

ASSESSMENT OF SERUM LIPIDS IN NIGERIANS WITH TYPE 2 DIABETES MELLITUS COMPLICATIONS

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ABSTRACT

Objective: To assess the serum lipids and lipoprotein cholesterol in patients with complicated type 2 Diabetes Mellitus (DM): Hypertensive diabetics and diabetic nephropathy.

Methodology: This is a cross-sectional study. A total of 52 type 2 DM patients and 20 healthy controls were studied. The patients' population consisted of 23 normotensive diabetics, 16 hypertensive diabetics and 13 patients with diabetic nephropathy. The serum total cholesterol, HDL-cholesterol and triglycerides were assayed in patients and controls, using standardized assay methods.

Results: The mean serum total cholesterol was higher in patients than controls. The normotensive diabetic patients had the lowest total cholesterol among the patients' groups 4.01 ± 0.82 mmol/L compared to the hypertensive diabetics 6.01 ± 0.93 mmol/L and the diabetic nephropathy patients 6.90 ± 1.20 mmol/L, ($P < 0.0001$). The prevalence of dyslipidaemia in the patients was between 25%-69%, lowest in the normotensive diabetics and highest in the diabetic nephropathy patients.

Conclusion: We hope that these findings will draw specific attention to the management of dyslipidaemia in patients with complicated type 2 DM especially diabetic nephropathy and hypertensive diabetics.

KEY WORDS: Dyslipidaemia, Type 2 DM Complications, Nigerians.

Pak J Med Sci October - December 2007 (Part-I) Vol. 23 No. 5 708-712

INTRODUCTION

Dyslipidaemia is identified as a risk factor in the development of type 2 DM complications and it contributes significantly to the development of macrovascular complications. Patients

with type 2 Diabetes mellitus (DM) often present with adverse lipoproteins disorders.¹ The patterns of dyslipidaemia in non-African type 2 Diabetes mellitus populations have been evaluated and the prognostic significance of lipoprotein fractions for the future risk of macrovascular complications defined.¹ Jarikre et al,² examined total cholesterol: high density lipoprotein cholesterol (HDL) ratios in Nigerians and defined a new emerging pattern of transitional dyslipidaemia in Nigerians. However, their study was among non-diabetic Nigeria population. The reported prevalence of diabetic dyslipidaemia varies from 25%-60%.³ In this study, we examined the serum lipid abnormalities in patients with complicated type 2 DM, with the aim of elucidating the type of lipoprotein disorders associated with diabetic nephropathy and diabetic hypertension in Nigerian diabetics. It is hoped that the outcome of this study will draw specific atten-

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- * Received for Publication: November 22, 2006
- * Revision Received: December 9, 2006
- * Second Revision: August 24, 2007
- * Final Revision Accepted: August 30, 2007

tion to the management of dyslipidaemia in patients with complicated type 2 DM especially patients with diabetic nephropathy and diabetic hypertensive.

PATIENTS AND METHODS

The study populations were diabetic patients attending the Medical Out Patient clinic of the University of Benin Teaching Hospital, Benin – City, in Southern Nigeria. A total of 52 type 2 DM patients and 20 healthy controls were studied. The patients were randomly selected and were aged between 38-80 years. Diabetes mellitus was diagnosed according to WHO criteria.⁴ and classified as type 2 also using WHO criteria.⁴ Hypertension was diagnosed and defined as blood pressure ³ 140/90mmHg.⁵ The patients were classified into three groups using serum creatinine and blood pressure levels. Subjects with serum creatinine < 124mmol/L (< 1.4mg/dl) and > 124mmol/L (> 1.4mg/dl) were assumed to have normal and impaired renal function respectively. The subjects were grouped as A = normotensive non-diabetics (n=20), B = normotensive diabetics (n=23), C = Hypertensive diabetics (n=16) and D = diabetic nephropathy (n=13).

All subjects gave informed consent after due explanation by any one of the researchers. Ethical clearance was sought and obtained for the study.

LABORATORY ASSAY METHODS

The subjects were fasted overnight (12-14 hrs) and 10mls of venous blood was obtained from the ante-cubital veins after routine aseptic procedure. The lipids were assayed using

already standardized and well-established methodologies.⁶⁻⁹ All assays were performed using kits manufactured by Human Diagnostic Laboratory (Germany). Total cholesterol assay was done using the modified Liebermann-Burchard's method of Abell et al,⁶ HDL-cholesterol by precipitation method.⁷ Triglyceride was assayed using enzymatic colorimetric method after hydrolysis of the triglycerides.⁸ LDL cholesterol was calculated by indirect method, using Friedewald et al equation⁹; summarized as follows:

$$[\text{LDL-Cholesterol}] = [\text{Total Cholesterol}] - [\text{HDL-Cholesterol}] - \frac{\text{Triglyceride}}{2.2}$$

(All concentrations are given in millimoles per liter).

Statistical analysis was performed using Instat graph pad soft ware version 2.05a. Means and standard deviations were determined for quantitative data, and frequency determined for categorical variables. Student-t test was used to test for significant association. Analysis of variance was used to compare multiple means, while Chi-squared test was used to analyze group differences for categorical variable. P – Value ≤ 0.05 was considered statistically significant.

RESULTS

A total of 52 type 2 diabetic patients and 20 healthy controls were studied. The mean age of the patients was not significantly different from that of the controls, 52.46 \pm 10 years in the controls, 53.9 \pm 11.2 in ND, 52.2 \pm 12.1 in HD, 55.0 \pm 9.2 years in DN patients, P = 0.87

Table-I: Mean (SD) Serum Concentrations of Lipid and Lipoproteins in patients and controls.

Lipid/Lipoprotein	A	B	C	D	P-value
	Controls (n=20)	ND(n=23)	HD(n=16)	DN(n=13)	
Total cholesterol (mmol/L)	4.01 \pm 0.82	5.68 \pm 1.01	6.01 \pm 0.93	6.9 \pm 1.20	0.0001
HDL-cholesterol (mmol/L)	1.19 \pm 0.21	0.86 \pm 0.17	0.85 \pm 0.18	0.75 \pm 0.13	0.0001
TG (mmol/L)	1.42 \pm 0.4	2.17 \pm 0.43	2.29 \pm 0.36	2.38 \pm 0.39	0.0001
LDL-cholesterol (mmol/L)	2.07 \pm 1.00	3.83 \pm 0.89	4.11 \pm 0.89	5.11 \pm 1.2	0.0001

Diabetic nephropathy patients have more severe dyslipidaemia than normotensive or hypertensive diabetic patients.

A. Controls

B. ND = Normotensive diabetics

C. HD = Hypertensive diabetics

D. DN = Diabetic nephropathy TG = Triglyceride

(ANOVA). So also was the sex distribution, although there were more females 32(61.5%) compared to the males 20(38.5%), $P = 0.85$. The mean duration of diabetes mellitus was 6.9 ± 6.36 years. Table-I shows that the mean serum total cholesterol was highest in diabetic nephropathy patients 6.9 ± 1.20 mmol/L when compared with diabetic hypertensive patients 6.01 ± 0.92 mmol/L or normotensive diabetics 5.68 ± 1.01 mmol/L, ($P < 0.0001$, ANOVA). So also is LDL cholesterol highest in diabetic nephropathy patients 5.11 ± 1.2 mmol/L when compared with diabetic hypertensive patients, 4.11 ± 0.89 mmol/L and normotensive diabetics 3.83 ± 0.89 mmol/L, ($P < 0.0001$, ANOVA).

Triglyceride disorder is also worse in diabetic nephropathy and HDL cholesterol lowest in diabetic nephropathy. The ratio of total cholesterol: HDL is 9.20 in DN, and 7.07 and 6.60 respectively in hypertensive and normotensive diabetics. Table-II compares the frequency of LDL, total cholesterol and HDL cholesterol disorder in the patients with ATP III classification.

DISCUSSION

The mean age of studied type 2 DM patients was 53 ± 11.2 years and the mean duration of type 2 DM was 6.9 years. There appears to be no sex predilection for type 2 DM according to this study. This is similar to other studies^{10,11} that reported no significant differences in the prevalence of type 2 DM between males and females. DM complications are however related to the duration, gender, and drug compliance.^{11,12}

Our study revealed combined hyperlipidaemia, hypercholesterolaemia and hypertriglyceridaemia. These findings are similar to the reports by Abdul Rahman et al,³ among their diabetic patients. The association of atherosclerosis, dyslipidaemia and diabetes was recognized as early as 1927 by Joslin.¹³ The cause of the lipid alteration among type 2 DM subjects is differential insulin distribution,¹⁴ which leads to increase in VLDL and triglyceride production through hepatic hyperinsulinaemia; this is combined with decreased

Table-II: Comparison of frequency of LDL, total and HDL cholesterol disorders in complicated type 2 DM with ATP III classification.¹³

ATP III classification	Diabetes mellitus complications		
	ND = 23n(%)	HD = 16n(%)	DN = 13n(%)
LDL- cholesterol (mmol/L)			
Optimum 2.6	2(8.7%)	1(6.3)	1(7.7)
Near optimum 2.6 – 3.3	6(26.1)	1(6.3)	0(0)
Border line high 3.4 – 4.1	5(21.7)	6(37.4)	1(7.7)
High 4.2 – 4.9	7(30.4)	7(43.7)	3(23.1)
Very high 4.9	3(13.1)	1(6.3)	8(61.5)
Total cholesterol (mmol/L)			
Desirable 5.2	7(30.4)	2(12.5)	1(7.7)
Border line 5.2 – 6.2	9(39.2)	6(37.5)	3(23.1)
High 6.2	7(30.4)	8(50.0)	9(69.2)
HDL cholesterol (mmol/L)			
Low 1.03	19(82.6)	14(87.5)	0(0)
High 1.5	4(17.4)	2(12.5)	13(100)
Triglyceride (mmol/L)			
Desirable < 1.7	15(65.2)	8(50)	9(69.2)
High > 2.3	8(34.8)	8(50)	4(30.8)

Serum total cholesterol, LDL cholesterol, HDL cholesterol and triglyceride are higher in Diabetic nephropathy patients than patients with Diabetic hypertension. ND = Normotensive diabetics
HD = Hypertensive diabetics DN = Diabetic nephropathy ATP III = Adult treatment panel III

catabolism of triglyceride-rich lipoprotein due to relative peripheral insulin deficiency.¹⁴

We found dyslipidaemia in normotensive diabetic patients, higher in patients with diabetic hypertension, and very gross in patients with diabetic nephropathy. Using the ATPIII cut-off marks for hypercholesterolaemia.¹⁵ Almost 30% of our normotensive diabetics had hypercholesterolaemia, (described as very high,³ 6.9mmol/L), but more than 69% of those with diabetic nephropathy had high hypercholesterolaemia (³ 6.9mmol/L). These results are similar to other reports,^{3,16} that document the incidence of dyslipidaemia among DM patients to vary from 25%-60% depending on the studied population and degree of glycaemic control.

The severe dyslipidaemia in diabetic nephropathy patients seen in this study may be related to reduced metabolic processes and impaired excretion of metabolic waste products.¹⁷ Hypertension even in the absence of diabetes mellitus is known to cause insulin resistance.¹⁸ The result of insulin resistance is chronic hyperglycaemia and increased lipolysis that result in elevated levels of lipids in the plasma. The treatment of hypertension with β -blockers as well as high doses of thiazide diuretics exacerbate the dyslipidaemia in patients with hypertension and diabetes mellitus.¹⁹ This mechanism may be partly responsible for the dyslipidaemia in the diabetic hypertensive patients in this series, as some of our patients were on these drugs at the time of this study.

The high percentage levels (30%-69%) of lipid abnormality found in this study approximate closely to what Emile et al,²⁰ found among their type 2 DM patients. This is comparable because we employed the same strict criteria of abnormality as; (according to ATPIII classification).¹⁵ In the population of the lipid Research Clinics Prevalence Studies, lipids and lipoproteins abnormalities rates were approximately 25% and 50% for triglyceride and cholesterol levels,²¹ respectively. We found a slightly higher hypertriglyceridaemia of between 38%-69% among our study groups. Low-density lipoprotein cholesterol levels were reported to be nor-

mal in DM by Ruderman et al.²² This is contrary to our findings of elevated LDL cholesterol levels in all our patients and it is marked in patients with diabetic nephropathy. We found hypertriglyceride in all our patients but were highest in patients with diabetic nephropathy.

CONCLUSIONS

We report disorders of total cholesterol, LDL cholesterol, HDL cholesterol and triglyceride, in patients with complicated type 2 DM: hypertensive diabetics and diabetic nephropathy. These lipid disorders are more in patients with diabetic nephropathy.

ACKNOWLEDGEMENT

We thank sincerely, Miss Rachel Orogun in the department of Chemical Pathology for typing the manuscript and Dr. C.O Imarengiaye of Anaesthesiology department, University of Benin for the review and useful input in data analysis.

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