



HEPATITIS C VIRUS AMONG HEALTH CARE WORKERS AND THE RISK FACTORS CONTRIBUTING FOR ITS INFECTION

Medical Science

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ABSTRACT

Back ground: Hepatitis C Virus (HCV) infection is one of the leading causes of morbidity and mortality in under-developed countries like Yemen. According to an estimate, 2.0 % of Yemeni's total population suffers from HCV infection which makes a total of 600,000 people. Hepatitis C has emerged as a big challenge for Yemen. Health care workers are at increased risk of being infected due to tremendous exposure.

Objective: The purpose of this study was to find the prevalence of hepatitis C, its risk factors contributing for infection among health care Workers at Sana'a City.

Methods: A cross sectional survey conducted among 345 health care workers in the main general hospitals and health centers in Sana'a City. Blood samples were collected, and HCV antibodies were measured by using both Enzyme Immunoassay (EIA) and Recombinant ImmunoBlot Assay (RIBA)

Results: The prevalence rate of Hepatitis C virus among HCWs was 4.1%. Those who used needle cupping, needle stick injury, surgical operation, the rate was (8.7%), (4.9%) and (4.2%) respectively.

Conclusion: The frequency of HCV among health care workers is high. Awareness programs, training and continuing education should be mandatory and establishment of a national policy roadmap to increase knowledge about hepatitis C prevention. It will decrease the incidence of hepatitis C infection among health care workers.

KEYWORDS

Hepatitis C virus, Health care workers, Risk factors, Yemen

INTRODUCTION

Hepatitis C Virus (HCV) infection is caused by direct contact of blood is considered as major a public health problem throughout the world. According to the WHO, approximately 180 million people in the world are chronically infected with HCV, more than 990,000 deaths per year (WHO, 2017, WHO, 2018). HCV is mainly transmitted by contact with infected blood due to injuries to the skin or mucous membranes (Askarian *et al.*; 2011). Acute infection is often asymptomatic and therefore frequently overlooked. In up to 80% of patients, the clinical course is chronic, leading to an increased risk of developing hepatic cirrhosis or hepatic cell carcinoma (Te and Jensen; 2009). There is no vaccine or post-exposure prophylaxis for HCV infection. Healthcare workers (HCWs) have contact with infected patients and their body fluids. A particularly important factor is repeated performance of exposure prone procedures (EPPs) that may cause injuries to employees (Deuffic-Burban *et al.*; 2011). Injuries to medical and health staff from sharp or pointed objects are among the most frequently reported occupational accidents in healthcare (Nienhaus *et al.*; 2012). Yemen is the second largest heavily populated and the poorest country in Arabian Peninsula; the prevalence of HCV in Yemenis was found to be 1.9 among general population (Chaabna *et al.*; 2016), 2.7%, 2.8% among blood donors and lymphoma patients respectively (Nagi ALHaj *et al.*; 2018). a Such prevalence of Hepatitis can reach up to 60% in haemodialysis patients (ALHaj *et al.*; 2018). b Not many studies are available on the frequency as well as determinants of Hepatitis C among HCWs working in Yemen. HCWs are considered to be the high-risk individuals because they are all the times exposed to contaminated sharp devices and get infected by multiple infectious diseases including hepatitis C. The risk factor for HCV transmission among healthcare workers at their workplace is a percutaneous injury like a needle stick injury (Kubitschke *et al.*; 2007). This study will help increasing awareness among HCWs about Hepatitis C virus and it will help them to practice the preventive measures. Also, will lead to urge the higher authorities to provide safety equipment, mandatory screening of blood transfusion before operations and to arrange training, and implement infection control policy and guidelines among HCWs. The purpose of our study was to determine the HCV prevalence and risk factors among HCWs in the main general hospitals and health centers in Sana'a City.

MATERIALS AND METHODS

Sample collection

A cross-sectional study was conducted with 345 HCW in the main general hospitals and health centers in Sana'a City. Blood samples were collected, separated stored at -20°C until use.

Experimental procedure

ELISA 3rd generation (ADALTISS EIAgen, Italy) was used for detection of antibodies to HCV in serum samples with slightly modified according to Al-Haj *et al.*; (2018). c Briefly, 500 ng peptide dissolved in 0.05 M carbonate bicarbonate buffer (pH 9.6) was immobilized in each of the wells of a q6-well microtiter plate (Falcon, Becton Dickinson labware, NJ, USA). Wells were washed with phosphate buffer containing 0.05 Tween-20 and blocked with buffer containing 2% bovine serum albumin fraction V (Sigma-Aldrich, St. Louis, MO, USA). in PBS-Tween for 1 hour at 37 °C. After washing, 100 µl of the test and the control sera (diluted 1:300) were reacted with the peptide for 1 hour at 37 °C. All the washes were carried out using an automated micro-plate washer (ELx 50, BIO-TEK instruments, Vermont, USA). Subsequently, 100 µl of tetra-methyl-benzidine (TMB)(Sigma-Aldrich, St. Louis, MO, USA) substrate was added; plate incubated at RT for 30 min and the reaction was stopped with 100 µl of 1 N H₂SO₄. The reading was taken at 450 nm wavelength with a reference at 630 nm using an automated micro-plate reader (ELx-800, BIO-TEK instruments, Vermont, USA).

Recombinant Immunoblot assay (RIBA):

The amount and profile of the HCV antibody was confirmed by the semiquantitative recombinant immunoblot assay (RIBA) (Acon, Spain). The assay utilizes well-defined antigens derived from HCV immunodominant proteins from the core region, the E2 hypervariable region (HVR), the NS3 helicase region and the NS4A, NS4B and NS5A regions. Band reactivity is graded by visual calibration against IgG control bands present on each strip. The intensity of the colored bands is proportional to the amount of bound antibody and is graded as - (none), ± and 1+ to 4 (Mona R *et al.*; (2016).

Statistical analysis

Data was analyzed statistically using the EPI-INFO statistical program version 6 (CDC, Atlanta, USA). The Chi-square test was used to analyse, the qualitative data, p value < 0.05 was considered as significant and Odds ratio with Ninety-five percent confidence interval was used to evaluate the association of various age groups with respect to gender of healthcare workers of male/female.

RESULTS

Table 1, showed the age and gender distribution of the study. Majority of health care workers were in age group 20 – 29 yrs (59.1 %), followed by age group 30 – 39 yrs (31 %) while age group 40 – 49 yrs counted (7.9 %) and age over 49 yrs was only counted 2%.

Table 1: Age and gender distribution of health care workers whom included in the study

Age groups/ Years	Male (n=172)		Female (n= 173)		Total (n=345)		χ^2	pv
	No.	%	No.	%	No.	%		
20 – 29	89	51.7	115	66.5	204	59.1	7.7	0.005
30 – 39	68	39.5	39	22.5	107	31	11.6	0.0006
40 – 49	10	5.8	17	9.8	27	7.9	1.93	0.16
> 49	5	2.9	2	1.2	7	2	1.8	0.17
Total	172	49.9	173	50.1	345	100		

Mean age = 29.8 years, SD. = 7.3, Min= 20 years, Max =60 years, Median =28year, Mode =25 years.

Table 2 describe the crude prevalence rate for different gender and age groups was 4.1 %, and male rate higher than female rate. While the rate Zero % was among age group > 49 yrs old but not significantly important.

Table 2: The Prevalence rate of HCV antibodies of different gender and age groups.

Gender	HCV Positive Antibodies (n= 14)		RR	CI	χ^2	PV
	No.	%				
Male (n= 172)	7	4.1	1.01	0.4 – 2.8	0.00	0.99
Female (n=173)	7	4.05	0.99	0.4 – 2.7	0.00	0.99
Age group						
20 – 29 (n= 204)	9	4.4	1.24	0.4 – 3.6	0.16	0.68
30 – 39 (n= 107)	4	3.7	0.9	0.3 – 2.7	0.04	0.84
49 (n= 27)	1	3.7	0.9	0.1 – 6.6	0.01	0.9
49 (n= 7)	0	0	NA	NA	0.3	0.58
Crude Prevalence	14	4.1				

RR Relative risk = > 1, CI Confidence intervals, χ^2 , Chi-square = (significant), p Probability value = 0.05 significant, Mean age = 29.8 years, NA. Not available

The prevalence rates and relative risks for different professional workers as indicate in Table 3, show the highest rate and significantly important was occurred among housekeeping workers (6.5%) and the relative risks (10.2), while, Nurse rate was (5.3%) but not significant important with relative risk (1.6). Doctors prevalence rate was 3.1 and Lab workers 2.1%.

Table 3: Prevalence rate and relative risk of HCV for different professional HCWs.

Professional worker	Positive HCV (n = 14)		RR	CI	χ^2	PV
	No.	%				
Nurse (n= 132)	7	5.3	1.6	0.6 – 4.5	0.85	0.3
Lab. Worker (n=97)	2	2.1	0.43	0.1 – 1.9	1.3	0.23
Doctor (n= 64)	2	3.1	0.7	0.2 – 3.2	0.18	0.67
Housekeeping (n= 46)	3	6.5	10.2	3.4 – 30	20.3	<0.001
Dentist (n= 6)	0	0	NA	NA	0.26	0.6

RR Relative risk = > 1, CI Confidence intervals, χ^2 , Chi-square = (significant), p Probability value = 0.05 significant, NA. Not available Table 4 Shows the potential risk factors of contracting HCV. The highest rate of contracting HCV associated with cupping (8.7%), needle stick injury (4.9%), followed by surgical operation (4.2%), While the dental visit (3.5%), and injected drug abuse has (2.7%).

Table 4: Potential risk factor of contracting risk factor of contracting HCV among health care workers

Risk factor	Positive HCV (n = 14)		RR	CI	χ^2	PV
	No.	%				
Dental visit (n= 200)	7	3.5	0.7	0.3 – 2	0.38	0.52
needle stick injury (n= 143)	7	4.9	1.4	0.5 – 3.9	0.44	0.5
Surgical operation (n= 95)	4	4.2	1.1	0.34 – 3.3	0.01	0.92
Injected drug abuse (n= 37)	1	2.7	0.6	0.03 – 4.7	0.2	0.65
Cupping (n= 23)	2	8.7	1.4	0.3 – 5.9	0.19	0.66
Blood transfusion (n= 20)	0	0	NA	NA	0.4 or 0.9	0.3

RR Relative risk = > 1, CI Confidence intervals, χ^2 , Chi-square = (significant), p Probability value = 0.05 significant, NA. Not available.

Table 5 shows the occupational risk factors of contracting HCV among health care workers, direct contacts with dental equipment have more risk factors (8%), then direct contact with surgical waste (5.8%), direct contact with patients (4.1%), direct with drugs (4 %), and direct contact with patient samples a percentage (3.6%).

Table 5: Occupational risk factor of contracting HCV among health care workers

Risk factor	Positive HCV		RR	CI	χ^2	PV
	No.	%				
Direct contact with patients (n= 291)	12	4.1	1.1	0.3 – 4.8	0.02	0.88
Direct contact with patient samples (n= 249)	9	3.6	0.7	0.3 – 2	0.45	0.5
Direct contact with surgical waste (n= 69)	4	5.8	1.6	0.5 – 4.9	0.67	0.41
Direct contact with dental equipment (n= 25)	2	8	2.2	0.5 – 9	1.1	0.29
contact with drugs (n= 25)	1	4	0.98	0.13 – 7.2	0.00	0.99

RR Relative risk = > 1, CI Confidence intervals, χ^2 , Chi-square = (significant), p Probability value = 0.05 significant.

DISCUSSION

We found that the prevalence of Hepatitis C among HCWs was 4.17%. It is similar to Khan, *et al;* (2011) study conducted in Pakistan among HCWs. It was even more than the prevalence of HCV among HCWs study conducted in Dhaka- Bangladesh, Poland and India (1% and 1.9% and 3% respectively (Shah *et al;* 2017). This difference is because the HCWs adopt better preventive measures in health-care centers. In contrary to that, we performed our study in the Yemeni Public Hospitals having lesser trained HCWs. According to previous study, the HCV prevalence in healthy adults in the general population of Yemen was 1.9.0% (Chaabna *et al;* 2016). Moreover, the non-occupational risk factors for HCV are also common among HCWs including doctors (physicians, consular), nurses, laboratory workers, dentist and cleaners. The highest rate of HCV occurred among cleaner (6.5%), with relative risk equal to 10.2, CI= 3.4 – 30, $\chi^2 = 20.3$, $P.V < 0.001$. The high prevalence rate among cleaners in our study may be due to the high accidental frequent exposure of cleaner to needles stick or deep injury during cleaning hospital environments and lack of infection control policies and guidelines. The HCV occupational transmission through needle stick was deep injury among health care workers have been confirmed by Garus *et al;* (2018). To understand and appreciate fully the various epidemiological patterns found in hepatitis C in Yemen, the sources of virus infections are required to be known Percutaneous or parenteral transmission is one of the principal modes of hepatitis C virus spread in communities and risk groups (Nicola *et al;* 2016). In our study there was no risk for blood transfusion. This factor has undergone a dramatic reduction in recent years in Yemen as a result of screening of blood for HCV antibodies, but it seems to be still as an important risk factor for contracting HCV infection, so that an addition of sensitive and specific anti-HCV testing should be added and distributed widely to clinics and hospitals to improve and wide spread in HCV testing in blood screening (Belinda *et al;* 2016). The higher prevalence of HCV among HCWs of our study may be attributed to these risk factors as well. Another study describes these non-occupational risk factors among HCWs. Those who used needle cupping, needle stick injury, surgical operation, dental visit and injected drug abuse were (8.7%), (4.9%), (4.2%) (3.5%) and (2.7%) respectively. Being a clean worker (6.5%) and nurse (5.3%), were associated with a higher risk of hepatitis C virus infection. The higher authorities should ensure the provision and the use of safety equipment

such as safe needle devices. The results of this study indicated that the prevalence of HCV among Yemeni health care workers was unaffected by age (age independent), but this result is different from other studies that covered wider range of age in several groups indicated that the prevalence of HCV is age dependent, in which increase with increasing age (ZhiLi, *et al*; 2016). For example, in India, the prevalence rate of HCV was approximately 4% among health care workers 20–30 years old, gradually increased in older ages and reached a peak of 5.6 in health care workers more than 45 years old (Jindal *et al*; 2006, ZhiLi, *et al*; 2016). Similar to absent or low risk of HCV found among recipients of blood products in our study, the hazards of surgery exposure also were not significant among our study group. This low risk for surgery is related to safe blood transfusion during surgery. When we considered other risk factors of contracting HCV among our HCWs, as cupping, dental visit and injected drug abuse, no significant association were found with them. To our knowledge, it is the first cross sectional study of HCV among HCWs in Yemen, but it has some limitations, such as a relatively small sample size and target only from the capital city and a selection bias is possible given the use of the data from a few public hospitals selected, but our study may be helpful for understanding the Prevalence of HCV in in Sana'a, Yemen and can provide important information about HCV prevalence among different ages and sexes of Health care workers in the very poor country and recently suffering from injustice civil war and siege where the health system and its services on the edge of collapse.

CONCLUSION

The frequency of HCV among health care providers is high. The HCWs are at high occupation risk to HCV infection, which is associated with the age, type of work, and length of service at Health setting, particularly in the professions that routinely perform exposure-prone procedures and handling blood-borne samples or other biological fluids. The knowledge about the prevention and treatment is poor among them. The use of preventive measures is poor. Safety equipment such as safe needle devices should be available. There should be mandatory training, continuing education for prevention of HCV in every hospital. These establishment of a national policy will help in decreasing the frequency of HCV and all other nosocomial infections.

CONFLICT OF INTEREST

This work has no conflict of interest to declare.

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