ORIGINAL ARTICLE

DYNAMIC MAGNETIC RESONANCE IMAGING: AN AID TO PREOPERATIVE PLANNING OF PELVIC ORGAN PROLAPSE

Bakhtawar Memon, Shaista Shoukat, Nimrah Sultana, Tahira Parveen, Nasreen Fatima, Tariq Mehmood

Department of Radiology, Jinnah Post Graduate Medical Centre, Karachi-Pakistan

Background: Magnetic resonance imaging (MRI) has been commonly used in the assessment of pre-operative pelvic organ prolapse to evaluate anatomical defects prior to surgery. This study aimed at evaluating the dynamic MRI reliability in the determination of pelvic organ prolapse and to assess its compliance with the physical examination for preoperative planning of women. **Methods:** A prospective cross-sectional study was performed at the radiology department of the Jinnah Postgraduate Medical Centre Karachi from April-October 2019. All women irrespective of age and parity status having obstructed defecation, constipation, organ prolapse, pelvic pain, or stress urinary incontinence undergoing dynamic pelvic MRI were consecutively enrolled. A brief history was obtained followed by a physical examination for pelvic organ prolapse followed by MRI examination. Kappa coefficient was applied to see the agreement of physical examination with MRI finding. **Results:** A total 38 women were included. A significantly moderate agreement was observed between MRI and physical exam findings with respect to the presence or absence of cystocele (K=0.554, p<0.001), rectocele (K=0.632, p<0.001), and enterocele (K=0.587, p<0.001). However, agreement with respect to the MRI and physical examination findings on uterine descent was non-significant (K=0.130, p 0.421). **Conclusion:** MRI examination is an effective diagnostic modality in determination of the pelvic organ prolapse in suspected symptomatic patients. MRI could add value primarily in research areas, taking into account its ability to examine the entire pelvis.

Keywords: Pelvic organ prolapse; Dynamic magnetic resonance imaging; Physical examination

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INTRODUCTION

The downward reduction of female pelvic organs, commonly known as pelvic organ prolapse, is a common problem for women.[1–3] Physical examination for suspected women with pelvic organ prolapse is a primary diagnostic procedure. However, there is a complicated set of measurements involved in this examination. In symptomatic women, surgical intervention is widely practice. It is reported that recurrence is noticed in women with pelvic organ prolapse surgery. A comprehensive preoperative assessment is of utmost importance.[4,5] For this reason, the use of radiographic imaging for the diagnosis of pelvic organ prolapse in at-risk women is of great importance. For the evaluation of pelvic organ prolapse, magnetic resonance imaging (MRI) has widely used in pre surgery for the determination of anatomical defects prior to intervention. This not only shows a better post-surgical outcome in suspected women but reduce recurrence probability as well.[6] A literary search disclosed a shortage of national and international studies on this problem. The underestimation of the prolapse of the pelvic organ might result in incomplete or inaccurate surgery. This ultimately results in the increased recurrence risk after prolapse surgery. We have planned this study to evaluate the dynamic MRI reliability in the assessment of pelvic organ prolapse. Secondly to evaluate the physical examination for preoperative planning of patient.

MATERIAL AND METHODS

This prospective cross-sectional study was performed at the radiology department of Jinnah Postgraduate Medical Centre Karachi from April-October 2019. All women irrespective of age and parity status having complaint of constipation, difficulty in defecation, pain of the pelvic region, organ prolapse or stress urinary incontinence undergoing dynamic pelvic MRI were consecutively included. The pelvic organ prolapse was defined as prolapse or dropping of any of the pelvic floor organs. All women with previous surgery for prolapse or pelvic floor dysfunction, and other findings which may distort pelvic anatomy such as a pelvic mass or history of pelvic radiation, and MRI claustrophobia were excluded. Epi Info sample size calculator was used for the estimation of sample size taking confidence interval 95%, reliability of cystocele in a previous study 82.5%[7], margin of error 10%. The sample size came out to be 55. However, for our objective this sample size is higher we cannot achieve such a sample in the mentioned period. Therefore, we have enrolled only 38 patients. All data were collected through a pre-structured questionnaire. A brief history of all patients was obtained followed by a physical examination for pelvic organ prolapse by Senior Gynaecologist. "Baden–Walker Halfway Grading

System" was used for the grading of the prolapse. MRI was performed using MRI scanner (Toshiba Vantage Elan 1.5 T). The urinary bladder was emptied about 3 hours prior to the conducting of MRI scan so that during MRI bladder would be moderately filled. The dynamic MRI scan led by sequences for the imaging of pelvic anatomy and for the presence of any abnormalities in the muscles. T2 weighted thin section sequences with "repetition time per echo time 300/102 ms", "field view 23.23 cm", and "matrix of 384.224" was acquired with twenty-five sections having five-millimetre section thickness. The time for the acquisition of image was 3 to 4 minutes. Initially, relaxation was performed followed by execution of straining-manoeuvres. The sequences acquired were subsequently evaluated. Pubococcygeal line was obtained from the pubis to the lower coccygeal-joint. Measurement of the prolapse was according to the gradings indicating grade I as "mild", grade II as "moderate", and grade III as "severe". Further, the presence of prolapse below the pubococcygeal line was graded as "mild" 3 cm or less, "moderate" 3 to 6 cm, and "serious" by >6 cm. The "anorectal angle" was assessed keeping values amid "108° and 127° at rest". While an increase measurement of about "15–20° on defecation". SPSS version 24 was used for the purpose of statistical analysis. Frequency and percentages were calculated for menopausal status, history of genital prolapse with surgical repair, previous delivery events, and pelvic organ prolapse findings on physical examination and MRI. Kappa coefficient was applied to see the agreement of physical examination with MRI finding.

RESULTS

Of total 38 patients, the median age was 44 (35–61) years. There were 21 (55.3%) women with pre-menopausal status whereas 17 (44.7%) women with post-menopausal status. The median parity was 4 (2–4). The frequency of previous delivery events showed that only vaginal delivery was observed in majority of the women, i.e., 29 (76.3%) followed by both caesarean and vaginal delivery in 9 (23.7%) whereas none of the patients had only caesarean history. Moreover, history of prolonged labour was found in 25 (65.8%) patients, previous perineal or vaginal tear (in 29 (76.3%), previous large birth weight infant in 17 (44.7%), previous episiotomy in 13 (34.2%) while previous operative vaginal delivery in 9 (23.7%) patients. The frequency of pelvic floor dysfunction showed that stress urinary incontinence was found in 25 (65.8%), genital prolapse in 29 (76.3%), and anal incontinence in 21 (55.3%) patients. (Table-1) Of the 38 women, agreement in the MRI and physical finding was found to be 78.94%. However, the agreement for grading of cystocele was found to be lower, i.e., 38.89%. A significantly moderate agreement was observed between MRI and physical finding with respect to cystocele (K=0.554, p<0.001) (Table-2) A significantly moderate agreement was observed between MRI and physical finding with respect to rectocele (K=0.632, p<0.001). Of the 38 women, agreement in the MRI and physical finding was found to be 81.57%. However, the agreement for grading of posterior compartment was found to be lower, 61.11%. (Table-3) Of the 38 women, agreement in the MRI and physical finding was found to be 73.68%. The agreement for grading of rectocele was found to be 51.72%. (Table-4) A significantly moderate agreement was observed between MR imaging and physical examination findings with respect to enterocele (K=0.587, p=<0.001). Amongst 38 patients, agreement in the MRI and physical finding was found to be 78.94%. (Table-5)

Table-1: Baseline characteristics of the patients (n=38)

	Median (IQR)
Age, years	44 (35–61)
Parity	4 (2–4)
	number (%)
Menopausal status	
Pre-menopausal	21 (55.3)
Post-menopausal	17 (44.7)
Previous delivery events	
Mode of delivery	
Only Vaginal delivery	29 (76.3)
Only Caesarean delivery	0 (0)
Both	9 (23.7)
Place of delivery	
Only Hospital delivery	13 (34.2)
Only Home delivery	12 (31.6)
Both	13 (34.2)
History of prolonged labour	25 (65.8)
Previous episiotomy	13 (34.2)
Previous perineal or vaginal tear	29 (76.3)
Previous large birth weight infant	17 (44.7)
Previous operative vaginal delivery	9 (23.7)
Pelvic floor dysfunction	
Stress urinary incontinence	25 (65.8)
Genital prolapse	29 (76.3)
Anal incontinence	21 (55.3)

Table-2: Agreement between physical examination and MRI findings regarding anterior compartment (cystocele)

MRI findings of the Anterior Compartments (n=38)	Physical findings of the Anterior Compartments			Percentage of agreement	K	*p*-value
	Normal	Cystocele				
Normal	9 (100)	0 (0)		78.94	0.554	<0.001
Cystocele	8 (27.6)	21 (72.4)				
Grading (n=36)						
	Grade I	**Grade II**	**Grade III**	38.89	0.205	0.014
Grade I	4 (26.7)	11 (73.3)	0 (0)			
Grade II	0 (0)	1 (33.3)	2 (66.7)			
Grade III	4 (22.2)	12 (66.7)	2 (11.1)			

Table-3: Agreement between physical examination and MRI findings regarding posterior compartment (rectocele)

MRI finding of the Posterior Compartments (n=38)	Physical finding of the Posterior Compartments			Percentage of agreement	K	*p*-value
	Normal	Rectocele				
Normal	13 (92.9)	1 (7.1)		81.57	0.632	<0.001
Rectocele	6 (25)	18 (75)				
Grading (n=18)						
	Grade I	**Grade II**	**Grade III**	61.11	0.357	0.024
Grade I	7 (100)	0 (0)	0 (0)			
Grade II	5 (45.5)	4 (36.4)	2 (18.2)			
Grade III	0 (0)	0 (0)	0 (0)			

Table-4: Agreement between physical examination and MRI findings regarding middle compartment

MRI finding of the Middle Compartments (n=38)	Physical finding of the Middle Compartments			Percentage of agreement	K	*p*-value
	Normal	Uterine Descent				
Normal	2 (25)	6 (75)		73.68	0.130	0.421
Uterine Descent	4 (13.3)	26 (86.7)				
Grading (n=29)						
	Grade I	**Grade II**	**Grade III**	51.72	0.585	0.274
Grade I	7 (70)	3 (300	0 (0)			
Grade II	6 (37.5)	5 (31.3)	5 (31.3)			
Grade III	0 (0)	0 (0)	3 (100)			

Table-5: Agreement between physical examination and MRI findings regarding enterocele (n=38)

MRI finding of Enterocele	Physical finding of Enterocele		Percentage of agreement	K	p-value
	Present	Absent			
Present	12 (100)	0 (0)	78.94	0.587	<0.001
Absent	8 (30.8)	18 (69.2)			
Total	20 (52.6)	18 (47.4)			

DISCUSSION

The findings of this study have reported a better agreement in the determination of pelvic organ prolapse using MRI exam. Moreover, a higher agreement in the MRI and physical finding was observed. Similarly, in the current study, a considerable agreement was observed between MRI and physical finding with respect to rectocele. A higher agreement in the MRI and physical finding was noted. The findings of enterocele were also found somewhat similar with the findings reported in a previous study.[7] Several other studies revealed greater concordance of dynamic MRI examination and physical examination.[8–12]

In contrast to our study finding, a non-significant agreement of rectocele finding in MRI and physical exam was reported in these studies.[8,9] However, our study finding was supported by a study conducted by Azab and colleague.[7]

In a study conducted by Gupta *et al*.[13] reported dynamic MRI was poorly correlated with physical examination in all three compartments, which, except for the middle compartment, did not match the results of this study. This may be due to the use of another staging scheme for MRI. In this study, grading system by "Baden–Walker Halfway" was utilized for determination of pelvic organ prolapse. However, Gupta *et al*[13] used "pelvic organ prolapses quantification system" (POP-Q system) for grading of pelvic organ prolapse. The "POP Q" for grading was utilized by several other studies as well.[14–16] However, like our study, various other studies have also used the grading system by "Baden–Walker Halfway".[9,17]

Thus, participation of more than one pelvic compartment is generally prevalent in pelvic organ prolapse imaging has a predominant function in accessing pelvic floor diseases. MR defecography, both with static anatomical and dynamic physiological

sequences, introduces as a reliable choice for non-invasive pelvic assessment, being able to determine the entire pelvic floor for ideal pre-operative patient management.[12,10,11]

The finding of the study could be highlighted in the light of limitation that we failed to correlate the finding of this study with the surgical outcome. Moreover, the sample used in the current study was limited due to limitation of study duration and resources. Despite of these imitation, as per our though literature search, this is the first of kind of local study on this topic that have determined the agreement level of dynamic MR imaging in determination of the pelvic organ prolapse. Further largescale multi-center studies are recommended to validate the finding of this study.

CONCLUSION

The excellent agreement in between the dynamic MRI classification of pelvic organ prolapse with the physical examinations was observed. The effect on the surgical choice would be definite. MRI could add value primarily in research areas, taking into account its ability to examine the entire pelvis, including support structures and organs

AUTHORS' CONTRIBUTION

BM: Performed the MRI procedure, data collection, interpretation of data and article writing. SS: Supervised and provide instruction for performing MRI procedure. NS: Data collection and performed MRI procedure. TP: Data collection and patient's examination. NF: Data collection and patient's examination. TM: Supervision

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Address for Correspondence:

Bakhtawar Memon, Flat # 102, 1st floor Royal residency, adjacent Sems banquet, Civil Lines Karachi-Pakistan
Email: bakhtawar2004@hotmail.com