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THE STRONG ASSOCIATION BETWEEN EPICARDIAL FAT THICKNESS AND ACUTE CORONARY SYNDROME: A CASE CONTROL STUDY IN EASTERN INDIA

Cardiovascular

Dr. Rana Bhattacharyya Senior Resident, Department of General Medicine, Midnapore Medical College and Hospital, Midnapore, West Bengal.

Dr. Bikas Chandra Seth Associate Professor, Department of General Medicine, Midnapore Medical College and Hospital, Midnapore, West Bengal.

Dr. Malay Acharyya* MD, DM, Associate Professor, Department of Cardiology, Midnapore Medical College and Hospital, Midnapore, West Bengal. *Corresponding Author

Dr. Tanmay Mukhopadhyaya Associate Professor, Department of Cardiology, Burdwan Medical College and Hospital, Bardhaman, West Bengal.

ABSTRACT

Objective: The present study has evaluated to detect the association between epicardial fat (ECF) thickness and coronary artery disease (CAD) among the patients of eastern India. **Materials & Methods:** A randomized, observational, prospective, case control, hospital based, single centre study was conducted among 100 patients were grouped into 50 cases and 50 controls. All the necessary clinical parameters were studied between the groups. **Results:** Regarding clinical parameters, the values of LDL, TG, TC, Waist/hip ratio (Male) and BMI were significantly (p=0.004, p=0.001, p=0.004, 0.026 and p=0.011) higher in case group when compared to control group. The ECG findings between case and control group a significant difference (p<0.001) was observed between the group. The mean of EFT between case and control group, the value was significantly higher in case group when compared to control group. The multivariate regression analysis for prediction of CAD in which the risk factors viz. LDL, TG, TC, Waist/hip ratio (Male), BMI and EFT were observed significant (p=0.007, p=0.002, p=0.007, p=0.05, p=0.014 and p<0.001). **Conclusion:** It is emphasized that statistically significant direct relationship between cardiovascular risk factors and independent prediction for coronary artery disease. The parameters viz. LDL, TG, TC, Waist hip ratio (male), BMI and EFT are important risk factors for the prediction of CAD.

KEYWORDS

Coronary artery disease, Epicardial fat thickness, Eastern India, Risk factors prediction, Strong relationship

INTRODUCTION

The epicardial fat (ECF) thickness is an independent predictor of major cardiovascular (CVD) adverse events. It has some physiological secretory functions and gives mechanical protection to coronary vessels, nerves and also provides cryoprotection of the heart. This secretory function causes disequilibrium in metabolic environment of myocardium.[1] ECF has potency of accelerating progression of sub clinical coronary atherosclerosis.[2] After several computed tomography (CT) coronary angiographies, it has been established that ECF is a powerful indicator of coronary calcium load and prevalence of ischemic heart disease (IHD). Fat depot around the heart can be divided into ECF and pericardial fat (PCF). Moreover, ECF lies over myocardium and beneath visceral pericardium. Atrioventricular, interventricular grooves in adults and in juveniles atrial free wall and atrial appendages commonly contain more ECF.[1,3]

The process of atherosclerosis, which is the principal cause of coronary artery disease (CAD) ultimately leads to formation of atheromatous plaque consisting of fat, smooth muscle, fibroblast, cellular infiltrate. As a result, there is reduction of luminal cross-sectional area of coronary arteries due to plaque formation. Luminal stenosis of near about 50% can maintain perfusion at rest but unable to meet 3 demands on exertion whereas 80% or more stenosis can result in ischemia at rest.[4]

According to the study of Global burden of diseases, the disability adjusted life years (DALY) lost in IHD in India in 1990 was 5.6 million in men and 4.5 million in women. In 2020, the projected figures were 14.4 and 7.7 million in men and women respectively. [5]

Numerous studies investigated that ECF were related to CAD.[6,7,8,9] Nevertheless, only ECF is an independent risk factor for the accelerated progression of sub-clinical coronary atherosclerosis. [2] But the study is lacking in the patients of the eastern part of India.

In this context, the present study was attempted to know the association between ECF thickness and CAD among the patients of eastern India.

MATERIALS AND METHODS

Study Design

A randomized, observational, prospective, case control, hospital based, single centre study was conducted among 100 patients were grouped into 50 cases and 50 controls.

Study Area

The study was carried out in Department of General Medicine and Department of Cardiology, Midnapore Medical College and Hospital, West Bengal, India for the period of 12 months (January 2023 to December 2023).

Inclusion And Exclusion Criteria

Inclusion Criteria

Patients admitted with clinical feature and ECG changes consistent with coronary artery disease are included as CASE in this study. Age and Sex matched CONTROLS who have no past history, current illness of coronary artery disease and may or may not have cardiovascular risk factors for CAD are included.

Exclusion Criteria

Known case of severe anaemia, past history of coronary artery stenting, coronary artery bypass grafting, pericardial effusion, post valve replacement, placement of pacing leads are excluded from study.

Study Procedures

Written informed consent was obtained from all the participants. A grand proforma was framed for recording of patients' information, clinical evaluation, anthropometric examination, ECG findings and routine biochemistry including fasting lipid profile and cardiac biomarker (Troponin T) (qualitative). Study group was divided in cases and controls. Trans thoracic Echocardiography (TTE) was then performed in both Case and control groups to measure diastolic EF thickness. These values are correlated with the cardiovascular risk factors to find significance of association and to predict cardiovascular outcome like CAD.

Statistical Analysis

The data were tabulated in Microsoft excel and analysed with SPSS (Version, 24) software. The continuous variables were presented with mean and standard deviation. The categorical variables were presented with frequency and percentage. Independent t test, chi square test as well as multivariate regression analysis was performed for the statistical analysis. The p value ≤ 0.05 is considered statistically significant.

RESULTS

Table 1 compared mean of clinical parameters between case and control group. The values of LDL, TG, TC, Waist/hip ratio (Male) and BMI were significantly (p=0.004, p=0.001, p=0.004, 0.026 and p=0.011) higher in case group when compared to control group but Waist/hip ratio (Female) was not observed statistically significant change.

Table 1: Mean Comparison Of Clinical Parameters Between Group

Parameters	Case (M ± SD)	Control (M ± SD)	P value
LDL (mg/dl)	117.83 ± 58.13	90.79 ± 28.66	0.004
TG (mg/dl)	154.09 ± 75.02	115.93 ± 19.38	0.001
TC (mg/dl)	194.62 ± 62.16	165.37 ± 33.31	0.004
Waist/hip ratio (Male)	0.91 ± 0.08	0.87 ± 0.05	0.028
Waist/hip ratio (Female)	0.88 ± 0.06	0.85 ± 0.04	0.223
BMI (Kg/m^2)	24.43 ± 3.01	23.03 ± 2.35	0.011

LDL = Low-density lipoprotein; TG = Triglycerides; TC = Total cholesterol; BMI = Body mass index

Table 2 compared mean of ECG findings between case and control group. A significant difference (p=0.001) was observed between the group.

Table 2: Comparison Of ECG Findings Between Group

Parameters	Group		Total	P value
	Case	Control		
CCS n (%)	21 (42.0)	0 (0.0)	21 (21.0)	0.001
NSTEMI n (%)	11 (22.0)	0 (0.0)	11 (11.0)	
STEMI n (%)	18 (36.0)	0 (0.0)	18 (18.0)	
NAD n (%)	0 (0.0)	50 (100.0)	50 (50.0)	
Total n (%)	50 (50.0)	50 (50.0)	100 (100.0)	

CCS = Chronic coronary syndrome; NSTEMI = Non-ST-elevation Myocardial Infarction; STEMI = ST-elevation Myocardial Infarction; NAD = No abnormalities detected

Table 3 compared mean of EFT between case and control group. The value was significantly (p<0.001) higher in case group when compared to control group.

Table 3: Comparison Of EFT Between Group

Parameters	Case (M ± SD)	Control (M ± SD)	P value
EFT (mm)	5.96 ± 1.29	4.04 ± 1.45	<0.001

EFT = Epicardial Fat Thickness

Table 4 evaluated multivariate regression analysis for prediction of CAD in which the risk factors viz. LDL, TG, TC, Waist/hip ratio (Male), BMI and EFT were observed statistically significant (p=0.007, p=0.002, p=0.007, p=0.05, p=0.014 and p<0.001) while Waist/hip ratio (Female) did not show significant difference.

Table 4: Multivariate Regression Analysis For Prediction Of CAD

Parameters	P value	Odds ratio	95% CI	
			Lower	Higher
LDL	0.007	0.986	0.977	0.996
TG	0.002	0.964	0.943	0.986
TC	0.007	0.988	0.979	0.990
Waist/hip ratio (Male)	0.05	2.576	0.969	6.846
Waist/hip ratio (Female)	0.670	1.440	0.269	7.714
BMI	0.014	0.821	0.701	0.962
EFT	<0.001	0.371	0.249	0.551

LDL = Low-density lipoprotein; TG = Triglycerides; TC = Total cholesterol; BMI = Body mass index; EFT = Epicardial fat thickness

DISCUSSION

This study was conducted on 100 patients (50 cases and 50 controls). Controls are age and sex matched with cases. We had taken the parameters like hyperlipidaemia (LDL, TG, and Total Cholesterol), BMI, and waist Hip ratio in male as modifiable risk factors.

Epicardial adipose tissue is a biologically active organ and is a predictor of cardiovascular disease strongly associated with obesity. Previous study reveals variable EFT cut off values for predicting coronary artery disease. EFT cut off >5 mm may be regarded as cardiovascular risk factor.

Study in Alappuzha by Vasu et al. [10] showed significant (p< 0.001) change for LDL of 141.3 ± 19.84 and 123.51±24.52 mg/dl in cases and controls, respectively. Similar study in New Delhi, India by Mastebhakti et al.[11] showed mean LDL of 96.90 ± 17.16 and 77.30 ± 9.94 mg/dl in cases and controls, respectively.

Study conducted by Vasu et al. [10] showed TG of 223.71 ± 27.37 and 202.32 ± 24.42 mg/dl in cases and controls respectively (p< 0.001). Study in Tamil Nadu by Verma et al. [12] revealed TG of 213.7 ± 27.3 and 211.3 ± 24.4 mg/dl in CAD and normal group without significant change (p=0.32). Another study conducted by Mastebhakti et al. [11] showed mean TG of 101.33 ± 23.57 and 93.80 ± 20.92 mg/dl in cases and controls respectively without significant differences (p=0.52).

A study performed by Mastebhakti et al. [11] showed mean total cholesterol of 153.55 ± 24.60 and 115.90 ± 30.89 mg/dl in cases and controls respectively with significant difference (p< 0.01). Another case control study in Iran by Faghihi et al. [13] observed total cholesterol of 157± 40 mg/dl in CAD and in non-CAD of 151± 41 mg/dl without significant change (p=0.55).

Similar study conducted by Verma et al. [12] revealed waist hip ratio of 0.94 ± 0.07 and 0.92 ± 0.06 in CAD and normal group, respectively with significant change (p<0.001). A study evaluated by Vasu et al., [10] where waist hip ratio of 0.92 ± 0.06 and 0.94 ± 0.07 in cases and controls, respectively with significant difference (p<0.001).

Faghihi et al. [13] showed 26.29 ± 4.26 kg/m^2 BMI in CAD group and 28.8 ± 4.3 kg/m^2 BMI in non-CAD group with significant change (p=0.047). Similar study in Mysore by Shambu et al.[14] revealed BMI of 23.61 ± 3.16 and 25.74 ± 3.37 kg/m2 in normal group and CAD group, respectively with significant difference (p=0.04).

Similar study by Sinha et al. [15] in Uttar Pradesh, showed significantly (p=0.003) elevated EFT value of in cases (5.16 ± 1.06 mm) when compared to control (4.23 ± 1.01 mm). Another case control study by Faghihi et al. [13] showed EFT in CAD group to be 4.2 ± 1.4 mm and in non- CAD group to be 2.6±1.2mm with significant change (p=0.01). Study by Verma et al.[12] revealed EFT of 4.3 ± 1.1 and 3.2 ± 1.2 mm in CAD and normal group, respectively with significant difference (p<0.001).

A study in Japan by Harada et al. [16] revealed that acute coronary syndrome patients had significantly (p=0.019) higher EFT than chronic coronary syndrome. A study in Chennai by Meenakshi et al.[17] reported that EFT emerged as an independent predictor of CAD among other well-known factors.

CONCLUSIONS

It is concluded that this study emphasized statistically significant direct relationship between cardiovascular risk factors and independent prediction for coronary artery disease. The parameters viz. LDL, TG, TC, Waist hip ratio (male), BMI and EFT are important risk factors for the prediction of CAD.

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