Role of Multislice Computed Tomography in Diagnosis of Congenital Coronary Arteries Anomalies

Essay
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List of Abbreviation

٣D & ٤D	Three and four dimensional
ACCF	American College of cardiology Foundation
ALCAPA	Anomoalous Origin of Left Coronary Artery from Pulmonary Artery
AV	Atrio Ventricular
Bpm	Beat per minute
CAD	Coronary artery disease
CPR	Curved Planner Reformatting
CT	Computed tomography
CTA	Computed tomographic angiography
CTCA	Computed tomography Coronary Angiography
CXA	Circumflex artery
DSCT	Dual source computed tomography
EBCT	Electron beam computed tomography
ECG	Electrocardiogram
EBT	Electron Beam tomography
FOV	Field of view
HR	Heart rate
HU	Hounsfield units
LAD	Left anterior descending artery
LCA	Left coronary artery
LCX	Left circumflex artery
LMCA	Left main coronary artery
LMT	Left main (coronary) trunk
LV	Left Ventricle

List of Abbreviation (Cont.)

MDCT	Multi detector computed tomography
MIP	Maximum intensity projection
MPR	Multiplanner Reformatted
MRA	Magnetic resonance angiography
MRCA	Medialized right coronary artery
MRI	Magnetic resonance imaging
MSCT	Multi slice computed tomography
PA	Pulmonary artery
PDA	Posterior descending artery
PLA	Postero-lateral artery
RCA	Right coronary artery
RVOT	Right ventricular outflow tract
SNA	Sinus node artery
SSD	Shaded surface display
TEE	Trans esophageal echocardiography
VR	Volume rendered

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Ahmad Refaat

Introduction

Congenital coronary arterial anomalies (i.e., abnormal origination or course of a coronary artery) lead to clinically significant problems. Symptomatic manifestations may include ischemia or syncope. Clinical presentation of anomalous coronary arteries is hard to distinguish from other more common causes of cardiac disease; however, anomalous coronary artery is an important diagnosis to exclude, particularly in young patients who present with unexplained symptoms (e.g., syncope) ***(So Kim et al., 2006).***

Multi slice computed tomography provides advanced spatial and temporal resolution of the heart and allows imaging of the major vessels of the chest, including the coronary arteries. This new technology lacks evidence based indications, but indirect evidence, using diagnostic performance data, decision models, and an expert consensus approach validates the following current indications. Future revisions to these indications will occur as evidence based studies become available ***(Schoepf et al., 2007).***

Current computed tomographic (CT) techniques combine high speed and spatial resolution with sophisticated electrocardiography synchronization and robustness of use. Application of these modalities for evaluation of coronary artery disease is a topic of active current research ***(Schoepf et al., 2007).***

Imaging of the heart has always been technically challenging because of the heart's continuous motion. The development of electrocardiographically (ECG) synchronized Multislice CT scanning and reconstruction techniques have yielded fast volume coverage and high spatial and temporal resolution as prerequisites for successful cardiac imaging ***(Schoepf et al.,2007).***

However, only one-third of all conventional coronary angiographic examinations are performed in conjunction with an interventional procedure, while the rest are performed only for diagnostic purposes that is, only for verification of the presence and degree of CAD In the face of limited health care resources and in the interest of patients who undergo unnecessary invasive tests, a reliable noninvasive tool for imaging of the coronary arteries and for early diagnosis of CAD is highly desirable ***(So Kim et al., 2006)***.

Aim of The Work

This essay aims at describing the role of multislice computed tomography in diagnosis of congenital coronary arteries anomalies.

Gross Anatomy of The Coronary Arteries

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 the ascending aorta in its anterior and left posterior sinuses respectively . Functionally; the coronaries are terminal arteries, which mean that their acute occlusion results in necrosis of their myocardial supply areas ***(Rodenwaldt, 2003)***.

Left Coronary Artery:

The left coronary artery is larger in caliber, supplying a greater volume of the myocardium. The initial stem of the left main trunk (LMT) extending between its ostium in the left posterior aortic sinus and its bifurcation, varies in length from few millimeters to few centimeters. It lies between the pulmonary trunk and the left auricular appendage, reaching the left atrioventricular sulcus, where the LMT divides into two main arteries:

- The anterior inter-ventricular (descending) artery (LAD).
- The left circumflex artery (LCx) **(Fig.٢ and ٣)*(Gray, 2002)***

The Left Anterior Descending Artery :(Fig.١)

Also named as anterior inter-ventricular artery is considered as the direct continuation of the LMT. It descends obliquely forward and to the left in the anterior inter-ventricular sulcus. It reaches the apex, terminating there in one third of hearts, but more often turning around the apex into the posterior inter-ventricular sulcus, in which it traverses a third to half of its length to meet the terminal twigs of the posterior descending artery (PDA). The LAD supplies right and left anterior ventricular and anterior septal remi ***(Gray, 2002).***

The right ventricular rami are few and small as the right ventricle being supplied almost totally by the RCA. From two to nine large left anterior ventricular rami (diagonal arteries) arise at acute angles from the anterior inter-ventricular artery to cross diagonally the left ventricular anterior aspect.The large terminals may reach the left border of the heart; one is often large and may arise separately from the LMT which then ends by trifurcation. The anterior septal rami terminals may reach the left border of the heart. One is often large and may arise separately from the LMT which then ends by trifurcation. The anterior septal remi leave the LAD almost perpendicularly, passing down in the septum, of which they usually supply about the ventral two thirds ***(Gray, 2002).***

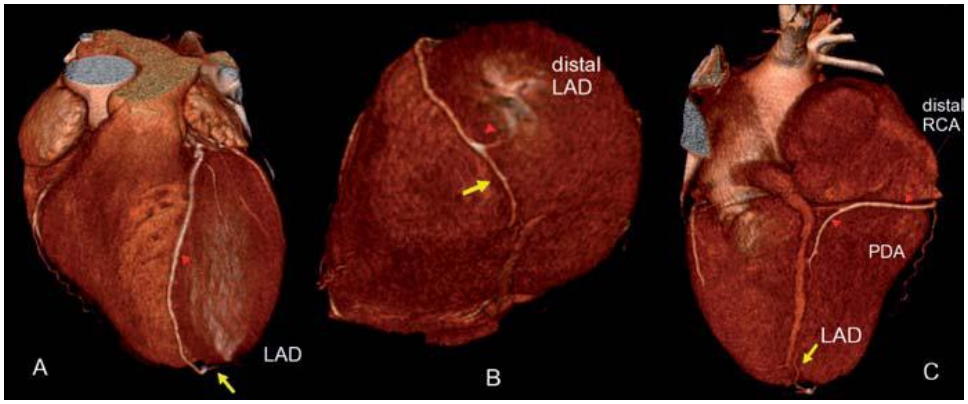

Fig. (١): Recurrent course of the distal segment of the left anterior descending (LAD) artery reaching the interventricular posterior groove. **A**: anterior view; **B**: apical view; C: posterior view. PDA: posterior descendingartery ***(Qouted from Guillem at al., 2006).***

The left Circumflex Artery (LCX):(Fig ٢ and ٣)

Is the second branch of the left coronary artery. It curves to the left in the atrio-ventricular sulcus, continuing around the left cardiac border into the posterior part of the sulcus. In about ٩٠٪ of cases, one or multiple large branches, known as the left (obtuse) marginal arteries, arise perpendicularly from the LCX to ramify over the lateral "obtuse" margin, supplying much of the adjacent wall of the left ventricle, usually down to

the apex. Smaller anterior and posterior rami of the circumflex artery also supply the left ventricle. Atrial rami from the circumflex artery supply the left atrium ***(Gray, 2002).***

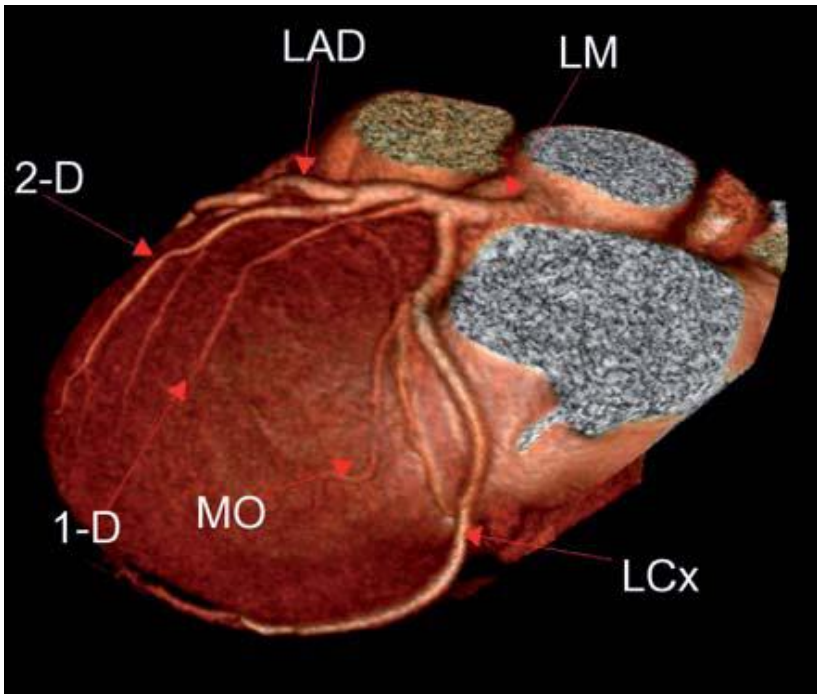

Fig. (٢): Left circumflex (LCx) artery ending at the (left) obtuse margin of the heart. LAD: left anteriordescending; LM: left main; MO: marginal obtuse; ١D and ٢D: first and second diagonal branches ***(Qouted from Guillem et al.,2006).***