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Original Research Article.

Effect of Abnormal Levels of Serum Calcium Along With Lipids on Risk of Myocardial Infarction

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ABSTRACT

Introduction: An association involving increased serum calcium and deviation of blood lipid profiles is suggested by research workers but any connection of this association with risks of increased acute myocardial infarction (AMI) is not yet stated. We wish to look at the association of abnormal serum calcium and lipid levels with occurrence of myocardial infarction.

Methods: A prospective case-control study consists of 50 AMI patients were diagnosed by cardiologists and 50 apparently healthy individuals entered in the study. Serum calcium, blood lipid profiles, and anthropometric parameters were assessed in these study individuals. Student's t-test was used to compare different values between patients and healthy individuals. Pearson's correlation coefficient was also used to determine the positive association between serum calcium, blood lipid profiles in this study population.

Results: Levels of serum calcium and blood lipid profiles in AMI patients were observed significantly higher than healthy individuals. Furthermore, serum calcium levels showed positive correlation with serum cholesterol levels in AMI patients.

Conclusions: These findings conclude that increased serum calcium and abnormal lipid profiles May perhaps a link with increased risk of AMI.

Keywords: Serum Calcium, Lipid Profiles, Acute Myocardial Infarction.

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INTRODUCTION

Calcium is an abundant cation that present in most part of a human body appears essential regulator in haemostatic systems which plays a key role in controlling various biological processes e.g., hormone secretion, intermediary metabolism and bone development.[1,2] Coronary arterial disease (CAD) is one of the leading causes of death across the Globe and in Bangladesh.[3] Epidemiological studies indicate that a sizeable number of people are suffering from CAD in particular AMI patients. Morbidity and mortality from CAD is also appallingly high in Bangladesh.[4,5] However, it is proposed that there is no association between changes in the calcium content of drinking water and cardiovascular mortality[6] and it is also recommended that calcium intake is not related to cardiovascular complications in some individual.[7] One possible explanation is calcium ions cannot be totally absorbed after ingestion. Interestingly, it is argued that serum calcium may control the level of high-density lipoprotein cholesterol (HDLc) whereas diminishing low-density lipoprotein cholesterol (LDLc).[8,9] As dyslipidemia is an important risk feature for CAD, it is vital to look at the relationship between abnormalities of serum calcium level with CAD. Published Data shown that CAD, hypertension and metabolic diseases are linked by common defects in metabolism of divalent cation such as calcium.[10] Hence an attempt should be made to prevent increased incidence of AMI and its complications could save many lives. The relationship between serum calcium and lipid profiles with incidence of CAD is proposed elsewhere while a positive relationship between serum calcium and CAD also has been reported earlier.[11] This study was aimed to look into association between serum calcium and lipid profiles with AMI patients in Bangladesh.

MATERIALS & METHODS

This was a prospective case control study conducted in the Department of Biochemistry, Dhaka Medical College, Dhaka between January 2013 and December, 2013.

Informed Consent

All protocols used for the recruitment of AMI patients or healthy individuals and collection of blood samples was reviewed and approved by the appropriate competent authority.

Study Populations

AMI patients Group-I (Gp-I): Fifty patients (31 males & 19 females) average age 53.30 ± 6.74 (mean±SD) years was diagnosed as AMI by Cardiologists who admitted in Dhaka Medical College Hospital (DMCH) entered in the study. The diagnosis of AMI was based on the electrocardiogram, ischemic cardiac pain lasting at least 30 minutes, and enzyme changes. Variables such as smoking, history of hypertension, diabetes mellitus, hypercholesterolemia, height, body weight, current medication prior to the AMI during admission were reviewed. Blood pressure, height and weight were measured. There was no specific predilection for race, religion and socioeconomic status.

Controls, Group-II (Gp-II): Fifty apparently healthy volunteers (31 male & 19 female) average age 51.86 ± 7.30 (mean±SD) years had no history of any blood pressure, diabetes or cardiovascular related diseases were entered as Controls.

Anthropometric Measurements

BMI of all individuals of Gp-I and & Gp-II were calculated using international standard formula:

BMI= Weight (Kg)/ [Height (m)].[2]

Biochemical Parameters

Fasting serum total cholesterol was estimated by enzymatic end-point (CHOD-PAP) method and reading was taken by semi-automated flow cell biochemistry analyzer (Evolution 3000). Fasting serum lipid, glucose and calcium test results of both groups were expressed in mg/dl and mmol/L according to manufacturer's instruction. BMI, blood pressure, fasting blood and total cholesterol were compared between Gp-I and Gp-II.

Statistical Analysis

Comparisons of biochemical and anthropometric characteristics between two groups were analyzed using unpaired student's 't' test. Pearson's correlation analysis was performed to investigate the possible association between serum concentration of calcium, lipid profiles with AMI patients. The SPSS version 17.0 was used for computing all analyzes. All results were expressed as mean ±SD. *p* value <0.05 was accepted as level of significance.

Table 1: Shows demographic characteristics of subjects including systolic blood pressure (SBP) and diastolic blood pressure (DBP) and results expressed as mean±SD.

Variables	Gp-I (n=50)	Gp-II (n=50)	p value
SBP (mm of Hg)	137.80±14.92	124.70±11.35	0.001
DBP (mm of Hg)	88.70±10.24	79.60±7.61	0.001
Fasting blood sugar (mmol/L)	5.3±.821	5.2±.709	0.297
Smoking (n)	30 (60%)	21 (42%)	0.01

Table 2: Shows comparison of mean values of anthropometric parameters between Gp-I and Gp-II using unpaired students 't' tests of the study subjects (n= number of subjects) and results expressed as mean±SD.

BMI(Kg/m²)	Gp-I (n=50)	Gp-II (n=50)	P value
Under weight (<18.5)	2(4%)	1(2%)	0.01
Normal (18.5-24.9)	2(4%)	22(44%)	0.001
Over weight (25-29.9)	34(68%)	21(42%)	0.001
Obese (≥30)	12(24%)	6(12%)	0.001

Table 3: Shows comparison of mean values of biochemical parameters between Gp-I and Gp-II using unpaired students't' tests of the study subjects. (n= number of subjects) and results expressed as mean±SD.

Variable	Gp-I (n=50)	Gp-II (n=50)	P value
Serum calcium (mmol/L)	2.61 ± 0.16	2.13 ± 0.15	0.001
Serum TG (mg/dl)	196.80±53.03	171.22±29.11	0.004
Serum TC (mg/dl)	181.82±128.54	112.96±52.85	0.002
Serum LDL-c (mg/dl)	129.62±37.08	110.83±27.07	0.005
Serum HDL-c (mg/dl)	34.88±10.19	40.99±6.43	0.208

Table 4: Shows correlation between serum calcium and blood lipid profiles by Pearson's correlation coefficient test; Significant= (P<0.05).

Lipid profile	Gp-I		Gp-II	
	r value	p value	r value	p value
TC	0.001	0.996	0.391	0.005
TG	-0.027	0.427	0.090	0.252
LDL -c	-0.104	0.236	0.204	0.156
HDL -c	0.304	0.016	-0.021	0.441

RESULTS

In demographic variables SBP was significantly higher in Gp-I as compared to Gp-II (p <0.001) which were 137.80±14.92 mm of Hg and 124.70±11.35 mm of Hg respectively. DBP was also significantly higher in Gp-I than Gp-II (p=0.001). Fasting blood glucose of Gp-I and Gp-II were 5.3±.821 and 5.2±.709 respectively. There was no statistically significant difference of mean blood glucose between Gp-I and Gp-II (p=0.297) observed.

BMI was observed significantly higher in Gp-I when compared with Gp-II (p=0.001) which were 27.34±3.37 kg/m² and 25.30±3.42 kg/m² respectively is shown in table II. Overweight and Obese are significantly more (p=.001) in Gp-I than in Gp-II. But frequency of normal BMI is significantly more (p=0.0x 01) in Gp-II than Gp-I.

In Gp-I, significant positive correlation was observed between serum calcium and TC (r=0.391, p=0.005). Although correlation between serum calcium with serum TG (r=0.090, p=0.252) and LDL-c (r=0.204, p=0.156) were positive in Gp-I, it was not significant. Correlation between serum calcium and HDL-c was negative and insignificant in Gp-I (r=-.021, p=.441). Whereas, correlation between serum calcium with other parameters of Lipid profile except HDL-c was insignificant in Gp-II. But a significant positive correlation was found between serum calcium and HDL-c (r=0.304, p=0.016) in Gp-I.

DISCUSSION

This study shows that serum calcium was higher in Gp-I than Gp-II, we are in agreement with Sabanayagam and Shankar[12] who earlier argued that higher serum calcium levels were positively linked with hypertension in adult USA subjects. Furthermore, Cook and colleagues observed that myeloperoxidase-mediated modulation of intracellular calcium ion levels may exacerbate endothelial dysfunction, a key early event in developing hypertension.[13] And it is understood that higher serum calcium level may influence the occurrences of CAD through blood pressure. A recent study suggested that supplementation with 2.25% $CaCO_3$ may perhaps reduce LDLc.[14] Opposing it, our results suggest that serum calcium level did not show a relationship with any parameters except triglyceride in either group after fine-tuning for age, sex, body mass index, height, and weight. It is also proposed that triglyceride level have an important positive correlation with serum calcium in normotensive group and that LDLc have a negative correlation with serum calcium in males but not in females.[15] In our study, hypertension was evenly distributed between the two groups, but it was observed that patients with higher cholesterol and triglyceride levels and are smoker have higher risks for occurrences of CAD suggesting an association of increased serum calcium with incidence of AMI. Published data shown a positive relationship between serum calcium and LDL cholesterol in premenopausal women[16] postulated that serum calcium and lipid may well be persuaded by sex and racial differences. Torres et al reported that a higher dietary calcium intake may perhaps be associated with less global adiposity.[17] In an earlier study our group examined that serum calcium is associated with occurrences of AMI[18] and this finding is consistent with others observation that increased serum calcium is a risk factor for CAD.[9,10] It is argued that a significant association between increased serum calcium and vascular calcification may well be able to complicate AMI 3. This study revalidated that lipid abnormalities in patients who have diabetes mellitus and a calcium deficiency may possibly be associated with impaired fasting blood glucose influencing type 2 diabetes mellitus, a known risk factor for CAD.[19] In future, we wish to expand this study in a large number of AMI patients involving a number of cardiac centres in Bangladesh.

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