Seroprevalence of Hepatitis C Virus among Population in Luxor Governorate, Egypt

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.

Aim: 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.

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

Results: Our results show that 584 (78.40 %) of the community were males and most of them were 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%) 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, history of schistosomiasis show low association with Anti-HCV. Among the community exposures, including blood donation and alcohol consumption but these associations are not important.

Conclusion: This study has been conducted to determine the prevalence rate of anti-HCV among community in Luxor governorate, Egypt. It is our hope that the data genarated will be an addition to the existing pool of HCV data available in the Egypt.

Keywords: Hepatitis C Virus; Antibody; Prevalence; Luxor; Risk factors

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Abbreviations: HCV: Hepatitis C Virus; EDHS: Egyptian Demographic Health Survey; EHIS: Egypt Health Issues Survey; PAT: Parenteral Antischistosomiasis Therapy; ELISA: Enzyme Linked Immunosorbent Assay

Introduction

Hepatitis C virus (HCV), was first identified in 1989 [1], it is a spherical, enveloped, single stranded RNA virus belongs to Flaviviridae family and having humans and chimpanzees as the only species vulnerable to its infection [2,3]. There are at least 7 genotypes and more than 67 subtypes of HCV were identified, the different HCV genotypes have different distribution [4]. HCV Genotype 4 is the predominant genotype being isolated from up to 91% of HCV-infected persons in Egypt [5].

HCV is a global public health problem, there are about 130 to 150 million people suffer from chronic HCV [6]. 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 [6,7].

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 [8,9].

HCV is a blood borne virus and absent from most body fluids except those contain blood. There are many risk factors contribute for the bulk of HCV transmission worldwide which are as follows: blood transfusions from unscreened donors, unsafe therapeutic injections, reuse of contaminated medical equipment, injection drug use and other healthcare related procedures [10]. In Developed countries have accumulated evidence that the predominant source of new HCV infections within their borders over the past few decades is injection drug use. Most developing countries, 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 [11].

Contaminated injection equipment appears to be the major risk factor for HCV transmission in several countries [12]. Catching HCV infection after the age of 40 may be associated with a more rapid progression of liver injury, as well as male gender [13]. Children appear to have a lower risk of disease progression [14]. Alcohol consumption increases HCV replication, enhances the progression of chronic HCV, and accelerates liver injury [15]. 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 [16].

Acute HCV infection is often difficult to detect given the stigmatization of risk groups and the generally asymptomatic nature of early infection [17]. HCV is not transmitted through casual contact such as sharing food or drinks with an infected person, kissing, and hugging. Also, it is not transmitted through breast milk [6].

Our study is 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, as primary prevention of HCV infection is to check transmission of virus unknowingly by apparently healthy individuals who are asymptomatic.

Materials and Methods

Study area and data collection

This study has been conducted from January through October 2016. The study has been carried out in Luxor governorate, Egypt. The population were males and females over 20 years old. They were randomly selected. Consent forms were prepared and approval of all subjects included in the study were obtained before blood was taken. In addition to the blood samples, all individual were interviewed and a questionnaire was filled to obtain information on age, place of living, education and other health care history. A total of seven hundred and forty five blood samples were collected for the study.

Collection and processing of blood samples

Blood samples were collected from each subject by venepuncture of the cubital veins. The site was cleaned thoroughly using 70% isopropyl alcohol in water and 1% iodine for one minute and allowed to dry. Taking precautions to avoid contamination of the site, about 3 milliliters of blood was collected using a sterile syringe and needle and dispensed into clean plastic. The blood samples were centrifuged at 4000 rpm for 10 minutes, and the serum obtained was stored at -20°C.

All serum samples were transported to the virology laboratory of botany and microbiology department, Al-Azhar university, Assiut branch; where all the processing has been carried out.

Serum Markers for HCV infection

Anti-HCV is studied using third-generation ELISA tests (Ortho Diagnostics, Raritan, NJ, USA; and Abbott Diagnostics, North Chicago, IL, USA). Results are read using EL x 800 universal microplate reader, (Biotek Instruments Inc.). All positive samples were retested using the same method (double ELISA).

Data analysis

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

Results

A total of 745 blood donors were included in the study. Their ages ranged from 20-65 years old. Out of the 745 population tested for anti-HCV, 584 (78.40 %) are males whereas 161 (21.60 %) are females. More than sixty six percent (66.16%) of the subjects are aged 31-50 years, while those aged ≤30 and ≥51 years are comparatively few (17.32% and 16.52 % respectively) (Table1). These observed differences are high statistically significant.

Gender specific prevalence of anti-HCV antibodies

Out of the 745 serum samples, 38 tested positive, implying an overall prevalence of 5.10 %. Thirty two (5.48%) of the 584 male subjects tested positive while 6 (3.73%) of the 161 female subjects tested positive (Table 2). This gender related prevalence of anti-HCV antibodies are high statistically significant (p =0.000**).

Age with gender specific prevalence of anti-HCV antibodies.

The seropositive cases related to age and genders are showed in Table 3. In 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 from 20-30 and 31-40 years show lowest prevalence of anti-HCV (2.60 % and 5.31 % respectively). In females predominant cases are 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 show lowest prevalence of anti-HCV (0 % and 3.03 % respectively). These observed differences are not statistically significant.

Many healthcare exposures are 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 & Figure 1). The strongest 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 none 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 the same: 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 Anti-HCV. Surgery related prevalence of anti-HCV antibodies are high statistically significant (P= 0.000**), while observed differences of history of schistosomiasis are not statistically significant (P = 251). Among the community exposures, including blood donation and alcohol consumption but these association are not important (Table 4 & Figure 2).

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

Age (Years)	Gender		Total, n (%)	Significance	
	Male, n (%)	Female, n (%)		$\chi 2$	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	>0.000**
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.

Gender	Anti- HCV		Total, n (%)	Significance	
	Positive, n (%)	Negative, n (%)		$\chi 2$	p value
Male	32 (5.48 %)	552 (94.52%)	584 (100%)		
Female	6 (3.73%)	155 (96.27%)	161 (100%)	14.55	0.000**
Total, n (%)	38 (5.10%)	707 (94.90%)	745 (100%)		

** high significant

Table 3: Gender and age specific Prevalence of Anti-HCV antibodies.

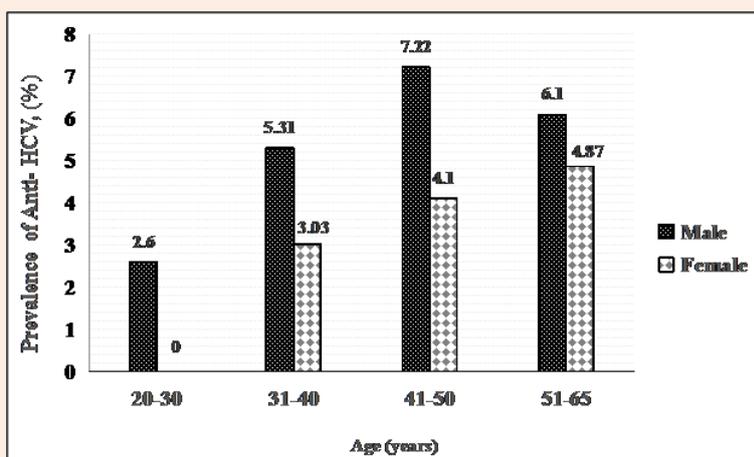| Age	Anti- HCV Positive, n (%)		Total, n (%)	Significance	
	Male	Female		χ^2	p value
20-30	3 (2.60%)	0 (0 %)	3 (2.32 %)		
31-40	11 (5.31%)	1 (3.03%)	12 (5.00 %)		
41-50	13 (7.22%)	3 (4.10%)	16 (6.32 %)	2.03	0.566 n.s.
51-65	5 (6.10%)	2 (4.87%)	7 (5.70 %)		
Total, n (%)	32 (5.48 %)	6 (3.73%)	38 (5.10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

n.s.= non significant

Figure 1: Gender and age specific Prevalence of Anti-HCV antibodies.

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

Risk factors	Participants, n (%)			Anti- HCV Positive, n (%)			χ2	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	0.000**
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	0.000**
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	0.000**
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	0.000**
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	0.560n.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
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 [18]. 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 [19]. 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 [20].

This study is performed in Luxor governorates of Egypt, where most of population live in rural regions. The present study documents small prevalence of HCV infection (5.10 %) in the study area as compared with other region in Egypt. Our results confirm findings in previous studies estimate 9% prevalence in Upper Egypt as compared 24% prevalence in the Nile Delta [21,22].

Among 745 samples tested, 584 (78.40%) are males and remaining 161 (21.60%) are females. The seroprevalence is higher among male 32 (5.48 %) as compared to female 6 (3.73%), these results agree with EHIS 2015, estimate that the prevalence of HCV among males are more than females, and to findings of

Vallab Ganesh Bharadwaj et al 2014., who also report higher prevalence of HCV in male (0.7%) as compared to female (0.66%) [23]. This male preponderance is explained by high exposure level pertaining to various risk factors of HCV transmission due to their lifestyle. These findings are not consistent with other studies where prevalence of anti-HCV antibody is higher among female as compared to male [24,25].
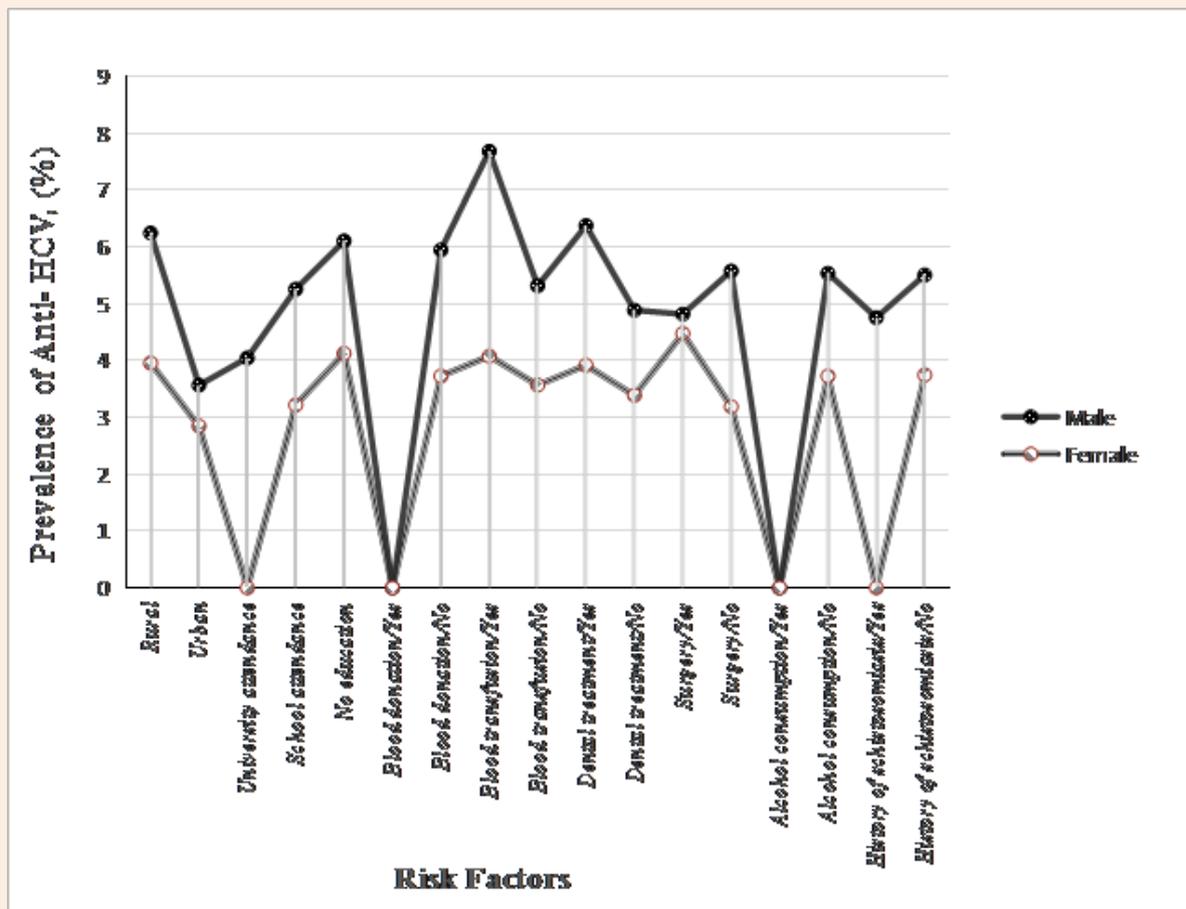

Figure 2: Risk factors related prevalence of anti-HCV antibodies.

Current study estimats that, the seroprevalence of HCV among older age groups is much higher than the younger ones. The seropositive cases in current study remain higher in 41-50 years followed by 51-65 years in males whereas in females predominant cases are in 51-65 years followed by 41-50 years. Various other studies have also demonstrated high seroprevalence of anti-HCV antibody among adult population [23,26,27].

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. [28] report that community who born after 1980 have modest to low exposure to risk factors such as PAT, blood transfusion and blood donation [28]. However, the association between aging populations and increased healthcare utilization [19], which in turn increase the risk for HCV transmission, and the high HCV positivity prevalence among individuals born before 1960 suggest that the latter cohorts may substantially contribute to the ongoing HCV transmission in Egypt [29].

In our study, prevalence of anti-HCV is 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 is similar to multiple studies conducted in rural areas of Delta governorates which show a prevalence ranging from 14.4 to 18.5% [21,30-32].

Also, we documente that a low level of education is associated with a higher seroprevalence of HCV infection, it is found that it is

higher in illiterate people (5.61 %) while it is much lower among people who have completed secondary education and higher education (5.15 % and 3.82 % respectively). These findings agree with what El-Zanaty & Way, 2009, report about the relation between educational level and HCV prevalence, it is found that it is higher in illiterate people (14.5%) while it is much lower among people who have completed secondary education and higher (4.1%) [19].

In a developed country, the risk factor of transmission through blood transfusion has greatly diminished with the introduction of effective screening. However, blood transfusion remains 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 [11]. In our study, we find that seropositive cases of Anti-HCV are more common in those who have received a blood transfusion than in those who have not (5.68 % and 5.02 % respectively). These results agree with Somaia et al. [33], report that anti-HCV antibody positive patients received blood transfusion more frequently than HCV antibody-negative patient [33].

In the present study, we demonstrate that the seropositive cases of anti-HCV remain highest 5.80 % in people who underwent dental treatment as compared with 4.14 % in people who did not undergo dental treatment. Various other studies report that, there is evidence of ongoing HCV incidence at dental and medical facilities [34,35], Although most studies have not found dental procedures to be a risk for HCV in Egypt or elsewhere [36,37].

In our finding exposures to surgery and history of schistosomiasis show low association with Anti-HCV, while the community exposures to blood donation and alcohol consumption do not show any association with Anti-HCV. Mohlman et al. [28] reported that not a statistically significant association between HCV positivity and blood donation [28]. However, many other studies reported that, there is relation between these risk factors and increasing prevalence of anti-HCV [19,34,38,39].

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 is 5.10% and is higher among male than female subjects. Prevalence increases with age, and there is 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 are not conventionally identified to be at risk of infection.

Recommendations

a. HCV prevention in Egypt must be a national priority.

b. Scientific research needs to be expanded to measure current HCV incidence rate and identify precisely the modes of HCV transmission in medical care, community, and house-hold settings.

c. Blood screening should take place carefully to reduce the number of transfusion.

d. Patient infected with HCV needs to be counseled to reduce the risk of HCV transmission to other persons.

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