



Pattern of Dyslipidemia Amongst Adult Diabetic Subjects : Cross Sectional Study From Tertiary Care Hospital In Lucknow.

Dr Meeta Pathak

MD (Pathology) Associate Professor, Department of Pathology, Career Institute of Medical Sciences and Hospital, Lucknow.

**Dr Mandira
Sharma**

MD (Pathology) Associate Professor, Department of Pathology, Career Institute of Medical Sciences and Hospital, Lucknow.

ABSTRACT

Background: Diabetes mellitus (DM) is a common secondary cause of hyperlipidaemia, particularly, if glycaemic control is poor, which in-turn is an important risk factor for atherosclerosis and coronary heart disease. The spectrum of dyslipidemia in diabetes mellitus can include all the various types of dyslipidemia identified in the general population

Objectives: To study the prevalence and pattern of dyslipidemia in type 2 diabetes. Material and Methods: It was a cross sectional study, done on type 2 diabetes patients attending medicine outpatient department of Career Institute of Medical Sciences and Hospital, Lucknow between July 2015 to December 2015. All the patients were interviewed with pre-designed Performa. Fasting lipid profile and Glycosylated hemoglobin (HbA1c) of patients were measured. Patients suffering from other causes of secondary dyslipidemia were excluded. Patients having one or more parameters outside the targets recommended by American Diabetes Association (ADA) were considered to have dyslipidemia. Results: Out of 200 diabetic patients enrolled in the study, 120 were male and 80 were female patients. The mean age of study population was 54.8 ± 10.12 (male: 54.7 ± 10.65 and female: 54.9 ± 9.42). Out of 175 DM dyslipidemic patients, 85 patients were having high serum cholesterol level, while lesser no. of patients, 65 had low serum HDL levels. About 125 had high serum triglyceride level, while almost similar number of patients, 105 also had serum LDL levels above normal range. About 100 patients also showed high serum VLDL levels. Conclusion: Majority of type 2 diabetic patients ($n=175$) were dyslipidemic. The most common pattern of dyslipidemia among males was combined dyslipidemia with high triglycerides (TG) and low High density lipoprotein (HDL) and in females it was high Low density lipoprotein (LDL) and low HDL. The most prevalent lipid abnormality in our study was high TG. Significant relation was found between HbA1c and serum lipid parameters.

KEYWORDS : Diabetes mellitus, Dyslipidemia, Lipid profile.

Introduction:

Diabetes mellitus is defined as a metabolic syndrome or disorder of multiple aetiologies characterised by chronic hyperglycaemia associated with impaired carbohydrate, fat, and protein metabolism. These abnormalities are the consequences of either inadequate insulin secretion or impaired insulin action or both.¹ The main types of diabetes are type-1 and type-2 diabetes and pancreatic B-cells deficiency or function deficiency leads to both type- 1 and type-2 diabetes. Restoration or replacement of B cells function is therefore the logical long-term solution to therapy of diabetes. Type-1 diabetes results from an irreversible loss of pancreatic B-cells and type-2 diabetes is primarily caused by impaired insulin action, but the risk of developing of type-2 diabetes rises exponentially with increasing obesity and insulin resistance and therefore temporary restriction of glucose control in patients with type-2 diabetes is often achieved through weight loss and increased physical activity.² The incidence of diabetes is growing at dramatic rates around the world³ and the prevalence and incidence of type-2 diabetes varies among ethnic groups, such as higher rates in Asians than in western population even under the condition of similar body mass index.⁴ If untreated diabetes can lead to serious problems like macrovascular and microvascular complications. The microvascular complications include retinopathy, nephropathy, and neuropathy (both distal polyneuropathy and autonomic neuropathy)⁵, while the macrovascular complications of diabetes include angina, myocardial infarction (MI), transient ischemic attack (TIA), and stroke.⁶ The pattern of dyslipidemia frequently observed in people with diabetes includes raised triglycerides, decreased HDL-C and slightly raised or normal plasma concentrations of LDL-C, with LDL-C, not being significantly different from that in non-diabetic individuals.^{7,8} As a result some have argued that to reduce the risk of future cardiovascular events in people with diabetes it may be more important to modify HDL-C and triglycerides level than to lower total cholesterol or LDL-C levels.⁹ In another study the hallmark of dyslipidemia in patients with type-2 diabetes and increased risk of cardiovascular disease and accelerated atherosclerosis are hypertriglyceridemia, decreased HDL-C and increased LDL-C levels. So lipid management is so critical in the diabetic patients, that physician of diabetic patients should not ask themselves, why they should institute lipid lowering therapy but why not institute lipid lowering therapy. Normal lipid levels for diabetics patients are LDL-C less than 100 mg/dl, HDL-C greater than 45 mg/

dl in males and 55 mg /dl in females, triglycerides less than 150 mg/dl, serum cholesterol less than 200 mg/dl¹⁰, and non-HDL-C less than 130 mg/dl.¹⁰ Dyslipidemia increases the risk of cardiovascular disease, heart attack and stroke and according to US Centre for Disease Control and Prevention it affects 70% to 97% of people with diabetes. If one has diabetes, lowering ones high triglycerides or cholesterol level is just as important as controlling blood sugar and blood pressure that is because people with diabetes are at high risk for dyslipidemia.¹¹ Accelerated atherosclerotic vascular disease demonstrated by the patients with diabetes is a result of the metabolic cascade, including insulin resistance, hypertriglyceridemia, hypertension, endothelial dysfunction, and subsequent increase in triglycerides, LDL, and very low-density lipoprotein (VLDL) synthesis and decrease in HDL.¹² However there is overwhelming evidence, that an elevated LDL-C concentration in plasma is atherogenic, whereas a high HDL-C level is cardioprotective.¹³ Atherosclerosis is an insidious and dangerous disease and the hallmark feature of atherosclerosis is the building of cholesterol in to lesions called plaques that can reduce the flow of blood.

Since controversies exist in different studies on the issue with ethnic groups, the present study was designed to evaluate the pattern of dyslipidemia in adult diabetics in district Lucknow.

Aims and objectives:

The present study aims to bridge the gap by studying prevalence, pattern and severity of dyslipidemia in diabetic patients especially in Lucknow District.

Material and methods:

A prospective cross-sectional study was planned to analyze the pattern of dyslipidemia in diabetic patients attending the Diabetes Clinic and Outpatient Department of Career Institute of Medical Institute Sciences and Hospital over a period of six months (July 2015 to December 2015).

The study population included already diagnosed, on treatment diabetic patients and newly diagnosed diabetes mellitus (DM) patients. The patients who already had history of CAD or cerebrovascular accident (CVA) or were diagnosed as having CAD or CVA on enrolment and patients already taking lipid-lowering drugs were excluded from

the study. Diabetic patients having other chronic systemic or metabolic disorder were not included in the study.

Detailed history and clinical examination of all the enrolled patients was done. Anthropometric measurements (weight, height, waist circumference (WC) and hip circumference) were taken using standard methods. Fasting blood sample was collected for serum lipid profile investigation after 10 hours overnight fast. serum cholesterol, serum triglyceride, serum HDL, serum LDL, serum VLDL levels were measured using calibrated ERBACHEM 5 Plus, semi-automated machine. Cut-off normal values for individual lipid levels were taken as per the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III).¹⁴ The term mixed dyslipidemia is used when two or more individual lipid levels were abnormal. The patients were categorized in different subgroups such as male/ female, urban/ rural, controlled/uncontrolled, obese/ nonobese, hypertensive/nonhypertensive for subgroup analysis of diabetic dyslipidemia. All diabetic patients were categorized as urban if living in place with >1 lac population, obese or nonobese using body mass index (BMI) criteria of ≥ 23 proposed for South- Asian population (IDF-modified ATP III criteria)¹⁴ and as hypertensive if their blood pressure is $\geq 130/85$. ADA criteria for treatment of diabetes (HbA1C <7% or fasting/preprandial plasma glucose <130 mg/dl and postprandial plasma glucose <180 mg/dl for two consecutive visits) were used to divide the patients in controlled and uncontrolled groups.¹⁵ All the observations were tabulated and results were expressed as percentage and mean SD (standard deviation).

Results:

Out of 200 diabetic patients enrolled in the study, 120 were male and 80 were female patients. The mean age of study population was 54.8 ± 10.12 (male: 54.7 ± 10.65 and female: 54.9 ± 9.42). The mean duration from the first diagnosis of diabetes for the study patients was 5.0 ± 4.6 years. Only 15 % of patients had DM since >10 years and 20% were diagnosed as diabetics in last two years only. Around, 37.5% were diabetics since 2-5 years and 35% were diabetics since 5-10 years. Further, 65% (n = 130) of patients were from urban area and 35% (n = 70) were from the rural area. The mean BMI of study population was 25.6 ± 5.81 (male: 24.5 ± 4.71 and female: 27.2 ± 6.81). Also, 70% (n = 140) of all diabetic patients participated in study were found to be obese by modified ATP III criteria of BMI ≥ 23 for South-Asian population. Only 25% of study patients were well-controlled. Only 75% (n = 150) were hypertensive and 61% (n = 122) were smokers, all were males (Table 1).

Individual serum lipid results were as follows. Mean serum cholesterol level was 190.9 ± 45.50 , mean serum triglyceride was 175.67 ± 69.44 , mean serum HDL was 42.5 ± 17.8 , mean serum LDL was 102.9 ± 35.06 and mean serum VLDL level was 35.5 ± 15.10 (Table 2). Out of 200 DM patients, 85 patients were having high serum cholesterol level, while lesser no. of patients, 65 had low serum HDL levels. About 125 had high serum triglyceride level, while almost similar number of patients, 105 also had serum LDL levels above normal range. About 100 patients also showed high serum VLDL levels.

Characteristics	No. of patients (n=200/%)	Dyslipidemia (n=175/%)	p-value
Age in years			
<45	62 (31%)	50 (80.64%)	<0.05
45-60	100 (50%)	90 (90%)	
>60	38 (19%)	35 (92.10%)	
Sex			
Male	120 (60%)	105 (87.5%)	<0.05
Female	80 (40%)	70 (87.5%)	
Locality			
Urban	130 (65%)	120 (92.30%)	<0.05
Rural	70 (35%)	55 (78.57%)	
Control of DM			
Controlled	50 (25%)	40 (80%)	<0.001
Uncontrolled	150 (75%)	135 (90%)	
Obesity			
Obese (BMI ≥ 23)	140 (70%)	130 (92.8%)	<0.001
Non obese (BMI<23)	60 (30%)	45 (75%)	

Hypertension			
Hypertensive	150 (75%)	135 (90%)	<0.05
Non hypertensive	50 (25%)	40 (80%)	
Smoking			
Smoker	122 (61%)	110 (90.16%)	<0.05
Non smoker	78 (39%)	65 (83.34%)	
Duration of DM			
<2 years	40 (20%)	27 (67.5%)	<0.05
2-5 years	75 (37.5%)	70 (93.34%)	
5-10 years	70 (35%)	65 (92.85%)	
>10 years	15 (7.5%)	13 (86.67%)	

Table 1: Patients characteristics and prevalence of dyslipidemia

Serum lipid	Mean \pm SD	Abnormal value	Deranged Lipid levels (n)
Cholesterol	190.9 ± 45.50	>200mg/dl	85
Triglyceride	175.67 ± 69.4	>150mg/dl	125
HDL	42.5 ± 17.8	<40mg/dl	65
VLDL	102.9 ± 35.6	>100mg/dl	100
LDL	35.5 ± 15.10	>32mg/dl	105

Table 2: Serum lipid levels of diabetic patients

Discussion:

Patients with DM have a 2- to 4-fold increased risk of cardiovascular, peripheral vascular and cerebrovascular disease, which are the leading causes of morbidity and mortality in this population. Many Western epidemiological studies have shown an association between diabetic dyslipidemia, which is characterized by hypertriglyceridemia; low levels of HDL cholesterol; postprandial lipemia and small, dense LDL cholesterol particles and the occurrence of cardiovascular disease.¹⁶⁻¹⁸

The analysis of data from our study provides an opportunity to examine dyslipidemia a major CAD risk factor, in population-based sample of well-characterized type 2 diabetic individuals. The present study shows very high prevalence of dyslipidemia (87.5%) in ethnic Luc-know diabetic population, which recommends the use of terminology - 'diabetes lipidus' for them.

The analysis of individual lipid levels shows that the mean levels of all lipids were in abnormal range. There has been a recent focus on the characteristic dyslipidemia of type 2 diabetes, which includes elevated triglycerides, low HDL cholesterol and a preponderance of small dense LDL particles. These characteristics were highly prevalent in diabetic

Limitations of study:

As it is a single centre study with a relatively small study population, results cannot be generalised to the entire population.

Conclusion:

Our study highlighted the very high prevalence of dyslipidemia associated with diabetes as one of the highest ranked risk factor for CAD in Indians. One or another lipid level is found to be abnormal in most of the diabetic patients, suggesting that whole lipid profile must be done and evaluated at regular intervals in these patients. The present study also highlights the importance of strict control of diabetes in prevention and treatment of dyslipidemia associated with diabetes as dyslipidemia is more frequent in uncontrolled diabetic patients than controlled ones. It is of paramount importance to aim for the stricter goals and specific thresholds for dyslipidemia in Indian diabetic patients to start early and prompt preventive measures to reverse the tide of the rising CAD epidemic in Asian Indians.

Acknowledgement:

We extend our sincere thanks to Dr.Abbishek Arun (MD) for his assistance in medical writing. We are also thankful to junior doctors and staff of Pathology and Medicine department Carrier Institute of Medical Sciences. Special thanks to everyone who participated in the study.

References:

- Riccardi G, Aggett P, Brighenti F, Delzenne N, Frayn K, Nieuwenhuizen A, et al. Body

- weight regulation, insulin sensitivity and diabetic risk. *Eur J Nutr* 2004;43(suppl 2):ii7-ii46.
2. Meier JJ. Beta cell mass in diabetes. *Diabetologia* 2008;51:703-13.
 3. Stookey DJ, Pieper FC, Cohen JH. Hypertonic hyperglycemia progresses to diabetes faster than normotonic hyperglycemia. *Eur J Epidemiol* 2004;19:935-44.
 4. Kasai T, Miyauchi K, Kajimoto K, Kubota N, Kurata T, Daida H. Influence of diabetes on >10 years outcomes after percutaneous coronary intervention. *Heart Vessels* 2008;23:149-54.
 5. Frier B, Yang P, Taylor WA. Diabetes, aging and physical activity. *Eur Rev Aging Phys Act* 2006;3:63-73.
 6. Bottle A, Millet C, Khunti K, Majeed A. Trends in cardiovascular admissions and procedure for people with and without diabetes in England, 1996-2005. *Diabetologia* 2009;52:74-80.
 7. Schulte BM, Shai I, Manson EJ, Li T, Rifai N, Jiang R, *et al*. Joint role of Non-HDL cholesterol and glycated hemoglobin in predicting future coronary heart disease events among women with type-2 diabetes. *Diabetologia* 2004;47:2129-36.
 8. Kengne PA, Patel A, Barzi F, Jamrozik K, Lam HT, Ueshima T, *et al*. Cholesterol, diabetes and major cardiovascular diseases in the Asia-Pacific region. *Diabetologia* 2007;50:2289-97.
 9. Codario RA. Diabetic dyslipidemia, In: Type-2 diabetes, prediabetes and the metabolic syndrome: The primary guide to diagnosis management. Totowa NJ: Humana Press Inc; 2005.p. 155-70.
 10. Bittner V, Hardison R, Kelsey FS, Weiner HB, Jacobs KA, Sopko G. Non-high-density lipoprotein cholesterol levels predict five-years outcome in the bypass angioplasty revascularization investigation. *Circulation* 2002;106:2537-42.
 11. Ansong R. Lowering high triglycerides, cholesterol is very important in diabetes. 2008. Available at: <http://cholesterol.about.com/lw/Health-Medicine/Conditionsand-diseases/Cholesterol-Triglycerides-and-Diabetes-1PT.htm>
 12. Lee J, Reding M. Effects of thiazolidinediones on stroke recovery; a case-matched controlled study. *Neurochem Res* 2007;32:635-8.
 13. Lemieux I, Lamarche B, Couillard C, Pascot A, Cantia B, Bergeron J, *et al*. Total cholesterol/HDL cholesterol ratio vs LDL cholesterol/HDL cholesterol ratio as indices of ischemic heart disease risk in men (The Quebec cardiovascular study). *Arch Intern Med* 2001;161:2685-92.
 14. Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Executive Summary of The Third Report of The National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, And Treatment of High Blood Cholesterol In Adults (Adult Treatment Panel III). *JAMA* 2001;285(19):2486-97.
 15. American Diabetes Association. Standards of medical care in diabetes - 2007. *Diabetes Care* 2007;30 Suppl 1: S4-S41.
 16. Low-density lipoprotein size, pravastatin treatment, and coronary events. *JAMA* 2001;286(12):1468-74.
 17. Sacks FM, Campos H. Clinical review 163: Cardiovascular endocrinology: Low-density lipoprotein size and cardiovascular disease: a reappraisal. *J Clin Endocrinol Metab* 2003;88(10):4525-32.
 18. Jungner I, Sniderman AD, Furberg C, Aastveit AH, Holme I, Walldius G. Does low-density lipoprotein size add to atherogenic particle number in predicting the risk of fatal myocardial infarction? *Am J Cardiol* 2006;97(7):943-6.