Published in final edited form as:

Female Pelvic Med Reconstr Surg. 2018 ; 24(1): 56–59. doi:10.1097/SPV.0000000000000438.

Effect of Cystocele Repair on Cervix Location in Women with Uterus In Situ

Carolyn W. Swenson, MD¹, Daniel M. Morgan, MD¹, Jenny George, MD¹, and John O. DeLancey, MD¹

¹University of Michigan Department of Obstetrics and Gynecology, Ann Arbor, MI

Abstract

Introduction and Hypothesis—Our objective was to test the hypothesis that cystocele repair, in the absence of hysterectomy or apical suspension, results in higher cervix location in some women.

Methods—We performed a retrospective chart review of women with a uterus in situ who underwent native tissue anterior repair without hysterectomy/apical suspension from 2008–2014. Demographics, medical history, and preoperative and six-week postoperative Pelvic Organ Prolapse Quantification System (POP-Q) measurements were abstracted. Cervix location was defined by the clinic POP-Q point C value. Women with higher (more negative) postoperative point C values were compared to those with a lower (more positive)/unchanged point C.

Results—Of the 33 women included, mean age was 59.8 ± 11.3 years. Median preoperative point C was -6.0 (interquartile range (IQR) $-6.75, -5.0$) and point Ba was $+2.0$ (IQR $+0.5, +3.0$). Point C was higher postoperatively in 21/33 (64%) women. Overall, point C was 1 cm higher post-versus preoperatively (-7.0 [IQR $-8.0, -6.0$] vs -6.0 [IQR $-6.75, -5.0$], $p < .001$) and point Ba was 4 cm higher (-2 [IQR $-3.0, -2.0$] vs 2.0 [IQR $0.5, 3.0$], $p < .001$). Compared to women with lower/unchanged postoperative point C, those with higher point C were older (53.9 ± 12.3 vs 63.1 ± 9.4 , $p = .02$) with lower parity (3.0 [IQR $2.0, 3.0$] vs 2.0 [IQR $2.0, 3.0$], $p = .028$).

Conclusions—The test of our hypothesis shows that in certain women with cystocele, anterior repair alone may be associated with higher cervix location six weeks postoperatively.

Keywords

Anterior repair; apical support; cystocele; hysterectomy; pelvic organ prolapse

Introduction

Pelvic organ prolapse is one of the most common indications for hysterectomy in the United States.¹ The most frequently affected site is the anterior compartment, which is involved in approximately 80% of surgical pelvic organ prolapse repairs.² Hsu et al found that over 70%

Corresponding Author: Carolyn W. Swenson, MD, University of Michigan Department of Obstetrics and Gynecology, L4000 Women's Hospital, 1500 E. Medical Center Dr., SPC 5276, Ann Arbor, MI 48109-5276, Phone: (734) 764-8429, Fax: (734) 647-9727, scarolyn@med.umich.edu.

Conflict of Interest: The authors report no conflict of interest.

of anterior vaginal wall descent is associated with descent of the cervix and vaginal length.³ While we know there is a clear relationship between uterine descent and prolapse of the anterior vaginal wall, we do not know whether there is a cause and effect relationship between the two.

During a dilation and curettage in a woman with normal support, the cervix can be drawn to within a centimeter of the hymenal ring.⁴ After the tenaculum is removed, it will return to a normal location. With a cystocele, the anterior vaginal wall is exposed to atmospheric pressure below the introitus—creating a pressure differential that can pull on the uterine ligaments and cause uterine descent.⁵ These observations raise the question of whether downward traction exerted on the uterus by a cystocele *causes* apical descent, or conversely, does cystocele result from apical descent? Answering these questions could have clinical implications regarding surgical management of women with anterior vaginal wall prolapse and a uterus in situ. If the low position of the uterus is caused by the cystocele, then removing the cystocele might be expected to result in the uterus being in a higher location postoperatively in the same way that releasing traction from a tenaculum allows the cervix to “recoil” to a more normal location. In this case, the additional morbidity of performing a hysterectomy and apical suspension would not be justified. Therefore, our objective was to test the hypothesis that cystocele repair, in the absence of hysterectomy or apical suspension, results in higher cervix location in some women six weeks postoperatively.

Materials and Methods

We performed a retrospective chart review of a convenience sample of women with a uterus in situ who underwent native tissue anterior repair for prolapse by a urogynecologist at the University of Michigan from November 2008 through December 2014. This study was approved by the University of Michigan IRB (HUM00113030). Women were included if they had a uterus at the time of anterior repair, did not undergo concomitant hysterectomy or apical suspension, and had pre- and postoperative POP-Q measurements documented.. Concomitant incontinence slings, both synthetic and fascial, were permissible. Demographics, medical history, and preoperative and six-week postoperative POP-Q examinations were abstracted.

In clinic, preoperative and postoperative measurements were performed with patients in the low lithotomy position using the standardized Pelvic Organ Prolapse Quantification System (POP-Q) ⁶. Cervix location was defined by the POP-Q point C value. Native tissue anterior repair was performed using the following technique: a transverse incision was made at the anterior cervicovaginal junction. The vaginal epithelium was sharply dissected off the underlying fibromuscular tissues along the length of the anterior vaginal wall to within 1 cm of the external urethral meatus and then further mobilized with blunt dissection. The fibromuscular layer was then plicated using interrupted stitches of a delayed absorbable suture. The excess epithelium was then trimmed and closed with a non-locking running absorbable suture. Cystoscopy was performed in all cases.

Postoperative POP-Q point C values were compared to the preoperative values for each subject. Using bivariate analyses, women with point C values that became higher (more

negative) after surgery were compared to those whose point C measurement did not change or became lower (more positive). Statistical analyses were generated using IBM SPSS® Statistics software, Version 21.0 (copyright 2012 IBM Corporation).

Results

Thirty-three women with a uterus in situ met inclusion criteria and underwent anterior repair without hysterectomy or apical suspension. Table 1 shows the demographics and clinic data for the women. Overall, mean age was 59.8 ± 11.3 years, mean BMI was 26.8 ± 3.6 kg/m², and 94% were Caucasian. Five women had prior pelvic surgeries that included: ovarian cystectomy, cesarean section, myomectomy, tubal ligation, and pelvic laparoscopy. At the time of preoperative exam, the median point C value was -6.0 (total range -1 , -10) and point Ba was $+2.0$ ($+0.5$, $+3.0$). Nearly half (15/33) of women had a concomitant incontinence sling—14 had a retropubic midurethral mesh sling and one had an autologous rectus fascia pubovaginal sling. No other concomitant procedures were performed. On average, women were seen back in clinic seven weeks after surgery. Overall, postoperative point C was 1 cm higher compared to the preoperative measurement (-7.0 [-8.0 , -6.0] vs -6.0 [-6.75 , -5.0], $p < .001$).

Figure 1 shows the change in pre- to postoperative point C location for each subject. In the majority of women, postoperative point C was higher (21/33 (64%)). Among those in whom point C was higher, the median amount was 2 cm (3.5, 1.0) and the distribution of values was as follows: 5 cm higher (N=3), 4 cm higher (N=2), 3 cm higher (N=2), 2 cm higher (N=7), and 1 cm higher (N=7). Postoperatively, point Ba was on average 4 cm higher (-2 [-3.0 , -2.0] vs 2.0 [0.5 , 3.0], $p < .001$). Of those women who had no change in/lower point C postoperatively, the median change was 0 cm (0, 0) and the distribution of values was as follows: no change (N=8), 0.5 cm lower (N=1), and 1 cm lower (N=3). Women in whom point C became higher postoperatively (N=21) were then compared to women in whom point C did not change or became lower (N=12) (Table 1). Those with improved apical support were older and of lower parity compared to women who did not show improvement. Groups did not differ in terms of race, BMI, prevalence of chronic constipation, menopausal status, or use of vaginal estrogen. Rates of concomitant incontinence sling and days to postoperative exam were also similar between groups.

Women with lower postoperative point C had higher BMI and parity compared to those with unchanged/higher postoperative point C (30.6 ± 3.9 kg/m² vs 26.2 ± 3.2 kg/m², $p = .02$; 3 (3, 3.75) vs 2 (2, 3), $p = .04$). The remaining demographic and operative variables in Table 1 were similar between groups (data not shown).

A simple linear regression was calculated to predict change in postoperative point C based on preoperative point C. A significant relationship was found, indicating that women with a lower preoperative point C were more likely to have greater elevation in postoperative point C (Beta = -0.385 , 95% CI $-.743$, $-.049$, $R^2 = 0.15$, $p = .027$). The Pearson correlation between age and preoperative point Ba was 0.61 ($p < .001$).

Discussion

This analysis shows that in certain women with cystocele and a uterus in situ, native tissue anterior repair alone is associated with higher point C six weeks postoperatively. Prior studies have demonstrated a strong correlation between anterior vaginal wall prolapse and apical descent^{3,7,8}; however, our study extends the literature by demonstrating that in certain women, eliminating the cystocele can result in a higher cervix location. This finding is consistent with our theory that a cystocele may cause apical descent in certain women by creating a downward traction force on the uterus. Following the anterior repair, the downward traction force is relieved, and the cervix resumes a higher position in the pelvis.

Our finding that cervix location was higher following an anterior repair provides clinical support for the results of prior biomechanical modeling of the anterior vaginal wall that has identified levator muscle impairment, increased abdominal pressure, and apical/paravaginal support defects to be the main contributors to cystocele formation.⁹ However, the occurrence of all three factors simultaneously is not necessarily a prerequisite for cystocele development. Some women with cystocele may have normal apical ligaments but still develop a cystocele due to levator injury and the pressure differential due to an exposed vagina. This is further supported by the work of Yousuf et al, whose biomechanical analyses suggest that once the anterior vaginal wall becomes exposed to atmospheric pressure, apical location becomes significantly lower.⁵ We also observed a greater improvement in postoperative apical support among women with a lower preoperative cervix location. This may suggest a ceiling effect wherein those with a higher cervix have less room to improve.

Prior work by Foon et al showed that cervix location in 35 women with preoperative stage II or III cystocele and stage I uterine prolapse was unchanged following native tissue anterior repair alone.¹⁰ Conversely, we found that on average, point C was 1 cm higher postoperatively. One explanation for this difference is that women in the current study had larger cystoceles compared to those in the Foon study (mean preoperative point Ba: $+1.70 \pm 1.61$ cm vs $+0.34 \pm 0.97$ cm); therefore, a greater traction force would be relieved following the anterior repair. However, because only the mean pre- and postoperative POP-Q point C values were presented by Foon et al, it is unknown from their study what proportion of those women had improvement in point C following surgery. Additionally, Foon et al found that in women whose cervix descended as much as 1 cm below the hymen with traction in the operating room, cystocele repair alone was successful in 34 of 35 women.

When we compared women with and without improvement in postoperative apical support, we found that women in whom apical support improved were on average 10 years older and of lower vaginal parity. Age was significantly correlated with preoperative point Ba; therefore, we suspect that women with improved postoperative apical support were older, because older women tend to have larger prolapses that subsequently create greater downward traction forces. Unfortunately, our sample is too small to allow for a meaningful multivariable analysis to investigate this hypothesis. It is unclear why parity differed between the groups.

Increasing genital hiatus size has been shown to be predictive of apical support loss; however, in the current study genital hiatus size was similar in both groups and is therefore not an explanation for our results.¹¹ Another possible contributing factor is length of the apical support ligaments, with longer ligaments associated with less apical support. We have developed a technique for measuring the uterosacral and cardinal ligaments at rest and during maximal Valsalva.¹² In the future, it may be possible to study whether preoperative apical ligament length differs between women with and without improvement in apical support following anterior repair.

The four women with lower postoperative cervix locations had higher BMI and higher parity compared to the remaining 29 women. Given the small sample size, this finding may be due to chance, but it is consistent with existing data showing a correlation between BMI, parity, and pelvic organ support.

Several factors should be kept in mind in interpreting the results of our study. Our main limitation is lack of data regarding long-term outcomes, reoperation for prolapse, and hysterectomy. We did not have a control group for comparison to help determine whether changes in point C were directly related to surgical intervention or simply variation between examinations. Our results may not be generalizable to surgeons who perform anterior repair using a different technique or with graft/mesh augmentation. Selection bias and ascertainment bias must also be considered and the small sample size from a single institution limits the generalizability of our results. The decision to perform an anterior repair and not a hysterectomy was made conservatively; only those women in whom the surgeon felt confident that abnormal uterine ligaments were not present underwent this approach. Therefore, our results are only representative of women with anterior vaginal wall prolapse in the absence of significant apical prolapse. We believe that larger prolapses would probably also show a larger recoil effect, but these typically had a hysterectomy. Strengths of our study include the fact that all native tissue anterior repairs and clinic measurements were performed by experienced urogynecologists using a standard technique.

In conclusion, our findings support our theory that in some women, the downward traction force from a cystocele may cause apical descent.

Acknowledgments

This research was supported by the National Institutes of Health Office of Research on Women's Health grant P50 HD044406. Investigator support for CWS was provided by the National Institute of Child Health and Human Development WRRH Career Development Award K12 HD065257. The National Institutes of Health did not play a role in the research design, data collection/analysis, decision to publish, or choice of journal for this manuscript.

References

1. Wu JM, Wechter ME, Geller EJ, et al. Hysterectomy rates in the United States, 2003. *Obstet Gynecol.* 2007; 110(5):1091–1095. [PubMed: 17978124]
2. Olsen AL, Smith VJ, Bergstrom JO, et al. Epidemiology of surgically managed pelvic organ prolapse and urinary incontinence. *Obstet Gynecol.* 1997; 89(4):501–506. [PubMed: 9083302]
3. Hsu Y, Chen L, Summers A, et al. Anterior vaginal wall length and degree of anterior compartment prolapse seen on dynamic MRI. *Int Urogynecol J Pelvic Floor Dysfunct.* 2008; 19(1):137–142. [PubMed: 17579801]

4. Bartscht KD, DeLancey JO. A technique to study the passive supports of the uterus. *Obstet Gynecol.* 1988; 72(6):940–943. [PubMed: 3186104]
5. Yousuf A, Chen L, Larson K, et al. The length of anterior vaginal wall exposed to external pressure on maximal straining MRI: relationship to urogenital hiatus diameter, and apical and bladder location. *Int Urogynecol J.* 2014; 25(10):1349–1356. [PubMed: 24737299]
6. Bump RC, Mattiasson A, Bo K, et al. The standardization of terminology of female pelvic organ prolapse and pelvic floor dysfunction. *Am J Obstet Gynecol.* 1996; 175(1):10–17. [PubMed: 8694033]
7. Summers A, Winkel LA, Hussain HK, et al. The relationship between anterior and apical compartment support. *Am J Obstet Gynecol.* 2006; 194(5):1438–1443. [PubMed: 16579933]
8. Rooney K, Kenton K, Mueller ER, et al. Advanced anterior vaginal wall prolapse is highly correlated with apical prolapse. *Am J Obstet Gynecol.* 2006; 195(6):1837–1840. [PubMed: 17132485]
9. Chen L, Ashton-Miller JA, DeLancey JO. A 3D finite element model of anterior vaginal wall support to evaluate mechanisms underlying cystocele formation. *J Biomech.* 2009; 42(10):1371–1377. [PubMed: 19481208]
10. Foon R, Agur W, Kingsly A, et al. Traction on the cervix in theatre before anterior repair: Does it tell us when to perform a concomitant hysterectomy? *Eur J Obstet Gynecol Reprod Biol.* 2012; 160(2):205–209. [PubMed: 22129812]
11. Lowder JL, Oliphant SS, Shepherd JP, et al. Genital hiatus size is associated with and predictive of apical vaginal support loss. *Am J Obstet Gynecol.* 2016; 214(6):718.e711–718. [PubMed: 26719211]
12. Luo J, Betschart C, Chen L, et al. Using stress MRI to analyze the 3D changes in apical ligament geometry from rest to maximal Valsalva: a pilot study. *Int Urogynecol J.* 2014; 25(2):197–203. [PubMed: 24008367]

Figure 1.
Change in POP-Q Point C preoperatively to postoperatively following an anterior repair in women with a uterus in situ

Table 1

Demographics and POP-Q Exams Comparing Women With and Without Higher Postoperative Point C after Undergoing Anterior Repair Without Hysterectomy

	Overall N=33	Postoperative Point C		P value
		Higher N=21	No Change/Lower N=12	
Age, years	59.8 ± 11.3	63.1 ± 9.4	53.9 ± 12.3	.02
Caucasian	93.8 (30/32)	90.5 (19/21)	100 (11/11)	.53*
Parity	2.0 (2.0, 3.0)	2.0 (2.0, 3.0)	3.0 (2.0, 3.0)	.028
Body Mass Index, kg/m ²	26.8 ± 3.6	26.6 ± 3.0	27.1 ± 4.5	.72
Chronic Constipation	15.2 (5)	14.3 (3)	16.7 (2)	1.00*
Postmenopausal	75.9 (22/29)	88.9 (16/18)	54.5 (6/11)	.07*
Vaginal or Oral Estrogen Use	21.2 (7)	19.0 (4)	25.0 (3)	.69*
Preoperative Clinic POP-Q				
Aa	1.0 (1.0, 2.0)	1.0 (0, 2.0)	0.5 (0, 1.75)	.63
Ba	2.0 (0.5, 3.0)	2.0 (1.0, 3.0)	1.0 (0, 2.0)	.31
C	-6.0 (-6.75, -5.0)	-5.0 (-6.0, -4.5)	-6.0 (-7, -5.25)	.17
Ap	-2.0 (-2.0, -1.25), N=32	-2.0 (-2.0, -1.0), N=20	-2.0 (-2.75, -2.0)	.34
Bp	-2.0 (-2.0, -1.5)	-2.0 (-2.0, -1.0)	-2.0 (-2.75, -2.0)	.40
Gh	3.5 (3.0, 4.0), N=32	3.5 (2.5, 4.0), N=20	3.5 (3.125, 4.0)	.49
Pb	3.0 (2.5, 3.625), N=30	3.0 (2.875, 3.125), N=18	3.0 (2.125, 4.0)	.76
TVL	10.0 (9.0, 11.0), N=32	10.0 (9.0, 10.75), N=20	10.0 (10.0, 10.875)	.44
Incontinence Sling Performed	45.5 (15)	33.3 (7)	66.7 (8)	.06
Change in Point C (Pre- to Postoperative exam), cm	-1.0 (-2.0, 0)	-2 (-3.5, -1.0)	0 (0, 0.875)	<.001
Time from Surgery to Postoperative Exam, days	42.9 ± 20.1	43.8 ± 23.4	41.3 ± 13.5	.75

Data presented as mean ± SD, median (IQR) or % (n/N). P values reflect the comparison between the two Postoperative Point C groups. P values determined using Chi-square or Fisher's exact (*); Mann-Whitney used for parity and POP-Q values.