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STUDY OF LIVER FUNCTION TESTS IN TYPE 2 DIABETES MELLITUS PATIENTS

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Abstract: This study was done to evaluate the liver function in patients with type 2 diabetes mellitus by measuring aspartate aminotransferase (AST), alanine aminotransferase (ALT), total protein and albumin. The study was carried out from the period of March 2014-February 2015 in Government General Hospital, Department of Biochemistry, Kurnool Medical College, Kurnool, Andhra Pradesh, India. 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 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, 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.

Keywords: Type 2 diabetes mellitus, hyperinsulinemia, liver function, metabolism, metabolic disorders,

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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) 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).

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). The present study was aimed to evaluate the liver function in diabetes type 2 compared to non diabetic control group.

MATERIALS AND METHODS

Study design and subjects:

Cross-sectional study was done in type 2 diabetic patients with long period of suffering from diabetes. This study was carried out in Government General Hospital, Department of Biochemistry, Kurnool Medical College, Kurnool. 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. The Reagent Kits of Aspartate aminotransferase (AST), alanine aminotransferase (ALT), total protein, albumin, and glucose were supplied by AGAPPE DIAGNOSTICS Ltd. Ernakulam, Kerala(ALT and AST), RECKON DIAGNOSTICS Ltd. Vadodara (Albumin and Total Protien).

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

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[*]	31.30	± 1.00	17.00 ± 1.11	0.001
AST U/L[*]	34.56	± 1.07	26.27 ± 0.88	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.

A total of 50 patients diagnosed as type 2 diabetes with 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, 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 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, 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. 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 AST (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 more than three drinks per day.

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

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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REFERENCES

1. Ahmed AM, Ahmed NH (2000). Hospitalization patterns of diabetic patients in Sudan. Diabetes Int., 9: 18–19.

2. Ahmed AM, Ahmed NH (2001). Diabetes mellitus in Sudan: the size of the problem and the possibilities of efficient care. Pract. Diab. Int., 18: 324-327.

3. Choudhary J, Sanyal AJ (2004). Insulin resistance and the pathogenesis of nonalcoholic fatty liver disease. Clin. Liver Dis., 8: 575–594.

4. Erbey JR, Silberman C, Lydick E (2000). Prevalence of abnormal serum alanine aminotransferase levels in obese patients and patients with type 2 diabetes. Am. J. Med., 109: 588–590.

5. Everhart JE (1995). Diabetes in America. 2nd ed. National Institute of Health. National Institute of Diabetes and Digestive and Kidney Diseases. Washington, DC: GPO: 457-483.

6. Gupte P, Amarapurkar D, Agal S, Baijal R, Kulshrestha P, Pramanik S (2004). Non-alcoholic steatohepatitis in type 2 diabetes mellitus. J. Gastroenterol. Hepatol., 19: 854-858.

7. Hanley AJ, Williams K, Festa A, Wagenknecht LE, D'Agostino RB Jr, Kempf J, Zinman B, Haffner SM (2004). Elevations in markers of liver injury and risk of type 2 diabetes: the insulin resistance atherosclerosis study. Diabetes, 53: 2623-2632.

8. Hanley AJ, Williams K, Festa A, Wagenknecht LE, D'Agostino RB, Jr, Haffner SM (2005). Liver markers and development of the metabolic syndrome: the insulin resistance, atherosclerosis study Diabetes,54:3140-3147.

9. Levinthal GN, Tavill AJ (1999). Liver disease and Diabetes Mellitus. Clin. Diabetes, 17: 73.

10. Marchesini G, Brizi M, Bianchi G (2001). Nonalcoholic fatty liver disease. A feature of metabolic syndrome. Diabetes, 50: 1844-1850.

11. Medina J, Fernandez S, Garcia B, Moreno O (2004). Approach to the pathogenesis and treatment of nonalcoholic steatohepatitis. Diabetes Car, 27: 2057–2066.

12. Meltzer AA, Everhart JE (1997). Association between diabetes and elevated serum alanine aminotransferase activity among Mexican Americans. Am. J. Epidemiol., 146: 565–571.

13. Nakanishi N, Shiraishi T, Wada M (2005). Association between fasting glucose and C-reactive protein in a Japanese population: The Minoh study. Diabete Res. Clin. Pract., 69: 88-98.

14. Nannipieri M, Gonzales C, Baldi S, Posadas R, Williams K, Haffner SM, Stern MP, Ferrannini E (2005). Liver enzymes, the metabolic syndrome, and incident diabetes: The Mexico City diabetes study. Diabetes Car., 28: 1757-1762.

15. Perry IJ, Wannamethee SG, Shaper AG (1998). Prospective study of serum gamma-glutamyltransferase and risk of NIDDM. Diabetes Car., 21: 732-737.

16. Salmela PI, Sotaniemi EA, Niemi M, Maentausta O (1984). Liver function tests in diabetic patients. Car., 7: 248-254.

17. Sattar N scherbakova O, Ford I, O Reilly DS, Stanely A, Forrest E, Macfaralane PW, Packard CJ,Cobbe SM, Shepherad J(2004).

18. Elevated alanine transaminase predicts new-onset thype 2 diabetes independently of classical risk factors, metabolic syndrome and C reactive protein in the west of Scotland coronary prevention study. Diabetes, 53: 2855-2860.