Hepatitis C virus risk factors in blood donors from Sohag governorate, Egypt

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Abstract

Egypt has the highest prevalence of hepatitis C virus (HCV) worldwide. Most of data came from lower Egypt regions (Cairo and northern to it). So, we decided to study risk factors and prevalence of HCV transmission in our governorate. In this cross sectional study, we recruited 631 blood donors from April, 2011 to March 2012 who were tested for anti-HCV, HBs Ag, anti-HBc and anti-HIV. Fifty seven donors were excluded as they are HBs Ag and anti-HBc positive. We found 138 (24%) HCV seropositive participants. Logistic regression final model demonstrated that endoscopy, hospital admission, socioeconomic status, IV drug use and age made a significant contribution to prediction (P=0.0001). The level of education also made significant contribution to prediction (P=0.014). In conclusion, it is wise to determine high HCV prevalence areas and risk factors for its seropositivity then build up a governorate suitable infection control program concentrating upon prevention more than treatment of HCV patients. Also, the introduction of pre-test and post-test counseling in blood banks will help in better donor selection and early detection of patients.

Introduction

Hepatitis C virus (HCV) is a major cause of chronic hepatitis and its serious consequences such as cirrhosis, liver cell failure or hepatocellular carcinoma.[1,2] Furthermore, HCV-related disease is the major indication for liver transplantation in USA.[3] About 180 million people are infected by HCV worldwide.[4]

The Egyptian Demographic Health Survey in 2008 has found that about 15% of women and men aged 15-59 had antibodies to the HCV virus in their blood. Ten percent (of women and men aged 15-59) were found to have an active infection.[5] Prevalence of chronic HCV infection in Egypt is higher among men than women (12% and 8%, respectively), increases with age (reaching >25% among persons aged >50 years), and is higher among persons residing in rural than urban areas (12% *versus* 7%).[5] Primary modes of HCV transmission include unsafe injections, other inadequate infection control practices, and unsafe blood transfusions.[6,7] HCV transmission also occurs among injection-drug users in Egypt.[8]

The Center for Disease Control and Prevention recommends that all people be assessed for HCV risk factors and that those with risk factors should be screened for HCV antibodies.[9]

Data about prevalence and risk factors for HCV seropositivity are mainly collected from studies done mainly in lower Egypt regions with few studies from upper Egypt mainly Asyut, minyah and Qena governorates.[10-15] Different environmental features, social habits and customs, type of jobs, housing levels and more urbanization of the lower Egypt may cause different prevalences of HCV seropositivity between the two areas. So we performed this study to determine the possible risk factors and prevalence of HCV transmission in Sohag governorate. Accordingly we can screen high risk populations, prevent disease spread and even early treatment before end stage liver disease.

Materials and Methods

This is a cross sectional study. We calculated the sample size to study HCV seropositivity with about 20% prevalence, a confidence level of 95% and a margin of error of 4%. We found it should not be less than 463 (20% added for possible drop out subjects) to do so. We recruited 631 blood donors (57 subjects were excluded because they are HBs Ag positive, all the others are HBs Ag and anti-HBc negative) who volunteered (no payment) to donate blood for first time during the period from April, 2011 to march 2012, in Sohag University Hospital blood bank, Sohag, Egypt. It serves most of the area of Upper Egypt including Sohag, Qena, Luxor, Red sea and Aswan governorates. To donate blood, the subject must be in good health and must be between 18 to 60 year old. Inclusion criteria include: volunteered, first time, blood donors who agree to fill the questionnaire. Exclusion criteria include: younger or older ages, anti-HIV positive, HBs Ag positive, anti-HBc positive, hypotension, anemia (Hb is less than 13 g% in men and less than 12 g% in women), severe chronic diseases and past history of jaundice or refused to fill the questionnaire. None refused to fill the questionnaire. Before enrolment an informed consent was taken from every participant who agreed to be included in this study. Questionnaire was designed and included questions concerning personal data included the age, sex, marital status, residence (*rural* means the countryside and villages or *urban* means big town and cities), occupation, education level (illiterate, preuniversity or higher) and socioeconomic status (person's position in society that is determined using the person's income, level of education, occupation and value of dwelling place). The work history included whether the subject has ever had jobs identified in the literature as having a potentially high risk of HCV exposure (*e.g.* health care workers). Also the subject was, specifically, asked about if his job necessitate dealing with blood or body fluids. History of blood or blood products transfusion, contact with another person's blood *e.g.*, during an accident or injury, received IV drugs (even once), history of tartar emetic treatment for schistosomiasis, hospital admission, surgical operations, digestive endoscopy, contact with patient on regular hemodialysis, treatment by a dentist, needle-stick and tattooing. Also, the presence of HCV infected household contacts, HCV infected sexual partner, extramarital sexual activity, multi-

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Dedication: this article is dedicated to the soul of Prof. M. Nafeh.

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ple sexual partners, previous incarceration, shaving (as commercial barbering or at home) and circumcision (at the hospital, at home or at private clinic). Sharing razors and toothbrushes with others. Filling the questionnaire, through direct interview with each participant, was done without knowing his/her anti-HCV status. Blood collected by venepuncture, serum or plasma might be used. Samples were tested for anti-HCV antibody, by enzyme linked immunosorbent assay (ELIZA) (AXSYM system, HCV version 3.0 ELIZA test system, ABBOTT, Germany) for detection of positive cases.

Ethical considerations

This study was approved by the institutional ethical review committees of Sohag university. Written informed consent from every patient was obtained by junior doctors in Tropical Medicine and Gastroenterology department.

Statistical analysis

The collected data was organized and tabulated and statistically analyzed using SPSS for Windows version 22.0. Chi square tests were used to check any difference, association or trend between groups. P<0.05 was considered to indicate a significance. Odds ratios and their 95% CI were calculated with 2×2 tables or logistic regression for variables with more than 2 levels. A logistic regression analysis was conducted to predict HCV seropositivity. As a preparatory step a correlation matrix (not shown), using Kendall's tau, was made including the independent and dependent variables. The independent variables which had no correlation with the dependent variable were excluded. Also, if two variables have ≥80% correlation, one of them was chosen according to plausibility, statistical association with dependent variable or according to authors preference. The model was built using the forward stepwise method. Variables were added to the model one at a time in the order of the magnitude of the calculated chi square tests starting with variables with higher values. Confounding effect between variables at the final model was followed with crosstabs analysis (not shown).

Results

Twenty four percent of the studied sample are HCV seropositive. There is a strong association among age, sex, level of education, marital status and socioeconomic status and HCV seropositivity. HCV seropositivity is more in eldest age group (more than 3 times), men (more than 3 times), illiterate people (more than 2.5 times), unmarried (more than 2.5 times) and in high socioeconomic level (more than 4 times) (Table 1). There is a significant trend for HCV seropositivity to increase with increasing participant age at P=0.0001 (Table 2).

Table 3 Indicates that the risk factors have significant statistical association with HCV seropositivity except having multiple sexual partners, having extramarital sexual activity, sharing razors and having tattoo. With highest odds ratio for previous incarceration, shaving in barber shop, having infected household contact and sharing toothbrushes.

As shaving and circumcision have peculiarities in our society especially between men and women so, we analyzed these two factors in men and women separately. As Table 4 shows there is a strong association among circumcision and shaving with HCV seropositivity in both females and males (P=0.0001). All risk factors have significant statistical association with HCV seropositivity. With highest odds ratio for previous endoscopy, cardiac catheterization, blood transfusion followed by needle stick (Table 5).

Table 6 showed the unadjusted and adjusted ORs of the variables in the full model. A test of the full model against a constant only model was statistically significant, indicating that the predictors as a set reliably distinguished between positive and negative participants (chi square=316.441,

Table 1. Sociodemographic characteristics of hepatitis C virus (HCV) negative and positive participants.

Sociodemographic characteristics	HCV test results		P-value	OR (95% CI)
	Negative (436) N (%)	Positive (138) N (%)		
Age (years)*				
20-25	163 (37.4)	35 (25.4)	0.0001	
>25-30	130 (29.8)	30 (21.7)	0.79	1.08 (0.63, 1.84)
>30-35	57 (13.1)	15 (10.9)	0.56	1.23 (0.62, 2.41)
>35-40	86 (19.7)	58 (42.0)	0.0001	3.14 (1.92, 5.15)
Sex				
Men	379 (86.9)	90 (65.2)		
Women	57 (13.1)	48 (34.8)	0.0001	0.29 (0.19, 0.46)
Level of education*				
High	83 (19.0)	18 (13.0)	0.003	
Preuniversity	275 (63.1)	77 (55.7)	0.37	1.29 (0.73, 2.28)
Illiterate	78 (17.9)	43 (31.3)	0.004	2.54 (1.35, 4.78)
Marital status				
Married	226 (51.8)	101 (73.2)		
Unmarried	210 (48.2)	37 (26.8)	0.0001	2.54 (1.67, 3.86)
Occupation				
Low risk	388 (89.0)	115 (83.3)	0.08	1.61 (0.94, 2.77)
High risk	48 (11.0)	23 (16.7)		
Socioeconomic status				
High	71 (16.3)	18 (13.0)		
Low	365 (83.7)	120 (87.0)	0.0001	0.23 (0.14, 0.40)
Residence				
Rural	297 (68.1)	101 (73.2)	0.26	0.78 (0.51, 1.20)
Urban	139 (31.9)	37 (26.8)		

* Their odds ratios are calculated with logistic regression.

P=0.0001 with df=9). Nagelkerke R^2 of 0.634 indicated a moderately strong relationship between prediction and HCV test result. Overall success of prediction was 88.7% (93.3% for negative and 73.9% for positive). The Wald criterion demonstrated that endoscopy, hospital admission, socioeconomic status, IV drug use and age made a significant contribution to prediction (P=0.0001). The level of education also made significant contribution to prediction (P=0.014).

Discussion and Conclusions

The purpose of this study was to assess the risk factors and prevalence of HCV transmission among the studied subjects and showed 24% of the subjects are seropositive. This seropositivity was more in eldest age group (with trend to increase with increasing participant age), men, with high socioeconomic level, illiterate and unmarried people. Many medical and social risk factors are significantly associated with HCV transmission. The full logistic regression model, including endoscopy, hospital admission, socioeconomic status, IV drug use, shaving, circumcision, tartar emetics, level of education and age, showed that these predictors as a set reliably distinguished between positive and negative participants. This can help us to screen high risk population, prevent disease spread or, at least, treat it early.

As all cross sectional hospital based studies, our study has some limitations. First, not all people in the wide area served by our hospital can easily reach the hospital. Second, those who offer to donate blood are usually young and healthy. Third, there may be reporting bias especially when questions touches the work environment. In addition, recall bias is another drawback. Lastly, this model was not yet validated. According to our knowledge this is the first study about this issue to be done in our area. The participation rate in our study is 100%. Volunteer

Table 2. Hepatitis C virus seropositivity by age (years).

	Age				P value	P value for trend
	20-25	>25-30	>30-35	>35-40		
Number per group	198	160	72	144		
Seropositivity, %	17.7	18.8	20.8	40.3	0.0001	0.0001

Table 3. Socially related risk factors of hepatitis C virus (HCV) negative and positive participants.

Risk factors	HCV test results		P-value	OR (95% CI)
	Negative (436) N (%)	Positive (138) N (%)		
Infected household contact	73 (16.7)	55 (39.6)	0.0001	3.29 (2.15, 5.03)
Multiple sexual partners	15 (3.4)	4 (2.9)	0.75	0.83 (0.27, 2.56)
Infected sexual partner	16 (3.7)	12 (8.7)	0.02	2.50 (1.15, 5.42)
Extramarital sexual relations	9 (2.1)	2 (1.5)	0.64	0.96 (0.14, 3.26)
Previous incarceration	12 (2.8)	13 (9.4)	0.001	3.67 (1.63, 8.25)
No (females)	49 (11.2)	40 (28.9)	0.0001	
Shaving*				
At home	52 (11.9)	22 (15.9)	0.048	1.93 (1.01, 3.70)
Barber shop	335 (76.8)	76 (55.1)	0.0001	0.28 (0.17, 0.45)
Private clinic	39 (8.9)	9 (6.5)	0.02	
Circumcision*				
Hospital	104 (23.9)	19 (13.8)	0.60	0.79 (0.33, 1.89)
At home	276 (63.3)	110 (79.7)	0.20	1.63 (0.76, 3.46)
Share razors	26 (5.9)	12 (8.7)	0.26	1.50 (0.73, 3.06)
Share toothbrushes	19 (4.4)	17 (12.3)	0.001	3.08 (1.55, 6.11)
Tattooing	23 (5.3)	11 (7.9)	0.24	1.55 (0.73, 3.27)

*Their odds ratios are calculated with logistic regression

Table 4. Circumcision and shaving association with hepatitis C virus (HCV) seropositivity in both females and males.

Risk factors	Sex	Variable	HCV test result		P value*
			Negative (436) N (%)	Positive (138) N (%)	
Circumcision	Females	Private clinic	0 (0.0)	9 (6.5)	
		Hospital	0 (0.0)	19 (13.7)	
		At home	57 (13.0)	19 (13.7)	0.0001
	Males	Private clinic	39 (8.9)	0 (0.0)	
		Hospital	104 (23.9)	0 (0.0)	
		At home	236 (54.1)	91 (65.9)	0.0001
Shaving	Females	No	49 (11.2)	0 (0.0)	
		At home	8 (1.8)	0 (0.0)	
		Commercial barber	0 (0.0)	47 (34.0)	0.0001
	Males	No	0 (0.0)	40 (29.0)	
		At home	44 (10.1)	22 (15.9)	
		Commercial barber	335 (76.8)	29 (21.0)	0.0001

*Done by Fisher exact test.

blood donors in our area are usually relatives of, and may live with, the patients who are in need for blood transfusion. The interview and filling the questionnaire was done by junior doctors in our department (well trained to do so). Filling the questionnaire was done before knowing the participant anti-HCV status.

Many studies were done in Egypt to assess the seropravelance of HCV. The seropravelance varies from 2.7% among student voluntary blood donors in Mansoura to 42% in patients referred for bone marrow examination.[16,17] HCV seroprevalences in agreement with our results were found by Arthur *et al.,* 1997 (24.8%), Quinti *et al.,* 1995 (20.8%) and El sadawy *et al*., 2004 (25.8%).[18-20]

Several authors studied the HCV seropravelance in Egypt and found, in agreement with our result, HCV seropositivity more in men, older age, low socioeconomic level and/or from rural areas.[20-24]

We found a significant trend for HCV seropositivity to increase with increasing participant age that is in agreement with Mohd Hanafiah *et al.,*[25] 2013 who stated three distinct epidemiological profiles of HCV transmission. In the first transmission type, prevalence is low among younger persons, and then rises steadily or sharply through middle age. After peak prevalence is reached, the seroprevalence declines in older ages. The peak prevalence seen in type 1 transmission is commonly referred to as the cohort effect. In type 2 transmission, prevalence is low in younger populations but increases dramatically and is sustained in older populations as a reflection of a past high risk of infection that is no longer present. Type 3 transmission is seen in areas where there was a higher risk of infection in the distant past yet a high risk of infection remains; prevalence is relatively high in all age groups, and increases steadily with age.

We categorized the risk factors into medically and socially related groups. Reker and Islam reviewed the literature between 2008 and February 2013 and found two major groups of risk factors for HCV transmission in Egypt: unsafe medical practices and other risk factors. Medical practice-related factors included surgery, IV injection, intravenous schistosomiasis treatment, gum disease treatment, stitches, and catheter use. The other risk factors important for transmission of HCV included illiteracy, mother's HCV status, parity and familial transmission.[26]

We put a model contains several predictors (digestive endoscopy, hospital admission, socioeconomic status, IV drug use, history of tartar injection, age, shaving, circumcision and level of education). This model has about 89% overall success of prediction of HCV status. We noticed that some of the adjusted ORs are lower than their respective unadjusted ones. This may be due to confounding effect as both of IV drugs and IV tartar variables, for instance, are significantly associated with all variables of age, level of education, socioeconomic level, shaving and circumcision.

A baseline assessment of Ministry of Health and Population (MOHP) facilities revealed 1) a lack of health-care workers with specific training or expertise in infection control; 2) a lack of formal infection control programs in most facilities; 3) poor understanding among health-care workers regarding standard precautions for infection control; and 4) absent or inadequate equipment reprocessing, sterilization practices, and waste management.[27] Given the high

Table 5. Medically related risk factors of hepatitis C virus (HCV) negative and positive participants.

Risk factors	HCV test results		P-value	OR (95% CI)
	Negative, N (%)	Positive, N (%)		
Blood transfusion	25 (5.7)	27 (19.5)	0.0001	3.99 (2.23, 7.16)
Dealing with patient blood or body fluids	32 (7.3)	21 (15.2)	0.006	2.26 (1.25, 4.07)
IV drugs (even once)	245 (56.1)	92 (66.6)	0.03	1.55 (1.04, 2.32)
History of tarter emetics	45 (10.3)	33 (23.9)	0.0001	2.73 (1.65, 4.49)
Hospital admission	127 (29.1)	81 (58.6)	0.0001	3.45 (2.32, 5.14)
Surgical operations	119 (27.2)	70 (50.7)	0.0001	2.74 (1.84, 4.06)
Previous endoscopy	9 (2.1)	23 (16.6)	0.0001	9.48 (4.27, 21.06)
Cardiac catheterization	8 (1.8)	10 (7.2)	0.003	4.17 (1.61, 10.81)
Treatment by a dentist	221 (50.6)	88 (63.7)	0.007	1.71 (1.15, 2.54)
Contact with hemodialysis patients	38 (8.7)	21 (15.2)	0.03	1.87 (1.06, 3.32)
Exposure to needle-stick	59 (13.5)	52 (37.6)	0.0001	3.86 (2.48, 6.00)

Table 6. Non adjusted and adjusted odds ratios of risk factors, in the final logistic regression model, by univariate and multivariate analyses, respectively.

Risk factors	Non adjusted OR (95% CI)	P value	Adjusted OR (95% CI)	P value
Endoscopy	9.49 (4.27, 21.07)	0.0001	19.64 (6.81, 56.66)	0.0001
Hospital admission	3.46 (2.33, 5.14)	0.0001	7.73 (2.60, 22.99)	0.0001
Socioeconomic status	0.23 (0.14, 0.40)	0.0001	0.14 (0.07, 0.29)	0.0001
Shaving	0.28 (0.17, 0.45)*	0.0001	1.30 (0.52, 3.27)	0.572
History of tartar	2.73 (1.66, 4.49)	0.0001	0.70 (0.09, 5.38)	0.732
Level of education	2.54 (1.35, 4.78)**	0.004	0.27 (0.09, 0.77)	0.014
IV drugs	1.56 (1.04, 2.33)	0.03	0.04 (0.02, 0.11)	0.0001
Circumcision	1.63 (0.76, 3.47)°	0.20	0.82 (0.36, 1.88)	0.643
Age	3.14 (1.92, 5.15)°°	0.0001	10.78 (4.47, 26.03)	0.0001

*Of at barber shop group done by logistic regression. **Of illiterate group done by logistic regression. °Of at home group done by logistic regression. °°Of >35-40 group done by logistic regression.

burden of viral hepatitis in Egypt, in 2006, MOHP established the National Committee for the Control of Viral Hepatitis (NCCVH). By April 2008, this committee had developed a National Control Strategy for Viral Hepatitis, which called for effective surveillance, enhancements in prevention to reduce the incidence of hepatitis B virus (HBV) and HCV infection, and expanded access to care and treatment for those with chronic infection. Actually, implementation has been largely limited to the care and treatment component of the strategy.[28]

It is good to have nation-wide infection control program but it is wiser if it is based upon each locality prevalence of risk factors. So it is mandatory to recognize, by more local studies, all possible risk factors in your locality. Introducing pre-test and post-test counseling in blood banks will result in better donor selection and identification of patients at an earlier stage where treatment would be more effective. But it is wiser to concentrate upon prevention rather than treatment especially in Egypt, a country with limited resources and high burden of HCV, in absence of vaccination and low priced effective treatment. Also, further studies are needed to check the validity of this model.

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