 20.**Galperim A, Mattos A, Stein A, Schneider N, Buriol A, Fonseca A, Lunge V, and Ikuta N.; Hepatitis C in hemodialysis: the contribution of injection drug use; *Braz J Infect Dis*; 2010; 14(4): 422-426.
 - 21.**Zaki M, Rafaat D, Eliwa A, AbdelsalamM.; Occult Hepatitis B among Patients under Hemodialysis at Mansoura University Hospitals: Prevalence and Risk Factors.; *Journal of Virology & Antiviral Research*; 2014; 3(1): 1-6.
 - 22.**Su Y, Yan R, Duan Z, Norris J. L, Wang L, Jiang Y, Xing W, Chen Y, Xiao Y, Li L, Tao J. and Wang N.; 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**: 425–432.
 - 23.**Zarkoon H, Shah K,Rehman H,Daud A, and Ahmed J.; Hepatitis C Virus Infection in Patients on Long Term Hemodialysis; *Gomal Journal of Medical Sciences*; 2008; 6(1): 1-4.
 - 24.**Surendra P, Venu G, Madhusudhana A, Balakrishnan N, Saravanan T, Sofia A, Subba TM; Prevalence and Risk Factors of Hepatitis C among Maintenance Hemodialysis Patients at a Tertiary-Care Hospital in Coimbatore, India; *Journal of Clinical and Diagnostic Research*; 2011; 5(4): 725-728.