Lipid profile in type ٢ diabetic patients in Mosul

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Abstract

Objectives: (a)To examine the effects of diabetes and its duration on lipid profile. (b)To determine the prevalence of dyslipidaemia on lipid profile.

Design: Case-control study.

Setting: The study was conducted in Al-Zahrawi private Hospital in Mosul from January to December ٢٠٠٤.

Participants: Three hundred and fifty six type ٢ diabetic patients who attended outpatient department and ٣٨٤ apparently healthy controls.

Main outcome measures: Plasma glucose and serum lipid profile in type ٢ diabetic patients were compared with controls. The collected data were analyzed by chi-square, Z, one-way ANOVA and Duncan tests.

Results: Serum total cholesterol (TC), low density lipoprotein cholesterol (LDL-C), very low density lipoprotein cholesterol (VLDL-C) and serum triglycerides (TG) were increased significantly (P<٠.٠٠١); however, high density lipoprotein cholesterol (HDL-C) was decreased significantly (P<٠.٠٠١) in diabetic patients as compared with controls. No significant difference was noticed between males and females for lipid profile. The lipid profile was increased with advancement of disease. There was a significant difference between patients in fasting plasma glucose and fasting serum lipid concentrations according to advancement of disease in duration. The prevalence of hypercholesterolaemia, hypertriglyceridaemia, hyper LDL cholesterolaemia and low HDL cholestrolaemia among the studied patients according to the recommendation of British Hyperlipidaemia Association (١٩٩٨) was ٦٩.٦%, ٣٦.٢%, ٦٨.٨% and ٦٤% respectively. Duration of disease was associated with higher incidence of dyslipidaemia.

Conclusion: Diabetes mellitus is associated with lipid abnormalities. Periodic check up of lipid profile is recommended for diabetic patients. There is positive relationship between duration of diabetes and lipid profile.

Key words: Lipid profile, Diabetes type ٢, Dyslipidaemia, Lipoproteins.

الخلاصـــة

أهداف البحث: أ – دراسة تأثير مرض السكري على واجهة شحوم مصل الدم وتأثير تقدم المرض على واجهة شحوم مصل الدم .

ب – دراسة نمط اضطراب شحمانية الدم في مرض السكري نمط ٢ .

التصميم : متابعة الحالات المرضية ومقارنتها مع عينات ضابطة .

مكان إجراء الدراسة والإطار الزمني لها : نفذت الدراسة في مستشفى الزهراوي الأهلي في الموصل أثناء الفترة من كانون الثاني ولغاية نهاية شهر كانون الأول سنة ٢٠٠٤ .وتم جمع نماذج الدم في حالة الصوم لكافة القياسات.

المشاركون : تكونت عينات الحالات المرضية من ٣٥٦ من مرضى السكر نمط ٢ مع ٣٨٤ من الأصحاء تتراوح أعمارهم بين ٣٧ – ٧٥ سنة اختيرت عشوائيا بين مراجعي العيادة الخارجية .

القياسات المستخرجة : تمت دراسة مقارنة التغيرات الكيمياوية الحيوية بواسطة اختبار Z بعد قياس المعدل والانحدار المعياري للكلوكوز والشحوم والبروتينات الشحمية. أما مقارنة التغيرات الكيمياوية الحيوية بين المجموعات فتم بواسطة اختباري جدول تحليل التباين وفحص دنكان فيما تمت دراسة نمط اضطراب شحمانية الدم بواسطة فحص مربع كاي.

النتائج : لوحظ ان هنالك ارتفاع معتد احصائيا في مستويات الكولسترول الكلي والشحوم الثلاثية والبروتين الشحمي خفيض الكثافة والبروتين الشحمي وضيع الكثافة لمرضى السكر بمقارنتهم مع الاصحاء (ب< ٠.٠٠١) مع انخفاض معتد احصائيا في البروتين الشحمي رفيع الكثافة (ب < ١ ٠٠ و ٠) . كما لوحظ عدم وجود فروقات ملحوضة بين المرضى الذكور والأناث. كذلك لوحظ وجود ارتفاع تدريجي ملحوظ في معدلات الكلوكوز وفي معظم الشحوم والبروتينات الشحمية بتقدم المرض وقد نوقشت الآليات الفيزيولوجية المرضية المحتملة والمتعلقة بهذه التغيرات .

صنف ارتفاع شحوم مصل الدم حسب توصيات الجمعية البريطانية لفرط شحوم الدم لعام ١٩٩٨ حيث لوحظ في مرضى السكر ارتفاع مستوى الكولسترول الكلي بنسبة ٦٩.٦% وارتفاع مستوى الشحوم الثلاثيه بنسبة ٣٦.٢% وارتفاع مستوى البروتين الشحمي خفيض الكثافة بنسبه ٦٨.٨ % مع نقصان في مستوى البروتين الشحمي رفيع الكثافة بنسبة ٦٤% . إن مرضى السكر امتازوا بانخفاض ملحوظ في البروتين الشحمي رفيع الكثافة مع زيادة في الكولسترول الكلي والشحوم الثلاثية والبروتين الشحمي خفيض الكثافة والبروتين الشحمي وضيع الكثافة.

الاستنتاج : مرض السكري يؤثر بشكلي سلبي على واجهة شحوم مصل الدم . يجب أن يكون هناك فحص دوري لواجهة شحوم مصل الدم لمرضى السكر. كما أن هنالك علاقة سلبية بين تقدم مرض السكري وواجهة شحوم مصل الدم .

Introduction

Several risk factors for coronary heart disease (CHD) have been reported including diabetes mellitus, obesity, hypertension and dyslipidaemia[١,٢]. Diabetes mellitus is regarded as a major independent risk factor responsible for hyperlipidaemia and CHD development[٣,٤]. Furthermore, dyslipidaemia has been shown to be the main contributor to the increased incidence of coronary events and death among diabetic subjects[٥]. Accordingly, management of type ٢ diabetes is essential by the control of hyperglycaemia and dyslipidaemia[٢]. In addition to that, much attention is focused to improve disordered lipoprotein metabolism, the changes observed were not only an elevated serum concentration of total cholesterol (TC) and triglycerides (TG) but also on altered composition and protein moieties of lipoproteins[٦, ٧].

This study was done to examine the effects of diabetes and its duration on lipid profile. In addition, to determine the prevalence of dyslipidaemia in type ٢ diabetic patients in Mosul.

Subjects and Methods

The study ran from January to December ٢٠٠٤. It was performed on patients diagnosed as diabetic and their fasting glucose was not less than ٧.٠ mmol/L[٨]. Patients with any other diseases except type ٢ diabetes were excluded from this study. Three hundred and fifty six diabetic patients were included in this study attending Al-Zahrawi Private Hospital outpatient department. Patients (١٨٤ males, ١٧٢ females) aged ٣٧-٧٥ years (mean $\pm$ SD, ٥٢.٥ $\pm$ ٦.٤). All patients were under treatment of sulfonylureas tablets in addition to diet restriction. Those patients were divided into three groups according to the duration of diabetes. Group I having diabetes for <٥ years (٧٥ males, ٧٤ females), group II having diabetes from ٦-١٠ years (٦٦ males, ٦٤ females), group III having diabetes >١٠ years (٤٣ males, ٣٤ females). The control group included ٣٨٤ apparently healthy subjects (١٨٢ males, ٢٠٢ females) aged ٣٨-٧٢ years (mean $\pm$ SD, ٤٨.٠ $\pm$ ٦.٥).

Blood sample (١٠ ml) was taken from each subjects after an overnight fasting and divided into two aliquots. The first aliquot was transferred into fluoride-oxalate tube for plasma glucose measurement and the other aliquot was transferred into plain tube for serum lipid profile. Determination of serum total cholesterol (TC), triglycerides (TG) and high density lipoprotein cholesterol (HDL-C) was performed by using enzymatic method[٩]. Low density lipoprotein cholesterol (LDL-C) was determined using Friedewald formula

for those with triglycerides <٤.٥ mmol/L[١٠].

LDL-cholesterol (mmol/l)= Total cholesterol– HDL-cholesterol –triglycerides x ٠.٤٥٥

VLDL-cholesterol was calculated from the formula:

VLDL-C (mmol/l) = Triglycerides x ٠.٤٥٥[١٠].

Classification of hyperlipidaemia and dyslipidaemia was based on the recommendation of the British Hyperlipidaemia Association (١٩٩٨)[١١] using thresholds of triglycerides >١٨٠ mg/dl (٢.٤ mmol/L), total cholesterol >١٩٤ mg/dl (٥.٠ mmol/L), LDL-C > ١١٦ mg/dl (٣.٠ mmol/L), HDL-C <٤٥ mg/dl (١.١٥ mmol/L), total cholesterol: HDL-C > ٥.٠, LDL-C:HDL-C >٢.٥, and triglycerides: HDL-C >٣.٠. A subject was considered dyslipidaemic when one of the above criteria was fulfilled[١١]. Data was represented as mean ± SD. Unpaired Z test was used to determine the difference between the means. Analysis of variance (ANOVA) and Duncan tests were used to compare the biochemical changes among the groups and within the groups. Chi-square test used for comparison of percentage. P-value at <٠.٠٥ was considered as significant.

Results

Table ١ showing that plasma glucose in the diabetic patients was significantly higher than in the control group (P<٠.٠٠١). Furthermore, total cholesterol, LDL-C, VLDL-C and TG were highly significant than those measurements in the control group (P<٠.٠٠١), at the same time HDL-C was significantly lower than that in the control group (P<٠.٠٠١) . In addition, there was no significant difference between males and females for plasma glucose and lipid profile (data is not shown).

According to the duration of diabetes an upward trend was observed in the mean plasma glucose and all serum levels of TC, LDL-C, VLDL-C and TG with advancement of the disease (P<٠.٠٠١) while there was a decline in HDL-C with advancement of the disease i.e. lower in group III than in group I and II. According to the duration of diabetes on plasma glucose and lipid profile a significant decrease was present within groups (P<٠.٠٥) (I, II and III) in the levels of fasting plasma glucose, TC and LDL-C, also there was significant increase between groups I and II, and groups I and III in the levels of VLDL-C and TG while there was a significant decrease between the same groups in the levels of HDL-C (Table ٢).

A subject was considered dyslipidaemic when the criteria of cutoff value was fulfilled according to the recommendation of British hyperlipidaemia Association (Recommendation of Coronary Prevention ١٩٩٨). The prevalence of hypercholesterolaemia, hypertriglyceridaemia, hyper LDL cholesterolaemia and low HDL cholesterolaemia among the type ٢ diabetes was ٦٩.٦%, ٣٦.٢%, ٦٨.٨% and ٦٤% respectively. An abnormal ratio of certain lipoprotein components was also noticed in the studied patients as such ratio has been recommended to use for assessment by British Hyperlipidaemia Association (١٩٩٨). However, ٥٣.٨% of patients had TC: HDL-C >٥.٠, ٧٦.٨% had LDL-C: HDL-C > ٢.٥ and ١٧.١% had TG/HDL-C > ٣.٠ (Table ٣). Comparison of percentage in the male and female groups using chi-square revealed statistically significant difference only in the LDL-C: HDL-C ratio (P<٠.٠٥).

Table (١): *Plasma glucose and serum levels of lipid profile in the control subjects and diabetic patients represented as mean ± SD.*

Parameters mmol/L	Control subjects (n=٣٨٤)	Diabetic patients (n=٣٥٦)	P-value
Glucose	٥.١١ ± ٠.٧٢	١٠.٦٨ ± ٣.٥١	p<٠.٠٠١
Total cholesterol	٤.٩٠ ± ٠.٨٨	٥.٦٤ ± ١.٠٧	p<٠.٠٠١
HDL-C	١.١٦ ± ٠.٢٥	١.٠ ± ٠.٢٠	p<٠.٠٠١
LDL-C	٢.٩٩ ± ٠.٨٨	٣.٤١ ± ١.١٠	p<٠.٠٠١
VLDL-C	٠.٣٠ ± ٠.١٧	٠.٤١ ± ٠.٢٥	p<٠.٠٠١
Triglycerides	١.٦٠ ± ٠.٨٤	٢.١٣ ± ١.٢٧	p<٠.٠٠١

Table (٢): *Plasma glucose and serum lipid profile in diabetic patients according to the duration of disease represented as mean ± SD.*

Parameters mmol/L	Group I <٥ years (n=١٤٩)	Group II ٦-١٠ years (n=١٣٠)	Group III >١٠ years (n=٧٧)	ANOVA
Glucose	٨.٦٥ ± ١.٩٩ a	١٠.٩٣ ± ٣.١٢ b	١٤.٢١ ± ٣.٥٣ c	p<٠.٠٠١ F=٥٢.٤
Total cholesterol	٥.٠٦ ± ٠.٨٣ a	٥.٤٧ ± ٠.٩٦ b	٦.٣٠ ± ١.٢٠ c	p<٠.٠٠١ F=٣٦.٤
HDL-C	١.١٣ ± ٠.٢٣ a	١.٠٥ ± ٠.٢٤ b	١.٠٣ ± ٠.٢٤ b	p=٠.١٩ F=٤.٠
LDL-C	٣.٠٨ ± ٠.٨٧ a	٣.٣٦ ± ٠.٩٨ b	٤.١٨ ± ١.١٤ c	p<٠.٠٠١ F=٣٢.٠
VLDL-C	٠.٣٥ ± ٠.١٩ a	٠.٤٤ ± ٠.٢٩ b	٠.٤٦ ± ٠.٢٧ b	p<٠.٠٠١ F=٦.٠
Triglycerides	١.٨٥ ± ٠.٩٥ a	٢.٣١ ± ١.٤٥ b	٢.٣٤ ± ١.٤٤ b	p=٠.٠٠٣ F=٦.٠

Different letters horizontally mean a significant difference at p<٠.٠٥ level according to Duncan test.

Table (٣): *Prevalence of dyslipidaemia in the diabetic patients according to the recommendation of the British Hyperlipidaemia Association. Results are expressed as number (%) of patients with gender prevalence.*

Sex	TG ≥٢.٤ mmol/L		TC ≥ ٥.٠ mmol/L		LDL-C ≥٣.٠ mmol/L		HDL-C ≤١.١٥		TC:HDL-C ≥٥		LDL-C:HDL-C ≥ ٢.٥		TG: HDL-C ≥٣	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Males	٥٨	١٦.٣	١٢٥	٣٥.١	١٢٠	٣٣.٧	١١٥	٣٢.٣	٩٦	٢٦.٩	١٣٣	٣٧.٥	٢٧	٧.٦
Females	٧١	١٩.٩	١٢٣	٣٤.٥	١٢٥	٣٥.١	١١٣	٣١.٧	٩٦	٢٦.٩	١٤٠	٣٩.٣	٣٤	٩.٥
Both	١٢٩	٣٦.٢	٢٤٨	٦٩.٦	٢٤٥	٦٨.٨	٢٢٨	٦٤	١٩٢	٥٣.٨	٢٧٣	٧٦.٨	٦١	١٧.١
P-value	NS		NS		NS		NS		NS		٠.٠٢ (S)		NS	

Discussion

In the present study (TC) was increased significantly in diabetic patients. This result was consistent with other studies[١٢-١٥]. Abate *et al*. (١٩٩٥) found that TC and LDL-C were increased in diabetes especially with advanced age[٦]. The major cause of increased atherogenic risk is hypercholesterolaemia, and both genetic disorders and diets enriched in saturated fat and cholesterol contributes to the elevated lipid levels characteristics of patients with premature CHD. There is now universal acceptance of cholesterol – diet CHD hypothesis[١٦].

It is well known fact that low HDL-C is common in type ٢ diabetes and may be a strong risk factor for CHD[١٧, ١٨]. Which is consistent with the present study results that low HDL-C is evident compared with the control group. Framingham study suggested that TC: HDL-C ratio is a useful summary of the joint contribution of TC and HDL-C to CHD[١٩].

High serum LDL-C was noted to be significantly increased with duration of the disease. This is in agreement with the findings of other studies[١٤, ٢٠, ٢١]. The fact that diabetes causes an increase in serum concentration of small, dense LDL molecules[٢٢, ٢٣], which easily undergo oxidation and speedup progression of atheromatous plaque[٧].

Serum triglycerides (TG) and VLDL-C are increased in diabetic patients which is obvious in the present study, and their levels were significantly increased with the duration of disease, which are consistent with other studies[٢٤, ٢٥], while are inconsistent with other studies[١٢, ٢٧]. This variation could be due to difference in geographical, cultural[٢٧] economical, social conditions[٢٨], dietary habits and genetic makeup[٢٩]. Moderately elevated levels of triglycerides are often associated with metabolic syndrome or syndrome X[٣٠]. Furthermore, the poorly controlled situation offers abundant substrates, including glucose, fatty acids and triglycerides[٣١]. High triglycerides and low HDL-C are reported as important and independent risk factors for CHD[٣٢].

There is a close relationship between triglycerides and small, dense LDL particles[٣٣] which are thought to be more atherogenic than native LDL-C[٣٤]. Triglycerides are also associated with increased levels of plasminogen activator inhibitor–١ which is also widely considered to be cardiovascular risk factor[٣٥].

In the present study the prevalence of hypercholesterolaemia, hypertriglyceridaemia, hyper LDL-cholesterolaemia and low HDL cholesterolaemia among type ٢ diabetes according to the recommendation of British Hyperlipidaemia Association (١٩٩٨),[١١] was ٦٩.٦%, ٣٦.٢%, ٦٨.٨% and ٦٤% respectively. These results are consisted with several other studies[٣٦, ٣٧]. Data from National Health And Nutrition Examination Survey (NHANES) study indicate that ٧٠% of diabetic patients have high or borderline high cholesterol[٣٨]. Never the less, the prevalence of hyper-triglyceridaemia in the present study falls in the range of ٢٠-٦٠% as reported in other study[٣٩]. The prevalence of low HDL-C levels in the present work was consistent with other studies[٣٦, ٣٧]. The possible explanation of dyslipidaemia which is double than normal in type ٢ diabetes is due to the fact that fat cells release large amount of free fatty acids to the circulation, which are taken up by the liver, then lipoprotein synthesis is enhanced followed by assembly and secretion of increased amount of VLDL-C[١٤].

In conclusion based on these findings subject with lipid abnormalities and higher plasma glucose should be early detected and carefully managed to prevent CHD because diabetes is usually regarded as major risk for CHD

and all diabetics should be educated about dyslipidaemia and their serum lipid levels should be checked regularly.

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