Correlation between impaired Aortic Distensibility and the severity of coronary artery disease and calcium scoring measured by cardiac CT

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Background:

Multi-slice cardiac CT has evolved as a noninvasive imaging technique for the evaluation of stenosis in the coronary arteries by what is called Coronary Computed Tomographic Angiography (CCTA), but it is also widely used in quantitative plaque assessments through Coronary Artery Calcium (CAC) scoring and plaque type identification (soft or Mixed VS calcific). Evaluation of aortic distensibility and aortic stiffness can also be performed through Multi-Slice Computed Tomography (MSCT) by calculating the Aortic Distensibility Index (ADI) and Pulse Wave Velocity (PWV).

Aim:

To evaluate whether impaired Aortic Distensibility Index (ADI) and Aortic Stiffness measured by Cardiac CT correlate with the severity of coronary artery disease and coronary calcium scoring in at-risk individuals (assessed by CCTA).

Patients and Methods:

We included 180 patients. Patients were classified into four groups according to their CAC score and according to the degree of stenosis based on CCTA. All patients in this study have undergone full history taking, and short clinical examinations including B.P. and H.R. measurements, standard ECG, routine laboratory investigations, and Multi-Slice CT Coronary Angiography (MSCT-CA).

All patients underwent coronary artery calcium (CAC) scanning and CCTA, and their ADI and Aortic Stiffness were measured. The maximum systolic and maximum diastolic cross sectional-area (CSA) of the ascending aorta (AAo) was measured 15-mm above the left main coronary ostium. ADI was defined as: [(Systolic CSA – Diastolic CSA)/ (Diastolic CSA in X systemic-pulse-pressure) X 10^3]. Aortic stiffness was measured as PWV using the **Bramwell- Hill equation** (3.57/ √distensibility).

Results:

There was a strong correlation between Aortic distensibility and Aortic stiffness (PWV) with degree of stenosis and coronary artery calcium.

In patients stratified based on the degree of calcium scoring (CAC score), there was a statistically significant negative correlation between calcium scoring and the ADI (Pearson's r= -0.771, p< .001), and a statistically significant positive correlation between calcium scoring and PWV (Pearson's r=0.817, p< .001).

In patients stratified based on the degree of stenosis, there was a statistically significant negative correlation between ADI and the Degree of stenosis (Pearson's r=-0.707, p< .001), and there was a statistically significant positive correlation between PWV and the Degree of stenosis (Pearson's r=0.697, p< .001).

Conclusion:

Impaired aortic distensibility strongly correlates with the severity of coronary atherosclerosis, degree of stenosis, and coronary artery calcium. The addition of ADI to CAC and traditional risk factors provides incremental value to predict at-risk individuals.

Keywords:

Aortic distensibility index, Aortic Stiffness, Pulse wave velocity Coronary computed tomographic angiography, Coronary artery calcium score.