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Hepatitis C Viral Prevalence and Seroconversion in Moroccan Hemodialysis Units: Eight Year Follow Up

Bahadi Abdelaali[1]*, Maoujoud Omar[1], Doblali Taoufik[2], Ahid Samir[3], Mrani Saad[2] and Benyahia M[1]

[1]*Department of Nephrology, Dialysis and Kidney Transplantation, Military hospital Mohammed Vth, Rabat, Morocco*
[2]*Department of Virology, Military Hospital Mohammed Vth, Rabat, Morocco*
[3]*Biostatistic Laboratory, Medicine Faculty, Rabat, Morocco*

Abstract

Introduction: The prevalence of Hepatitis C Virus (HCV) in chronic hemodialysis patients is eight times higher than among the general population. It is estimated between 3 and 65.8% in different studies and countries and is a contributor to mortality in this population. The aim of this study is to define the factors influencing prevalence and seroconversion of HCV in an ambispective study including 15 centers and 163 hemodialysis patients.

Methods: Multicenter ambispective Study including 167 patients treated in 15 dialysis centers in 4 cities and over a period of 8 years. In 2002, all patients underwent determination of liver enzymes, a serological survey and qualitative research of HCV RNA by polymerase chain reaction followed by a genotyping for patients confirmed positive by the method LIPA. Serological status and movement of patients between centers was followed for 8 years. In 2010, the survivors benefit serology of viral hepatitis B and C (4th generation ELISA) with research of viral RNA by PCR.

Results: The mean age of patients at baseline was 51 years of which 11% were diabetic with a mean of 55 months on hemodialysis. The prevalence of HCV was 33.4% with significantly higher ALT in positive patients and genotype 1b was most frequent (54%). Statistical analysis found that the factors of prevalence are: time on hemodialysis, number of units visited (2.2 vs. 3, p<0.001), number of red blood cells transfused (1.5 vs. 2.5, p=0.009) and area of the unit. After 8 years, overall survival was 58.2% with a prevalence of HCV at 26.2%. During follow-up, 7 seroconversion were objectified and the only factor found is the number of centers visited.

Conclusions: These data suggest that nosocomial transmission plays an important role hence the importance of strict implementation of the recommendations of prevention against the transmission of HCV in particular the training of personnel and control the transfer of patients between centers.

Keywords: Hemodialysis; Hepatitis C virus; Prevalence; Seroconversion

Introduction:

Hepatitis C virus (HCV) infection represents a big public health challenge in this millennium and the World Health Organization estimates that, until 1998, 170 million people carried the HCV worldwide and in recent years 200 million or 3% of the world population is infected with this virus [1]. Low prevalence is reported in Europe and North America, while it's high in the Far East and Africa where the prevalence exceeds 10% in Egypt. In Morocco, a recent study showing that among the 8326 samples tested by third generation ELISA, 161 samples were positive, so a prevalence of 1.93% [2].

In dialysis the problem is much broader, with a prevalence that can reach 80% and an incidence of more than 9% per year [3-6]. To this is added a high mortality in hemodialysis patients infected with HCV according to many authors [7-10]. In Morocco it is estimated that the prevalence of hepatitis C virus in dialysis is 32% according to the National Register "MAGREDIAL [4]. But this rate varies widely among centers from 11 to over 85% [4-5].

Prevalence and seroconversion Factors of hepatitis C virus in hemodialysis have been widely reported across several studies including the multicenter international DOPPS (Dialysis Outcomes and Practice Patterns Study) which included 12 countries and more than 900 units dialysis [6]. In our country, these factors have rarely been studied where the value of this work. The aim of this study is to define the factors influencing prevalence and seroconversion of HCV in ambispective study including 15 centers.

Materials and Methods

Patients

This ambispective study was performed between January 2002 and October 2010. All patients on chronic hemodialysis and treated in 2002 in 15 units at four cities (Rabat, Sale, Khemisset and Meknes) were included. Demographic data and clinical history of these patients were collected retrospectively at inclusion. Also, the virological status of HCV was defined by PCR in all patients. These patients were followed up for eight years especially their virologic status.

Practice pattern analysis

Associations among the prevalence of HCV infection and facility practice patterns were examined using logistic regression, with results presented using adjusted odds ratios. Facility characteristics and practice patterns modeled as predictor variables included facility seniority, facility size (number of patients), presence of a protocol

***Corresponding author:** Bahadi Abdelaai, Department of Nephrology, Dialysis and Kidney Transplantation, military hospital Mohammed Vth, Rabat, Morocco, E-mail: bahadiali@gmail.com

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for HCV-infected patients, treatment of HCV-infected patients at an isolation station, treatment of HBV-infected patients at an isolation station, facility screening for HCV at least yearly, number of isolation stations (per increase by one station), patients per station (per one unit increase), routine administration of HBV vaccine, ratio of staff-to-patient, patient-to-station ratio, station-to-superficies ratio, highly trained staff, experienced direct patient care staff and inexperienced direct patient care staff as defined at the DOPPS study:

- √ Trained staff: having received specialized training in dialysis for over two years
- √ Experienced staff: practicing in center hemodialysis for more than three years
- √ Inexperienced staff: hemodialysis center in exercising for less than three years

Laboratory assays

In 2002, hemodialysis patients included had received liver enzymes (Electro-Chemiluminescence Immuno-Assay ECLI), serology for HCV (3rd generation ELISA), HIV serology, search for HBs Ag by ELISA and Research of viral RNA by PCR (Cobas, Roche Diagnostics) with a sensitivity of 50UI/ml. Patients confirmed positive by PCR genotyping received by Inno-LiPA. Between 2002 and 2010, patients received regular monitoring of transaminases and C viral status (ELISA 3rd generation) and B by searching for HBsAg by ELISA (Enzygnost HBsAg 5.0).

In 2010, surviving patients received a dosage of transaminases, search for HBsAg, and C serology finding viral RNA in the laboratory of Virology HMIMV. C serology was performed by ELISA 4th generation and the search for viral RNA by real-time PCR with Cobas Taqman kit with detection limit was 15 IU/ml. genotyping analysis was not performed in 2010. The collection of blood for the detection of viral RNA was performed in the Virology laboratory at hospital or in the hemodialysis unit at the connection of the patient before anticoagulation. In this case, the tubes were identified immediately brought to the laboratory of virology at least 2 hours or immediately centrifuged, whichever was longer and the sera were stored at - 80°C.

Classification of HCV status

A patient was considered HCV positive if the HCV RNA viral research was considered positive and HCV negative if the serology and research of viral RNA were negative. The prevalence of HCV was calculated by comparing the number of HCV positive patients by PCR to the number of patients included. The seroconversion rate was determined by the number of cases of HCV seroconversion per 100 patients per year and seroconversion was defined by both a PCR negative in 2002 and a positive serology during follow-up confirmed by PCR in 2010, PCR negative and positive in 2002 in 2010.

Statistical methods

Statistical analysis was performed by SPSS version 15. Qualitative data were expressed by frequency (percentage) and quantitative data by mean ± standard deviation or median ± quartiles. The variables included were: demographics (age and sex), the number of months on hemodialysis, transfusion (number of red blood cell transfusion and year), history of dental, endoscopy, surgery, to hepatitis B infection, heart disease and diabetes.

The comparison of data between two groups positive and negative HCV was performed by the Student test for quantitative variables and by chi-square test for qualitative variables. We used multiple logistic regressions to identify risk factors for hepatitis C virus positive.

Results

We included 163 dialysis patients in 14 different dialysis centers in the private sector and the center of HMIMV hemodialysis, their mean age was 51.25 ± 14.9 years, with 70% aged over 45 years with a male predominance (100 / 61.3%) (Table 1). These patients were on hemodialysis for 6 years on average. Nephropathy in our cohort was related to diabetes in nineteen patients (11.6%), chronic glomerulopathy in 27 patients (16.6%) and was unknown in 72 patients (44.2%).

Regarding risk factors for transmission of bloodborne viruses inquiry, we found that 91 patients (55.8%) received transfusions. 56 (34.1%) patients received more than 3 red blood cell (GC) and 21 (12.9%) were transfused before 1994, the year of early screening for HCV antibodies in blood products.

Prevalence of hepatitis C virus in 2002

Of the 163 sera studied, we found that 65 patients had anti-HCV (39.9%), 13 (8%) had chronic viral hepatitis B, 3 (1.8%) patients with co-infection and B C. HCV RNA was detected in 56 patients (34.3%) corresponding to a prevalence of HCV in our population in 2002 of 34.3% (Table 2). Of the 65 sera positive by ELISA, the search for viral RNA was negative in 9 (6.4%) patients. These false positive cases have involved former patients infected with the virus removed (spontaneous clearance) which corresponds to a sensitivity of 100%.

Genotype 1 was present in 43 patients (76%) including 29 patients (51.7%) were genotype 1b, three patients (5.3%) genotype 1a and 11 patients (19.6%) genotype 1 non-classified (LIPA limit of the method used.) Genotype 2 was shown in 13 patients (23.2%) of which 09 (16.1%) were genotype 2a/2c and four patients (7.1%) genotype 2 Unclassified.

Characterisics	
Patients	163
Facilities	15
Age (year)	51.25 ± 14.9
Male (n / %)	100 / 61.3
Female (n/ %)	63/ 38.7
Initial Nephropathy : (n / %)	
Diabetes	19 / 11.6
chronic Glomerulonephritis	27 / 16.6
tubulo-interstitial Nephropathy	23/ 14.1
Vascular	16 / 9.8
Hereditary	6 / 3.7
Unknown	72 / 44.2
Months on hemodialysis	73.3 ± 55.6
Number of facilities visited by patient (n)	2.5 ± 1.42

Table 1: Demographic and clinical characteristics of patients at inclusion.

Parameter	
GOT UI/l	23.2 [13 – 18]
GPT UI/l	26.5 [11.4 – 17.4]
Ag HBs positive (n / %)	13 / 8
HIV positive (n)	0
anti-HVC positive (n / %)	65 / 39.9
Ag HBs and anti-VHC positive (n / %)	3 / 1.8
HCV RNA positive (n / %)	56 / 34.3

Table 2: Liver enzymes and viral status of patients in 2002.

Factors prevalence of hepatitis C virus in 2002

The comparison of clinical data between patients HCV positive and HCV negative patients in 2002 showed that the first group were significantly older hemodialysis (9 versus 7 years, p=0.02), attended more centers (3.04 versus 2.21, p=0.001), received more red blood cells and were transfused before 1994. Comparison of liver enzymes between these two groups showed that these enzymes were significantly higher in HCV positive patients (Table 3).

Regarding the characteristics of the centers, it was found that the prevalence of hepatitis C virus was significantly related to the area of the center, the number of nurses especially trained and experienced but also the number of caregivers (Table 4).

The search for risk factors for hepatitis C virus positive in our population in 2002 was conducted by logistic regression showed that the factors involved in hemodialysis were seniority and the number of red blood cells transfused (Table 5).

Regarding the characteristics of the center who influenced the prevalence of hepatitis C, we found that the number of patients, generating and testing of hepatitis C virus and the area of the center were risk factors for HCV in our population (Table 6).

During the monitoring we found that 26 patients (15.95%) changed hemodialysis center, including 7 patients (4.2%) changed city. Regarding replacement therapy, only two patients were transplanted and no patient was transferred to peritoneal dialysis. Overall survival of our patients was 63.19% since we identified 60 deaths (Figure 1). We found that the average age of deceased patients was 57.2 ± 13.8 years and 27 (45%) were HCV positive.

Mortality among HCV positive patients was higher compared with HCV negative hemodialysis patients (50% versus 30.8%). Although the cause of death had been identified in some cases, we found that mortality was significantly correlated with HCV (Figure 2).

During the follow up, we also found a case of seroconversion of HBV and no HIV seroconversions. After 8 years of follow up, the number of survivors was 103 since we recorded 60 deaths (58.2%). The demographic characteristics of survivors in 2010 are summarized in Table 6.

Prevalence of hepatitis C virus in 2010

Of the 103 surviving patients in 2010 and tested for hepatitis C virus by PCR, viral RNA was detected in 27 patients. Thus, the prevalence of hepatitis C virus was 26.2%. In this phase we have found no false negative or false positive.

Factor	Hépatite C positive n = 56	Hépatite C negative n = 107	p
Age (year)	53.07 ± 14.13	50.29 ± 15.25	0.259
Months on Hemodialysis	**112.6 ± 70.7**	**87.32 ± 62.26**	**0.02**
Number of facilities visited	**3.04 ± 1.65**	**2.21 ± 1.2**	**0.001**
Number of RBC transfused	**2.59 ± 2.45**	**1.6 ± 1.9**	**0.006**
Endoscopy (n / %)	28 (50)	50 (46.7)	0.487
surgery (n / %)	35 (62.5)	55 (51.4)	0.287
Dental cares (n / %)	38 (67.9)	75 (70.1)	0.96
Number of vascular access mean ±ET	1.64 ± 0.74	1.72 ± 0.97	0.609
Liver enzymes :			
ASAT (UI/L)	**34.48 ± 28**	**17.25 ± 9**	**<0.0001**
ALAT (UI/L)	**41.21 ± 42.3**	**18.77 ± 18.7**	**<0.0001**
Male (%)	66.07	58.9	0.372
Transfusion (%)	64.28	51.4	0.117
Transfusion before 1994 (%)	**21.42**	**7.4**	**0.005**
Gangrene (%)	1.7	1.8	0.506
Hepatitis B virale (%)	3.5	10.28	0.32

Table 3: Comparison of clinical and laboratory data between patients with HCV - and HCV +.

Factor	Hepatitis C positive Mean ± ET N = 56	Hepatitis C negative Mean ± ET N = 107	p
Facility seniorety (years)	17.41 ± 5.74	15.34 ± 5.31	0.028
Number of patients	74.16 ± 26.18	64.9 ± 17.6	0.01
Number of dialysis machines	21.17 ± 6.9	17.61 ± 6.02	0.002
Superficie of facility (m²)	506.6 ± 316.2	346.8 ± 192.6	0.0001
Numbre of HCV screning test per year	2.21 ± 0.65	1.82 ± 0.67	
Paramedical staff:			
Nurses	8.13 ± 3.74	8.41 ± 5.3	0.015
Formed staff	7 ± 3.51	6.39 ± 4.39	<0.0001
Experimented staff	6.68 ± 5.53	5.9 ± 3.09	0.002
Inexperimented staff	1.29 ± 1.26	1,64 ± 1.38	0.873
Help-caregiver	7.33 ± 2.01	8.12 ± 2.5	0.046
Ratio :			
Nurses/patients	0.12	0.15	0.15
Patients/machines	3.49	3.91	0.004
Area/machines	22.63	19.1	0.002

Table 4: Comparison of the data center between the two groups.

Factor	Separate model			Combined model		
	O.R	CI	p	O. R	C.I	p
Age (years)	1.01	0.99 - 1.03	0.258			
Male (%)	1.36	0.69 - 2.36	0.37			
Time on HD (mois)	**1.006**	**1.01 - 1.1**	**0.022**	**1.009**	**1.001 – 1.017**	**0.048**
Years on HD* >5 (%)	2.13	1.09 – 4.18	0.026			
Years on HD > 10 (%)	3.4	1.55 – 7.5	0.002			
Nbr. units Freq (n)**	**1.56**	**1.18 - 1.9**	**0.001**	**1.37**	**1.01 – 1.85**	**0.043**
NUF > 2 (%)	2.78	1.42 - 5.42	0.03			
Transfusion (%)	1.7	0.87 - 3.31	0.117			
N CG***	**1.34**	**1.04 - 1.73**	**0.022**	**1.69**	**1.13 – 2.5**	**0.008**
NCG > 3 (%)	3.37	1.3 – 8.7	0.012			
Year of transfusion***	0.34	0.12 - 0.94	0.039	1.97	0.39 – 9.7	0.405
Endoscopy	1.14	0.59 - 2.19	0.69			
Dental care	0.9	0.44 - 1.8	0.76			
Surgery	1.57	0.81 - 3.05	0.177			
Hépatitis B	0.32	0.06 - 1.51	0.151			

*HD: hemodialysis; **NUF: number of dialysis units frequented; ***transfusion before 1994

Table 5: Risk factors for Hepatitis C in 2002.

Factor	Separate model			Combined model		
	OR	C.I	p	OR	C.I	p
Seniority of unit	1.07	1.007 – 1.13	0.028	0.94	0.86-1.03	0.22
S. > 15 years	2.49	1.2 – 5.1	0.014			
Number of patients	1.02	1.005 – 1.038	0.01	0.89	0.8-0.9	0.03
Patients > 50	1.68	0.62 – 4.52	0.3			
Patients > 60	0.43	0.63 – 2.85	0.432			
Patients > 70	2.24	1.153 – 4.36	0.017			
Number of machins	1.09	1.03 – 1.16	0.002	1.28	1.003-1.63	0.047
Area of the unit	1.03	1.001 – 1.004	0.0001	1.004	1.001-1.007	0.022
Isolement HCV	0.06	0.009 – 0.506	0.009	0.21	0.01-2.4	0.204
HCV screening/year	2.41	1.44 – 4	0.001	4.69	1.7-12	0.02
Number of nurses	0.98	0.92 – 1.05	0.71			
Formed staff	1.03	0.95 – 1.12	0.37			
Experimented staff	1.07	0.97 – 1.19	0.14			
Inexperimented staff	0.81	0.63 – 1.05	0.11			
Help cargivers	0.94	0.82 – 1.07	0.38			
Ratio :						
Nurses/patients	0.11	0.006 – 2.2	0.15			
Patients/machines	0.5	0.313 – 0.802	0.004	1.2	1.04-1.7	0.41
Area/machines	1.08	1.03 – 1.14	0.002	0.26	0.8-1.1	0.82

*HD: hemodialysis; **NUF: number of dialysis units frequented; ***transfusion before 1994

Table 6: Risk factors for Hepatitis C associated with data centers in 2002.

Risk factors for HCV in 2010

Analysis of demographic and clinical data of patients in 2010 using logistic regression showed that risk factors of HCV were positive in the age and number of hemodialysis centers attended (Table 7). Regarding practices of the centers, the risk factors for HCV were identified: the number of patients and nurses experienced (Table 8). Thus, the risk of hepatitis C increased with the number of patients cared for at the center and the number of experienced nurses.

Rate of HCV seroconversion

Patient follow HCV negative in 2002 identified 7 cases of seroconversion which corresponds to a seroconversion rate of 0.81 per 100 patients per year (Figure 1). This low number of seroconversion did not allow a reliable statistical comparison to find risk factors for hepatitis C virus seroconversion.

Discussion

Prevalence of hepatitis C virus in hemodialysis

The prevalence of HCV is much higher in dialysis than in the general population. Fabrizi confirmed that if the prevalence of HCV in the general population did not exceed 20% in endemic countries, it exceeds in chronic hemodialysis patients 80% [2].

This prevalence, as in the general population varies between geographical areas and countries. In developed countries, according to the DOPPS study, the prevalence of HCV varies between 2% in the United Kingdom and 20% in Italy with a downward trend between the three phases of this international multicenter study including 12 countries and interesting over 38,000 patients in 900 dialysis units [6]. In developing countries, the situation is very special because the prevalence of HCV may exceed 80%.

In Morocco, the prevalence is 32% according to the record Moroccan "MAGREDIAL [4]. However, there is an overall average because the prevalence varies in the same country and depending on the dialysis units. In a recent Moroccan study including 5 centers (one in the public sector, one of the HMIMV and three private sectors) and more than 300 patients, the prevalence of HCV by ELISA 3rd generation averaged 68% but found that prevalence varied between the centers of 11 to 91% [5]. Within the public center hemodialysis center University Ibn Sina, the prevalence of HCV studied by third generation ELISA was 60% [11]. This already high prevalence's were probably underestimated by default systematic research of viral RNA C, recommended by KDIGO in situations of high prevalence.

Our study is the first in Morocco who have studied the prevalence of HCV in search of the viral RNA. This prevalence was 34% and 25% interest of all dialysis patients from 15 dialysis units, in four different cities in three different geographical areas, and has no center includes the public sector. This result might seem comparable to the national register "MAGREDIAL" which we believe leads by default precision of the serological method used the uniformity of use by different centers and were purely retrospective information collected on HIV status. The high prevalence were found in studies including public centers, the study of factors explaining this difference were not the object of our study, but still requires further studies to identify such forward-looking.

Factors prevalence of hepatitis C virus in hemodialysis

Several factors have been implicated in the prevalence of hepatitis C virus but most cities are the transfusion and length of hemodialysis. Other factors were highlighted by the multicenter DOPPS. According to this study, the prevalence of HCV increases with the number of years on hemodialysis, male sex, diabetes, black race, hepatitis B virus and alcohol abuse.

The relationship between the prevalence of HCV in hemodialysis and age has been shown in several studies [12-15]. This link could be explained by the fact that older hemodialysis are more likely over time to infection with blood-borne viruses, especially since these patients were started on replacement therapy before the actual awareness of the importance the implementation of universal hygiene measures in hemodialysis and systematic anti-HCV among donors of blood components. In our study, the number of years on hemodialysis is a risk factor for prevalence of HCV. Many studies, including the DOPPS study, showed that risk in the world [13,16]. The average duration of dialysis patients HCV (+) in hemodialysis units worldwide ranged between 2.75 and 10.6 years. In Morocco, among hemodialysis center CHU Ibn Sina it was 10.6 years in our series, it is 9.5 years.

Factor	HVC + N = 27	HVC - N = 76	Separate model			Combined model		
			O.R	CI	p	OR	CI	p
Age (year)	47.9	48.59	0.99	0.96 – 1.02	0.83	-		
Male (%)	61.7	56.5	1.11	0.45 – 2.72	0.809	-		
Months on HD	162.88	138.9	1.01	1.004 – 1.026	0.01	1.02	1.008-1.04	0.009
> 10 ans (%)	81.04	68.42	2.03	1.52 – 3.68	0.201			
> 15 ans (%)	44.4	18.42	3.54	1.36 – 9.2	0.009			
NCF (n)	3.44	2.3	1.65	1.22 – 2.25	0.001	1.64	1.06-2.47	0.048
Transfusion (%)	70.3	50	2.25	0.88 – 5.77	0.09	2.55	0.6-10	0.193
NUT***	2.7	1.93	1.14	0.95 – 1.38	0.144	1.23	0.73-1.68	0.404
Endoscopy (%)	0.85	0.84	1.009	0.669 – 1.531	0.96	-		
Dental care(%)	1.85	1.71	1.07	0.78 – 1.46	0.652	-		
Surgery (%)	1.29	1.19	1.05	0.76 – 1.47	0.73	-		
Hepatitis virale B (%)	3.7	9.2	0.38	0.045 – 3.23	0.37	-		

Table 8: Risk factors of in survivors on 2010.

Factor	HVC +	HVC -	Separate model			Combined model		
			OR	I.C	p	OR	IC	p
Unit seniority (year)	20.11	16.32	1.13	1.04 – 1.23	0.004	0.87	0.71-1.08	0.23
patients Number	85.85	64.46	1.06	1.03 – 1.097	0.0001	1.3	1.08-1.56	0.004
Machines Number	23.29	18.36	1.12	1.03 – 1.22	0.004	0.97	0.67-1.4	0.87
Unit superficy (m^2)	598	349.4	1.004	1.002 –1.006	0.0001	1.004	0.99-1.01	0.54
Isolement HVC(%)	0	25	0	0 – 6.1	0.71	-		
HVC screening per year	2.48	1.76	3.92	1.07 – 14.2	0.038	1.2	0.4-3	0.088
Nurses number	8.74	8.64	1.004	0.92 – 1.09	0.93	-		
Formed nurses	7.29	6.72	1.03	0.93 – 1.13	0.559	-		
Experimented nurses	7.18	6.09	1.09	0.96 – 1.24	0.15	1.19	0.04-0.83	0.027
In-experimented nurses	1.48	1.55	0.96	0.69 – 1.33	0.812	-		
Help-caregivers number	7.44	7.72	0.95	0.797 – 1.14	0.61	-		

Table 9: Practice risk factors of HVC on 2010.

The threshold of seniority has been extensively researched and according to some studies, this risk is increased significantly when the number of years on hemodialysis more than ten years [14-19]. Portuguese authors have shown that patients managed by hemodialysis for only three years were 13 times greater risk of infection than those treated for only one year [20]. In a study conducted in five Moroccan centers the prevalence of anti-HCV increased significantly when the number of years on hemodialysis more than five years [21]. In our study, it was noted that the risk of HCV is increased three-fold the number of years on hemodialysis more than ten years.

Blood transfusion is also among the factors most often implicated in the prevalence of HCV [22]. This link could be explained by the frequency of transfusion in the hemodialysis population especially before the introduction of routine screening for HIV in blood products [23,24].

In our series, the number of red blood cells was an independent factor in the prevalence of HCV in 2002, especially when this number exceeded three pellets. However, this factor has lost weight over the years, since patients are transfused less and receive more and more erythropoiesis-stimulating agent as evidenced by the decreased number of red blood cell transfusion in 2010. In addition, since 1994 all blood products are tested for antibodies to HCV. This observation was confirmed by numerous studies, particularly in Brazil, where the prevalence of hepatitis C virus was 37.8% before the introduction of screening for HCV in red blood cells in 1993 with a risk sixfold [25-28]. After that date, the prevalence of HCV in this population decreased to 16.5% in 2002 [29]. In Morocco, the detection of HCV in blood products was introduced in 1994. In our study we found that patients transfused before 1994 were three times more risk of hepatitis C than those transfused after that date.

In our study the number of CGT at baseline in the HCV + group was 2.59 vs. 1.6 for the HCV-group with a significant difference between the two groups in multivariate analysis. The risk of HCV was multiplied by more than three times when this number exceeded three red blood cells. Similar results were reported in several studies [25-30]. However, it was noted as in several studies, only 26 of the 56 HCV + patients were never transfused, highlighting the involvement of other factors in the prevalence of HCV. Some authors have found no relationship between transfusion and HCV + [31,32].

In our study, we found that the total number of hemodialysis patients cared for in the center area of the center and the number of experienced nurses to influence the C viral status of the patient.

In the literature the total number of hemodialysis patients treated in the center has never been described as a risk factor of HCV because this parameter has always been based on the number of nurses or the number of generators. The report nurse-patient relationship is more objective to better reflect the practices of the centers and the quality of care. In our study, we found that the risk of HCV increased with the number of patients treated in the center especially when it exceeded 70 patients. By cons, we did not find any relationship between reports nurse / patient, patient / generator and the viral status of the patient.

We also found in our study that the risk of HCV increases with the area. This could be explained by the fact that the number of hemodialysis supported increased with the size of the centers (correlation coefficient 0.75, p=0.001).

About paramedics in our study we focused only on the number and experience of paramedics. We noted that the risk of HCV was related to the number of experienced nurses at the center. Their number was significantly higher in the HCV positive group. It is a result opposite to what was reported in the literature, especially in the DOPPS study, prevalence and risk of seroconversion were lower in dialysis units with a large number of experienced nurses [32-36]. This result could be explained by the lack of training for experienced nurses leading to a relaxation of the application of universal rules of hygiene, even if a correlation was found between the number of chronic hemodialysis and the number of nurses Experienced (correlation coefficient 0.54, p=0.03).

The seroconversion of hepatitis C virus in hemodialysis

Prospective studies mono-centric and multicenter helped establish the incidence of HCV seroconversion in hemodialysis [32,37-43]. The annual incidence varies between studies and countries with low or zero rate in developed countries, and over 10% in emerging countries. In Morocco the incidence of HCV seroconversion was 9.4 per 100 patients per year according Sekkat et al. [5]. This rate was confirmed in a retrospective mono-centric to the Ibn Sina Hospital where it was reported an annual rate ranging between 2 and 10% of patients in care for most hemodialysis twice a week between 1999 and 2009.

These two studies considered in the incidence of seroconversion were they have been carried out by 4th generation ELISA which lack sensitivity in situations of high prevalence of HCV in hemodialysis [44]. As was done in our study, only the search of the viral RNA would clarify the true incidence of seroconversion. However, this direct test given its high cost may not always be achieved. In our study the incidence of HCV seroconversion was 0.81 per 100 patients per year which is comparable to the rates quoted in developed countries. The limitations of our study were non-achievement of genotype in patients' verimation in 2010, the only way to eliminate secondary infection by other genotypes and the non-realization of phylogenetic study in patients cured (by spontaneous viral clearance) re-infected. The low number of seroconversion in our study could also partly be explained by the high mortality observed in the hepatitis C virus positive, which has undoubtedly reduced the number of patients' contaminants.

Prevention of hepatitis C virus in hemodialysis

Our low incidence of seroconversion could be explained, despite the limitations of our study than in the observance of universal precautions in health centers included. However, these measures had not been assessed in our study. We by cons interested in evaluating some ways controversial, in particular the isolation of HCV positive hemodialysis.

The strategy of isolation coupled with improved hygiene has proven effective in limiting the transmission of hepatitis B in hemodialysis centers before the introduction of HBV vaccination [45,46]. This measure is now recommended for patients infected with HBV [47]. During the past decade, several studies from emerging countries with high prevalence of HCV in hemodialysis, showed that the isolation of HCV positive patients significantly reduced the incidence of seroconversion without specifying their strategies vis-à-vis universal rules of hygiene [48]. The ideal would be to assess the results of a prospective randomized trial with two groups' isolation versus absence of isolation "in one hemodialysis unit and with the same medical and paramedical staff. For the moment, is not found in the literature such a test.

In our work we found that the isolation of HCV positive hemodialysis was performed by only two centers (13.3%) in contrast to HBV where the isolation was performed in 11 centers (73.3%). We found that isolation was significantly associated with low prevalence of HCV, however, in multivariate analysis of isolation was not a risk factor for hepatitis C virus Nevertheless, we hypothesize that in our context, given the high prevalence of HCV in our centers, isolation of HCV + patients in time or space, in addition to the implementation of universal hygiene procedures would constitute a cornerstone in the prevention of transmission of HCV.

Conclusion

Hepatitis C virus is a major concern in hemodialysis, where its prevalence is much higher than in the general population. In our study the prevalence of hepatitis C virus in hemodialysis is 34.3% by investigating the viral RNA. This prevalence is lower than those reported in other studies Moroccan but it remains very high compared to developed countries where it does not exceed 20%.

Risk factors for prevalence of hepatitis C virus in our context are mainly the seniority and number of hemodialysis centers frequented. The number of red blood cell transfusion in 2002 was a factor in the prevalence of hepatitis C with a threefold risk when the number was greater than three.

The center practices significantly influence the prevalence, in particular, the number of patients cared for in a center regardless of the number of nurses, because we did not find any link between the prevalence of HCV and nurses report on patients. Ironically we found that the number of nurses experienced negatively influenced the prevalence underscoring the importance of training staff even experimented on universal hygiene measures.

The incidence of seroconversion in our cohort was 0.9 per 100 patients / year, which remains very low compared to other series including Moroccan public centers. This low incidence does not permit to search for possible factors for seroconversion. It is itself an excellent result which should not lead to neglect rigorous and continuous application of universal rules of hygiene. This result was offset by a high mortality rate of HDC-C virus carriers in our study.

This epidemiological feature Moroccan plead for a policy of isolation certainly centers with low prevalence of dialysis organization dedicated, as patients are carriers of the virus or not (although the character of significance has not been highlighted in multivariate analysis in our study) in combination with mandatory universal measures of hygiene. In centers with high prevalence, we plead for obvious reasons of logistics for a strengthening of the universal rules of hygiene without isolation.

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