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Gender disparity impact on the vascular calcification and pericardial fat volume in patients with suspected coronary artery disease

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ABSTRACT

Background: There is no consensus in the literature on the influence of gender on the correlations between coronary artery calcification (CAC) with aortic root calcification (ARC) and pericardial fat volume (PFV).

Objective: To investigate the impact of gender on the correlations between PFV, CAC and ARC in Iraqi patients with suspected coronary artery disease (CAD) assessed by multi-detector CT (MDCT).

Methods: One hundred and thirty consecutive Iraqi patients with intermediate pretest probability of ischemic heart disease who underwent MDCT examination for assessment of CAD were recruited between January and December 2014. Of these, 111 patients were found to be eligible and were enrolled in the study. Patients were divided into a male group ($n = 54$) and a female group ($n = 57$).

Results: In male patients, PFV showed no significant correlation with CAC and ARC. CAC showed a significant correlation with ARC ($r = 0.392$, $P = 0.003$). The correlation between CAC and ARC persisted even after adjustment for PFV, age and cardiac risk factors ($P = 0.01$, CI = 0.067–0.492). In female patients, PFV showed a significant correlation with CAC ($r = 0.413$, $P = 0.001$) and this correlation persisted even after multivariate regression adjustment for ARC, age and cardiac risk factors ($P = 0.016$, CI = 0.067–0.612) while there was no significant correlation between PFV and ARC. ARC showed no significant correlation with CAC and PFV. ARC showed a significant association with male gender ($P = 0.04$) while there was no significant difference in PFV and CAC between the two groups of study.

Conclusion: PFV was significantly associated with CAC in female patients while ARC showed a significant association with CAC in male patients.

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Introduction

Gender disparity plays an important role in cardiovascular disease prevalence and burden with significant gender related differences reported in cardiovascular clinical presentation mortality, morbidity and risk factors profiles [1].

Coronary artery calcification (CAC) is a reported imaging marker of subclinical atherosclerosis and has incremental prognostic values beyond those of traditional cardiac risk scores for cardiovascular disease (CVD) prognosis and it may help in reclassification of patients at increased risk [2,3].

Pericardial fat is an adipose tissue surrounding the heart, with anatomic proximity to the epicardial coronary arteries. In recent years, pericardial fat volume (PFV) has been proposed as an imaging biomarker of increased cardiovascular risk [4,5].

To the best of the authors' knowledge, there is little information regarding the association between aortic root calcification (ARC) and coronary atherosclerosis markers and calcification, because the evaluation of the aortic root or thoracic aorta calcification is not a standard part of the routine cardiovascular workup.

The main aim of this study was to investigate the impact of gender disparity on the correlations of PFV, CAC and ARC in patients with intermediate test probability of coronary artery disease (CAD) assessed by multi-detector CT (MDCT).

Materials and methods

This cross-sectional study was carried out at the Cardiology Center at Al-Sader Teaching Hospital. Informed consent was obtained from all individual participants included in the study. The study was approved by our institution. One hundred and thirty consecutive Iraqi patients with intermediate pretest probability of ischemic heart disease based on their age, sex and cardiac symptoms and who underwent 64-slice MDCT angiography for assessment of CAD were recruited between January and December 2014. Of these, 111 patients were found to be eligible and were enrolled in the study.

Nineteen patients were excluded because of a poor examination technique or motion artifact ($n = 8$), aortic root anomalies or dissection ($n = 2$), difficulty in accurate pericardial fat volume calculation or segmentation of fat ($n = 6$), or data were missing ($n = 3$).

For analytical purposes, patients were divided into two groups according to their gender: male group [$n = 54$ (49%)] and female group [$n = 57$(51%)].

Using standard physician-based questionnaires, a history of conventional cardiac risk factors for CAD was obtained from each patient at the time of coronary MDCT angiography examination including a positive family history of premature CAD (occurring before the age of 55 years in men and before 65 years in women), current smoking history (more than 10 cigarettes per day in the last year), a history of hypertension or use of anti-hypertension medications, hyperlipidemia that was defined as total cholesterol ≥200 mg/dl or triglyceride levels ≥150 mg/dl or use of lipid lowering drugs, a history of diabetes mellitus or use of insulin or diabetic lowering drugs and obesity with a body mass index ≥30. Patients with two or more cardiac risk factors were considered to have multiple risk factors.

CT scan protocol

CT coronary angiography was performed with a 64-slice scanner (Aquilon 64, v. 4.51 ER 010; Toshiba Medical Systems, Tochigi, Japan). Before multi-slice CT angiography was performed, a non-contrast CT was acquired to measure the calcium score according to the Agatston for total heart calcium (summed across all lesions identified within coronary arteries) using a sequence scan with a slice thickness of 3 mm [6].

Coronary calcification area was defined as at least three contiguous voxels with a CT density >130 Hounsfield units. When the patient's heart rate was more than 65 bpm, a β-blocker (metoprolol; 20–60 mg orally) was administered before the scan. A bolus of 80 ml contrast medium (Omnipaque; 350 mg/ml iodine) was injected intravenously at a rate 5 ml/s, followed by 30 ml of normal saline. The scan was obtained from the aortic arch to the level of the diaphragm during a single breath hold. Using retrospective ECG-gating and ECG-dependent tube current modulation, the following parameters were performed: collimation, width 32.5 cm × 32.5 cm; slice thickness 0.5 mm; rotation time 0.35 s; tube voltage 120 kV; maximum effective tube current 890 mA; and table feed 0.3 mm/rotation at 75% of R–R cardiac cycle. Examination time took ~10 s. CT images were reconstructed using a smooth kernel (B25f) with a slice thickness of 0.5 mm (increment of 0.3 mm). CT data sets were transferred to a dedicated workstation (Vitrea 2 Workstation; Vital Image, Plymouth, MN, USA) for image analysis.

The aortic root was defined as the part of the aorta lying within 3 cm from the caudal aspect of the aortic annulus containing sinuses of Valsalva and the sinotubular junction. The total calcium score of the aortic root was calculated using Agatston method according to this definition. Areas in the aortic root with an attenuation >130 Hounsfield units and an area >1 mm^2 were considered to be calcified lesions. All MDCT images were assessed by two independent radiologists with more than 5 years' experience in coronary MDCT angiography interpretation.

PFV was defined as any fatty tissue located within the pericardial sac and measured three-dimensionally with the contrast-enhanced phase. PFV was measured three-dimensionally with the contrast-enhanced phase. The layer of the pericardium was manually traced and a three-dimensional image of the heart was constructed. Then the PFV was quantified by calculating the total volume of the tissue whose CT density ranged from −250 to −20 HU within the pericardium by using three D workstation statistical analysis.

Statistical analysis

Data are presented as mean ± standard deviation or as numbers with percentages, as appropriate. Categorical data are expressed as frequencies and group comparisons were performed using Pearson's chi-square test. Continuous variables are presented as mean ± standard deviation and were compared using the Student's *t*-test or analysis of variance, as