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ORIGINAL ARTICLE

Symptoms of pelvic floor dysfunction are poorly correlated with findings on clinical examination and dynamic MR imaging of the pelvic floor

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Abstract
Introduction and hypothesis The aim of the study was to determine whether patients' symptoms agree with findings on clinical examination and dynamic MR imaging of the pelvic floor.
Methods Symptoms of pelvic organ dysfunction were measured with the use of three validated questionnaires. The domain scores were compared with POP-Q and dynamic MR imaging measurements. The Spearman's rank correlation coefficient (r_s) was used to assess agreement.
Results Only the domain score genital prolapse was significantly correlated in the positive direction with the degree of pelvic organ prolapse as assessed by POP-Q and dynamic MR imaging (r_s=0.64 and 0.27, respectively), whereas the domain score urinary incontinence was inversely correlated (r_s=−0.32 and −0.35, respectively).
Conclusions The sensation or visualization of a bulge in the vagina was the only symptom which correlated positively with the degree of pelvic organ prolapse, and clinical examination and dynamic MR imaging showed similar correlation in this respect.

Keywords Agreement · Magnetic resonance imaging · Pelvic organ prolapse · POP-Q · Questionnaire · Symptom

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Introduction

Pelvic organ prolapse (POP) and symptoms of pelvic organ dysfunction are both common in the general population and may occur concurrently, but independently. Therefore, a good understanding of the interrelation is of utmost importance and aids in the (preoperative) counseling of patients. The correlation between patients' symptoms and clinical staging of POP is known to be poor. Previous studies have, for example, shown little or no agreement between POP severity and symptoms of bladder and bowel dysfunction [1–7]. The only symptom which has previously shown to be well correlated with the severity of prolapse was "to see or to feel a bulge in the vagina" [1, 5, 8–12]. Furthermore, in a study on the comparison of POP-Q and ultrasound staging of prolapse, the two methods performed similar with regards to the identification of women with the sensation or visualization of a lump in the vagina [13]. Dynamic MR imaging of the pelvic floor is another potentially useful diagnostic tool in the preoperative assessment of pelvic floor dysfunction [14]. Until now, however, there are no studies available, which have assessed the agreement between measurements on dynamic MR imaging and patients' symptoms. The aim of the present study was to determine whether patients' symptoms assessed with validated questionnaires agree with staging of POP on POP-Q and dynamic MR imaging.

Materials and methods

This observational study was performed at the Radboud University Nijmegen Medical Centre, the Netherlands, from September 2005 through January 2008. The center is a national tertiary referral center for women with pelvic organ dysfunctions. Inclusion criteria were consecutive women with pelvic organ dysfunction, i.e., pelvic organ prolapse, urinary or defecatory disorders, who underwent dynamic MR imaging in the inclusion period. MR imaging was performed as part of routine clinical practice in patients with recurrent prolapse, especially in the posterior compartment, and in case the patient's complaints did not correspond with clinical findings.

The study was submitted to and deemed exempt by the local institutional review board.

Symptom assessment

Patients' symptoms were measured with the use of the disease specific quality of life questionnaires urogenital distress inventory (UDI), defecatory distress inventory (DDI), and the incontinence impact questionnaire (IIQ). The questionnaires have previously been validated for the Dutch language [15, 16]. The UDI consist of 11 items and five domains on bothersome urinary complaints. The DDI measures bothersome defecatory complaints and consists of 11 items and five domains. The IIQ consists of 13 items and measures the impact of urinary incontinence on quality of life in five domains. The score on each domain of these questionnaires ranges from 0 till 100, where 0 indicates the best quality of life and 100 indicates the poorest quality of life.

Clinical examination

Clinical assessment of POP was performed with the use of POP-Q by one out of three gynecologists experienced in the assessment of POP. In the POP-Q, nine measurement points are assessed during maximal Valsalva maneuver and in the supine lithotomy position (except the transvaginal length, which is measured at rest). Only the measurements of POP-Q points Ba, C, and Bp were used in this study. Ba is the most descended edge of the anterior vaginal wall in centimeters relative to the hymenal remnants, and C represents either the most distal edge of the cervix or the leading edge of the vaginal vault after total hysterectomy, whereas Bp is the most descended edge of the posterior vagina wall.

Dynamic MR imaging protocol

The dynamic MR imaging examination was performed with the patient in the supine position with parallel and slightly flexed legs. Patients were requested not to void for 1–2 h prior to the examination. The rectum was opacified using 100–150 ml ultrasound gel. The urethra, bladder, and vagina were not opacified. No premedication was given. MR images were acquired using a 3T MR scanner (TIM TRIO, Siemens Medical, Germany) and an eight-channel body-phased array coil. MR images were obtained in the sagittal plane using a half-Fourier acquisition single-shot turbo spin-echo sequence (2,000 ms/90 ms repetition time/echo time; 150° flip angle), with a temporal resolution of 1 s during 2 min. During the MR examination, the patient was asked to relax the pelvic floor muscles, to contract the muscles slowly, relax again, and then to increase the intraabdominal pressure and strain in order to defecate. To assure that the patient followed the instruction given, all images were viewed online on the MR console. A whirl of urine in the bladder and/or a dent into the cranial portion of the bladder, seen on the sagittal images, indicated adequate straining.

The images were analyzed at a later stage on a console with zoom facilities and electronic calipers. The observer was blinded to the patients' symptoms and the clinical findings. The midsagittal images on maximal strain were used to assess the prolapse. The pubococcygeal line was defined as a straight line between the inferior rim of the pubic bone and the last visible coccygeal joint, the H-line as a straight line between the inferior rim of the pubic bone and the posterior wall of the anal canal on the level of the impression of the puborectal sling, and the mid-pubic line as a line drawn through the longitudinal axis of the pubic bone, passing through its midequatorial point [17].

On maximum strain, the leading edge of the bladder (anterior compartment), the cervix or vaginal vault (central compartment), and the most anteriocaudal point of the anterior rectal wall or the most distal portion of the peritoneal sack containing peritoneal fat or small bowel loops (posterior compartment) was determined in centimeters perpendicular to the three reference lines.

Statistical methods

The most descended POP-Q point and the most descended measurement on dynamic MR imaging (irrespective of the compartment) were used in the analysis. Spearman's rank correlation coefficient was used to test the correlation between the different measurements, i.e., the domain scores on the questionnaires, the most descended POP-Q point, and the most descended MR imaging measurement. A Spearman's correlation coefficient of more than 0.80 denotes excellent correlation, between 0.80 and 0.60 good correlation, between 0.60 and 0.40 moderate correlation, and below 0.40 poor correlation, respectively. SPSS version 16.0 (SPSS, Inc.,Chicago, IL, USA) was used to perform

the statistical analysis. P values <0.05 were considered statistically significant.

Results

One hundred and twenty women underwent dynamic MR imaging of the pelvic floor during the study period. Sixty-nine of these women had completed the questionnaires and were included in the analysis. Sixty-six of these sixty-nine women underwent POP-Q examination. Women's baseline characteristics and clinical measurements are shown in Table 1. Ninety percent of the women had a previous history of one or more gynecological operations, i.e., a hysterectomy, POP surgery, or urinary incontinence surgery.

Tables 2, 3, and 4 show the mutual correlations between domain scores (e.g., the UDI domain scores vs. the UDI domain scores, the DDI domain scores vs. the DDI domain scores, and the IIQ domain scores vs. the IIQ domain scores). The statistical significant results of these mutual correlations had a positive direction (r_s range=0.26; 0.59), with the exception of the correlation between the domain score "genital prolapse" with the domain score "urinary incontinence" (r_s=−0.42). This negative correlation can be explained by the fact that more severe POP may result in a decrease of urinary incontinence symptoms due to more obstruction.

The statistical significant correlation between the most descended POP-Q point with the most descended measurement on dynamic MR imaging was r_s=0.39. The statistical significant correlations between the three reference lines, e.g., the most descended measurement in relation to the pubococcygeal line vs. the H-line, the pubococcygeal line vs. the mid-pubic line, and the H-line vs. the mid-pubic line were r_s=0.94, r_s=0.79, and r_s=0.83, respectively. For the ease of presentation, the results in Table 5 are shown in relation to the pubococcygeal line only. In view of the high correlations, however, the results apply to the two other reference lines as well.

Table 5 shows the Spearman's correlation between the domain scores of the questionnaire with the most descended POP-Q point and with the most descended measurement on dynamic MR imaging in relation to the pubococcygeal line, respectively. The correlations were mostly negative and only moderate to poor. The domain scores "obstructive micturition", genital prolapse, and "physical functioning" correlated statistically significant with the most descended POP-Q point in the positive direction (r_s=0.35, 0.64, and 0.36, respectively), as did the domain score genital prolapse with the most descended MR imaging measurement (r_s= 0.27). The strongest correlations were between the UDI domain score genital prolapse and the most descended

Table 1 Characteristics of the women included in the study (n=69)

	Values
Baseline characteristics	
Age (years)	54 (31; 75)
BMI (kg/m^2)	26 (20; 36)
Parity[a]	2 (1; 6)
Number of previous gynecological operations[a]	
None	7 (10%)
1 or 2 operations	22 (32%)
≥3 operations	40 (58%)
Types of gynecological surgery[a]	
POP surgery	34 (49%)
Urinary incontinence surgery	16 (23%)
Hysterectomy	39 (57%)
Clinical measurements	
POP-Q (cm)	
Ba	−2 (−3; +4)
C	−6 (−9; +3)
Bp	0 (−3; +4)
Most descended point	0 (−3; +4)
MRI, most descended (cm)	
PCL	0.4 (−1.2; 2.5)
H-line	0.5 (−1.2; 2.6)
MPL	0.6 (−1.6; 2.9)
UDI	
Overactive bladder	33.3 (0; 100.0)
Urinary incontinence	16.7 (0; 100.0)
Obstructive micturition	16.7 (0; 100.0)
Discomfort/pain	33.3 (0; 100.0)
Genital prolapse	33.3 (0; 100.0)
DDI	
Constipation	16.7 (0; 100.0)
Obstructed defecation	16.7 (0; 83.3)
Pain	0.0 (0; 100.0)
Incontinence	16.7 (0; 100.0)
Flatulence	33.3 (0; 100.0)
IIQ	
Physical functioning	33.3 (0; 100.0)
Mobility	38.9 (0; 100.0)
Social function	22.2 (0; 88.9)
Embarrassment	16.7 (0; 100.0)
Emotional health	33.3 (0; 100.0)

n number of patients, *BMI* body mass index, *POP-Q* pelvic organ prolapse (quantification), *cm* centimeters relative to the hymen, *Ba* most descended edge of the anterior vaginal wall on strain, *C* most descended edge of the cervix or vaginal vault on strain, *Bp* most descended edge of the posterior vagina wall on strain, *MRI* magnetic resonance imaging, *PCL* pubococcygeal line, *MPL* mid-pubic line, *UDI* urogenital distress inventory, *DDI* defecatory distress inventory, *IIQ* incontinence impact questionnaire

[a] Data presented as median (range) or number of patients

Table 2 The mutual correlation of the urogenital distress inventory domain scores

	Overactive bladder		Urinary incontinence		Obstructive micturition		Discomfort/pain		Genital prolapse	
	n	r_s	*n*	r_s	*n*	r_s	*n*	r_s	*n*	r_s
Overactive bladder	60	1.00	60	0.41[a]	60	0.45[a]	58	0.47[a]	57	0.06
Urinary incontinence			63	1.00	63	−0.06	61	0.28[b]	60	−0.42[a]
Obstructive micturition					65	1.00	63	0.26[b]	62	0.39[a]
Discomfort/pain							67	1.00	63	0.28[b]
Genital prolapse									65	1.00

n number of patients, r_s Spearman's rank correlation coefficient

[a] Correlation is significant at the 0.01 level (two-tailed)

[b] Correlation is significant at the 0.05 level (two-tailed)

POP-Q point (r_s=0.64) and between the DDI domain score "flatulence" and IIQ domain score "embarrassment" and the most descended MR imaging measurement (r_s=−0.41 and −0.47).

Discussion

This observational study is, to our knowledge, the first report on the agreement between patients' symptoms as assessed with validated questionnaires and findings on dynamic MR imaging of the pelvic floor. These results were offset against the agreement between patients' symptoms and POP-Q findings. In view of the low correlations, dynamic MR imaging of the pelvic floor is not likely to have an additional value in the prediction of symptoms, and clinical examination can thus be regarded as the golden standard. As confirmed by previous studies, to see or to feel a bulge in the vagina was the only symptom that correlated well with the degree of POP [1, 5, 8–12].

Our findings are of utmost importance in the counseling of POP patients and the discussion on patient's expectations. Patients with symptoms other than the sensation or visualization of a bulge in the vagina need to be informed that their symptoms might not be a direct result of the POP. Consequently, it is unclear to what degree these symptoms improve following surgical treatment.

More severe POP may result in a decrease of urinary incontinence symptoms due to more obstruction. Although there are some previous studies that support this theory [2, 5], others have reported that urinary incontinence symptoms were not associated with the degree of POP [1, 6, 9, 10]. In the present study, however, the relationship between more severe prolapse and urinary incontinence was reflected in the inversed correlations between more bother on the domain score urinary incontinence and genital prolapse, as well as the domain score urinary incontinence and more severe POP on MR imaging and clinical examination. Less incontinence at higher prolapse stages was also demonstrated in the inversed correlation between several domain scores of the IIQ with the degree of POP. As expected, these impact scores had a statistically significant positive correlation with the domain score urinary incontinence of the UDI.

Table 3 The mutual correlation of the defecatory distress inventory domain scores

	Constipation		Obstructed defecation		Pain		Incontinence		Flatulence	
	n	r_s	*n*	r_s	*n*	r_s	*n*	r_s	*n*	r_s
Constipation	65	1.00	64	0.56[a]	64	0.55[a]	63	−0.15	63	−0.14
Obstructed defecation			65	1.00	63	0.51[a]	64	0.02	64	0.05
Pain					65	1.00	63	0.00	63	0.08
Incontinence							66	1.00	65	0.49[a]
Flatulence									66	1.00

n number of patients, r_s Spearman's rank correlation coefficient

[a] Correlation is significant at the 0.01 level (two-tailed)

[b] Correlation is significant at the 0.05 level (two-tailed)

Table 4 The mutual correlation of the incontinence impact questionnaire domain scores

	Physical functioning		Mobility		Social function		Embarrassment		Emotional health	
	n	r_s	*n*	r_s	*n*	r_s	*n*	r_s	*n*	r_s
Physical functioning	65	1.00	64	0.35[a]	60	0.43[a]	62	0.00	65	0.24
Mobility			66	1.00	62	0.51[a]	63	0.46[a]	66	0.48[a]
Social function					62	1.00	59	0.39[a]	62	0.58[a]
Embarrassment							64	1.00	64	0.59[a]
Emotional health									67	1.00

n number of patients, r_s Spearman's rank correlation coefficient

[a] Correlation is significant at the 0.01 level (two-tailed)

[b] Correlation is significant at the 0.05 level (two-tailed)

The main question remains why the degree of POP correlates so poorly with various patients' complaints, with the exception of the question on to see or to feel a bulge in the vagina. It might be partly due to the fact that POP and pelvic floor dysfunctions are both very common disorders. Our results suggest that bladder and bowel dysfunctions coexist without a causal relation to the degree of prolapse.

Table 5 Spearman's correlation between questionnaire domain scores and the most descended POP-Q point and the most descended measurement on dynamic MR imaging

		POP-Q		MR imaging[a]	
		n	r_s	*n*	r_s
UDI	Overactive bladder	58	−0.06	60	−0.17
	Urinary incontinence	61	−0.32[b]	63	−0.35[c]
	Obstructive micturition	62	0.35[c]	67	0.07
	Discomfort/pain	64	0.24	65	−0.01
	Genital prolapse	62	0.64[c]	65	0.27[b]
DDI	Constipation	62	0.00	65	−0.03
	Obstructed defecation	62	0.05	65	−0.05
	Pain	62	−0.04	65	−0.08
	Incontinence	63	−0.11	66	−0.25[b]
	Flatulence	63	−0.02	66	−0.41[c]
IIQ	Physical functioning	62	0.36[c]	65	0.06
	Mobility	63	−0.16	66	−0.27[b]
	Social function	59	0.00	62	−0.15
	Embarrassment	61	−0.25[b]	64	−0.47[c]
	Emotional health	64	−0.18	67	−0.33[c]

POP-Q pelvic organ prolapse-quantification, *MR* magnetic resonance, *n* number of patients, r_s Spearman's rank correlation coefficient, *UDI* urogenital distress inventory, *DDI* defecatory distress inventory, *IIQ* incontinence impact questionnaire

[a] Measurements in relation to the pubococcygeal line

[b] Statistically significant at the 0.05 level (two-tailed)

[c] Statistically significant at the 0.01 level (two-tailed)

In the present, study we report on the agreement of symptoms with the most descended edge of prolapse. We did, however, analyze the data on the agreement between symptoms and the descent in each compartment separately. Overall, this resulted in even poorer correlations between pelvic floor dysfunctions and cystocele, uterine descent/vaginal vault prolapse, or rectocele separately. In other words, there are no specific symptoms related to the descent in the different compartments.

In dynamic MR imaging, various reference lines may be used to stage POP [17]. The preferable reference line is, however, a subject of ongoing debate [17, 18]. In the present study, there was a good to excellent mutual correlation between the MR imaging measurements in relation to the three different reference lines. This shows that the differences between the reference lines are only minor and either choice for a reference line seems correct. We choose to present the results for the pubococcygeal line since this is the most widely used reference line, and the measurements previously showed good reproducibility [18]. The results hold true, however, for the other reference lines as well.

The results of our study may have been influenced by the tertiary referral patient population, which consisted of 62 women (90%) who had at least one previous operation for POP or urinary incontinence. In this specific patient population, the evaluation of symptoms in relation to POP stages may be more complex, regardless of the modality used. Until now, it is unclear to what extent our results apply to other populations as well, such as to women without previous surgery.

In conclusion, to see or to feel a bulge in the vagina was the only symptom that correlated with the degree of POP. In comparison with clinical examination, dynamic MR imaging had no additional value in the prediction of symptoms with increasing degree of POP. However, the fast majority of the included women had previous one or more pelvic surgical procedure(s). The conclusions may therefore not be the same to naive patients.

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Conflicts of interest None.

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