The Egyptian Journal of Radiology and Nuclear Medicine (2014) **45**, 1003–1010

Egyptian Society of Radiology and Nuclear Medicine

The Egyptian Journal of Radiology and Nuclear Medicine

www.elsevier.com/locate/ejrnm
www.sciencedirect.com

ORIGINAL ARTICLE

Dynamic magnetic resonance imaging; reliability of assessment and correlation with clinical findings of pelvic organ prolapse

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Received 10 June 2013; accepted 18 March 2014
Available online 10 May 2014

KEYWORDS

Dynamic MRI;
Pelvic organ prolapse;
Incontinence;
Pelvic floor

Abstract *Introduction:* Pelvic floor dysfunction and prolapse affect about 50% of women past middle age. Failure to recognize the complex set of pelvic floor defects in individuals leads to most postsurgical failures. Diagnosis and grading of pelvic floor dysfunction is primarily done by physical examination. Imaging does not have yet an established role in the investigation of prolapse, yet it is expected to play a role in preoperative planning identifying soft tissue abnormalities which will help avoiding recurrence.

Aim of the work: This is a prospective study targeted at defining the role of MRI in assessment of pelvic floor prolapse in females.

Methods: Dynamic and static MRI was performed in 40 female patients complaining of pelvic organ prolapse and/or stress urinary incontinence or fecal incontinence. Full history was taken and clinical examination performed and findings compared with MRI results.

Results: Good concordance was found between dynamic MRI and clinical examination in all three compartments, it was 82.5% in the anterior compartment, 80% in the posterior compartment, 85% in enteroceles and 65.0% in the middle compartment.

Conclusion: Dynamic MRI is expected to be a promising imaging tool and to play a larger role in the preoperative planning of pelvic organ prolapse in the near future.

1. Introduction

A total of 50% of parous women past middle age, experience symptoms of pelvic pain, pressure, dyspareunia, incontinence, incomplete emptying consistent with pelvic floor dysfunction, and up to 16% have gross pelvic organ prolapse (1,2).

Pelvic floor weakness has many complex causes. The risk factors for pelvic floor dysfunction include pregnancy, multiparity, advanced age, menopause, obesity, connective tissue

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Peer review under responsibility of Egyptian Society of Radiology and Nuclear Medicine.

0378-603X © 2014 Production and hosting by Elsevier B.V. on behalf of Egyptian Society of Radiology and Nuclear Medicine.
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disorders, smoking, chronic obstructive pulmonary disease, and any other factors that result in a chronic rise in intraabdominal pressure. A consensus conference statement from the National Institutes of Health concluded that age, sex, and vaginal parity are established risk factors (3).

Diagnosis and grading of pelvic floor dysfunction is primarily done by physical examination, which involves a complex set of measurements. As up to one-third of patients undergoing prolapse surgery require a second operation, preoperative assessment needs to accurately define the defects in the fascial supports that led to prolapse (4). This necessitates the use of radiographic imaging, such as voiding cystourethrography, evacuation proctography, and cystourethrography yet patient discomfort, complexity, invasiveness, radiation exposure, and relative lack of understanding of detailed anatomy and pathophysiology of pelvic prolapse and relaxation by general radiologists resulted in the relatively sparse use of these procedures (4,5).

Recently, MR imaging has been used in pre-operative evaluation of pelvic organ prolapse to identify before surgery various anatomical defects which may improve the post-surgical outcomes in selected patients and thereby decrease the chances of recurrence (6).

The present study was planned to assess the reliability of MRI in the evaluation of pelvic organ prolapse and its agreement with physical examination.

2. Patients and methods

2.1. Patients

This study is a clinical trial (prospective study) which was carried out in the Department of Radiodiagnosis at Ain Shams University Hospital from February 2011 to December 2012. Forty-eight women with pelvic organ prolapse and/or stress urinary incontinence or fecal incontinence were included, eight patients were excluded (four patients declined performing MRI, three were excluded due to the presence of urgent symptoms (detruser instability) and one due to marked obesity). Patients were recruited from the Department of Obstetrics and Gynaecology, Ain Shams University.

2.2. Methods

The baseline clinical evaluation included an interview and a physical examination in which prolapse was graded according to the Baden–Walker Halfway Grading System (Table 1) (7).

Ultrasonography of the abdomen and pelvis was conducted in all subjects to evaluate for residual urine and rule out uterine abnormalities. Urodynamic studies were done for patients with urinary incontinence while defecography and or electromyography were done for patients having fecal incontinence.

Table 1 Clinical grading of pelvic organ prolapse (Goodrich et al. (17)).

Grade 0	No prolapse
Grade 1	Halfway to hymen
Grade 2	To hymen
Grade 3	Halfway past hymen
Grade 4	Maximum decent

2.2.1. Patient preparation

All patients did enemas on the night before and in the morning of the exam and all were asked to void urine 1 h before the study.

Scan protocol: After obtaining a written informed consent, patients underwent static and dynamic MRI examination using 1.5 Tesla Superconductive G.E. Signa LX scanner phased array pelvic coil.

2.2.2. MRI technique

The patient was positioned supine during the procedure without tilting the pelvis. Mixture of Ultrasound gel (Aquasonic) and saline was used to opacify rectum and vagina during the examination.

Sagittal, small field of view axial T2WI (to obtain high-resolution images of the muscles and fascial condensations of the pelvic floor) and coronal turbo spin-echo sequences were performed.

The static images were reviewed to check for motion or wrap around artifacts.

We choose the midsagittal slice showing the urinary bladder, urethra, uterus, vagina, rectum and the anal canal, dynamic images were taken with ultra fast T_2 weighted sequences (single – shot fast spin – echo sequence) (SSFSE), with the patients instructed to perform maximum straining for 10 s and then to release and to repeat that cycle several times till they were instructed to stop.

2.2.3. Imaging parameters

Sagittal T2W: TR 3000, TE 100, slice thickness 4 mm, gap 1.5 mm, field of view (FOV) 220.
Axial T2W: TR 3500, TE 80, slice thickness 2 mm, gap 1 mm, FOV 225.
Axial T1W: TR 420, TE 10, slice thickness 2 mm, gap 1 mm, FOV 255.
Coronal T2W: TR 3500, TE 80, slice thickness 2 mm, gap 1 mm, FOV 220.
Dynamic SSFSE: TR 3000, TE 160, FOV 290, number of dynamic scans 60, time 3 min.

2.2.4. Image analysis

The images were interpreted parallelly by two radiologists with at least 5 years experience drawing the following lines (on the chosen midsagittal slice showing the urinary bladder, urethra, uterus, vagina, rectum and the anal canal):

1. pubococcygeal line (PCL) → drawn from the lower border of the symphysis pubis to the last visible coccygeal joint.
2. Hiatal (H-line) → drawn from the lower border of the symphysis pubis to the ano-rectal junction.
3. Muscular pelvic floor relaxation (M-line) → drawn from the end of the hiatal line perpendicular to the pubococcygeal line.

These lines were drawn at rest and during maximum straining, and were used to assess the degree of hiatal enlargement and muscular pelvic floor relaxation of the HMO grading system (H line, M line, organ prolapse) (Table 2) (8).