UROGYNECOLOGY

Rates of colpopexy and colporrhaphy at the time of hysterectomy for prolapse

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BACKGROUND: It has been shown that addressing apical support at the time of hysterectomy for pelvic organ prolapse (POP) reduces recurrence and reoperation rates. In fact, national guidelines consider hysterectomy alone to be inadequate treatment for POP. Despite this, anterior and posterior colporrhaphy are frequently performed without a colpopexy procedure and hysterectomy alone is often utilized for treatment of prolapse.

OBJECTIVE: The objectives of this study were to: (1) determine rates of concomitant procedures for POP in hysterectomies performed with POP as an indication, (2) identify factors associated with performance of a colpopexy at the time of hysterectomy for POP, and (3) identify the influence of surgical complexity on perioperative complication rates.

STUDY DESIGN: This is a retrospective cohort study of hysterectomies performed for POP from Jan. 1, 2013, through May 7, 2014, in a statewide surgical quality database. Patients were stratified based on procedures performed: hysterectomy alone, hysterectomy with colporrhaphy and without apical suspension, and hysterectomy with colpopexy with or without colporrhaphy. Demographics, medical history and intraoperative care, and perioperative care were compared between the groups. Multivariable logistic regression models were created to identify factors independently associated with use of colpopexy and factors associated with increased rates of postoperative complications.

RESULTS: POP was an indication in 1557 hysterectomies. Most hysterectomies were vaginal (59.6%), followed by laparoscopic or robotic (34.1%), and abdominal (6.2%). Hysterectomy alone was performed in 43.1% (95% confidence interval [CI], 40.6—45.6) of cases, 32.8% (95% CI, 30.4—35.1) had a colporrhaphy without colpopexy, and 24.1% (95% CI, 22—26.3) had a colpopexy with or without colporrhaphy. Use of colpopexy was independently associated with patient age >40 years, POP as the only indication for surgery (odd ratio [OR], 1.6; 95% CI, 1.185—2.230), laparoscopic surgery (OR, 3.2; 95% CI, 2.860—5.153), and a surgeon specializing in urogynecology (OR, 8.2; 95% CI, 5.156—12.923). The overall perioperative complication rate was 6.6%, with the majority being considered minor. Complications were more likely when the procedure was performed with an abdominal approach (OR, 2.3; 95% CI, 1.088—4.686), with the use of a colpopexy procedure (OR, 3.1; 95% CI, 1.840—5.194), and by a surgeon specializing in urogynecology (OR, 2.2; 95% CI, 1.144—4.315).

CONCLUSION: Colpopexy and colporrhaphy may be underutilized and are potential targets for quality improvement. Performance of additional procedures at the time of hysterectomy increased the rate of perioperative complications. Long-term consequences of these surgical practices deserve additional study.

Key words: apical suspension, colpopexy, colporrhaphy, pelvic organ prolapse, surgical quality measures

Introduction

Hysterectomy is the second most common surgical procedure performed on women in the United States.[1] Pelvic organ prolapse (POP) is the most common indication for hysterectomy in postmenopausal women,[2] and is the indication for 14% of hysterectomies in the United States.[3]

The role of hysterectomy in the treatment of prolapse is controversial and is an area of active investigation. However, it has been shown that addressing apical support at the time of hysterectomy for POP reduces recurrence and reoperation rates.[4] In fact, national guidelines consider hysterectomy alone to be inadequate treatment for POP.[5] Despite this, anterior and posterior colporrhaphy are frequently performed without a colpopexy procedure[4,6] and hysterectomy alone is often utilized for treatment of prolapse.[7]

Our primary objectives were to describe how often concomitant prolapse procedures are used at the time of hysterectomy for POP, to identify those factors associated with use of colporrhaphy and colpopexy (apical suspension) at the time of hysterectomy for POP, and to identify the influence of surgical complexity on perioperative complication rates.

Materials and Methods

This is a retrospective analysis of hysterectomies from the Michigan Surgical Quality Collaborative (MSQC). Funded by the Blue Cross Blue Shield of Michigan/Blue Care Network, MSQC consists of 52 hospitals voluntarily collecting perioperative surgical data on a sample of patients, irrespective of a patient's insurance, for general surgery, vascular surgery, and hysterectomy cases. This represents 30.2% of hospitals in Michigan. Of these hospitals, 19.2% have ≥500 beds and 53.9% are teaching institutions. Hysterectomy-specific data collection began in January 2013. Data collection occurs on a rotating schedule of different days of the week. The first 25 cases meeting the *Current Procedural Terminology* (*CPT*) code inclusion criteria at each participating institution during consecutive 8-day cycles throughout the year are selected. Cases are followed for 30 days postoperatively to capture readmissions and complications. Dedicated registered nurses trained in data abstraction collect data

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from hospital records. Provider specialty is identified by the nurse abstractor at the hospital where the surgery was performed based on personal knowledge of the physicians' practice. The data collection is standardized and regularly reviewed through site visits, conference calls, and internal audits.

We reviewed hysterectomies in the database performed from Jan. 1, 2013, through May 7, 2014. The data presented represent all hysterectomy-specific data available at the time of analysis. Inclusion criteria were age >18 years and a preoperative indication of POP in the operative report. Route of hysterectomy was determined with operative note review. Total and subtotal hysterectomies were grouped together based on surgical approach. Robotic-assisted laparoscopic and laparoscopic hysterectomies were both included as laparoscopic approach. Vaginal and laparoscopic-assisted vaginal hysterectomies were considered vaginal approach. Concomitant procedures were determined with *CPT* codes. *CPT* codes indicating use of colporrhaphy were the following: 57240 (anterior), 45560 or 57250 (posterior), and 57260 or 57265 (combined anterior and posterior). *CPT* codes indicating use of colpopexy or apical suspension were the following: 57425 (laparoscopic), 57280 (abdominal), 57282 (extraperitoneal), and 57425 (intraperitoneal). Subjects were stratified based on surgical intervention into 3 cohorts. In the first group are hysterectomy only cases, in which there were no *CPT* codes for either colporrhaphy or colpopexy. In the second group are hysterectomy with colporrhaphy cases, in which *CPT* codes for colporrhaphy are present but *CPT* codes for colpopexy are not. In the third group are hysterectomy with colpopexy cases, in which *CPT* codes for colpopexy are present and those for colporrhaphy may or may not be present. Perioperative complications were identified by chart review. Data abstracters reviewed the patient chart using predetermined definitions to identify the various complications. For example, urinary tract infection (UTI) was identified when the patient reported symptoms of UTI in conjunction with a positive urinalysis, urine culture, or both. Complications were then classified as either major or minor. Major complications included deep incisional surgical site infection (SSI), organ/space SSI, pneumonia, unplanned intubation, pulmonary embolism, acute renal failure/insufficiency, stroke, cardiac arrest, myocardial infarction, cardiac arrhythmia, transfusion, deep vein thrombosis, sepsis, *Clostridium difficile* infection, and central line-associated bloodstream infection. UTI and superficial SSI were considered minor complications. Conversion from planned surgical route was not considered a complication. The institutional review board at the University of Michigan deemed analyses regarding this data set to be exempt from formal institutional review board approval (HUM00073978).

Bivariate analyses were used to compare the 3 patient groups stratified by surgical procedures and to identify variables for the multivariate analyses. Categorical variables were compared with χ^2 statistics and analysis of variance with Welch adjustment for normally distributed, continuous variables. Nonnormally distributed variables were analyzed with nonparametric Kruskal-Wallis test. Clinically relevant factors also statistically significant in bivariate analysis ($P < .05$) were entered into a stepwise multivariable logistic regression algorithm. The outcome variables of interest were (1) use of colpopexy and (2) any perioperative complication. Variables were evaluated for collinearity through correlation analyses. Final models included only significant variables. Model fit was assessed with Hosmer-Lemeshow χ^2 tests and C-statistics (Tables 1-3). Analyses were performed using SPSS, Version 21.0 (IBM Corp, Armonk, NY) and SAS, Version 9.3 (SAS Institute, Cary, NC).

Results

Among 9860 hysterectomies in the MSQC, POP was listed as a preoperative indication for 1557 (15.8%) and as the only indication for 878 (8.9%). The indication for surgery was missing for 49 (0.5%). The mean age of women was 56.7 ± 12.9 years, the mean body mass index (BMI) was 28.9 ± 6 kg/m^2, and the majority of women were white (1369, 87.9%). Physicians identified as obstetrician-gynecologists performed 90.2% of the hysterectomies for prolapse, urogynecologists performed 7.8%, and the remaining 2% were performed by gynecologic oncologists, general surgeons, or both. When prolapse was an indication, the most common route of hysterectomy was vaginal or laparoscopic-assisted vaginal (59.6%). Of the remaining cases, 34.1% were robotic-assisted laparoscopic or laparoscopic, and 6.2% were abdominal.

Figure 1 displays procedures performed at the time of hysterectomy for POP. In 43.1% (95% confidence interval [CI], 40.6−45.6) of cases, POP was treated with hysterectomy alone. Hysterectomy with colporrhaphy but without colpopexy was performed in 32.8% (95% CI, 30.4−35.1). There were 376 colpopexies (24.1%; 95% CI, 22−26.3) performed. Of these, 79 (21%) were extraperitoneal colpopexies, 136 (36.2%) were intraperitoneal colpopexies, and 161 (42.8) were sacral colpopexies. Generalist obstetrician-gynecologists performed a colpopexy in 289 (25.1%) of their cases with POP. In comparison, urogynecologists performed a colpopexy in 87 (71.9%) of their cases. Patients of urogynecologists were older than those of other providers (60.1 vs 56.4 years, $P = .03$), more likely to have POP as the sole indication for their hysterectomy (68.6% vs 55.4%, $P = .003$), and more likely to have an ASA class ≥3 (31.4% vs 19.9%, $P = .003$), but were no more likely to have prior pelvic surgery (40.5% vs 46.7%, $P = .113$) or abdominal surgery (34.6% vs 36.8%, $P = .39$).

Comparisons of demographic and perioperative characteristics associated with the 3 cohorts are shown in Table 1. Women having hysterectomy alone were younger, had higher BMI, were more likely to be non-white, had higher prevalence of other indications (in addition to POP) for hysterectomy, had lower prevalence of ASA class ≥3, had lower prevalence of Medicare insurance, and had higher prevalence of prior pelvic surgery. Of the 878 women who had

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TABLE 1
Factors associated with surgery performed for pelvic organ prolapse

	Hysterectomy only, N = 671	Hysterectomy with colporrhaphy, N = 510	Hysterectomy with colpopexy ± colporrhaphy, N = 376	*P* value (ANOVA or χ^2)
Age, y	53.2 ± 13	59.6 ± 12.3	59 ± 12.2	<.0001
BMI, kg/m^2	29.4 ± 6.3	28.4 ± 5.6	28.6 ± 12.9	.02[a]
Parity	2 [2–3]	2 [2–3]	2 [2–3]	.67
Non-white race	102 (15.2)	50 (9.8)	36 (9.6)	.004
ASA class 3–4	122 (18.2)	109 (21.4)	93 (24.7)	.04
Insurance				<.0001
Medicaid	49 (7.3)	23 (4.5)	8 (2.1)	
Medicare	139 (20.7)	179 (35.1)	111 (29.5)	
Medicaid and Medicare	7 (1)	10 (2)	8 (2.1)	
Private insurance	445 (66.3)	284 (55.7)	213 (56.6)	
Uninsured	11 (1.6)	3 (0.6)	3 (0.8)	
Other	20 (3)	11 (2.2)	33 (8.8)	
Prior pelvic surgery	334 (49.8)	218 (42.7)	167 (44.4)	.04
Sole indication POP	290 (43.2)	342 (67.1)	246 (65.4)	<.0001
Other indications				
AUB/leiomyomas	274 (40.8)	106 (20.8)	74 (19.7)	<.0001
Chronic pain/endometriosis	188 (28)	74 (14.5)	66 (17.6)	<.0001
Other	84 (12.5)	37 (7.3)	30 (8)	.004
Surgical approach				<.0001
Laparoscopic	239 (35.6)	94 (18.4)	198 (52.7)	
Abdominal	74 (11)	9 (1.8)	14 (3.7)	
Vaginal	358 (53.2)	406 (79.6)	164 (43.6)	
Concomitant sling	41 (6.1)	56 (11)	115 (30.6)	<.0001
Oophorectomy	523 (77.9)	406 (79.6)	310 (82.4)	.2
Specimen weight	87 [54–128.5]	64.5 [44–97]	67 [45.4–108]	<.0001[a]
Severe adhesions	25 (3.7)	11 (2.2)	14 (3.7)	.3
Surgical time, h	2.1 ± 1.2	2.1 ± 0.9	2.7 ± 1.2	<.0001[a]
Urogynecologist	25 (3.7)	9 (1.8)	87 (23.1)	<.0001

Data presented as mean ± SD, n (%), or median [interquartile range].

ANOVA, analysis of variance; *AUB*, abnormal uterine bleeding; *BMI*, body mass index; *POP*, pelvic organ prolapse.

[a] Welch adjustment for nonnormal distribution.

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POP as the sole indication for hysterectomy, 290 (33%) had hysterectomy without concomitant procedures and 246 (28%) had a colpopexy. Women who had colporrhaphy at the time of hysterectomy without colpopexy had higher prevalence of vaginal hysterectomy. Those who had colpopexy performed were more likely to have had their procedure done by an urogynecologist, had higher utilization of laparoscopic approach, and had higher rates of concomitant incontinence sling. Compared to other practitioners, urogynecologists were more likely to perform a concomitant sling (10.6% vs 49.6%, $P < .0001$) and more likely to perform colpopexy (20.1% vs 71.9%, $P < .0001$). However, urogynecologists were not more likely to report adhesions adding to operative complexity (3.3% vs 2.5%, $P = .6$) or perform concomitant salpingo-oophorectomy (79.5% vs 80.2%, $P = .9$).

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TABLE 2
Multivariable model of factors associated with performance of colpopexy at time of hysterectomy

Variable	Crude OR	Adjusted OR	95% CI	Regression coefficient	SE	*P* value
Constant	—	—	—	−3.2294	0.3245	<.0001
Hospital size ≥500 beds Reference: <500 beds	1.8112	1.854	1.291–2.661	0.6172	0.1844	.0008
Sole indication POP Reference: Multiple indications including POP	1.6438	1.609	1.172–2.210	0.4759	0.1619	<.0001
Surgical approach Reference: Vaginal						
Laparoscopic	3.164	4.350	3.197–5.92	1.4703	0.1572	<.0001
Abdominal	0.722	1.145	0.574–2.286	0.1354	0.3527	.7
Age, y Reference: Age <40						
40–49	2.17	1.729	0.900–3.325	0.5478	0.3335	.1
50–59	2.634	2.245	1.166–4.325	0.8089	0.3344	.02
60–69	3.414	3.057	1.580–5.916	1.1175	0.3369	.0009
≥70	2.904	2.592	1.312–5.123	0.9525	0.3476	.006
Urogynecologist Reference: All other surgeons	10.156	8.016	5.057–12.706	2.0814	0.2350	<.0001

Variables entered: age in deciles, body mass index, non-white race, prior pelvic surgery, urogynecology specialist, hospital size, teaching status of institution, insurance status, indication for surgery, surgical approach.

Hosmer-Lemeshow goodness of fit test = 0.8257, 9 groups.

C-statistic = 0.752.

CI, confidence interval; *OR*, odd ratio; *POP*, pelvic organ prolapse.

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TABLE 3
Multivariable model of factors associated with any perioperative complication at time of hysterectomy for pelvic organ prolapse

Variable	Crude OR	Adjusted OR	95% CI	Regression coefficient	SE	*P* value
Constant	—	—	—	−3.264	0.6157	<.0001
Surgical approach Reference: Vaginal						
Laparoscopic	0.58	0.369	0.202–0.674	−0.9962	0.3069	.001
Abdominal	2.018	2.148	1.022–4.512	0.7643	0.3788	.04
Colpopexy Reference: No colpopexy	2.944	2.909	1.720–4.922	1.0679	0.2683	<.0001
Urogynecologist Reference: All other surgeons	3.136	2.088	1.071–4.073	0.7364	0.3409	.03

Variables entered: age, Charlson Comorbidity Index, body mass index, concomitant oophorectomy, specimen weight, severe adhesions, surgical time, urogynecology specialist, surgical approach, performance of apical suspension.

Hosmer-Lemeshow goodness of fit test = 0.695; 10 groups.

C-statistic = 0.701.

CI, confidence interval; *OR*, odd ratio.

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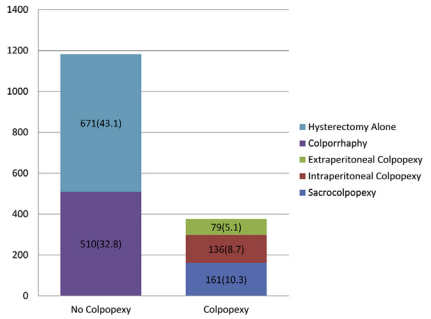
FIGURE 1
Procedures performed at time of hysterectomy for pelvic organ prolapse (POP)



Q6 Number and percentage of women having additional prolapse-directed procedures at time of hysterectomy for POP. Numbers in colored bars represent n for each group and percentage of all hysterectomies performed for POP in Michigan Surgical Quality Collaborative database.

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The multivariable regression model with colpopexy as the outcome of interest is presented in Table 2. Candidate factors entered were age by decile, BMI, non-white race, prior pelvic surgery, urogynecology subspecialist, insurance status, surgical indication, and surgical approach. The model was also controlled for hospital bed size. After these factors were controlled for, age >49 years, POP being the sole indication for surgery, use of laparoscopy vs vaginal approach, and a surgeon specializing in urogynecology were independently associated with colpopexy.

The overall complication rate was 6.6%. The rates of major and minor complications were 1.9% and 4.9%, respectively. Postoperative UTI was the most common complication, affecting 2.8% (n = 43). Postoperative blood transfusions were reported in 1% (n = 17). Complications occurring in <1% of cases included superficial SSI (n = 6), organ or space infection (n = 6), pulmonary embolism (n = 3), unplanned intubation (n = 3), acute renal insufficiency (n = 2), myocardial infarction (n = 1), cardiac arrhythmia (n = 2), deep vein thrombosis (n = 2), and sepsis (n = 5). Within the 30-day postoperative period, there were 48 (3.1%) readmissions, 49 (3.1%) reoperations, and 117 (7.5%) emergency department evaluations.

Comparisons of complication rates between groups stratified by surgical procedures are presented in Figure 2. We created a multivariable model to predict any perioperative complication (intraoperative and postoperative adverse events, as well as 30-day readmission or reoperation). In the model, performance of colpopexy, urogynecology subspecialist provider, and abdominal surgical approach were associated with increased odds of complication (Table 3). Laparoscopic approach was associated with Q5 an increased complication rate when compared to the vaginal approach. Given the unexpected findings that vaginal approach and surgery performed by urogynecologist were associated with an increased complication rate we created a second model looking at any complication other than UTI. Once UTI is excluded, the complication rate of urogynecologists compared to other providers was no longer significant (odd ratio, 0.915; 95% CI, 0.257−3.263). In addition, laparoscopic approach compared to vaginal approach no longer had a protective effect (odd ratio, 1.119; 95% CI, 0.5−2.509). Hosmer-Lemeshow test with 7 groups was 0.633 and C-statistic was 0.633. Due to the rarity of major perioperative complications, it was not feasible to create a model looking at these more serious adverse Q4 events. [F2]

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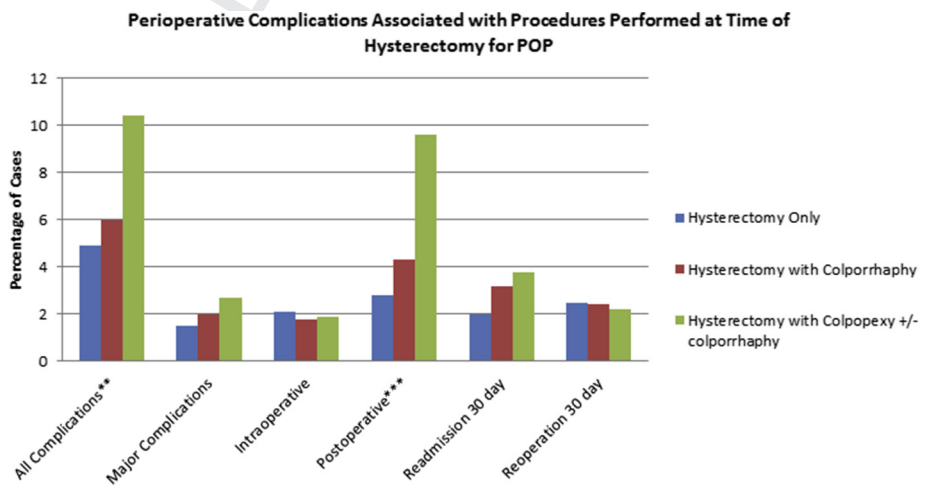
FIGURE 2
Perioperative complications associated with procedures performed at time of hysterectomy for prolapse



Percentage of women having perioperative complications at time of their hysterectomy for prolapse based on types of procedures performed. $^{**}P = .003$, $^{***}P < .0001$, all other $P > .05$.

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Comment

In this study, we found evidence that prolapse procedures at the time of hysterectomy for POP were underutilized. One third of cases in which prolapse was the sole indication for surgery had no concomitant prolapse procedures performed. This number increased to 43% when prolapse was 1 of several indications for surgery. While hysterectomy alone may be appropriate treatment for a small group of women, it is highly unlikely to be sufficient for a group this large. This cohort's long-term outcome is unknown, but with reported symptomatic recurrent prolapse rates of 20-25%[8,9] and reoperation rates as high as 29%,[10,11] it is important to evaluate what is happening in clinical practice.

The relationship between surgeon specialty and the likelihood of undergoing a colpopexy is worthy of comment. Colpopexy was utilized in 24% of cases and urogynecologists were vastly more likely to perform a colpopexy, consistent with prior work by Yurteri-Kaplan et al.[12] This is a finding that may reflect the training and experience of subspecialists. There is a learning curve in performing the dissections necessary for these procedures and in managing the risk of complications. The risks of ureteral and bladder injury with intraperitoneal colpopexy range from 1-5%,[13] while hemorrhage with extraperitoneal colpopexy or sacral colpopexy can be massive and life-threatening. These types of major injuries were extremely rare in our cohort, likely related to the concentration of these procedures in subspecialists' practices. Our data revealed that the increase in all complications for urogynecologists was related to UTIs—an expected finding given the potential for voiding dysfunction when undertaking additional procedures for prolapse and urinary incontinence. Another unexpected finding was the increased complication rate for vaginal compared to laparoscopic procedures, but again, once UTI was excluded complications were similar between groups. The increased rate of UTI in the vaginal group could be related to increased tissue manipulation around the urethra. Major complications were similar among the groups. Like our study population, Kantartzis et al[14] noted a statistically significant higher rate of complications for procedures including colpopexy.

The rate of colpopexy at the time of hysterectomy we found is consistent with previous reports in the literature. Eilber et al[4] reported that 21-26% of hysterectomies for prolapse among Medicare beneficiaries included a colpopexy. In contrast, Alas et al[15] and Kantartzis et al[14] both reviewed their experiences at a single center and reported that 48% and 55% hysterectomies for POP had concomitant apical procedures. These studies reflect the fact that rates of colpopexy will vary remarkably among hospitals and that subspecialty training is associated with higher rates of utilization.

Another independent predictor of colpopexy was increasing age. This finding is in agreement with the study of Kantartzis et al,[14] which found that women >75 years were more likely to have a colpopexy. In our population, older women were also more likely to have surgery with an urogynecology subspecialist. The higher rates of colpopexy among women treated by subspecialists in urogynecology could reflect referral bias, either for more advanced POP or perhaps for increased medical complexity as indicated by the higher proportion of women having ASA class ≥3. This finding is particularly interesting given the general concern that younger women are likely at increased risk for symptomatic recurrence and may be the group which would benefit most from appropriate colporrhaphy and colpopexy.

There are several considerations when assessing this study's findings. A major strength is the large size of the data set with dedicated chart abstraction and a formal auditing process to ensure data accuracy. These findings reflect a variety of practices in community and academic centers, making the data more generalizable even though the data are from only 1 state. It should be noted that the current MSQC sampling methodology is unweighted and does not directly support estimation of hysterectomy rates of the target population or total case volume for the target population at a hospital. With these limitations in mind, hospital bed size was included in the multivariable analysis to account for this potential site variation. The lack of data on severity of POP is also a limitation. For instance, we do not know if urogynecologists were referred more severe cases of prolapse, leading to a higher rate of colpopexy, or whether they were more likely to perform a procedure due to their subspecialty training. Furthermore, although it is widely accepted that hysterectomy alone is not adequate treatment for prolapse, we do not have long-term outcome data for this cohort and cannot determine if women who had hysterectomy alone truly had higher failure rates. Another limitation is the identification of provider specialty, which is based on the provider's proclaimed specialty status and not board certification status. It is possible that some providers are misclassified; however, their classification reflects their reputation within the community since the nurse abstractors are employed by the hospital and familiar with local practice patterns. A further limitation is the potential for missing data in our complication analysis. It is possible that some patients sought care for perioperative complications outside of hospitals in the MSQC system. These complications were not captured by the data abstractors and complication rates may be higher than reported.

This study provides information about current practice patterns in prolapse care in a diverse patient/physician population. While the American Congress of Obstetricians and Gynecologists expressly states that hysterectomy alone is not acceptable treatment for prolapse, 43.1% did not have either colporrhaphy or colpopexy to address pelvic floor laxity. While there are no outcome data for this cohort, these women could be at increased risk for surgical failure and repeated surgery. It is also important to note that while additional surgery may be indicated for many

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women with POP, it may come at the cost of increased minor perioperative complications. In this analysis, we did not find any significant increase in major complications. Ultimately, the relative risks and benefits of additional surgery and recurrent prolapse should be considered carefully based on particular patient characteristics—most importantly, patient goals and specifics of their disease state. To best determine how to treat and counsel women with prolapse, data on recurrence with and without colporrhaphy and with and without colpopexy are needed. ■

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