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Original Research Article

Ischemia Modified Albumin (IMA) and lipid profile in Coronary Artery Disease with and without type 2 Diabetes Mellitus

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Abstract: Coronary artery disease (CAD) is caused by atherosclerosis of the coronary arteries and is the leading cause of mortality and morbidity among patients with type 2 diabetes mellitus. Various types of markers have been used so far in order to reveal CAD and ischemia-modified albumin (IMA), also called cobalt binding albumin was reported as an early biomarker in cardiovascular disorders. The present study was conducted with an objective to evaluate the role of ischemia modified albumin in coronary artery disease with and without type 2 diabetes mellitus. A total of one hundred twenty (120) subjects (age group 25-70 years) of both sexes were enrolled in this study. The subjects were categorized into four groups i.e. Group I (30 normal healthy individuals), Group II (30 patients with diabetes mellitus with coronary artery disease), Group III (30 non-diabetic patients with coronary artery disease) and group IV (30 patients with diabetes mellitus without coronary artery disease). Serum ischemia modified albumin was estimated by albumin cobalt binding test using spectrophotometer. The mean serum level of IMA was increased in groups II and III and was statistically highly significant but it was significantly increased (but not highly significant) in group IV compared to that of control group. The level of IMA was increased in all the studied groups, so it may be used as a diagnostic marker of CAD. Also, as IMA is a marker of oxidative stress, antioxidants may be supplied to these patients so that they can counterbalance the oxidants.
Keywords: Coronary artery disease, Ischemia Modified Albumin, Diabetes Mellitus

INTRODUCTION:

Coronary artery disease (CAD) is caused by atherosclerosis of the coronary arteries that leads to a restriction of blood flow to the heart [1]. CAD is the leading cause of mortality and morbidity among patients with type 2 diabetes mellitus [2]. The common pathophysiological feature of the CAD spectrum is the rupture or erosion of atheromatous plaque [3]. There are two major risk factors for coronary artery disease (CAD) namely, type-2 diabetes and hyperlipidemia. Hyperlipidemia has a documented causative relation with CAD, but the major risk associated with diabetes may be due to the associated hyperlipidemia. Dyslipidemia is very common in type-2 diabetics and the most common abnormality seen is increased serum triglyceride levels. The next common abnormality is decreased serum high-density lipoprotein cholesterol (HDL-C) levels and increased serum low-density lipoprotein cholesterol (LDL-C) levels [4]. Dyslipidemia is common in diabetes mellitus, as both insulin deficiency and resistance affects enzymes and pathways of lipid metabolism [5].

Complication of type two diabetes mellitus leads to dyslipidemia that generates ROS, which introduces new functional groups (hydroxyl & carbonyl groups) in proteins. Among these proteins, ischemia-modified albumin (IMA) was reported as an early biomarker in cardiovascular disorders. Ischemia Modified Albumin (IMA), also called cobalt binding albumin is serum albumin that modified at the N-terminal portion, especially at aspartate-alanine-histidine-lysine sequences, by oxidative stress generated during ischemia [6, 7].

In Indian Scenario, very little study has been carried out regarding role of ischemia modified albumin in CAD with and without type 2 diabetes mellitus, hence we sought to investigate the levels of IMA in CAD with and without type 2 diabetes mellitus.

MATERIALS AND METHODS:

The present study was conducted in the Department of Biochemistry in collaboration with Department of

Medicine and Department of Cardiology at MGM's Medical College & Hospital, Kamothe, Navi Mumbai. Total 120 subjects of either sex having age 25-70 years were selected for the present study and were categorized into the following four groups.

Group-I:-30 Healthy individuals comprised Control Group.
Group-II:-30 patients with Diabetes Mellitus with Coronary Artery Disease
Group-III:-30 Non-Diabetic Patients with CAD.
Group-IV:-30 patients with Diabetes Mellitus without Coronary Artery Disease

All biochemical investigations were done at the central laboratory of MGM's Hospital, Kamothe, Navi Mumbai. The study was conducted after getting approval from Institutional Ethical Committee.

Inclusion criteria:

Following patients were included for the present study –

- Patients with Diabetes Mellitus with Coronary Artery Disease.
- Patients with Diabetes Mellitus without Coronary Artery Disease.
- Non-Diabetic Patients with CAD.
- Healthy Control individuals from in and around MGM's Medical College and Hospital.

Exclusion criteria:

Patients with renal disease, liver disease, malnutrition, sexually transmitted disease, rheumatoid arthritis, sepsis, asthma, malignancy, pregnant women and chronic illness were excluded from the present study.

Sample collection and processing:

About 2-3 ml blood sample was collected from cases (within 6 hours after onset of chest pain) and controls & about 3ml in the next morning for lipid profile with all the aseptic precautions. All the samples were centrifuged at 3000 rpm for 10 minutes in order to get serum and were kept at -20^0 C till analysis.

Parameters measured:

Following parameters were measured in the present study

1. Ischemia Modified Albumin (IMA) by Albumin cobalt binding (ACB) test method (using spectrophotometer chemito-uv2300).
2. Serum cholesterol by CHOD-POD method.
3. Serum triglyceride by GPO-PAP method.
4. Serum HDL-Cholesterol by Immuno-inhibition method.
5. LDL (Calculated with the help of Friedwald's formula)

Statistical Analysis:

Results were statistically analyzed by 'SPSS, Version 16'. All results arepresented as mean ± S.D. A 'p' value of less than 0.05 wasconsidered significant.

RESULTS AND DISCUSSION

Coronary artery disease (CAD) is highly prevalent and is major cause of morbidity and mortality in diabetic patients. Type-2 diabetes mellitus is a multifactorial disease that combines hereditary and environmental factors. Two major metabolic derangements characterize diabetes mellitus: decreased insulin secretion and insulin resistance and insulin resistance independently predict cardiovascular disease (CVD) and coronary atherosclerosis. Diabetes mellitus and obesity are predictors of myocardial infarction (MI). About 25% of patients who present with an acute myocardial infarction have diabetes mellitus. Diabetes mellitus is a predictor of ischemic stroke and heart failure, and diabetes increases the overall cardiovascular risk in patients with heart failure. So, diabetes mellitus has been considered as a coronary heart disease risk factor equivalent and there seems to be an association between hyperglycemia and cardiovascular disease (CVD) [8].

The mean value of total cholesterol was increased in study group II & IV ($P \leq 0.001$), as compared to healthy control (group-I) and was statistically highly significant. In group III, it was although increased significantly ($P \leq 0.05$) but within range. Mean value of triglyceride, LDL cholesterol were increased in all study groups (II, III & IV) ($P \leq 0.001$) as compared to control group (I) and were statistically highly significant whereas the mean level of HDL-Cholesterol was decreased significantly in all study groups (II, III, IV) ($P \leq 0.05$) as compared to control group-I. [Table No-1, Figure No-1].

In our study, we found that levels of total cholesterol, triglycerol (TG) & LDL-cholesterol were significantly elevated in study groups (II, III, IV) ($P \leq 0.001$) as compared to healthy controls (group-I). Our study is in consistent with the study conducted by Ishfaq *et al.;* who showed the high prevalence of dyslipidemia in subject with type 2 diabetes mellitus and also stated that hypertriglyceridemia is more common than hypercholesterolemia in diabetic subjects [9].

In present study, mean level of ischemia modified albumin (IMA) was increased in study groups II (CAD with DM) & III (CAD) as compared to control (group-I) and mean level of IMA was also increased in group IV (T2DM) ($P \leq 0.05$) as compared to controls (group-I) and was statistically highly significant ($P \leq 0.001$). But,Ma *et al.;* conducted a study on type 2 diabetic patients with peripheral arterial disease and reported higher levels of total cholesterol, LDL and IMA in those patients [10].Blood levels of IMA rise promptly during myocardial ischemia triggered by a primary reduction of blood flow to the heart [3]. The increase in IMA in CAD may be due to increased oxidative stress, which causes modification of albumin

at N-terminal portion, especially at asparted-alanine-histidine-lysine sequences [6].

Table 1: Comparison of Lipid Profile and IMA in Control Group (i.e. Group-I) & Study Groups (i.e. Groups-II, III and IV)

Parameters	Group-I (Controls) Mean± SD	Group-II (CAD with DM) Mean± SD	Group-III (CAD) Mean± SD	Group-IV (T2DM) Mean± SD
T. Cholesterol (mg/dl)	176.6±26.2	207.4±20.5**	200.3±30.4*	192.3±11.2**
Triglyceride (mg/dl)	144.0±29.6	207.1±46.0**	193±41.7**	182.7±41.9**
HDL-C (mg/dl)	36.2±5.6	32.1±5.7*	32.8±7.2*	32.6±5.1*
LDL-C (mg/dl)	111.6±23.5	133.8±23.9*	128.9±33.6*	123.1 ±16.5*
IMA (ABSU)	0.37±0.05	0.47±0.06**	0.65±0.1**	0.39±0.04*

*p ≤ 0.05 significant,**p ≤ 0.001 highly significant

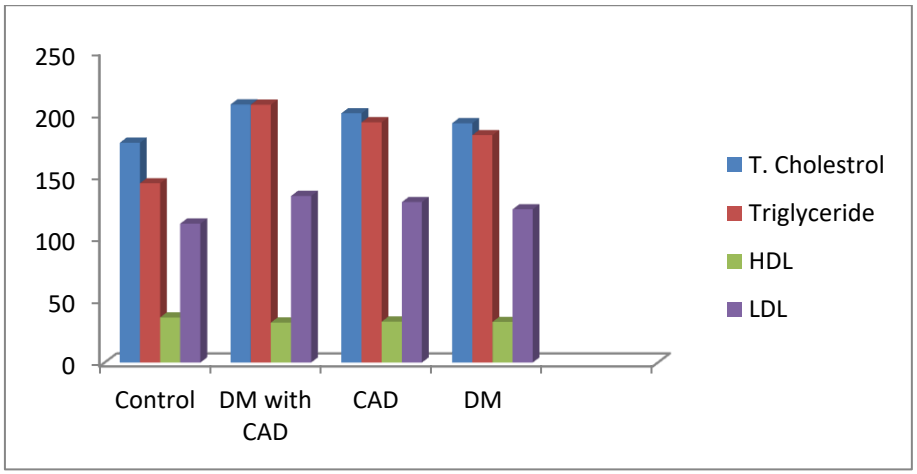

Fig 1: Showing serum Lipid Profile Levels in Control & Study Groups.

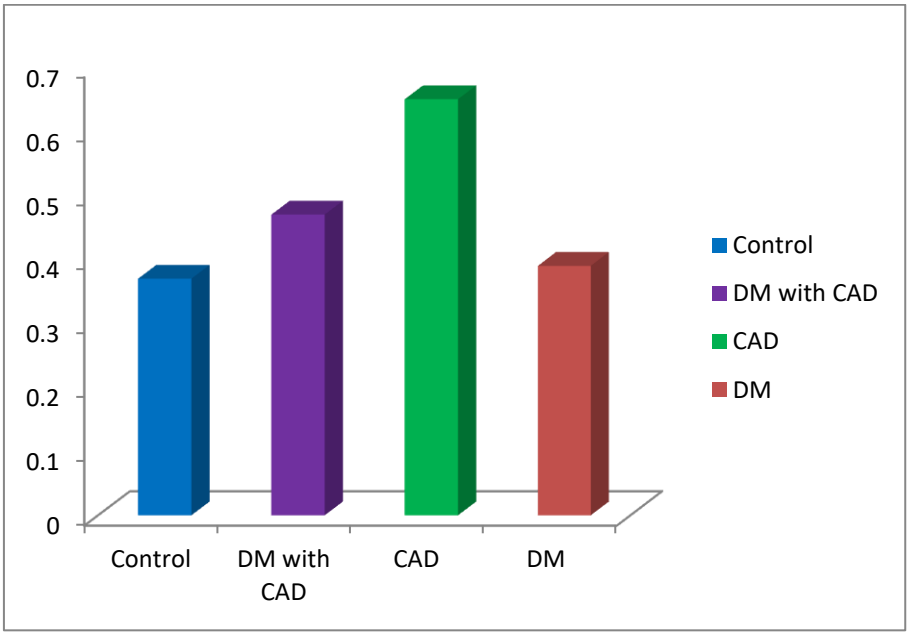

Fig 2: Showing serum IMA levels in control & study groups.

CONCLUSION:

Based on the observations of present study, following conclusions can be drawn-

1. Firstly, the level of IMA was increased in all the studied groups, so it may be used as a diagnostic marker of CAD.

2. Secondly, as IMA is a marker of oxidative stress, antioxidants may be supplied to these patients so that they can counterbalance the oxidants.

However, further studies with adequate sample size are warranted to finally accept the concept.

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