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Hepatitis C Virus Seroconversion Among Hemodialysis Patients and the Role of Hepatitis C Virus Positive Patient's Isolation in Benha, Egypt

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Abstract: The prevalence of hepatitis C virus (HCV) infection in hemodialysis units (HD) is higher than among normal population. Seroconversion was included in many previous studies which constitute a great problem against infection control policies. The aim of this study was to evaluate seroconversion rate and the effect of isolation of hepatitis C positive patients as infection control method. This is controlled prospective study that included 90 patients for 2 years. Isolation policy of hepatitis C positive patients was implemented in the second year of the study. The prevalence of HCV was 48.9% among hemodialysis patients. Seroconversion rate decreased from 15.2% in the first year to 5.1%in the second year after application of isolation. The duration of hemodialysis in months, positive history of blood transfusion and the amount of transfused blood were considered significant factors affecting seroconversion. so we concluded that Isolation of hepatitis C positive patients as an infection control policy is mandatory to control HCV seroconversion in Egypt.

Keywords: HCV, Isolation, Seroconversion and HD

1. Introduction

End stage renal disease (ESRD) has become a public Health problem worldwide as the total number of patients was increasing duo to the increased prevalence of hypertension and diabetes mellitus [1]. Also ESRD patients are requiring different modality of renal replacement therapy (RRT), which put more burdens on health budget especially in devolving countries [2].

Egypt has the largest burden of HCV infection worldwide which is the most common chronic blood-borne infection [3, 4]. The at risk groups include patients that receive multiple blood transfusions as hemophiliacs, individuals who are intravenous and inhalant drug users and hemodialysis patients [5].

The prevalence of HCV infection among HD patients is generally much higher than general population due to underlying impaired cellular immunity which increases their susceptibility to infection. Also HD requires prolonged vascular access and exposure to contaminated equipment. In addition HD patients required blood transfusion, frequent hospitalization and surgery, which increase opportunities forgetting nosocomial infection exposure [6]. HD staff was found also to be an important factor in transmission of HCV infections among HD patients [7].

The prevalence of HCV infection among HD patients in developed countries ranges from 3.6 to 20% and is higher in the developing countries [8] and in Egypt, it ranges from 49% to 64% [9].

HCV is responsible for over one million patient's deaths from cirrhosis and liver cancer every year [4]. It has been associated with high morbidity and mortality rates and the management of these infections among HD patients with specific antiviral agents is associated with high rates of adverse effect [10].

Isolation of HCV positive patients in HD units is recommended by many authors [11, 12].

The rational of this study was to declare that isolation of hepatitis C positive patients as an infection control policy is mandatory to control HCV seroconversion in Egypt.

2. Patients and Methods

This controlled prospective study was conducted at HD unit, Benha university hospital from October 2014 to October 2016. We included all the patients who were on HD and at the end of the study and exclude all patients who transferred from our unit, died before the end of the study or received any HD sessions outside our unit. Also we did not include new HD patient who started HD after the study had been started. Final number of the study was 90 patients.

The aim of this study was to evaluate seroconversion rate and the effect of isolation of hepatitis C positive patients as infection control method.

All new patients who will start HD sessions must do virology testing for Human immunodeficiency virus (HIV), hepatitis B virus (HBV) and HCV, and it must be repeated every 3 months. But we don't accept HBV or HIV positive patients.

For all patients, complete history was taken including age, gender, duration of HD, any surgical procedure, family history of HCV infection, vascular access and history of blood transfusion.

For HCV diagnosis we used third generation enzyme-linked immunosorbant Assay (ELISA) for detection of HCV antibodies (AB). Follow up of patients was carried out without isolation in the first year; then we applied isolation policy of HCV positive patients in October 2015, and follow up the patients continued for another year.

Annual serocnversion (any patient who was HCV AB negative and became HCV AB positive) rate was calculated as number of HCV positive seroconverted patients in one year subdivided by number of HCV negative patient and multiply by 100.

3. Statistical Analysis

The collected data were summarized in terms of mean ±SD for quantitative data and frequency and percentage for categorical data. The test of proportion (Z-test), chi square test and fisher exact test were used to compare categorical variables while student t test was used to compare quantitative variables. A P-value <0.05 was considered statistically significant. All statistical analysis was carried out using the computerized Statistical Package for Social Science (SPSS; Version 20.0 for Windows, SPSS Inc., Chicago, IL).

4. Results

This study included 90 patients on regular HD in Benha University Hospital, Egypt (56.7% were male and 43.3% were female). They had a mean age of 54.41 years (standard deviation 10.81). The prevalence of HCV infection was 48.9% (44 patients). Among the negative group for HCV infection (46 patients) who started HD, 9 patients seroconverted at the end of the study. Participants had been on dialysis for a mean duration of 44.39 months (standard deviation 18.1). About one third of them had positive history of blood transfusion (more than 50% of them get ≥3 units (Table 1).

Table 1. *Characteristics of patients.*

	Value
Age in years	
Mean ± SD (range)	54.41± 10.81 (21-76)
Sex n (%)	
Male	51(56.7)
Female	39(43.3)
HCV n (%)	
Positive	44(48.9)
Negative	46(51.1)
Vascular access	
AVF	63(70.0)
Catheter	27(30.0)
Duration of HD in months	
Mean ± SD (range)	44.39±18.1 (12-120)
Blood transfusion n (%)	
Yes	30(33.3)
No	60(66.7)
Amount of blood transfusion (32)	
<3 units	14(46.7)
≥3 units	16(53.3)
Conversion from negative HCVAB to positive	
Yes	9/46
No	37/46

Table 2 showed that there were no significant difference between cohorts with HCV infection versus cohorts without it regarding age, sex and vascular access (p>0.05).

Table 2. *Comparison between HCV positive and negative patients.*

	Positive HCV (44)	**Negative HCV (46)**	**test**	**P***
Age in years Mean ± SD (range)	53.07±10.95 (21-76)	55.70±10.62 (30-71)	#1.17	0.25
Sex n (%)				
Male	25(56.8)	26(56.5)	$0.01	0.98
Female	19(43.2)	20(43.5)		
Vascular access				
AVF	31(70.5)	32(69.6)	$0.01	0.93
Catheter	13(29.5)	14(30.4)		

#= student t test $=chi square test

The cohort was divided into two groups: Group I consisted of 9 patients (66.7% male and 33.3% female) who were negative for HCV when they started HD and seroconverted during HD to HCV positive and group II consisted of 37 patients (54.1% male and 45.9% female) who were negative for HCV when they started HD and remained negative.

Comparison between the studied groups with regard to the risk factors for HCV seroconversion showed that the duration of HD in months (67.11±12.26 in group I and 40.73±17.29in group II) and a positive history for blood transfusion and amount of transfused blood were the significant factors between the two studied groups.

A positive family history of HCV infections and surgical operation history were non-significant among the studied groups (Table 3).

Table 3. *Seroconversion to HCV seropositive patients among HCV seronegative patients.*

	Group I Positive seroconversion (9)	Group II Negative seroconversion (37)	Test	P*
Age in years Mean ± SD (range)	51.89±10.86 (30-67)	56.62±10.51 (30-71)	#1.20	0.24
Sex n (%)				
Male	6(66.7)	20(54.1)	^0.10	0.76
Female	3(33.3)	17(45.9)		
Duration of HD in months Mean ± SD (range)	67.11±12.26 (49-90)	40.73±17.29 (12-90)	#4.31	0.001**
Blood transfusion n (%)				
Yes	6(66.7)	29(78.4)	^4.97	0.03*
No	3(33.3)	8(21.6)		
Amount of blood transfusion				
<3 units	1(16.7)	7(87.5)	^4.43	0.04*
≥3 units	5(83.3)	1(12.5)		
Surgery n (%)				
Yes	8(88.9)	22(59.5)	^1.62	0.13
No	1(11.1)	15(40.5)		
Family history				
Yes	7(77.8)	23(62.2)	$0.78	0.38
No	2(22.2)	14(37.8)		
After one year (before isolation)	7/46(15.2)	39(84.8)	£6.57	0.001**
After 2 years (after isolation)	2/39(5.1)	37(94.9)	£12.70	0.001**

#= student t test ^= fisher exact test $= chi square test £=z test *=sig **=highly sig

After one year (before isolation) 15.2% of the negative group for HCV infection had converted while only 5.1% converted in the second year of the study (after isolation) which was statistically significant (p=0.02) (Table 4).

Table 4. *Seroconversion before and after isolation.*

	Before isolation (46)	After isolation (39)	Z test	P*
Positive conversion	7(15.2)	2(5.1)	2.0	0.02*
Negative conversion	39(84.8)	37(94.9)	0.23	0.41

5. Discussion

Contaminated blood products and needles and instruments were considered as major sources for transmission of HCV [13]. Also, inadequate application and or breakdown of infection control policies in HD units (contamination of dialysis machines and, improper decontamination and sterilization, inadequately trained staff and unawareness of the value of hand washing) increase the transmission of HCV [14].

Several studies have reported nosocomial patient to patient transmission of HCV infection among HD patients [15, 16].

This study evaluated the incidence of seroconversion of HCV among HD patients in Benha university hospital HD unit, and the effect of isolation of HCV positive patients on HCV seroconversion.

Isolation included dedicated HD machines, personnel, area and other barrier precautions (aprons, gowns, or gloves), used by healthcare professionals take care of HCV positive patients.

As regard general Characteristics of this study, it was found that the mean age of starting HD was 54.41 years. This was in agreement with some Egyptian studies [17, 18, and 19]. The increasing mean age of HD starting reflects the improvement of health care; but, we are still away from developed countries as the mean age in the United State was 61.1 years [20] and the median age in the United Kingdom was 65.9 years [21], but we are better than other developing countries as in Sudan (45.78 years) [22].

According to the gender, more than half of patients was male (56.7). This was in accordance with previous Egyptian studies [18, 19] which found that male constituted 53.7% and 61.0% respectively. Also in United States the male patients were more than female patients on HD as males represented about 55.0 % to 61.0 % according to different areas in United States [23].

In our study patients used only 2 types of vascular access, arterio-venous fistula (AVF) and temporary catheter. According to National Kidney Foundation, AVF is the best choice for HD, followed by arteio- venous graft and lastly catheter [24]. In this study there were 63 % of patients uses AVF and 27.0% uses catheters.

In the present study, the prevalence of HCV among HD patients was 48.9 % which was higher than Al Gharbiyah governorate, Egypt (35.0%) [19], Kafer El-Shakh governorate, Egypt (39.7%) [25] and much higher than in developed countries (3.6 to 20.0%) [8] and Morocco (32.0%) [26]. High prevalence of HCV among HD patients in Egypt is coinciding with that Egypt has the largest epidemic for

hepatitis C virus Worldwide [27].

As a comparison between HCV positive and HCV negative patients, we found that the mean age of HCV positive patients (53.07 years) was lower than HCV negative patients (55.7 years). The same result was reported in Libya [28]. But in Saudi Arabia they found that HCV is more common among the elderly as the immunity decreased with aging [29].

In our study the number of males was more than females in both HCV positive patients (56.8 %) and HCV negative patients (56.6 %). This was in agreement with Ayman, 2007 who added that Most of the studies did not find any effect of the sex on the incidence or prevalence of HCV infection [30].

The Dialysis Outcome and Practice Pattern Study (DOPPS) showed that high HCV seroconversion was associated with a longer duration on dialysis, and seroconversion was associated with an increase in the HCV prevalence, but not with the isolation of HCV-infected patients [31].

In our study there were 46/90 HCV negative patients at the start and at the end of the study after two years 9/46 patients had been seroconverted to be HCV positive with seroconvertion rate 15.2 % in first year and 5.1% in second year.

As regard comparison between seoconverted HCV patients (group I) and none seroconverted HCV patients (group II), we found that mean age of group I was insignificantly lower than mean age of group II. This wasn't in agreement with another study done in Egypt as they found the mean age in seroconverted HCV patient was higher than non-seroconverted patient [32]. This can be explained as in our study that the mean age of HCV positive patients was lower than HCV negative patients.

In this study males were more than females in seoconverted HCV patients. This was in accordance with another study in Egypt in which males were more in seroconverted and females were more in non-seroconverted [18].

According to duration of HD in months, group I had significantly longer duration than group 2 ($p< 0.001$). And this was in agreement with Soliman etal., who added that the duration on regular HD was found to be a significant predictor for HCV seroconversion in HD patients [32]. Also in another study done in Menoufia governorate, Egypt, they found that long duration of HD led to more exposure in HD units, with increased risk of HCV nosocomial infection [18].

The history of blood transfusion and total number of units (more than 3 units) were significant risk factors for HCV seroconversion in this study. Blood transfusion was still a significant relative risk for HCV seroconversion in HD patients [32] even after the introduction of nucleic acid amplification testing for the screening of blood donors which has markedly reduced the risk of HCV transmission through blood product transfusion [33]. But another study reported that blood transfusion had no significance as a risk factor in HCV seroconvertion [18].

In this study the surgical history was more insignificantly in group 1 than group 2. This also was reported in another study as it found that surgical history had no significance as a risk factor in HCV seroconvertion [18].

As regard family history, positive family history was more common in the seroconverted HCV patients; but this was not significant. This wasn't in agreement with another study that found that positive family history of HCV infection was significant risk factor for HCV seroconversion in HD patients [18].

HCV seroconvertion rate (15.2 %) in first year (no isolation) was compared with a study done at Al Gharbiyah governorate, Egypt where HCV seroconversion rate was 11% [19] but the prevalence of HCV-Ab was 35% in all HD patients in comparison with our study which was 48.9 %.

Improving Global Outcome (KDIGO guidelines) didn't recommend the isolation policy for HCV-infected patients and did not even recommend the use of dedicated machines for them [34]. But in 2 studies in Saudi Arabia and Spain, they concluded that complete isolation of HCV-negative and HCV-positive patients and machines with strict adherence to infection control policies and procedures, can even eliminate nosocomial transmission and obtain reduction in prevalence and seroconvesion of HCV [35, 36].

Finally, HCV seroconversion in first year (before isolation) was 15.2 % (7 patients from 46 HCV negative patients) and decreased to 5.1 % (2 patients from 39 HCV negative patients), and this decrease was statistically significant ($p <0.02$). This was agreed by Egyptian study compare between centers uses isolation of HCV positive patients and others don't, and found that seroconversion seen only in units not use isolation [17]. Other studied in Egypt in three different governorates found that incidence of HCV seroconversion is significantly lower in the group of patients within units implementing isolation programs of the HCV infected patients [32]. Also studies done in Saudi Arabia and Spain supported our finding and added that, strict isolation is mandatory in HD units [35, 36]. But in another study done in Peru, they did not found differences in terms of the number of participants developing HCV infection when comparing the use of dedicated HD machines for HCV infected patients with the use of non-dedicated machines [11].

6. Conclusion

In areas with high prevalence of HCV like Egypt, the prevalence of HCV in HD patients is high. So application of infection control policies and procedures which including isolation of HCV positive patients helps in decreasing HCV seroconversion.

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