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Original Research Article

EFFECT OF ACUTE MYOCARDIAL INFARCTION ON CHOLESTEROL RATIOS

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Abstract

Background: Myocardial infarction generally occurs with the abrupt decrease in coronary blood flow that follows a thrombotic occlusion of a coronary artery previously narrowed by atherosclerosis. Present study aimed to study effects of acute myocardial infarction (MI) on cholesterol ratios. **Materials and Methods:** The study was conducted at the intensive coronary care unit and medical wards of Tirunelveli Medical College Hospital, Tirunelveli during the period of August 2004 to August 2005. The serum lipid profile was measured within the first 24 hours of the onset of symptoms of myocardial infarctions and again at day 4 post myocardial infarctions. The serum total cholesterol, triglyceride levels, total cholesterol / HDL cholesterol and LDL cholesterol / HDL ratios were recorded for all patients. **Result:** Total 100 patients with confirmed diagnosis of acute myocardial infarction fulfilling the criteria were enrolled in the study. Total serum cholesterol (190.10±25.75 vs 172.50±27.05 mg/dL) and triglycerides (124.98±38.35 mg/dL vs 143.22±35.64 mg/dL) showed significant increase from Day 1 post MI to Day 4 post MI. The ratio of total cholesterol to HDL cholesterol and the ratio of LDL cholesterol to HDL cholesterol was 4.30±0.36 on day 1 post-MI and 4.38±0.36 on day 4 post-MI and 2.71±0.40 on day 1 post-MI and 2.69±0.38 on day 4 post-MI respectively. **Conclusion:** T MI significantly reduces the total serum cholesterol levels and increases the serum triglyceride levels. But the MI has no significant effect on the cholesterol ratios.

INTRODUCTION

Coronary artery diseases remains the most common cause of death despite significant advertisement in its prevention and treatment.[1] Myocardial infarction (MI) generally occurs with the abrupt decrease in coronary blood flow that follows a thrombotic occlusion of a coronary artery previously narrowed by atherosclerosis. The injury is facilitated by factors such as cigarette smoking, hypertension, dyslipidemia, diabetes and a number of other factors.[2] The risk of coronary artery disease in Indians is 3-4 times higher than white Americans and 20 times higher than Japanese.[3]

Aggressive management of the risk factors is one of the crucial elements in the treatment of patients with coronary artery disease. Serum markers that are used for cholesterol risk assessment and management are total cholesterol, low density lipoprotein (LDL) cholesterol level and high density lipoprotein (HDL) Cholesterol level. Patients with acute myocardial infarctions should have plasma lipid levels determined within 24 hours of the onset of symptoms of acute infarction.[4]

The studies like Muligan et al (1984), Jacobson et al (1996), and number of other studies have questioned the validity of the plasma lipid levels measures beyond 24 hours from the onset of myocardial infarction.[5-6]

The studies have demonstrated that acute myocardial infarction results in a transient decline in the serum cholesterol levels, which becomes apparent after 24 hours of onset of myocardial infarction and may last for 2 to 3 months.[7] Therefore in situations in which plasma lipid levels are not determined within 24 hours of the onset of MI symptoms, the cholesterol measurements are usually deferred until the effect of acute infarction is fully resolved. Which may result in an inappropriate delay in the management of hyper cholesterolemia.[4]

The ratios of total cholesterol to HDL cholesterol and LDL cholesterol to HDL cholesterol also can be used as predictors of acute coronary events.[5,8] Hence the purpose of the present study was to

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determine whether the acute MI affects the value of the serum cholesterol ratios as it does with absolute serum cholesterol levels.

MATERIALS AND METHODS

The study was conducted at the intensive coronary care unit and medical wards of Tirunelveli Medical College Hospital, Tirunelveli during the period of August 2004 to August 2005.

Inclusion Criteria

Total 100 patients who were admitted with a confirmed diagnosis of acute myocardial infarction were enrolled in the study

Exclusion Criteria

Patients with symptoms suggestive of acute myocardial infarctions ≥ 12 hours. Patients having hospital stays of ≥ 4 days and already receiving lipid – lowering medications.

Methodology

The diagnosis of acute myocardial infarctions was made if patients had ischemic type chest pain for ≥ 30 minutes with evidence of ST- Segment elevation of ≥ 1 mm in two anatomically contiguous leads on the ECG or the appearance of a new left bundle branch block. Patients who had symptoms suggestive of acute myocardial infarction but did not meet the ECG diagnostic criteria, needed to have serum creatinine kinase MB levels that were more than twice the upper limit of normal. All the patients were followed from the day of admission to the day of discharge.

Lipid Measurements

Besides clinically examination and routine investigation, the serum lipid profile was measured within the first 24 hours of the onset of symptoms of myocardial infarctions and again at day 4 post myocardial infarctions. The serum total cholesterol triglyceride levels were measured by colorimetric test and HDL cholesterol is measured by precipitation assay. The LDL cholesterol value was calculated by using the Friedewald formula; LDL cholesterol=total cholesterol-HDL-Cholesterol-(triglyceride/5). The cholesterol ratios then were calculated by using the total cholesterol / HDL cholesterol and LDL cholesterol / HDL, cholesterol ratios.[9] All the blood samples were 12 hours fasting samples

Statistical Analysis

Continuous variables were expressed as the mean ≥ standard deviation (SD) and the category variables were expressed as a percentage. The student ‘s’ ‘t’ test was used to compare lipid values and ratios between day 1 post MI and day 4 post MI. A two tailed ‘P’ value of < 0.05 was considered to be significant.

RESULTS

The clinical characteristics of the study patients are summarized in [Table 1]. In present study 81% patients were male. The mean age was 64±12 year. The hypertension was present in 33% patients, and diabetes mellitus was present in 29% patients. 37% were smokers, and 16% patients had family histories of coronary artery disease. The non-ST elevation MI was diagnosed in twenty 20% patients whereas 80% patients were reported with ST elevation MI. Total 16% patients were found obese in current study.

Table 1: Different characteristics of patients

Parameters	Frequency (%)
Gender	
Female	19 (19%)
Male	81 (81%)
Age (mean ± SD)	64 ± 12
Hypertension	33 (33%)
Diabetic mellitus	29 (29%)
Smokers	37 (37%)
Positive family history	16 (16%)
Non ST elevation myocardial infarction	20 (20%)
ST elevation myocardial infarction	80 (80%)
Obesity	16 (16%)

All serum lipid levels changed significantly between day 1 post-MI (ie, within 24 h) and day 4 post-MI. From day 1 post-MI to day 4 post-MI, serum total cholesterol levels (190.10±25.75 vs 172.50±27.05 mg/dL, respectively; p = 0.01). The serum triglyceride levels increased significantly from 124.98±38.35 mg/dL on day 1 post-MI to 143.22±35.64 mg/dL on day 4 post-MI (p < 0.006). Regardless of these significant changes in the absolute lipid levels, however, the cholesterol ratios remained unchanged between day 1 post-MI and day 4 post-MI. The ratio of total cholesterol to HDL cholesterol was 4.30±0.36 on day 1 post-MI and 4.38±0.36 on day 4 post-MI (change was not significant), and the ratio of LDL cholesterol to HDL cholesterol was 2.71±0.40 on day 1 post-MI and 2.69±0.38 on day 4 post-MI (change not significant) [Table 2].

Table 2: Comparison of serum lipid values on Day 1, Day 4

Serum Lipids	Within 24 hrs of Myocardial infarction Day-1	Day-4 Post Myocardial infarction	‘Z’ and ‘P’ Values
Total Cholesterol (mg/dl)	190.10±25.75	172.50±27.05	0.01

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Triglycerides (mg/dl)	124.98±38.35	143.22±35.64	0.006
Total Cholesterol/HDL	4.30±0.36	4.38±0.36	0.33
LDL Cholesterol/HDL	2.71±0.40	2.69±0.38	0.06

DISCUSSION

Many studies in the past few decades have shown that acute myocardial infarction results in a significant decrease in the serum levels of total cholesterol, LDL cholesterol and HDL cholesterol.[6,10] The acceptable time for the measurement of plasma lipids after an acute myocardial infarction is within 24 hours after the onset of symptoms and the plasma lipid levels measured beyond 24 hours are mostly considered to be valid.[4]

The post myocardial infarction decline in serum cholesterol occurs because of the acute – phase response, and is of greatest extent by days 4 to day 5 post-myocardial infarction.[11-12] Acute myocardial infarction like my any other tissue injury, initiates various local and systemic reactions.[13] The local response includes vasodilation, leucocyte infiltration and chemotaxis, monocyte and macrophone activation and cytokine release.[14] The cytokines act on the systemic targets, including the liver to generate changes in the concentration of various heterogeneous plasma proteins, collectively known as acute-phase reactants including lipoproteins.15 By day 4 to 5 post-myocardial infarction, there is a significant decrease in the serum concentration of apoprotein A-1 and apoprotein-B reflecting the maximum decrease in the serum cholesterol level by the time.[16] While the serum cholesterol level decreases after an acute myocardial infarction the serum triglyceride level increases.

This paradoxical rise in serum triglycerides is due to increase in serum-C reactive protein level which may increase to levels that are several hundred-fold higher than baseline 4 days after any myocardial infarction.[17] The C-reactive protein binds selectively with very LDL and interferes with its catabolism thereby increasing the serum triglyceride concentration.[18]

The magnitude of the decrease in serum cholesterol level after myocardial infarction is positively correlated with the infarct size and is not dependent on the patient's age or sex, the development of arrhythmias, the medications being received or the development of heart failure.[19] The decrease in serum cholesterol levels after acute myocardial infarction is transient and these levels gradually return to the baseline pre-myocardial infarction values in 2 to 3 months.[4] Therefore most experts recommend measuring the serum cholesterol levels within the first 24 hours after the onset of an acute infarction (or) otherwise deferring measurement until 2 to 3 months after the myocardial infarction.[20,7]

However deferring the measurement of serum cholesterol levels in patients whose cholesterol levels were not determined within the first 24 hours after the onset of acute infarction can lead to a delay in initiating the appropriate cholesterol lowering therapy for the secondary prevention of future coronary events.[21] The National cholesterol education program guidelines recommend using the absolute value of total cholesterol, LDL, cholesterol and HDL cholesterol as determined of the cholesterol risk and the therapeutic goals have been set forth using these absolute serum cholesterol levels. These guidelines emphasized the issue stating that LDL cholesterol and HDL cholesterol are independent risk factors requiring individual attention.

Several large-scale epidemiologic studies have shown that the total cholesterol / HDL cholesterol ratio are also strong predictors of coronary artery disease events because these ratios sum up the importance of both the total cholesterol or the LDL cholesterol and HDL cholesterol collectively. The study has shown that in certain situations in which the plasma cholesterol levels are not measured within the first 24 hours after the onset of acute myocardial infarction, cholesterol ratios determined from the serum cholesterol measurements taken after 24 hours of the onset of acute infarction could be used reliably for cholesterol risk assessment.9 Because at day 4 post-myocardial infarction when the absolute values of serum total cholesterol. Significantly decreased from the baseline value at day one post-infarction, the ratios at total cholesterol to HDL cholesterol and LDL cholesterol to HDL cholesterol remained unchanged.

The ratios of total cholesterol to HDL cholesterol and LDL cholesterol to HDL cholesterol that have been reported to correlate with the development of acute coronary events are > 4, 3 and > 2, 7 respectively. In the study the mean (± standard deviation) total cholesterol to HDL cholesterol ratio was 4.30 ± 0.36 at day one. Post myocardial infarction and did not change significantly at day -4 posts-infarction. These findings suggest that the cholesterol ratios could be used to determine cholesterol risk in patients who experienced acute myocardial infarctions and may have an advantage in situations in which the absolute total and fractionated cholesterol levels are longer applicable because of the effect of the acute myocardial infarction (beyond 24 hours after the onset of acute myocardial infarction).22 The results observed in the studies of acute myocardial infarction on cholesterol and cholesterol ratios like Chamsi-Pasha et al, Brugada et al, and PyFe T et al are consistent with the present study.[4,7,11]

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CONCLUSION

A study of 100 patients admitted with acute myocardial infarctions has revealed that, acute myocardial infarction significantly reduces the total serum cholesterol levels and increases the serum triglyceride levels. But the acute myocardial infarction has no significant effect on the cholesterol ratios (LDL cholesterol/HDL cholesterol ratios and cholesterol / HDL cholesterol ratio). So after 24 hours of acute myocardial infarction assessment of cholesterol ratios will be more appropriate than assessing total cholesterol levels.

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