# THE ROLE OF MULTI DETECTOR COMPUTED TOMOGRAPHY CORONARY ANGIOGRAPHY (MDCTCA) IN EVALUATION OF PATIENTS WITH RECENT ONSET CHEST PAIN

***Thesis***

*Submitted for partial fulfillment of Master Degree*
***in Radiodiagnosis***

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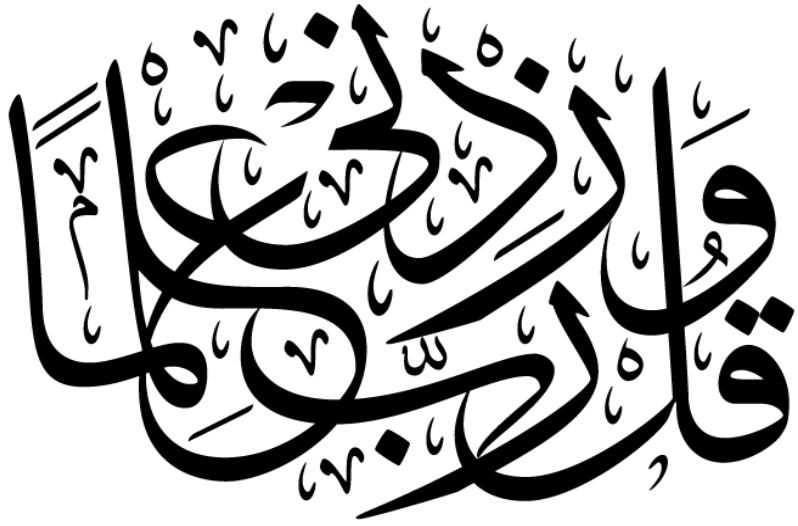
وقل رب زدني علما

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*I Praise **Allah** Thank Him, Seek His Help, Guidance and Forgiveness … then:*

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# List of Abbreviations

| | |
|---|---|
| 3D | Three Dimension |
| ACD | Acute Coronary Disease |
| ACE | Automatic Exposure Control |
| ACS | Acute Coronary Syndromes |
| AHA | American Heart Association |
| Ao | Aorta |
| AP | Antero-Posterior |
| AVN | Atrioventricular Node |
| BMI | Body Mass Index |
| bpm | Beat per Minute |
| CABG | Coronary Artery Bypass Grafting |
| CAC | Coronary Artery Calcium |
| CACS | Coronary Artery Calcium Score |
| CAD | Coronary Artery Disease |
| CHD | Coronary Heart Disease |
| CT | Computed Tomography |
| CTCA | CT Coronary Angiography |
| D | Diagonal Branch |
| DM | Diabetes Mellitus |
| EBCT | Electron Beam Computed Tomography |
| ECG | Electrocardiography |
| HU | Hounsfield Unit |
| IHD | Ischemic Heart Disease |
| IMB | Inferior Marginal Branch |
| KV | Kilo Volt |

| | |
|---|---|
| kVp | Kilo Voltage Peak |
| LAD | Left Anterior Descending |
| LAO | Left Anterior Oblique |
| LCX | Left Circumflex |
| LM | Left Main Coronary |
| LV | Left Ventricle |
| mA | milli-Ampere |
| mAS | milli-Ampere Second |
| MDCT | Multidetector Computed Tomography |
| MI | Myocardial Infarction |
| MIP | Maximum Intensity Projection |
| MPR | Multiplanar Reformation |
| MSCT | Multislice Computed Tomography |
| NPV | Negative Predictive Value |
| PDA | Posterior Descending Artery |
| PLB | Posterior Lateral Branch |
| RAO | Right Anterior Oblique |
| RCA | Right Coronary Artery |
| RI | Ramus Intermedius Artery |
| ROI | Region Of Interest |
| S | Septal branch |
| SD | Standard Deviation |
| UA | Unstable Angina |
| VR | Volume Rendering |
| | |

# INTRODUCTION

Recent onset chest pain was defined as an unstable angina, which is a clinical syndrome between stable angina and acute myocardial infarction in which the thoracic pain may mark the onset of acute myocardial infarction. It typically occurs at rest and has a sudden onset, sudden worsening, and recurrence over days and weeks. It carries a more severe short-term prognosis than stable chronic angina ***(Russo et al., 2010)***.

It is also defined as chest pain with altered frequency or character that is suspicious for acute coronary disease (CAD) ***(Dedic et al., 2011)***.

Coronary artery disease (CAD) remains the commonest cause of morbidity and mortality in the developed countries, and a leading cause of death in Western countries ***(Koulaouzidis et al.,2012)***.

MDCTCA allows anatomical, non-invasive imaging of the coronary arteries in patients with stable and unstable angina by performing non-invasive angiography, including:

- Detection of coronary atherosclerosis by assessing the coronary artery calcium (CAC) (calcium score)
- Important information regarding the coronary plaques (Site, Size, Shape, and Number).

- Identifying the degree of coronary lumen stenosis.
- Defining therapeutic options, and determining prognosis ***(Nasti et al., 2011)***.

Until recently, invasive coronary angiography (ICA) has been the gold standard for accurate assessment of the presence, extent and severity of CAD. However, it is an invasive procedure and not without complications, especially in high risk and unstable patients ***(Koulaouzidis et al.,2012)***.

Computed tomography coronary angiography (CTCA) is a rapid, non-invasive diagnostic tool, which has gained increasing acceptance as an alternative means of accurate and safe detection of coronary atherosclerotic plaques and CAD ***(Koulaouzidis et al.,2012)***.

With the advent of technology, the performance of this modality has further improved, providing near 100% sensitivity and >90% specificity as well as further reducing radiation dosage to approximately 10% than of invasive coronary angiography. Moreover, a CTCA study can be completed within minutes and along with its non-invasive characters may enable optimal CAD detection with decreased health care costs and fewer complications ***(Koulaouzidis et al.,2012)***.

With the recent development of the latest models of Multislice CT (MDCT) such as 16, 64, 128 dual source, 256

and 320 slice CT scanners, the diagnostic accuracy of MDCT angiogram in CAD has significantly improved. The clinical application of CT angiogram is of enormous clinical value even with patients who have a low likelihood of CAD.

MDCT has further contributed to better image quality in cardiac imaging by the introduction of dual source CT in 2006, as the temporal resolution is shortened from 165 to 83 ms and heart rate dependence is eliminated. Several meta-analysis of 64slice CT studies have reported an impressive range of results in sensitivity and specificity (99% sensitivity and 89% specificity in 28 studies) ***(Chopra and Peter, 2012)***.

# AIM OF STUDY

To evaluate the patients with recent onset chest pain by the use of Multi Detector CT Coronary Angiography, and asses the frequency, pattern, and severity of coronary artery disease among them.

# NORMAL CORONARY ARTERIES

There are left and right main coronary systems. The left coronary system comprises the left main artery (LM), which bifurcates into the left anterior descending artery (LAD) and the left circumflex artery (LCX). The right coronary system comprises the right coronary artery (RCA) (Fig 1) ***(Mahani & Agarwal, 2011).***

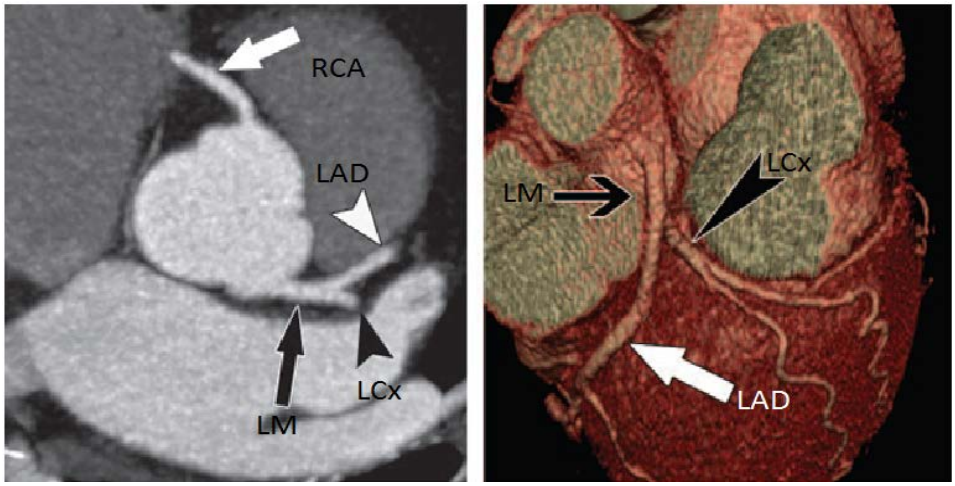


**Fig 1: Origin of the Coronary Arteries. (a)** Axial MPR image & **(b)** 3D VR image show the origin of the coronary arteries from the aorta. The LM bifurcates into the LAD and the LCx. LM= Left main coronary artery, LAD= left anterior descending artery, LCx= left circumflex artery, MPR=multiplanar reconstruction, VR=Volume Rendering ***(Quoted from Kini et al., 2007).***

The myocardial distribution of the coronary arteries is somewhat variable, but the right coronary artery (RCA) almost always supplies the right ventricle (RV), and the left coronary artery supplies the anterior portion of the ventricular septum

and anterior wall of the left ventricle. The vessels that supply the remainder of the LV vary depending on the coronary dominance ***(Kini et al., 2007).***

## Right Coronary Artery and its Branches

The RCA arises from the anteriorly positioned right sinus of Valsalva at a slightly lower level than the origin of the left main coronary artery (Fig 2), and courses through the right atrioventricular groove. The conus artery is the first branch of RCA in 50% of cases, and it supplies the right ventricular infundibulum. In the remaining 50% of cases, the conus artery arises directly from the aorta separately from the RCA (Fig 3) ***(Mahani & Agarwal, 2011).***

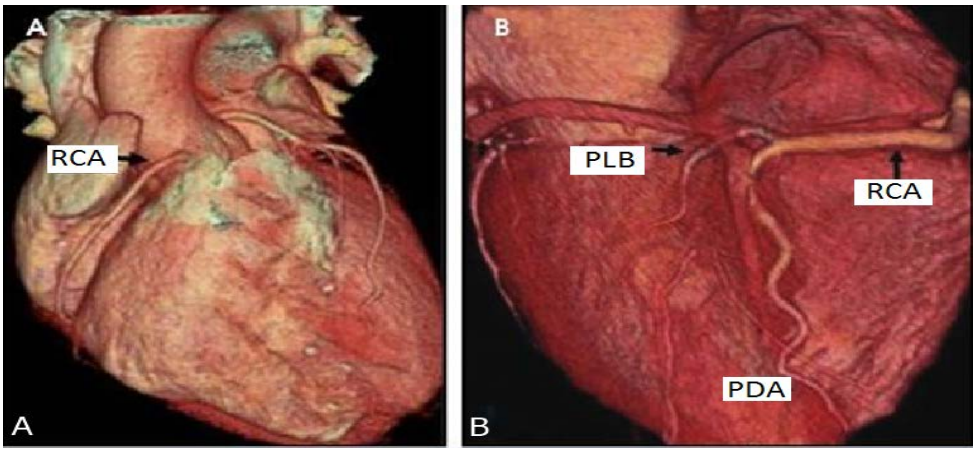


**Fig 2: Right coronary artery (RCA) anatomy. (A)** 3D VR image shows the normal origin of RCA and its course in the right AV groove. **(B)** 3D VR image shows the posterior descending artery (PDA) and posterior lateral branch (PLB) in a right dominant coronary artery system ***(Quoted from Mahani & Agarwal, 2011).***