

The role of dynamic magnetic resonance imaging in female pelvic floor dysfunction

Essay

Submitted for partial fulfillment of Master degree in Radiodiagnosis

By

Fatma Magdy Mohamed Salama

M.B.,B.Ch. Faculty of Medicine Ain Shams University

Supervised By

Prof. Dr. Yasser Abd El Azeim Abbas

Professor of Radio-diagnosis Faculty of Medicine Ain Shams University

Dr. Hossam Moussa Sakr

Lecturer of Radiodiagnosis Faculty of Medicine Ain Shams University

Radiodiagnosis Department Faculty of Medicine Ain Shams University 2010



دور فحص الرنين المغناطيسي الديناميكي في تقييم الاختلال الوظيفي لقاع الحوض عند النساء

رسالة توطئة للحصول على درجة الماجستير في الأشعة التشخيصية

مقدمة من

الطبيبة/ فاطمة مجدى محمد سلامة بكالوريوس الطب والجراحة كلية الطب جامعة عين شمس

تحت اشراف الأستاذ الدكتور/ باسر عبدالعظيم عباس أستاذ الأشعة التشخيصية كلية الطب- جامعة عين شمس

> الدكتور/ حسام موسي صقر مدرس الأشعة التشخيصية كلية الطب - جامعة عين شمس

> > كلية الطب جامعة عين شمس ٢٠١٠

List of Contents

Title	Page
• Abbreviations	i
• List of figures	iii
• List of tables	vii
• Introduction and aim of the work	1
• Chapter 1: - Basic and radiological anatomy of fe floor	•
• Chapter 2: - Pathology of pelvic floor dysfunction	ı 24
• Chapter 3:	
- Imaging modalities used for diagnos dysfunction	
• Chapter 4: - Technique of dynamic MRI	63
• Chapter 5: - Dynamic MRI findings in pelvic floo	• •
• Summary and Conclusion	125
• References	127
Arabic Summary	

Acknowledgment

First and foremost, thanks to Allah, to whom I relate any success in achieving any work in my life.

I wish to express my deepest thanks, gratitude and appreciation to Prof. Or. Passer Abd El Azeim Abbas, for his sincere encouragement, constant advice and valuable guidance throughout the performance of this work.

I owe special gratitude to Tr. Cossam Moussa Sakr, for his close supervision and continuous advice which gave me the best guide during different stages of this work.

I would like to thank my professors, my father, my mother, my brothers, my sister, my fiancé and my colleagues for their support and moral encouragement.

Satma Magdy Balama

Abbreviations

3 D..... Three-dimension ARA..... Anorectal angle cm..... Centimeter F..... French FIESTA..... Fast Imaging Employing Steady State Acquisition FISP..... Fast imaging with steady-state precession FOV..... Field of view FSE..... Fast Spin Echo GRASS..... Gradient recalled acquisition in the steady state GRE..... Gradient echo HASTE...... Half-Fourier acquisition turbo spin-echo HMO...... H line, M line, Organ prolapse Hz.....Hertz mg......Milligram MHz..... Mega Hertz mL..... Milliliter mm..... Millimeter mmol/L.....Millimole per liter MRI..... Magnetic Resonance Imaging msec..... Millisecond NEX..... Number of excitations ODS..... Obstructed defecation syndrome PC..... Personal computer PCL..... Pubococcygeal line S (2, 3, 4).... Sacral nerve roots 2, 3, 4 Sec..... Second SP-GRE..... Spoiled Gradient Echo SSFSE...... Single Shot Fast Spin Echo

SUI	Stress urinary incontinence
T	.Tesla
TE	. Echo time
TR	. Repetition time
TSE	Turbo spin echo
US	.Ultrasonography
VCUG	.Voiding cystourethrography

Eist of Figures

Figure No.	Title	Page No.
1.1	Pelvic fascia	4
1.2	Floor of female pelvis	7
1.3	Muscles of the pelvis - lateral view	7
1.4	Female perineum	10
1.5	Muscles of the perineal body	11
1.6	Female urinary bladder and urethera	12
1.7	Female pelvis lateral view	14
1.8	Female pelvis lateral view	16
1.9	Anorectal angle	19
1.10	Anal canal and anal sphincters	21
2.1	The urethral support (Hammock theory)	25
2.2	Sagittal schematic of the pelvis demonstrates various sites of prolapse	30
2.3	Sagittal section of the pelvis showing cystocele and rectocele	32
2.4	Grades of uterine prolapse	35
2.5	Whole uterus outside the body (procidentia)	36
2.6	Enterocele	37
2.7	Full-thickness rectal prolapse protruding through the anal opening	39
3.1	Lateral dynamic cystoproctogram	48
3.2 A	Lateral dynamic fluoroscopic image obtained with patient straining during cystographic phase	49
3.2 B	Sagittal true fast imaging in a steadystate free precession MR image obtained with patient straining	49
3.3	Measurement of the ARA with dynamic fluoroscopic defecography	51
3.4 A	Lateral evacuation proctogram shows a large anterior rectocele	52
3.4 B	Lateral evacuation proctogram a high-grade intrarectal intussusception	52
3.5 A	Lateral radiograph shows an anterior rectocele	52
3.5 B	Lateral radiograph shows an enterocele	52

3.6	Transverse endoanal US image	54
3.7	Dynamic translabial US	56
3.8	Endoanal MR imaging coil	57
3.9	Normal MRI anatomy, axial proton-density-weighted GRE endoanal image	58
3.10	Normal MRI anatomy, coronal T2-weighted fast spin-echo image	59
3.11 A	Photograph of endourethral MR coil	60
3.11 B	Photograph of endovaginal coil.	60
3.12 A	Intraurethral MR images obtained with endourethral coil	60
3.12 B	Transverse T2-weighted fast spin-echo MR image obtained with an endovaginal coil.	60
3.13 A	Dorsal lithotomy view of 3D model of female pelvis	62
3.13 B	Lateral view of 3D model of female pelvis	62
4.1 A	Midline sagittal HASTE image shows multicompartmental prolapse	71
4.1 B	Midline sagittal true fast imaging with FISP image shows multicompartmental prolapse	71
4.2	Dynamic MR performed with a superconducting open-magnet system.	73
4.3 A	Axial MR image used as localizer for dynamic MRI	74
4.3 B	Midsagittal T1-weighted spoiled gradient- echo MR section	74
4.4	Uterine prolapse in kinematic HASTE MR images	78
4.5	Drawing of the sagittal midline view of the female pelvis showing PCL, H and M lines	80
4.6	Anatomic landmarks and reference lines used in the HMO system	81
4.7	Drawings illustrate the puborectalis muscle originating from the pubic symphysis and surrounding anorectal junction during rest, squeezing and straining.	84
4.8	Measurement of the ARA with dynamic open MRI.	84
4.9	Sagittal FIESTA images in normal volunteer woman.	85
5.1	Short urethral sphincter at MR imaging.	87

5.2	Variable appearances of urethral diverticula at axial MR images.	89
5.3	Sagittal T2 weighted images show urethral diverticula.	90
5.4	Sagittal single-shot fast spin-echo image shows urethral hypermobility and urethral funneling.	91
5.5	Axial T2-weighted fast spin-echo image shows a discontinuous left periurethral ligament	92
5.6	Sequential images from a cine movie show a rotation of the urethral axis	93
5.7	Urethral hypermobility in sagittal MR image	94
5.8 A	Axial T2-weighted fast spin-echo image shows an intact pubococcygeus muscle	95
5.8 B	Axial T2-weighted fast spin-echo image shows disrupted pubococcygeus muscle	95
5.9	Sagittal T2-weighted fast spin-echo MR image shows normal anatomy of urethra	97
5.10	Midsagittal single-shot fast SE MR images shows pelvic floor relaxation, cystocele, urethrocele, and urethral hypermobility	98
5.11	Sagittal MR images show hydronephrosis, endometrial hyperplasia or malignancy, and severe cystourethrocele	99
5.12	Sequential images from a cine movie show a large cystocele and little leakage of urine	100
5.13 A, B	Sagittal T2-weighted images show significant a cystocele and a large fibroid	101
5.13 C	Axial T2-weighted image shows mild widening of the levator hiatus	101
5.14	Sagittal FIESTA images show sever uterine and posterior compartment descent	102
5.15	midsagittal MR images show peritoneocele and pelvic floor enlargement	103
5.16	Sagittal FIESTA images show severe vaginal prolapse and a large enterocele	104
5.17	MR images show uterine procidentia	104
5.18 A	Sagittal MR image shows anterior rectocele	106
5.18 B	Sagittal MR image shows a small posterior rectocele	106

5.19	MR images show a moderate rectocele	107
5.20	MR images show an anterior rectocele	108
5.21	Sagittal HASTE MR image shows a rectocele	108
5.22	Sagittal FIESTA images show a peritoneocele	110
5.23	Sequential images quoted from a movie show a large rectocele and large enterocele	110
5.24	Drawings and corresponding sagittal FIESTA images illustrate degrees of intrarectal intussusceptions	111
5.25	Sequential images quoted from a movie show a full-thickness extraanal rectal prolapse	112
5.26	Sagittal FIESTA image shows redundant infolding of the mucosal layer in the posterior and anterior rectal wall	113
5.27	Dynamic MR images show descending pelvic floor syndrome	115
5.28	The anorectal angle (ARA)	117
5.29	Sagittal FIESTA images show failed normal opening of the anorectal angle	119
5.30	Dynamic MR images show spastic pelvic floor syndrome	120
5.31	Recurrent cystocele after sacrocolpopexy (Midsagittal T2-weighted MR images).	122
5.32	Illustrative case	123

Eist of tables

Table No.	Title	Page No.
2.1	Risk factors for urinary incontinence	26
2.2	Symptomatic comparison between SUI and urge incontinence	29
2.3	Risk factors associated with pelvic organ prolapse	31
2.4	Grades of uterine prolapse	34
2.5	Causes of pelvic outlet obstruction	44
4.1	Suggested protocol for dynamic MRI in pelvic floor dysfunction	69
4.2	Parameters used for dynamic MRI of the pelvic floor	76
4.3	The HMO system grading of pelvic floor relaxation	82
4.4	The HMO system grading of pelvic organ prolapse	82

Introduction Aim of The Work

Easic

Radiological

anatomy of female

pelvic floor

Zathology of pelvic floor dysfunction

Smaging modalities used for diagnosis of petric floor dysfunction