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Original article

The Achievability of Bilateral Opportunistic Salpingectomy (BOS) During Non-Descent Vaginal Hysterectomy (NDVH) for Benign Diseases: Insights from a 15-Year Retrospective Analysis at Benha University Hospital

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Abstract:

Background: bilateral salpingectomy (BS) and bilateral salpingo-oophorectomy (BSO) during non-descent vaginal hysterectomy (NDVH) considered technically unfeasible in presence of relative contraindications (RCs). **Aim:** To evaluate effect of RCs on success of BS/BSO execution during NDVH for benign gynecological conditions. **Patients and Methods:** This retrospective study included women who consented to NDVH ± BS/BSO for benign indications between 2008 and 2025 at a university hospital and referral private centers. RCs included obesity class III (BMI ≥40 kg/m²), nulliparity, 1-4 cesarean sections (CSs), enlarged uterus (CUS ≥12 weeks, US volume ≥280 cm³, or postoperative uterine weight ≥280 grams), absent uterine descent, known adhesions, negative or limited sliding on transvaginal sonography (TVS), and known adnexal pathology. **Results:** 1512 undergoing NDVH ± BS/BSO, 485 (32.1%) were in 0RCs and 1027 (67.9%) ≥1 RCs groups. BS/BSO was achieved in 1447 (95.7%) and failed in 65 (4.3%), with no significant difference between groups (95.68% vs. 95.72%, p=0.9). Multivariable logistic regression showed higher odds (OR) of failure with ≥3 CSs (2.45, p=0.0051), ≥4 CSs (6.15, p=0.0001), adnexal pathology (3.42, p=0.0035), and limited sliding on TVS (anterior 3.18, p=0.0001; posterior 4.77, p=0.0005). Enlarged uterus showed non-significantly increased odds versus 0RCs, non-enlarged (1.54, p=0.43 and 1.36, p=0.31). Women with ≥4 RCs had significantly higher odds of failure versus 0- 2 RCs (2.38–2.55, p<0.01). **Conclusion:** NDVH with BS/BSO is feasible and safe, even with RCs. However, women with ≥3 CSs or ≥4 RCs should be counseled about a potentially lower success rate and consider alternative approaches such as vaginal natural orifice transluminal endoscopic surgery (vNOTES).

Keywords: non- descent vaginal hysterectomy (NDVH), Bilateral Opportunistic Salpingectomy (BOS), bilateral salpingo-oophorectomy (BSO), vNOTES, ovarian cancer (OC).

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Introduction

High-grade serous ovarian carcinoma (HGSOC), the most lethal as well as often unscreenable form of ovarian cancer (OC), is now understood to often originate in the distal fallopian tubes [1-5]. This revelation has led to the adoption of bilateral opportunistic salpingectomy (BOS) during gynecologic surgeries as a preventive measure against OC. Professional bodies, including the ACOG (American College of Obstetricians and Gynecologists) [6],RCOG (Royal College of Obstetricians and Gynecologists)[7],FIGO(International Federation of Gynecology and Obstetrics)[8]as well as GSA (Germany speaking countries including Germany, Austria and Switzerland, also known as DACH) intergroup including German Ovarian Cancer Commission of DGGG, the NOGGO (North-Eastern German Society of Gynecologic Oncology),AGO Austria and AGO Swiss[9], advocate for BOS during hysterectomy procedures when appropriate. Also, recent peer reviewed literatures found no impact of BOS even as alternatives to tubal ligation as a permanent sterilization on Ovarian Reserve (OR) [10-13].

While BOS is commonly performed during abdominal (TAH) and laparoscopic (TLH) hysterectomies, its implementation during non-descent vaginal hysterectomy (NDVH) remains less prevalent as well as a subject of surgical and academic debate [3,4,10]. This underutilized BOS in NDVH possibly due to the limited pelvic access intrinsic to the vaginal route technical challenges, visibility concerns, or perceived procedural complexity associated with the vaginal surgery, in addition to lack of NDVH training and shifting to shining TLH worldwide [14-18]. However, given the benefits of BOS beside advantages of NDVH over TAH and TLH as minimal invasiveness, shorter operative times, reduced hospital stays and faster recovery [19-21], it's imperative to assess its feasibility during NDVH.

An elegant decision analysis by SGS (society of gynecologic surgeon) found that routine planned BOS during VH prevents one OC case per 225 surgeries and one death per 450, is more cost-effective due to fewer future benign adnexal surgeries, and, despite a slight increase in manageable major complications (7.95% vs 7.68%), results in about three additional complications per five cancers prevented and six per five deaths prevented [22]. Editorial and comment articles in ACOG related publications reinforcements the SGS study's conclusion that planned BOS during VH is a cost-effective approach with minimal additional risk, offering a proactive measure in the prevention of OC [22,23]. Recent peer-reviewed data suggest that BOS during VH is achievable in a substantial proportion of cases, with a high success rate, and without significantly increasing surgical risk [24,25].

In essence, this study aims to provide insights into the feasibility, safety, and potential benefits of incorporating BOS into the routine practice of non-descent vaginal hysterectomy (NDVH) for benign conditions as well as providing gynecological surgeons with the gained surgical tips and tricks helping in executing BOS at NDVH. Drawing from a 15+ year retrospective analysis of cases executed by dedicated gynecologic surgeons (GS) who are strongly committed to the vaginal approach, this research seeks to contribute to the growing evidence base that supports integrating OC prevention with routine gynecologic surgery.

Patients and Methods

This retrospective cohort study was conducted at Benha University Hospital (BUH) and affiliated private centers in Egypt, encompassing cases from January 2008 to April 2025 and included 1512 patients underwent NDVH. Ethical approval was obtained from the Institutional Review Board of Benha

Faculty of Medicine (IRB No: RC 18-9-2023). All women undergoing NDVH for benign indications were eligible, excluding those with pelvic organ prolapse (POP) or incomplete medical records. Preoperative (PO), intraoperative (IO), and postoperative (PO) data were collected as outlined in a previously published article [(26)].

NDVH procedures were performed under regional anesthesia by experienced gynecologic surgeons. Women over 50 years were generally offered bilateral prophylactic salpingo-oophorectomy (BPSO), while those under 45 were considered for ovarian conservation unless adnexal pathology (BISO), was present. For women aged 45–50, the decision was individualized. Following the introduction of risk-reducing salpingectomy (RRS), BOS was offered regardless of the choice to conserve ovaries. Initially, adnexal structures were removed using the conventional clamp–cut–transfix technique with curved serrated clamps (Fig. 1-a), despite that we didn't specific adnexal clamp like Sheth clamp [(27).] Over time, energy-based devices (e.g., LigaSure Impact and Biclamp 200) were adopted, and various techniques reported by ACOG, AAGL, and SGS were implemented (28–30). Techniques such as uterine bisection with unilateral adnexal securing (Fig. 1-b, d, f), round ligament-first approach, uterine retroversion with cervical elevation (Fig. 1-c, e, h), and extended lithotomy Trendelenburg positioning improved visualization and access. In select cases, a handmade tie over a reusable note-pusher was used to secure the adnexal pedicle. The vNOTES approach was not employed due to unavailability of the disposable access platform.

For the purpose of analysis regarding limitations to the execution of BOS or BP/ISO during NDVH, participants were classified into two groups, similar to classifications reported in previous studies (31–33). The first group included participants without relative contraindications (nRCs = 0 RCs), while the second included participants with one or more relative contraindications (≥1 RCs) to NDVH. Relative contraindications (RCs) to NDVH, as documented in the literature, include obesity (≥ class I), nulliparity, prior cesarean delivery, adhesions from previous surgeries, enlarged uterus, absence of prolapse, and benign adnexal pathology (32–34). However, in this study, obesity was only considered a relative contraindication if ≥ class III (BMI ≥ 40 kg/m²) (34,35). We defined absence of prolapse intraoperatively as the lack of uterine descent, unlike other studies that used terms such as "cervix high," "cervix not visualized," or "cervix tucked under the pubis." An enlarged uterus was defined as ≥12 weeks in size or >280 grams by physical exam or transvaginal ultrasonography (TVS). Nulliparity was defined as no delivery at or beyond 28 weeks' gestation, regardless of pregnancy history or abortion type. Lack of vaginal birth included both nulliparous women and those with only cesarean deliveries (36). Adhesions were assessed preoperatively by TVS on the sagittal plane using the sliding sign: the uterus was gently mobilized against the bladder anteriorly and rectum posteriorly. Absence or limitation of sliding in either direction was considered a negative sliding sign and thus an RC for NDVH. We also considered the presence of recognized adnexal pathologies as RCs, including large (>3 cm) simple cysts or complex cysts with normal tumor markers or approved by oncology as well as Prior cesarean deliveries (≥1) and known adhesions. Achievability was defined as successful completion of BOS or BSO, whether prophylactic(P) or indicated(I), in patients who consented to the procedure. Success was defined as removal of both fallopian tubes in participants without a history of salpingectomy, or unilateral removal in cases with prior unilateral salpingectomy.

The procedure was considered unsuccessful when only one or neither tube was removed, or if the presence of tubes was not confirmed in the pathology report.

Based on the reported overall feasibility rate of opportunistic bilateral salpingectomy (BOS = PBS = OBS) of 86.8% during vaginal hysterectomy (VH) in both groups with and without relative contraindications (RCs) in SGS study (31), we calculated the required sample size using the online ClinCalc Sample Size Calculator. To detect a statistically significant difference (SSD) of over 10% in BOS reported achievability in SGS study (31), with 90% power and an alpha error of 0.05, a sample size of 312 participants was estimated. For a smaller SSD of 5%, 1,602 participants would be required under the same statistical parameters. When the power was set to 80%, the required sample sizes were reduced to 234 for a 10% SSD and 1,198 for a 5% SSD, respectively. If our estimated BOS achievability was assumed to be lower than that reported achievability in SGS study (31), the required sample size increased to 466 for 10% SSD and 1,660 for a 5% SSD at 80% power. These numbers further rose to 622 and 2,220, respectively, if the power increased to 90% while maintaining the same alpha error.

Statistical Analysis

Continuous variables following normal distribution were presented as means ± standard deviations and compared using independent (two-sample) t-tests. Categorical data were expressed as counts and percentages and compared using Fisher's exact test. To evaluate the impact of RCs on unsuccessful BOS, multivariable logistic regression analyses were conducted. Statistical analyses were performed using MedCalc Statistical Software version 16 (MedCalc Software bvba, Ostend, Belgium), with significance set at $p < 0.05$.

Results

This retrospective study included 1,512 women who underwent non-descent vaginal hysterectomy (NDVH) over a period exceeding 15 years. Participants were stratified into two groups based on the presence or absence of certain characteristics that may render NDVH technically difficult or less feasible: those with no relative contraindications (0RCs group, n=485; 32.02%) and those with one or more relative contraindications (≥1RCs group, n=1,027; 67.92%).

Table (1) summarizes the baseline demographic and clinical characteristics of the participants. Women in the ≥1RCs group were significantly older (49.1 ± 4.4 vs. 47.5 ± 7.3 years; $p = 0.0001$) and had higher BMI (35.6 ± 5.6 vs. 32.4 ± 5.5 kg/m²; $p = 0.0001$). They also had lower parity (3.8 ± 1.4 vs. 4.1 ± 1.3; $p = 0.0001$) and fewer vaginal deliveries, alongside a significantly higher cesarean section rate (66% vs. 0%; p = 0.0001). Furthermore, 37% of women in the ≥1RCs group had a "virgin" lower abdomen, compared to 100% in the 0RCs group ($p = 0.0001$).Uterine size was markedly larger in the ≥1RCs group based on clinical uterine size (CUS in weeks: 17.1 ± 6.4 vs. 7.9 ± 4.8; $p = 0.0001$), ultrasound-estimated uterine volume (USUV: 365 ± 97 vs. 95 ± 43 cm³; $p = 0.0001$), and histopathologic uterine weight (>280g in >66% of cases; p = 0.0001).The ≥1RCs group also showed significantly higher prevalence of medical comorbidities, including hypertension, diabetes mellitus (DM), uncontrolled DM, elevated preoperative HbA1c, and prolonged hospital stays (all $p = 0.0001$). Gynecologic indications were also more common in this group, including leiomyomas, abnormal uterine bleeding (AUB), endometrial hyperplasia (EH, including cystic adenomatous forms), adenomyosis, and pelvic pain/endometriosis ($p < 0.05$). In contrast, all women in the 0RCs group had at least

one prior vaginal delivery and a virgin lower abdomen

Table 1: Baseline demographic and clinical characteristics of 1512 women who go through non- descent vaginal hysterectomy (NDVH) stratified by non-relative contraindications (nRCs) and relative contraindications (RCs) groups.

Variables	nRCs(n=485) (32.02%)	RCs(n=1027) (67.92%)	Δ (95% CI)	P value
Age (year)	47.5 ± 7.3 (35– 69)	49.1± 4.4 (36– 76)	1.6(1.00 to 2.19)	0.0001
BMI (kg/m2)	32.4 ± 5.5 (18.5– 39.9)	35.6 ± 5.6 (22.4 – 67.6)	3.2(2.59to 3.80)	0.0001
Nulliparity	N/A (0.0)	220 (21.42%)	--	--
Absent of prior VD	N/A (0.0)	750(73.02%)	--	--
Post-menopausal	183 (37.73%)	357(34.76%)	2.97 (2.17 to 8.2)	0.2607
CUS (weeks)	7.9 ± 4.8 (6 – 12)	17.1 ± 6.4 (12– 28)	9.2(8.55to9.84)	0.0001
USUV (Cm3)	95 ± 43 (60 – 280)	365 ± 97 (280 – 1800)	270(260 to 279)	0.0001
Parity				
Total	4.1 ± 1.3(1-10)	3.8 ± 1.4(0-9)	0.3(0.44to0.15)	0.0001
Vaginal	4.1 ± 1.3(1-10)	1.7 ± 0.9(0-9)	2.4(2.51to2.28)	0.0001
Cesarean section	N/A (0.0)	2.1 ± 0.5(0-9)	---	----
Uterine weight(g)				
<280	485 (100%)	455 (44.30%)	56(51.29to60.54)	0.0001
>280	N/A 0 (0%)	572(66.69%)	N/A	
Indication for hysterectomy:				
- Leiomyoma	184 (37.93%)	783(76.24%)	38.3(33.1 to 43.2)	0.0001
- AUB	378 (77.93%)	879 (85.58%)	7.65 (3.5 to 12)	0.0002
-EH includes CAEH	112 (23.09%)	578(56.28%)	33.19 (28.1 to 37.82)	0.0001
- Adenomyosis	176(36.28%)	576(56.08%)	19.8 (14.46 to 24.9)	0.0001
- Pain/endometriosis	134 (27.62%)	356(34.66%)	7 (2 to 11.85)	0.0063
- CIN includes(IIIIII)	45 (9.27%)	164(15.96%)	6.69 (3 to 9.96)	0.0004
- Genetic prophylaxis	4(0.82%)	24(2.33%)	1.51 (0.02 to 2.73)	0.0418
- Other	6(1.23%)	28 (2.72%)	1.49 (0.16 to 2.84)	0.0678
Comorbidity:	89(18.35%)	515(50.14%)	31.79 (27.001 to 36.2)	0.0001
- HTN	56(11.54%)	245(23.85%)	12.31 (8.28 to 16.02)	0.0001
- DM	35(7.21%)	122(11.87%)	4.66 (1.78 to 7.86)	0.002
- uncontrolled DM	12(2.47%)	86(8.37%)	1.9 (1.53 to 2.26)	0.0001
- POHBA1C (%)	7.3 ± 2.4 (4.5%-13.4%)	9.2 ± 3.7 (4.9-21.5%)	1.9(1.53 to2.26)	0.0001
- LOPA (days)	1.8 ± 1.1 (0-5)	5.8±3.2(0-8)	4 (3.70 to 4.29)	0.0001
- others	34(7.01%)	145(14.11%)	7.10 (4.18 to 10.22)	0.0001
PO HB (g/dl)	11.2 ± 3.9 (9.5-13.1)	10.8± 4.1(9.7-12.9)	0.4(0.83to0.03)	0.073
PO HCT %	36.8 ± 8.1 (31.9-42.1)	37.3 ± 7.1 (31.4-41.6)	0.5 (0.30to1.30)	0.222
PO transfusions	14(2.88%)	23 (2.23%)	0.65 (0.94 to 2.6)	0.4445
PO IV Iron	233 (48.041%)	483 (47.03%)	1.011 (4.35 to 6.39)	0.7133
PO erythropoietin	43 (8.86%)	83 (8.08%)	0.78 (2.09 to 4.01)	0.6086
Previous pelvic surgery:				
- Cesarean section	0(0%)	623(60.66%)	60.66(57.53to63.60)	0.0001
- lower abdominal surgeries	0(0%)	23 (2.23%)	2.23 (1.15to3.32)	0.0009
- virgin lower abdomen	485 (100%)	381(37.09%)	62.91(59.81to65.81)	0.0001
ASA score:				
- ASA 1	282(58.14%)	623 (60.66%)	2.52 (2.74 to 7.8)	0.3509
- ASA 2	147(30.30%)	283 (27.55%)	2.75 (2.07 to 7.74)	0.2687
- ASA 3	41(8.45%)	82 (7.98%)	0.47 (2.35 to 3.66)	0.7550
- ASA 4	16 (3.29%)	39 (3.79%)	0.50 (1.73 to 2.34)	0.6276

NDVH: Non-descent vaginal hysterectomy, RCs: relative contraindications, nRCs: no relative contraindications, BMI: Body mass index, CUS: Clinical uterine size, USUV: Ultrasound uterine volume, HTN: Hypertension, DM: Diabetes mellitus, VD: Vaginal delivery, PO: preoperative, CSs: Cesarean sections, IV: Intravenous, POHBA1C: Preoperative Glycated Hemoglobin A1C, DOPHS: Duration of preoperative hospital stay, ASA: American Society of Anesthesiologists, HB: Hemoglobin, HCT: Hematocrit, PO: postoperative, AUB: Abnormal uterine Bleeding, EH: Endometrial Hyperplasia, CAEH: Complex atypical endometrial hyperplasia, CIN: Cervical intraepithelial neoplasia, Δ (95% CI): mean or percent difference with 95% confidence interval. Values were given as mean ± 2 standard deviations (range), or number (percent), P value< 0.05: significante.

Table (2): Impact of relative contraindications (RCs) burden on the success [Unsuccessful (unsuc) *vs* Successful(suc)]bilateral opportunistic salpingectomies (BOS=RRS=OBS=BPS) and bilateral prophylactic or indicated salpingo- oophorectomy (BP/ISO=BSO) during non-descent vaginal hysterectomy (NDVH).

Relative Contraindications (RCs)	Total(n=1512)	Unsuccessful BOS, BSO (n=65) (4.29%)	Successful BOS, BSO (n=1447) (95.71%)	Unadjusted OR* (95%CI)	P value
No RCs (nonexposed group)	485(32.02%)	21(4.32%)	464(95.68%)	Reference	
Any RCs (exposed group)	1027(67.92%)	44(4.28%)	983 (95.72%)	0.98(0.58 to 1.68)	0.96
Number RCs					
- 0(nonexposed group)	485(32.02%)	21(4.32%)	464(95.68%)	Reference	
- 1(exposed group e 1 RCs)	1027(67.92%)	44(4.28%)	983 (95.72%)	0.98(0.58 to 1.68)	0.96
- 2 (exposed group e 2 RCs)	765(50.59%)	31(4.05%)	734 (95.94%)	0.93(0.52 to 1.64)	0.81
-3 (exposed group e 3 RCs)	356(23.35%)	19 (5.33%)	337(94.66%)	1.24(0.65 to 2.35)	0.49
-≥4 (exposed group e ≥4 RCs)	123(8.13%)	12(9.75%)	111(90.24%)	2.38(1.40 to 5.00)	0.02
Obesity (BMI≥40kg/m^2)	187 (12.36%)	10(5.35%)	177(94,65%)	1.24(0.57 to 2.70)	0.57
Nulliparity	220 (14.55%)	11(5%)	209(95%)	1.16(0.55 to 2.45)	0.69
Absent vaginal birth	750 (49.60%)	22(2.93%)	728(97.07%)	0.66(0.36 to 1.22)	0.19
With at least 1 CS	530 (35.05%)	13(2.45%)	517(97.55%)	0.55(0.27 to 1.12)	0.10
With at least 2 CSs	410 (27.11%)	17(4.15%)	393(95.85%)	0.95(0.49 to 1.83)	0.89
With at least 3 CSs	210 (13.88%)	21(10%)	189(90%)	2.45(1.31 to 4.60)	0.0051
With ≥ 4 CSs	124(8.20%)	27(21.78%)	97(78.22%)	6.15(3.33 to 11.32)	0.0001
Known adhesions	560(37.03%)	29(51.78%)	531(49.22%)	1.20(0.67 to 2.14)	0.52
Adnexal pathology	67(4.43%)	9(13.43%)	58(86.57%)	3.42(1.49 to 7.81)	0.0035
Enlarged uterus≥280 grams	255 (16.86%)	14(5.49%)	241(94.51%)	1.28(0.64 to 2.56)	0.48
Uterus weight < 280 grams	1247(82.24%)	51(4.08%)	1196(95.92%)	0.94(0.56 to 1.58)	0.82
Uterus ≥280 vs < 280 grams	---	----	-----	1.36(0.74 to 2.50)	0.31
Lack of uterine decent IO	750 (49.60%)	21(2.8%)	729(97.2%)	0.63(0.34 to 1.17)	0.15
limited anterior sliding on TVS	230(15.21%)	29(12.6%)	201(78.39%)	3.18(1.77 to 5.72)	0.0001
limited posterior sliding on TVS	45(2.97%)	8(17.77%)	37(82.22%)	4.77(1.98 to 11.52)	0.0005

NDVH: Non-descent vaginal hysterectomy, RCs: relative contraindications, nRCs: no relative contraindications, UnSuc: unsuccessful, Suc: successful, BOS: bilateral opportunistic salpingectomies, BSO: bilateral prophylactic or indicated salpingo- oophorectomy, CSs: cesarean sections, CI: confidence interval, OR: odds ratio, OR (95%CI): odds ratio with 95% confidence interval, IO: Intraoperative, TVS: trans vaginal ultrasonography. Values were given as mean±2standard deviations (range) or number (percent), P value< 0.05: significante.

Table (2) illustrates the impact of individual and cumulative RCs on the success of BOS=RRS=OBS, or BP/ISO at NDVH. Among the total 1,512 women, 1,027 (67.92%) were exposed to at least one RC (≥1RCs group). Of these, 765 (50.59%) had ≥2 RCs, 356 (23.35%) had ≥3 RCs, and 123 (8.13%) had ≥4 RCs. RCs included: Obesity(BMI ≥40 kg/m²): 187 (12.36%), Nulliparity 220 (14.55%), Absent vaginal birth history750 (49.60%), ≥1 Cesarean section (CS)530 (35.05%), ≥2 CSs 410 (27.11%), ≥3 CSs 210 (13.88%), ≥4 CSs 124 (8.20%), Known adhesions 560 (37.03%), Adnexal pathology 67 (4.43%), Enlarged uterus (≥280 g) 255 (16.86%), Lack of intraoperative uterine descent 750 (49.60%) , Limited anterior sliding 230 (15.21%) and Limited posterior sliding 45(2.97%). BS/BSO were successfully achieved in 1,447 of 1,512 patients (95.71%), including 464/485 (95.68%) in the 0RCs group and 983/1027 (95.72%) in the ≥1RCs group, with no significant difference ($p = 0.96$). Subgroup analysis also showed no significant difference in success between 0RCs and ≥2RCs ($p = 0.81$) or ≥3RCs ($p = 0.49$), but success was significantly lower in women with ≥4RCs ($p = 0.02$). Among individual RCs, significantly lower success was observed in those with ≥3 CSs (p =

0.0051), ≥4 CSs (p = 0.0001), limited anterior sliding on TVS (p = 0.0001), and limited posterior sliding on TVS (p = 0.0005). Failure occurred in 65 patients (4.29%): 21/485 (4.32%) in 0RCs and 44/1027 (4.28%) in ≥1RCs, with no significant difference.

Table (3) intraoperative outcomes in 1512 women who go through non- descent vaginal hysterectomy (NDVH) stratified by non-relative contraindications (nRCs) and relative contraindications (RCs) groups.

Variables	nRCs(n=485) (32.02%)	RCs(n=1027) (67.92%)	Δ (95% CI)	P value
Actual OR time	71± 18 (30– 160)	131± 55 (70-230)	60(54.97to65.02)	0.0001
EBL (ml)	185 ± 90 (60-1600)	315 ± 150 (100 -1700)	130 (115.5 to 144)	0.0001
IO blood transfusion	12 (2.47%)	22 (2.14%)	0.33 (-1.17to2.26)	0.9009
Spinal anesthesia	485 (100%)	1027 (100%)	N/A	
General anesthesia	89 (18.35%)	139 (13.53%)	4.82 (0.92 to 8.9)	0.0145
Endotracheal tube	24 (4.95%)	55 (5.35%)	0.40 (2.2 to 2.6)	0.7442
Morcellations techniques	289 (59.58%)	754(73.42%)	13.84 (8.73% to 18.97)	0.0001
- Cervical amputation	121 (24.94%)	321(31.25%)	6.31 (1.4 to 10.9)	0.0118
- bisection	123(25.36%)	432(42.06%)	16.70 (11.6 to 21.4)	0.0001
- myometrial coring	40 (8.24%)	345(33.59%)	25.35 (21.38 to 28.9)	0.0001
- wedge resection	30 (6.18%)	324(31.53%)	25.35 (21.6 to 28.7)	0.0001
- myomectomy	75 (15.46%)	456(44.38%)	28.92 (24.3 to 33.1)	0.0001
- spiral morcellate	21 (4.32%)	435(42.32%)	38 (34.2 to 41.3)	0.0001
NDVH techniques				
Traditional	160 (32.98%)	352 (34.27%)	1.29 (3.8 to 6.2)	0.6209
Energy based	325 (67.01%)	675 (65.72%)	1.29 (3.8 to 6.2)	0.6209
Additional procedures				
- VOBS	386 (79.58%)	815 (79.35%)	0.23 (4.25 to 4.4)	0.9178
- VP/IBSO	78 (16.08%)	168 (16.35%)	0.27 (3.8 to 4.1)	0.8944
- Conversion to TAH	0(0%)	18(1.75%)	1.75(0.73 to 2.75)	0.0034
PO uterine weight (g)	105 ± 53 (60 – 280)	365 ± 117 (280 – 1800)	260 (249 to 270.9)	0.0001
Uterus weight (category)				
- Tiny (≤100 g)	254(52.37%)	308(29.98%)	22.39 (17 to 27.5)	0.0001
- Average (101–280 g)	231(47.62%)	404(39.33%)	8.29 (2.94 to 13.6)	0.0023
- Substantial (280–600 g)	0(0%)	204(19.86%)	19.86(17.40 to 22.41)	0.0001
- Huge (>600 g)	0(0%)	111(10.81%)	10.81(8.88 to 12.85)	0.0001
IO complications				
- vesical injuries	3 (0.61%)	15(1.46%)	0.85(-0.46to1.86)	0.15
- rectal injuries	0 (0%)	4 (0.38%)	0.38 (-0.43to0.98)	0.17
- ureteral injuries	0 (0%)	0 (0%)	0%) (-0.78 to 0.37)	--
- blood transfusion	1 (0.20%)	8 (0.77%)	0.57(t-0.45to1.33)	0.17
- conversion to laparotomy	0 (0%)	18 (1.75%)	1.75 (0.73to2.75)	0.0034
- unintended organ injury	3 (0.61%)	19(1.85%)	1.24(-0.11to2.33)	0.060
- total IO complications	6 (1.23%)	37(3.60%)	2.37(0.63 to3.85)	0.009
- bleeding requiring	0 (0%)	11 (1.07%)	1.07(0.15to1.90)	0.02
conversion	6 (1.23%)	18 (1.75%)	0.52(-1.04to1.72)	0.44
- anesthetic complications	2 (0.41%)	6(0.58%)	0.17(-0.95to0.91)	0.66
- hematoma	0(0%)	18(1.75%)	1.75 (0.73to2.75)	0.0034
- strategic conversion				

NDVH: Non-descent vaginal hysterectomy, RCs: relative contraindications, nRCs: no relative contraindications, Δ(95% CI): Point estimate difference with 95% confidence interval, OR: operative room, EBL: estimated blood loss. VOBS: Vaginal opportunistic bilateral salpingectomy, VP/IBSO: Vaginal prophylactic or indicated bilateral salpingo-oophorectomy, IO: intraoperative, PO: postoperative, TAH: total abdominal hysterectomy. Values were given as mean ± 2standard deviations(range) or number (percent), P value<0.05: significante.

Table (4) postoperative outcomes in 1512 women who go through non- descent vaginal hysterectomy (NDVH) stratified by non-relative contraindications (nRCs) and relative contraindications (RCs) groups.

Variables	nRCs(n=485) (32.02%)	RCs(n=1027) (67.92%)	Δ (95% CI)	P value
PO severe pain - at 6h - at 24 h	214(44.12%) 125 (25.77%)	680 (66.23%) 421 (40.99%)	22.11 (16.7 to 27.3) 15.22 (10.18 to 19.9)	0.0001 0.0001
Analgesic requirements over 24h -Total narcotic (mg) -Total parental NSAID (mg)	14.7± 6.2 (10-40) 120 ± 55 (100-200)	23.8 ± 9.2 (20-60) 175 ± 75 (100-300)	9.1(8.19 to10.00) 55 (47.5 to 62.48)	0.0001 0.0001
PO nausea and vomiting	94 (19.38%)	394 (38.37%)	18.99 (14.2 to 23.4)	0.0001
PO blood transfusion	5 (1.03%)	15 (1.46%)	0.43 (1.04 to 1.53)	0.4946
Perioperative BT	17(3.51%)	37(3.60%)	0.09 (2.16 to 1.94)	0.9299
PO HB (g/dl)	10.5 ± 1.3 (9.6-11.6)	10.4 ± 1.1 (9.5-12.2)	0.1 (0.22 to 0.02)	0.1204
PO HCT (%)	35.9 ± 11.4 (34-48)	36.2 ± 10.9 (33-46)	0.3 (0.89 to 1.49)	0.6227
Time to get out of bed (h)	3.1 ± 2.4 (2-7)	5.1 ± 4.1 (2-8)	2 (1.60 to 2.39)	0.0001
Time to flatus (h)	5.1 ± 3.2 (3-14)	7.1 ± 4.8 (2-18)	2 (1.52 to 2.47)	0.0001
Absolute change in HB (g/dl)	0.9 ± 0.4 (0.6-1.4)	1.2 ± 0.6(0.7-1.7)	0.3 (0.24 to 0.35)	0.0001
Return to usual activity time (d)	13.8 ± 6.6 (3-32)	17.3 ± 8.7 (5-36)	3.5 (2.62 to 4.37)	0.0001
Resumption of coitus (d)	20.1 ± 5.4 (5-55)	24.2 ± 8.8 (7-56)	4.1 (3.24 to 4.95)	0.0001
Vaginal spotting	245 (50.5%)	670 (65.2%)	14.7 (9.37 to 19.97)	0.0001
Infectious morbidity - Pelvic cellulitis - Granuloma formation - Cystitis - SSI within 30 d - Febrile morbidity	 26 (5.36%) 12 (2.47%) 76 (15.67%) 0 (0%) 66 (13.61%)	 86 (8.37%) 32 (3.12%) 156 (15.19%) 6(0.58%) 66 (6.43%)	 3.01 (0.17 to 5.5) 0.65 (1.36 to 2.2) 0.48 (3.28 to 4.5) 0.58(-0.26 to 1.26) 7.18 (3.9 to 10.7)	 0.0370 0.4830 0.8091 0.093 0.0001
Wound complications	0 (0%)	4(0.38%)	0.38(-0.43 to 0.98)	0.17
Reoperation for wound	0 (0%)	4(0.38%)	0.38(-0.43 to 0.98)	0.17
VTE morbidity DVT Pulmonary embolism	 4 (0.82%) 1 (0.2%)	 22(2.14%) 5 (0.48%)	 1.32 (0.14 to 2.51) 0.28 (0.7 to 0.94)	 0.0652 0.4151
Need for VTE prophylaxis	23 (4.74%)	98 (9.5%)	4.76 (1.95 to 7.25)	0.0014
Duration of VTE prophylaxis (d)	0.6 ± 0.1(0.4-2)	2.1 ± 0.8 (1-9)	1.5 (1.42 to 1.57)	0.0001
PO vaginal length (cm)	6.9 ± 1.8 (7-9)	7.1 ± 1.6 (7-9)	0.2 (0.01 to 0.38)	0.0296
Vesicovaginal fistula	0 (%)	2(0.19%)	0.19 (-0.60 to 0.69)	0.33
Total PO complications	156(32.16%)	345 (33.59%)	1.43 (3.69 to 6.39)	0.5815
Admission variables - LOHD (d) - SDD - LOHD more than 3 days - Return to ED - Readmission within 30 days	 0.8 ± 0.3 (0.3-4) 445(91.75%) 11(2.27%) 123(25.36%) 25(5.15%)	 1.8 ± 0.4(0.3-10) 945(92.02%) 35(3.41%) 145(14.12%) 35(3.41%)	 1.00(0.95 to 1.04) 0.27 (2.53 to 3.43) 1.14 (0.84 to 2.77) 11.24 (6.92 to 15.76) 1.74 (0.34 to 4.26)	 0.0001 0.8572 0.2286 0.0001 0.1058

NDVH: Non-Descent Vaginal Hysterectomy, RCs: relative contraindications, nRCs: no relative contraindications, PO: Postoperative, Δ(95% CI): Point estimate difference with 95% confidence interval, NSAID: Non-steroidal anti-inflammatory drugs, VTE: venous thromboembolism, LOHD: length of PO hospital duration, SDD: same day discharge, IO: Intraoperative, SSI: surgical site infection, PE: Pulmonary embolism, DVT: deep venous thrombosis, ED: emergency department, HB: Hemoglobin, HCT: Hematocrit, BT: blood transfusion, h: hours, d: days, Values were given as mean ± standard deviation or number (percent), P value<0.05 : significante.

Tables (3) and (4) demonstrate that patients in the ≥1RCs group experienced significantly more challenging intraoperative and postoperative outcomes. Intraoperatively, they had longer OR times, greater estimated blood loss, increased use of morcellation, more conversions to TAH, and higher uterine weights (all p=0.0001, except conversion *p*=0.0034). Postoperatively, the same group reported higher pain scores at 6h and 24h, greater analgesic use (both narcotics and NSAIDs), more nausea/vomiting, longer time to mobilization and flatus, greater hemoglobin drop, delayed return to activity and coitus, more spotting, higher febrile morbidity, longer VTE prophylaxis, extended hospital stay, and more ED visits (all *p*=0.0001).

Table (5) reveals, through multivariable logistic regression, that unsuccessful BS/BSO was significantly associated with ≥3 CSs (OR=5.55), ≥4 CSs (OR=6.46), adnexal pathology (OR=3.42), limited anterior (OR=3.34) and posterior sliding on TVS (OR=4.89), all *p*<0.01. Enlarged uterus >280g was not significantly associated with failure (OR=1.54, *p*=0.43) than 0RCs, (OR=1.36, *p*=0.31) versus uterus < 280 grams.

Table (6) shows that patients with ≥4 RCs had significantly higher odds of failure compared to those with 0 (OR=2.38), 1 (OR=2.41), or 2 RCs (OR=2.55), all p<0.01.

Table (5) Multivariable logistic regression estimating the association between relative contraindications (RCs) and the likelihood of unsuccessful bilateral opportunistic salpingectomy (BOS=RRS=OBS=BPS) and / or bilateral prophylactic or indicated salpingo-oophorectomy (BP/ISO) during non-descent vaginal hysterectomy (NDVH)

Variable	OR (95%CI)	P value
Age at hysterectomy (years)	1.28(0.56 to 2.75)	0.53
Obesity (BMI≥40kg/m^2)	1.19(0.58 to 2.49)	0.63
Nulliparity	1.22(0.64 to 2.18)	0.59
Absent vaginal birth	0.52(0.28 to 1.19)	0.14
With at least 1 CS	0.51(0.22 to 1.22)	0.19
With at least 2 CSs	0.91(0.42 to 1.78)	0.78
With at least 3 CSs	2.55(1.23 to 4.75)	0.0051
With ≥ 4 CSs	6.46(3.13 to 12.32)	< 0.0001
Known adhesions	1.14(0.67 to 2.14)	0.52
Adnexal pathology	3.42(1.35 to 7.73)	0.0037
Enlarged uterus ≥ 280 grams	1.54 (0.54 to 2.46)	0.43
Lack of uterine decent IO	0.67(0.54 to 1.24)	0.11
limited anterior sliding TVS	3.34(1.28 to 5.65)	0.0002
limited posterior sliding TVS	4.89(1.79 to 12.12)	0.0006

NDVH: Non-descent vaginal hysterectomy, RCs: relative contraindications, nRCs: no relative contraindications, BOS: bilateral opportunistic salpingectomies, BP/ISO: bilateral prophylactic or indicated salpingo- oophorectomy, CSs: cesarean sections, CI: confidence interval, OR: odds ratio, OR (95%CI): odds ratio with 95% confidence interval, IO: intraoperative, TVS: transvaginal ultrasonography, *P* value< 0.05: significante

Table (6) Multivariable logistic regression assessing the impact of the number of relative contraindications (RCs) on the likelihood of unsuccessful bilateral opportunistic salpingectomy (BOS=RRS=OBS=BPS) and / or bilateral prophylactic or indicated salpingo-oophorectomy (BP/ISO) during non-descent vaginal hysterectomy (NDVH).

Variable	OR (95%CI)	P value
1RC vs 0RC	0.98(0.58 to 1.68)	0.96
2 RCs vs 0RC	0.91(0.49 to 1.71)	0.78
2 RCs vs 1RC	0.94(0.59 to 1.50)	0.80
3 RCs vs 0 RC	1.19(0.58 to 2.55)	0.54
3 RCs vs 1 RC	1.25(0.72 to 2.18)	0.41
3 RCs vs 2 RCs	1.33(0.74 to 2.39)	0.33
≥4 RCs vs 0 RC	2.38(1.40 to 5.00)	0.02
≥4 RCs vs 1 RC	2.41(1.23 to 4.70)	0.0097
≥4 RCs vs 2 RC	2.55(1.27 to 5.13)	0.0081
≥4 RCs vs 3 RC	1.91(0.90 to 4.07)	0.0905

NDVH: Non-descent vaginal hysterectomy, RCs: relative contraindications, 0RCs: no or zero relative contraindications, BOS: bilateral opportunistic salpingectomies, BP/ISO: bilateral prophylactic or indicated salpingo- oophorectomy, CSs: cesarean sections, CI: confidence interval, OR: odds ratio, OR (95%CI): odds ratio with 95% confidence interval, *P* value< 0.05: significante

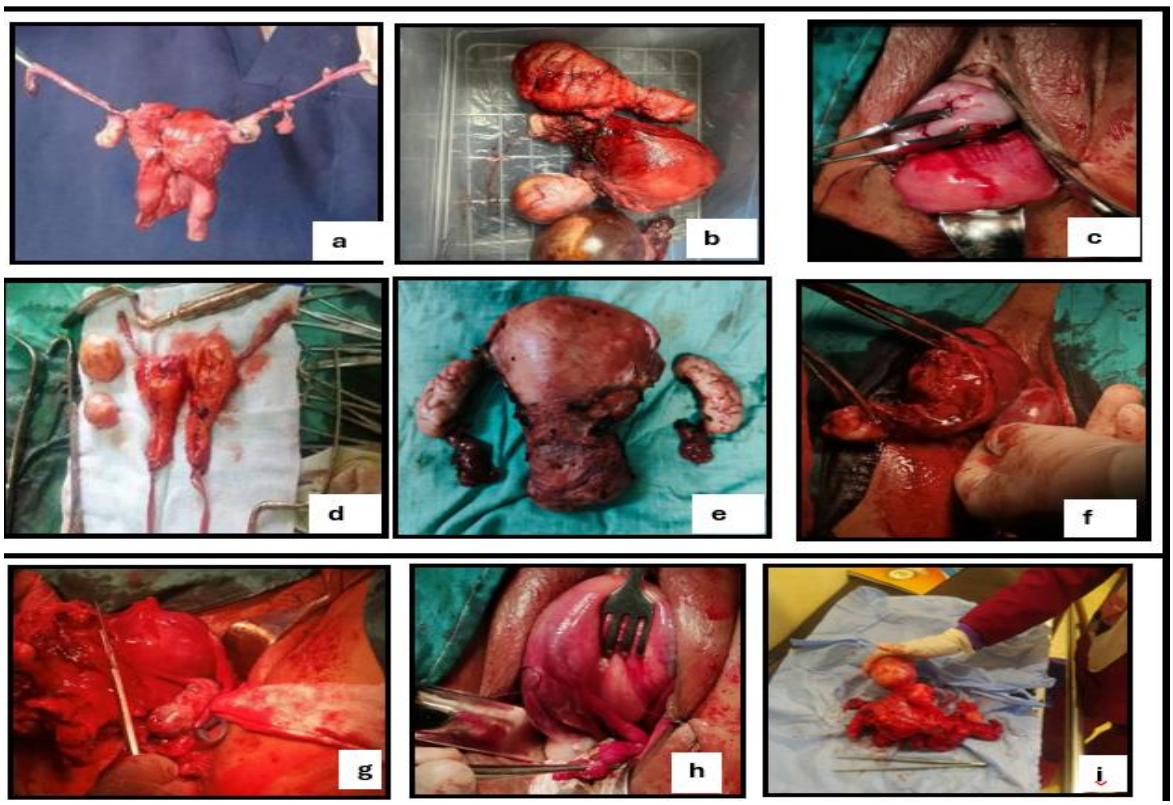

Figure 1: A: PostOperative(PO) Non-descent vaginal hysterectomy (NDVH) with bilatteral salpingo-oophorectomy (BSO) our intial NDVH in 2008; B: PO NDVH with BSO, uterus was 14 preoperative(PO) and 650 grams PO in which uterus was bisected and ovaried showed bilateral mature teratoma, performed e Ligasure Impact ; C: Intropperative(IO) NDVH in which we trun the funds upward and the cervix downward after taking out both tubes with ligasure Impact, D: NDVH with BOS uterus was 16 weeks preoperative(PO) and 685 grams postoperative (PO) in which bisection and myomectomy applied with conventional BS by calmping; E: NDVH with BSO, uterus was 12 weeks PO,performed e Ligasure Impact; F: IO NDVH with uterine bisection and delivery of

the right adnexa G: IO NDVH with BSO a huge uterus delived in feiled with the right sided adenexa still connected H: IO NDVH with downward rotation of uterine fundus deivering both tube operated upon it with ligasure Impact to achive BS; I : NDVH) with BSO, uterus was 24 weeks PO and 1500 grams PO.

Discussion

The integration of RRS during NDVH for benign conditions has gained momentum as a preventive measure against HGSC, now widely believed to originate in the fallopian tubes [1–5]. Major professional bodies including ACOG [6], RCOG [7], FIGO [8], and the GSA(DACH) intergroup [9] have endorsed OBS as a strategy for OC prevention, recommending its consideration during hysterectomy for benign indications. ACOG Committee Opinion No. 774 supports BPS as a safe adjunct to hysterectomy, noting it does not increase complications [6]. Additionally, ACOG Committee Opinion No. 701 (2017, reaffirmed 2021) emphasizes that the need to perform BPS should not deter the use of the vaginal route as the preferred approach [37]. Further supporting the safety and efficacy of BOS, the HYSTUB randomized controlled trial [38], a Cochrane systematic review [39], and recent peer-reviewed studies [10–13, 24, 25] have shown that adding BS does not negatively affect ovarian reserve (as measured by serum AMH) or increase surgical morbidity. A 2017 systematic review in ACOG's Green Journal also reported no absolute contraindications to the vaginal route, even in cases of high BMI, nulliparity, prior cesarean delivery, or enlarged uteri plus It confirmed the feasibility of performing BS/BSO at VH[32].From an economic standpoint, a decision analysis model [22], with an accompanying editorial [22] and comment [22], found OBS during VH to be a dominant strategy—preventing one OC case per 225 procedures and one death per 450—with minimal added risk. This body of evidence reinforces OBS as a clinically and economically favorable approach in gynecologic surgery.

Our retrospective analysis reinforces the safe and feasible execution of BOS at NDVH. The high success rate achieved in our cohort aligns closely with previous reports. A systematic review and meta-analysis published in the ACOG Green Journal in 2017 highlighted a pooled BOS success rate of approximately 82% during VH for benign conditions [32]. Similarly, a 2019 study published in the Journal of Minimally Invasive Gynecology [31] reported an overall BOS success rate of 86.8%, with no significant difference between patients without 0RCs and those with ≥1 RCs (84.9% vs 89%, p = 0.15) [32]. Importantly, the addition of salpingectomy did not lead to a significant increase in operative time or complication rates in these studies, as well as in other relevant literature [24, 25, 31, 32]. Our analysis evaluated several features traditionally considered limiting to NDVH—such as nulliparity, obesity ≥ class I, enlarged uterus, lack of prolapse, and prior cesarean sections (CSs)—alongside others not extensively assessed in international literature, including absence of prior vaginal birth, class III obesity (BMI ≥ 40 kg/m²), prior lower abdominal surgeries, suspected pelvic adhesions, adnexal pathologies, intraoperative absence of uterine descent, and limited anterior or posterior sliding on transvaginal sonography (TVS). Despite these factors, we found that NDVH with BOS or BP/ISO remained safely achievable in most cases. In our multivariable logistic regression models, significantly increased odds of unsuccessful BS/BSO were associated with ≥3 CSs (OR 5.55), ≥4 CSs (OR 6.46), adnexal pathology (OR 3.42), limited anterior sliding (OR 3.34), and limited posterior sliding (OR 4.89). Participants with ≥4 RCs also had higher

odds of failure compared to those with 0RCs (OR 2.38), 1RC (OR 2.41), and 2RCs (OR 2.55). While an enlarged uterus >280 grams showed mildly increased, nonsignificant odds (OR 1.54, p=0.43) than 0RCs and (OR 1.36, p=0.31) than uterus < 280 grams, our findings echo SGS study [31], who found no significant limitation from uterine size or RC presence. Our higher BOS/BSO success rate [95.7% vs. 86.8% in SGS study [31]] may be attributed to longer study duration, exclusion of POP cases, early adoption of extended lithotomy positioning, and uniform surgeon experience—all factors potentially enhancing adnexal access and surgical feasibility.

Our study's findings support the growing consensus that BS/BSO during NDVH is both feasible and advantageous. The procedure was completed without the need for conversion to abdominal or laparoscopic routes, thus preserving the core benefits of VH—namely, shorter hospital stays and quicker recovery. Our results reinforce that there are no absolute contraindications to VH and that traditionally perceived relative contraindications—including nulliparity, obesity, lack of prolapse, enlarged uterus—do not preclude its safe execution. Moreover, even more challenging factors such as prior cesarean deliveries, absence of prior vaginal birth, suspected pelvic adhesions, limited or absent sliding of the uterus on TVS, adnexal pathology, and BMI ≥40 kg/m² did not prevent successful completion of BS/BSO during NDVH. Given that BS/BSO was achievable in the majority of these high-risk cases, we advocate for the continued prioritization of the vaginal route when appropriate. Patients should be encouraged to choose this approach, and preoperative counseling should include the option of vNOTES if standard vaginal access proves insufficient to complete adnexal procedures [40].

The main strength of our study lies in its comprehensive assessment of the safe achievability of BS/BSO during NDVH, exclusively performed by experienced gynecologic surgeons dedicated to prioritizing the vaginal route whenever feasible. Conducted across both a major tertiary referral hospital and affiliated private centers, the approach ensured that alternative surgical routes were considered only when the vaginal route was clearly unsafe or impractical. This methodology allowed for the inclusion of a large proportion of women with RCs—a subgroup often underrepresented in previous literature—enabling broader, more generalizable conclusions. A key methodological strength was the deliberate exclusion of pelvic organ prolapse (POP), a condition that typically facilitates easier adnexal access. By excluding POP, we ensured more uniform surgical challenges across study groups, enhancing the study's internal validity. Additionally, many women with ≥1 RCs in our cohort presented with overlapping complex indications such as AUB, EH, adenomyosis, and leiomyomas—conditions that mirror real-world clinical practice. This further enhances the applicability and clinical value of our findings, especially when compared to earlier studies that included POP as a dominant indication [25,32]. However, the retrospective design and the setting in specialized centers with highly skilled surgeons may limit generalizability to less-experienced or community-based settings. Future prospective studies should investigate long-term outcomes, preservation of ovarian function, and patient-centered metrics. Nonetheless, our 15+ years of accumulated experience strongly support the feasibility, safety, and preventive value of incorporating BS/BSO during NDVH in line with current clinical guidelines.

Conclusion

The need to perform an opportunistic salpingectomy should not be viewed as a contraindication to pursuing the vaginal route for benign hysterectomy. Our

findings demonstrate that bilateral opportunistic salpingectomy (BOS) can be successfully achieved in the majority of cases, regardless of the presence of relative contraindications (RCs). Nevertheless, patients with prior cesarean sections, or multiple RCs should be appropriately counseled about the increased risk of unsuccessful salpingectomy via the vaginal approach. In such scenarios, planning for an alternative vaginal route procedure as vNOTES for adnexal removal may be warranted to ensure optimal outcomes.

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