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Research Article

Study of Lipid Profile among Diabetic Patients with Reference to Different Ranges of Urinary Albumin Excretion

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ABSTRACT

Introduction: Among the various complications of diabetes mellitus (DM), diabetic nephropathy takes a huge toll on patient. Type 2 DM are usually dyslipidemic in spite of good glycemic control. This study was aimed to know the change in the lipid profile of diabetic patients without nephropathy, with incipient nephropathy and with overt nephropathy and to study the prevalence of dyslipidemia in diabetic patients without nephropathy, with incipient nephropathy and with overt nephropathy.

Methodology: Cross-sectional study conducted on 58 diagnosed cases of type 1 DM (T1DM; n=28) and type 2 DM (T2DM; n=30), were randomly selected on pre-decided inclusion and exclusion criteria. Clinical and appropriate laboratory examinations were done. Statistical analysis was done using Microsoft Excel.

Results: The male to female ratio was 1.32. In T1DM & T2DM, most cases were 30-40 years and >45 years respectively. In T1DM & T2DM, 21.43%, 50% and 28.57% & 43.33%, 40% and 16.67% were normoalbuminuric, microalbuminuric and macroalbuminuric, respectively. Glycemic control (HbA1c) in T1DM & T2DM was 42.9% and 40% respectively. More deranged lipid profile was noted among cases with micro or macro albuminuria. Triglycerides and VLDL values were significantly higher in all three groups in both T1DM and T2DM.

Conclusion: Lipid profile becomes more atherogenic in DM with nephropathy. Though the lipid profile is comparatively less atherogenic than 'western studies due to lower BMI and lower dietary fat consumption, still both the incipient and overt nephropathy group are more dyslipidemic and are at greater cardiovascular risk than patients without nephropathy.

Keywords: Dyslipidemia, Type 2 Diabetes Mellitus, Diabetic nephropathy, Microalbuminuria, Macroalbuminuria.

INTRODUCTION

Diabetes mellitus is the most common endocrine disease. At present, it is one of the leading health problems of modern society with being the seventh most common cause of mortality. [1, 2] There are many long-term complications – of diabetes which can affect almost every system of the body. Among the microvascular complications – retinopathy, nephropathy and neuropathy are important. Macrovascular complication leads to extensive premature atherosclerosis, ischaemic heart disease, stroke and peripheral vascular diseases are common in diabetics. [3, 4, 5] Out of these complications, diabetic nephropathy is the one of the leading causes of ESRD. Nephropathy complicates 30% of cases of type I DM and approximately 20% cases of type II DM.[5, 6] However, most diabetic patients with ESRD have type II DM because of greater prevalence of type II DM worldwide (90% of all individuals with diabetes). [7]

Hyperglycemia and hypertension are the two important risk factors for development of diabetic nephropathy. Risk factors also include hyperlipidemia. On the other hand, gradually progressing nephropathy also causes hyperlipidemia. So diabetic nephropathy and hyperlipidemia are interrelated. [8-10]

Current concept is that mechanism of such complications is glycation of proteins due to chronic hyperglycemia, i.e., non-enzymatic addition of hexoses to proteins leads to formation of advanced glycosylation and products (AGEs). The AGEs with other factors like growth factor, angiotensin II, endothelin, glomerular hyper perfusion, increased glomerular capillary pressure, increased basement-membrane thickening etc. causes nephropathy. [11, 12] Earliest manifestation of incipient nephropathy is microalbuminuria, i.e., urine albumin excretion 30 – 300 mg/24 hrs. Albumin is a plasma protein which is excreted in urine in very small amount, i.e., <30 mg/24 hrs. in normal person. When urine albumin amount is >300 mg/24 hours, it signifies overt nephropathy. [13, 14]

Patients, with type I DM with good glycemic control are not hyperlipidemic generally but patients with type 2 DM are usually dyslipidemic in spite of good glycemic control. Hyperlipidemia includes elevated triglycerides, elevated LDL-C and decreased HDL-C. [15] Elevated plasma LDL-C level are usually not a feature of DM and suggest the presence of underlying lipoprotein abnormality or may indicate development of diabetic nephropathy. The small dense

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particle of LDL found in type – II DM are more atherogenic due to glycation and easy oxidation. [16]

So, study of lipid profile in diabetics, particularly a comparative study in different ranges of urinary albumin excretion namely, normoalbuminuria, microalbuminuria and macroalbuminuria is important.

AIMS AND OBJECTIVES:

1. To study the change in the lipid profile of diabetic patients without nephropathy, with incipient nephropathy and with overt nephropathy.
2. To study the prevalence of dyslipidemia in diabetic patients without nephropathy, with incipient nephropathy and with overt nephropathy.

MATERIALS AND METHODS

This cross-sectional study was conducted on 58 diagnosed cases of type 1 and type 2 diabetes mellitus patients. The study was conducted in the Department of Physiology, Biochemistry and General Medicine of Darbhanga Medical College and Hospital, Laheriasarai, Biahr, India. The cases were randomly selected from outdoor and indoor of General Medicine department in one year from March 2021 to February 2022.

Inclusion Criteria- Cases who fulfill at least one of the following criteria: [4]

1. Symptoms of diabetes plus random plasma glucose concentration ≥200 mg/dl.
2. Fasting plasma glucose ≥126 mg/dl where fasting is defined as no caloric intake for at least 8 hrs.
3. Two-hour plasma glucose ≥200 mg/dl during an oral glucose tolerance test performed by using 75 gm of anhydrous glucose dissolve in water.

Exclusion Criteria- Patients of DM receiving ACE inhibitors or ARBs or hypolipidemic drugs or patients with underlying infection were not included in the study.

After establishing the diagnosis through history, detailed clinical examination and blood sugar estimation, the patients were subjected to following tests:

1. Routine and microscopic urine examination.
2. Estimation of 24 hrs. protein excretion in urine.
3. Lipid profile – Total cholesterol, LDL-C, VLDL, HDL-C, TG.
4. Glycosylated haemoglobin (HbA1c) level in plasma
5. Blood sugar
6. Blood urea and serum creatinine

The data collected were assessed to arrive at a definite conclusion. Statistical analysis was done using Microsoft Excel. Result has been depicted in form of text, table or figure, as appropriate.

RESULTS

After consideration of all the inclusion and exclusion criteria, a total of 58 patients were included in the study. Out of 58, 30 patients had type II DM and rest 28 were diagnosed with type I DM. Overall, male to female ratio was 1.32. For type I DM, majority of the patients were in their 3rd decade of life while more than three-fourth of the patients with type II DM had crossed 45 years. Patients from both the groups were classified based on their urinary albumin excretion for further analysis. [Figure 1 and 2] Good glycemic control (HbA1c) was noted among 42.9% of type I DM and 40% of type II DM. [Table 1] For all the components of lipid profile, mean with standard deviation was calculated for patients of both type I and type II DM. The mean was calculated separately for patients belonging to groups based on Urinary Albumin Excretion (UAE). [Table 2] It was observed that more deranged lipid profile was noted among patients with micro or macro albuminuria. [Table 3]

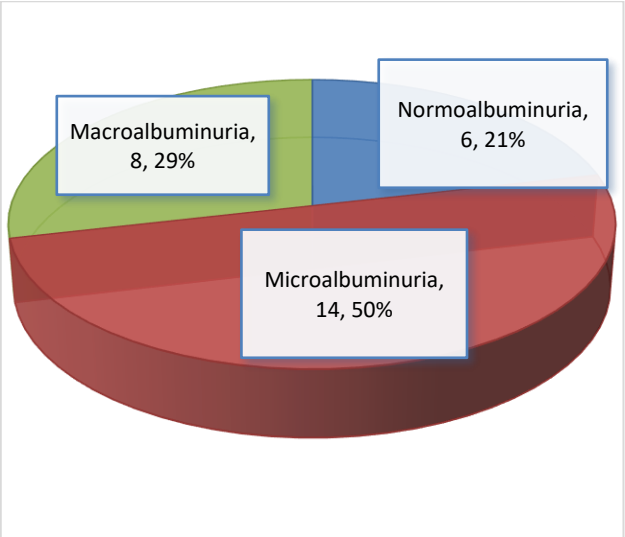

Figure 1: Pie distribution of type I DM patients based on their urinary albumin excretion

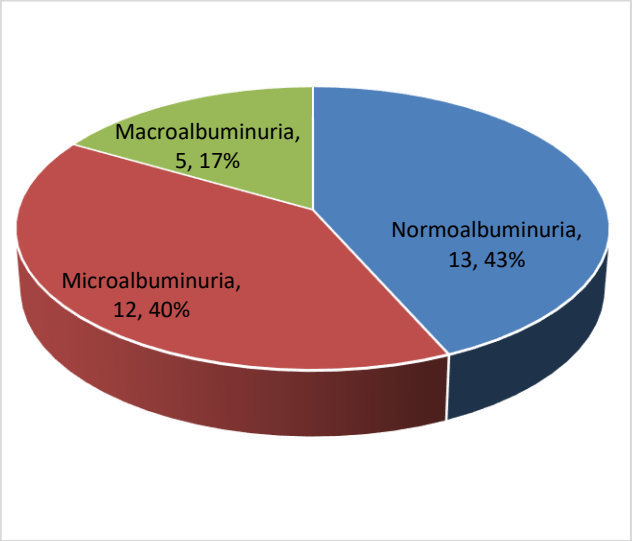

Figure 2: Pie distribution of type II DM patients based on their urinary albumin excretion

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Table 1: Distribution of patients with good and poor glycaemic controls in relation to urinary albumin excretion

HbA1c (%)	Type 1 DM (n=28)			Type 2 DM (n=30)		
	Normo	Micro	Macro	Normo	Micro	Macro
<7	3	6	3	6	5	1
>7	3	8	5	7	7	4

HbA1c- Glycated Hemoglobin, DM- Diabetes mellitus, Normo- Normal Albuminuria, Micro- Microalbuminuria, Macro- Macroalbuminuria

Table 2: Mean of various parameters of lipid profile for patients with Type I and Type II DM belonging to various groups based on UAE (Urinary Albumin Excretion)

DM	UAE	Mean TC±SD (mg/dl)	Mean TG±SD (mg/dl)	Mean HDL±SD (mg/dl)	Mean LDL±SD (mg/dl)	Mean VLDL±SD (mg/dl)
Type I	Normo	158.8±16.08	119.4±19.71	46.08±10.66	115.8±6.69	24.8±7.07
	Micro	162.5±16.94	129.2±21.41	45.4±16.01	118.7±9.86	29.2±7.75
	Macro	199.06±31.33	157.4±14.21	40.9±19.9	147.2±23.6	35.01±3.42
Type II	Normo	176.35±20.03	143.4±17.9	40.9±13.17	125.2±13.94	29.3±9.35
	Micro	189.4±31.41	147.94±8.59	45.01±14.11	135.9±30.01	31.1±7.45
	Macro	230.8±21.63	169.3±9.78	40.01±14.8	167.8±4.19	37.1±2.39

DM- Diabetes mellitus, UAE- Urinary Albumin Excretion, TC- Total cholesterol, TG- Triglyceride, HDL- High-density lipoprotein, LDL- Low-density lipoprotein, VLDL- Very low-density lipoprotein

Table 3: Relation of urinary albumin excretion with lipid profile

Mg/dl		Type 1 DM (n=28)			Type 2 DM (n=30)		
		Normo (n=6)	Micro (n=14)	Macro (n=8)	Normo (n=13)	Micro (n=12)	Macro (n=5)
Total Cholesterol	<150	4	7	1	5	3	0
	150-200	2	7	3	8	5	1
	>200	0	0	4	0	4	4
Triglycerides	<100	1	3	0	0	0	0
	100-150	3	5	1	5	4	0
	>150	2	6	7	8	8	5
HDL-C	<35	0	5	4	4	5	3
	35-60	6	9	4	9	7	2
	>60	0	0	0	0	0	0
LDL-C	<100	3	5	1	5	3	0
	100-160	3	9	4	8	4	1
	>160	0	0	3	0	5	4
VLDL	<25	1	2	0	0	0	0
	25-35	4	6	2	5	4	0
	>35	1	6	6	8	8	5

DISCUSSION

The present cross-sectional study was carried out on patients of diabetes mellitus, both type I DM and type II DM on treatment (insulin or OHA). Total number of the patients were 58, of which 28 were type I DM and 30 type II.

The prevalence of microalbuminuria and macro albuminuria was higher in this study compared to the Western population.[17, 18] In our study, in type I DM category, 21.43%, 50% and 28.57% were normoalbuminuric, microalbuminuric and macroalbuminuric respectively. Similarly, in type II DM category, 43.33%, 40% and 16.67% were normoalbuminuric, microalbuminuric and macroalbuminuric respectively. So, the prevalence of proteinuria is distinctly higher in our study. This difference can probably be explained by greater prevalence of poor glycemic control. This explanation is in accordance with

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other studies relating the influence of poor glycemic control, both long and short duration based, on the incidence of microalbuminuria and macroalbuminuria, as also the diminution of urinary albumin excretion by better glycaemic control in the long-term in the microalbuminuric patients. [19-21] However, an inherent susceptibility to nephropathy is also evident from the fact that a substantial number of patients with poor glycemic control had abnormal urinary albumin excretion.

Regarding lipid profile analysis, it had been seen that especially the triglycerides and VLDL values were significantly higher in all three groups in both type I DM and type II DM than the control groups. HDL-C level was not significantly different in all the three subgroups than the control. It has been established with so many studies. [22, 23] Comparing various degrees of UAE, in both type I DM and type II DM, total cholesterol level was significantly higher in macroalbuminuric group, whereas difference in cholesterol level between other two groups was not significant. This study has also shown that although higher in macroalbuminuric subgroup, these values are individually much lower than Western studies, especially in normoalbuminuric and macroalbuminuric subsets in type 1 DM patients. This is probably due to lower prevalence of obesity in type I and type II DM patients in our study. LDL-C, Triglycerides and VLDL also show significantly higher level in macroalbuminuric group in comparison to normoalbuminuric and microalbuminuric groups in both type I DM and type II DM category. [23, 24] In the macroalbuminuric subjects, poor glycemic control was the main reason behind the higher levels of triglycerides, total cholesterol, LDL-C and VLDL. Particularly the presence of relatively lower and poor glycemic control is responsible for influencing the lipid profile in diabetic patients. Conflicting reports exist, but majority of them show a positive correlation, especially in type II DM. [25, 26]

Increased UAE in patients with dyslipidemia may be secondary to dyslipidemia-associated endovascular damage. In this regard, there is some evidence that lipid reduction by antilipemic agents might decrease proteinuria in diabetic patients; however, presence of direct causal correlation between dyslipidemia and diabetic renal damage is still a subject of controversy. Studies across the globe suggests that in type I dm every one percent increase in HbA1c variability was associated with 90 percent higher first hospitalization risk and 392% higher recurrent hospitalization risk. In type II DM, 1% increase in HbA1c variability was associated with 556% higher first hospitalization risk and 573% higher recurrent hospitalization risk. They concluded thatHbA1c variability is strong predictor for hospitalization diabetic patients. [27, 28]

CONCLUSION

Our study concludes that lipid profile becomes more atherogenic in DM with nephropathy. This study, being a cross-sectional study, may only be the tip of the iceberg. Though the lipid profile is comparatively less atherogenic than 'western studies due to lower BMI and lower dietary fat consumption, still both the incipient and overt nephropathy group are more dyslipidemic and are at greater cardiovascular risk than patients without nephropathy'. So, the detection of clinical and subclinical proteinuria and their interference with dietary modification and pharmacological means, especially ACE inhibitors and correction of lipid profile, good glycemic control, BP control will certainly reduce both cardiovascular and renal risk to a great extent.

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