Relationship between Lipid Profile and Renal Function Parameters in Patients with Acute Myocardial Infarction

Mufeed J. Ewadh, Abdulsamie H. Alta'ee
College of Medicine, Babylon University, Hilla P.O. Box 473, IRAQ.
Firas J. Mostafa
College of Medicine , Kerbala University , Kerbala, IRAQ
Kadhum J.AL-hamdani
College of Medicine, Babylon University, Hilla P.O. Box 473, IRAQ.
Saad H.Abdul Latif
College of Education ,Kerbala University , Kerbala , IRAQ
All'a H.Abid
College of Medicine, Babylon University, Hilla P.O. Box 473, IRAQ.
Osama M.Fakri
Merjan Teaching Hospital ,Hilla, IRAQ
Rafid S.Ewadh
College of Medicine, Babylon University, Hilla P.O. Box 473, IRAQ.

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Abstract

Background: Cardiovascular disease(CVD) are related to multiple metabolic risk factor as hypertension , diabetes mellitus, hyperlipidaemia and cystiene level, as well.
Objective: To investigate the association between lipid profile as risk index for CVD and renal function parameters in patients with acute myocardial infarction (AMI).
Methods: One hundred and one patients (51 males, 50 females) with AMI admitted to Merjan Teaching Hospital in Hilla city on 2007 and fifty five (30 males, 25 females) apparently healthy persons as a controls subject to present study. Determination of blood Total cholesterol (TC), triacylglycerol (TG), high density lipoprotein (HDL)-cholesterol, serum creatinine (Cr) and serum uric acid (UA) were preformed using colorimetric methods. Very low density lipoprotein (VLDL)-cholesterol and low density lipoprotein (LDL) -cholesterol was determined using mathematical method. Risk index of lipid profile determined by dividing TC/ LDL –cholesterol.
Results: Serum Cr and UA found to be significantly increased in patients with AMI when compared with healthy controls. Total cholesterol , VLDL- cholesterol, LDL-cholesterol and TG of patient with AMI in both gander found to be significantly increase when compared with healthy controls. HDL- cholesterol of patients found to be decreased.
Conclusion: Serum Cr and serum UA can be regarded as risk factor for patient with CVD.

الخلاصة

ترتبط الأمراض القلبية الوعائية بالعديد من العوامل المخطرة الايضية كارتفاع ضـغط الـدم وداء الـسكري ووفرة الدهون في الدم ومستويات السستين.

تهدف هذه الدراسة لتقصي العلاقة بين معالم الدهون كعوامل مخطرة للأمراض القلبية الوعائية ومتغيـرات وظائف الكلية عند المرضى المصابين بأحتشاء العضلة القلبية.

شملت هذه الدراسة مائة وواحد مريضا مصابا بأحتشاء العضلة القلبية (51 ذكر و50 أنثى) من الداخلين إلى مستشفى مرجان التعليمي في مدينة الحلة خلال العام 2007 ،وكذلك شملت خمسة وخمسون (30 ذكـر و25 أنثى) شخصا سليما كمجموعة سيطرة. تم تقدير كل من الكولسترول الكلي (TC) في الدم والكليسرايد ثلاثي الأسيل (TG) وكولسترول البروتين الدهني عالي الكثافة (HDL) وكريياتنين وحـامض يوريـك المـصل بطريقة لونية. بينما قدر كل من كولسترول البروتين الدهني واطئ الكثافة (LDL) و كولسترول البـروتين الدهني واطئ الكثافة جدا (VLDL) بطريقة حسابية. كما قدر عامل الخطورة بقسمة الكولـسترول الكلـي/ كولسترول البروتين الدهني واطئ الكثافة.

أظهرت النتائج ارتفاعا معنويا في كل من تركيز حامض اليوريك ،والكرياتنين، وكولسترول البروتين الدهني واطئ الكثافة، و كولسترول البروتين الدهني واطئ الكثافة جدا ،والكليسرايد ثلاثي الأسيل ،في حين انخفـض تركيز كولسترول البروتين الدهني عالي الكثافة ،عند المرضى مقارنة بمجموع السيطرة.

تستنتج الدراسة إمكانية اعتبار كرياتنين وحامض يوريك المصل كعوامل مخطرة عند المرضـى المـصابين بالأمراض القلبية الوعائية.

Introduction

The main cause of morbidity-mortality in developed countries is cardiovascular disease (CVD). Hypertension, cigarette smoking, diabetes mellitus and hyperlipidaemia are the most important risk factors.[1,2].

American Heart Association on Dec. 18, 2007 released updated cardiovascular disease mortality statistics. According to a new report from the U.S. deaths from heart disease and stroke remain two of the nation's top causes of death. "Nearly 2,400 Americans die of CVD each day ,an average of one death every 37 seconds," states the American Heart Association. Stroke strikes every 40 seconds in the U.S., on average, and stroke accounts for about one in every 17 U.S. deaths, according to preliminary 2005 data cited in the report.[3]

The second edition of 2005 European cardiovascular disease statistics published by the British Heart Foundation and the European Heart Network shown that each year CVD causes over 4.35 million deaths in Europe and over 1.9 million deaths in the European Union (EU). CVD causes nearly half of all deaths in Europe (49%) and in the EU (42%). CVD is the main cause of death in women in all countries of Europe and is the main cause of death in men in all countries except France and San Marino. Overall CVD is estimated to cost the EU economy €169 billion a year.

Researchers were proposed the "Oxidative-modification hypothesis" of atherosclerosis to explain the atherogenesis , they suggests that atherogenesis is initiated by oxidation of the lipids in LDL. According to this hypothesis, LDL initially accumulates in the extracellular subendothelial space of arteries and, through the action of resident vascular cells, is mildly oxidized to a form known as minimally modified LDL [4] The later produces monocyte chemotactic protein, granulocyte and macrophage colony-stimulating factors by inducing local vascular cells. These factors stimulate monocyte recruitment and differentiation to macrophages in arterial walls. [5] The accumulating monocytes and macrophages stimulate further peroxidation of LDL. The

products of this reaction make apolipoprotein B-100 more negatively charged. By asset of its increased negative charge, this completely oxidized LDL is recognized by scavenger receptors on macrophages and internalized to form so-called foam cells.[6]

Several studies have verified that the prognosis of a variety of diseases is worsened by the concomitant existence of renal dysfunction [7-9]. Generally, different analyses of patients groups with diabetes, congestive heart failure, MI and hypertension will nearly always comprise renal function as an independent predictor of mortality and morbidity. [10,11]

Such analyses are complicated by the fact that a number of diseases are also predictors of reduced renal function. Therefore, it is unclear whether renal dysfunction is a risk factor per se, or whether it is merely a marker of diseases connected with renal dysfunction. If the association between renal dysfunction and mortality were direct, it could indicate that measures of renal function were a sensitive estimator of cardiovascular risk.[12]

Serum Cr is commonly conventional measure of renal function in clinical medicine.[13] Level of Cr in serum is associated with all-cause mortality or stroke in middle-aged and elderly people and in patients with insulin-dependent diabetes or previous cardiovascular disorders.[14-16] Likewise, numerous studies have shown that the serum levels of UA predicts mortality, cardiovascular events, or stroke.[14,17-19]

Various epidemiological studies has been confirmed a positive association between serum UA and cardiovascular diseases such as stroke or ischemic heart disease since the 1950s. [17]

This study was design to investigate the relationship among lipid profile, serum Cr, and serum UA in Iraqi patients with AMI, and it has, to the best of our knowledge, never been tested in the Iraqi population.

Patients and Methods

One hundred and one patients (51 males, 50 females) with AMI clinically diagnosed by ECG admitted to Merjan Teaching Hospital in Hilla city on 2007 and fifty five (30 males ,25 females) apparently healthy persons as a controls subject to present study. Patients in this study do not suffer from renal dysfunction. Twenty nine of male patients and nineteen of female patients subject to present study suffer from hypertension. Also, fifteen male patients and eight of female patients are smokers.

The mean age of male patients were (50.65 ± 19.15 years) and (51.14 ± 10.88 years) for female patients, whereas those of healthy persons were (51.22 ± 11.53 years) for males and (50.27 ± 13.21 years) for females.

Determination of blood TC, TG, HDL-cholesterol was determined using commercially available kits (Biomagreb kit, Morocco).

VLDL-cholesterol was determined using the following formula:[20]

VLDL-cholesterol = TG / 5

LDL-cholesterol was determined using the following equation:

TC = HDL-cholesterol + VLDL-cholesterol + LDL-cholesterol (fasting)

Risk index of lipid profile was determined by dividing TC/ LDL – cholesterol.

UA was determined enzymatically using Biomaghreb kit (Morocco). In which UA is oxidized by uricase to allantoine and H_2O_2, the later react with 4-aminophenazone in

presence of peroxydase to form colored quinoneimine.

Cr was determined using Spinreact kit (Spain), depending upon Jaffe's method. According to Jaffe's method, Cr in basic picrate solution forms a colored complex, which was measured colorimetrically.

Statistical Analysis

All values were expressed as mean ± standard deviation (SD). Student's t-test was used to estimate differences between the groups and differences were considered significant when the probability was ($p < 0.05$).

Results

Serum total cholesterol, HDL-cholesterol,LDL- cholesterol, VLDL-cholesterol, TG, the risk factor of CVD, Cr and UA of patients with AMI and healthy controls subject to present study are listed in Table 1

Table 1: Serum lipid profile, Cr and UA of patients with AMI and healthy controls.

	Female							Male						
	Control			AMI				Control			AMI			
	Mean	SD	No	Mean	SD	No	Sign.	Mean	SD	No	Mean	SD	No	Sign.
Total cholesterol (mg/dL)	179.2	19.7	25	214	20.66	50	S	185.2	30.42	30	219	28.93	51	S
HDL-cholesterol (mg/dL)	41.13	1.55		40.46	3.45		S	40.5	2.09		34.7	4.3		S
VLDL-cholesterol (mg/dL)	31.56	15.26		39.56	13.88		S	31.6	10.05		36.25	9.4		S
LDL- cholesterol (mg/dL)	98.51	14.27		156.95	27.6		S	108	28.93		159.57	24.21		S
Risk index	4.35			6.03			S	4.57			6.31			S
Triacylglycerol (mg/dL)	157.8	76.32		177.8	69.4		S	158	50.26		181.29	47.22		S
Creatinine (mg/dL)	0.674	0.08		1.64	0.41		S	0.736	0.125		1.86	0.68		S
Uric acid (mg/dL)	5.11	0.507		6.61	1.34		S	5.28	0.55		6.88	1.49		S

S = Significant

As shown in Table 1 total cholesterol , VLDL- cholesterol, LDL-cholesterol and TG of patient with AMI in both gander found to be significantly increased when compared with healthy controls.

HDL- cholesterol of patients with AMI found to be decreased when compared with healthy controls. Thus, risk index of lipid profile for CVD of patients with AMI was significantly increased when compared with healthy controls.

On the other hand, serum Cr and serum UA found to be significantly increased when compared with healthy controls.

The correlations between serum UA and serum Cr were studied by plotting them against LDL-cholesterol and show positive association in patients with AMI, but this association was not significant, as shown in Figures 1,2,3, and 4.

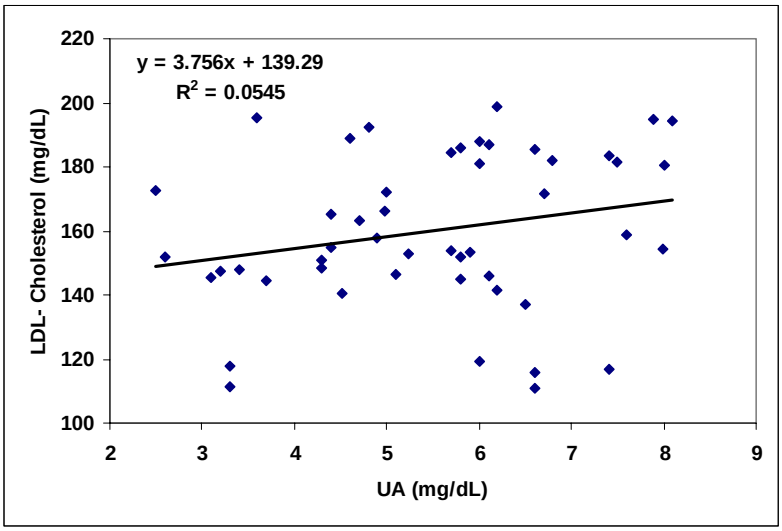

Figure 1 The association between serum UA and LDL-cholesterol in male patients with AMI

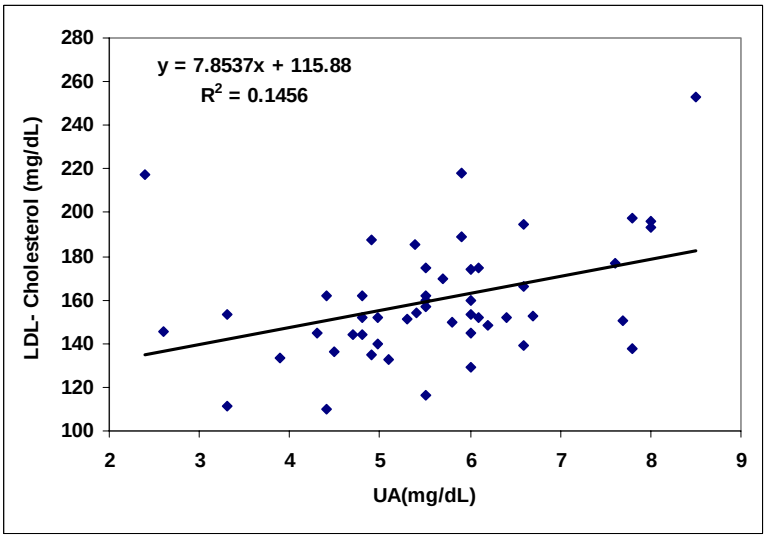

Figure 2 The association between serum UA and LDL-cholesterol in female patients with AMI

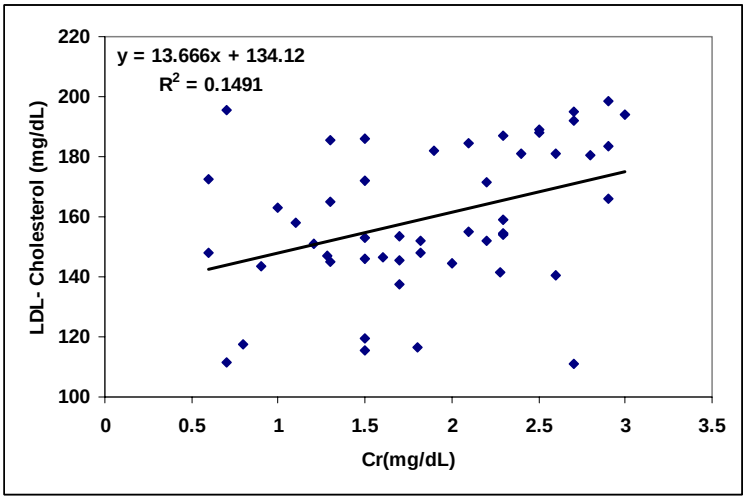

Figure 3 The association between serum Cr and LDL-cholesterol in male patients with AMI

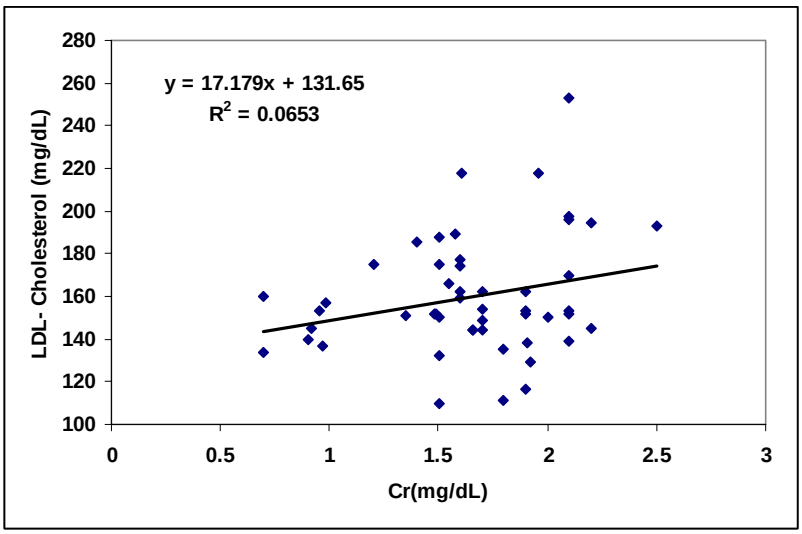

Figure 4 The association between serum Cr and LDL-cholesterol in female patients with AMI

Discussion

Current Canadian guidelines and many other countries to estimate the risk of vascular disease attributable to serum lipid concentrations require measurement of total cholesterol, triglycerides, and HDL cholesterol, as well as calculation of LDL cholesterol and the total cholesterol/HDL cholesterol ratio [(21)]. The actual decision of whether therapy is necessary is determined on the basis of these values, as well as the presence of other risk factors such as age, sex, increased blood pressure, and whether there is evidence of coronary disease or diabetes. Necessarily, a considerable amount of information must be integrated to reach an appropriate decision. If treatment is decided, current practice is to measure or calculate all five lipid indices on each of the return visits. Again this information must be integrated to

determine whether the therapy used has achieved the desired targets.[22]

From this point, researchers always seek about new risk index for CVD to aid in the diagnosis and disease management.

Uric acid is one of the major endogenous water-soluble antioxidants of the body.[23] There is accumulating evidence that increased oxidative stress is closely related to diabetes and its vascular complications.[24] Thus, high circulating uric acid levels may be an indicator that the body is trying to protect itself from the deleterious effects of free radicals by increasing the products of endogenous antioxidants. Interestingly, uric acid prevents oxidative modification of endothelial enzymes and preserves the ability of endothelium to mediate vascular dilatation facing oxidative stress.[23] There is also some evidence that uric acid may have a direct role in the atherosclerotic process, because human atherosclerotic plaque contains more uric acid than do control arteries.[25]

Creatinine is a breakdown product of creatine phosphate (substrate of CK) in muscle, and is usually produced at a fairly constant rate by the body (depending on muscle mass).[26]

This may explain why elevation in serum creatinine occurred in patients with AMI in the presence of high levels of CK (one of most known serum markers of AMI) due to infarct cardiac muscle.[4, 27]

In population-based study carried out in Finland, in which the cardiovascular risk factors were determined in patients with non insulin dependant diabetes mellitus (NIDDM), In this study, men with high uric acid level had higher levels of serum creatinine and total triglycerides and lower levels of HDL cholesterol, and plasma glucose than men with low levels. Whereas, women with high uric acid levels had higher serum Cr and TG levels as well as lower LDL-cholesterol, and plasma glucose levels than those with low uric acid levels [28]

In this study the correlations between serum UA and serum Cr with LDL-cholesterol show positive association in patients with AMI, as shown in Figures 1,2,3, and 4, i.e. when UA or Cr elevated LDL-cholesterol increase too and vise versa.

In conclusion the result of present study supports previous studies and gives rise to the hypothesis that serum Cr and serum UA may be predictors of mortality for CVD, and may be used to screen the improvement of patients with AMI .

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