Role of MDA, GGT, TAC in the diagnosis of Patients with Acute Coronary Syndrome

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Abstract

Background: Oxidative stress and free radicals have an important role in developing atherosclerosis which is a cause of acute coronary syndrome. This study was measured serum MDA, GGT and TAC to compare their levels in patients with ACS.

Materials and Methods: To evaluate the levels of MDA, GGT, and TAC we measured patients who admitted to the coronary care unit (CCU). 50 patients with ST-elevation myocardial infarction (STEMI), 50 patients with Non-ST elevation myocardial infarction (NSTEMI), 50 patients with unstable angina (UA) and 50 persons as control healthy group.MDA was determined by spectrophotometer, GGT was measured by the kinetic method and TAC was measured by sandwich ELISA method to quantify their levels.

Results: The current study has shown a significant increase in the serum level of MDA in patients with ACS apart from those with unstable angina when compared to the control group. This increase was so comparable to GGT show a higher significantly increase in NSTEMI compared to STEMI and UA. Among these groups, there was a significant difference when compared to the control group. While TAC hasn't shown significant differences in STEMI, NSTEMI, and UA when compared to the control group.

Conclusion: Both GGT and MDA are significantly increased in all types of ACS in an ascending manner from UA to STEMI while TAC is not influenced by stress related to ACS.

Keywords: acute coronary syndrome, Malondialdyhde, gamma-glutamyl transferase, total antioxidant capacity.

1- INTRODUCTION

Acute coronary syndrome (ACS) constitutes a heterogeneous group with regard to clinical findings, degree of ischemia, coronary anatomy and prognosis. The term of " acute coronary syndrome " consist of ST-segment elevation myocardial infarction (STEMI) can be determined by thrombus fully occlude in the coronary artery, no ST-segment elevation myocardial infarction (NSTEMI) and unstable angina pectoris (UA) can be recognized through partially occludes the coronary artery (1) ACS has a high mortality rate, is an intricate cardiovascular complication consequent to atherosclerosis owing to combination of abnormalities in chronic inflammatory, oxidative stress, and susceptibility to thrombosis (2). There are many factors that affected the risk of ACS such as; sex, family history, age, and ethnicity. but there are risk factor can be modified, including an elevated level of serum cholesterol, LDL – cholesterol, hypertension, obesity, diabetes type 2, smoking and sedentary lifestyle (3). Oxidative stress is considered a risk factor for aging and an increase in oxidative stress with aging also contributes to the

development of chronic inflammation and diseases (4). MDA is a three-carbon atom with a low molecular weight of aldehyde spontaneous breakdown product of peroxide derived from free radicals attack unsaturated fatty acid (5). Gamma-glutamyl transferase (GGT) is an enzyme found on the upper surface of the membrane in different cells (6). The GGT position in the tissue leads to the suggest that GGT included in the transport of amino acids through the " gamma-glutamyl cycle "(6). The close relation between cardiovascular disease and GGT might be clarified by the fact that GGT is a marker of oxidative stress and inflammation. Serum GGT has been demonstrated in atherosclerotic plaques from coronary arteries, which can have a role in the progression course of vascular disease (7). The elevated GGT depends on the severity of lesions in each classification (7). Total antioxidant capacity (TAC) is believed more reliable biological information than that obtained from measuring the concentration of individual antioxidants (8).

2- Materials and Method :

Five milliliters of whole blood were drowning from patients who admitted to the coronary care unit (CCU) in Ibn AL- Bitar center for cardiac surgery in Baghdad, during the period from January 2019 to September 2019. The study consists of 150 patients average age between (35 – 75) years with ACS. Among these patients, 50 patients presented with ST-elevation myocardial infarction (STEMI), 50 patients with non-ST elevation myocardial infarction (NSTEMI), 50 patients with unstable angina and 30 persons act as the control group. The diagnosis of ACS includes a history of chest pain, changes in ECG and elevation of cardiac troponin. patients with heart failure, DCM, CABG, pregnant women were excluded from this study. The samples were run on the centrifuge to collect the serum to be tested for the MDA, GGT and TAC. MDA was measured

by spectrophotometer by using reagents TCA (trichloroacetic acid) Alpha Chemika, India company and TBA (Thiobarbituric acid) supplied by Merck, USA. GGT measured by the kinetic method supplied by the human company. TAC was determined by the sandwich ELISA method supplied by Omnignotica forschungs GmbH.

3 – Statistical analysis :

The data in our research were presented in (mean ± SE). The SPSS test program was depended to evaluate all the parameters in our research. The considered P-value was < 0.05 to be an edge of the significant level. To explore the variation among different groups. The comparison between various groups was determined by ANOVA test.

4 – Results :

A total number of 200 individuals were included in our study, 150 of them had ACS while the other 50 act as a control group with comparable sex and age. The mean age group of patients group was 63.4 years compared to 65.2 years in the control group. Of the total 150 patients, 98 were males while 52 were females because an expected finding as ACS is more common in males. The final data of recent work has been expressed in the table below (1) and figures 1, 2,3 which shows the average serum level MDA in the studied population. The (mean ± SE) of serum level MDA was statistically determined in STEMI (5.07 ± 0.26), (4. 28 ± 0.32) in NSTEMI, (3.93 ± 0.36) in UA and (2.06 ± 0.07) in control group. The mean of GGT in these groups were STEMI (73.20 ±5.15), NSTEMI (87.24 ± 5.30), UA (35.40 ± 2.03) and control group (12.85 ± 1.66) . while the results of TAC in various groups were (1.004 ± 0.08) in STEMI, (0.959 ± 0.12) in NSTEMI, (1.104 ± 0.10) and control group (1.593 ± 0.11).

Table (1): *Comparison between different groups in MDA, TAC, and GGT.*

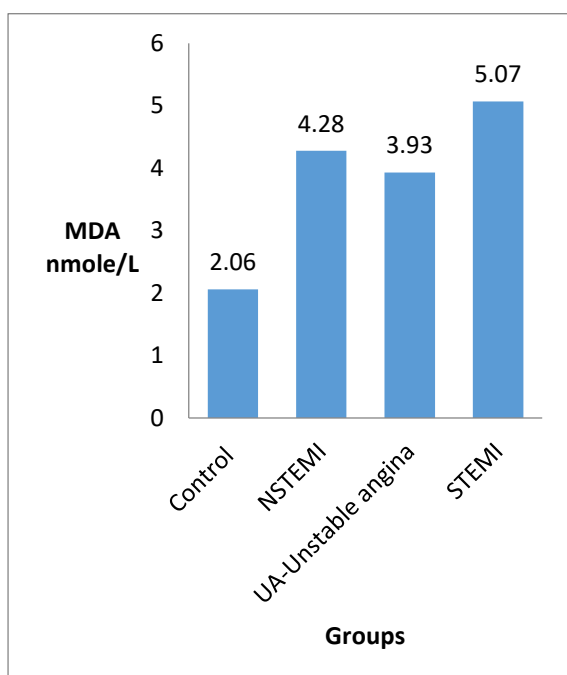| Groups	Mean ± SE MDA (nmol/L)	Mean± SE TAC (mmole/L)	Mean± SE GGT (U/ L)
Control	2.06 ± 0.07	1.593 ± 0.11	12.85 ± 1.66
STEMI	5.07 ± 0.26	1.004 ± 0.08	73.20 ±5.15
NSTEMI	4.28 ± 0.32	0.959 ± 0.12	87.24± 5.30
UA	3.93 ± 0.36	1.104 ± 0.10	35.40 ± 2.03
P- value	P < 0.0001	P < 0.0013	P < 0.0001

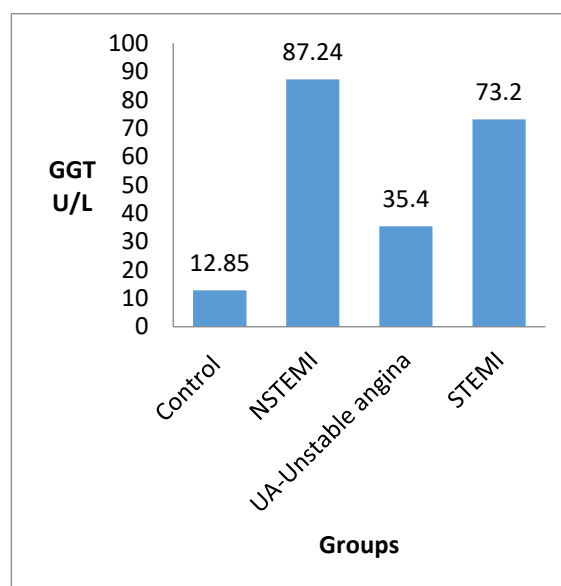Figure (1): *comparison between different groups in MDA*

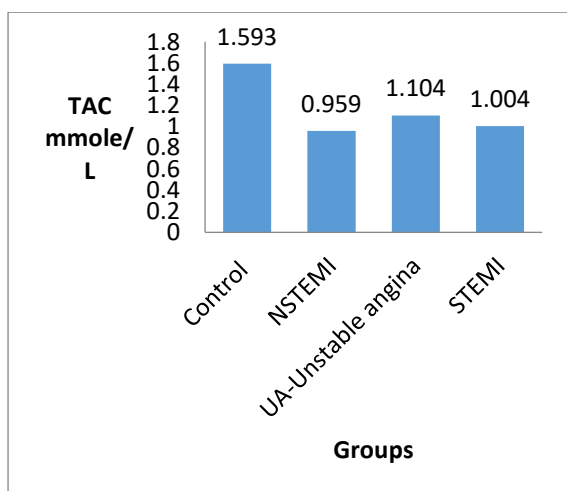Figure (2): *Comparison between different groups in TAC*

Figure (3): *Compassion between different groups in GGT*

5- Discussion :

In this study, we aimed to determine the level of some parameters that deal with oxidative stress in patients of ACS. The data results accordingly with previous works done by many researchers from different countries showing a significant elevated in the level of MDA that acceptable with our result such as Yu Yin et al (9), They said that MDA is the end product of lipid peroxidation in cell membrane, and indirect image the line of cell damage. Myocardial infarction is more related to necrotic area accumulation by a large number of neutrophils that release more oxygen-free radicals. Cardiomyocyte is very sensitive to oxygen free radicals because the cardiac muscle is consuming energy organs. In MI, the myocardial

injury occurs when finding abundant free radicals which lead to lipid peroxidation in the cell membrane and caused mitochondrial function impairment, reduced myocardial systolic function, and eventually induced MI (9).

our results were an agreement with Ahmed Abduljalal Abduljabbar et al,(10) They approved the reason why the MDA level is high is still ambiguous, but some believed that the prostaglandin activity is the main cause. As previously had been concluded by many researchers(11). that condition like hypoxia, myocardial ischemia and platelet aggregation leading to rising in a release the rate of prostaglandin . during the atherosclerotic reaction, MDA will elevated in lipid peroxidation and transported by low-density lipoprotein (LDL)and attached to combine with the cholesterol esters that are presented to those cells and tissue s (12).

GGT act as a risk factor for cardiovascular disease and our results in our study was an agreement with Yan Kyung Cho, et al. (12)The degradation of extracellular glutathione by GGT accelerated the e body' pro-oxidant status and the production of reactive oxygen species, which results in atherosclerotic change(13). GGT catalysis of LDL oxidation in atherosclerotic plaque instability (14). triggers the apoptosis of vascular cells, and causes the release of lipid lysosome enzymes into the subendothelial space, which enhances the production of atherosclerotic plaque in necrotic cores (15). The cleavage of glutathione by GGT produces cysteinyl glycine, which is reductant of Fe^{+3} to Fe^{+2} and a free trial radical, to produce a local pro-oxidant action and causing LDL oxidation which taken up by scavenger receptor system, leading to the generation of foam cells and development of early lesion (16). Kormas, et al. proved when elevated the level of N- L ratio and the later consider as a marker for ACS when elevated GGT(17).

TAC is an indicator of the activity of all antioxidants. It is a more important marker for giving a piece of biological information about oxidative stress (18). Akboga, et al. approved that the growing body of platelet act as initial the development of atherosclerotic lesion that bind to endothelial cell and leukocyte. The platelet adhesion to endothelial surface and produce a signals to the recruitment of monocyte in the site

of inflammation, TAC will inhibit platelet activation and monocyte adhesion and keep it against the cytotoxic effect of oxidized LDL(19). The patients with ACS had low TAC activity compared with the healthy control group. This condition appeared to be correlated with induced oxidative conditions, leading to extensive oxidative stress and increase susceptibility of the erythrocyte membrane to this oxidant status (20). jean –Claude identified that oxidative stress seems to be significant in both the initial and late stages of atherosclerotic progression. Endothelial dysfunction and increased vascular oxidative stress predict the risk of cardiovascular events in patients with ACS(21). A non-significance difference in TAC levels among three groups NSTEMI, STEMI, UA was observed. The manufacture of free radicals is thought to encourage endothelial dysfunction among these groups which is an early step of atherosclerosis. (22).

6- Conclusion:

The present study showed that both GGT and MDA are significantly increased in STEMI, NSTEMI than UA. while TAC is not influenced by stress related to ACS. We came to the fact that these markers may play a critical role in the analysis and predictions of ACS.

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