CORRELATION OF SERUM LIPID PROFILE WITH GLYCEMIC CONTROL IN TYPE 2 DIABETICS

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ABSTRACT

Objective: *To determine serum lipid profile in controlled and uncontrolled Type 2 Diabetics and to know statistically significant differences in serum lipid profile between these two groups.*

Material and Methods: *During study period, 100 Type 2 DM patients, 50 each having good glycemic control (HbA1c < 7%) and poor glycemic control (HbA1c > 8.2%) were selected on the basis of convenient purposive sampling technique. Brachial venous blood samples were collected for fasting plasma glucose, HbA1c and serum lipid profile from all subjects in the morning after 12 hours fast at presentation in out doors at CMH Kohat laboratory. Their dyslipidemia was compared with reference to glycemic control in type 2 Diabetics.*

Results: *Out of 100 patients, 72% were males and 28% females. The mean age of group 1 was 51.06 and group 2 was 52.86 and total mean of 100 patients was 51.96 with a standard deviation + 7.82 years. Mean total cholesterol was 4.38±1.09 mmol/L in group 1 versus 5.95±1.27 mmol/L in group 2 (P=0.001). Mean Triglycerides were 2.13-±0.74 mmol/L in group 1 versus 3.11±1.00 mmol/L in group 2 (P=0.001). Mean LDL-C was 2.34±0.95 mmol/L in group 1 versus 3.53 ±1.09 mmol/L in group 2 (P=0.001). Mean HDL cholesterol was 1.06-±0.007 mmol/L in group 1 versus 0.99 ±0.008 mmol/L in group 2 (P=0.002).*

Conclusion: *In Type 2 DM patients good glycemic control is associated with statistically significant differences in total cholesterol, triglycerides, LDL-C and HDL-C.*

Key Words: *Type 2 diabetes, Dyslipidemia, Glycemic control, Glycosylated hemoglobin HbA1c.*

INTRODUCTION

Diabetes Mellitus is an increasingly important medical and public health issue. The world wide prevalence of type 2 DM has been estimated to rise from 150 million to 225 million by the end of 2010 and to as many as 300 million by 2025.[1,2] The epidemic is particularly acute in the South East Asia[3] whereby Pakistan will have the highest growth in diabetes. Type 2 DM is the major problem and will account for over 90% of these cases.[4]

Various studies conducted in Pakistan have reported 7-11% prevalence of DM .[5] Currently it is 8th in the world according to World Health Organization (WHO) estimation of prevalence of diabetes and by year 2025 is expected to rise to 4th position.[6] The prevalence of diabetes in North West Frontier Province (NWFP), according to WHO criteria, is 11.1%.[7]

Dyslipidemia is an important component of the metabolic syndrome observed in type 2 DM patients and is characterized by moderate hypertriglyceridemia and low levels of HDL-C. [8] Type 2 DM is associated with various patterns of dyslipidemia that predispose patients to macrovascular complications like CHD. Once clinical disease develops the patients have a poorer prognosis than normoglycaemic individuals with normal lipids. Similarly hypertriglyceridemia, low HDL-C and high LDL-C represent a high risk group for CHD morbidity and mortality in type 2 DM.[9] Elevated serum triglycerides are commonly associated with insulin resistance and represent a valuable clinical marker of metabolic syndrome[10]. Worsening of glycemic control deteriorates lipid

DISTRIBUTION OF PATIENTS BY AGE

Age (Years)	Group I (n=50)	Group 2 (n=50)
	Frequency (%)	Frequency (%)
35-40	06(12)	04 (08)
41-45	09(28)	04 (08)
46-50	12(24)	12 (24)
51-55	06(12)	10 (20)
56-60	09(18)	15 (30)
60-65	08(16)	05 (10)
Mean ± SD	51.06 ± 8.31	52.86 ± 7.27

Table 1

and lipoprotein abnormalities and particularly total and LDL-C is elevated with poor control of DM.[11]

Duration of diabetes is associated with higher incidence of dyslipidemia. Adult Treatment Panel III (ATPIII) study made diabetes a CHD equivalent, thereby elevating it to the highest risk category[12]. In newly diagnosed and established diabetics correlation was found between HbA1c levels and carotid intima-media thickness.[13] The oxidation of lipoproteins, in particular LDL-C, seems to be increased in diabetic patients, especially those with poor glucose control, hypertriglyceridemia, and microvascular and macrovascular disease. Oxidation of LDL-C results in a moiety that is cytotoxic to vascular endothelial and smooth muscle cells, contributing to atherogenesis.[14] For every one-percentage point increase in HbA1c, the relative risk for any cardiovascular event was 1.18 (95% CI 1.10-1.26)[15]. DM is associated with a greater risk of morbidity and mortality from cardiovascular disease (CVD). Serum lipids are frequently abnormal and are likely to contribute to the risk of coronary artery disease.[16]

Keeping in view the large number of type 2 DM patients and poor knowledge of the subject, most patients are prone to develop multiple lipid disorders. Very few studies have been conducted in our community to know the impact of glycemic control on lipid profile in type 2 DM. Our study focused on Pakistani community and gave results that are applicable to our patients and the impact of the results will help patients with type 2 DM in reducing the irreversible complication associated with this disorder.

DISTRIBUTION OF PATIENTS BY SEX IN TWO GROUPS

Sex	Group I (n=50)	Group 2 (n=50)
	Frequency (%)	Frequency (%)
Male	40(80)	32 (64)
Female	10 (20)	18 (36)
Total	50 (100)	50 (100)

Table 2

MATERIAL AND METHODS

This cross-sectional comparative study was carried out at Combined Military Hospital Kohat, Patients were enrolled from Medical out patient department. Detailed history and clinical data was obtained. Informed consent was taken from all the patients recruited in the study.

One hundred Type 2 DM patients were selected on the basis of convenient purposive sampling technique until sample size of 50 patients in each group with regard to glycemic control was achieved. Study Group 1 was having good glycemic control (HbA1c < 7%), and Study Group 2 was having poor glycemic control (HbA1c > 8.2%).

Inclusion Criteria for the study were:

1. Patients with at least one year history of type 2 DM on medication.
2. Males and females between 35-65 years of age.

Exclusion Criteria for the study were:

1. Type 2 DM patients with hypertension and ischemic heart disease.
2. Those patients who were on lipid lowering therapy.
3. Family history of hyperlipidemia.
4. Terminally ill patients.

Brachial venous blood samples were

DISTRIBUTION OF PATIENTS BY LIPID PROFILE

Lipid Profile	Group I (n=50)	Group 2 (n=50)	p- Value
	Mean ±SD	Mean ±SD	
Serum Total Cholesterol (mmol/L)	4.38 ± 1.09	5.95 ± 1.27	< 0.001
Serum Triglycerides (mmol/L)	2.13 ± 0.74	3.11 ± 1.00	< 0.001
Serum LDL-C (mmol/L)	2.34 ± 0.95	3.53 ± 1.09	< 0.001
Serum HDL-C (mmol/L)	1.06 ± 0.007	0.99 ± 0.008	< 0.002

Table 3

DISTRIBUTION OF PATIENTS BY DURATION OF DM-2

Duration of DM2 (Years)	Group I (n=50)	Group 2 (n=50)
	Frequency (%)	Frequency (%)
01-05	15 (30)	07 (14)
06-10	18 (36)	16 (32)
11-15	13(26)	20 (40)
16-20	04(08)	17 (34)
Mean ± SD	8.72 ± 4.57	10.84 ± 4.46

Table 4

collected for FPG, HbA1c and serum lipid profile (serum total cholesterol, triglycerides, HDL-C and LDL-C) from all subjects in the morning after 12 hours fast at presentation. Blood samples for lipid profile were analyzed by enzymatic colorimetric technique at Combined Military Hospital Kohat Laboratory. Instruments and technicians were same to decrease margins of errors. The cost of laboratory tests was completely borne by the hospital authorities.

All the data was compiled in computer on SPSS program, version 10.0 and was analyzed accordingly. For qualitative variables such as sex and category of glycemic control frequencies, ratios and percentages were calculated. Chi-square test was used to determine significant differences of frequencies between the groups.

For quantitative variables such as age, various lipid components (serum total cholesterol, triglycerides, HDL-C and LDL-C), FPG, HbA1c level, duration of type 2 DM and BMI mean and standard deviation were calculated. The Student T test was applied to determine significant differences between means of the groups. A P value of less than 0.05 was considered significant.

Operational Definition

i. Good Glycemic Control; HbA1c Levels: Less than 7% and FPG 90–125 mg/dl (5-6.9 mmol/L)

ii. Poor Glycemic Control; HbA1c Levels: More than 8.2 % and FPG more than 169 mg/dl (9.4mmol/L).

RESULTS

In this study 100 adult patients with Type 2 DM were selected, fulfilling inclusion criteria. They were divided into two groups on the basis of glycemic control with 50 patients in each group. Study Group 1 was having good glycemic control (HbA1c < 7%), and Study Group 2 was having poor glycemic control (HbA1c > 8.2%). The mean age of group 1 was 51.06 and of group 2 was 52.86 and total mean age of 100 patients was 51.96 with a standard deviation ± 7.82 years (table-1,2). Out of 100 patients 72 % were males, and 28% were females. In group 1 there were 80 % (40) males and 20 % (10) females. In group 2 there were 64 % (32) males and 36 % (18) females.

In group 1 of 50 patients, the mean FPG was 8.35 with standard deviation ± 2.20 mmol/L and mean HbA1c level was 6.17 with standard deviation ± .60 indicating good glycemic control. In group 2 of 50 patients, the mean FPG was 14.10 with standard deviation ± 3.48mmol/L and mean HbA1c level was 8.76 with standard deviation ± .53 indicating poor glycemic control.

Mean total cholesterol was 4.38±1.09 mmol/L in study group 1 versus 5.95±1.27 mmol/L in group 2 (P<0.001) Mean Triglycerides were 2.13 ±0.74 mmol/L in study group 1 versus 3.11±1.00 mmol/L in group 2 (P< 0.001). Mean LDL cholesterol was 2.34-±0.95 mmol/L in group 1 versus 3.53 ±1.09 mmol/L in group 2 (P<0.001). Mean HDL cholesterol was 1.06-±0.007 mmol/L in group 1 versus 0.99 ±0.008 mmol/L in group 2 (P< 0.002)(table-3).

Mean duration of DM was 8.72 ±4.57 years in study group 1 versus 10.84±4.46 years in study group 2.The mean BMI was 23.08 ±3.79 in group 1 versus 26.12 ±5.46 in group 2(table-4).

In study group 1, 10 patients had their total Cholesterol above 5.2mmol/L while the same was true for 35 patients in study group 2. On the other hand 40 patients in study group 1 and 15 in study group 2 had Cholesterol in the normal range.

In case of Triglycerides, 10 patients in study group 1 while 41 patients in study group 2 had above 2.3 mmol/L. LDL-C was above 3.4 mmol/L in 5 patients in study group 1 and 28 patients in study group 2. HDL-C levels though marginally better in the study group 1 but were not significant than study group 2.

The mean lipid level in both groups was compared and a p value< 0.001, which was statistically significant, was found in all lipid fractions.

DISCUSSION

Duration of Diabetes mellitus (DM) is associated with higher incidence of dyslipidemia. Type 2 DM is associated with a marked increase in the risk of Coronary heart disease (CHD) and dyslipidemia is believed to be a major cause of increased risk[17].

Patient with DM have a two to six fold increased risk of CHD, peripheral vascular disease and cerebrovascular disease than those without it[18]. Approximately 80% diabetics die from large blood

vessel disease as compared to 50% of the rest of population[19]. Usual risk factors of CHD accounts for only 25-50 % of increased atherosclerosis risk in DM. Other obvious factors are hyperglycemia and dyslipidemia[17]. It is widely recognized that atherosclerosis is a multifactorial process with lipids intimately and fundamentally involved in its evolution, both in the diabetic and non-diabetic individuals.

Dyslipidemia in diabetics have been described time and again in numerous international study trials with consistent findings and few differences. The Cholesterol and Recurrent Events study has shown that effective lipid lowering therapy in type 2 DM decreases cardiac events. The ADA has reported that well controlled type 1 diabetics have a lipid disorder similar to the rest of the population, while well controlled type 2 diabetics have a mixed hyperlipidemia with high triglycerides, low HDL-C and high LDL-C levels.[20] On the other hand in poorly controlled type 2 diabetics have a mixed dyslipidemia resulting in high cholesterol and triglyceride level. These observations have marked resemblance to the results of present study, which also showed elevated cholesterol and triglyceride level in the both groups but more so in the uncontrolled one.

In view of these results, the aim is to achieve very tight glycemic control especially in uncontrolled type 2 diabetics. UKPDS[21] and DCCT[22] study group have all concluded that intensive glycemic control with either suphonylureas or insulin initiated early in the course of DM significantly reduces microvascular and macrovascular end points. Aboola-Abu CF[23] in Nigeria also had similar findings. They reported that better glycemic control helped improve dyslipidemia. It has also been reported that controlling dyslipidemia and good glycemic control delays atherosclerosis and prevent CHD.[24]

In a similar trial (n = 120) by Amer W, Zafar S and Majrooh A, all lipid fractions were deranged in patients with uncontrolled type 2 DM.[25] It was a retrospective cohort study, in which type 2 DM patients were enrolled on the basis of good control (HbA1c < 8) and uncontrolled (HbA1c > 8), and the out- come was the change in the lipid profile of both these groups. Lipid profile evaluation included fasting serum total cholesterol, triglyceride, HDL-C, LDL-C and VLDL. The mean lipid levels in both groups were compared and a p value <0.005,which was statistically significant was found in all lipid fractions.

Another study conducted in Department of Internal Medicine, Civil Hospital, Karachi concluded that individuals with good glycemic control (HbA1c <7 %) had statistically significant differences in the values of total cholesterol, triglycerides and VLDL as compared to individuals with poor glycemic control.[26]

There were obvious limitations to our study i.e. being single centered and a small sample size.

CONCLUSION

Elevated total serum cholesterol, Triglyceride, LDL-C and low HDL-C were observed in type 2 diabetics with poor glycemic control compared to patients with good glycemic control. The glycemic control of the patient has got a strong impact on the serum lipid level and dyslipidemia is frequently encountered in those diabetics who have got poor glycemic control. Patients should be educated about regular monitoring of lipid profiles and if found to be abnormal, should control blood sugar and lipids very effectively.

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