e-ISSN: 0975-1556, p-ISSN:2820-2643
Available online on www.ijpcr.com
International Journal of Pharmaceutical and Clinical Research 2025; 17(1); 721-725

Original Research Article

Study of Liver Stiffness using Fibroscan in Type 2 Diabetes Mellitus and its Correlation with Risk Factors

Vinita Yadav[1], Anil Samaria[2], Monika Chowdhary[3], Sahil Khan[1], Meenakshi Samaria[4], Pearl Samaria[5]

[1]PG Resident, Department of General Medicine, Jawaharlal Nehru Medical College & Hospital, Ajmer (Raj.)
[2]Senior Professor and Unit Head, Department of General Medicine, Jawaharlal Nehru Medical College & Hospital, Ajmer (Raj.)
[3]Assistant Professor, Department of General Medicine, Jawaharlal Nehru Medical College & Hospital, Ajmer (Raj.)
[4]Senior Professor, Department of Obstetrics and Gynecology, Jawaharlal Nehru Medical College & Hospital, Ajmer (Raj.)
[5]MBBS, Mahatma Gandhi Medical College, Jaipur (Raj.)

Received: 26-10-2024 / Revised: 27-11-2024 / Accepted: 28-12-2024
Corresponding Author: Dr. Sahil Khan
Conflict of interest: Nil

Abstract:

Background: Non-alcoholic fatty liver disease (NAFLD) is a growing concern among patients with type 2 diabetes mellitus (T2DM). This study aimed to assess liver stiffness using FibroScan in newly diagnosed T2DM patients and investigate its correlation with various risk factors.

Methods: This cross-sectional study included 200 newly diagnosed T2DM patients. Liver stiffness was measured using transient elastography (FibroScan). Comprehensive data including demographics, anthropometric measurements and biochemical parameters were collected. Statistical analysis was performed to determine correlations between liver stiffness and various risk factors.

Results: The study revealed a NAFLD prevalence of 41% in the newly diagnosed T2DM population. Notably, 8% of subjects exhibited severe fibrosis (F3-F4). The majority of patients (32%) were in the 41-50 years age group. BMI analysis showed that 47% of subjects were either overweight (27%) or obese (20%). Statistical analysis demonstrated significant positive correlations between liver stiffness and body mass index (BMI) ($r=0.38$, $p<0.001$), fasting blood sugar (FBS) ($r=0.62$, $p<0.01$), aspartate aminotransferase (AST) ($r=0.29$, $p=0.035$) and alanine aminotransferase (ALT) levels ($r=0.32$, $p=0.027$). Interestingly, lipid profile parameters did not show significant correlations with liver stiffness.

Conclusion: A substantial proportion of newly diagnosed T2DM patients present with significant liver fibrosis. The study highlights the importance of BMI, FBS and liver enzymes as indicators correlated with increased liver stiffness. These findings suggest that early screening for NAFLD using non-invasive methods like FibroScan could be beneficial in the management of T2DM patients.

Keywords: Type 2 diabetes mellitus, Non-alcoholic fatty liver disease, FibroScan, Liver stiffness, Risk factors, Transient elastography.

Introduction

Diabetes mellitus (DM) is a complex group of metabolic disorders characterized by persistent hyperglycemia, resulting from defects in insulin secretion, insulin action, or a combination of both[1]. The liver as a central organ in glucose homeostasis plays a crucial role in the pathophysiology of diabetes and its complications. Notably, there is a significant association between diabetes mellitus and the development and progression of non-alcoholic fatty liver disease (NAFLD) [2-4]. NAFLD has emerged as one of the most prevalent chronic liver conditions worldwide with a global prevalence estimated at around 25% [5]. This prevalence is even higher in individuals with prediabetes underscoring the close relationship between glucose metabolism and liver health [6]. In India, which has been dubbed the "Diabetes capital of the world," NAFLD is becoming the predominant cause of liver dysfunction, reflecting the intertwined epidemics of diabetes and fatty liver disease [7]. Liver fibrosis is a critical factor in determining the prognosis of chronic liver diseases, including NAFLD [8]. It serves as an independent risk factor for severe complications such as liver cirrhosis,

hepatic decompensation, hepatocellular carcinoma and liver-related mortality [9]. Historically, liver biopsy has been the gold standard for diagnosing and staging NAFLD. However, its invasive nature and associated risks make it impractical for large-scale screening and repeated assessments [10]. In recent years, transient elastography (TE), commonly known as FibroScan has gained prominence as a non-invasive technique for assessing liver fibrosis. This method measures liver stiffness, which has been shown to correlate well with the degree of liver fibrosis in various liver diseases, including NAFLD [10]. The advent of such non-invasive techniques has opened new avenues for screening and monitoring liver health in high-risk populations, such as those with T2DM. The present study was designed with two primary objectives: first, to estimate the degree of hepatic stiffness using FibroScan in newly diagnosed type 2 diabetes mellitus patients and second, to investigate the correlation between liver stiffness and other risk factors including lipid profile and liver function tests. By exploring these relationships, we aim to contribute to the growing body of knowledge on the interplay between diabetes and liver health and potentially inform strategies for early detection and management of NAFLD in diabetic populations.

Methodology

This cross-sectional study was conducted in the Department of Internal Medicine at Jawaharlal Nehru Medical College and Hospital, Ajmer, over a period of one year from November 2022 to October 2023. The study protocol was approved by the institutional ethics committee and informed consent was obtained from all participants. A total of 200 newly diagnosed type 2 diabetes mellitus patients were enrolled in the study. The sample size was determined using the formula n = z2pq/d2 based on the prevalence of the disease. Inclusion criteria were limited to newly diagnosed T2DM patients. Exclusion criteria encompassed patients with a history of alcohol intake, viral hepatitis, alcoholic liver disease, chronic liver disease, hepatic abscess, malignancy, morbid obesity, gestational diabetes mellitus, type 1 diabetes mellitus and secondary diabetes.

Upon enrollment, a comprehensive medical history was obtained from each patient including detailed information about their diabetes diagnosis and any related symptoms. A thorough physical examination was conducted with particular attention to signs of liver disease. Anthropometric measurements including height and weight were recorded and Body Mass Index (BMI) was calculated. All patients underwent an abdominal ultrasound examination to assess for the presence of hepatic steatosis. Blood samples were collected for laboratory investigations, which included liver function tests (aspartate transaminase [AST], alanine transaminase [ALT], alkaline phosphatase) and lipid profile (LDL, HDL, serum triglycerides and total cholesterol). These tests were performed using spectrophotometric methods on an auto-analyzer without regard to the time since the last meal. The cornerstone of our study was the assessment of liver stiffness using transient elastography. All patients underwent FibroScan examination using an EchoSens device with a 50-MHz transducer standard M-probe. The procedure was performed in the radiology department by trained technicians. For each patient, at least 10 valid readings were obtained by placing the transducer in the liver area. The median value of these readings was used for analysis.

Data analysis was performed using SPSS version 22.00 for Windows. Descriptive statistics were used to characterize the study population. The chi-square test was employed to assess associations between categorical variables, while Pearson's correlation coefficient was used to evaluate the relationship between continuous variables. A p-value of less than 0.05 was considered statistically significant. The results were then interpreted in the context of existing literature on NAFLD in diabetic populations.

Results

The study included 200 newly diagnosed type 2 diabetes mellitus patients with a notable male preponderance (65.5% males vs. 34.5% females). This gender imbalance could potentially influence the study's outcomes and should be considered when interpreting results. The mean age of participants is 55.7 ± 12.3 years, indicating that the study population primarily consists of middle-aged to older adults, which is consistent with the typical age range for Type 2 Diabetes Mellitus (T2DM) onset and diagnosis. The mean BMI of 28.9 ± 4.7 kg/m² falls within the overweight category suggesting that a significant portion of the study population has excess body weight. This is further detailed in the BMI breakdown, which shows that while 42% of participants have a normal BMI, a combined 47% are either overweight (27%) or obese (20%). Interestingly, 11% of participants are underweight, which could warrant further investigation. Regarding comorbidities, hypertension is present in 34.5% of the participants, while hypothyroidism affects 9.5%. These comorbidities are important to consider as they may interact with or influence the primary condition under study. The mean fasting blood sugar (FBS) of 147.17 ± 19.12 mg/dL and post-prandial blood sugar (PPBS) of 189.05 ± 12.57 mg/dL both indicate elevated blood glucose levels, confirming the diabetic status of the study population. Overall, this demographic profile presents a study population that is predominantly male, middle-aged to older with a tendency towards

being overweight or obese and exhibiting blood glucose levels consistent with diabetes.

Table 2 presents the distribution of liver fibrosis stages as measured by FibroScan. While 59% of subjects showed no significant fibrosis (F0), 41% demonstrated some degree of liver fibrosis. Importantly, 8% (F3+F4) had severe fibrosis, indicating advanced liver disease. This high prevalence of liver fibrosis in newly diagnosed T2DM patients is alarming and underscores the need for early screening and intervention. The substantial proportion with F1 and F2 fibrosis (33%) represents a group that might benefit from targeted interventions to prevent progression to more severe stages.

Table 3 summarizes key biochemical parameters in the study population. The mean triglyceride level (154.58 mg/dL) is slightly elevated, while the mean HDL (38.70 mg/dL) is lower than optimal, both of which are common in T2DM and contribute to cardiovascular risk. The mean LDL (138.19 mg/dL) is also higher than the recommended level for diabetic patients. Interestingly, the mean AST (20.8 U/L) and ALT (23.5 U/L) levels are within normal ranges suggesting that liver enzymes alone may not be reliable indicators of NAFLD in this population.

Table 1: Demographic characteristics of the study population

Characteristic	N (%) or Mean ± SD
Gender	
- Male	131 (65.5%)
- Female	69 (34.5%)
Age (years)	55.7 ± 12.3
BMI (kg/m²)	28.9 ± 4.7
- Underweight	22 (11%)
- Normal	84 (42%)
- Overweight	54 (27%)
- Obese	40 (20%)
Co-morbidities	
- Hypertension	79 (34.5%)
- Hypothyroidism	19 (9.5%)
FBS (mg/dL)	147.17 ± 19.12
PPBS (mg/dL)	189.05 ± 12.57

Table 2: Liver stiffness distribution among the study subjects

Liver Stiffness	N=200	%
F0	118	59
F1	49	24.5
F2	17	8.5
F3	9	4.5
F4	7	3.5

Table 3: Biochemical parameters among the study groups

Variables	Mean ± SD
Triglyceride	154.58 ± 14.15
HDL	38.70 ± 5.73
LDL	138.19 ± 12.83
AST	20.8 ± 7.1
ALT	23.5 ± 7.9

Table 4: Correlation of hepatic stiffness with various parameters

Variables	r value	p value
Triglyceride	-0.13	0.24
HDL	0.12	0.31
FBS	0.62	<0.01*
LDL	0.08	0.57
AST	0.29	0.035*
ALT	0.32	0.027*
BMI	0.38	<0.001*
*: statistically significant		

This correlation analysis provides crucial insights into the relationships between various parameters and liver stiffness. The strongest correlation is observed with FBS ($r=0.62$, $p<0.01$), indicating that poor glycemic control is closely associated with increased liver stiffness. Significant positive correlations are also seen with AST, ALT and BMI, reinforcing the interconnection between liver health, body weight and liver enzyme levels. Surprisingly, lipid profile parameters (triglycerides, HDL, LDL) show weak and non-significant correlations with liver stiffness suggesting that traditional lipid markers may not be reliable indicators of liver fibrosis in this population.

Discussion

The findings of this study provide important insights into the prevalence and correlates of liver fibrosis in newly diagnosed T2DM patients. The observed NAFLD prevalence of 41% is consistent with previous studies, such as Atan et al., who reported a pooled prevalence of 54% in T2DM patients [11]. However, our slightly lower prevalence might be attributed to the fact that our study focused on newly diagnosed T2DM patients suggesting that NAFLD can develop early in the course of diabetes.

The age distribution of our study population with the majority falling in the 41-50 and >60 years categories, aligns with the typical age of T2DM onset and progression. This highlights the importance of screening for NAFLD in middle-aged and older adults with newly diagnosed T2DM. The male preponderance in our study (65.5%) is noteworthy and consistent with some previous studies, such as Kalra et al., who found a higher NAFLD prevalence in male T2DM patients [12].

The high proportion of overweight and obese individuals (47%) in our study population underscores the close relationship between excess body weight, T2DM and NAFLD. This finding is in line with Younossi et al., who reported that the prevalence of NAFLD rises to 70% in patients with obesity and T2DM [5]. The significant positive correlation between BMI and liver stiffness ($r=0.38$, $p<0.001$) further reinforces this association and highlights the importance of weight management in preventing and managing NAFLD in T2DM patients.

The liver stiffness distribution in our study with 8% of patients showing severe fibrosis (F3-F4) is particularly concerning. This is comparable to the findings of Alagesan et al. who reported severe fibrosis in 14% of males and 11% of females with T2DM [13]. The presence of advanced fibrosis in newly diagnosed T2DM patients suggests that liver damage may begin early in the course of diabetes possibly even before the clinical diagnosis of T2DM is made.

The strong positive correlation between FBS and liver stiffness ($r=0.62$, $p<0.01$) is a key finding of our study. This aligns with the observations of Mohan V et al., who found that the prevalence of NAFLD increases with increasing severity of glucose intolerance [14]. It suggests that poor glycemic control may be a driving factor in the development and progression of liver fibrosis in T2DM patients.

The significant correlations between liver enzymes (AST and ALT) and liver stiffness, despite mean enzyme levels being within normal ranges are intriguing. This supports the findings of Mofrad et al., who noted that patients with NAFLD can have normal ALT values [15]. It suggests that while elevated liver enzymes can be indicative of NAFLD, normal levels do not rule out the presence of significant liver fibrosis.

Interestingly, our study did not find significant correlations between lipid profile parameters and liver stiffness. This contrasts with some previous studies but aligns with the findings of Prasetya IB et al., who also reported no significant association between HDL and triglyceride levels and NAFLD [16]. This discrepancy highlights the complex relationship between lipid metabolism and liver fibrosis in T2DM patients and suggests that traditional lipid markers may not be reliable indicators of NAFLD risk in this population.

The use of FibroScan as a non-invasive method for assessing liver fibrosis in our study aligns with the growing trend towards non-invasive NAFLD screening in high-risk populations. As highlighted by Newsome et al., non-invasive tests like FibroScan can efficiently identify patients at risk of progressive NASH, potentially reducing unnecessary liver biopsies [17].

Our findings have important clinical implications. They suggest that screening for NAFLD should be considered in all newly diagnosed T2DM patients, regardless of their lipid profile or liver enzyme levels. The strong correlations with BMI and FBS indicate that weight management and glycemic control should be key focuses in preventing and managing NAFLD in this population.

However, our study has some limitations. The cross-sectional design prevents us from establishing causal relationships or observing the progression of liver fibrosis over time. Additionally, the lack of liver biopsies means we cannot definitively confirm the diagnosis of NAFLD or the exact stage of fibrosis. Future longitudinal studies with larger, more diverse populations and histological confirmation would be valuable in further elucidating the relationship between T2DM and NAFLD.

Conclusion

This study provides valuable insights into the prevalence and correlates of liver fibrosis in newly diagnosed type 2 diabetes mellitus patients. The finding that 41% of the study population had some degree of liver fibrosis with 8% showing severe fibrosis, underscores the importance of early screening for NAFLD in diabetic patients. The significant positive correlations observed between liver stiffness and BMI, fasting blood sugar and liver enzymes (AST and ALT) highlight these parameters as potential indicators of liver health in T2DM patients. These findings support the use of non-invasive techniques like FibroScan for routine assessment of liver health in diabetic populations. The lack of significant correlation between liver stiffness and lipid profile parameters suggests that traditional markers of metabolic health may not always reflect liver status in T2DM patients. This emphasizes the need for direct assessment of liver health, rather than relying solely on routine metabolic parameters. Our study reinforces the recommendations of recent guidelines advocating for routine screening of NAFLD in T2DM patients. Early identification of liver fibrosis could enable timely interventions, potentially preventing progression to more severe liver disease and associated complications.

Future research directions could include larger, multi-center studies to further validate these findings across diverse populations. Longitudinal studies would be valuable in understanding the progression of liver fibrosis in T2DM patients over time and the impact of various interventions on liver health outcomes.

References

1. Reaven GM. Role of insulin resistance in human disease. Diabetes. 1988; 37(12): 1595-607.
2. Hazlehurst JM, Woods C, Marjot T, et al. Non-alcoholic fatty liver disease and diabetes. Metabolism. 2016; 65(8):1096–108.
3. McPherson S, Hardy T, Henderson E, et al. Evidence of NAFLD progression from steatosis to fibrosing-steatohepatitis using paired biopsies: implications for prognosis and clinical management. J Hepatol. 2015; 62(5): 1148–55.
4. Kang SH, Lee HW, Yoo JJ, et al. KASL clinical practice guidelines: Management of non-alcoholic fatty liver disease. Clin Mol Hepatol. 2021; 27(3): 363–401.
5. Younossi Z, Anstee QM, Marietti M, et al. Global burden of NAFLD and NASH: trends, predictions, risk factors and prevention. Nat Rev Gastroenterol Hepatol 2017; 15: 11–20.
6. Bae JC, Cho YK, Lee WY, et al. Impact of non-alcoholic fatty liver disease on insulin resistance in relation to HbA1c levels in nondiabetic subjects. Am J Gastroenterol. 2010; 105(11): 2389–95.
7. Joshi SR, Parikh RM. India; the diabetes capital of the world: Now heading towards hypertension. J Assoc Physic India. 2007; 55: 323.
8. Bataller R, Brenner DA. Liver fibrosis. J Clin Invest. 2005; 115(2): 209–18.
9. Berumen J, Baglieri J, Kisseleva T, et al. Liver fibrosis: Pathophysiology and clinical implications. Wiley Interdiscip Rev Syst Biol Med. 2021; 13(1): e1499.
10. Foucher J, Chanteloup E, Vergniol J, et al. Diagnosis of cirrhosis by transient elastography (FibroScan): a prospective study. Gut. 2006; 55(3): 403-8.
11. Atan NA, Koushki M, Motedayen M, et al. Type 2 diabetes mellitus and non-alcoholic fatty liver disease: a systematic review and meta-analysis. Gastroenterol Hepatol Bed Bench. 2017; 10(1): S1.
12. Kalra S, Vithalani M, Gulati G, et al. Study of prevalence of non-alcoholic fatty liver disease in type 2 diabetes patients in India. J Assoc Physic India. 2013; 61: 448-53.
13. Alagesan, Kumar S. Assessment of liver involvement in type 2 diabetes mellitus using fibroscan® and correlation with risk factors. Int J Adv Med 2019; 6: 594-8.
14. Mohan V, Farooq S, Deepa M, et al. Prevalence of non-alcoholic fatty liver disease in urban south Indians in relation to different grades of glucose intolerance and metabolic syndrome. Diab Res Clin Pract. 2009; 84: 84-91.
15. Mofrad P, Contos MJ, Haque M, et al. Clinical and histologic spectrum of non-alcoholic fatty liver disease associated with normal ALT values. Hepatology. 2003; 37(6): 1286-92.
16. Prasetya IB, Hasan I, Wisnu W, et al. Prevalence and profile of fibrosis in diabetic patients with non-alcoholic fatty liver disease and the associated factors. Acta Medica Indonesiana. 2017;49(2):91-8.
17. Newsome PN, Sasso M, Deeks JJ, et al. FibroScan-AST (FAST) score for the non-invasive identification of patients with non-alcoholic steatohepatitis with significant activity and fibrosis: a prospective derivation and global validation study. The lancet Gastroenterology & hepatology. 2020; 5(4): 362-73.