Role of Multidetector Computed Tomography for Non Invasive Evaluation of Ischemic Heart Disease

Essay

Submitted for Partial Fulfillment of the Requirements for Master Degree in **Diagnostic Radiology**

By

Samia Aboelnour Abdeltwab Abdellateef

M.B., B.Ch Ain Shams University

Supervised by

Prof. Dr: Dalia Zaki Zidan

Assistant professor of Diagnostic Radiology

Faculty of Medicine-Ain Shams University

Prof. Dr: Ahmed Fathi Abd Elghany

Assistant Lecturer of Diagnostic Radiology

Faculty of medicine-Ain Shams University

Faculty of Medicine

Ain Shams University

2012

بسم الله الرحمن الرحيم

سنريهم آياتنا في الآفاق و في أنفسهم حتي يتبين لهم أنه الحق

صدق الله العظيم

سورة فصلت .. آيه ٥٣

Acknowledgement

First of all thanks to Allah to whom I relate any success in achieving any work in my life.

I would like to express my sincere gratitude to Doctor/Dalia Zaki Zidan, Assistant Professor of Radiodiagnosis, Faculty of Medicine, Ain Shams University, for her kind supervision, valuable advice and unlimited help in providing all the facilities for this work.

I would like to express my great appreciation to Doctor/ Ahmed Fathi Abd El Ghany, Assistant Professor of Radiodiagnosis, Faculty of Medicine, Ain Shams University, for his kind supervision, continuous support and encouragement throughout this work.

Last but not least, I want to thank my family for their endless help.

Samia Abo El Nour

List of contents

List of abbreviations

3D	Three dimentional
ACS	Acute coronary syndrome
AVnode	Atrioventricular node.
BMI	Body mass index
BP	Betablockers
bpm	Beat per minute
CABG	Coronary artery bypass grafting
CAC	Coronary artery Calcium
CAD	Coronary artery disease
CCS	Chronic coronary syndrome
CCTA	Coronary CT angiography
COPD	Chronic obstructive pulmonary disease
CS	Coronary sinus
CTA	Computed tomographic angiography
CTCA	Computed tomographic coronary angiography
CTDE	Delayed-enhancement computed tomography
CTFP	first-pass perfusion computed tomography
EBCT	Electron beam computed tomography
ECG	Electrocardiographically
ED	Effective radiation dose
EF	Ejection fraction
FBP	Filtered back-projection algorithm
FOV	Field of view
GSV	Great saphenous vein
HR	Heart rate
HU	Hounsfield unit
IHD	Ischemic heart disease
IM	Inter muscular
IMA	Internal mammary arteries
IV	Interavenous
IV	Interventricular.
IVC	Inferior vena cava.
IVUS	Intravascular ultrasound
KV	Kilo volt

kVp	Kilovolts peak
LA	Left atrium
LAD	Left anterior descending artery
LCA	Left coronary artery
LCX	Left circumflex artery
LDL	Low-density lipoprotein
LIMA	Left internal mammary artery
LM	Left main
LV	Left ventricle
mAs	Milliampere
MDCT	Multi detector computed tomography
MI	Myocardial infarction
MIP	Maximum intensity porojection
MPR	Multi planar reformat
MSCT	Multislice computed tomography
mSv	Milliseiver (unit for radiation measurement)
MV	Mitral valve
NYHA	New york heart association
PACS	Picture archiving and communication system
PET	Positron emission tomography
PVs	Pulmonary veins
RA	Right atrium
RCA	Right coronary artery
RV	Right ventricle
SA node	Sinoatrial node
SBP	Systolic blood pressure
SMC	Smooth muscle cell
SNR	Signal to noise ratio
SPECT	Single photon emission computed tomography
SVC	Superior vena cava
TRO CT	Triple-rule-out computed tomography
VR	Volume averaging
VRT	Volume-rendering technique

List of figures

١

List of figures (cont.)

List of figures (cont.)

List of tables

INTRODUCTION

Although coronary angiography has become a safe procedure with only a small risk coronary arteries associated, the inconvenience for the patient and the economic burden have both fueled the quest to find an alternative, noninvasive method to visualize and assess coronary arteries(***Ohnesorge et al.,2000***).

Since 1999, mechanical multidetector computed tomography (MDCT) systems with simultaneous acquisition of four slices and half-second scanner rotation have become available. Multi-row acquisition with these scanners allows for considerably improved visualization of the coronary arteries ***(Ohnesorge et al., 1999).***

Two types of CT scanners are available for imaging the heart. The first is electron beam CT (EBCT), which is an older technology infrequently used today. The second is multidetector helical CT (MDCT), which represents most CT use. Electron beam CT does not use a mechanical rotating gantry. Instead, an electron gun generates electrons, which are then electromagnetically steered across a stationary tungsten anode ***(Gerber et al., 2002).***

Much like contrast magnetic resonance (CMR), CT can also be used for assessing the extent of scar and tissue viability. Although the notion of using contrast-enhanced CT to assess viability is not new, recent advances in its temporal and spatial resolution with multidetector CT technology have renewed the clinical interest for this application ***(*Gerber *et al., 2006).***

The 320-Multidetector CT has craniocaudal coverage of 16cm in a single gantry rotation, which allows coronary imaging in a single heartbeat in a majority of patients. This eliminates potential artifacts at the transitions zone between gantry rotations, which are still seen with current state of the art 64-slice systems. Coupled with prospective image acquisition, the radiation exposure appears to compare favorably to current CT systems ***(Husmann et al., 2008).***

Aim of the work

To highlight the role of Multi detector CT in the evaluation of ischemic heart disease and its importance of being non invasive diagnostic technique.

Anatomy of the heart

The heart has a pyramidal shape and lies in the anterior mediastinum immediately posterior to the central portion of the diaphragm (Fig. 1-1) ***(Sutton et al., 2003).***

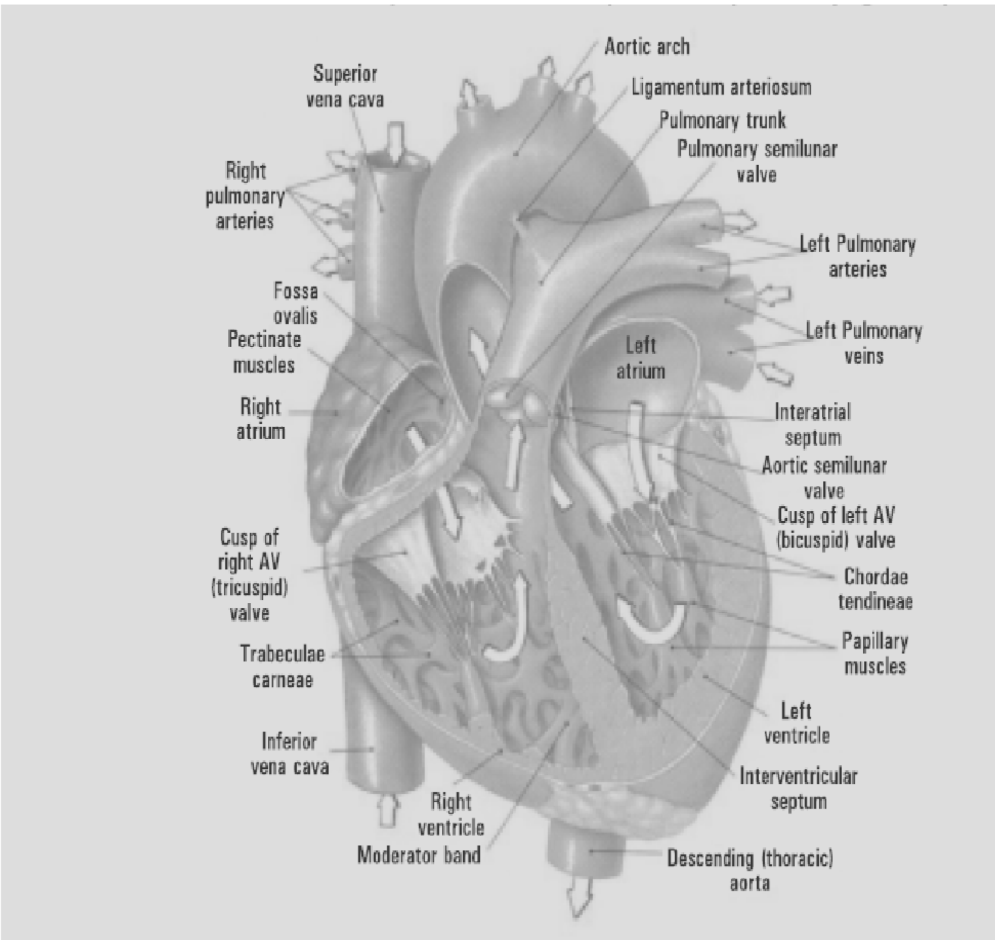

Fig. (1-1): Anatomy of heart ***(Urmil ,2010).***

The pericardium

The pericardium is normally thin paper, measuring 2 mm or less. It is composed of two layers, the parietal layer and the serous layer. The tough outer parietal layer envelops the heart and attaches to the sternum and proximal great vessels; in fact, most of the ascending aorta and main pulmonary artery, portions of the venae cavae, and most of the pulmonary veins are intrapericardial . The inner, more delicate serous layer, lines both the fibrous pericardium and the outer surface of the heart and great vessels (Fig 1-2) ***(Malouf et al., 2005).***

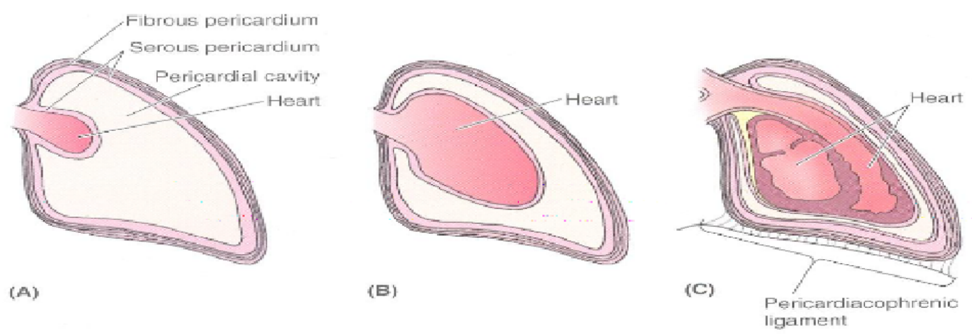

Fig. (1-2)

(A) The heart occupies the middle mediastinum and is enclosed by the pericardium, composed of two parts. The tough,outer fibrous pericardium. Within it is a double-layered sac, the serous pericardium.

(B) The developing heart invaginate the serous sac and obliterate the pericardial cavity.

(C) Leaving only a potential space ***(Moore and Dalley, 1999).***