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Correlation of Epicardial Adipose Tissue Thickness with the Presence and Severity of Angiographic Coronary Artery Disease: A Cross Sectional Study

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ABSTRACT

Background: Epicardial Adipose Tissue Thickness (EATT) has clinically correlated with abdominal fat and metabolic syndrome. The incidence of CAD is likely to increase further because of rapid urbanisation and its accompanying lifestyle changes, including changes in diet, physical inactivity, drug and alcohol intake, as well as an increase in the prevalence of DM.
Objective: To correlate the Epicardial Adipose Tissue Thickness (EATT) to predict presence and severity of angiographic coronary artery disease.
Materials & Methods: This was a cross sectional observational study conducted in department of General medicine at Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar, India from March 2019 to March 2020. 100 consecutive patients were enrolled with age more than 18 to 75 years undergoing coronary angiography for this study. Written informed consent was obtained from all the participants.
Results: In this study consisting of 100 participants participated in the study having mean age of 56.53 ± 10.46 years. Mean EATT score in obese patients found more which 12.6 with SD of 3.481 compare to Overweight and Normal patients. The cutoff value of EAT on echocardiography to diagnose significant CAD was 6.50 mm on receiver operating characteristic curve analysis with an area under the curve being 0.872 and sensitivity of 95.6% and specificity of 77.8%.
Conclusion: Use of EAT thickness measurement in routine practice could be of assistance in identifying patients at risk and guiding them in proper control risk factors and, if required, undergoing evaluations with invasive approaches.

Keywords: Angiogram, EAT Thickness, BMI, CAD.

INTRODUCTION

Epicardial Adipose Tissue Thickness (EATT) has clinically correlated with abdominal fat and metabolic syndrome. There is yet no definite value considered normal for EAT thickness. There are inconsistencies in the literature regarding EAT thickness. EAT has endocrine, paracrine, vasocrine, and inflammatory characteristics [(1-3)] and is associated with metabolic syndrome [(4)], insulin resistance [(5)], coronary artery disease [(6-7)], and hypertension [(8-9)]. Therefore, measurement of EAT thickness has gained importance.

The incidence of CAD is likely to increase further because of rapid urbanisation and its accompanying lifestyle changes, including changes in diet, physical inactivity, drug and alcohol intake, as well as an increase in the prevalence of DM.[(10-11)]

Epicardial fat or Epicardial Adipose Tissue (EAT) represents a true visceral fat and has been suggested as a cardio metabolic risk factors. Studies shown that EAT may not be only a predictor for

atherosclerosis but may also play a direct local role in the pathogenesis of atherosclerosis [12-13].

Some studies found a significantly increased risk of presence of coronary plaque with increasing volume of EAT over that segment and the significance were preserved after adjustment for conventional cardiovascular risk factors. [14]

Objective:

To Correlate the Epicardial Adipose Tissue Thickness (EATT) to predict presence and severity of angiographic coronary artery disease.

MATERIALS & METHODS

This was a cross sectional observational study conducted in department of General medicine at Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar, India from March 2019 to March 2020. 100 consecutive patients were enrolled with age more than 18 to 75 years undergoing coronary angiography for this study. Written informed consent was obtained from all the participants. This study was approved by the Institutional Scientific and Ethical committee for human studies.

Sample size was calculated by using the single proportion formula.

$$\boldsymbol{n = Z_{\alpha}^{2} * \frac{P(1-P)}{m.e^{2}} = 100}$$

Where Z_{α} is 95% Normal variate values was 1.96. & m.e means absolute precision for the normality with the consider for 6% of proportion of CAD patients. Total 100 sample was consider with adjustment of 15% non response rate.

Detailed medical history were obtained from the patients including age, gender, history of diabetes, hypertension, smoking and family history of premature CAD. Physical examination were obtained from the patients including pulse rate, bp, cardiac & respiratory system, BMI, waist circumference. Patients further underwent study interventions, CBC, Echocardiogram was performed at the time of admission & one day after coronary angiogram for calculate Epicardial Adipose Tissue Thickness.

Statistical Analysis:

Quantitative data were expressed as a Mean $\pm$ Std. deviation & Qualitative data were expressed as s frequency or percentage. Mean difference between groups were analysed using Multi Way Anova test. Correlation analysis was performed using Pearson Correlation Coefficient. Level of statistical significance was consider p value is less than 0.05.

RESULTS

In this study there were total 100 patients who had given consent for the study having mean age of 56.53 years with standard deviation of 10.46 years. Maximum 42 (42%) patients were belong to the more than 60 years age followed 89 (89%) patients were male. 53 (53%) were had hypertension & 45 (45%) were addicted for tobacco.

Table No. 1: Frequency Distribution of CAD patients.

Variables		Frequency	Percentage
Age group	Less than 30 years	2	2.0%
	31 - 40 years	7	7.0%
	41 - 50 years	20	20.0%
	51 - 60 years	29	29.0%
	More than 60 years	42	42.0%
Gender	Male	89	89.0%
	Female	11	11.0%
Co-morbidities	Diabetes Mellitus	27	27.0%
	Hypertension	53	53.0%
	Other	20	20.0%
Substance Abuse	Alcohol	24	24.0%
	Tobacco	45	45.0%
	Non User	31	31.0%

Table No 2: Estimation of EATT according to the CAD patients with Body Mass Index.

Angiographics Findings	Body Mass Index (Mean ± S.D.)			
	Normal (n = 14)	Over Weight (n = 71)	Obese (n = 15)	Total
Normal (n = 9)	5.33 ± 2.52	6.00 ± 3.03	0.00 ± 0.00	5.78 ± 2.73
Single Vessel (n = 38)	7.20 ± 1.03	7.73 ± 0.78	8.00 ± 1.41	7.61 ± 0.89
Double Vessel (n = 34)	9.00 ± 0.00	9.80 ± 1.21	9.33 ± 1.53	9.74 ± 1.21
Triple Vessel (n = 19)	0.00 ± 0.00	12.67 ± 2.18	14.50 ± 2.42	13.63 ± 2.43
Total	6.93 ± 1.64	9.08 ± 2.32	12.60 ± 3.48	9.31 ± 2.89
Angiographics Findings			P Value = 0.001 (S)	
Body Mass Index			P Value = 0.592 (S)	
Angiographic findings with BMI			P value = 0.408 (NS)	

In table 2 shows that the average EAT thickness in obese patients was 12.60 ± 3.48 & in according to angiographic findings average EAT thickness was 13.63 ± 2.43 of triple vessel findings. Also shows that the EAT thickness was statistically significant in Angiographic findings but EAT thickness was not statistically significant in BMI or interaction also not statistically significant.

In table 3 was shown that the HDL, Height, PT & PT INR was negatively correlated with EAT thickness. All other parameters was positively correlated with EAT thickness. Also found that Angiographic findings, Age, HDL, Cholesterol, HDL ratio, Weight, BMI, Waist circumference & Syntax score was statistically significant with EAT thickness.

Table No3 : Correlation of EATT in CAD patients.

Correlations	EATT	P Value
Angiographics Findings	0.822	0.000 (S)
Age	0.227	0.023 (S)
SBP	0.122	0.227 (NS)
DBP	0.065	0.520 (NS)
PR	0.006	0.954 (NS)
HDL	-0.549	0.000 (S)
Cholesterol	0.373	0.000 (S)
HDL Ratio	0.625	0.000 (S)
LDL	0.149	0.139 (NS)
Weight	0.451	0.000 (S)
Height	-0.145	0.151 (NS)
BMI	0.609	0.000 (S)
Waist Circumference	0.486	0.000 (S)
Syntax score	0.582	0.000 (S)
PT	-0.007	0.943 (NS)
PT INR	-0.152	0.131 (NS)
RBC	0.062	0.539 (NS)
Hb	0.043	0.668 (NS)
WBC	0.043	0.673 (NS)
Serum Urea	0.023	0.823 (NS)
Serum Creatinine	0.142	0.159 (NS)

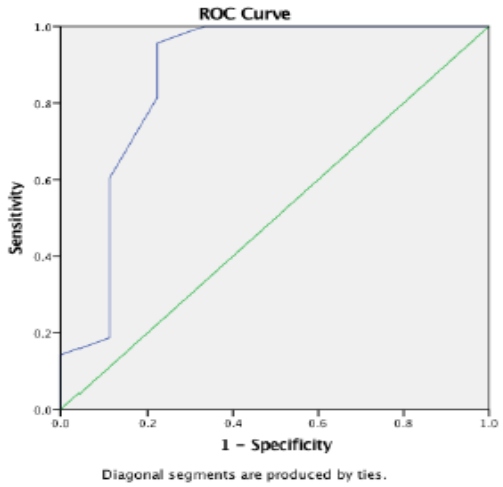
Table No. 4: Area Under Curve for EAT Thickness with the presence of Angiogram.

Area Under the Curve	Std. Error	Asymptotic Sig.	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.872	0.089	0.000	0.697	1.000

Table No. 5: EAT Thickness Sensitivity and Specificity value for Predict Presence of Angiogram.

Coordinates of the Curve		
Positive if Greater Than or Equal To	Sensitivity	1 - Specificity
2.0000	1.000	1.000
3.5000	1.000	0.889
4.5000	1.000	0.667
5.5000	1.000	0.333
6.5000	0.956	0.222
7.5000	0.813	0.222
8.5000	0.604	0.111
9.5000	0.385	0.111
10.5000	0.275	0.111
11.5000	0.187	0.111
12.5000	0.143	0.000
13.5000	0.132	0.000
14.5000	0.099	0.000
15.5000	0.044	0.000
17.0000	0.011	0.000
19.0000	0.000	0.000

Also above table and figure shows that Area under curve was 0.872 for EAT thickness with Angiogram presence. Therefore found that the cut off value for EAT thickness was 6.5 with 95.6% sensitivity & 77.8% specificity for the presence of Angiogram.



DISCUSSION

This cross sectional, Observational study was conducted on 100 patients with established or suspected coronary artery disease who were admitted to Department of General medicine, Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar and underwent coronary angiogram. Echocardiographic measurement of epicardial adipose tissue (EAT) thickness was done accordingly after admission.

Mean age of the study population was 56.53 ± 10.46 years. The mean age was not statistically different in males and females (P = 0.624). Of the study population of 100 patients, 89 were males and 11 were females, this reflects an increased prevalence of CAD in males. 27% of the study group were diabetics. Diabetics had a mean EAT thickness of 9.78±3.27 mm compared 9.14±2.74 which was statistically not different, P = 0.328. Similar results were obtained in the study conducted by Jeong et al [(15)] (p-value = 0.067). 53% of the study group were Hypertensive. Hypertensive had a mean EAT thickness of 9.64±3.16 mm compared 8.94±2.53 which was statistically not different, P = 0.225. Similar results were showed in the study conducted by Jeong et al and [(15)] (p-value = 0.761). 24% of the study group were addicted by alcohol. A total of 14 patients had normal BMI, with 71 patients (71%) overweight and 15 patients being obese (15%). All the obese patients had abnormal EAT levels. However the correlation between the two parameters was weak, Pearson's R value = 0.609. This finding was similar to previous studies [(16-18)].

In the Present study Lipid variable like Total Cholesterol (r=0.373, p<0.001), TG (r=0.221, p=0.029), LDL (r=0.149, p<0.001) shown positive correlation with EAT Thickness and negative correlation with HDL (r=-0.549, p<0.001). Similar to present results equal correlation shown by Lipid profile with EATT in the study conducted by Faroque et al. [(19)], similar results observed by Pruthvi et. al. [(20)] but correlation with EATT was strong.

Receiver operating characteristics (ROC) curve was used to determine the high risk value Of EATT to predict CAD. EATT of 6.50mm was determined as a high risk value for predicting significant CAD with 95.6 % sensitivity and 77.8 % specificity. In study by Burak et al, they found a good correlation between SYNTAX score and EAT thickness, r = 0.69, P <0.001 [(16)]. Pruthvi et al. [(20)] studied A EAT value of >6.23 mm on ROC curve analysis with a sensitivity of 100% and a specificity of 70% predicted significant CAD. Which is nearly equal to present study. Study conducted by faroque et al [(19)] found similar results to the our results.

CONCLUSION

The EATT assessed by transthoracic echo could be convincingly used as a screening test in predicting obstructive CAD. Use of EAT thickness measurement in routine practice could be of assistance in identifying patients at risk and guiding them in proper control risk factors and, if required, undergoing evaluations with invasive approaches. EAT thickness increased with the severity of CAD; i.e. it was thicker in multi-vessel coronary artery disease than in single vessel or non-significant coronary artery disease.

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