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Detecting the Prevalence of Hepatitis C Virus among Iraqi People

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Abstract

Background: Infection with the hepatitis C virus (HCV) is a major public health issue worldwide and remains a vital etiology of long-term hepatitis. This study aimed to detect the prevalence of HCV infection among Iraqi people. This research was proposed to detect the frequency of HCV infection in renal failure patients, thalassemia patients, blood donors, and Iraqi medical staff. Such prevalence potentially could assist in the development of a preventive program for this infection and orient future studies.

Methods and Results: Cross-sectional research was conducted in Thi-Qar Province (Iraq). The enrolled 1650 individuals (1180 males and 470 females, age range of 1-85 years) were classified into four study groups. Group 1 included 120 patients with renal failure, Group 2 included 220 patients suffering from thalassemia, Group 3 included 1259 blood donor subjects, and Group 4 included 51 subjects from the medical staff. Serum anti-HCV-IgG-Abs were detected qualitatively by a human HCV-IgG-ELISA Kit (MyBioSource, USA). The findings revealed that out of 1650 subjects, only 53(3.2%) were infected with HCV. The highest prevalence was reported among thalassemia patients 34/220(15.45%), followed by renal failure patients 8/120(6.66%) and then the medical staff group 3/51(5.88%), whereas the lowest prevalence was reported among the blood donor group 8/1259(0.64%). The total infection rate of HCV was higher among males [33/53(62.3%)] than females [20/53(37.7%)], with significant differences (P<0.05). We found a significant difference in HCV infection rate according to the age range of the study subjects (P<0.05). The higher infection percentages of 29/53(54.7%) and 15/53(28.3%) were found in age groups of 1-20 years and 21-40 years, respectively, followed by the age group of 41-60 years, which had infection percentages of 7/53(13.2%), while the lowest infection rate was reported in the age group of more than 60 years, which was 2/53(3.8%).

Conclusion: The frequency rate of HCV infection among Iraqi people is similar to those in most Asian and non-Asian studied populations, and the infection rate was higher in males and inversely correlated with the age of the subjects. The main routes of HCV infection were blood transfusions, renal dialysis, and HCWs. Thalassemic and hemodialysis patients were potentially vulnerable to HCV infection. Effective screening methods and blood donor screening protocols are likely required to prevent the spread of HCV infection.(**International Journal of Biomedicine. 2023;13(2):234-240.**)

Keywords: hepatitis C virus • blood transfusions • thalassemia • renal dialysis

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Abbreviations

Abs, antibodies; **Ags**, antigens; **HCC**, hepatocellular cancer; **HCV**, hepatitis C virus; **HCWs**, health care workers; **HRP**, horseradish peroxidase.

Introduction

The hepatitis C virus (HCV) is a diminutive enveloped RNA virus from the *Hepacivirus* genus and the *Flaviviridae* family. HCV has positively polarized, single-stranded genomic RNA; it forms the virion after being assembled by the core protein and enclosed by lipid bilayers that have the E1 and E2 viral glycoproteins. All have recently been defined as HCV genotypes that are hepatotropic and lethal, despite the differences in nucleotide sequences between them.[1] HCV infection causes an asymptomatic acute stage, but there is a high chance of having chronic HCV infection in about 75% of people who are acutely infected, in which 27% of patients develop liver cirrhosis, and 25% have HCC during

the first two decades following infection. One percent of the world's population is thought to have chronic HCV infection. In contrast, it has been estimated that about 14 million individuals in the European Union/European Economic Area have had chronic HCV infection, indicating a considerably high incidence of 1.5% in this area.[2] Previous research from the region's nations revealed that the prevalence of HCV was 1.1% in Yemen, <1% in Iran, 1.8% in Saudi Arabia's youth, 4% in Pakistan's blood volunteers, and 0.2% among Iraqi people.[3]

To detect HCV infection, molecular and serological techniques are used. The serological tests are used to detect anti-HCV-Abs and HCV-Ags in the serum and/or plasma that are quickly obtained from venipuncture. Consequently, the serological assays are appropriate for mass screening of the general population for HCV. Additionally, the use of serological assays for monitoring treatment and confirming virologic clearance is extremely appropriate. Enzyme immunoassays are typically utilized in HCV screening settings to identify anti-HCV-Abs and HCV-Ags.[4] For patient screening, a third-generation anti-HCV ELISA with great sensitivity is frequently used. Most third-generation ELISA tests currently available for the detection of HCV-Abs either depend solely on synthetic peptide Ags, recombinant protein Ags, or a combination of these types of HCV-Ags.[5]

The incidence of HCV infection is dramatically elevated in patients on maintenance hemodialysis, and this virus has been implicated in serious consequences, ranging from persistent hepatitis to severe cirrhosis and HCC.[6] In regard to the usual course of HCV disease in renal failure subjects, controversial findings persist even in subjects with normal renal findings. Since HCV infection has a long duration, is generally asymptomatic, and has a disease onset that is difficult to define, defining the disease's natural history of infection remains challenging.[7] In many nations, post-transfusion hepatitis and end-stage liver disease are the diseases most frequently caused by HCV. The overall survival of patients with hereditary hemolytic anemia, especially thalassemia, has been improved with regular blood transfusions, but there is a substantial threat that they will acquire a blood-borne viral infection, particularly the hepatitis virus.[8] In general, body piercing, tattoos, intravenous drug use, iatrogenic exposures, vertical transmission, and highly risky sexual intercourse are all involved in the transmission of HCV, which occurs when an individual meets contaminated blood.[9] Blood transfusions contribute to the increasing spreading pool of viral infections that can also be transmitted from asymptomatic infected people. Screening and evaluating the donor not only reduces the risk of transmission through contaminated blood products but also gives details on the rates of infection prevalence in the neighborhood. It is crucial to evaluate and track the prevalence and trend of HCV in blood donors to evaluate the quality and efficacy of donor screening, public awareness campaigns, blood screening assays, and the possible threat of HCV infection conveyed through transfusions.[10] Blood safety has been enhanced by the regulation of screening assays and the invention and introduction of HCV nucleic acid technology. Transfusion-transmitted HCV infection still exists, despite highly sensitive diagnostic technology.[11] Infectious blood-borne infections, such as HCV, pose a serious threat to HCWs, wherever they are working. The use of contaminated sharp tools, improper injection methods, mishandling of biological materials, and a lack of education are the main origins of the infection. The total number of people with HCV infection has a significant impact on the number of infected HCWs. This rate is frequently high among HCWs working in less developed nations.[12] There is no vaccination to prevent HCV infection, and HCV therapy is expensive. Consequently, it is crucial to prevent primary HCV infection. Any HCV infection prevention program must be supported by precise data, including statistics on its prevalence. For the prevalence of HCV infections among Iraqis in some provinces, a small number of studies were conducted in past years. However, they are few and insufficient. This research was proposed to detect the frequency of HCV infection in renal failure patients, thalassemia patients, blood donors, and Iraqi medical staff. Such prevalence potentially could assist in the development of a preventive program for this infection and orient future studies.

Materials and Methods

Study design and subjects

Cross-sectional research was conducted in Thi-Qar Province (Iraq). The enrolled patients suffered from clinical manifestations of renal failure and/or thalassemia, whereas the other enrolled subjects were blood donors and medical staff individuals. The current study was carried out from August 2019 to October 2020.

A total of 1650 individuals (1180 males and 470 females, age range of 1-85 years) attending the Public Health Laboratory, Hereditary Blood Diseases Center, Al-Hussein Teaching Hospital's Renal Dialysis Unit, and Central Blood Bank were enrolled in this study, and they were classified into four study groups. Group 1 included 120 patients with renal failure, Group 2 included 220 patients suffering from thalassemia, Group 3 included 1259 blood donor subjects, and Group 4 included 51 subjects from the medical staff.

Eligibility criteria

Group 1: All patients with frequent renal dialysis who attended the Renal Dialysis Unit of Al-Hussein Teaching Hospital during the period of the current study were enrolled after giving their approval. Group 2 included patients with a completely confirmed diagnosis of thalassemia disease who attended the Hereditary Blood Diseases Center during the recent study time after giving their approval. Group 3 included the blood donor volunteers who attended the Central Blood Bank at the time of the current study after giving their approval to take a sample. Group 4 included the medical staff subjects from different medical centers in Thi-Qar Province who were approved to give a sample; the subjects had randomly selected specializations, like physician, dentist, laboratory assistant, radiologist, etc.

Samples collection

From each subject, 3-4 mL of peripheral blood was collected by vein puncture. Blood samples were allowed to complete the clotting process at ambient temperature before being centrifuged at 1500 rounds per minute for 10 minutes to

obtain the serum, which was then stored at -20C° till required for the serological test.

Serological test

The serological test was executed in the Public Health Laboratory at the Health Office of Thi-Qar. Anti-HCV-IgG-Abs were detected qualitatively by a human HCV-IgG-ELISA Kit (MyBioSource, USA). This kit was based on indirect ELISA techniques. Ninety-six well plates were pre-coated with recombined HCV-Ags. Test samples were loaded into the wells, and a wash buffer was used to remove any unbound conjugates. If there were any HCV-IgG-Abs in the samples, they would then form an immunological complex when HRP-conjugated anti-human-IgG-Abs were added. Substrates containing tetra-methyl-benzidine were utilized to observe the HRP enzymatic process. Horseradish peroxidase accelerated the reaction to create a blue-colored product, which turned yellow once the acidic stop solution was added. A microtiter plate reader (Biokit, Germany) was used to determine the optical density of the formed color, and the results were regarded as negative and/or positive according to their absorbance values.

Statistical analysis was performed using the statistical software package SPSS version 24.0 (SPSS Inc, Armonk, NY: IBM Corp). Frequencies and percentages were used as descriptive statistics. The relationships between the variables were assessed using the chi-square test. The findings were regarded as statistically significant at a *P*-value lower than 0.05.

The study was approved by the Ethics Committee of the Thi-Qar Health Department, Ministry of Health, Iraq (Agreement No: 155). All participants provided written informed consent.

Results

A total of 1650 subjects (age range of 1-85 years, 1180 males and 470 females) were enrolled in the current study after strict application of the eligibility criteria mentioned in the materials and methods.

Figure 1 shows the results of anti-HCV-(IgG)-Abs in the total sum of the study groups. The findings revealed that out of 1650 subjects, only 53(3.2%) were infected with HCV, whereas 1597/1650(96.8%) were negative for HCV.

Figure 2 shows the prevalence of HCV according to study groups. The highest prevalence was reported among thalassemia patients 34/220(15.45%), followed by renal failure patients 8/120(6.66%) and then the medical staff group 3/51(5.88%), whereas the lowest prevalence was reported among the blood donor group 8/1259(0.64%). The total infection rate of HCV was higher among males [33/53(62.3%)] than females [20/53(37.7%)], with significant differences ($P<0.05$) (Table 1). We found a significant difference in HCV infection rate according to the age range of the study subjects ($P<0.05$) (Table 2). The higher infection percentages of 29/53(54.7%) and 15/53(28.3%) were found in age groups of 1-20 years and 21-40 years, respectively, followed by the age group of 41-60 years, which had infection percentages of 7/53(13.2%), while the lowest infection rate was reported in the age group of more than 60 years, which was 2/53(3.8%).

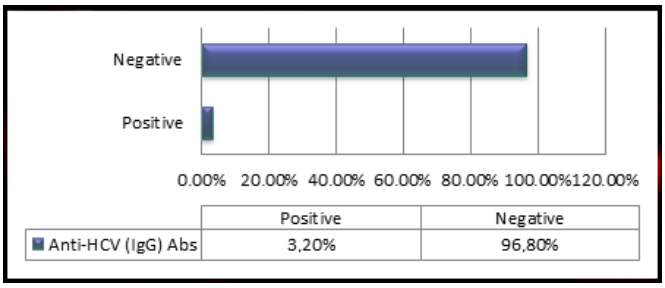

Fig. 1. *The HCV prevalence in the study population*

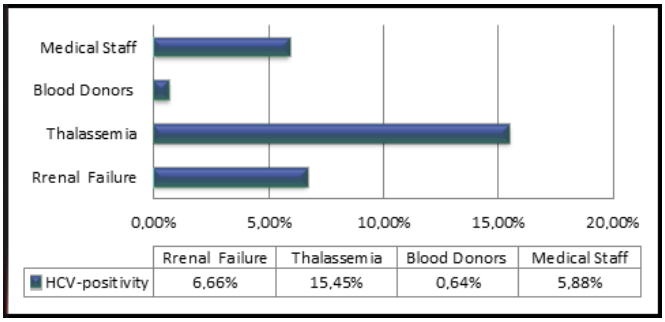

Fig. 2. *HCV prevalence within each study group*

Table 1.

HCV prevalence according to gender

Study group	Anti-HCV-IgG-Abs positivity		
	Males	Females	Statistics
	n (%)	n (%)	
Renal Failure (n=8)	5 (62.5)	3 (37.5)	*P=0.9156
Thalassemia (n=34)	20 (58.8)	14 (41.2)	
Blood Donors (n=8)	6 (75)	2 (25)	
Medical Staff (n=3)	2 (66.7)	1 (33.3)	
Total (n=53)	33 (62.3)	20 (37.7)	$P<0.05$

**Yates' P-value*

Table 2.

HCV prevalence according to the age range of the study subjects

Age Subgroup (year)	Positive subjects for HCV				
	Renal Failure (n=8)	Thalas-semia (n=34)	Blood Donors (n=8)	Medical Staff (n=3)	Total (n=53)
	n (%)	n (%)	n (%)	n (%)	n (%)
1-20	0 (0)	29 (85.3)	0 (0)	0 (0)	29 (54.7)
21-40	4 (50)	5 (14.7)	4 (50)	2 (66.7)	15 (28.3)
41-60	3 (37.5)	0 (0)	3 (37.5)	1 (33.3)	7 (13.2)
>60	1 (12.5)	0 (0)	1 (12.5)	0 (0)	2 (3.8)
Total	8 (100)	34 (100)	8 (100)	3 (100)	53 (100)
Statistics	$P<0.05$				

Discussion

HCV is one of the most common contagious diseases in humans, which is characterized by a wide number of clinical manifestations, including acute and/or fulminant hepatitis. HCV infection also may be clinical without symptoms or may be developed into chronic hepatitis and cirrhosis of the liver. Various behavioral, environmental, and host elements affect the prevalence of HCV infection, which fluctuates from one country to another.[13] In contrast to developing nations like Iraq, where researchers are still working to control the infection, the incidence rate of HCV infection was decreased in developed countries.[14] Due to Iraq's turbulent social and political circumstances throughout the past few decades, data on the frequency of HCV infection in the general population are not available. The only information on the prevalence of viral hepatitis in Iraq that has been published, as far as we are aware, was from studies on blood donors.

Research from nearby nations revealed a fluctuation in the incidence levels of HCV infection, which had a range of 0.4%-19.2%.[15] In this study, the total prevalence of HCV infection was 3.2% (Figure 1). Consistent with our findings, another previous study at Duhok City found that the prevalence of HCV was 2.8%.[3] On the other hand, the results of the current study were less than those in a previous study conducted in Iraq by Hamied et al.,[16] which reported the HCV prevalence in Baghdad province (8.3%), and more than the findings obtained by Tarky et al.[13] in all Iraqi governorates (0.4%) and Abdul-Kareem et al.[17] in Al-Najaf province (0.34%). In comparison with findings of the previous research in other countries, the findings of the current study were in agreement with those in Turkey (2.4%),[18] Thailand (2.8%), and Vietnam (2%-2.9%), less than those in Taiwan (4.4%), Pakistan (4.7%) and Egypt (14.9%), and more than those in Iran (0.5%), USA (0.01%), Australia (1.3%), China (1%-1.9%), Saudi Arabia (1%-1.9%), and Syria (1-1.9%).[19-22] The variations in the study population, sample-collecting methods, and diagnostic techniques may partially explain these variations in the prevalence rates. To investigate this, further population-based studies are required.

Patients with thalassemia and hemoglobinopathies need frequent blood transfusions, which are important for the improvement of their survival and reduce dangerous complications that are produced by severe anemia.. On the other hand, these frequent blood transfusions will increase the probability of infection with different microbes, especially, human immunodeficiency virus, HCV, and hepatitis B virus.[23] Consistent with these findings, the prevalence ratio of HCV in the current study was 15.45% from 220 patients suffering from thalassemia. Previous studies in Duhok City (Iraq)[24] and Mosul City (Iraq)[25] reported that patients with thalassemia had HCV prevalence of 11.05% and 17%, respectively, which is in line with current data. The findings of the present study were lower than other previous studies in other Iraqi cities, including Diyala (26.4%)[26] and Karbala (37%),[27] and higher than Babylon city (7.5%).[28] This variation in the prevalence of HCV among thalassemia patients may belong to variations in hygienic surveillance, especially tests of blood. In addition, it reflects the variation in health awareness of the citizens in these cities. HCV is characterized by low viral load, a long incubation period that may be extended to six months, and being asymptomatic in acute and chronic periods, all these reasons will delay the seroconversion and, finally, delay diagnosis of HCV in blood donors, leading to an increase the probability of HCV infection among patients with thalassemia and hemoglobinopathies through hemolysis, and this explains the elevated HCV infection rates among thalassemia patients in the current study. To limit HCV infection, many nations have integrated molecular biology technologies into standard protocol testing that can detect the depleted levels of virus nucleic acid.[29]

HCV infection was a critical concern in hemodialysis centers. Both nosocomial infection and blood transfusion are considered major factors in the dissemination of HCV infection.[30] Hemodialysis patients in the province of Thi-Qar (Iraq) had an overall percentage of HCV infection of 6.66%, according to the findings of the present study. This finding was closer to that reported in Baghdad province (Iraq) (7.1%),[31] Al-Anbar province (Iraq) (11.7%),[32] and Mexico (6.7%).[33] This prevalence was low when compared with reports from Sulaimani (Iraq) (26.7%)[34] and other developing countries (24% in Iran, 30% in India, and 26% in Oman),[35] but it is high when compared to reports from Western countries such as the United Kingdom (0.4%).[36]

As previously illustrated above, HCV is a parenterally transmitted blood-borne virus. Before the onset of symptomatic liver diseases, infection typically results in a chronic, asymptomatic carrier status for many years. Healthcare workers infected with HCV may not be aware of their condition or the possibility of transmitting the disease to patients. The possible acquisition of blood-borne viral infection is increased by HCWs who perform exposure-prone operations, where an injury to the worker may expose the patient's open tissues to the HCW's blood and vice versa.[37] In the current study, we found that the prevalence of HCV infection among HCWs was 5.88%. It is closer to the results of ALHaj et al.,[38] and Ansari and Dixit[39] studies that were conducted in Yemen (4.17%) and India (4%) among HCWs, respectively. However, it was higher than the rate of HCV among HCWs in Dhaka-Bangladesh (1%), Poland (1.9%), and India (3%).[40] These differences were due to the HCWs' use of various preventive measures at different healthcare facilities. Overall, the current research may be useful for comprehending the prevalence of HCV among HCWs in the province of Thi-Qar (Iraq).

For the prevalence of HCV among blood donors, a recent study revealed that 0.64% of people had HCV-Abs. In agreement with these findings, previous studies in Baghdad[41] and Babylon[42] governorates showed a closer prevalence rate of HCV infection (0.7% and 0.5%, respectively). As compared to other nations, the incidence of HCV among Kuwaiti nationals and non-Kuwaiti Arab first-time blood donors was reported to be 0.8% and 5.4%, respectively.[43] According to a hospital-based study conducted in Jordan, 0.9% of blood donors had HCV infection.[44] Overall, the variations in the prevalence of HCV infection may have been for different reasons, such as sample size, type of technique used (ELISA, Minividas,

Immunofluorescences, or Chemiluminescence), variations in kit types and their trademark, time of incubation during the test procedure and the differences in blood test procedures between countries, cities, and societies. In addition to that, the variations in customs and social customs in each society, such as tattoos, body piercing, and taking drugs by injection. The level of hygienic surveillance, as well as hygienic awareness of people, may interpret all these variations in results.

The results of the present study exhibited a significantly higher frequency percent of HCV positivity among males (62.3%) than females (37.7%). The current study findings were consistent with previous findings reported by other authors in Iraq[45] and Iran.[46] Data of blood donors from Pakistan and America, as well as outpatient clinic visitors from India[47] and American blood donors,[48] were also similar to our findings, and males had a higher prevalence than females. In Egypt, villagers and male blood donors were found to have a higher prevalence rate of HCV than females.[49,50] Although males in Pakistan had slightly greater probability trends than females among all age categories, these differences were not statistically significant.[51] In Poland, a large-scale survey found no differences in HCV prevalence based on the gender of subjects.[52] For the age groups distribution, the prevalence of HCV infection was significantly highest among persons in the age group of 1-20 years, followed by the age group of 21-40 years, and these results agreed with Amin et al.,[53] who reported that the 20 - 24-year-old age group had the highest HCV prevalence, with a strong majority of the infected population below the age of 50 years. The trend of seroprevalence through ages in Australasia's Western Pacific region showed a significant increase in HCV prevalence, which reaches its peak at 20 to 24 years of age. Additionally, Central Europe exhibited an early peak in children between the ages of 1-4 years.[54] In the current study, the prevalence of HCV infection decreased with age beyond 60 years, which may be related to the deterioration in functional ability and economic strength that causes a decline in the number of elder tests.

The first limitation of the current study was a small sample size because only one province of Iraq (Thi-Qar) was included. Another limitation was the time of the sample collection, because the serological test may have revealed negative results when the sample was collected during the window period of HCV infection. Most of the information available about the incidence of HCV infections in Iraq emerged from laboratory findings and personalized research projects at some academic institutions. Therefore, to reduce the infection with HCV, we suggested continuing monitoring of blood banks, HCWs, as well as patients, and introducing a highly sensitive molecular technology (PCR) for detecting HCV biomarkers within the window period.

Conclusion

In Iraq, 3.2% of the population had HCV infection, which was similar to those in most Asian and non-Asian studied populations, and the infection rate was higher in males and inversely correlated with the age of the subjects. The main routes of HCV infection were blood transfusions, renal dialysis, and HCWs. Thalassemic and hemodialysis patients were potentially vulnerable to HCV infection. As a result, effective screening methods and blood donor screening protocols are likely required to prevent the spread of HCV infection. The risk of HCV infection is higher among HCWs; hence, HCWs should take proper precautions while handling blood and other biological fluid and samples. Aseptic procedures should be carried out to prevent needle stick injury.

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Competing Interests

The authors declare that they have no competing interests.

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