ACH Med J
(2023) 3: 116-123
ISSN:2822-5872
Doi : 10.5505/achmedj.2023.09797

RESEARCH ARTICLE

Agreement Analysis of the Magnetic Resonance Defecography and Clinical Examination Findings in the Evaluation of Pelvic Floor Disorders

Esra Civgin[1], Hasan Yigit[2], Fehime Funda Dogulu[3], Pinar Nercis Kosar[2], Selma Uysal Ramadan[4]

[1]Department Of Radiology, Ankara City Hospital, Ankara, Turkey

[2]Department Of Radiology, Ankara Training And Research Hospital, Ankara, Turkey

[3]Department Of Obstetrics And Gynecology, Koru Ankara Hospital, Ankara, Turkey

[4]Division Of Radiology, Ankara Atatürk Sanatory Education And Research Hospital, Ankara, Turkey

Article Info

Received Date: 07.04.2023
Accepted Date: 25.05.2023

Keywords:

cystocele, enterocele, magnetic resonance defecography, pelvic floor disorders, rectocele, uterine prolapse

Abstract

Introduction: Pelvic floor disorders (PFD) are more frequently seen in women and impairs quality of life. The aim of this study was to find agreement between the clinical examination and magnetic resonance defecography (MRD) findings of female patients with PFD related symptoms and to discuss the findings of MRD in PFD. **Methods:** Seventy-six female patients with complaints of PFD and undergone MRD were included in the study. The pubococcygeal line was used as the reference line for pelvic organ prolapse evaluation in MRD. MRD and clinical examination findings were compared. **Results:** Agreement between the MRD and clinical examination findings concerning the presence of cystoceles, rectoceles, entero/peritoneocele was 75%, 50%, and 60.52% respectively. However, the agreement was weaker in terms of pelvic organ prolapse grading (44% for cystoceles, 32% for rectoceles). Since there was no uterine prolapse detected on clinical examination an agreement test for uterine prolapse could not be performed. **Conclusion:** MRD is complementary to clinical examination in terms of its ability to comprehensively evaluate all compartments simultaneously. MRD provides additional information to the clinical examination in patients with symptoms related to PFD and should be utilized, in symptomatic cases, if the clinical examination findings are negative or if multicompartmental pathologies are suspected.

Correspondence Address: Üniversiteler Mahallesi 1604. Cadde No: 9 Çankaya Ankara - Türkiye
Phone: +90 312 552 60 00-7951 / **e-mail:** esrayurduseven@gmail.com

Introduction

Pelvic floor disorders (PFD) include pelvic organ prolapse (POP), urinary incontinence (UI), obstructed defecation, and fecal incontinence.[1] PFD affect daily life causing a variety of symptoms such as pelvic pain, incontinence, constipation, sexual dysfunction, and perineal palpable mass.[2-4] PFD are 3-7 times more common in women than men.[5] Risk factors include advanced age, high body mass index, chronic increase in intra-abdominal pressure, genetics, race, connective tissue diseases, previous pelvic surgery, multiparity, and vaginal birth.[1,6] In the United States, the number of women presenting with at least one of the PFD was 28.1 million in 2010 and it is estimated to increase to 43.8 billion by 2050.[7] The high prevalence of PFD has led it to be labeled a "secret epidemic".[8] In the literature, the reoperation rates for UI and POP range from 17% in the general population to 43-56% in tertiary centers.[9-11] Although the reason for the failure of surgical treatment is not fully understood, it may be related to sole reliance on clinical examination for evaluation of prolapse. Magnetic resonance defecography (MRD) allows the complex, multiplanar, and multiparametric evaluation of the pelvic floor structures and pelvic organs in a single examination without using ionizing radiation, and provides both anatomical and functional information in a non-invasive way.[12] The aim of this study was to find agreement between the clinical examination and MRD findings of female patients with PFD-related symptoms and to discuss the findings of MRD in PFD.

Material and Methods

This study was designed as a prospective, cross-sectional observational study. The institutional review board approval was taken (Date:6.3.2013, File number:4113) before the study. The female patients, over 18 years of age who presented to gynecology outpatient clinics with PFD complaints (like incontinence, constipation, incomplete evacuation, sexual dysfunction, and perineal palpable mass, etc) and underwent dynamic MRD between March 2013 and May 2014 in our department were listed. Patients who had artifacts on MRD images that made evaluation impossible and those who could not complete the MRD were excluded from the study. Patients who did not have clinical examination results were also excluded. Seventy-six female patients who met the criterias were included in the study. The clinical staging of POP was performed by the gynecologist (FFD), using Baden–Walker halfway grading system that consists of four grades: grade 0 – no prolapse, grade 1 - halfway to hymen, grade 2 – to hymen, grade 3 – halfway past hymen, grade 4 –maximum descent.[13] Clinical examination results were recorded.

MRD procedure

The MRD procedure was explained to the patient and an informed consent form was obtained from the patients. Patient was directed to urinate 1 hour before the MRD appointment time. The patient was positioned in the right decubitus position on the MR table. Ultrasound gel was used to better examine the vaginal and rectal walls and to facilitate evacuation. The jelly was given by using a 50 cc syringe and 20/22 gauge catheter, approximately 30-50 ccs to the vagina and approximately 150-250 cc to the rectum until stimulation of evacuation. The patient was rolled into the supine position, and a supporting pillow was placed under the legs to bend the knees at an angle of approximately 45° to facilitate evacuation.

Imaging was performed with a 1.5T MRI machine (Signa HDi, GE Medical Systems, Milwaukee, Wisconsin, USA). An eight-channel phased-array coil was placed over the pelvic region. After resting axial, sagittal, coronal T2-weighted fast spin-echo (T2W FSE) and axial, and coronal Fast Imaging Employing Steady State Acquisition (FIESTA) sequences, dynamic scanning was initiated. Dynamic imaging was obtained by repeated acquisitions (3-second rate of each image acquisition) through a midline sagittal plane during rest, squeeze, and defecation. In case of a suspicion of prolapse and a patient who performs inadequate Valsalva maneuver or evacuation, dynamic post-defecation straining images in the sagittal, coronal and axial plane were obtained to take additional clues for diagnosis. Before the procedure was finalized, the images were evaluated by the radiologist (EÇ) and additional images were taken if necessary.

Image analysis

The image analysis was performed on a remote workstation (Advantage Windows, version 4.3;

GE Medical Systems) by two radiologists with consensus who were unaware of clinical examination. A dedicated read was performed for the research study.

The resting images were evaluated in terms of the morphology and configuration of the puborectal and iliococcygeus muscles, urethral ligaments, and the appearance of the vagina, posterior wall of the bladder. The integrity of the anal sphincter was also evaluated.

In the sagittal dynamic images, a pubococcygeal line (PCL) was drawn extending from the inferior border of the symphysis pubis to the last sacrococcygeal joint to be used as a reference line in the evaluation based on the 'three-compartment model'.[14] An enterocele, sigmoidocele, peritoneocele was defined as descensus or herniation of the small bowel or peritoneal cul- de sac or sigmoid colon below the PCL.[15-17] The reference points were the inferior border of the bladder base for the anterior compartment, the uterine cervix or the vaginal apex (for hysterectomized patients) for the middle compartment.[18] Presence of organ prolapsus, rectocele, entero-peritoneocele, sigmoidocele, and rectal intussusception/prolapse were evaluated and the presence, if any, cystocele, uterus prolapse and rectocele was graded. The grading was performed using the image obtained from the midsagittal region during maximum straining/defecation that showed the maximum organ descent. For cystocele and uterus prolapsus an organ descent of ≤3 cm was graded as mild (grade I), 3-6 cm as moderate (grade 2), and >6 cm as severe (grade 3).[19] A rectocele was defined as any rectal protrusion extended line of the anterior border of the anal canal.[20] Rectocele ≤ 2 cm was graded as small (grade I), [2-4] cm as moderate (grade 2), and > 4 cm as severe.[20]

Statistical analysis

The analysis of the data was performed using SPSS for Windows version 15. The descriptive statistics were expressed as mean ± standard deviation for normally distributed variables, as median (min-max) for variables with a non-normal distribution, and as the number of cases and percentage (%) for nominal variables. The nominal variables were assessed by Pearson's chi-square or Fisher's exact test. During the examination of the relationship between the continuous variables, Spearman's correlation test was used when the distribution was not normal, and the Pearson correlation test was utilized when it was normal. In order to compare the agreement between the clinical examination and MRD findings, the Cohens's kappa coefficient (κ) and significance were calculated. Values of κ as measurement of agreement were categorized as no agreement (κ<0.20), minimal (κ=0.21-0.39), weak (κ=0.40-0.59), moderate (κ =0.60-0.79), strong (κ=0.80-0.90), and almost perfect agreement (κ>0.90).21 The results were considered to be statistically significant if p was <0.05.

Results

Seventy-six patients participated in the study. All of the patients were female and the mean age was 46 +/- 11.8 years. Table 1 presents pathologic findings identified in the clinical examination of patients. Table 2 presents pathologic findings detected in the dynamic MRD of the patients. Sixty-two (82%) of the 76 patients had pathologic clinical examination findings, but 14 (18%) had complaints of PFD but no clinical examination findings. In 2 of 14 patients, no POP was detected on MRD while 12 patients had pathologic findings. MRD findings of patients with no clinical examination findings for POP were shown in Table 3.

Table 1: Pathologic findings detected in clinical examination of patients.

	Clinical Examination Findings	Number of Patients n (%)
Cystocele	Grade I	25 (32.89)
	Grade II	19 (25)
	Grade III	4 (5.26)
	Total	48 (63.15)
Entero/Peritoneocele		3 (3.94)
Rectocele	Grade I	16 (20.51)
	Grade II	15 (19.73)
	Total	31 (40.78)

The data were given as n (%)

Table 4 and Table 5 present the percentages of agreement between the MRD and clinical examination findings in terms of the presence of

Table 2: Pathological findings detected in the Dynamic MRD.

	MRD Finding	Number of Patients n (%)
Cystocele	Grade I	39 (51.31%)
	Grade II	25 (32.89%)
	Grade III	1 (1.31%)
Uterine prolapse	Grade I	24 (31.57%)
	Grade II	8 (10.52 %)
Entero/Peritoneocele		33 (43.42%)
Rectocele	Grade I	23 (30.26%)
	Grade II	44 (57.89%)
Rectal prolapse		23 (30.26%)
Rectal descent		
	Mild (< 3cm)	21 (27.63%)
	Moderate (3-6 cm)	31 (40.78%)
	Severe (> 6 cm)	24 (31.57%)

The data were given as n (%)

cystoceles, and rectoceles, and POP grading, respectively. Since uterine prolapse (UP) was not detected in clinical examination, an agreement test was not applicable to this condition. Although none of the patients had UP according to clinical examination, grade I in 24 patients (32.4%) and grade II in 7 patients (9.5%), UP was detected in the MRD. Furthermore, it was observed that as the severity of the cystocele or rectocele revealed by MRD increased, the grading of UP also increased (p=0.01 / 0.03 and r=0.662 / 0.249, respectively).

Table 3: MRD findings of patients with no clinical examination findings for pelvic organ prolapse.

		MRD Findings Uterine		
Patient	Age	Cystocele Grade	Uteri Prolapse Grade	Rectocele Grade
1	62	1		1
2	32	1		2
3	30			1
4	39	1		1
5	25	1		1
6	33			1
7	51	1		
8	55	2	2	2
9	59	1	1	2
10	43	1	1	2
11	46			2
12	56			2

Table 4: Results of agreement between the MRD and clinical examination findings concerning the presence of cystoceles, rectoceles, and entero/peritoneocele

		Dynamic MRD		Agreement	Disagreement	Kappa* (κ)	p**
		negative	positive	%	%		
Cystocele							
Clinical Examination	Negative	10	18	75%	25%	0.385	**< 0.001**
	Positive	1	47				
Entero/ peritoneocele							
Clinical Examination	Negative	43	30	60.52%	39.47%	0.102	**0.044**
	Positive	0	3				
Rectocele							
Clinical Examination	Negative	8	37	50%	50%	0.123	0.054
	Positive	1	30				

* Cohen's kappa (κ) coefficient; no agreement (κ<0.20), minimal (κ=0.21-0.39), weak (κ=0.40-0.59), moderate (κ =0.60-0.79), strong (κ=0.80-0.90), and almost perfect agreement (κ>0.90).21
** p<0.05 was considered statistically significant.

Seventy-two of the 76 patients (94.7%), we observed pathologies in MRD involving a compartment that had not been covered by clinical examination. Of the 23 patients that were referred to the clinic with a pre-diagnosis of a cystocele accompanied by a rectocele, 18 (78.2%) out of 23 patient had additional pathologies involving the middle compartment in MRD (UP in 3 cases, entero/peritoneocele in 2 cases and UP+entero/peritoneocele in the remaining 13 patients).

Table 5: Results of agreement between the MRD and clinical examination findings concerning cystocele and rectocele grading

		MRD grade				Agreement %	Kappa (κ)*	p**
		0	1	2	3			
Cystocele								
Clinical Examination	0	10(90.9%)	16(41.02%)	2(8%)	0(0%)	44.74	0.205	0.004
	1	1(9.09%)	13(33.33%)	11(44%)	0(0%)			
	2	0(0%)	9(23.07%)	10(40%)	0(0%)			
	3	0(0%)	1(2.56%)	2(8%)	1(100%)			
Rectocele								
Clinical Examination								
	0	8(88.88%)	18(78.26%)	19(43.18%)	-	32.89	0.108	0.058
	1	0(0%)	4(17.39%)	12(27.27%)	-			
	2	1(11.11%)	1(4.34%)	13(29.54%)	-			

* Cohen's kappa (κ) coefficient; no agreement (κ<0.20), minimal (κ=0.21-0.39), weak (κ=0.40-0.59), moderate (κ =0.60-0.79), strong (κ=0.80-0.90), and almost perfect agreement (κ>0.90).21
** p<0.05 was considered statistically significant.

Post-defecation straining images gave additional remarkable MRD findings. Figure 1 and Figure 2 demonstrate UP and peritoneocele detected only in post-defecation images taken during straining.

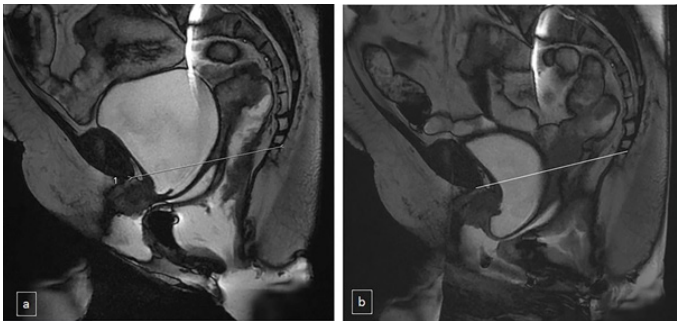

Figure 1: The MRD images of a 61-year-old patient presenting with the complaint of incontinence and a grade II cysto/rectocele in the clinical examination: a) defecation and b) post-defecation straining images. The white line in a and b is pubococcygeal line. The post-defecation image revealed further emptying of the patient's bladder and higher severity of the cystocele compared to the defecation image. In addition, the uterine prolapse and peritoneocele which did not appear in a were easily noticed in b.

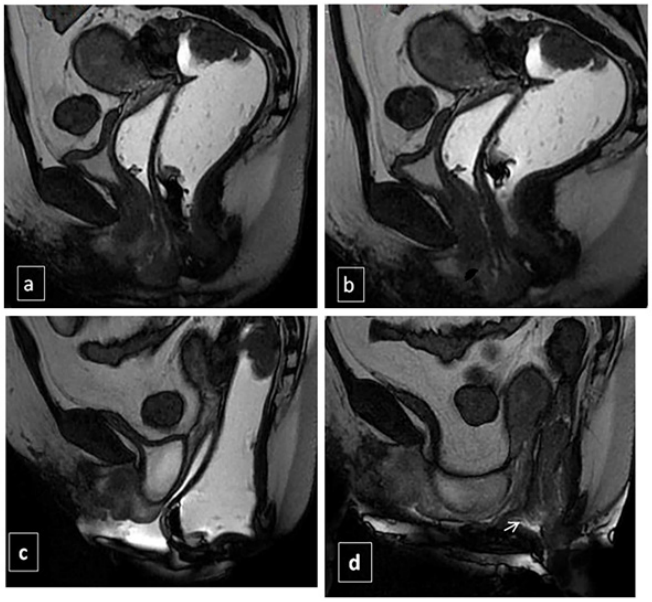

Figure 2: The MRD images of a 40-year-old patient presenting with the complaint of incontinence, and grade II cystocele and grade I rectocele in the clinical examination. The images taken during a) resting, b) squeezing, and c) straining revealed a grade II cystocele, a rectocele, grade I uterine prolapse, and a peritoneocele, and d) the post-defecation image showed rectal prolapse (white cursor).

Discussion

PFD are usually multicompartmental, rarely occur in isolation and that a thorough evaluation of the pelvis is necessary for any woman presenting with PFD symptoms.[20]-[22] Clinicians should bear in mind that patients may be reluctant to express some embarrassing symptoms related to PFD. Detailed assessment of extension of organ prolapse and the degree of pelvic floor relaxation is important for proper surgical planning and to reduce reoperation rates. Clinical examination is often insufficient to assess the whole pelvic organs and pelvic floor related pathologies. Differentiation of cystocele, enterocele, and high rectocele by clinical examination alone is often difficult.[22] MRD allows the complex, multiplanar, and multiparametric evaluation of the pelvic floor soft tissues and pelvic organs in a single examination without using ionizing radiation, and provides both anatomical and functional information, requiring no patient preparation.[10] Imaging has been shown to depict prolapse in asymptomatic compartments that may be occult on physical examination.[20] In many cases, the data obtained from imaging calls for changes to the operative approach, and the treatment method may need to be switched from surgical to medical or vice versa.[23] There are studies in the literature on the comparison of MRD and clinical examination findings in the evaluation of female POP.[24]-[28] In this current study, the highest agreement between MRD and clinical examination was seen in the detection of cystoceles. Other studies also showed a higher correlation between MRD and clinical grading for anterior compartment prolapse than middle and posterior compartment prolapse.[25]-[27] This suggests a better agreement in the anterior compartment. The lack of statistically significant correlation between MRD and clinical examination in the middle and posterior compartments suggests that MRD may provide additional anatomic information in these compartments.[27] In this current study, we found a weak agreement in the presence and grading of cystoceles (kappa = 0.385 and 0.205, respectively) and no agreement in the presence of entero/peritoneocele and rectocele (kappa = 0.102 and 0.123, respectively). Enteroceles are usually not detected in clinical examination. In the literature, the percentage of enterocele detection in MRD in patients without a previous clinical diagnosis of this condition has been reported as 15% by Elshazly et al., 20% by Rentsch et al. and

13.33% by Paetzel et al.[29-31] These researchers concluded that MRD is superior to clinical examination in the detection of cystoceles, enteroceles, and pelvic floor descent. In this current study, of the 73 patients that were not pre-diagnosed with an enterocele, 9 (12.3%) were found to have an enterocele and 27.3% had a peritoneocele, albeit mild, according to MRD. Lin et al. reported that clinical examination detected only 30% of total MRD detected enteroceles and misdiagnosed 10% of these patients with a rectocele.[25] However, there are also several studies reporting that MRD performed in the supine position may not be as adequate as x-ray defecography in the identification of invagination and entero/peritoneocele due to the inappropriate physical conditions and the supine position removing the effect of gravitation.[32-33] To overcome this deficiency, it was suggested that following the resting and straining sequences in MRD, post-evacuation scans should be obtained during strong straining.[34] Multiple defecatory attempts in MRD help to reveal cul-de-sac hernias.[26] Also, the images obtained at straining after defecation were particularly useful for detecting entero/peritoneocele and rectal prolapse. In this current study, no patient was found to have UP on clinical examination and 75% of UPs detected on MRD were of mild severity. Mild UP may not be detected on clinical examination due to patient and/or clinician-related factors. Clinician-related factors such as different examination methods, differences in measurement techniques, reader variability, or patient-related factors such as obesity, reluctance or embarrassment associated with symptoms, poor Valsalva performance of patients during clinical examination may have led to underdiagnosis of PFD. PFD are generally known to be multicompartmental, in accordance with this information, we identified a significant ($p< 0.05$) relationship between the detection of UP and the presence of cystoceles and rectoceles, and multi-compartment defects consistent with UP. We observed that as the severity of the cystocele or rectocele detected in MRD increased, the severity of UP also increased. This indicates that MRD provides additional findings to clinical examination, especially in cases where multi-compartment pathologies are suspected. In many cases, the data obtained from imaging calls for changes to the operative approach, and the treatment method may need to be switched from surgical to medical or vice versa.34 MRI is a useful extension of the clinical examination and is more accurate than clinical examination alone in diagnosing pelvic prolapse.[22] In this study, the overall findings showed that MRD detected more pathologies than clinical examination. The current study has limitations. First, the study sample size was relatively small. Secondly, since X-ray defecography was not performed in our department we could not compare our findings with a gold standard test. Thirdly, we could not compare the effect of MRD findings on treatment plans as we could not follow the treatment of patients. Fourthly, none of the patients in the study demonstrated UP or grade 4 prolapse in clinical examination so patient and/or clinician-related factors were another limitation of current study. Fifth, the coexistence of pathology involving more than one component may cause overlapping of symptoms and affect clinical examination findings.

Conclusion

MRD is complementary to clinical examination in terms of its ability to comprehensively evaluate all compartments simultaneously. MRD provides additional information to the clinical examination in patients with symptoms related to PFD and should be utilized, in symptomatic cases, if the clinical examination findings are negative or if multicompartmental pathologies are suspected.

References

1. Fiaschetti V, Pastorelli D, Squillaci E, et al. Static and dynamic evaluation of pelvic floor disorders with an open low-field tilting magnet. Clin Radiol.2013;68(6):e293-e300.
2. Stoker J, Halligan S, Bartram CI. Pelvic floor imaging. Radiology. 2001;218(3):621-41.
3. Lowder JL, Ghetti C, Moalli P, Zyczynski H, Cash TF. Body image in women before and after reconstructive surgery for pelvic organ prolapse. Int Urogynecol J. 2010;21(8):919-25.
4. Kammerer-Doak D. Assessment of sexual function in women with pelvic floor dysfunction. Int Urogynecol J Pelvic Floor Dysfunct.2009;20(Suppl1):45-50.
5. Weber AM, Abrams P, Brubaker L, et al. The standardization of terminology for researchers in female pelvic floor disorders. Int Urogynecol J Pelvic Floor Dysfunct 2001;12(3):178-86.
6. Shek KL, Dietz HP. Assessment of pelvic organ prolapse: a review. Ultra-

sound Obstet Gynecol. 2016;48(6):681-92.
7. Wu JM, Hundley AF, Fulton RG, Myers ER. Forecasting the prevalence of pelvic floor disorders in U.S. Women: 2010 to 2050. Obstet Gynecol.2009;114(6):1278-83.
8. DeLancey JO. The hidden epidemic of pelvic floor dysfunction: achievable goals for improved prevention and treatment. Am J Obstet Gynecol. 2005;192(5):1488-95.
9. Kjolhede P, Noren B, Ryden G. Prediction of genital prolapse after Burch colposuspension. Acta Obstet Gynecol Scand.1996;75(9):849-54.
10. Wiskind AK, Creighton SM, Stanton SL. The incidence of genital prolapse after the Burch colposuspension. Am J Obstet Gynecol.1992;167(2):399-405.
11. Denman MA, Gregory WT, Boyles SH, Smith V, Edwards SR, Clark AL.Reoperation 10 years after surgically managed pelvic organ prolapse and urinary incontinence. Am J Obstet Gynecol.2008;198(5):555.e1-5.
12. Iacobellis F, Reginelli A, Berritto D, et al. Pelvic floor dysfunctions: how to image patients? Jpn J Radiol. 2020;38(1):47-63.
13. Baden WF, Walker TA, Lindsday HJ. The vaginal profile. Tex Med J.1968;64:56-8.
14. Kelvin FM, Maglinte DD, Hale DS, Benson JT. Female pelvic organ prolapse: a comparison of triphasic dynamic MR imaging and triphasic fluoroscopic cystocolpoproctography. AJR Am J Roentgenol.2000 Jan;174(1):81-8.
15. Bremmer S, Mellgren A, Holmström B, López A, Udén R. Peritoneocele: visualization with defecography and peritoneography performed simultaneously. Radiology.1997;202:373–7.
16. Healy JC, Halligan S, Reznek RH, Watson S, Phillips RKS, Armstrong P. Patterns of prolapse in women with symptoms of pelvic floor weakness: assessment with MR imaging. Radiology.1997;203:77–81.
17. Lienemann A, Anthuber C, Baron A, Kohz P, Reiser M. Dynamic MR colpocystorectography assessing pelvic-floor descent. Eur Radiol.1997 ;7(8):1309–17.
18. Marchionni M, Bracco GL, Checcucci V, et al. True incidence of vaginal vault prolapse. Thirteen years of experience. J Reprod Med.1999;44(8):679-84.
19. Kelvin FM, Hale DS, Maglinte DT, Patten BJ, Benson JT. Female pelvic organ prolapse: diagnostic contribution of dynamic cystoproctography and comparison with physical examination. AJR Am J Roentgenol.1999;173(1):31–7.
20. Maglinte DDT, Kelvin FM, Hale DS, Benson JT. Dynamic cystoproctography: a unifying diagnostic approach to pelvic floor and anorectal dysfunction. AJR Am J Roentgenol.1997;169(3):759–67.
21. McHugh ML. Interrater reliability: the kappa statistic. Biochem Med (Zagreb). 2012;22(3):276-82.
22. Comiter CV, Vasavada SP, Barbaric ZL, Gousse AE, Raz S. Grading pelvic prolapse and pelvic floor relaxation using dynamic magnetic resonance imaging. Urology. 1999;54(3):454-7.
23. Silva AC, Maglinte DD. Pelvic floor disorders: what's the best test? Abdom Imaging.2013;38(6):1391-408.
24. Pannu HK, Scatarige JC, Eng J. MRI diagnosis of pelvic organ prolapse compared with clinical examination. Acad Radiol.2011;18(10):1245-51.
25. Lin FC, Funk JT, Tiwari HA, Kalb BT, Twiss CO. Dynamic Pelvic Magnetic Resonance Imaging Evaluation of Pelvic Organ Prolapse Compared to Physical Examination Findings. Urology.2018;119:49-54
26. Swamy N, Bajaj G, Olliphant, SS, et al. Pelvic floor imaging with MR defecography: correlation with gynecologic pelvic organ prolapse quantification. Abdom Radiol. 2021;46(4):1381-9.
27. Pollock GR, Twiss CO, Chartier S, et al. Comparison of magnetic resonance defecography grading with POP-Q staging and Baden-Walker grading in the evaluation of female pelvic organ prolapse. Abdom Radiol. 2021 Apr;46(4):1373-80.
28. Arian A, Ghanbari Z, Pasikhani M D, et al. Agreement of manual exam (POP-Q) with pelvic MRI in assessment of anterior pelvic organ prolapse. Iran J Radiol.2017;14(4):e38542.
29. Elshazly WG, El Nekady Ael A, Hassan H. Role of dynamic magnetic resonance imaging in management of obstructed defecation case series. Int J Surg.2010;8(4):274-82.
30. Rentsch M, Paetzel C, Lenhart M, Feuerbach S, Jauch KW, Fürst A. Dynamic magnetic resonance imaging defecography: A diagnostic alternative in the assessment of pelvic floor disorders in proctology. Dis Colon Rectum. 2001;44(7):999-1007.
31. Paetzel C, Strotzer M, Fürst A, Rentsch M, Lenhart M, Feuerbach S. Dynamic MR defecography for diagnosis of combined functional disorders of the pelvic floor in proctology. Rofo.2001;173(5):410-5.
32. Pilkington SA, Nugent KP, Brenner J, et al. Barium proctography vs magnetic resonance proctography for pelvic floor disorders: a comparative study. Colorectal Dis.2012;14(10):1224-30.

33. Faucheron JL, Barot S, Collomb D, Hohn N, Anglade D, Dubreuil A. Dynamic cystocolpoproctography is superior to functional pelvic MRI in the diagnosis of posterior pelvic floor disorders: results of a prospective study. Colorectal Dis.2014;16(7): O240-7.
34. Kelvin FM, Maglinte DD. Dynamic cystoproctography of female pelvic floor defects and their interrelationships. AJR Am J Roentgenol. 1997;169(3):769-74.