

Comparison of surgical outcomes between manual free vaginal morcellation and no vaginal morcellation for uterine extraction during total laparoscopic hysterectomy: Retrospective cohort study

Total laparoskopik histerektomi sırasında uterus ekstraksiyonu için manuel serbest vajinal morselasyon ile vajinal morselasyon yapılmaması arasındaki cerrahi sonuçların karşılaştırılması: Retrospektif kohort çalışması

Onur YAVUZ¹, Aslı AKDÖNER¹, Kadir Alper MANKAN¹, Ali Hakan KULA¹, Berkay DELİKAYA¹, Ufuk ATLIHAN², Mehmet GÜNEY¹

¹Dokuz Eylül University School of Medicine, Department of Gynecology and Obstetrics, Izmir, Turkey

²Private Karatas Hospital, Department of Obstetrics and Gynecology, Izmir, Turkey

ABSTRACT

Aim: We aimed to compare the surgical outcomes between manual free vaginal morcellation and no vaginal morcellation for uterine extraction during total laparoscopic hysterectomy (TLH) performed in a tertiary center.

Materials and Methods: A total of 397 TLH either with or without oophorectomy, for a benign indication, surgeries performed at our tertiary hospital between March 2022 and May 2024 were analyzed in our study. Patients who underwent manual free vaginal morcellation were defined as Group I (n=85, 21.4%) and patients who did not undergo vaginal morcellation were defined as Group II (n=312, 78.6%). Demographic characteristics, laboratory values, operation characteristics and histopathological reports were accessed from the hospital database.

Results: The median uterine weight of the morcellation group was greater. Median morcellation time was 9 minutes. While the median operation time of Group I was 80 minutes, it was 70 minutes for Group II (p<.01). The groups were similar with regard to postoperative urinary tract, intraoperative urinary tract and intraoperative bowel injuries. Intraoperative vaginal or perineal laceration was detected at a greater rate in the morcellation group.

Conclusion: For large uteruses, TLH is still the best option for suitable patients when performed by experienced surgeons. It has been revealed that manual free vaginal morcellation, performed without the need for additional incisions, is safe, low-cost and practical in total laparoscopic hysterectomies with benign indications.

Keywords: Hysterectomy, laparoscopy, large uteruses, morcellation

ÖZ

Amaç: Üçüncü basamak bir merkezde yapılan total laparoskopik histerektomi (TLH) sırasında uterus ekstraksiyonu için manuel serbest vajinal morselasyon ile vajinal morselasyon yapılmaması arasındaki cerrahi sonuçları karşılaştırmayı amaçladık.

Gereç ve Yöntemler: Üçüncü basamak hastanemizde Mart 2022 ile Mayıs 2024 tarihleri arasında benign endikasyonla ooferektomili veya ooferektomisiz toplam 397 TLH ameliyatı analiz edildi. Manuel serbest vajinal morselasyon yapılan hastalar Grup I (n=85, %21,4), vajinal morselasyon yapılmayan hastalar ise Grup II (n=312, %78,6) olarak tanımlandı. Hastane veri tabanından demografik özelliklere, laboratuvar değerlerine, operasyon özelliklerine ve histopatolojik raporlara ulaşıldı.

Bulgular: Morselasyon grubunun medyan uterus ağırlığı daha fazlaydı. Medyan morselasyon süresi 9 dakika idi. Grup I'in medyan ameliyat süresi 80 dakika iken Grup II'nin medyan operasyon süresi 70 dakikaydı (p<.01). Gruplar ameliyat sonrası üriner sistem, ameliyat sırasında üriner sistem ve ameliyat sırasında barsak yaralanmaları açısından benzerdi. Morselasyon grubunda intraoperatif vajinal veya perineal laserasyon daha fazla tespit edildi.

Sonuç: Büyük uterularda TLH, deneyimli cerrahlar tarafından yapıldığında uygun hastalar için hala en iyi seçenektir. Benign endikasyonlu total laparoskopik histerektomilerde ek kesi gerektirmeden yapılan manuel serbest vajinal morselasyonun güvenli, düşük maliyetli ve pratik olduğu ortaya çıktı.

Anahtar Kelimeler: Büyük uterus, histerektomi, laparoskopi, morselasyon

Cite as: Yavuz O, Akdöner A, Mankan KA, Kula AH, Delikaya B, Atlıhan U et al. Comparison of surgical outcomes between manual free vaginal morcellation and no vaginal morcellation for uterine extraction during total laparoscopic hysterectomy: Retrospective cohort study. Jinekoloji-Obstetrik ve Neonatoloji Tıp Dergisi 2024;21(3):238–244.

Geliş/Received: 13.07.2024 • **Kabul/Accepted:** 21.08.2024

Sorumlu Yazar/Corresponding Author: Onur YAVUZ, Dokuz Eylül University Hospital, İnciraltı, 35330, Balçova, İzmir/Turkey

E-mail: o-yavuz@hotmail.com

Cevrimiçi Erişim/Available online at: <https://dergipark.org.tr/pub/jgon>

INTRODUCTION

One of the most popular surgical procedures in gynecology is the hysterectomy, which is carried out using several techniques (1). Nowadays, laparoscopic hysterectomy (LH), a minimally invasive approach, has replaced vaginal and abdominal hysterectomy (2). Shorter hospital stays, quicker recuperation times, less discomfort, higher postoperative quality of life, less morbidity and mortality and more favorable cosmetic results compared to the open approach are all linked to laparoscopic surgery (3).

However, large uterine sizes may limit the surgeon's manipulation and visualization of the entire surgical field during laparoscopy. In a research by Bonilla et al. in 2007, it was reported that this restriction may increase intraoperative and postoperative complications (4). In 2014, Milad et al. stated that the rate of these complications will increase when morcellation of the uterus is required (5). The specimen can be extracted from the abdomen via mini-laparotomy, colpotomy, or vaginally by cold scalpel manual morcellation, with or without the tissue containment systems. Power morcellators can also be used during extraction with tissue containment systems in appropriately selected patients (6).

Although the minimally invasive surgical approach has many advantages over the open surgical approach, in 2017 the American Congress of Obstetricians and Gynecologists did not recommend LH in patients with large uteruses routinely (7). It has been specifically stated that the best approach is for the gynecologist to discuss the procedure and complications with the patient in detail and make a common decision (7,8)

In 2021, Emery et al. evaluated the effect of uterine weight on operation complications and results in LH cases performed for benign indication (9). While it was stated that the large uterus group had longer operation time and more morcellation, it was emphasized that the complication rate did not increase with the advantages of minimally invasive surgery (9).

As mentioned above, there are conflicting results in the literature regarding LH and manual free vaginal morcellation for large uteruses. In our study, we aimed to compare the surgical outcomes between manual free vaginal morcellation and no vaginal morcellation for uterine extraction during total laparoscopic hysterectomy (TLH) performed in a tertiary center.

MATERIALS AND METHODS

This was a retrospective cohort study conducted at a tertiary center. Every individual person participating in this study gave their

informed permission. The study was conducted in accordance with the Declaration of Helsinki's guiding principles. Institutional ethics committee approval was provided (Registration number: 2024/19-09; Date:29/05/2024).

A total of 397 TLH either with or without oophorectomy, for a benign indication, surgeries performed at our tertiary hospital between March 2022 and May 2024 were analyzed in our study. Patients who underwent manual free vaginal morcellation were defined as Group I (n=85, 21.4%) and patients who did not undergo vaginal morcellation were defined as Group II (n=312, 78.6%). Gynecological malignancies and concomitant surgical procedures were not included in the research. Demographic characteristics, laboratory values, operation characteristics and histopathological reports were accessed from the hospital database. All patients were routinely examined at a follow-up visit in the sixth postoperative week. Patients were questioned about possible complications.

The surgical technique involved a TLH that was standardized. The arms of the patients were positioned next to their bodies in the lithotomy posture. A urinary Foley catheter was inserted into the bladder at the beginning of the procedure. A Veress needle was used to produce pneumoperitoneum. Throughout the surgery, the intra-abdominal pressure was 12 mmHg. One 10 mm umbilical port was inserted for the optic laparoscope, and two 5 mm accessory ports were used for the standard laparoscopic instruments (lower right quadrant or upper left quadrant with left lower quadrant depending on primary surgeon preference). Depending on the patient's individual characteristics, the surgeon entered the abdomen through Palmer's point. To move the uterus during the dissection, a uterine manipulator (HOHL; Karl Storz, Tuttlingen, Germany) was utilized. The European Society for Gynecological Endoscopy established standards for the surgical procedures (10). When the surgeon could not remove a large uterus vaginally in one piece, surgeon preferably used the free manual vaginal cold scalpel morcellation technique. Under camera visualization, the cervix is grabbed with a tenaculum and brought into the vagina. Breisky-Navratil vaginal retractors are used to provide exposure and protect the vaginal walls, rectum, and bladder. The morcellation procedure is performed within the vagina with a no. 10 scalpel and a wedge resection technique(8). Using the intracorporeal knots approach, multifilament absorbing running suture was used to stitch the vaginal cuff. Surgeons (MG and OY) who undertake routine surgery carried out all of the surgical operations. In case of urinary tract and bowel injuries, consultations were requested from the urology and general surgery surgeons.

Analyzes were performed with SPSS version 26.0 (IBM Inc., Chicago, IL, USA). Normality analysis was realized according to

the Kolmogorov-Smirnov test. Variables that did not show normal distribution were analyzed with the Mann-Whitney U test. These results were shown as median (minimum-maximum) numbers for each group. In the analysis of categorical data, Chi-square test and Fisher precision test were employed. These were presented as counts and percentages (%). The results were 95% confidence interval (CI). The p value taken statistically significant was $<.05$.

RESULTS

Comparison of demographic characteristics of groups were listed in Table 1. The age of all patients was between 34 and 85 years (median 49 years). The median age of Group I was 47 and Group II was 51 ($p<.0001$). The groups were similar in terms of body mass index (BMI) and subgroup BMI characteristics ($p>.05$). Gravidity, parity and previous abdominopelvic surgery did not differ between groups ($p>.05$). Previous cesarean section rate and nulliparity rate were statistically higher in the morcellation group (44.7% vs 32.3%, $p=0.03$; 36.5% vs 25%, $p=.03$, respectively). Although the rate of cardiopulmonary disease was found to be higher in Group II, the groups were alike (27.1% vs 37.5%, $p=.07$). Chronic pelvic discomfort was the most prevalent reason for surgery across the board for this group (43.6%). This was followed by abnormal uterine bleeding (33.8%) and benign adnexal mass (22.7%). Indication for

abnormal uterine bleeding was similar between groups (27.1% vs 35.6%, $p=.1$). While chronic pelvic pain was greater in the morcellation group ($p<.01$), benign adnexal mass was greater in Group II ($p<.01$).

Comparison of laboratory, surgery and histopathological features of the groups were shown in Table 2. Bimanual uterine examination >12 weeks had a greater rate in each subgroup analysis in Group I ($p<.05$). The uterine weight of all patients ranged from 18 grams to 1253 grams (median 117 grams). The median uterine weight of the morcellation group was greater (320 grams vs 94.5 grams, $p<.01$). In the subgroup analysis of uterine weight >250 grams, Group I was statistically significantly heavier in each subgroup ($p<.05$). Abdominal access via Palmer's point and conversion to laparotomy were similar between groups. Although preoperative hemoglobin and postoperative hemoglobin values were greater in Group II ($p=.02$; $p=.01$, respectively), the hemoglobin drop was not different among the groups ($p=.3$). On the other hand, the blood transfusion requirement rate was higher in Group I (8.2% vs 3.2%, $p=.04$). Morcellation time for Group I ranged from 1 to 17 minutes (median 9 minutes). The duration of all operations was between 30 and 200 minutes (median 70 minutes). While the median operation time (skin incision to skin closure) of Group I was 80 minutes, it was 70 minutes for Group II ($p<.01$). The groups were similar with regard to duration of hospitalization. Ultrasonographically confirmed

Table 1. Comparison of demographic characteristics of groups

Variables	All patients (n=397,100%)	Group I (n=85,21,4%)	Group II (n=312,78,6%)	p value
Age (years)	49 (34-85)	47 (37-65)	51 (34-85)	<0.01
BMI (kg/m ²)	28.2 (17.2-41.7)	28.5 (18.8-41.7)	28.1 (17.2-41)	0.5
Subgroup of BMI (n,%)				
<25 kg/m ²	85 (21.4%)	18 (21.2%)	67 (21.5%)	0.1
25-30 kg/m ²	177 (44.6%)	37 (43.5%)	140 (44.9%)	
30-40 kg/m ²	128 (32.2%)	26 (30.6%)	102 (32.7%)	
>40 kg/m ²	7 (1.8%)	4 (4.7%)	3 (1%)	
Gravidy (n)	2 (0-13)	2 (0-5)	2 (0-13)	0.1
Parity (n)	2 (0-11)	2 (0-5)	2 (0-11)	0.1
Nulliparity (n,%)	109 (27.5%)	31 (36.5%)	78 (25%)	0.03
Previous abdominopelvic surgery (n)	0 (0-4)	0 (0-4)	0 (0-4)	0.1
Previous cesarean section (n,%)	138 (34.8%)	38 (44.7%)	100 (32.3%)	0.03
Cardiopulmonary disease (n,%)	140 (35.3%)	23 (27.1%)	117 (37.5%)	0.07
Indications (n,%)				
Abnormal uterine bleeding	134 (33.8%)	23 (27.1%)	111 (35.6%)	<0.01
Benign adnexal mass	90 (22.7%)	8 (9.4%)	82 (26.3%)	<0.01
Chronic pelvic pain	173 (43.6%)	54 (63.5%)	119 (38.1%)	<0.01

BMI: Body mass index

Table 2. Comparison of laboratory, surgery and histopathological features of the groups

Variables	All patients (n=397,100%)	Group I (n=85,21,4%)	Group II (n=312,78,6%)	p value
Bimanual uterine examination (weeks) (n,%)				<0.01
<12 weeks	240 (60.5%)	0 (0%)	240 (76.9%)	<0.01
12-16 weeks	90 (22.7%)	27 (31.8%)	63 (20.2%)	0.02
16-20 weeks	44 (11.1%)	37 (43.5%)	7 (2.2%)	<0.01
20-24 weeks	23 (5.8%)	21 (24.7%)	2 (0.6%)	<0.01
Uterus weight (grams)	117 (18-1253)	320 (95-924)	94.5 (18-1253)	<0.01
Subgroup weight of uterus (grams)				<0.01
<250 grams	315 (79.3%)	24 (28.2%)	291 (93.3%)	<0.01
250-500 grams	51 (12.8%)	35 (41.2%)	16 (5.1%)	<0.01
500-750 grams	26 (6.5%)	23 (17.1%)	3 (1%)	<0.01
>750 grams	5 (1.3%)	3 (3.5%)	2 (0.6%)	0.03
Palmer's point (n,%)	2 (0.5%)	0 (0%)	2 (0.6%)	0.4
Conversion to laparotomy (n,%)	9 (2.3%)	0 (0%)	9 (2.9%)	0.1
Preoperative hemoglobin (mg/dL)	12.6 (7.8-16)	12.4 (8.1-14.1)	12.7 (7.8-16)	0.02
Postoperative hemoglobin (mg/dL)	11.9 (6.9-13.7)	11.7 (6.9-13.7)	12 (7.1-15.1)	0.01
Hemoglobin drop (mg/dL)	0.6 (0.1-5.9)	0.7 (0.1-2.8)	0.6 (0.1-5.9)	0.3
Blood transfusion requirement (n,%)	17 (4.3%)	7 (8.2%)	10 (3.2%)	0.04
Operation time (minutes)	70 (30-200)	80 (35-200)	70 (30-200)	<0.01
Duration of hospitalization (days)	2 (1-21)	2 (1-21)	2 (1-14)	0.1
Intraoperative urinary tract injuries (n,%)	3 (0.8%)	2 (2.4%)	1 (0.3%)	0.05
Bladder injury	2 (0.5%)	1 (1.2%)	1 (0.3%)	0.3
Ureteral injury	1 (0.3%)	1 (1.2%)	0 (0%)	0.05
Intraoperative bowel injuries (n,%)	3 (0.8%)	0 (0%)	3 (1%)	0.3
Sigmoid colon	2 (0.5%)	0 (0%)	2 (0.6%)	0.4
Rectum	1 (0.3%)	0 (0%)	1 (0.4%)	0.6
Intraoperative vaginal or perineal laceration	13 (3.3%)	10 (11.8%)	3 (1%)	<0.01
Intraoperative transient hematuria	11 (2.8%)	10 (11.8%)	1 (0.3%)	<0.01
Postoperative urinary tract injuries (n,%)	3 (0.8%)	1 (1.2%)	2 (0.6%)	0.6
Bladder injury	1 (0.3%)	0 (0%)	1 (0.3%)	0.6
Ureteral injury	2 (0.6%)	1 (1.2%)	1 (0.3%)	0.6
Postoperative vaginal vault dehiscence (n,%)	4 (1%)	0 (0%)	4 (1.3%)	0.2
Postoperative surgical site infection (n,%)	3 (0.8%)	1 (1.2%)	2 (0.6%)	0.6
At least one myoma uteri (>4cm) (n,%)	32 (8.1%)	21 (24.7%)	11 (3.5%)	<0.01
Adenomyosis (n,%)	76 (19.1%)	29 (34.1%)	47 (15.1%)	<0.01

at least one myoma uteri (>4 cm) and histopathologically confirmed adenomyosis were at a greater rate in Group I (24.7% vs 3.5%, $p<.01$; 34.1% vs 15.1%, $p<.01$, respectively).

The groups were similar with regard to postoperative urinary tract, intraoperative urinary tract and intraoperative bowel injuries ($p=.6$; $p=.05$; $p=.3$; respectively). Intraoperative bladder injury was detected in one participant in the morcellation group.

In the non-morcellation group, bladder injury was detected in one patient intraoperatively and one patient in the postoperative period. All bladder injuries detected occurred on the posterior wall of the bladder during vesicouterine dissection. Those detected intraoperatively were repaired laparoscopically, while those detected postoperatively were performed laparotomy. In the morcellation group, ureteral injury was found in one participant intraoperatively and in one participant in the postoperative period,

while in the non-morcellation group, ureteral injury was observed in one participant in the postoperative period. In the morcellation group, a D-J ureteral stent was performed after laparoscopic extravesical ureteroneocystostomy for the full-thickness laceration detected intraoperatively in the left ureter. In both groups, patients who were diagnosed with a full-thickness laceration in the left ureter on the second postoperative day, first underwent nephrostomy, and then ureteroneocystostomy was performed via laparotomy at the third month. In the group without morcellation, two patients had a sigmoid colon injury and one patient had a rectum injury, which was detected intraoperatively. Sigmoid colon injuries occurred during extensive adhesiolysis. The rectum injury occurred while inserting a uterine manipulator. Primary repair of bowel injuries was performed via laparotomy. The surgery of six participants in the non-morcellation group was converted to laparotomy due to the presence of extensive adhesions. All nine patients who converted to laparotomy were in the non-morcellation group (0% vs 2.9%, $p=.1$). Intraoperative vaginal or perineal laceration was detected at a greater rate in the morcellation group (11.8% vs 1%, $p<.01$). Lacerations were primarily sutured. Vaginal vault dehiscence occurred between the 7th and 10th postoperative days. Repair of dehiscence was performed vaginally. Surgical site infection occurred between 24 and 48 hours postoperatively. Appropriate antibiotic therapy was prescribed.

DISCUSSION

In this current study, operation time was longer, intraoperative vaginal or perineal laceration and intraoperative transient hematuria complications were more common in the manual free vaginal morcellation group. Regarding other intraoperative or postoperative problems, the groups were comparable.

Numerous research examining various methods of morcellation have been published after the US Food and Drug Administration released their safety statement and cautionary notice regarding the application of laparoscopic power morcellators (11). In a retrospective cohort study, Meurs et al. compared power intraperitoneal morcellation, manual vaginal morcellation, and manual mini laparotomic morcellation after laparoscopic or robot-assisted LH or myomectomy with and without the use of an endoscopic bag (12). They discovered that there were no appreciable differences between the methods in terms of anticipated blood loss, duration of stay, or postoperative complications (12).

On the other hand, Raiomono et al. compared perioperative surgical results between contained and free manual vaginal morcellation of large uteri following TLH. They found that contained manual

morcellation appeared to save operative time compared with free morcellation (11). It has been demonstrated that the use of a specimen retrieval bag surrounding the uterus during morcellation prevented sudden detachment of the tissues, regardless of their size, and allowed adequate mobilization. However, they did not evaluate morcellation time in their retrospective study (11). Additionally, they did not observe any difference with regard to intraoperative and postoperative complications between the groups (11).

Wang et al. compared patients with uterus size larger than 12 weeks but smaller than 16 weeks in two groups according to whether free manual morcellation was performed after TLH (13). While the uterus size was similar between the groups, the uterine weight was greater in the morcellation group. There were more patients with myoma uteri and adenomyoma in the morcellation group. The non-morcellation group had more intraoperative complications, longer operation time and longer uterine removal time. Conversion to laparotomy and postoperative complications were similar between groups (13).

In a meta-analysis, uterine weight >250 g, BMI ≥ 30 kg/m², previous surgery history, adhesions, comorbidity and advanced age were identified as factors associated with operation time, complications and conversion to laparotomy in LH surgeries (14).

Asgari et al. investigated the elements that predict the requirement for morcellation via transvaginal or mini-laparotomy in TLH (15). According to multiple modified Poisson regression analysis, uterine cross-sectional area >36.5 cm², uterine size >13 weeks, largest myoma uteri diameter >4 cm were associated with the specified morcellation types. Uterine length >10 cm was found to be unrelated (15).

In another study including patients underwent total laparoscopic due to malignant and benign indication, risk elements associated with perineal/vaginal lacerations and vaginal removal in TLH were examined (16). One significant risk factor for perineal or vaginal lacerations was a uterus transverse diameter of ≥ 5 cm in individuals with a normal-sized uterus, but interestingly, it was not in patients with large myomas (≥ 5 cm) (16).

In our study, the median age of the morcellation group was younger. BMI was similar between groups. Although parity did not vary among groups, the rate of nulliparity was greater in the morcellation group. It is thought that this situation increases the need for morcellation (16). Previous cesarean section history, which increases the risk of complications as stated in the literature (17), was greater in the morcellation group. Cardiopulmonary disease comorbidity prolongs the operation time and increases the risk of complications, both in terms of anesthesia and surgery. The groups are similar in this

feature. The uterine size >12 weeks had a greater rate in each subgroup analysis in Group I. The median uterine weight of the morcellation group was greater. In the subgroup analysis of uterine weight > 250 grams, Group I was statistically significantly heavier in each subgroup. The median operation time in the morcellation group was 10 minutes longer. Median morcellation time was 9 minutes. At least one myoma uteri (>4 cm) and adenomyosis were more common in the morcellation group. Intraoperative vaginal or perineal laceration and intraoperative transient hematuria were statistically greater in the morcellation group. Although conversion to laparotomy and postoperative complications were higher in the non-morcellation group, this difference was not statistically significant.

Urinary tract injuries following laparoscopic hysterectomy were evaluated in a systematic study, and the total risk for LH was 0.73%. The rates of ureteral and bladder injuries varied from 0.02% to 0.4% and 0.05% to 0.66%, respectively (18). Inan et al. reported the probability of lower urinary tract injury during TLH was 2.01% (17). In Larena et al.'s review, the overall incidence of bowel injury in gynecological laparoscopy was reported as 0.1% (19). Factors such as enlarged uterus, endometriosis, comorbidity, extensive adhesions, and previous pelvic/abdominal surgery increase the risk of genitourinary and bowel injuries (19,20). The patients analyzed in our study were at high risk of complications in terms of demographic and surgical characteristics. Despite these risks, the rate of all urinary tract injuries, both intraoperative and postoperative, was 1.5% and rate of bowel injuries was 0.8% in the entire cohort. These rates are compatible with the literature. Additionally, these complications did not occur during morcellation.

The most important limitation of our study is its retrospective design. Another weakness is that uterine length, uterine size, number of myoma uteri, and location of myoma uteri cannot be included in the analysis. We think that these factors may affect the morcellation procedure. Its strength is that surgical procedures are managed in a multidisciplinary tertiary center with the same experienced surgical team, and that it provides incidental data on TLH operations, as it includes a large cohort, as well as evaluating the effectiveness of morcellation. Additionally, we would like to point out that the patients in our study had a high risk of complications.

CONCLUSION

For large uteruses, TLH is still the best option for suitable patients when performed by experienced surgeons. It has been revealed that manual free vaginal morcellation, performed without the need for additional incisions, is safe, low-cost and practical in total

laparoscopic hysterectomies with benign indications. There is a need for prospective studies involving the cohort at high risk of complications, where measurement and mapping of myoma uteri and uterus are recorded in preoperative ultrasound evaluation.

Conflict of Interest

The authors have no conflicts of interest to declare.

Funding Statement

The authors received no funding for this work.

Authors' Contributions

Concept: O.Y., Design: O.Y. and M.G., Data Collection or Processing: K.A.M., A.H.K., B.D., Analysis or Interpretation: O.Y. and A.A., Literature Search: O.Y., A.A., K.A.M., Writing: O.Y., U.A.

Ethical Statement

Ethical permission required for the study was obtained by Izmir Dokuz Eylul University Ethics Committee (Registration number: 2024/19-09; Date:29/05/2024).

REFERENCES

- Orhan A, Ozerkan K, Kasapoglu I, Ocakoglu G, Cetinkaya Demir B, Gunaydin T, et al. Laparoscopic hysterectomy trends in challenging cases (1995-2018). *J Gynecol Obstet Hum Reprod*. 2019 Dec;48(10):791–8.
- Stoller N, Wertli MM, Zaugg TM, Haynes AG, Chiolero A, Rodondi N, et al. Regional variation of hysterectomy for benign uterine diseases in Switzerland. *PLoS One*. 2020;15(5):e0233082.
- Aarts JWM, Nieboer TE, Johnson N, Tavender E, Garry R, Mol BWJ, et al. Surgical approach to hysterectomy for benign gynaecological disease. *Cochrane database Syst Rev*. 2015 Aug;2015(8):CD003677.
- Bonilla DJ, Mains L, Whitaker R, Crawford B, Finan M, Magnus M. Uterine weight as a predictor of morbidity after a benign abdominal and total laparoscopic hysterectomy. *J Reprod Med*. 2007 Jun;52(6):490–8.
- Milad MP, Milad EA. Laparoscopic morcellator-related complications. *J Minim Invasive Gynecol*. 2014;21(3):486–91.
- ACOG Committee Opinion, Number 822: Uterine Morcellation for Presumed Leiomyomas. *Obstet Gynecol*. 2021 Mar;137(3):e63–74.
- Committee Opinion No 701: Choosing the Route of Hysterectomy for Benign Disease. *Obstet Gynecol*. 2017 Jun;129(6):e155–9.
- Donat LC, Clark M, Tower AM, Menderes G, Parkash V, Silasi DA, et al. Transvaginal morcellation. *J Soc Laparoendosc Surg*. 2015;19(2):1–8.
- Lambat Emery S, Boulvain M, Petignat P, Dubuisson J. Operative Complications and Outcomes Comparing Small and Large Uterine Weight in Case of Laparoscopic Hysterectomy for a Benign Indication. *Front Surg*. 2021;8(October):1–6.
- Nelson G, Altman AD, Nick A, Meyer LA, Ramirez PT, Ahtari C, et al. Guidelines for pre- and intra-operative care in gynecologic/oncology surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations--Part I. *Gynecol Oncol*. 2016 Feb;140(2):313–22.
- Raimondo D, Raffone A, Franceschini C, Virgilio A, Palermo R, Borghese G, et al. Comparison of perioperative surgical outcomes between contained and free manual vaginal morcellation of large uteruses following total laparoscopic hysterectomy. *Int J Gynecol Obstet*. 2024;164(3):1167–73.
- Meurs EAIM, Brito LG, Ajao MO, Goggins ER, Vitonis AF, Einarsson JI, et al. Comparison of Morcellation Techniques at the Time of Laparoscopic Hysterectomy and Myomectomy. *J Minim Invasive Gynecol*. 2017;24(5):843–9.
- Wang H, Li P, Li X, Gao L, Lu C, Zhao J, et al. Total laparoscopic hysterectomy in patients with large uteri: Comparison of uterine removal by transvaginal and uterine morcellation approaches. *Biomed Res Int*. 2016;2016:1–7.

14. Driessen SRC, Sandberg EM, la Chapelle CF, Twijnstra ARH, Rhemrev JPT, Jansen FW. Case-Mix Variables and Predictors for Outcomes of Laparoscopic Hysterectomy: A Systematic Review. *J Minim Invasive Gynecol.* 2016;23(3):317–30.
15. Asgari Z, Enzevaei A, Hosseini R, Behnia-Willison F. Predictive factors of the need to morcellate in total laparoscopic hysterectomy. *Aust New Zeal J Obstet Gynaecol.* 2021;61(5):759–64.
16. Chikazawa K, Imai K, Ko H, Ichi N, Misawa M, Kuwata T. Risk factors associated with perineal and vaginal lacerations and vaginal removal in total laparoscopic hysterectomy. *Gynecol Minim Invasive Ther.* 2022;11(3):150–4.
17. İnan AH, Budak A, Beyan E, Kanmaz AG. The incidence, causes, and management of lower urinary tract injury during total laparoscopic hysterectomy. *J Gynecol Obstet Hum Reprod.* 2019;48(1):45–9.
18. Adelman MR, Bardsley TR, Sharp HT. Urinary tract injuries in laparoscopic hysterectomy: a systematic review. *J Minim Invasive Gynecol.* 2014;21(4):558–66.
19. Llarena NC, Shah AB, Milad MP. Bowel injury in gynecologic laparoscopy: a systematic review. *Obstet Gynecol.* 2015 Jun;125(6):1407–17.
20. Thurston J, Murji A, Scattolon S, Wolfman W, Kives S, Sanders A, et al. No. 377-Hysterectomy for Benign Gynaecologic Indications. *J Obstet Gynaecol Canada.* 2019;41(4):543–57.