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ORIGINAL ARTICLE

Perioperative complications following colpocleisis with and without concomitant vaginal hysterectomy

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Abstract
Introduction and hypothesis Pelvic organ prolapse is common in the elderly population and may be surgically treated with colpocleisis. We aimed to identify and compare surgical characteristics and 30-day perioperative complications in patients who underwent colpocleisis with and without concomitant vaginal hysterectomy (VH) using the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database.
Methods Women who underwent vaginal closure procedures from 2006 to 2014 were identified utilizing Current Procedural Terminology (CPT) codes for LeFort colpocleisis (57120) and vaginectomy (57110). Patients undergoing a concomitant VH were identified by CPT codes ranging from 58260 to 58294. Variables including patient demographics, operative time, hospital length of stay, transfusion, and reoperation were evaluated. Specific medical complications, surgical site infection, and urinary tract infection (UTI) rates were calculated. Variables were analyzed using chi-squared, Fisher's exact, student's *t* tests and logistic regression.
Results We identified 1,027 women in the ACS-NSQIP database who underwent vaginal closure procedures. The majority of patients (893, 87.0%) underwent colpocleisis alone, and the remainder (134, 13.0%) underwent concomitant VH. Operative times were shorter in patients undergoing colpocleisis alone. UTI was the most common postoperative complication affecting 4.3% of the entire cohort. Twelve women (1.2%) had a serious medical complication, seven who underwent colpocleisis alone and five who underwent colpocleisis with concomitant VH. In backward logistic regression, serious medical complications were the only variable independently associated with VH at the time of colpocleisis ($p < 0.05$).
Conclusions Colpocleisis is a safe procedure with rare serious adverse events.

Keywords Colpocleisis · Pelvic organ prolapse · Vaginal hysterectomy

Introduction

Pelvic floor disorders (PFDs) including urinary incontinence (UI), fecal incontinence, and pelvic organ prolapse (POP), are highly prevalent conditions that affect 25% of women in the US [1, 2]. Co-occurrence of PFDs is high, and many women suffer from more than one PFD [3]. Specifically, between 1979 and 2006, over 5.6 million inpatient procedures for POP were performed in the US [4]. Based on data from a US claims and encounters database between 2007 and 2011, the estimated lifetime risk of surgery for either stress UI (SUI) or POP in women is 20.0% by the age of 80 years [5]. With the aging US population and the higher prevalence of PFDs in the elderly, the number of women who will undergo surgery for SUI or POP in 2050 is estimated to increase by 47% [6].

Symptomatic POP may be treated with pelvic floor physical therapy, pessary placement, or reconstructive or

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obliterative surgery. Reconstructive surgery aims to restore normal vaginal anatomy while obliterative surgery (colpocleisis) reduces the pelvic viscera and surgically closes a portion of the vaginal canal. Colpocleisis surgical success rates are high, typically ranging between 91% and 100% in the literature [7]. Moreover, colpocleisis is associated with high patient satisfaction [8, 9], low risk of regret [10, 11], and low complication rates (6.8–15%) [12–14]. Specific complications following colpocleisis, including venous thromboembolism, transfusion, and bowel or bladder injury, are rare [15], and obliterative procedures carry lower risks of complications in the elderly than reconstructive procedures [16]. Furthermore, gynecologic malignancies following colpocleisis are rare, but because colpocleisis precludes future endometrial or cervical evaluation, the need for preoperative endometrial evaluation and cervical cancer screening has been suggested [17]. While concomitant vaginal hysterectomy (VH) may reduce the risk of future endometrial pathology, it is associated with increased operative time and surgical blood loss compared with colpocleisis alone [18, 19]. Therefore, the role of VH at the time of colpocleisis remains controversial.

Our objective was to identify and compare surgical characteristics and 30-day perioperative complications in patients who underwent colpocleisis with and without concomitant VH using the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database.

Materials and methods

Following approval from the Northwestern University Institutional Review Board, we retrospectively reviewed data from the ACS-NSQIP database. Data collection methods for the NSQIP database have previously been described and validated [20, 21]. A comprehensive analysis of NSQIP data has also demonstrated high inter-rater reliability [22].

Women who underwent vaginal closure procedures from 2006 to 2014 were identified utilizing Current Procedural Terminology (CPT) codes for LeFort colpocleisis (57120) and vaginectomy (57110). Patients undergoing a concomitant VH were identified by additional CPT codes ranging from 58260 to 58294. Patients undergoing concomitant laparoscopic or abdominal procedures, or procedures unrelated to POP, were excluded from the analysis.

Demographic, preoperative medical comorbidities, operative, and postoperative factors were abstracted from the database. Demographics included age and body mass index. Preoperative medical comorbidities included bleeding disorders, congestive heart failure, chronic obstructive pulmonary disease, diabetes, dyspnea, hypertension, steroid use, tobacco use, and American Society of Anesthesiologists class. Operative factors included anesthesia type, operative time, need for transfusion, and concomitant midurethral sling placement. Postoperative factors at 30 days included length of stay, urinary tract infection (UTI), return to the operating room (OR), and serious medical complications including ventilator dependence for greater than 48 h, cardiac arrest, myocardial infarction (MI), cerebrovascular accident (CVA), sepsis, organ space infection and deep vein thrombosis (DVT).

Postoperative complications at 30 days were defined according to NSQIP criteria. UTI was defined as: (1) fever, symptoms of UTI, and positive urine culture with >105 colonies/mL of no more than two species of organisms, or (2) fever or symptoms plus: positive dipstick, pyuria, positive gram stain, two cultures with repeated isolation of >102 colonies/mL of the same uropathogen, <105 colonies/mL of a single uropathogen in patient being treated with antimicrobial therapy, or physician's diagnosis. Return to OR was defined as any return to the OR within 30 days for any surgical procedure. Cardiac arrest was defined as the absence of cardiac rhythm or presence of chaotic cardiac rhythm resulting in a cardiac arrest requiring the initiation of cardiopulmonary resuscitation, which included chest compressions. MI was defined as documentation of ECG changes indicative of acute MI, new troponin elevation or physician diagnosis of MI. CVA was defined as an embolic, thrombotic or hemorrhagic vascular accident or stroke with motor, sensory or cognitive dysfunction that persisted for 24 h or more. Organ space infection was defined as an infection related to the operation that involved any part of the anatomy (e.g., organs or spaces) other than the incision. DVT was defined as identification of a new blood clot via duplex ultrasonography, venography or CT. The patient must have been treated with anticoagulation therapy, placement of vena cava filter, or clipping of the vena cava.

Variables were analyzed using the chi-squared, Fisher's exact, and Student's t tests for categorical and continuous variables, respectively. Backward logistic regression, including all variables significant ($p < 0.05$) in a bivariate analysis, was used to determine variables independently associated with colpocleisis with or without VH. Statistical analysis was carried out using SPSS version 20 (IBM Corp., Armonk, NY).

Results

We identified 1,027 women in the database who underwent vaginal closure procedures between 2006 and 2014. The majority of patients (893, 87.0%) underwent colpocleisis alone, and the remainder (134, 13.0%) underwent concomitant VH. Patients who underwent colpocleisis were older than patients who underwent colpocleisis and VH, but there was no significant differences in preoperative medical comorbidities between the two groups (Table 1). Operative times were shorter in patients undergoing colpocleisis alone. Concomitant

Table 1 Demographics, preoperative, and operative factors

	Colpocleisis ($N = 893$)	Colpocleisis with vaginal hysterectomy ($N = 134$)	p value
Demographics, mean ± SD			
Age (years)	79.4 ± 6.9	76.7 ± 6.6	<0.001
Body mass index	27.2 ± 5.4	27.2 ± 5.3	0.99
Preoperative factors, *n* (%)			
Bleeding disorders	24 (2.7)	0	0.06
Congestive heart failure	3 (0.3)	0	0.66
Chronic obstructive pulmonary disease	44 (4.9)	4 (3.0)	0.39
Diabetes	167 (18.7)	20 (14.9)	0.29
Dyspnea	53 (5.9)	11 (8.2)	0.31
Hypertension	690 (77.3)	96 (71.6)	0.15
Steroid use	22 (2.5)	6 (4.5)	0.25
Tobacco use	31 (3.5)	3 (2.2)	0.61
ASA class 3/4	49 (5.5)	11 (8.2)	0.21
Operative factors			
Operative time (min), mean ± SD	101.6 ± 51.0	144.3 ± 59.4	<0.001
Transfusion, *n* (%)	16 (1.8)	3 (2.2)	0.73
Concomitant midurethral sling placement, *n* (%)	352 (39.4)	51 (38.1)	0.76

ASA American Society of Anesthesiologists, *SD* standard deviation

incontinence procedures were also common, with 403 women (39.2%) undergoing midurethral sling placement for SUI.

UTI was the most common postoperative complication affecting 4.3% of the entire cohort (4.7% colpocleisis, 1.5% colpocleisis with VH; $p = 0.11$). In the bivariate analysis, there were no significant differences in sepsis ($p = 0.43$), CVA ($p = 0.98$), organ space infection ($p = 0.24$), MI ($p = 0.05$), cardiac arrest ($p = 0.13$), DVT ($p = 0.13$), or dependence on a ventilator for more than 48 h ($p = 0.13$) between the two groups.

Twelve women (1.2%) had a serious medical complication, seven who underwent colpocleisis alone and five who underwent colpocleisis with concomitant VH (Table 2). Of the seven women with complications following colpocleisis alone, three had sepsis, two had a CVA, one had an organ space infection, and one had an MI. Of the five women with serious complications following colpocleisis with VH, one had sepsis, one had an MI, one had an organ space infection, one had a DVT, and one had cardiac arrest, and was dependent on a ventilator for greater than 48 h. In backward logistic regression, serious medical complications were the only variable independently associated with VH at the time of colpocleisis ($p < 0.05$).

Discussion

As demonstrated in this large, national database study, colpocleisis is a safe procedure with rare serious adverse events. Although overall complication rates are low, when VH is performed at the time of colpocleisis, there is a significant increase in the risk of serious medical complications, which is independent of patient age and longer operative times. This finding suggests that VH should not be performed routinely at the time of colpocleisis unless there is specific uterine or cervical pathology that requires hysterectomy.

Table 2 Postoperative complications

	Colpocleisis ($N = 893$)	Colpocleisis with vaginal hysterectomy ($N = 134$)	p value
Postoperative factors			
Length of stay (days), mean ± SD	1.4 ± 2.7	1.3 ± 2.7	0.64
Return to operating room, *n* (%)	12 (1.3)	2 (1.5)	0.70
Postoperative complications, *n* (%)			
Urinary tract infection	42 (4.7)	2 (1.5)	0.11
Serious medical complications	7 (0.8)	5 (3.7)	0.03

SD standard deviation

The relationship between operative time and perioperative morbidity has been established. Studies in gynecology have shown that increased operative times are associated with postoperative complications in vaginal, laparoscopic, and robotic hysterectomy [23, 24]. Although not well studied in women undergoing POP repair, it is conceivable that increased operative time is likely to contribute to perioperative morbidity in this patient population. Additionally, the risk of perioperative complications has been reported to increase in patients 65 years of age and older, as compared with younger women undergoing POP repair [16, 25]. Thus, the increased operative time necessary to also perform a VH may increase potential perioperative morbidity in this elderly population.

VH at the time of colpocleisis may be performed with the intention of preventing future uterine malignancy. The risk of unanticipated premalignant or malignant uterine pathology found at the time of POP repair is low, ranging from 0.8% to 2.9% in recent studies [26–28]. This finding has been echoed in a decision analysis showing that colpocleisis alone is preferred to concomitant hysterectomy in women over the age of 40 years [29]. As a result, the potential morbidity associated with concomitant VH should be weighed against a patient's risk of developing uterine cancer.

The strengths of this study include its use of a large, national, multicenter database which relies on patient medical chart abstraction to obtain 30-day patient outcomes. Limitations of the NSQIP database have been reported by prior studies. As this was a retrospective study, its design was subject to the associated limitations inherent in retrospective studies, including information bias. Additionally, although the NSQIP database has been shown to have high rates of accuracy and reliability, the possibility of coding error exists. The database also does not provide specific information regarding severity of comorbidities, indications for surgery, or specific outcomes related to a given procedure.

Our study confirmed that colpocleisis remains a safe treatment modality for POP in the geriatric population and that VH should only be performed for specific indications.

Compliance with ethical standards

Financial disclaimer None.

Conflicts of interest None.

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