



A Novel Approach to Combined Vaginal and Laparoscopic Gynecological Surgery

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ABSTRACT

Background and Objectives: In this case series, we propose a novel approach to combined vaginal and laparoscopic surgery in which a posterior colpotomy and 2 5-mm abdominal incisions are used to perform benign gynecological procedures. We seek to assess the safety and feasibility of this technique in difficult surgical candidates such as those with obesity or prior laparotomies, as well as to detail intra- and postoperative complications associated with the procedure.

Methods: We collected demographic, clinical, intra-operative, and postoperative data on 45 women who underwent a combined vaginal and laparoscopic gynecological surgery for benign indications by a single surgeon between February 2013 and August 2017.

Results: From February 2013 through August 2017, 45 women underwent a combined vaginal and laparoscopic surgery at 2 institutions. Procedures included adnexal surgery (n = 32, 71%), and total hysterectomy (n = 13, 29%). Of patients who underwent adnexal surgery, two had minor postoperative complications. No patients had major complications. In addition, no patients had postoperative vaginal infections or pelvic abscesses, and there were no readmissions within 30 days after the procedures.

Conclusion: Our proposed combined vaginal and laparoscopic approach to benign gynecological surgery can be utilized in difficult surgical candidates including those with obesity, nulliparous patients, and those with prior abdominal surgery. Our data has shown that this approach is safe and effective.

Key Words: Colpotomy, Laparoscopy, Transvaginal, Gynecology, Benign.

INTRODUCTION

The use of a posterior colpotomy has been one of the mainstays of gynecologic surgery, and surgeons have utilized this incision to perform simple vaginal hysterectomies, to drain pelvic abscesses or sample fluid collections, and more recently to perform adnexal surgery and hysterectomies through the transvaginal natural orifice transluminal endoscopic surgery (NOTES) technique.^{1,2}

Moreover, several studies have been published recently demonstrating the use of a posterior colpotomy incision to remove specimens during benign gynecologic surgery.³⁻⁶ As these studies have demonstrated, traditional removal of gynecologic specimens had included an extension of one of the laparoscopic port sites. However, with specimen removal through a posterior colpotomy, extension of laparoscopic incisions can be avoided for faster wound healing, less pain and better cosmesis. The use of posterior colpotomy incisions may have been relatively underutilized due to concerns for postoperative infections, dehiscence or dyspareunia, which are nonproven concerns in the literature.

Given that cosmesis is a priority for many patients with benign disease, and its low rate of adverse events, we propose to expand on the use of posterior colpotomy, and utilize it as an additional surgical port site with an assistant surgeon operating from the vagina. This is an attractive addition, as it will decrease the number of abdominal incisions necessary to perform benign gynecologic laparoscopic surgery.

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In this case series, we present a group of patients who underwent a combined vaginal and laparoscopic approach to benign gynecological surgery by a single surgeon. Our approach involves only 2 5-mm abdominal incisions in addition to a posterior colpotomy. We seek to assess the safety and feasibility of this technique in difficult surgical candidates such as those with obesity or prior laparotomies, as well as to detail intra- and postoperative complications associated with the procedure.

MATERIALS AND METHODS

Forty-five women underwent combined vaginal and laparoscopic surgery for benign indications by a single surgeon between February 2013 and August 2017.

Demographic and clinical data were abstracted from the electronic medical records including age, parity, body mass index (BMI), prior surgery, medical comorbidities, indication for gynecologic surgery, and preoperative pelvic pain or dyspareunia. Data relating to the surgery were also collected, including surgical procedures performed; number, size, and location of abdominal laparoscopic incisions; operative time; estimated blood loss; intra-operative complications; preoperative antibiotics used; postoperative complications; hospital length of stay; specimen size; and postoperative pain. Estimated blood loss values denoted as “minimal” were treated as 15 cc.

Surgical Technique

This posterior colpotomy technique has been described in detail in a prior study published from our institution.³

Briefly, all patients provided informed consent. The patients received intravenous prophylactic antibiotics for prevention of surgical-site infection according to our hospital protocol. After induction of general anesthesia, patients are placed in the dorsal lithotomy position, and prepped and draped. A disposable uterine manipulator, such as the Kronner Manipujector Uterine Manipulator/Injector (Cooper Surgical, Inc, Trumbull, CT, USA) was placed.

Pneumoperitoneum was established at the left upper quadrant of the umbilicus with a Veress needle. In this technique, Veress needle with a VersaStep radially expandable sleeve (Covidien, Mansfield, MA, USA), was inserted into the abdomen and insufflation to the surgeon's desired intra-abdominal pressure was obtained. At that point, a 5-mm trocar was introduced, and a 5-mm

articulated laparoscopic camera was introduced. The abdomen was surveyed, and the surgeon made a decision regarding placement of the second abdominal trocar: either in the right lower quadrant of the umbilicus, right lower quadrant of abdomen, or left lower quadrant of the abdomen (**Figure 1**). The patient was then placed in the Trendelenburg position.

To perform the posterior colpotomy, a STEP access needle with a VersaStep radially expandable sleeve was placed through the vagina into the posterior cul-de-sac between the uterosacral ligaments under direct visualization. This is done at a level 1–2 cm below the cervix in the posterior fornix. A 12-mm trocar was then placed through the expandable sleeve (**Figure 2**). The operator utilizing that site used an articulated grasper to assist the primary surgeon (**Figure 3**).

In the setting of adnexal surgery, the freed specimen was placed in a laparoscopic specimen retrieval bag and removed from the posterior colpotomy port site. If necessary, they were morcellated vaginally within the bag. In the setting of hysterectomy, the posterior colpotomy incision was incorporated into the full colpotomy at the end of the procedure. The colpotomy incision was then closed vaginally with a delayed absorbable suture. At completion of the procedure, the patients had 2 5-mm laparoscopic incisions and a reapproximated colpotomy incision (**Figure 4**).



Figure 1. Two trocars are noted at the patient's umbilicus.

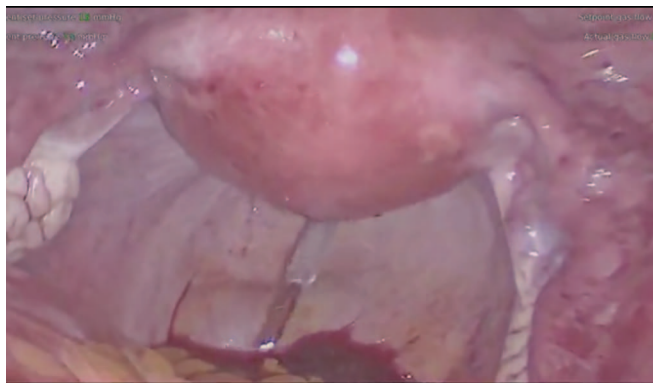


Figure 2. The Veress needle is being placed into the posterior cul-de-sac to form the posterior colpotomy.

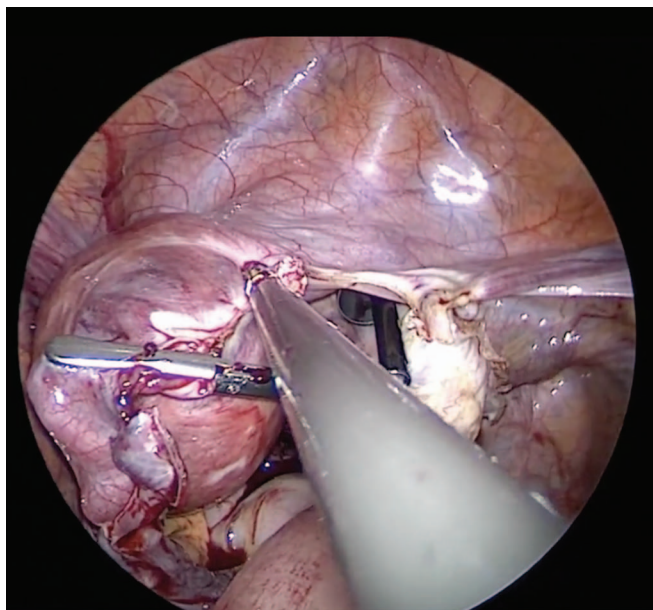


Figure 3. The surgical assistant is using the articulated grasper from the posterior colpotomy trocar to retract the uterus.

Statistical Analysis

Descriptive statistics were used to analyze the data. Continuous variable results were reported as mean standard deviation (SD) and range. Categorical data were reported as percentages of the total. Statistical analysis was performed with Stata version 13.1 (StataCorp, LLP, College Station, TX, USA).

RESULTS

From February 2013 through August 2017, 45 women underwent combined vaginal and laparoscopic surgery for benign indications by a single surgeon at 2 hospitals

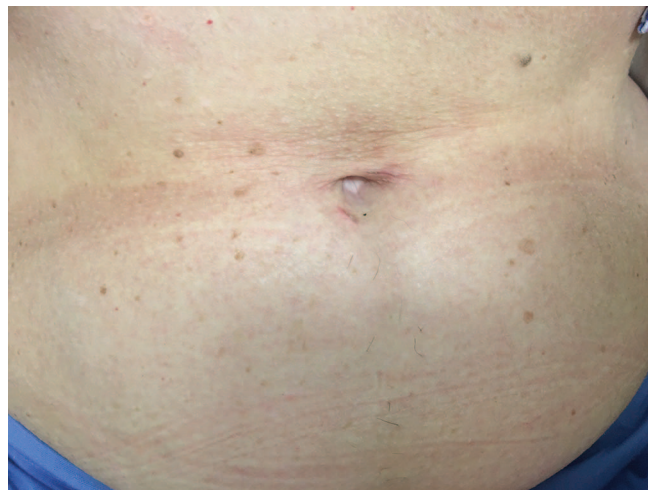


Figure 4. Healed umbilical incisions at the post-operative exam.

(one academic and one community). Patient characteristics are summarized in **Table 1**. Average patient age was 53.7 ± 10.0 years (mean \pm SD) and age ranged from 36 to 72 years. Thirty-seven patients identified as white (82%), 2 identified as African-American (4%), 2 identified as Asian (4%), and 3 identified as Hispanic (7%). BMI was 27.7 ± 6.5 kg/m² (range, 18.0–45.8 kg/m²), with 6 obese women (11%), 2 women (4%) with severe obesity, and 3 women (6%) with morbid obesity. Parity ranged from 0 to 7, with 10 nulliparous women (22%) and 11 women who had never had a previous vaginal delivery (24%). Twenty-four women ($n = 24$) had prior abdominal or pelvic surgery (53%), including open surgery (22%), laparoscopic surgery (13%), or unspecified type of surgery (11%). Patient medical and surgical history prior to the colpotomy procedure have been detailed in **Table 1**.

Surgical procedure information is summarized in **Table 2**. Surgical indications included adnexal cyst (36%), risk-reducing surgery for history of breast cancer or related mutations (24%), abnormal uterine bleeding (18%), cervical dysplasia or cervical adenocarcinoma in situ (4%), desire for sterility (2%), or multiple indications (16%). Procedures included unilateral or bilateral salpingectomy and oophorectomy (69%); unilateral or bilateral salpingectomy only (2%), or total hysterectomy (TH; 29%). The abdominal incisions were located either both in the peri-umbilical area (69%), umbilicus and right lower quadrant (24%), or umbilicus and left lower quadrant (7%).

Surgical outcomes are summarized in **Tables 3, 4, and 5**. Thirty-two patients (71%) underwent adnexal surgery and 13 patients (29%) underwent TH. Operative time for ad-

Table 1. Patient Demographics and Operative Characteristics						
	N	%	Mean	SD	Min	Max
Overall	45	100				
Age			53.69	9.56	36	72
Race						
White	37	82.22				
African-American	2	4.44				
Asian	2	4.44				
Hispanic	3	6.67				
BMI, kg/m ²			27.67	6.49	18.02	45.83
<18.5 (underweight)	1	2.22				
18.5–25 (normal)	14	31.11				
25–30 (overweight)	19	42.22				
30–35 (obesity)	6	11.11				
35–40 (severe obesity)	2	3.70				
>40 (morbid obesity)	3	5.56				
Gravida			2.36	1.79	0	7
Para			1.80	1.25	0	5
Nulliparous	10	22.22				
Nulliparous + Multiparous with no previous vaginal delivery	11	24.44				
Previous abdominal or pelvic surgery	24	53.33				
Laparotomy	10	22.22				
Laparoscopy	6	13.33				
Unknown	5	11.11				
Previous medical history						
BRCA1+	1	2.22				
BRCA2+	7	15.56				
History of dyspareunia	1	2.22				
History of endometriosis	2	4.44				
History of PE/DVT	0	0.00				
Obstructive sleep apnea	4	8.89				
Heart murmur	3	6.67				
Thyroid disease	4	8.89				
Diabetes mellitus	4	8.89				
Osteopenia/osteoporosis	5	11.11				
Hypertension	10	22.22				
Hyperlipidemia	9	20.00				
Anxiety or depression	13	28.89				
History of smoking	21	46.67				
Benign adnexal mass	22	48.89				
Any cancer	22	48.89				
Breast cancer	15	33.33				
BMI, body mass index; DVT, deep venous thrombosis; PE, pulmonary embolism.						

Table 2.
Surgical Procedure Information

	N	%
Overall	45	100
Surgical indication(s)		
Adnexal cyst	16	35.56
RRS (for +BRCA or history of breast cancer)	11	24.44
AUB	8	17.78
Cervical dysplasia or AIS	2	4.44
Desire for sterility	1	2.22
Multiple indications:	7	15.56
Adnexal cyst + RRS	3	6.67
Adnexal cyst + AUB	2	4.44
AUB + RRS	1	2.22
Adnexal cyst +RRS + AUB	1	2.22
Surgical procedure(s)		
Salpingectomy and oophorectomy, unilateral and/or bilateral	31	68.89
Salpingectomy, unilateral and/or bilateral	1	2.22
TH	13	28.89
TH only	0	0.00
TH and adnexal surgery	13	28.89
Location of ports		
Umbilicus +RLQ	11	24.44
Umbilicus +LLQ	3	6.67
Both periumbilical	31	68.89

AIS, adenocarcinoma in situ; AUB, abnormal uterine bleeding; LLQ, Left lower quadrant; RLQ, Right lower quadrant; RRS, risk reducing salpingo-oophorectomy; TH, total hysterectomy.

nexal surgery was 63.8 ± 18.5 minutes (range, 34–148 minutes), and operative time for TH was 107.5 ± 25.1 minutes (range, 63–148 minutes). Mean estimated blood loss was 29.5 ± 42.3 cc (range, 10–250 cc) for adnexal surgery and 170.4 ± 208.5 cc (range, 15–700 cc) for TH. Hospital length of stay was 0.6 ± 0.5 days (range, 0–1 days) overall, 0.7 ± 0.5 days (range, 0–1 days) for adnexal surgery, and 0.5 ± 0.5 days (range, 0–1 days) for TH. Total specimen weight was 41.7 ± 38.2 g (range, 6–155 g) for adnexal surgery, and 156.8 ± 88.8 g (range, 40–307 g) for TH. There were no intra-operative complications noted. Two patients who underwent adnexal surgery had postoperative complications; one had a urinary tract infection and one had new-onset dyspareunia. No patients

who underwent TH had intra- or postoperative complications. None of the patients had any major complications related to creation of the colpotomy incision, retrieval of the specimen, or healing of the colpotomy incision. In addition, no patients had postoperative vaginal infections or pelvic abscesses, and there were no readmissions within 30 days of surgery. It was noted that severe obesity in two patients with BMI > 40 added 30 minutes to operative time without intra-operative complications.

DISCUSSION

In this case series, we propose a surgical technique in which we expand on the use of the posterior colpotomy as a specimen retrieval site, and utilize it as a port site in addition to 2 5-mm abdominal incisions. Despite robust evidence in both general surgery and gynecological surgery literature on the safety and effectiveness of posterior colpotomy, fears still abound in the patient population regarding complications from the procedure. Bucher et al⁸ published a study in 2011 in the general surgery literature regarding female perception of different modes of cholecystectomy including transumbilical laparoendoscopic single-site surgery, compared with natural orifice transluminal endoscopic surgery (NOTES), which included a posterior colpotomy. The authors reported that 96% of the women had concerns regarding the transvaginal approach, which included dyspareunia, infertility, refusal of short-term sexual abstinence, and decreased sensibility during intercourse. Interestingly, also reported in the general surgery literature regarding transvaginal NOTES cholecystectomy, Kobiela et al⁹ published a study in 2011 evaluating the partner's response toward transvaginal approach, which was found to be mostly negative especially in young, sexually active males.

As noted previously, ample evidence has been published in both the gynecological and general surgery literature regarding the lack of complications associated with a vaginal approach. Posterior colpotomy has been utilized for both specimen retrieval and as part of NOTES successfully, without an increased risk in complications.^{3,6,7} Indeed, Uccella et al⁶ in 2013 noted a paucity of postoperative events, dyspareunia, and sexual dysfunction attributable to colpotomy. Another study by Ou et al¹⁰ has reported that in 143 patients who underwent vaginal extractions for uterine myomas, 40% achieved pregnancy after surgery, alleviating concerns about risk of infertility secondary to the posterior colpotomy approach.

Different variations on a combined vaginal and laparoscopic approach to surgery have been published in both

Table 3.
Surgical Outcomes (Combined Outcomes After TH and Adnexal Surgery)

	N	%	Mean	SD	Min	Max
Overall	45	100				
Operative time (minutes)			76.7	28.7	34	148
Estimated blood loss			70.2	131.5	10	700
Hospital length of stay (days)			0.6	0.5	0	1
Specimen weight	39	86.67	80.1	80.5	6	307
Uterus weight	21	46.67	17.7	31.0	2.5	146
Adnexal weight	34	75.56	73.6	81.3	6	307
Intraoperative complication	0	0.00				
Any postoperative complication	2	4.44				
New-onset dyspareunia	1	2.22				
Urinary tract infection	1	2.22				

Table 4.
Surgical Outcomes after Adnexal Surgery

	N	%	Mean	SD	Min	Max
Overall	32	100				
Operative time (minutes)			63.8	18.5	34	128
Estimated blood loss			29.5	42.3	10	250
Hospital length of stay (days)			0.7	0.5	0	1
Specimen weight	26	81.25	41.7	38.2	6	155
Uterus weight	20	62.50	18.3	31.7	2.5	146
Adnexal weight	25	78.13	41.7	39.2	6	155
Intraoperative complication	0	0.00				
Any postoperative complication	2	6.25				
New-onset dyspareunia	1	3.13				
Urinary tract infection	1	3.13				

the general surgery and gynecological literature.^{11–13} Bulian et al¹¹ published a prospective, randomized trial in 2015 comparing the experience of female patients who underwent either a laparoscopic cholecystectomy 3-trochar technique versus an umbilical assisted transvaginal cholecystectomy technique. The authors reported that the patients who underwent the transvaginal cholecystectomy reported decreased pain, increased satisfaction with cosmesis, and a better short-term postoperative quality of life. In the gynecological literature, Tsin et al¹³ published on their experience with minilaparoscopy-assisted natural orifice surgery, which included 100 cases of ovarian cystec-

tomies, oophorectomies, myomectomies, appendectomies and cholecystectomies. In Tsin's technique, the posterior vaginal fornix was utilized for the insertion of a larger 10–12-mm port in order to introduce operative instruments and to extract the specimen. Three 3-mm mini-laparoscopy ports were utilized on the abdomen. Consistent with the above-mentioned results, Tsin and his colleagues had excellent results, with only one postoperative complication of a fever after an ovarian cystectomy.¹³

In this case series, we aimed to introduce a new technique in combined vaginal and laparoscopic surgery, specifi-

	N	%	Mean	SD	Min	Max
Overall	13	100				
Operative time (minutes)			107.5	25.1	63	148
Estimated blood loss			170.4	208.5	15	700
Hospital length of stay (days)			0.5	0.5	0	1
Specimen weight	13	100.00	156.8	88.8	40	307
Uterus weight	1	0.08	4.0	—	4	4
Adnexal weight	9	69.23	162.4	102.9	40	307
Intraoperative complication	0	0.00				
Any postoperative complication	0	0.00				

cally with the goal of improved cosmesis in benign gynecological surgery. We believe that by using a posterior colpotomy as an additional trocar site, and only two 5-mm incisions in the abdomen, a large majority of benign gynecological surgeries including hysterectomies and adnexal surgeries can be performed. Our results demonstrate that this can be successfully implemented in a diverse patient population, including women of all ages and BMIs, women who are nulliparous, and those with prior abdominal or pelvic surgery.

As noted in **Table 3 and 4**, one patient (1/45, 2%) noted new-onset dyspareunia following the surgery. The authors hypothesize that this most likely occurred since the colpotomy incision was placed immediately below the cervix, which resulted in obliteration of the posterior fornix upon healing. With this in mind, the authors have emphasized the formation of the posterior colpotomy at a location 1–2 cm below the cervix.

Our study has several strengths: it is a large case series with consistent postoperative outcomes. It also encompassed a wide patient population, including nulligravid patients and patients with a wide range of BMIs. This technique might provide a useful alternative to conventional laparoscopy in the obese population, as it decreases the number of abdominal incisions and thus the risk of surgical site infection and port site hernias. While this demonstrates a generalizability to a greater gynecological population, the authors concede that this technique may not be prudent in more complex surgeries such as staging for pelvic malignancies or deep infiltrating endometriosis, as the ergonomics of this technique make it difficult to perform fine dissection along the pelvic sidewalls. Limitations include that the

outcome reflects the work of a single surgeon, and the possibility of selection bias.

CONCLUSION

We propose a novel technique in combining a vaginal and laparoscopic approach in benign gynecological surgery, which utilizes a posterior colpotomy and two abdominal 5-mm incisions to improve cosmesis. The safety and efficacy of this approach makes it a feasible alternative in difficult surgical candidates including those with high BMIs, nulliparous patients, and those with prior abdominal and pelvic surgery.

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1. To perform the posterior colpotomy, a STEP access needle is placed through the vagina into the posterior cul-de-sac between the uterosacral ligaments at _____ the cervix.
 - a. 2-3 in below
 - b. 2-3 cm above
 - c. 4-5 cm below
 - d. 1-2 cm below
2. After the surgeon surveys the abdomen for the placement of the second abdominal trocar, which position is the patient place in?
 - a. Supine
 - b. Trendelenburg
 - c. Lateral
 - d. Reverse Trendelenburg
3. Surgical indications for this procedure include:
 - a. Adnexal cyst
 - b. Abnormal uterine bleeding
 - c. Cervical dysplasia
 - d. All of the above
4. Pneumoperitoneum was established at the _____ of the umbilicus.
 - a. Left upper quadrant
 - b. Right upper quadrant
 - c. Left lower quadrant
 - d. Right upper quadrant
5. After the surgeon's desired intra-abdominal pressure is obtained, what is introduced?
 - a. 5-mm trocar
 - b. 5-mm articulated laparoscopic camera
 - c. Only a 5-mm trocar
 - d. Both a 5-mm trocar and 5-mm camera
6. A surgeon may decide to place the second abdominal trocar either in the:
 - a. Right lower quadrant of the umbilicus
 - b. Right lower quadrant of abdomen
 - c. Left lower quadrant of the abdomen
 - d. Any of the above
7. At completion of the procedure, the patient had how many incisions?
 - a. 1
 - b. 2
 - c. 3
 - d. 4
8. What size trocar is placed through the expandable sleeve for the posterior colpotomy?
 - a. 10-mm
 - b. 12-mm
 - c. 14-mm
 - d. 15-mm
9. The majority of incisions were located in the:
 - a. Peri-umbilical area
 - b. Umbilicus and right lower quadrant
 - c. Umbilicus and left lower quadrant
 - d. None of the above
10. What were the two factors that were different about this procedure than previous similar operations?
 - a. Using a posterior colpotomy as an additional trocar site
 - b. Using only two 5-mm incisions
 - c. Both a and b
 - d. Only a

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