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EVALUATION OF CARDIOVASCULAR DISEASE AND FATTY LIVER DISEASE IN TYPE 2 DIABETES SUBJECTS ON ULTRASONOGRAPHY

Dr. Samir Kathale

MBBS, DNB (Radiodiagnosis), MNAMS, Assistant Professor, Department of Radiodiagnosis, Chandulal Chandrakar Memorial Government Medical College and Hospital, Durg, Chhattisgarh

Email id: samirkathale81@gmail.com

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ABSTRACT

Background: nonalcoholic fatty liver disease (NAFLD) can raise the risk of cardiovascular disease in individuals with type 2 diabetes mellitus. Liver disease deaths can rise up to 22 times in persons with type 2 diabetes mellitus.

Aim: The purpose of this study was to evaluate liver involvement in individuals with type 2 diabetes mellitus and investigate the relationship between various cardiovascular parameters and non-alcoholic fatty liver disease in these individuals.

Methods: 75 individuals with type 2 diabetes mellitus and fatty liver alterations on ultrasonography were included in this prospective clinical investigation, and the relationship between these changes and cardiovascular changes was evaluated.

Results: Based on diabetes duration, ischemia changes on ECG, and the highest incidence of LVDD in subjects with HbA1c of 7.1–8, hypertension is considerably greater in persons with fatty liver compared to subjects without fatty liver, and most subjects with diabetes have had the disease for 5–10 years. A total of 78.66% (n=59) study individuals had hypertension, with 13.33% (n=10) having grade 0 hypertension, 45.33% (n=34) having grade 1 hypertension, and 20% (n=15) having grade 2 hypertension. Grade 0, 1, 2, and 3 hypertension was observed in 10.66% (n = 8), 10.66% (n = 8), and 0 study participants, respectively, in non-fatty liver individuals; a total of 21.33% (n = 16) research subjects had this condition. With $p<0.0001$, this difference was statistically significant.

Conclusion: The current study comes to the conclusion that individuals with type 2 diabetes mellitus primarily displayed left ventricular diastolic dysfunction on echocardiographic examinations.

Keywords: Ultrasonographic examination, Type 2 diabetes, fatty liver, non-alcoholic fatty liver disease, cardio-vascular risk

INTRODUCTION

Non-alcoholic fatty liver disease, or NAFLD for short, is a disorder marked by hepatic fat buildup. In individuals without a history of heavy alcohol consumption, the illness can develop from steatosis to cirrhosis, hepatocellular carcinoma, and steatohepatitis. When there is no concomitant inflammation and a hepatocyte involvement of greater than 5%, it is distinguished and distinguished from steatosis. Individuals with type 2 diabetes mellitus also have higher odds of developing cirrhosis and fibrosis, which increases the risk of non-alcoholic fatty liver. The presence of nonalcoholic fatty liver disease (NAFLD) can raise the risk of cardiovascular disease in individuals with type 2 diabetes mellitus. Liver disease deaths can rise up to 22 times in persons with type 2 diabetes mellitus.1 One of the main causes of chronic liver illnesses, the incidence of nonalcoholic fatty liver disease (NAFLD) is rising worldwide. It encompasses a broad range of conditions, from mild liver steatosis to the severe

kind known as non-alcoholic steatohepatitis, or NASH. Non-alcoholic fatty liver disease has a high incidence worldwide, however the prevalence varies depending on the region and study site. According to statistics from the literature, the prevalence was as high as 70% in obese persons compared to around 35% in subjects with a normal body weight. In participants of normal weight, the prevalence of steatohepatitis was 3%, whereas in those of obese weight, it was 18%. The primary cause of about one-third of people with chronic liver disease is non-alcoholic fatty liver disease. Nearly 50–80% of people with abnormal liver enzymes also have NAFLD, which is mostly controlled by comorbid diseases such as dyslipidemia, diabetes, and obesity.2

Over 90% of patients undergoing bariatric surgery have steatosis, a condition associated with extreme obesity defined as a BMI of greater than >35 kg/m2. Additionally, steatosis is present in almost 3/4 of individuals with type 2 diabetes mellitus, which doubles the likelihood of cirrhosis in those with co-occurring NAFLD and diabetes mellitus. Among all people with hyperlipidemia, roughly one-third had hypercholesterolemia and two-thirds have hypertriglyceridemia. On ultrasonography, these subjects have fatty liver.

Liver imaging is a valid and dependable approach to determine whether NAFLD is present. Data from earlier studies shows a correlation between cardiovascular events and the ultrasound-detected diagnosis of NAFLD. Cardiovascular events are responsible for a higher death rate in NASH sufferers as compared to the general population.3.

Subjects with non-alcoholic fatty liver disease (NAFLD) have increased atherogenesis, which can be explained by a number of underlying mechanisms such as altered pro- and anticoagulant factor production, decreased adiponectin levels, oxidative stress, chronic inflammation, atherogenic dyslipidemia, insulin resistance, and/or genetic predisposition. These reasons can all be active at the same moment. Regardless of the NAFLD stage, a robust correlation is seen between adipose tissue insulin resistance (IR) and hepatic and NAFLD.

When evaluating insulin resistance, the amount of fat in the liver can function as a separate, synergistic predictor. Atherogenic dyslipidemia can result from the macro-inflammatory phase of non-alcoholic fatty liver disease (NASH).4 The goal of the current investigation was to determine if non-alcoholic fatty liver disease and other cardiovascular parameters were correlated with liver involvement in individuals with type 2 diabetes mellitus.

MATERIALS AND METHODS

The goal of the current prospective clinical and observational study is to determine the relationship between non-alcoholic fatty liver disease and various cardiovascular parameters in individuals with type 2 diabetes mellitus, as well as to evaluate liver involvement in these individuals.

The individuals who visited the Institute's Department of Radiodiagnosis made up the study population. The study's inclusion requirements were patients who were willing to participate, had a verified diagnosis of Type 2 diabetes mellitus, and had fatty abnormalities in their liver as determined by ultrasonography. All participants with diabetes mellitus were evaluated for inclusion using regular ultrasonography to detect hepatic fatty alterations. Subjects with a history of hepatotoxic drug consumption, HBS Ag or anti-HCV positive, known hepatic illness, and a history of chronic drinking were excluded based on certain criteria. The study had 102 participants in total, both male and female, with type 2 diabetes mellitus verified by ultrasonography and fatty abnormalities in the liver.

These comprised 102 participants, each of which was split up into three groups of 34 subjects. Twenty-four individuals in the control group were diabetics with normal liver function on imaging. Based on how long the diabetes had been present, three groups were created: Group I had the disease for less than five years, Group II for five to ten years, and Group III for more than ten years.

Following final inclusion, each participant had a thorough history obtained, and then there were exams, lab tests, documentation, and a systematic questionnaire-based evaluation. Using SPSS software version 21 (Chicago, IL, USA) for statistical assessment and one-way ANOVA and t-test for result formulation, the gathered data were examined. The data were presented as a mean, standard deviation, percentage, and number. At $p<0.05$, the significance threshold was maintained.

RESULTS

In order to evaluate liver involvement in individuals with type 2 diabetes mellitus and determine the relationship between various cardiovascular parameters and non-alcoholic fatty liver disease in these individuals, the current prospective clinical and observational investigation was carried out. According to age distribution, fatty liver was

observed on ultrasonography in about 74.66% (n=56) of study participants, but not in 25.33% (n=19) of research participants. The study found that the majority of participants with fatty liver were between the ages of 51 and 60 (n = 22). This was followed by the age group of 41 to 50 (17.33%, n = 13), and the age group of above 80 (1.33%, n = 1), which had the fewest patients.

Similar findings were seen for non-fatty liver, with 9.33% (n=7) of the patients being between the ages of 51 and 60, followed by 6.66% (n=5) of the subjects being between the ages of 41 and 50. The least number of respondents were in the 71–80 age range, with 1.33% (n=1) of the subjects being between the ages of 71 and 80, and no subjects being beyond 80 (Table 1).

When LVDD was evaluated according to the length of diabetes, it was shown that participants with diabetes for less than five years had 2.66% (n=2) of those with Grade 0 LVDD. Grades 1 through 3 were covered in 18.66% (n = 14), 8% (n = 6), and 2.66% (n = 2) of the topics.

Grade 0, 1, 2, and 3 LVDD were observed in 5.33% (n=4), 14.66% (n=11), 13.33% (n=10), and 8% (n=6) study participants in subjects with diabetes lasting 5–10 years, respectively. In contrast, LVDD of Grades 0, 1, 2, and 3 was observed in 10.66% (n=8), 13.33% (n=10), and 2.66% (n=2) subjects in subjects with diabetes lasting more than 10 years. At p=0.4356, this was not statistically significant. Additionally, depending on the length of diabetes, ischemia alterations on the ECG were observed in 29.33% (n=22) of people with diabetes for less than five years, 28% (n=21) of respondents with diabetes for five to ten years, and 18.66% (n=14) of subjects with diabetes for more than ten years. With p=0.31, this difference was statistically not significant (Table 2).

When hypertension based on the distribution of fatty liver was evaluated in the study subjects, it was observed that, of the subjects with fatty liver, 13.33% (n=10) had hypertension grade 0, 45.33% (n=34) had hypertension grade 1, 20% (n=15) had hypertension grade 2, and 78.66% (n=59) had hypertension grade 2. Grade 0, 1, 2, and 3 hypertension was observed in 10.66% (n = 8), 10.66% (n = 8), and 0 study participants, respectively, in non-fatty liver individuals; a total of 21.33% (n = 16) research subjects had this condition. With p<0.0001, this difference was statistically significant (Table 3).

5.33% (n=4) of the study subjects had LVDD of grade 0 for HbA1c of 6.4–7, while 2.66% (n=2) of the subjects had HbA1c of more than 10. The study subjects' LVDD prevalence was determined based on their HbA1c status. HbA1c values of 6.4-7, 7.1-8, 8.1-10, and >10 were seen in 8% (n = 6), 12% (n = 9), 14.66% (n = 11), and 8% (n = 6) of the study participants with Grade 1 LVDD. 4% (n = 3), 12% (n = 9), 10% (n = 8), and 13.33% (n = 10) of the trial participants had grade 2 LVDD, with HbA1c values of 6.4-7, 7.1-8, 8.1-10, and >10, respectively. With HbA1c of 6.4-7, 7.1-8, 8.1-10, and >10, respectively, 1.33% (n=1), 1.33% (n=1), 2.66% (n=2), and 4% (n=3) of the participants had grade 3 LVDD (Table 4).

DISCUSSION

In order to evaluate liver involvement in individuals with type 2 diabetes mellitus and determine the relationship between various cardiovascular parameters and non-alcoholic fatty liver disease in these individuals, the current prospective clinical and observational investigation was carried out. When LVDD was evaluated according to the length of diabetes, it was shown that participants with diabetes for less than five years had 2.66% (n=2) of those with Grade 0 LVDD.

Grades 1 through 3 were covered in 18.66% (n = 14), 8% (n = 6), and 2.66% (n = 2) of the topics. Grade 0, 1, 2, and 3 LVDD were observed in 5.33% (n=4), 14.66% (n=11), 13.33% (n=10), and 8% (n=6) study participants in subjects with diabetes lasting 5–10 years, respectively. In contrast, LVDD of Grades 0, 1, 2, and 3 was observed in 10.66% (n=8), 13.33% (n=10), and 2.66% (n=2) subjects in subjects with diabetes lasting more than 10 years. At p=0.4356, this was not statistically significant. Additionally, depending on the length of diabetes, ischemia alterations on the ECG were observed in 29.33% (n=22) of people with diabetes for less than five years, 28% (n=21) of respondents with diabetes for five to ten years, and 18.66% (n=14) of subjects with diabetes for more than ten years.

With p=0.31, this difference was statistically not significant. These findings corroborated those of research by Targher G et al. (2007) and Bluemke DA et al. (2008), which found that most people with diabetes that had been living with the condition for five to ten years had both ischemia abnormalities on their ECG and LVDD. When hypertension based on the distribution of fatty liver was evaluated in the study subjects, it was observed that, of the subjects with fatty liver, 13.33% (n=10) had hypertension grade 0, 45.33% (n=34) had hypertension grade 1, 20% (n=15) had hypertension grade 2, and 78.66% (n=59) had hypertension grade 2.

Grade 0, 1, 2, and 3 hypertension was observed in 10.66% (n = 8), 10.66% (n = 8), and 0 study participants, respectively, in non-fatty liver individuals; a total of 21.33% (n = 16) research subjects had this condition. With $p<0.0001$, this difference was statistically significant. These findings aligned with research conducted in 2016 by Francque SM et al7 and Zeb I et al8, which found that those with fatty liver had considerably higher blood pressure than those without fatty liver.

Based on the HbA1c status of the study subjects, the prevalence of LVDD was evaluated in the current study. It was found that 2.66% (n=2) of the study subjects had a HbA1c of greater than 10 and that 5.33% (n=4) of the study subjects had LVDD of grade 0.

. HbA1c values of 6.4-7, 7.1-8, 8.1-10, and >10 were seen in 8% (n = 6), 12% (n = 9), 14.66% (n = 11), and 8% (n = 6) of the study participants with Grade 1 LVDD. 4% (n = 3), 12% (n = 9), 10% (n = 8), and 13.33% (n = 10) of the trial participants had grade 2 LVDD, with HbA1c values of 6.4-7, 7.1-8, 8.1-10, and >10, respectively. With HbA1c of 6.4-7, 7.1-8, 8.1-10, and >10, respectively, 1.33% (n=1), 1.33% (n=1), 2.66% (n=2), and 4% (n=3) of the individuals had grade 3 LVDD. These findings were in line with research conducted in 2015 by Arulanandan A et al. and in 2010 by Soderberg C et al., who found that people with a HbA1c of 7.1–8 had the highest prevalence of LVDD.

CONCLUSION

Within its limitations, the present study concludes that left ventricular diastolic dysfunction was mainly seen abnormality on echocardiographic examination in subjects with type 2 diabetes mellitus, the highest prevalence of LVDD in subjects with HbA1c of 7.1-8, hypertension is significantly higher in subjects with fatty liver compared to subjects without fatty liver, and based on diabetes duration, LVDD and ischemic changes on ECG is seen in majority subjects of diabetes with 5-10 years. However, the present study had a few limitations including small sample size, short monitoring period, and geographical area biases. Hence, more longitudinal studies with larger sample size and longer monitoring period will help reach a definitive conclusion.

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TABLES

S. No	Age range (years)	Fatty liver		Non-fatty liver		p-value
		Percentage (%)	Number (n)	Percentage (%)	Number (n)	
1.	**<40**	6.66	5	5.33	4	0.4147
2.	**41-50**	17.33	13	6.66	5	
3.	**51-60**	29.33	22	9.33	7	
4.	**61-70**	16	12	2.66	2	
5.	**71-80**	4	3	1.33	1	
6.	**>80**	1.33	1	0	0	
7.	**Total**	74.66	56	25.33	19	

Table 1: Age-wise distribution of fatty liver disease in study subjects

S. No	Diabetes Duration	Left Ventricular Diastolic Dysfunction (LVDD)								Total		p-value
		0		1		2		3				
		%	n	%	n	%	n	%	n	%	n	
1.	**<5**	2.66	2	18.66	14	8	6	2.66	2	32	24	0.4356
2.	**5-10**	5.33	4	14.66	11	13.33	10	8	6	41.33	31	
3.	**>10**	0	0	10.66	8	13.33	10	2.66	2	26.66	20	
4.	**Total**	8	6	44	33	34.66	26	13.33	10	100	75	
5.	**Diabetes Duration**	**Ischemic changes on ECG**								**Total**		**p-value**
		Absent				**Present**				**%**	**n**	
		%		**n**		**%**		**n**				
6.	**<5**	29.33		22		4		3		33.33	25	0.31
7.	**5-10**	28		21		12		9		40	30	
8.	**>10**	18.66		14		8		6		26.66	20	
9.	**Total**	76		57		24		18		100	75	

Table 2: Cardiovascular changes based on diabetes duration in study subjects

S. No	Liver status	Hypertension						Total		p-value
		0		1		2		%	n	
		%	n	%	n	%	n			
1.	**Fatty liver**	13.33	10	45.33	34	20	15	78.66	59	<0.0001
2.	**Non-fatty liver**	10.66	8	10.66	8	0	0	21.33	16	
3.	**Total**	24	18	56	42	20	15	100	75	

Table 3: Hypertension based on the distribution of fatty liver disease in study subjects

S. No	HbA1c	Left Ventricular Diastolic Dysfunction (LVDD)								Total		p-value
		0		1		2		3				
		%	n	%	n	%	n	%	n	%	n	
1.	**6.4-7**	5.33	4	8	6	4	3	1.33	1	18.66	14	0.2569
2.	**7.1-8**		0	12	9	12	9	1.33	1	25.33	19	
3.	**8.1-10**		0	14.66	11	10	8	2.66	2	28	21	
4.	**>10**	2.66	2	8	6	13.33	10	4	3	28	21	
5.	**Total**		6	42.66	32	40	30	9.33	7	100	75	

Table 4: LVDD prevalence Hypertension based on HbA1c status in study subjects