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Research Article

Transaminase and Creatinine Predict Diastolic and Systolic Dysfunction in Patients with Myocardial Infarction

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ABSTRACT

Background: Acute myocardial infarction occurs due to coronary artery blockage usually caused by atherosclerotic clot or spasm of the arteries. Aspartate transaminase (AST or GOT) is found in the liver, heart (cardiac muscle), skeletal muscle, kidneys, brain, and red blood. Alanine aminotransferase cells (ALT or GPT) is mainly distributed in the liver, and increased serum ALT is a marker of liver injury. Creatinine is a breakdown product of creatine phosphate in muscle, and is usually produced at a fairly constant rate by the body (depending on muscle mass). Objectives: This study aimed to explore the level and relationship of serum alanine aminotransferase [ALT], aspartate aminotransferase [AST] and creatinine with different risk factors, systolic dysfunction, Diastolic dysfunction and Mitral Regurgitation in myocardial infarction. Patients and methods: A total of 90 patients were recruited and 20 healthy person as controls group. Initial coronary echocardiography was performed to evaluate the severity of coronary lesions, Serum GOT,GPT,Creatinine, glucose, lipid profile was done (within 24 h from admition) by colorimetric method in all patients group and control group. Estimation of Logistic regression analysis was employed for the evaluation of clinical characteristics and biochemical parameters, aiming to explore the relationship between biochemicals and CHD. Results: This study included 90 patients with mean±SD of age was (66.88±13.55) years, and (44.33±9.79) years for healthy control group, The patients with AMI were found to have significantly higher mean (± SD) value of serum GOT, GPT, and creatinine concentrations as compared with control group. The mean(± SD) of serum GOT concentrations was found significantly higher in the Stage 1 than Stage 2 of Diastolic dysfunction (P-value≤ 0.05),while serum GPT concentrations was found non significantly higher in the Stage 2 than Stage1 of Diastolic dysfunction (P-value > 0.05). The serum creatinine concentrations was found significantly higher in the Stage 2 than Stage1 of Diastolic dysfunction (P-value≤ 0.001). The mean(± SD) of serum GOT concentrations was found significantly higher in the absence of mitral regurgitation (MR) (P-value≤ 0.05),while serum GPT concentrations was found non significantly higher in the presence of MR (P-value> 0.05).There was highly significant difference in mean(± SD) of serum creatinine concentrations in the presence of MR (P-value ≤ 0.001). Conclusions: Serum GPT, GOT, creatinine concentrations Predict early left ventricular ejection dysfunction. The serum creatinine concentrations and serum GPT concentrations was Predict early Diastolic dysfunction and Mitral Regurgitation in patients with myocardial infarction, there was non-significant changes in the serum concentrations of GOT, GPT and creatinine concentrations in the presence or absence of risk factor (Diabetes mellitus, Dyslipidemia, Hypertension, , Obesity, Smoking), fibrinolysis treatment (Actilyse) and types of MI.

Keywords: Transaminase, Creatinine, myocardial infarction.

INTRODUCTION

Acute coronary syndrome usually occurs as a result of one of three problems: ST elevation myocardial infarction non ST elevation myocardial infarction, or unstable angina[1]. These types are named according to the appearance of the electrocardiogram (ECG/EKG) as non-ST segment elevation myocardial infarction (NSTEMI) and ST segment elevation myocardial infarction (STEMI)[2].

Acute myocardial infarction occurs due to coronary artery blockage usually caused by atherosclerotic clot or spasm of the arteries[3,4,5]. Coronary artery occlusion interrupts the coronary blood supply needed to satisfy myocardial demands, leading to oxygen and nutrient deprivation of the heart, eventually destroying cardiac tissue[6].

CHD is a disease caused by different risk factors at distinct levels, of which type 2 diabetes, dyslipidemia, obesity and smoking are known important risk factors of CHD[5,6] , poor diet, and excessive alcohol intake, among others[7,8].

Aspartate transaminase (AST) or aspartate aminotransferase, also known as AspAT/ASAT/AAT or serum glutamic oxaloacetic transaminase (SGOT), is a pyridoxal phosphate (PLP)-dependent transaminase enzyme AST catalyzes the reversible transfer of an α-amino group between aspartate and glutamate and, as such, is an important enzyme in amino acid metabolism[9-

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[12]. AST is found in the liver, heart (cardiac muscle), skeletal muscle, kidneys, brain, and red blood cells[13]. AST may be elevated also in diseases affecting other organs, such as myocardial infarction, acute pancreatitis, acute hemolytic anemia, severe burns, acute renal disease, musculoskeletal diseases, and trauma[14].

ALT is mainly distributed in the liver, and increased serum ALT is a marker of liver injury. The increase in serum ALT is mainly ascribed to disordered glucose metabolism and related nonalcoholic fatty liver disease (NAFLD) beside viral hepatitis and excessive drinking[15].

Creatinine is a breakdown product of creatine phosphate in muscle, and is usually produced at a fairly constant rate by the body (depending on muscle mass)[16].

Serum creatinine is the most commonly used indicator (but not direct measure) of renal function. Elevated creatinine is not always representative of a true reduction in GFR. A high reading may be due to increased production of creatinine not due to decreased kidney function, to interference with the assay, or to decreased tubular secretion of creatinine[17].

Reduced renal function may also play a role in reduced drug clearance, indicating the need for downward adjustment of doses of medications frequently used in the treatment of ACS, such as low-molecular-weight heparin (LMWH) or the small molecule GP IIb/IIIa blockers eptifibatide and tirofiban[18].

Echocardiography uses ultrasound beams reflected by cardiovascular structures to produce characteristic lines or shapes caused by normal or altered cardiac anatomy in one, two, or three dimensions by M (motion)–mode, two-dimensional, or three-dimensional echocardiography, respectively[19].

PATIENTS AND METHODS

A total of 90 patients were recruited, and 20 healthy person as controls group. patients with MI admitted from January 2016 to December 2017 in Baghdad Teaching hospital were recruited in the prospective, observational study. ECGs was performed upon hospital admission. Each tracing was evaluated by two cardiologists for the presence or absence of acute ischemic changes based on the presence or absence of (1) ST-segment depression 0.5 mm and ST segment elevation of ≥ 0·1 mV in 1 of the limb leads or ≥ 0.2 mV in ≥ 2 of the chest leads (2) T wave changes, the patients were divided into two groups according to type of ST segment in MI (STEMI & NON STEMI). The patients were also subdivided into two groups according to Gender (male & female).

Data on patient characteristics were acquired, written informed consent was obtained from all patients before inclusion into the study. The Ethics Committee of the hospital approved this study.

The echocardiographic recordings were analyzed with dedicated software (Echopac, GE Vingmed

Ultrasound). Left ventricular ejection fraction (LVEF) was assessed by Simpson's method from the grayscale digital recordings.

Blood samples were taken from a peripheral vein and immediately analyzed at our central laboratory. *Serum Preparation.* Blood samples (3mL) were collected in dry test tubes and allowed to coagulate at an ambient temperature for 30min. Serum was separated by centrifugation at 2000 rpm for 10min.

Serum Biochemical Parameters. The collected serum was used for determination of cardiac marker enzymes aspartate transaminase (AST), and alanine transaminase (ALT), Serum was also used for the estimation of creatinine, total cholesterol (TC) and triglycerides (TG) using commercially available standard assay kits (Standbio Laboratory, Boerne, TX, USA). Glucose level was measured by using enzymatic colorimetric method.

Body mass index (BMI) was calculated as weight (kg) divided by height (m) squared. Prevalent diabetes was defined as a fasting serum glucose .126 mg/dl or current use of any diabetes medication. Prevalent hypertension was defined as seated diastolic blood pressure .90 mmHg, systolic blood pressure .140 mmHg or use of anti-hypertensive drugs, dyslipidemia was defined as atherogenic index > 3.2. Current smokers were defined as self-reported regular smoking.

Statistical analysis

Statistical analysis was performed using SPSS Statistics 20. Continuous data are expressed as mean ± standard deviation (SD). Pearson's or Spearman's rank correlation coefficients were calculated. Differences in continuous variables between groups were calculated by Student's t-test, if ND. Otherwise, Mann-Whitney U test. p-values ≤ 0.05 were considered statistically significant.

RESULTS

This study included 90 patients with mean±SD of age was (66.88±13.55) years, and (44.33±9.79) years for healthy control group, the mean value of patients age with AMI was significantly higher when compared with the mean value of healthy control age ($p \leq 0.05$), as shown in (table 1).

The patients with AMI were found to have significantly higher mean (± SD) values of serum GOT, GPT, and creatinine concentrations as compared with mean (± SD) values of serum control group.

The table (2) shows effect of gender, risk factor and fibrinolysis treatment (Actilyse) and type of MI (NSTEMI, STEMI) on serum biochemicals level in patients with myocardial infarction (MI).

The study patients divided into Male (n = 60) and Female (No. = 30) groups, the mean(± SD) value of serum GOT concentrations was found significantly higher in Male group than Female group, (P-value=0.03), there were non significant difference in mean(± SD) value of serum GPT, creatinine concentration between two groups(P-value >0.05).

The mean(± SD) value of serum GOT concentrations was found significantly higher in non diabetic patients than diabetic patients, (P-value≤ 0.001), there were non significant difference in mean(± SD) value of serum GPT, creatinine concentration between two groups(P-value >0.05).

The mean(± SD) value of serum GOT concentrations was found significantly higher in non dyslipidemic patients

Table 1: The mean ±SD of biochemical variable in patients with myocardial infarction (MI) and Control group.

Group	Number of subjects (n)	Mean ±SD of age	Mean ±SD of serum GOT(IU/L)	Mean ±SD of serum GPT(IU/L)	Mean ±SD of serum Creatinine
patients	90	66.88±13.55	98.77±96.75	47.11± 24.43	1.94±2.20
Control	20	44.33±9.79	11.00±2.73	11.00± 2.73	0.53±0.15
P-Value		0.005**	0.028*	0.003**	0.08*

Results expressed as Mean (± SD). * (P≤0.05) ** (P≤0.01), *** (P≤0.001)

Table 2: Effect of gender, risk factor and fibrinolysis treatment (Actilyse) on serum biochemicals level in patients with myocardial infarction (MI):

Factors	No.	Mean± SD of serum GOT (IU/L)	P-Value	Mean± SD of serum GPT (IU/L)	P-Value	Mean± SD of serum creatinine (mg/dl)	P-Value
Gender							
Male	60	122.83± 45.54	0.03	58.16±9.10	0.1	1.33±1.1021.	0.25
female	30	50.66 ±45.54	S	25.00±3.78	NS	33± 0.35	NS
Diabetes mellitus							
NO							
YES	40	152.5±64.68	0.0001	39.00±8.18	0.09	1.12±.29	0.11
	50	55.80±13.96	HS	53.60±13.22	NS	2.60±1.28	NS
Dyslipidemia							
NO	80	100.0±36.54	0.001	41.25±6.41	0.001	1.22±0.17	0.18
YES	10	89.0±10	HS	94.00±0.0	HS	7.70±O.O	NS
Hypertension							
NO	20	154.50±109.50	0.26	43.00±9.0	0.24	0.80±.00	0.27
YES	70	82.85±31.97	NS	48.28±10.430	NS	2.27±0.92	NS
Obesity							
NO	60	91.66±36.13	0.318	42.50±11.28	0.46	2.21±1.11	0.22
YES	30	113.00±76.17	NS	56.33±9.76	NS	1.40±0.26	NS
Smoking							
NO	60	52.33±11.89	0.004	40.83±11.12	0.5	2.38±2.651.0	0.21
YES	30	191.66±72.83	HS	59.66±7.66	NS	6±0.37	NS
Actilyse							
NO	70	116.57±39.27	0.078	36.33±10.38	0.17	2.12±0.94	0.44
YES	20	36.50±8.50	NS	44.20±4.00	NS	1.3± .50	NS

Results expressed as Mean (± SD). NS: Non-significant (p >0.05); (ANOVA) Mean was significantly different at p ≤ 0.05 at 95% confidence limit. HS: Highly significant (p≤0.001).

than dyslipidemic patients, (P-value≤ 0.001), while serum GpT concentrations was found significantly higher in
dyslipidemic patients than non dyslipidemic patients (P-value≤ 0.001). There was non significant difference in mean(± SD) value of serum creatinine concentration between two groups(P-value >0.05).

The mean(± SD) value of serum GOT concentrations was found significantly higher in smoking patients than non smoking patients, (P-value≤ 0.05), there were non significant difference in mean(± SD) value of serum GPT and creatinine concentration between two groups(P-value >0.05).

The t- test revealed there were non-significant difference in the serum GOT, GPT and creatinine mean ±SD levels in the presence(YES) or absence(NO) of Hypertension, Obesity, fibrinolysis treatment (Actilyse) and types of MI (p > 0.05).

Table (3) shows the mean(±SD) value of serum GOT, GPT, creatinine levels according to diastolic dysfunction stages, 48 patients out of 90 patients have diastolic dysfunction, the mean(± SD) value of serum GOT concentrations was found significantly higher in the Stage 1 than Stage 2 (P-value≤ 0.05),while the mean(±SD) value of serum GPT concentrations was found non significantly higher in the Stage 2 than Stage1 (P-value> 0.05). The serum creatinine concentrations was found significantly higher in the Stage 2 than Stage1 in the (P-value≤ 0.001).

The table (4) shows distribution of serum biochemical level by mitral regurgitations (MR) echocardiographic Finding. The mean(± SD) value of serum GOT concentrations was found significantly higher in the absence of MR (P-value≤ 0.05),while serum GPT concentrations was found non significantly higher in the presence of MR (P-value> 0.05).There was highly

Table 3: The mean(±SD) value of serum biochemical levels according to diastolic dysfunction Stages.

Diastolic dysfunction Stages (DDS)	Number of patients=68	Mean± SD of serum GOT (IU/L)	Mean± SD of serum GPT (IU/L)	Mean± SD of serum creatinine (mgldl)
1	32	122.66±45.61	45±18.30	1± 0.11
2	16	51.00±19.13	51.3±38.85	3.8± 1.93
P-value	----	0.03 S	0.1 NS	0.001 HS

Results expressed as Mean (± SD). NS: Non-significant ($p > 0.05$); (ANOVA) Mean was significantly different at $p \leq 0.05$ at 95% confidence limit. HS: Highly significant ($p \leq 0.001$).

Table 4: Distribution of serum GOT, GPT, creatinine concentrations by mitral regurgitation (MR) echocardiographic Finding.

Mitral regurgitations (MR)severity	Mean± SD of serum GOT (IU/L)	Mean± SD of serum GpT (IU/L)	Mean± SD of serum creatinine (mgldl)
NO	51.00± 19.13	45.00± 7.47	1.0±0.1
Mild	122.66± 45.61	51.33± 22.43	3.8±1.9
P-value	0.03 s	0.1NS	0.001 HS

Results expressed as Mean (± SD) significantly different at $p \leq 0.05$ NS: Non-significant ($p > 0.05$)

Table 5: The correlation (r) of serum biochemical level with age and LVEF% for patients group.

parameters	GOT (IU/L)	GPT (IU/L)	Creatinine (mgldl)
Age (year) (r)	r= 0.5 P= 0.1 NS	r= 0.595 P= 0.09 NS	r= 0.002 P= 0.99 NS
GPT(IU/L)	r= 0.2 P= 0.5 NS	-	r= 0.6 P= 0.04 S
creatinine	r= - 0.1 P= 0.6 NS	-	-
LVEF%	R=-0.2 P=0.5 NS	R=-0.6 P=0.8 NS	R=-0.1 P=0.7 NS

NS: Non-significant ($p > 0.05$).
S: significant ($p \leq 0.05$).

significant difference in mean(± SD) value of serum creatinine in the presence MR (P-value ≤ 0.001).

The study showed that there was non-significant positive correlation between age values and serum GOT, creatinine levels (r = 0.5, 0.002) (P= 0.1, 0.9) respectivly,. However, there was non-significant negative correlation between age values and GPT (r = - 0.59), (P = 0.0 9). A non-significant positive correlation (r = 0.2; p=0.5) was observed between serum GPT and serum GOT level in the patients, a significant positive correlation was observed between serum GPT and serum creatinine level in the patients(r=0.6),(p=0.04).

A non significant negative correlation (r = - 0.1 ; p=0.6) was observed between serum creatinine level and serum GOT in the patients.

Nonsignificant inverse relationship was noted between serum GPT, GOT, creatinine concentrations and left ventricular ejection Fraction (LVEF) (r = -0.6, -0.1, -0.2) (P = 0.8, 0.7, 0.5).

The t-test reveld that there was non significant difference in the mean (± SD) value of serum biochemical markers & age between STEMI group and NSTEMI group (P-value > 0.05), Table(6).

The table (7) show distribution of patients sample according to treatment ,90 patients on Statin, 30 patients on Angiotensin converting enzyme inhibitor (ACEI), 90 patients on Anti PT,90 patients on VD, 20 patients on Insulin, 20 patients on Actilyse, 70 patients on Anticoagulant, 80 patients on B-Blocker.

DISCUSSION

Ageing is a degenerative process where important physiological processes are declined and aged individuals generally suffer cardiovascular dysfunction, diabetes, and neurological disorder[20,21].

The mean±SD of patients age value with AMI was significantly higher when compared with the mean value of healthy control age ($p \leq 0.05$), as shown in (table 1). This result was the same as that of Ibrahim (2007)[22] who found that the mean age for patients with IHD in Erbil was 58 years and this indicated that most of the patients were in their middle age.

The patients with AMI were found to have significantly higher mean (± SD) value of serum GOT, GPT as compared with mean (± SD) value of serum control group.

Injury to heart tissues results in the release of ALT and AST which are present in cardiac muscle and can be found in blood stream[23]. Increased activities of ALT and AST were found due to the leakage of these enzymes as a result of necrosis induced by ISO in rats[24].

Okabe H. Showed that in the presence of myocardial injury or liver injury, mitochondrion related oxidative stress may cause injury to mitochondria, cell necrosis and mitochondrial disintegration and AST is released into blood. Thus, AST may serve as a parameter used to evaluate the extent of liver injury or myocardial injury, therapeutic efficacy, and prognosis of these diseases[25].

ALT is closely related to endothelial dysfunction induced atherosclerosis and inflammation[26].

Table 6: Distribution of biochemical markers & age according to types of myocardial infarction (MI), 1 represent STEMI, 0 represent NSTEMI.

parameters	STEMI	Mean±Std. Deviation	P-value
AGE	.00	75.33±5.03	.086
	1.00	66.20±13.44	NS
GPT	.00	36.33±13.79	0.540
			NS
	1.00	44.20±21.24	
GOT	00	126.66±122.90	0.666
			NS
	1.00	84.00±101.44	
CRE	.00	.93±.23	.086
			NS
	1.00	1.40±.53	

NS: Non-significant (p >0.05).

The patients with AMI were found to have significantly higher mean (± SD) value of serum creatinine concentrations as compared with mean (± SD) value of serum control group.

Cardiovascular diseases are the main cause of death in patients with terminal renal failure; therefore, such diseases are very common in this type of patient. On the other hand, renal failure is a very strong prognostic factor in patients with heart disease and represents a determinant of mortality in the follow-up of those who have undergone coronary artery bypass grafting[27] or a percutaneous coronary intervention[28,29] and those who have suffered an acute myocardial infarction (AMI)[30-37.]

The mean(± SD) value of serum GOT concentrations was found significantly higher in smoker patients than nonsmoker patients, (P-value≤ 0.001), The mean(± SD) value of serum GPT concentrations was found non significantly higher in smoker patients than nonsmoker patients. The mean(± SD) value of serum creatinine concentrations was found non significantly lower in smoker patients than nonsmoker patients (P-value >0.05).

Pannuru Padmavathi et al.[38] were observed enhanced activities of the serum enzymes *viz.*, transaminases (Aspartate Aminotransferase (AST) and Alanine Aminotransferase (ALT)), alkaline phosphatase (ALP), lactate dehydrogenase (LDH) and with no change in *γ*-glutamyl transferase (*γ*GT) . Wannamethee SG1, Shaper AG[39] reported that Cigarette smoking was significantly associated with increased levels of gamma-glutamyl transferase (GGT) and alkaline phosphatase (ALP) (P < 0.0001) and was inversely associated with increased aspartate aminotransferase (AST).

Savdie E et al.[40] showed that Smoking was associated with a decreased serum creatinine concentration as was drinking three or more drinks per day.

The mean(± SD) value of serum GOT was found significantly higher in non-diabetic patients than diabetic patients, (P-value≤ 0.001), while the mean(± SD) value of serum GPT, creatinine concentration were non significantly higher in diabetic patients than non-diabetic patients, (P-value >0.05).

Metabolic syndrome is associated with increased cardiovascular morbidity and mortality. Nonalcoholic fatty liver disease (NAFLD) is closely associated with metabolic syndrome. Kyung Eun Yun et al. findings demonstrate that elevated ALT levels are independently associated with increased CVD- or diabetes-related mortality in Koreans. Thus, elevated ALT levels, as a marker for NAFLD, may serve as a surrogate predictor of CVD- or diabetes-related mortality among the Korean population[41].

Nobuko Harita et al reported that: Lower serum creatinine was associated with an increased risk of type 2 diabetes. Because skeletal muscle is one of the target tissues for insulin, skeletal muscle mass might be associated with type 2 diabetes. Serum creatinine is a possible surrogate marker of skeletal muscle mass[42].

Taken together, our results reveal that the occurrence and development of CHD are related to multiple factors and caused via multiple steps. Classic risk factors of CHD including type 2 diabetes, hypertension, dyslipidemia, history of smoking, and family history of CHD, TG and LDL-C are also confirmed in the present study. Moreover, our results also indicate that AST and ALT are new risk factors of CHD. In addition, serum AST and ALT may serve as independent predictors of CHD and be used for the early diagnosis and prevention of CHD.

Non-significant inverse relationship was observed between left ventricular ejection Fraction (LVEF) and serum GPT, GOT, creatinine concentrations (r = -0.6, -0.1, -0.2) (P = 0.8, 0.7, 0.5). Table (5) There were no previous studies in this section to be relied on for comparison.

Echocardiography can measure several parameters as an expression of systolic function of the heart. These parameters are LVEF, fractional shortening, stroke volume and cardiac index, systolic tissue velocity of the mitral annulus and myocardium, strain, and regional wall motion analysis. Although LVEF has many limitations, including load dependency, it is a strong predictor of clinical outcome in almost all major cardiac conditions, and it is used to select optimal management strategies[43].

LVEF= LVEDV- LVESV/LVEDV

Table (3) showed the mean(±SD) value of serum GOT, GPT, creatinine levels according to diastolic dysfunction stages, The mean(± SD) value of serum GOT concentrations was found significantly higher in the Stage 1 than Stage 2 (P-value≤ 0.05),while serum GPT concentrations was found non significantly higher in the Stage 2 than Stage1 (P-value> 0.05). The serum creatinine concentrations was found significantly higher in the Stage 2 than Stage1 in the (P-value≤ 0.001). There were no previous studies in this section to be relied on for comparison.

Assessment of diastolic function should be an integral part of an evaluation of cardiac function because about 50% of patients with heart failure have preserved LVEF, diastolic dysfunction can be graded according to the diastolic filling pattern.

Grade 1 (mild dysfunction): impaired relaxation with normal filling pressure

Table 7: Descriptive of treatments.

Drugs	Statin	ACEI	Anti PT	VD	Insulin	Actilyse	Anti coagulant	B-Blocker
Patients number	90	30	90	90	20	20	70	80

ACEI=Angiotensin converting enzyme inhibitor
PT = Platelet
VD = Vaso Dilator

Grade 2 (moderate dysfunction): pseudo normalized mitral inflow pattern
Grade 3 (severe reversible dysfunction): reversible restrictive (high filling pressure)
Grade 4 (severe irreversible dysfunction): irreversible restrictive (high filling pressure)[44].
The table (4) shows distribution of serum biochemical level by mitral regurgitation (MR) echocardiographic Finding. The mean(± SD) value of serum GOT concentrations was found significantly higher in the absence of MR (P-value≤ 0.05),while serum GPT concentrations was found non significantly higher in the presence of MR (P-value> 0.05).There was highly significant difference in mean(± SD) value of serum creatinine in the presence MR (P-value ≤ 0.001). There were no previous studies in this section to be relied on for comparison.
ACS may result in varying degrees of ischemic injury and subsequent LV dysfunction. Numerous studies have shown that the degree of LV systolic dysfunction is a major if not the most important determinant of long-term outcome in ACS[45]. Development of MR during ACS may be due to ischemic injury of the papillary muscle apparatus and/or dilation of the left ventricle and has been linked to death and development of heart failure in patients with acute MI independently of LVEF and clinical confounders[46].

CONCLUSIONS

Serum GPT, GOT, creatinine concentrations Predict early left ventricular ejection dysfunction. The serum creatinine concentrations and serum GPT concentrations was Predict early Diastolic dysfunction and Mitral Regurgitation in myocardial infarction. there was non-significant changes in the serum concentrations of GOT, GPT and creatinine in the presence or absence of risk factor (Diabetes mellitus, Dyslipidemia, Hypertension, Obesity, Smoking), fibrinolysis treatment (Actilyse), and types of MI.

ETHICAL CLEARANCE

The Ethics Committee of the hospital approved this study. The study conformed to the guiding principles of the ethics committee of Baghdad University. All patients gave their written informed consent to participate.

SOURCE OF FUNDING

Self.

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