NON-INVASIVE ASSESSMENT OF RENAL ARTERY STENOSIS

Essay

Submitted for Fulfillment of Master Degree in Radiodiagnosis

By

Rasha Anwar Abd Al-Wahhab

M.B.B.CH

Cairo University

Supervised By

Dr./ Ihab Ismail Ali Bakr

Professor of Radiodiagnosis

Faculty of Medicine

Cairo University

Dr./ Abo El-Magd Mohamed Elbohy

Lecturer of Radiodiagnosis

Faculty of Medicine

Cairo University

Faculty of Medicine

Cairo University

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Dedication

To my parents, my brothers, my sister, and my friends, with love, for their love.
To my father, for your never-ending support.

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ABSTRACT

Renal artery stenosis (RAS) is a well-recognized cause of hypertension and an important cause of progressive renal insufficiency. In renal transplant patients, RAS is also a cause of refractory hypertension and allograft dysfunction. Accurate detection and treatment of clinically relevant stenosis may cure or improve hypertension and preserve renal function. Current treatment options include medical therapy, percutaneous renal artery angioplasty with or without stent placement, or surgical revascularization.

In cases of RAS, the cause in the vast majority of patients is either atherosclerosis or fibromuscular dysplasia (FMD). Atherosclerosis accounts for 70% to 90% of cases of RAS and usually involves the ostium and proximal third of the main renal artery. FMD is a collection of vascular diseases that affects the intima, media and adventitia and is responsible for 10% to 30% of cases of RAS.

Key Words : RAS - FMD - RVHT - IA-DSA

List of Abbreviations

- 3D: **T**hree **D**imensional
- ACE: **A**ngiotensin **C**onverting **E**nzyme
- AI: **A**cceleration **I**ndex
- ASL: **A**rterial **S**pin **L**abeling
- AT: **A**cceleration **T**ime
- CE-MRA: **C**ontrast **E**nhanced **M**agnetic **R**esonance **A**ngiography
- CPR: **C**urved **P**lanar **R**eformation
- CT: **C**omputed **T**omography
- CTA: **C**omputed **T**omographic **A**ngiography
- DCE: **D**ynamic **C**ontrast **E**nhanced
- dRI: **d**ifference in **R**esistive **I**ndex
- ESP: **E**arly **S**ystolic **P**eak
- FMD: **F**ibro**M**uscular **D**ysplasia
- Gd-BCA: **G**adolinium- **B**ased **C**ontrast **A**gent
- GRE: **G**radient **E**cho sequences
- IA-DSA: **I**ntra **A**rterial **D**igital **S**ubtraction **A**ngiography
- IVC: **I**nferior **V**ena **C**ava
- MDCT: **M**ulti**D**etector **C**omputed **T**omography
- MIP: **M**aximum **I**ntensity **P**rojection
- MPR: **M**ulti**P**lanar **R**eformation
- MRA: **M**agnetic **R**esonance **A**ngiography
- MRI: **M**agnetic **R**esonance **I**maging
- NSF: **N**ephrogenic **S**ystemic **F**ibrosis
- PC: **P**hase-**C**ontrast
- PRF: **P**ulse **R**epetition **F**requency
- PSV: **P**eak **S**ystolic **V**elocity
- RAR: **R**enal artery/**A**ortic velocity **R**atio
- RAS: **R**enal **A**rtery **S**tenosis
- RI: **R**esistance **I**ndex
- RVHT: **R**eno**V**ascular **H**yper**T**ension

- SLIP: **S**patial **S**pin **L**abeling **P**ulse
- SSD: **S**haded **S**urface **D**isplay
- SSFP: **S**teady **S**tate **F**ree **P**recession
- TOF: **T**ime **O**f **F**light
- TR: **R**epetition **T**ime
- TRAS: **T**ransplant **R**enal **A**rtery **S**tenosis
- US: **U**ltra**S**oun
- VR: **V**olume **R**endering

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INTRODUCTION & AIM OF WORK

INTRODUCTION

Renal artery stenosis (RAS) is one of the main causes of secondary systemic arterial hypertension while in the vast majority of patients the cause is either atherosclerosis or fibromuscular dysplasia, RAS is a potentially curable cause of secondary hypertension **(*Leiner & Michaely, 2008*)**.

Imaging techniques have an important role in the early discovery of RAS. Although renal angiography is the gold standard for the diagnosis of RAS, it is invasive and causes the potential risk of haematoma, pseudoaneurysm, contrast agent induced nephropathy and atheromatous embolization **(*Zeller et al., 2008*)**.

Owing to the recent technologic improvements, there is an increasing interest in the use of non-invasive and less invasive imaging procedures such as color duplex ultrasonography, computed tomography angiography (CTA) and magnetic resonance angiography (MRA) for the diagnosis of renovascular hypertension **(*Broekhuizen et al., 2001*)**.

Color duplex ultrasonography is a non-invasive frequently repeatable bed-side examination and is currently a reliable method to differentiate between a hemodynamically significant and insignificant stenoses using peak systolic velocities, renal artery velocity/aorta velocity ratio (RAR), side-to-side difference of intra-renal resistivity index(RI) and acceleration times **(*Zeller et al., 2008*)**.

Multidetector CTA has become a principal imaging modality that is commonly used for assessment of renal vasculature and has challenged the role of conventional angiography. It is an excellent imaging technique; being fast and non-invasive tool that provides highly accurate detailed evaluation of renal arteries **(*Türkvatan et al., 2009*)**.

Gadolinium-enhanced MRA is a sensitive non-invasive modality used in the assessment of clinically significant renal artery stenosis **(*Law et al., 2008*)**. Recent technical developments in MRA enable the acquisition of isotropic submillimeter spatial resolution data sets, facilitating the detection of renal artery narrowing with high accuracy and demonstrating the functional consequences of RAS, such as a decline in renal perfusion and glomerular filtration **(*Leiner & Michaely, 2008*)**.

AIM OF THE WORK

The aim of the work is to determine and compare the role of color duplex ultrasonography, CTA and MRA as non-invasive imaging techniques in evaluating the possibility of renovascular hypertension and to assess their accuracy in depicting stenosis.

Key words: (RAS, Color duplex ultrasonography, CTA and MRA).

REVIEW OF LITERATURE

GROSS ANATOMY