**Effects of human papillomavirus and LEEP on sexual function**

**Abstract**

**Aim:** We evaluated the sexual function of human papillomavirus (HPV)-positive patients after colposcopy and loop electrosurgical excision procedure (LEEP).

**Materials and Methods:** This study enrolled 344 patients with an HPV infection detected on routine screening in 2020–2022. Sexual function was evaluated using the Female Sexual Function Index (FSFI), which consists of six sections: desire, arousal, lubrication, orgasm, satisfaction, and pain.

**Results:** The mean age of the 344 HPV-positive patients was 37.2 ± 8.2 years, and 28.2% of them were unmarried. Colposcopy, cervical biopsy, and LEEP were performed in 251 (73.0%), 189 (54.9%), and 42 (12.2%) patients, respectively. The sexual history and FSFI scores of the patients were recorded. The total and individual parameter scores on the FSFI decreased significantly after colposcopy. Similarly, the total and individual parameter scores on the FSFI were lower at 8 weeks after LEEP compared to those before LEEP.

**Conclusion:** Cancer-related fear and anxiety and LEEP may cause sexual dysfunction in HPV-positive patients.

**Key words:** Human papillomavirus, sexual dysfunction, loop electrosurgical excision procedure, colposcopy

**Introduction**

Human papillomavirus (HPV) infection is the most common sexually transmitted viral infection in humans [1]. The lifetime probability of acquiring HPV infection among sexually active people is almost 80–90% [2,3]. Two previous studies reported HPV positivity rates of 17.9% and 23% in Turkish women [4,5]. HPV has more than 120 types, of which 40 affect the anogenital region. Infection with HPV types 16 and 18 (70%) carries the highest risk of cervical cancer [6]. Cervical HPV disease may transform into low- or high-grade cervical intraepithelial neoplasia (CIN). Although most HPV infections are self-limiting and asymptomatic, some may progress to cervical cancer [6].

Low-grade CIN (i.e., CIN1) can be managed with careful observation, whereas high-grade and persistent CIN1 is treated with excision (cold blade conization and loop electrosurgical excision procedure [LEEP]) or ablation (cryotherapy and laser ablation) [6].

Although previous studies have evaluated the cancer risk in HPV patients, their psychological problems, including post-diagnosis sexual difficulties, have not been evaluated previously. Anxiety can affect sexual function by decreasing desire, gratification, sexual arousal, spontaneous lubrication, and orgasmic capacity, and it may cause dyspareunia [7]. Patients referred for colposcopy often have anxiety and up to half of them have a fear of developing cancer [7].

We evaluated the sexual function in HPV-positive patients who underwent colposcopy and LEEP.

**Materials and Methods**

We enrolled 340 patients diagnosed with an HPV infection on routine screening in 2020–2022. Patients with a history of HPV positivity, cancer, psychiatric disease, or abdominal or vaginal surgery were excluded. In addition, we exclued patients using drugs that may cause sexual dysfunction and those who underwent a cervical biopsy under general anesthesia. The Female Sexual Function Index (FSFI) was used to evaluate the sexual function of the patients.

Patients infected with HPV types other than 16–18 and those with normal cytology were not subjected to further testing and were followed up after 1 year. Patients with HPV 16–18 or cytological abnormalities (atypical squamous cells, low-/high-grade CIN) underwent colposcopy and a cervical biopsy if necessary. LEEP was performed in patients with suspected cancer, high-grade CIN, an unclear transformation zone, or carcinoma *in situ*. Only 1-cm-thick cervical tissue was removed to preserve fertility and cervical continence, which prevents miscarriages and premature birth. LEEP was performed under general anesthesia by a gynecological oncology surgeon.

The FSFI was utilized at the time of diagnosis, 4 weeks after colposcopy, and 8 weeks after LEEP through telephonic interviews. The FSFI indicates sexual function and consists of six sections; namely, desire, arousal, lubrication, orgasm, satisfaction, and pain [8]. The FSFI components were scored on a Likert scale. An FFSI score < 26.55 indicates sexual dysfunction [9].

Categorical variables are presented as frequencies and percentages, whereas quantitative variables are expressed as means ± standard deviations and 95% confidence intervals (CIs), unless stated otherwise. Continuous variables were compared using the Student’s *t-*test and Mann-Whitney Utest. Normally distributed variables were compared using a paired *t*-test. Categorical variables were compared using the *χ*2 test. A paired *t*-test was performed to compare dependent variables. All statistical analyses were performed using MedCalc software (version 14.0 for Windows; Mariakerke, Belgium). *P* < 0.05 was considered to indicate statistical significance.

**Results**

The mean age of the 344 HPV-positive patients was 37.2 ± 8.2 years, and 28.2% of the patients were unmarried. Colposcopy, cervical biopsy, and LEEP were performed in 251 (73.0%), 189 (54.9%), and 42 (12.2%) patients, respectively. Table 1 presents the patients’ demographic information.

The FSFI scores of the patients were recorded at admission, 4 weeks after diagnosis and colposcopy, immediately before and after LEEP, and 8 weeks after LEEP. In addition, the sexual history of the patients was recorded at admission. The individual parameter and total FSFI scores decreased significantly before and after colposcopy, and decreased slightly at 8 weeks after LEEP compared to that before the procedure. Table 2 demonstrates a significant difference in FSFI scores after compared to before diagnosis and LEEP.

**Discussion**

HPV is a sexually transmitted disease that is associated with psychological and physical problems, including cervical cancer and vulvar condylomas. HPV-positive patients may experience psychological distress during the provision of information related to the disease, diagnotic procedures (e.g., colposcopy and biopsy), and treatment (e.g., LEEP). The various emotions experienced by HPV-positive patients include denial, dread, concern, depression, and sadness. Even patients with a normal colposcopy and low risk of malignancy experience significant psychological distress, which may lead to sexual avoidance and dysfunction in women. The FSFI is commonly used to evaluate the sexual function of women [10]. In the present study, sexual dysfunction was caused by an HPV infection diagnosis and by undergoing colposcopy and LEEP.

Previous studies have suggested that HPV-positive patients have sexual dysfunction and decreased sexual desire [11,12]. Moreover, sexual desire, arousal, lubrication, orgasm, and satisfaction were significantly decreased in HPV-positive patients [2]. HPV persistence and recurrence were associated with increased patient concerns about sexual desire [11], and the concerns, rather than the physical burden of HPV treatment, were the most distressing for women [11]. Precancerous cervical lesions regress over time, and approximately 30% of high-grade CINs can transform into invasive cancer. Despite being provided this information, the anxiety and fear of patients did not decrease significantly [11]. HPV infection is associated with negative effects on depression and anxiety [2,13–16]. Depression has significant negative effects on orgasm and sexual satisfaction [2]. Independent of the cervical cytology, a positive HPV test may cause self-blame and negative feelings toward sexual intercourse [17]. Although warts are the most obvious clinical manifestations of an HPV infection, studies have reported that there is no significant difference in psychosexual concerns among HPV-positive patients with and without genital warts [18]. Patients with HPV 16 and 18 infection have greater sexual dysfunction compared to those with other HPV types due to the higher risk of cancer with HPV 16 and 18 infections. In our study, a diagnosis of HPV infection affected all FSFI components, particularly arousal (p = 0.005) and orgasm (p = 0.003), which may be due to cancer-related anxiety.

LEEP leads to dyspareunia and reduced spontaneous sexual interest, intercourse frequency, sexual arousal, lubrication, and orgasm [19–25]. However, some previous studies have reported that LEEP does not affect female sexuality when compared with presurgical sexual function [7,26]. The dyspareunia after LEEP decreases almost 6 months to 2 years after the procedure [7,27]. Patients with a high anxiety level at the initial presentation had more frequent dyspareunia and negative sexual feelings compared to those with a low anxiety level [7]. LEEP was associated with a significant decrease in overall and orgasm-related satisfaction, and vaginal elasticity (p < 0.05) [21]. In the present study, the FSFI score decreased after LEEP. It is probable that the fear of cancer leads to reduced interest in sexual intercourse. Previous studies have suggested that sexual dysfunction is related to anxiety, rather than physical disability, as sexuality returns to normal over time.

The present study had a few limitations. First, this was a retrospective study. Second, cervical biopsy was not performed under general anesthesia, which may have led to increased fear and anxiety in patients. By contrast, the study also had a few strengths, including the large number of included patients and the use of a validated tool to evaluate the sexual function of patients.

In conclusion, HPV infection and LEEP lead to sexual dysfuction due to cancer-related fear and anxiety.

**References**

1. Graziottin A, Serafini A. HPV ınfection in women: Psychosexual ımpact of genital warts and ıntraepithelial lesions. J Sex Med 2009;6:633–45.

2. Mercan R, Mercan S, Durmaz B, Sur H, Kilciksiz CM, Kacar AS, Apaydin Z, Ayhan C, Ata B. Sexual dysfunction in women with human papilloma virus infection in the Turkish population. J Obstet Gynaecol. 2019 Jul;39(5):659–63.

3. Bosch FX, Broker TR, Forman D, et al. Comprehensive control of human papillomavirus infections and related diseases. Vaccine. 2013; 31(Suppl 7):H1–H31.

4. Demir ET, Ceyhan M, Simsek M, Gunduz T, Arlier S, Aytac R, Aycan AE, Gurbuz V. The prevalence of different HPV types in Turkish women with a normal Pap smear. J Med Virol. 2012 Aug;84(8):1242–7.

5. Dursun P, Altuntas B, Kuscu E, Ayhan A. Women's knowledge about human papillomavirus and their acceptance of HPV vaccine. Aust N Z J Obstet Gynaecol. 2009 Apr;49(2):202–6.

6. Cendejas BR, Smith-Mccune KK, Khan MJ. Does treatment for cervical and vulvar dysplasia impact women's sexual health? Am J Obstet Gynecol. 2015 March ; 212(3): 291–7.

7. Hellsten C, Lindqvist PG, Sjöström K. A longitudinal study of sexual functioning in women referred for colposcopy: A 2-year follow up. BJOG. 2008 Jan;115(2):205–11.

8. Rosen R, Brown C, Heiman J, Leiblum S, Meston C, Shabsigh R, Ferguson D, D’Agostino R Jr. The Female Sexual Function Index (FSFI): A multidimensional self-report instrument for the assessment of female sexual function. J Sex Marital Ther 2000;26:191–208.

9. Pérez-López FR, Fernández-Alonso AM, Trabalón-Pastor M, Vara C, Chedraui P; MenopAuse RIsk Assessment (MARIA) Research Group. Assessment of sexual function and related factors in midaged sexually active Spanish women with the six-item Female Sex Function Index. Menopause 2012;19:1224–30.

10. Wiegel M1, Meston C, Rosen R. The female sexual function index (FSFI): Cross-validation and development of clinical cutoff scores. J Sex Marital Ther 2005;31:1–20.

11. Nagele E, Reich O, Greimel E, Dorfer M, Haas J, Trutnovsky G. Sexual activity, psychosexual distress, and fear of progression in women with human papillomavirus-related premalignant genital lesions. J Sex Med. 2016 Feb;13(2):253–9.

12. Ferenidou F, Salakos N, Vaidakis N, Paltoglou G, Bakalianou K, Papadimitriou G, et al. The impact of HPV diagnosis on women’s sexual and mental health: Preliminary findings. Clin Exp Obstet Gynecol 2012;39:79–82.

13. Maissi E, Marteau TM, Hankins M, Moss S, Legood R, Gray A. Psychological impact of human papillomavirus testing in women with borderline or mildly dyskaryotic cervical smear test results: Cross sectional questionnaire study. BMJ. 2004 May 29;328(7451):1293.

14. Kola S, Walsh JC. Patients' psychological reactions to colposcopy and LLETZ treatment for cervical intraepithelial neoplasia. Eur J Obstet Gynecol Reprod Biol. 2009 Sep;146(1):96–9.

15. Heinonen A, Tapper AM, Leminen A, Sintonen H, Roine RP. Health-related quality of life and perception of anxiety in women with abnormal cervical cytology referred for colposcopy: An observational study. Eur J Obstet Gynecol Reprod Biol. 2013 Jul;169(2):387–91.

16. McCaffery K, Waller J, Nazroo J, Wardle J. Social and psychological impact of HPV testing in cervical screening: A qualitative study. Sex Transm Infect 2006;82:169–74.

17. Dominiak-Felden G, Cohet C, Atrux-Tallau S, Gilet H, Tristram A, Fiander A. Impact of human papillomavirus-related genital diseases on quality of life and psychosocial wellbeing: Results of an observational, health-related quality of life study in the UK. BMC Public Health 2013;13:1065.

18. Conaglen HM, Hughes R, Conaglen JV, Morgan J. A prospective study of the psychological impact on patients of first diagnosis of human papillomavirus. Int J STD AIDS. 2001 Oct;12(10):651–8.

19. Hellsten C, Lindqvist PG, Sjöström K. A longitudinal study of sexual functioning in women referred for colposcopy: A 2-year follow up. BJOG. 2008 Jan;115(2):205–11.

20. Serati M, Salvatore S, Cattoni E, Zanirato M, Mauri S, Siesto G, Cromi A, Ghezzi F, Bolis P. The impact of the loop electrosurgical excisional procedure for cervical intraepithelial lesions on female sexual function. J Sex Med. 2010 Jun;7(6):2267–72.

21. Inna N, Phianmongkhol Y, Charoenkwan K. Sexual function after loop electrosurgical excision procedure for cervical dysplasia. J Sex Med 2010;7:1291–7.

22. Hellsten C, Lindqvist PG, Sjostrom K. A longitudinal study of sexual functioning in women referred for colposcopy: A 2-year follow up. BJOG. 2008; 115(2):205–11.

23. Howells RE, Dunn PD, Isasi T, et al. Is the provision of information leaflets before colposcopy beneficial? A prospective randomised study. Br J Obstet Gynaecol. 1999; 106(6):528–34.

24. Serati M, Salvatore S, Cattoni E, et al. The impact of the loop electrosurgical excisional procedure for cervical intraepithelial lesions on female sexual function. J Sex Med. 2010; 7(6):2267–72.

25. Wiegel M, Meston C, Rosen R. The female sexual function index (FSFI): Cross-validation and development of clinical cutoff scores. J Sex Marital Ther. 2005; 31(1):1–20.

26. Serati M, Salvatore S, Cattoni E, Zanirato M, Mauri S, Siesto G, Cromi A, Ghezzi F, Bolis P. The impact of the loop electrosurgical excisional procedure for cervical intraepithelial lesions on female sexual function. J Sex Med 2010;7:2267–72.

27. Kilkku P, Gronroos M, Punnonen R. Sexual function after conization of the uterine cervix. Gynecol Oncol 1982;14:209–12.

**Table 1**. Demographic characteristics of the patients

|  |  |
| --- | --- |
|  | **Patients (n = 344)** |
| **Age, years, mean ± StD** | 37.2 ± 8.2 |
| **Parity, mean ± StD** | 1.6 ± 1.1 |
| **Marital status, n (%)**  **- Single**  **- Married** | 97 (28.2)  247 (71.8) |
| **HPV type, n (%)**  **- 16/18**  **- Others** | 176 (51.2)  168 (48.8) |
| **Cytology, n (%)**  **- Normal**  **- CIN1**  **- CIN2/3** | 211 (61.3)  91 (26.5)  42 (12.2) |
| **Colposcopy, n (%)** | 251 (73.0) |
| **Biopsy, n (%)** | 189 (54.9) |
| **Grade of biopsy, n (%)**  **- 1**  **- 2**  **- 3**  **- 4** | 106 (56.1)  43 (22.8)  14 (7.4)  26 (13.8) |
| **Biopsy result, n (%)**  **- Normal**  **- Low-grade CIN**  **- High-grade CIN** | 139 (73.5)  11 (5.8)  39 (20.6) |
| **LEEP, n (%)** | 42 (12.2) |
| **LEEP size, cm, mean ± StD** | 2.9 ± 0.3 |

HPV: human papillomavirus, CIN: cervical intraepithelial neoplasia, LEEP: loop electrosurgical excision procedure, StD: standard deviation

**Table 2**. FSFI components before and after diagnosis and LEEP

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Before diagnosis** | **After diagnosis/colposcopy** | **p-value** | **Before LEEP** | **After LEEP** | **p-value** |
| **Desire** | 4.9 ± 0.9 | 4.7 ± 0.8 | 0.019 | 4.3 ± 0.6 | 3.8 ± 1.1 | 0.012 |
| **Arousal** | 4.8 ± 0.9 | 4.5 ± 1.0 | 0.005 | 4.2 ± 0.7 | 3.7 ± 1.0 | 0.008 |
| **Lubrication** | 4.8 ± 0.9 | 4.6 ± 0.8 | 0.007 | 4.3 ± 0.6 | 3.9 ± 0.7 | 0.025 |
| **Orgasm** | 4.6 ± 0.9 | 4.4 ± 1.2 | 0.003 | 4.3 ± 0.7 | 3.9 ± 0.7 | 0.006 |
| **Satisfaction** | 4.8 ± 0.9 | 4.7 ± 0.9 | 0.022 | 4.2 ± 0.6 | 3.6 ± 1.0 | 0.001 |
| **Pain** | 4.6 ± 0.9 | 4.4 ± 0.8 | 0.018 | 4.0 ± 0.7 | 3.5 ± 1.1 | 0.018 |
| **Total** | 28.7 ± 2.8 | 27.5 ± 3.2 | > 0.001 | 25.6 ± 1.5 | 22.5 ± 4.5 | > 0.001 |

LEEP: loop electrosurgical excision procedure

**Laparoscopic surgery for large adnexal masses (> 12 cm): A single-port vs. conventional approach**

**Abstract**

**Aim:** We compared single-port and multiport laparoscopic surgery (SPLS and CMLS, respectively) for a large adnexal mass (AM).

**Materials and Methods:** We retrospectively analyzed the data from 43 patients who underwent SPLS (n = 17) or CMLS (n = 26) for large AMs (≥ 12 cm) between 2016 and 2021. The primary outcome was postoperative improvement according to the Quality of Recovery (QoR)-40 questionnaire score at 24 h postoperatively. The port sites were evaluated using the Patient and Observer Scar Assessment Scale, which is composed of the Observer Scar Assessment Scale (OSAS) and Patient Scar Assessment Scale (PSAS).

**Results:** There were no significant differences between the groups in terms of age, menopausal status, body mass index, or mass size. The operation time was shorter in the SPLS than the CPLS group (42.6 ± 3.6 vs. 48.8 ± 6.0 min; p < 0.001). In the SPLS and CMLS cohorts, unilateral salpingo-oophorectomy was performed in 35.3% and 23.1% of patients, respectively (p = 0.383). The QoR-40 score was significantly higher in the SPLS than the CMLS group (154.7 ± 11.7 vs. 142.3 ± 17.4; p = 0.014). The OSAS and PSAS scores were lower in the SPLS than the CMLS group.

**Conclusion:** CMLS and SPLS can be performed for large cysts that are not at high risk of malignancy. The postoperative recovery time was shorter in patients after SPLS compared to CMLS.

**Key words:** Laparoscopy, large adnexal mass, single-port laparoscopic surgery

**Introduction**

Approximately 10% of women undergo surgery for an adnexal mass (AM) during their lifetime [1]. Most AMs are benign and occur during the premenopausal period. Minimally invasive surgery (MIS) is preferred for AMs because it is associated with a more rapid recovery, fewer adhesions, a faster return to social life, and better cosmetic outcomes than other approaches. AMs tend to affect relatively young women [2].

Large AMs are associated with prolonged operative times and an increased risk of malignancy [3–5]. Some surgeons recommend open abdominal surgery (i.e., laparotomy) for patients with AMs larger than 8–10 cm [6,2,3] because they do not benefit from laparoscopy (LS). Large AMs may be inadvertently ruptured by the insertion of a Veress needle or trocar.

Conventional multiport LS (CMLS) is associated with trocar-related complications, such as poor cosmetic results, bleeding, hernia, visceral injury, and wound infection. Although single-port laparoscopic surgery (SPLS) is often performed for AMs and gynecological surgeries, it is not suitable for large AMs. However, there is a lack of previous studies on this topic. In the present study, we compared the outcomes of CMLS and SPLS for large AMs.

**Materials and Methods**

We retrospectively analyzed the data of 43 women who underwent SPLS (n = 17) or CMLS (n = 26) due to large AMs (≥ 12 cm) between 2016 and 2021. The patients underwent a preoperative ultrasound and magnetic resonance imaging to assess the morphology and dimensions of the mass. We excluded patients with suscpected cancer, deeply infiltrating endometriosis, and an indication for hysterectomy or myomectomy. We recorded the demographic information, CA-125 level, cyst dimension, surgery duration, estimated blood loss, transfusion, postoperative hospital stay, analgesic requirement, perioperative complications, and follow-up duration. The International Ovarian Tumor Analysis (IOTA) scoring system was used to exclude malignancy [7]. The time between the first skin incision and closure was recorded as the operating time.

The CA-125 level was measured using a Cobas 8000 Automatic Biochemical Analyzer (Roche Diagnostics GmbH, Mannheim, Germany) and commercial reagents. Hemoglobin was measured using an XN-1000 Hematology Analyzer (Sysmex, Kobe, Japan). Our standard preoperative and postoperative patient care protocols have been published previously [8].

CMLS: A pneumoperitoneum was created using a Veress needle. A 12-mm trocar was inserted through a vertical incision made above the umbilicus. Then, a telescope was used for abdominal observation. Three 5-mm trocars were inserted at the levels of the navel and below the abdomen under telescopic observation. Although the trocars’ positions varied, they were usually inserted into the right lateral, left lateral, and suprapubic regions. The fascia underlying the umbilical incision was closed with 1.0 Prolene sutures.

Patients were placed in the Trendelenburg position and the pelvic masses were freed by dissection. In cases with cyst rupture in the abdomen, the contents were aspirated. One of the 5-mm trochords was converted to a 10-mm trochord, and an endobag and 40-cm-long cord were inserted into the abdomen. After placing the specimen in the endobag, its mouth was sealed by pulling the string. Then, the endobag and trocar were removed from the abdomen. Once the endobag mouth protruded out of the incision, the specimen inside the bag was aspirated or dissected.

SPLS: Octoport™ or SILS® port, a four-channel single-port system, was used for SPLS. The port was inserted through a 3-cm umbilical incision. A 10-mm telescope was held by the assistant at an angle of 30°. The surgeon guided the laparoscopic instruments with both hands. A Rumi cannula was handled by the second assistant and used to manipulate the uterus. The cyst was punctured, and its contents were aspirated. Then, oophorectomy was performed using a LigaSure device (Medtronic, Dublin, Ireland). The remnant cyst tissue was excised. The port was removed, and the openings in the fascia and skin were sutured.

The time of specimen collection was calculated as the time between opening the bag and removing it completely from the abdomen. The operation duration was calculated as the time from the first skin incision to the end of skin suturing. The fascia opened in the umbilicus was sutured under direct observation using 0 vicryl. The fasciae of the additional 5-mm incisions were not sutured. The skin incisions were sutured with absorbable 4-0 vicryl. Local anesthesia was not applied to the incisions.

Postoperative (24 h postoperatively) recovery was evaluated using the Quality of Recovery (QoR)-40 questionnaire, which consists of five sections: physical cosiness (12 questions), sentimental condition (9 questions), physical independence (5 questions), psychological assistance (7 questions), and soreness (7 questions). The QoR-40 questionnaire rates the answers on a Likert scale (never, sometimes, generally, often, and always), with a total score of 40–200 [9].

At 6 weeks postoperatively, the port spaces of the patients were evaluated. The Patient and Observer Scar Assessment Scale system was used to evaluate the healing status of the port areas. The system consists of two parts: the Observer Scar Assessment Scale (OSAS) and Patient Observer Scar Assessment Scale (PSAS) [10]. The OSAS and PSAS consist of six sections each. The OSAS score ranges from 1 (normal skin) to 10 (worst possible incisions) for each section and from 6 (normal skin) to 60 (worst possible scar) for the total score. The PSAS score ranges from 1 (best outcome) to 10 (worst outcome) for each section and from 6 (best outcome) to 60 (worst outcome) for the total score. The OSAS was administered by an observer (K.G.) and the PSAS was completed by the participants.

The statistical analyses were performed using MedCalc software (version 14.0 for Windows; Mariakerke, Belgium). Categorical variables are presented using closeness and ratio. Numerical data are presented as the mean ± standard deviation. Continuous variables were analyzed using the Student’s *t*-test. Categorical variables were analyzed using the χ2 test. Logistic regression analysis was performed to identify predictive factors. The outcomes are presented as odds ratios (ORs) and 95% confidence intervals (CIs). P < 0.05 was considred to indicatee statistical significance.

**Results**

Table 1 presents the demographic data of the study participants. There were no differences in the groups in terms of year, menopausal status, body mass index, or mass size. The operation period was shorter in the SPLS than the CPLS group (42.6 ± 3.6 vs. 48.8 ± 6.0 min, respectively; p < 0.001). Unilateral salpingo-oophorectomy was performed in 35.3% and 23.1% of patients in the SPLS and CMLS groups (p = 0.383). There were no complications due to Veress needle or trocar insertion. No umbilical hernias were observed during follow-up.

The excised biopsy specimens were benign and borderline in 95.3% and 4.7% (n = 2) of patients, respectively. Two CMLS group patients (aged 36 and 40 years) had a borderline ovarian tumor. These patients were followed for 44 and 57 months, respectively, and no recurrence was observed. In these patients, frozen section analysis showed benign features and oophorectomy was performed. The tumors were 17 and 18 cm in size, and the CA-125 levels were 8 and 14 [Units?], respectively. The patients were not administered any additional surgical procedures or adjuvant treatments.

The QoR-40 scores were significantly higher in the SPLS than the CMLS group (154.7 ± 11.7 vs. 142.3 ± 17.4. respectively; p = 0.014). The median QoR-40 score in all participants was 149. Table 2 presents the regression analysis of the risk factors for QoR-40 score ≥ 150. SPLS was the only independent prognostic factor (OR = 0.1, 95% CI = 0.1–0.6; p = 0.012). The OSAS and PSAS scores were lower in the SPLS than the CMLS group (Table 1).

**Discussion**

In the present study, we evaluated the LS procedures for large AMs and found that SPLS was associated with a higher postoperative recovery score than CMLS. Preoperative ultrasonography, other imaging methods, or tumor markers can be used to evaluate the suitability of LS for large AMs.

LS is the gold standard surgical treatment for benign AMs [11]. However, some surgeons discourage the use of LS for large pelvic masses due to the higher risk of malignancy, high risk of intraoperative rupture, and technical difficulties. Childers et al. [12] reported that 86% of pelvic masses and 79.2% of large AMs (> 10 cm) were benign. In our study, none of the patients had a malignancy and were evaluated by experts using a preoperative ultrasound, magnetic resonance imaging, or computed tomography. Benign and borderline histology features were observed in 95.3% and 4.7% of patients, respectively. In a study of 186 cases who underwent LS for a large AM (> 10 cm), the median duration of hospital stay was 1 day (range = 1–3 days) [6]. There were no complications due to the insertion of a Veress needle or trocar [6]. Malignancy was observed in 17 (9.1%) patients. Our patients did not develop any complications due to the insertion of the Veress needle or trocar, and the median duration of insertion was 1 day (range: 1–3).

Various materials and tools have been developed for the laparoscopic removal of large AMs without rupture or intraperitoneal exfoliation. It is difficult to explore the entire abdomen without removing an AM. The risk of cyst rupture is greater during MIS because of the inadequate working space and vacumm for the extraction of cyst ingredients [1]. The risk of rupture during LS for AMs ranges from 22–100% [6,13–16]. The rupture of cancers is an independent prognostic factor of disease-free survival [17]. Predictive models for malignancy risk have been described, based on the RMI [18], IOTA guidelines [7], and ROMA score [19].

In our study, LS was performed for large AMs. The postoperative improvement was better following CMLS than SPLS. The operation duration was shorter in the SPLS than the CMLS group. Because the surgical team was experienced and often comprised the same individuals, it was easier to remove the specimen from the large incision during SPLS. The time was wasted during CMLS because the lateral trocar was expanded to 10 mm when the endobag was removed.

In previous studies, the pain scores were lower for small-port incisions than large-port incisions [20]. Mini-laparoscopic gynecological surgery uses fewer ports to prevent incisional pain and provide excellent cosmetic results. In our study, the OSAS and PSAS scores were lower after SPLS than after CMLS. The greater number of incisions and longer total incision length may have increased the pain score for CMLS.

SPLS was the only independent factor associated with the quality of recovery. Trocar-related complications, such as poor cosmetic results, bleeding, herniation, and wound infection, may occur after CMLS. The QoR-40 score was lower for CMLS than SPLS due to the increased number of incisions in the fascia for the increased number of trocars and higher tension in the fascia. In addition, better cosmetic results were obtained in the SPLS group compared to the CMLS group.

Our study had a few limitations, including the retrospective study design, incomplete data, and small sample size. Retrospective studies may be affected by bias, such as selection and recall, which can affect the outcomes. Despite these limitations, both groups had similar demographic characteristics and follow-up knowledge. The study procedures were performed by the same surgical team, which may have improved the postsurgical outcomes.

In conclusion, LS is suitable for large cysts that are not at risk of malignancy. The postoperative recovery time was shorter after SPLS than CMLS.