Journal of Cardiovascular Disease Research
ISSN:0975-3583,0976-2833 VOL14, ISSUE 05, 2023

Original research article

The effect of acute myocardial infarction on the ratios of total cholesterol to HDL (High Density Lipoprotein) cholesterol and of LDL (Low Density Lipoprotein) cholesterol to HDL (High Density Lipoprotein) cholesterol

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Abstract

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 ipoprotein (LDL) cholesterol level and high-density lipoprotein (HDL) cholesterol level. Hundred patients who were admitted with a confirmed diagnosis of acute myocardial infarction were enrolled in the study. The diagnosis of acute myocardial infarction was made if patients had ischemic type chest pain for 2:30 minutes with evidence of ST-segment elevation of 2:1mm in two anatomically contiguous leads on the ECG or the appearance of a new left bundle branch block. The ratio of low-density lipoprotein cholesterol to high density lipoprotein cholesterol (LDUHDL ratios) on day^{-1} post myocardial infarction and day-4 post myocardial infarction were 2.710 and 2.690 respectively. The ratio of low-density lipoprotein cholesterol to high density lipoprotein cholesterol (LDUHDL ratios) on day-1 post myocardial infarction and day-4 post myocardial infarction were 2.710 and 2.690 respectively.
Keywords: Acute myocardial infarction, HDL, LDL

Introduction

Coronary artery disease remains the most common cause of death despite significant advancement in its prevention and treatment.

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. The injury is facilitated by factors such as cigarette smoking, hypertension, dyslipidaemia, diabetes and a number of other factors [1].

According to Davidson MA *et al*., the risk of coronary artery disease in Indians is 3-4 times higher than white Americans and 20 times higher than Japanese.

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 ipoprotein (LDL) cholesterol level and high-density lipoprotein (HDL) cholesterol level [2].

Patients with acute myocardial infarctions should have plasma lipid levels determined in 24 hours of the onset of symptoms of acute infarction [3].

The studies like Mulligan IP *et al*. (1984), Jacobson TA *et al*. (1996), Scrass R Marshall R *et al*. (1987) and many other studies have questioned the validity of the pasma lipid levels measures beyond 24 hours from the onset of myocardial infarction [4].

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 5. Therefore in situations in which plasma lipid levels are not determined within 24 hours of the onset of myocardial infarction 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 cholesteremia [5].

The ratios of total cholesterol to HDL cholestero l and of LDL cholesterol to HDL cholesterol also can be used as predictors of acute coronary events [6].

Methodology

- Hundred patients who were admitted with a confirmed diagnosis of acute myocardial infarction were enrolled in the study.
- The diagnosis of acute myocardial infarction was made if patients had ischemic type chest pain for 2:30 minutes with evidence of ST-segment elevation of 2:1mm in two anatomically contiguous leads on the ECG or the appearance of a new left bundle branch block.

Inclusion criteria

- Patients with symptoms suggestive of ACS presenting within 12 hours.
- ECG evidence of Ml.
- Increased biomarkers of myocardial infarction.

Exclusion criteria

- Symptoms suggestive of acute myocardial infarction 2:12 hours.
- Hospital stays of <4 days.
- Already receiving lipid-lowering medications.
- All the patients were followed from the day of admission to the day of discharge.

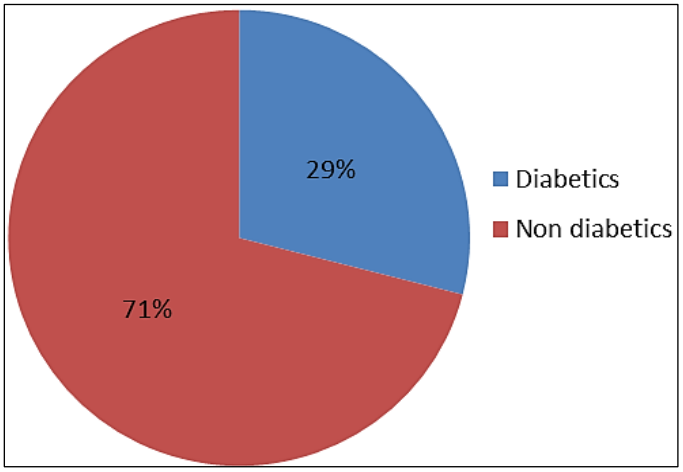
Prior to conducting the study, approval was obtained from the Institutional Ethical Committee. Patients or their close relatives were approached during the hospitalization and informed consent was sought for enrolment into the study.

Besides clinical examination and routine investigation, the serum lipid profile was measured within the first 24 hours of the onset of symptoms of myocardial infarction and again at day 4 post myocardial infarction. 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 Friedewaldformula. LDLcholesterol = totalcholesterol-HDLcholesterol-(triglyceride/5).

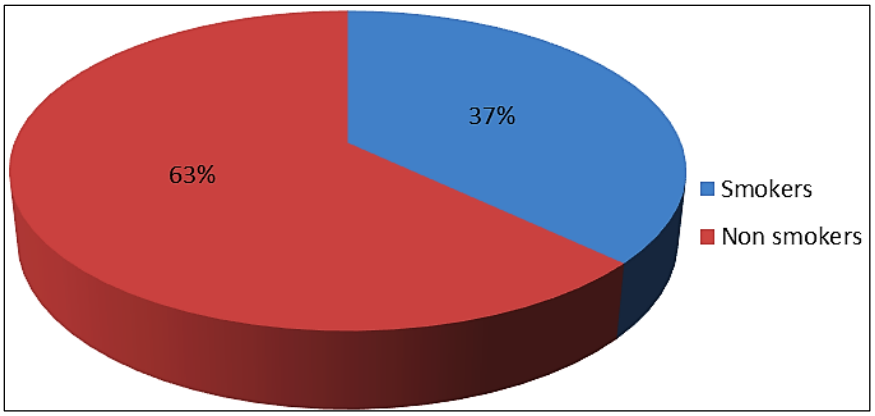
The cholesterol ratios then were calculated by using the total cholesterol /HDL cholesterol .and LDL cholesterol *I* HDL cholesterol ratios. All the bloodsamples were 12 hours fasting samples.

Results



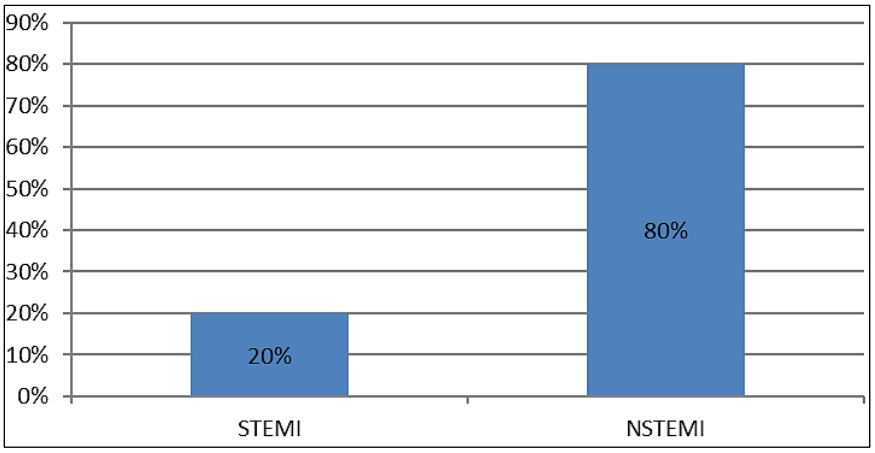
Graph 1: Diabetes

Twenty nine (29%) percent of the patients studied were diabetic.



Graph 2: Smoking

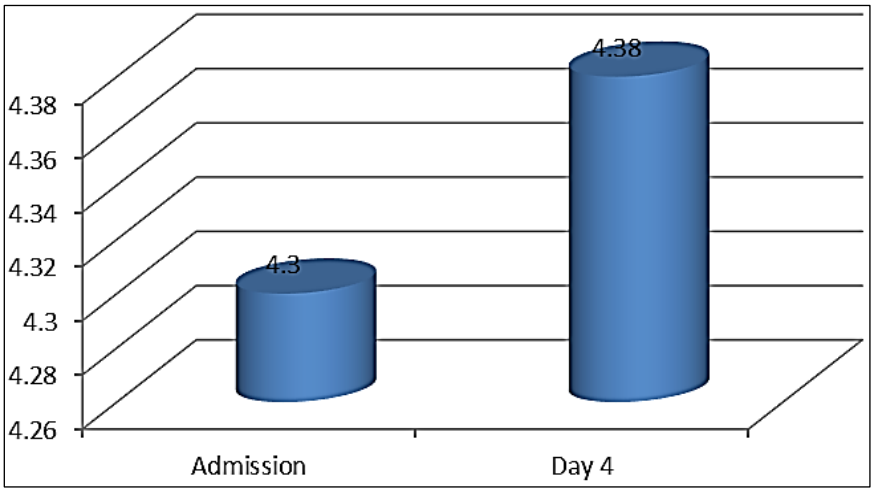
Thirty seven (37%) percent of the patients studied were smokers.



Graph 3: STEMI & NSTEMI

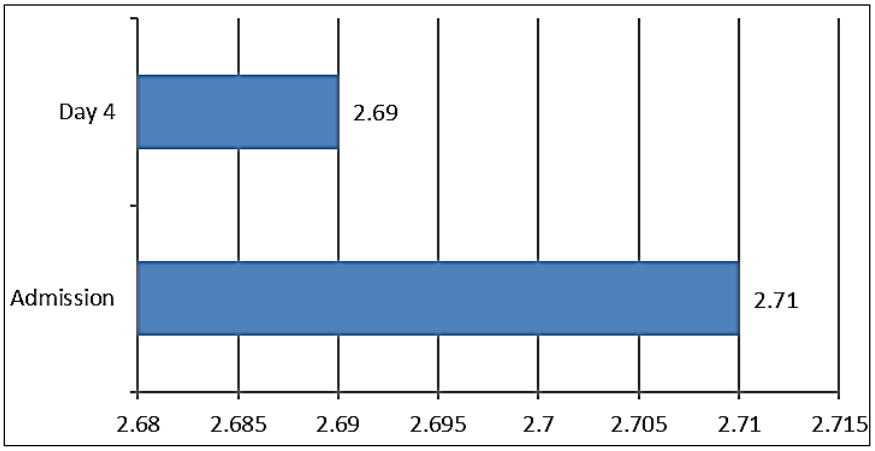
- Out of the hundred patients studied, non-ST elevation myocardial infarction was diagnosed in 20% patients. 80% of the patients studied were diagnosed to have ST elevation myocardial infarction.
- 16% of the patients had family history of coronary artery disease.

Regarding the Cholesterol ratios, the ratio at total cholesterol to High Density Lipo protein cholesterol (Cholesterol *I* HDL ratio) on day-1 post myocardial infarction and day 4 post myocardial infarction were 4.300 and 4.380 respectively.



Graph 4: TC/HDL Ratio

The ratio of low-density lipoprotein cholesterol to high density lipoprotein cholesterol (LDUHDL ratios) on day-1 post myocardial infarction and day-4 post myocardial infarction were 2.710 and 2.690 respectively.



Graph 5: LDL/HDL Ratio

Table 1: Comparison of the Serum Lipid Values and Ratios Between Within 24 Hours of Myocardial Infarction and Day-4 Post Myocardial Infarction

Serum lipids	At Admission	Day-4	P Value
Total cholesterol HDL cholesterol ratio	4.30 ± 0.36	4.38 ± 0.36	0.33
LDL cholesterol HDL cholesterol ratio	2.71± 0.40	2.69 ± 0.38	0.06

Discussion

The National cholesterol Education program guidelines recommend using the absolute values 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.

The ratio between total cholesterol and HDL cholesterol do not vary significantly between the two groups. The ratio between LDL and HDL cholesterol also has no significant variation.

In study by Shri vastava *et al*. [7] conducted in 400 confirmed AMI patients, all serum lipid levels changed significantly between day 1 post-Ml (i.e., within 24 hours) to day 2. The results indicate a trend of significantly reduced TC, LDL and HDL, and elevated TG levels, along with pro-and anti-inflammatory markers ($p<0.001$), between day 1 and the day 2 serum samples of AMI patients. It concluded that considering that phasic changes in serum lipid and lipoprotein levels occur after 24 hours of ACS, the findings of this study emphasize the need for assessment of the lipid profile of these patients to be made at admission, so as to identify patients at a higher potential risk. But no comparison of cholesterol ratios is done in this study.

Gorecki *et al*. [8] observed higher levels of TC and LDL in patients with complicated versus those with uncomplicated clinical course of infarction, suggesting higher levels of these biomarkers during the first 24 hours of AMI have a strong negative prognostic value.

Gaziano *et al*. [9] found that the mean TC and LDL levels were significantly lower while in-hospital than levels 2 to 3 months later; however, from a clinical perspective, in- hospital levels can be used to guide decisions regarding lipid-lowering therapy, which can begin in the immediate post-Ml setting.

Rosoklija *et al*. [10] have followed-up the HDL cholesterol levels in STEMI patients from 24 hours to 3 months and concluded that the optimal times for determining the HDL level are the first 24 hours of the actual event; this is due to the fact that after the first 24 hours there is a relevant decrease of the HDL cholesterol level in the blood.

In Haseeb Khan *et al*. [11] there were significant decreases in TC, LDL and HDL levels in both STEMI and NSTEMI patients as compared to normal subjects; Serum TG levels did not differ significantly among the study groups.

In LATIN tria1 [12] which is a multicenter trial conducted in Italy, the median hospital stay was 9 and for Ml.LDL-cholesterol concentrations showed a statistically significant decrease between at admission and following day morning. The average decreases in total cholesterol and LDL-cholesterol between admission and the following morning were 7 and 10% respectively for Ml. HDL-cholesterol serum levels did not vary between admission and the following morning, decreased significantly at discharge and returned to baseline values at 3 months. Triglyceride serum levels decreased slightly (5% decrease between admission and the following morning, probably due to the fasting state) both in patients with Ml.

In LATIN trial, if lipid levels measured at admission are considered 55.8% of Ml patients are identified as candidates for pharmacological intervention. If lipid levels measured following morning are considered, 38.1% of population are identified with LDL-cholesterol levels <130 mg/di are identified as candidates for

pharmacological intervention. Follow up lipid levels were done at end of 3 months which showed after 3 months total cholesterol and HDL-cholesterol levels returned to baseline values, while LDL-cholesterol concentrations were still significantly lower compared to baseline.
Another possible explanation for the morning fall in total and LDL-cholesterol levels found in our study may be the presence of a circadian rhythm leading to a morning nadir in the concentration of lipoproteins.

Conclusion

- But acute myocardial infarction does not affect the cholesterol ratios. (Cholesterol I HDL and LDL I HDL cholesterol ratios) even 24 hours after infarction.
- Therefore following acute myocardial infarction, the cholesterol ratios are valid and very useful in risk assessment.
- Treatment for hypercholesterolemia may be done on the basis of these cholesterol ratio in situations in which absolute levels of serum cholesterol and triglycerides are not valid. {After 24 hours of onset of acute myocardial infarction).

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