Nurses' Performance, isolation policy and HCV Sero-conversion among Hemodialysis Patients in Egyptian Hospitals

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Abstract: HCV infection remains highly prevalent both in developed and less-developed countries. In spite of considerable decline in the incidence and prevalence of HCV infection among HD patients in many countries, this infection still remains a major problem among patients on maintenance HD especially in Egypt. Clearly, strict adherence to standard precautions including isolation precautions is the key stone in the prevention of nosocomial transmission of HCV in hemodialysis units. **Study design and aim of the work**: This study was conducted in the HD units at four Egyptian hospitals, two public and two private hospitals. First phase; cross section – exploratory phase to document nurses' knowledge, practice and application of isolation policy in the units. Second phase; prospective phase to the HCV sero-negative cases to detect sero-conversion rate. **Statistical analysis:** the public units (Group A) was compared with private units(group B) using suitable significant tests with significant level P value<0.05, calculation of HCV period prevalence, incidence and incidence density. **Results:** group B units follow isolation policy for HCV positive patients while group A units don't, nurses training sessions, knowledge and practices are significantly better in group B units than in group A, seroconversion rate is higher significantly in group A units than in group B. **Conclusion and recommendations:** HDUs that conform to policies and regulation related to infection control and isolation of HCV sero-positive cases had significant low incidence rate for HCV sero-conversion.

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1. Introduction:

Hepatitis C virus (HCV) infection is especially problematic in patients with end-stage renal disease (ESRD) who are undergoing hemodialysis (HD) (1). The prevalence of HCV infection is higher among HD patients than in the general population, and several routes of transmission are thought to originate from HD units (1, 2). There is wide variation in the prevalence of HCV infection among different HD units and countries as shown by Dialysis Outcomes and Practice Patterns Study (DOPPS). The mean prevalence of HCV in different HD facilities is 13.5% and varied among countries from 2.6% to 22.9% (3). On the other hand **Kellerman and Alter,** mentioned that; the worldwide data suggest that the prevalence of hepatitis viruses among chronic renal failure (CRF) cases could be as high as 80% (4).

Zakaria reported that Egypt has the highest countrywide prevalence of hepatitis C virus in the world. This prevalence exceeds other countries in the region and elsewhere with comparable socioeconomic living conditions (5). At the community level, Egypt Demographic and **Health Survey** (2008) showed that the percentage of HCV antibody positive cases was 14.7% and the percentage positive on HCV RNA test was 9.8% (6). In Egypt the prevalence ranges from 13-48% among HD units patients; MOH report (Egyptian Ministry of Health), unpublished data 2006. The main reasons for high incidence of infections is the high prevalence of HCV infection in the general population, lack of standard of infection prevention precautions and effective vaccination, inadequate disinfection procedures of dialysis machines and other medical equipment, as well as spread of infection from patient to patient, especially in dialysis centers with a high percentage of infected patients (7,8). **A.Mele et al said that** "A high prevalence of infected patients with HCV in the dialysis setting increases the risk for HCV nosocomial transmission" (9)

HCV infection is associated with greater mortality (10-12). As a cause of death, hepatocellular carcinoma and liver cirrhosis are significantly more frequent among anti-HCV-positive than anti-HCV-negative dialysis patients (12). Risk factors for HCV infection in dialysis patients include number of blood transfusions, duration of HD, and mode of dialysis, prevalence of HCV infection in the dialysis unit, previous organ transplantation, intravenous drug use, male gender, older age, and nosocomial transmission of HCV in HD units (13-16). Clearly, strict adherence to standard precautions "universal precautions" and careful attention to hygiene are the key stone in the prevention of nosocomial transmission of HCV in

hemodialysis units (17) . However, those hemodialysis units with a high HCV prevalence or in which there is no fulltime infection control personnel dedicated to the infected patients during the hemodialysis sessions, could have a greater risk of sero-conversion. Therefore, isolation in special units or dialyzing patients in specific sessions must be considered (18). The role of service providers especially nurses in to assure following the standard precautions is crucial in reducing the prevalence of HCV infection in the HD units in hospitals. Periodic assessment of the prevalence and incidence of HCV infection among HD patients presents important indicators for compliance of the service providers towards the standards of infection prevention in hospitals.

The study objectives:

1- Identify the period prevalence of HCV infection in the HD units,
2- Assess the nurses' knowledge about the standard of infection control precautions in Hemodialysis Units,
3- Explore the nurses' practices regarding the infection prevention precautions in Hemodialysis Units,
4- Identify incidence of sero-conversion of viral hepatitis C infections among hemodialysis patients,
5- Examine the association between following the standards of infection prevention precautions by HDUs with the frequency of occurrence of HCV infection.

Study hypothesis:

HDUs that fulfill standards of infection control and having nurses with adequate knowledge and skills and follow the standard precautions to prevent infection in HD units especially isolation of HCV positive patients, could contribute in reducing the incidence of HCV infections among HD patients indicated by sero- conversion rate.

2. Methodology:

Study setting:

This study was conducted in the Hemodialysis Units at four Egyptian hospitals .Two of the selected hospitals were public general hospital that provide fee-free services. The other two hospitals are private hospitals. The study was conducted in the HD units of the selected hospitals. The investigators considered that private hospitals have good surveillance system and ensure compliance of service providers to standard infection control precautions in the HD units.

Study population:

All renal failure patients admitted to the hemodialysis units of the four hospitals from January to December 2008 and investigated for viral markers at least three times (one at the time of admission and the others each 3 months) had been included in the study. All nurses working in the HD units in the four hospitals had been included in the study.

Study design:

The study was composed of two phases:

1- **Cross section – exploratory (situation analysis)phase:**

The objectives of this phase were to assess the prevalence of HCV infection among HD admissions, and to assess the level of nurses' knowledge and the current practices regarding commitments to the standards of infection prevention protocols.

Sample Size and Techniques

-HD patients: All admissions to the HD units in the four hospitals throughout a period of January to December 2008 had been included in the study.
-Nurses: All nurses working in the HD units in the four hospitals had been included in the study

Types and Sources of data: quantitative data had been collected through:

-Direct observation of the HD unit work environment, equipment and operations related infection control (including isolation policies)
-Structured interview with patients,
-Reviewing patients' hospital records, especially lab investigations related to HCV infection (anti-HCV antibodies detected by ELISA)
-Structured interview with nurses to identify levels of knowledge regarding infection control
-Direct observation of operations using a checklist to assess the nurses' performance.

Data collection Instruments:

- Checklist for HD unit that included items related to availability and proper operation of equipment and isolation policies.
- A questionnaire form had been used to identify the demographic characteristics, Exposure to risks of hepatitis C infection among hemodialysis patients. The form included items to be completed from the patients' records regarding lab investigation findings from time of admission and at a frequency of every three months for HCV infection.
- A questionnaire to assess nurses' knowledge concerning route of transmission, methods of effective prevention of hepatitis infection and previous training in infection control.
- Observational check list to record performance of nurses regarding application of isolation policy, methods of disinfection and the

conforming to standard precautions recommended by CDC (19).

Methods of Data Collection:

- Observation and recording information about HD unit facilities for infection control
- Structured interview with patients was done using the patient questionnaire form. The form included also information derived from the patients' hospital records regarding anti-HCV detected by ELISA
- Structured interview with nurses to assess their knowledge about standards infection control in HD units
- Direct observation of operations by observing and recoding nurses' performance according to standard checklist

Data analysis plan:

The analysis of data derived from the first phase was aiming at allocating patients into two groups and hospitals into two groups:

Patients' groups:

1. Seropositive cases: they are the patients who showed positive serological test to HCV at time of admission to the hospital.
2. Sero-negative cases: they are the patients who showed negative results by ELISA at time of admission to the hospital.

Hospital Groups:

Group A: The two hospitals that showed less satisfactory fulfillment of standard requirements for HDU-infection control facilities and didn't apply isolation policy for positive HCV patients.

Group B: The two hospitals that showed satisfactory fulfillment of standard requirements for HDU-infection control facilities and applied isolation policy for positive HCV patients.

2- Prospective/follow up phase to the HCV sero-negative cases

The follow up phase was 12 months in duration. It started from January to the end of December 2009. During this phase, all the records of the sero-negative patients determined at the first phase were reviewed every 3 months to check for sero-conversion. (It is to be noted that the serological analysis is done routinely every 3 months in the four units for all patients.)

The objectives of this phase were to detect the frequency/time of sero-conversion of sero-negative cases detected in the first phase, study the characteristics of patients with sero- conversion and association between the frequency of sero-conversion, and performance level of the HDUs in Infection control especially adoption of HCV isolation policy.

Data management and statistical analysis:

The data was coded and entered using the statistical package SPSS version 16. The data were summarized using descriptive statistics: mean, standard deviation, minimal and maximum values for quantitative variables and percentage for qualitative values. Statistical differences between groups were tested using T- test for quantitative normally distributed variables, Nonparametric Mann Whitney test for abnormally distributed quantitative variables and Chi Square test for qualitative variables. P-value less than 0.05 were considered statistically significant.

Period prevalence and sero-conversion rate of HCV were calculated.

Cumulative incidence and incidence density were calculated to describe the rate at which new infections are occurring. The duration of exposure to HD/days had been calculated for each patient throughout the study period to calculate the incidence density.

Incidence density= Number of new cases (sero-conversion) during a given period * 10000
Total person-days of exposure to dialysis sessions

Comparison between groups considered the independent variables (patients' characteristics, Type of HDUs regarding commitments to infection control standards and the independent variables (HCV sero-conversion).

Ethical consideration:

All the included subjects were treated according to the Helsinki Declaration of biomedical ethics (20) Written consent was obtained after proper orientation of the subjects regarding the objectives of the study. Presentation of the results for all dialysis units, hospitals and for all patients was anonymous, to be sure of data confidentiality.

3. Results:

Information derived from the study had been presented in three main themes:

1- HD Units' Facilities for CDC Standard for Infection Control:

Findings from study the HD units in the four hospitals came to categorize the two public hospital dialysis units as "Group A HDU" (57 dialysis machines) they have dedicated machines (two at each unit) for HBV positive patients but they doesn't follow isolation policy for HCV positive patients. The two private dialysis units Group B units" (49

dialysis machines) apply isolation policy for both HBV (two at each unit) and HCV positive patients (five machines at each unit). Group A units use chemical disinfection as rinsing of the machine at the end of the day, while in group B units they rinse the machine using heat disinfection after each patient.

The total number of nurses in group A HDUs was 38 nurses while at group B units they were 36 nurses. The ratio of nurses to HDU machines was 10:15 in the Group A HDUs, and 10:14 in the Group B HDUs

2-**Nurses' Performance in infection control in HDUs:**

Table (1) shows that the proportion of nurses in group B HDUs who received training courses on infection control was significantly higher than that for nurses of group A HDUs. The table shows also that significant proportions of Group B HDUs compared to Group A HDUs nurses had demonstrated satisfactory performance related to application of the standard precautions and CDC guidelines

3- **Nurses' knowledge about Infection control in HDUs:**

Table (2) illustrates the nurses' knowledge score about the mode of transmission of HCV among dialysis patients. They were asked to rank the mode of transmission to "one" as least likely and "10" as the most likely. In group B units nurses ranked "nurses practice" then "blood transfusion" as highly responsible for HCV transmission while group A nurses ranked "dialysis in other center" as the highest cause responsible for HCV transmission, nurses in group B showed significant better scores in several points.

4- Prevalence of HCV infection among HDUs' patients at time of hospital admission:

During the first phase of the study, 957 patients were undergoing hemodialysis but the study including only 914 (484 from general hospitals [group A] and 430 from the private hospitals [group B] and 43 patients were excluded either due to their admission less than 3 months or their fate were unknown. Accordingly the average number of patients per machine per year (turnover) was 8.5 patients /machine for group A and 8.88.5 patients /machine for group B. Figure (1) demonstrates that out of the total HDUs patients (n=914), 531 patients (58%) were HCV antibodies positive. There was no statistically significant differences between Group A (59%) and Group B (57%) regarding the prevalence of HCV infection at the time of HDUs admission. chi-square=0.42, P value <0.52. This considers the period prevalence of HCV antibodies among patients attending dialysis units within a period of one year (From January to December 2008).

5- HCV Sero-conversion among HDUs' patients:

The sero-negative patients (group A=198, group B=185) identified during the first phase of the study had been followed up for 12 months and all patients were tested at least twice for HCV antibodies by ELISA. Group A (with no isolation of HCV infected patients) had 46 seroconverted patients (23%) i.e. was negative at the start of this period then become positive for HCV antibodies while group B (with isolation of HCV infected patients) had 24 seroconverted patients (13%) with chi-square=6.74, P value = 0.009 with odds ratio (95% CI)= 2.03(1.18-3.49) (Figure 1).

Information pertaining to the age and sex structure of HCV sero-negative cases for the studied two groups of HDUs patients is illustrated in Table (3). The table shows that more than half of sero-negative cases were in the age group 50 - <70 years old. The proportion of males is nearly equal to females regarding the prevalence of HCV infection. There were no statistically significant difference between the Group A and Group B HDU regarding the percent distribution of patient with HBV negative ELISA results at time of admission in the study.

The characteristics of HDUs' patients whose reports showed HCV sero-conversion had been illustrated in Table (4). It is obvious from the table that the incidence of HCV sero-conversion across the age groups indicates that the age group 30-<50 had reported the highest incidence compared for other age groups and for both group A patients (32.4%) and group B patients. Nevertheless, there were no statistically significant differences regarding the incidence of sero-convergence at different age groups for the studied group A and B HDUs' patients. However, Group A had reported a significantly high incidence of sero- conversion among males (25.7%) than males in group B (10.4%) (p=0.005).

Table (5) shows that, different percentages of both group A and group B seroconverted patients gave a history of exposure to risk factors for HCV infections especially blood transfusion (more than 60%). However, there was no statistically significant difference between the two groups of patients regarding the proportion of seroconverted patients who had been exposed to the three types of risks (i.e. blood transfusion, surgical procedure and /or dental care).

Estimation of the incidence density rate was done by calculating number of seroconverted patients in relation to the sum of duration of exposure to HD services (from starting day of dialysis of each patient to the end of study period). Table (6) The incidence density of sero-conversion was significantly higher among Group A (18.9/10000) than group B (5.01/10000).

Figure (2) Added another dimension to HCV nosocomial infection. The figure illustrate the cumulative percentage of positive anti-HCV antibody cases of all studied patients according to duration of dialysis (from January 2008 to December 2009) it shows that patients on dialysis for one year had 16.7% positive cases while patients with five years dialysis had 51.1% positive cases.

4. Discussion

HCV infection remains highly prevalent both in developed (21) and less-developed countries (22). In spite of considerable decline in the incidence and prevalence of HCV infection among HD patients in many countries, this infection still remains a major problem among patients on maintenance HD (23, 24) especially in our country. Patients undergoing hemodialysis are at the highest risk of becoming infected with HCV, HBV and HIV. While infection with HCV was identified more frequently than HBV and HIV (25). Also varying prevalence rates have been reported from different Middle Eastern countries and the figures have varied from as low as 26.5% from Oman to as high as 80% from Egypt (26).

Table (1): Percent of Nurses in the two studied groups according to history of training and observed performance in infection control in the HDUs

	Group A Nurses (No=38)		Group B Nurses(No=36)		X^2	*P* value
Previous infection control training courses	21	55.2%	29	80.6%	5.4	0.02
Clean surface of machine after each patient	21	55.2%	34	94.4%	14.9	<0.001
Clean tables after each patient	18	47.4%	29	80.6%	8.79	0.003
Change gloves after each practice	5	13.2%	25	69.4%	24.3	<0.001
Sharing supplies between patients	38	100%	30	83.3%	0.01*	<0.001
Place supplies on the top of dialysis machine	32	84.2%	12	33.3%	19.85	<0.001

*Fisher exact test was used as there is one cell with less than 5 observations

Table (2): Achieved mean score of knowledge about items of infection transmission in the HDUs for the two studied groups of nurses in the four hospitals.*

Items of nurses' opinion	Mean ± SD of Nurses opinion		t-test	P value
	Group A	Group B		
Nurses think that blood transfusion is responsible for the infection	6±4	9±2	3.43	0.001
Nurses think that HCV is transmitted by contaminated hemodialysis machine	6±2.9	7±3.5	1.34	0.18
Nurses think that HCV is transmitted by contaminated hemodialysis chairs	3.6±3	3.9±3	0.43	0.67
Nurses think that HCV is transmitted by contaminated dialysis tables	4±3	4±3	0.00	1.0
Nurses think that nurse's practice which transmit the HCV from patient to patient	5.8±3.6	9.6±3.4	4.66	<0.001
Nurses think that HCV is transmitted by sharing supplies and instruments	2.8±3	6±4	3.91	<0.001
Nurses think that HCV is transmitted by dialysis in other centers	7.8±2.7	6.3±3.2	2.17	0.033
Nurses think that HCV is transmitted by contaminated food	2.9±2.8	3.6±3.2	1.0	0.319

*They were asked to rank their opinion on scale of 10, as 1 is the least likely and 10 as the most likely.

Table (3): Percent distribution of HCV sero-negative HDUs patients in Groups A and B by age and sex

Age group (year)	Group A (–ve) HCV patients (198)		Group B (–ve) HCV patients(185)		X^2	P value
< 30	17	8.7%	18	9.7 %	0.17	0.98
30- <50	37	18.8%	35	18.1 %		
50- < 70	104	52.4%	95	51.3 %		
> = 70	40	20.1%	37	19.9 %		

Table (4) Percent of HCV sero-converted patients by age, sex and exposure to risk factors for the two studied A and B HDUs groups

Items	Group A Seroconverted (N0=46)		Group B Seroconverted (No=24)		X^2	P value
Age group (years)						
< 30	2/17	11.8 %	1/18	5.5 %	0.6	0.5
30- <50	12/37	32.4%	6/35	17.1%	2.24	0.13
50- < 70	25/104	24.0%	15/95	12.6%	2.10	0.14
> = 70	7/40	17.5 %	2/35	14.2%	0.16*	0.11
Sex						
Males	**26/101**	**25.7%**	**10/96**	**10.4%**	**7.74**	**0.005**
Females	**20/97**	**20.6%**	**14/89**	**15.7%**	**0.74**	**0.38**

*Fisher exact test was used as there is one cell with less than 5 observations

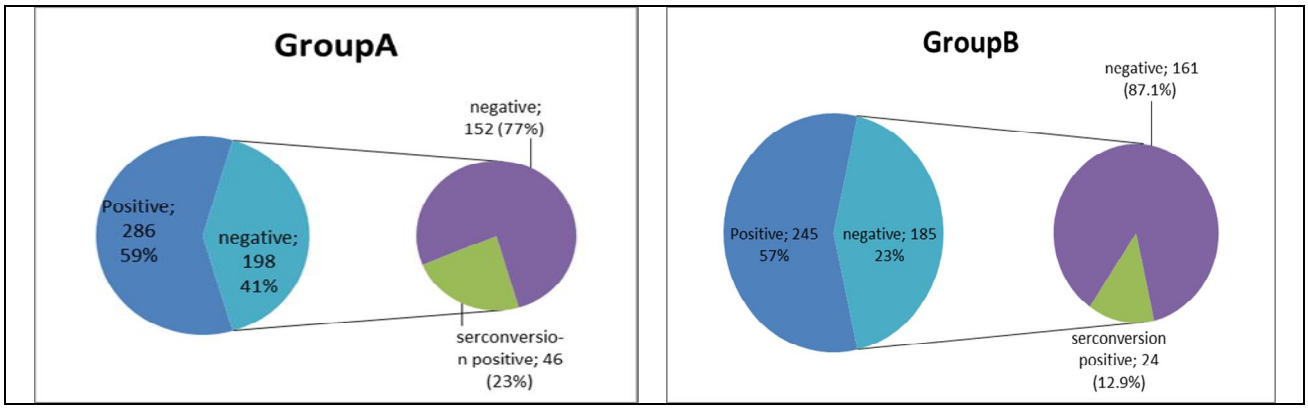

Figure (1) Period prevalence and Incidence of +ve sero-conversion among HD patients in the study groups (group A=484 group B=430)

Table (5) Percent of HCV sero-converted patients by age, sex and exposure to risk factors for the two studied A and B HDUs groups

Exposure to HCV risk of Infection	Group A Seroconverted (N0=46)		Group B Seroconverted (No=24)		X^2	P value
Blood transfusion	30 / 46	(65%)	16 / 24	(66.7%)	0.01	0.9
Surgical procedures	2 / 46	(4.3%)	1/ 24	(4.1%)	1.0*	0.97
Dental care	7 / 46	(15.2%)	4 / 24	(16.7%)	0.03	0.87

*Fisher exact test was used as there is one cell with less than 5 observations

Table (6) Incidence density of HCV sero-conversion for the studied group A and B of HDUs' patients

Group A (198 sero-negative patients)			Group B(185 sero-negative patients)			X^2	P value
HCV Seroconverted patients	Total HD days	Incidence density	HCV Seroconverted patients	Total HD days	Incidence density	32.12	<0.001
46	24314	18.9 /10000	24	47885	5.01 / 10000		

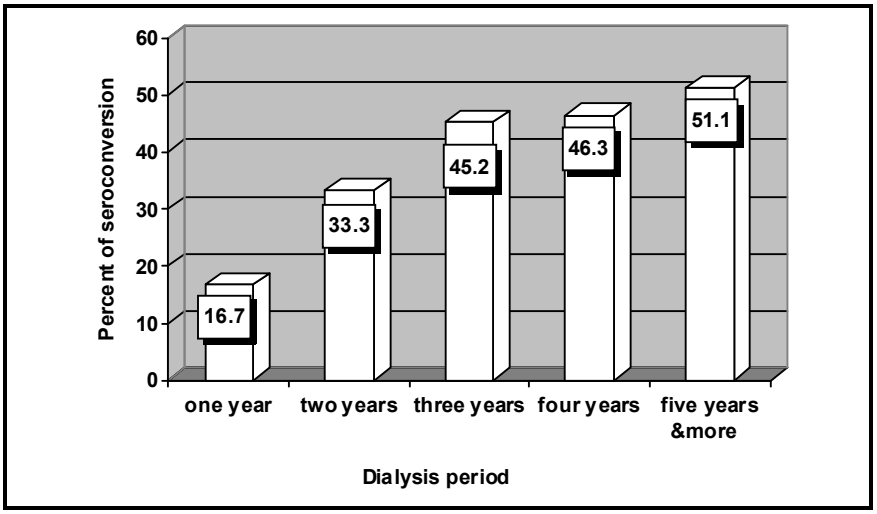

Figure (2) Cumulative percentage of HCV seroconverted patients according to the duration of exposure to dialysis sessions

In the current study, the prevalence of HCV infection among HD patients (59% in group A units while 57% in group B units) using ELISA technique, was higher than that seen in other representative study conducted at Egyptian HD units using random sample of MOH dialysis units composed of 48 HD units on the average the prevalence was 52% (27).. The high prevalence of hepatitis C in Egyptian studies is in concordance with high prevalence of the HCV infection in Egypt. **Frank *et al.***. reported that Egypt has the highest countrywide prevalence of hepatitis C virus in the world (28). A study conducted in Egypt showed that the prevalence of anti-HCV was 24.5% (5). **Another study** reported that 78% of

patients with ultrasound-detected cirrhosis of Egyptian cross sectional survey were anti HCV positive in the Nile Delta [29]. On the other hand in **Kosova a** study was conducted on 583 ESRD patients on maintenance HD from six HD centers, they reported an anti-HCV antibody prevalence rate of 43%(30`). In a descriptive study conducted in Iran, the prevalence of positive HCV antibodies decreased from 14.4% in 1999 to 4.5% in 2006 (31). In Izmir, Turkey, **the** sero-prevalence of HCV infection was 19% among 437 HD patients (32). While in Salvador, Northeastern Brazil , the anti-HCV seroprevalence among HD patients was 10.5% (33). At Northern Part of Iran, 18.4% of 163 studied HD patients were found positive for anti-HCV antibody by ELISA (34). In a descriptive study conducted at northern Iran, they mentioned that; the prevalence of HCV infection in HD patients has decreased significantly during the past decade in most HD units in the province of Mazandaran,; in December 2001, the prevalence of antibody against HCV was 18%, whereas by December 2006, it was 12% (35). In Saudi Arabia, **study was conducted on** 180 patients at HD unit, 34 (18.9%) patients were positive for anti-HCV antibody (36). While another study, in Casablanca reported higher rate, a retrospective study performed on 186 chronic HD patients, reported a high prevalence of HCV infection (76%) (37). In the study performed by **Silva.** HCV-RNA was detected in 92 (73.6%) of 125 anti-HCV-positive patients (31). **Dattolo** showed that HCV-RNA was positive in 18 (75%) of 24 anti-HCV-positive subjects (38). As confirmed in many studies that the spread of HCV infection in HD units is mainly due to nosocomial transmission from patient to patient (39-47). The importance of this route of transmission is evidenced by the high HCV prevalence in some HD units.(48) In our study after prospective follow up of the antibody HCV negative patients group A units 46 patients out of 198 (23%) suffered from seroconversion (Fig.1) with incidence density 18.9/10000 patient's days; while in group B units out of 185 patients 24 (12.9%) were HCV seroconverted with incidence density 5.01/10000 patient's days (*P* value <0.001) Table 6 By checking the isolation policy at each group, it was noticed that group A units doesn't follow isolation policy for HCV positive patients while group B units adopts HCV isolation policy. However, there is no consensus on the necessity of infection control isolation of HCV positive patients as they conclude that strict adherence to the universal infection control precautions is enough to fully prevent HCV nosocomial transmission (49-54), but recently, some reports have recommended the adoption of infection control isolation measures in centers with high HCV prevalence (55-56) which is applicable on our country situation and as recommended in January 2007 by Egyptian **Ministry of Health (MOH)**, Infection Control Program in Egypt (**ICP**) (57). A study conducted on a representative sample of 48 Egyptian HD units recommended adoption of isolation policy; as they found significant higher incidence rate of HCV seroconversion among units which do not adopt isolation policy (206/4154) comparing with (61 / 3989) at units adopt isolation policy; with p value < 0.01.(28) So, the usage of dedicated machines for HCV infected patients in a defined area of the unit is important, provide that they are attended by devoted personnel to avoid nosocomial transmission of HCV to uninfected patients (58,59). Although hemodialysis machines can act as vertical HCV transmission vectors (53,60), their disinfection can be adequately performed (61 - 64), as it was noticed in our study that all nurses in group A units use chemical disinfection to rinse the machine at the end of the day. While group B units' policy, is using heat disinfection to rinse the machine after each patients. As was mentioned in APIC guideline 2010; there are two methods of disinfecting the dialysate pathways (internal) of the HD machine: heat and chemical. The standard as recommended by HD machine manufacturers is to perform disinfection of the dialysate pathways at the end of each treatment day using heat disinfection. (65).However, nowadays, vertical HCV transmission by monitors is exceptional, being the horizontal patient-to-patient transmission the most important; CDC (66) has recommended a training and educational program for HD personnel before they begin working in the units. From this study, it was interest to find only 55.2% of group A units' nurses received infection control sessions while group B nurses 80.6% had previous training on infection control with p value =0.02. This could explain practices noticed in group B nurses were significantly better than group A nurses' practice (Table 1) as cleaning surfaces of the machine and tables after each patient, 69,4% of nurses in group B changes gloves after each patients while 13.2 % from group A did, 33.3% of group B places supplies on the top of the dialysis machine which is forbidden by CDC recommendations but they are significantly lower than group A percentage (84.2%). In spite of the significant difference between the two groups in sharing supplies between patients both had very high percentage in a contraindicated practice (Group A 100%, Group B 83.3%) this poor practice share in increasing of the probability of HCV transmission and positive serocoversion of HD patients so as mentioned in other study we conclude that inadequate application of standard precautions primarily responsible for spread of the infection in HD units (66-67). Thus, lack of proper and targeted

education could explain nurses' perception about how HCV is transmitted. The knowledge of group B nurses is significantly better in considering nurses practices are involved in transmission of HCV from patient to patient, also in using shared instruments and supplies and finally in considering blood transfusion one of the important method of HCV transmission while in contrary nurses in group A significantly consider HCV is more transmitted by dialysis in other center while there is no significant difference between two groups concerning other modes of transmission. In our study we tried to find other significant different risks between Group A units and group B units associated with seroconversion; (Table 3) Showed no significant difference between age groups in both study groups concerning HCV negative patients (patients have been followed in the prospective part of the study). Tab. 4 showed that no significant difference in HCV seroconversion rate between each age group in the studied units after one year follow up, similar finding was reported by Bassem etal in Egypt (28). While in the current study an increasing cumulative seroconversion was found ranging from 16.7% among patients who were on dialysis for one year to 51.1% among those on HD for five or more years (figure 2). This was similar to the findings of a study conducted in Taiwan; the annual incidence of HCV infection was 14.6% reaching a cumulative prevalence of 60% after six years [68]. In another one in Saudi Arabia in which a significantly increasing annual prevalence of HCV infection among dialysis patients was found. It ranged from 16.4% among patients who were on dialysis for one year to 94.5% among those on dialysis for three or more years. They added that the annual HCV seroconversion rate in the Kingdom of Saudi Arabia was 7 to 9%[69]. In Kuwait, it was estimated that there is an annual increment in the incidence of positive anti-HCV seroconversion that is equal to 11.5% of patients on dialysis [70]. On the other hand, the current study showed that; there is no statistically significant difference between studied groups of units, concerning sex distribution among HCV negative patients (Table 3). While concerning seroconversion after one year, we found significant difference between A & B groups of units in males only while no difference found between females (Table 4). Concerning other risk factors for HCV transmission we didn't find significant difference between the study groups A&B; as blood transfusion, surgical procedures and dental care (Table 5).

The strengths of the study were related to the selection of the topic of HCV as a nosocomial infection among the vulnerable patients with high frequency of exposure to the risk of HD. The study design considered estimation of the incidence of HCV sero-conversion as indicator of nosocomial infection in HDUs. Despite testing the knowledge and practice of nurses in the studied HDUs, the study considered nosocomial infection as multifactorial where service providers' performance as well as infection control policies and regulations are pivotal in determining the incidence of seroconversion. The study raised an important issue related to disparity regarding access to quality health services and acquiring HCV infection. The Group A-HDUs in public hospitals with fee-free service, being not conforming to quality infection control standards, especially isolation of HCV positive patients, thus exposes poor patients to the risk of HCV infection.

Limitations of the study is related to depending on the hospital regulations regarding frequency and type of lab tests. Serological test for anti-HCV antibody were performed routinely each three months on the recruited HD patients using third generation enzyme-linked immunosorbent assay (ELISA) kit. With no consecutive confirmation of positive cases by polymerase chain reaction (PCR) or recombinant immunoblot assay (RIBA), as recommended by CDC (70)

Conclusion and recommendations:

The study concluded that HDUs that conform to policies and regulation related to infection control and isolation of HCV sero-positive cases had significant low incidence rate for HCV sero-conversion.

The study recommended that, surveillance system should include both ensuring conforming to CDC policies and regulations related to infection control in HDUs, as well as periodic estimation of the incidence of HCV seroconversion, for timely decision making to improve the quality of services.

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