Evaluation of Coronary Artery Disease Among Population With Fatty Liver Disease Using Multi-slice Computed Tomography

Thesis

Submitted for Partial Fulfillment of the Master Degree
in Radio-diagnosis

By

Sarmad Fatah Aziz

M.B.CH.B

Under Supervision of

Prof. Dr. Wahid Hussein Tantawy

Professor of Radio-diagnosis
Faculty of Medicine, Ain Shams University

Dr. Khaled Ahmad Mohamad Ali

Lecturer of Radio-diagnosis
Faculty of Medicine, Ain Shams University

Faculty of Medicine

Ain Shams University

2018

بسم الله الرحمن الرحيم

قالوا

سبحانك لا علم لنا إلا ما علمتنا إنك أنت العليم الحكيم

صدق الله العظيم

سورة البقرة الآية: ٣٢

Acknowledgments

First and foremost, I feel always indebted to **Allah,** *the Most Beneficent and Merciful who gave me the strength to accomplish this work,*

I wish to express my deepest gratitude and thanks to **Prof. Dr. Wahid Hussein Tantawy** *Professor of Radio-diagnosis, Faculty of Medicine – Ain Shams University, for his unlimited help and giving me the privilege to work under his supervision.*

Words fail to express my appreciation to **Dr.Khaled Ahmad Mohamad Ali,** *Lecturer in Radio-diagnosis, Faculty of Medicine – Ain Shams University, for the time and efforts he has devoted to accomplish this work.*

To my great lovely family, thank you for your support and patience.

Sarmad Fatah Aziz

List of Contents

Subject *Page No.*

List of Abbreviations

Abbr.	Full-term
AHA	**:** American Heart Association
ATP	**:** Adenosine tri phosphate
AV groove	**:** Atrioventricular groove
AVN	**:** Atrioventricular node
CAD	**:** Coronary artery disease
CHD	**:** Coronary artery disease
CRP	**:** C-reactive protein
CT	**:** Computed tomography
CTA	**:** CT angiography
CVD	**:** coronary vascular disease
EBCT	**:** Electron beam CT
ECG	**:** Electrocardiogram
FFA	**:** Free fatty acids
FGF	**:** Fibroblast growth factor
FL	**:** Fatty Liver
FLD	**:** Fatty liver disease
HDL	**:** High density lipoprotein
HUs	**:** Hounsfield units
IGF-1	**:** Insulin-like growth factors IGF-1 and IGFBP-3
IHD	**:** Ischemic heart disease
IL-1	**:** Interleukin 1
IMB	**:** Inferior marginal branch
KVp	: Kilovoltage peak
LA	**:** Left atrium
LAD	**:** Left anterior descending
LCA	**:** Left coronary artery

LCx **:** Left circumflex artery
LDL-C **:** Low density lipoprotein cholesterol
LDLs **:** Low-density lipoproteins
LM **:** Left main coronary artery
LV **:** Left ventricle
LVH **:** Left ventricular hypertrophy
mAs **:** Milliampire second
MDCT : Multidetector computed tomography
MI **:** Myocardial infarction
MIP **:** Maximum intensity projection
MPR **:** Multi-planar reformation
MRI **:** Magnetic resonance image
MS **:** Metabolic syndrome
MSCT **:** Multislice computed tomography
NASH **:** Non-alcoholic steatohepatitis
NHLBI **:** National Heart, Lung, and Blood Institute
OM **:** Obtuse marginal
PDA **:** Posterior descending artery
PDGF **:** Platelet-derived growth factor
PLB **:** Posterior lateral branch
RA **:** Right atrium
RCA **:** Right coronary artery
ROI **:** Region of interest
RV **:** Right Ventricle
RVOT **:** Right ventricular outflow tract
TNF **:** Tumor necrosis factor
US **:** Ultrasound
VRT **:** Volume rendering technique

List of Tables

List of Figures

Figure No.	Title	Page No.

List of Cases

Introduction

Coronary artery disease (CAD) is a complex chronic inflammatory disease, characterized by remodeling and narrowing of the coronary arteries supplying oxygen to the heart. It can have various clinical manifestations, including stable angina, acute coronary syndrome, and sudden cardiac death. It has a complex etiopathogenesis and a multifactorial origin related to environmental factors, such as diet, smoking, and physical activity, and genetic factors II that modulate risk of the disease both individually and through interaction ***(Sayols-Baixeras et al., 2014).***

Fatty liver disease (FLD) is increasingly recognized as the most common liver disorder in Western countries. It is the most common cause of liver enzyme abnormalities in clinical practice, with a prevalence of 15%–20% in the general population and increases steadily to 70%–90% in obese or type 2 diabetic patients ***(Assy et al., 2000).***

Risk factors for atherosclerosis, such as obesity, diabetes & dyslipidemia, are frequently associated with FLD ***(Akahoshi et al., 2001).***

Fatty liver is blamed to play a role in development of atherosclerosis. However, few clinical studies have examined the association between fatty liver disease and subclinical coronary atherosclerosis in patients with low to intermediate cardiovascular risk factors ***(Hamaguchi et al., 2007).***

Moreover, FLD has been included among the components of metabolic syndrome, a clinical condition with a high risk of coronary artery disease (CAD) ***(Malik et al., 2004).***

Recognition of a role for FLD in development of CAD will allow more individuals from the general population with subclinical CAD to be detected at earlier stages when fatty liver is identified. Presence of fatty liver may help in cardiovascular risk stratification and assessment ***(Assy et al., 2010).***

The standard of reference for diagnosis of CAD is still the conventional coronary angiography, however, it is an invasive technique associated with non negligible complication. Moreover, this procedure offers little information on coronary artery wall changes associated with the early stage of coronary artery disease ***(Lefebvre et al., 2007).***

Computed tomography (CT) has evolved continuously since its introduction to medical imaging in the early 1970s. Over the years, all major aspects (e.g., spatial resolution and acquisition speed) have improved, through changes in both hardware and software. A recent stage in the development of

CT is the introduction of multislice computed tomography (MSCT) ***(Flohr et al., 2005).***

Multislice CT coronary angiography has been proposed as a noninvasive modality to help detect coronary plaques and classify coronary artery disease (CAD) ***(Akabame et al., 2008).*** It has been used successfully to quantify coronary artery calcium, which helps to predict the presence of coronary artery disease ***(Shavelle et al., 2000).***

Current results, using the 64- channels scanners show that MSCT angiography is a good non-invasive coronary imaging modality that is able to evaluate the coronary anatomy and early detect and grade coronary lesions competing with other non invasive examinations used to detect CAD ***(Pugliese et al., 2006).***

Coronary CT angiography (CTA) can evaluate both calcified plaque and non calcified plaque. Coronary CTA is able to show the lumen of the coronary arteries as well as the vessel wall, analogous to intravascular sonography ***(Leber et al., 2005).***

Multiple studies have shown coronary CTA to have a high negative predictive value for the detection of coronary atherosclerosis: greater than 95% for significant stenosis and approximately 90% for any plaque ***(Kelly et al., 2008).***

Aim of the Work

The aim of this study is to evaluate the presence & the severity of coronary artery disease among FLD population & to evaluate the association of FLD and CAD using MSCT and the possibility of considering FLD as a predictor for CAD.

Anatomy of the Coronary Vessels

Gross anatomy of coronary arteries

The two coronary arteries arise from the aortic sinuses, which are three small dilatations lie opposite the cusps of the aortic valve, in the initial portion of the ascending aorta & supply the muscle & other tissues of the heart. They encircle the heart in the coronary sulcus & send marginal & interventricular branches in the interventricular sulci, which ultimately converge toward the apex of the heart ***(Drake et al., 2009).***

Coronary arteries & their major branches are distributed over the surface of the heart lying within subepicardial connective tissue. The right coronary artery (RCA) arises from the right aortic sinus of the ascending aorta, while the left main coronary artery (LMCA) arises from the left aortic sinus of the ascending aorta ***(Snell, 2004).***

➢ Left coronary artery (LCA):

The left main (LM) coronary artery courses for a variable distance from the left coronary sinus before giving rise to the left anterior descending (LAD) and circumflex (LCX) arteries (Figure 1). The length of the LM artery has been reported to vary from 5 to 20 mm. In approximately 15% of cases, a third vessel, the ramus intermedius (RI) artery (Figure 1B), arises from the LM artery between the