Serum CK-MB, fasting lipid profile and lipid indices in patients with myocardial infarction -A case control study

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Abstract

Introduction: Coronary artery disease (CAD) is the leading cause of death worldwide. Deranged lipid metabolism is one of the important factors leading to development of myocardial infarction (MI). The study was designed to determine and correlate conventional lipid parameters and novel lipid atherogenic indices with serum CKMB in subjects presenting with MI at a tertiary care hospital.

Materials and Methods: The study comprised of 50 subjects presenting with MI as cases and 50 age & sex matched, non-diabetic subjects as controls. Data related to serum CKMB levels were collected. Fasting venous blood samples were analysed for lipid profile. Non HDL and various other lipid ratios such as TG/HDL, Atherogenic Index of Plasma (AIP), Castelli Risk Index (CRI I & II) and Atherogenic Coefficient (AC) were calculated. Comparison between cases and controls was done using Student's t test. Correlation between CK MB with lipid parameters was done using regression analysis. Statistical significance was considered as $p < 0.05$.

Result: Serum CKMB levels in MI patients were significantly increased ($p < 0.001$). All the lipid parameters except HDLc were significantly increased among cases with MI ($p<0.001$). All the calculated ratios were found to be significantly elevated in cases ($p<0.001$) as compared to controls. A positive correlation was found between non-HDL, sdLDL and CRI II with CKMB.

Conclusion: The findings of this study conclude that assessment of lipid profile and lipid ratios even in a normal individual is important as they are considered as atherogenic factors for the development of myocardial infarction and other coronary complications.

Keywords: Atherogenic index of plasma, Castelli risk index, CKMB, coronary artery disease, Lipid profile, Myocardial infarction.

Introduction

Coronary artery disease (CAD) is the leading cause of death in many developed countries affecting two thirds of the population worldwide.[1] Myocardial infarction (MI) is most commonly due to occlusion of the coronary artery following the rupture of a vulnerable atherosclerotic plaque present in the walls of the artery. The pathogenesis of MI is multifactorial; however, previous studies have implicated impaired lipid metabolism as one of the crucial factors in the development of this disease.[2] The atherogenic metabolic triad [hyperinsulinemia, high levels of apolipoprotein B and small dense low-density lipoprotein (sdLDL) particles] has been highly associated with heart disease, but these parameters are routinely difficult to obtain, which makes their use impractical in screening individuals at high cardiovascular risk or established CAD.[3] Low high density lipoproteins (HDL), high triglycerides (TG) and high low density lipoproteins (LDL) levels have been associated with increased incidence of CAD.[4] It has been put forward that the different combinations of these lipid profile parameters can be used to ascertain high risk individuals especially in places where there is dearth of facilities for testing the extended lipid profile. Thus, the present study was conducted with the objective of assessing the significance of non HDL and various lipid ratios like TG/LDL, Atherogenic Index of Plasma (AIP), Castelli Risk Index (CRI) and Atherogenic Coefficient (AC) in subjects who have developed MI.

Materials and Methods

In this cross sectional study, 50 consecutive patients diagnosed with MI presenting to the tertiary care hospital were recruited. Fifty non-diabetic subjects were taken as controls. The patients were aged less than 55 years. The subjects in both the groups were age and sex matched. Patients with Type 2 Diabetes Mellitus (T2DM), pre-existing dyslipidemia, thyroid dysfunction, on steroids, past history of any heart disease, and chronic kidney disease were excluded. The study protocol was approved by the Institutional Ethics Committee. Informed consent was obtained from all the subjects. All the clinical findings were noted. Data related to serum CKMB levels were collected. After obtaining the informed consent from all the participants, total of 5ml blood was withdrawn aseptically from the antecubital vein from each subject in plain vacutainer after 12hrs overnight fast. The samples were centrifuged at 3000 rpm for 10 min to separate. The serum with no sign of hemolysis was used for analysis of all the lipid parameters. Total cholesterol, HDL, TG were measured in serum by commercially available kits in autoanalyser. Serum LDL and very low density lipoprotein (VLDL) were calculated using the Friedwald's formula. Non-HDL was calculated as difference of HDL from TC. Atherogenic coefficient was calculated as ratio of non HDL with HDL. Castelli Risk Index I (CRI I) is calculated by the formula TC/ HDL. Castelli Risk Index II (CRI II) is calculated by the formula LDL/ HDL. LDL particles, or surrogate marker for small dense LDL (sdLDL) is calculated by TG/ HDL. Atherogenic Index (AI) of plasma was calculated by the formula logTG/HDL.

Statistical analysis was done using SPSS. Categorical data was expressed as frequency and percentage. Quantitative data were expressed as mean ± SD. Comparison of quantitative variables between cases and controls was done using Student's t test. Correlation between serum CK MB with lipid parameters was done using regression analysis. Statistical significance was considered as $p < 0.05$.

Result

The clinical characteristics of acute myocardial infarction patients and control subjects have been shown in Table 1. There is no significance of age groups between the MI patients and normal (control) groups. The cases and controls were both age and sex matched. The mean age of the controls was 48.2±2.97 years and that of cases was 49.10±3.37 years. CKMB levels in MI patients are significantly increased ($p < 0.001$). All the lipid parameters, except HDL, were significantly increased among cases with MI ($p<0.001$). All the calculated ratios were found to be significantly elevated in cases ($p<0.001$) as compared to controls. (Table 2) Regression analysis was done to correlate the various lipid indices with CKMB levels in cases. Non-HDL, TG:HDL, CRI II showed significantly contributing to the increased risk of MI; with non HDL contributing to 21.8% to the total risk; CRI II – 8.8% and TG/HDL – 6% to the total variations seen in MI patients. (Table 3)

Table 1: Demographic and biochemical parameters in cases of MI and controls

Parameters	Controls (n=50)	Cases of MI (n=50)	p value
Age (in years)	48.20±2.97	49.10±3.37	0.170
Male n (%)	32(64%)	32(64%)	
TC(mg/dl)	159.04±8.36	219.52±23.22	<0.001
TG(mg/dl)	69.98±10.04	156.22±29.07	<0.001
HDL(mg/dl)	50.50±6.35	37.92±9.70	<0.001
LDL(mg/dl)	91.24±12.69	150.45±23.95	<0.001
VLDL(mg/dL)	1.46±0.44	31.06±8.76	<0.001
CKMB (ng/dL)	1.27±0.55	6.57±2.90	<0.001

Values are expressed in mean with standard deviation (mean ± SD).
*p<0.001- Considered as significant.
n= number of subjects.

Table 2: Comparison of various lipid indices among the two groups

Parameters	Controls (n=50)	Cases of MI (n=50)	p value
Non-HDL	108.54±11.46	181.60±23.99	<0.001
TG:HDL	1.41±0.31	4.30±1.13	<0.001
CRI I (TC:HDL)	3.20±0.47	6.00±1.12	<0.001
CRI II (LDL:HDL)	2.92±0.52	4.07±1.05	<0.001
Atherogenic Index (AI)	0.037±0.01	0.63±0.05	<0.001
Atherogenic Coefficient (AC)	2.20±0.47	5.00±1.12	<0.001

Values are expressed in mean with standard deviation (mean ± SD).
*p<0.001- Considered as significant.
n= number of subjects.

Table 3: Correlation of CKMB with HDL, non HDL & lipid indices

Parameter	Coefficient of correlation (r)	Coefficient of determination (R^2)	p value
HDL	-0.104	0.01	0.208
Non-HDL	0.467	0.218	<0.001
TG:HDL	0.250	0.06	<0.05
CRI II (LDL:HDL)	0.297	0.088	<0.05

Discussion

A significantly increased risk of CAD in the presence of dyslipidemia has been demonstrated in several studies.[5-7] In this study, the lipid disorders and their patterns were evaluated in patients who were diagnosed with acute MI. Major CAD risk factors including age, male gender, hypertension and smoking were noted to be very much prevalent in the study group. The mean age of the patients having MI were mostly in the later part of 5^{th} decade, as found in other studies.[2,8,9] The male preponderance (64%) was seen in this study too similar to various other studies conducted worldwide.[5,10,11]

In the current study, serum CK MB was used as a cardiac marker to confirm the presence of MI. Serum CKMB was higher in cases in comparison to controls. ($p<0.001$).

Our study showed high levels of serum cholesterol, TG, LDL, VLDL and low levels of HDL in cases compared to controls. This is in concordance with the findings of a study done by Temelkova-Kurktschiev TS et al who reported the risk factors of stroke and MI to be hypercholesterolemia, hypertriglyceridemia and low HDL levels.[12] Among the lipid parameters, low HDL level is considered to be an independent risk factor for the development of coronary artery disease.[4]

This study was designed to evaluate the usefulness of determining non-HDL and several other lipid ratios in MI patients. All the calculated parameters such as non HDL, TG: HDL, CRI I & II, AI and AC were significantly elevated in cases when compared to controls. These calculated parameters have been proved to be useful predictors of atherogenesis.[4,13,14]

Regression analysis revealed non-HDL contributed most towards the total risk of developing CAD (21.8%), followed by CRI II (8.8%) and TG: HDL (6%). Non-HDL also showed a better correlation with serum CK MB levels compared to the other calculated parameters. ($r = 0.467$, $p < 0.001$).

Non-HDL is far more superior than conventional lipid profile in predicting long term cardiovascular outcome. Non-HDL takes into account LDL, VLDL, intermediate density lipoproteins (IDL), lipoprotein (a), chylomicrons and chylomicron remnant concentrations. Therefore, non-HDL can be considered a superior measure of atherogenic particles and atherogenic risk.[13]

Conclusion

The present study showed maximum cases of MI in the 5th decade, with male preponderance. There was a significant elevation in the serum enzymes CKMB in MI patients. Since CKMB is the most specific isoenzyme for the heart, the elevation in CKMB levels is significant.

A significant increase in total cholesterol, triglycerides, LDLC, VLDL-C, with a significant decrease in HDL-C was observed in MI patients as compared to healthy controls. The calculated lipid parameters were also found to be elevated in MI patients. Out of which, non-HDL showed a better correlation with serum CKMB levels.

The present study concludes the importance of assessing calculated lipid parameters as they are determinants for impending development of MI and other coronary complications. Non-HDL and other calculated ratios may be used in addition to conventional lipid profile to screen normal individuals and aid in therapeutic management.

Conflicts of Interest: None.

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