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Surgeon Specialty and Pelvic Organ Prolapse Surgery: the ACS-NSQIP

Sarah Ashmore MD*, Jinxuan Shi MA, Margaret G Mueller MD and Kimberly Kenton MD

Section of Urogynecology and Reconstructive Pelvic Surgery, University of Chicago, Chicago, IL, USA.

***Correspondence:**
Sarah Ashmore, MD, Section of Urogynecology and Reconstructive Pelvic Surgery, University of Chicago, Chicago, IL, USA, Phone: (970) 581-1554.

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ABSTRACT

Importance: *Suspension of the vaginal apex is the cornerstone of success in surgery for pelvic organ prolapse (POP).*

Objective: *We aimed to identify differences in surgeon subspecialty with respect to performing an apical suspension procedure verse an isolated anterior and/or posterior repair for the treatment of POP.*

Study Design: *This was a retrospective cohort study using the 2014 to 2021 American College of Surgeons National Surgical Quality Improvement Program database to determine differences in surgeon subspecialty of women undergoing apical suspension procedures compared to isolated anterior and/or posterior repair for POP. Surgeries were identified using CPT codes. Sacrocolpopexy, uterosacral ligament suspension, and sacrospinous ligament suspension were defined as apical suspension surgeries. Non-apical suspension surgeries included isolated anterior and/or posterior repair. Obliterative surgeries were excluded. Surgeon subspecialty included Urogynecology and Reconstructive Pelvic Surgeons (URPS) and Obstetrics and Gynecology (OBG).*

Results: *5,226 POP surgeries were performed which included 2,021 apical and 3,205 isolated anterior/posterior repairs. The majority of surgeries were performed by URPS (70.1%). Surgeon specialty differed significantly between cohorts ($p<0.001$). URPS were more likely to perform apical suspensions (78.6% vs 64.8%) compared to non-apical suspensions. OBG were more likely to perform non-apical suspensions (35.3% vs 21.4%). On multivariable logistic regression, patients who underwent apical suspension had an increased odd of having their surgery by a URPS (aOR 2.2, 95% CI 1.92-2.53) compared to an OBG.*

Conclusions: *Urogynecologists were more likely to perform apical suspension procedure at the time of POP repair than OBG, suggesting a possible advantage to have an URPS perform POP surgery.*

Keywords

Pelvic organ prolapse, Sacrocolpopexy, Uterosacral ligament suspension, Gynecology, Surgery.

Introduction

A woman's lifetime risk of undergoing surgery for pelvic organ prolapse (POP) is approximately 11-13% [1,2]. Almost 20% of hysterectomies performed in the United States annually are for POP, yet hysterectomy alone is insufficient at correcting POP [3,4]. Addressing apical support at the time of prolapse surgery is critical to a successful repair and decreasing the risk of recurrence [5,6]. However, a disappointingly low rate of apical suspensions are performed at the time of hysterectomy for POP and apical suspension is more commonly performed post-hysterectomy [7-9].

Literature suggests that surgeon specialty and volume are

influencing factors in whether apical suspension is addressed at the time of hysterectomy for POP [9-12]. Urogynecology and Reconstructive Pelvic Surgeons (URPS) are 5 times more likely to address apical support at the time of hysterectomy for POP compared to Obstetrician Gynecologists (OBG) [9]. URPS are fellowship-trained surgeons specialized in addressing pelvic floor disorders and training includes native-tissue and mesh augmented reconstructive pelvic surgeries for uterovaginal and vaginal vault prolapse. Authors have found that URPS frequently perform the majority of prolapse surgeries [9-11]. However, literature is limited to identifying trends in prolapse surgery performed at the time of hysterectomy or only anterior predominant or stage IV prolapse [9-13].

It is essential to explore trends in POP surgeries with or without a concomitant hysterectomy for uterovaginal and vaginal vault prolapse. We aimed to determine differences in surgeon specialty for both uterovaginal and vaginal vault prolapse surgeries utilizing a large, national database. We hypothesized that surgeons specialized in treating pelvic floor disorders are more likely to perform apical suspensions at the time of POP surgery.

Methods

A retrospective cohort study was performed utilizing the 2014 to 2021 American College of Surgeons National Surgical Quality Improvement (ACS-NSQIP) Gynecology Participant Use Data File (PUF) to determine differences in surgeon specialty of subjects undergoing apical suspension procedures verse isolated non-apical suspensions for POP. Institutional Review Board exemption was obtained. The ACS-NSQIP database includes extensive preoperative, intraoperative, and postoperative data through 30-days after index surgery for each subject. Data is extracted by trained Surgical Clinical Reviewers (SCRs). SCRs undergo rigorous training and regular audits are performed to ensure data accuracy, quality, and completeness. Over 700 hospitals across 49 of 50 states are represented within the ACS-NSQIP database.

Adult women undergoing apical suspension procedure or isolated anterior and/or posterior repair for POP were included. We utilized current procedural terminology (CPT) codes to identify surgical procedures for inclusion. Apical suspensions included sacrocolpopexy, uterosacral ligament suspension, and sacrospinous ligament suspension. Isolated anterior and/or posterior repair were included as non-apical suspensions. Obliterative surgeries were excluded. Surgeon specialty was categorized into URPS and OBG. Subjects were excluded if surgeon specialty was not available. The primary objective of this study was to determine the role of surgeon specialty in the performance of apical and isolated non-apical suspension procedures for POP. Secondary aims were to identify differences in demographics, clinical characteristics, and 30-day perioperative outcomes between apical and isolated non-apical suspension cohorts.

Statistical analysis was performed using R version 4.4.1. Group comparisons were performed using student's t-test for continuous variables and chi square Fisher's exact test for categorical variables. A multivariable logistic regression was performed to determine factors associated with apical suspension at the time of surgery for POP after controlling for potential confounding variables. Backwards selection was performed to select variables for inclusion in the regression model. Variables with a $p<0.10$ on univariate analysis were included.

Results

From 2014-2021, 5,226 women underwent apical or isolated non-apical suspensions for POP: 2,021 (38.6%) women had apical suspension procedures, and 3,205 (61.3%) had isolated anterior and/or posterior repairs (Table 1). Median (range) age of the cohort was 64 years (54-72), and BMI was 27.5 kg/m^2 (24.4-31.5). The majority was white (54.6%) with American Society of Anesthesiologists (ASA) class 2 physical status (62.8%). Surgeries were most commonly performed by URPS (70.1%). 972 (18.6%) and 1,321 (25.3%) women underwent a concomitant hysterectomy and sling respectively. Other POP procedures included vaginal mesh placement (4.2%) and paravaginal repair (0.6%).

Women who underwent apical suspension procedures differed from those undergoing isolated anterior/posterior repairs: they were more likely to have a higher BMI (27.6 kg/m2 vs 27.5 kg/m2, p=0.006) and have class 2 or 3 ASA physical status (93.9% vs 87.7%, p<0.001). Apical suspensions were more likely to be performed at the time of abdominal (3.5% vs 0.1%) and total laparoscopic (3.0% vs 0.5%) hysterectomies, while isolated anterior and/or posterior repairs were most performed at the time of vaginal (17.7% vs 9.7%) hysterectomy (p<0.001). Concomitant vaginal mesh placement and paravaginal repair were more likely to occur at the time of apical suspension (6.6% vs 3.7%, p<0.001). Apical suspension procedures were associated with longer operating time (p<0.001), postoperative length of stay (p<0.001), and higher readmission rate (p=0.003) compared to isolated non-apical suspensions for POP.

Surgeon specialty significantly varied with apical and isolated non-apical suspensions (Table 1). Overall, URPS performed 43.3% apical suspensions and 56.7% non-apical suspensions. OBGs performed 27.8% apical suspensions and 72.2% non-apical suspensions. After comparing surgeon specialty for apical and non-apical suspensions, URPS were more likely to perform apical suspensions (78.6% vs 64.8%, p<0.001) compared to non-apical suspensions at the time of POP surgery. OBG more commonly performed non-apical suspensions compared to apical suspensions (35.2% vs 21.4%, p<0.001). A multivariable logistic regression was performed to identify if surgeon specialty was associated with apical suspension at the time of POP surgery after controlling for potential confounding variables (Table 2). Variables were included by backwards selection as previously described and final variables were BMI, ASA class, surgeon specialty, hysterectomy, and other POP surgery. URPS surgeons were 2.2 times (aOR 2.20, 95% CI 1.92-2.53) more likely to perform an apical suspension at the time of surgery for POP compared to OBG.

Patients with ASA class 2 (aOR 1.93, 95% CI 1.53-2.45) and class 3 (aOR 2.17, 95% CI 1.69-2.8) had higher odds of apical suspension compared to ASA class 1. Compared to patients who did not have a concomitant hysterectomy, abdominal (aOR 15.46, 95% CI 5.57-42.96) and laparoscopic hysterectomies (aOR 8.70, 95% CI 4.93-15.35) were associated with high odds of apical suspension while vaginal hysterectomy (aOR 0.40, 95% CI 0.41-0.59) was associated with lower odds. Odds of paravaginal repair (aOR 45.94, 95% CI 6.03-350.09) was higher at the time of apical suspension compared to no concomitant other POP surgery

Table 1: Demographics, clinical characteristics, and perioperative outcomes.

Variable	Entire cohort (n=5,226)	Apical suspension (n=2,021)	Non-apical suspension (n=3,205)	*p*
Age; *years*	64 (54-72)	64 (55-71)	64 (53-72)	0.63
Race				
American Indian or Alaska Native	40 (0.8%)	23 (1.1%)	17 (0.5%)	
Asian	93 (1.8%)	42 (2.1%)	51 (1.6%)	
Black or African American	176 (3.4%)	90 (4.5%)	86 (2.7%)	0.84
Native Hawaiian or Pacific Islander	7 (0.1%)	4 (0.2%)	3 (0.1%)	
White	2855 (54.6%)	1427 (70.6%)	1428 (44.6%)	
Other	13 (0.2%)	6 (0.3%)	7 (2.2%)	
BMI; kg/m^2	27.5 (24.4-31.5)	27.6 (24.6-31.8)	27.5 (24.3-31.3)	0.006
ASA Class				
Class 1	476 (9.1%)	113 (5.6%)	363 (11.3%)	
Class 2	3284 (62.8%)	1276 (63.1%)	2008 (62.7%)	<0.001
Class 3	1424 (27.2%)	623 (30.8%)	801 (25.0%)	
Class 4	35 (0.7%)	8 (0.4%)	27 (0.8%)	
Current Smoker; *yes*	339 (6.5%)	145 (7.2%)	194 (6.1%)	0.12
Co-morbidities				
Congestive Heart Failure	13 (0.2%)	4 (0.2%)	9 (0.3%)	
Ascites	2 (0.04%)	1 (0.05%)	1 (0.03%)	
Hypertension on medication	2058 (39.4%)	847 (41.9%)	1211 (37.8%)	
Dialysis	8 (0.2%)	2 (0.01%)	6 (0.2%)	0.36
History of cancer	5 (0.1%)	3 (0.1%)	2 (0.06%)	
Chronic steroid use	109 (2.1%)	37 (1.8%)	72 (2.2%)	
History bleeding disorder	39 (0.7%)	19 (0.9%)	20 (0.6%)	
Diabetes on medications	590 (11.3%)	260 (12.9%)	330 (10.3%)	
Surgeon specialty				
Urogynecology	3666 (70.1%)	1588 (78.6%)	2078 (64.8%)	<0.001
Obstetrics and Gynecology	1560 (29.9%)	433 (21.4%)	1127 (35.2%)	
Concomitant sling; *yes*	1321 (25.3%)	529 (26.2%)	729 (22.7%)	0.24
Hysterectomy				
Total abdominal	75 (1.5%)	71 (3.5%)	4 (0.1%)	
Laparoscopic assisted vaginal	55 (1.1%)	24 (1.2%)	31 (1.0%)	<0.001
Total laparoscopic	77 (1.5%)	61 (3.0%)	16 (0.5%)	
Total vaginal	765 (14.6%)	197 (9.7%)	568 (17.7%)	
None	3981 (76.2%)	1409 (69.7%)	2572 (80.2%)	
Other POP Surgery				
Vaginal Mesh Placement	222 (4.2%)	106 (5.2%)	116 (3.6%)	<0.001
Paravaginal Repair	30 (0.6%)	29 (1.4%)	1 (0.03%)	
Operative Time; *minutes*	107 (72-153)	138 (96-189)	91 (62-130)	<0.001
Length of stay; *days*	1 (0-1)	1 (1-2)	1 (0-1)	<0.001
Postop complication; *yes*	380 (7.3%)	152 (7.5%)	228 (7.1%)	0.58
Reoperation; *yes*	66 (1.3%)	29 (1.4%)	37 (1.2%)	0.38
Readmission; *yes*	95 (1.8%)	51 (2.5%)	44 (1.4%)	0.003

Table 2: Multivariable logistic regression.

Variable	Adjusted Odds Ratio	95% Confidence Interval
BMI		
Underweight	0.59	0.32-1.07
Normal weight	1.06	0.89-1.26
Overweight	0.99	0.84-1.16
*Class 1 Obesity	--	--
Class 2 Obesity	1.21	0.95-1.53
Class 3 Obesity	1.34	0.96-1.87
ASA Class		
Class 1*	---	---
Class 2	1.93	1.53-2.45
Class 3	2.17	1.69-2.8
Class 4	0.72	0.31-1.67
Surgeon specialty		
Obstetrics and Gynecology*	---	--
Urogynecology	2.20	1.92-2.53
Hysterectomy		
None*	---	---
Total abdominal	15.46	5.57-42.96
Laparoscopic assisted vaginal	1.38	0.78-2.42
Total laparoscopic	8.70	4.93-15.35
Total vaginal	0.49	0.41-0.59
Other POP surgery		
None*	---	---
Vaginal Mesh Placement	1.07	0.79-1.44
Paravaginal Repair	45.94	6.03-350.09
*Referent		

Discussion

Our study found that only 40% of women had an apical suspension performed at the time of POP surgery between 2014 and 2021 utilizing the ACS-NSQIP Gynecology PUF. URPS were almost two times more likely to perform apical suspensions at the time of prolapse surgery compared to OBG. ASA class, route of concomitant hysterectomy, and additional POP surgery were also associated with increased odds of apical suspension at the time of prolapse surgery. Overall, the majority of women underwent isolated anterior and/or posterior repairs as surgical management of POP. It is well understood that addressing apical support at the time of prolapse surgery is critical to reducing the risk of recurrent POP. Eilber et al. utilized a national database to investigate the role of vaginal apical suspension in long-term outcomes of prolapse surgery [6]. After 10 years from primary prolapse surgery, reoperation rate for recurrent POP was significantly reduced when an apical suspension was performed at the time of anterior and/or posterior repair. Furthermore, the highest reoperation rate occurred after isolated anterior repair. Several studies have identified that anterior predominant prolapse is linked with apical descent [5,14]. In a cohort of 325 participants, support of the vaginal apex was strongly correlated with the most prolapse portion of the anterior vaginal wall and moderately correlated with the most prolapse portion of the posterior vaginal wall [14]. There was a strong linear relationship between the apex and the distal anterior vaginal wall on exam. Rooney et al. found that the apex is approximately 4.5 cm proximal to the most prolapse portion of the anterior vaginal wall in subjects with anterior predominant POP. Summers et al. similarly reported that half of anterior compartment prolapse is explained by poor apical support [5]. Prior literature highlights the importance of addressing apical support at the time of POP surgery and that isolated anterior and/or posterior repair is insufficient to address POP.

Despite this evidence, majority of women underwent isolated anterior and/or posterior repair to address POP in our study. Our findings are consistent with previous literature describing a significant number of women undergoing non-apical suspension procedures to surgically address POP. Surgeon specialty and training significantly impacts the likelihood of addressing the apex at the time of prolapse surgery. Sheyn et al. performed a retrospective cohort study utilizing the ACS-NSQIP database to determine if apical suspension at the time of vaginal hysterectomy for POP varied by surgeon specialty [9]. OBG were more likely to perform a vaginal hysterectomy without an apical suspension compared to URPS. URPS was the only significant factor on multivariable logistic regression that increased the odds of the performance of an apical suspension. Additionally, fellowship-trained URPS are more likely to performed proposed quality measures such as apical suspension at the time of surgery for POP compared to grandfathered URPS [11]. High-volume surgeons are also more likely to address apical support at the time of hysterectomy for POP compared to low-volume surgeons [12]. A significant volume of POP surgeries are being performed by non-fellowship trained OBG who are not addressing apical support at the time of surgery. Our findings strengthen the current body of literature highlighting an area to improve education and the quality of surgical care being provided to women with POP.

In our study, route of hysterectomy and ASA class were also associated with apical suspension at the time of POP surgery on multivariable logistic regression. Women undergoing an abdominal or total laparoscopic hysterectomy were more likely to undergo an apical suspension procedure compared to participants who did not have a concomitant hysterectomy. Vaginal hysterectomy was associated with lower odds of apical suspension. ASA class 2 and 3 also had increased odds of apical suspension compared to class 1 women. Northington et al. similarly found that concomitant hysterectomy was associated with apical suspension procedure in participants undergoing surgery for anterior predominant prolapse; however, route of hysterectomy was not significantly different between groups [13]. Age >50 years old and hospital type were associated with increased odds of apical suspension. In a retrospective cohort study utilizing the ACS-NSQIP database, apical suspension performed for stage IV POP was inversely associated with concomitant hysterectomy without any other significant variables on multivariable logistic regression [8]. In a separate study, Sheyn et al. did not find any variables associated with apical suspension at the time of vaginal hysterectomy for POP outside of surgeon specialty [9]. However, Sheyn et al. did perform propensity score matching using preoperative clinical data to ameliorate selection bias. Further research is needed to identify variables associated with apical suspension at the time

of prolapse surgery outside of surgeon specialty given these conflicting findings.

Our study has several strengths and limitations. To the best of our knowledge, we are the first to report differences in apical suspension procedures in women undergoing surgery for both uterovaginal and vaginal vault prolapse utilizing a large, national database. Prior literature is limited to either stage IV, anterior predominant, or uterovaginal POP only [8,9,13]. We are also the first to report differences in surgeon specialty and apical suspension procedures for both uterovaginal and vaginal vault prolapse utilizing a large, national database. The ACS-NSQIP database has stringent reporting criteria with frequent audits. Hundreds of hospitals across the United States participate allowing for a large, diverse, generalizable cohort of women. Despite rigorous SCR training, limitations include typical limits of a retrospective cohort study. There is potential for missing variables and coding errors. We could not account for certain factors like hospital location and surgeon volume. Unlike prior studies, we did not perform a propensity score matching to account for possible selection bias. The ACS-NSQIP database does not report severity of preoperative prolapse or POP quantification system. Severity of POP can impact patient counseling and procedural choice, which we were unable to control for in our study. We were also unable to distinguish patients undergoing surgery for recurrent POP. Surgeon specialty of URPS and OBG was distinct variables throughout the 2014-2021 database utilized. However, NSQIP determines surgeon specialty by what is listed in the hospital database. We assume that URPS specialty will include both grandfathered and fellowship-trained surgeons, however, surgeons practicing URPS prior to the availability of board examination in 2013 may be listed in the hospital system as an OBG [14].

Urogynecologists were more likely to address apical support at the time of surgery for POP, however, there still was a significant number of isolated anterior and/or posterior repairs performed by both URPS and OBG. Our study adds to the current body of literature suggesting a potential advantage of having fellowship-trained URPS performing POP surgery. As prior studies demonstrate the importance of addressing apical support at the time of POP surgery to decrease recurrence rates, our study identifies potential gaps in education to improve the quality of care being offered to women with POP.

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