PREVALENCE AND RISK FACTORS FOR HEPATITIS C VIRUS INFECTION AMONG GENERAL POPULATION IN LUXOR GOVERNORATE, EGYPT

By

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ABSTRACT

Background: Hepatitis C virus (HCV) is one of the hepatitis viruses that transmitted through blood or blood products. HCV has been implicated as a major reason of chronic liver disease and hepatocellular carcinoma worldwide.

Objective: This study aimed to determine the seroprevalence of HCV antibodies among community in Luxor governorate, Egypt. Moreover to assess if there is any association with the population group, sex, age and other different risk factors.

Patients and methods: We randomly selected 745 blood samples; from males and females of different ages (20-65 years). Samples were collected from Luxor governorate, Egypt. Seras from all subjects were tested for hepatitis C virus antibodies using rapid test method and confirmed by the enzyme linked immunosorbent assay (ELISA third generation).

Results: Our results showed that 584 (78.40 %) of the community were males and most of them aged between 31 and 50 years. Thirty two (5.48%) from blood samples of males were anti-HCV seropositive, and the highest prevalence of anti-HCV (7.22%) of age groups from 41-50 years. One hundred and sixty one (21.60%) from the community were female and most of them aged between 41 - 65 years. Six (3.73%) of female subjects tested positive for anti-HCV and the highest prevalence of anti-HCV (4.87%) was with age groups from 31-40 years. Four risk factors reflecting high mechanisms of HCV transmission have been associated with HCV infection including residing in rural areas, no education, blood transfusion, and dental treatment. Exposures to surgery and history of schistosomiasis showed low association with Anti-HCV. Among the community exposures, were blood donation and alcohol consumption but these associations were not important.

Conclusion: This study has been conducted to determine the prevalence rate of anti-HCV among community in Luxor governorate, Egypt.

Key words: HCV, Hepatitis, anti-HCV.

INTRODUCTION

Hepatitis C virus (HCV) is a global public health problem. There are about 130 to 150 million people suffering from chronic HCV *(WHO, 2015)*. The highest prevalence of HCV in the world occurs in Egypt with estimates higher than 10% among the general population. There are approximately, 3.7 million persons in Egypt have chronic HCV infection in 2015 *(Mastoi et al., 2010*; *WHO, 2015*, and *El-Ghitany, 2019)*.

The high prevalence of HCV is not the only problem, but the high incidence of HCV is another important issue which reflects the new HCV infections that occurs annually, where about 160,000 to 500,000 new HCV infections occur annually *(Miller and Abu-Raddad, 2010 and Breban et al., 2013)*.

Reuse of contaminated medical equipment, injection drug use and other health care related procedures *(Sharma et al., 2015)*. Unsafe therapeutic injections and transfusions are likely to be the major modes of transmission, especially in countries where age-specific seroprevalence rates suggest ongoing increased risk of HCV infection *(Mazen et al., 2019)*.

Contaminated injection equipment appears to be the major risk factor for HCV transmission in several countries *(Shepard et al., 2005)*. Catching HCV infection after the age of 40 may be associated with a more rapid progression of liver injury, as well as male gender *(Svirtlih et al., 2007)*. Children appear to have a lower risk of disease progression *(Pawlowska et al., 2015)*. Alcohol consumption increases HCV replication, enhances the progression of chronic HCV, and accelerates liver injury *(Gitto et al., 2009)*. Treatment of schistosomiasis patients by using parenteral antischistosomal therapy (PAT) campaigns is believed to be the major historic cause for increasing the prevalence of HCV in Egypt *(Frank et al., 2000)*.

Our study was undertaken to know the current prevalence of anti-HCV antibodies and risk factors related to anti-HCV antibodies in population of Luxor region of Egypt.

MATERIALS AND METHODS

This study has been conducted during the period from January through October 2016. The study has been carried out in Luxor governorate, Egypt. The population was males and females over 20 years old. They were randomly selected. All serum samples were transported to the virology laboratory of botany and microbiology department, Al-Azhar University, (Assiut), where all the processing has been carried out.

Consent forms and approval from all subjects included in the study were obtained. All individual were interviewed, and a questionnaire was filled to obtain information on age, place of living, education and health care history. A total of seven hundred and forty five blood samples were collected for the study.

Collection and processing of blood samples: About 3 milliliters of blood were collected and centrifuged at 4000 rpm for 10 minutes. The obtained serum was stored at -20°C.

Serum Marker for HCV infection: Anti-HCV was studied using third-

generation ELISA test (Ortho Diagnostics, Raritan, NJ, USA; and Abbott Diagnostics, North Chicago, IL, USA). Results were read using EL x 800 universal micro- plate reader, (Biotek Instruments Inc.). All positive samples were retested using the same method (double ELISA).

Statistical analysis:

Data were analyzed using the SPSS version 16. Qualitative variables were described as numbers and percentages. Chi square or Fisher's exact test was used for comparison between groups as appropriate. Odds ratios and their 95% confidence intervals were calculated. P value ≤ 0.05 was considered statistically significant.

RESULTS

A total of 745 blood samples were included in the study. Their ages ranged from 20-65 years old. Out of these samples, 584 (78.40 %) were males, and 161 (21.60 %) were females. 66.16% of the subjects aged 31-50 years, while those aged ≤30 and ≥51 years were (17.32% and 16.52 % respectively). These observed differences are high statistically significant (Table 1).

Gender specific prevalence of anti-HCV antibodies: Out of the 745 serum samples, 38 were tested positive, implying an overall prevalence of 5.10 %. Thirty two (5.48%) of the 584 male subjects were tested positive, while 6 (3.73%) of the 161 female subjects were tested positive. This gender related prevalence of anti- HCV antibodies were highly statistically significant (Table 2).

Age with gender specific prevalence of anti-HCV antibodies: The Males age groups 41-50 years have the highest prevalence of anti-HCV 13 (7.22 %), followed by age-groups 51- 65 years with 5 (6.10 %) prevalence, while age-groups from31-40 and 20- 30 years showed lowest prevalence of anti-HCV (5.31 % and 2.60 % respectively). Females predominant cases were in age groups 51-65 years with 2 (4.87 %) followed by age-groups 41-50 years with 3 (4.10 %) prevalence, while age-groups from 20-30 and 31-40 years showed lowest

prevalence of anti-HCV (0 % and 3.03 % respectively). These observed differences were not statistically significant (Table 3).

Many health care risk factors were associated with anti-HCV in the gender-adjusted analysis, including residence, education, surgery, blood transfusion and donation, alcohol consumption and history of schistosomiasis (Table 4).

The strength of these associations is for community residing in rural versus urban areas 31 of 542 (5.72 %) versus 7 of 203 (3.45 %) respectively with non-statistically significant (P = 0.202). History of blood transfusion is reported in 88 (11.81%) community. Anti-HCV is more common in those who have received a blood transfusion than in those who have not received blood: 5 (5.68 %) and 33 (5.02 %), respectively with high statistically significant (P = 0.000). Dental treatment are associated with anti-HCV status among those 25 (5.80 %) compared with 13 (4.14 %) no dental treatment with non-statistically significant (P = 321). Education shows association with Anti-HCV and more common in those who have no education than University attendance 72 (5.61 %) and 6 (3.82 %) respectively with high statistically significant (P= 0.000).

Exposures to surgery, history of schistosomiasis show low association with

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Anti-HCV. Surgery related prevalence of anti-HCV antibodies were high statistically significant (P = 0.000), while observed differences of history of schistosomiasis were not statistically significant (P = 251). Among the community exposures, including blood donation and alcohol consumption but these association are not important (Table 4).

Table 1: Age and gender distribution of population in Luxor, Egypt

Gender / Age (years)	Male, n (%)	Female, n (%)	Total, n (%)	X^2	*P* value
20-30	115(19.70 %)	14(8.70 %)	129(17.32 %)		
31-40	207(35.44 %)	33(20.50 %)	240(32.21 %)		
41-50	180(30.82 %)	73(45.34 %)	253(33.95 %)	35.38	0.001**
51-65	82(14.04 %)	41(25.46 %)	123(16.52 %)		
Total n: (%)	584(100 %)	161(100 %)	745(100 %)		

**High significant

Table (2): Gender related Prevalence of Anti-HCV antibodies

Anti-HCV / Gender	Positive, n (%)	Negative, n (%)	Total, n (%)	X^2	*P* value
Male	32 (5.48 %)	552 (94.52%)	584 (100%)		
Female	6 (3.73%)	155 (96.27%)	161 (100%)	14.55	0.001**
Total, n (%)	38 (5.10%)	707 (94.90%)	745 (100%)		

** High significant

Table (3): Prevalence of Anti-HCV antibodies related to gender and age

Anti- HCV Positive, n (%) / Age (years)	Male	Female	Total, n (%)	X^2	P value
20-30	3 (2.60%)	0 (0 %)	3 (2.32 %)		
31-40	11 (5.31%)	1 (3.03%)	12 (5.00 %)		
41-50	13 (7.22%)	3 (4.10%)	16 (6.32 %)	2.03	0.566 n.s.
51-65	5 (6.10%)	2 (4.87%)	7 (5.70 %)		
Total, n (%)	32 (5.48 %)	6 (3.73%)	38 (5.10 %)		

n.s.= Non significant

Table (4): Risk factors related Prevalence of anti-HCVantibdies among population in Luxor governorate, Egypt

Parameters / Risk factors	Participants, n (%)			Anti- HCV Positive, n (%)			X²	p value
	Male	Female	Total	Male	Female	Total		
Residence								
Rural	416 (71.23 %)	126 (78.26%)	542 (72.75 %)	26 (6.25%)	5 (3.96%)	31 (5.72 %)	4.623	0.202n.s.
Urban	168 (28.77 %)	35 (21.74 %)	203 (27.25 %)	6(3.57 %)	1(2.85%)	7 (3.45 %)		
Education								
University Attendance	148 (25.34 %)	9 (5.60 %)	157 (21.08 %)	6 (4.05 %)	0 (0 %)	6 (3.82 %)	298.3	0.001**
School Attendance	76 (13.01 %)	31 (19.25 %)	107 (14.36 %)	4 (5.26 %)	1 (3.22 %)	5 (5.15 %)		
No education	360 (61.65 %)	121 (75.15%)	481 (64.56 %)	22 (6.11%)	5 (4.13 %)	27 (5.61 %)		
History of Blood donation								
Yes	47 (8.05%)	0 (0 %)	47 (6.31 %)	0 (0 %)	0 (0 %)	0 (0 %)	210.1	0.001**
No	537 (91.95 %)	161 (100 %)	698 (93.69 %)	32 (5.95%)	6 (3.73 %)	38 (5.44 %)		
History of Blood Transfusion								
Yes	39 (6.68 %)	49 (30.43 %)	88 (11.81%)	3(7.69 %)	2 (4.08 %)	5 (5.68 %)	70.89	0.001**
No	545 (93.32%)	112 (69.57%)	657 (88.19 %)	29(5.32 %)	4 (3.57 %)	33 (5.02 %)		
Dental Treatment								
Yes	329 (56.34%)	102 (63.35%)	431 (57.85 %)	21 (6.38%)	4 (3.92 %)	25 (5.80 %)	3.495	0.321n.s.
No	255 (43.66 %)	59 (36.65%)	314 (42.15 %)	11 (4.89%)	2 (3.39 %)	13 (4.14 %)		
Surgery								
Yes	83 (14.21 %)	67 (41.61 %)	150 (20.13%)	4 (4.82 %)	3 (4.48 %)	7 (4.66 %)	63.62	0.001**
No	501 (85.79 %)	94 (58.39 %)	595 (79.87 %)	28 (5.58%)	3 (3.19 %)	31 (5.21 %)		
Alcohol Consumption								
Yes	6 (1.03%)	0 (0 %)	6 (0.81 %)	0 (0 %)	0 (0 %)	0 (0 %)	2.06	0.560 n.s
No	578 (98.97 %)	161 (100 %)	739 (99.19 %)	32 (5.54%)	6 (3.73 %)	38 (5.14 %)		
History of Schistosomiasis								
Yes	21 (3.60 %)	1 (0.62 %)	22 (2.95 %)	1 (4.76 %)	0 (0 %)	1 (4.55 %)	4.103	0.251 n.s
No	563 (96.40 %)	160 (99.38%)	723 (97.05 %)	31 (5.51%)	6 (3.75 %)	37 (5.12 %)		

n.s.= Non significant   **High significant

DISCUSSION

Egypt has the highest prevalence of HCV in the world, with more than 20% positive for HCV among blood screening and testing for the Egyptian blood donors *(WHO, 2016)*. In 2008, Egypt Demographic and Health Survey (EDHS) using a national representative sample estimated the prevalence of HCV to be 14.7% among Egyptian between 15-59 years of age by using HCV antibody test, which means that those people have been exposed to HCV *(El-Zanaty and Way, 2009)*. In 2015, Egypt Health Issues Survey (EHIS) using a nationally representative sample reported that 10% of Egyptians between 15-59 years of age have been infected with HCV infection, while 7% are chronic active hepatitis C patients *(EHPM, 2015* and *Abo-Amer et al., 2018)*.

This study was performed in Luxor governorates of Egypt, where most of population live in rural regions. The present study documented small prevalence of HCV infection (5.10 %) in the study area as compared with other region in Egypt. Our results confirmed findings in previous studies estimating 9% prevalence in Upper Egypt as compared to 24% prevalence in the Nile Delta *(Abdel-Aziz et al., 2000* and *Mohamed et al., 2005)*.

Among the tested samples, 78.40% were males and, 21.60% were females. The seroprevalence was higher among males (5.48 %) as compared to females (3.73%). These results agreed with *EHPM (2015)*, which estimate that the prevalence of HCV among males are more than females, and to findings of *Vallab et al. (2014)* who also report higher prevalence of HCV in males (0.7%) as compared to females (0.66%). This male preponderance is explained by high exposure level pertaining to various risk factors of HCV transmission due to their lifestyle. These findings were not consistent with other studies where prevalence of anti-HCV antibody is higher among female as compared to male *(Ramarokoto et al., 2008*; Ayele and *Gebre, 2013* and *Abo-Amer et al., 2018)*.

Current study estimated that, the seroprevalence of HCV among older age groups was much higher than the younger ones. The seropositive cases in current study remained higher in 41-50 years followed by 51-65 years in males, whereas in females predominant cases were in 51-65 years followed by 41-50 years. Various other studies have also demonstrated high seroprevalence of anti-HCV antibody among adult population *(Siddiqui et al., 2009*; *Vallab et al., 2014* and *Verma et al., 2014)*.

In this study, four risk factors reflecting direct mechanisms of HCV transmission have been associated with HCV infection: Residence, education, blood transfusion and Dental treatment. *Mohlman et al. (2015)*, report that community who born after 1980 have modest to low exposure to risk factors such as PAT, blood transfusion and blood donation. However, the association between aging populations and increased health care utilization *(El-Zanaty and Way, 2009)*, which in turn increase the risk for HCV transmission. The high HCV positivity prevalence among individuals born before 1960 suggests that the latter cohorts may substantially contribute to the

ongoing HCV transmission in Egypt *(Breban et al., 2014)*.

In our study, prevalence of anti-HCV was higher among community residing in rural versus urban areas (5.72 % vs. 3.45 % respectively). This pattern of high anti-HCV prevalence in rural areas was similar to multiple studies conducted in rural areas of Delta governorates which show a prevalence ranging from 14.4 to 18.5% *(Abdel-Aziz et al., 2000*; *Stoszek et al., 2006*; *Badr et al., 2016* and *Abo-Amer et al., 2018)*.

Also, we documented that a low level of education was associated with a higher seroprevalence of HCV infection. It was found that it was higher in illiterate people (5.61 %) while it was much lower among people who have completed secondary education and higher education (5.15 % and 3.82 % respectively). These findings agreed with the report of *El-Zanaty and Way (2009)* about the relation between educational level and HCV prevalence. It was found that it was higher in illiterate people (14.5%), while it was much lower among people who have completed secondary education and higher (4.1%).

In a developed country, the risk factor of transmission through blood transfusion has greatly diminished with the introduction of effective screening. However, blood transfusion remained an important past and a potential current risk for HCV transmission in developing countries, where anti-HCV screening is limited by technical and financial factors *(Wasley and Alter, 2000)*. In our study, we found that seropositive cases of Anti-HCV were more common in those who have received a blood transfusion than in those who have not (5.68 % and 5.02 %

respectively). These results agreed with *Mousa et al (2016)*, those anti-HCV antibody positive patients received blood transfusion more frequently than HCV antibody- negative patient.

In the present study, we demonstrated that the seropositive cases of anti-HCV remain highest in people who underwent dental treatment as compared with people who did not undergo dental treatment. Various other studies reported that there is an evidence of ongoing HCV incidence at dental and medical facilities *(Kalil et al., 2010* and *Barakat and El-Bashir, 2011)*, although most studies have not found dental procedures to be a risk for HCV in Egypt or elsewhere *(Habib et al., 2001* and *Enomoto et al., 2001)*.

In our finding exposures to surgery and history of schistosomiasis showed low association with Anti-HCV, while the community exposures to blood donation and alcohol consumption did not show any association with Anti-HCV. *Mohlman et al (2015)* reported a non-statistically significant association between HCV positivity and blood donation. However, many other studies reported that there is a relation between these risk factors and increasing prevalence of anti-HCV *(El-Zanaty and Way, 2009*; *Kalil et al., 2010*; *Amer et al., 2015* and *Yuan et al., 2004)*.

CONCLUSION

The current study provides information on anti-HCV prevalence in the general population from Luxor Governorate, Upper Egypt. The anti-HCV prevalence in the community was 5.10% and was higher among male than female subjects. Prevalence increased with age, and there was a sharp increase after 30 years of age. Other relatively common exposures

included rate of education, blood transfusion, residence and dental treatment. HCV transmission in Egypt has reached diverse population groups including those who were not conventionally identified to be at risk of infection.

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عوامل المخاطر وإنتشار فيروس التهاب الكبد الوبائي سي بين السكان في محافظة الأقصر بمصر

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خلفيــة البحـث: فيـروس التهـاب الكبـد الوبـائي سـي (HCV) هـو واحـد مـن فيروسـات التهـاب الكبـد التـي تنتقـل عـن طريـق الـدم أو منتجاتـه. تـم توصـيف فيـروس التهاب الكبـد الوبـائي سـي كسـبب رئيسـي لمـرض التهـاب الكبـد المـزمن وسـرطان الكبـد فـي جميع أنحاء العالم.

الهـدف مـن البحـث: تهـدف هـذه الدراسـة الـى تحديـد معـدل الانتشـار المصـلي للأجسـام المضـادة لفيـروس التهـاب الكبـد الوبـائي سـي بـين السـكان فـي محافظـة الأقصـر بجنـوب مصـر وتقيـيم مـا إذا كـان هنـاك عوامـل خطرتـؤثر علـي نسـبة الإصـابة بفيـروس التهـاب الكبـد الوبـائي سـي مثـل نـوع الجـنس والمرحلـة العمريـة والتـاريخ الصحي للحالات المصابة وعوامل الخطر المختلفة الأخرى.

المرضـي وطـرق البحـث: فـي هـذه الدراسـة قمنـا بإختيـار 745 عينـة دم عشـوائة فـي الفتـرة مـن ينـاير الـى اكتـوبر 2016 لأشـخاص مـن مناطقـة متنوعـة فـي محافظـة الأقصـر بمصـر مـن أعمـار مختلفـة مـن مختلـف الأعمـار (20-65 سـنة) مـن الـذكور والإنـاث، ثـم بعـد ذلـك تـم عمـل مسـح عـن الأجسـام المضـادة لفيـروس التهـاب الكبـد الوبائي سي بإستخدام تقنية اختبار الإليزا.

النتـائج: أظهرتنتـائج الدراسـة أن 584 (40,78 ٪) مـن العينـات العشـوائية التـي تـم اختبار هـا كـانوا مـن الـذكور ومعظـم أعمـار هم تتـراوح بـين 31- 50 سـنة. بينمـا كانـت نسـبة الإنـاث مـن العينـات العشـوائية المختـارة للدراسـة هـي 161 (21,60 ٪) وتتـراوح أعمـار معظمهـن بـين 41- 65 عامـاً. أظهـرت النتـائج أن 32 (48,5 ٪) مـن الـذكور إيجـابين لمضـاد التهـاب الكبـد الفيروسـي سـي وأعلـى معـدل انتشـار لمضـادات فيـروس التهـاب الكبـد (22,7 ٪) للـذكور كانـت فـي الفئـات العمريـة مـن

50-41 ســـنة. بينمـــا كانـــت الإصـــابة بمضـــادات فيـــروس الإلتهـاب الكبـد الوبـائي ســـي بـــين الإنـــاث 6 أشـــخاص (3,73٪) وأن أعلـــى انتشـــار (4,87٪) لمضـــادات فيـــروس التهـاب الكبـد ســي يقـع بـين الفئـات العمريـة مـن 31- 40 عامًـا. ارتبطـت أربعـة عوامـل خطـر رئيسـية للأشـخاص أصـحاب العينـات العشـوائية المصـابين بفيـروس الإلتهـاب الكبـد الوبـائي سـي تعكـس آليـات عاليـة لإنتقـال الفيـروس، هـذه العوامـل تشـمل الإقامـة فـي منطقـة ريفيـة ، عـدم التعلـيم ، التعـرض لنقـل الـدم وزيـارة عيـادات الاسـنان. التعـرض للجراحـة والإصـابة بالبلهارسـيا أظهـرت ارتباطًـا منخفضًـا بمخـاطر انتقـال فيروس التهاب الكبد الوبائي سي.

الإستنتاج: أجريـت هـذه الدراسـة لتحديـد معـدل انتشـارالتهاب الكبـد الوبـائي سـي بـين الأشـخاص الـذين يقطنـون فـي محافظـة الأقصـر - مصـر ،وكذلك عوامـل انتشـارها. نأمـل أن تكـون هـذه النتـائج إضـافة إلـى النتـائج السـابقة والتـي تتنـاول العوامـل ونسـب إنتشار فيروس التهاب الكبد الوبائي سي في مصر.