Seroprevalence of Hepatitis B and C Viral Infections among Type 2 Diabetics: A Cross-sectional Study in the Cape Coast Metropolis

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Abstract

Background: Type 2 diabetes comes with various complications and this may be compounded by morbidities of hepatitis B virus (HBV) and hepatitis C virus (HCV) infections. Aims: This study examined the prevalence of HBV and HCV infections among type 2 diabetics as well as its associated factors. This randomized cross-sectional study was conducted at the Diabetic Clinic of the Central Regional Hospital, Cape Coast between December 2012 and April 2013. Subjects and Methods: A well-structured questionnaire was used to recruit 110 type 2 diabetics. Venous blood samples were collected for the estimation of blood glucose and to screen for HBV and HCV infections. Data analysis was carried out using SPSS Version 17.0. Descriptive analysis was performed and results expressed as means (SD) and n (%). P < 0.05 was considered significant. Results: Prevalence of HBV in type 2 diabetics was 5.5% (6/110). No type 2 diabetic was positive for HCV. The prevalence of HBV infection in the type 2 diabetes mellitus (T2DM) participants was higher (5.5% [6/110]) than that of HCV (0/110). A total of 69.1% (76/110) T2DM patients had poor glycemic control. Mean waist and hip circumference was higher among HBV-negative T2DM participants (99.3; 106.9) than HBV-positive participants (87.2; 101.8). Conclusions: The seroprevalence of HBV was higher than that of HCV in T2DM patients. T2DM patients would require necessary preventive measures like prophylaxis, to reduce the risk of HBV infection and its ramifications.

Keywords: Diabetes mellitus, Ghana, Hepatitis B, Hepatitis C, Prevalence

Introduction

Hepatitis B virus and hepatitis C virus (HBV and HCV) infections are common diseases of the world, infecting an estimated 2 billion and 3.9 million people including an estimated 400 million chronic cases.[¹] These infections have a high rate of development of liver cirrhosis and can cause serious mortality, raising a major concern for global health.[¹]

Over the years, prevalence of diabetes mellitus (DM) has been increasing worldwide, with an estimated rate of 2.8% recorded in 2000 and projected to be around 4.4% in 2030.[²]

Allison et al., in 1994, suggested that HCV may be associated with type 2 DM (T2DM).[³] The complex interaction of chronic HBV and HCV infections with the host hepatic glucose and lipid metabolism, however, has not been fully understood and remains to be determined.[⁴]

Various studies have reported on the prevalence of HBV and HCV in T2DM patients. In a study conducted at Multan, the seroprevalence of HCV was higher in T2DM patients than in healthy controls.[⁵] However, a study in Nigeria by Balogun et al., recorded no prevalence of HCV in T2DM.[⁶] Chen et al., (2006), found that the prevalence of hepatitis B was similar to that of the control group.[⁷]
Furthermore, Onyekwere et al., in 2002 found that diabetics in Lagos were not more predisposed to chronic HBV infection than the rest of the population, and therefore would require no special anti-HBV prophylaxis.[8]

So far, there is a paucity of data on the prevalence of HBV and HCV infections among diabetics in Ghana. To enable better management of T2DM patients, especially to prevent such added on infections and its morbid consequences, it is prudent to study the seroprevalence of HBV and HCV infection in T2DM as well as its associated factors.

### Subjects and Methods

#### Study area and subjects

This simple randomized cross-sectional study was conducted from December 2012 to April 2013, at the Diabetic Clinic of the Central Regional Hospital, Cape Coast, Central Region, Ghana. A total of 110 participants with diagnosed, confirmed type 2 diabetes were recruited. A structured, pretested questionnaire was administered to collect demographic and clinical information of patients. Type 1 diabetics, organ transplant recipients and dialysis patients were excluded from the study.

#### Ethical consent

This study was approved by authorities of the Central Regional Hospital, Cape-Coast and the Institutional Review Board of the University of Cape-Coast. Informed consent was sought from the participants before recruitment onto the study.

#### Blood pressure measurement

Blood pressure was measured by trained personnel (nurse), with a mercury sphygmomanometer and a stethoscope (Accoson dekamet, England). Measurements were taken only after participants had rested for at least 15 min.

#### Anthropometric measurements

The height (to the nearest 0.1 cm) without footwear, with a stadiometer (Lindels, Klippan, Sweden) and weight (to the nearest 0.1 kg) in light clothing, with a weighing balance (Seca, Hamburg, Deutschland) were measured. The body mass index (BMI) was then calculated as the ratio of the weight (kg) and the square of the height (m²).

The hip circumference at the widest portion of the buttocks and waist circumference midway between the inferior margin of the last palpable rib and the suprailiac crest (both to the nearest 0.1 cm) were also measured using a measuring tape. The waist-to-hip ratio was calculated from the waist circumference/hip circumference.

#### Blood sample collection

About 3 ml venous blood was drawn from each study participant after an overnight fast (12-14 h). 2 ml was dispensed into a serum separator tube and centrifuged at 1500 rpm for 5-10 min. The serum was dispensed into cryovials and aliquots stored at -80°C until assayed. The remaining 1 ml was dispensed into fluoride oxalate anticoagulated tubes for estimation of blood glucose.

#### Serological tests

The serum was analyzed for the detection of hepatitis B surface antigen (HBsAg) using a One-step HBsAg Test Strip (Runbio Biotech Co. Limited, Guangdong, China), and anti-HCV antibodies using advanced quality rapid anti-HCV test strip (InTec Products, Inc., Xiamen, China).

#### Biochemical tests

**Glucose estimation**

Glucose from blood in the fluoride oxalate tube was estimated using the glucose oxidase/peroxidase method (Barham and Trinder, 1972), as per manufacturer’s instructions. All reagents were from Fortress diagnostics (Fortress diagnostics, Antrim, United Kingdom).

#### Statistical analysis

Data analysis was carried out using the Statistical Package for Social Scientists (SPSS) Version 17.0 (Chicago IL, USA). Descriptive analysis with frequency distribution tables was performed and the results expressed as means (SD) and n (%). The t-test, Chi-square and Fisher’s test were used for comparisons as appropriate. P < 0.05 was considered significant.

### Results

Of the total population, 5.5% (6/110) of the type 2 diabetics were positive for HBV. None of the type 2 diabetics was positive for HCV. The prevalence of HBV infection in the T2DM participants was higher (5.5% [6/110]) than that of HCV (0/110).

Tables 1 and 2 describe the demographic and clinical characteristics of T2DM participants in relation to gender. Of the total number of females, 43.5% (40/92) were in their fifth decade of life and 53.3% (49/92) had secondary education. Present family history of diabetes (55.4% [51/92]), obesity (51.1% [47/92]), high blood pressure (92.4% [85/92]), and high waist-hip ratio (85.9% [79/92]) were more prevalent in female T2DM participants. There was a significant difference in level of education, occupation, duration of diabetes, BMI, and blood pressure ($P = 0.02$; $P < 0.01$; $P < 0.001$; $P = 0.03$; $P = 0.03$ respectively) when compared between males and females. A total of 69.1% T2DM patients (76/110) had poor glycemic control, of which 66.7% (12/18) were males and 69.6% (64/92) were females.

Table 3 shows the demographic, clinical, and biochemical characteristics of participants, relative to hepatitis B status. The mean waist and hip circumference was higher among
the HBV-negative T2DM participants (99.3 and 106.9 respectively) compared to the HBV-positive participants (87.2 and 101.8 respectively).

Discussion

The current study determined the seroprevalence of HBV and HCV infections among T2DM patients. It also determined possibility of associated factors with these infections. The prevalence of HBV infection was low, but higher than that of HCV in type 2 diabetics.

This lower seroprevalence of HBV is contrary to other studies conducted in various countries,[7-10] all of which reported a higher seroprevalence rate of HBV in diabetic patients than in nondiabetics. The contrastingly low prevalence of hepatitis B in this study might be due to differences in geographical location or failure to identify infected patients because of the serologic window during the incubation period following infection. It could also be due to the presence of some rare variants escaping the serologic assay for HBsAg,[11] and the problem of occult HBV infections,[11,12] in which neither HBsAg nor anti-HBc are detected. Therefore, since we performed a serologic assay, the possibility of false negatives cannot be ruled out. Furthermore, patient antibody may also have been bound with viral antigen in immune complexes, thereby preventing antibody detection.[13]

In endemic areas such as Africa and Asia, most infections are known to occur in infants and children as a result of maternal-neonatal transmission or close childhood contact.[14] This study however was conducted on adults and this group is thought to have comparatively lower prevalence rates.

Yet another theory could be the uptake of preventive measures by participants, especially through vaccination. The current study however is limited by the nondetermination of HBV antibody titer levels, thus this cannot be ascertained.

The seroprevalence of hepatitis C in the T2DM patients is in consonance with a study conducted in Nigeria,[6] which recorded no prevalence of HCV infection among T2DM individuals, in a descriptive case-control study.

The seroprevalence of HBV infection was higher than HCV infection in T2DM, just as found in a study conducted in
Nigeria, where no HCV infection was found among diabetics.[6]
This contrasts the findings in other studies, which found a higher
seroprevalence of HCV than HBV in the T2DM patients.[7] This
might be due to the higher endemicity of the HBV in Ghana.[15]

Hepatitis B-negative participants had a higher waist
circumference with a significant difference in waist-hip ratio.
Interestingly, other studies have proved otherwise.[16,17] Others
have argued that high waist circumference and waist-hip ratio
(a measure of visceral obesity) can lead to the development
of type 2 diabetes,[18] and hence frequent use of intramuscular
injections, a risk factor for HBV infection. Another theory to
support this association is the complex interaction of chronic
HBV and HCV infections with the host hepatic glucose and
lipid metabolism. However, this has not been fully understood
and remains to be determined.[4]

In contrast, the current study found otherwise and this could be
that in this era of disposable sharps used in these procedures,
risk of contracting HBV infection is relatively low and thus
individuals may have contracted these infections from other
sources, rather than through diabetes management procedures.

Similar schools of thought have reported that glycemic control
may be associated with the development of HCV infection.[5,7]
However, the findings in this study reported no prevalence
of HCV infection among the T2DM participants, thus this
association couldn’t be ascertained.

This study has some limitations. Our inability to confirm the
results of screening by polymerase chain reaction to detect
HBV and HCV might have led to many false-negatives.
The cross-sectional design of our study precluded drawing a
pathophysiological causal inference between T2DM and the
risks of HBV and HCV. Furthermore, fasting blood glucose,
which gives a crude estimate of glycemic control, was used
instead of glycated hemoglobin.

Conclusion
The seroprevalence of HBV was higher than that of HCV
in T2DM patients. T2DM patients would require necessary
preventive measures like prophylaxis, to reduce the risk of
HBV infection and its ramifications.

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