Risk Factors of Hepatitis C in the Suez Canal Region, Egypt

Hesham El-Sayed[1], Sohair Mehanna[2], Adel Hassan[3], Mahmoud Sheded[4], Shaimaa Sahmoud[1], Samar Elfiky[1], Zeinab Khadr[2]

[1]*Department of Pediatrics, Faculty of Medicine, Suez Canal University, Egypt.*
[2]*Social Research Center, American University in Cairo, Egypt.*
[3]*Department of Infectious Diseases, Faculty of Medicine, Suez Canal University, Egypt.*
[4]*Department of Endemic and Infectious Diseases, Faculty of Medicine, Suez University, Egypt.*

Corresponding Author
Adel Hassan

Mobile:*+2 01005665450*

E mail*: ahadel2001@yahoo.com*

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Background and study aim: Egypt has very high prevalence of Hepatitis C virus (HCV) infection Aim: To identify possible risk factors of HCV in Suez Canal region of Egypt.

Materials and Methods: HCV positive individuals in 5 different hospitals and control blood donors were subjected to anti HCV tests and interview questionnaire to identify risk factors.

Results: A total of 1176 subjects were studied for HCV, of which 539 were HCV-positive and637 HCV-negative donors. Subjects who achieved less than university education, unemployed or gaining less than 600 Egyptian pounds monthly had an increased risk of HCV (OR= 4.18, CI3.28-5.34, p 0.000), (OR= 3.26, CI 2.55-4.16, p 0.000), and (OR= 3.32, CI 2.59-4.26, p 0.000). Informal male circumcision doubled the risk of HCV (OR= 2.08, CI 1.53-2.83, p 0.000). Shaving at a barber and sharing razors increased HCV risk 2 times, while sharing tooth brushes increased it 7 times (OR = 7.23, CI 2.74-18.79, p 0.000). HCV risk increased after endoscopy (OR =3.62, CI2.02-6.52, p 0.000), blood transfusion (OR 3.47, CI 2.18-5.54, p 0.000), and injection treatment(OR= 1.41, CI 1.02-1.95, p 0.040). Any delivery and dental care in governmental clinic were independent risk factors (OR 2.57, CI 1.25-5.30, 0.011), (OR 1.46, CI 1.08-1.97, p 0.014). Schistosomiasis parenteral treatment doubled the HCV risk (OR= 2.09, CI 1.35-3.23, p 0.001) and chronic kidney disease patients were more at risk (OR= 2.95, CI 1.40-6.24, p 0.005).

Conclusion: Infection control in medical practice and behavioral modifications in this region is essential to prevent HCV transmission.

INTRODUCTION

Infection by hepatitis C virus (HCV) is now recognized as a major world public health problem. The global prevalence of anti HCV increased from 2.3% to 2.8 % between 1990 and 2005 **[1]**. While regions like central and east Asia and North Africa/middle East are estimated to have high prevalence (>3.5%), areas like South Asia, Latin America and Australia have moderate prevalence (1.5-3.5%), whereas Asia Pacific, Tropical Latin America, and North America have low prevalence (<1.5%) **[1]**. Infection with HCV is a major health problem in Egypt **[2]**. The Egyptian Demographic Health Survey (DHS) 2015 estimated that overall 6.3% had ever been infected with hepatitis C virus while only 4.4% had active hepatitis C. These numbers were lower than the 14.7% overall prevalence of positive patients for antibody to HCV found in the 2009 DHS survey **[2]**. Certain governorates in Egypt are identified as high prevalent areas like the interface between the governorate of Beni Suef and Minya, Faiyum, Dakahlia, Kafr el Sheikh, Monufia, and Minya **[3]**. Apart from the usual modes of transmission, such as intravenous drug usage, the main risk factors for transmission in Egypt historically have included the parenteral antischistosomal therapy (PAT), shared or reused needles, poorly sterilized surgical or dental equipment, and blood transfusions **[4]**. Contrary to this historical view, in a cluster-based analyses a rather weak and statistically

not significant association between HCV prevalence and previous PAT was found. In Suez, despite there was no reported PAT exposures nor a history of PAT campaigns, HCV prevalence was nearly as high as the national HCV prevalence **[3]**. Few data are available about the risk factors associated with HCV infection in the Suez Canal region in Egypt. There is need for proper program to control spread of the disease and to alleviate the suffering of the people. It is essential to understand the dynamics of its transmission that can be utilized to guide screening procedures as well as provide insight into the control and prevention of the disease. Furthermore, there is need to identify the risk factors that are responsible for the continued endemic transmission of HCV in Egypt. This work studied the behavioral aspects and life style of HCV patients in the Suez Canal region in Egypt compared to controls from the same region.It also describes the demographic characteristics of HCV infected patients in the Suez Canal region. This study was conducted during the years 2014-2017.

MATERIALS AND METHODS

A case-control study was conducted among HCV positive individuals referred to the Suez Canal University Hospital in Ismailia governorate, the Communicable Diseases Research and Training Center in Suez governorate, and three Fever Hospitals in Port-Said, Ismailia, and Suez Governorates from October 2014 to September 2017. On the basis of a specially designed protocol, standard commercially available tests and physical examinations were performed. The analysis included data of medical history, physical examination and serological evaluation. All subjects were evaluated using a face-to-face questionnaire about demographic and socioeconomic aspects, parenteral exposure to blood or blood products, social and sexual behavior, occupational exposure, intravenous drug use, tattooing, acupuncture, surgery, previous hospitalization and parenteral administration of drugs, personal history of jaundice or hepatitis or history of these diseases in the cases' and controls' families. The control group consisted of blood donors referred to the Regional Blood Transfusion clinics. None of the control group subjects were HBsAg positive, HIV-positive or have any signs or symptoms of hepatitis. Antibodies to HCV were detected employing a commercially available second-generation enzyme immunoassay (Organon/ Teknica UB/HCV EIA). Positive serum specimens were retested using a second-generation recombinant immunoblotassay (RIBA-2) and a polymerase chain reaction for HCV RNA(Abbott Lab., Abbott Park, IL, USA).

Reported risk factors among infected subjects ("HCV- positive") were compared to those of subjects never exposed ("HCV-negative") to HCV.

Statistical analyses:

Collected data were coded, analyzed and computed, using the Statistical Package for Social Sciences (SPSS) version 10 (SPSS Inc., Chicago, IL, USA). Simple statistics such as frequency, and standard deviation were used. Chi-square and Student's t-tests were used for comparison.

We conducted age adjusted multivariate logistic regression analysis to identify risk factors associated with HCV infection.

RESULTS

A total of 1176 subjects were studied for HCV, of which 539 were HCV-positive and 637were HCV-negative donors comprised the control group. 1.6% of the patients had both HCV and HBV infections. Mean age of the patients was 48.3 (SD 11.00) years. Of the 539 patients, 276 (52.21%) were males, and 71.79% were from urban areas. Of the studied patients and their families, 6.13% of the spouses and 0.56% of their children had HCV. Demographic factors significantly affected the risk of HCV transmission as we found that patients who achieved less than university education, unemployed, or gaining less than 600 Egyptian pound monthly income had an increased risk of HCV (OR= 4.18, CI 3.28-5.34, p 0.000), (OR= 3.26, CI 2.55-4.16, p 0.000), and (OR= 3.32, CI 2.59-4.26, p 0.000). People who ever travelled abroad was almost 2 times more prone to infection than those who didn't (OR= 1.64, CI 1.26-2.14, p 0.000). Marriage was found one of the risk factors of HCV transmission among our study group as we found that subjects who ever married were about 5 times more likely to have HCV (OR= 5.45, CI 3.64-8.17, p 0.000). Male circumcision by informal health providers doubled the risk of HCV (OR= 2.08, CI 1.53-2.83, p 0.000). Shaving at a barber, sharing razors and tooth brushes were also risky (OR = 1.81, CI 1.27-2.58, p 0.001), (OR = 2.43, CI 1.54-3.84, p 0.001), and (OR = 7.23, CI 2.74-18.79, p 0.000). Ear piercing increased the risk of

HCV transmission (OR= 3.11, CI 2.23-3.35) while other practices like Smoking hubble-bubble and tattoo formation were of insignificant risk (p= 0.440, and 0.184). Hospital admissions and major surgical procedures weren't identified as independent risks of HCV (p 0.861, p 0.086), but risk increased after endoscopy (OR =3.62, CI 2.02-6.52, p 0.000), blood transfusion (OR 3.47, CI 2.18-5.54, p 0.000), and injection treatment inside hospitals (OR= 1.41, CI 1.02-1.95, p 0.040). Any delivery was a risk factor (OR 2.57, CI 1.25-5.30, 0.011), Caesarean section (CS) delivery or episiotomy almost doubled the risk (OR 2.50, CI 1.42-4.39, p 0.001), and home delivery was also identified as a risk factor (OR 0.36, CI 0.20-0.65, p 0.001). Dental care in governmental clinic only was of a significant risk (OR 1.46, CI 1.08-1.97, p 0.014). HCV infection was also more common among persons having history of schistosomiasis infection (OR= 1.74, CI 1.29-2.35, p 0.000), especially among those received injections for treatment (OR= 2.09, CI 1.35-3.23, p 0.001). An increased risk of infection was found in chronic kidney disease patients (OR= 2.95, CI 1.40-6.24, p 0.005) but not in diabetics receiving frequent injection (p 0.319).

Table (1): Demographic characteristics of the study group

	HCV positive Cases (n=539)		**HCV negative Controls (n=637)**	
	N	**%**	**N**	**%**
Age (years)				
< 30	35	6.49	244	38.30
> 30	504	93.51	393	61.70
Mean age years ± SD	48.3 ± 11		34.28 ±10.9	
Gender				
Male	276	51.21	486	76.29
Marital status				
Never married	31	5.75	159	24.96
Previously married	68	12.62	27	4.24
Currently married	440	81.63	451	70.80
Educational attainment				
No education	203	37.66	97	15.23
Read and write	147	27.27	97	15.23
Less than University	156	28.94	318	49.92
University and more	33	6.13	125	19.62
Work status				
Not working	283	52.50	161	25.27
Workman	150	27.83	254	39.87
Employee	106	19.67	222	34.86
Monthly income				
<200	86	15.96	24	3.77
200-400	97	17.99	56	8.79
400-	92	17.07	76	11.93
600-	107	19.85	107	16.79
800-	115	21.34	175	27.47
+ 1000	42	7.79	199	31.25
Place of residence				
Urban	387	71.79	350	54.95
Rural	152	28.21	287	45.05
Previously travelled abroad	162	30.06	132	20.72

Table (2): Demographic and behavioral risk factors associated with HCV transmission

Variable	Cases=539		Controls=637		OR	95% CI	P value
	N	%	N	%			
Less than university education	348	64.56	194	30.46	4.18	3.28-5.34	0.000*
Unemployment	283	52.50	161	25.27	3.26	2.55-4.16	0.000*
Low economic status (<600 LE/mo.)	270	50.09	148	23.23	3.32	2.59-4.26	0.000*
Ever travelled abroad	162	30.06	131	20.57	1.64	1.26-2.14	0.000*
Ever married	508	94.25	478	75.04	5.45	3.64-8.17	0.000*
Males circumcised by informal health care provider	222	41.19	121	19.00	2.08	1.53-2.83	0.000*
Tattoo	25	1.69	17	2.67	0.78	3.67	0.184
Shaving at barber	453	84.04	494	77.55	1.81	1.27-2.58	0.001*
Sharing razors	84	15.58	46	7.22	2.43	1.54-3.84	0.001*
Sharing tooth brush	37	6.8	6	0.94	7.23	2.74-18.79	0.000*
Ear piercing	207	39.13	82	12.87	3.11	2.23-3.35	0.000*
Smoking hubble-bubble	82	15.21	94	14.76	0.86	0.59-1.26	0.440

OR:Odds Ratio (Age-adjusted OR based on multivariate logistic-regression model)
CI:Confidence Interval, * statistically significant.

Table (3): Health care risk factors associated with HCV infection

Variable	Cases=539		Controls=637		OR	95% CI	P value
	N	%	N	%			
Hospital and clinic exposures							
i. Admissions	272	50.46	239	37.52	1.26	0.77-1.36	0.861
ii. Injections in the hospital	167	30.98	112	17.58	1.41	1.02-1.95	0.040*
iii. Major surgical procedures	285	52.88	280	43.96	1.11	0.84-1.46	0.476
iv. Endoscopy	92	17.07	17	2.67	3.62	2.01-6.52	0.000*
v. Blood transfusion	131	24.30	30	4.71	3.47	2.18-5.54	0.000*
Obstetric exposures (women)							
1. Any delivery	239	92.64	98	78.40	2.57	1.25-5.30	0.011*
2. Surgical delivery (CS or episiotomy)	110	44.00	30	31.91	2.50	1.42-4.39	0.001*
3. Home delivery	74	30.71	36	37.89	0.36	0.20-0.65	0.001*
Dental treatment							
A. Any treatment	476	88.64	453	71.34	1.43	0.98-2.08	0.064
B. Private clinic	251	46.57	310	48.67	0.86	0.66-1.14	0.303
C. Governmental clinic (e.g., MOH)	227	42.12	143	22.45	1.46	1.08-1.97	0.014*
Chronic medical diseases							
a. History of schistosomiasis	241	44.71	134	21.04	1.74	1.29- 2.35	0.000*
b. Schistosomiasis injections treatment	146	27.09	34	5.34	2.09	1.35-3.23	0.001*
c. Diabetics receiving frequent injection	49	9.09	12	1.88	1.43	0.71-2.86	0.319
d. Chronic kidney disease	48	8.91	11	1.73	2.95	1.40-6.24	0.005*

OR:Odds Ratio(*Age-adjusted OR based on multivariate logistic-regression model)*
CI:Confidence Interval, * statistically significant.

DISCUSSION

Hepatitis C infection is a raising problem and its long term complications like cirrhosis and hepatocellular carcinoma is considered a particular health burden **[5]**. Route of transmission varies between developed and developing countries. In developed countries after the World War II and up until 1980s parenteral exposure to contaminated blood and blood products and the use of injectable drugs were the most common source of infection **[6]**. The routine screening of HCV in the donated blood eliminated this source of infection in most of the developed countries leaving the illicit use of injectable drugs the most common rout of transmission **[7]**. In the developing countries, the nosocomial transmission of HCV is the main source of new HCV infection due to the reuse or under sterilization of medical equipment **[8,9, 10]**. In our study we found the prevalence of Co infection of both hepatitis B and C virus was 1.6%. This might be explained by the fact that both infections share common routes of infection. Nevertheless, this prevalence was lower than what an Italian study reported of almost 7% of hepatitis B positive patients with anti HCV as well **[11]**. We found that anti HCV were more common in urban than rural areas in the Suez Canal region (71.79%, and 28.21% respectively),which was the contrary of what the latest DHS survey reported of whole Egypt **[2]**. Of our studied patients and their families, 6.13% of the spouses and 0.56% of their children had HCV. Although some studies found a higher HCV sero-prevalence of family member **[12,13]**, others found only 1.33% **[14]**. Similar to our study among the household contacts of HCV seropositive index cases, spouses were found to be the most affected but still this can't be explained by the sexual transmission only as partners tools sharing is a risky behavior by itself **[15]**. Illiteracy, unemployment, and low economic status increased the risk of HCV by 3 to 4 folds. In the same way, we previously identified socioeconomic status and knowledge as risk factors of hepatitis in Ismailia as one of the governorates in Suez Canal area **[16]**. Others also found that HCV in Egypt were common among low educated patients and that mothers of low education tend to share personal tools **[17]**. Sharing tools was repeatedly identified as a risk factor of HCV transmission **[10,17]**. It increased the risk in our group up to 7 times. In our study, shaving at a barber, sharing razors and tooth brushes were significant predictors of HCV infection. In two previous studies conducted in Egypt one study identified barber shaving as a risk factor **[17]** while the other one didn't **[10]** although the former one was more recent. Like many other studies **[10,17,19]** we found that circumcision by informal health care provider was a predictor of HCV infection. Our results revealed that major surgical procedures didn't significantly increase the risk of HCV, but risk increased after endoscopy, blood transfusion, and injection treatment inside hospitals. Blood transfusion is identified as a current risk factor of HCV transmission in the developing countries like Egypt **[20]**. Interestingly, when Upper Egypt and The Nile Delta was compared, unlike Upper Egypt blood transfusion was not a risk of HCV infection in the Nile Delta what might be explained by the younger age in the latter as the donor anti HCV screening was started in Egypt in 1991 **[20]**. Several invasive procedures were associated with acquiring new HCV infections as they were identified as the most common risk factor of HCV transmission even in developed countries **[21-23]**. In Egypt the specific increase in the prevalence of new HCV infection after endoscopy procedures might be explained by the high number of patients with chronic hepatitis B and schistosomiasis requiring endoscopy what could be minimized with following the recommended sterilization techniques **[24-26]**. Our finding went with what repeatedly found by others regarding the parenteral anti schistosomiasis therapy risk of causing HCV **[27-32]**; as we found that history of schistosomiasis increased the risk by 2.5 folds, and those who reported a history of parenteral therapy for schistosomiasis were almost three times as likely to have anti-HCV than those who did not. Obstetric exposure was a predictor of HCV infection in our study group but was not a significant factor in other studies **[10,17]**. In Suez Canal area, dental care in governmental centers only was still a significant risk of HCV. In Alexandria any dental care was identified risky **[19]** while dental care in Upper Egypt and Sharkia governorates wasn't a risk factor of HCV transmission **[10,17]**. Health care exposure was also identified as the most important risk factor of the ongoing HCV transmission; probably due to the lack of decontamination techniques before the minor procedures **[33]** what might explain the increased risk of HCV in patients with chronic kidney disease in our study.

CONCLUSION

Our data indicate that history of blood transfusion; endoscopy and multiple injections are important risk factors for HCV infection in Egypt. Therefore, focusing on medical practices and infection control in health facilities is essential for HCV transmission prevention. Furthermore, Improvements in certain lifestyle patterns and customs such as sharing razors and tooth brushes especially among HCV patients and their contacts should be taken in consideration through community education program.

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Ethical approval

Consent for an interview was taken from each participant, who was assured about the confidentiality of his information. The Ethics Committee of the Ministry of Health and Population approved the study on 12/12/2012 (No: 35-2012/1).

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Conflicts of interest

There are no conflicts of interest.

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