

Ultrasonographic evaluation of fatty liver disease and cardiovascular diseases in type 2 diabetic patients

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Abstract

Aim: To find out hepatic involvement in type 2 diabetic patients and to correlate the associations between non-alcoholics fatty liver disease and different Cardiovascular risk factors. **Methods:** The prospective and observational study was conducted in the Department of Radiology, Katihar Medical College and Hospital, Katihar, Bihar, India and Arc Hospital, Bhagalpur from June 2019 to December 2019. A total of 150 patients diagnosed as having type 2 diabetes and with liver Ultrasound scan showing fatty changes were included in this study. **Results:** We have found most of the cases of fatty liver (28.67%) were in the age group of 50-60 years. There were 2% cases with fatty liver above 80 years age. Among the 80% fatty liver cases 46.67% were males and 33.33% were females. 5 % of patients did not show any left ventricular diastolic dysfunction. 45.83% showed type 1, 43.33% showed type 2, 5.84% showed type 3 diastolic dysfunction. Type 3 LVDD was found mostly (3.33%) in cases with duration of diagnosis >10 years group. 27.33% subjects showed ischemic changes in their ECG. Statistical significance not found. **Conclusion:** Left ventricular diastolic dysfunction found to be the prime echocardiographic abnormality in type 2 diabetes mellitus patients.

Keywords: Cardio-vascular risk, Non-alcoholic fatty liver disease, Type 2 diabetes.

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Introduction

The term Non-alcoholic fatty liver disease (NAFLD) is categorized by accumulation of fat in liver which changes from simple steatosis to steatohepatitis, cirrhosis and hepatocellular carcinoma (HCC) in lack of excessive alcohol intake.[¹] NAFLD is distinct by macrovascular steatosis of more than 5% hepatocytes in the absence of inflammation. Type 2 Diabetes Mellitus (T2DM) patients seem to have an increased risk of developing NAFLD than non-diabetic subjects and certainly have higher risk of increasing fibrosis and cirrhosis. Existence of NAFLD in T2DM may also contribute to increased cardiovascular disease risk.[2] T2DM surges the risk of liver associated death by up to 22-fold in patients with NAFLD.[3]

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Non-alcoholic fatty liver disease (NAFLD) is the upcoming leading cause of chronic liver disease in the United States and its prevalence is increasing worldwide. It is a spectrum of liver diseases that ranges from simple steatosis to a progressive form of liver disease called non-alcoholic steatohepatitis (NASH). The prevalence of NAFLD is remarkably high in populations of both industrialized and developing countries, although there is variation depending on the criteria used and the population studied.[4] In one study of adults based on histological findings, mild to severe steatosis was shown in 70% of obese patients compared to 35% of lean patients. Steatohepatitis was found in 18.5% of obese patients, compared to 2.7% of lean patients.[5] In the primary care setting, NAFLD accounts for at least one third of cases of suspected chronic liver disease. Among patients with abnormal liver enzymes, NAFLD accounts for 40-80% of cases, with its prevalence strongly influenced by the presence of coexisting obesity, diabetes and dyslipidaemia.[6] In severely obese patients (usually defined as BMI >35kg/m²), the prevalence of steatosis is over 90% from patients undergoing bariatric surgery.[7] From another perspective, three-quarters of type 2 diabetic

patients have steatosis. The coexistence of diabetes in NAFLD patients more than doubles the prevalence of cirrhosis from 10-25%.[8] Among patients with hyperlipidemia, at least two-thirds with hypertriglyceridemia and one-third with hypercholesterolemia have fatty liver by ultrasonography.[9] Liver imaging may be a more reliable method for diagnosing NAFLD. In three large population studies, ultrasound imaging suggestive of NAFLD was independently associated with cardiovascular events.[10-12] Overall survival was reduced in subjects with NASH compared to the general population due to increased mortality by cardiovascular disease. Importantly in this study, only subjects with NASH had significantly reduced survival.[13-14] 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.[15] All these mechanisms are present at the same time. NAFLD, regardless of its stage, is strongly associated with hepatic and adipose tissue insulin resistance (IR). In fact, liver fat content can be used as an independent predictor of insulin resistance. These mechanisms work synergistically.[16] NAFLD, especially in its necro-inflammatory form (NASH), may cause atherogenic dyslipidemia.[17] The aim of this study was to ultrasonographically evaluate fatty liver disease and cardiovascular diseases in type 2 diabetic patients

Material and Methods

The prospective and observational study was conducted in the Department of Radiology, Katihar Medical College and Hospital, Katihar, Bihar, India and Arc Hospital, Bhagalpur from June 2019 to December 2019.

Inclusion criteria

Patients having been diagnosed as type 2 diabetic and Liver USG scan showing fatty changes (USG will be done in patients of diabetes as a routine investigation).

Exclusion criteria

Long term history for chronic alcoholism, known hepatic disease, HBS Ag or anti HCV positivity, history of ingestion of hepatotoxic drugs, blood for ANA positivity were excluded from the study.

Methodology

Total of 150 patients diagnosed as type 2 diabetic and with liver USG scan showing fatty changes were included in this study. Study population was divided in three groups, according to the duration of the diagnosis of diabetes. Each group had at least 40 patients. Control group consisted of age matched 30 patients having type 2 diabetes without having evidence of fatty liver. Study method was Interview schedule questionnaire, OPD records, bedside tickets, physical examinations and laboratory measurements.

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Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2010) and then exported to data editor page of SPSS version 19 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics included computation of percentages and means. Test applied for the analysis was chi-square test. The confidence interval and p-value were set at 95% and 5%.

Results

Table 1: Age distribution

Age	Fatty liver	%	Non-Fatty liver	%	Total	%	P value
Below 40	10	6.67	7	4.66	17	11.33%	0.4145
40-50	27	18	11	7.33	38	25.33%	
50-60	43	28.67	14	9.33	57	38%	
60-70	24	16	4	2.67	28	18.67%	
70-80	6	4	1	0.67	7	4.67%	
Above 80	3	2	0	0	3	2%	
Total	120	80	30	20	150	100	

Table 2: Prevalence of LVDD with duration of diabetes

Duration of diabetes	LVDD				Total	P-value
	0	1	2	3		
5-10 year	4	17	19	5	45	0.4354
	(2.63%)	(14.17%)	(15.83%)	(4.04%)	(37.5%)	
5	3	21	13	2	39	
	(2.5%)	(17.5%)	(10.83%)	(1.67%)	(32.5%)	
10	0	12	20	4	36	
	0	(10%)	(16.67%)	(3.33%)	(30%)	
Total	6	55	52	7	120	
	(5%)	(45.83%)	(43.33%)	(5.84%)	(100%)	

Table 3: Prevalence of ischemic changes in ECG with duration of diabetes

Duration of diabetes	Ischemic changes in ECG			P-value
	Absent	Present	Total	
5-10	43	18	61	0.29
	28.67	12	40.67	
0-5	44	6	50	
	29.33	4	33.33	
>10	28	11	39	
	18.67	7.33	26	
Total	109	41	150	
	72.67	27.33	100	

Table 4: Prevalence of hypertension with hepatic status

Status of liver	HTN			Total	p- value
	0	1	2		
Fatty liver	20	69	31	120	<0.001
	13.33	46	20.67	80	
Non-fatty liver	15	15	0	30	
	10	10	0	20	
Total	35	84	31	150	
	23.33	56	20.67	100	

Table 5: Prevalence of LVDD with A1C in fatty liver

A1C	LVDD				Total	P-value
	0	1	2	3		
6.4-7	3	11	3	1	18	0.2571
	2.5	9.17	2.5	0.83	15	
7.1-8	0	15	16	1	32	

	0	12.5	13.33	0.83	26.67	
8.1-10	0	17	15	1	33	
	0	14.16	12.5	0.83	27.5	
>10	1	12	19	5	37	
	0.83	10	15.83	4.16	30.83	
Total	4	55	53	8	120	
	3.33	45.83	44.17	6.67	100	

Table 6: PPBS by LVDD in fatty liver

PPBS	LVDD				Total	P-value
	0	1	2	3		
≤200	13	7	10	0	30	<0.001
	8.67	5.84	6.67	0	20	
>200	6	67	38	9	120	
	4	44.67	25.33	6	80	
Total	19	72	49	10	150	
	12.67	48	32.67	6.66	100	

Discussion

Liver ultrasonography results, although not sufficiently sensitive to detect liver inflammation and fibrosis, correlate well with the histological finding of fatty infiltration. In addition, international guidelines have been proposed for the diagnosis of different degrees of steatosis. NAFLD is associated with various metabolic abnormalities, including central obesity, type 2 diabetes, dyslipidaemia, high blood pressure, and metabolic syndrome (MetS). Fatty liver can develop as the result of various metabolic conditions that promote fat accumulation and inflammation in the liver. Otherwise, NAFLD may contribute to the development of MetS.

There is increasing evidence for an association between NAFLD and an increased risk of cardiovascular morbidity and mortality. The association between NAFLD and cardiovascular risk factors can largely explain the higher risk of cardiovascular disease among people with NAFLD. The aim of this study was to assess the prevalence of fatty liver disease in known Type 2 diabetic cases and whether, these cases do have increased association of cardiovascular risk factors with them compared to the population with type 2 diabetes without fatty liver disease. Banerjee S et al in their study showed fatty change in 43%, non-alcoholic steatohepatitis (NASH) could be identified in 40% with more advanced disease in 23% of the study population.[18]

High levels of CRP is a potent cardiovascular risk factor. Chia-Hung Chiang et al established in their study that NAFLD patients have increased risk of CVD

and elderly subjects have raised CRP value with a p value 0.004.[19] We have found significant association of hypertension with fatty liver disease in present study population as 56% cases showed grade 1 and 20.67% grade 2 hypertension (p-value was significant). Present findings are supported by a study from Targher et al as they showed, 27.54% cases with grade 2 hypertension in study population with an odd ratio 1.42 with a significant p value.[20] Hypertensive patients were mostly associated with left ventricular hypertrophy as detected in present study, p value was significant (p<0.001). According to Bleumke DA et al, abnormal left ventricular mass and geometry stands out to be potential marker of myocardial remodelling and cardiovascular disease.[21]

Conclusion

This study was done among the diabetic patients with fatty liver, to specifically assess the whole spectrum of disease, both from cardiovascular and metabolic perspective. Authors reviewed multiple studies across the globe in this respect. These studies established the association of different cardiovascular parameters in fatty liver patients, whether diabetic or non-diabetic. We have found, quite the same results among present study population, who had association of multiple cardiovascular abnormalities, in comparison to the patients without fatty liver. Liver appears to be the window to the Heart. We studied 150 cases, among them 120 patients had fatty liver and 30 cases without fatty liver diagnosed by abdominal ultrasonography. Most of the Diabetic NAFLD cases were detected in

their 50 to 60 years age group, with a male preponderance. Ultrasonography remains a reliable non-invasive method for detection. Association of NAFLD with various physical and metabolic parameters like WHR, BMI, hyperlipidemia (hypertriglyceridemia specially), was proved beyond doubt and was found to be significantly associated with fatty liver disease when compared with age-matched control. CRP is found to be an independent coronary risk associate in Diabetic NAFLD patient.

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