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Cosmetic Outcome of Robotic Surgery Compared to Laparoscopic Surgery for Benign Gynecologic Disease

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ABSTRACT

Background and Objectives: This study was designed to compare patients who have undergone conventional laparoscopic surgery with those who undergone multiport robot-assisted laparoscopic surgery for benign gynecological diseases regarding cosmetic results, patient satisfaction, and quality of life.

Methods: Sixty-four patients who underwent either robot-assisted or conventional laparoscopic surgery for benign gynecological diseases from July 1, 2019 to March 31, 2020 at Acibadem Mehmet Ali Aydinlar University Hospital were enrolled. Patients were evaluated using the Patient and Observer Scar Assessment Scale, visual analog scale for cosmetic satisfaction, body image questionnaire, and 12-item Short Form Survey six months postoperatively.

Results: The median patient assessment scale and observer assessment scale (general) values were significantly higher in the robotic group than in the laparoscopic group. The mean body image questionnaire (cosmetic section) and visual analog scale values were significantly higher in the laparoscopic group than in the robotic group. No significant differences in body image scale, body image questionnaire 9–10, and 12-item Short Form Survey values were observed between the groups. The number of patients with previous surgical history was significantly higher in the laparoscopic group than in the robotic group.

Conclusion: Although esthetic concerns are not a priority consideration when deciding an appropriate surgical method, the higher cosmetic satisfaction rate in the laparoscopic group than in the robotic group suggests that cosmetic results should be discussed with patients after evaluating other factors.

Key Words: Body image questionnaire, Cosmetic satisfaction, Laparoscopy, Patient and Observer scar assessment scale, Robotic surgery.

INTRODUCTION

Scar formation can have a psychological effect on patients.[1,2] Quick recovery, short hospital stay, good cosmetic outcome, and high quality of life are among the advantages of minimally invasive surgery.[3] Studies have compared the cosmetic results of single-port laparoscopic surgery cases in general surgery and urology.[4–6] Only a few studies have compared the cosmetic results and quality of life rates of conventional laparoscopic surgery (CLS) with those of multiport robot-assisted laparoscopic surgery (RALS) in terms of patient satisfaction in benign gynecological surgery.[7–10]

In this study, we demonstrate that esthetic satisfaction of a patient is a factor that should be evaluated and discussed before deciding any surgical approach. Thus, we compared cosmetic perceptions and quality of life of patients who had undergone CLS with those of patients who had undergone RALS at our clinic. Furthermore, we determined the differences in cosmetic and surgical outcomes due to port size and placement between both multiport techniques, which currently stand out for their cosmetic superiority.

MATERIALS AND METHODS

This was a nonrandomized, prospective cohort study conducted at Acıbadem Mehmet Ali Aydınlar University

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Ethics approval: Our study was approved by the Medical Ethics Committee of the Institutional Ethical Review Board of the Acibadem Mehmet Ali Aydinlar University School of Medicine (ATADEK-2018/8) and registered at clinicaltrials.gov (NCT04064216).

Informed consent: Dr. Esra Ozbasli declares that written informed consent was obtained from the patient/s for publication of this study/report and any accompanying images.

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Hospital, Istanbul, Turkey, from July 1, 2019 to March 31, 2020. It was approved by the Medical Ethics Committee of the Institutional Ethical Review Board of the Acıbadem Mehmet Ali Aydınlar University School of Medicine (ATADEK-2018/8) and registered at ClinicalTrials.gov (NCT04064216). Written informed consent was obtained from all participants.

Subjects

We determined the sample size based on the method used in a randomized controlled study conducted by Song et al.[11] In this study, 40 patients with hysterectomy indication were evaluated to determine whether laparoendoscopic single-site surgery (LESS) is superior to multiport laparoscopy regarding cosmetic satisfaction. In Song et al.'s study, body image scale (BIS) values of the two groups at the fourth postoperative week were compared using the Power and Sample Size Statistics Program, version 3.1.2 (Vanderbilt University, 2015). Assuming that the difference between the averages is 1.3, the standard deviation value is 1.5, the α error (p value) is 0.05, and the 1-β error (power) value is 0.90, 29 individuals per group was determined to be sufficient to examine the null hypothesis.

In this study, 105 patients who underwent either RALS or CLS for benign gynecological diseases at our clinic were assessed for eligibility. The choice of surgical route (i.e., RALS or CLS) was determined according to the patient's preference in line with the suggestion made by the primary surgeon (MG) before the surgery. The patient's indication and any contraindications for the chosen method were considered. Before the operations, patients were informed in detail about both the surgical methods, including the locations and sizes of the incisions to be made. The primary surgeon was unaware of which patients would be invited to the study and which patients agreed to participate during the selection of the surgical method and while performing the operation. Since CLS was unsuitable in some patients due to surgical and technical difficulties, this study was nonrandomized. Informed consent to participate in the study was obtained by the assistant surgeon from all participants. Patient demographics and surgical features were prospectively collected. The patients were informed that the questionnaires (i.e., Patient and Observer Scar Assessment Scale [POSAS], visual analog scale [VAS], 12-item Short Form Survey [SF-12], and body image questionnaire [BIQ]) would be sent by email to be completed six months postoperatively and that they would be invited to the clinic for evaluating their incisions by the clinician. Sixty-four patients were examined (**Figure 1**). Patients with benign gynecological diseases ages 18 to 70 years who were operated by the same surgeon (MG) who used the same size, number, and type of trocar were included in the study. Patients who were suspected of malignancy, were aged less than 18 years, had a uterine size of more than 20 gestational weeks at a pelvic examination, and had any additional incision or whose incisions were extended to remove additional tissue were excluded from the study.

Data were obtained from the patients on the day of hospitalization. Operative time was defined as the elapsed time from the intubation to the extubation of the patient. Blood loss amount was evaluated by the difference in the total amount of suction and irrigation. Length of hospital stay was defined as the number of days from the operation to discharge. Early postoperative complications were defined as all postoperative complications that occurred within two weeks postoperatively.

The POSAS, BIQ, and VAS for cosmetic satisfaction, and SF-12 for health-related quality of life (HRQoL) were sent to the patients via email. As part of the Observer Scar Assessment Scale (OSAS), the patients were invited to the clinic, and their incision scars were evaluated by a clinician who was blinded to the study.

Surgical Technique

All surgeries were performed under general anesthesia, with the patient in the lithotomy position with steep (30 degree) Trendelenburg. The pneumoperitoneum was established up to a pressure of 14 mm Hg with insufflation of carbon dioxide throughout the operation.

In CLS, a 10-mm 0 degree scope and three ancillary 5-mm ports were used. One 10-mm trocar was placed in the umbilicus. Secondary ports were inserted under laparoscopic vision. One horizontal 5-mm trocar was placed at the suprapubic area, and two horizontal 5-mm trocars were placed in the right and left lower quadrants. The lower quadrant ports were placed approximately 2 cm medial and superior to the anterior superior iliac spine and lateral to the border of the rectus muscle. All skin incisions were made within the Langer's lines of the skin. A 10-mm laparoscope and nonarticulating instruments were used.

All RALS cases were performed using the da Vinci Xi Surgical System (Intuitive Surgical, Sunnyvale, CA), and three robotic arms (8-mm umbilical and right and left ancillary ports) and one 12-mm assistant port with a smoke evacuator (Airseal®; SurgiQuest, Inc, Milford, CT, USA)

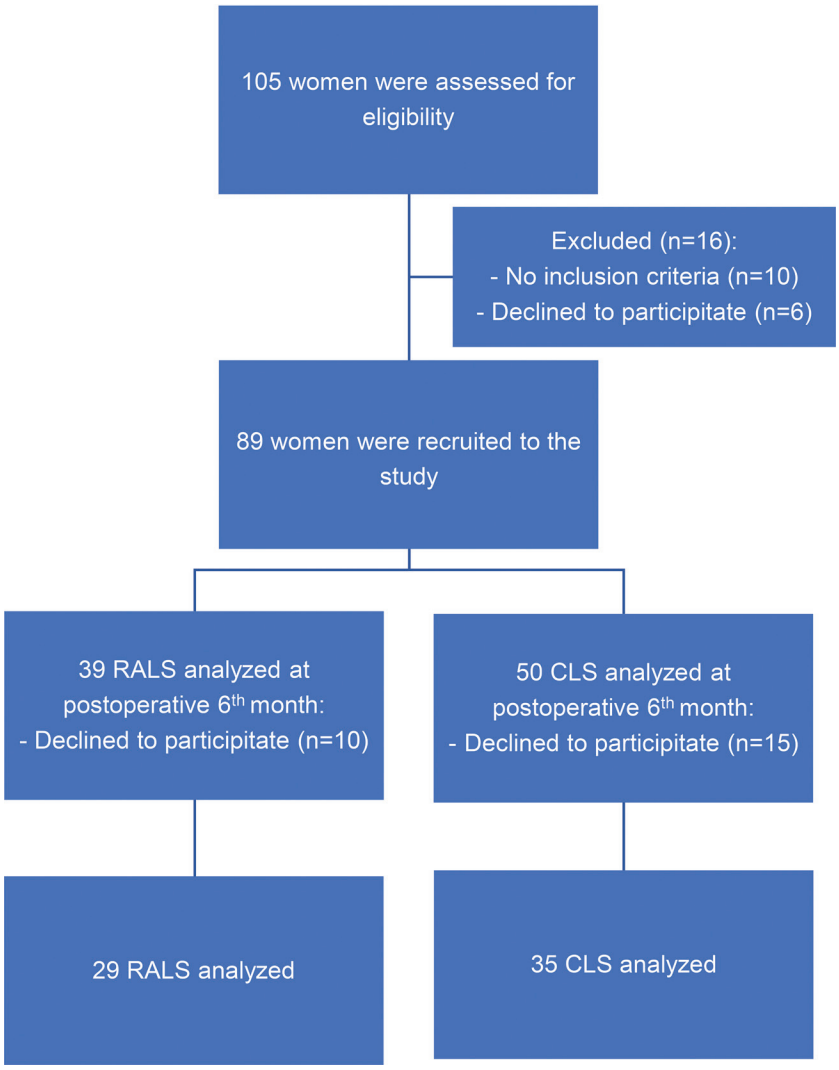

Figure 1. Patient flowchart from recruitment to study completion.

were used in all robotic cases. The right and left ancillary ports were placed 8–10 cm lateral and 3 cm inferior to the umbilical trocar. An arc across the fundus of the uterus was established. The assistant port was placed approximately 5–7 cm superior to the midclavicular line between the umbilical trocar and the left ancillary robotic port (**Figure 2**).

The fascia and skin were closed layer by layer. The fascia at the umbilical site in CLS and 12-mm assistant post site in RALS were closed using 0 Polysorb™ braided absorbable (Covidien®, Medtronic Inc., Minneapolis, MN, USA) suture in an interrupted figure-of-eight fashion. All skin incisions were sutured using 4-0 monofilamentous absorbable subcuticular Monocryl® (Ethicon®, Johnson & Johnson Inc., Cincinnati, Ohio, USA) sutures and then reinforced with wound closure strips (Omnistrip®, Hartmann Inc., Ljubljana, Slovenia), which were removed 1 week postoperatively.

All surgeries were performed by the same surgeon (MG) who had advanced experience in minimally invasive surgery. The surgical team consisted of the primary surgeon (MG), an assistant surgeon (EO), and a scrub nurse. Assistance during all surgeries and suturing of skin incisions were performed by the same assistant surgeon (EO).

Outcome Measures

The primary outcomes were patient-perceived cosmesis and patient–observer scar assessment. Cosmetic perception

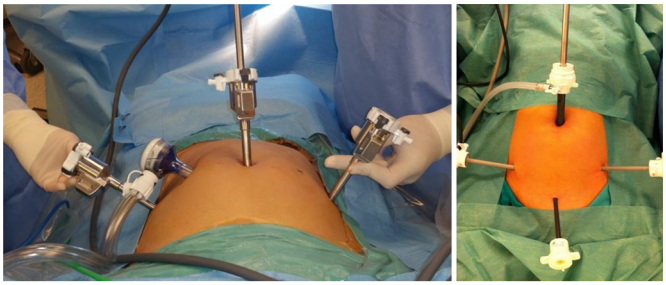

Figure 2. Trocar localizations. MRAS, multiport robot-assisted laparoscopic surgery; CLS, conventional laparoscopic surgery.

and satisfaction of the patients were measured using the POSAS, BIQ, and VAS six months postoperatively. The secondary outcome was HRQoL evaluated using the SF-12 filled in by the patients six months postoperatively.

The POSAS (**Figure 3**) is a validated questionnaire designed to evaluate different types of scar, such as burn or linear scars.[12–13] It consists of two parts: the patient portion (PSAS) that obtains the patient's opinion about scar characteristics with six items, such as color, pliability, thickness, relief, itching, and pain, and the observer's portion (OSAS) that evaluates scar features with five items, such as vascularization, pigmentation, thickness, relief, and pliability. Each item has a score of 10 points. The score of 10 reflects the worst scar imaginable. The total score comprises the sum of the scores of each item. The lowest scores reflect a normal score. In addition to scar assessment, the observer and patients provided a general opinion on the appearance of the scar, where a score of 10 reflects the worst possible scar appearance.

The BIQ was used to assess the postoperative cosmesis and body image of the study population. It consists of three parts. Items 1 – 5 measured the BIS, which evaluated the patients' perception and satisfaction with their bodies. The score ranged from 5 to 20, with higher scores representing greater body image perception. Items 6–8 measured the cosmetic scale (CS), which evaluated the satisfaction of the patients regarding their scar's physical appearance. The scores ranged from 3 to 24, with higher scores indicating greater cosmetic satisfaction. Items 9 and 10 measured the patients' self-confidence preoperatively and postoperatively. The score ranged from 2 to 20, with higher scores indicating greater self-confidence preoperatively and postoperatively.[14]

As reported by van de Kar et al.,[12] the POSAS is an appropriate scale that has good internal consistency, reliability, and agreement for evaluating linear scars. Moreover, another study has shown that the BIQ has high internal consistency for body image and cosmetic subscales (Cronbach's α of 0.80 and 0.83, respectively).[14]

A VAS, which consisted of a 10-cm line with verbal descriptions, was used to measure the patients' overall satisfaction with their scar appearance. Accordingly, 1 point indicated "not satisfied at all," whereas 10 points indicated "very satisfied."

The SF-12 was created by obtaining 12 items from eight SF-36 subheadings. This instrument has physical (SF-12 PCS) and mental (SF-12 MCS) state assessment scales with regression analysis applied to the general population and has been considered a reliable, valid, and brief tool for determining HRQoL.[15–17] The SF-12 PCS and MCS were calculated as detailed by Ware et al.,[15] with higher scores indicating higher health levels.

Statistical Analysis

Continuous variables were expressed as means ± standard deviations and medians (min – max), whereas categorical variables were expressed as numbers or percentages, where appropriate. The Kolmogorov–Smirnov goodness of fit test was used to examine data distribution. For normally distributed data, an independent sample *t* test was used to compare the clinical outcomes and scores between the groups. When the distributions were not normal, the Mann–Whitney U-test was used to compare these variables. The χ^2 test was used to compare categorical data. The linear relationship between the variables was evaluated using the Pearson and Spearman correlation test, where appropriate. The data collected were analyzed using Statistical Package for Social Sciences, version 24.0 (IBM Corporation, Armonk, NY, USA). A two-tailed p value of less than 0.05 indicated statistical significance.

RESULTS

Sixty-four patients were analyzed in this study and were divided into two groups: [i] the RALS (n = 29) and [ii] CLS (n = 35) groups. Among the demographic parameters that may have affected homogeneity, no statistically significant differences in age, average body mass index (BMI), and parity and menopause rates were observed between the groups. The number of patients with surgical history (most commonly Cesarean section) was significantly higher in the CLS group (60.0%) than in the RALS group (24.1%) ($P < .05$) (**Table 1**).

The surgical indications observed in both groups are detailed in **Table 1**; myomectomy was the most common

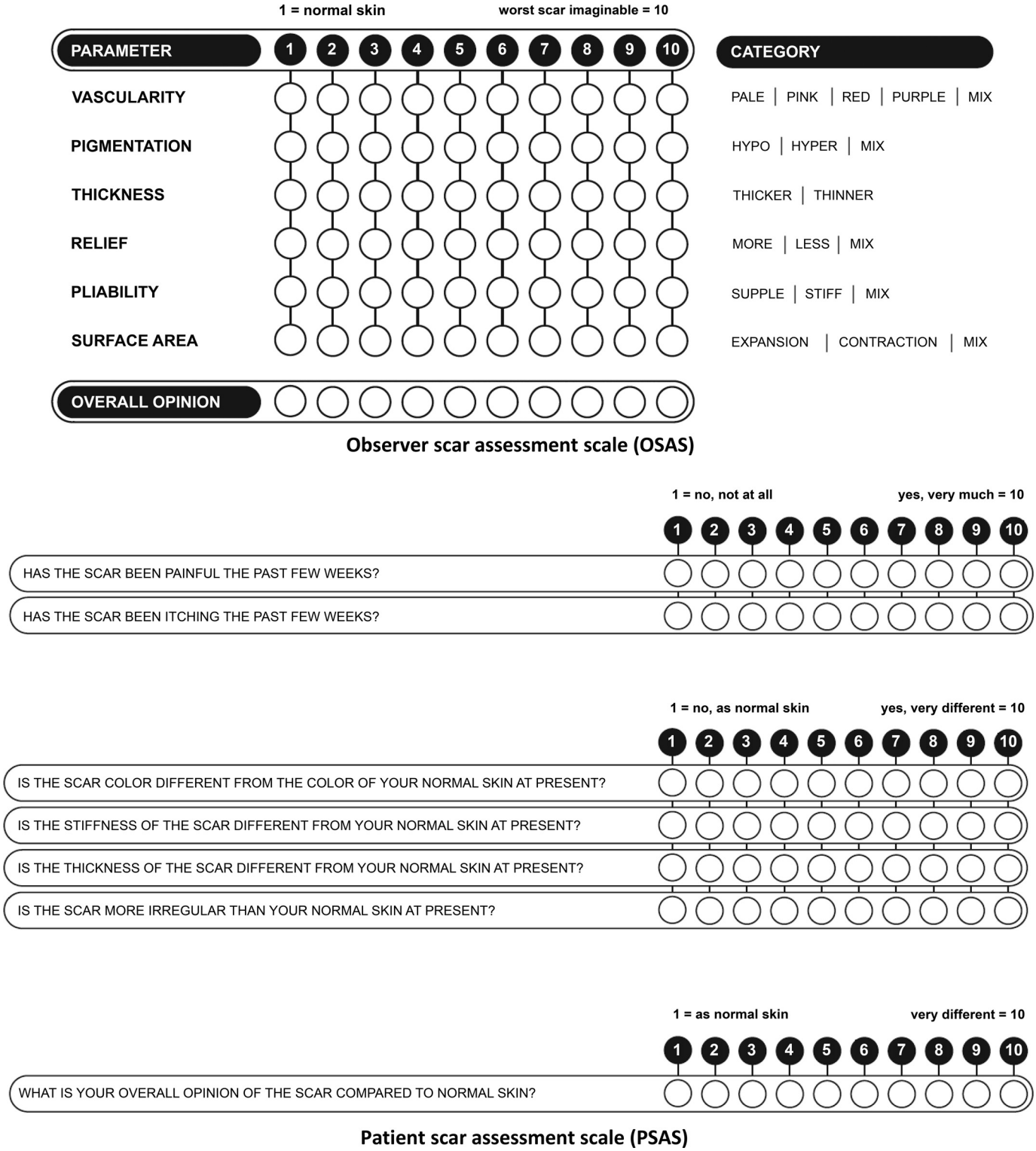

Figure 3. The patient and observer scar assessment scale.

procedure in the RALS group, whereas hysterectomy was the most common procedure in the CLS group.

The mean operative duration, hospital stay, and blood loss were significantly higher in the RALS group. However, no statistically significant difference in the mean duration to first mobilization was observed between the two groups ($P > .05$) (**Table 2**).

Laparoscopic/laparotomic conversion, major intraoperative complications, early postoperative complications, and portside hernia or wound infection were not observed in either group.

Regarding the need for antiemetic therapy, no statistically significant difference was observed between the RALS and CLS groups (51.7% and 51.4%, respectively) ($P > .05$).

The median PSAS and OSAS values were significantly higher in the RALS group ($P < .05$). Meanwhile, the mean BIQ (CS) and VAS values were significantly higher in the CLS group ($P < .05$). BIS, BIQ 9 – 10, SF-12 PCS, and SF-12 MCS values did not show statistically significant differences between the two groups ($P > .05$) (**Table 3**).

In the RALS group, the PSAS had a negative correlation with age, BMI, parity, menopause, and previous abdominal surgery. The CS (BIQ 6 – 8) had a positive correlation with age, BMI, parity, menopause, and previous abdominal surgery. The VAS had a positive correlation with age, BMI, parity, and menopause. In the CLS group, the PSAS had a negative correlation with age, parity, and previous abdominal surgery. The CS (BIQ 6 – 8) had a positive correlation with parity and previous abdominal surgery. The VAS had a positive correlation with age, parity, and previous abdominal surgery (**Table 4**).

DISCUSSION

In this study, whether RALS had a cosmetic advantage over CLS was investigated using the POSAS, BIQ, and VAS to evaluate cosmetic satisfaction and the SF-12 to evaluate HRQoL. We observed that patients regarded laparoscopic surgery as cosmetically superior to robotic surgery. Our findings are compatible with Goebel's[18] findings. In this

Table 1.
Demographic Features of the Robotic and Laparoscopic Surgery Groups

Indication for Surgery				
Uterine myoma	20 (69.0)	11 (31.4)	31 (48.4)	
Abnormal uterine bleeding	9 (31.0)	3 (8.6)	12 (18.8)	
Adnexal mass	0 (0.0)	13 (37.1)	13 (20.3)	< 0.001**
Endometrioma	0 (0.0)	4 (11.4)	4 (6.3)	
Others	0 (0.0)	4 (11.4)	4 (6.3)	
Type of Surgery				**< 0.001****
Robotic multiple myomectomy	19 (65.5)	0 (0.0)	19 (29.7)	
RTH, BSO	8 (27.6)	0 (0.0)	8 (12.5)	
RTH	2 (6.9)	0 (0.0)	2 (3.1)	
TLH, BSO	0 (0.0)	11 (31.4)	11 (17.2)	
LS multiple myomectomy	0 (0.0)	6 (17.1)	6 (9.4)	
LS cystectomy	0 (0.0)	7 (20.0)	7 (10.9)	
LS for stage 4 endometriosis	0 (0.0)	7 (20.0)	7 (10.9)	
TLH	0 (0.0)	3 (8.6)	3 (4.7)	
LS ectopic pregnancy	0 (0.0)	1 (2.9)	1 (1.6)	
Total	29 (100.0)	35 (100.0)	64 (100.0)	

*Independent samples t test.
**χ^2 test ([a]Fisher's exact test).
BMI, body mass index; SD, standard deviation; RTH, BSO, robotic total hysterectomy total hysterectomy with bilateral salpingo-oophorectomy; RTH, robotic total hysterectomy; TLH, BSO, total laparoscopic hysterectomy with bilateral salpingo-oophorectomy; LS, laparoscopy; TLH, total laparoscopic hysterectomy.

Table 2.
Surgical Features of the Robotic and Laparoscopic Surgery Groups

	Robotic Group (mean ± SD) (n = 29)	Laparoscopic Group (mean ± SD) (n = 35)	p^1
Operative duration (min)	216.03 ± 65.67	93.00 ± 35.29	< 0.001*
Hospital stay (day)	2.07 ± 0.70	1.65 ± 0.64	0.017*
Time to first mobilization (min)	381.03 ± 208.36	368.00 ± 159.28	0.778*
Blood loss (min)	233.10 ± 142.90	114.29 ± 59.62	< 0.001**
	$p^2 < 0.001$**	$p^2 < 0.001$**	

*Independent sample t test ($p^1 < 0.001$).
**Paired sample t test ($p^2 < 0.001$).
SD, standard deviation.

study, scars due to robotic surgeries were ranked as the least appealing scar type (42%), and no patient selected this surgical approach as the first choice. Moreover, 74% of the patients preferred minilaparotomy, whereas 26% preferred traditional laparoscopy.

On the surgeon's perspective, enhanced dexterity, greater visualization, greater precision, shorter hospitalization, reduced blood loss, faster recovery time, and minimal scarring are the main advantages of robotic surgery. Although these are important factors that might affect a patient's decision on which surgical approach to choose, cosmetic outcomes are also an important factor on the patient's perspective. In a study by Currie et al.,[19] 68% of women preferred the Pfannenstiel incision, whereas only 31% selected laparoscopic incisions for hysterectomy. In 2013, Yeung et al.[8] have reported that although laparoscopic incisions were the first choice, minilaparotomy was the second preferred horizontal incision. Thus, note that size might not be the only factor to determine cosmetic satisfaction. In this study, the location of the incisions was the second crucial factor in decision making. This finding suggests that the lower cosmetic satisfaction among patients who underwent robotic surgery can be attributed to the location of robotic incisions (i.e., upper abdominal region) relative to that of laparoscopic incisions (i.e., lower abdominal region).

Studies have shown that etiology, size, location, suturing technique, patient's age, race, and genetic predisposition affect wound healing.[20–22] Although no statistically significant differences in average age and BMI were observed between both groups, a correlation between age and cosmesis was observed, supporting the findings of Olweny's study,[23] which

Table 3.
Comparison of Scale Scores Related to Cosmetics and Quality of Life between Groups

	Robotic Group Median (min–max) (n = 29)	Laparoscopic Group Median (min–max) (n = 35)	p
PSAS	24 (7–63)	13 (7–45)	0.007*
OSAS parameters	31 (7–53)	20 (10–49)	0.066*
OSAS general	6 (1–9)	3 (2–9)	0.040*
BIS (BIQ 1–5)	6 (5–11)	5 (5 – 8)	0.177*
CS (BIQ 6–8)	16 (6–24)	22 (13–27)	0.001*
VAS	7 (3–10)	9 (5–10)	< 0.001*
SF-12 PCS	55.25 (38.97–63.19)	55.29 (32.68–62.48)	0.767*
SF-12 MCS	51.90 (31.75–60.76)	52.77 (17.84–60.22)	0.558*

*Mann–Whitney U-test.
PSAS, patient scar assessment scale; OSAS, observer scar assessment scale; BIS, body image scale; CS, cosmetic scale; BIQ, body image questionnaire; VAS, visual analog scale; SF-12 PCS, 12-item Short Form physical composite scale; SF-12 MCS, 12-item Short Form mental health composite scale.

Table 4.
Correlations Between Patient Characteristics and Outcome Measures

RALS	PSAS	CS (BIQ 6–8)	VAS
Age			
r	−0.412 (*)	0.552 (*)	0.458 (*)
p	0.026	0.002	0.013
N	29	29	29
BMI			
r	−0.448 (*)	0.434 (*)	0.411 (*)
p	0.015	0.019	0.027
N	29	29	29
Parity			
r	−0.461 (**)	0.491 (**)	0.465 (**)
P	0.012	0.007	0.011
N	29	29	29
Menopause			
R	−0.382 (**)	0.462 (**)	0.386 (**)
p	0.041	0.012	0.038
Previous abdominal surgery			
r	−0.383 (**)	0.389 (**)	0.360 (**)
p	0.040	0.037	0.055
N	29	29	29

*Pearson correlation coefficient; **Point-biserial correlation coefficient.
PSAS, patient scar assessment scale; CS, cosmetic section; BIQ, body image questionnaire; VAS, visual analog scale; RALS, robot-assisted laparoscopic surgery; CLS, conventional laparoscopic surgery; BMI, body mass index; r, correlation coefficient; p, probability value; n, number.

showed that "cosmesis may be a more important preoperative consideration for younger patients and those with benign conditions."

Son et al. have revealed that incision design, atraumatic handling of soft tissue, hemostasis, aseptic techniques, and tension-reducing approaches in the postoperative period are modifiable factors that affect scar formation.[24] Although this study was not homogeneous in terms of the types of surgery performed and operative times, it was homogeneous in terms of modifiable factors affecting scar formation, ethnicity, BMI, and age. As such, considering the mechanisms of scar formation, we believe that this inhomogeneity in the type of surgery did not affect the cosmetic outcomes of the skin incisions, which were the primary outcome investigated in this study.

Although our clinic used the same number of ports during both procedures, the port size and location in RALS differed from those in CLS. Accordingly, the port size and locations were identified as among the underlying factors for the lower cosmetic satisfaction scores in patients who underwent RALS, which is consistent with the results reported by Abbas et al.[25]

In this study, similar to Bush's study,[10] the number of patients with surgical history was significantly higher in the CLS group (60.0%). Furthermore, in the CLS group, a positive correlation was found between abdominal surgical history and the CS and VAS, and a negative correlation was found between abdominal surgical history and the PSAS. In the RALS group, a negative correlation between abdominal surgical history and the PSAS and a positive correlation between abdominal surgical history and the CS were observed. These findings are consistent with the findings of Goebel's study,[18] which suggested that patients with a history of surgery are less concerned with the location of further incisions. In this study, this suggestion explains the higher cosmetic satisfaction scores in the CLS group, which has a significantly higher number of patients with surgical history.

Similar to Soto's study,[26] which compared the laparoscopic and robotic surgical approaches for endometriosis in terms of quality of life, in this study, no statistical difference in HRQoL was observed between the two groups.

In contrast to Corrado,[7] this study showed that the RALS group had significantly greater blood loss and longer hospital stay than the CLS group. Although a meta-analysis[27] conducted in 2014 found no statistically significant difference in operative duration between both procedures, this study revealed that the RALS group had a significantly higher operative duration than the CLS group, which is a finding similar to that reported in Corrado's study. These results may be due to the difference in surgical indications between the two groups; however, these findings were not the primary outcome of this study.

This study has some limitations. First, this study included a small sample size; however, a study power of 90% was obtained. Second, the design of this study lacked randomization. Similar to numerous studies on surgery in the literature, in this study, employing randomization was difficult. Another limitation of this study is that a 5-mm scope in the CLS group and a 5-mm assistant port in the RALS group could not be used in line with the primary surgeon's preference. Moreover, we think that comparing outcomes of patients whose surgery was performed by different surgeons with diverse levels of experience

would be useful. Finally, 6 months of follow-up seemed short to discuss cosmetic benefits.

Despite the inhomogeneity in the type of surgery performed, we believe that the exclusion of surgeries due to malignancy reduced the possibility of bias due to anxiety.

Some strengths of this study are worth noting, one of which is the use of four questionnaires to postoperatively evaluate patient satisfaction. Moreover, both the patient and observer evaluated the scar. All patients included in this study were Caucasian, while the same surgeon performed all surgeries. Furthermore, all surgical incisions were sutured by the same surgeon using the same suture material and technique, with none of the patients developing a wound infection.

Despite the limitations, this study is unique in terms of comparing RALS and CLS because of the limited number of studies evaluating cosmetic satisfaction in the gynecological field.

CONCLUSION

Esthetic satisfaction cannot be the primary factor in deciding the surgical approach; however, it should not be ignored. This study emphasizes the need to provide detailed information about the cosmetic outcomes to the patient before the surgery, considering that patient satisfaction was higher in the CLS group than in the RALS group in terms of cosmetic results. More prospective randomized studies with a longer follow-up period and larger sample size are needed to determine, among other factors, the importance of the cosmetic outcome to patients.

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