Original Research Article

A correlative study of cardiac enzyme markers and lipid profiles in coronary artery disease

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Abstract

Background: Coronary heart disease also called Coronary artery disease or Ischemic heart disease is characterized by, an inadequate supply of oxygen-rich blood to the heart muscle (myocardium) because of narrowing or blocking of a coronary artery by fatty plaques Increased triglycerides (TG), low-density lipoprotein (LDL), total cholesterol, decreased high-density lipoprotein (HDL), smoking, obesity are considered to be major risk factors for the development of AMI. **Objectives**: The present study aimed to assess the levels of serum lipid profiles and cardiac enzyme markers in patients with coronary artery disease. The study also aimed to compare and correlate the levels of lipid profiles and cardiac markers of coronary artery disease patients with healthy normal persons. **Materials and Methods**: Patients with Coronary artery disease (n=30) and healthy controls (n=30) were the subjects of this study. The blood samples were collected under aseptic precautions into plain vacutainer tubes , heparine tube and then the serum obtained after centrifuging the blood is proceeded for the estimation of lipid profile and cardiac enzymes. **Results**: Patients with Coronary artery disease had shown significant rise in CK-MB and AST and the lipid parameters like Low Density Lipoprotein (LDL) and Total cholesterol (TC) had shown significant increase in cases compared to normal healthy individuals. The CK-MB showed a significant positive correlation with AST and also showed positive correlation with increase in TC, HDL, LDL. **Conclusions**: The level of cardiac enzyme markers and lipid parameters in this study clearly shows that there is significant rise in levels of CK-MB, AST, TC , LDL in patients suffering from coronary artery disease. Also there is significant positive correlation between CK-MB and AST which is statistically significant. The estimation of levels of these parameters would serve as tool for future prophylaxis of CAD patients for either treatment or life style modifications.

Keywords: Coronary Artery Disease; Lipid Profile; Acute Myocardial Infarction; Cardiac Enzymes

Introduction

Coronary artery disease (CAD) is one of the leading causes of ischemic heart disease and remains the most common cause of death despite significant advancements in prevention and treatment. A drastic rise in the stressful yet sedentary life style, food intake rich in high energy and fat, smoking, lack of physical activities leading to obesity has led to the sharp rise in MI cases even in developing countries. According to WHO planned in the year 2005 that the coronary heart disease causes for 7.6 million deaths (13.2% of total deaths) whole world. Above 80% of these deaths took place in fewer developing countries[1]. IHD is estimated to be the most important cause of mortality by the end of 2020 worldwide. High levels of TC, LDL, TG and low levels of HDL cause deposition of lipid in arteries thus causing atherosclerosis. So lipid profiles are routinely measured for risk assessment in preventing CAD[2].

Total Cholesterol measures all lipoprotein sub-classes to assess a patient's overall cholesterol level. High levels of cholesterol in the blood are associated with atherosclerosis and an increased risk of heart disease. As such cholesterol testing plays a vital role in preventative health care. Both the American National Cholesterol Education Programme (NCEP) and the European Society of Cardiologists (ESC) recommend levels below 5mmol/l.

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High triglyceride levels increase the atherogenicity of HDL and LDL cholesterol. Triglyceride levels are elevated immediately after a meal with high levels dramatically affecting the accuracy of HDL and LDL measurements. A triglyceride concentration below 1.7 mmol/L is desirable. Levels higher than this are not only associated with an increased risk of heart disease but also Type 2 diabetes, kidney disease, hypothyroidism and pancreatitis.

High-density lipoproteins (HDL-C) are one of the major classes of plasma lipoproteins. HDL-C is often referred to as 'good cholesterol' since it transports cholesterol from the tissues to the liver for removal from the body. High levels of HDL-C can lower an individual's risk of developing heart disease. If HDL-C accounts for 20% of an individual's total cholesterol then the risk of developing heart disease is less than average. The NCEP recommends the following: Low <1.01mmol/l, Borderline 1.01–1.54 mmol/l, Desirable 1.54mmol/l.

Serum CK-MB kinetics gives useful information regarding the extent and timing of myocardial injury. It begins to increase between 3-5 hours after the onset of infarction and peaking at 16-20 hours. It has been considered as the 'Gold Standard' for confirmation of MI[3]. However, the techniques used (electrophoresis and immunoinhibition) to quantitate CKMB catalytic activity were not sensitive enough for early use, being relatively non-specific and long turn-around time restricted its use primarily for confirming MI at 24 hours post injury [4]. Recently, the measurement of mass concentration of CKMB has increased its sensitivity and specificity enabling to measure small changes during the early hours following MI.

The levels of serum AST activity begin to rise 3-8 hours after the onset of the myocardial injury with peak levels on an average at 24 hours and finally it returns to normal levels in 3-6 days[5]. It was considered as a very good marker of cardiac injury as it was found to be normal in pulmonary embolism, acute abdominal conditions and other heart conditions such as angina and pericarditis.

This study is designed to evaluate the lipid profile levels during AMI and correlating with the changes in serum enzyme markers in patients with coronary heart disease.

Objectives of the study

1. To estimate the levels of serum lipid profiles in patients with coronary artery disease
2. To estimate the levels of cardiac enzyme markers in patients with coronary arterydisease

To compare and correlate the levels of lipid profiles and cardiac markers of coronary artery disease patients with healthy normal persons

Materials and methods

Source of data

This study was done at Rohini Diagnostic centre, LB Nagar Hyderabad. The study protocol was approved by Ethics Committee of the institution. Voluntary informed consent was taken from the subjects of the study. The study subjects comprised of patients with coronary heart disease (group-1) and Controls (group-2). The age of the subjects ranged from 35 to 85 years. Group-1: Thirty patients diagnosed with coronary artery disease in comprised this group. Age and sex matched normal healthy individuals formed the group-2.

Exclusion criteria

Coronary artery disease patients with other systemic illness or any other chronic disease.

Collection of Samples

Study type

Case control study

Sample and sampling technique

Diagnosed cases of coronary artery disease as well as normal persons were selected randomly as subjects for the study. 3-4 ml of blood is collected using aseptic precautions into plain vacutainer tubes , heparine tube and then the serum obtained after centrifuging the blood is proceeded for,

1. Estimation of serum lipid profile (TC, HDL, LDL, TG)
2. Estimation of serum cardiac enzyme markers (AST, CK-MB)

Results

The result of the six parameters ie; Total cholesterol, Triglycerides, LDL, HDL, CK-MB , AST done on patients with coronary artery disease and normal subjects is shown in the table 1 to 5 respectively. It is evident from (**Table 5)** that CK-MB showed a significant increase ($p = 0.000$) in cases compared to controls, as it is a good marker of AMI, similarly AST also showed a significant increase ($p = 0.000$) in AMI patients. Total Cholesterol and LDL showed a significant increase ($p = 0.000$) in cases compared to controls. The TG and HDL levels showed slight increase in cases compared to controls but this was not statistically significant ($p < 0.05$).

Correlation study **(Table 7)** revealed significant positive correlation between CK-MB and AST ($r = 0.850$, $p = 0.000$) and CK-MB showed positive correlation with TC, HDL, and LDL ($r = 0.088$, $p = 0.644$; $r = 0.042$, $p = 0.827$; $r = 0.083$, $p = 0.664$) which is statistically not significant. Similarly the AST also showed positive correlation with the TC, LDL ($r = 0.055$, $p = 0.772$; $r = 0.060$, $p = 0.754$) and negative correlation with HDL ($r = -0.157$, $p = 0.407$) which is statistically not significant.

Table 1:Comparison levels of Total cholesterol in patients withCoronary artery disease and normal subjects.

Group	N	Minimum	Maximum	Mean	Std.Deviation	Median	t value	p value
CAD	30	107	281	213.13	41.170	212.00	5.033	.000
Controls	30	107	198	170.43	21.545	172.00		
Total	60	107	281	191.78	39.049	191.50		HS

Table 2: Comparison level of LDL in patients with Coronary arterydisease and normal subjects

Group	N	Minimum	Maximum	Mean	Std.Deviation	Median	t value	p value
CAD	30	47	202	145.17	36.078	144.50	4.243	.000
Controls	30	91	147	114.40	16.617	113.00		
Total	60	47	202	129.78	31.877	129.00		HS

Table 3: Comparison levels of HDL in patients with Coronary arterydisease and normal subjects.

Group	N	Minimum	Maximum	Mean	Std.Deviation	Median	Mann- Whitney Test Zvalue	p value
CAD	30	26	147	52.23	27.559	44.50	1.22	.222
Controls	30	26	65	42.47	8.411	43.00		
Total	60	26	147	47.35	20.793	43.00		NS

Table 4: Comparison levels of Total triglycerides in patients withCoronary artery disease and normal subjects

Group	N	Minimum	Maximum	Mean	Std.Deviation	Median	t value	p value
CAD	30	37	212	123.57	44.901	119.50	1.697	.095
Controls	30	64	158	106.73	30.594	101.50		NS
Total	60	37	212	115.15	39.027	108.50		

Table 5: Comparison levels of CK-MB in patients with Coronary arterydisease and normal subjects.

Group	N	Minimum	Maximum	Mean	Std.Deviation	Median	Mann-Whitne Test value y Z	p value
CAD	30	14	378	56.77	65.143	41.20	5.47	.000
Controls	30	11	24	17.63	3.828	17.00		HS
Total	60	11	378	37.20	49.824	22.00		

Table 6: Comparison levels of AST in patients with Coronary arterydisease and normal subjects.

Group	N	Minimum	Maximum	Mean	Std.Deviation	Median	Mann- Whitney Test Zvalue	p value
CAD	30	22	379	75.98	68.855	59.50	6.04	.000
Controls	30	15	48	24.17	7.657	21.00		
Total	60	15	379	50.07	55.150	31.50		HS

Table 7: Showing Pearson correlation values for cardiac enzyme markers with differentparameters of lipid profile.

		Karl pearson correlation coefficient r value	p value	
CKMB	AST	.850	.000	sig
	TOTAL CHOL	.088	.644	NS
	TG	.231	.219	NS
	HDL	.042	.827	NS
	LDL	.083	.664	NS
AST	TOTAL CHOL	.055	.772	NS
	TG	.237	.208	NS
	HDL	-.157	.407	NS
	LDL	.060	.754	NS

Discussion

The root cause of AMI is mainly atherosclerosis. Contrary to earlier belief, research in the last two decades has shown that atherosclerosis is neither a degenerative disease nor inevitable due to ageing. On the contrary, atherosclerosis seems to be a chronic inflammatory condition that is converted to an acute clinical event by induction of plaque rupture which in turn leads to thrombosis. Hence inflammation occupies a very important central position in all phases of atherosclerosis, although inflammation must smoulder for decades before resulting in a clinical event like AMI[6].

According to the study conducted by Sharbari basu et.al[7], CK-MB appears to be a better indicator of AMI as compared to cardiac troponins especially within the first few hours of AMI. These results were in agreement with an earlier study conducted by Collinson et.al[8] where during the initial 12 hours, CK-MB was a better indicator of AMI as compared to cardiac Troponin T. When new diagnostic tests are compared against the gold standard CK-MB, they were found to have decreased diagnostic efficiency, although they are more cardio specific[9].

The lipid abnormality is one important risk factor for Ischemic heart disease. There are a number of risk factors which influence the formation of plaques due to excess cholesterol. The plaques that are deposited on the walls of the blood vessels reduce blood flow to the heart muscle and cause ischemia. Due to the ischemia the myocardial cells are damaged. The MB isoform of creatine kinase released from the damaged myocardial cells reach the blood stream quickly resulting in a rapid peak of serum CK-MB levels in the first few hours. The CK-MB had shown highly significant rise in our study with about three-fold rise in the serum of patients with AMI compared to controls. The AST is another traditional cardiac enzyme which has been used as one of the markers for AMI. But the specificity is poor with a lot of false positive elevations (Skeletal injury, Liver damage, pulmonary embolism etc.). Since it offers no traditional benefits for the diagnosis of AMI, it is no longer used as a routine test[10]. However the AST levels showed a significant rise in cases compared to controls with about 3 -fold rise. The correlation study showed significant positive correlation between AST and CK-MB ($r= 0.850$, $p<0.001$). The false positive rise of AST in the patients was avoided by excluding the patients with skeletal injury, liver damage, and pulmonary embolism.

Decreased HDL and rise in TC and LDL is the main cause for atherosclerosis[11]. However there are several risk factors that

enhance atherosclerosis, so lipid parameters should be checked for risk assessment and its management. But the diagnosis of lipid parameters in this study revealed a significant rise in serum levels of TC, LDL. The TG and HDL showed slight increase in the cases compared to controls, but not statistically significant (**Table 3, 4**). But the correlation study showed CK-MB has positive correlation with TC and LDL whereas, AST showed negative correlation with HDL which are statistically not significant.

Some studies showed that there are correlations between the occurrence of AMI and abnormality of lipid profiles[12]. Some other study showed that there was an increase in serum triglycerides during AMI[13]. Elevated serum cholesterol has depended on elevated consumptions of fat and genetic basis[14]. LDL carries the most of cholesterol in the plasma and increasing of LDL depend on increasing of total cholesterol level[15]. Study by Sandkamp et.al[16] showed increased levels of LDL-Cholesterol in AMI patients and this is in agreement with this study.

Study by Sreenivasan R.S et al, Identification and prediction of coronary heart disease in patients with Apo-lipoprotein levels ,concluded that the levels of total cholesterol, triglycerides, LDL-cholesterol and VLDL-cholesterol were significantly increased in plasma of CHD patients as compared to normal and the levels of HDL- cholesterol were moderately increased. About 70.0% of CAD can be prevented or delayed with dietary choices and lifestyle modifications. Exercise and a diet with minimal saturated lipid will help the patients to increase their serum HDL and lower triglyceride levels and also helps to prevent future atherogenic damaging in AMI patients.

The Adult Treatment Panel III or ATP III from the National Cholesterol Education Program (NCEP) has summarized the current recommendations for the management of high serum cholesterol. These guidelines are based upon epidemiologic observations that showed a graded relationship between the total cholesterol concentration and coronary risk.

Conclusion

The findings obtained in this brief study which was conducted on patients with coronary artery disease to determine the correlation between lipid profile and cardiac enzyme markers , shows that levels of CK-MB, AST, Total cholesterol, LDL are elevated in cases compared to controls which is statistically significant . CK-MB also showed significant positive correlation with AST. However no significant correlation is seen with TC, HDL, and LDL. The estimation of levels of cardiac enzyme markers and lipid parameters in patients with CAD , would serve as a tool for future prophylaxis of coronary artery disease patients for either treatment or life style modifications. It is also advisable for all clinicians to go through these tests for better treatment and prevention of CAD. This study is done with small number of patients; hence future studies should be done in same line with large number of patients for comparing and correlating the lipid profiles and enzyme markers in coronary artery disease.

Conflict of Interest: Nil

Source of support: Nil

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