ISSN2515-8260 Volume 09,Issue 01,2022

Prospective and observational ultrasonographic evaluation of fatty liver disease and cardiovascular diseases in type 2 diabetic patients

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Abstract

Aim: To evaluate fatty liver disease and cardiovascular diseases in type 2 diabetic patients using ultrasonography.

Methodology: The prospective and observational study was conducted in the Department of Radiology, Maharishi Markandeshwar Medical College and Hospital, Kumarhatti, Himachal Pradesh for the period 9 months. 300 patients diagnosed with type 2 diabetes and ultrasound abdomen showing fatty changes in liver without any other co-morbidities were included. Patients were divided in three groups according to the duration of the diagnosis of diabetes. The distributions of different groups were GROUP A- less than 5 years, GROUP B-in between 5 to 10 years and GROUP C-more than 10 years. A brief history was taken of the patient's complaints and then the patients Random blood sugar and BMI values, as mentioned in the patient's case paper were recorded and then ultrasonographic evaluation of the study subjects was performed by a single radiologist and the following parameters were examined after obtaining informed consent-Liver echogenicity, Portal Vein Doppler study, Mesenteric fat pad thickness and Carotid Artery Doppler study. Study method was Interview schedule questionnaire, OPD records, bedside tickets, physical examination and laboratory measurements.

Results: Out of the 300 patients, 145 (48.3%) were males, and 155 (51.7%) were females. Majority (39%) of the patients belonged to 50-60 years of age group followed by 25.7% patients in the age group of 40-50 years. 18.3% belonged to 60-70 tears of age, 10.7% were less than 40 years, and 6.3% belonged to more than 70 years of age. Out of the 300 cases, 225 (75%) cases had fatty liver and 75 (25%) cases had non-fatty liver. Out of the included patients, 33.4% (100) were in group A, 40% (120) were in group B, and 26.6% (80) were in group C. Out of 300 patients, 70 (23.3%) cases had ischemic changes, but majority of patients (230, 76.7%) did not have ischemic changes.

Conclusion: Liver ultrasound examination should be considered in every patient with newly diagnosed type 2 diabetes because the prevalence of NAFLD is extremely high in this group of patients. It can be said that there was an association between cardiovascular risk factors and NAFLD in patients with type 2 diabetes mellitus.

Keywords: Ultrasonography, diabetes mellitus, CVD, risk factors

Introduction

Nonalcoholic fatty liver disease (NAFLD) is the most common form of chronic liver damage and its prevalence has increased worldwide, especially in obese and diabetic populations [1]. It has been reported that NAFLD has a prognostic value for liver cirrhosis and cardiometabolic diseases, in particular, in type 2 diabetes. NAFLD may be diagnosed when the fat content in the liver exceeds 5% to 10% of the weight of the organ in patients in whom secondary causes

ISSN2515-8260 Volume 09,Issue 01,2022

of hepatic steatosis are excluded and who consume less than 10 g of ethanol per day [2]. The major risk factors for NAFLD are obesity and diabetes. The mechanism by which diabetes causes fatty liver is through insulin resistance, oxidative stress and inflammation. The prevalence of NAFLD in an Indian study was found to be 5-28% in the general population, while it was 44-72% in patients with type 2 diabetes mellitus [3]. T2DM surges the risk of liver associated death by up to 22-fold in patients with NAFLD [4].

Growing evidence indicates the complex relation between diabetes mellitus and NAFLD with each condition being a prognostic factor for the other [5].A number of studies suggested that, in patients with type 2 diabetes, the dynamic progression of pathological changes in the liver may lead to cirrhosis [6].

Additionally, it has been reported that NAFLD is associated with an increased risk of cardiovascular disease (CVD) [7]. Several mechanisms have been postulated for development of accelerated atherosclerosis in patients with NAFLD, including genetic predisposition, insulin resistance, atherogenic dyslipidemia, oxidative stress, chronic inflammation, reduced levels of the adiponectin and altered production of pro and anticoagulant factors [8].

Materials and Methods

The prospective and observational study was conducted in the Department of Radiology, Maharishi Markandeshwar Medical College and Hospital, Kumarhatti, Himachal Pradesh from April 2021 to December 2021. 300 Patients diagnosed with type 2 diabetes and ultrasound abdomen showing fatty changes in liver without any other co-morbidities were included. Patients were divided into three groups according to the duration of the diagnosis of diabetes.

Methodology

A brief history was taken of the patient's complaints and then the patient's Random blood sugar and BMI values as mentioned in the patient's case paper were recorded and then ultrasonographic evaluation of the study subjects was performed by single radiologist and the following parameters were examined after obtaining consent-Liver echogenicity, Portal Vein Doppler study, Mesenteric fat pad thickness and Carotid Artery Doppler study. Study method was Interview schedule questionnaire, OPD records, bedside tickets, physical examination and laboratory measurements. Study population was divided in three groups, according to the duration of the diagnosis of diabetes. The distributions of different groups were GROUP A-less than 5 years, GROUP B-in between 5 to 10 years and GROUP C-more than 10 years.

Results

Out of the 300 patients, 145 (48.3%) were males, and 155 (51.7%) were females. Majority (39%) of the patients belonged to 50-60 years of age group followed by 25.7% patients in the age group of 40-50 years. 18.3% belonged to 60-70 tears of age, 10.7% were less than 40 years, and 6.3% belonged to more than 70 years of age. Out of the 300 cases, 225 (75%) cases had fatty liver and 75 (25%) cases had non-fatty liver.

Table 1: Age distribution

Age	Fatty liver	%	Non-Fatty liver	%	Total	%	P value
< 40	21	7	11	3.7	32	10.7%	0.3846
40-50	52	17.3	25	8.3	77	25.7%	
50-60	89	29.7	28	9.3	117	39%	
60-70	45	15	10	3.3	55	18.3%	
> 70	18	6	1	0.4	19	6.3%	
Total	225	75	75	25	300	100	

ISSN2515-8260 Volume 09,Issue 01,2022

Out of the included patients, 33.4% (100) were in group A, 40% (120) were in group B, and 26.6% (80) were in group C. Out of the 300 patients, 70 (23.3%) cases had ischemic changes, nut majority of patients (230, 76.7%) did not have ischemic changes.

Table 2: Prevalence of ischemic changes in ECG with duration of diabetes

Duration of diabetes	Ischemic changes in ECG			P-value
	Absent	Present	Total	
Group A (<5 years)	86 (28.7%)	14 (4.7%)	100 (33.4%)	0.2477
Group B (5-10 years)	83 (27.7%)	37 (12.3%)	120 (40%)	
Group C (>10 years)	61 (20.3%)	19 (6.3%)	80 (26.6%)	
Total	230 (76.7%)	70 (23.3%)	300 (100%)	

Out of the 300 patients, 38 patients (12.7%) did not have LVDD (Left Ventricular Diastolic Dysfunction), 79 (29.7%) had Grade 1, 140 (46.7%) had grade 2, and 43 (14.3%) cases had grade 3 LVDD.

Table 3: Prevalence of LVDD with duration of diabetes

Duration of diabetes	LVDD				Total	P-value
	No	Grade 1	Grade 2	Grade 3		
Group A (<5 years)	16 (5.3%)	35 (11.7%)	38 (12.7%)	11 (3.7%)	100 (33.4%)	0.4354
Group B (5-10 years)	21 (7%)	31 (10.3%)	50 (16.7%)	18 (6%)	120 (40%)	
Group C (>10 years)	1 (0.3%)	13 (4.3%)	52 (17.3%)	14 (4.7%)	80 (26.6%)	
Total	38 (12.7%)	79 (29.7%)	140 (46.7%)	43 (14.3%)	300 (100%)	

Discussion

NAFLD and cardiovascular disease are associated with metabolic syndrome, they are also independently associated through several common risk factors and hence NAFLD is important for the pathogenesis of CVD. These independent risk factors could accelerated atherogenesis and they possibly include genetic factors, atherogenic dyslipidemia, chronic inflammation and imbalance of procoagulant and anticoagulant factors.

The intima-media thickness (IMT) of the carotid artery can be measured non-invasively by ultrasound techniques. An increased IMT has been shown to be a risk factor for myocardial infarction and stroke. A meta-analysis by Cai J *et al.* of 7 studies on Carotid IMT has shown that the IMT in NAFLD patients increased 0.16 mm compared with the control group, and the risk of carotid plaque was 3.73 times than that of the controls [9]. A study by Wang *et al.* further showed that ALT level is proportionally associated with the risk of carotid IMT in subjects with fatty liver [10]. Furthermore, the severity of liver histopathology among NAFLD patients is strongly associated with early carotid atherosclerosis, independent of age, sex, BMI, smoking, LDL cholesterol, insulin resistance, and the presence of metabolic syndrome [11]. Carotid intima media thickness (CIMT) is a well-studied phenotype of atherosclerosis. UsingB mode ultrasound the CIMT can be assessed quickly, non-invasively at relatively low cost [12].

A study by Jayarama*et al.*, reported the prevalence of NAFLD to be 60% in type 2 diabetic patients that was comparable to the prevalence in the present study [13]. There was no significant difference in gender-related prevalence of NAFLD in patients with type 2 diabetes in this study and the results were similar to the study done by Prashanth *et al.*[14].

It is regarded that the presence of ultrasonographic features of NAFLD is an independent risk factor for CVD such as coronary heart disease, hypertension, heart failure, and stroke [15-18]. Hamaguchi*et al.*[19] showed that the incidence of acute cardiovascular events was higher in patients with ultrasound features of NAFLD. The results of numerous studies suggest that fatty liver increases an association of metabolic syndrome and/or type 2 diabetes with subclinical atherosclerosis [20].

Conclusion

From this study, it can be concluded that there is established association of different cardiovascular parameters in fatty liver patients. Liver ultrasound examination should be considered in every patient with newly diagnosed type 2 diabetes patients because the prevalence of NAFLD is extremely high in this group of patients. It can be said that there is an association between cardiovascular risk factors and NAFLD in patients with type 2 diabetes mellitus.

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