

## Pelvic organ prolapse and anorectal manometry: a prospective study

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### Abstract

The aim of this study was to evaluate associations between anal sphincter pressure and stage of prolapse and bowel and prolapse symptoms among women undergoing prolapse surgery and to determine whether anal sphincter pressure could predict symptomatic and anatomical outcomes of prolapse surgery. Forty-two women with pelvic organ prolapse (POP) stage 2-3 were included in this prospective longitudinal study. Pre- and postoperative evaluation by means of a symptom questionnaire, clinical examination and anorectal manometry. The vaginal prolapse surgery included at the very least posterior colporrhaphy. Analysis of variance and covariance and logistic regression models were used for statistical analyses. The anal sphincter pressure at rest and squeeze was significantly lower in women with the symptom vaginal protrusion than in the women without the symptom. No associations were found between anal sphincter pressure and the extent or degree of prolapse or subjective and anatomical outcomes of POP surgery. The prolapse symptom vaginal protrusion is associated with a low anal sphincter pressure but the anal sphincter pressure does not seem to predict the outcome of POP surgery, neither regarding symptoms nor anatomy.

### Introduction

Symptoms of genital prolapse include local symptoms such as experiencing a feeling of vaginal protrusion and pelvic pressure and heaviness, and bowel symptoms.<sup>1</sup> Approximately one third of women with pelvic organ prolapse (POP) have symptoms of disturbed bowel emptying.<sup>2</sup>

The bowel symptoms are mainly associated with posterior vaginal wall prolapse, but not with the degree of the prolapse.<sup>3</sup> The results concerning subjective outcomes of surgery of the posterior vaginal wall, especially the bowel symptoms, are contradictory and ambiguous.<sup>4-7</sup> Morphologic studies with magnetic resonance imaging and ultrasonography have revealed structural damage to pelvic floor muscles in women with pelvic floor dysfunction (PFD).<sup>8-10</sup> Although plausible, it is still unclear if and how these changes influence the function of the pelvic floor muscles and whether POP, symptoms of PFD or outcome of POP surgery are associated with pelvic floor function.

Analyses of the function of pelvic floor muscles can be established either by direct measurement of muscle fiber functions by means of electromyography<sup>11</sup> or by means of anorectal manometry, which measures the unified function of the internal and external anal sphincter muscles and the puborectalis muscles.<sup>12</sup> Anorectal manometry (ARM) is a method that assesses the anorectal function and provides insight into the pathophysiology of anorectal disorders. This method is useful in discriminating functional defecatory disorders from other causes of constipation because symptoms alone do not suffice.<sup>12,13</sup> However, only a few studies have been presented concerning ARM findings after posterior colporrhaphy.<sup>14-17</sup> Most of these studies were conducted on small population samples and the results are contradictory. Whether ARM parameters are associated with symptoms of pelvic floor dysfunction and degree or extent of POP or can predict outcome of vaginal POP surgery is unclear. The aims of this study were to analyze associations between ARM findings and preoperative symptoms of prolapse, bowel symptoms and extent of the prolapse in women undergoing posterior colporrhaphy. In addition we wanted to evaluate whether the preoperative ARM findings were associated with subjective and objective outcomes of the POP surgery.

### Materials and Methods

This is a prospective longitudinal study of ARM in women who underwent POP surgery. Women admitted to the Department of Obstetrics and Gynecology at the University Hospital in Linköping, Sweden for surgical treatment of symptomatic genital prolapse, consisting of at least a symptomatic rectocele and who were scheduled for at least a posterior colporrhaphy, were eligible for the study. Exclusion criteria were previous surgery for either POP, urinary or fecal incontinence, or having had a total hysterectomy. Women with significant physical, neurological or psychic disability and women with a complete vaginal

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Key words: anorectal manometry, bowel dysfunction, outcome of surgery, POP surgery, prolapse symptom.

Acknowledgements: the study received financial support with unrestricted grants from *Konsult Thure Carlssons Minnesfond*, from *Lions Forskningsfond mot Folksjukdomar vid Hälsouniversitet i Linköping* and from the County Councils of Östergötland, and Örebro and Linköpings University.

We are indebted to assistant nurse Mrs Ritva Johansson, for her devoted work with the anorectal manometry.

Contributions: KC, JB, PK, study planning and conducting; KC, JB, OH, PK, data processing and analyzing. All authors contributed to manuscript elaboration and final approval.

Conflict of interests: the authors declare no potential conflict of interests.

Received for publication: December 2011.

Revision received: March 2012.

Accepted for publication: May 2012.

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Urogynaecologia 2012; 26:e4  
doi:10.4081/uj.2012.e4

eversion (stage 4 prolapse) were also excluded from the study. The inclusion of women in the study took place between November 1999 and March 2004. The Regional Ethical Review Board in Linköping approved the study.

All the participants in the study were clinically examined preoperatively by one single investigator (KC). In all 220 women were admitted to the hospital for surgical treatment of pelvic prolapse consisting of a symptomatic rectocele during the time period and were thus eligible for the study. Given the constraint that all women in the study were to be examined by a single physician, only those patients scheduled for preoperative evaluation on the days when this physician was in residence were given written and verbal information about the study. Eventually 46 women were enrolled. Two of these women refrained from surgery, one woman did not need a posterior colporrhaphy, and one woman did not have POP surgery due to the disclosure of an ovarian malignancy at the preoperative assessment of the POP. The

remaining 42 women constitute the study group as shown in Figure 1.

Preoperatively the POP was evaluated by means of the pelvic organ prolapse quantification system (POP-Q).<sup>18</sup> The pelvic examination was conducted in the lithotomy position and the patient had emptied the urinary bladder immediately before the examination.

Clinical and demographic data were obtained at the interview and by a questionnaire encompassing detailed questions concerning urinary, prolapse and bowel symptoms preoperatively. This procedure was repeated two to three years postoperatively and at long-term follow-up in 2008.

The questionnaire consisted of questions concerning pelvic floor dysfunction excerpted from validated questionnaires published by Uustal Fornell *et al.* and Hallböök *et al.*<sup>19,20</sup> The questions were constructed as simple sentences and the answers were given by placing a cross or checkmark in boxes next to the written alternatives.

The vaginal surgery was performed under general or regional anesthesia. All patients underwent a posterior colporrhaphy. Basically, the colporrhaphy, posterior as well as anterior, was performed according to the methods as described by Thomson and Rock with midline fascial plication.<sup>21</sup> Plication of the levator ani muscles and perineorrhaphy was performed if the attachments to the perineal body preoperatively were found to be disrupted and the perineal body was deficient, respectively. Surgery of the anterior and apical vaginal compartments was performed concomitantly if considered necessary by the surgeon depending on the pre- and peroperative status and symptoms. The colporrhaphies were carried out with the two-layer suturing technique, one of the vesicovaginal fascia and rectovaginal fascia using interrupted sutures and the second by suturing the vaginal epithelium. Only resorbable sutures were used in the colporrhaphies. Surgery in the apical compartment was either amputation of the cervix or vaginal hysterectomy. Meshes and implants were not allowed. Twelve experienced gynecologists performed the surgery. The surgeons were blinded for the results of the preoperative anorectal manometry findings.

### Anorectal manometry

The ARM was conducted according to the method described by Sundblad *et al.*<sup>22</sup> using the stationary pull-through technique. The equipment used was ABB Goerz. Metrawatt SE 120; with microtip transducer (MTC®; MMS ups 2020, Enschede, NL) and the computer program software MMS Version 8.3; Windows™ (version 2004 (8.0.4) ©4D SA, 1985-2006; 4D Sweden AB, Isafjordsgatan 36, 164 40 Kista).

Briefly, the ARM was conducted as follows: the patient had an enema to clean the rectum

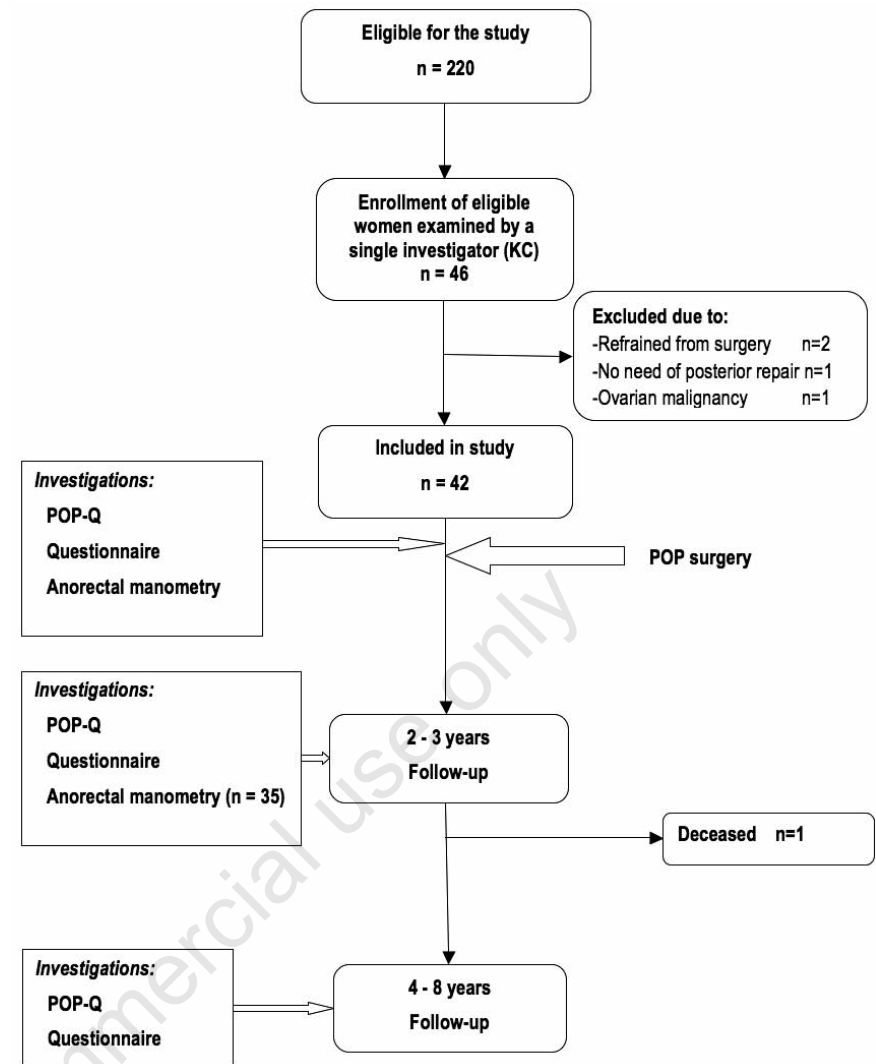


Figure 1. Flow chart of the study population. One woman deceased before long-term follow-up and two other women did not want to participate in the clinical examination at long-term follow up. Follow-up visits with clinical examination were conducted approximately two years postoperatively in these three women. No questionnaires were obtained postoperatively from the deceased woman and one of the two women who declined to participate in the clinical assessment at follow-up.

before the manometry (Klyx® 120 mL, Ferring A/S, Denmark). The patient was positioned in the left lateral position, and the catheter was gently inserted 8 cm in the rectum. Following equilibration, the pressures were measured at rest, while the patient performed a single maximal squeeze effort, followed by a period of rest. The measurements were repeated at 6 cm and at five subsequent stations by 1 cm intervals, as the catheter was progressively moved in caudal direction. The maximal anal resting pressure and squeeze pressure were determined and registered. The pressure measurements were manually transferred to the computer. From the graphic presentation of the pressure-distance plot the area under the curve at the distance zero to five cm from the

anal verge was automatically calculated by the software Kalkylations 4<sup>th</sup> Dimension, 4-D Runtime Interpreted™ according to the method described by Hallböök *et al.*<sup>23</sup> All ARM examinations and readings were carried out by one assistant nurse.

### Statistics

Data are presented as median and (range), mean±1 standard deviation (SD) or as number and (%), as appropriate. Univariate analyses of paired data on a continuous scale were performed with the Wilcoxon Signed Rank test.

Associations between subjective symptoms and objective clinical measurements preoperatively and the ARM findings were evaluated by means of analysis of variance (ANOVA) and

analysis of covariance (ANCOVA) tests as appropriate. Subsequent post hoc testing was done with Fisher's PLSD test. Multiple logistic regression models were established to analyze the associations between the preoperative results of the ARM measurements and symptoms and objective clinical measurements at follow-up. In the multivariate models adjustments were carried out simultaneously for age, parity and body mass index, and in the logistic regressions models the preoperative symptom and objective clinical measurements, respectively, were also included in the adjustments. Initially all ANOVA/ANCOVA models were performed with full interaction effect. Since no significant interaction effects were observed the models were re-calculated and the final analyses included interactions up to a depth of 1.

A  $P < 0.05$  was selected as level of statistical significance. Statistical analyses were carried out with the software StatView® for Windows, Copyright®, 1992-1998, Version 5.0.1 (SAS Institute Inc., SAS Campus Drive, Cary, NC 27513, USA).

## Results

The flow chart of the study population is shown in Figure 1. The ARM was performed preoperatively in all 42 women and repeated median 3.6 years (range 2.1-7.7 years) later in 35 women. Median follow-up time of the clinical examination was 6.4 years (range 1.7-8.3 years).

All patients underwent posterior colporrhaphy; 23 (55%) had perineorrhaphy and 38 (90%) plication of the levator ani muscles concomitantly. Thirty (71%) had other surgical prolapse procedures done at the time of the posterior repair. In 19 (45%) an anterior colporrhaphy combined with either a cervical amputation (Manchester repair, 12 women) or vaginal hysterectomy (seven women) were carried out; in eight an anterior colporrhaphy; in two vaginal enterocele plasty, and in one woman amputation of the cervix was done. Three women had Kelly plication concomitantly for urinary incontinence.

During the period of follow-up one woman received an anterior colporrhaphy due to a new prolapse, two women underwent tension-free vaginal tape for stress urinary incontinence and another woman had abdominal total hysterectomy because of endometrial carcinoma between primary prolapse surgery and the long-term follow-up. Demographic, clinical and descriptive data are shown in Table 1.

The results of the ARM measurements preoperatively and the repeated measurements median 3.6 years later are depicted in Table 2. Preoperative bowel and prolapse symptoms and the outcome of these at long-term follow-up are shown in Table 3.

The anal pressures and pressure-areas, at rest and squeeze were consistently lower in those who had the symptom vaginal protrusion than in those without the symptom (Table 4). Otherwise, none of the other symptoms described in Table 3

were associated with the results of the ARM measurements (data not shown).

The POP-Q staging of the genital prolapse and the outcome at long-term follow-up is presented in Table 5. None of the ARM measure-

**Table 1. Demographic, descriptive and clinical data of 42 women preoperatively and at follow-up median 6.4 years later.**

	Preoperative		At follow-up	
	Median or number	Range or %	Median or number	Range or %
Age (years)	62.4	30.2-81.2	68.8	36.6-87.5
Parity	3.0	1-6	3.0	1-6
Anal sphincter rupture	2	4.8%	2	4.8%
Menopausal	36	86%	38	90%
BMI (kg/m <sup>2</sup> )	26.1	19.3-36.8	26.6*	19.7-42.4
BMI < 25	16	38.1%	14	35.0%
BMI ≥ 25 and < 30	18	42.9%	19	47.5%
BMI ≥ 30	8	19.0%	7	17.5%
<i>Previous surgery</i>				
Hysterectomy-subtotal	2	4.8%	2	4.8%
Hysterectomy/concomitant to POP surgery	---	---	7	16.7%
Hysterectomy-total abdominal	---	---	1	2.5%
Hemorrhoids	1	2.4%	1	2.5%
<i>Co-morbidity</i>				
Diabetes mellitus	2	4.8%	2	4.8%
Chronic pulmonary diseases	1	2.4%	2	4.8%
<i>Medication</i>				
Estrogen treatment - Systemically	12	28.6%	2	4.8%
Estrogen treatment - Vaginally	17	40.5%	14	33.3%
Diuretics	1	2.4%	3	7.1%

BMI, body mass index; POP, pelvic organ prolapse. \*Weight at follow-up was not obtained in two women.

**Table 2. Anorectal manometry measurements preoperatively and at repeated measurement, median 3.6 years later.**

	Preoperative			Follow-up			P*
	Mean	Median	Range	Mean	Median	Range	
MARP (mmHg)	53	42	21-122	43	43	14-75	0.0114 <sup>†</sup>
MASP (mmHg)	103	95.5	40-260	88	87	29-166	0.0125
ARPA (mmHg • cm)	155	131	61.5-370	120	111.5	42-256	0.0135
ASPA (mmHg • cm)	298	276.5	123-717.5	237	233	94-408.5	0.0019

MARP, maximal anal resting pressure; MASP, maximal anal squeeze pressure; ARPA, anal resting pressure area; ASPA, anal squeeze pressure area. \*Wilcoxon Signed Rank test. The preoperative values were significantly higher than the values at follow-up.

**Table 3. Outcome of symptoms in 42 patients at postoperative follow-up.**

Symptoms	Preoperative (proportion, %)	Outcome of symptoms at follow-up		
		Resolved completely or improved* (proportion)	Persistent or worse <sup>†</sup> (proportion)	De novo <sup>#</sup> (proportion)
<i>Prolapse symptoms</i>				
Vaginal protrusion	23/42 (55%)	18/22	4/22	1/18
Pelvic pressure/heaviness	29/42 (69%)	19/28	9/28	2/12
<i>Bowel symptoms</i>				
Problems with emptying the bowel	17/37 (46%)	13/16	3/16	2/19
Splinting	11/37 (30%)	9/11	2/11	2/24
<i>Fecal incontinence</i>				
Gas	18/36 (50%)	9/17	8/17	3/17
Liquid	5/36 (14%)	1/4	3/4	1/30
Solid	1/36 (3%)	0/1	1/1	1/33

All questions were not answered by all women. The number of affirmatives for each question is given in the denominator. \*Significant improvement means that the symptom still exist but has changed from occurring weekly or more often to occur less than once a week; †Persistent means that the symptom is still present as unchanged or have either improved, but not significantly, or have become worse; #De novo means that the symptom was not reported preoperatively but developed during follow-up period and reported as occurring at the follow-up.

ments were significantly associated with POP-Q stage overall or with any of the compartments even when subdivided into those with and without surgery in the specific compartment (*data not shown*).

In the multiple logistic regression models adjusted simultaneously for age, parity and BMI at follow-up and preoperative symptoms and POP-Q staging, respectively, none of the preoperative anorectal manometric measurements were found to be significantly associated with the bowel or prolapse symptoms or POP-Q stage at follow-up median 6.4 years after primary POP surgery (*data not shown*).

## Conclusions

This study showed that the prolapse symptom vaginal protrusion was associated with the anal sphincter function as determined by anorectal manometry. Otherwise no significant associations were observed for the other prolapse and bowel symptoms or for any of the anatomical measurements of the prolapse. We failed to demonstrate any association between ARM findings and outcome of vaginal POP surgery concerning symptoms and anatomy.

The symptom vaginal protrusion was strongly associated with a weak anal sphincter muscle. Vaginal protrusion is the single symptom that is most strongly associated with vaginal prolapse.<sup>24</sup> This might imply that the damage to the pelvic floor is more pronounced in those who develop this symptom. So far, this actually has no clinical impact concerning choice of treatment of the POP or operation method. The lack of statistically significant associations between the anal sphincter pressures and the subjective and objective outcomes of the prolapse surgery might imply that the anal sphincter function is not clinically important for the outcome of transvaginal rectocele repair. However, many of the bowel dysfunction symptoms, even some which may be related to the sphincteric function, disappeared after posterior colporrhaphy.

In the literature views on the impact of POP surgery on bowel symptoms are not all in agreement; both improvement of symptoms and deterioration and development of *de novo* symptoms have been reported.<sup>4,6,7</sup> The anatomical outcome, however, seems to be essential for relief of the bothersome symptoms of straining and incomplete emptying.<sup>6,25</sup> Improvement of symptoms of bowel emptying and splinting as well as symptoms of vaginal protrusion were found in 80% of the women in our study whereas symptoms of fecal incontinence persisted. This coheres with results of other studies.<sup>14,26</sup> Fecal incontinence is associated with previous rupture of the anal sphinc-

ter and pudendal nerve damage.<sup>3</sup> Neither of these conditions is treated with traditional posterior colporrhaphy. Our finding of *de novo* fecal incontinence after posterior colporrhaphy is similar to that of Gustilo-Ashby *et al.*<sup>6</sup> despite a significantly longer follow-up period in our study.

The study also revealed that the anal sphincter function deteriorated significantly over time. The anorectal sphincter function deteriorates with age.<sup>27</sup> We found the age-adjusted reduction in anal pressures to be almost seven times higher than expected. This strongly suggests that the prolapse surgery may influence the muscle function of the pelvic floor or that the pelvic floor muscle function due to the pre-existing damage is more prone to deteriorate

in women with prolapse than in normal women. Plication of the levator muscles may affect the anal sphincter function mechanically. Surgically induced neuropathy might be another possible explanation for our findings.<sup>28</sup> The prevalence of fecal incontinence did not change after the operation in our study despite the decreased anal pressure. The continence is, however, not only a matter of anal sphincter function but involves the physiological interaction of rectal mobility and sensation and the integrity of the pelvic floor structures.<sup>29</sup>

A methodological concern in this study is the sample size and patient selection process. The main prerequisite to participate in the study was a symptomatic rectocele that was to

**Table 4. Statistically significant associations between prolapse and bowel symptoms and preoperative anorectal manometry findings.**

Symptom	Anorectal manometry measurement	Group with the symptom Mean±1 SD	Group without the symptom Mean±1 SD	Analysis of covariance* P-value	Fishers' PLSD test P-value
Vaginal protrusion		(n=23)	(n=19)		
	MARP	42±14	67±31	0.0027	0.0014
	MASP	84±27	125±55	0.0097	0.0042
	ARPA	125±46	193±90	0.0106	0.0026
	ASPA	250±78	356±156	0.0195	0.0078

MARP, maximal anal resting pressure; MASP, maximal anal squeeze pressure; ARPA, anal resting pressure area; ASPA, anal squeeze pressure area. \*Adjusted for age, parity and body mass index.

**Table 5. Distribution of pelvic organ prolapse quantification system stage preoperatively and at follow-up in 42 women with primary prolapse surgery. Sub classification of anterior and apical vaginal compartments is included according to whether or not surgery was performed in the compartment.**

POP-Q staging	Pre-operative (no.)		Postoperative follow-up	
	Stage 0-1 (no.)	Stage 2 (no.)	Stage 3 (no.)	Stage 3 (no.)
<i>Anterior compartment POP-Q stage</i>				
Stage 0-1 Anterior colporrhaphy	1	1	0	0
No anterior colporrhaphy	15	10	4	1
Stage 2 Anterior colporrhaphy	10	5	4	1
No anterior colporrhaphy	0	0	0	0
Stage 3 Anterior colporrhaphy	16	5	8	3
No anterior colporrhaphy	-----	-----	-----	-----
<i>Apical compartment POP-Q stage</i>				
Stage 0-1 Apical repair	9	9	0	0
No apical repair	20	20	0	0
Stage 2 Apical repair	7	7	0	0
No apical repair	-----	-----	-----	-----
Stage 3 Apical repair	6	6	0	0
No apical repair	-----	-----	-----	-----
<i>Posterior compartment POP-Q stage</i>				
Stage 0-1	14	12	2	0
Stage 2	15	7	7	1
Stage 3	13	12	0	1
<i>Overall POP-Q stage*</i>				
Stage 0-1	-----	-----	-----	-----
Stage 2	12	5	6	1
Stage 3	30	9	17	4

POP-Q, pelvic organ prolapse quantification system. \*Overall POP-Q stage reflects the stage of the most prominent prolapse part of the three compartments.

be treated with a posterior colporrhaphy. It may be difficult to study the outcome of genital prolapse surgery for many reasons. Genital prolapse constitutes a heterogeneous group of conditions with different anatomic expressions of damage to fascial and neuromuscular structures producing different symptoms. Even prolapse surgery is heterogeneous with variations due to individual surgeons. Since we intended to investigate the muscle function of the pelvic floor by means of anorectal pressure measurements, we selected women who were scheduled to a posterior repair because of a symptomatic rectocele. The size and degree of the rectocele varied and about 30% of the women in this study had a rectocele stage 0-1. Women with rectocele present a complex clinical picture with gynecologic and anorectal symptoms. Around 20% of the patients, in this study, had at long-term follow-up persistent bowel symptoms and additional 10% developed *de novo* anorectal symptoms. The majority of the women also presented with prolapse of other vaginal compartments and had concomitant surgery in these compartments as well. The use of posterior repair in genital prolapse surgery has decreased in Sweden.<sup>30</sup> In a study by Olsen *et al.* comprising nearly 400 prolapse operations, only a minority (7%) of prolapse procedures were isolated repair of rectocele.<sup>31</sup> Thus it would be even more difficult and time consuming to select a homogeneous group of women with similar anatomical defects needing isolated posterior repair.

In conclusion, the prolapse symptom vaginal protrusion is associated with a low anal sphincter pressure but the anal sphincter pressure does not seem to predict the outcome of POP surgery, either regarding symptoms or anatomy. The symptoms of genital prolapse and the bowel *sensation* improve significantly after vaginal POP surgery. Well-designed trials with sufficient statistical power are needed to determine the impact of pelvic floor musculature on pelvic floor function and outcome of genital prolapse surgery.

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