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ORIGINAL ARTICLE

Measuring the impact of a posterior compartment procedure on symptoms of obstructed defecation and posterior vaginal compartment anatomy

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Abstract
Introduction and hypothesis We hypothesized that there would be a significant difference in changes in obstructed defecation symptoms and posterior compartment prolapse between women who underwent posterior vaginal wall prolapse repair (PR) and those who did not.
Methods This was a two-site prospective cohort study of women undergoing prolapse or incontinence surgery in which a PR was, or was not, performed at the discretion of the surgeon. Women were assessed using validated obstructed defecation questionnaires and standardized examination measures (including POP-Q, measurement of transverse gh, and assessment for a rectovaginal pocket and laxity) prior to pelvic surgery and 12 weeks after surgery.
Results Of 68 women who underwent surgery, 43 had PR. The PR group had higher obstructed defecation symptoms and greater posterior compartment prolapse at baseline. At 12 weeks, obstructed defecation symptoms had improved significantly more in the PR group than in the no PR group (all $p<0.03$). Anatomic outcomes showed greater improvement in point Bp in the PR group (−3.4 vs. −0.7 no PR, $p<0.001$) and resolution of the rectovaginal pocket (86 % vs. 42 %, $p=0.002$). There were no significant changes in obstructed defecation symptoms or anatomic outcomes from baseline in the no PR group, while the PR group showed significantly improved obstructed defecation symptoms and anatomic outcomes after repair ($p<0.001$ for both).
Conclusions Significant improvements in obstructed defecation symptoms and posterior compartment prolapse were seen after PR, but not in women who did not receive PR. Obstructed defecation symptoms, Bp and rectovaginal pocket were the measures best able to demonstrate improvement after PR. We recommend the use of these measures to assess the impact of surgery in the posterior compartment.

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Keywords Anatomic measures · Obstructed defecation · Posterior repair · Rectocele · Symptom measures

Introduction

Posterior vaginal compartment prolapse can be due to various etiologies including a weakened posterior vaginal wall from aging or childbirth or connective tissue disorders, damage to levator ani muscles, nerve stretch injury from childbirth, and apical descent. Posterior compartment prolapse can take the form of rectocele, enterocele, and/or perineal descent. This posterior compartment prolapse occurs in up to 18 % of

women, and is anticipated to be a major reason for prolapse surgery as the population ages [1, 2]. Defecatory dysfunction is a heterogeneous disorder that encompasses any difficulty with passing stool, excluding anal incontinence. It is likely associated with anatomic abnormalities in the posterior compartment [3]. Unfortunately, little consensus exists as to which symptoms are related specifically to posterior compartment prolapse, though limited evidence suggests correlations between presence of posterior compartment prolapse and incomplete emptying, disimpaction, splinting, "digitation", and straining [4–8]. Together, these symptoms likely represent a subset of defecatory dysfunction related to obstructed defecation. We believe that obstructed defecation symptoms (represented by splinting, digitation, straining and incomplete emptying) may be specifically related to posterior compartment prolapse. However, which of these symptoms can be expected to improve with treatments is unclear, making patient counseling a challenge. Reliable measures that describe the severity of obstructed defecation symptoms and posterior compartment prolapse as well as measures that respond to intervention are needed to evaluate and treat symptomatic posterior compartment prolapse. Once these outcome measures have been established, well-designed randomized controlled trials can be performed to investigate the best surgical treatments to restore the anatomy and function of the posterior vaginal compartment.

The main objective of this study was to assess the ability of previously studied symptom-based and anatomic measures to discriminate women with clinically significant posterior compartment prolapse that improves after prolapse repair (PR) [4]. We hypothesized that there would be a significant difference in changes in obstructed defecation symptoms and posterior compartment prolapse between women who underwent PR and those who did not have PR. We aimed to demonstrate optimal measures for identifying clinically significant posterior compartment prolapse that will benefit from PR.

Materials and methods

This was an IRB-approved observational prospective cohort study conducted at the University of California San Diego and Kaiser Permanente San Diego Female Pelvic Medicine Clinics between July 2010 and February 2012. The data presented here represent a planned substudy of patients who had surgery as part of a larger, previously published study [4]. A convenience sample of English-speaking women over the age of 18 years, with pelvic floor dysfunction (with or without prolapse, and with or without obstructed defecation), in whom surgery for any pelvic floor dysfunction was planned (including anterior and posterior colporrhaphy, apical suspensions, incontinence procedures) were screened for eligibility, and written informed consent was obtained from participants. Women who had not completed child-bearing, women who had a history of pelvic malignancy, pelvic irradiation, colorectal surgery (except hemorrhoidectomy) or neurologic disease (such as spinal cord injury, multiple sclerosis, cerebral vascular accident, etc.), and women with any limitation to their expected ability to comply with the follow-up requirements were excluded.

Our previous work explored interrater and intrarater reliability of multiple symptom-based and anatomic measures of the posterior compartment and showed a significant, although weak, correlation between symptoms of obstructed defecation and posterior compartment prolapse prior to surgery [4]. These measures were included in this study (Table 1). The current study included those subjects who underwent pelvic floor surgery for incontinence and/or prolapse. Subjects were grouped into those who did versus those who did not have a PR.

Symptom-based and anatomic measures were obtained at baseline, and 6 and 12 weeks postoperatively. Symptom-based measures included a series of validated questionnaires commonly used to assess obstructed defecation and pelvic floor dysfunction: the short form of the Pelvic Floor Distress Inventory (PFDI), the Obstructed Defecation Syndrome (ODS) questionnaire, and the Bristol Stool Scale [5–7]. A subscale of the PFDI was calculated using questions 4, 7, and 8 referring to splinting, straining, and incomplete emptying, respectively. The responses to these three questions were summed to a maximum score of 12. We refer to these three questions collectively as the PFDI-Obstructed (PFDI-O), to represent obstructed defecation. The ODS questionnaire is a validated, disease-specific, scoring system commonly used in the colorectal literature, which measures constipation severity, specifically outlet obstruction [6]. It has not been widely used or studied in the urogynecology literature.

Anatomic measures included standard POP-Q evaluation and supplemental anatomic measures of the posterior compartment explored in our previous work including measurements of "transverse gh" (the maximum transverse diameter of the genital hiatus during straining), rectovaginal "pocket" (presence of a pocket along the posterior vaginal wall during digital rectal examination), and rectovaginal "laxity" (subjective presence of posterior wall laxity past the hymen during digital rectal examination; see Table 1) [4].

The decision whether or not to perform a posterior repair was determined by the surgeon in an informed decision-making process with the patient. There was no standardized approach among the surgeons as to whether or not a PR was to be performed; rather each surgeon assessed each individual patient's symptoms and anatomy and tailored the surgical approach to each patient.

Open source statistical software R (version 2.14.2) was used for data analysis. Continuous variables are summarized as means and standard deviations. Ordinal variables are

Table 1 Outcome measures studied

Measures	Range
Symptom-based	
PFDI (Pelvic Floor Distress Inventory)	0 – 300
CRADI (Colorectal Anal Distress Inventory subscale of the PFDI)	0 – 100
PFDI-O (sum of PFDI questions 4, 7, 8	0 – 12
PFDI 4 (splinting)	0 – 4
PFDI 7 (straining)	0 – 4
PFDI 8 (incomplete emptying)	0 – 4
ODS (Obstructed Defecation Syndrome questionnaire)	0 – 31
ODS 1 (mean time spent at toilet to defecate)	0 – 4
ODS 2 (number of attempts to defecate per day)	0 – 4
ODS 3 (frequency of anal/vaginal digitation "splinting")	0 – 4
ODS 4 (frequency of laxative use)	0 – 4
ODS 5 (frequency of enema use)	0 – 4
ODS 6 (frequency of incomplete/fragmented defecation)	0 – 4
ODS 7 (percent of straining at defecation)	0 – 4
ODS 8 (stool consistency)	0 (soft), 1 (hard), 2 (hard and few), 3 (fecaloma)
Anatomic	
POP-Q points (Bp, Ap, gh ± pb)	–
Transverse gh (maximum transverse diameter of genital hiatus during strain in centimeters)	–
Pocket (subjective presence of a pocket along the posterior vaginal wall during digital rectal examination: yes/no)	–
Laxity (subjective presence of posterior wall laxity past the hymen during digital rectal examination: yes/no)	–

summarized as medians with ranges. Subjects who underwent surgery were grouped by whether they had a PR as described above and the following analysis was performed. First, baseline measures, changes from baseline to 6 weeks, and changes from baseline to 12 weeks were compared between the two groups using the two-sample *t* test, Wilcoxon test, Fisher's exact test, and proportional odds models as appropriate. Due to the observational nature of these comparisons (i.e. nonrandomized), baseline measurements that were unbalanced between the groups were also adjusted for. Longitudinal outcomes at 6 and 12 weeks were jointly analyzed using marginal models (linear, logistic, or proportional odds as appropriate) and the generalized estimating equations method, while adjusting for the baseline measure of the particular outcome under consideration. Within each surgical group the changes from baseline to 6 and 12 weeks, respectively, were analyzed using the paired *t* test, one-sample Wilcoxon test, and McNemar's test as appropriate. Finally, the changes in symptom scores and the changes in anatomy were correlated at 12 weeks using Spearman's and Pearson's correlation coefficients.

A post-hoc power analysis of the between-group and within-group analyses was performed. For the between-group analyses, with group sizes of 42 and 23, we expected to have at least 80 % power to detect an effect size (ratio of the difference in mean changes to the common standard deviation) of 0.74 or larger when using the two-sample *t* test or Wilcoxon test. For the between-group analyses requiring the two-sample *t* test with equal variances, with a significance level of 0.05 and group sizes of 42 and 23, we expected to have at least 80 % power to detect an effect size of 0.738 or larger. For the within-group analysis, with a group size of 42, we expected to have at least 80 % power to detect an effect size of 0.44 or larger; if the group size were 23, the minimum detectable effect size was 0.61. For the within-group analyses requiring the paired *t* test, with a significance level of 0.05 and a group size of 42, we expected to have at least 80 % power to detect an effect size of 0.443 or larger; if the group size were 23, the minimum detectable effect size was 0.61.

Results

The mean age of the 68 subjects included in this analysis was 58.6 ± 11.8 years and 90 % were Caucasian. The main presenting complaints were bulge/prolapse in 78 %, and defecatory dysfunction in 10 %. The median number of bowel movements per week was 7. The median Bristol stool scale

score was 3, which is stool described as "like a sausage, but with cracks on its surface". Pelvic surgery had been performed in 40 % of patients, including posterior repair 6 %, apical suspension in 3 %, anterior repair in 15 % and hysterectomy in 37 % (includes concomitant procedures). Over half of the subjects (59 %) reported at least moderate bother from at least one obstructed defecation symptom. Specifically, 37 % reported splinting, 42 % straining, and 46 % incomplete emptying as measured by the PFDI. The full range of posterior compartment prolapse was seen in this group with a median descent (Bp) of −0.5 cm (range −3 to +9). Posterior compartment prolapse at or beyond the hymen (Bp ≥0) was found in 49 (41 %) and about one quarter 31 (26 %) had posterior compartment prolapse past the hymen (Bp >0). Of the 68 women, 43 had PR: 29 % had a concomitant hysterectomy (48 % in the no PR group and 19 % in the PR group, $p = 0.022$), 40 % had anterior compartment surgery ($p = 0.212$), and 49 % had apical surgery (68 % in the no PR group and 37 % in the PR group, $p = 0.028$).

Women with and without PR were compared at baseline (Table 2). Demographics were similar in the two the groups. As expected, there were baseline differences in symptoms and anatomy between the groups. Subjects who underwent a PR were more likely to be bothered from obstructed defecation symptoms. They reported higher bother from splinting and straining and increased frequency of splinting (PFDI 4, PFDI 7, and ODS 3, as well as higher scores on the scale sums PFDI-O and ODS total). The PR group had greater posterior compartment prolapse than the no PR group as measured by point Bp (0.6 vs. −1.0 cm, $p = 0.003$) and posterior wall laxity demonstrated on clinical examination (93 % vs. 72 %, $p = 0.03$)

We examined how each of these measures changed after surgical intervention comparing those with and without PR surgery. The results between 6 and 12 weeks were similar (data not shown); thus we report baseline and 12-week data in Table 3. At 12 weeks, bother from most obstructed defecation symptoms was significantly improved in women who underwent a PR compared to those who did not (CRADI, PFDI-O, PFDI 4, PFDI 7, PFDI 8, ODS total, ODS 2, and ODS 3). Similarly, anatomic measures of posterior compartment prolapse were also significantly improved in the PR group (Bp, Ap, pocket, and laxity). Due to baseline differences between the surgical groups, we adjusted for the baseline measurements and other covariates in regression

models, and only the anatomic measures (Bp, Ap, pocket, and laxity) remained significantly different between the two groups at 12 weeks. This implies that the difference in changes in symptom measures were largely due to the imbalance at baseline; at 12 weeks the two surgical groups became more comparable in these measures. Longitudinal analyses (using both 6 and 12 week data) reinforced these findings by similarly demonstrating significant differences in improvement in bother from splinting, straining, and incomplete emptying (PFDI-O, PFDI 7, PFDI 8, ODS total) and in anatomic measures of the posterior wall (Bp, Ap, gh + pb, pocket, and laxity; data not shown). Using a model selection algorithm to adjust all analyses of the outcomes in relation to the baseline measures, confirmed that Bp, posterior vaginal wall pocket and laxity were significantly improved in the PR group compared with the no PR group (data not shown).

In the within-group analyses assessing change from baseline to 12 weeks, the PR group showed significant improvement on most of the obstructed defecation measures (PFDI-O, PFDI 4, PFDI 7, PFDI 8, ODS total, ODS 1, ODS 2, ODS 3, ODS 6, ODS 7, ODS 8). The subjects who did not have a PR only showed a significant improvement in the frequency of incomplete or fragmented defecation (ODS 6). As expected, the PR group demonstrated significant improvement in all the anatomic measures over 12 weeks. Interestingly, the group that did not have PR also showed improvement in measures of posterior compartment anatomy including Ap, gh + pb, transverse gh, perineal body with straining, and laxity of the posterior vaginal wall. We suspected that this was due to concomitant apical procedures [8]. Thus, a subanalysis of the six subjects in the no PR group who did not have an apical repair (i.e. purely an anterior compartment repair or incontinence surgery) demonstrated improvement in collective bowel symptoms (CRADI) at 12 weeks, but not in obstructed defecatory symptoms (PFDI-O or Total ODS). Further, no improvement was shown in any of the above measures of posterior compartment anatomy except transverse gh (data not shown). Thus, obstructed defecation symptoms and posterior compartment prolapse did improve after PR and apical repairs, but not in women without PR.

Finally, we correlated the change in each obstructed defecation symptom with the change in each anatomical measure from baseline to 12 weeks, and the only clinically meaningful correlation ($r > 0.5$) was between frequency of splinting (ODS 3) and improved Bp ($r = 0.5$, CI 0.13 – 0.86). Other statistically significant correlations were between Bp and PFDI-O ($r = 0.391$, $p = 0.002$) and between Ap and PFDI-O ($r = 0.351$, $p = 0.007$).

Discussion

We conducted this study in order to identify the best outcome measures for use in the study of surgical treatment of symptomatic posterior compartment prolapse. From a variety of obstructed defecation symptoms and posterior compartment anatomy measures, measures of obstructed defecation, most notably the PFDI-O (questions 4, 7, and 8 summed and

Table 2 Baseline demographics, concomitant surgical procedures, symptoms, and anatomy

		Entire cohort ($n = 68$)	PR group ($n = 43$)	No PR group ($n = 25$)	p value
Demographics					
Age (years), mean (SD		58.6 (11.8)	59.9 (10.9)	56.3 (13.1)	0.25[b]
Parity, median (range)		2 (0 – 5)	2 (0 – 5)	2 (0 – 5)	0.140[c]
Race, *n* (%)	Caucasian	61 (90)	40 (93)	21 (84)	0.26[d]
	Hispanic	5 (7)	3 (7)	2 (8)	
	Asian	2 (3)	0 (0)	2 (8)	
Presenting complaints, *n* (%)[a]	Prolapse/bulge	53 (78)	34 (79)	19 (76)	0.99[d]
	Defecatory dysfunction	18 (26)	6 (14)	1 (4)	0.25[d]
	Urinary incontinence	7 (10)	11 (26)	7 (28)	0.95[d]
	Fecal incontinence	1 (1)	0 (0)	1 (4)	0.37[d]
	Recurrent UTIs	1 (1)	1 (2)	0 (0)	1.00[d]
Bowel movements per week, median (range)		7 (1 – 50)	7 (1 – 50)	7 (2 – 21)	0.352[c]
Bristol Stool Scale score, median (range)		3 (1 – 7)	3 (1 – 6)	4 (1 – 7)	0.364[c]
Previous prolapse repair, *n* (%)		6 (5)	4 (6)	2 (3)	1.00[d]
Previous hysterectomy, *n* (%)		25 (37)	17 (40)	8 (32)	0.718[d]
Concomitant procedures, *n* (%)					
Hysterectomy		20 (29)	8 (19)	12 (48)	**0.022**[d]
Anterior compartment surgery		27 (40)	20 (47)	7 (28)	0.212[d]
Posterior compartment surgery		43 (68)	43 (100)	0 (0)	**0.001**[d]
Apical prolapse surgery		32 (49)	16 (37)	17 (68)	**0.028**[d]
Incontinence surgery		31 (46)	18 (42)	13 (52)	0.578[d]
Symptom-based measures					
CRADI, mean (standard deviation)		34.7 (21.6)	36.9 (22.4)	31 (20)	0.27[b]
PFDI	PFDI-O, mean (SD)	6.46 (4.07)	7.35 (3.93)	4.92 (2.93)	**0.017**[b]
			7 (4)	5 (4)	**0.02**[c]
	PFDI 4, median (range)	2 (0 – 4)	2 (0 – 4)	1 (0 – 4)	**0.02**[e]
	PFDI 7, median (range)	2 (0 – 4)	3 (0 – 4)	2 (0 – 4)	**0.04**[e]
	PFDI 8, median (range)	3 (0 – 4)	3 (0 – 4)	2 (0 – 4)	0.12[e]
ODS	Total, mean (SD)	8.1 (5.2)	9.0 (5.6)	6.5 (4.1)	**0.048**[b]
	ODS 1, median (range)	0 (0 – 2)	0 (0 – 2)	0 (0 – 2)	0.69[e]
	ODS 2, median (range)	1 (0 – 4)	1 (0 – 4)	1 (0 – 2)	0.07[e]
	ODS 3, median (range)	2 (0 – 4)	2 (0 – 4)	0 (0 – 4)	**0.003**[e]
	ODS 4, median (range)	0 (0 – 4)	0 (0 – 4)	0 (0 – 4)	0.33[e]
	ODS 5, median (range)	0 (0 – 1)	0 (0 – 1)	0 (0 – 1)	NA
	ODS 6, median (range)	3 (0 – 4)	3 (0 – 4)	2 (0 – 4)	0.90[e]
	ODS 7, median (range)	1 (0 – 4)	1 (0. 4)	1 (0 – 4)	0.40[e]
	ODS 8, median (range)	0 (0 – 2)	1 (0 – 2)	0 (0 – 2)	0.19[e]
Anatomic measures					
Bp, median (range)		0 (−3 – 9)	0 (−2 – 9)	−2 (−3 – 6)	**0.003**[b]
Ap, median (range)		0 (−3 – 3)	0 (−2 – 3)	−2 (−3 – 3)	**<0.001**[b]
C, median (range)		−5 (−9 – 9)	−5.5 (−9 – 9)	−4 (−6 – 7)	**0.02**[b]
Gh + pb, median (range)		8 (4 – 12)	8.5 (5.5 – 12)	8 (4 – 11)	0.08[b]
Transverse gh, median (range)		2.5 (0 – 6)	2 (0 – 6)	3 (0.5 – 4)	0.44[b]
Perineal body with straining, median (range)		2 (0 – 4)	2 (0 – 4)	2 (0 – 4)	0.96[b]
Rectovaginal pocket, *n* (%)		60 (88)	40 (93)	20 (80)	0.13[d]
Rectovaginal laxity, *n* (%)		58 (85)	40 (93)	18 (72)	**0.03**[d]

NA not applicable

p values in bold are statistically significant (<0.05)

[a] An individual patient may have presented with more than one complaint

[b] *t* test

[c] Wilcoxon test

[d] Fisher's Exact test

[e] McNemar's test

separately), POP-Q point Bp, and evidence of pocket of the posterior vaginal wall on digital rectal examination, were found to be the most responsive measures as they demonstrated significant improvement in the PR group compared with the no PR group (between-group analysis) and only showed improvement in the PR group (within-group analysis). The change in obstructed defecation symptoms (frequency of splinting, PFDI-O) and anatomy measures (Bp and Ap) were weakly to moderately correlated. Despite this moderate correlation they detected the most change after intervention.

There are few studies that have rigorously evaluated the effect of PR on obstructed defecation symptoms specifically using validated or standardized questionnaires specific for obstructed defecation (as opposed to general bowel symptoms

Table 3 Comparison of change in symptom-based and anatomic measures at 12 weeks between and within the no posterior compartment repair and posterior compartment repair group

Measure[a]		Change from baseline to 12 week		*p* value		
		PR repair ($n=42$[b])	No PR repair ($n=23$[c])	Between-group analysis	Within-group analysis	
					PR repair ($n=42$)[a]	No PR repair ($n=23$)[b]
Symptom-based measures						
CRADI, mean (SD)		−25 (22)	−13 (20)	0.02[d]	<0.001[d]	0.006[d]
PFDI-O	**PFDI-O**, mean (SD)	−6 (4)	−2 (5)	0.003[d]	<0.001[d]	0.06[d]
	PFDI 4, median (range)	−2 (−4 – 1)	0 (−4 – 2)	0.03[e]	<0.001[e]	0.05[e]
	PFDI 7, median (range)	−2 (−4 – 1)	0 (−4 – 4)	0.04[e]	<0.001[e]	0.32[e]
	PFDI 8, median (range)	−2 (−4 – 2)	0 (−3 – 4)	0.001[e]	<0.001[e]	0.27[e]
ODS	Total, mean (SD)	−4.9 (5.4)	−1.6 (3.2)	0.007[d]	<0.001[d]	0.04[d]
	ODS 1, median (range)	0 (−2 – 1)	0 (−2 – 1)	0.42[e]	0.008[e]	0.49[e]
	ODS 2, median (range)	−1 (−3 – 1)	0 (−1 – 1)	0.03[e]	0.03[e]	0.59[e]
	ODS 3, median (range)	−1 (−4 – 2)	0 (−3 – 4)	<0.001[e]	<0.001[e]	0.79[e]
	ODS 4, median (range)	0 (−4 – 4)	0 (−2 – 1)	0.82[e]	0.61[e]	0.19[e]
	ODS 5, median (range)	0 (−1 – 0)	0 (0 – 0)	NA	NA	NA
	ODS 6, median (range)	−1 (−4 – 2)	0 (−4 – 1)	0.33[e]	<0.001[e]	0.004[e]
	ODS 7, median (range)	0 (−3 – 1)	0 (−3 – 3)	0.42[e]	<0.001[e]	0.27[e]
	ODS 8, median (range)	0 (−2 – 1)	0 (−2 – 2)	0.16[e]	0.007[e]	0.24[e]
Anatomic measures						
Bp, mean (SD)		−3.4 (2.1)	−0.7 (1.8)	<0.001[d]	<0.001[d]	0.08[d]
Ap, mean (SD)		−3.0 (1.1)	−0.5 (0.8)	<0.001[d]	<0.001[d]	0.02[d]
Gh + pb, mean (SD)		−0.8 (1.9)	−1.1 (1.3)	0.41[d]	0.02[d]	<0.001[d]
Transverse gh, mean (SD)		−1.1 (1.0)	−1.1 (1.0)	0.94[d]	<0.001[d]	<0.001[d]
Perineal body with straining, mean (SD)		−0.67 (1.1)	−0.7 (0.9)	0.94[d]	<0.001[d]	0.005[d]
Rectovaginal pocket		Resolved: 65 % No change: 35 % New: 0 %	Resolved: 37 % No change: 53 % New: 11 %	0.03[f]	<0.001[g]	0.10[g]
Rectovaginal laxity		Resolved: 86 % No change: 14 % New: 0 %	Resolved: 42 % No change: 3 % New: 5 %	0.002[f]	<0.001[g]	0.02[g]

NA not applicable

[a] Outcome measures in bold type are those that show a significant difference between groups and within the posterior repair group, and not in the no posterior repair group

[b] Sample size may be as low as 24 due to missing data

[c] Sample size may be as low as 18 due to missing data

[d] Two-sample or paired *t* test

[e] Two-sample or one Wilcoxon test

[f] Fisher's Exact test

[g] McNemar's test

such as anal incontinence and "constipation"). Our findings are consistent with the existing literature demonstrating that PR improves posterior compartment anatomy, and bowel symptoms, most often evacuation, constipation, straining, incomplete emptying, and fecal incontinence [9–15]. This is in contrast to the findings of one study that showed a worsening of bowel symptoms including splinting, digitation, and incontinence [5]. Our study is unique in that we sought to determine the optimal measure of improvement in obstructed defecation symptoms and anatomy by exploring a wider variety of outcomes than have been previously evaluated for reproducibility.

The strengths of our study included the prospective study design, diverse patient population, and that interrater and intrarater reliability testing was performed first to ensure that our outcome measures were reproducible [4]. Weaknesses included the nonrandomized study design and thus the PR and no PR group had inherent differences and surgeon bias, and knowledge of anatomy and symptoms likely played a distinct role in the decision to perform PR. Further, our sample size was small and our follow-up was short at 12 weeks. We also had some missing data, although the rate was not greater than 30 %. A small number of our patients (six) that did not have an apical repair or PR (i.e., only an anterior repair or incontinence surgery). It was interesting that we did not note any improvement in obstructed defecation symptoms or posterior compartment anatomy in this group, suggesting

that concomitant apical procedures with or without a PR may improve symptoms and anatomy. This is in agreement with the findings of a subanalysis of the E-CARE trial showing that obstructed defecation symptoms may improve after abdominal sacral colpopexy regardless of PR, and with the findings of a large retrospective study of abdominal sacral colpopexy with and without PR demonstrating improved posterior compartment prolapse anatomy and improved obstructed defecation symptoms regardless of PR [16, 17]. Further studies exploring the impact of apical repair on obstructed defecation symptoms and posterior compartment anatomy are warranted.

While we do not suggest using these measures as the sole screening tool to determine which patients would benefit from a PR, we do feel that these posterior compartment defect symptoms and anatomy are likely to improve after PR in those women who exhibit them. In order to evaluate these measures as a screening test we would have to calculate sensitivity and specificity, but this is difficult as we did not have any controls who did not undergo surgery (true negatives) in our study. Despite our previous work that suggested only a weak link between existing measures of obstructed defecation and posterior compartment prolapse at baseline, it does appear that PR can improve anatomy and symptoms in the posterior compartment in patients with obstructed defecation and posterior bulge symptoms at baseline [4]. PFDI-O and Bp demonstrated the greatest improvement after PR and only within the PR group. Although many potential instruments are available for the assessment of anatomy and function of the posterior compartment, we recommend the use of PFDI-O (questions 4, 7, and 8 of the PFDI), point Bp, and presence of a rectovaginal pocket as the most responsive outcome measures for symptomatic posterior compartment prolapse after surgical intervention. Further use of these measures in future studies is needed to fully assess the impact of surgery in the posterior compartment.

Compliance with ethical standards

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