



Role of MDCT Angiography in Diagnosis of Lower Limb Peripheral Arteries Diseases

Thesis

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

By

Ali Basyoni Amin Abdel Keream

M.B.B.Ch.,

Faculty of Medicine-Ain Shams University (2013)

Supervised by

Prof. Mohamed Shaker Ghazy

Professor of Radiodiagnosis

Faculty of Medicine – Ain Shams University

Dr. Haytham Mohamed Nasser

Lecturer of Radiodiagnosis

Faculty of Medicine – Ain Shams University

Faculty of Medicine

Ain Shams University

2018

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قَالَ

لَسْبَدَانِكَ لَا عِلْمَ لَنَا
إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ
الْعَلِيمُ الْعَظِيمُ

صدق الله العظيم

سورة البقرة الآية: ٣٢

Acknowledgment

*First and foremost, I feel always indebted to **ALLAH**, the Most Kind and Most Merciful.*

*I'd like to express my respectful thanks and profound gratitude to **Prof. Mohamed Shaker Ghazy**, Professor of Radiodiagnosis Faculty of Medicine – Ain Shams University for his keen guidance, kind supervision, valuable advice and continuous encouragement, which made possible the completion of this work.*

*I am also delighted to express my deepest gratitude and thanks to **Dr. Haytham Mohamed Nasser**, Lecturer of Radiodiagnosis Faculty of Medicine – Ain Shams University, for his kind care, continuous supervision, valuable instructions, constant help and great assistance throughout this work.*

Ali Basyoni Amin Abdel Keream





This work is dedicated to . . .

My beloved Father, to whom I owe everything I ever did in my life and will achieve.

My Mother for always being there for me through out my personnel and professional life and all the nights she stayed with me.

My Brothers and *My Sister* for their support



List of Contents

Title	Page No.
List of Tables	6
List of Figures	8
List of Abbreviations	11
Introduction	1
Aim of the Work.....	14
Review of Literature	
▪ Anatomy	15
▪ Pathology.....	31
▪ Principles of Multislice.....	48
Patients and Methods	63
Results	76
Illustrative Cases	90
Discussion	100
Conclusion.....	105
References	106
Arabic Summary	—

List of Tables

Table No.	Title	Page No.
Table (1):	The branches of the abdominal aorta may be divided in to three sets: visceral, parietal, and terminal.	17
Table (2):	Identifying lesion location by symptoms in PAD	37
Table (3):	Available section width combinations for different multiple-Row detector CT configurations.	57
Table (4):	Sex-point system of the degree of occlusion.....	72
Table (5):	Demographic characteristics of the study population.....	76
Table (6):	Diagnostic accuracy of CTA for detection of aortoiliac disease.....	77
Table (7):	Diagnostic accuracy of CTA for detection of femoral artery disease.	78
Table (8):	Diagnostic accuracy of CTA for detection of popliteal artery disease.	79
Table (9):	Diagnostic accuracy of CTA for detection of peroneal artery disease.	80
Table (10):	Diagnostic accuracy of CTA for detection of PTA disease.....	81
Table (11):	Diagnostic accuracy of CTA for detection of ATA disease.....	82
Table (12):	Intermethod agreement between CTA and DSA for grading of aortoiliac disease.	84
Table (13):	Intermethod agreement between CTA and DSA for grading of femoral artery disease.....	84
Table (14):	Intermethod agreement between CTA and DSA for grading of popliteal artery disease.....	85
Table (15):	Intermethod agreement between CTA and DSA for grading of peroneal artery disease.....	86

List of Tables Cont...

Table No.	Title	Page No.
Table (16):	Intermethod agreement between CTA and DSA for grading of PTA disease.	87
Table (17):	Intermethod agreement between CTA and DSA for grading of ATA disease.	88

List of Figures

Fig. No.	Title	Page No.
Figure (1):	Anatomy of abdominal aorta.....	16
Figure (2):	Illustrative Diaphragm of Abdominal Aorta Branches	18
Figure (3):	CTA with 3D Reconstruction, DSA of Abdominal Aorta.....	19
Figure (4):	Common iliac, external iliac, internal iliac and common femoral arteries	21
Figure (5):	The femoral artery.....	23
Figure (6):	The popliteal artery.....	26
Figure (7):	The anterior and posterior tibial artery	28
Figure (8):	Radiological anatomy of the common iliac, external iliac and lower limb arteries.....	30
Figure (9):	In atherosclerosis, arteries are clogged by an accumulation of plaques -which are made up of cholesterol particles, fat, calcium, cellular waste and other substances.	34
Figure (10):	Types of aneurysms.....	42
Figure (11):	CT Generations.	48
Figure (12):	Different generation CT scanners.....	49
Figure (13):	Technique of spiral CT	50
Figure (14):	Single-slice versus multi-slice CT	52
Figure (15):	Detector array design of MSCT scanners.....	54
Figure (16):	Slice definition is achieved by electronically combining adjacent detector rows and employing appropriate pre- and post patient collimation.....	55
Figure (17):	Slice selections on a 16-channel scanner.....	58
Figure (18):	To scan the same volume in the same time with single-section helical CT	62
Figure (19):	Diagnostic accuracy of CTA for different arteries.	83

List of Figures Cont...

Fig. No.	Title	Page No.
Figure (20):	Agreement between CTA and DSA for grading the severity of PAD in different arteries.	89
Figure (21):	Bilateral lower limb CT angiography revealed. Moderate stenosis of the right superficial femoral artery (SFA) (white arrow).	90
Figure (22):	a) Right iliac angiography revealed, superficial femoral artery (white arrow), profunda femoris artery (Red arrow), b) DSA showing moderate stenosis of the Rt. SFA (arrow blue).	91
Figure (23):	Lower limb CT angiography revealed. Mild right PTA stenosis (Red arrow) & attenuated right ATA (white arrow).	92
Figure (24):	a) Below knee DSA showing right PTA stenosis (blue arrow), b) Below knee DSA showing attenuated middle third of right ATA (white arrow).	93
Figure (25):	Lower limb CT angiography revealed marked attenuated stenotic segments of left ATA (red arrow).	94
Figure (26):	Left below knee DSA showing attenuated ATA just after its origin (red arrow).	95
Figure (27):	Lower limb CT angiography revealed moderate stenosis of left upper third of SFA (white arrow).	96
Figure (28):	a) Iliac angiography showing the superficial femoral artery (red arrow) and profunda femoris artery (white arrow). b) The DSA revealed marked stenotic left SFA segments (blue arrows)	97

List of Figures Cont...

Fig. No.	Title	Page No.
Figure (29):	CT angiography revealed the right tibio-perneal trunk is occluded just after its origin.....	98
Figure (30):	Below knee left lower limb DSA revealed the tibio-perneal trunk is occluded just after its origin with good collaterals (red arrow).	99

List of Abbreviations

<i>Abb.</i>	<i>Full term</i>
<i>ATA.....</i>	<i>Anterior tibial artery</i>
<i>AVF.....</i>	<i>Arterio-venous fistula</i>
<i>DSA.....</i>	<i>Digital subtraction angiography</i>
<i>MDCT.....</i>	<i>Multi-detector row CT</i>
<i>MR.....</i>	<i>Magnetic resonance</i>
<i>MRI.....</i>	<i>Magnetic resonance imaging</i>
<i>PAA.....</i>	<i>Popliteal artery aneurysm</i>
<i>PAD.....</i>	<i>Peripheral arterial disease</i>
<i>PTA.....</i>	<i>Posterior tibial artery</i>
<i>SFA.....</i>	<i>Superficial femoral artery</i>
<i>TAO.....</i>	<i>Thromboangiitis obliterans</i>

INTRODUCTION

Peripheral arterial disease (PAD) reflect systemic atherosclerosis and is associated with long term disability and increased cardiovascular complications.

Lower limb peripheral artery disease is the third leading cause of atherosclerotic cardiovascular morbidity after coronary heart disease and stroke, it is estimated to affect 200 million people globally (*Rudan et al., 2013*).

Reduction of blood supply to a lower limb initially presents as intermittent claudication, while further restriction of flow leads to ischemic pain at rest, if not treated ulceration and gangrene may occur and can result in loss of a limb. Accurate characterization of number, level and severity of lesions is necessary to plan treatment (*Koshy et al., 2009*).

The diagnosis and management of PAD is based on careful history, physical examination and a variety of diagnostic tools.

Conventional angiography is the gold standard for imaging of lower extremity occlusive disease. However, this method is invasive and expensive and has a definite, although low, morbidity (*Soto et al., 2001*).

Compared with conventional angiography, CT angiography is less costly and faster, does not require assembly

of an angiographic team to perform the study, permits a wider variety of manipulations of the volumetric data set for image display and analysis in contrast to the limited projections routinely obtained during conventional angiography, and has fewer potential complications (*Rubin et al., 2000*).

AIM OF THE WORK

Our objective in this study is to discuss the peripheral arterial diseases (PAD) and to evaluate accuracy of MDCT angiography in diagnosis of the (PAD) compared to the Digital subtraction angiography (DSA) as pre-operative evaluation of lower limb peripheral arterial diseases.

Chapter 1

ANATOMY

Arterial flow to the lower limbs comes from the abdominal aorta, which gives the iliac systems. The anatomy will be discussed due to their great importance in the examination of lower limb arterial system.

The abdominal aorta:

The abdominal aorta (**Fig. 1**) begins at the aortic hiatus of the diaphragm in front of the lower border of the body of the last thoracic vertebra, it descends in front of the vertebral column. It ends on the body of the fourth lumbar vertebra, commonly a little to the left of the midline by dividing into the two common iliac arteries. It diminishes rapidly in size, in consequence of the many branches which it gives of (*Standring et al., 2005*).