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Original Article

Hepatitis C among Hospital Personnel and Patients at a General Hospital in Kafr Elsheikh Governorate, Egypt

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Abstract

Background: To fight against hepatitis C virus (HCV) epidemic in Egypt, it is crucial to understand the actual HCV situation. Hospitals have been accused as being an epicenter for sustained HCV spread in Egypt. Health care workers (HCWs) as well as patients admitted to hospitals are at special risk of acquiring HCV infection compared to the general population.

Aim: To compare between the occurrence of hepatitis C in hospital personnel and patients at a general hospital in Kafr Elsheikh Governorate with reference to associated risk factors among both groups.

Methods: This cross-sectional study was conducted from January through December 2018 on 203 hospital personnel and 197 patients admitted to Desouk General Hospital in Kafr Elsheikh Governorate, Egypt. A questionnaire for socio-demographic characteristics and HCV risk factors was filled for each participant. For HCWs, questions on occupational exposure were added. A blood sample was withdrawn from each participant to be tested for anti-HCV by enzyme-linked immunosorbent assay (ELISA) test.

Results: The occurrence of anti-HCV among patients was significantly higher than among hospital personnel (18.8% *vs* 9.4%). Old age, low level of education, rural residence and living in bad housing conditions were significantly associated with anti-HCV positivity among both hospital personnel and patients. However, other parameters as male sex, insufficient income, illicit drug use (IDU), hemodialysis, blood transfusion**,** hospital admission and receiving any drug by injection or infusion were significant risk parameters for anti-HCV positivity among patients only.

Conclusion: The occurrence of HCV in Egypt was substantially high among studied patients. Thus, continuous monitoring and screening of Egyptians are recommended especially after the implementation of the initiative of 100 Million Healthy Lives for HCV control.

Keywords: anti-HCV, hepatitis C risk factors, hospital personnel, Kafr Elsheikh, Egypt, blood transfusion

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INTRODUCTION

Hepatitis C represents a major global pandemic. It is linked to liver morbidity and mortality ranging from chronic hepatitis to hepatocellular carcinoma. Approximately, 70 million were chronically infected with hepatitis C worldwide. The World Health Organization (WHO) Global Health Sector Strategy (2016-2021) on viral hepatitis focuses on hepatitis B virus and HCV. It provides a plan to eliminate HCV public health problem by 2030 through improving diagnosis and treatment. It targets to diagnose 90% of those infected with HCV and cure more than 80% of those diagnosed. Hence, continuous close observation is obligatory for detection and management of such cases.[(1)]

In 2008, the highest prevalence of HCV worldwide was reported from Egypt; according to Egypt Demographic and Health Survey, which was performed on a great representative sample of the Egyptian population. In Egypt Health Issues Survey (EHIS) 2015, a significant decline in HCV antibodies from 14.7% in 2008 to 10% in 2015 was reported in those aged 15-59 years.[(2, 3)] The Egyptian Ministry of Health and Population (MOH) set up the National Committee for Control of Viral Hepatitis (NCCVH) in 2006 to fight against HCV epidemic in Egypt. Its main

duty was to estimate the actual weight of HCV problem and develop a sound basic framework for the national treatment program.[4]

Hospitals have been accused of being an epicenter for sustained HCV spread in Egypt where hospitalization is considered a major risk factor for acquiring HCV. Increased risk of acquiring HCV among Egyptian hospitalized patients has actually been reported, for instance in dialysis patients. Invasive techniques, lack of infection control measures as well as high HCV prevalence in Egyptians may explain such finding.[5, 6]

Health care workers (HCWs) are a special working class that is more vulnerable to biological risks throughout their usual working activities. They are exposed to several biological hazards and accidental infections. HCWs with contact to injections, sharp instruments and blood or blood products have a greater risk of contracting HCV.[7] The implementation of standard precautions by HCWs is the most important factor in decreasing blood-borne pathogen transmission risk.[8]

The aim of the present study was to compare between the occurrence of hepatitis C in hospital personnel and patients at a general hospital in Kafr Elsheikh Governorate with reference to associated risk factors among both groups.

METHODS

This cross-section study was conducted from January through December 2018 on 203 hospital personnel and 197 patients attending or admitted to Desouk General Hospital in Kafr Elsheikh Governorate, Egypt.

Target population:

- All hospital personnel (HCWs in different job categories including physicians, nurses, laboratory technicians, clinical waste handlers in addition to administrative workers)
- Patients attending the out patients clinics as well as those admitted to the hospital.

Sample size and Sampling technique:

- With a prevalence of hepatitis C of about 8% and 18% among health care workers and hospital patients, respectively with 5% alpha level and 80% power, the minimum required sample size was approximately 177 from each group.[9] Sample size was calculated using G* power 3.1.9.6. This number was increased to 200 to adjust for anticipated dropouts.
- Convenient sampling was adopted where samples were consecutively collected. Among participants, 203 HCWs and 197 patients agreed to participate.

Data collection methods and tools:-

1) Full history taking: A predesigned questionnaire after being tested in a pilot study was used to collect data from each participant including:

a) Socio-demographic data such as name, age, sex, education, marital status, occupation, housing conditions, residence, income, habits …..etc.
b) History of different hepatitis risk factors as illicit drug use (IDU), hemodialysis, tattooing, HCV positive partner, blood transfusion, surgical procedures, hospital admission, unsafe injection, social practice as sharing common sharps indoors or outdoors. For HCWs, questions on occupational risks as accidental exposure to blood were added.

2) Laboratory investigations: Three ml of blood were collected aseptically from every individual included in the study. Centrifugation was performed at 5000 rpm to separate the serum. Separated serum was stored at -20ºC for detection of HCV antibodies by ELISA test (Ortho HCV Version 3.0 ELISA test system, NJ, USA). According to the manufacturer, the test had a specificity of 100.0 % and a sensitivity of 100.0% with a 95% exact confidence interval of 92.9% to 100.0%.

Statistical analysis

IBM SPSS software package version 20.0 (Armonk, NY: IBM Corp) was used to analyze the collected data. Qualitative variables were represented using frequency and percentage. Quantitative data were represented as range, mean ± standard deviation or median and interquartile range (IQR). Comparison between different groups for categorical variables was performed using Chi-square test. Correction for chi-square when more than 20% of the cells have expected count less than 5 was done using Fisher's Exact or Monte Carlo correction. Comparison between two different groups for normally distributed quantitative variables was carried out using Student t-test. Significance of the obtained results was judged at the 5% level.[10]

Ethical considerations:

- The study was conducted in compliance with the Helsinki Declaration and was approved by the Ethics Committee of the High Institute of Public Health, Alexandria University and Ethics Committee of the Egyptian Ministry of Health.
- A written informed consent was collected from all participants. Anonymity and confidentiality were confirmed.

RESULTS

In the present cross-sectional study, 203 hospital personnel and 197 patients at Desouk General Hospital, in Kafr Elsheikh Governorate were screened for HCV infection by testing for HCV antibodies. HCV antibodies were positive in 19 (9.4%) and 37 (18.8%) among hospital personnel and patients, respectively. These results were statistically significant. ($x^2 = 7.372$, $p=0.007$). (Figure 1)

Figure (2) demonstrated that among the 203 studied HCWs, hospital workers had the highest anti-HCV positivity followed by nurses, technicians, clerks and doctors (18.2%, 15.1%, 10.5%, 5.1%, 2.4%, respectively) However, these results were not statistically significant.

Table (1) showed the association between the anti-HCV positivity and socio-demographic, occupational and other hepatitis risk factors among the studied HCWs. Anti-HCV was significantly more prevalent among older age group than among younger age group (17.3% *vs* 6.6%, respectively, *p=0.029*). Regarding sex, 10.0% of females were anti-HCV positive compared to 7.0% males. A higher proportion of married HCWs were positive for anti-HCV compared to unmarried group (10.4% and 3.3%, respectively). It was also demonstrated that with decreasing the education level among HCWs, the positivity of anti-HCV significantly increased. HCWs with low level of education (less than secondary) had nearly fifteen times higher risk for HCV antibody positivity (OR=14.833, *p=0.007*) None of the enrolled HCWs reported history of being IDU or IDU partner. Only two of the HCWs had history of hemodialysis and both were anti-HCV negative. It was also illustrated in this table that living in old rent apartment and rural areas was significantly associated with anti-HCV positivity. HCWs living in old rent apartment had approximately nine times higher risk of being anti-HCV positive (OR=8.837, *p=0.002*), while those of rural residence had nearly four times higher risk for HCV antibody positivity (OR=4.442, *p=0.004*). Higher percentages of anti-HCV positivity have also been associated with insufficient income (18.8% vs 8.6%), accidental exposure to blood (11.5% *vs* 4.7%), HCV positive partner (14.6% *vs* 7.7%), history of blood transfusion (16.7% *vs* 7.5%) history of surgical or dental procedures (9.9% *vs* 4.8%), prior hospital admission (13.5% *vs* 6.1%), as well as receiving any drug by injection or infusion (11.4% vs 4.8%). However, these results were not statistically significant.

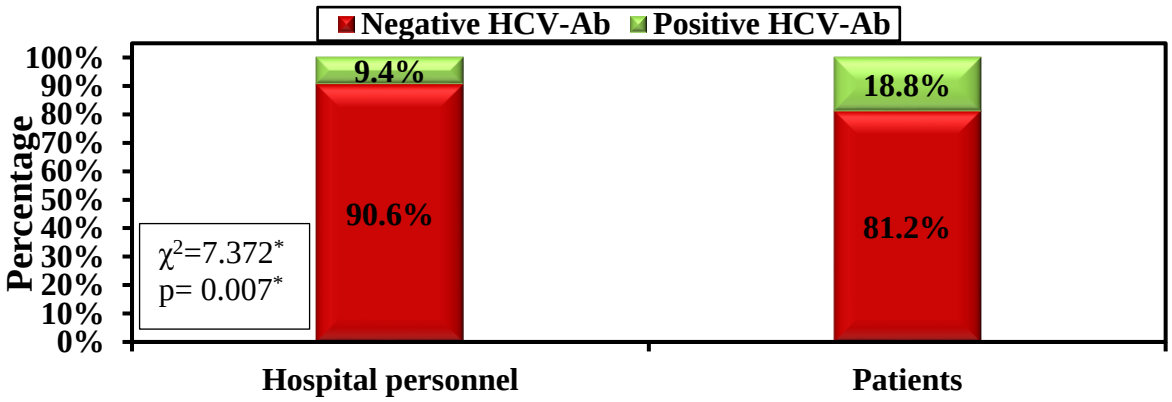

Figure (1): Distribution of the studied hospital personnel and patients at Desouk General Hospital, Kafr Elsheikh Governorate according to anti-HCV status

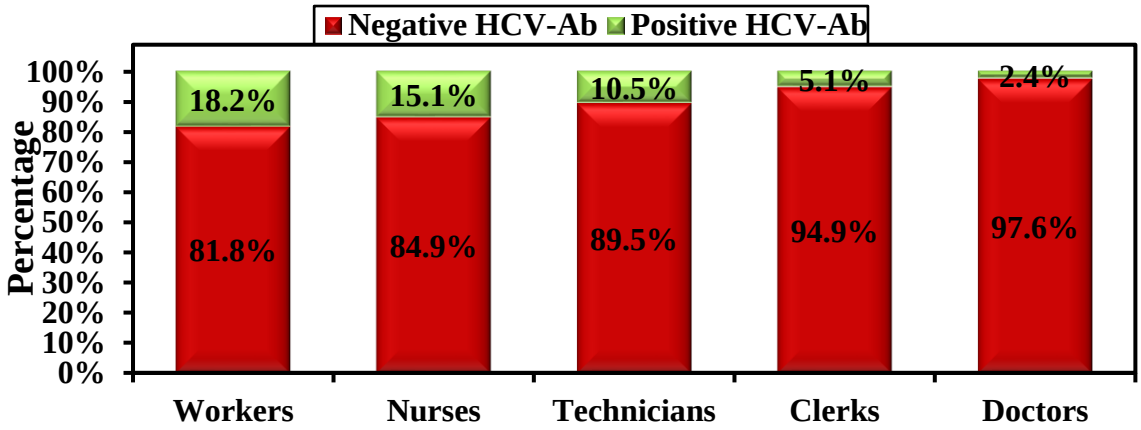

Figure (2): Anti-HCV status in relation to occupation among the studied HCWs at Desouk General Hospital, Kafr Elsheikh Governorate

Table (1): Socio-demographic, occupational and other risk factors associated with anti-HCV positivity among the hospital personnel at Desouk General Hospital, Kafr Elsheikh Governorate

	Anti-HCV		Crude OR 95%CI (LL – UL)	P[a]
	Negative (n=184)	Positive (n = 19)		
Age (years)				
<40	141 (93.4%)	10 (6.6%)	Reference	
≥40	43 (82.7%)	9 (17.3%)	2.951 (1.126 – 7.731)	0.029*
Sex				
Male	40 (93.0%)	3 (7.0%)	0.675 (0.187 – 2.432)	0.769
Female	144 (90.0%)	16 (10.0%)	Reference	
Marital status				
Un-married	29 (96.7%)	1 (3.3%)	Reference	0.319
Married	155 (89.6%)	18 (10.4%)	3.368 (0.433 – 26.222)	
Level of education				
Less than secondary education	2 (66.7%)	1 (33.3%)	14.833 (1.036 – 212.470)	0.007*
Secondary education	93 (86.1%)	15 (13.9%)	4.785 (1.339 – 17.093)	
High education	89 (96.7%)	3 (3.3%)	Reference	
Housing				
Shared housing	27 (87.1%)	4 (12.9%)	2.993 (0.752 – 11.915)	
Old rent apartment	16 (69.6%)	7 (30.4%)	8.837 (2.499 – 31.250)*	0.002*
New rent apartment	40 (93.0%)	3 (7.0%)	1.515 (0.346 – 6.638)	
Private property	101 (95.3%)	5 (4.7%)	Reference	
Place of residence				
Rural area	31 (77.5%)	9 (22.5%)	4.442 (1.667 – 11.833)*	0.004*
Urban area	153 (93.9%)	10 (6.1%)	Reference	
Income				
Insufficient	13 (81.3%)	3 (18.8%)	2.466 (0.636 – 9.570)	0.177
Sufficient	171 (91.4%)	16 (8.6%)	Reference	
History of tattooing				
No	159 (90.3%)	17 (9.7%)	Reference	1.000
Yes	25 (92.6%)	2 (7.4%)	0.748 (0.163 – 3.437)	
Health care worker upon accidental exposure to blood				
No	61 (95.3%)	3 (4.7%)	Reference	0.121
Yes	123 (88.5%)	16 (11.5%)	2.645 (0.742 – 9.425)	
HCV positive partner				
No	143 (92.3%)	12 (7.7%)	Reference	0.163
Yes	41 (85.4%)	7 (14.6%)	2.035 (0.752 – 5.501)	
History of blood transfusion				
No	149 (92.5%)	12 (7.5%)	Reference	0.079
Yes	35 (83.3%)	7 (16.7%)	2.483 (0.912 – 6.765)	
History of surgical or dental procedures				
No	20 (95.2%)	1 (4.8%)	Reference	0.700
Yes	164 (90.1%)	18 (9.9%)	2.195 (0.278 – 17.335)	
History of hospital admission				
No	107 (93.9%)	7 (6.1%)	Reference	0.075
Yes	77 (86.5%)	12 (13.5%)	2.382 (0.897 – 6.329)	
Receiving any drug by injection or infusion				
No	60 (95.2%)	3 (4.8%)	Reference	0.131
Yes	124 (88.6%)	16 (11.4%)	2.581 (0.724 – 9.199)	
Social practice				
No	155 (90.1%)	17 (9.9%)	Reference	0.744
Yes	29 (93.5%)	2 (6.5%)	0.629 (0.138 – 2.869)	

[a]: Chi square/Fisher Exact /Monte Carlo test p: p value for comparing between the studied groups
*: Statistically significant at $p \leq 0.05$ OR: Odds ratio; 1= no risk factor; <1= Protective factor; >1= risk factor
C.I: Confidence interval LL: Lower limit UL: Upper Limit

Table (2): Socio-demographic and hepatitis risk factors associated with anti-HCV positivity among the patients at Desouk General Hospital, Kafr Elsheikh Governorate

	Anti-HCV		Crude OR	P[a]
	Negative (n=160)	Positive (n = 37)	(95%CI (LL – UL))	
Age (years)				
<40	136 (86.1%)	22 (13.9%)	Reference	<0.001*
≥40	24 (61.5%)	15 (38.5%)	3.864 (1.759 – 8.486)	
Sex				
Male	125 (77.6%)	36 (22.4%)	10.080 (1.334 – 76.142)*	0.007*
Female	35 (97.2%)	1 (2.8%)	Reference	
Marital status				
Un-married	31 (86.1%)	5 (13.9%)	Reference	0.406
Married	129 (80.1%)	32 (19.9%)	1.538 (0.554 – 4.269)	
Level of education				
Less than secondary education	52 (70.3%)	22 (29.7%)	3.131 (1.086 – 9.024)	0.009*
Secondary education	71 (87.7%)	10 (12.3%)	1.042 (0.332 – 3.274)	
High education	37 (88.1%)	5 (11.9%)	Reference	
Housing				
Shared housing	79 (76.0%)	25 (24.0%)	3.112 (1.200 – 8.068)*	0.046*
Old rent apartment	10 (76.9%)	3 (23.1%)	2.950 (0.633 – 13.753)	
New rent apartment	12 (80.0%)	3 (20.0%)	2.458 (0.538 – 11.224)	
Private property	59 (90.8%)	6 (9.2%)	Reference	
Place of residence				
Rural area	92 (76.0%)	29 (24.0%)	2.679 (1.153 – 6.226)*	0.019*
Urban area	68 (89.5%)	8 (10.5%)	Reference	
Income				
Insufficient	20 (62.5%)	12 (37.5%)	3.360 (1.461 – 7.726)*	0.003*
Sufficient	140 (84.8%)	25 (15.2%)	Reference	
IDU or IDU partner				
No	146 (85.9%)	24 (14.1%)	Reference	<0.001*
Yes	14 (51.9%)	13 (48.1%)	5.649 (2.367 – 13.478)*	
History of hemodialysis				
No	156 (83.0%)	32 (17.0%)	Reference	0.013*
Yes	4 (44.4%)	5 (55.6%)	6.094 (1.550 – 23.950)*	
History of tattooing				
No	150 (82.9%)	31 (17.1%)	Reference	0.086
Yes	10 (62.5%)	6 (37.5%)	2.903 (0.983 – 8.579)	
HCV positive partner				
No	99 (83.9%)	19 (16.1%)	Reference	0.239
Yes	61 (77.2%)	18 (22.8%)	1.538 (0.749 – 3.157)	
History of blood transfusion				
No	67 (100.0%)	0 (0.0%)	-	<0.001*
Yes	93 (71.5%)	37 (28.5%)		
History of surgical or dental procedures				
No	22 (78.6%)	6 (21.4%)	Reference	0.699
Yes	138 (81.7%)	31 (18.3%)	0.824 (0.308 – 2.202)	
History of hospital admission				
No	123 (86.6%)	19 (13.4%)	Reference	0.002*
Yes	37 (67.3%)	18 (32.7%)	3.149 (1.500 – 6.614)*	
Receiving any drug by injection or infusion				
No	58 (92.1%)	5 (7.9%)	Reference	0.008*
Yes	102 (76.1%)	32 (23.9%)	3.639 (1.344 – 9.854)*	
Social practice				
No	45 (86.5%)	7 (13.5%)	Reference	0.252
Yes	115 (79.3%)	30 (20.7%)	1.677 (0.687 – 4.092)	

[a]: Chi square/Fisher Exact/ Monte Carlo test p: p value for comparing between the studied groups
*: Statistically significant at p ≤ 0.05 OR: Odds ratio; 1= no risk factor; <1= Protective factor; >1= risk factor
C.I: Confidence interval LL: Lower limit UL: Upper Limit

Table (2) shows the association between the anti-HCV positivity and socio-demographic and hepatitis risk factors among the studied patients. Older age (≥40 years) was significantly associated with HCV seropositivity (*p<0.001*). Regarding sex-specific prevalence, anti-HCV was significantly higher among males compared to females (22.4% *vs* 2.8%, *p= 0.007*). Anti-HCV was more prevalent among married patients (19.9%), those with education less than secondary level (29.7%) and those living in shared houses (24.0%). Patients from rural areas as well as those with insufficient income had nearly 3-fold increase in the odds ratio of anti-HCV positivity (OR=2.679, *p=0.019* and OR=3.360, *p=0.003*, respectively). It was also demonstrated that approximately 6-fold increase in the risk of anti-HCV

positivity has been associated with IDU or hemodialysis (OR=5.649, *p<0.001* and OR=6.094, *p=0.013*, respectively). Patients previously admitted to hospitals or have received any drug by injection or infusion, had nearly three to four times higher risk of being anti-HCV positive (OR=3.149, *p=0.002* and OR=3.639, *p=0.008, respectively*). Regarding blood transfusion, all the anti-HCV positive patients were among those received blood transfusion (*p<0.001*). Higher proportion of patients with history of tattooing, HCV partner or risky social practice were positive for HCV antibodies (37.5%, 22.8% and 20.7%, respectively) compared to patients without such risk factors (17.1%, 16.1 and 13.5%, respectively). However, these results were not statistically significant.

Table (3) showed multivariate logistic regression analysis for the parameters affecting HCV among the studied HCWs and patients. All the variables that had significance level ≤ 0.05 in the bivariate analysis were included in the multivariate logistic regression model.

For HCWs: age, level of education, housing conditions and place of residence were included in the initial model. The most significant risk factor for HCV positivity was increasing in age. It is the only parameter that remained significant for HCWs after multivariate logistic regression. (aOR= 1.085, *p=0.038*). For participating patients, the initial full model included: age, sex, level of education, housing conditions, place of residence, income, IDU or IDU partner, history of hemodialysis, prior hospital admission and receiving any drug by injection or infusion. The most significant risk parameter for anti-HCV positivity among those patients was male sex followed by IDU then increasing in age. Being male had approximately eleven-fold higher risk for HCV antibody positivity (aOR= 11.195, *p=0.049*) while, IDU or IDU partner had nearly 4-times higher risk of being anti-HCV positive (aOR=4.148, *p=0.005*) among enrolled patients. Increasing age was also a significant risk factor for anti-HCV positivity among studied patients (aOR=1.070, *p=0.036*).

Table (3): Multivariate logistic regression analysis for the parameters affecting anti-HCV among hospital personnel and patients at Desouk General Hospital, Kafr Elsheikh Governorate

	Hospital personnel (n = 19 *vs.* 184)		Patients (n = 37 *vs.* 160)	
	p	aOR (95%C.I)	p	aOR (95%C.I)
Age (years)/increasing	0.038*	1.085 (1.004-1.172)	0.036*	1.070 (1.004-1.140)
Sex				
Male			0.049*	11.195(1.005-124.746)
Female				Reference
Level of education/increasing	0.282	0.706(0.375-1.330)	0.295	0.836 (0.598-1.169)
Housing				
Shared housing	0.334	2.421 (0.403-14.537)	0.218	2.184 (0.630-7.577)
Old rent apartment	0.117	4.005 (0.706-22.713)	0.167	3.610 (0.585-22.266)
New rent apartment	0.336	2.219 (0.438-11.250)	0.707	1.405 (0.239-8.267)
Private property		Reference		Reference
Place of residence				
Rural area	0.406	0.533(0.121-2.349)	0.527	1.535 (0.407-5.787)
Urban area		Reference		Reference
Income				
Insufficient			0.345	0.604(0.212-1.722)
Sufficient				Reference
IDU or IDU partner				
No				Reference
Yes			0.005*	4.148 (1.527-11.268)
History of hemodialysis				
No				Reference
Yes			0.344	2.186 (0.433-11.053)
History of hospital admission				
No				Reference
Yes			0.528	1.369 (0.516-3.636)
Receiving any drug by injection or infusion				
No				Reference
Yes			0.089	2.765 (0.856-8.931)

aOR: Adjusted odds ratio; 1= no risk factor; <1= protective factor; > 1= risk factor
C.I: Confidence interval LL: Lower limit UL: Upper Limit
#: All variables with p<0.05 in bivariate were included in the multivariate *: Statistically significant at p ≤ 0.05

DISCUSSION

HCV infection remains to be a public health problem since its emergence in Egypt. It has replaced schistosomiasis for the liver disease burden. HCV infection represents a unique situation in Egypt and is expected to remain so till its elimination, hopefully

soon.[4] It is noteworthy to continuously evaluate HCV situation in Egypt.

Anti-HCV prevalence among the enrolled HCWs was 19 (9.4%). Similar finding was announced by Elbahrawy et al.,[11] at Lower Egypt governorates and by Anwar et al.,[12] in Ain Shams hospitals in Cairo where the frequency of HCV among HCWs was 8.7% and 8.00%, respectively. Higher prevalence was reported in the study carried by El-Sokkary et al., [13] who found that the prevalence of HCV infection among HCWs in Zagazig University Hospital was 37.7%. The authors attributed this to noncompliance to infection control measures.

The anti-HCV prevalence was 18.8% among participating patients. Recently, nearly similar result (19.8%) was estimated among hospitalized patients in Ain Shams University Hospitals.[12] Lower anti-HCV prevalence of 12.4% was reported in a cross-section study conducted on patients admitted for elective eye surgery in a specialized eye hospital in Cairo.[14]

The percentage of anti-HCV positivity was significantly higher among old aged HCWs than younger HCWs (17.3% vs 6.6%, respectively). Older HCWs had approximately 3-fold higher risk for anti-HCV positivity (OR=2.951, *p=0.029)*. This was in line with results reported in other studies conducted in different governorates in Egypt.[15, 16]Age was also reported as a significant risk factor for the patients enrolled in this study. Patients ≥40 years old had nearly 4-fold increase in risk of anti-HCV positivity (OR=3.864, *P<0.001*). In accordance, it was estimated that HCV RNA positivity increased with age.[11] Even after multivariate analysis, old age remained a risk factor for HCV positivity among both groups. Increased HCV occurrence with increasing age may be explained by decreased Immunity with advanced age as a result of potential exhaustion of T-cell repertoire over time following multiple stimulations. Also, patients' ≥ 40 years may have previously received parenteral anti-schistosomal therapy which was the main cause for HCV epidemic in Egypt.

Among HCWs, HCV antibody positivity was more prevalent among females. This was in line with results obtained in another study performed on HCWs.[12] In contrast, Abdelrheem et al.,[16] in their study on HCWs in Aswan found a significant increase in HCV seroprevalence rate among males compared to females. Similarly a meta-analysis conducted on HCV associated risk factors in HCWs over nearly 25 years demonstrated male sex as a risk factor for anti-HCV positivity. [17] However, male sex was a significant risk factor among our patients (OR=10.080, *p=0.007*). This was consistence with results from another study where anti-HCV positivity was higher among male patients.[17] Males are more exposed to infection with blood borne pathogens as a result of drug use and traumatic sex practice.

The distribution of positivity according to the marital status showed that the highest HCV positivity was among married HCWs and patients (10.4% vs 3.3% and 19.9% vs 13.9%, respectively). However these results were not statistically significant. In accordance with these results, Bayomy Helal et al., [18] found that HCV-positive contacts were more likely married, supporting the possibility that HCV is transmitted between spouses. Studies in Pakistan and Cameroon showed that sexual relation had a role in HCV transmission.[19, 20]

In the present study, decreased level of education was a significant risk factor for anti-HCV positivity among studied patients and vice versa (*P=0.009*). Anwar et al.,[12] declared that among people completing secondary education and higher, HCV occurrence was much lower than that in illiterate people (14.0% *vs* 29.17%, respectively). The likelihood of reuse of unsterilized material in this context might explain the observed relation.

Regarding housing conditions, the highest anti-HCV prevalence in HCWs was among those living in old rent apartments. They had approximately 9-times increased risk of being anti-HCV positive (OR=8.837, *p=0.002*). This association could be attributed to the fact that individuals living in unstable housing are more exposed to environments with risky behavior. Unstable housing besides being associated with poor health outcomes, is also linked to increased emergency department and hospital service use.[21]

Among HCWs and patients, anti-HCV positivity was significantly higher in those residing rural versus urban areas (22.5% vs 6.1%, and 24.0% vs 10.5%, respectively). Patients and HCWs from rural areas had a nearly three to four greater risk for HCV positivity (OR=2.679, *P*=0.019 and OR=4.442, *P*=0.004, respectively). The same was observed by Anwar et al.,[12] in their study on patients and HCWs in Ain Shams University Hospitals, Cairo where higher proportion of HCV antibody was among HCWs and patients residing rural areas outside Cairo (11.11% vs 7.32%, p=0.5 and 30.54% vs 14.41%, p<0.001, respectively) Patients residing rural areas had approximately 3-fold increase in risk of anti-HCV positivity (OR=2.61, p<0.001). The high HCV prevalence in rural areas may be explained by lack of adequate treatment as well as inaccessible referral centers in such areas.

In this study, HCV positivity was higher among those with insufficient income among HCWs and patients (18.8% vs 8.6% and 37.5% vs 15.2%, respectively). Patients with insufficient income had 3-fold increase risk than those with sufficient income (OR=3.360, *p=0.003*). This result was statistically significant implying that poverty was a risk for HCV infection. Lower socioeconomic sectors of the population have been reported to have high HCV prevalence. About

quarter of the Egyptian population lives under the national poverty line having an income below one and half dollar per day.[2] Accordingly, HCV can be associated with low socioeconomic condition due to poverty and lack of education.

In the present study the positivity of HCV among the different categories of HCWs was as follows 18.2%, 15.1%, 10.5%, 5.1% and 2.4% among hospital workers, nurses, technicians, clerks and doctors, respectively. Goniewicz et al., [22] reported an increased HCV prevalence among nurses compared to physicians. Prolonged exposure of nurses to needle stick injury, incidental blood exposure and body fluids splash was associated with increased prevalence of HCV infection compared to other hospital employees. Among HCWs enrolled, the highest anti-HCV prevalence was among hospital workers (18.2%). This was consistence with results from another study in Upper Egypt where anti-HCV prevalence among porters and cleaners was 21.7%.[16] Much higher prevalence was reported among cleaning workers in Ain Shams Hospitals reaching 40.0%. [12] Cleaning workers are more exposed to HCV infections as a result of continuous handling of infected material, low level of education and lack of field training.

Drug users are a specific population with various high risk behaviors for HCV acquisition. In the current work, HCV was positive in 48.1% of IDU compared to 14.1% of those having no such history. IDU patients had nearly 6-fold greater risk than those without such history (OR=5.649, $p<0.001$). Even after multivariate analysis, IDU remained a great risk predictor among studied patients (aOR=4.148, *p=0.005*). A large – scaled study conducted in four fever hospitals in Egypt between 2002 and 2012 reported IDU as an independent risk factor with 4-fold increase risk of HCV transmission. [5] Another study showed that IDU was a leading HCV mode of transmission that emerged as an HCV risk factor in Greater Cairo.[23] This may be attributed to injection of used needles or syringes as well as multiple sex-partners. Under-estimation of IDU as a result of cultural and religious stigma aggravated the problem.

Anti-HCV was positive in 55.6% among hemodialysis patients compared to 17.0% in non-hemodialysis patients ($p=0.013$). The risk of HCV positivity in hemodialysis patients was significantly six-times higher than in other patients (OR=6.094, *p=0.013*). In 2003, the Hellenic Center for Infectious Diseases Control and the Hellenic Society of Nephrology carried out a survey among 7016 hemodialysis patients. Results showed a mean anti-HCV prevalence of 7.5%, with 2% dialysis-related risk per year. HCV prevalence varied widely among hemodialysis patients worldwide, ranging from 1% to 90%.

In this study, anti-HCV was positive in 37.5% with tattooing compared to 17.1% without tattooing among the studied patients, while among HCWs anti-HCV was positive in 7.4% with tattooing compared to 9.7% with no statistical significant difference in both groups. A previous study reported an association between tattoo exposure and hepatitis C infection in a very large ethnically diverse population of HCV cases and uninfected controls.[24] The Meta-analysis of Observational Studies in Epidemiology (MOOSE) guidelines was used to explore HCV risk of infection from tattooing. No conclusive evidence for increased risk of HCV infection from tattooing received in professional parlors. However, tattooing had two to three times greater risk when applied in prison settings or by friends. Prevention interventions are needed to avoid the transmission of hepatitis C from tattooing and piercing in prisons, homes, and other potentially non sterile settings.[25]

As regards blood transfusion HCV was significantly associated with patients who transfused blood (*p<0.001*). Prior to universal screening of blood in 1990, multiply transfused persons showed high HCV infection rate. The risk of active infection was transfusion associated with the number of transfusions of blood products.[26]

In the current work, HCV positivity was not statistically associated with surgical or dental procedures. On the other hand, a study done in Al Farsha area, South-western Saudi Arabia showed a statistical significance of HCV with a history of surgical operations (24.6%) and tooth extraction (29.9%). Their work aimed to study the risk factors for HBV and HCV seroprevalence in dentistry setting.[27]

In the present work, history of previous hospital admission accounted for 32.7% HCV positivity compared to 13.4% for non-previously admitted patients. Patients with history of hospital admission had 3 times greater risk than those without such history (OR=3.149, *p=0.002*). Hepatitis C outbreaks transmitted by health-care related procedures, have pointed to nosocomial transmission of HCV. In a retrospective epidemiological analysis, hospital admission was the highest risk factor in 73 (67%) cases. Among them 33 underwent surgery and 24 were admitted to a medical emergency unit or a medical ward; the remaining 16 patients underwent an invasive diagnostic or therapeutic procedure.[28]

In this study, HCV positivity was associated with those receiving any drug by injection or infusion (23.9%) compared to 7.9% of those not reporting such history (*p= 0.008*) in patients tested. The risk of HCV positivity in patients who have received drugs by injection or infusion was approximately 4-times higher than those who have not (OR=3.639, *p=0.008*). Because blood-to-blood contact represents the main mode of HCV transmission, various risk factors exist

for injection drug users regarding the route of drug administration: injection. Sharing of contaminated needles has been shown to be the main risk factor for HCV transmission.[29]

The results of the current work showed that HCV positivity was higher among those sharing tools (20.7%) compared to those non-sharing (13.5%) in studied patients. The risk was higher in sharing social practice like shaving tools or tooth brush or home equipment outside the health care settings as reported by Yahia. [30]

Understanding the current situation of HCV problem in Egypt is crucial to achieving the World Hepatitis Alliance target which aimed at the elimination of viral hepatitis by 2030. HCV prevention and control should be a national priority issue. Political, health care system and community collaboration must be met. The Egyptian National Committee for the Control of Viral Hepatitis adopted a strategy aiding in the unique battle against HCV prevalence rate. It directs the present and prospective strategies for HCV screening besides facing the challenges of HCV prevention to prove that the HCV elimination has come to be a real possibility.

CONCLUSION

The seroprevalence of anti-HCV was high among studied patients. Male sex, IDU and old age were the most important risk factors for HCV acquisition. Low socio-economic conditions, poor educational level, bad social practice, hemodialysis, blood transfusion**,** hospital admission and receiving any drug by injection or infusion are important factors associated with HCV infection. Although HCWs HCV seropositivity was lower than among patients; yet it remained relatively high particularly among cleaning workers. High HCV prevalence among both groups highlights the impact of HCV acquisition in this setting that should be targeted in preventive programs.

RECOMMENDATIONS

1. Continuous monitoring and screening of Egyptians particularly among patients and HCWs are recommended especially after the implementation of the initiative of 100 Million Healthy Lives for HCV control.
2. Preventive actions should be launched to discourage drug use and limit HCV acquisition among drugs users.
   Health education programs about HCV modes of transmission, high-risk behaviors and methods of prevention should be instituted at medical care fields as well as among general population to raise awareness (HCV awareness programs).

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

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