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Prevalence and Risk Factors of HCV Infection among Haemodialysis Patients at Dialysis Centers in Khartoum State - Sudan

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Abstract: *Hepatitis C virus infection continues to be a major public health problem warranting high priority efforts for control and treatment. Hepatitis C virus infection is a major health problem among dialysis patients in developing countries. This study was conducted to measure the prevalence of HCV and to identify the possible risk factors associated with HCV infection among haemodialysis patients at dialysis centers in Khartoum State, Sudan.*
Methods: *A cross- sectional facility based study was conducted at ten dialysis centers. A total of 287 subjects were selected. A structured questionnaire was used to collect data on socio-demographic characteristics and risk factors. ELISA was used to test sera for anti-HC. For the analysis, Z-test and Chi-Square test were used.*
Results: *Field workers interviewed ten dialysis centers with a total of 287 study subjects. Sixty out of 287 (20.9%) was found to be anti-HC reactive. The multivariate analysis indicated as risk factors associated to anti-HCV positivity the number of blood transfusion received, duration of dialysis treatment, number of units of treatment, history of surgeries, multiple injections and using share razors. P values = (0.0001, 0.0031, 0.0001, 0.0018, 0.0005 and 0.0002) respectively. The study demonstrated that, duration of dialysis, changing of units of treatment, blood transfusions received, history of surgeries, multiple injections and share razors were considered important risk factors for anti-HC positivity.*
Keywords: *HCV, Haemodialysis patients, risk factor, Khartoum State, Sudan*

I. Introduction

Hepatitis C virus (HCV) was first characterized by Choo and colleagues in 1989[1]. Approximately, 170 million people worldwide are chronically infected with the hepatitis C virus (HCV). The prevalence of HCV infection in patients undergoing dialysis is persistently greater than that in the general population being endemic in haemodialysis (HD) units around the world, predominantly in Mediterranean and developing countries of the Middle and Far East. Nosocomial transmission of HCV infection has been reported to be a considerable route in modern hospital dialysis units, particularly during the outbreaks of infection [1-6].

WHO estimates that HCV infection has an estimated worldwide prevalence of >500 million cases. Low endemicity areas Include North America, Western Europe and Australia, where anti-HCV anti-bodies <1.5%. Areas with intermediate endemicity Include Mediterranean countries and Asia (Anti-HCV 1–2%), while the highest endemicity has been detected in Africa, South- Eastern Asia and Latin America (Anti-HCV >2%) [7].

Haemodialysis patients are at high risk of hepatitis C infection. Some factors are especially related with these high prevalence rates, such as blood transfusions, length of dialysis time, Kidney transportation, nosocomial contamination, exposure to needle puncture or lesions by cutting instruments, intravenous drugs user, non-isolation of positive patients and others [8-15].

The prevalence of HCV infection varies greatly among various populations of patients on HD from different geographic regions. The prevalence rates in developed countries such as in Japan (2.5%), Holland (4%), the United Kingdom (4%), Germany (7%), Belgium (7%) and Sweden (10%) are low. However, prevalence is a little bit higher in the USA (14%), France (15%), Spain (22%) and Italy (30%), in China 41.1% [16,17, 26].

In developing countries the prevalence is higher: in Egypt (52.3 to 82.3%), in Saudi Arabia (18.9 to 52.5%), in Yemen (33.8%), in Syria (24.4 to 48.9%), in Tunisia (23%), in Brazil (18%), in Turkey (21%), in India (27.7%), and in Iran (18.4%) [3,6,16,18,23,]. In Libya 31.1%, in Palestine 24.68%, in Pakistan 23.7%, in Kosova 43%. [9, 24 , 25,27] .

In Sudan located in area with highest endemicity of HCV infection (Anti-HC >2%)[7]. Several studies were conducted showed prevalence rates of HCV range from 6.5% to 23.7% in haemodialysis patients in different cities through the country [28,29] among HCWs in dialysis units in Khartoum was 1.8% [30]. Other

study show the prevalence of HCV among dialysis patients was 8.5% [31]. The aim of this study was to estimate the prevalence rate of anti-HCV, and to identify possible risk factors for patients in haemodialysis units in Khartoum State, Sudan.

II. Material And Methods

Study design: This study was observational, cross-sectional facility based study. It was conducted at ten dialysis centers (units) in Khartoum State.

Study area: Khartoum State is one of the 16 States of Sudan. Khartoum is the political capital and commercial centre of the Sudan with an area of 28165 Km2. It is a located between latitudes 15o- 16o North and longitudes 34o - 31.5o East. Khartoum state can be divided into three geographical areas. The first area: start from Almogran and it lies through between two Nile (Blue and White Nile) until Aljazera state southern, it involve two locality (Khartoum and Jabal Alawlia). The second area: is located in the North side, between Blue Nile and river Nile, it involves North Khartoum locality and East Nile locality. The third area: is located in west White Nile and river Nile and it involve three localities (Omdurman, Umbada and Karari) [8], [9]. There are twenty public dialysis facilities in Khartoum State, this facilities it serve about (2650) haemodialysis patients.

Methods of data collection: A total of 287 subjects were selected using statistical equation ($n = N/1+N(e)^2$).Where **n** is the sample size, **N** is the population size, and **e** is the level of precision at Confidence Level is 95% [16]. A structured questionnaire was used to collect information on socio-demographic characteristics of patients such as, age, gender, marital status, original residence and occupation and past medical history such as blood transfusion and the number of transfusions received, the duration of the haemodialysis treatment, the number of haemodialysis units visited, the use of injectable drugs, surgical operation, sexual habits and tattoos. The nurses responsible for the staff at the studied clinics were interviewed in order to assess whether the prevention measures recommended by the US Center for disease Control and Prevention were being followed.

Laboratory investigation: Under sterilized condition about (5 ml) of venous blood was taken from each study subject through venepuncture using a vacutainer device, the samples was stored upright in an ice box (vaccine carrier) at a temperature of 2–8 degree centigrade and brought to laboratory at the end of the day. Then the sera were separated by centerfugiation at 3000 rpm for 5mintes, sera were stored at -20o c till the testing. All samples were tested for anti-HC by Enzyme-Linked Immunosorbed Assay (ELISA) using commercially available kits (manufactured by Diagnostic Automation, INC. USA).

Data analysis: Data were processed using the Statistical Package for Social Sciences (SPSS) for WINDOW version 19. For the analysis, binomial test (Z-test) for single proportion and some non-parametric tests such as Odds ratio (OR), 95% confidence interval of CI, and Chi-square test (X^2) were used, P. value of < 0.05 was considered statistically significant. Informed consent from the selected haemodialysis patients was obtained.

III. Results

Two hundred and eighty seven (287) haemodialysis were enrolled in this study70.1% (204/287) of them were males while 329.9% (83/287) were females, 45.6% of participant in age group above 45 years while 32.4% (93/287) of them in age group 30 – 45 and 22% less than 30 years old. 74.6% of participant were un married while 25.4% were married. Regarding to educational level of patients 21.2% (61/287) were illiterate while 12.6% were graduate (Table1).

Table 2 show the Prevalence of HCV infection according to demographic characteristics of haemodialysis patients. The result show the prevalence HCV infection among haemodialysis patients was 29.9% (60/287). The results show there is no different according to sex OR 1.28 (95% CI 0.67-2.45, P = 0.45). regarding to age group the findings shows the prevalence of HCV increase with increasing in age, the results show there was no statistical association between age group and anti-HC positivity (P = 0.92). the results show there is no statistical relationship between marital status, educational level and anti-HC positivity (P.values > 0.05).

Table 3 shows the relationship between duration of dialysis, blood transfusion frequency, frequency of dialysis centers and Anti-HC positivity. The results showed there was strongly association between long duration of dialysis and anti-HC positivity (P = 0.0001 at X^2 = 22.888). The results show the HCV infection increase with increasing in number of blood transfusion, the findings show there was statistical association between blood transfusion and HCV positivity (P = 0.0064 at X^2 = 12.304). The result show the patients dialysis in more than three centers more likely to be infected with HCV, the results show there was very strong statistical significant between frequency of dialysis centers and anti-HC positivity (P = 0.00001 at X^2 =33.372).

able 4 demonstrate the relationship between Anti-HC positivity and some risk factors. The findings show there was significant between history of surgeries and HCV positivity OR 2.52(1.41- 4.51, P = 0.0018), also there was strong statistical association between Intravenous drug users (Multiple injections) and positivity of HCV OR

4.11 (1.86-9.07, P = 0.0005). The results show the patients share the razors were three-and forty seven times more likely to have HCV infection compared with those not share razors, the results show there statistically significant 3.47(1.80 – 6.68).

The results show there was no relationship between HCV positivity and tattoos, shaving in community barbers and piercing ears OR/ 95% CI and P. values = 1.26(0.58 - 2.75, 1.25(0.70-2.22, 1.26(0.58 - 2.75 and 0.554, 0.435, 0.554) respectively.

Table (1): Characteristics of haemodialysis patients – Dialysis centers - Khartoum State - Sudan (n=303)

Variable	Frequency	%
Study group	**287**	**100**
Gender		
Male	204	70.1
Females	83	29.9
Age group		
< 30	63	22
30 - 45	93	32.4
> 45	131	45.6
Marital status		
Married	73	25.4
Unmarried	214	74.6
Education level		
Illiterate	61	21.2
Basic	97	33.8
Secondary	93	32.4
Graduate	36	12.6

Table (2) Prevalence of HCV infection according to demographic characteristics of haemodialysis patients

Variables	Anti-HC				Total		Odds	Confidence interval (CI)	P. value
	Negative		Positive						
	No	%	No	%	No	%			
Gender							1.28	0.67 - 2.45	0.45
Mal	159	55.4	45	15.7	204	70.1			
Females	68	23.7	15	5.2	83	29.9			
Age group									
< 30	51	17.8	12	4.2	63	22			0. 92*
30 - 45	73	25.4	20	7.0	93	32.4			
> 45	103	35.9	28	9.7	131	45.6			
Marital status									
Unmarried	166	57.9	48	16.7	214	74.6			
Married	61	21.2	12	4.2	73	25.4	1.46	0.73 – 2.95	0.27
Education level									
Illiterate	48	16.7	13	4.5	61	21.2			0.98
Basic	78	27.2	19	6.6	97	33.8			
Secondary	73	25.4	20	7.0	93	32.4			
Graduate	28	9.7	08	2.9	36	12.6			

**P-value considered significant at less than 0.05 levels*

Table (3) Relationship between duration of dialysis, blood transfusion frequency, frequency of dialysis centers and Anti-HC positivity

Variable	Anti-HC		Total	Chi- square	P. Value
	Negative	Positive			
	No (%)	No (%)	No (%)		
Duration of dialysis					
< one year	50(17.5)	7(2.4)	57(19.9)		
1 -5	137(47.8)	28(9.7)	165(57.5)	22.888	0.0001*
6-10	31(10.8)	15(5.2)	46(16)		
>10	09(3.1)	10(3.5)	19(6.6)		
Blood transfusion (frequency)					
< 5times	64(2.2)	8(2.9)	72(25.1)		
5-10	55(19.2)	18(6.2)	73(25.4)	13.865	0.0031*
>10 times	44(15.3)	23(8.0)	67(23.4)		
None	64(22.3)	11(3.8)	75(26.1)		
Frequency of dialysis center					

2 centers	90 (31.3)	10(3.5)	100 (34.8)		
3	41(14.3)	22(7.7)	63(22.0)	33.372	0.0001*
4	19(6.6)	15(5.2)	34(11.8)		
> = 5	15(5.2)	10(3.5)	25(8.7)		
centers	58(20.2)	07(2.5)	65(22.7)		
None					

**P-value considered significant at less than 0.05 levels*

Table (4) Relationship between Anti-HC positivity and some risk factors

Variable	Anti-HC		Total	Odds (Confidence interval) (CI)	P. Value
	Negative	Positive			
	No (%)	No (%)	No (%)		
History of surgeries					
Yes	81(28.2)	35(12.2)	116(40.4)	2.52(1.41- 4.51)	0.0018*
No	146(50.6)	25(8.7)	171(59.6)		
Multiple injections					
Yes	139(48.4)	52(18.1)	191(66.5)	4.11 (1.86-9.07)	0.0005*
No	88(30.6)	08(2.9)	96(33.5)		
Using share razors					
Yes	64(22.3)	25(8.7)	89(31.0)	3.47(1.80 – 6.68)	0.0002*
No	178(62.0)	20(7.0)	198(69.0)		
Tattoos					
Yes	31(10.8)	10(3.5)	41(14.3)	1.26(0.58 - 2.75)	0.554
No	196(68.3)	50(17.4)	246(85.7)		
Shaving in community barbers					
Yes	112(39.0)	33(11.5)	145(50.5)	1.25(0.70-2.22)	0.435
No	115(40.1)	27(9.4)	142(49.5)		
Piercing ears					
Yes	31(10.8)	10(3.5)	41(14.3)	1.26(0.58 - 2.75)	0.554
No	196(68.3)	50(17.4)	246(85.7)		

**P-value considered significant at less than 0.05 levels*

IV. Discussion

Hepatitis C virus (HCV) infection is a major health problem among haemodialysis (HD) patients in developing countries. Hepatitis C virus infection is a major health problem among haemodialysis patients. In our study we found that, the prevalence of HCV among haemodialysis patients was 29.9% (95% CI 0.67-2.45). our result was greater than that found among haemodialysis patients in Sudan (6.5%, 8.5% and 23.7%) [28,31,29]. Also our findings greater than that in developed countries, in USA 14%, in France (15%), United Kingdom (4%), Germany (7%) and Spain (22%) [16,17, 26]. Our finding was lower than that found haemodialysis patients; in Egypt (52.3 to 82.3%), in Saudi Arabia (52.5%), in Yemen (33.8%), in Syria (24.4 to 48.9%), in Kosova 43% and in China (41.1%) [9, 24 , 25,26,27].

On sex distribution, the results show there is no different according to sex OR 1.28 (95% CI 0.67 - 2.45, P = 0.45). Our finding disagree with that recorded in Palestine among haemodialysis patients, Male patients were found to be more susceptible to HCV than female patients (p = 0.01) [22].

The results showed, the positivity of HCV increase with age. In spit that there was no a significant relationship was found between HCV prevalence and age of patients (P = 0.024). Our results disagree with that found among haemodialysis patients in Sudan, HCV seropositivity was significantly associated with older age[29]. Also agree with that reported in haemodialysis patients Palestine- Gaza strip [22].

In our study 73.9% (212/287) of patients received blood transfusion, with 67 (23.4%) patients having received more than 10 units of blood. This results showed there was significant association between blood transfusion or the number of units received and HCV positivity (P = 0.0031). This result agrees with that found among haemodialysis patients in Sudan, neither blood transfusion, nor the number of blood units received, were significantly associated with hepatitis C seropositivity [29]. Also agree with that recorded among Chinese haemodialysis units, there was an association between the history of blood transfusions and kidney transplantation and the prevalence of HCV infection [15]. Also in line with study carried out in dialysis units in Kosovo, the study showed that duration of dialysis and numbers of transfusions are risk factors for development of HBV and HCV infection [25].

Regarding to the duration of dialysis, the study showed the positivity of HCV increase with increase in duration, the prevalence reach 52.6% (10/19) among those dialysis more than 10 years. The results showed there was a very strong statistical association between long duration of dialysis and HCV positivity *(P=0.0001)*. This is in line with what was found by others studies where the risks of HCV infection increase with long duration. In Sudan [29]. In Egypt [2]. In Palestine [27]. In Kosovo [25]. In China [15].

The study show that, the patients have history of dialysis in multiple centers, more susceptible to be infected with HCV infection. The result show there was statistical association between anti-HC positivity and dialysis in multiple centers (P = 0.0001). This is in line with that was found: In Sudan, HCV seropositivity was significantly associated with dialysis in multiple centers [29]. In Libya, a study showed that HBV or HCV infection was associated with a history of HD in another centre either in Libya or abroad [24].

Our findings revealed that, history of surgeries, multiple injections and using share razors were other risk factors of anti-HC positivity. The results show patients with surgical operation were two-and five times more likely to have HCV infection compared to those who have no history of surgical operation OR 2.52(1.41-4.51, P = 0.0018). This result consists with that reported in Sudan, the HCV seropositivity significantly associated with previous surgery [29]. Also agree with that reported among patients in Pakistan, history of surgeries has been present in patients who developed hepatitis C [9]. In relation to multiple injections and HCV infection, our result show patients using multiple injections were four-and twelve times more likely to get HCV infection than those who have not using multiple injections 4.11 (1.86-9.07, P = 0.0005). This is in line with that was found in Pakistan, history of surgeries has been present in patients who developed hepatitis C [9]. Regarding to using share razors, the study show patients using share razors with others more likely to be infected with HCV three-and forty seven times than those not share razors 3.47(1.80 – 6.68, P = 0.0002).

The study show there was no statistical relationship between HCV positivity and tattoos, shaving in community barbers and piercing ears P. values (0.554, 0.435 and 0.554) respectively.

V. Conclusion

The study show the prevalence of HCV among haemodialysis patients was 20.9%. (Blood transfusions received, duration of dialysis, changing of units of treatment, history of surgeries, multiple injections and share razors) statistically significant predictors factors of anti-HC positivity.

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