



## Study of Lipid Profile in Acute Myocardial Infarction within 24 Hours

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### ABSTRACT

**Background:** Increased level of total cholesterol and LDL-cholesterol disturbs the endothelial function that may cause various cardio vascular disease and coronary heart disease. In addition, it can be expected, that hypercholesterolemia may unfavourably influence the course of the acute myocardial infarction. The aim of the study was to check whether patients with lipid levels above normal first 24 hours of myocardial infarction have an unfavorable clinical outcome.

**Methods:** Study was designed on 60 patients (46-men and 14-women) of different age groups admitted with myocardial infarction within first 24 hours of onset of symptoms. 20 normal healthy individuals with normal ECG and no family history of coronary heart disease were selected as control. The clinical history and physical examination confirmed the AMI by the cardiac specific enzyme Creatine Kinase (CK) and Creatine Kinase myocardial b fraction (CK-MB), Troponin (T) and ECG. Blood samples were taken within 24 hours of acute myocardial infarction. Serum concentration of TC, TG, HDL-C were estimated by semi auto analyser. Analysis of variance (ANOVA) followed by Tukey's post hoc test was done to evaluate the association between the mean values of serum samples and clinical outcome. A probability value  $p < 0.05$  was considered statistically significant.

**Result:** In the control group, the means of TC, TG, HDL-C, LDL-C and VLDL-C were found to be 172.2 mg/dl, 147.6 mg/dl, 45.52, 97.16 mg/dl and 29.52 mg/dl respectively. In the present case study, the mean TC was 208.53 mg/dl, mean TG was 168.73, mean HDL-C was 41.65 mg/dl, mean LDL-C was 133.13 mg/dl and mean VLDL-C was 33.74 mg/dl.

**Conclusion:** We found that the occurrence of disease is more in male patient than the female and the male/female ratio was 3.28:1. The patients above the age of 60 years were more prone to develop myocardial infarction and the major risk factors were smoking, hypertension and diabetes. It has also been observed that most of the patients had high level of LDL-cholesterol and low level of HDL-cholesterol within 24 hours onset of myocardial infarction.

**Keywords:** Acute Myocardial Infarction (AMI), Myocardium, Cardiac Specific Enzyme, Lipoproteins.

### Introduction

Ischemic heart disease (IHD) or Coronary Artery disease (CAD) is a condition in which there is an inadequate supply of blood and oxygen to a portion of the myocardium; it typically occurs when there is an imbalance between myocardial oxygen supply and demand. The most common cause of myocardial ischemia is atherosclerotic disease of an epicardial coronary artery (or arteries) sufficient to cause a regional reduction in myocardial blood flow and inadequate perfusion of the myocardium supplied by the involved coronary artery. For many years, it has been proclaimed that coronary heart disease (CHD) was not applicable to traditional risk factors in up to 50 % of cases and was finally concealed after careful and detailed re-analysis (1). Dyslipidemia is still a major risk factor for CHD. Epidemiological studies have conclusively linked high levels of total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C) and low levels of

high density lipoprotein cholesterol (HDL-C) with CHD incidence and mortality (2). It is well known that early treatment of hyperlipidemia followed by acute myocardial infarction (AMI) provides potential benefits to reduce the morbidity and mortality of CHD. However, lipid and lipoproteins level gets changed during acute illnesses that results delay in treatment choice (3). In post-acute coronary events, acute phasic changes occur that alter the lipid profile levels during tissue necrosis. Modifications of serum lipids after AMI induce the reduction in TC, LDL and HDL, in the range of 10 - 20 %, with the reciprocal increase in triglyceride (TG) of approximately 20 - 30 % (1). Several mechanisms accounts for these changes which include the acute phase response associated with up-regulation of LDL-receptor (R) activity and reduction in several pivotal HDL regulatory proteins. From many clinical studies it is clear that phasic changes do occur in patients undergone AMI and therefore it is recommended for

detection of hyperlipidemia in patients with AMI so that the serum lipids should be assessed either within 24 hours after infarction or after 2-3 months of AMI (4). Accurate knowledge of baseline lipid levels may affect the initiation of lipid lowering therapy, the selection of a specific statin and its dosage, and recognition of the potential need for adjunctive lipid therapy, and it may also influence the patient's willingness to adhere to a recommendation for long-term lipid-lowering therapy (5). Besides alterations in the lipoproteins, acute-phase response is also associated with changes in serum concentration of inflammatory markers. The patients with major adverse cardiac events shows intra-cardiac inflammatory response in AMI that appears as a result of the evolution of myocardial necrosis, shown by higher C-reactive protein (CRP) and interleukin (IL)-6 levels in those patients (6). IL-6 is a multifunctional cytokine regulating humoral and cellular responses which plays central role in inflammation and tissue injury. Similarly to CRP, whose synthesis is stimulated by IL-6, high circulating concentrations of IL-6 are associated with increased risk of cardiovascular events (7).

Several population based prospective studies of CHD have reported a close association of subtle, prolonged increases in baseline high sensitive hs-CRP levels with cardiovascular risk (8). The majority of authors concur in that the admission hs-CRP concentration reflects the baseline inflammatory status of the patient; thus, patients with AMI and high hs-CRP levels at admission usually experience more cardiovascular complications during follow-up (9,10) stated that increase in concentration of low density lipoprotein (LDL) cholesterol or decrease in level of high density lipoprotein (HDL) cholesterol are important risk factors for coronary atherosclerosis. In addition to these risk factors, high level of total cholesterol and LDL-cholesterol also disturbs the endothelial function (11). Thus it can be expected, that hypercholesterolemia may influence the course of the acute myocardial infarction in an unfavorable manner. An another study investigated the lipid profile in cardiac patients (myocardial infarction, angina pectoris, coronary heart disease, ischemic heart disease), diabetic patients and normal humans (12). Higher level of total cholesterol, LDL-C and triglyceride were found in both cardiac and diabetic patients, however, cardiac patients had much lower level of HDL-C as compared to normal humans. Dietary and exercise strategies can lead to modest

and variable improvements in HDL-C concentrations and other vascular risk factors also which may be associated with greater anti-oxidative potential of HDL (13).

The best-known function of HDL is its antiatherogenic ability for promoting the efflux of cholesterol from cells.

Temelkov, 2009 et al (14) reported that patients with hypercholesterolemia, hypertriglyceridemia and low HDL-c are more prone towards macro vascular disease, which automatically leads to stroke and myocardial infarction. The aim of this study was to prospectively evaluate the magnitude of the variations in lipid levels in a large population of patients admitted for acute myocardial infarction (MI) 24 hours of onset of symptoms. Clinical data and blood samples were prospectively collected from consecutive patients with MI.

### Materials and Methods

The present work has been carried out in 60 cases (male: 46 and female: 14), attending in emergency of Katihar Medical College and Hospital and 20 normal healthy persons with normal ECG and no family history of coronary heart disease were selected as control. We included patients if they met all the following criteria: (a) all patients had AMI at baseline; (b) blood sample for lipid profile and inflammatory markers estimation was obtained within 24 h from the onset of symptoms. Informed consent were taken from the cases and controls before enrolment in the study. Men and women of different age groups are admitted with first myocardial infarction within first 24 hours of onset of symptoms (Table 1). The presence of different risk factors in cases are also enlisted (Table 2). Diagnosis of acute myocardial infarction was based on the presence of any two of the following classical findings. Clinical history and physical examination data, focusing on characteristics of chest pain lasting more than 30 minutes and presence of cardiovascular risk factors were recorded for every patient. Rise and fall of cardiac specific enzyme-CK and CKMB (elevation to at least twice the upper limit of normal range) or Troponin 'T' positivity by kit method [Roche CARDIAC Trop T Sensitive test (visual)]. Patients admitted with AMI, but having one or more of the findings were excluded from the study i.e. having definite history of ECG evidence of prior MI, patients presenting more than 24 hours of onset of symptoms, chronic renal failure/renal

parenchymal disease, nephritic syndrome, liver disease, disabling terminal illness.

Blood samples were taken within 24 hours of acute myocardial infarction. Serum concentration of TC, TG, HDL-C were estimated by semi auto analyzer (Transasia Bio-Medicals Ltd.). For TG; 1ml blood was centrifuged. Then 10 ml serum mixed with reagent. For TC; 10ml serum was taken after centrifugation and mixed with 1ml cholesterol reagent. For HDL-C estimation; 0.2 ml serum was mixed with HDL reagent 0.2 ml to precipitate serum which was centrifuged at 2000 rpm for 10 minutes, 20ml supernatant was again mixed with 1 ml HDL reagent. The entire reagent was incubated at 37°C and took its reading. Serum Na<sup>+</sup>/K<sup>+</sup>, B. Urea, S. Creatinine were estimated to rule out electrolyte imbalance and renal failure. Troponin (T) was tested only qualitative by kit method as mentioned earlier. Appearance of 2 lines was taken as positive while single line was taken as a valid but negative test. Hb%, TLC, DLC, ESR were routinely measured in each and every patient. Blood sugar fasting and post prandial was done to know the glycaemic status of the patient. Serum bilirubin, SGPT, Serum albumin & globulin were done to exclude significant liver derangement. Independent sample t-tests were used to compare the mean values of variables between the AMI and control groups, whereas chi-square test was used for association between two categorical variables. To evaluate the association between serum samples the mean values were compared by one way analysis of variance (ANOVA) followed by Tukey's post hoc test. A probability value  $p < 0.05$  was considered statistically significant.

## Results

The serum lipid profile of total cholesterol (TC), total triglyceride (TG), high density lipoprotein-cholesterol (HDL-C), low density lipoprotein-cholesterol (LDL-C) and very low density lipoprotein-

cholesterol (VLDL-C) were estimated and their association, as well as causation in myocardial infarction was determined. The levels of total cholesterol, HDL-C, triglyceride and LDL-C in cases and controls are shown in table 3. In the control group, the mean TC was 172.2 mg/dl, mean TG was 147.6 mg/dl, mean HDL-C was 45.52, mean LDL-C was 97.16 mg/dl and mean VLDL-C was 29.52 mg/dl. In the control group, the mean total cholesterol in men was 177.4 mg/dl and in women was 156.6 mg/dl. The mean HDL-C in men was 44.34 mg/dl and in women was 49.04 mg/dl. According to these readings the TC/HDL-C ratio in men was 4.08 whereas only 3.202 in women showing a better profile in women. Lipid profile among cases and control with AMI are listed in table 4. In addition TC/HDL-C ratio of two sexes in control and patients with AMI are given in table 5. However, the details analytical values of given parameters are provided in table 6. The analysis showed that the highest number of cases was found in the age of 61-70 years i.e. 36.6%. Incidence of acute myocardial infarction in the young age group (30-40 years) was 10% and this is also significant. Acute myocardial infarction patients showed a male preponderance. The male to female ratio was 3.28:1. Hypertension was present in 40% cases, smoking habit was present in 36.6% and 16.6% of cases were diabetic. A family history of coronary artery disease was present in 26.6% of cases. Serum Total Cholesterol (TC), Total Triglyceride (TG), HDL-Cholesterol, LDL-Cholesterol and VLDL-cholesterol were estimated in all 60 patients and 20 control subjects. In addition, the mean total cholesterol in control group was 177.4 mg/dl and 156.6 mg/dl in men and women respectively. Similarly, the mean HDL-C in men and in women was 44.34 mg/dl and 49.04 mg/dl respectively. The TC/HDL-C ratio in men was 4.08 whereas only 3.202 in women showing a better profile. Depression of HDL-Cholesterol in cases as compared to control subjects was also significant.

**Table 1: Incidence of acute myocardial infarction in different age groups.**

Age groups (years)	No. of cases
30 – 40	6
41 – 50	17
51 – 60	14
61 – 70	20
71 – 80	3
Total	60

**Table 2: Showing the presence of different risk factors in cases.**

Sl. No.	Risk factors	No. of cases
1.	Diabetes Mellitus	10
2.	Hypertension	25
3.	Family history of coronary artery Disease	16
4.	Family history of dyslipidemia	5
5.	Smoking	22

**Table 3: The levels of Total cholesterol, HDL-C, Triglyceride and LDL-C in cases and controls.**

Finding	Levels	Case	Control
Total cholesterol	< 200 mg/dl	20 (43.5%)	14 (93.3%)
		6 (42.8%)	4 (80%)
	200-239 mg/dl	17 (36.9%)	1 (6.6%)
		8 (57.2%)	1 (20%)
	≥ 240 mg/dl	9(19.6%)	Nil
HDL-C	< 35 mg/dl	13 (21.7%)	Nil
	35 – 60 mg/dl	47 (78.3%)	20 (100%)
	> 60 mg/dl	Nil	Nil
Triglyceride	< 150 mg/dl	29 (48.3%)	8 (40%)
	> 150 mg/dl	31 (51.7%)	12 (60%)
LDL-C	< 100	5 (8.3%)	10 (50%)
	100-129	20 (33.3%)	9 (45%)
	> 130	35 (58.4%)	1(5%)

**Table 4: Lipid profile among cases and control with AMI.**

Serum Lipids	Case		Control	
	Mean (mg/dl)	(Standard deviation (+S.D. mg/dl))	Mean (mg/dl)	(Standard deviation (+S.D. mg/dl))
TC	208.53	24.709	172.2	16.618
TG	168.73	50.769	147.6	24.724
HDL-C	41.65	6.617	45.52	6.441
VLDL-C	33.74	10.153	29.52	4.944
LDL-C	133.13	19.74	97.16	15.891
TC/HDL-C ratio	5.154	0.946	3.86	0.717

**Table 5: TC/HDL-C ratio of two sexes in control and patients with AMI.**

Sex	Case				Control			
	No.	Mean TC mg/dl	Mean HDL-C	TC/ HDL-C ratio	No.	Mean TC mg/dl	Mean HDL-C	TC/ HDL-C ratio
Male	46	214.43	40.54	5.447	15	177.4	44.34	4.08
Female	14	189.14	45.31	4.19	5	156.6	49.04	3.202

**Table 6: The significance of clinical characteristics of patients and controls.**

Finding		Range	Mean	(Value Mean) <sup>2</sup>	Z value	p-value
TC	Case	160 – 252	208.53	36633.92	7.42	<0.001
	Control	146 – 207	172.2	5247.2		
TG	Case	106 – 408	168.73	154651.96	2.46	<0.01
	Control	96 – 199	147.6	11614.8		
LDL	Case	84 – 175.8	133.13	23380.4	8.23	<0.001
	Control	72 – 136	97.16	4798.36		
HDL	Case	29.2 – 50.8	41.65	2627.52	2.31	<0.01
	Control	31.4 – 55	45.52	788.426		
VLDL	Case	21.2 – 81.6	33.74	6185.85	2.46	<0.01
	Control	19.2 – 39.8	29.52	464.52		
TC/HDL	Case	3.715 – 7.606	5.154	53.696	6.45	<0.001
	Control	2.78 – 5.54	3.86	9.7695		

## Discussion

A series of changes in lipid metabolism occur during acute phase response. In the present study majority of the patients are in old age groups (i.e. 61-70 years). In a study by American Heart Association reported that approximately 4/5<sup>th</sup> of myocardial infarction occurred in individuals aged 65 years and above. It was further also supported by various other studies previously done by Volmink 1998 et al (15) and Pedoe 1999 et al (16) that showed that most of the myocardial infarction occurred above 60 years and 70 years of age. In the present study out of total 60 patients the number of male patients are higher than the female (M=46 and F=14). The male/female ratio was 3.28:1. Our study was again supported by Lerrier, DJ and Kannel WB (17) who observed 60% of coronary events occurred in men. Furthermore, Lampe 2000 et al (18) and Tunstall-Pedoe 1999 et al (16) reached to the finding that for every 4.1 males only 1 female suffered myocardial infarction and 75% of the sufferers of myocardial infarction were males respectively. So, the study showed male preponderance in acute myocardial infarction. In the present study history of smoking was found in 22 patients (36.6%). Literatures are available in support of smoking as risk factors of hypertension which was predictors of cardiovascular risk Nina 2007 et al and Jan Borgel 2006 et al in (19,20). Hypertension was related to the incidence of myocardial infarction, in current study, 24 patients (40%) are found to be hypertensive; it was supporting the study done by Sajuelsson et al (1990) previously. It was further also supported by Bartel 2007 et al (21), who observed similar relationship between hypertension and myocardial infarction.

Moreover, various papers have revealed that diabetes was closely related to increased incidence of myocardial infarction (22). In our study, the history of Diabetes Mellitus cases were present in 10 patients (16.6%) was again supported by various previously reported data.

In the present study it is noted that family history of coronary artery disease is present in 16 patients (26.6%). In 1984, a study performed by Shea 1984 et al (23) observed that relatives of angiographically demonstrated coronary artery disease had a significantly greater risk for coronary artery disease than control. The present study we estimated total cholesterol (TC), total triglyceride (TG), high density lipoprotein-cholesterol (HDL-C), very low density lipoprotein-cholesterol (VLDL-C) and low density lipoprotein-cholesterol (LDL-C). In the control group, the means of TC, TG, HDL-C, LDL-C and VLDL-C were found to be 172.2 mg/dl, 147.6 mg/dl, 45.52, 97.16 mg/dl and 29.52 mg/dl respectively. In addition, the mean total cholesterol in control group was 177.4 mg/dl and 156.6 mg/dl in men and women respectively. Similarly, the mean HDL-C in men and in women was 44.34 mg/dl and 49.04 mg/dl respectively. Previous studies have reported that normal female have a lower TC, a higher HDL-C and a lower TC/HDL-C ratio (24). Jan Borgel 2006 et al in (20) demonstrated that females had a lower LDL-C and TC and a higher HDL-C as compared to males. Similar pattern was also reported by Stefan Wieczorek 2007 et al in (25). Among the cases in the present study, the mean TC was 208.53 mg/dl, mean TG was 168.73, mean HDL-C was 41.65 mg/dl, mean LDL-C was 133.13 mg/dl and mean VLDL-C was 33.74



mg/dl. The LDL-C was higher than optimal value showed that levels of these parameters are highly associated in the patients of myocardial infarction as compared to normal population. Similar studies have also been done previously by Nikolaus 2005 et al (26) in 2003; they observed a higher LDL-C and TC as risk factors for the development of myocardial infarction. The mean TC when compared to control showed an increased value. The HDL-C was lower in cases (mean 41.65 mg/dl) than control (mean 45.52 mg/dl). Low HDL-C was a predictor of CHD. However, Hulley SB 1980 et al (27) showed an inverse relationship between HDL-C levels and incidence of myocardial infarction. In the present study the mean TC/HDL-C ratio in cases was 5.154 and that in control was 3.86, so a higher value for the patients of myocardial infarction. In a co-operative lipoprotein phenotyping study showed that a high TC/HDL-C ratio was a predictor of myocardial infarction (28). Nina K. Bartel 2007 et al (19) predicted that a TC/HDL-C ratio greater than 4 was related to the risk of myocardial infarction. Jan Borgel 2006 et al (24) demonstrated that a more than optimal TC/HDL-C ratio was directly related to the risk of myocardial infarction.

### Conclusion

In current study, it has been observed that there is a male predominance as regards myocardial infarction. The patients above the age of 60 years were more prone to develop myocardial infarction and the major risk factors were smoking, hypertension and diabetes. Within 24 hours of myocardial infarction, it has been observed that most of the patients had high level of LDL-cholesterol and low level of HDL-cholesterol. None of the patients had high HDL-cholesterol but all patients had high total cholesterol. Hence, inference may be drawn from the present study that the patients who are having low HDL-cholesterol are prone to develop myocardial infarction. This may be an important guideline for preventing cardiac strokes, in future.

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