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Original Article

Hepatitis-C Virus Infection and Exposure to Blood and Body Fluids among Nurses and Paramedical Personnel at the Alexandria University Hospitals, Egypt

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ABSTRACT

Background: Worldwide, prevalence of anti-HCV positivity in health care workers (HCWs) ranges from 0% to 9.7%. The current study was conducted to calculate prevalence of HCV infection, frequency and characteristics of blood and body fluid (BBF) exposure among HCW at the Alexandria University Hospitals.
Methods: Hospital-based cross-sectional approach was adopted. At the Hospitals, 62.2% of available nurses and paramedical personnel voluntarily participated (n = 499), and were interviewed, screened for HCV antibodies. Quantitative estimation of HCV-RNA was done to seropositive cases.
Results: Prevalence of anti-HCV antibodies and HCV infection was 8.6%, and 4.4% respectively. The frequency of BBF exposures was 66.7%. Blood/blood products were mainly involved (92.1%). More than half of exposed HCWs reported not wearing personal protective devices. Anatomical site of exposure was mainly right hand palm (36.2%). Regarding needle-stick injuries, two thirds of injured HCWs were the original user of sharp item which was contaminated in 79.7% of injuries. In 70.2% of injuries, disposable syringes were involved and occurred during item disposal. About 61% of injuries were superficial.
Conclusion: Prevalence of HCV infection among HCWs is similar to that among general population in the country. Nurses and housekeepers are frequently exposed to BBF. Adherence to infection control measures according to the National Guidelines is crucial to reduce HCV transmission.

1. Introduction

Globally, according to the World Health Organization (WHO), there is a variation in Hepatitis-C Virus (HCV) epidemiology; some countries are considered to have a low endemicity, with less than 1.5% of HCV chronic carriers, while others have a moderate endemicity, with 1.5–3.5% of subjects carrying HCV infection. In some regions such as the Middle East and Northern Africa, HCV endemicity is high; more than 3.5% of the population having chronic HCV infection.[1] The global prevalence of anti-HCV was estimated at 2% and the viraemic prevalence was 1.4% among adults.[2]

Egypt has one of the highest global burdens of HCV.[3] According to Egypt Health Survey 2015, 6.3% of population aged 1–59 years have HCV antibodies, and 4.4% have HCV RNA compared with 3.6% and 2.4% respectively, in our city.[4] The Country Health Issues Survey 2015, showed that HCV PCR positive adults decreased by 30% compared to the Country Demographic and Health Survey 2008. The decline mostly reflects the aging out of the population tested of individuals aged 53–59 on 2008.[4]

HCV infection progresses to chronicity in 70% of cases. If left untreated, 14% to 45% of patients develop liver cirrhosis 20 years after acquisition of disease, and 1–5% will develop liver cancer.[3] Worldwide, approximately 27% of chronic liver cirrhosis and 25% of hepatocellular carcinoma can be attributed to hepatitis C.[5]

Occupational exposure of health care workers (HCWs) to HCV infection occurs through percutaneous exposure (75%) or mucosal-cutaneous exposure (25%) to patient's infected blood, blood derivative, or body fluids.[6] Worldwide, the prevalence of anti-HCV positivity in HCWs ranges from 0% to 9.7%.[7]

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The WHO states that among the 35 million HCWs worldwide, about 3 million receive percutaneous exposures to bloodborne pathogens each year; 0.9 million of those are exposed to HCV.[8] In percutaneous exposure, HCW receive an injury with a sharp contaminated object.[9] Needlestick and sharp injuries (NSSIs) are considered as a part of "Unsafe injections".[10] Nurses generally are the occupational group with the highest risk of NSSIs.[11] The estimated risk of transmission of HCV infection from an infected patient to the HCW following a NSSI is 0.8–3%.[12] An average of 4 NSSIs per year per HCW was found in Eastern Mediterranean Region.[13]

The rate of transmission of HCV infection among HCWs can be five times higher in percutaneous than in mucosal-cutaneous exposure. Highest rates of HCV transmission follow exposure to blood or its products, compared with ascitic or cerebrospinal fluid. The extent and depth of the cutaneous or mucosal wound and the volume of blood transferred greatly affect the rate of HCV transmission.[14]

Lack of infection control (IC) measures is an essential risk factor for HCV in our country. In 2002, the Ministry of Health and Population (MOHP) developed a national plan to establish an IC program structure, develop IC guidelines, and promote occupational safety.[15] In 2008, those IC guidelines were revised by the WHO. In 2011, the program underwent an International Health Regulations assessment, which concluded that the program had substantially decreased iatrogenic transmission of HCV.[16]

In 2012, the MOHP in our country, developed the "Plan of action for the prevention, care and treatment of viral hepatitis" (POA), which focuses on the seven main components of viral hepatitis prevention and control: surveillance, IC, blood safety, hepatitis B virus vaccination, care and treatment, communication and research.[17]

The current study was conducted at the Alexandria University Hospitals (AUHs) to: (1) calculate the prevalence of HCV infection among nurses and paramedical personnel (PP); (2) study the frequency and characteristics of NSSIs and blood and body fluid (BBF) exposures among nurses and PP during 6 months period; and (3) assess post-exposure management (PEM) adopted at the UHs.

2. Material and methods

Hospital-based cross sectional approach was adopted. The study was conducted in different departments at the AUHs; Main University Hospital, Pediatrics Hospital, gynecology/obstetrics Hospital and Orthopedics Hospital. The fieldwork of the study started on first of October 2015 throughout end of March 2016.

All nurses and PP were invited to participate in the research. Initially, 582 responded and had willingness to participate. The response rate was 72.6%. However, 83 were excluded because their activities did not include contact with patients or with BBF from patients, thus, didn't have the potential for exposure to NSSIs as well as infectious materials. Those excluded subjects worked as medical records technicians and radiology technicians. Those who were included in the research (n = 499) represented 62.2% of the overall number of nurses and PP who were available and in charge at time of study. It comprised: nurses (n = 372); laboratory technicians (n = 14); workers providing housekeeping and laundry services (n = 94); and PP at sterilization and central supply units (n = 19).

2.1. Study tools

2.1.1. An interview questionnaire[18–20]

HCWs (nurses and PP) were interviewed to collect information about: (a) *sociodemographic and occupational characteristics*; (b) *frequency of accidental exposure to NSSIs, and BBF* during 6 months prior to the study to get more reliable answers as such information is 'memory dependent'; (c) *Characteristics of the last NSSI and BBF exposure* experienced by the injured HCW, regarding the type of device causing the injury; mechanism, site and depth of injury, and use of gloves at time of exposure; and (d) *PEM* including reporting and blood test for the source patient as well as injured HCW for HCV infection.

2.1.2. Collection of blood sample to test for HCV infection status

Serum blood samples were collected from nurses and PP (n = 499) to be screened for the presence of HCV antibodies by chemiluminescent enzyme immunoassay (Siemens Healthcare Diagnostics, USA) for qualitative detection of IgG antibodies to HCV.[21] The test employed two recombinant HCV antigens of NS3, NS4, NS5 regions (c200 and NS5) and synthetic peptide of the core (c22). The chemiluminescent reaction was directly proportional to the amount of anti-HCV present in the sample. The results were expressed as an Index. Samples with an index value <0.8 were considered negative. Samples with an index value $\geq$0.8 and <1 were considered equivocal. Samples with an index value >1 were considered positive.

Plasma was collected from seropositive cases (n = 43) for quantitative estimation of HCV-RNA in serum: HCV RNA in plasma was detected by automated extraction/real-time RT-PCR based assay for quantification of HCV RNA (COBAS Ampliprep™/COBAS TaqMan™, "CAP/CTM" Roche Molecular Systems, Pleasanton, CA, USA).[22] The assay lower detection limit was 15 IU/ml and upper detection limit was 6.9×10^7 IU/ml using primers located in the highly conserved 5′ non translated region (NTR).

Blood samples were analyzed at the Central Laboratories at the Alexandria Faculty of Medicine.

2.2. Statistical analysis of the data

The collected data were coded and typed onto computer files using SPSS software program version 20.0.[23] Descriptive statistics included, frequency, percentages, median and inter-quartile range were used.

2.3. Ethical clearance

The study was approved by the Research Ethics Committee at the Alexandria Faculty of Medicine. Objectives of the study, procedures, types of information to be obtained, and publication were explained to participants. An informed written consent was obtained from each participant. Collected data were confidentially kept.

3. Results

3.1. Sociodemographic and occupational characteristics

Males constituted 22% of the interviewed HCWs. The median age of HCWs was 39.0 years old. The majority had nursing diploma (62.0%). The median duration of employment was 17.0 years (Table 1).

3.2. Prevalence of HCV infection among HCWs

Screening of HCWs (n = 499) for HCV antibodies, revealed 43 seropositive cases (8.6%). Plasma was collected from seropositive cases for quantitative estimation HCV RNA in serum. According to the results, 22 HCWs had HCV infection (4.4%), five of them knew that they were infected and they were on treatment. The

Table 1
Distribution of the studied nurses and PP according to their sociodemographic and occupational characteristics.

Sociodemographic and occupational characteristics	Nurses & PP (n = 499)	
	No.	%
Gender		
Male	110	22.0
Female	389	78.0
Age (Years)		
Min-Max	20–60	
Median (Q1-Q3)	39.0 (31.0–46.0)	
20-	102	20.4
30-	157	31.5
40-	151	30.3
50–<60	89	17.8
Level of education		
Read and write	64	12.8
Preparatory	40	8.1
Secondary	41	8.2
Nursing Diploma	310	62.1
University graduate or higher	44	8.8
Occupation		
Nursing staff	372	74.6
Laboratory technicians	14	2.8
Housekeepers and laundry service workers	94	18.8
Workers at Sterilization and Central Supply Units	19	3.8
Duration of employment (Years)		
Min-Max	1–38.0	
Median (Q1-Q3)	17.0 (9.0–24.0)	
1–	136	27.3
10–	155	31.0
20–	142	28.5
30–<40	66	13.2

Abbreviations: HCV: hepatitis C virus; PP: paramedical personnel; (Q1-Q3): interquartile range.

Table 2
Socio-demographic and occupational characteristics of the HCV-PCR positive nurses and PP.

Socio-demographic and occupational characteristics	HCV-PCR positive nurses &PP (n = 22)	
	No.	%
Gender		
• Male	7	31.8
• Female	15	68.2
Age (years)		
Min-Max	22.0–58.0	
Median (Q1-Q3)	49.0 (39.0–56.0)	
• 20–	1	4.5
• 30–	4	18.2
• 40–	7	31.8
• 50–<60	10	45.5
Level of education		
• Read and write	6	27.4
• Preparatory	1	4.5
• Secondary education	3	13.6
• Nursing Diploma	12	54.5
• University graduate or higher	0	0.0
Occupation		
• Nursing staff	13	59.1
• Lab technician	1	4.5
• Housekeeping/laundry service	6	27.3
• Sterilization/Central supply staff	2	9.1
Duration of employment (years)		
Min-Max	4.0–36.0	
Median (Q1-Q3)	27.0 (17.0–34.0)	
• 1–	1	4.5
• 10–	5	22.7
• 20–	8	36.4
• 30–<40	8	36.4

Abbreviations: HCV: hepatitis C virus; PP: paramedical personnel; (Q1-Q3): interquartile range; PCR: polymerase chain reaction; Lab: laboratory.

majority of the PCR-positive HCWs were females (68.2%), aged 50 to <60 years old (45.5%), of nursing staff (59.1%), and had a duration of employment between 20 to < 40 years (72.8%) (Table 2). Moreover, 27.3% and 18.2% of PCR-positive HCWs experienced frequent (5 times or more) NSSIs and BBF exposures respectively in the last 6 months.

3.3. Prevalence of NSSIs and BBF exposures during the last six months

About 45% of the studied HCWs experienced accidental NSSIs (n = 223). Among those who had NSSIs, 13.5% experienced ≥5 injuries (n = 30). Moreover, 38.2% of the HCWs experienced BBF exposure by means other than NSSIs (n = 191). Among those who had been exposed to BBF, 45.5% had ≥5 exposures (n = 87).

Frequent NSSIs or BBF exposures (5 times or more), was mostly among females (66.7%, 71.3% respectively), who aged 30 to <40 years (40%, 40.3% respectively), and had duration of employment <20 years (66.7%, 75.9% respectively). It was mostly among the nursing staff (70%, 71.3% respectively) followed by housekeepers and laundry workers (26.7%, 27.6% respectively) (Table 3).

3.4. Characteristics of the last NSSI and BBF exposure (among 158 nurses and 213 PP)

In 51.6% of NSSIs, the source patient was identifiable but not tested for HCV infection. About two thirds of injured HCWs (61.4%) were the original user of the sharp item which was contaminated in 79.7% of injuries. Disposable syringes were involved in the majority of injuries (70.2%), followed by needles for IV line (12.6%). Moreover, 70.3% of NSSIs occurred during disposal of item. The most common injured sites were right hand palm (23.4%) followed by right fingers (18.4%). Superficial NSSIs with little or no bleeding were found among 60.8%, while deep injuries were among 8.2% only. At time of NSSI, 60.8% HCWs were wearing single pair gloves, and 5.7% were wearing double pair gloves (Table 4).

Blood/blood products were involved in the majority (92.1%) of BBF exposures. The source patient was identifiable but not tested for HCV infection in 73.4% of exposures. HCWs reporting not wearing personal protective devices at time of exposure were 52.6%, thus, the mechanism of contact in 71.4% of exposures was through touching unprotected skin. Majority of HCWs reported exposure to small amount of BBF (66.2%) and duration of contact less than 5 min (75.1%) (Table 5).

3.5. Post-exposure management

After last exposure to a NSSI or BBF exposure, the majority of HCWs did not report their exposure (84.8%, and 82.6% respectively), the source patient was not tested for HCV infection (77.2%, 86.4% respectively), and a small number of injured HCWs were tested for HCV infection (10.8% and 9.9% respectively) (Table 6).

4. Discussion

A critical component of our National IC program is promotion of occupational safety and health. A survey on 2002 revealed that HCWs in Egypt engaged in unsafe practices when using and disposing sharps and experienced frequent needlestick injuries (NSIs) (average of 4.9 NSIs per year).[16] In Egypt POA, one of goals of promoting IC practices to reduce transmission of viral hepatitis is to reduce occupational transmission of viral hepatitis.[17]

Table 3
Socio-demographic and occupational characteristics of the nurses and PP frequently^ exposed to NSSIs and BBF.#

Socio-demographic and occupational characteristics	Nurses & PP with frequent^ NSSIs (n = 30)		Nurses & PP with frequent^ BBF exposures (n = 87)	
	No.	%	No.	%
Gender				
• Male	10	33.3	25	28.7
• Female	20	66.7	62	71.3
Age (years)				
Min-Max	20.0–56.0		20.0–58.0	
Median (Q1-Q3)	34.5 (26.5–45.5)		34.0 (27.0–41.0)	
• 20–	8	26.7	25	28.7
• 30–	12	40.0	35	40.3
• 40–	3	10.0	22	25.3
• 50–<60	7	23.3	5	5.7
Level of education				
• Read and write	4	13.3	16	18.4
• Preparatory	4	13.3	6	6.9
• Secondary education	2	6.8	7	8.0
• Nursing Diploma	19	63.3	50	57.5
• University graduate or higher	1	3.3	8	9.2
Occupation				
• Nursing staff	21	70.0	62	71.3
• Lab technician	0	0.0	1	1.1
• Housekeeping/laundry service	8	26.7	24	27.6
• Sterilization /Central supply staff	1	3.3	0	0.0
Duration of employment (years)				
Min-Max	1.0–34.0		1.0–36.0	
Median (Q1-Q3)	12.5 (4.5–23.5)		12.0 (5.0–19.0)	
• 1–	11	36.7	34	39.1
• 10–	9	30.0	32	36.8
• 20–	6	20.0	18	20.7
• 30–<40	4	13.3	3	3.4

Abbreviations: PP: paramedical personnel; Lab: Laboratory; NSSIs: needlestick and sharps injuries; BBF: blood and body fluid; (Q1-Q3): interquartile range.
^ 5 times or more during the last 6 months.
# Exposure to blood and body fluid by means other than needlestick and sharps injuries.

Among the studied HCWs, anti-*HCV* anti*bodies* was detected in 8.6%, and the *prevalence of HCV infection* was 4.4%. Similarly, Okasha O et al., 2015, reported 8.0% sero-prevalence anti-HCV among HCWs at Ain Shams University Hospitals in Egypt.[24] Moreover, Coppola N et al., 2016, reported 8.0% prevalence of anti-HCV positivity among HCWs in Egypt. Worldwide, the prevalence of anti-HCV positivity in HCWs was reported in the Spain (0.62%), Pakistan (3.2–5.6%), Georgia (5%), Denmark (0.14), Poland (0.8%), the United States (0.7%), Albania (0.6), and Turkey (0.3%).[7]

Most of studies that compared the prevalence of anti-HCV positivity in HCWs and in the general population of the same country showed similar prevalence in the two groups.[25–28] In the current research, the prevalence of anti-HCV positivity among HCWs at UHs (8.6%) was higher than among general population in Egypt (6.3%)[4] and in Alexandria (3.6%),[4] while the prevalence of HCV infection among HCWs at UHs was similar to the prevalence among general population in Egypt (4.4%)[4] and higher than the prevalence in Alexandria (2.4%).[4] This would be explained by the fact that HCWs are exposed to human blood and potentially infectious materials more frequently than the general population. Moreover, among blood borne pathogens, HCV is most frequently transmitted through percutaneous or mucosal-cutaneous exposure.[9] Furthermore, studied HCWs are less adherent to guidelines for self-protection. During last 6 months, the non-use of personal protective devices among HCWs exposed to BBF and gloves among HCWs exposed to NSSI was 52.6% and 33.5% respectively, Also HCWs got high incidence *of accidental exposure* to *NSSIs* (44.7%) and *BBF* (38.2%). A study in Pakistan revealed lower prevalence of anti-HCV positivity among HCWs (4%) than blood donors (14%), which would be difficult to explain.[29]

In the current study, relatively high incidence of accidental NSSIs (44.7%; with13.5% of the injured HCWs reported ≥5 injuries) and BBF exposures (38.2%; with 45.5% had ≥5 exposures) was found among studied HCWs during the last 6 months. The findings of the current research are consistent with the results of another study conducted among HCWs in operating rooms at the Alexandria Main University hospital, where 61.3% of HCWs experienced sharp injury (24.6% of them had ≥5 injuries), and 66.7% of HCWs experienced BBF exposures (47.1% of them had ≥5 exposures).[30] In addition, Hanafi MI et al., 2011 study reported that 67.9% of HCWs had at least 1 needlestick injury in the previous 12 months with 5% experienced more than 3 injuries.[31] However, lower prevalence of sharp injuries among HCWs was reported in Kenya (19%).[32] Yousafzai et al., 2013 found 26.7% of practitioners in private medical clinics had at least 1 sharp injury in the last 6 months.[33]

Health care workers who experienced frequent NSSIs or BBF exposures, were mostly the nurses (70%, 71.3% respectively) followed by housekeepers/laundry workers (26.7%, 27.6% respectively). This would be explained by the fact that nurse is the HCW more frequently and directly dealing with needles and sharp objects in admission wards and intensive care units. Similarly, Gholami et al., 2013 showed that nurses reported the highest frequency of NSSIs.[34] Lower percentage was reported by Sultan YH, 2016 (20.8% among nursing staff, and 14.6% among housekeepers), in operating rooms, where highest percentage of frequent NSSIs was among surgeons.[30] Nursing personnel constituted 33.9% of HCWs that experienced NSSIs at Main University Hospital, Frankfurt.[35]

In the current study, about two thirds of HCWs who got *NSSI or BBF exposure*, were the original user of sharp item. Similar results

Table 4
Characteristics of the last NSSI as experienced by the injured nurses and PP.

Characteristics of the last NSSI	Injured nurses & PP (n = 158)	
	No.	%
Injured HCW was the original user of the sharp item		
No	61	38.6
Yes	97	61.4
Sharp item contamination		
Contaminated	126	79.7
Uncontaminated	13	8.2
Unknown	19	12.1
Type of device caused the injury		
Disposable syringe	111	70.2
Needle on IV line	20	12.6
Suture needle or scalpel	10	6.4
Arterial/central line catheter	6	3.8
Others (ABG syringe, lancet, spinal/epidural needle, scissors, etc.)	11	6.9
Mechanism of injury & timing		
Before use of item	13	15.8
During use of item	47	8.9
Between steps	25	3.2
Needle recapping	14	3.2
Needle withdrawal	5	14.6
Device left on floor	5	4.4
After use and before disposal	23	12.0
During disposal	7	70.3
After disposal	19	0.6
Anatomical site of the injury		
Right hand palm	37	23.4
Right hand dorsum	9	5.7
Right Thumb	15	9.5
Right Fingers	29	18.4
Left hand palm	22	13.8
Left Thumb	23	14.6
Left Fingers	23	14.6
Depth of the injury		
Superficial[^]	96	60.8
Moderate[$]	49	31.0
Deep[*]	13	8.2
Gloves used at time of the injury		
Single pair gloves	96	60.8
Double pair gloves	9	5.7
No gloves	53	33.5

Abbreviations: HCW: health care worker; NSSIs: needlestick and sharps injuries; PP: paramedical personnel; IV line: intravenous line; ABG: arterial blood gas.
[^] Little or no bleeding.
[$] Skin punctured, some bleeding.
[*] Deep stick/cut, or profuse bleeding.

Table 5
Characteristics of the last BBF exposure[#] as experienced by the exposed nurses and PP.

Characteristics of last BBF exposure	Exposed nurses & PP (n = 213)	
	No.	%
BBF involved in the exposure		
• Blood/blood products	196	92.1
• Vomitus	6	2.8
• Urine	5	2.3
• Sputum	3	1.4
• Others[*]	3	1.4
Body fluid was visibly contaminated with blood (n = 17)		
• No	7	41.2
• Yes	10	58.8
Portal of exposure		
• Intact skin	178	83.6
• Eyes	18	8.4
• Non-intact skin	14	6.6
• Mouth	3	1.4
Mechanism of contact with BBF		
• Touch unprotected skin	152	71.4
• Soaked garments/clothes	39	18.3
• Gaps in garments	22	10.3
PPD worn at time of exposure		
• None	112	52.6
• Single pair gloves	68	31.9
• Lab coat	19	8.9
• Double pair gloves	7	3.3
• Others[$]	7	3.3
Cause of exposure		
• Direct contact	159	74.6
• Leaked IV tube/bag	22	10.3
• Touch contaminated equip.	13	6.1
• Leaked specimen container	10	4.8
• Others[^]	9	4.2
Duration of contact of BBF with skin/mucous membranes		
• <5 min	160	75.1
• 5–<15 min	26	12.2
• 15 min–<1 h	17	8.0
• 1 h or more	10	4.7
Amount of BBF in contact with skin/mucous membranes		
• Small amount	141	66.2
• Moderate amount	49	23.0
• Large amount	23	10.8

Abbreviations: BBF: blood or body fluid; PP: paramedical personnel; PPD: personal protective devices; Lab: laboratory.
[#] Exposure to blood and body fluid by means other than needlestick and sharps injuries.
[*] Saliva and pleural fluid.
[$] Surgical mask, surgical gown, and goggles.
[^] Feeding/ventilator leak, touch contaminated sheets, and during suction.

were reported in Sultan YH, 2016 (66.2%) in operating rooms,[30] however, Jagger J et al., 2010 showed that nurses and technicians were most often injured by devices originally used by others (77.2% and 85.1% of injuries, respectively).[36] In the present study, the sharp item was contaminated in 79.7% of injuries, while Sultan YH, 2016 reported 80%.[30]

In the current study, at time of NSSI, 60.8% injured HCWs were wearing single pair gloves, and 5.7% were wearing double pair gloves. On the contrary, in Sultan YH et al. (2010) study, 46.7% HCWs reported wearing single pair gloves, and 32.3% were wearing double pair gloves at time of injury[30]; HCWs in operating rooms tend to wear double gloves to ensure protection because operating room is one of the highest-risk hospital settings for percutaneous injury. Naghavi SHR et al., 2009 in UK, reported that double gloves were worn in 15% injuries among doctors.[37] In Mbaisi EM et al., 2013 study, double gloves were worn by 9% of the HCWs.[32] The difference might be due to research settings with variable adherence to protectives guidelines.

The most common injured sites in the present study were right hand palm (23.4%) followed by right fingers (18.4%). Conversely, other studies reported that most of NSSIs were in left fingers, followed by right fingers, left and right thumb.[30,37] The difference may be attributed to practical procedures details. In the present study, most of NSSIs were superficial, followed by moderate and deep injuries (60.8%, 31.0%, and 8.2% respectively). This may reflect some attention still paid by the HCWs during practices. Similar ranking was reported in other studies; (55.4%, 35.9%, and 9% respectively)[30] and (67.8%, 30%, and 1.7% respectively).[32]

On studying *PEM*, the majority of the HCWs did not report their NSSI or BBF exposure (84.8%, and 82.6% respectively). Likewise, high prevalence of non-reporting was reported in AUHs by Sultan YH, 2016 (97.9%)[30] and Hanafi MI et al., 2011 (74.7%)[31] However, Naghavi SHR et al., 2009 found that 25.8% of injured personnel

Table 6
Post-exposure management as reported by nurses and PP following their last NSSI or BBF exposure.[#]

Post-exposure management	NSSI (n = 158)		BBF exposure (n = 213)	
	No.	%	No.	%
Reporting				
• Yes	24	15.2	37	17.4
• No	134	84.8	176	82.6
Reasons for not reporting	[n = 134]		[n = 176]	
• Lack of time	40	29.9	5	2.8
• Ignorance	69	51.5	7	3.9
• Low risk source	1	7.4	68	38.6
• Not important to report	43	32.1	75	42.6
• No reporting system	55	41.0	58	32.9
Source patient blood testing for HCV infection				
• Not tested	122[^]	77.2	184[*]	86.4
• Tested:	36	22.8	29	13.6
– Negative	20	12.7	13	6.1
– Positive	16	10.1	16	7.5
Injured/exposed HCW seen by any physician				
• Infection control HCW	39	24.7	24	11.3
• Physician at Emergency Room	3	1.9	0	0.0
• Not seen	116	73.4	189	88.7
Injured/exposed HCW blood testing for HCV infection				
• Not tested	141	89.2	192	90.1
• Tested:	17	10.8	21	9.9
– Negative	14	8.9	18	8.5
– Positive	3	1.9	3	1.4

Abbreviations: HCV: hepatitis C virus; NSSI: needlestick and sharps injury; BBF: blood or body fluid; HCW: health care worker.
[^] The source patient was either not identified (n = 59) or identified but not tested (n = 63).
[*] The source patient was either not identified (n = 49) or identified but not tested (n = 135).
[#] Exposure to blood and body fluid by means other than needlestick and sharps injuries.

reported all their sharp injuries, 22.5% reported some and 51.7% reported none.[37] The difference may be due to variation in availability and implementation of reporting regulations.

The studied HCWs who experienced NSSIs and BBF exposure, stated reasons for not reporting their injuries as follows; lack of time (29.9% and 2.8% respectively), low risk source (7.4% and 38.6% respectively), and lack of reporting system (41.0% and 32.9% respectively). Those reasons were similar to those reported in other studies, for example, lack of knowledge (35.5%,[30] 22.6%[31]), no time to report (10.7%,[30]16.5%,[31] 30%[38]); not important to report (1.7%,[30] 22.5%[38]); low risk source (0.8%,[30] 19.9%,[31] 39.3%[38]); use of self-care (14.7%,[31] 1.1%[38]); and lack of reporting system (51.2%).[30]

As reported by HCWs in the current research, following exposure to NSSI or BBF, the source patient was not tested for HCV infection in 77.2% and 86.4% respectively. Similar percentage was reported in Sultan YH, 2016 (71.3%).[30] On the contrary, a study conducted by Himmelreich et al., 2013, found that the index patients for 86.5% of NSIs underwent serum testing for HCV infection, and for the remaining 13.5%, the index patient was either unknown or blood testing was refused.[35]

Majority of the studied exposed HCWs were not tested for HCV infection following NSSIs (78.4%), and BBF exposure (90.1%). This coincides with Sultan YH, 2016, where only 29.3% of exposed HCWs were tested for HCV infection.[30] On the contrary, Malka et al., 2012, found in Romania that all HCWs who reported an occupational exposure to a blood-borne infection were tested for HCV infection at the day of the event and were followed at least once during the first year "short-term follow-up" and after 12 months and more "long-term follow-up".[39] The difference may be explained by variation in availability of PEM guidelines, awareness about, and implementation by HCWs. Regarding *injection and sharps safety management policy adopted in AUHs*; the studied HCWs reported lack of guidelines outlining PEM (58.9%), lack of injection safety training courses within the last 2 years (65.9%), and lack of support and counselling following NSSI or BBF exposure (49.1%). Higher percentages were reported by Sultan YH, 2016 at the operating rooms of the Alexandria Main University Hospital, (84.9%, 77.7%, and 75% respectively).[30]

5. Limitations of the study

Participation in the current research was completely voluntary. The relatively low response rate may be partially due to stigma carried by hepatitis C,[40] fear of recognition of the disease which might lead to job discrimination or may cost them their jobs.

6. Conclusion

The study revealed that among nurses and PP at the AUHs, the prevalence of anti-HCV positivity was 8.6% and HCV infection was 4.4%. Further comparative cross-sectional studies are required to compare between HCWs and general population regarding the prevalence of anti-HCV positivity and HCV infection. Moreover, the current study highlighted that nurses and housekeepers have frequent NSSIs and BBF exposures. Our Country POA IC measures including promotion of safe devices use, needle stick surveillance programs, safe disposal of sharps, and development of manual for management of occupational exposure to blood borne pathogens, are all objectives to reduce occupational transmission of HCV. Great effort is being undertaken; necessitating continuous monitoring for improvement with emphasis on implementation to achieve adequate results. It is recommended to analyze occupational and non-occupational risk factors of HCV infection among nurses and paramedical personnel at the AUHs.

Conflict of interest

Authors declare that there is no conflict of interest.

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