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Original Research

Mapping the Intersection of Liver Enzyme Elevations and Renal Dysfunction in Type 2 Diabetes Mellitus: A Tertiary Care Perspective

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ABSTRACT:

Background: Diabetes Mellitus (DM) and hypertension often coexist, exacerbating cardiovascular, renal, and hepatic complications. This study aims to explore the relationship between liver dysfunction and renal microvascular complications in Type 2 Diabetes Mellitus patients. **Methods:** A correlational study was conducted over 18 months with 200 patients diagnosed with Type 2 DM. Investigations included liver function tests, abdominal ultrasonography, and urine spot microalbumin. Data were analyzed using SPSS version 21.0. **Results:** The majority of patients were aged 61-70 years, with equal gender distribution. Elevated liver enzymes (SGOT, SGPT, ALP, GGTP) correlated significantly with longer diabetes duration and poor glycemic control. Increased BMI was associated with liver dysfunction. NAFLD prevalence was notable among the cohort. **Discussion:** Liver dysfunction was prevalent among Type 2 DM patients, significantly correlated with age, disease duration, and BMI. Elevated GGT levels reflected oxidative stress and hepatobiliary damage, aligning with existing literature. The study underscores the importance of monitoring liver function to manage diabetes complications effectively. **Conclusion:** Elevated liver enzymes in Type 2 DM patients are linked with prolonged disease duration, poor glycemic control, and increased BMI. The findings highlight the need for comprehensive liver function monitoring in diabetic management. Limitations include a small sample size and lack of lifestyle factor analysis. Future research should involve larger, multi-center studies to validate these findings.

Keywords: Diabetes Mellitus, liver dysfunction, renal microvascular complications, non-alcoholic fatty liver disease, glycated hemoglobin, liver enzymes, microalbuminuria.

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INTRODUCTION

Diabetes Mellitus continues to be a significant public health challenge worldwide. The co-occurrence of diabetes and hypertension is more frequent than would be expected by chance alone. In individuals with diabetes, hypertension considerably raises the risk and accelerates the progression of cardiovascular disease, peripheral vascular disease, stroke, retinopathy, and nephropathy. Many Type 2 Diabetic patients may experience hypertension years before the onset of overt diabetes.[1] At the time of Type 2 Diabetes Mellitus diagnosis, approximately 70-80% of patients are already hypertensive. Blood pressure often escalates even further in those who develop diabetic nephropathy later on. Predisposing factors such as obesity, insulin resistance, hypertriglyceridemia, elevated low-density lipoproteins, decreased high-density lipoproteins, abnormal glucose tolerance, and hypertension—along with genetic predisposition and abdominal obesity—contribute to vascular inflammation. This inflammation, triggered by excessive reactive oxygen species, initiates damaging processes in various organ systems, particularly the liver and kidneys. An early stage of diabetic renal disease, known as incipient diabetic nephropathy, is marked by increased albumin excretion of 30-300 mg/day. This phase of microalbuminuria can be reversed with proper and consistent glycemic control. However, without intervention, this condition may progress to overt nephropathy, eventually leading to end-stage renal disease.[2]

Microalbuminuria in patients with Diabetes Mellitus (DM) has been linked to factors such as advancing age, female gender, poor glycemic control, longer disease duration, diabetic retinopathy, and the presence of hypertension. Diabetes Mellitus is reaching epidemic levels in India, significantly contributing to morbidity and mortality, and placing a heavy burden on both families and the healthcare system. Currently, over 62 million people in India are diagnosed with diabetes, and projections suggest that by 2030, this number could rise to 100 million. Research conducted in various regions globally has reported differing prevalence rates of Non-Alcoholic Fatty Liver Disease (NAFLD) in Type 2 Diabetes Mellitus. The association between NAFLD and the duration of diabetes has also been studied, yielding inconsistent results.[3] However, studies examining the relationship between liver dysfunction and nephropathy in diabetic patients are limited. This study was therefore undertaken to explore the correlation between liver and kidney dysfunction in diabetes mellitus, utilizing parameters such as liver enzymes, abdominal ultrasonography, and urine spot microalbumin to aid in better diagnosis and management.

OBJECTIVES OF THE STUDY

1. To investigate liver dysfunction in patients with Type 2 Diabetes Mellitus.
2. To examine the relationship between liver dysfunction and microalbuminuria.

MATERIALS AND METHODS

Source of Data

The study involved patients aged over 30 years, diagnosed with Type 2 Diabetes Mellitus.

Study Design

This correlational study was conducted over 18 months, from January 2017 to June 2018. A total of 200 patients participated. Informed consent was obtained from all participants before their inclusion. Patient information, including detailed medical history, clinical features, and investigation reports, was recorded on a pre-designed form.

Investigations

The study included a range of investigations: Complete Blood Count, Serum Total Bilirubin, Direct Bilirubin, Indirect Bilirubin, Aspartate Aminotransferase (AST), Alanine Aminotransferase (ALT), Alkaline Phosphatase, Total Serum Protein, Serum Albumin, Serum Globulin, Prothrombin Time and International Normalized Ratio (INR), Fasting Lipid Profile, Abdominal Ultrasound, HBs Ag, HCV, Serum Urea, Serum Creatinine, Urine Spot Microalbumin, HbA1c, and GGTP. Liver function test results were compared with microalbuminuria levels.

Inclusion Criteria

All patients aged over 30 years with a diagnosis of Type 2 Diabetes Mellitus, whether recently or previously diagnosed.

Exclusion Criteria

1. Patients with a history of alcohol consumption exceeding 9 units per week.
2. Patients with a history of Hepatitis B or Hepatitis C.
3. Patients who have used methotrexate, amiodarone, glucocorticoids, synthetic estrogens, or nucleoside analogues for more than one month.
4. Patients with pre-existing renal dysfunction prior to the onset of Diabetes Mellitus.

Data Analysis

Data were analyzed using frequency, percentage, mean, standard deviation, Pearson correlation coefficient, Student's t-test, and Chi-square test with SPSS version 21.0 for Windows.

RESULTS

Table 1: Demographic Characteristics of Patients

Demographic Categories	Characteristics (N, %)
Age Group (years)	
40 and below	16 (8.0)
41 – 50	44 (22.0)
51 – 60	56 (28.0)
61 – 70	60 (30.0)
Above 70	24 (12.0)
Gender	
Male	100 (50.0)
Female	100 (50.0)
BMI (kg/m²)	
≤18	14 (7.0)
18 – 25	94 (47.0)
≥25	92 (46.0)
Total	200 (100)

The table outlines the demographic characteristics of 200 patients. The majority (30%) are aged 61-70 years, followed by 28% aged 51-60 years. Those aged 41-50 years constitute 22%, while 12% are above 70 years, and 8% are 40 or younger. Gender distribution is equal, with 50% male and 50% female. In terms of Body Mass Index (BMI), 46% have a BMI between 18 and 25, 46% are classified as overweight or obese (BMI ≥25), and 7% are underweight or normal weight (BMI ≤18). This distribution helps contextualize the study's findings on diabetes and associated conditions.

Table 2: Correlation of Liver Function Test Parameters with Duration of Diabetes Mellitus

Liver Function Test Parameter	≤5 Years	≥5 Years	Total	p-value
SGOT	6	70	76	0.005 (HS)
SGPT	10	82	92	0.005 (HS)
ALP	12	58	70	0.000 (HS)
GGTP	10	20	30	0.000 (HS)
Bilirubin	16	22	38	0.0189 (sig)
PT	10	18	28	0.000 (HS)
INR	8	24	32	0.000 (HS)

The table presents liver function test parameters in patients with Type 2 Diabetes Mellitus, divided by disease duration. It shows that elevated levels of SGOT, SGPT, ALP, GGTP, Bilirubin, PT, and INR are significantly more common in patients with a diabetes duration of 5 years or more compared to those with a shorter duration. The p-values for SGOT, SGPT, ALP, GGTP, PT, and INR are all below 0.01, indicating high statistical significance, while Bilirubin has a p-value of 0.0189, also significant. These results suggest that prolonged diabetes duration is associated with worsening liver function.

DISCUSSION

This study investigated liver dysfunction and renal microvascular complications in type 2 diabetes patients. The findings reveal a notable prevalence of liver dysfunction among the cohort, with the majority falling within the 61-70 age range and a mean age of 58.15 years. Elevated levels of liver enzymes, including ALT, AST, GGT, and ALP, were observed to correlate positively with patient age, duration of diabetes, and glycemic control, as measured by HbA1c. Furthermore, increased BMI was significantly associated with liver dysfunction. These results are consistent with previous studies, such as those by Idris et al., which also found that liver dysfunction in diabetic patients was strongly linked to age, BMI, disease duration, and glycemic control.[4,5]

GGT, a key marker of hepatobiliary disorders, was elevated in 15% of the study population. GGT elevation is indicative of oxidative stress and hepatobiliary damage, often exacerbated by diabetes-induced free radical production. The observed correlation supports findings from various studies that have linked increased GGT levels with diabetes and hyperglycemic states. The role of GGT in reflecting liver damage and its association with diabetic conditions are well-documented, reinforcing the relevance of GGT as a diagnostic marker.[6,7]

The study also highlights the prevalence of non-alcoholic fatty liver disease (NAFLD) in diabetic patients. NAFLD is frequently associated with insulin resistance, which promotes excessive fatty infiltration in the liver. This condition is further exacerbated by inflammation and oxidative stress, leading to elevated liver enzyme levels. Our study's findings align with this understanding, as a significant correlation was found between liver dysfunction—evidenced by biochemical tests—and radiological findings of liver abnormalities. This underscores the importance of monitoring liver function in diabetic patients to manage and potentially mitigate associated complications.[8,9,10]

CONCLUSION

This study provides valuable insights into the prevalence of liver dysfunction and its correlation with renal microvascular complications in patients with type 2 diabetes. We observed a significant association between elevated liver enzyme levels and longer duration of diabetes, poor glycemic control, and increased BMI. These findings emphasize the critical need for comprehensive monitoring of liver function in diabetic patients to manage potential complications effectively. The study also highlights a notable prevalence of non-alcoholic fatty liver disease (NAFLD) among the cohort, reinforcing the connection between insulin resistance and liver dysfunction.

However, there are limitations to this study. The relatively small sample size and its focus on a single tertiary care hospital may limit the generalizability of the findings. The cross-sectional design of the study does not allow for causal inferences between liver dysfunction and diabetes-related complications. Additionally, the study did not explore other potential contributing factors such as lifestyle and dietary habits, which could influence liver and renal health. Future research with larger, multi-center samples and longitudinal designs is needed to further investigate these associations and to develop targeted interventions for managing liver and kidney complications in diabetes.

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