Correlation between Peri-Coronary Epicardial Adipose Tissue Volume, Cardiac Calcification and the Severity of Coronary Artery Disease by Multi Slice Computed Tomography

Thesis

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قَالُوا

سُبْحَانَكَ لَا عِلْمَ لَنَا
إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ
الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم

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Tarek Ramzy El Mawardy

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List of Abbreviations

Abb.	Full term
AHA	American Heart Association
AS	Aortic stenosis
AT	Adipose tissue
AUC	Area under curve
AV	Aortic valve
AVC	Aortic valve calcification
AVS	Aortic valve sclerosis
BMI	Body mass index
BMP	Bone morphogenic protein
CABG	Coronary artery bypass grafting
CACS	Coronary artery calcium score
CAD	Coronary artery disease
CCS	Coronary calcium score
CHD	Coronary heart disease
CI	Confidence interval
CRP	C-Reactive protein
CT	Computed tomography
DBP	Diastolic blood pressure
EAT	Epicardial adipose tissue
EBCT	Electron beam computed tomography
ECG	Electrocardiogram
FFA	Free fatty acid
HDL	High density lipoprotein
HS	Highly significant
HU	Hounsfield unit
IL-6	Interleukin-6
IQR	Inter-quartile range
IVUS	Intra vascular ultra sound
JNK	Jun N-terminal kinase

List of Abbreviations *(Cont...)*

Abb.	Full term
KV	Kilo volt
LA	Left atrium
LAD	Left anterior descending
LCX	Left circumflex artery
LDL	Low density lipoprotein
LM	Left main coronary artery
LV	left ventricle
M RNA	Messenger riboneucleutide acid
MA	Milli ampere
MCP-1	Monocyte chemoattractant protein-1
MDCT	Multidetector computed tomography
MESA	Multi-Ethnic Study of Atherosclerosis
MRI	Magnetic resonance imaging
MSCT	Multi Slice computed tomography
NF	Nuclear factor
NPV	Negative predictive value
NS	None significant
NSTEMI	Non ST elevation myocardial infarction
OR	Odds ratio
P Value	Probability value
PAF	Plasminogen activator factor
PET	Positron emission tomography
PPV	Positive predictive value
RA	Right atrium
RCA	Right coronary artery
ROC	Receiver operating characteristic curve
RV	right ventricle
S	Significant
SBP	Systolic blood pressure

List of Abbreviations (Cont...)

Abb.	Full term
SD	Standard deviation
SE	Standard error
SPECT	Single photon emission computed tomography
SPSS	Statistical Package For Social Science
TAVI	Transcatheter aortic valve Implantation
TNF-α	Tumor necrosis factor-α
UCP1	uncoupled protein 1
VAT	Visceral adipose tissue
VEGF	Vascular endothelial growth factor

Abstract

Background: Epicardial adipose tissue (EAT) is a complex endocrine organ that plays an important role in the development of unfavorable metabolic and cardiovascular risk profile. EAT may express a variety of inflammatory mediators which may contribute to the pathogenesis of coronary artery disease (CAD). Aortic and mitral valve calcification may reflect generalized atherosclerosis in the elderly and may be a marker of high prevalence and severity of CAD. There is a direct correlation (extent, severity and the future CV events) between the coronary artery calcium and the CAD.

Aim of the study: To correlate peri-coronary epicardial adipose tissue and coronary artery calcification and valvular (aortic and mitral) calcification with the severity of the coronary artery disease.

Methods: The study recruited 200 patients with suspected coronary artery disease. The amount of EAT surrounding the left main and the three main coronary arteries was quantified in axial cuts with the most distinct layer of EAT. The amount of calcium in the aortic and mitral valve and the coronaries were quantified with multi-detector computed tomography MDCT using dedicated software for measuring calcium score that is based on Agatson score. Coronary artery disease severity was assessed in terms of number of vessels affected and the severity of coronary stenosis by multi-planner reformation technique.

Results: Based on the finding of the MDCT and according to the presence of calcification in the aortic or the mitral valves, and the significance of the coronary artery disease, patients were classified into two groups, **group (I):** 115 patients with normal coronaries or with non significant lesions in their coronaries, and **group (II):** 85 patients with significant coronary artery disease. The Mean $\pm$ SD (in millimeters) of EAT for the entire study cohort in various coronary artery locations were as follows: LM EAT 9.82 $\pm$ 2.67, proximal LAD EAT 10.06 $\pm$ 2.80, mid LAD EAT 9.15 $\pm$ 2.41, distal LAD EAT 6.46 $\pm$ 1.87, proximal LCX EAT 8.10 $\pm$ 1.90, distal LCX EAT 6.83 $\pm$ 1.79, proximal RCA EAT 10.23 $\pm$ 2.42, mid RCA EAT 9.26 $\pm$ 2.72, distal RCA EAT 7.25 $\pm$ 2.58. Statistically highly significant difference were observed between the two groups with regards to LM EAT, proximal, mid and distal LAD EAT, proximal and distal LCX EAT, proximal, mid and distal RCA EAT (8.38 $\pm$ 2.18 Vs 11.77 $\pm$ 1.94 P: 0.000, 8.49 $\pm$ 2.21 Vs 12.18 $\pm$ 2.00, 7.93 $\pm$ 1.77 Vs 10.81 $\pm$ 2.16, 5.45 $\pm$ 1.26 Vs 7.82 $\pm$ 1.68 P: 0.000, 7.08 $\pm$ 1.34 Vs 9.46 $\pm$ 1.67, 6.05 $\pm$ 1.50 Vs 7.89 $\pm$ 1.61 P: 0.000, 9.01 $\pm$ 1.94 Vs 11.88 $\pm$ 1.99, 8.07 $\pm$ 2.32 Vs 10.86 $\pm$ 2.39, 6.31 $\pm$ 2.26 Vs 8.51 $\pm$ 2.45 P: 0.000; respectively). Statistically highly significant difference were observed between the two groups with regards calcium score and the severity of CAD in the three major vessels (LAD, LCX and RCA) and the total calcium score in all vessels (35 (16 – 85.5) Vs 179.5 (59.5 – 243) P: 0.000, 20.5 (7 – 50.5) Vs 56 (33 – 95) P: 0.000, 31 (9 – 54) Vs 97 (54 – 199) P: 0.000, 12 (0 – 84) Vs 286 (106 – 511) P: 0.000; respectively) while calcium score in the LM was not statistically significant with the severity of CAD (4 (3 – 26) Vs 12 (9 – 16) P: 0.360). As regards aortic valve calcification there was statistically highly significant difference between the two groups; P value 0.000, while mitral valve calcification was found to be not statistically significant between the two groups P: 0.272.

Conclusion: The present study demonstrated a significant correlation between the peri-coronary epicardial adipose tissue, coronary calcification and aortic valve calcification and the severity of the coronary artery disease.

Keywords: Epicardial adipose tissue; coronary calcification; valvular calcification; CAD.

AIM OF THE WORK

1- To correlate peri-coronary epicardial adipose tissue volume and the severity of coronary artery disease by MSCT.

2- To correlate the coronary calcium score (number of vessels affected, degree of calcium), mitral anular calcification, aortic valve calcification and the severity of the coronary artery disease by MSCT.