

Seroprevalence of Hepatitis B and C Viruses Among Diabetes Mellitus Patients in Duhok Province

Yasen Rashad Abdulkareem, Sabri Khalaf Shaikho¹

Azadi Teaching Hospital, Duhok General Directorate of Health, Duhok, ¹Department of Medicine, College of Medicine, University of Duhok, Duhok, Iraq,

Abstract

Background and Objective: Patients with diabetes mellitus are at high risk of developing hepatitis B virus (HBV) and hepatitis C virus (HCV) infections owing to frequent hospitalization and blood investigations. The aim of this study was to determine the prevalence of HBV and HCV infections among diabetes mellitus (DM) patients in Duhok. **Materials and Methods:** In this cross-sectional study, a total of 200 patients with DM type 1 and 2 were included. Patients' serum samples were obtained to study HBsAg, and anti-HCV assays were done by the enzyme immunoassay method. Patients diagnosed to be positive for HBsAg and anti-HCV were referred to the infectious diseases unit for further evaluation. **Results:** The mean age of patients was 53.33 ± 11.25 years (mean $\pm$ SD). More than two-thirds of them (70.0%) were females. The crude prevalence rates of HBV and HCV in patients with T2DM were 1.5% and 1.0%, respectively. The diabetes-specific seroprevalence of infection with HBV and HCV was 1.5% and 1.0%, respectively. The study did not show that baseline and clinical characteristics are related to developing viral hepatitis infection in diabetic patients. **Conclusion:** The study showed a very low seroprevalence of HBsAg and anti-HCV infection in type 2 diabetic patients with no relationship with clinical information.

Keywords: Anti-HCV infection, HBsAg, seroprevalence, viral infection

INTRODUCTION

Diabetes mellitus (DM) is a complex chronic non-communicable disease associated with disorders of carbohydrate, lipid, and protein metabolism.^[1] The disease is defined by the increased blood glucose level due to defective insulin action or defective insulin secretion, following progressive beta cells destruction or both. There are different types of DM, including type 1 DM (T1DM), type 2 DM (T2DM), and gestational DM.^[2]

Generally, viruses are implicated in the pathogenesis of T1DM either directly by destroying insulin-producing pancreatic β -cells through cytolytic infection or by triggering to β -cell-specific autoimmunity, leading to the development of T1DM. However, the exact mechanism of hepatitis B virus (HBV) and hepatitis C virus (HCV) in DM is unknown.^[3]

Patients with diabetes are at high risk of developing HBV and HCV due to frequent hospitalization and blood investigations.^[4] Outbreaks of HBV infection have been

reported among diabetic patients who share a blood glucose meter without cleaning and disinfecting between uses. It is associated with limited awareness of the high risk for HBV and HCV transmission during finger stick blood glucose testing.^[5]

The literature has reported that diabetic patients are at risk of developing non-alcoholic steatohepatitis.^[6] The studies have shown synergistic impacts of parenteral viral hepatitis with diabetes in the development of chronic liver diseases.^[7,8] There are few studies on the prevalence of HBV and HCV in diabetic patients in this region. Merza^[9] included 375 diabetic patients in a study. He reported that 8 (2.13%) and 2 (0.53%) patients had HBV and HCV infections, respectively. The alcoholism was reprieved

Address for correspondence: Dr. Yasen Rashad Abdulkareem,
College of Medicine, University of Duhok, Duhok, Iraq.
E-mail: yasen.abdulkareem85@gmail.com

Submission: 22-February-2021 **Accepted:** 04-May-2021
Published Online: 29-September-2021

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How to cite this article: Abdulkareem YR, Shaikho SK. Seroprevalence of hepatitis B and C viruses among diabetes mellitus patients in Duhok province. Med J Babylon 2021;18:219-23.

Access this article online

Quick Response Code:



Website:
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DOI:
10.4103/MJBL.MJBL_16_21

to associate with both infections. Hemodialysis was determined to be a risk factor for HCV infection among diabetic patients.

The diagnosis of HBV and HCV is made by serologic assays. In these tests, human antibodies that are generated through a response to HCV and HBV infection are detected. The positive HCV antibodies means active infection, past HCV infection, or a false-positive test.^[10,11]

The prevalence of HBV infection in the Eastern Mediterranean Region is 3.3% when compared with 1–2% (excluding Egypt).^[12,13] The prevalence rates of HBV and HCV are 1.6% and 0.4% in Iraq, respectively.^[14]

The aim of this study was to identify the frequency of HBV and HCV infections among DM patients in Duhok province.

PATIENTS AND METHODS

Study design and patients

In this cross-sectional study, the patients who attended the tertiary clinic between July and November 2017 and diagnosed with DM were included. The patients accepted to participate in a blood test for HBsAg, anti-HCV, and anti-HIV. The patients were selected from the Azadi Teaching Hospital in Duhok city. This hospital is a tertiary referral hospital dealing with all patients of DM from Duhok province. There is an outpatient clinic for interviewing and managing such cases and also fourth floor inpatient cases.

Inclusion and exclusion criteria

The patients who were diagnosed with T2DM were eligible to participate in this study. The patients with gestational diabetes, other causes of viral hepatitis, e.g. cytomegalovirus infection, and other types of hepatitis, e.g. autoimmune hepatitis, were excluded from the study.

Data collection and laboratory investigation

The patient demographic profile and other risk factors associated with DM were recorded in a pre-designed questionnaire. Blood samples were taken from all patients. An aliquot of 5 mL of blood was obtained from an antecubital vein by a sterile disposable syringe. The blood was poured into a clean plain tube without anticoagulant and centrifuged at 3000 rpm for 5 min. The serum was separated for both enzyme-linked immunosorbent assay to detect HBsAg and anti-HCV (Fortress Diagnostics Limited, Antrim, UK), according to manufacturer's instructions,^[15,16] and biochemical tests, i.e. ALT and AST. Furthermore, fasting plasma glucose and random glycemia were done using Cobas c 311/Cobas c 6000, and glycosylated hemoglobin using Cobas c 311 was also performed. Patients who were diagnosed to be positive for HBsAg and anti-HCV were referred to the infectious diseases unit for further evaluation.

HBV infection was defined based on the presence of HBsAg marker and HCV based on the presence of anti-HCV marker. DM was diagnosed as fasting blood sugar ≥ 126 mg/dL and HbA1c more or equal to 6.5%.

Statistical analysis

The general information of the patients was reported in mean (SD) or number (%). The prevalence of alcohol consumption, medical conditions, HBV, and HCV in diabetic patients was determined in number (%). The association of clinical aspects of T2DM patients with HBV and HCV infection was examined in Fisher's exact test. The significant level of difference was determined in a *P*-value of less than 0.05. The statistical calculations were performed by IBM Corp., Released 2017, IBM SPSS Statistics for Windows, Version 25.0, IBM Corp., Armonk, NY, USA.

RESULTS

In the current sample, 200 patients were recruited, with more than two-thirds (70.0%) being females and the remaining (30.0%) being males. The majority of the patients (97.5%) were diagnosed with T2DM, with just a small percentage (2.5%) having T1DM. Just 6.5% of the overall patients were smoking, and only 6.5% drank alcohol. In addition, the mean age of the patients was 53.33 ± 11.25 years (mean $\pm$ SD) [Table 1].

The study revealed that a considerable percentage of the patients were hospitalized (74.0%) and underwent surgery (68.0%) and dental procedures (79.5%) for their health conditions before study recruitment. A small percentage of them were diagnosed with jaundice (10.5%), underwent hemodialysis (2.5%), had immunosuppressive drugs (2.0%), and one-fourth of the patients had a blood transfusion (25.5%) [Table 2].

The crude prevalence rates of HBV and HCV in patients with DM were 1.5% and 1.0%, respectively. The diabetes-specific seroprevalence rates of infection by HBV and HCV in patients with type 2 diabetes were 1.5% and 1.0%,

Table 1: Baseline characteristics of patients with DM

Patients' characteristics (<i>n</i> = 200)	Frequency distribution	
	Frequency	Percentage
Gender		
Male	60	30.0
Female	140	70.0
Diabetes mellitus types		
Type 1 DM	5	2.5
Type 2 DM	195	97.5
Smoking, yes	13	6.5
Alcohol consumption, yes	3	1.5
	Mean	Standard deviation
Age, year	53.33	11.25

respectively. The patients with T1DM were not affected by HBV and HCV [Table 3].

The study did not show any association of hepatitis B infection with smoking ($P = 0.188$), alcohol consumption ($P = 1.00$), having jaundice ($P = 0.291$), hospitalization ($P = 1.00$), surgery ($P = 1.00$), dental procedures ($P = 1.00$), hemodialysis ($P = 0.075$), blood transfusion ($P = 1.00$), and immunosuppressive drugs ($P = 0.061$) [Table 4].

Table 2: Clinical characteristics of patients with DM

Patients' clinical characteristics (n = 200)	Frequency distribution	
	Frequency	Percentage
Jaundice	21	10.5
Hospitalized	148	74.0
Surgery	136	68.0
Dental procedure	159	79.5
Hemodialysis	5	2.5
Blood transfusion	51	25.5
Immunosuppressive drugs	4	2.0
	Median	Interquartile

Table 3: Seropositivity of HBV and HCV infections in diabetic patients

Diabetic patients (n = 200)	Frequency distribution	
	Frequency	Percentage
All patients		
Hepatitis B	3	1.5
Hepatitis C	2	1.0
Type 2 DM		
Hepatitis B	3	1.5
Hepatitis C	2	1.0
Type 1 DM		
Hepatitis B	0	0.0
Hepatitis C	0	0.0

DM = diabetes mellitus

Similar to HBV, the study did not show any relationship of HCV with general and clinical aspects of type 2 diabetic patients, as shown in Table 5.

DISCUSSION

The present study was conducted to examine the seroprevalence of HBV and HCV in patients with T1DM and T2DM. The overall prevalence rates of HBV and HCV in patients with type 2 diabetes were 1.5% and 1.0%, respectively. The patients with type 1 diabetes were not affected by HBV or HCV in the present study sample size. In addition, the study showed that the seroprevalence of HBV and HCV is not associated with baseline or clinical characteristics of the patients ($P > 0.05$).

The seropositivity of HBV and HCV in T1DM and T2DM has been explored by other studies as well. The studies have reported the conflicting findings across the world. For example, Chen *et al.*^[17] conducted a study to find out the seroprevalence of HBV and HCV infections in 820 patients with T2DM in Taiwan. They reported 13.5% seropositivity of HBsAg in patients versus 12.4% among control group with no significant difference; similarly, anti-HCV seropositivity was 6.8% in patients when compared with 2.6% in the control subjects with a substantial difference. The seropositivity that they reported is so higher compared to our study (1.5% for HBsAg and 1.0% for anti-HCV infection). Several other studies showed the higher rates of seropositivity HCV antibodies in patients with DM, in particular, in type 2 diabetes.^[18-23] Possibly, the seroprevalence found in the present study is one of the lowest. The author could back this difference to the different geographic areas. The seroprevalences of HBV in diabetic and non-diabetic patients are controversial in the literature. Some studies have reported higher prevalence^[24,25] in contrast to others.^[4,26] Possibly, the low prevalence of the infections, especially HCV, in diabetic patients may back to a low prevalence of these viruses in this region.^[27,28]

Table 4: Association of clinical aspects of type 2 diabetic patients with hepatitis B infection

Type 2 diabetic patients (n=195)	HBV seroprevalence		P-value (two-sided)*
	Positive HBV	Negative HBV	
Smoking	1 (33.3%)	12 (6.3%)	0.188
Alcohol consuming	0 (0.0%)	3 (1.6%)	1.00
Jaundice	1 (33.3%)	20 (10.4%)	0.291
Hospitalized	2 (66.7%)	143 (74.5%)	1.00
Surgery	2 (66.7%)	132 (68.8%)	1.00
Dental procedures	3 (100%)	154 (80.%)	1.00
Hemodialysis	1 (33.3%)	4 (2.1%)	0.075
Blood transfusion	1 (33.3%)	50 (26.0%)	1.00
Immunosuppressive drugs	1 (33.3%)	3 (1.6%)	0.061

*Fisher's exact test was performed for all statistical analyses.

Table 5: Association of clinical aspects of type 2 diabetic patients with hepatitis C infection

Diabetic patients (n=195)	HCV seroprevalence		P-value (two-sided)*
	Positive HCV	Negative HCV	
Smoking	0 (0.0%)	13 (6.7%)	1.00
Alcohol consuming	0 (0.0%)	3 (1.6%)	1.00
Jaundice	0 (0.0%)	21 (10.9%)	1.00
Hospitalized	1 (50.0%)	144 (74.6%)	0.448
Surgery	0 (0.0%)	134 (69.4%)	0.097
Dental procedures	1 (50.0%)	156 (80.8%)	0.353
Hemodialysis	0 (0.0%)	5 (2.6%)	1.00
Blood transfusion	1 (50.0%)	50 (25.9%)	0.456
Immunosuppressive drugs	0 (0.0%)	4 (2.1%)	1.00

*Fisher's exact test was performed for all statistical analyses.

Moreover, the current study showed that baseline and clinical characteristics of the patients are not associated with HBV and HCV in diabetic patients. This findings are in agreement with the findings reported by Chen *et al.*,^[17] as they could not observe any substantial difference in HCV infection risk factors between anti-HCV-positive and -negative DM patients. Greca *et al.*,^[23] reported higher serum levels of aspartate aminotransferase (0.90 ± 0.83 vs. 0.35 ± 0.13 μ kat/L) and alanine aminotransferase (0.88 ± 0.93 vs. 0.38 ± 0.19 μ kat/L).

Interpretation of the findings reported in the current study must be made with caution, as we did not take into account the control for the recruited cases. In addition, making a between-study comparison seems difficult as the studies have considered the controls from various sources in health settings. For example, some of the studies^[18,20] used blood donors as controls making the possible bias in this regard, and Mason *et al.*,^[29] collected their study control among those patients referred for radionuclide thyroid scans.

The possible reason behind higher chance of hepatitis virus infection among diabetic patients may be self-monitoring of blood glucose, insulin injection, and frequent hospitalization and medical interventions, making the patient at a higher risk of infections. In our study, we did not find that hospitalization is associated with HBV and HCV. Possibly, it backs to successful antiseptic techniques and infection control strategies of the hospitals.

The other risk factors of exposure to viral hepatitis infections are blood transfusion history, tattooing, intravenous drug abuse, hemodialysis, non-disposable needle exposure, abortion, and frequent dental procedures.^[30,31] We could not find an association of HBV and HCV with the blood transfusion and dental procedures in the present study. This infers the sound and possibly safe procedure in Central Bank of Duhok Governorate for blood transfusion purposes and safe dental procedures. Therefore, it is necessary to take our focus on other routes of infections.

The family history could be a risk factor for HCV and HBV development among diabetic patients as confirmed by Behrendt and Ruiz^[32] and Zein *et al.*^[33] However, this kind of association was not found in this study.

Implications of the study

It is required to make caution on patients with diabetes in terms of viral hepatitis infections as the considerable number of previous studies reported the higher rates of infections. The clinicians should refer the suspected diabetic patients to relevant medical tests because presence of HCV infections puts the patients at risk of DM-related chronic complications.^[34]

Limitations of the study

The findings reported in the present study must be analyzed in the illumination of the study design and sampling methods. The present investigation used cross-sectional design and the patients were recruited in a purposive way. It is possible that patients recruited in the current study do not reflect all diabetic patients. In addition, the cross-sectional design does not reflect the etiopathologically causal inference between T2DM and the risks of viral hepatitis.

CONCLUSIONS AND RECOMMENDATIONS

This study found that the seroprevalence of HBV and HCV infections is so low in patients with diabetic patients (T1DM and T2DM). In addition, these infections are not associated with general and clinical characteristics of patients.

It is recommended that the suspected diabetic patients be referred to medical tests for the further complication prevention. In addition, the special preventive measures are recommended to be performed in health settings to reduce the possible routes of infection among patients.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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