Clinical Study

Laparoscopic Risk-Reducing Salpingo-Oophorectomy: The Brigham and Women's Experience

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Objective. To establish short-term surgical outcomes of three-port laparoscopic risk-reducing salpingo-oophorectomy (RRSO) in women with hereditary breast-ovarian cancer syndrome (HBOC). **Methods.** The medical records of all HBOC women that underwent laparoscopic RRSO between January 2001 and December 2010 were retrospectively reviewed. Demographic data, operative details, and short-term surgical outcomes were obtained and subjected to SAS. Statistical univariate and multivariate analyses were performed. **Results.** 358 patients met study criteria with 277 (77.4%) carrying a documented BRCA mutation. The predominant technique utilized three ports (two 5 mm and one 10/12 mm), a 5 mm laparoscope and a 5 mm Ligasure pulsatile bipolar device. Mean operative time was 58.3 minutes (SD 22.6, 26.0–197.0), significantly affected by BMI greater than 30 ($P < 0.0001$) and status of adhesions ($P = 0.001$). Estimated blood loss (EBL) was negligible in 96.9% of cases. Seven patients required conversion to laparotomy. No major intraoperative complications were recorded. One-night hospital admission rate was less than 2.0% while postoperative complication rate was 3.1%. Malignancy was revealed in 14 patients (3.9%). **Conclusion.** In HBOC population, three-port laparoscopic RRSO is a simple, reproducible, and safe procedure with low conversion rate, short operative time, minimal EBL, low surgical morbidity, and rapid postoperative recovery.

1. Introduction

Risk-reducing salpingo-oophorectomy (RRSO) is considered the gold standard for ovarian, fallopian, and primary peritoneal cancer prevention in women with documented BRCA-1 and -2 mutations or family history consistent with hereditary breast-ovarian cancer syndrome (HBOC) [1, 2]. RRSO reduces HBOC women's estimated 10–65% lifetime risk of developing ovarian cancer by approximately 80–96% and their overall mortality by 76% [3–5]. In addition, RRSO has been found to halve the risk of breast cancer in premenopausal HBOC women who have not undergone prophylactic mastectomy [6], while improved quality of life, including satisfaction and mitigation of cancer risk anxiety, has also been reported by women who elected this procedure [7, 8].

However, skepticism regarding RRSO-related surgical risks is frequently encountered during the decision-making process. Despite its common utilization in the general population, short-term surgical outcomes, morbidity, and overall safety of standardized laparoscopic salpingo-oophorectomy (LSO) in the particular cohort of HBOC women have not been established thus far. The application of LSO for risk-reducing purposes is often accompanied by considerable differences compared to reports derived from the general population. This is mostly attributed to the higher rate of previous abdominal surgeries performed in HBOC women, including transverse rectus abdominis myocutaneous (TRAM) flaps for breast reconstruction. Age ≤ 45 years and absence of hormone replacement therapy at the time of surgery have also been considered risk factors for surgical complications and morbidity associated with RRSO [9]. Furthermore,

TABLE 1: Criteria of risk reducing salpingo-oophorectomy.

Proven germline mutations in <i>BRCA1</i> or <i>BRCA2</i> genes in themselves or at least one of their close relatives OR
Personal history of breast cancer before the 36th year of age OR
Family history of breast and/or ovarian cancer even in the absence of an identifiable mutation with
(i) at least two first-degree relatives diagnosed with cancer: at least one with invasive breast cancer before the age of 41 years or ovarian cancer at any age OR
(ii) three first- or second-degree relatives from the same lineage diagnosed with breast and/or ovarian cancer at any age

data derived from HBOC population are limited to a few studies [10–13] with relatively small number of patients, mostly of undefined genetic status, and wide variations in their outcomes. The information gap becomes even more apparent with the emergence of minimally invasive alternatives, such as laparoendoscopic single-site surgery (LESS) [14]. According to preliminary data, LESS represents a feasible technique with excellent clinical outcomes and overall low perioperative complication rates, provided that both laparoscopic surgical expertise and optimal instrumentation are available. However, a thorough short- and long-term assessment in HBOC women, based on comparative baseline data of conventional laparoscopy, is still missing.

We undertook a retrospective study evaluating our ten-year experience on standardized approach to laparoscopic RRSO, as utilized in a pure cohort of HBOC women. We aim to establish a reference point in HBOC population for short-term surgical outcomes and overall safety of this procedure, the contemporary information of which can facilitate counseling and decision-making process and can serve as a comparative baseline for developing techniques, such as LESS.

2. Material and Methods

2.1. Study Population. An institutional-review-board- (IRB-) approved retrospective analysis of all women who underwent consented RRSO at Brigham and Women's Hospital between January 2001 and December 2010 was performed. Eligible for inclusion were those women who, regardless of prior surgical history, were referred to our service by the Cancer Risk and Prevention Clinic of Dana-Farber Cancer Institute as meeting the criteria for risk-reducing surgery (Table 1). Women with synchronous abnormalities detected in their preoperative pelvic ultrasound as well as those who underwent RRSO with concomitant hysterectomy and/or other surgical procedures were excluded from the study. Once patients were selected, individual subject data were retrospectively collected from institution's longitudinal medical records (LMRs).

2.2. Surgical Protocol. All operations were performed in the Gynecologic Oncology Division of Brigham and Women's Hospital, and second assist was primarily provided by resident or fellow staff. Robotic-assisted approach was not utilized in this cohort.

General endotracheal anesthesia was administered, and the patient was prepped and draped in modified dorsal lithotomy position. A Foley catheter and a Jarcho uterine

manipulator were placed. After the appropriate safety pause, the umbilicus was infiltrated with local anesthesia to decrease postoperative pain and everted, and a small incision was made through which a Veress needle (Ethicon Endosurgery, Inc.) was passed. Following insufflation, a 5 mm umbilical, a 5 mm right lower quadrant, and 10/12 mm left lower quadrant port were placed under direct vision. In some cases with suspected peritoneal adhesions, entrance into the abdomen was achieved utilizing direct optical entry with either the Hasson technique with a 10 mm scope (Ethicon Endosurgery, Inc.) or, alternatively, the left upper quadrant approach through Palmer's point with a 5 mm scope. Pelvic washings were obtained and sent for cytological examination. The patient was placed in Trendelenburg position, and after a thorough abdominal and pelvic inspection, the procedure was undertaken with an identical approach in both sides: the ureter was clearly identified; the gonadal pedicle was isolated, clamped, sealed, and divided with ample distance from the ovarian hilum, utilizing a 5 mm LigaSure device (LigaSure, Covidien, Dublin, Ireland); uterine attachments were taken at the cornua, and the ovary was advanced off the pelvic sidewall with care to destroy all the visible proximal fallopian tube; lateral attachments were also sealed; the completely freed ovary and tube were placed into tissue recovery bag and drawn through the 10/12 mm port site for permanent pathologic evaluation. Once hemostasis was ascertained, the lower quadrant ports were removed and the fascial defect from the 10/12 mm port was closed with 0 Vicryl suture. Pneumoperitoneum was released. With all trocars removed, skin incisions were closed with 4-0 Monocryl in a subcuticular fashion. Finally, after the removal of the vaginal instruments and the Foley catheter, the patient was extubated and sent to the day surgical recovery area.

Estimated blood loss, presence of adhesions, intraoperative complications, and procedure's length were recorded. All specimens were sent to a dedicated gynecologic pathologist for extensive pathological evaluation including step sectioning of the ovary and distal fallopian tube (SEE-FEM protocol) [15].

2.3. Outcome Measures. Outcome measures primarily included the safety of RRSO. Conversion rate, duration of hospital stay, and complication rates were used for the assessment of RRSO's safety. Conversion rate was calculated as the proportion of cases that were initiated laparoscopically but converted to laparotomy. Intraoperative complications included vascular or visceral injuries requiring or not blood transfusion. Hospital stay was considered prolonged when medical records indicated hospital admission for

TABLE 2: Demographic and clinical characteristics of the study population by genetic status.

	Overall*	BRCA-1	BRCA-2	BRCA1/2	HBOC	<i>P</i>
Age						
<i>N</i> (%)	358/358 (100%)	147 (41.1%)	126 (35.2%)	4 (1.1%)	81 (22.6%)	ANOVA <i>P</i> -value 0.0005
Mean age (SD)	48.1 (9.2)	45.9 (8.4)	49.9 (10.2)	42.8 (9.7)	49.7 (7.9)	
BMI						
<i>N</i> (%)	349/349 (100%)	145 (41.5%)	124 (35.5%)	4 (1.1%)	76 (21.8%)	ANOVA <i>P</i> -value 0.84
Mean BMI (SD)	26.0 (5.2)	26.1 (5.1)	26.1 (5.6)	25.8 (4.9)	25.5 (5.1)	
Pre-menopausal status						
<i>N</i> (%)	188/356 (52.8%)	92 (62.6%)	59 (46.8%)	1 (25.0%)	36 (45.6%)	Fisher's exact <i>P</i> -value 0.01
Positive previous surgical history						
<i>N</i> (%)	173/357 (48.5%)	70 (47.6%)	63 (50.4%)	1 (25.0%)	39 (48.2%)	Fisher's exact <i>P</i> -value 0.83
Previous diagnosis of breast cancer						
<i>N</i> (%)	189/357 (52.9%)	79 (53.7%)	67 (53.6%)	2 (50.0%)	41 (50.6%)	Fisher's exact <i>P</i> -value 0.96

* Refers to the total number of patients (pts) with nonmissing data for the indicated variable.

** All variables as assessed by the time of RRSO.

one or more nights. All complications during the six-week post-operative followup were recorded with a grade (I, II, IIIa, IIIb, IVa, IVb, or V) assigned according to the modified Clavien-Dindo classification [16]. Specifically, grade I identified the presence of any deviation from the normal postoperative course without the need of intervention or pharmacologic treatment other than antiemetics, antipyretics, analgesics, diuretics, electrolytes, physiotherapy, or wound complications opened at the bedside; grade II identified complications requiring the use of intravenous medications, total parenteral nutrition, enteral nutrition, or blood transfusion; grade III identified complications requiring surgical, endoscopic, or radiologic intervention not under (grade IIIa) or under (grade IIIb) general anesthesia; grade 4 identified life-threatening complications requiring intensive care or intensive care unit management with single (IVa) or multiorgan (IVb) dysfunction; grade 5 identified complications resulting in patient's death. The length of the study period did not allow the utilization of a validated pain-scoring scale. Thus, we evaluated post-operative pain by considering only the cases seeking medical intervention for pain resolution, as recorded in the standard (between 14th and 21st post-operative day) or unscheduled post-operative visits. Cases reporting persistent pain related to the above-mentioned complications were not included. The operative time was assessed from the time of skin incision to the time of skin closure. Estimated intra-operative blood loss was categorized as of less than 50 cc, from 50 to 150 cc and more than 150 cc. Adhesion status was designated as present or absent adhesions without further quantification.

2.4. Statistical Analysis. We used Fisher's exact tests to compare the characteristics of patients by their genetic status and by type of surgical procedure. Univariate analyses of continuous variables were tested by t-tests and analysis of variance (ANOVA) followed by the Bonferroni post hoc test for all pairwise comparisons. Additionally, we used multivariate linear regression models to examine the mean

differences in surgical times by patient characteristics and surgical variables. All analyses were performed using SAS version 9.2 (SAS Institute Inc., Cary, NC).

3. Results

3.1. Population Characteristics. Of all women who underwent risk-reducing surgery at Brigham and Women's Hospital between January 2001 and December 2010, 358 women met our inclusion criteria and were, therefore, subjected to our final analysis. BRCA mutation was identified in 277 patients (77.4%): 147 with BRCA-1 (41.1%), 126 with BRCA-2 (35.2%), and 4 with BRCA-1&2 (1.1%) mutations. Eighty-one patients (22.6%) had a strong family history consistent with HBOC syndrome: 43 were BRCA negative and 38 had not been tested by the end of the study. Mean age at the time of RRSO was 48.1 years (SD 9.2, range 24.0–76.0). As expected, patients with BRCA-1 mutation underwent RRSO at a significantly younger age (45.9 years, SD 8.4, range 34–76) when compared to other subgroups ($P = 0.0005$). This was also reflected in women's menopausal status by the time of surgery. BRCA-1 carriers were more likely to be premenopausal when compared to other subgroups ($P = 0.02$). 173 of 357 patients (48.5%) had prior history of abdominal surgery with 126 of them having at least one prior laparotomy. 52.9% of women were treated for previously diagnosed breast cancer. Demographic and clinical characteristics of this cohort are summarized in Table 2.

3.2. Surgical Variables and Complications. Seven patients (2%), who were operated on during the first five years of the study period, required conversion to laparotomy (Table 3). Five cases were converted secondary to extensive intraperitoneal adhesions attributed to previous surgeries or advanced endometriosis. One case was converted because of difficulty in gaining access to the peritoneal cavity and one case because of identified occult malignancy in frozen

TABLE 3: Surgical variables of seven patients who underwent conversion to laparotomy.

Case no.	Year	Reason for conversion	Prior surgical history*	Adhesion status	Oper. time (min)	EBL	Admitted nights	Complication**
1	2001	Adhesions	–	Dense	108	100 cc	2	None
2	2001	Adhesions	+	Dense	88	100 cc	2	None
3	2001	Adhesions	+	Dense	129	75 cc	2	None
4	2002	Entrance	–	None	66	< 50cc	0	None
5	2005	Adhesions	–	Dense	117	75 cc	3	None
6	2005	Adhesions	+	Dense	244	300 cc	3	None
7	2005	Malignancy	–	None	161	300 cc	2	None

* Positive “+” or negative “–” surgical history including both laparoscopies and laparotomies.

** Intra- and postoperative complications as well as persistent postoperative pain as reported in the standard or unscheduled postoperative visits.

section. Patients converted to laparotomy had a two- or threenight hospital admission and uneventful recovery.

Surgical variables were analyzed in 351 patients who had a complete laparoscopic RRSO. Entrance into the peritoneal cavity was achieved utilizing a Veress needle in 320 of 351 cases (91.2%), whereas difficulties encountered in the remaining 31 cases (8.8%) were overcome with an open technique. Since 2006, the LigaSure pulsatile bipolar device has been used in our practice as the exclusive energy source. Prior to 2006, there were 47 patients for whom the 5 mm Gyrus device (Gyrus, Olympus, Tokyo, Japan) was utilized. The surgical variables are summarized in Table 4. Mean operative time was 58.3 minutes (median time 55 minutes), and only 36.1% of patients had their operation extended beyond 60 minutes. Multivariate analysis revealed a significant decrease in the mean operative time over the study period (67.3 minutes from 2001 to 2005 versus 54.9 minutes from 2006 to 2010). All factors with a potential impact on operative time are summarized in Table 5.

Intra-operative complications, as defined previously, were not identified in this cohort of women. Hospital admission took place in 7 of 351 patients (less than 2%) whose surgery was completed laparoscopically. None of these admissions was planned because of comorbid medical conditions. Patients were admitted overnight because of uncontrolled pain (x2), nausea and vomiting (x1), extensive lysis of adhesions (x2), post-operative hematoma (x1), and reaction to Toradol (x1), all requiring observation. Post-operative complications during the first six weeks after surgery occurred in 11 of 351 patients (3.1%). One patient required reoperation to reduce an incisional hernia (complication grade IIb). Another patient was readmitted to control persistent nausea and vomiting due to exacerbation of an underlying syndrome (grade I). The remaining nine patients had unplanned hospital visits due to incisional hematoma (x4; all grade I), incisional cellulitis (x4; all grade I), and protrusion of extraperitoneal tissue from the umbilical port (x1; grade I). None in this cohort required post-operative transfusion. Complaints for continuing or increasing pain, unrelated to the above-mentioned complications, were recorded in five patients. Apart from one patient who required lumbar steroid injections to alleviate the pain, in all the remaining cases pain was

TABLE 4: Surgical variables of 351 patients who underwent laparoscopic RRSO.

	N = 351
<i>Number of ports</i>	
2	2 (0.6%)
3	287 (81.8%)
4	53 (15.1%)
5	9 (2.6%)
<i>Scope Size</i>	
5 mm	296 (84.3%)
10 mm	55 (15.7%)
<i>Entrance to peritoneal cavity</i>	
Veress	320 (91.2%)
Open	31 (8.8%)
<i>Energy source</i>	
Ligasure	303 (86.3%)
Gyrus	47 (13.4%)
Ligasure and Gyrus	1 (0.3%)
<i>Estimated blood loss (cc)</i>	
< 50	340 (96.9%)
50–150	8
>150	3
<i>Status of adhesions</i>	
Absent	287 (81.8%)
Present	64 (18.2%)

limited shortly after surgery utilizing conventional analgesic medication.

3.3. Cancer Risk. Histopathological examination of the surgical specimens revealed malignancy in 14 of 358 cases (3.9%); 9 of 14 identified malignancies were fallopian in origin with a predominance in serous histology. One case revealed poorly differentiated ovarian endometrioid adenocarcinoma. This was the only case with advanced stage disease at the time of prophylactic surgery. The precise histopathological reports, the disease status until the last contact as well as the clinical profile of those patients are summarized in Table 6.

TABLE 5: Operative time (minutes) by patient- and surgical-related factors.

	<i>n</i> *	Mean (SD)	Median (min-max)	<i>P</i>	Linear regression <i>P</i> -value†
Operative time (overall)					
	346	58.3 (22.6)	55.0 (26.0–197.0)		
< 60	221 (63.9%)				
60–90	99 (28.6%)				
> 90	26 (7.5%)				
Operative time by BMI					
BMI <30	269	55.8 (20.6)	53.0 (26.0–192.0)	ANOVA <i>P</i> < 0.0001	Referent
30 ≤ BMI ≤ 40	59	65.2 (26.2)	61.0 (29.0–197.0)	Correlation coefficient <i>r</i> = 0.17, <i>P</i> = 0.001	0.003
BMI > 40	9	82.1 (35.6)	74.0 (50.0–158.0)		0.004
Operative time by menopause					
Pre	180	59.6 (22.9)	56.0 (28.0–197.0)	<i>t</i> -test <i>P</i> = 0.24	0.07
Post	164	56.7 (22.3)	52.0 (26.0–192.0)		
Operative time by prior surgical history					
Negative	224	56.6 (20.5)	53.5 (28.0–158.0)	<i>t</i> -test <i>P</i> = 0.08	0.89
Positive	121	61.4 (25.8)	55.0 (26.0–197.0)		
Operative time by second assist					
Resident/intern	240	58.4 (22.8)	55.0 (26.0–197.0)	<i>t</i> -test <i>P</i> = 0.98	0.68
Attend/fellow	97	58.3 (23.0)	54.0 (28.0–138.0)		
Operative time by status of adhesions					
Absent	282	55.8 (20.0)	53.0 (26.0–197.0)	ANOVA <i>P</i> = 0.001	<0.0001
Present	64	69.0 (29.3)	61.0 (30.0–192.0)		
Operative time by energy source					
Ligasure	299	57.0 (23.1)	52.0 (26.0–197.0)	<i>t</i> -test <i>P</i> = 0.001	0.23
Gyrus	46	66.3 (17.0)	63.0 (38.0–108.0)		
Operative time by entrance into the peritoneal cavity					
Veress	315	57.2 (22.5)	54.0 (26.0–197.0)	<i>t</i> -test <i>P</i> = 0.007	0.14
Open	31	68.6 (20.4)	65.0 (42.0–108.0)		
Operative time by scope size					
5 mm	291	56.7 (23.2)	51.0 (26.0–197.0)	<i>t</i> -test <i>P</i> = 0.0002	0.26
10 mm	54	66.9 (16.3)	63.5 (38.0–108.0)		

**n*: number of patients with nonmissing data for both surgical time and indicated variables.

†Adjusted for age and year of surgery and each variable in the table.

4. Discussion

According to our study findings, three-port laparoscopic RRSO, utilizing a 5 mm laparoscope, a 5 mm Ligasure pulsatile bipolar device, and a 10 mm retrieval port, provides a simple and safe risk-reducing approach for women with HBOC syndrome. The outlined surgical steps constitute a feasible and reproducible technique, as evidenced by the median operative time of 55 minutes which is considerably shorter than the 105 minutes reported by Kenkhuis et al. [12]. Optimization of this surgical approach through significant improvement in training and instrumentation (replacement of the 5 mm Gyrus pulsatile bipolar device by the 5 mm LigaSure system and that of 10 mm by 5 mm laparoscope) has jointly led to impressive reduction in operative times over the ten-year study period. Importantly, learning curve analysis was found independent of the provided second assist, even though standard laparoscopic RRSO represents one of the first surgical procedures performed by our

interns. While a 55-minute operation appears longer when compared with the 35 minutes in the case of LESS [14], it is unclear what the difference would be with less experienced surgeons. The only factors that significantly led to prolonged operative time in our study were BMI greater than 30 and the presence of intra-abdominal adhesions. Given that HBOC women are more likely to have undergone abdominal surgery, including TRAM flap reconstruction on the ground of therapeutic or prophylactic breast surgery and ovarian cystectomy or tubal ligation as part of extensive surveillance, the consequent formation of adhesions may increase the complexity of a following operation. Such complicating factors were not considered criteria for patients' exclusion from the present study. Nevertheless, they were responsible for only five conversions to laparotomy, all taking place prior to 2006. Since 2006, they no longer prevented us from the completion of our laparoscopic procedures even though encountered dense adhesions may have substantially increased the surgical length in some of these cases. In total,

TABLE 6: Cases with identified malignancy on histopathological evaluation of the surgical specimens.

Age	Mutation	Parity*	Menopause	History of breast cancer	Histopathology	Followup (months)	Disease status
73	BRCA-1	Multi	Yes	Positive	Fallopian papillary serous carcinoma, grade 3/3	42	No recurrence
61	BRCA-1	Multi	Yes	Negative	Fallopian endometrioid adenocarcinoma, grade 2/3	73	No recurrence
57	BRCA-1	Multi	Yes	Positive	Tubal intraepithelial carcinoma with focally invasive serous carcinoma	26	Dead due to breast cancer metastases
51	BRCA-1	Multi	No	Negative	Tubal intraepithelial carcinoma	25	No recurrence
49	BRCA-1	Multi	Yes	Negative	Mullerian adenocarcinoma, grade 2/3	50	No recurrence
48	BRCA-1	Multi	No	Negative	Tubal intraepithelial carcinoma, bilaterally metastatic ovarian serous carcinoma	18	No recurrence
46	BRCA-1	Multi	Yes	Positive	Ovarian endometrioid adenoCa, grade 3/3, stage III	34	No recurrence
41	BRCA-1	Multi	No	Negative	Tubal intraepithelial carcinoma	24	No recurrence
66	BRCA-2	Multi	Yes	Positive	Fallopian serous adenocarcinoma in situ	74	No recurrence
63	BRCA-2	Unknown	Yes	Positive	Granulosa cell tumor	5	Unknown
61	BRCA-2	Multi	Yes	Negative	Bilateral fallopian serous carcinoma, grade 3/3 with invasive foci and metastatic implants in the serosa	73	Recurrence after 69 m: pelvic Serous Adenocarcinoma, grade 3/3
43	BRCA-2	Multi	No	Positive	Fallopian serous adenocarcinoma in situ	73	No recurrence
38	BRCA-2	Multi	Yes	Positive	Breast cancer metastasis to both ovaries	88	Dead due to breast cancer metastases
40	not tested	Nulli	No	Positive	Granulosa cell tumor	100	No recurrence

* Parity: multi = multiparous, nulli = nulliparous.

we had seven conversions to laparotomy (2%), all recorded prior to 2006. Our conversion rate was comparable to the reports of Kenkhuis et al. [12] and Meeuwissen et al. [11]. Contrary to those reports, however, none of our cases was converted because of an intraoperative complication. The risk-reducing LESS study [14] reported no conversions but the fact that this result was confined to a very small study population needs to be also considered.

Aside from the low conversion rate, safety of this laparoscopic approach is also supported by the negligible blood loss (<50 mL) in 96.9% of our cases as well as the low overall complication rate. More specifically and in line with LESS study, no major intra-operative complications were encountered. Kenkhuis et al. [12] described one major intra-operative complication in a cohort of 159 women while Meeuwissen et al. [11] reported three among 133 operated women, all representing the underlying reason of conversion to laparotomy. In our cohort, the hospital admission rate was less than 2% (7/351). Admissions were exclusively of one-night length for observatory purposes. During the six-week follow-up time, 3.1% of our patients experienced a post-operative complication. With the exception of one patient, who experienced grade IIb complication, the remaining

patients recovered successfully from grade I complications with standard management. Due to heterogeneity of inclusion criteria and data analysis, neither hospital admission nor post-operative complication rate can be subjected to direct comparisons with the aforementioned studies. Nevertheless, an important issue that should be addressed in the case of LESS [14] is the risk of hernia formation, especially in mesh TRAM flap patients. It is unclear whether the use of a larger LESS incision in these patients compromises their mesh resulting in increased rates of hernia formation.

Owing to the subjective nature of pain assessment and the lack of a validated pain-scoring scale, we decided to evaluate separately the cases with reports for continuing or increasing pain in the standard post-operative visit. We had four women who complained of minor ongoing pain unrelated to the above-mentioned complications. They were uneventfully managed with conventional analgesic medications. Only one patient required an unscheduled post-operative visit for the administration of lumbar steroid injections secondary to exacerbation of an underlying back condition.

The extensive step-sectioning pathological evaluation of the surgical specimens [15] led to a 3.9% detection

rate of occult carcinoma, which lines with the 2–17% cancer detection rate previously described for prophylactic specimens [10, 15, 17, 18]. Not surprising was the predominance of early carcinomas of fallopian origin and serous histopathology. Most women were documented BRCA mutation carriers. Although the time of intervention was apparently delayed, the mean age of 52.6 years is included in the 40–59 years category with the greatest uptake of RRSO [19]. Comprehensive long-term follow-up data cannot be provided for this cohort. Nevertheless, all women with occult malignancy (except for one patient diagnosed with granulosa cell tumor) were successfully followed up, and their disease course up to their last contact is shown in Table 6.

There are several limitations to this study that must be considered when interpreting the data: the retrospective nature of the study and the susceptibility to all biases inherent in such a design, the lack of a validated pain-scoring scale and the exclusive use of our institution's medical records to obtain any long-term data.

In conclusion, women with HBOC syndrome need to receive evidence-based counseling regarding the outcomes and overall safety of all RRSO approaches offered to them. We report the hitherto missing outcomes of standardized three-port laparoscopic RRSO in the HBOC population, to establish a contemporary performance baseline for this modality with regard to both patients and physicians. Three-port laparoscopic RRSO is an option that utilizes simple and feasible surgical steps with proven safety, low surgical morbidity, low conversion rate, and rapid post-operative recovery. Aside from facilitating the decision-making process, this paper provides a reference point for comparative studies required for the incorporation of novel surgical technologies into clinical practice, as well as an evidence-based tool for centers where only established modalities are utilized.

Conflict of Interests

The authors declare that they have no conflict of interests.

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