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Epicardial adipose tissue thickness, carotid intima media thickness and total cholesterol/HDL ratio—A combined cut off for detecting coronary artery disease

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ABSTRACT

Background: One of the important aspect in dealing with coronary artery disease (CAD) is the ability to identify the individuals in early stage of CAD, before development of any adverse clinical event, chronic disability or death.
Objective: The ability of Epicardial Adipose Tissue Thickness (EATT) and Carotid Intima Media Thickness (CIMT) to predict presence and severity of CAD. To try and establish a reliable cut-off for detecting coronary artery disease.
Methods: It is a single centre, retrospective case-control study. 244 patients who underwent coronary angiogram were enrolled for the study. Echocardiographic of assessment of EATT was done by 2 cardiologists and CIMT measurement was done by experienced radiologist who were blinded to the clinical or the angiographic data.
Results: The mean EATT and CIMT in CAD and control group were 4.59 ± 1.75 and 2.38 ± 1.47 $P < 0.001$ and 0.97 ± 0.2 and 0.63 ± 0.18 $P < 0.001$, respectively. EATT cut off 3.35 mm predicted CAD with a sensitivity of 81.4% and 80.3% specificity. The CIMT cut off to predict CAD showed significant correlation ($P < 0.001$; OR: 19.1, 95% C.I: 6.6–55.1) with a sensitivity of 83.6% and a specificity of 80.3%. The combined cut off (EATT, CIMT and Total cholesterol/HDL ratio) showed a significantly better sensitivity of 88% and a specificity of 85.2% in its ability to predict CAD.
Conclusion: The combined cut off could serve as an effective and useful tool for detecting CAD.

1. Introduction

Coronary Artery Disease (CAD) now leads to more death and disability in low- and middle-income countries, such as India, with rates increasing disproportionately compared to high-income countries. Unadjusted CAD rates in India have ranged from 1% to 13.2% in urban populations and 1.6% to 7.4% in rural populations.[1] In a study from urban population like Chennai the reported prevalence of CAD was 11%.[2] This alarming increase in CAD prevalence is a cause of concern. While the major aspect in dealing with CAD is identification and modification of risk factors, equally important is the ability to identify the individuals in early stage of CAD, before development of any adverse clinical event, chronic disability or death.

Patients with increased visceral fat have also been found to be at increased risk for cardiovascular events. Epicardial fat or Epicardial adipose tissue (EAT) represents a true visceral fat and has been suggested as a cardiometabolic risk factor.[3] Epicardial fat is the adipose tissue present between the myocardium and the visceral pericardium and it has been credibly shown to be a true visceral fat and with all the specific traits of insulin resistant states.[4] Epicardial adipose tissue thickness (EATT) has clinically correlated with abdominal visceral fat and metabolic syndrome.[3,5] EATT showed good correlation in subclinical atherosclerosis and coronary artery disease.[6–13] These previous studies showed wide variations in the mean EAT and the ability to predicting CAD. Hence there is a need to study the correlation between EAT and the extent of coronary

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artery involvement and to establish a reliable range of values for predicting CAD.

Carotid intima media thickness (CIMT) has been proposed as a reliable surrogate marker for coronary atherosclerosis.[14–17] There are studies comparing EATT and CIMT in various disease populations. It has been compared in patients with diabetes mellitus, metabolic syndrome, hypertensive patients to assess the vascular function and Human Immunodefiency Virus (HIV) patients taking Highly Active Anti-Retroviral Therapy (HAART).[18–21] However, there are no studies to compare or correlate EATT and CIMT to the extent of coronary artery disease by coronary angiography and in the ability to predict the coronary artery disease

2. Materials and methods

The study was a single centre, retrospective case – control study, conducted from November 2013 to March 2014. Study was conducted with institutional ethical committee approval. Patients undergoing coronary angiogram in the department of cardiology for indications including: chronic stable angina, unstable angina/Non-ST Elevation Myocardial Infarction (NSTEMI), acute and recent ST elevation Myocardial Infarction (STEMI) were enrolled for the study. Of the total 340 patients who underwent angiogram during this period 96 patients were excluded as per criteria and 244 patients were included for the study. Enrolled patients were divided into two groups for the study. Study group with abnormal coronary angiogram and control group with normal coronary angiogram.

2.1. Exclusion criteria

Age less than 18 and age more than 75 years, Poor Echo Window, pericardial effusion, Chronic Kidney Disease (CKD) patients undergoing routine Coronary Angiogram CAG before renal transplantation.

2.2. Data collection technique and tools

Institutional ethical committee approval was obtained for the study. Written and Informed consent was obtained from all patients at the time of admission. A proforma for each patient was filled which included the demographic data, symptom history, A complete risk factor profile (including diabetes, hypertension, dyslipidemia, smoking, family history, prior history of CAD). Physical examination included measuring the pulse rate, blood pressure, Height and body weight, cardiac & respiratory system clinical examination.

2.3. Investigations

Complete blood investigations including blood counts, blood sugar, urea and creatinine, liver function test, were taken at admission. Lipid profile was done in overnight fasting state. A 12-lead electrocardiogram was obtained. Echocardiogram was performed at time of admission. Coronary angiogram was performed during index hospitalization.

2.4. Sample collection

2.4.1. Echocardiographic measurement

Echocardiography was performed by experienced cardiologists using Philips HD 11 XE ultrasound machine (Koninklijke Philips NV, Netherlands). The images are stored in the computerised database for further calculations. The offline measurement of EATT was done by 2 cardiologists who were blinded to the clinical and angiographic data. With the patient in left lateral position, the EATT is measured from the free wall of right ventricle (RV) in parasternal long axis view. Epicardial fat is identified as an echo-free space between the RV myocardium and the visceral pericardium (epicardium), measured perpendicularly on the free wall of right ventricle at end-diastole for 3 cardiac cycles (Fig. 1).[3,4,6] Aortic annulus was used as the anatomic landmark. The measurements were performed at a point on the free wall of the RV, along the midline of the ultrasound beam and perpendicular to the aortic annulus. The average values from 3 cardiac cycles were used for statistical analysis.

2.4.2. Ultrasound quantification of Carotid intima media thickness

Carotid arteries were evaluated using Esoate my lab50 ultrasound machine (Genoa, Italy). Measurements were done with a 10 MHz transducer. All examinations were done by experienced radiologist who were blinded to the clinical, EAT or the angiographic data. Examination involved scanning of involved a transverse and longitudinal scanning of the common carotid artery, bifurcation, and internal carotid artery. The Carotid Intima Media Thickness (CIMT) was measured on the far wall at 1 cm from bifurcation of the common carotid artery as the distance between the lumen intima interface and the media-adventitia interface. At least three measurements were performed on both sides, and the average measurement was taken as the CIMT.[15–17,23] All measurements were made by semi-automated method at a plaque-free site. The Intima Media Thickness (IMT) was assessed as abnormal if the values were more than 75th percentile for age and sex.[24]

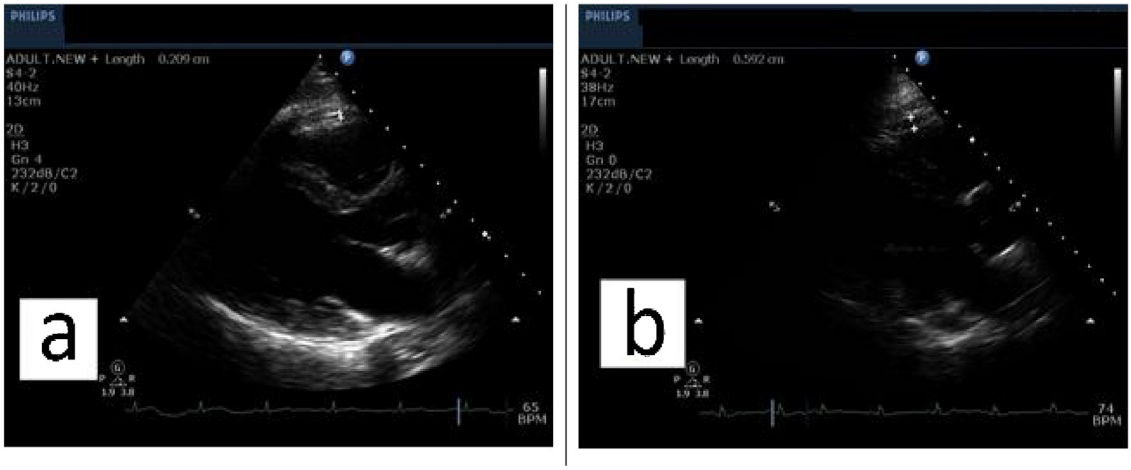

Fig. 1. Examples of estimation of Epicardial Adipose Tissue thickness (EATT) by Trans Thoracic Echocardiography: a) Normal EATT. b) Increased EATT.

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