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Original Research Article

Study of Lipid Profile in Stress Induced Type 2 Diabetic Nephropathy Patients

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Abstract

Stress-induced type 2 diabetes is associated with dyslipidemia, a recognised risk factor for diabetic kidney disease (DKD). There is mounting evidence that some lipid ratios may offer extra insight into lipid metabolism when compared to established lipid measures. Therefore, the purpose of the current investigation was to determine which lipid index was most closely connected to stress-induced DKD.

Methodology: Diabetes stress questionnaire used to diagnose patients with stress-induced T2D while ruling out other kidney disorders and urinary tract infections. Urinary creatinine was assessed along with lipid profiles, and lipid ratios were computed using the associated lipid parameters. The immunoturbidimetry method was used to assess the level of urinary albumin.

Results: Compared to T2D patients without nephropathy, these individuals had greater prevalences of hypertension, use of insulin and statins, higher blood urea nitrogen (BUN) levels, creatinine (Cr) levels, uric acid (UA) levels, cystatin C levels, poorer eGFRs, and lower LDL-C/Apo B ratios ($P < 0.05$). Other than the LDL-C/Apo B ratio between patients with and without nephropathy, there were no differences in the percentage of male patients, BMI, diastolic blood pressures, s, or lipid indices ($p > 0.05$).

Conclusion: Among the many lipid indices, the LDL-c/Apo B ratio in patients with stress-induced T2D was most closely associated with nephropathy (DNP), and a lower LDL-C/Apo B ratio was linked to a higher risk of DNP in T2D patients.

Keywords: Diabetes, Lipid Metabolism, Nephropathy, Blood Urea Nitrogen, Diastolic Blood Pressure.

Introduction

Stress can be sudden or chronic. While both can have a variety of negative side effects, prolonged stress can have detrimental long-term impacts on one's health. The two hormones that respond most strongly to stress are glucocorticoids (GC) and catecholamines. Although these hormones have no adverse effects in the short term, they

may cause problems with glucose homeostasis in the long run. In addition to these, stressed hyperglycemia provides a source of energy for the immune system and brain during stressful, injured, and infectious conditions. [1-3]. Diabetic kidney disease (DKD) affects 20% of patients with type 2 diabetes (T2D) and is one of the major microvascular consequences of T2D [1].

High levels of triglycerides (TG), low-density lipoprotein cholesterol (LDL-C), and low levels of high-density lipoprotein cholesterol are typical characteristics of dyslipidaemia in T2D patients (HDL-C). The mainstay of today's lipid-lowering medications, statins, work by blocking cholesterol synthase to lower plasma levels of LDL-C and TG [4-7]. Statins are advised by all available recommendations, and while they can lower proteinuria and all-cause mortality, they do not prevent the advancement of end-stage renal disease [8]. Consequently, it is conceivable that the standard lipid indices do not accurately reflect the risk of nephropathy, and it is desirable to look for new lipid-lowering therapeutic targets. In diabetic patients, there is a significant correlation between oxidative stress and hyperglycemia, and diabetes is associated with elevated reactive oxygen species (ROS) generation and diminished antioxidant defence [9]. Conversely, hyperglycemia may result in oxidative stress by activating stress pathways and causing mitochondrial dysfunction [10–11].

Methodology

In this observational study, patients diagnosed with stress induced T2D with the help of diabetes stress questionnaire and according to the statement of the American Diabetes Association and screened for nephropathy were enrolled from the inpatient department of Bio Chemistry, Index Medical College. Type 1 diabetes, secondary diabetes, previous and ongoing malignant tumors, chronic hepatitis and heart failure, acute diabetic complications and other kidney diseases, and urinary tract infection were all excluded. Finally, the current research included 156 T2D patients. Each subject signed written informed consent after thoroughly understanding the current research protocol. The study was in accordance with the Declaration of Helsinki and approved by the medical research ethics committee of the index medical college, Indore.

Laboratory Examination and Calculation

Following enrolment, fresh morning first-void urine samples and fasting blood samples were collected for the determination of the laboratory variables urinary albumin and urinary creatinine, respectively. An automated biochemical analyzer was used to measure the lipid profiles and urine creatinine, and lipid ratios were determined using the appropriate lipid parameters.

The immunoturbidimetry method was used to assess the level of urinary albumin. Urinary albumin to urine creatinine ratio (UACR) was an algorithm used to measure this ratio. Based on the CKD-EPI creatinine-cystatin C equation, estimated glomerular filtration rate (eGFR) was determined (2012) [12]. NEPHROPATHY can be diagnosed in a patient with T2D if their eGFR is less than 60 ml/min/1.73 m2 or their UACR is less than 30 mg/g and has persisted for longer than 3 months [13].

Results

Among the recruited 136 T2D patients, patients combined with Nephropathy accounted for 15.38%. As shown in Table 1, T2D patients with Nephropathy had older ages, longer diabetic durations, higher systolic blood pressures, a higher prevalence of hypertension, higher prevalence of insulin, and statins users, higher blood urea nitrogen (BUN) levels, creatinine (Cr) levels, uric acid

(UA) levels, cystatin C levels, UACR levels, lower eGFRs, and lower LDL-C/Apo B ratios (all $p < 0.05$) than T2D patients without NEPHROPATHY. There were no differences in proportion of males, BMI, diastolic blood pressures, s and lipid indices other than LDL-C/Apo B ratio between patients with and without NEPHROPATHY ($p > 0.05$).

There were significant differences in the proportion of patients with nephropathy among Group

Table 1: Clinical characteristics of study variables

Variable	Group 1 (*n*=78) Diabetic subjects without nephropathy	Group 2 (*n*=78) Diabetic subjects with nephropathy	*P* value
Mean age, yr	54.28±9.26	55.72±10.33	0.155
Mean duration(DM)	10.76±7.61	12.27±7.04	0.166
Sex, male:female	70:22	61:28	0.256
BMI (kg/m2)	25.63 ± 4.04	25.55 ± 3.36	0.842
SBP (mmHg)	132 (123-145)	142 (126-157)	<0.001
DBP (mmHg)	81.37 ± 11.04	81.43 ± 10.50	0.726
Cr (umol/L)	54.0 (46.0-63.0)	86.0 (68.0-116.0)	<0.001
Serum UA (umol/L)	290.5 (232.3-354.8	380 (313.0-472.0)	<0.001

Table 2: Lipid indices of diabetic and non-diabetic Nephropathic patients

Variables value	Diabetic nephropathy	Non diabetic nephropathy	P
TG (mmol/L)	1.42 (1.06-2.59)	1.79 (1.14-2.83)	0.457
TC (mmol/L)	4.66 (3.74-5.03)	4.17 (3.57-4.96)	0.321
HDL-C (mmol/L)	1.12 (0.96-1.31)	1.12 (0.92-1.30)	0.260
LDL-C (mmol/L)	2.75 ± 0.86	2.61 ± 1.00	0.051
Apo A1 (mmol/L)	1.07 (0.97-1.20)	1.05 (0.94-1.19)	0.215
Apo B (mmol/L)	0.94 (0.75-1.09)	0.83 (0.77-1.07)	0.785
TG/HDL-C (mmol/mmol)	1.43 (0.86-2.72)	1.79 (0.94-2.82)	0.339
LDL-C/Apo B (mmol/mmol)	2.91 (2.59-3.34)	2.84 (2.38-3.08)	< 0.001
HDL-C/Apo A1 (mmol/mmol)	1.03 (0.93-1.13)	1.22 (0.92-1.12)	0.509

Discussion

In the present investigation, we assessed the relationships between several lipid indices and the likelihood of developing nephropathy in T2D patients. In contrast to patients without nephropathy, we discovered that patients with nephropathy had lower levels of the LDL-C/Apo B ratio. eGFR, UACR, and cystatin C were all substantially correlated with the LDL-C/Apo B ratio. We also showed that the prevalence of nephropathy is independently correlated with the LDL-C/Apo B ratio. Furthermore, we found that a low LDL-C/Apo B ratio was associated with a higher risk of nephropathy even in patients with normal lipid profiles.

In patients with T2D, hyperlipidemia is a known risk factor for developing DKD. As a result of the glomerular filtration barrier being compromised and proteinuria eventually developing, hyperlipidemia has the potential to promote the death of podocytes, a kind of kidney epithelial cell

[14].In along with podocytes, hyperlipidemia can support glomerulosclerosis, interstitial fibrosis, and the progression of proteinuria by affecting glomerular endothelial and mesangial cells which promotes collagen and fibronectin accumulation [15]. Renal tubular injury is a vital component of DKD, and even precedes the occurrence of glomerular injury [16]. When combined with proteinuria, hyperlipidemia can cause renal tubular injury through the mechanism that albumin can serve as a carrier of fatty acids and promote fatty acid deposition in the kidney [17].

Also, by producing too many adipokines and activating a number of signalling pathways, ectopic lipid deposition in the kidney can cause localised oxidative stress and inflammation [18]. The current investigation showed a strong correlation between the occurrence of DKD in patients with T2D and the LDL-C/Apo B ratio. There have been numerous studies looking at the connections between lipid indices and DKD, yet there are differences amongst them. High levels of TG and low levels of HDL-C at baseline, but not levels of LDL-C, were able to predict the decrease of renal function in a 2.9-year follow-up research. Retnakaran R *et al*. demonstrated that serum TG and LDL-C levels were predictors of proteinuria in patients with T2D, which was slightly different from the study mentioned above [19].

The fall in eGFR and rise in proteinuria were both positively correlated with the TG/HDL-C ratio in a long-term research involving a sizable Japanese population. Other research, however, did not find any correlations between lipid indices and DKD or DKD indicators. Important markers of kidney function include UACR, eGFR, and cystatin C, which represent the glomerular filtration barrier, glomerular filtration function, and tubular function, respectively. We found that TG and the TG/HDL-C ratio were only positively correlated with UACR in this study.

Conclusion

A decreased LDL-C/Apo B ratio may be a potent risk factor and therapeutic target for the prevention and treatment of DNP in patients with T2D due to its tight association with the risk of DNP. The LDL-C/Apo B ratio should always be checked, even in type 2 diabetes patients with normal lipid profiles.

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