

Original Research Article

## **Total Cholesterol/HDL Ratio –An Individual Predictor of Atherosclerosis in Acute Coronary Syndrome**

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**Abstract:** Cardiovascular diseases are responsible for 25% of DALY lost due to non-communicable diseases in industrialized and developing countries. Life style modification reduces the cholesterol content to a certain extent which can decrease the severity of the presentation of the disease. A persistently high cholesterol levels can almost precipitate a cardiac event. The aim of this study is to estimate Lipid profile and CK-MB and to prove that Total Cholesterol /HDL ratio is a better predictor of atherosclerosis in Acute Coronary Syndrome. In this study lipid profile and CK-MB was evaluated in fifty subjects who were admitted in the Intensive Coronary Care unit with complaints of chest pain and ECG changes suggestive of Acute Coronary Syndrome and compared with fifty healthy subjects. The statistical analysis was done by student t-test and pearsons correlation in SPSS version 17. The study group showed the mean value of total cholesterol to be  $217.02 \pm 34.34$  than in the control group which was  $182.33 \pm 14.52$  and that of HDL cholesterol to be  $37.60 \pm 3.70$  and  $42.71 \pm 3.48$  in control group. The ratio of Total Cholesterol /HDL ratio showed a significant increase than the normal level of  $<3.5$  which is suggested as a clinical goal for coronary artery disease prevention with a sensitivity of 82.5% in relation to individual sensitivity. Hence it can be concluded that though a low level of HDL-C and increase in total cholesterol itself has a strong relation to atherosclerosis the ratio bears considerable importance as a predictive and prognostic indicator for acute coronary syndrome, as HDL cholesterol does not involve the cholesterol associated with LDL-Cholesterol and reverse cholesterol transport.

**Keywords:** CAD - coronary Artery disease, ACS - Acute coronary syndrome, HDL-C - high density lipoprotein cholesterol, LDL-C - low density lipoprotein cholesterol

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### **INTRODUCTION**

The acute coronary syndrome (ACS) is the clinical manifestation of the critical phase of coronary artery disease (CAD). ACS describes the spectrum of clinical manifestations which follow disruption of coronary arterial plaque, complicated by thrombosis, embolization, and varying degrees of obstruction to myocardial perfusion [1]. The myocardial ischemia occurs when oxygen supply does not meet the myocardial demand, usually seen in atherosclerotic disease of the epicardial coronary artery. When ischemia is severe, prolonged necrosis or infarction occurs [2]. The clinical features depend on extent and severity of myocardial ischemia.

ACS refers to a range of myocardial ischemic states which includes patient with ST-segment elevation myocardial infarction (STEMI), non-STEMI, and unstable angina. It has been predicted that CAD might become the most prevalent disease in India by the year 2020[3]. CAD is a chronic process that begins during adolescence and slowly progresses throughout life. The myocardial infarction and its complications are the principal cause of death in patients with CAD [4]. The CAD rates in urban India are similar to more affluent overseas Indians [5]. Conventional risk factors such as hypertension, diabetes mellitus, hypercholesterolemia, and smoking are increased in Indians due to urbanization and Western acculturation. Presence of hypercholesterolemia is sufficient to initiate the disease process by inducing an endothelial injury in the

coronary arteries. Serum cholesterol concentration associated with low density lipoprotein which serves as a vehicle for the delivery of cholesterol to peripheral tissues play a major role in precipitating CAD [6].

#### Pathogenesis of atherosclerosis

Atherosclerosis is a complex disease that involves lipoprotein influx and modification, increased prooxidant stress and inflammatory angiogenic and fibro proliferative responses intermingled with extra cellular matrix and smooth muscle cell proliferation resulting in the formation of atherosclerotic plaque [7]. Acute changes that disrupts a plaque are i) Rupture, fissuring or ulceration of plaques exposing highly thrombosed plaque constituents or underlying sub endothelial basement membrane, ii) Hemorrhage into the core of plaques with expansion of plaque volume and worsening of the limited occlusion, iii) Rupture of plaques fibrous cap causes thrombosis that leads to episodes of unstable angina [8].

#### Pathophysiology of IHD

The extent of damage to myocardium and the irreversibility of the ischemic cardiac muscle depend on

1. The metabolic needs of the under perfused tissue.
2. Degree of existing collateral vessels.
3. Location, severity, duration and rate of development of arterial occlusion [9].

The total/high-density lipoprotein (HDL) cholesterol ratio, known as the atherogenic or Castelli index is an important component and indicator of vascular risk, the predictive value of which is greater than the isolated parameters. In this respect, an increase in total cholesterol concentration, and specifically LDL cholesterol, is an atherogenic lipid marker, whereas reduced HDL cholesterol concentration is correlated with numerous risk factors, including the components of the metabolic syndrome, and probably involves independent risk. When total cholesterol, HDL cholesterol, and total/HDL cholesterol ratio are compared between an apparently healthy population and myocardial infarction survivors, the total/HDL cholesterol ratio is found to present less superposition of populations. This illustrates the high discriminatory power for coronary heart disease presented by the total/HDL cholesterol ratio, as well as its great predictive capacity. The value of this parameter when the lipid profile is within desirable range should be emphasized[10].

#### AIM AND OBJECTIVES

Aim of the study is to estimate CK-MB, and Lipid profile along with blood urea and serum creatinine and objective is to correlate Total cholesterol/HDL ratio with CK-MB.

#### MATERIALS AND METHODS:-

The study was conducted after getting the approval from the ethical committee of Govt. Stanley Medical College. 100 subjects were chosen for the study. Both males and females in the age group of 30-70 years were included and an informed consent was obtained from all of them.

Fifty subjects with normal, clinical, biochemical parameters and with normal ECG served as the control group. They were selected from the master health checkup outpatient department of Govt. Stanley Medical College.

Fifty subjects who were admitted in Intensive coronary care unit [ICCU] with complaints of chest pain (of < 6 hours duration), with Electro cardio graphic findings showing ST changes formed the study group and they were selected from the department of cardiology, Govt. Stanley Medical College.

#### Inclusion criteria

1. Patients admitted with complaint of chest pain within 6 hours of onset.
2. Electro cardio graphic findings showing abnormal ST-T wave changes (ST segment elevation or depression or deep symmetrical T wave inversion).

#### Exclusion criteria

1. Presence of renal diseases.
2. Presence of cirrhosis,
3. Presence of stroke, skeletal muscle injury, malignancy, trauma.
4. Critically ill patients.
5. Ongoing infectious diseases.
6. Serum albumin < 2 gms/dl ,
7. Serum creatinine > 3 mgs/dl.

#### SAMPLE COLLECTION AND PROCESSING:-

5ml of blood samples were collected by vene puncture with strict aseptic precaution as soon as the subjects got admitted as per the inclusion criteria. The samples were centrifuged and serum separated. One part of the sample was taken and analysis of CK-MB, albumin and creatinine were done immediately. 12-14 hours fasting sample was also collected from all subjects during their hospital stay and analysis of total

cholesterol, triacylglycerol and high density lipoprotein were done.

**STATISTICAL ANALYSIS**

The statistical analysis was done in SPSS version 17.0. The results were expressed as mean ± SD and analyzed by Student t-test and Pearsons correlation.

**RESULTS**

A total of 100 patients were included in the present study. Out of the 100, 50 were study group [IHD patients within 6 hours of onset of Chest pain] and other 50 were controls [Normal individuals].

Table 1 shows age distribution among the study and control group.

**Table 1: Age Distribution Among The Study And Control Group:-**

Group	N	Minimum age	Maximum age	Mean	Standard Deviation	Student independent ‘t’ test
Control	50	35	67	51.48	8.853	P=0.09
Study	50	35	68	52.04	9.178	Not Significant

Male and Female patients in the age group of 35 years to 70 years were taken in the study. Both the study and control group were age matched.

The serum levels of CK-MB total cholesterol, Triacylglycerol and High density lipoprotein were estimated for all the patients taken for the study. Very low density lipoprotein and low density lipoprotein

values were calculated. Mean and standard deviation were calculated for the quantitative variables, Total cholesterol, Triacylglycerol, High density lipoprotein, very low density lipoprotein and low density lipoprotein, & CK-MB, in both study and control group. The values were analyzed and the results are presented in table-2.

**Table 2: Comparison Of Biochemical Parameters In The Study And Control Group**

S. No	Variables	Study (n=50) Mean ± SD	Control (n=50) Mean ± SD	P value
1.	TC mg/dl	217.02±34.34	182.33±14.52	P=0.05*
2.	TGL mg/dl	208±38.09	132.67±17.79	P=0.15NS
3.	HDL mg/dl	37.60±3.70	42.71±3.48	P=0.001**
4.	VLDL mg/dl	42.06±7.52	27.51±0.28	P=0.21 NS
5.	LDL mg/dl	135.98±32.43	131±14.91	P=0.05*
6.	TC/HDL ratio	5.86±1.33	4.30±.54	P=0.001**
7.	CK-MB	451.2.± 54.5	12.32.± 4.23	P=0.05*

\*P<0.05, \*\*P<0.001, s. Significant, NS – Not Significant, BMI: Body Mass Index, TC: Total Cholesterol, TGL: Triglycerides, HDL: High Density Lipoprotein, VLDL: Very Low Density Lipoprotein, LDL: Low Density Lipoprotein.

Correlation between Total cholesterol /HDL ratio and Ck-MB were analyzed using pearson’s

correlation analysis. The results are presented in table 3.

**Table 3: Pearson’s Correlation Analysis Of Total Cholesterol/Hdl Ratio With Other Variables**

Total cholesterol/HDL ratio	Age	CK-MB	TC	TAG	HDL	LDL	VLDL
Correlation 1	0.132	0.53	0.482	0.062	0.374	0.55	0.459
Significance [2 tailed]	0.031	<0.001	0.004	0.06	0.001	0.002	0.56
	S	S	S	NS	S	S	NS

This table shows the significant correlation of Total cholesterol/HDL ratio with CK-MB, Total Cholesterol, HDL-C, LDL-C.

**DISCUSSION**

CAD in Indians has been rising steadily over past 40 years affecting mainly younger age group in the absence of traditional risk factors. Rising affluence, sedentary and stressful life styles are additional risk factors for CAD occurrence at younger age group.

Traditional risk factors used in the prediction of atherosclerosis are Total Cholesterol, Triacylglycerol and low density lipoprotein while High density lipoprotein is a marker of anti atherogenic potential in an individual[11]. Possible association of other modifiable risk factors like Hypertension, Diabetes, Smoking and alcohol consumption also necessitates the predilection for a serious outcome.

In the Pearson's correlation analysis, there is a significant correlation noticed between total cholesterol/HDL ratio and CK-MB with age, Total cholesterol and LDL. Progressive atherosclerosis with increasing age leads to ischemia with super added risk factors precipitating the development of atherosclerosis at an early age. In the present study, TC/HDL ratio in study group is higher than control group ( $5.86 \pm 1.33$  versus  $4.30 \pm .54$ ). This matched with the study done in south India by D. Rajasekar et al. and Angeline et al. [12]. Major reason for increasing TC/HDL ratio seen in present study may be due to the dietary changes in the form of increase intake of foods of animal origin, increase in intake of saturated hydrogenated fat and there is also decrease intake of dietary fibers.

Individuals with a high total/HDL cholesterol or LDL/HDL cholesterol ratio have greater cardiovascular risk owing to the imbalance between the cholesterol carried by atherogenic and protective lipoproteins. This may be due to an increase in the atherogenic component contained in the numerator, a decrease in the anti-atherosclerotic trait of the denominator, or both[13].

Prevalence of CAD is higher in south Indians compared to other states[14]. Indians are at increased risk of developing myocardial infarction almost 10 years earlier than counterparts in developed countries as well as in other developing countries[15]. This scenario is also seen in lower income group in spite of difference in life styles, culture etc., indicating the urgency of addressing the associated risk factors[16].

## CONCLUSION

High level of total cholesterol/HDL ratio has significant association with acute coronary syndrome in present study. Alteration in food habits and life style changes can decrease the effects of modifiable risk factors over atherosclerosis which can delay the onset of ischemia.

## LIMITATION

Study with large sample size is to be conducted to confirm the findings of present study.

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