Study of Lipid Profile, Lipid Peroxidation and DNA Damage in Patients with Coronary Artery Disease

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Abstract

Background and Objective: This study was conducted to investigate some clinical aspects of coronary artery patients, as it included some tests for lipid oxidation and DNA damage and the extent of their association with the risk of coronary artery disease in the Iraqi population. **Results**: The lipid showed significant differences between the preferred messages in measuring lipids, TG (P = 0.005), high-density lipoprotein P = 0.018 (HDL) and low-density lipoprotein (vLDL) P = 0.004. It was named in lipid profile, and it was named In seizure patients (nonSTEMI). The glutathione analysis showed a significant decrease in patients compared to healthy subjects, and the unstable, non-Stemi and Stemi-series results were significant, and the significant differences were at (P = 0.00036). As for the research results, the significant differences were when they were high (P = 0.00072). The results of the comet assay showed differences between the four groups, for the group of patients with unstable angina and who suffer from a heart attack (Non-Stemi), the results showed close to average levels in the genetic material (P = 0.00014). The highest damage in the genetic material of patients with coronary artery disease was in patients suffering from a heart attack (Stemi) where the level of significant damage was very large compared to the rest of the groups (P = 0.00025). The results obtained on the biochemical levels of GHs, VLDL, HDL, TG and MDA showed significant differences between the healthy and the groups of patients with coronary artery disease below the probability level (P> 0.05). Also, the incidence of DNA damage in patients with coronary artery disease is much greater than healthy patients, and this indicates a significant effect of DNA damage on blood vessels, and on the other hand, STEMI patients are the most vulnerable to infection.

Key words*:Coronary artery disease, DNA damage, Antioxidant, Lipid profile.*

Inroduction

Coronary heart disease (coronary heart disease) is the leading cause of death in developed countries,with its introduction as stable angina, myocardial infarction and sudden coronary death [1,2]. Coronary artery disease usually appears as a heart attack at first, and becomes more complicated with heart failure or an irregular heartbeat. The primary mechanism is coronary arteriosclerosis. Risk factors for coronary artery disease include high blood pressure, obesity, diabetes, increased blood cholesterol levels, smoking, lack of exercise, poor diet, excessive alcohol consumption, and depression [3]. Thus, atherosclerosis can be assessed by testing the levels of cholesterol, triglycerides and lipoproteins in the blood [4,5]. Acute coronary syndrome is a term used to describe a group of symptoms that lead to acute myocardial ischemia. ACS is produced in a myocardial

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injury called a myocardial infarction (MI). The ACS includes unstable angina, non-elevated myocardial infarction (NSTEMI), and elevation-induced myocardial infarction (STEMI) [6]. Patients with STEMI have an elevation in the ST segment seen on the ECG machine. Usually the symptoms are similar in nature to angina pectoris, such as chest pain, but it is more severe and prolonged and is not relieved by nitroglycerin treatment under the tongue[7].

Material and Methods

This study is a case-control study of 80 samples divided into four groups: 20 healthy controls, 20stable angina patients, 20 STEMI patients and 20 Non-STEMI patients. The sample of this study was collected in The Ibn Al-Bitar center for cardiac surgery in Baghdad/Iraq. Between December 2018 and July 2020. The following detailed information was obtained: age, gender, date of onset of disease. Blood samples were taken from venous about 7ml for different analysis. After centrifuging, serums were separated and stored at -80 C until measuring the concentration lipid profile,glutathione peroxidase (GPX1) and Malondialdehyde (MDA). All biochemical tests were done by Kenza 240 TX (Biolabo, France) and biolabo kits.DNA damage was measured by Comet Assay Kit (Trevigen, USA) andSYBR Green Dye (Sigma, Canda) . We used the serum for all samples and whole blood EDTA to DNA extraction.Friedewald formula was applied for LDL cholesterol measurement.

Staistical Analalysis

Statistical calculations were made using the Statistical Package for the Social Sciences (SPSS) (version 20.0) program (IBM SPSS Statistics, SPSS Inc., Chicago, Illinois, USA). The Anderson-Darling test was performed to test the adherence of continuous, parametric,variables to the normal distribution. Normally distributed continuous parametric variables, with no significant outlier, presented using their mean and standard deviation (mean±SD) and parametric tests were used; independent t-test was used to analyze the differences between the mean of two groups, while one-way ANOVA was used to analyze the differences between the mean of more than two groups. The statistical tests were approved by assuming a null hypothesis of no difference between the mean of variables, a P-value ≤ 0.05 was considered statistically significant.

Result and Discussion

The obtained result in table (1) showed that the levels of total cholesterols in the four groups are not significantly changed atP> 0.05 and the groups recorded normal values of TC. The levels of triglycerides between the groups of patients and the healthy control group showed significant differences P = 0.005. As for the values of TG in Non-STEMI patients, which were very high compared to the other groups (250.10 + 134.89). This is indicated by a study conducted on patients with coronary artery disease, as (90.47%) of men with artery disease Coronary syndrome and (72.97%) of women with coronary artery disease had a cholesterol level less than 200 mg / dl [8]. Another study indicated that the results of lipids showed an increase in the levels of TC and LDL and a decrease in TG, and there was no change in the level of HDL in STEMI patients than non-STEMI patients[9].

Table 1: Comparison of lipid profile between CAD and healthy control

Parameters / Groups	TC. (mean+SD)	TG (mean+SD)	HDL (mean+SD)	LDL (mean+SD)	vLDL (mean+SD)
Control	A 154.20+22.13	A 92.80+26.25	A 45.930+6.697	A 89.70+23.88	A 18.30+5.31
Unstable	A 141.90+33.43	A 150.60+121.30	B 32.370+9.496	A 78.00+22.22	A 31.60+23.21
Non STEMI	A 167.60+37.61	B 250.10+134.89	A 41.210+9.251	A 83.90+31.09	B 49.70+26.98
STEMI	A 152.50+56.76	A 138.40+34.43	B 35.500+12.583	A 93.50+46.01	A 26.90+6.10
LSD	Non Sign.	70.225	7.328	Non Sign.	13.742
P-value	0.551	0.005	0.018	0.723	0.004

The concentrations HDL was significantly related to the disease, as the concentration of HDL decreased significantly in patients with unstable angina (32,370 + 9,496) and in the STEMI patients (35,500 + 12.583), while healthy controls was (45.930+6.697) ₹which indicated significant differences between the groups, P = 0.018. No significant increase in mean LDL values was observed in the patient groups when compared with control (P = 0.723). The average level of VLDL in CAD patients with Non-STEMI (49.70 + 26.98) which significantly increased over the rest of the other groups (P = 0.004). The results of previous studies proved that cases of hyperlipidemia in relation to the increase of all lipids except for HDL, which is low. Patients with comorbidities also had fatty features that deviated from the normal range.[10]Table (2) shows that the average values for the level of GPx decreased significantly in patients (P = 0.00036), as the average values in the healthy control were (112.65 + 5.67). Which means that the level of glutathione peroxidase decreases in patients with unstable myocardial infarction (88.42 + 5.60), but it decreases significantly in Non- STEMIpatients (74.00 + 4.74) and in STEMI patients (68.62 + 3.38). The average concentration of MDA in the blood serum of all patients increased with a significant difference (P=0.00072) compared to the healthy (6.045 + 0.803). Furthermore, the results showed an increase in the concentration of MDA in patients with Unstable angina (11.170 + 1.347) and a greater concentration in Non-STEMI patients elevation (13.435 + 0.979) and STEMI patients (13.435+0.979).

The results of the current study showed decrease in the efficacy of glutathione peroxide in all patients with

coronary artery disease, which in turn was attributed to the deficiency of glutathione and increased reactive oxidative stress (ROS). It also showed a significant increase in the concentration of melondialdehyde (MDA) in patients more than healthy controls, as the current results of this study are consistent with those of [11,12]. In a comparative study by [13] between 50 patients and 50 healthy subjects, which indicated that coronary artery disease is associated with oxidative stress, lipid peroxidation, inflammation, and elevated liver enzyme activity. Coronary artery disease is a fatal disease that requires proper medical care. Antioxidant treatment may prevent disease progression. Consistent with the results of the current study, the results of the study by [14]indicated that the concentration of melondialdehyde (MDA) was significantly increased in patients with cardiac arrest more than in healthy subjects, and it increased to a greater degree in STEMI patients more than Patients with myocardial infarction and non-STEMI patients. As for glutathione, the level of glutathione in patients with cardiac arrest is much lower than that of glutathione in healthy subjects, and it decreases to a greater degree in STEMI patients. In a study conducted by [15] on heart patients, which recorded a clear increase in MDA and a decrease in the effectiveness of Gpx in patients, and it indicated the effectiveness of antioxidants in reducing MDA and this would reduce the risk of infection. Cardiovascular disease.

Table (3) shows some criteria for measuring the damage caused by the DNA in the white blood cells of patients with coronary artery disease and comparing them with the apparently healthy ones, as they were divided into several groups according to the amount of damage. The current results indicated that there were significant differences between the group in which no harm occurred (P = 0.00016), so the percentage was the largest in healthy people, and the percentage of non-damage in the genetic material in STEMI patients was much less than the rest of the patients. .The incidence of little damage in the genetic material of healthy people was greater than that of patients, as the results showed that there were significant differences between the groups of patients and healthy subjects (P = 0.00033).[16] in a comparative study of coronary patients indicated that DNA damage in the leukocytes of coronary patients had higher values of percentage of tail DNA (2.1x), And Tail Mean Moment Migrations (3 x) and Tail Length (3 x), indicating high DNA damage in peripheral leukocytes of CAD patients in compared with normal controls. In addition, there was an increase in the irreversible and reversible genetic damage to the white blood cells / lymphocytes in the peripheral blood of patients with coronary artery disease. Since oxidative stress may be involved as a major contributor to the development of atherosclerosis, it may also be a causative factor in DNA damage in coronary artery disease where DNA damage occurs frequently in cells exposed to reactive oxygen species (ROS). Furthermore, the average damage in the genetic material, the results indicated that there was a very large significant decrease in healthy subjects compared to patient groups (P=0.00014). The results also indicate a significant increase in the damage of genetic material in patients with unstable myocardial infarction, with no significant differences between non-STEMI patients and STEMI patients that recorded the highest average damage rate at ($P \leq 0.05$).

As shown in Table (3), where the percentage of high damage in the genetic material of healthy people decreased compared to groups of coronary artery patients. STEMI and non-STEMI patients did not show significant differences between them, but they were greater than high damage in the genetic material for healthy subjects and all groups of patients and healthy subjects showed statistically significant significant differences (P = 0.00025). Some studies give evidence for the concept that patients with coronary artery disease show changes in DNA repair and DDR gene expression, and some are related to the functional form of the disease itself, as the results prove that the DNA damage occurring in the blood cells of patients is STEMI. It was much greater than the damage done in the rest of the patients with coronary artery and that the percentage of DNA damage in healthy people decreased significantly. In addition to that patients with coronary artery showed

changes in the process of repairing the damaged DNA and geneexpression such changes may be due to the amount of progression of the atherosclerotic process in patients [17]. The results of the current study are consistent with the results of many studies conducted to find out the amount of damage to the DNA of white blood cells for coronary artery patients in different geographic regions and many population groups, as these studies recorded a significant increase in the percentage of damage to the DNA of patients much greater. Of the healthy subjects that reported a small percentage of the damage may be due to the natural repair process that occurs to DNA[18, 19,20].

Table 2: Comparison of glutathione peroxidase (GPX1) and Malondialdehyde (MDA) between CAD and healthy control .

Parameters / Groups	GPx pg/ml (mean+SD)	MDA nmol/ml (mean+SD)
Control	A 112.65+5.67	A 6.045+0.803
Unstable	B 88.42+5.60	B 11.170+1.347
Non STEMI	C 74.00+4.74	C 13.435+0.979
STEMI	C 68.62+3.38	D 15.625+1.135
LSD	8.441	1.276
P-value	0.00036	0.00072

Table (3): The levels of damage in the genetic material (DNA damage) in healthy people and groups of patients with coronary artery disease.

Parameters / Groups	No Damage % (mean+SD)	Low Damage % (mean+SD)	Medium Damage % (mean+SD)	High Damage % (mean+SD)
Control	A 47.837+1.623	A 39.092+1.239	A 6.522+0.370	A 6.550+0.689
Unstable	B 40.638+2.183	B 32.407+1.223	B 12.820+1.931	B 14.140+1.319
Non STEMI	B 40.870+0.937	BC 30.115+2.095	B 13.775+0.615	B 15.237+0.967
STEMI	C 33.467+1.581	C 28.522+2.192	C 19.340+1.199	C 18.670+2.436
LSD	2.269	2.517	3.153	2.411
P-value	0.00016	0.00033	0.00014	0.00025

Conclusion

High levels of lipid profile and MDA asscociate with the increase damge in DNA of CAD. Furthermore, the significant decrase in the activity of GPx enzyme in patients with CAD. The incidence of DNA damage in patients with coronary artery disease is much greater than that of healthy people, and this indicates a significant effect of DNA damage on blood vessels. On the other hand, STEMI patients are the most vulnerable to injury.

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