Role of Multi Slice CT-Angiography In The Evaluation of Diseases of Coronary Arteries

Thesis

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List of Abbreviations

• **AHA**	American heart association.
• **AMI**	Acute myocardial infarction.
• **CABG**	Coronary artery bypass graft.
• **CAD**	Coronary artery disease.
• **CTA**	Computed tomographic angiography.
• **CXR**	Chest X ray.
• **EBCT**	Electron beam CT.
• **ECG**	Electrocardiography.
• **IHDs**	Ischemic heart diseases.
• **IMA**	Internal mammary artery.
• **IVUS**	Intravascular ultrasonography.
• **LAD**	Left anterior descending.
• **LCX**	Left circumflex artery.
• **LM**	Left main coronary artery.
• **MIP**	Maximum intensity projection.
• **MPR**	Multi planar reformat.
• **MSCT**	Multi Slice CT.
• **PDA**	Posterior descending artery.
• **RCA**	Right coronary artery.
• **ROI**	Region of interest.
• **SSD**	Surface shaded display.
• **VRT**	Volume rendering technique

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INTRODUCTION

Coronary and cerebrovascular diseases result in more death, disability, loss of income, and reduced quality of life than all other diseases combined. Coronary artery disease is No. 1 cause of mortality in the United States. In 1997 alone, cardiovascular diseases claimed nearly 1 million lives, with coronary artery diseases accounting for 50% of these deaths. More alarming is the fact that half of the approximately 1.5 million Americans suffering of acute myocardial infarctions annually have no prior history of heart diseases. **(Statler and Brazaitis, 2003)**

Also, in 1998, about 600,000 deaths caused by coronary artery diseases was reported in Europe. **(Kopp et al, 2001)**

The socioeconomic importance of heart diseases provides considerable motivation for development of radiological tools for non-invasive imaging of the coronary arteries. **(Schoepf et al, 2004)**

Cardiac imaging is becoming a practical application of computed tomography (CT) with the availability of up to 64 slice scanners. The role of imaging is progressing from simple determination of the presence of arterial calcifications on non-enhanced scans to demonstration of vascular stenosis on coronary CT angiograms , not only vulnerable plaques but also vulnerable patients . (**Pannu et al, 2003)**

With current technology, the accuracy of CT coronary angiography for detection of coronary artery stenosis appears promising enough to warrant pursuit of this application, but sensitivity is still not high enough for routine diagnostic needs. The high negative predictive value of a normal CT coronary angiogram, however, may be useful for reliable exclusion of coronary artery stenosis. **(Schoepf et al, 2004)**

The combination of the advantages of invasive coronary angiogram (e.g., high temporal and spatial resolution, blood flow information, assessment of functional parameters and collateral circulation) with the gross morphologic superiority of Multi-Slice CT can be of great benefit to the operative outcome. **(Herzog et al, 2003)**

The challenges of CT angiography of the coronary arteries have been partially met and will likely be overcome with continued evolution of the technology. (**Pannu et al, 2003)**

Aim of the work

To emphasize the role of multi-slice CT in evaluation of the diseases of the coronary arteries in comparison to the conventional coronary angiography

GROSS ANATOMY OF THE CORONARY ARTERY

The heart is a hollow muscular organ of a somewhat conical form; it lies between the lungs in the middle mediastinum and is enclosed in the pericardium. The heart is subdivided by septa into right and left halves, and a constriction subdivides each half of the organ into two cavities, the upper cavity being called the atrium, the lower the ventricle. The heart therefore consists of four chambers, right and left atria, and right and left ventricles.

The division of the heart into four cavities is indicated on its surface by grooves. The atria are separated from the ventricles by the coronary sulcus (*auriculoventricular groove*); this contains the trunks of the nutrient vessels of the heart, and is deficient in front, where it is crossed by the root of the pulmonary artery. The interatrial groove, separating the two atria, is scarcely marked on the posterior surface, while anteriorly it is hidden by the pulmonary artery and aorta. The ventricles are separated by two grooves, one of which, the anterior longitudinal sulcus, is situated on the sternocostal surface of the heart, close to its left margin, the other posterior longitudinal sulcus, on the diaphragmatic surface near the right margin **(William et al.,1995).**

The human heart normally has two coronary arteries named after the location of their main branches in the coronary sulcus. The right and left coronary arteries issue from ascending aorta from the anterior and left posterior sinuses respectively(figure 1). Variations are uncommon, but the two may start separately or in common from the sinus. Three or even four coronary arteries have been observed. Functionally; the coronaries are terminal arteries, which mean that their acute occlusion results in necrosis of their myocardial supply areas**, (Rodenwaldt J 2003)**

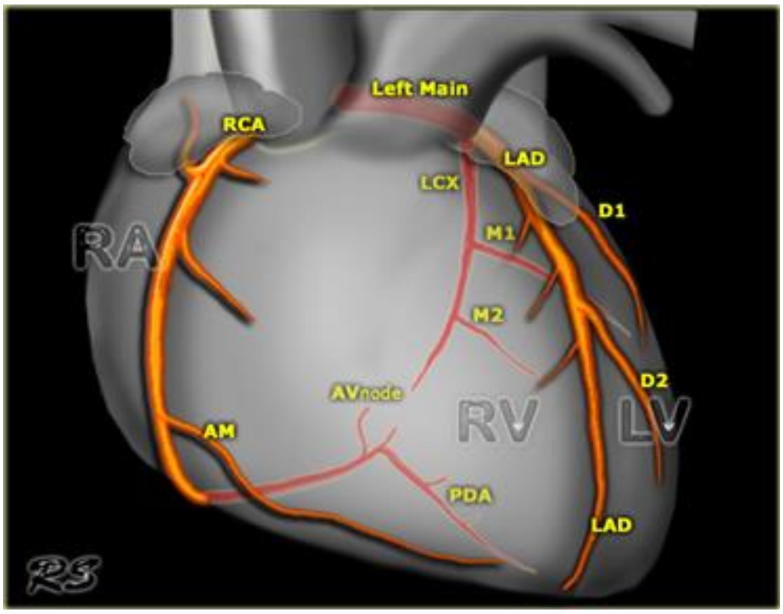

Fig. 1: Coronary arteries viewed on the sterno-costal surface

(Carl Jaffe and Patrick J. Lynch,2007)

Origin:

The aortic valve has three semi-lunar cusps anterior, right and left posterior cusps, above each cusp a localized dilatation or sinus these are known as the sinuses of Valsalva ***(Edward WD,1984).***

The RCA arises from the anterior sinus and this known as the Rt. coronary sinus.

The LCA arise from the Lt. Posterior sinus which also known as the Lt. coronary sinus (Fig. 2).

No artery arises from the Rt. Posterior sinus, which called as the non coronary sinus ***(Edward WD, 1984).***

Fig. 2: Aortic sinuses of Valsalva. The left aortic sinus gives rise to the left coronary artery. The right aortic sinus which lies anteriorly, gives rise to the right coronary artery. ***(Carl Jaffe and Patrick J. Lynch,2007)***

Right coronary artery:

RCA arises from anterior aortic sinus. It passes at first anteriorly and slightly to the right between the right atrium and the pulmonary trunk, where the sinus usually bulges. Reaching the atrio-ventricular (coronary) sulcus, it descends in this almost vertically to the right cardiac border, curving around it into the posterior part of the sulcus where it approaches its junction with both inter-atrial and inter-ventricular grooves, a region known as the crux of the heart. In 60% of subjects, the artery reaches the crux and ends a little left to it by variable anastomosis with the left circumflex artery. In a minority, the RCA ends near the right cardiac border (l0%) or between this and the crux (l0%); more often (20%) it reaches the left border replacing part of the left circumflex artery.

Branches of the RCA (fig. 3 &4) supply both the right atrium & ventricle and variably, parts of the left chambers as well as the right atrio-ventricular septum. The first branch (may arise separately from the anterior aortic sinus in 36% of cases) is the **right conus artery**, It supplies the atrio-ventricular "A-V" node in most cases.