

DYSLIPIDAEMIA IN TYPE 2 DIABETES MELLITUS PATIENTS

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ABSTRACT

BACKGROUND

Dyslipidaemia is one of the major risk factors for cardiovascular disease in diabetes mellitus. It has been seen in many trials and studies that good glycaemic control has prevented the cardiovascular morbidity and mortality. The rationale of this study was to detect the lipid abnormality in diabetic patients.

MATERIALS AND METHODS

This cross-sectional observational study was conducted to estimate prevalence of dyslipidaemia among diabetic patients of KIMS, Hubli. A total of 100 patients were included out of which 62 were males and 38 females.

RESULTS

There was a positive correlation between PPBS and dyslipidaemia with p value=0.01. However, when correlation between dyslipidaemia and duration of diabetes was compared, it was not significant with p value of 0.64. CVS status, elevated urea and elevated creatinine were not significant when compared to dyslipidaemia. Parameter correlated between capillary and venous estimate showed that the total cholesterol, triglyceride, LDL, VLDL and HDL were highly significant with p value <0.001.

CONCLUSION

Our study showed that there is increased incidence of dyslipidaemia in diabetes patients. Hence, constant monitoring of lipid profile is required in diabetes patients to reduce the risk of CVS diseases.

KEYWORDS

Dyslipidaemia, Diabetes, LDL VLDL, HDL.

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BACKGROUND

Diabetes mellitus is one of the major health burden and an important public health problem.¹ It is the leading cause of cardiovascular problems, its early detection and good glycaemic control can reduce the complications.² Although, some studies have found a weak association, other studies confer at least a twofold excess risk independently from other conventional risk factors.^{3,4}

Dyslipidaemia and atherosclerosis are the main risk factors that accelerate onset of chronic complications such as cardiovascular disease in diabetes mellitus. Long-standing hyperglycaemia is associated with increased end-organ damage because of atherosclerosis.^{5,6} The abnormalities associated with diabetes namely insulin resistance hyperinsulinaemia, hyperglycaemia is termed as metabolic syndrome, which increases the cardiovascular

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and cerebrovascular mortality and morbidity.⁷

Elements of the metabolic syndrome are strong risk factors for microvascular and macrovascular complications.^{8,9} Early intervention by reducing the lipid levels in diabetic individuals has been shown to reduce cardiovascular and cerebrovascular morbidity and mortality.¹⁰

Dyslipidemia in type 2 diabetes mellitus is unique in the form of higher concentration of LDL low density lipoprotein cholesterol (VLDL-C) and a low High density lipoprotein (HDL), and high triglyceride level. The term diabetic dyslipidemia includes increased triglycerides, reduced HDLC and increased, dense LDL particles.

The lipid abnormalities observed in diabetes mellitus are due to increased free fatty acid flux secondary to insulin resistance aggravated by increased inflammatory adipokines.¹¹ In some of the studies, it was observed that the most common pattern of dyslipidaemia among type 2 diabetic patients is an elevated triglyceride level and a decreased high-density lipoprotein cholesterol level.¹²

Good glycaemic control has favourable effects on lipoprotein levels in diabetic patients when compared with uncontrolled diabetic individuals.^{13,14}

Identifying the prevalence of dyslipidaemia and establishing its relationship with glycaemic control may

help us in making necessary implementations in order to reduce the cardiovascular complications associated with diabetic dyslipidaemia. Therefore, in the current study, we aimed to evaluate the prevalence of dyslipidaemia and its association with glycaemic control among the type 2 diabetic Indian population.

MATERIALS AND METHODS

This cross-sectional observational study was conducted to estimate the prevalence of dyslipidaemia among diabetic patients of KIMS, Hubli. A total of 100 patients were included out of which 62 were males and 38 females. Patients receiving drug therapy for diabetes and not on treatment of dyslipidaemia were included in the study. Study was approved from ethical committee. Study was explained to the participants in their own language and written informed consent was obtained from all prior to participation in study.

Two venous blood samples were collected from the patients one after an overnight fasting and the other 2-hours postprandial. Serum sample was analysed for parameters like fasting blood glucose, postprandial blood glucose and serum lipid was analysed with aid of lipidometer (capillary) and also by standard method (venous), which include total cholesterol, triglycerides, High-Density Lipoprotein (HDL), Low-Density Lipoprotein (LDL) and Very Low-Density Lipoprotein (VLDL). Lipidometer is a handheld device that can be used to conduct various types of lipid tests and it's portable and gives quick results.

Statistical Analysis

Association between dyslipidaemia and other features of study participants were analysed by p value based on chi-square test. Correlation between capillary lipid profile and venous lipid profile were assessed by value based on Pearson's correlation.

RESULTS

Table-1 shows the sociodemographic details, risk factors and clinical features of study population (n=100). Our study population had total 62 males and 38 females (Figure

1). Risk factors such as smoking was prevalent in 33 and hypertension in 55 individuals of the study population (Table 2, Figure 3). When the correlation between dyslipidaemia and duration of diabetes was compared, it was not significant with p value of 0.64 (Table 2). Similarly, CVS status, elevated urea, elevated creatinine were not significant when compared to dyslipidaemia. Only PPBS was significantly correlated with dyslipidaemia indicating that those with uncontrolled diabetes had higher risk for dyslipidaemia and CVS diseases. Table 3 shows correlation between capillary lipid profile and venous lipid profile. Parameter correlated between capillary and venous estimate showed that the total cholesterol, triglyceride, LDL, VLDL and HDL were highly significant with p value of <0.001 (Figure4).

Sl. No.	Characteristics	n (%)
1.	Gender	
	Male	62 (62)
	Female	38 (38)
2.	Duration of DM	
	≤5 years	55
	>5 years	45
3.	Risk Factors	
	Smokers	33
	Hypertension	55
	BMI ≥25 kg/m ²	30
4.	Biochemical Parameters	
	FBS elevated	62
	PPBS elevated	62
	HbA1c (<6.5)	91
	Elevated urea	53
	Elevated creatinine	22
5.	Clinical Picture	
	Diabetic foot	6
	Fundus abnormal	54
	ECG abnormal	79
6.	Dyslipidaemia	53

Table 1. Sociodemographic Details, Risk Factors and Clinical Features of Study Population (N=100)

Sl. No.	Study Parameters	Dyslipidaemia		X² value, df@	Odds Ratio (95% CI)	p value #
		Present N (%)	Absent N (%)			
1.	Duration of DM					
	>5 years	28 (52.8)	27 (57.4)	0.215, 1	0.8 (0.4-1.8)	0.64
	≤5 years	25 (47.2)	20 (42.6)			
	Total	53 (100)	47 (100)			
2.	CVS Changes					
	Yes	43 (81.1)	36 (76.6)	0.309, 1	1.3 (0.5-3.4)	0.57
	No	10 (18.9)	11 (23.4)			
	Total					
3.	Elevated Urea					
	Yes	30 (56.6)	23 (48.9)	0.588, 1	1.3 (0.6-2.9)	0.44
	No	23 (43.4)	24 (51.1)			
	Total					
4.	Elevated Creatinine					
	Yes	14 (26.4)	8 (17)	1.28, 1	1.7 (0.6-4.6)	0.25
	No	39 (73.6)	39 (83)			
	Total					

5.	Obese status					
	Yes	16 (30.2)	14 (29.8)	0.002, 1	1 (0.4-2.4)	0.96
	No	37 (69.8)	33 (70.2)			
	Total					
6.	Elevated FBS					
	Yes	37 (69.8)	25 (53.2)	2.92, 1	2 (0.9-4.6)	0.87
	No	16 (30.2)	22 (46.8)			
	Total					
7.	Elevated PPBS					
	Yes	39 (73.6)	23 (48.9)	6.42, 1	2.9 (1.3-6.7)	0.01*
	No	14 (26.4)	24 (51.1)			
	Total					
8.	Elevated HbA1c					
	Yes	48 (90.6)	43 (91.5)	0.02, 1	0.9 (0.2-3.5)	0.87
	No	5 (9.4)	4 (8.5)			
	Total					
Table 2. Association between Dyslipidaemia and Other Features of Study Participants						

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Note- @ df - degrees of freedom, #p value based on chi-square test, CI - confidence interval, * statistically significant ($p < 0.05$).

Sl. No.	Parameter Correlated Between Capillary and Venous Estimate	Correlation Co-Efficient (r)	p value#
1.	Total cholesterol	0.93	<0.001*
2.	Triglyceride	0.87	<0.001*
3.	LDL	0.91	<0.001*
4.	VLDL	0.83	<0.001*
5.	HDL	0.76	<0.001*

Table 3. Correlation between Capillary Lipid Profile and Venous Lipid Profile

p value based on Pearson's correlation, * Statistically significant.

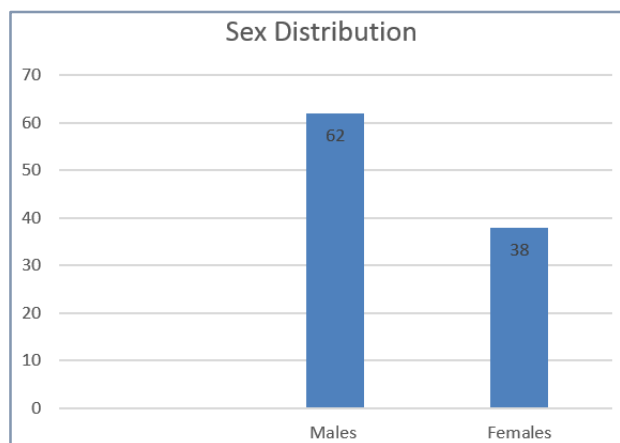


Figure 1. Distribution of Gender

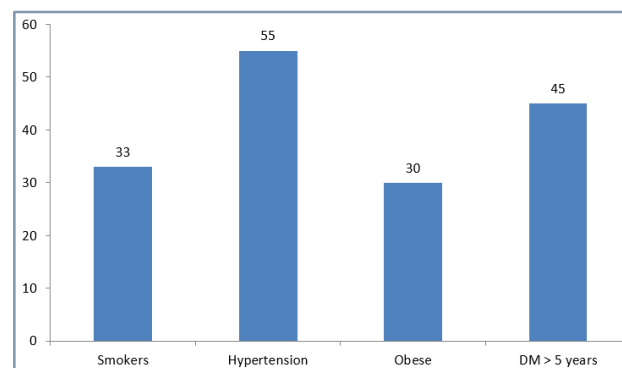


Figure 3. Distribution of Risk Factors Among Study Participants (n=100)

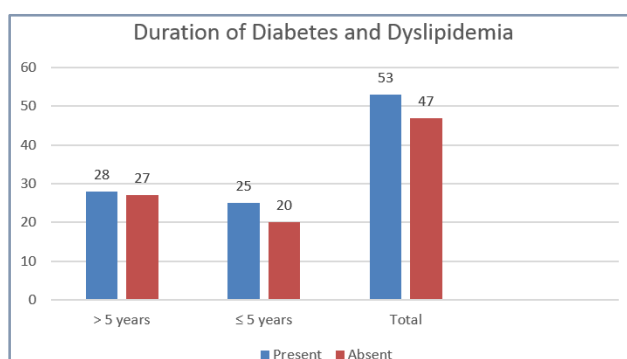


Figure 2. Prevalence of Dyslipidaemia Based on Duration of Diabetes

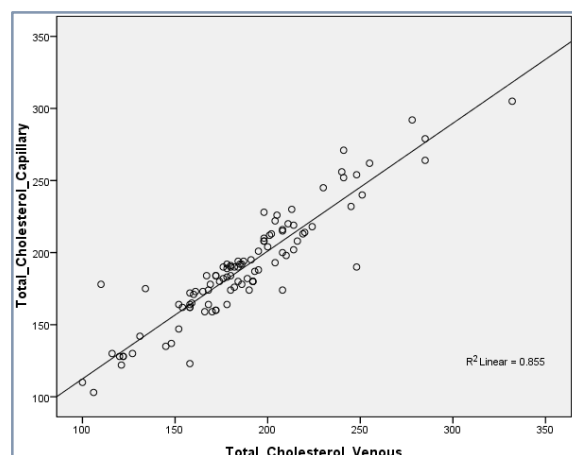


Figure 4. Correlation between Capillary and Venous Total Cholesterol ($r=0.93$, $p < 0.001$)

DISCUSSION

This study aimed to evaluate the prevalence of dyslipidaemia and its association with glycaemic control among the type 2 diabetes patients.

The relation between diabetes mellitus and serum lipid profile had been much discussed during the past decades. Both lipid profile and diabetes have been shown to be the important predictors for metabolic disturbances including dyslipidaemia, hypertension, cardiovascular diseases, hyperinsulinaemia, etc. Dyslipidaemia as a metabolic abnormality is frequently associated with diabetes mellitus. Dyslipidaemia prevalence depends on glycaemic control and other risk factors such as obesity, age, dietary habits.¹⁵

Recent studies also showed that poor glycaemic control may lead to reduced renal function, endothelial dysfunction, nephropathy and dyslipidaemia.¹⁶ Therefore, diabetic patients should be advised to maintain good glycaemic control in order to prevent the complications associated with diabetic dyslipidaemia.

However, the glycaemic control by itself may not be sufficient to control diabetic dyslipidaemia. Along with glycaemic control, diabetic subjects may also need direct lipid management.¹⁷

While features such as the presence of nephropathy or retinopathy identify higher risk groups, the use of other biomarkers of risk and likely need for enhanced treatment are often not appreciated. The presence of macroalbuminuria for example is a risk factor for CHD even at low levels and its severity is also predictive of future events.¹⁸ Most of the studies suggest strict control of dyslipidaemia in patients with diabetes to prevent cardiovascular complications.^{19,20} Importantly, lipid targets are easier to achieve than blood pressure or glycaemia targets. Some studies recommended cholesterol levels below 100 mg/dL in patients with CHD.^{21,22}

A recent position statement from the ADA recommends a screening lipid profile at the time of diagnosis at age 40 years and periodically thereafter.²³

Our study found significant results when dyslipidaemia was compared with PPBS indicating that those with uncontrolled diabetes had higher lipid level and prone for dyslipidaemia and greater risk for cardiovascular diseases (Table 2).

When correlation between capillary lipid profile and venous lipid profile data revealed that the total cholesterol, triglyceride, LDL, VLDL and HDL were comparable and highly significant with p value of <0.001 (Table3).

Lipid estimation was done with aid of lipidometer (capillary) and also by standard venous method. The device is similar to a glucometer. Utilising a lancet, a small amount of blood, which is collected in a capillary tube and placed on a handheld monitor that records lipid values. Our study indicated that this method is safe, easy and gives same results as routine lipid assessment and can be used for assessing lipid profile with sensitivity and specificity.

Capillary lipid profile testing is a convenient method of testing dyslipidaemia in type 2 diabetes patients. Studies also suggest cholesterol measured from capillary plasma

(obtained via a fingerstick) tends to run 2 to 4% higher than venous plasma cholesterol.²⁴

Several studies showed that insulin affects the liver apolipoprotein production and regulates the enzymatic activity of lipoprotein lipase and cholesterol ester transport protein, which causes dyslipidaemia in diabetes mellitus. Moreover, insulin deficiency reduces the activity of hepatic lipase and several steps in the production of biologically active lipoprotein.²⁵

In SHIELD (study to help improve early evaluation and management of risk factors leading to diabetes), a community-based population survey conducted in the United States, the author performed a multivariate analysis of 23,001 diabetic individuals. They concluded that dyslipidaemia was independently associated with a higher likelihood of type 2 diabetes diagnosis (odds ratio, 3.95; P <0.0001).²⁶

In uncontrolled diabetic patients due to insulin resistance, the levels of very low-density lipoproteins in the circulation is diminished. The level of total cholesterol is within range in patients with good glycaemic control and its level raised as glycaemic control worsens.²⁷ Therefore, improving glycaemic control can substantially reduce the risk of cardiovascular events in diabetic patients.

Dyslipidaemia management in people with diabetes mellitus just like in any other individual starts with a thorough evaluation that aims to identify secondary causes that might contribute to the abnormal lipid profile.²⁸ Lifestyle changes including increased physical activity and dietary modifications are the cornerstones in management of diabetes.^{29,30}

Several authors have suggested use of statins in diabetic dyslipidaemic individuals for increasing the HDL and decreasing LDL levels. During statin therapy, it is advised to monitor regularly side effects of the drugs and liver functions and lipid-lowering medications should be discontinued or adjusted if the CK or the AST exceed three times the upper limit of the reference range value.

In the HATS study, it was reported that the combination of simvastatin and niacin was fairly well-tolerated by patients with diabetes.³¹

CONCLUSION

Our study found that there is increased incidence of dyslipidaemia in diabetes patients. Hence, constant monitoring of blood lipids is required in diabetic patients to reduce the risk of CVS diseases. Our study compared lipid levels by estimation from both venous plasma (standard) and also by capillary method (lipidometer), which showed that both methods of detection had comparable results and lipidometer helped simplify the detection of dyslipidaemia in type 2 diabetes mellitus and required less amount of blood was portable and results could be obtained instantaneously. Thus, early detection of dyslipidaemia helps in reducing elevated lipid levels, which will allow patients with diabetes to lead longer healthier lives.

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