Determination of Some Biochemical Marker Levels in Serum of Patients with Congestive Heart Failure, Angina Pectorisand Myocardial Infarction

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ABSTRACT

The study enrolled a total of 33 patients with congestive heart failure, angina pectoris and myocardial infarction for evaluation of the activity of enzymes, creatine kinase, and aspartate transaminase, concentrations of calcium, cholesterol, and triglyceride and they were compared with 16 normal healthy human. .This study involved three groups of patients a first one consisted of 9 patients with congestive heart failure. Second group of 9 patients with angina pectoris with chest pain. Third group consisted of 15 patients with myocardial infarction. They were obtained from Ibn-Al-Bay tar hospital and Ibn-Al-Nafess for cardiac care unit of Baghdad. They were investigated for enzymes activity and concentration of calcium, cholesterol, and triglyceride.

There was very highly significant increase in the activities of creatine kinase, aspartate transaminase ($P< 0.001$) with different heart diseases when compared with normal healthy subjects. The result demonstrated a statistically significant decrease in the concentration of calcium ($P< 0.001$) and significant increase in concentration of Cholesterol and triglyceride when compared with normal healthy subjects with different heart diseases ($P< 0.001$).

Keywords: creatine kinase, myocardial infarction, angina pectoris, congestive heart failure, cholesterol.

تحديد مستوى بعض المؤشرات الكيموحيوية في مصل مرضى عجز القلب الاحتقاني والذبحة الصدرية والجلطة القلبية

الخلاصة

شملت الدراسة 33عينة من امصال المرضى المصابين بـــأمراض احتقـــان القلـــب والذبحـــة الصدرية والجلطة القلبية وتم تقدير فعالية انزيمـــات الكريـــاتين كاينيزواسبارتيتترانســـامينبزوتراكيز الكالسيوم والكوليسترول والشحوم الثلاثية لهؤلاء المرضى وتمت مقارنتهم مع16 عينة منالأشـــخاص الاصحاء.

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تضمنت الدراسة ثلاث مجاميع من المرضى المصابين بأمراض القلب، شملت المجموعة الاولى تسعة اشخاص من المرضى المصابين بأمراض احتقان القلب ، المجموعة الثانية المرضى المصابين بأمراض الذبحة الصدرية وكان عددهم تسعة والمجموعة الثالثة كانت لخمسة عشر عينة من المرضى المصابين بأمراض الجلطة القلبية. تم جمع العينات للمرضى الراقدين في مستشفى ابن البيطار ومستشفى ابن النفيس/ وحدة العناية المركزة لأمراض القلب في بغداد وتم تقدير فعاليةالانزيمات كرياتين كاينيزوالاسبارتيتترانساميناز لهذه العينات وتراكيز الكالسيوم والكولسترول والشحوم الثلاثية . بينت النتائج ارتفاع احصائي ملحوظلفعالية انزيمات الكرياينكاينيزوالاسبارتيتترانساميناز $P<0.001$في كلحالاتامراض القلب المختلفة عند مقارنتها بالأشخاص الاصحاء، كما اوضحت النتائجوجود نقصان معنويملحوظفيمستوى الكالسيوم $P<0.001$ وارتفاع في تراكيز الكولسترول والشحوم الثلاثية $P<0.001$عند مقارنتها بالأشخاص الاصحاء لكل حالات امراض القلب

INTRODUCTION

Heart disease has become a major health hazard in middle life and in old age. Myocardial infarction, it is a heart disease, usually leads to a number of complications resulting in a decreased cardiovascular functional ability [1]. Acute myocardial infarction (AMI), more commonly known as a heart attack,which is a medical condition that occurs when the blood supply to a part of the heart is interrupted most commonly due to plaque. Plaque is buildup in the coronary arteries, it is a material composed mainly of lipid, cholesterol and calcium[2,3].The resulting ischemia diseases causes damage and potential death of heart muscle, atherosclerotic coronary heart disease, congestive heart failure andangina pectoris of acute chest pain and myocardial infarction[3,4].

Creatine kinase (CK) also known as creatinephosphokinase (CPK) is an enzyme (EC 2.7.3.2) expressed by various tissue and cell types. CK is important enzyme in tissue cell that consumes ATP rapidly, especially a skeletal and cardiac muscle. It catalyzes the conversion of creatine to create phosphocreatine and consumes adenosine triphosphate (ATP) and adenosine diphosphate (ADP) [5,6]. It is distributed in variousorgans; the highest activities in decreasing order are skeletal and heart muscle, brain, retina,hair cell of the inner ear, spermatozoa and smooth muscle, nervous systems,[7,8].

Elevation of CK is an indication of damage to muscle of heart. It is therefore indicative of injury, myositis,myocardial infarction, myocarditis ,malignant, hyperthyroidism, ,hyperthermia, muscular dystrophy, after surgery, after moderately sever exercise and in patient with hypothyroidism and patients with severehypokalemia due to changes induced

in skeletal muscle. [7,8,9]. Intermediate level of CK are found in brain, brown adipose tissue, seminal vesicles fluids, endothelial cells and macrophages and only low level found in lung, spleen, blood cell and serum[7,8,9].

Aspartate transaminase(AST) orglutamic oxaloacetic transaminase (GOT) is widely distributed in heart tissues and skeletal muscles, red blood cells, and kidneys. It is less specific for liver diseases. Theaminotransferase catalyze the reversible transformation of α – ketoacids into amino acids [10].

Calcium is essential for heart muscle contraction nerve impulse, blood cholesterol levels. Increasing calcium may normalize heart arrhythmia sufferers [11].

The goal of the present study aimedat evaluation of the activities of enzymes creatine kinase, aspartate transaminase and concentration of blood calcium, cholesterol and triglyceride inpatientswith different heart diseases, congestive heart failure, angina pectoris and myocardial infarction.

MATERIALS AND METHODS

This study included a number of 33 patients with different heart diseases,they were divided into three pathological groups. The first group was of 9 patients with congestive heart failure comprised of 4 males and 5females with (M± SD) ages for both sexes (54.5±8.4) years. The second group consisted of 9 patients with angina pectoris of 5 males and 4 females with (M± SD) ages for both sexes (51.0±11.7) years. The third group of 15 patients with myocardial infarction of 8 males and 7 females with (M± SD) ages for both sexes (60.13±9.95) years. They were obtained fromIbn-Al-Baytar hospital and Ibn-Al-Nafessform cardiac care unit in Baghdad. The patients will receive a number of diagnostic tests, such as electrocardiogram (ECG), a chest X-ray and blood tests for detecting heart muscle damage. Normal healthy subjects were 16 and consisted of 8 males and 8 females with (M± SD) ages for both sexes (54.37±9.68) years. Normal subjects were obtained from routine clinical work of different hospitals of Baghdad and they were assessed by blood test and clinical examination.

Five milliliter of venous Blood samples were collected from each subject by evacuated tubes without any anticoagulant for the biochemical assessment. The serum wasseparated immediately after centrifugation at 10000 rpm for ten minutes ,refrigerated and stored at $4C^{o}$ until time of analysis within12 hours of collection. All patients groups have been identified through appropriate history and physical examination and selected laboratory test.

ASSAY METHOD

All the samples of patient and normal subjects were investigated for the enzymes activity of creatine kinase, aspartate oxaloacetic acid transaminase and for concentration of calcium, cholesterol and triglyceride.

Creatine kinase activity was measured at 30°C by spectrophotometer using kit method CK-NAC IFCC single vial reagent for quantitative determination of CK activity in human serum, Biolabo SA Reagents, mazing France [12].

GOT measured by kit method, GOT color linear chemical SL, Reitman-Frankel colorimetric method [13].Calcium concentration measured by colorimetric method using kit reagent Randox[14].Total cholesterol determined in serum by enzymatic colorimetric method using kit cholesterol MR CE linear chemical SL [15].Triglyceride was measured by using kit CE triglyceride GPO-POD Enzymatic colorimetric method (Spinreact S.A.U.) [16].

STATISTICAL ANALYSIS

Statistical analyses selected were mean and standard (M±SD), coefficient of Variation (CV) and unpaired student's test [17].

RESULTS

A total number of 33 patients of different heart disease were included in this study; the results were illustrated in tables 1 to5. They wereinclude17 males and 16 females and compared with 16 normal healthy individuals 8 males and 8 females.

Table (1) shows the activities of CK and GOT and calcium concentration in serum of normal individual subjects.

Tables (2,3,4) demonstrate the content of enzymes CK and GOT activities and calcium concentration in serum of patients with congestive heart failure, angina pectoris and myocardial infarction respectively.

The results for the enzyme activities of CK and GOT show very highly significant increases in comparison with normal subjects ($P< 0.001$) for the different pathological states of heart.

There was statistically very highly significant decrease in concentration of calcium ($P< 0.001$), with congestive heart failure, angina pectoris and myocardial infarction.

It was demonstrated in table 5that there was a statistically significant increase in concentration of cholesterol and triglyceride in comparison with normal subjects ($P< 0.001$).

DISCUSSION

Heart attack is the leading cause of death for both men and women all over the world. According to the world health organization, the diagnosis of

acute myocardial infarction requires the history of characteristic chest pain and changes of electrocardiogram and elevation of cardiac enzyme [2,3,18]. Heart tissue injury may release cardiac enzymes into the circulation and

elevate serum enzyme levels. Determination of cardiac enzymes is most frequently required for confirmation of suspected myocardial infarction.

Diagnosis required knowledge of enzyme change produced by other cardiac disease and pulmonary causes of chest pain [19,20]. Result in table 1 shows that creatine kinase activity was higher for males than females, since creatine kinase rise effected by age and others factors. The serum creatine kinase level in healthy individuals depends on age ,lean body mass and physical activity, some common causes of elevated CK in the serum is strenuous exercise, intramuscular injections and myocardium infarction[19 ,20].Creatine kinase is a muscle enzyme that is elevated in the blood following some kind of muscle damage, and it is associated with a variety of diseases, disturbance of CK system have been observed in muscle ,brain, cardiac and renal diseases as well as in cancer ,on other hand they were found to have antitumor ,antiviral and antidiabetic effect and to protect tissues from hypoxia ,ischemic, neurodegenerative or muscle damage [7 ,20].

The results in tables (2,3,4) demonstrate a remarkable significant difference in serum CK and GOT activities for patients with congestive heart failure, angina pectoris and myocardial infarction in comparison with control subjects. The raised values for the activities of CK were 7.2, 5.1, 4.5 and for GOT were 6.6, 4.8, 4.0 times the upper normal limit with congestive heart failure, angina pectoris and myocardial infarction respectively . In the present study, it was observed that in patients with prolonged cardiac pain but without other clinical or electrocardiography evidence of infarction, there was increasing in serum CK and GOT activities. The activities was due to releasing of enzymes into blood by necrosis of heart muscle after acute myocardial infarction, rate of releasing of enzyme depending on their intracellular location and molecular weight ,the local blood and lymphatic flow. The present results are in agreement with the references [9,21] , elevation of CK is an indication of damage mainly to plasma membrane of cardiac muscle in all pathological cases of heart failure. It was concluded that the congestive heart failure allow a patient to high risk of myocardial infarction.

Maximal plasma CK values are often used as enzymatic test in acute myocardial infarction. The cardiovascular functional ability is a reliable parameter, which may define the lesion of the cardiovascular system following myocardial infarction [21]. It has been observed that higher concentration of CK isoenzyme (MBCK) in heart muscle result from ischemic stress,and it has been found to be significantly higher in heart muscles of human myocardium with coronary artery disease, aortic stenosis or heart failure compared to normal [22].

Elevation of serum GOT in all pathological case was observed, a patients with congestive heart failure were show very highly significant increase in GOT (P< 0.001), and also a remarkable change was observed *in* case of angina pectoris and myocardial infarction (P< 0.001) .

Calcium supplements can be useful in congestive heart failure as they increase the contractility of heart muscle. In myocardial cells the activity of the slow calcium channels is regulated by number of mechanism including cyclic nucleotide level, the ATP level and PH [23]. There was significantly a considerable decrease in calcium concentration in all states of patients with congestive heart failure, angina pectoris and myocardial infarction in comparison with normal, tables (2,3 ,4) this may impair ability to deliver ATP to energy consuming system.

It is illustrated from table 5 that is very highly significant increase in concentration of cholesterol and triglyceride with congestive heart failure, angina pectoris and myocardial infarction as compared with normal subjects (P< 0.001). Both hypercholesterolemia [3] and hypertriglyceridemia [23] lead to angina pectoris due to chest pain and ischemia of heart muscle due to obstruction of coronary arteries; they are a risk factors for heart diseases [23,24]. The elevation of blood cholesterol level play important role in the pathogenesis of atherosclerosis, due to precipitation of it on the vascular walls leading to an increase in the shear stress on the vessels, decreasing the lumen size and increase in the vascular resistance[3,24].The state of oxidative stress is considered as one of the important mechanism in the pathogenesis of ischemic heart diseases and play role in the pathogenesis of coronary artery diseases. Some people that takestatins for medications, which are commonly used todecrease serum cholesterol levels, may be associated with elevation of CPK level because statins can cause muscle cell death [3,23,24].

Sodium and potassium have been investigated in the present study for a groups of patients when compared with normal, it was observed that there was no significant difference in congestive heart failure , but there remarkable difference in case of angina pectoris and myocardial infarction .

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Table (1) The activities of creatine kinase, glutamic oxaloacetic transaminase and calcium concentration in serum of normal individual group for both sexes.

Sex & No. of cases	M ± SD			
	Age (year)	CK activity U/L	GOT activity U/L	Serum Calcium mmol/L
Male (8)	50.9±10.84 CV*=21.3%	87.60±17.50 CV=19.40 %	22.12±4.34 CV=19.60%	2.18±0.18 CV=8.25%
Female(8)	57.9±7.43 CV=12.83% t*=1.50 N.S	65.30±12.0 CV=18.37 % t*=2.98 P< 0.02	19.0±5.15 CV=27.10% t=1.315 N.S	3.13±0.16 CV=7.51% t=0.58 N.S
Total (16)	54.37±9.89 CV=17.80%	76.45±14.8 CV=19.35	20.56±4.88 CV=23.73%	2.15±0.17 CV=7.9%

CV*= Coefficient of Variation.

t*= Comparison between both sexes.

Table (2) the content of enzyme CK & GOT activities and calcium concentration in serum of patients with congestive heart failure.

Sex & No. of cases	M ± SD			
	Age (year)	CK activity U/L	GOT activity U/L	Serum Calcium mmol/L
Male (4)	56.2±6.29 CV=11.19 %	519.75±58.49 CV=11.25 %	117.25±50.54 CV=43.12%	0.685±0.078 CV=11.38%
Female(5)	53±10.41 CV=19.64 % t*=0.487 N.S	570.2±41.47 CV=7.27% t*=1.52 N.S	150.2±46.37 CV=30.87% t*=1.02 N.S	0.592±0.075 CV=12.66% t*=1.81 N.S
Total (9)	54.5±8.4 CV=15.41 %	547.8±53.38 CV=9.74% t**=33.6 P< 0.001	135.5±48.31 CV=35.65% t**=9.59 P< 0.001	0.633±0.086 CV=13.58% t**=24.9 P< 0.001

t*= Comparison between both sexes.

t**= Comparison between patients and normal healthy individual.

Table (3) the content of enzyme CK & GOT activities and calcium concentration in serum of patients with Angina pectoris.

Sex & No. of cases	M ± SD			
	Age (year)	CK activity U/L	GOT activity U/L	Serum Calcium mmol/L
Male (5)	49.0±12.72 CV=25.95%	379.0±37.46 CV=9.88%	94.9±34.94 CV=36.81 %	0.58±0.062 CV=10.68 %
Female(4)	53.5±11.68 CV=21.83% t*=0.546 N.S	403.5±55.76 CV=13.81% t*=0.79 N.S	102.75±28.44 CV=27.67 % t*=0.362 N.S	0.622±0.049 CV=7.87% t*=1.04 N.S
Total (9)	51±11.71 CV=22.96% t**=0.77 N.S	389.9±45.10 CV=11.56% t**=25.80 P< 0.001	98.12±30.55 CV=31.13 % t**=10.09 P< 0.001	0.599±0.054 CV=9.01% t**=26.74 P< 0.001

t*= Comparison between both sexes.

t**= Comparison between patients and normal population group.

Table (4) the content of enzyme CK and GOT activities, and calcium concentration in serum of patients with myocardial infarction.

Sex & No. of cases	M ± SD			
	Age (year)	CK activity U/L	GOT activity U/L	Serum Calcium mmol/L
Male (8)	60.37±11.23 CV=18.60%	329±90.72 CV=27.57%	70.12±19.15 CV=27.31%	0.685±0.119 CV=17.37%
Female(7)	59.85±9.15 CV=15.28% t*=0.097 N.S	351.71±92.95 CV=26.42% t*=0.478 N.S	98.57±55.37 CV=56.17% t*=1.369 N.S	0.617±0.081 CV=13.128% t*=1.27 N.S
Total (15)	60.13±9.95 CV=16.54% t**=1.63 N.S	339.6±89.19 CV=26.26% t**=11.64 P< 0.001	83.4±41.39 CV=49.62% t**=6.03 P< 0.001	0.654±0.105 CV=16.05% t**=29.24 P< 0.001

t*= Comparison between both sexes.
t**= Comparison between patients and normal population group.

Table (5) Mean + SD values of serum total cholesterol and triglyceride concentrations in patients with different heart diseases.

	Normal	Pathological state		
Parameter	N=16	Congestive heart failure N=9	Angina pectoris N=9	Myocardial infraction N=15
Cholesterol mmol/L	4.40±1.0 CV=22.72%	6.1±1.2 CV=19.7% t=4.09 P< 0.001	5.7±0.86 CV=11.92% t=3.87 P< 0.001	7.2±0.90 CV=12.5% t=8.014 P< 0.001
Triglyceride mmol/L	1.8±0.36 CV=20%	3.9±0.69 CV=17.69% t=10.5 P< 0.001	4.2±0.52 CV=12.38% t=14.45 P< 0.001	3.47±0.60 CV=17.29% t=9.38 P< 0.001

t = Comparison between patients and normal population group.