Correlation between Coronary Computed Tomography Angiography, Computed Tomography Calcium Score and Invasive Coronary Angiography in Symptomatic Coronary Artery Disease Patients.

Hiba Al-Dhubhani, Nisrin Alshamrani, and Rahif Khaled
Supervisor: Dr. Entesar Zawam Dalah
Medical Diagnostic Imaging Department, College of Health Sciences, University of Sharjah, UAE

INTRODUCTION

Coronary artery disease (CAD) is a disease characterized by narrowing of the coronary arteries due to accumulation of plaque, cholesterol, and calcium within the walls of the coronary arteries [1]. Cardiovascular disease was the number one cause of deaths in 2014 accounting for 30% of all death cases in the UAE [2]. While invasive imaging procedures remain unreplaceable in diagnosing and treating stenosis in CAD patients, a need arises for a noninvasive imaging technique for preventive purposes in asymptomatic or minimally symptomatic patients [3].

OBJECTIVE

The primary aim of this study is to evaluate stenosis using Coronary Computed Tomography Angiography (CCTA) and Computed Tomography Calcium Scoring (CTCS), and correlate the findings with Invasive Coronary Angiography (ICA) in symptomatic Coronary Artery Disease (CAD) patients.

MATERIALS & METHODS

The study included 24 patients (14 males and 10 females: mean age 62.3 years ranging from 34–74, with known CAD. The data was retrieved from the Radiology Department of University Hospital in Sharjah and was retrospectively reviewed. All patients have undergone ICA, 16 undergone CCTA, and 22 undergone CTCS. CCTA and CTCS were preformed using Multi Detector Computed Tomography (MDCT), Fig 2. CCTA and ICA stenosis measurement was done using the Quantitative Coronary Angiography (QCA) method, Fig 1.

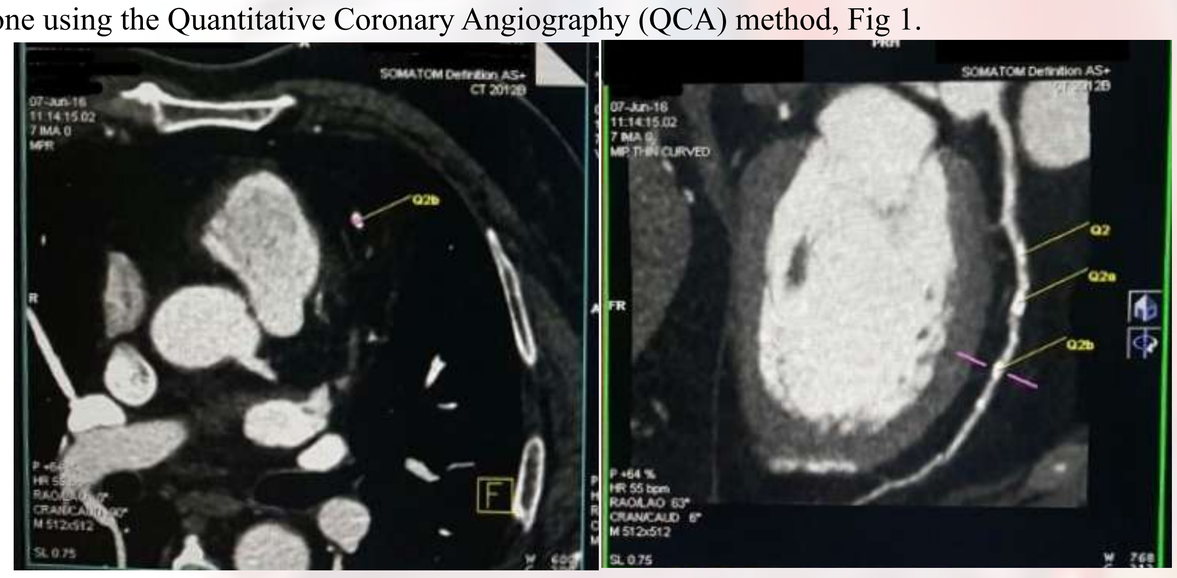

Fig 1, QCA stenosis measurement in CCTA showing severity and type of plaque present in a defined ROI.

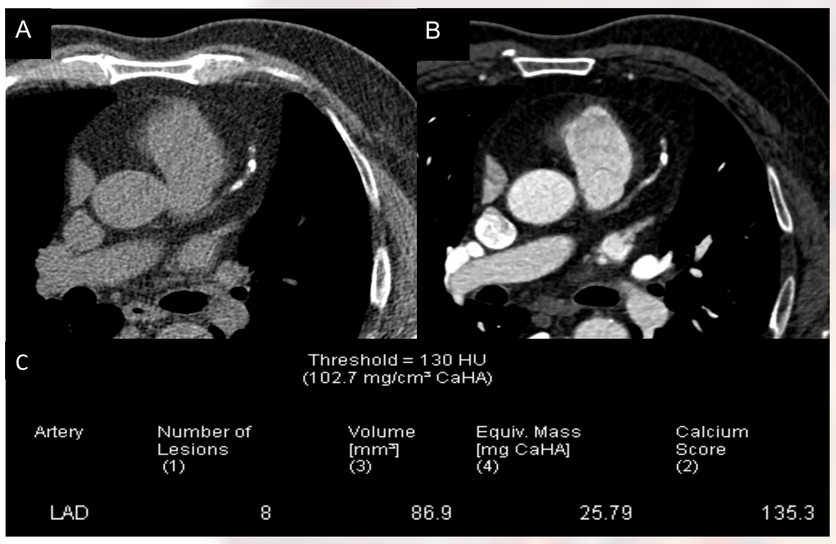

Fig 2, An axial view of the LAD showing multiple calcification plaques in CTCS (A) and CCTA (B) and calcium score results (C) using MDCT.

Statistical Analysis

All the statistical analysis was performed using GraphPad Prism 7 (version 7.03) as well as IBM SPSS (version 22) statistical software.

RESULTS & DISCUSSION

Finding 1: CCTA vs ICA

Table 1: Segment-based (≥50%) diagnostic accuracy of MDCT showing an underestimation of significant stenosis in 13%, and an overestimation in 10% of patients comparing to ICA.

True positive	**13**
True negative	136
False positive	20
False negative	26
Sensitivity	39.4%
specificity	84.0%

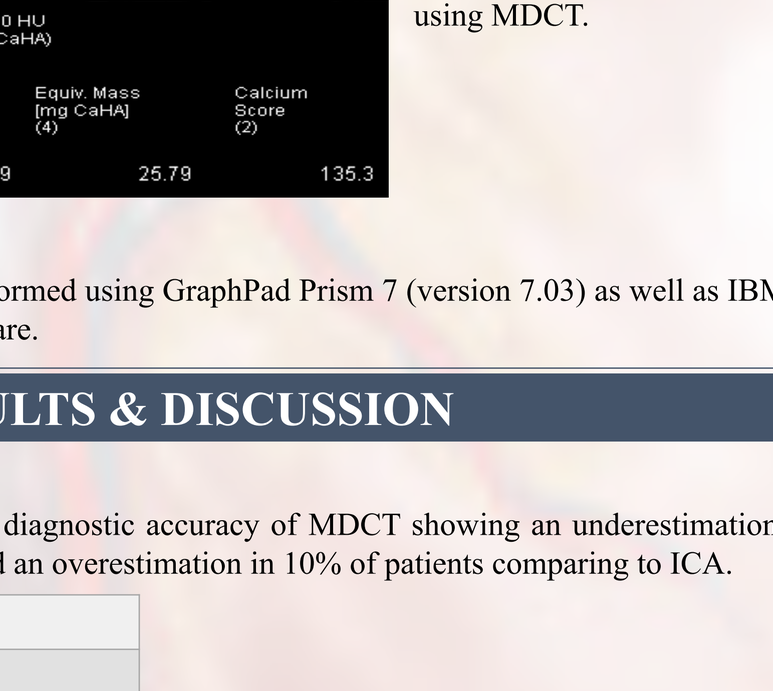

Fig 3: Spearman rank correlation graph showing significantly (P=0.0002) weak correlation between CCTA and ICA.

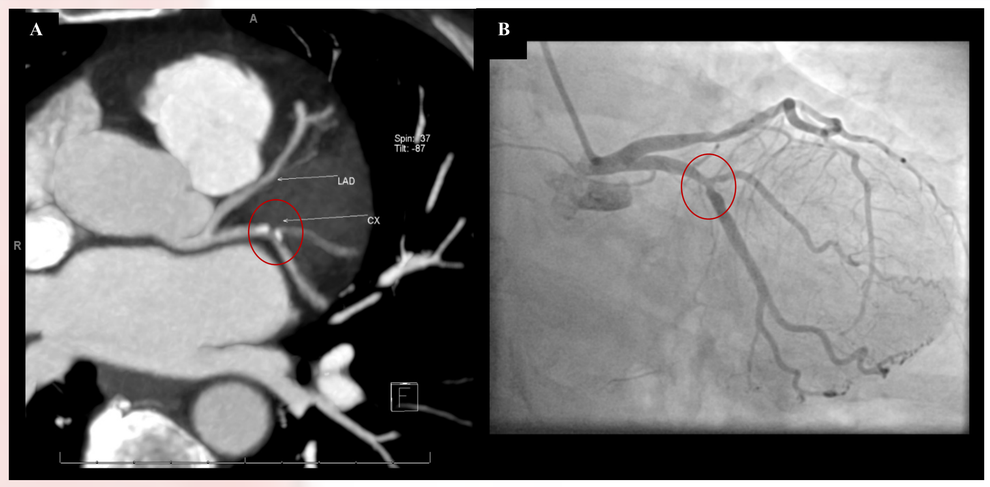

Fig 4: CCTA image showing calcific plaques at the mid portion of LCX and origin of OM (A), ICA image shows narrowing of the mid portion of LCX which indicates stenosis (B).

Table 2, Vessel-based diagnostic accuracy of MDCT showing LAD to have the lowest detection specificity and LM to have the highest.

	TP	TN	FP	FN	Sensitivity	Specificity
LM	*	12	3	*	*	100%
LAD	10	1	1	3	90.9%	25.0%
LCX	4	7	2	2	66.7%	77.8%
RCA	2	8	2	3	50.0%	72.7%

*There was no positive results reported in ICA for LM.

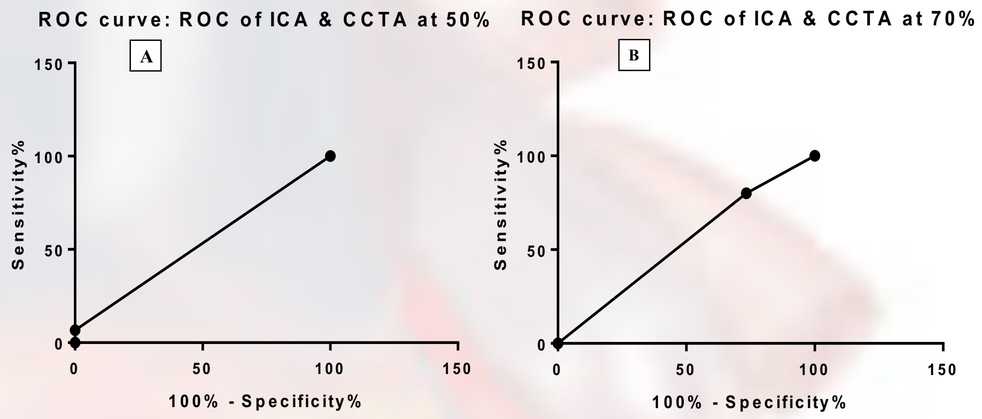

Fig 5: ROC curve of CCTA vs ICA in ≥50% (A), and ≥70% (B) stenosis. Both thresholds reveal the same area under curve of 0.5333 with a confidence interval of 0.3238 to 0.7429

Finding 2: CTCS vs ICA

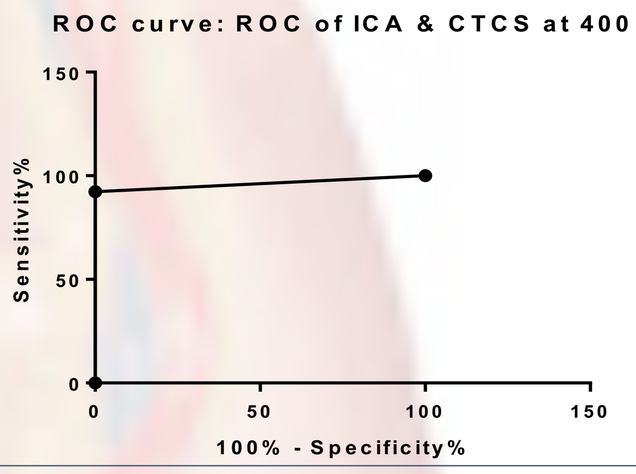

Fig 6: ROC for identifying significant (≥50%) stenosis by CTCS with ≥400 threshold showing high detection accuracy of significant stenosis with urea under curve of 0.9615.

CONCLUSIONS

Our results indicate that CTCS is a reliable technique to detect significant coronary stenosis as agreeing with [1] finding. Hence it has the potential to be used as a predicting method for stenosis in symptomatic patients before invasive procedures. Demonstrated also is a significant stenosis measurements in CTCS which correlates better than CCTA with ICA. Additionally, there was weak correlation between CCTA and ICA. However, CCTA detection accuracy might be better in newly formed coronary lesions than the detection of significant chronic coronary stenosis. This observation reasonably agrees with [4 and 5].

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