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Postprandial Dyslipidemia as a Screening Tool for Risk Stratification of Acute Coronary Syndrome in Type 2 Diabetes Mellitus

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Abstract
Background: Type 2 Diabetes Mellitus is associated with the development of premature atherosclerosis. Deficiency of insulin and insulin resistance influences important enzymes and pathways in lipid metabolism. Diabetic dyslipidemia plays an important role in the pathogenesis of accelerated atherosclerosis.
Methods: A total of 100 Type 2 Diabetes Mellitus (DM) patients who presented as in-patients with Acute coronary syndrome (ACS) were taken as cases and 50 controls with no diabetes mellitus were included. Lipid profile, fasting and postprandial was done for this study.
Results: Our study shows statistically significant difference between cases and controls lipid profile in fasting and postprandial state. Lipid profile showed significant postprandial elevation of triglycerides(TGs), Very low density lipoproteins(VLDL) and decrease in High density lipoproteins(HDL) in cases.
Conclusion: Postprandial lipid profile especially 4hours after normal meals may be an ideal evaluation tool to look for Coronary artery disease (CAD) risk in DM. Previously TGs have been suggested but our study also shows significant changes even in HDL and VLDL. Hence, including postprandial lipid profile in DM patients is a better predictor for risk stratification of Myocardial infarction and also to decide appropriate initiation of statin therapy.

Key words: *Type 2 Diabetes Mellitus, Acute coronary syndrome, Fasting and postprandial lipid profile*

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I. Introduction

Type 2 Diabetes Mellitus is associated with the development of premature atherosclerosis. Deficiency of insulin and insulin resistance influences important enzymes and pathways in lipid metabolism leading to lipid abnormalities in diabetes mellitus.[1,2,3]

Diabetic dyslipidemia is a triad of raised Triglycerides (TGs), Low density lipoproteins cholesterol(LDL-C) and Very low density lipoproteins cholesterol (VLDL-C) and decrease in high density lipoproteins cholesterol (HDL-C). This plays an important role in the pathogenesis of accelerated atherosclerosis.[4] It has been proposed the lipid particles composition in diabetics compared to non diabetics is more atherogenic. Of a 24 hour Triglyceride level, fasting triglyceride values are the lowest and thus can be deceiving. Many previous studies have shown raised postprandial Triglyceride rich lipoprotein to be related to coronary artery disease in diabetic subjects.[5,6]

Most endothelial damage takes place, when the vascular endothelium is exposed to the effects of triglycerides which is more during postprandial state. High cardiovascular mortality is attributed to exaggerated, prolonged postprandial dyslipidemia.[7]

There are very few studies including postprandial complete lipid levels, hence this study aims to compare fasting and postprandial lipid profile in diabetes mellitus presenting with acute coronary syndrome.

II. Materials And Methods:

Type 2 Diabetes Mellitus (DM) patients who presented as in-patients with Acute coronary syndrome (ACS) to Tertiary health centre PESIMSR(Peoples education society institute of Medical Sciences and Research), Kuppam, Andhra Pradesh, India, who fulfilled the Inclusion and Exclusion criteria were selected for the study. A total of 100 patients were included in the present study. A total of 50 subjects who were normal apparently and did not have diabetes mellitus were taken as controls.

2.1. Inclusion criteria:
Patients with Type 2 diabetes mellitus and ACS

2.2. Exclusion criteria:
Patients with hepatic disease, previous CAD, smokers , alcoholics, hypothyroidism, renal disorders, Type 1 diabetes mellitus, family history of dyslipidemia.
Patients on medications such as hypolipidemics, beta blockers and steroids were excluded.

The data was collected as per a pre tested proforma that included various socio-economic parameters like age, gender etc. All the subjects with diabetes presenting with ACS underwent fasting and postprandial lipid profile, and the data was analyzed.

Fasting and Postprandial lipid profile which included serum total cholesterol, serum triglycerides, LDL cholesterol, HDL cholesterol and VLDL were estimated in a NABL(National Accredition Board for Testing and Calibration Laboratories) laboratory of PESIMSR for all cases and controls. Blood was collected from patients after an overnight fasting (12hours) and 4-hour postprandial (after a standard meal) for lipid profile values. The standard meal consisted of a diet that provided 600 K Calories.

The Adult Treatment Panel III (ATPIII) of the National Cholesterol Education Program (NCEP) has established the goal of an LDL cholesterol level less than100mg/dl for patients with preexisting CAD or CAD risk equivalents. In this subset of patients, the NCEP has also determined that a total cholesterol level above 200 mg/dl, HDL cholesterol level less than 40mg/dl and a triglyceride level higher than 150 mg/dl are major CHD risk factors.[8] In our study lipid levels, above the range mentioned by these guidelines are considered to have dyslipidemia.

2.3. Descriptive statistics:
The data was entered into MS Excel 2007 version and analyzed using SPSS 20 software. Using percentages Categorical data was analyzed and the continuous data were analyzed using mean and standard deviation.
Chi-square test was used for inferential statistics. Outcome of continuous variables with a normal distribution was compared between the groups using student "t test" and Paired "t test".
A probability value of less than 0.05 was considered as statistically significant.

III. Results

The study groups, cases and controls were age and gender matched. A total of 100 cases (patients with type 2 diabetes mellitus with ACS) and 50 controls were included in the study. The mean age in our study was 56.59±11 years for cases and 55.96±12.02 for controls with 30% in the age group 51-60 years. Males formed 58% and females 42% of the study population.

Most of the patients had been diabetic for 6-10 years(46%) duration, and 28% of them had from 1-5 years. Only 2% of the cases were newly diagnosed. Nearly 80% of the cases had poor glycemic control with HbA1C>7%. Hypertension (140/90 mm of hg) was present in 36% of the cases. Table 1 shows the association between duration of Diabetes mellitus, presence of dyslipidemia and Coronary artery disease (CAD).

TABLE 1: Association between Hypertension, Dyslipidemia and CAD

Cases with Diabetes Mellitus	Cases with Hypertension	Dyslipidemia	Coronary artery disease
Newly diagnosed	0	2	2
1-5 years	6	24	28
6-10 years	9	36	46
10-15 years	9	9	12
>15 years	12	12	12
Total	36	83	100

In the present study, 83% of the cases had dyslipidemia. Dyslipidemia and ACS appeared to go hand in hand in cases with diabetes over a duration of 1 year to 15 years duration in our study. ACS incidence was close to 100% in combined presence of diabetes mellitus and dyslipidemia. It was noted that high HbA1C was associated with dyslipidemia, with 100% of patients having ACS when HbA1C was >10.0%

Among the cases 35% of them had fasting TC>200mg/dl and 42% had postprandial total cholesterol>200 mg/dl. Only 12% and 20% of controls had high fasting and postprandial total cholesterol levels >200mg/dl respectively as shown in Table2.

TABLE 2: Total cholesterol levels among Cases and Controls

Total cholesterol(mg/dl)	Number of cases		Number of controls	
	Fasting	Postprandial	Fasting	Postprandial
<200	65	58	44	40
201 – 240	25	22	5	6
>241	10	20	1	4
Total	100	100	50	50

In the current study as shown in Table 3, in the fasting state 30% cases and 72% controls had TG < 150 mg/dl. Postprandially only 4% of cases had lower triglycerides and still 60% of controls had TG< 150 mg/dl. Postprandial TG levels above 200mg/dl was found in 70% of the cases.

TABLE 3: Comparison of Fasting and Postprandial Triglycerides among cases and controls.

Triglycerides(mg/dl)	Number of cases		Number of controls	
	Fasting(%)	Postprandial (%)	Fasting(%)	Postprandial (%)
<150	30 (30%)	4 (4%)	36 (72%)	30 (60%)
151 – 199	28 (28%)	9 (9%)	7 (14%)	8 (16%)
200-299	38 (38%)	46 (46%)	7 (14%)	10 (20%)
300-399	4 (4%)	33 (33%)	0	2 (4%)
>400	0	8 (8%)	0	0
Total	100	100	50	50

Majority of the cases had postprandial decrease in HDL to <35mg/dl. Higher LDL levels were observed among cases when compared to controls. In our study, VLDL comparison between cases and controls showed both fasting and postprandial levels to be increased and statistically significant ($p<0.05$).

Table 4 shows the mean ± Standard deviation(SD) of lipid profile fasting and postprandial in cases and controls.

TABLE 4: Lipid profile of Cases and Controls

LIPID PROFILE (NORMALVALUES)	Groups	Fasting Mean+SD	Postprandial Mean+SD	P value
Total Cholesterol (<200 mg/dl)	Cases Controls	183.39±42.43 133.88±38.45	191.99±43.95 145.18±40.86	0.003 <0.001
Triglycerides (<150 mg/dl)	Cases Controls	186.38±59.03 127.06±46.57	288.91±78.31 149.66±58.06	<0.000 <0.000
High Density lipoprotein (40-60 mg/dl)	Cases Controls	37.22±10.01 37.88±9.12	34.75±9.64 36.84±8.97	<0.000 0.139
Low Density Lipoprotein (60-100 mg/dl)	Cases Controls	107.3±35.45 71.82±32.71	99.34±36.32 77.18±33.13	<0.005 0.074
Very Low Density Lipoprotein (25-40 mg/dl)	Cases controls	38.34±12.29 24.76±10.47	55.65±15.90 29.96±11.84	<0.000 <0.000

SD- standard deviation

IV. Discussion

Diabetes mellitus and dyslipidemia are important cardiovascular risk factors. Dyslipidemia is a commonly associated metabolic abnormality in diabetic mellitus.

The mean age in our study was similar to a study done by Sumesh raj et al[9] which showed mean age of 56.6±11.9 years in cases and a study by Babu R et al[10] showed a mean age of 57.02±12.43.Male and female ratio was 1.38:1 in our study.

The duration of diabetes was between 1-5 years in 28% of cases similar to a study by Babu et al[10] and 46% in patients with duration 5-10 years. There was no significant correlation between duration of DM and the presence of dyslipidemia in our study which is similar to the study done by SV Madhu et al[11]. HbA1C was statistically significant with a mean of 8.59±1.37 in cases, with 80% having HbA1C>7% which is similar to a study by Babu R et al[10].There was no significant correlation with dyslipidemia even though more number of patients had dyslipidemia with higher HbA1C. The prevalence of hypertension was similar to other studies.[9,10]

In the present study, mean total cholesterol both during fasting and postprandial state was higher in cases as compared to controls which was similar to studies done by Sumesh raj et al[9] and Vinod V Wali et al[12]. Fasting TGs were elevated in 70% of cases compared to 28% in controls which was statistically significant. Similar findings were shown by SV Madhu et al study[11]. Boccalondro et al[13] showed relevance of postprandial TG elevation in IHD as compared to healthy cases. Postprandial hypertriglyceridemia is linked to both symptomatic as well as asymptomatic macrovascular diseases in DM. Hence increased risk of atherosclerosis in them may be because of higher postprandial lipaemia. Some studies have revealed significant association of

postprandial lipaemia and insulin resistance.[14,15] In the present study, mean TG value was 288.91±78.31 in postprandial state, having significance statistically. Similar findings were noted by Babu et al[10] and Vinod V Wali et al[12].

In a study by Suryabhan et al[16], postprandial lipid profile significantly increased compared to fasting profile. High postprandial TGs had strong and independent association with CAD.

In our study, decrease in postprandial HDL was significant from a mean of 37.22±10.01 mg/dl during fasting to 34.75±9.64 mg/dl postprandially which was similar to other studies.[17-20]

Fasting and postprandial LDL was higher in cases than controls, which is similar to other studies.[11,12] LDL decreased slightly in postprandial state in the present study while in a study done by Madhu et al[11] showed postprandial increase in LDL. In our study, there was significant rise in postprandial VLDL (from 38.34±12.29 mg/dl to 55.65±15.90 mg/dl) in cases than controls, similar to study done by Gandiah et al[21]. Similar findings were noted in a study by SV Madhu et al[11].

The postprandial metabolic abnormality and associated oxidative stress may be linked to insulin resistance, thereby increasing cardiovascular incidence disproportionately.

The limitation of our study is small sample size and it was a single center study.

V. Conclusion

Postprandial lipid profile especially 4hours after normal meals may be an ideal evaluation tool to look for CAD risk in DM. Previously TGs have been suggested but our study also shows significant changes even in HDL and VLDL. Hence, including postprandial lipid profile in DM patients is a better predictor for risk stratification of Myocardial infarction and also to decide appropriate initiation of statin therapy.

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