Published in final edited form as:

Int Urogynecol J. 2017 June ; 28(6): 899–905. doi:10.1007/s00192-016-3201-7.

Ligament Shortening Compared to Vaginal Colpopexy at the Time of Hysterectomy for Pelvic Organ Prolapse

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Abstract

Introduction and Hypothesis—Performance of a colpopexy at the time of hysterectomy for pelvic organ prolapse (POP) is a potential measure of surgical quality. However, there has not been a direct comparison between vaginal colpopexy and the classic technique of ligament shortening and reattachment. We sought to test the null hypothesis that there is no difference in prolapse recurrence between the techniques.

Methods—We performed a retrospective chart review of 330 vaginal hysterectomies performed for prolapse, comparing symptomatic and/or anatomic recurrence rate between those having a vaginal colpopexy (uterosacral ligament suspension (USLS) or sacrospinous ligament suspension (SSLS)) and those having ligament shortening and reattachment. Clinically relevant variables statistically associated with recurrence on univariate analysis were used to create a multivariable logistic regression model to predict recurrence.

Results—With a mean follow-up of 20 months, there was no significant difference between symptomatic and/or anatomic recurrence rates (19.4%, N=41 vs. 11.8%, N=14, p=0.07). Cases where a colpopexy was performed had a higher baseline prolapse stage (3 [2,5] vs. 2 [1,3], p<.0001). On multivariable logistic regression, the procedure performed was not associated with

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Conflicts of Interest:

PS Fairchild: None

NS Kamdar: None

ER Rosen: None

CW Swenson: None

JOL DeLancey: Advisory Committee, NIH Office for Research on Women's Health

DE Fenner: None

DM Morgan: UpToDate, royalties for authorship

Data contained in this manuscript were presented as a non-oral poster at the 42nd Annual Society of Gynecologic Surgeons Scientific meeting in Palm Springs, CA April 10–13, 2016.

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recurrence (OR 1.57, 95% CI 0.79 – 3.12). Having a baseline prolapse of 4 cm or greater was associated with recurrence (OR 2.63, 95% CI 1.32 – 5.22), as was length of time from hysterectomy (OR 1.02 per month, 95% CI 1.01 – 1.04).

Conclusions—When compared to vaginal colpopexy, selective use of the ligament shortening technique at the time of vaginal hysterectomy was associated with similar rates of prolapse recurrence. Preoperative prolapse size was the factor most strongly associated with recurrence.

Keywords

Apical Support; Colpopexy; Hysterectomy for Prolapse; Recurrence

Introduction

Fourteen percent of all hysterectomies in the United States are performed for pelvic organ prolapse (POP)[1] and among postmenopausal women, uterine prolapse is the most common indication [2]. Reoperation for prolapse has been reported to be as high as 20% [3] and is more common when the indication for hysterectomy is prolapse [4]. Recurrence of POP following hysterectomy is lower with the performance of concomitant pelvic floor repairs [3,5]; however, prior studies do not always identify the type of concomitant repair or method of apical support. In fact, the largest study to look at apical suspension at the time of surgery for POP includes hysterectomy itself as an apical support procedure without distinguishing whether or not additional suspension steps were taken [3].

In an effort to decrease the recurrence rate, apical suspension at the time of hysterectomy for prolapse was proposed by the American Urogynecologic Society as a quality assessment criterion [6]. As of September 2015, the National Quality Forum (NQF) endorses this measure. According to their recommendation, a vaginal apical suspension, or sacral colpopexy [7], should be performed at the time of hysterectomy for POP [6]. These vaginal colpopexy procedures—uterosacral ligament suspension (USLS) [8] and sacrospinous ligament suspension (SSLs) [9]—are accepted and effective methods of suspension of the apex that have been shown to have similar results [10]. Other techniques of restoring apical support are not mentioned by the NQF and might not be considered compliant with these recommendations. Specifically, they do not discuss the following well-established technique of addressing apical support at the time of vaginal hysterectomy: 1) shortening of the cardinal and uterosacral ligaments to the extent allowed by ureter location; 2) closure of the enterocele; and 3) reattachment of the shortened ligaments to the vaginal cuff [11]. We will refer to this process as the “ligament shortening” technique. While all three of these methods utilize a vaginal approach to restore apical support without the use of mesh, USLS and SSLs require greater skill to perform and may be associated with increased risk of operative complications [12]. Furthermore, it is unknown how outcomes from the ligament shortening technique compare to those of USLS and SSLs.

In our experience, the ligament shortening technique is an effective procedure to address apical support in properly selected patients. In fact, the concept that ligament shortening and re-attachment is an appropriate treatment for apical prolapse is consistent with new biomechanical evidence that increased ligament length, not abnormal ligament stiffness, is

the primary factor associated with apical prolapse [13,14]. A randomized trial comparing approaches to management of the apex would answer this question; however, before contemplating and designing such a trial, information from an observational study is needed to assess the magnitude of differences, if any, between approaches, and to determine the sample size needed for the trial to be adequately powered. Therefore, we sought to compare rates of symptomatic and/or anatomic recurrence following hysterectomy for POP between women undergoing a ligament shortening support technique and those having vaginal colpopexy (USLS or SSLS), using retrospective data from our institution.

Materials and Methods

We performed a retrospective chart review of patients undergoing vaginal hysterectomy (VH) for POP with a Female Pelvic Medicine and Reconstructive Surgery (FPMRS) provider at the University of Michigan from March 1, 2006 to January 8, 2014. The start date was chosen due to its coincidence with our department's establishment of a quality improvement database for hysterectomy. The University of Michigan IRB (HUM00055112) approved this study. Women were included if there was a minimum of three months postoperative follow-up at the time the chart review was performed. A minimum of three months follow up was chosen because this is when all the delayed absorbable sutures have been resorbed. This is plausibly the point when we would begin to see failures occur. Exclusion criteria included hysterectomies performed for indications other than POP or by non-FPMRS providers and postoperative follow-up of less than three months. Chart review was performed by two of the authors (P.S.F. and E.R.R.) to obtain demographics, surgical history, preoperative prolapse data, perioperative findings, operative procedures performed, postoperative complications, and postoperative clinic exam results. All consultations were performed in attending physician clinics either by the attending physician or under their direct supervision. In this clinical practice, patients typically have a follow up appointment six weeks from their surgery, then again at one year from the date of surgery.

Because outcomes of USLS and SSLS have been demonstrated to be similar in randomized trials, women were divided into two groups based on the type of apical support procedure performed at the time of the hysterectomy: vaginal colpopexy (SSLS or USLS) and the ligament shortening technique. The decision to perform a vaginal colpopexy or ligament shortening is at the discretion of the surgeon. Women are typically consented for vaginal hysterectomy and anterior/posterior colporrhaphy, with apical suspension as indicated by operative findings. In general, if the cervix is not more than 3 to 5 cm below the hymen with traction in the OR, then this technique is considered. After the hysterectomy is completed, the ligament strength and position with respect to the hymen is assessed. When these pedicles and the posterior cul de sac (e.g. point D) are well above the hymen, the surgeon may decide that a uterosacral or sacrospinous colpopexy is not required. The steps for achieving apical support using the ligament shortening technique are performed as follows: 1) shortening of the cardinal/uterosacral ligaments to just below the palpated or expected location of the ureter; 2) Closure of the enterocele with a single purse-string of permanent suture; and 3) Reattachment of the shortened uterosacral/cardinal ligament complex to the vaginal cuff in the manner described by Richardson [15], utilizing a single delayed-absorbable suture on each side. All women undergoing hysterectomy for benign indications

at our institution undergo routine screening cystourethroscopy to evaluate post-procedural bladder integrity and ureteral efflux.

Prolapse recurrence was assessed based on the date of the clinical note that was farthest out from the index surgery. Three definitions for recurrence were established: 1) Symptomatic recurrence was defined as patient report of recurrent bulge symptoms; 2) Anatomic recurrence was defined as having any compartment below the hymen on exam; and 3) Composite recurrence was defined as symptomatic and/or anatomic recurrence. Apical recurrence was defined as descent of POP-Q point C below one half total vaginal length [16].

Baseline differences between the two surgical groups were compared using Chi-Square or Fisher's exact tests for categorical variables. For continuous variables, Student's *t* tests were used for those that were normally distributed and Mann Whitney U for those that were nonparametric. Statistical significance was calculated when $P < 0.05$. Differences between those with and without each type of recurrence were similarly compared if $P < 0.05$. Clinically relevant and statistically significant variables associated with each type of recurrence were considered in a multivariable logistic regression model using stepwise selection.

Study data were collected and managed using REDCap (Research Electronic Data Capture) electronic data capture tools hosted at the Michigan Institute for Clinical & Health Research at the University of Michigan [17]. Data were analyzed using SAS v9.3 (Cary, NC, USA) and SPSS Version 22.0 (IBM Corp., Armonk, NY, USA).

Results

Of the 628 vaginal hysterectomies performed for POP by the FPMRS division during the study period, 330 (52.5%) met inclusion and exclusion criteria. The 298 excluded cases did not have a follow-up appointment at three months or later. When compared to the 330 included cases, the 298 cases without the requisite follow up did not differ with respect to demographic characteristics, preoperative prolapse size, or procedure performed (all $p > 0.05$, data not shown). The ligament shortening technique was performed in 36.1% (N=119) and vaginal colpopexy in 63.9% (N=211) of cases. Of the vaginal colpopexies, 71.1% (N=150) were USLS and 28.9% (N=61) were SSLs.

In a comparison of recurrence between groups, composite recurrence was higher in the vaginal colpopexy group than in the ligament shortening group; however, the difference did not reach statistical significance (19.4%, N=41 vs. 11.8%, N=14, $p=0.07$). Results were similar for anatomic recurrence (15.6%, N=33 vs. 8.4%, N=10, $p=0.05$) and symptomatic recurrence (15.2%, N=43 vs. 9.2%, N=11, $p=0.1$). In looking at recurrence rates for the entire study population, 13% (N=43) of women had an anatomic recurrence, 13% (N=43) had a symptomatic recurrence, and 16.7% (N=55) had composite recurrence. Of the anatomic recurrences, 27.9% (N=12) were asymptomatic. Of symptomatic recurrences, 27.9% (N=12) did not meet the definition of anatomic recurrence. In looking more closely at the 12 cases with symptomatic but not anatomic recurrence, 75% (n=9) had either the

anterior or posterior wall at the level of the hymen and 25% (N=3) had all segments above the hymen. The anatomical apical recurrence rate was 3% (N=10). The most common site of anatomic recurrence was anterior (48.8%, N=21), while posterior recurrence was present in 27.9% (N=12) of cases. Anterior + apical and posterior + apical recurrences were present in 7% (N=3) and 9.3% (N=4), respectively. Recurrence occurred in all compartments for 7% (N=3) of women.

Table 1 shows baseline preoperative characteristics and the comparisons by group. Age, BMI, parity, and prior POP surgery were similar between groups. Compared to women in the ligament shortening group, those who underwent vaginal colpopexy more frequently had prolapse of all compartments, prolapse that was stage III, and prolapse that extended 4 cm or more beyond the hymen.

Table 2 shows perioperative variables, including concomitant procedures performed, as well as intraoperative and postoperative complications. None of the patients had a hysterectomy alone for treatment of prolapse. Posterior colporrhaphy was performed more frequently in the vaginal colpopexy group (29.9% vs. 18.5%; $p=0.02$). Rates of posterior or combined colporrhaphy and performance of anti-incontinence procedures were similar between groups. Overall, the most common intraoperative complication was bladder injury in 1.8% (6/330) of cases, and the most common postoperative complication was UTI in 7.9% (26/330). Complications were rare and similar between groups. The two intensive care unit admissions, neither were directly related to the specific surgical procedures. One occurred due to hyponatremia and the other was the result of traumatic intubation. The mean length of follow-up (time elapsed between surgery and last assessment) was 20 months and did not differ between groups. The range of follow-up was three to 98 months.

Table 3 shows the comparison between cases with and without any type of recurrence. For each type of recurrence (symptomatic, anatomic, or composite), groups were similar in terms of age, parity, BMI, and prior POP repair. Patients with anatomic or composite recurrence more frequently had a maximal prolapse size that was 4 cm or greater. This group comprised 49% of all recurrences. The trend was the same for symptomatic recurrence, but did not reach statistical significance. Compared to those without it, women with POP recurrence of any type had greater mean preoperative maximal prolapse size. On average, women with recurrence of any type had an eight month longer time to follow-up compared to those without recurrence.

In order to identify variables independently associated with POP recurrence, multivariable logistic regression models were developed using factors significant in bivariate analyses and controlling for age, BMI, concomitant anterior/posterior colporrhaphy, and apical support group, with the ligament shortening technique as the referent group (Table 4). Once a candidate model was obtained, further diagnostic analyses were conducted, including Hosmer-Lemeshow Goodness-of-Fit tests, concordance statistics, and post-hoc decile analysis of predicted and observed rates. Final models for each type of recurrence were adjusted for age and body mass index (BMI). For prolapse size, a sensitivity analysis was conducted to assess the highest likelihood of recurrence based on a range of sizes for the preoperative prolapse extension beyond the hymen. Chi-Square testing was conducted, with

4 cm beyond the hymen having the most significant association with recurrence. Apical support group (vaginal colpopexy or ligament shortening) was not significantly associated with any of the definitions of POP recurrence. Concomitant anterior and posterior repair decreased symptomatic recurrence, but not composite or anatomic recurrence. Each additional month of follow-up was associated with a 2% increased odds of recurrence for all types. The most significant factor associated with recurrence was preoperative prolapse size 4 cm beyond the hymen, which more than doubled the odds of both symptomatic and anatomic recurrence and increased composite recurrence odds by 57%.

Discussion

Women having hysterectomy for prolapse by an FPMRS surgeon at our institution had similar POP recurrence rates and perioperative outcomes at nearly two years when comparing those who underwent ligament shortening to those who had a vaginal colpopexy. This finding is relevant and timely given the National Quality Forum's endorsement of colpopexy at the time of hysterectomy for prolapse. This metric will be used to assess the quality of care [18]. In establishing a benchmark, it will be important to recognize that a colpopexy is not necessary for every hysterectomy. Women who demonstrate normal support following reattachment of the vagina to a shortened uterosacral/cardinal ligament complex, may not require additional apical procedures.

Our study is an important addition to the literature regarding concomitant procedures for prolapse. Using search terms "pelvic organ prolapse" and "recurrence" in combination with "ligament shortening" and "traditional" or "classical," we were unable to identify comparisons of ligament shortening techniques and vaginal colpopexy at the time of hysterectomy. Such comparisons are vital to the development of appropriate and fair quality measures. There is a known association between apical and anterior support [19–21], but there is a paucity of literature comparing traditional apical support techniques to vaginal colpopexy. In a prior population-based study, Blandon et al. found that the need for repeat prolapse surgery was lower when women undergoing hysterectomy for prolapse had concomitant prolapse repairs [5]. In another investigation, Eilber et al. reported that reoperation rates for prolapse were higher when colporrhaphy was performed without hysterectomy [3]. These studies demonstrate that prolapse repairs and hysterectomy are important in restoring vaginal support, but neither addresses the usefulness of vaginal colpopexy at hysterectomy. Our study suggests that it is important to consider a colpopexy, but that it is not necessary in every hysterectomy for prolapse.

The need for colpopexy in this cohort was assessed by expert surgeons with a series of intraoperative steps and decisions. Our results should not be interpreted as implying that ligament shortening and reattachment is sufficient for all patients. Furthermore, this technique does not consist of simply tying the uterosacral ligaments together or attaching a non-shortened uterosacral/cardinal ligament complex to the cuff. During the hysterectomy, ureteral palpation is used routinely to guide uterosacral ligament shortening, and afterwards, the effect of enterocele closure, vaginal reattachment of the cardinal and uterosacral ligaments, and anterior and posterior colporrhaphy are carefully considered. It should also be noted that we have not used this technique in a post-hysterectomy prolapse.

There are limitations to consider with this study. There is selection bias in an observational cohort such as this, where women who had prolapse 4cm beyond the hymen were more likely to undergo a vaginal colpopexy. We hypothesize that women with more severe prolapse are more likely to need a colpopexy to restore vaginal support in all areas. As this was a retrospective chart review, we could not evaluate or address all potential confounders; however, we did attempt to control for confounding by gathering patient-specific data such as prolapse size, and included it in the multivariable analysis. This allowed us to discriminate the effect of prolapse size and type and its association with prolapse recurrence. We were limited by a loss to follow-up, as is true in most surgical follow-up studies [22]. However, we did compare those patients with and without the requisite follow-up and found that they were similar with respect to baseline characteristics. In addition, as our mean follow-up time was around 20 months, our findings are limited to looking at relatively early failures. Thus we cannot draw conclusions about the long term recurrence rate with either approach in the current cohort. Finally, we did not have validated questionnaire data regarding patient symptoms and cannot comment on symptoms associated with recurrence.

When compared to vaginal colpopexy, selective use of the ligament shortening technique at the time of vaginal hysterectomy was associated with similar rates of POP recurrence and complications. Preoperative prolapse size was the factor most strongly associated with all forms of recurrence. In considering the recent push for quality measures in prolapse care, it is important that proposed measures are based on evidence demonstrating improvement in patient outcomes. In light of our data, we propose that this measure be revised so that surgeons who appropriately assess and describe the need for an apical vaginal suspension are not punished when a colpopexy is deemed not necessary.

Brief Summary: A ligament shortening technique for apical support during vaginal hysterectomy in appropriate patients has similar results as uterosacral or sacrospinous suspension.

Acknowledgments

Investigator support for C.W.S. was provided by the National Institute of Child Health and Human Development WRRH Career Development Award # K12 HD065257, and for J.O.L.D. by the Office for Research on Women's Health P50 HD044406. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Investigator D.M.M. receives salary support from the Michigan Surgery Quality Collaborative. Use of the REDCap software was funded through Michigan Institute for Clinical & Health Research grant CTSA:UL1RR024986.

Abbreviations

BMI	Body Mass Index
FPMRS	Female Pelvic Medicine and Reconstructive Surgery
LS	Ligament Shortening
POP	Pelvic Organ Prolapse
SSLS	Sacrospinous Ligament Suspension

USLS Uterosacral Ligament Suspension

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Brief Summary

A ligament shortening technique for apical support during vaginal hysterectomy in appropriate patients has similar results as uterosacral or sacrospinous suspension.

Table 1

Preoperative Characteristics and Comparisons

	Ligament Shortening N=119	Vaginal Colpopexy N=211	P value
Age, years	59.9±11.7	60±11	0.85
BMI, kg/m ²	28.52±6.3	27.2±5.2	0.06
Parity	2 [2,4]	2 [2,3]	0.9
Prior Surgery for POP	7.6 (9)	8.5 (18)	0.8
Preop POP-Q stage			<.0001
2	31.9 (38)	19.4 (41)	0.01
3 (<4 cm)	47.1 (56)	39.3 (83)	0.17
3 (4 cm)	19.3 (23)	29.9 (63)	0.03
4	1.7 (2)	11.4 (24)	0.001 **
Preop Max Prolapse Stage	2 [1,3]	3 [2,5]	<.0001
Preop POP Compartment *			0.001
Anterior Only	12.6 (15)	3.8 (8)	0.003
Posterior Only	2.5 (3)	3.3 (7)	1.00 **
Apical Only	7.6 (9)	4.7 (10)	0.29
Anterior/Apical	52.1 (62)	39.3 (83)	0.02
Posterior/Apical	1.7 (2)	3.3 (7)	0.50
Anterior/Posterior	5 (6)	7.6 (16)	0.37
All Compartments	18.5 (22)	37.9 (80)	0.0002
Preop POP-Q points			
Ba	2 [1,3]	2 [1,4]	0.1
Bp	-1 [-2,0]	0 [-1.9,1]	<.0001
C	-2 [-4,0]	0 [-3,4]	<.0001

Mean±SD, % (N), Median [IQR], P values shown are Chi square for categorical variables, t-tests for continuous variables, Mann Whitney U for comparison of medians

BMI = body mass index; POP = pelvic organ prolapse;

* Compartment considered involved in prolapse if below hymen for anterior/posterior wall and if descent of Point C was one half total vaginal length for apex

** Fisher's exact test

Table 2

Perioperative Events and Complications

	Ligament Shortening N=119	Vaginal Colpopexy N=211	P value
Concomitant Procedures			
Anterior Repair Alone	26 (21.8)	38 (18)	0.4
Posterior Repair Alone	22 (18.5)	63 (29.9)	0.02
Combined A&P Repair	71 (59.7)	110 (52.1)	0.2
Incontinence Sling	37 (31.1)	55 (26.1)	0.3
Intraoperative Events *			
Length of Surgery, minutes	150.1±47.8	159.5±48.5	0.09
Any Intraop Complication	5.9 (7)	4.7 (10)	0.6
Bladder Injury	2.5 (3)	1.4 (3)	0.4 **
Ureter Injury	0 (0)	1.9 (4) ^	0.3 **
Rectal Injury	1.7 (2)	0 (0)	0.1 **
Intraop Hemorrhage	0.8 (1)	1.4 (3)	1 **
EBL, mL	159±207.2	166.3±255.9	0.8
Postoperative Events			
Any Postop Complication	10.1 (12)	10.4 (22)	0.9
Length of Stay, days	1.5±0.7	1.4±0.9	0.7
Admission >7 days	0 (0)	0.5 (1)	0.6 **
ICU Admission	0 (0)	0.9 (2)	0.4 **
Readmission	1.7 (2)	2.8 (6)	0.4 **
UTI	9.2 (11)	7.1 (15)	0.5
Pelvic Abscess	0 (0)	1.9 (4)	0.2 **
Cardiac Complication	0 (0)	0.5 (1)	0.6 **
Nerve Injury	0 (0)	0.5 (1)	0.6 **
Length of Follow-up, months	21±18.7	19.5±17.4	0.8

Mean±SD, % (N), P values shown are Chi square for categorical variables, t-tests for continuous variables

EBL = estimated blood loss; ICU = intensive care unit; UTI = urinary tract infection

* Intraoperative injuries were identified via operative note review and considered significant if they required removal of sutures or performance of additional procedures to resolve

** Fisher's exact test

^ All injuries due to ureteral kinking which resolved with suture removal

Table 3

Factors Associated with Recurrence

Factor	Composite Recurrence			Anatomic Recurrence			Symptomatic Recurrence		
	Yes N=55	No N=275	P value	Yes N=43	No N=287	P value	Yes N=43	No N=287	P value
Age	59.4±10.7	60.2±11.3	0.7	61.5±9.1	59.8±11.5	0.06	58.3±11.4	60.2±11.2	0.5
Parity	2[2.4]	2[2.3]	0.98	3[2.4]	2[2.3]	0.8	2[2.3]	2[2.3]	0.7
BMI	27±5.8	27.8±5.2	0.2	27.6±6.1	27.7±5.1	0.07	26.9±6.1	27.8±5.1	0.06
Prior Hernia Repair	10.9 (6)	8.4 (23)	0.5	14 (6)	8 (23)	0.2	9.3 (4)	8.7 (25)	0.9
Prior Prolapse Repair	12.7 (7)	7.3 (20)	0.2	9.3 (4)	8 (23)	0.8	14 (6)	7.3 (21)	0.1
Max Size 4 cm	49.1 (27)	30.9 (84)	0.009	55.8 (25)	30.7 (88)	0.001	46.5 (20)	32.1 (92)	0.06
Max Size (cm)	3.7±2.5	2.9±2.2	0.02	4.1±2.6	2.8±2.2	0.001	3.6±2.8	2.9±2.2	0.02
Anterior Repair Alone	21.8 (12)	18.9 (52)	0.6	20.9 (9)	19.2 (55)	0.8	18.6 (8)	19.5 (56)	0.9
Posterior Repair Alone	32.7 (18)	24.4 (67)	0.2	27.9 (12)	25.4 (73)	0.7	37.2 (16)	24 (69)	0.07
Combined Anterior/Posterior Repair	67.6 (25)	75 (156)	0.3	71 (22)	74.3 (159)	0.7	70.4 (19)	74.3 (162)	0.7
Length of Follow-Up (months)	26.7±22.3	18.6±16.5	0.01	27.1±21.8	18.9±17	0.02	26±20.8	19±17.2	0.04

Mean±SD, % (N), Median [IQR]; P values shown are Chi square for categorical variables; t-tests for continuous variables; Mann Whitney U for comparison of medians

BMI = body mass index

Table 4**Multivariable Regression for Recurrent Prolapse**

Independent Variable	Odds Ratio	95% CI	Regression Coefficient	Standard Error	P value
Composite Recurrence					
Intercept	----	----	0.23	1.36	0.90
Vaginal Colpopexy (ref: Ligament Shortening)	0.93	0.4 – 2.18	–0.07	0.43	0.87
Anterior/Posterior Repair Follow-up (per month)	0.35 1.02	0.11 – 1.16 1.01 – 1.04	–1.05 0.02	0.61 0.01	0.08 0.003
Prolapse Size 4 cm	2.7	1.36 – 5.38	0.99	0.35	0.005
Symptomatic Recurrence					
Intercept	----	----	0.87	1.47	0.55
Vaginal Colpopexy (ref: Ligament Shortening)	0.79	0.32 – 1.9	–0.23	0.46	0.61
Anterior/Posterior Repair Follow up (per month)	0.23 1.02	0.06 – 0.95 1.00 – 1.03	–1.46 0.02	0.72 0.01	0.04 0.03
Prolapse Size 4 cm	2.5	1.16 – 5.31	0.91	0.39	0.02
Anatomic Recurrence					
Intercept	----	----	–2.50	1.54	0.10
Vaginal Colpopexy (ref: Ligament Shortening)	1.11	0.41 – 2.98	0.10	0.51	0.84
Anterior/Posterior Repair Follow up (per month)	0.43 1.02	0.11 – 1.69 1.01 – 1.04	–0.83 0.02	0.69 0.01	0.23 0.005
Prolapse Size 4 cm	2.85	1.35 – 6.01	1.05	0.38	0.01

Factors entered were age, body mass index (BMI), length of follow-up, performance of traditional colpopexy, performance of concomitant anterior and posterior repair, and prolapse size 4 cm. Hosmer and Lemeshow tests were 0.29, 0.21, and 0.06 respectively. C statistics 0.70, 0.71, and 0.69 respectively.