Role MSCT coronary angiography in evaluating patients with ischemic heart disease

Thesis

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List of Abbreviations

3D	Three Dimension	**LAD**	Left Anterior Descending
ACD	Acute Coronary Disease	**LAO**	Left Anterior Oblique
ACS	Acute Coronary Syndrome	**LM**	Left Main Coronary
AEC	Automatic Exposure control	**LCX**	Left Circumflex
AHA	American Heart Association	**LV**	Left Ventricle
Ao	Aorta	**mA**	milli-Ampere
AP	Antero posterior	**mAS**	milli-Ampere Second
AVN	Atrioventricular Node	**MDCT**	Multi-Detector ComputedTomography
BMI	Body Mass Index	**MI**	Myocardial Infarction
bpm	Beat per Minute	**MIP**	Maximum Intensity Projection
CABG	Coronary Artery Bypass Grafting	**MPR**	Multi-Planar Reformatting
CACS	Coronary Artery Calcium Scoring	**MSCT**	Multi-Slice Computed Tomography
CAD	Coronary Artery Disease	**mSV**	milli-Sievert
CHD	Coronary Heart Disease	**mS**	milli-Second
CT	Computed Tomography	**NPV**	Negative Predictive Value
CTCA	CT Coronary Angiography	**OM**	Obtuse Marginal Artery
D	Diagonal branch	**PDA**	Posterior Descending Artery
DM	Diabetes Mellitus	**PLB**	Posterior Lateral Branch
DSCT	Dual Source CT	**RAO**	Right Anterior Oblique
EBCT	Electron Beam CT	**RCA**	Right Coronary Artery
ECG	Electrocardiography	**RI**	Ramus Intermedius Artery
HU	Hounsfield Unit	**ROI**	Region Of Interest
IHD	Ischaemic Heart Disease	**S**	Septal Branch
IMB	Inferior Marginal Branch	**SD**	Standard Deviation
KV	Kilo Volt	**VR**	Volume Rendering Reformatting
KVP	Kilo Voltage Peak	**RV**	Right ventricle

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Abstract

This study included 25 patients (14 males and 11 females). Their ages ranged between 40-70 years. All presented with ischemic heart disease diagnosed by history, examination and laboratory investigation were referred to radio-diagnosis department of Ain shams university hospital for CT coronary angiography examination. The preliminary results have shown the great role of CT coronary angiography examination in detecting the presence and assessing extent of ischemic lesion (disease extension and coronary plaque scores) and guiding further clinical management.

(***Key Words***: *CT coronary angiography , iscemic heart disease*)

Introduction

Ischemic heart disease most commonly due to coronary artery disease is still one of the most frequent cause of death worldwide. Computed tomography coronary angiography (CTCA) is a useful tool for the non-invasive assessment of coronary artery disease (CAD)(**Arbab-Zadah et al., 2012).**

In the past, emergency department triage based on history, clinical examination, serial electrocardiogram (ECG), and biomarkers alone as diagnostic tools for ischemic coronary heart disease , some of results were false negative and 2% of the patients discharged who were later on diagnosed with ((Acute Coronary Syndrome)); such patients have higher mortality rates. Accordingly, it is now standard in many emergency departments and chest pain centers to evaluate such patients with a “rule-out myocardial infarction” strategy followed by stress testing and/or cardiac imaging; Advances in coronary computed tomographic angiography (CCTA) have made it possible to image the coronary vessels rapidly and non-invasively, with excellent accuracy for detecting the presence and assessing the severity of luminal stenosis and extraluminal plaque **(Goldstein et al., 2011).**

Treatment of patients with acute chest pain mostly due to ischemic heart disease by an inconclusive initial evaluation with the use of biomarkers and ECG testing is often challenging and inefficient .The majority of patients have underlying CAD **(Hoffman et al., 2012)**.

Contrast-enhanced computed tomographic angiography (CCTA) has high affinity for the detection of clinically significant CAD, as compared with invasive coronary angiography in patients in a stable condition with suspected or known CAD (**Hoffman et al., 2012).**

Before advent of CT scan, conventional coronary angiography was the gold standard for assessment of the heart and coronary arteries, owing to its excellent spatial and temporal resolution; however, the procedure is invasive and can cause serious complications, for example thromboembolism and arterial dissection. Non-invasive imaging methods such as (CTA) can therefore be advantageous. Also the applications of coronary artery CTA have, in the past, been limited by problems such as cardiac motion, respiratory motion and the small size of coronary arteries. However, technological advances with MSCT scanners have enhanced the spatial and temporal resolution and overcome the problems achievable by CTA **(Huang et al., 2010) .**

Contrast-enhanced MSCT is a non-invasive technique for the detection, visualization and characterization of stenotic artery disease. It could act as a gatekeeper prior to cardiac catheterization and finally replace conventional diagnostic modalities. Recent generations of MSCT machines with higher and developing spatial and temporal resolution own a non-invasive approach to accurately delineate coronary vessel anatomic structures, with increasingly more detector rows number and higher gantry speeds, allowing for best visualization of the coronary arteries (**Youssef et al., ٢٠١٤).**

Aim of the work

The aim of the study is to evaluate the rule of multi-slice CT coronary angiography in evaluation of patients with ischemic-coronary artery disease.

Chapter 1

Anatomy of Coronary Arteries

The **coronary arteries** arise just distal (superior) to the aortic valve from the coronary sinuses and supply myocardium with oxygenated blood. They divide and encircle the heart to cover its surface with a meshy network resembling perhaps a slightly crooked crown.

The typical anatomical division consists of two coronary arteries, a left coronary and a right coronary, originated from the left and right aortic or coronary sinuses respectively, in the proximal ascending aorta. They are the only two branches of the ascending aorta.

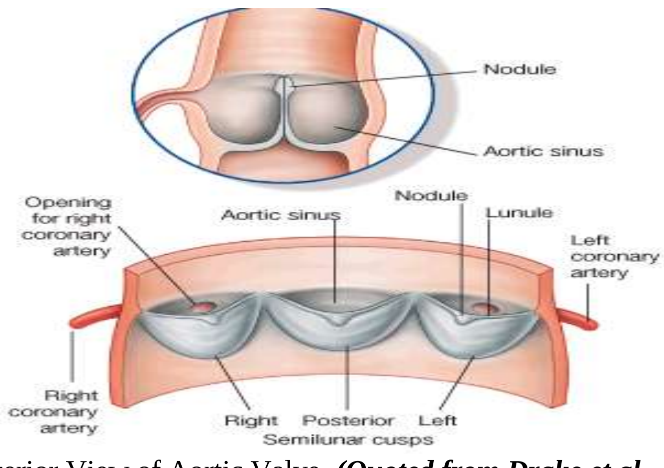

Fig. (1). Anterior View of Aortic Valve**. *(Quoted from Drake et al., 2007).***

The right coronary artery

The course of right coronary(RCA) artery in the right atrioventricular groove to the inferior surface of the heart, where upon it turns anteriorly at the crux as the inferior interventricular artery (in right dominant circulation).

Right coronary artery branches:

- Conus artery , may arise directly from aorta in (30-35%) of patients , it is supply RV outflow track
- sino-atrial-nodal artery may arise directly from left circumflex artery
- Acute marginal branches (A1 or AM1, 2, etc) which are supply the free wall of RV
- Sinotubular artery
- Inferior interventricular artery (posterior descending artery, **PDA**)
- Branch to atrioventricular node **(Ryan et al ,2011)**

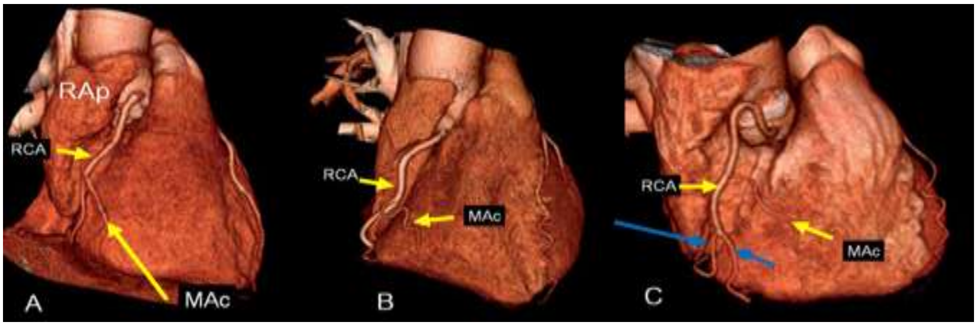

Fig. (2). Anatomy of the right coronary artery (RCA). A: Proximal and middle segments of the vessel coursing in close relationship with the right atrial appendage (RAp) and giving origin to the marginal acute branch (MAc); B: Example of a tortuous MAc; C: Early bifurcation of the RCA at its middle segment (blue arrows). ***(Quoted from Petracca, 2006).***

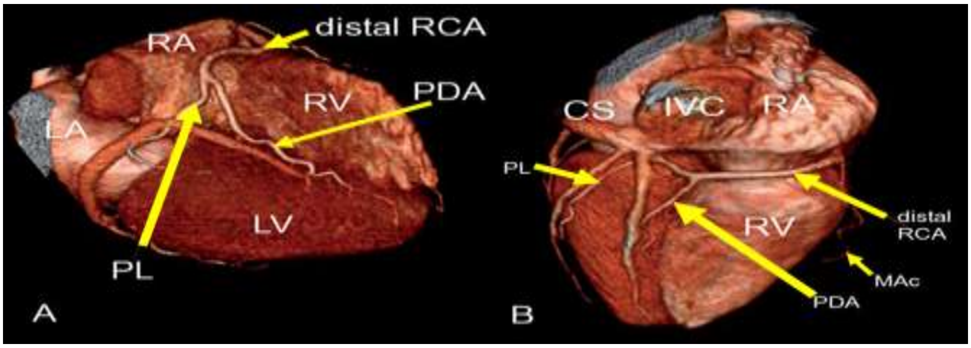

Fig. (3). Anatomy of the distal (RCA). A: Bifurcation of the vessel near the region of the crux cordis into a posterior descending artery (PDA) and a posterolateral (PL) branch; B: Example of a long PL branch reaching the left margin of the heart; a marginal acute (MAc) artery is also seen over the right margin; CS: coronary sinus; IVC: inferior vena cava; LA: left atrium; LV: left ventricle; RA: right atrium; RV: right ventricle**. *(Quoted from* Petracca*, 2006).***

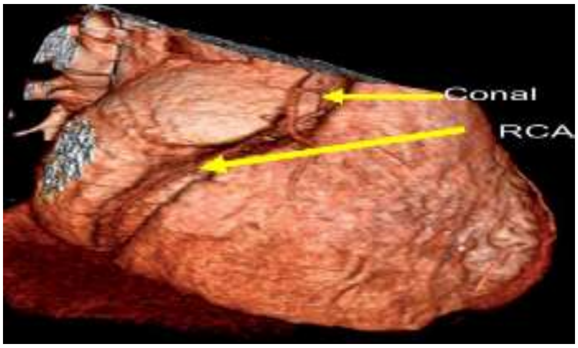

Fig (4). Right conal artery in a case with a relatively narrow right coronary artery (RCA). ***(Quoted from Petracca, 2006).***

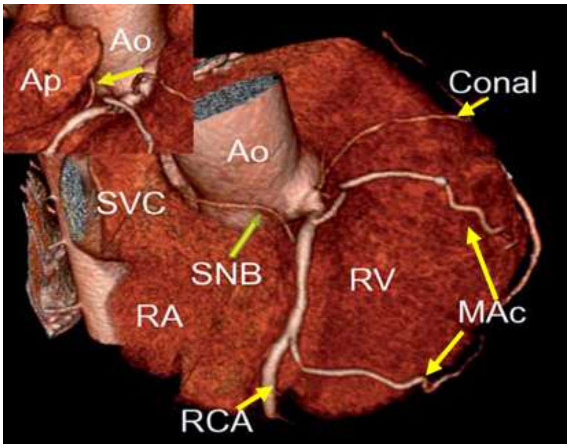

Fig.(5) Sinus node branch (SNB) coursing close to the right atrial appendage (Ap) (see inset, at top left)and ending near the region of drainage of the superior vena cava (SVC). Ao: aorta; MAc: marginal acute branch; RA; right atrium; RV: right ventricle. ***(Quoted from Petracca, 2006).***