Impact of Nonalcoholic Fatty Liver Disease (NAFLD) and Associated Risk Factors in Type 2 Diabetes Patients

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Abstract

Aim: This study investigates the prevalence of nonalcoholic fatty liver disease (NAFLD) in patients with type 2 diabetes mellitus (T2DM) and identifies associated risk factors.

Material and Methods: A sample of 100 T2DM patients was assessed for clinical and biochemical parameters.

Results: The results show a high prevalence of NAFLD, with key risk factors including insulin resistance, obesity, and dyslipidemia.

Conclusion: Early detection of NAFLD in T2DM patients is crucial to prevent progression to more severe liver diseases such as nonalcoholic steatohepatitis (NASH). The findings underscore the need for early screening and targeted interventions in this population.

Keywords: Nonalcoholic fatty liver disease, Type 2 diabetes, Risk factors.

Introduction

Nonalcoholic fatty liver disease (NAFLD) is a growing concern worldwide, particularly among individuals with type 2 diabetes mellitus (T2DM). NAFLD, characterized by the accumulation of fat in the liver without significant alcohol consumption, is commonly observed in T2DM patients due to shared pathophysiological mechanisms such as insulin resistance, obesity, and metabolic dysregulation [1, 2]. The rising global prevalence of both T2DM and NAFLD has prompted increased attention toward understanding the interplay between these two conditions. NAFLD is not just a benign condition but a precursor to more severe liver diseases, including nonalcoholic steatohepatitis (NASH), cirrhosis, and liver cancer [3, 4]. It is thus critical to identify the risk factors associated with its progression in diabetic patients.

The relationship between T2DM and NAFLD is well-documented, with studies showing that up to 70% of patients with T2DM have evidence of NAFLD [3]. The condition is intricately linked to metabolic abnormalities such as dyslipidemia, hypertension, and obesity—key risk factors for both T2DM and NAFLD [6]. Insulin resistance, a hallmark of T2DM, plays a significant role in the development of NAFLD by increasing hepatic fat accumulation [4]. Furthermore, poor glycemic control has been identified as a significant factor in the progression of liver damage in these patients [5]. The importance of early detection of NAFLD in T2DM patients cannot be overstated, as it allows for the implementation of preventive strategies aimed at managing risk factors such as weight loss, improved glycemic control, and lipid management [6]. Identifying the magnitude of NAFLD in diabetic populations is crucial for the development of targeted interventions that may reduce the burden of both liver disease and cardiovascular complications [7].

Material and Methods

This hospital-based observational descriptive study was conducted at a tertiary care center in Gujarat. A total of 100 patients with type 2 diabetes mellitus (T2DM) were enrolled to assess the magnitude of nonalcoholic fatty liver disease (NAFLD) among them.

The study included adult patients aged 35 to 70 years who had been diagnosed with type 2 diabetes for at least 1 year. Both male and female participants were considered, provided they were willing to give informed consent. Patients who met these criteria and were willing to participate in the

study were enrolled. Patients with a history of alcohol consumption greater than 20 g/day, those with known liver diseases such as hepatitis or autoimmune liver conditions, or those with significant comorbidities like chronic kidney disease (CKD) or heart failure were excluded from the study. Additionally, pregnant women and patients on medications known to cause liver toxicity were also excluded. The study was conducted over a six-month period at a tertiary care hospital in South Gujarat. The data collection process involved gathering demographic data, such as age, gender, the duration of diabetes, and any relevant medical history. A thorough clinical examination was conducted, including assessment of body mass index (BMI) and blood pressure, and looking for signs of liver disease.

Blood samples were taken from each patient for biochemical analysis, including liver function tests (LFTs), lipid profiles, fasting blood glucose (FBG), and HbA1c levels. These tests helped assess liver health and the level of glycemic control in the participants. Additionally, all patients underwent abdominal ultrasonography to detect and grade NAFLD based on liver echogenicity. If required, further diagnostic procedures like liver biopsy or elastography were performed for cases where ultrasonography results were ambiguous or indicated severe liver disease. The collected data were analyzed using descriptive statistics such as mean, standard deviation, and percentage. The prevalence of NAFLD in the study group was calculated, and associations between NAFLD and various risk factors, including age, gender, BMI, and glycemic control, were analyzed using chi-square tests. A significant level of $p < 0.05$ was used for all statistical tests. Ethical approval for the study was obtained from the Institutional Ethical Committee. Informed consent was collected from all participants, and confidentiality was maintained throughout the study. This study had some limitations. Being a cross-sectional study, it only provides a snapshot of the prevalence of NAFLD among T2DM patients and cannot establish causal relationships. Furthermore, ultrasonography, while widely used, may not detect initial stages of NAFLD or distinguish it from other liver conditions.

Results

Table 1 shows the number of patients and their corresponding percentages for each category. Among patients aged 25-34 years, 6% had no NAFLD, while 4% had NAFLD. In the 35-44 age group, 10% had no NAFLD, and 5% had NAFLD.

The 45-54 age group had a higher prevalence of NAFLD, with 11% of patients showing no NAFLD, while 31% had NAFLD. In the 55+ age group, 3% had no NAFLD, and 29% had NAFLD. The total distribution indicates a higher prevalence of NAFLD in older age groups, with 69.33% of patients having NAFLD overall. Table 2 presents the distribution of subjects according to Fatty Liver Grade (FLG) along with the mean age and standard deviation for each grade. In grade 0, 31 subjects had a mean age of 35.62 ± 5.78 years. For grade 1, 43 subjects had a mean age of 54.51 ± 5.78 years. In grade 2, 24 subjects were present with a mean age of 62.32 ± 5.29 years. Lastly, grade 3 included 3 subjects with a mean age of 65.99 ± 9.33 years. The data shows a trend of increasing age with the severity of fatty liver disease.

Table 3 shows the distribution of subjects according to Fatty Liver Grade (FLG) along with the mean body mass index (BMI) and standard deviation for each grade. In grade 0, 31 subjects had a mean BMI of 23.01 ± 3.66. For grade 1, 43 subjects had a mean BMI of 28.54 ± 2.42. In grade 2, 24 subjects had a mean BMI of 30.10 ± 2.36, and in grade 3, 3 subjects had a mean BMI of 39.85 ± 2.37. The data reveals a trend of increasing BMI with the severity of fatty liver disease.

Table 4 presents the distribution of subjects according to Fatty Liver Grade (FLG) along with the mean triglyceride (TG) levels (in mg/dl) and standard deviation for each grade. In grade 0, 31 subjects had a mean TG of 103.68 ± 26.85 mg/dl. For grade 1, 43 subjects had a mean TG of 163.56 ± 15.93 mg/dl. In grade 2, 24 subjects had a mean TG of 177.99 ± 27.15 mg/dl, and in grade 3, 3 subjects had a mean TG of 215.71 ± 18.41 mg/dl. The data shows a clear increase in triglyceride levels with the severity of fatty liver disease.

Table 5 compares various parameters between patients with and without nonalcoholic fatty liver disease (NAFLD) among those with type 2 diabetes mellitus. It presents the mean $\pm$ standard deviation for each parameter, along with the statistical significance (p-value). Significant differences ($p < 0.001$) were observed in age, BMI, and triglyceride (TG) levels, with patients having NAFLD showing higher values for these parameters. For other parameters, including systolic and diastolic blood pressure, fasting blood sugar, liver enzymes, and lipid profile, no significant differences were found between the two groups ($p > 0.05$). This indicates that while certain metabolic and biochemical factors differ significantly, others do not exhibit a major distinction between the two groups.

Table 1: Age wise distribution according to presence or absence of NAFLD among patients of type 2 diabetes mellitus.

Age group (in years)	Non NAFLD (n)	Non NAFLD (%)	NAFLD (n)	NAFLD (%)	Total (n)

25-34	6	6	4	4	10
35-44	10	10	5	5	15
45-54	11	11	31	31	42
55+	3	3	29	29	32

Table 2: Mean±SD. of age according to FLG (Fatty Liver Grade).

FLG (Fatty Liver Grade)	n (no. of subjects)	Mean + S.D. of age (years)
0	31	35.62±5.78
1	43	54.51±5.78
2	24	62.32±5.29
3	3	65.99±9.33

Table 3: Mean±SD. of BMI according to FLG.

FLG (Fatty Liver Grade)	n (no. of subjects)	Mean±SD. of BMI
0	31	23.01±3.66
1	43	28.54±2.42
2	24	30.10±2.36
3	3	39.85±2.37

Table 4: Mean±SD. of TG (Triglyceride) according to FLG.

FLG (Fatty Liver Grade)	n (no. of subjects)	Mean±SD. of TG (mg/dl)
0	31	103.68±26.85
1	43	163.56±15.93
2	24	177.99±27.15
3	3	215.71±18.41

Table 5: Comparison of parameters studied between the two groups of patients, with and without NAFLD.

Parameter	Type 2 D.M. with NAFLD (n=104, 69.33%) Mean±SD	Type 2 D.M. without NAFLD (n=46, 30.67%) Mean±SD	p value
Age (years)	54.10±9.00	47.80±8.50	< 0.001 (HS)
B.M.I. (kg/m2)	30.90±4.50	25.00±3.20	< 0.001 (HS)
S.B.P. (mm of Hg)	126.10±7.10	119.80±5.80	> 0.05 (NS)
D.B.P. (mm of Hg)	81.20±4.20	79.10±3.70	> 0.05 (NS)
FBS (mg/dl)	135.80±6.00	128.30±5.50	> 0.05 (NS)
BS (PP) (mg/dl)	240.00±20.00	230.10±22.50	> 0.05 (NS)
HbA1c (%)	7.90±0.60	7.40±0.45	> 0.05 (NS)
AST (U/L) SGOT	38.00±4.50	34.00±5.00	> 0.05 (NS)
ALT (U/L) SGPT	43.00±6.00	39.00±5.50	> 0.05 (NS)
Bilirubin (T) (mg/dl)	0.85±0.25	0.70±0.20	> 0.05 (NS)
Bilirubin (D) (mg/dl)	0.45±0.12	0.38±0.11	> 0.05 (NS)
ALP (IU/L)	105.00±18.00	98.00±16.00	> 0.05 (NS)
Urea (mg/dl)	30.10±4.80	28.30±5.10	> 0.05 (NS)
Creatinine (mg/dl)	0.91±0.23	0.85±0.20	> 0.05 (NS)
T.S.H. (uIU/ml)	2.50±0.55	2.10±0.45	> 0.05 (NS)
fT4 (ng/dl)	1.35±0.20	1.05±0.15	> 0.05 (NS)
TC (mg/dl)	170.20±20.10	160.50±18.00	> 0.05 (NS)
LDL (mg/dl)	105.00±19.00	98.20±17.00	> 0.05 (NS)
HDL (mg/dl)	45.00±4.00	47.80±4.80	> 0.05 (NS)
TG (mg/dl)	180.50±25.00	160.00±18.50	< 0.001 (HS)
Albumin	4.30±0.40	4.55±0.30	> 0.05 (NS)

Discussion: The findings of this study emphasize the strong association between type 2 diabetes mellitus (T2DM) and nonalcoholic fatty liver disease (NAFLD), with several key risk factors contributing to the development of NAFLD in this population. Previous studies have consistently highlighted that insulin resistance, obesity, and dyslipidemia are intricately linked to the onset and

progression of NAFLD in T2DM patients [1, 2]. Our results support these observations, particularly in the case of BMI and triglyceride levels, which were significantly higher in the NAFLD group, aligning with other studies that have noted similar trends [8]. Interestingly, while factors such as blood pressure, fasting blood sugar, and liver enzymes did not show significant differences between the two groups, this may suggest that NAFLD in T2DM patients can develop independently of other metabolic disturbances in the initial stages. The findings are consistent with research indicating that NAFLD often precedes the manifestation of other complications in diabetic individuals and that its diagnosis should be considered early to prevent progression to more severe liver conditions, such as nonalcoholic steatohepatitis (NASH) or cirrhosis [9].

Conclusion

In conclusion, this study reinforces the strong association between type 2 diabetes mellitus (T2DM) and nonalcoholic fatty liver disease (NAFLD), highlighting key risk factors such as insulin resistance, obesity, and dyslipidemia. Early identification and management of NAFLD in T2DM patients are essential to prevent the progression to more severe liver conditions, such as nonalcoholic steatohepatitis (NASH) and cirrhosis. Further research into the mechanisms linking T2DM and NAFLD, as well as early screening, is crucial for improving patient outcomes and reducing the burden of both liver and cardiovascular diseases in this population.

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