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Full Length Research Paper

Liver function tests in type 2 Sudanese diabetic patients

Ayman S. Idris[1]*, Koua Faisal Hammad Mekky[1], Badr Eldin Elsonni Abdalla[2] and Khalid Altom Ali[3]

[1]Department of Biochemistry, Faculty of Science and Technology, Al-Neelain University, P. O. Box 12702, Al Baladya St. Khartoum, Sudan.
[2]Department of Biochemistry, Faculty of Medicine, University of Gezira, Sudan.
[3]Department of Biochemistry, Faculty of Medicine, International University of Africa, Sudan.

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This study was planned to evaluate the liver function in patients with type 2 diabetes mellitus by measuring aspartate aminotransferase (AST), alanine aminotransferase (ALT), gamma glutamyl transpeptidase (GGT), total protein and albumin. The study was carried out in Wad Medani, Abo Agla Diabetes Centre. 50 patients with type 2 diabetes mellitus (23 male and 27 female) were included in the study. Their ages ranged between 43 and 79 years. Thirty matched normal individuals were taken as control group. In the present study, mean values of ALT, AST and GGT were significantly higher in patients than in the control (P<0.001). Total protein and albumin concentrations in patients were lower compared to control group (P<0.01). The mean of serum glucose in patients revealed significant difference (P<0.000) in comparison to the control group. Although the differences were statistically significant, the means of ALT, AST, GGT, total protein and albumin were falling within the normal range. Overall 11 patients (22%) had at least one or more abnormal liver function test enzymes.

Key words: Type 2 diabetes mellitus, hyperinsulinemia, liver function, metabolism, metabolic disorders, Sudanese.

INTRODUCTION

The liver plays a major role in the regulation of carbohydrate metabolism, as it uses glucose as a fuel, it has the capability to store glucose as glycogen and also synthesize glucose from non-carbohydrate sources. This key function of liver makes it vulnerable to diseases in subjects with metabolic disorders, particularly diabetes (Levinthal and Tavill, 1999). Increased activities of liver enzymes such as aspartate aminotransferase (AST), alanine aminotransferase (ALT) and γ-glutamyltranspeptidase (GGT) are indicators of hepatocellular injury. Increased activity of these markers is associated with insulin resistance (Marchesini et al., 2001), metabolic syndrome, and type 2 diabetes (Wannamethee et al., 2005; Sattar et al., 2004; Nakanishi et al., 2005). However, most of these studies were performed in Western countries (Hanley et al., 2005; Perry et al., 1998), and the two studies from Japan and Korea were not community-based (Wannamethee et

*Corresponding author. E-mail: aymansalih89@yahoo.com.

Abbreviations: AST, Aspartate aminotransferase; **ALT,** alanine aminotransferase; **BMI,** body mass index; **GGT,** gamma glutamyl transpeptidase; **LFTs,** liver function tests.

al., 2005).

An association exists between diabetes and liver injury (Erbey et al., 2000). Liver pathology among diabetics is similar to that of alcoholic liver disease, including fatty liver (steatosis), steatohepatitis, fibrosis, and cirrhosis (Erbey et al., 2000). Elevated serum activity of the two aminotransferases, aspartate aminotransferase (AST) and alanine aminotransferase (ALT), is the most frequently measured indicator of liver disease and occurs in diabetics more frequently than in the general population (Everhart, 1995). The same spectrum of liver injury and enzyme changes in diabetes has also been described among overweight individuals without diabetes. Whether an association of liver disease with diabetes is independent of confounding factors, such as overweight and alcohol consumption is unknown (Erbey et al., 2000). Nearly 70 to 80% of the diabetic subjects have been reported to have hepatic fat accumulation, referred to as nonalcoholic fatty liver (NAFL) (Gupte et al., 2004). NAFL leads to nonalcoholic steatohepatitis (NASH), a progressive fibrotic disease, which can result in cirrhosis or liver related death (Wong et al., 2004; Choudhury and Sanyal, 2004).

Nonalcoholic fatty liver (NAFL) was first reported in 1980's in obese females with diabetes. There is renewed interest recently because of the increased prevalence of NAFL in diabetes and as it has been shown to be a predisposing factor for insulin resistance and hyperinsulinemia (Hanley et al., 2004). Further proof for the association of liver disease with diabetes comes from the insulin resistance atherosclerosis study (IRAS), which showed that liver function markers like the aspartate aminotransferase (AST) and alanine aminotransferase (ALT) are predictors of incident diabetes (Hanley et al., 2004). Presently there are not much therapeutic options for nonalcoholic fatty liver except correction of obesity with hypocaloric diets and physical exercise and controlling hyperglycemia with diet, insulin, or oral hypoglycemic agents (Medina et al., 2004).

Sudan (and most of Africa) is believed to have one of the highest mortality rates for a non infectious disease. One study indicated that 10% of adult patient deaths in hospitals were caused by diabetes (Ahmed and Ahmed, 2000). The current prevalence of diabetes in Sudan is unknown although the very initial study estimated the prevalence by 3.4% (Ahmed and Ahmed, 2001) and with no doubt the risk of morbidity due to this disease is increasing, especially in the urban areas. Therefore, the comprehensive study of the diabetes mellitus and its impact is needed to be undertaken. The present study was aimed to evaluate the liver function in Sudanese patients with long standing diabetes type 2 compared to non diabetic control group.

MATERIALS AND METHODS

Study design and subjects

Cross-sectional study was done in Sudanese type 2 diabetic patients with long period of suffering from diabetes. This study was carried out in Abo Agla Diabetic Centre, Wad Medani, and Central Sudan. In this study, Diabetic patients who have the disease for at least five years were tested for liver function.

Exclusion criteria

We excluded patients with history of liver diseases, or severe or debilitating diseases such as cancers and severe anemia (hemoglobin<10 g/dl); also we excluded patients with clinical and subclinical hypothyroidism, and patients with any history of taking tamoxifen, corticosteroids, and amiodarone.

Ethical consideration

The objectives of the study were explained to all individuals participating in this study. All participants who agreed were given written acceptance form.

Blood sample

5 ml of venous blood were drawn from each volunteer in this study using a disposable plastic syringe. The blood was poured in a plane container and then centrifuged after clotted. Serum was kept at -20°C in sterile condition till used. Aspartate aminotransferase (AST), alanine aminotransferase (ALT), gamma glutamyl transpeptidase (GGT), and concentrations of total protein, albumin, and glucose were measured and analyzed using Roche Diagnostic/Hitachi 902(Hitachi, Japan).

Questionnaire and Statistical analysis

A questionnaire was specifically designed to obtain information which helps in either including or excluding certain individuals in or from the study, respectively. The data obtained during the current study were analyzed statistically to determine the significance of the different parameters by mean of SPSS package (spss11). The values presented as Means ± SE unless otherwise stated.

RESULTS

A total of 50 patients diagnosed as type 2 diabetes with

Table 1. Demographic and clinical characteristics of diabetic patients and healthy controls.

Characteristic	Patients (n = 50)	Control (n = 30)
Mean age (years)	64	59
Male/female (No.)	23/27	14/16
Normal (BMI less 25)	32	20
Overweight (BMI more than 25)	14	7
Obese (BMI more than 30)	4	3

Table 2. Mean values of the biochemical parameters in diabetic patients and control group.

Parameters	Patients	Control	*P* value
ALT U/L*	30.30 ± 1.00	18.00 ± 1.11	0.001
AST U/L*	35.56 ± 1.07	25.27 ± 0.88	0.001
GGT U/L*	20.76 ± 0.94	10.77 ± 0.50	0.001
Total Proteins g/dl*	7.67 ± 0.07	8.24 ± 0.09	0.01
Albumin g/dl*	3.85 ± 0.03	4.41 ± 0.06	0.01
Glucose mg/dl*	168.84 ± 10.97	91.4 ± 2.15	0.00

*Values represent Mean ± SE.

duration greater than 5 years and 30 individuals as control group were selected to perform this study. The average age was 64±9.8 years, ranging between 43 and 79 years in diabetic patients and 59±8.4 years in a range of 45 through 78 in control group. Among the patients group 23 patients were males representing 46% and 27 patients were females representing 54%, on the other hand, 14 of the control group were male (46%) and 16 were female (54%). The mean duration of diabetes was 8.64 ± 0.74 years, ranging of 5 through 27 years. In general, 32 patients (64%) had body mass index (BMI) <25 kg/m2; 14 patients (28%) had BMI between 25 and 30 kg/m2 and 4 patients (8%) with BMI>30 kg/m2. A family history of diabetes was reported only by 33 patients (66%) (Table 1).

In the current study, ALT, AST, GGT, total proteins, albumin and serum glucose were estimated in type 2 diabetic patients and control group. As presented in Table 2, mean values of ALT, AST and GGT liver enzymes were significantly higher in type 2 diabetic patients than in control group (P ≤ 0.001). In contrast, values of total protein and albumin concentrations were significantly lower in comparison to the control group at 99.0% significance level. The mean value of serum glucose was clearly higher in diabetic patients than in control group (P ≤ 0.000) (Table 2). Moreover, comparison of the prevalence of the liver function tests normality and abnormality states versus the weight status in type 2 diabetic patients and control groups was conducted (Table 3).

DISCUSSION

Although the differences were statistically significant, the means of ALT, AST, GGT, Total protein, and Albumin were within the normal values. Overall, 11 patients (22%) had at least one or more abnormal liver enzymes. 6 patients (12%) had elevated ALT, 6 patients (12%) had elevated AST, 6 patients (12%) had elevated GGT. This is in agreement with Salmela et al., (1984). 57% of the 175 diabetic outpatients (100 subjects) had at least one abnormal liver function test; 27% (48 subjects) had at least two abnormal tests. The type 2 diabetic patients more frequently had elevated ALT (22.9 vs. 5.3%) and GGT (23.7 vs. 10.5%) levels than those with type 1 diabetes. Our results also agree with Nannipieri et al. (2005). An elevated serum alanine aminotransferase level is greater among persons with type 2 diabetes, those who are overweight or obese, men, and those who consume

Table 3. Prevalence of abnormal liver function test by weight status in type 2 diabetes mellitus and control group.

Group	Patients (LFTs)		Control (LFTs)	
	Abnormal	Normal	Abnormal	Normal
Normal weight	5	27	0	20
Overweight	4	10	1	6
Obese	2	2	1	2
Total	11	39	2	28

more than three drinks per day.

Meltzer and Everhart (1997) previously noted a greater prevalence of abnormal alanine aminotransferase levels among Mexican Americans with diabetes (Meltzer and Everhart, 1997). And disagree with Erbey et al. (2000) of the total sample, 4.1% had elevated ALT, and 6.7% had type 2 diabetes. Of those with type 2 diabetes, the prevalence of elevated ALT was 7.8%, compared to 3.8% prevalence in those without diabetes. The limitations of this analysis include its cross-sectional design. Thus, it is not possible to determine if diabetes preceded or followed the elevations in liver function tests levels, nor it is possible to determine whether, we observed chronic or transient elevations in liver function test levels, reducing bias in the ascertainment of diabetes and of abnormal liver function levels.

In conclusion, values of the liver function tests in patients with type 2 diabetes mellitus were significantly higher than that of control. Moreover, patients had lower albumins in comparison to the control group and 22% of the patients had at least one or more elevated liver enzyme levels in the serum, and the entire patients had normal values of total protein and albumin concentrations. Because of high liver enzymes level in serum of patients with type 2 diabetes mellitus, performance of liver function tests is highly recommended for diabetic patients. Further studies on the liver function on diabetic patients need to be performed.

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