

PREVALENCE OF HCV INFECTION AMONG HEALTH CARE EMPLOYEE AT AL AZHAR UNIVERSITY HOSPITALS IN CAIRO, EGYPT

By

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Abstract

HCV-infection is the main cause of chronic liver disease among Egyptians, the most commonly infected population with HCV genotype 4. Evidences of HCV-transmission that are associated with health-care settings have consistently accumulated over recent years worldwide. Therefore, healthcare workers (HCWs) are the target population of the current study. The study evaluated prevalence of HCV-infection among different sectors of HCWs at Al Azhar University Hospitals. The population (n=239) were divided into four groups. G1(n=59) included healthy controls who were not working at hospitals. Other subjects (n=180) consisted three equal groups (2, 3 & 4) who were working at Al-Azhar University Hospitals. Respectively, workers, nurses and physicians presented group 2, 3 & 4 (n=60 each) from different hospital wards. Based upon duration of employment at hospitals, subjects in each of the last three groups were subdivided into 3 sub-groups (n=20 each). Risk-factors that were thought to have an impact on acquisition of HCV-infection were evaluated. The overall prevalence of HCV infection in study populations was 21.34% with the highest rate in nurses (38.3%) and workers (20%) when compared to controls (15.3%) and physicians (11.7%; P<0.05). The significantly increased HCV infection in nurses compared to physicians (P<0.05) was found during all employment periods. Needle stick injury, incidental exposure to blood and body fluid splashes were respectively prominent risk-factors among nurses (70%, 60% & 35%) and workers (35%, 21.7% & 18.3%). Nurses and hospital workers had high prevalence of HCV infection. Long duration of nurse employment was associated with increased frequency of needle sticks and subsequently high prevalence of HCV-infection, but not physicians.

Key words: Egypt, Al-Azhar University Hospitals, HCV, HCWs, Risk Factors.

Introduction

Hepatitis C virus (HCV) infection is one of the main causes of chronic liver disease worldwide (EASL, 2015). Egypt has been considered one of the most endemic countries for HCV infection. HCV prevalence among the 15-59 years age subpopulation was found to be 14.7% according to The Egyptian Demographic Health Survey (EDHS) (El-Zanaty and Way, 2009). HCV transmission was found to be higher among drug addicts, homosexuals, those who received repeated blood transfusion, unsafe medical or surgical procedures, invasive procedures such as tattooing and acupuncture, also previous history of receiving parenteral anti-Schistosomal treatment (EASL, 2015). The origin of the HCV epidemic in Egypt is believed to be related to mass anti-schistosomal parenteral treatment campaigns

conducted in the 1960s-80s using insufficiently sterilized injection material (Frank *et al*, 2000). Evidence of ongoing transmission of HCV that is associated with health-care settings has consistently accumulated over recent years (Mahmoud *et al*, 2013).

So, healthcare professionals who work in close contact with patients in Egypt are at increased risk of HCV infection and other blood borne pathogens (Lee, 2009), with an estimated annual number of 4.9 needle sticks per HCW (Talaat *et al*, 2003). There were few comprehensive studies on the current prevalence among HCWs in Egypt, with reported HCV seroprevalence ranging from 7.7% to 16.6% (Abdelwahab *et al*, 2013). HCV infection may be presented either in acute form tending to be asymptomatic or chronic form. Progression to persistent or chronic infection occurred in about three

quarters of cases with variable rates of the fibrosis progression (EASL, 2015).

This work aimed to study prevalence of HCV among health care personals at Al Azhar University Hospitals for boys in Cairo. The study extended to cover acquisition of HCV infection in association with specific risk factors and employment duration.

Patients and Methods

The study was approved by the ethical committee at Al Azhar Faculty of Medicine. A cross sectional study that included 239 subjects who were classified into 4 groups. G1: included 59 ages and sex-matched healthy individuals who were not working at hospitals and not known to have a liver disease as control group. One hundred and eighty subjects working at Al-Azhar university hospitals classified into 3 groups. G2: contained 60 medical workers from different hospital wards. G3: included 60 nurses from different hospital wards. G4: consisted of 60 physicians with different specialties. All subjects in last 3 groups were subdivided into 3 subgroups, 20 subjects each, according to the duration of their employment at hospitals as follows: subgroup a: 1 year +/-6 months, subgroup b: 3 years +/-6 months and subgroup c: 5 years +/-6 months.

Inclusion criteria: persons with mean age (18-60 years) and a written consent was signed by each participant. Exclusion criteria: Patients with known history of liver disease, immunocompromised patients (diabetic patients and patients on corticosteroids), persons with history of receiving parenteral anti-schistosomal treatment, blood transfusion, and intravenous drugs abuse, hemodialysis. The pregnant women and individuals with the history of contact to canal water were also excluded.

Study population were subjected to: 1) Full history taking with special emphasis on HCV risk factors at hospitals such as: needle stick injury, incidental blood exposure, body fluid splash, as well as, shared nail clipper, tattoo, house hold contacts with HCV and visiting dental clinics. 2) Thorough clinical examination. 3) Laboratory investigations including: liver biochemical profile: (AST, ALT, ALP, serum albumin, total bilirubin), HCV-Ab testing using 3rd generation ELISA, as well as HCV/RNA by real time PCR to confirm infection in HCV-Ab positive cases (with a detection limit of 12 IU/ml real-time PCR).

Statistical analysis: Data were analysis using SPSS software version 22. P value was considered significant at ≤ 0.05 .

Results

The demographic features of studied populations revealed male predominance (149) of the total subjects (259) (62.34%). Age mean \pm Standard Deviation of the studied subjects was 33.37 ± 8.77 years. Table 1 and figure 1 demonstrated both prevalence and distribution rates of HCV infections among all study groups. Prevalence of HCV infection was respectively 15.3%, 20%, 38.3% and 10% in controls, workers, nurses, and physicians.

Nurses showed the highest HCV prevalence compared to controls & physicians ($P < 0.05$), but not workers ($P > 0.05$). The distribution of 51 anti-HCV-IgG antibody positive subjects was respectively 17.65%, 23.53%, 45.1, & 13.73 in controls, workers nurses and physicians respectively. The highest share of HCV infection was in nurses compared to other groups ($P < 0.05$). The results are shown in tables (1, 2, 3 & 4) and figures (1, 2, 3 & 4). All subjects presented with positive anti-HCV IgG antibodies had RNA genomic viremia.

Table1. Prevalence of percent positive anti-HCV IgG antibody responses in all study groups

Anti-HCV IgG antibody results	Controls (n=59)	Workers (n=60)	Nurses (n=60)	Physician (n=60)
Anti-HCV IgG positive: n (%)	9 (15.3%)	12 (20.0%)	23 (38.3%)	7 (10.0%)
Anti-HCV IgG negative: n (%)	50 (84.7%)	48 (80%)	37 (61.7%)	53 (90%)
P value: comparing the studied 3 groups to controls		0.041	0.005	0.556

Nurses and workers had significantly increased frequency of chronic viral hepatitis by serum anti-HCV IgG antibodies compared to controls and physician ($P < 0.05$), with insignificant difference on comparing controls with physicians ($P > 0.05$).

Comparison of means \pm SD of both IgG antibody optical density (OD) values and viral loads in infected subjects of each group (9 controls, 12 workers, 23 nurses, and 7 physicians) with each other did not show any significant changes ($p > 0.05$). On the

other hand, figure 2 illustrated the comparison of ELISA OD reading of all individual subjects in different study groups. The mean ELISA OD reading of nurses was significantly higher compared to the other study groups ($P < 0.05$).

Table 2: Anti-HCV IgG antibody ELISA OD reading & HCV SRT-PCR subjects presented with positive serology in all groups

Groups (# of anti-HCV IgG Abs positive subjects in each group)	ELISA OD Reading Mean \pm SD	HCV-RNA PCR Mean \pm SD
Controls (n=9)	0.6002 \pm 0.1935	1,240,263 \pm 925221.01020
Workers (n=12)	0.5718 \pm 0.1638	658302.681 \pm 658302.6810
Nurses (n=23)	0.6061 \pm 0.1796	1,409,585 \pm 911813.20290
Physicians (n=7)	0.4651 \pm 0.1212	900,074 \pm 741219.3204000
P – Values: Controls VS Work	0.719184933	0.545987752
Controls VS Nurse	0.935233822	0.646210224
Controls VS Physicians	0.129478107	0.43811877
Worker VS Nurses	0.583762976	0.884782555
Worker Vs physicians	0.110124901	0.110124901
Nurses VS physicians	0.063093523	0.180428469

OD = Optical density, SRT-PCR = Serum real time-polymerase chain reaction. Abs=Antibodies

All positive HCV IgG Ab cases in the study subjects had detectable HCV RNA by real time PCR. Both serum anti-HCV IgG antibodies and SRT-PCR loads had insignificant changes on comparing all groups with each other.

The needle stick injury, incidental blood exposure, and body fluid splash occurred more often in workers, nurses, and doctors compared to controls ($P < 0.05$). Nurses had significantly higher frequency of needle stick injury, incidental blood exposure, body fluid splash, and shared nail clipper compared to workers ($P < 0.05$). Visiting dental clinic was performed more often by nurses compared to controls and workers ($p < 0.05$). Needle stick injury and shared nail clipper were less frequent in physicians compared to nurses ($p < 0.05$). No significant changes were observed among groups as to tattoo and house hold contact with HCV infection ($P > 0.05$). The most prominent HCV infec-

tion risk factors in controls were the house hold contact with HCV infection and shared nail clipper ($P < 0.05$); the same finding was reported in workers, despite close to significant association with needle stick injury ($P = 0.07$). The two main risk factors (needle stick injury and incidental blood exposure) were significantly present in nurses ($P < 0.05$) compared to the rest of risk factors. Needle stick injury, incidental blood exposure, house hold contacts with HCV, body fluid splash, and visiting dental clinic were equally preset in physicians, and they were significantly higher than shared nail clipper and tattoo ($P < 0.05$).

Table 3: Frequencies' of exposure to risk factors in all groups.

Groups	Needle stick injury No (%)	Incidental blood exposure No (%)	Body fluid splash No (%)	Shared nail clipper No (%)	Tattoo No (%)	House hold contact No (%)	Visiting dental clinic No (%)
Control n = 59	3 (5.1%)	4 (6.7%)	0 (0%)	19 (32.3%)	8 (13.6%)	23 (39%)	15 (25.4%)
Workers n = 60	21 ^a (35%)	13 ^a (21.7%)	11 ^a (18.3%)	26 (43.3%)	2 (3.3%)	28 (46.7%)	14 (23.3%)
Nurses n = 60	42 ^{a, b} (70%)	36 ^{a, b} (60%)	21 ^{a, b} (35%)	12 ^b (20%)	5 (8.3%)	24 (40%)	25 (41.7%) ^{a, b}
Physicians N = 60	30 ^{a, c} (50%)	28 ^{a, b} (46.7%)	13 ^a (21.7%)	0 ^{a, b, c} (0%)	0 (0%)	19 (31.7%)	20 (33.3%)

a: p-value < 0.05 compared to control group. **b:** p-value < 0.05 in comparison with workers group. **c:** p-value < 0.05 upon comparing to nurses group.

Studying the relationship of employment duration with probability of HCV infections in all groups was demonstrated in table 4. Within each group, no significant changes in frequency of HCV infection were reported in the studied subgroups upon comparison with each other ($P>0.05$). On the other hand, figure 4 illustrated the correlation of HCV infection with duration of employment in

each subgroup category of the studied three groups. Nurses had significantly increased HCV infection rates compared to physicians ($P<0.05$) after working for at least 3 years, otherwise no significant changes were noted on comparing the three groups with each other at the rest of the three periods ($P>0.05$).

Table 4: Prevalence of HCV infection in study subgroups by SRT-PCR

Subgroups	Physicians (7/60 = 10.0%)	Workers (12/60 = 20.0%)	Nurses (23/60 = 38.3%)
Subgroup (a) (n=20)	2 (10%)	2 (10%)	5 (25%)
Subgroup (b) (n=20)	2 (10%)	4 (20%)	8 (40%)
Subgroup (c) (n=20)	3 (15%)	6 (30%)	10 (50%)
P Value a vs. b	1.00	0.6141	0.5006
a vs. c	1.00	0.2351	0.1910
b vs. c	1.00	0.7164	0.7511

Duration of employment didn't not have any significant changes on HCV infection rates ($p>0.05$) within each group. Subgroup (a): duration of work at the hospital 1 year \pm 6 months. Subgroup (b): duration of work at the hospital 3 years \pm 6 months. Subgroup (c): duration of work at the hospital 5 years \pm 6 months.

Correlation of risk factors frequencies in subgroups with employment durations showed the following: 1) no significant changes in all risk factors prevalence in worker's subgroups when compared to each other ($P>0.05$) 2) Needle stick injury had a higher prevalence in nurse's subgroup 3c (95%) in comparison to both subgroups 3a (45%) & 3b (70%) ($P<0.05$) 3) Incidental blood exposure and body fluid splash were increased in subgroup 3b (80% & 55%), with insignificant decrease in subgroup 3c (45% & 20%) ($P>0.05$) 4) Needle stick injury was reported by 65% of physicians in subgroup 4b and 30% in subgroup 4a ($p<0.05$) associated with insignificant decline in subgroup 4c (55%; $P>0.05$).

Discussion

The current study addresses prevalence of HCV infection among the substantial risk groups of hospital employees. Highest prevalence was recognized among nurses compared to physicians, and workers. The main source of infection in nurses was found to be related to needle stick injury, incidental blood exposure, and body fluid splash. Prolonged exposure of nurses to the mentioned risk factors was associated with increased prevalence of HCV infection compared to other hospital employees after three years of

employment. This was proved particular among nursing staff by Abdel-Motagaly *et al.* (2017) who reported that nurses thought a little needle pricking might be a carrier of one of many transferred diseases. This would be explained by the fact that HCV infection starts early during the first year of employment. For this reason, we strongly recommend that nurses should receive early training programs on practices that is related to ID prevention and control.

The hepatitis C virus (HCV) infection acquired its major risk from being unnoticed in majority of cases, variability in the clinical presentations, and its late burden on liver e.g. extensive fibrosis and cirrhosis with or without hepatocellular carcinoma. Despite the number of chronically infected persons worldwide is estimated to be about 160 million, only a fraction of them are aware of their infection. Despite the mass screening that currently happening in Egypt, the implementation of extended criteria for routine screening for HCV was a controversial subject among different stakeholders (EASL, 2015).

The present study tried to uncover the questionable facts behind the increased risk of HCV infection among hospital personnel who live in one of the most endemic areas

for HCV infection worldwide (Gorodin *et al*, 2013). The targeted populations of our study included Al Azhar University Hospital employees who are working in patient's wards. The prevalence of HCV infection as well as risk factors for HCV transmission in each group were studied to find out the most important risk factors for the HCV infection among health care personnel. Controlling these risk factors will lead to correction and improvement of the quality of health education among medical workers.

The present study reported high prevalence of HCV infections among nurses and workers more than normal population because of occupational exposure to needle stick injury, body fluids and blood of HCV infected patients, and they have long standing contact with HCV patients in hospitals. Goniewicz *et al*. (2012) reported the same conclusions. Justification of the increased HCV prevalence among nurse would be related to the fact that globally, more than 35 million health care workers face the risk of sustaining a percutaneous injury with a contaminated sharp object every year. The fact that injuries of medical and health staff from sharp or pointed objects are among the most frequently reported occupational accidents in healthcare workers was added by Manzoor *et al*. (2010). The multiplicity of risk factors related to their work at hospital that added to other risk factors outside the hospital might play a key role in the increased infection transmission as reported by Westermann *et al*. (2015).

The current study found that all positive anti-HCV Ab IgG antibody cases had detectable HCV RNA genomic particles by real time PCR. This finding indicated that none of the HCV infected cases has a chance to spontaneously clear the HCV infections as used to be normally happening in 15 to 25%. This would be explained by continuously repeated exposure to risk factors that lead to reinfections. Unfortunately, this explanation might not be applicable to controls that can be excused by the small number of

anti-HCV IgG antibody positive subjects. However, control subjects and workers in current study were found to share nail clipper and to have a house hold contact with HCV infection more than any of the studied groups. On the other hand, continuous needle stick injury and incidental blood exposure explained the high prevalence of HCV infection among nurses that has a reasonable probability of RNA-genomic seroconversion (Manzoor *et al*, 2010; Westermann *et al*, 2015). The present data agreed with other developing countries e.g. Saudi Arabia and Pakistan (Mahfouz *et al*, 2009; Manzoor *et al*, 2010; Okasha *et al*, 2015). In developed countries like USA and UK, incidence of needle stick injury in nurses is respectively 16.3% & 48% (Goniewicz *et al*, 2012) that could be prevented by using the safety devices and the health education programs (Westermann *et al*, 2015).

The present study reported incidental blood exposure in 60% of nurses, 46.7% of physicians and 21.7% of medical workers, while body fluid splash was identified in 35% of nurses, 21.7% of physicians and 18.3% of medical workers. Exposure to HCV infected body fluid as well as needle stick injury play a key role in jeopardizing occupational health and safety that face healthcare professionals globally and are associated with high prevalence of infection among HCWs (Deisenhammer *et al*, 2006; Mbaisi *et al*, 2013; Markovic-Denica *et al*, 2015). Other risk factors like dental clinic visit and shared nail clipper were also reported in the current work, which might have a role in HCV transmission (Perdelli *et al*, 2008; Cavalhiero *et al*, 2009).

The duration of employment was found in our work to have a positive impact on liability to HCV infection in nurses and was attributed to increased exposure to needle stick injury and infected fluid splash. Despite needle stick injuries (NSIs) were more frequent in inexperienced personnel, current findings on the incidence of NSI in the health service show that nursing and medical

personnel are the most frequently affected professional group (Goniewicz *et al*, 2012).

It should be remembered that the risk of seroconversion after an injury depends on factors including the type of injury (deep cuts or pricks), the quantity of infectious material transferred, the virus load in the index patient and possibly genetic factors in the injured person (Westermann *et al*, 2015). Our data failed to establish the relationship between the duration of employment with probability of increased HCV circulation among members of other groups as well as their subgroups.

It was highly recommended by authors of current study to address frequency of occult HCV (OCI) in all groups by screening for the intracellular genomic RNA strands (Abd Alla *et al*, 2017), as it plays a role in prevalence estimation as well as viral management (Abd Alla and El Awady 2017).

Conclusion

The current study showed an increase in the prevalence of HCV infection in HCWs (medical workers and nurses) compared to controls (p-value<0.05). The longer work duration of health care workers at hospitals was not associated with higher prevalence of HCV infection (p-value<0.05).

The needle stick injury was the most important occupational health hazard in nurses and workers with alarmingly high rates and continues to be the major threat to the health of HCWs.

It was recommended to use safe practices for working with blood to help minimizing occupational exposure. Strict adherence to universal precautions is essential to prevent iatrogenic transmission of the infection is highly advisable. The screening of the nurses after needle stick injury and promotion of safety measures against it should be encouraged.

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Explanation of figures

Fig. 1: Percent distribution of anti-HCV IgG antibody positive subjects in study groups (n=51). Nurses had a significantly higher share of HCV infection compared to controls, workers and physicians ($P < 0.05$) with insignificant changes in infection rates on comparing workers, physicians and controls with each other ($P > 0.05$).

Fig. 2: Anti-HCV IgG antibody responses in all study groups. Anti-HCV IgG antibodies were significantly higher in nurses compared to controls, workers and physicians ($P < 0.05$). Same changes were significantly increased in workers compared to physicians ($P = 0.045$). Dotted line = Cutoff point of ELISA Optical Density (OD) Reading. Dashed lines = Mean ELISA OD reading.

Fig. 3: Frequency of risk factors in each of four study groups. Most prominent HCV infection risk factors in controls (A) and workers (B) were the house hold contact with HCV infection (6) and shared nail clipper (4) ($P < 0.05$ compared to other risk factors). Needle stick injury (1) and incidental blood exposure (2) significantly present in nurses (C) ($P < 0.05$). Needle stick injury (1), incidental blood exposure (2), House hold contact with HCV (6), body fluid splash (3), and visiting dental clinic (7) equally observed in physicians (D), but they are significantly higher than Shared nail clipper (4) and tattoo (5) ($P < 0.05$). 1 = Needle stick injury. 2 = incidental blood exposure. 3 = Body fluid splash. 4 = Shared nail clipper. 5 = Tattoo. 6 = House hold contact with HCV. 7 = Visiting dental clinic.

