Role of MRI and Ultrasound in diagnosis of stress incontinence in females with pelvic floor dysfunction

Thesis *Submitted for partial fulfilment of M.SC. Degree in radiodiagnosis*

By

Soha Sami Mohammed , MBBCH

Faculty of medicine,Cairo university

Supervised by

Professor .DR. Eman Abbas Hosny

Professor of radiology

Faculty of medicine, Cairo university

Professor *DR. Ahmed zakria*

Professor of Gynecology and Obstetrics

Faculty of medicine,Cairo University

DR. Mona EL- Kalioubie

Lecturer of radiology

Faculty of medicine,Cairo University

Faculty of medicine,Cairo university

2015

Acknowledgments

First of all I would like to thank **God** for all the great things I have in my life and for the ability to finish this work.

I am deeply grateful to **Prof. Dr. EMAN ABBAS , Professor of Radio-diagnosis, Cairo University** for her encouragement and valuable guidance in making this study possible.

I am really grateful to **Dr. Mona EL kalioubie, lecturer of Radio-diagnosis, Cairo University** for her sincere guidance, continuous encouragement, and valuable advice. I owe her a lot, and without her I could not be able to achieve this work.

I extend my thanks to **Dr. Soha Talaat , Professor of Radio-diagnosis, Cairo University** who helped me a lot throughout this work and gave me great clues and guidance.

I would also like to convey my thanks to **Dr. Ahmed Zakaria , Lecturer of Gynecology and Obstetrics, Cairo University** for his help

Finally, I would like to express my deep appreciation to my family for their continuous and unlimited support and encouragement.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Diagrams

LIST OF ABBREVIATIONS

2D : two-dimensional.

3D : three-dimensional.

4D : four-dimensional.

AC: anal canal.

ARJ: anorectal junction .

ARA : ano-rectal angle

AS: anal sphincter complex.

ATFP: arcus tendineus fascia pelvis.

ATLA : arcus tendineus levator ani.

B: bladder.

BSSFP:balanced steady-state free precession

BN : bladder neck.

C: coccygeus muscle

CUG : cystourethrogram.

CNS : central nervous system

DICOM : Digital Imaging and Communications in Medicine.

DM :diabetes mellitus

EAS: external anal sphincter.

EO : external urethral orifice.

FOV : Field of View.

FSE : fast-spin echo

GRE :gradient recalled echo

HASTE : Half Fourier Acquisition Single shot Turbo spin Echo.

IC : iliococcygeus muscle.

IPR: inferior pubic ramus

IS : ischial tuberosity.

ISD : intrinsic sphincter deficiency

ISP : ischial spine

ISS : intersphincteric space

IOM :internal obturator muscle

L: levator ani.

L2 : second lumbar vertebra.

LA : levator ani muscle.

LUG :levator - urethra gap

LUT : lower urinary tract

LS :lissosphincter

LL : longitudinal layer

RS :rhabdosphincter

MRI: magnetic resonance imaging.

MM : muscularis submucosae ani

NPV: negative predictive value

O : obturator muscle.

OF : obturator foramen.

PA: puboanalis

PB : pubic bone.

P: perineal body.

PC : pubococcygeus muscle.

PCF: pubocervical fascia

PCL :pubococcgeal line.

PFD: pelvic Floor Dysfunction.

PFMC :pelvic floor muscle contraction

POP : pelvic organ prolapse.

PR : puborectalis muscle.

PS :pubic symphysis

PULs : Pubo urethral ligaments.

PPV : positive predictive value

R: rectum.

SD : standard deviation

SE: standard error of the mean

SP: symphysis pubis.

SUI: stress urinary incontinence.

T : Tesla

T2WI : T2-weighted images.

TPUS : transperineal ultrasonography.

TUI : tomographic ultrasound imaging

TSE : turbo spin-echo.

TVS : transvaginal ultrasonography.

SNR : signal-to-noise ratio

SSFSE :single-shot fast spin echo sequences

U : urethra.

UB: urinary bladder.

UT: uterus.

UTI : urinary tract infection

UUI : Urge Urinary Incontinence.

UVJ : urethrovesical junction.

V : vaginal vault.

Abstract

Objective:
Stress urinary incontinence (SUI), defined as involuntary loss of urine during increased abdominal pressure, due to intrinsic sphincter deficiency or to hypermobility of the bladder neck or urethra is the most commonly encountered type of female urinary incontinence. Our study aimed at assessing and comparing the role of ultrasound (US) and magnetic resonance imaging (MRI) in those patients.

Methods:
Twenty patients (mean age: 44.05 years old) with an established clinical diagnosis of SUI as well as 5 female volunteers (mean age: 43 years old) underwent pelvic floor (perineal) 2D-US and MRI (static & dynamic). The US evaluation included measurement of the bladder wall thickness, detrusor muscle thickness, urethral length and thickness as well as assessment of the retrovesical angle at rest and with strain. At MRI, descent of the bladder below the pubococcygeal line, H & M lines measurements, levator plate orientation, vaginal configuration, puborectalis muscle and levator hiatus width were assessed.

Results:
MRI study showed that in patients, there was statistically significant ($p<0.05$) elongation of H line at rest and with pelvic strain (mean: 6.43 versus 4.71cm in controls at rest and 7.69 versus 5.20cm with strain respectively), widening of the elevator hiatus (4.17 cm versus 3.20cm in controls) as well as puborectalis abnormalities (in 55% of patients). On trans-vaginal US, there was statistically significant increased detrusor muscle thickness with SUI (mean: 0.16 versus 0.12cm in controls), shortened urethral length (2.74 versus 3.17cm in controls) and increased retrovesical angle with strain (140 versus 121° in controls)

Conclusion:
2D perineal US can efficiently be used as a screening modality to detect patients with functional abnormality in the context of stress urinary incontinence. Further MRI assessment of the pelvic floor can be indicated to detect the anatomical defects. Such a combined approach can lead to more successful patient management and subsequently decreases the rate of postoperative recurrence.

Key Words: stress incontinence; pelvic floor muscles; magnetic resonance imaging; ultrasound.