

Original Research

Analysis of 783 Cases of Total Laparoscopic Hysterectomy for Benign Indications: Experience from a Turkish University Hospital

Ali Buhur^{1,*}, Omer Unal¹¹Clinic of Gynecology and Obstetrics, Kanuni Sultan Süleyman Training and Research Hospital, 34303 Istanbul, Turkey*Correspondence: drbuhur@hotmail.com (Ali Buhur)

Academic Editor: Dah-Ching Ding

Submitted: 14 December 2022 Revised: 30 January 2023 Accepted: 30 January 2023 Published: 10 March 2023

Abstract

Background: This study aimed to assess the results of 783 total laparoscopic hysterectomies performed in our clinic for benign reasons.**Methods:** This study was conducted at a tertiary hospital between January 2017 and December 2020. The results of 783 patients who underwent total laparoscopic hysterectomy for benign indications were evaluated retrospectively, with major and minor complications thoroughly analyzed. Patients' demographic characteristics were evaluated, including mean age, mean parity, body mass index (BMI), current medical diseases, previous surgeries, hysterectomy indications, operation time, uterus weights, estimated blood loss, and length of hospital stay. The ethics committee of Istanbul Kanuni Sultan Süleyman Training and Research Hospital provided the study's ethical approval (Approval No. 2021.11.290). SPSS for Windows 24.0 (SPSS Inc., Chicago, IL, USA) was used for statistical analysis, and data were presented as mean, standard deviation, and ratio, with statistical significance set at $p < 0.05$. Preoperative and postoperative variables were compared using a paired *t*-test. **Results:** For the study's 783 patients, the average age was 50.16 years (range, 33–82), average parity was 3.26 (0–16), and average BMI was 24.37 (21–33) kg/m². Uterine myoma was the most common reason for hysterectomy in 244 (31.16%) patients, followed by abnormal uterine bleeding in 239 (30.52%) patients. The rate of major complications was 46 (5.8%), and the rate of minor complications was 42 (5.5%). Overall, there were 88 (11.30%) complications. The complication rate and operation indications were comparable to those reported in the literature. **Conclusions:** Although Laparoscopic hysterectomy is a minimally invasive type of hysterectomy, surgeons should be aware of potential complications during the procedure. Early diagnosis and management of complications reduce morbidity and mortality.**Keywords:** complication; early diagnosis; hysterectomy; laparoscopy; management

1. Introduction

Hysterectomy is an elective gynecological surgical procedure performed worldwide [1]. It can be performed by abdominal, vaginal, laparoscopic, or robotic surgery. Vaginal hysterectomy was first performed by Recamier in 1829, and abdominal hysterectomy by Charles Clay in 1843 [2]. Laparoscopic hysterectomy was first performed by Reich *et al.* [3]. An increase in the rate of total laparoscopic hysterectomy (TLH) has been observed for hysterectomies performed for benign indications [4]. In a recent study in England, the rate of TLH increased from 16% to 47% among all hysterectomies performed in the last seven years, whereas the rate of abdominal hysterectomy decreased from 73% to 46% [5]. Lee SH *et al.* [6] found no difference in complication rates in the meta-analysis outcomes comparing vaginal hysterectomy (VH) and TLH. Allam *et al.* [7] reported fewer complications in the TLH group using the electrosurgical bipolar vessel sealing technique than in the total abdominal hysterectomy (TAH) and VH groups. Laparoscopic hysterectomy results in less blood loss than abdominal hysterectomy. Lower rates of wound infections, shorter hospitalization times, and less workforce loss due to shorter patient recovery times have led to a rapid increase in the popularity of laparoscopic hysterectomy [8].

Currently, minimally invasive methods are recommended in hysterectomies performed for benign reasons [9]. In gynecology, uterine fibroids are very common, adversely affecting women's health and pregnancy. It is important to choose an effective treatment. Compared with laparotomy, laparoscopic myomectomy reportedly involves less blood loss, shorter hospital stay, shorter recovery period and higher pregnancy rate [10,11].

While laparoscopic hysterectomy is a minimally invasive procedure, surgeons must be aware of potential TLH complications and be able to recognize and manage potentially fatal TLH complications. This study aimed to assess the results of 783 total laparoscopic hysterectomies performed in our clinic for benign reasons.

2. Materials and Methods

This descriptive study was conducted at Kanuni Sultan Süleyman Training and Research Hospital from January 2017 and December 2020. This study adheres to the provisions of the Helsinki Declaration and was approved by the ethics committee of Istanbul Kanuni Sultan Süleyman Training and Research Hospital (Approval Number: 2021.11.290). All patients provided written informed consent before surgery. Of the 797 patients involved in this



study, 14 were excluded: 12 had missing records due to lack of postoperative follow-up, and two had histopathological malignancy results. The 783 women (aged 40 to 80 years) who underwent TLH for benign indications were reviewed retrospectively.

The demographic characteristics of the patients were assessed, including mean age, mean parity, body mass index (BMI), current medical diseases, previous surgeries, hysterectomy indications, operation time, uterus weights, estimated blood loss, length of hospital stay, and major and minor intraoperative and postoperative complications. The preoperative and postoperative hemoglobin difference was measured. Operation time was defined as the time between the first incision in the umbilicus and the removal of the primary trocar. Uterus weight was measured using a precision scale at the pathology laboratory immediately after the procedure. All operations were performed by consultants and specialists. The length of hospital stay was measured from the day of procedure until discharge. Patients who experienced postoperative spontaneous micturition and defecation were quickly mobilized; patients with no significant complaints were discharged. Pelvic examinations, cervical-vaginal smears, and endometrial sampling were preoperatively performed.

Patients received mechanical bowel cleansing with a rectal enema the night before the procedure. All patients received 1 g of cefazolin intravenously one hour before surgery and six hours afterward. For thromboembolism prevention, 0.4 mL of enoxaparin was administered subcutaneously eight hours before the procedure and continued at 24-hour intervals throughout hospitalization. Patients were postoperatively monitored for one month. The study's data were collected over the course of six months.

2.1 Surgical Technique

All surgeries were performed under general anesthesia and in the dorsal lithotomy position by the same group of surgeons. All patients had a Foley catheter inserted into their bladders, and a nasogastric tube was placed in their stomachs. The procedures were carried out using a 10-mm 30° telescope, advanced bipolar electrocoagulation (Ligasure, Covidien, MA, USA), classic bipolar electrocoagulation (Robi bipolar, Karl Storz Company, Tutlingen, Germany; Unipolar hook, Karl Storz Company, Tutlingen, Germany), and a uterine manipulator (Rumi II, Cooper Surgical Inc., Trumbull, CT, USA). In these operations, the multiport technique was used.

Following a 5 mm vertical incision in the umbilicus, the umbilicus was lifted with laundry clamps. A Verres needle was inserted into the abdomen (14 mmHg pressure), pneumoperitoneum was achieved, and a 10-mm trocar was inserted into the abdomen. For patients with prior abdominal surgery and suspected periumbilical adhesions, the primary trocar was introduced 2–3 cm below the left subcostal border on the left midclavicular line, also known as the

Palmer point, followed by the insertion of a 10-mm 30° telescope into the abdomen. The second and third incisions were made 3 cm medial to the right and left anterior superior iliac spines of the abdomen to the avascular lower quadrants, and 5-mm trocars were inserted into these incisions. A third 5-mm trocar was inserted into the suprapubic region at the midline, 6 cm above the pubic symphysis. The round ligaments and uterine ovarian or infundibula pelvic ligaments were coagulated and cut on both sides with a Ligasure (Medtronic USA Inc., Minneapolis, MN, USA). The bladder was removed from the cervix using blunt and sharp dissections. The uterine arteries were coagulated and cut bilaterally. The parametrial tissues around the cervix were coagulated and cut with a Ligasure, and bleeding was controlled with Robi classical bipolar electrocoagulation. The uterus was then removed from the uterovaginal tract. Morcellation with a scalpel was used to remove the uterus from the vaginal tract when necessary. The vaginal cuff was laparoscopically sutured with a V-loc zero-numbered wound closure suture (Medtronic, Minneapolis, MN, USA).

2.2 Statistical Analysis

SPSS for Windows 24.0 (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. The data are presented as mean, standard deviation, and ratio. Statistical significance was set at $p < 0.05$. The Kolmogorov–Smirnov test was used to assess the normality of the distribution of continuous variables. A paired *t*-test was used to evaluate preoperative and postoperative variables.

3. Results

The 783 patients had a mean age of 50.16 ± 7.67 years. The mean parity was 3.26 ± 1.95 ; the data of parity was normally distributed and calculated with mean and standard deviation, and the mean BMI was 24.37 ± 1.84 kg/m². Sixty-one percent of the patients were menopausal, and 39% were of reproductive age. The proportion of patients who had undergone abdominal surgery was 241 (30.7%); cesarean section ($n = 135$, 17.2%) was the most recent surgery, and salpingo-oophorectomy ($n = 468$, 59.7%) was the most concurrent surgery. The demographic characteristics of the patients are presented in Table 1.

As shown in Table 2, the most common indications for operation were uterine myoma ($n = 244$, 31.16%), and abnormal uterine bleeding ($n = 239$, 30.52%). As shown in Table 3, the operative time was 112.92 ± 17.31 minutes, and the mean hemoglobin loss was 1.49 ± 1.25 g/dL. The duration of hospitalization was 2.37 ± 0.72 days, and the uterus weight was 180.57 ± 31.07 . As for histopathology results (Table 4), 320 (40.8%) of the patients had uterine myoma (the most common histopathological result), 84 (10.72%) had adenomyosis, and 90 (11.5%) had adenomyosis.

Major complications (Table 5) were observed in 46 (5.8%) patients, and minor complications in 42 (5.5%). We identified and managed the complications early, and only

Table 1. Demographic features.

Demographic features	Mean $\pm$ SD	Range
Age (years)	50.16 $\pm$ 7.67	33–82
Parity (number)	3.26 $\pm$ 1.95	0–16
BMI (kg/m ²)	24.37 $\pm$ 1.84	21–33
Menopause	478 (61.0)	
Premenopause	306 (39.0)	
Previous pelvic surgery	n = 241 (30.8%)	
Cesarean operation	135 (17.2)	
Myomectomy	3 (0.4)	
Appendectomy	19 (2.4)	
Cholecystectomy	20 (2.6)	
Other surgeries	64 (8.1)	
Simultaneous surgery	n = 783 (100%)	
Salpingectomy	285 (36.4)	
Salpingo-oophorectomy	468 (59.8)	
Colposuspension (Burch)	30 (3.8)	

Values are presented as mean $\pm$ SD or n (%).

BMI, body mass index.

Table 2. Operative indications for total laparoscopic hysterectomy.

Indications	n	%
Uterine myoma	244	31.16
Abnormal uterine bleeding	239	30.52
Adnexal mass	71	9.06
Cervical intraepithelial neoplasia	53	6.76
Endometrial hyperplasia without atypia	52	6.64
Postmenopausal bleeding	44	5.61
Endometrial polyp	40	5.10
Adenomyosis	25	3.19
Uterine prolapse	15	1.91

Table 3. Results of total laparoscopic hysterectomy.

	Mean $\pm$ SD	Range
Operative time (min)	112.92 $\pm$ 17.31	48–170
Pre- and postoperative mean hemoglobin loss (g/dL)	1.49 $\pm$ 1.25	1–4
Length of hospital stay (d)	2.37 $\pm$ 0.72	1–10
Weight of uterus (g)	180.57 $\pm$ 31.07	75–320

three (0.38%) had to be re-operated. In our study, nine (1.15%) patients converted to laparotomy: two (0.25%) were due to anatomical difficulties and widespread intra-abdominal adhesions, two (0.25%) were due to intractable bleeding, two (0.25%) were due to intestinal injury, and three (0.38%) due to ureteral injury. Six (0.8%) bladder injuries occurred during anterior peritoneal dissection of the broad ligament from the bladder in patients with a history of abdominal surgery. All bladder injuries were observed intraoperatively and repaired laparoscopically. Three (0.4%) ureteral injuries occurred while attempting to seal the uter-

Table 4. Histopathology results of total laparoscopic hysterectomy.

Histopathology results	n (%)
Uterine myoma	320 (40.8)
Adenomyosis	84 (10.72)
Adenomyosis + myoma	90 (11.5)
Cervical intraepithelial neoplasia	65 (8.30)
Endometrial polyp	54 (6.89)
Para ovarian cyst	30 (3.83)
Benign ovarian cyst	45 (5.74)
Endometrial hyperplasia	55 (7.02)
Atrophic endometrium	22 (2.80)
Endometrioma	18 (2.29)

ine arteries and control bleeding. Three (0.38%) intestinal complications occurred: two were noticed during the surgery and treated with sutures after conversion to laparotomy, while the other was detected on postoperative day one, for which the damaged large intestine was repaired with reoperation. Mean intraoperative hemoglobin loss was 1.49 $\pm$ 1.25 g/d. Inferior epigastric vein injury occurred in one case (0.12%) due to the placement of accessory trocars.

Table 5. Complications.

Major complications	N = 46 (5.8%)
Bleeding requiring blood transfusion	14 (1.8)
Conversion to laparotomy	9 (1.1)
Ureteral injury	3 (0.4)
Bladder injury	6 (0.8)
Vaginal cuff dehiscence	5 (0.6)
Bowel injury	3 (0.4)
Reoperation	3 (0.4)
Vascular injury	1 (0.1)
Intra-abdominal hematoma	2 (0.2)
Minor complications	N = 42 (5.5%)
Fever	18 (2.30)
Vaginal cuff infection	4 (0.51)
Trocar site infection	6 (0.76)
Mild ileus	5 (0.63)
Shoulder pain	4 (0.51)
Vaginal cuff bleeding	5 (0.63)

4. Discussion

While laparoscopic surgery has become more common in gynecology, replacing open surgical procedures as the preferred method in most cases, complications are frequently reported. In the study, the major complication rate was 5.8%, with an overall rate of 11.3%. We identified and managed the complications early, and only three (0.38%) required re-operation. Surgeons should be aware of TLH complications and be able to recognize and manage them, as these complications can be fatal. The most common rea-

sons for hysterectomy were uterine myoma (31.16%) and abnormal uterine bleeding (30.52%).

Although there has been no change in hysterectomy indications for at least 50 years, alternative operative methods have recently begun to expand. TLH has recently become an option, with rapidly increasing popularity and applicability. Driessen *et al.* [12] reported that the incidence of laparoscopic hysterectomy increased from 3% in 2002 to 10% in 2007 and 36% in 2012 in the Netherlands. According to the results of a 2015 Cochrane review [13] that evaluated the most appropriate hysterectomy technique for benign indications, vaginal hysterectomy was notably superior to the abdominal and laparoscopic approaches and was recommended as the first-choice modality. Patients for whom vaginal hysterectomy is unsuitable may undergo a laparoscopic procedure to avoid abdominal hysterectomy; however, it should be noted that laparoscopic hysterectomy is associated with more urinary tract complications.

The main concern in laparoscopic hysterectomy is the increased rate of complications in the urinary system compared to that of other hysterectomy techniques [14]. In a study comparing 3190 laparoscopic hysterectomies with abdominal and vaginal approaches, Donnez *et al.* [15] reported that the laparoscopic approach was not associated with an increase in major complications when performed in experienced hands. Different complication rates related to TLH have been reported in the literature. Fuentez *et al.* [16] reported a major complication rate of 1.93% and a minor complication rate of 4.29% in 2888 cases. Moreover, Wattiez *et al.* [17], Makinen *et al.* [18], Tamburacı *et al.* [19], and Buhur *et al.* [20] reported complication rates of 19% in 2434 cases, 11.7% in 1647 cases, 9.3% in 300 cases, and 8.86% in 158, respectively. The rate of major complications in the current study was 5.8% and the rate of minor complications was 5.5%. The overall complication rate, in line with the aforementioned literature, was 11.3%. In patients with previous abdominal surgery and suspected periumbilical adhesions, the primary trocar was introduced at Palmer's point. Blunt and sharp dissections were performed carefully to remove the bladder from the cervix, especially for patients with prior abdominal surgery.

The literature's most common indications for hysterectomy are uterine myoma and abnormal uterine bleeding [21]. Herein, uterine myoma (31.16%) and abnormal uterine bleeding (30.52%) were the most common causes of hysterectomy. In the literature, the conversion rates from laparoscopy to laparotomy range from 0.03% to 6.6% (Kim *et al.* [22], Lijoi *et al.* [23], Housmans *et al.* [24], Settles *et al.* [25], Takahashi *et al.* [26], Casarin *et al.* [27]). Donnez, O and Donnez, J [28] reported that the most significant risk factors for conversion to laparotomy were previous cesarean section and pelvic surgery. However, in that study, in cases with such history and suspicion of periumbilical adhesion, the primary trocar was not introduced classically from the umbilicus, but from the Palmer point. In our study,

nine (1.15%) patients converted to laparotomy. Chapron *et al.* [29] revealed a mean hemoglobin loss of 1.3 g/dL in a series of 96 laparoscopic hysterectomy cases. O'Hanlan *et al.* [30] have shown a mean blood loss of 130 ± 189 mL in their study of 830 patients. Our mean hemoglobin loss during and after surgery was 1.49 ± 1.25 g/dL.

Wong *et al.* [31] reported a urinary tract injury rate of 0.24%. Bladder injury is three times more common than ureter injury and is usually due to the use of a monopolar energy source longer than necessary while performing anterior peritoneal dissection of the broad ligament, or colpotomy in cases with prior abdominal surgery. In our patients with bladder injury, bladder catheterization was continued for 10 days after surgery to prevent vesicovaginal fistula formation and to help the bladder healing. During the postoperative period, no vesicovaginal or ureteral vaginal fistulas were observed.

Three (0.4%) ureteral injuries occurred while attempting to seal the uterine arteries and control bleeding. All ureteral injuries were observed during the operation, and a urologist was called to the operating room for assistance. A double-J catheter was inserted into the ureter, and conversion to laparotomy was required for the ureter to be repaired. Double-J catheterization was continued for 21 days postoperatively. No vesicovaginal or ureteral vaginal fistulas were observed during postoperative follow-up. Although laparoscopic hysterectomy is a minimally invasive type of hysterectomy, surgeons should be aware of potential complications during the procedure. Early diagnosis and management of complications reduce morbidity and mortality.

We used a uterine manipulator in all cases, permitting the desired mobilization of the uterus, removal of adjacent organs (e.g., bladder and ureter) from the surgical area, and minimizing the risk of injury.

Vaginal cuff dehiscence after TLH can occur spontaneously or after coitus. Postoperative coitus is one of the most frequent triggers of vaginal cuff dehiscence. Hur *et al.* [32] have reported that rupture of the vaginal cuff in TLH is associated with electrosurgery-related suboptimal healing, tissue necrosis, and devascularization.

Other risk factors for vaginal cuff dehiscence include smoking, obesity, constipation, menopause, vaginal infection, and hematoma formation. Additionally, suture techniques used in laparoscopy may be effective in preventing vaginal cuff dehiscence. Siedhoff *et al.* [33] did not observe vaginal cuff dehiscence in any patient who received barbed sutures. Although we used one-way barbed sutures in our clinic, five (0.6%) patients had vaginal cuff dehiscence in the third week after surgery due to coitus. The vaginal cuff was then sutured secondarily through the vaginal route.

Shen *et al.* [34] reported an intestinal complication rate of six (2.11%) in their study of 284 cases. In our study, three (0.38%) intestinal complications occurred: two were noticed intraoperatively and treated with sutures after con-

version to laparotomy. The other was detected on the first postoperative day; the damaged large intestine was repaired with reoperation. Early diagnosis of intestinal complications is vital because of the high morbidity and mortality risk. Inferior epigastric vein injury occurred in one of our cases (0.12%) due to the placement of accessory trocars, a rate consistent with that reported in the literature (0.1–6.4%) [35]. The injury was treated with bipolar electrocautery and fascia closure sutures without converting to laparotomy. This highlights the importance of paying attention to accessory trocar placement; complications related to insertion are rare, but the mortality rate is 13% [36].

The duration of TLH is generally longer than that of other hysterectomy methods [37]. However, differences between the average operation times may depend on the surgeon's laparoscopic experience, patient characteristics, adequacy of equipment, and the auxiliary team. Perino *et al.* [38] reported an average operative time of 104.1 ± 26.98 min, Bonilla *et al.* [39] reported 123 min, and Cheung *et al.* [40] reported 108.2 min. Our mean operative time was 112.92 ± 17.31 min. Candiani *et al.* [41] reported the hospital stay as 2.7 days and Morelli *et al.* [42] as 2.9 days in laparoscopic hysterectomy. In our study, it was 2.37 ± 0.72 days. The average weight of the uteri removed was 180 g; this value is lower than the mean uterus weight reported elsewhere (220–259 g) [43,44]. For this reason, morcellation with a laparoscopic cold knife to remove the uterus was necessary in 54.8% of cases.

The data were meticulously collected, and the sample size was deemed to be sufficient for the estimation. The effects of surgical experience, which may have an impact on every parameter, were determined in this study. Our findings should contribute to the formulation of alternative application options.

Limitations of the study include the short-term follow-up period. Moreover, the study was descriptive and retrospective and was conducted in a Turkish tertiary hospital; these factors may have limited the ability to draw causal relationships and the generalizability of the study.

5. Conclusions

Although laparoscopic hysterectomy is a minimally invasive type of hysterectomy, surgeons should be aware of potential complications of TLH, and be able to recognize and manage TLH complications, as these complications can be fatal. Early diagnosis and management of complications reduce morbidity and mortality.

Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Author Contributions

AB conceptualized and designed the study; AB, OU conducted statistical analysis and wrote the article; AB, OU contributed to the interpretation of results; AB, OU provided final approval and had the manuscript ready for publication. All authors read and approved the final manuscript.

Ethics Approval and Consent to Participate

The ethical committee of Istanbul Kanuni Sultan Süleyman Training and Research Hospital accepted this study, which was carried out in compliance with the Declaration of Helsinki as revised in 2013 (Application No. KAEK/2021.11.290). Due to the study's retrospective character, the need for patient consent for both participation and publishing was waived. All patients provided written, fully informed consent before surgery.

Acknowledgment

The authors would like to thank Ejeer English editing service for the premium English editing. Certificate Number PE202301092.

Funding

This research received no external funding.

Conflict of Interest

The authors declare no conflict of interest.

References

- [1] ACOG Committee Opinion No. 444: choosing the route of hysterectomy for benign disease. *Obstetrics and Gynecology*. 2009; 114: 1156–1158.
- [2] Sutton C. Hysterectomy: a historical perspective. *Bailliere's Clinical Obstetrics and Gynaecology*. 1997; 11: 1–22.
- [3] Reich H, De Caprio J, McGlynn F. Laparoscopic hysterectomy. *Journal of Gynaecological Surgery*. 1989; 5: 213–216.
- [4] Desai VB, Guo XM, Fan L, Wright JD, Xu X. Inpatient Laparoscopic Hysterectomy in the United States: Trends and Factors Associated With Approach Selection. *Journal of Minimally Invasive Gynecology*. 2017; 24: 151–158.e1.
- [5] Madhvani K, Curnow T, Carpenter T. Route of hysterectomy: a retrospective, cohort study in English NHS Hospitals from 2011 to 2017. *BJOG: an International Journal of Obstetrics and Gynaecology*. 2019; 126: 795–802.
- [6] Lee SH, Oh SR, Cho YJ, Han M, Park J, Kim SJ, *et al.* Comparison of vaginal hysterectomy and laparoscopic hysterectomy: a systematic review and meta-analysis. *BMC Women's Health*. 2019; 19: 83.
- [7] Allam IS, Makled AK, Gomaa IA, El Bishry GM, Bayoumy HA, Ali DF. Total laparoscopic hysterectomy, vaginal hysterectomy and total abdominal hysterectomy using electrosurgical bipolar vessel sealing technique: a randomized controlled trial. *Archives of Gynecology and Obstetrics*. 2015; 291: 1341–1345.
- [8] Kluivers KB, Opmeer BC, Geomini PM, Bongers MY, Vierhout ME, Bremer GL, *et al.* Women's preference for laparoscopic or abdominal hysterectomy. *Gynecological Surgery*. 2009; 6: 223–228.
- [9] AAGL Advancing Minimally Invasive Gynecology Worldwide. AAGL position statement: route of hysterectomy to treat be-

- nign uterine disease. *Journal of Minimally Invasive Gynecology*. 2011; 18: 1–3.
- [10] D'Silva EC, Muda AM, Safiee AI, Ghazali WAHW. Five-Year Lapsed: Review of Laparoscopic Myomectomy versus Open Myomectomy in Putrajaya Hospital. *Gynecology and Minimally Invasive Therapy*. 2018; 7: 161–166.
 - [11] Shen Q, Chen M, Wang Y, Zhou Q, Tao X, Zhang W, *et al*. Effects of laparoscopic versus minilaparotomic myomectomy on uterine leiomyoma: a meta-analysis. *Journal of Minimally Invasive Gynecology*. 2015; 22: 177–184.
 - [12] Driessen SRC, Baden NLM, van Zwet EW, Twijnstra ARH, Jansen FW. Trends in the implementation of advanced minimally invasive gynecologic surgical procedures in the Netherlands. *Journal of Minimally Invasive Gynecology*. 2015; 22: 642–647.
 - [13] Aarts JWM, Nieboer TE, Johnson N, Tavender E, Garry R, Mol BWJ, *et al*. Surgical approach to hysterectomy for benign gynaecological disease. *The Cochrane Database of Systematic Reviews*. 2015; 2015: CD003677.
 - [14] Garry R, Fountain J, Mason S, Hawe J, Napp V, Abbott J, *et al*. The eVALuate study: two parallel randomised trials, one comparing laparoscopic with abdominal hysterectomy, the other comparing laparoscopic with vaginal hysterectomy. *British Medical Journal*. 2004; 328: 129.
 - [15] Donnez O, Jadoul P, Squifflet J, Donnez J. A series of 3190 laparoscopic hysterectomies for benign disease from 1990 to 2006: evaluation of complications compared with vaginal and abdominal procedures. *BJOG: An International Journal of Obstetrics and Gynaecology*. 2009; 116: 492–500.
 - [16] Fuentes MN, Rodríguez-Oliver A, Naveiro Rilo JC, Paredes AG, Aguilar Romero MT, Parra JF. Complications of laparoscopic gynecologic surgery. *Journal of the Society of Laparoendoscopic Surgeons*. 2014; 18: e2014.00058.
 - [17] Wattiez A, Soriano D, Cohen SB, Nervo P, Canis M, Botchorishvili R, *et al*. The learning curve of total laparoscopic hysterectomy: comparative analysis of 1647 cases. *The Journal of the American Association of Gynecologic Laparoscopists*. 2002; 9: 339–345.
 - [18] Mäkinen J, Brummer T, Jalkanen J, Heikkinen A, Fraser J, Tomás E, *et al*. Ten years of progress—improved hysterectomy outcomes in Finland 1996–2006: a longitudinal observation study. *BMJ Open*. 2013; 3: e003169.
 - [19] Tamburaci E, Mulayim B. Analysis of 300 total laparoscopic hysterectomy cases performed by the same surgeon: laparoscopic hysterectomy cases performed by the same surgeon. *Aegean Journal of Obstetrics and Gynecology*. 2021; 3: 20–24.
 - [20] Buhur A, Erdem D. Evaluation of Total Laparoscopic Hysterectomy Operations in Benign Indications. *Turkish Journal of Health and Sport*. 2022; 3: 9–13.
 - [21] Mereu L, Carlin R, Pellegrini A, Guasina F, Berlanda V, Tateo S. Total laparoscopic hysterectomy for benign disease: outcomes and literature analysis. *Gynecological Surgery*. 2018; 15: 1–7.
 - [22] Kim SM, Park EK, Jeung IC, Kim CJ, Lee YS. Abdominal, multi-port and single-port total laparoscopic hysterectomy: eleven-year trends comparison of surgical outcomes complications of 936 cases. *Archives of Gynecology and Obstetrics*. 2015; 291: 1313–1319.
 - [23] Lijoi D, Farina M, Puppo A, Novelli A, Ferrero S. Application of failure mode and effect analysis in total laparoscopic hysterectomy in benign conditions. *Minerva Ginecologica*. 2019; 71: 272–280.
 - [24] Housmans S, Noori N, Kapurubandara S, Bosteels JJA, Cattani L, Alkatout I, *et al*. Systematic Review and Meta-Analysis on Hysterectomy by Vaginal Natural Orifice Transluminal Endoscopic Surgery (vNOTES) Compared to Laparoscopic Hysterectomy for Benign Indications. *Journal of Clinical Medicine*. 2020; 9: 3959.
 - [25] Settnes A, Topsoe MF, Moeller C, Dueholm M, Kopp TI, Norrbom C, *et al*. Reduced Complications Following Implementation of Laparoscopic Hysterectomy: A Danish Population-based Cohort Study of Minimally Invasive Benign Gynecologic Surgery between 2004 and 2018. *Journal of Minimally Invasive Gynecology*. 2020; 27: 1344–1353.e3.
 - [26] Takahashi A, Uemura M, Kitazawa J, Nakata M, Hayashi Y. Laparoscopic Hysterectomy for Benign Pathology Does Not Yield More Perioperative Complications than Abdominal or Vaginal Hysterectomies: Our Experience in Introducing Laparoscopic Hysterectomy. *Gynecology and Minimally Invasive Therapy*. 2020; 9: 215–219.
 - [27] Casarin J, Cromi A, Bogani G, Multinu F, Uccella S, Ghezzi F. Surgical morbidity of total laparoscopic hysterectomy for benign disease: Predictors of major postoperative complications. *European Journal of Obstetrics, Gynecology, and Reproductive Biology*. 2021; 263: 210–215.
 - [28] Donnez O, Donnez J. A series of 400 laparoscopic hysterectomies for benign disease: a single centre, single surgeon prospective study of complications confirming previous retrospective study. *BJOG: An International Journal of Obstetrics and Gynaecology*. 2010; 117: 752–755.
 - [29] Chapron C, Dubuisson JB, Ansquer Y, Capella-Allouc S. Hysterectomy with adnexectomy. Can operative laparoscopy offer advantages? *The Journal of Reproductive Medicine*. 1997; 42: 201–206.
 - [30] O'Hanlan KA, Dibble SL, Garnier A, Reuland ML. Total laparoscopic hysterectomy: technique and complications of 830 cases. *Journal of the Society of Laparoendoscopic Surgeons*. 2007; 11: 45–53.
 - [31] Wong JMK, Bortoletto P, Tolentino J, Jung MJ, Milad MP. Urinary Tract Injury in Gynecologic Laparoscopy for Benign Indication: A Systematic Review. *Obstetrics and Gynecology*. 2018; 131: 100–108.
 - [32] Hur H, Guido RS, Mansuria SM, Hacker MR, Sanfilippo JS, Lee TT. Incidence and patient characteristics of vaginal cuff dehiscence after different modes of hysterectomies. *Journal of Minimally Invasive Gynecology*. 2007; 14: 311–317.
 - [33] Siedhoff MT, Yunker AC, Steege JF. Decreased incidence of vaginal cuff dehiscence after laparoscopic closure with bidirectional barbed suture. *Journal of Minimally Invasive Gynecology*. 2011; 18: 218–223.
 - [34] Shen C, Lu H, Chang S. Characteristics and management of large bowel injury in laparoscopic-assisted vaginal hysterectomy. *The Journal of the American Association of Gynecologic Laparoscopists*. 2002; 9: 35–39.
 - [35] Shirk GJ, Johns A, Redwine DB. Complications of laparoscopic surgery: How to avoid them and how to repair them. *Journal of Minimally Invasive Gynecology*. 2006; 13: 352–361.
 - [36] Chandler JG, Corson SL, Way LW. Three spectra of laparoscopic entry access injuries. *Journal of the American College of Surgeons*. 2001; 192: 478–491.
 - [37] Leung SW, Chan CS, Lo SFL, Pang CP, Pun TC, Yuen PM. Comparison of the different types of “laparoscopic total hysterectomy”. *Journal of Minimally Invasive Gynecology*. 2007; 14: 91–96.
 - [38] Perino A, Cucinella G, Venezia R, Castelli A, Cittadini E. Total laparoscopic hysterectomy versus total abdominal hysterectomy: an assessment of the learning curve in a prospective randomized study. *Human Reproduction*. 1999; 14: 2996–2999.
 - [39] Bonilla DJ, Mains L, Rice J, Crawford B. Total laparoscopic hysterectomy: our 5-year experience (1998–2002). *The Ochsner Journal*. 2010; 10: 8–12.
 - [40] Cheung VYT, Rosenthal DM, Morton M, Kadanka H. Total laparoscopic hysterectomy: a five-year experience. *Journal of Ob-*

stetrics and Gynaecology Canada. 2007; 29: 337–343.

- [41] Candiani M, Izzo S, Bulfoni A, Riparini J, Ronzoni S, Marconi A. Laparoscopic vs vaginal hysterectomy for benign pathology. *American Journal of Obstetrics and Gynecology*. 2009; 200: 368.e1–e7.
- [42] Morelli M, Caruso M, Noia R, Chiodo D, Cosco C, Lucia E, *et al*. Total laparoscopic hysterectomy versus vaginal hysterectomy: a prospective randomized trial. *Minerva Ginecologica*. 2007; 59: 99–105.
- [43] Wallwiener M, Taran F, Rothmund R, Kasperkowiak A, Auwärter G, Ganz A, *et al*. Laparoscopic supracervical hysterectomy (LSH) versus total laparoscopic hysterectomy (TLH): an implementation study in 1,952 patients with an analysis of risk factors for conversion to laparotomy and complications, and of procedure-specific re-operations. *Archives of Gynecology and Obstetrics*. 2013; 288: 1329–1339.
- [44] Boosz A, Lermann J, Mehlhorn G, Loehberg C, Renner SP, Thiel FC, *et al*. Comparison of re-operation rates and complication rates after total laparoscopic hysterectomy (TLH) and laparoscopy-assisted supracervical hysterectomy (LASH). *European Journal of Obstetrics, Gynecology, and Reproductive Biology*. 2011; 158: 269–273.