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Revisiting the Epidemiology of Viral Hepatitis C in Rural Areas in Egypt: Results from a Screening Campaign

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Abstract

Background: Egypt has the highest known prevalence of HCV in the world, a problem which represents a major challenge to healthcare policymakers in the country.

Aim of Study: This study aimed to highlight on the prevalence of HCV infection in rural areas of this country and to clarify the association between different risk factors and the prevalence of HCV infection.

Material and Methods: A screening campaign was conducted in five villages present in rural Menoufia Governorate. Blood samples from consented participants were tested for HCV antibodies. For assessment of the contribution of different risk factors with hepatitis C infection, we interviewed participants to complete the study questionnaire. Results were tabulated and analyzed by suitable statistical tests to assess the prevalence of HCV infection in these areas and possible risk factors that are significantly associated with infection.

Results: Out of 14000 participants, 14.8% (n=2071) of the screened sample tested positive for HCV antibodies. Various risk factors were significantly associated with higher risk for acquiring HCV including parenteral antischistosomaiasis therapy, invasive medical procedures and other important risk factors.

Conclusion: One of each six in the population of rural Menoufia is seropositive for HCV. Our results thus confirm the severity of the current disease burden in the Nile Delta of Egypt. There are significant risk factors associated with HCV infection, suggesting the need for more strict infection control measures specially upon using invasive medical procedures.

Key Words: *Hepatitis C – Prevalence – Epidemiology – Risk factors – Egypt.*

Introduction

SINCE its discovery in 1989 **[1]**, hepatitis C virus (HCV) has emerged as a global concern for health authorities all over the world. The global prevalence of HCV infection in the year 2015 was 1.0%, with the highest prevalence in the Eastern Mediterranean Region (2.3%) followed by the European one (1.5%) **[2]**.

HCV infection causes life-threatening health problems. It was estimated that the annual rates of liver decompensation, death/transplantation, and hepatocellular carcinoma (HCC) in HCV patients to be 6.37%, 4.58%, and 3.36%, respectively **[3]**.

Egypt has the highest prevalence of HCV infection, with 92.5% of patients infected with genotype 4, 3.6% patients with genotype 1, 3.2% patients with multiple genotypes, and <1% patients with other genotypes **[4-7]**.

In the year 2014, Egypt had about 125,000 viremic individuals with new diagnosis of HCV each year: 10% of those had chronic hepatitis, 30% with compensated cirrhosis, while the majority (60%) were diagnosed with decompensated cirrhosis or HCC **[8,9]**.

This high prevalence of HCV in Egypt has been attributed to the 1960s-1980s mass treatment campaigns of schistosomiasis **[10,11]**. The government that considered the eradication of endemic schistosomiasis a national health priority led mass treatment campaigns along the country using a multiple-dose regimen of Parenteral Antischistmisasis Therapy (PAT). With inadequate sterilization of used needles and syringes; this nationwide health promoting campaign ended with a catastrophic resulting spread of HCV infection that replaced schistosomaiasis as the predominant cause of liver disease in Egypt **[10,11,12]**. Frank and colleagues described this as the largest known iatrogenic blood-borne epidemic along history **[10]**.

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Although the use of PAT discontinued in 1982 after the availability of Praziquantel, an oral anti-schistsomiasis drug [10], PAT-related epidemic led to a consequent spread by other modes of transmission that is responsible for the high current prevalence rate.

In 2008, a Demographic and Health Survey (DHS) was carried out in Egypt, providing for the first time a unique opportunity for HCV antibody testing on a nationwide representative sample of individuals (6052 women and 5074 men). It showed that 10% of the population aged 15-59 years had a chronic infection, which after inclusion of older age groups adds up to around 6 million chronic infections throughout the country [13,14]. Men were more likely to be infected than women, and infection increased sharply with age, with higher prevalence in rural than urban areas.

Several studies showed a variable geographic distribution of the disease in Egypt, with rural areas having higher prevalence rate than urban areas (12 versus 7%) [15]. The Nile Delta is reported as having the highest prevalence along the country. In a large study in the Nile Delta in 1996, a sero-prevalence of 24% and viremic prevalence of 15% among 3,999 examined adults and children, with sero-prevalence in adults >40% [16]. This geographic distribution is thought to be related to the pattern of PAT campaigns and distribution of schistosomiasis in the country [10].

Most of the previously conducted studies addressed certain populations e.g. blood donors. However, there is a lack of community-based studies that is focused on a certain group of the population [17]. Such community-based studies are required to give more accurate data about the burden of the disease [17].

This study, which comes as part of a community screening campaign, would highlight on the prevalence of HCV in rural areas of Menoufia, a governorate present in the Nile Delta of Egypt. We have also studied the association between different risk factors and the HCV infection in this population sample. This would help to provide an additional scientific document that could participate in identifying the current magnitude of such health problem in Egypt.

Material and Methods

A community screening campaign was conducted in 5 villages present in rural Menoufia, Egypt. Menoufia governorate is situated in the Nile delta of Egypt during 2019 and has a total population of about 2.3 million [18]. The governorate is divided into administrative subdivisions with a main city center and accompanying villages for each subdivision. Screened villages were selected using a multistage random sampling technique that yielded (Zewair, Met-Khakan, Dabayba, Met Abo-Sheikha and Shobra-Bass).

All residents in selected villages were invited to participate in the screening campaign with the aim of hepatitis C detection. This was announced in local media where participation was encouraged by local civil communities and religious representatives in these villages. Centers for data collection were established in each village with the aid of volunteering local communities. Participants were informed about the objectives and general methodology and were consented for participation in the screening study.

A blood sample was obtained from each participant and screening was performed using Enzyme-Linked Immunosorbent Assay (ELISA). Participants who were seropositive for HCV antibodies were referred for further diagnostic evaluation using confirmatory PCR for HCV, liver tests, kidney functions tests and ultrasonography of the abdomen.

A team of health professionals was trained to standardize the data collection procedures during the campaign. For assessment of associated risk factors, the team interviewed participants and completed a well-structured questionnaire. Participants who approved being screened for HCV but refused the interview were reported only in the overall prevalence but were excluded from the remaining data analysis. To facilitate the presentation of data, participants were classified into 2 groups; questionnaire-respondents (QR group) who completed the study questionnaire; and questionnaire-non-respondents (QNR group) who refused the interview. All participants including the QR group and QNR group were presented using the term (ELISA group).

Information obtained during the interview included sociodemographics of participants; brief past-medical history; history of risk factors commonly associated with HCV infection and answers to questions assessing the level of knowledge regarding the modes of transmission and available treatment options for HCV. The used questionnaire was developed after comprehensive literature review and was pilot studied on 30 participants for assessment of its clarity, language and duration. Statistical analysis was performed using IBM SPSS v.24 for windows. The significance of difference

between studied categorical variables was tested using Pearson's chi-square test. A p-value of less than 0.05 was considered statistically significant.

Results

Respondents:

14965 participants were screened for hepatitis C antibodies (ELISA group); of which 93.6% (n=14000) completed the study questionnaire (QR Group). 6.4% (n=965) refused participation in the campaign's accompanying interview and were excluded from the risk factors analysis, Table (1).

Prevalence and risk factors:

HCV tested positive in 14.8% (n=2071) of the screened sample. For participants who completed the questionnaire, a significant association was found between having HCV antibodies and illiteracy. Also, a similar association was found with participants who were between 20-39 years old. Interestingly, those who were single had significantly lower prevalence than participants with a history of marriage, Table (2).

Participants with a history of multiple syringe use were more likely to have HCV than those without. HCV infection was also significantly higher in those with a history of circumcision, Table [3]. Within the circumcised group; participants whose circumcision was done by a non-physician were more likely to test positive for HCV than those who were circumcised by a doctor (35.6% vs. 18.7% *respectively, p<0.05), Table (3).

Medical procedures that were more likely to be associated with HCV infection were tooth extraction, surgical operations, endoscopy and history of receiving blood transfusion.

Significantly higher prevalence was found in those with past history of fatty liver and in participants with past history of schistosomiasis. Parenteral anti- schistosomiasis treatment was associated with significantly higher likelihood of having hepatitis C, Table (3).

Knowledge:

54.8% (n=403) of surveyed sample had misconceptions about the mode of transmission of HCV while 31.6% (n=232) showed good knowledge regarding the treatment options present for the disease. Fig. (1), shows the information required about HCV that should be targeted in awareness campaigns according to participants responding to the study questionnaire.

Table (1): Sociodemographic characteristics for all the participants in the study.

Socio demographic data	N	%
Gender:		
Males	5902	42.2
Females	8098	57.8
Age group:		
<20 years	3112	22.3
20-<40 years	5544	39.6
40-<60 years	4752	33.9
≥60 years	582	4.2
Village:		
Zewair	2866	20.5
Met-Khakan	3497	25.0
Dabayba	5364	38.3
Shobrabas	1570	11.2
Met-Abosheikha	703	5.0
Occupation:		
Student	2639	18.9
Worker	6332	45.2
Employee	2599	18.6
Medical/Paramedical	2188	15.6
Unemployed	181	1.3
Others (child below school age)	61	0.4
Marital status:		
Single	3657	25.5
Married	9701	69.3
Divorced	35	0.2
Widow	697	5.0
Educational level:		
Illiterate	4022	28.7
Basic education	2863	20.5
Secondary education	5549	39.6
University degree	1566	11.2

Table (2): Association between different variables and HCV seropositivity.

Demographic data	Positive 2071 N (%)	Negative 11929 N (%)	OR (95% CI)	p-value
Gender:				
Males	893 (15.1%)	5009 (84.9%)	1.05	0.35*
Females	1178 (14.5%)	6920 (85.5%)	(0.95-1.15)	
Age group:				
<20 years	413 (13.2%)	2709 (86.8%)		0.00001 *
20-<40 years	771 (13.9%)	4773 (86.1%)		
40-<60 years	769 (16.2%)	3983 (83.8%)		
≥60 years	118 (20.3%)	464 (79.7%)		
Marital status:				
Single	519 (14.6%)	3048 (85.4%)	1.03	0.636
Previously married	1552 (14.9%)	8881 (85.1%)	(0.92-1.14)	
Occupation:				
Medical/ Paramedical	21 (11.6%)	160 (88.4%)	1.33 (0.84-2.09)	0.223
Others	2042 (14.8%)	11716 (85.2%)		
Level of educational:				
Illiterate	3436 (85.5%)	581 (14.5%)		0.825
Basic education	2445 (85.4%)	418 (14.6%)		
Secondary education	4719 (85.0%)	830 (15.0%)		
University degree	1326 (84.7%)	240 (15.3%)		

* Pearson's Chi-Square Test.
p-values in bold are statistically significant.

Table (3): Association between medical history-related risk factors and HCV seropositivity.

Risk factors	Positive 2071 N (%)	Negative 11929 N (%)	OR (95% CI)	*p*-value
Unintentional needle rick:				
Yes	1041 (14.7%)	6038 (85.3%)	0.99 (0.89-1.08)	0.79
No	1030 (14.9%)	5891 (85.1%)		
Tattooing:				
Yes	26 (16.0%)	136 (84.0%)	1.1 (0.72-1.68)	0.73
No	2045 (14.8%)	11793 (85.2%)		
Ear piercing:				
Yes	1113 (14.7%)	6480 (85.3%)	0.98 (0.89-1.07)	0.64*
No	958 (15.0%)	5449 (85.0%)		
Circumcision:				
Yes	1908 (14.9%)	10901 (85.1)	1.1 (0.93-1.31)	0.28
No	163 (13.7%)	1028 (86.3%)		
Family member with HCV:				
Yes	954 (15.4%)	5249 (84.6%)	1.09 (0.99-1.19)	0.08
No	1117 (14.3%)	681 (85.7%)		
Multiple syring use:				
Yes	163 (15.7%)	875 (84.3%)	1.08 (0.91-1.28)	0.42
No	1908 (14.7%)	11054 (85.3%)		
Tooth extraction:				
Yes	1409 (14.2%)	8482 (85.8%)	0.87 (0.78-0.96)	0.005*
No	662 (16.1%)	3447 (83.9%)		
Hospital admission:				
Yes	885 (50.7%)	859 (49.3%)	9.62 (8.6-10.75)	0.49*
No	1186 (9.7%)	11070 (90.3%)		
Surgical operations:				
Yes	922 (15.8%)	4903 (84.2%)	1.15 (1.05-1.26)	0.004*
No	1149 (14.4%)	7026 (85.9%)		
History of CS:				
Yes	265 (4.6%)	5550 (95.4%)	0.17 (0.15-0.19)	0.0001 *
No	1806 (22.1%)	6379 (77.9%)		
Endoscopy:				
Yes	562 (55.7%)	447 (44.3%)	9.57 (8.36-10.95)	0.0001 *
No	1509 (11.6%)	11482 (88.4%)		
Blood transfusion:				
Yes	463 (33.7%)	910 (66.3%)	3.49 (3.08-3.94)	0.0001 *
No	1608 (12.7%)	11019 (87.3%)		
Previous bilharziasis:				
Yes	542 (16.7%)	2705 (83.3%)	1.21 (1.09-1.35)	0.0006*
No	1529 (14.2%)	9224 (85.8%)		
Parentral anti-bilharzial:				
Yes	201 (14.9%)	1553 (85.1%)	0.72 (0.62-0.84)	0.0001 *
No	1870 (15.3%)	10376 (84.7%)		
Renal dialysis:				
Yes	75 (73.5%)	27 (26.5%)	16.56 (10.64-25.78)	0.0001 *
No	1996 (14.4%)	11902 (85.6%)		
Cardiac catheter:				
Yes	14 (56.0%)	11 (44.0%)	7.37 (3.34-16.26)	0.001 *
No	2057 (14.7%)	11918 (85.3%)		
Organ transplantation:				
Yes	10 (62.5%)	6 (37.5%)	9.64 (3.5-26.56)	0.001 *
No	2061 (14.7%)	11923 (85.3%)		

* Pearson's Chi-Square Test. *p*-values in bold are statistically significant.

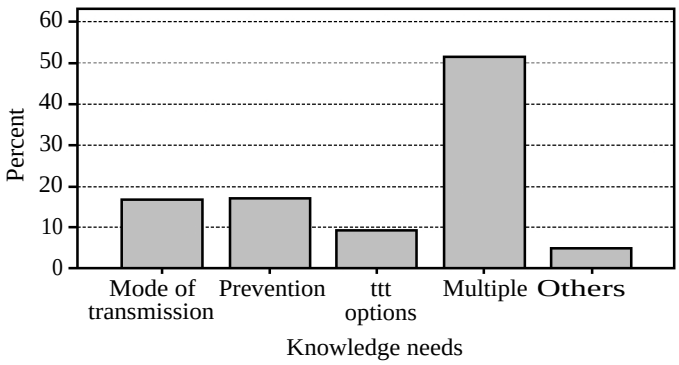

Fig. (1): Knowledge needs according to surveyed sample.

Discussion

Egypt has the highest prevalence of hepatitis C virus (HCV) infection worldwide, but has taken the largest step towards elimination of the disease so far, with treatment of the greatest number of individuals in the world with highly effective direct-acting antiviral therapy.

The current study aimed to determine the seroprevalence of HCV among five villages present in rural Menoufia Governorate. Included participants were 8098 females (57.8%) and 5902 males (42.2%). In our study, the anti-HCV prevalence was 2071/14,000 (14.8%). This is in accordance with Lehman and Wilson concluded that HCV prevalence in Egypt was around 12% when they used data collected in the same governorate (Menoufia Governorate) **[19]**. Also Silva et al concluded that HCV prevalence among populations at high risk was 14.3% **[20]**. Also Abdel-Wahab et al., concluded that Egypt has the highest prevalence of adult HCV infection in the world, averaging 15%-25% in rural communities **[21]**.

On trying to find a significant association between having HCV antibodies and certain age group, in this study the age between 20-39 years was significantly associated with having HCV infection. Fatma et al., concluded that the age between 15 up to 59 years is an important risk factor for HCV transmission **[22]**.

Also, prevalence of HCV was different in males than in females. Elsabawy et al., confirmed the fact that there is a gap between males and females according to prevalence of viral hepatitis in Egypt, where the percentage of infected males is higher than females **[23]**.

In our study, participants with a history of multiple syringe use were more likely to have HCV. This was in accordance with Celeste and Islam who concluded that (IV) injections was one of the most significant risk factors for HCV transmission **[24]**.

Also, HCV positivity in our cohort was significantly higher in those with history of circumcision. Habib et al., documented that male circumcision by informal health care provider was a risk factors for HCV transmission **[25]**.

Another significant risk factor which was strongly related to HCV infection in this cohort was illiteracy. According to the 2015 EHIS (Egypt Health Issues Survey), 22% of women and 8% of men aged between 15-59 years were illiterate **[13]**.

In this study, two hundreds and one participants (14.9%) of those who tested positive for HCV antibodies had history of previous parenteral treatment for shistosomiasis. Van-Lume et al., concluded that HCV infection rates in schistosomiasis treated populations range from 1% in Ethiopia to 50% in Egypt **[26]**. El-Sadawy M et al., concluded that the prevalence of HCV infection in Sharkia Governorate is estimated to range from 4.8% among people younger than 20 years old to 41.9% among those over 40 years old, with an average prevalence of 25.8%. The significant predictors of HCV infection, were previous parenteral therapy for Schistosomiasis among those over 20 years old, blood transfusion, invasive procedures (surgery and endoscopy) and use of contaminated syringes as well as shaving at community barbers **[27]**.

In our study, 54.8% (n=403) of surveyed sample had misconceptions about the mode of transmission of HCV. In Doa'a et al., study, over 45% of the participants did not know about viral hepatitis disease manifestations, and 22% did not know the causes of HCV infection. Among those who knew that it is a virus, 81% mentioned incorrect modes of transmission **[28]**.

Conclusions:

HCV infection is a major health problem in Egypt. Routes of transmission and risk factors for this infection are well established. All efforts should be exerted to bring HCV disease to an end. Our study revealed that participants from rural villages in Egypt, were unaware of the routes of transmission for this virus and suffered from profound misconceptions The results of this study may supply important information that may be used to improve training of healthcare workers and agricultural extension workers, both of whom could play a greater role in educating the Egyptian population about major risk factors for HCV transmission.

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إعادة النظر فى وبائيات الإلتهاب الكبدى الفيروسى سى فى المناطق الريفية فى جهورية مصر العربية (نتائج من حملة لمسح انتشار الفيروس)

إن جمهورية مصر العربية لديها أعلى معدل انتشار معروف لمرض الإلتهاب الكبدى الفيروسى سى فى العالم، وهى مشكلة تمثل تحدياً كبيراً لواضعى سياسات الرعاية الصحية فى البلاد.

وتهدف هذه الدراسة: إلى تسليط الضوء على إنتشار عدوى فيروس الإلتهاب الكبدى سى فى المناطق الريفية من هذا البلد وتوضيح العلاقة بين عوامل الخطر المختلفة وإنتشار الإصابة بفيروس الإلتهاب الكبدى سى. وقد أجريت حملة فحص فى خمس قرى موجودة فى محافظة المنوفية الريفية. وتم اختيار عينات الدم من المشاركين بعد أخذ موافقتهم لفحص الأجسام المضادة لفيروس الإلتهاب الكبدى سى. وكذلك لتقييم مساهمة عوامل الخطر المختلفة فى الإصابة بالإلتهاب الكبدى الفيروسى سى، حيث تم مقابلة المشاركين لإستكمال الاستبيان المستخدم فى هذه الدراسة لتقييم عوامل الخطر للإصابة بفيروس الإلتهاب الكبدى سى. ومن ثم تم جدوَلة النتائج وتحليلها عن طريق اختبارات إحصائية مناسبة لتقييم مدى انتشارعدوى فيروس الالتهاب الكبدى سى فى هذه المناطق وعوامل الخطر المحتملة المرتبطة بشكل كبير بحدوث العدوى. وقد وجد أنه من بين ١٤٠٠٠ مشارك فى الدراسة، ١٤.٨٪ (٢٠٧١) من عينات الدم التى تم فحصها إيجابية للأجسام المضادة لفيروس الإلتهاب الكبدى سى. وارتبطت عوامل الخطر المختلفة بشكل كبير مع ارتفاع خطر أكتساب فيروس الالتهاب الكبدى سى ومن بين عوامل الخطورة العلاج المضاد للبلهارسيا عن طريق الحقن الذين أعطى للمرضى فى الماضى، والإجراءات الطبية الغازية وعوامل الخطر الهامة الأخرى وقد استخلصت هذه الدراسة أنه واحد من كل ستة من سكان الريف بمحافظة المنوفية يكون إيجابى المصل لفيروس الالتهاب الكبدى سى. وتؤكد نتائجنا شدة عبء المرض الحالى فى دلتا النيل فى جمهورية مصر العربية. هناك عوامل خطر كبيرة مرتبطة بعدوى فيروس الالتهاب الكبدى سى، مما يشير إلى الحاجة إلى اتخاذ تدابير أكثر صرامة للسيطرة على العدوى خاصة عند استخدام الإجراءات الطبية الغازية.