

**FREQUENCY AND RISK FACTORS OF HEPATITIS C INFECTION AMONG A SAMPLE  
OF EGYPTIAN SUBJECTS AN OBSERVATIONAL CROSS SECTIONAL STUDY**

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**Abstract**

Introduction: Hepatitis C infection is an epidemic disease that has different routes of infection. Egypt is among the three highest countries reported with the disease; the prevalence is 14.7%. Aim of the study: was to measure the frequency and the risk factors of Hepatitis C infection among a sample of Egyptian subjects seeking dental care. Subjects and methods: three hundred and eighty four outpatients of the diagnosis clinic in the Faculty of Oral and Dental Medicine, Cairo University were surveyed using a questionnaire for assessment of risk factors of HCV infection. Patients who reported exposure to one or more risk factors were subjected to a screening test using ELISA. Results: Seventy-nine patients reported exposure to one or more risk factors. The extra oral surgery was the most common risk factor (73%), followed by blood / blood products transfusion (7.5%). ELISA test was positive in 7 patients among the 79 patients who reported exposure to risk factors. The most common risk factors associated with positive anti-HCV antibodies were parental antischistosomal therapy (PAT) (OR=62.6667), abnormal alanine aminotransferase (ALT) (OR=49.8667) levels, extra-oral surgeries (OR=38.3529) followed by infected needle stick injury (OR=31.25) and blood transfusion (OR=12.4). Conclusion: it was concluded that a history of PAT remains a risk factor associated with positive anti-HCV antibodies, even after controlling unsafe parenteral therapy. More attention should be paid to infection control measures in health care settings in order to reduce the transmission of HCV infection.

**Keywords:** HCV, HCV epidemiology, Egyptians, HCV transmission, HCV risk factors, HCV manifestations, HCV diagnosis, HCV prevention.

## **Introduction**

Screening for HCV is recommended in populations depending on demography, previous exposures, high-risk behaviors, and medical conditions (*Centers for Disease Control and Prevention (CDC) 1998; Smith et al. 2012; Moyer 2013*). Individuals recommended for HCV testing should first be tested for anti-HCV (*Alter, Kuhnert, & Finelli, 2003; Center for Disease Control & Prevention (CDC), 2013*). A positive anti-HCV result indicates either current active HCV infection (acute or chronic), past infection that has resolved, or a false-positive test result (*Pawlotsky, 2002*). HCV nucleic acid test (NAT) to detect viremia is necessary to confirm HCV infection and guide clinical management, including initiation of HCV treatment (*Kdigo 2008*).

An estimated 130–170 million people, i.e. about 3% of the world's population, are chronically infected with HCV and over 350,000 patients die from the HCV-related liver diseases annually which include liver cirrhosis and hepatocellular carcinoma (HCC) (*WHO 1999b; WHO 2011*).

HCV prevalence as measured by the Egyptian Demographic Health Survey (EDHS) was 14.7% among a nationally representative sample of 11,126 Egyptians aged 15–59 years old (*El-Zanaty & Way, 2009*). According to the studies conducted among the general populations, the prevalence of HCV varied from 13 to 22% (*Paez Jimenez et al., 2010; Tabll et al., 2011*). It had been confirmed that Egypt's hepatitis C epidemic originated in the 1960s and 1970s during a mass campaign of parenteral antischistosomal therapy (PAT) using improperly sterilized glass syringes (*Maegraight, 196; Frank et al., 2000*). Today, HCV infection and its complications are among the leading public health challenges in Egypt (*Miller & Abu-Raddad, 2010; Mohamoud et al., 2013*).

The aim of the present study was to measure the frequency and the risk factors of Hepatitis C infection among a sample of Egyptian subjects seeking dental care.

## **Subjects and Methods**

A simple random sample of 384 adult outpatients with age ranging from 18 to 60 years, attending the Diagnosis clinic at the Faculty of Oral and Dental medicine Cairo University, was recruited. Randomization was done by second party (screening officer) in the Diagnosis clinic, at the Faculty of Dentistry, Cairo University in order to avoid selection bias. The Ethical Committee of the Faculty of Oral and Dental Medicine, Cairo University approved the study. The aim of the study and its benefits were explained to each participant

with emphasis on confidentiality of the collected data. Each participant signed an informed consent before being enrolled in the study.

The participants were assessed using risk factor questionnaire that includes the following risk factors for Hepatitis C infection: individuals with persistently abnormal alanine aminotransferase (ALT) levels, those born to HCV-positive women, persons who ever injected illegal drugs, including those who injected once or a few times many years ago and don't consider themselves as drug users, living together for >1 year and sharing bathroom items with HCV-infected individuals, living together for >1 year and sharing bathroom items with individuals who inject illegal drugs, needlestick injury in HCV-endemic country (Egypt), having received blood or blood products in Egypt, subjected to extra-oral surgeries, haemodialysis patient, haemophilia patient, subjected to major oral surgical procedures in Egypt and subjected to parenteral antischistosomal therapy (PAT) in the 1960s and 1970s in Egypt (*Centers for Disease Control and Prevention (CDC) 1998b; Zuure et al. 2010*).

Patients with at least one risk factor was subjected to a screening test for anti-HCV namely enzyme-linked immunosorbent assay (ELISA test) in the clinical laboratory at the Faculty of Medicine, Cairo University (*bioelisa HCV 4.0, Code: 3000-1115, 96 tests*). Those with positive results were informed of the necessity to carry out polymerase chain reaction test (PCR) to confirm the diagnosis of HCV infection.

The primary outcome was the estimation of the frequency of HCV infection among patients who were exposed to one or more risk factors. The secondary outcome was the identification of the potential risk factors for HCV infection among a sample of outpatients in Faculty of Oral and Dental Medicine Cairo University.

Sample size calculation revealed that a total sample size of 384 was satisfactory to obtain confidence coefficient 95% and 5% margin of error ( $\alpha=0.05$ ) ( Bartlett et al. 2001, Vanvoorhis & Morgan, 2007).

Statistical analysis was done using Statistical Package for Social Sciences, Version 21.0 (SPSS, IBM) for Windows. Continuous variables were analyzed as mean values  $\pm$  standard deviation (SD) or median (range) as appropriate. Percentages were calculated for categorical data. Odds ratio (OR) and 95% Confidence interval were estimated to know the relationship between an outcome and certain factors.

## Results

The total number of patients with risk factors was 79 patients (20.05%). Their mean age was  $39.61 \pm 13.73$ . About 57% of the patients were females, while 43% were males. Regarding the marital status, 77% were married and 23 % were single. Patients who received no education were 50.6%, while 49.4% were educated. Regarding the level of education, 12.82% went to college, 66.67% received high school education, while 20.51% went to school. The majority (91%) of patients were from Lower Egypt (Table 1).

Regarding the frequency of the risk factors among the 79 patients, extra oral surgery was the most common (73%), followed by blood or blood products transfusion in Egypt (7.5%). Illegal drugs injection and living or sharing bathroom items with HCV infected individuals for over 1 year and abnormal alanine aminotransferase levels; each was present in two cases (2.6%). Each of the following risk factors was present in one case (1.3%): Major intra-oral surgery in Egypt, parental antichistosomal therapy, infected needle stick injury in Egypt. Six cases (7.8%) were associated with two risk factors, while one case (1.3%) was associated with 4 risk factors (Fig. 1).

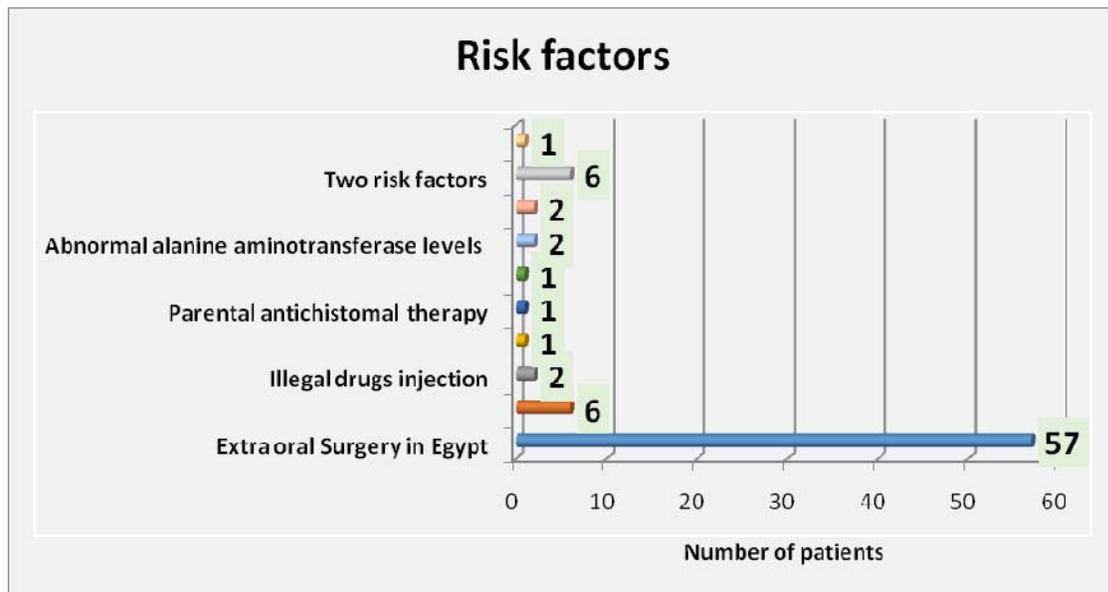


Fig. (1): Bar chart showing frequency distribution of risk factors among patients.

**Table (1) Summary of basic parameters of patients having a single<sup>#</sup> risk factor**

Risk factor	No.	Age Mean ±SD	Gender Percent (Number)	Marital status Percent (Number)	Education Percent (Number)	Level of education Percent (Number)	Birth place Percent (Number)
Extra oral Surgery in Egypt	57	39.05±13.5	Female: 58.6%(34) Male: 41.4%(23)	Married: 79.3% (45) Single: 20.7%(12)	No: 49.1% (28) Yes: 50.9% (29)	College: 17.2% (5) High school: 65.5% (19) School: 17.2% (5)	L. Egypt: 89.5% (51) U. Egypt: 10.5% (6)
Blood or blood products transfusion in Egypt	6	26.07±8.24	Female: 83.3%(5) Male: 16.7%(1)	Married: 66.7%(4) Single: 33.3%(2)	Yes 100%	High school: 83.3%(5) School: 16.7% (1)	L. Egypt
Illegal drug injection	2	22 ±1.41	Male: 100%(2)	Single	No	-----	L. Egypt
Abnormal alanine aminotransferase levels	2	42.5±14.8	Female: 100%(2)	Married	No	-----	L. Egypt
Living & sharing bathroom items with HCV infected individuals > 1 year	2	45±14.14	Male: 50%(2) Female: 50% (2)	Married	No	-----	L. Egypt
Parental antischistosomal therapy	1	47	Male	Married	No	-----	L. Egypt
Infected needle stick injury	1	36	Female	Married	No	-----	L. Egypt
Major oral surgery	1	47	Male	Married	Yes	High school	L. Egypt

*L. Egypt: Lower Egypt, U. Egypt: Upper Egypt*

*#Patients with two risk factors (6 patients) and four risk factors (1 patient) are not included in this table*

Positive ELISA test was found in 7 patients (8.9%) of those having risk factors. Their basic parameters are summarized in table (2). Among the 7 positive cases, four cases were exposed to extra oral surgery in Egypt (57.1%) and one of these two cases had PAT. Each of the following risk factors was reported in one case: blood transfusion and abnormal alanine

transferase level. One case was exposed to two risk factors namely abnormal alanine transferase levels and infected needle stick injury.

Table (2) illustrates that the highest OR was in PAT (62.6667) followed by abnormal ALT levels (OR=49.8667) then extra-oral surgeries (OR=38.3529).

**Table (2): Data related to positive ELISA cases (n=7) and odd ratios**

Parameter	Mean ±SD	Frequency*	Odd ratio	95% Confidence interval	
				Lower limit	Upper limit
Age	43.14±13.13	---	---	---	----
Gender	-----	Male: 3 Female: 4	1.425	0.3142	6.4633
Marital status	-----	Married: 7	Infinity	NaN	Infinity
Education	-----	Not educated: 6 High school: 1	4.2249	0.5021	35.5514
Birth place	----	Lower Egypt: 7	Infinity	NaN	Infinity
Regularity of dental treatment	----	Irregular: 7	Infinity	NaN	Infinity
Extraction	----	6	5.8763	0.7008	49.2741
Operative	----	1	1.0867	0.1281	9.2164
Extra oral surgery	----	4	38.3529	4.5236	325.1698
Parenteral antischistosomal therapy (PAT)	----	1	62.6667	3.4939	1123.9918
Blood transfusion	----	1	12.4	1.2512	122.8885
Abnormal alanine amino transferase level	----	2	49.8667	6.7827	366.6207
Infected needle stick	----	1	31.25	2.4834	393.2289

\*One case had both PAT and extra-oral surgery; another case had both infected needle stick and abnormal alanine aminotransferase level NaN: undefined or unrepresentable value

**Discussion**

The frequency of risk factors for transmission of HCV infection in the present study using the HCV risk factors questionnaire showed significant exposure to different risk factors among the studied population. No previous studies in the same setting were performed to determine the frequency of risk factors for transmission of HCV infection. *Medhat et al., (2002)* in a survey in Upper Egypt used an adjusted questionnaire including normal individual activities and found that endoscopy, blood transfusion and exposure to PAT

campaign had the highest rates among different risk factors for HCV infection transmission. Also *Habib et al., (2001)* in a survey in Nile Delta region used a similar questionnaire with adjustments reported high exposure rates among habitants of rural village in Nile Delta region to anti-schistosomiasis injection therapy and blood transfusion. The difference in the frequency of risk factors among studies may be related to the variation in the study setting and the included risk factors in the different surveys. The questionnaire employed in the present study was based on the most recent evidence on risk factors associated with HCV transmission in different settings, using data from Center of Disease Control and Prevention (*Zuure et al., 2010*). The majority of the included subjects were born in Lower Egypt which has lower prevalence of HCV infection according to previous studies (*Stoszek et al., 2006; El-Raziky, 2007; El-Zanaty, 2009*), this also might be a confounder for such low prevalence of HCV antibodies.

The socio-demographic data and the education level of participants who were exposed to risk factors of HCV transmission were different from previous studies in Egypt (*Habib et al., 2001; Medhat et al., 2002; el-Sadawy et al., 2004*), also different from other countries with lower HCV prevalence such as Italy and USA (*Guadagnino et al., 1997; Armstrong et al., 2006*).

Many risk factors have been accused to transmit HCV infection among Egyptian population. Regarding dental treatment as a risk factor for HCV infection transmission; the literature is full of contrary even in the same country. It was reported in Nile Delta that none of dental exposures was associated with anti-HCV (*Habib et al., 2001*). Also in Upper Egypt, no significant association between dental treatment and anti-HCV prevalence was reported (*Medhat et al., 2002a*), even in rural areas there were studies that pointed out the non-significant association between anti-HCV and dental treatment (*Arafa et al., 2005; Saleh et al., 2008*). On the other hand in another endemic country Pakistan, a study concluded that dental treatment was the main risk factor in individuals with positive anti-HCV antibodies (*Naoman et al. 2013*). In the present study only major intra-oral surgeries which includes invasive surgical procedures such as cleft palate and lip repair or plates placement were included in the risk factors questionnaire as recommended by *Zuure et al. (2010)*. The low frequency of hemophilia as a risk factor in our study may be related to the setting. Patients were recruited from the outpatient clinic while hemophilic patient doesn't frequently visit dental clinic because of their special needs that may hinder their health in general.

The present study revealed that out of 384 patients 79 (8.9%) reported the exposure to one or more risk factors. Among the 79 patients; seven patients were positive anti- HCV. Both *Nafeh et al. (2000)* and *Medhat et al. (2002)* reported a positive anti-HCV prevalence of 8.7% among a representative sample in a community in Upper Egypt, while *Saleh et al. (2008)* found that the prevalence of positive anti-HCV was 4.9% among a representative sample of pregnant women from three rural villages in Menoufia Governorate in the Nile Delta, attending community health centers (CHC) in the villages for prenatal care. *AbdulQawi et al. (2010)* reported a positive anti-HCV prevalence of 8.6% among a representative sample of pregnant women treated at Benha University. In a systematic review *Mohamoud et al. (2013)* reported a positive anti-HCV prevalence between 0- 40% among general population groups in Egypt. It is clear that a wide range in the frequency of positive HCV antibodies exists when the whole country is considered.

The present study revealed that PAT (OR=62.6667), abnormal alanine aminotransferase (ALT) levels (OR=49.8667), extra-oral surgeries (OR=38.3529), followed by infected needle stick injury (OR=31.25) and blood transfusion (OR=12.4) to be the most common risk factors associated with positive anti HCV antibodies. The findings of the present study were in agreement with *Nafeh et al. (2000)*; *Medhat et al. (2002)*; *Paez Jimenez et al. (2009)* who reported that invasive healthcare procedures were associated with increased risk for anti-HCV antibodies. Moreover the findings of blood transfusion as a risk factor for positive HCV antibodies were in agreement with *Medhat et al. (2002)*; *AbdulQawi et al. (2010)*. The finding of abnormal alanine aminotransferase (ALT) levels as a risk factor for HCV infection were also reported by *Saleh et al. (2008)*. The present study was in agreement with *Nafeh et al. (2000)*, *Medhat et al. (2002)* and *Saleh et al. (2008)* who reported that the history of PAT remains a risk factor associated with HCV infection, even after controlling of the malpractice in parenteral therapy.

However, the results of the present study didn't reveal that the injection drug users (IDUs) are at increased risk for HCV infection. This finding is in contradiction with the study of *Paez Jimenez et al. (2009)*. HCV infection of husband or other household members was not a risk factor for positive anti-HCV in our study which was in contrast to *AbdulQawi et al. (2010)*. The possible explanation of this contradiction may be related to the limited number of patients included in the study with these two risk factors.

As for the basic parameters associated with positive HCV antibodies, the present study was in accordance with *Nafeh et al. (2000)*, *Medhat et al. (2002)* and *AbdulQawi et al.*

(2010) who found that the old age and the lack of education to be associated with increased risk for positive anti-HCV. Six cases out of 7 with positive anti-HCV cases weren't educated while only one case graduated from high school. In agreement with *Nafeh et al. (2000)* a higher HCV prevalence was reported in lower Egypt compared to upper Egypt as all of the 7 positive anti-HCV were from lower Egypt. The tenable explanation for the higher prevalence of positive anti-HCV in lower Egypt in the present study may be related to the studied population where 91% of patients were recruited from Lower Egypt namely the capital "Cairo". The limitation of the present study is related to the setting that the included patients were from one governorate. Further studies with wide distribution over the country would help in identifying the different prevalence of HCV infection in Egypt.

The epidemiology of HCV infection in Egypt has not been well characterized. It is important to understand the mode of transmission of HCV among communities and health care settings in order to formulate the strategies of prevention of HCV infection in Egypt. In order to be able to control HCV infection, short-run intervention strategies and long-run prevention strategies should be applied. HCV testing in Egypt is recommended depending on demography, previous exposures, high-risk behaviors, and medical conditions. The essential resources for high-quality studies of the seroprevalence and the major modes of HCV transmission in Egypt should be made available.

Within the limitation of the present study, it could be concluded that:

- 1- Extra-oral surgery is the most predominant risk factor among the studied group followed by blood transfusion.
- 2- PAT, abnormal alanine aminotransferase levels, extra-oral surgeries followed by infected needle stick injury and blood transfusion are associated with increased risk for positive anti-HCV antibodies. PAT is still associated with an increased risk of infection.
- 3- Older age group, illiteracy as well as male gender are associated with increased risk for positive anti-HCV antibodies.

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