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Does uterus volume affect the total laparoscopic hysterectomy outcomes?

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Ethics Committee Approval
Ethics Committee approval was taken from the University of Health Science Adana City Training and Research Hospital Ethical Committee, 20.05.2020 and no:872.
All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

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Abstract

Background/Aim: Increased uterus weight, high body mass index (BMI), and history of abdominal surgeries increase the risk of complications in total laparoscopic hysterectomy (TLH), similar to other types of surgery. However, there are conflicting reports about improving technology. This study aimed to retrospectively investigate the clinical features and postoperative results of TLH cases regarding uterine volume performed for benign reasons in our clinic.

Methods: In this retrospective cohort study, 252 patients were included. The demographic data of all patients, including BMI, pre-operative uterine volumes, operation times, number of cesarean sections, history of lower abdominal operation, indications, pre-operative and postoperative hemoglobin differences, complications, length of hospital stay, and final pathologies were reviewed. The uterine volume was measured using the prolate ellipsoid formula before surgery, using the maximum length and anteroposterior and transverse diameters of the uterine corpus. The normal uterine volume with these measurements (8 cm long, 4 cm high, and 5 cm wide) was estimated as 83.2 cm^3. The patients were classified into two groups according to uterine volume (Group 1 Normal volume ≤83.2 cm^3 and Group 2 uterine volume >83.2 cm^3). Surgical outcomes of patients were compared between groups.

Results: Two-hundred-fifty-two women were included in the study. The mean uterine volumes of groups 1 and 2 were 53.66 cm^3 (2.25) and 296.33 cm^3 (6.25), respectively. In group 1, the mean operation time was 111.14 (6) min, compared to 118.2 (3.06) min in group 2; there was no significant difference (P = 0.164). The mean postoperative hospital stays of groups 1 and 2 were 3.21 (0.15) and 3.34 (0.09) days, respectively, and there was no significant difference (P = 0.706). The mean blood loss values of groups 1 and 2 were 1.34 g/dl (0.19) and 1.16 g/dl 0.06), respectively.

Conclusion: According to our results, TLH is a safe method even in patients with a larger uterus; operating time, blood loss, and postoperative hospital stays did not differ according to uterine volume.

Keywords: Laparoscopic hysterectomy, Uterine volume, Surgery outcome

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Introduction

Hysterectomy is one of the most common gynecologic operations performed worldwide for indications such as abnormal uterine bleeding, uterine leiomyoma, uterovaginal prolapse, endometriosis, adenomyosis, and pelvic inflammatory disease [1]. It has been shown in the literature that laparoscopic hysterectomy is better than abdominal hysterectomy in terms of intraoperative blood loss, postoperative analgesic requirement and wound infection, faster recovery time, return to daily activities, and avoidance of large abdominal scarring [2]. Total laparoscopic hysterectomy (TLH) has become a well-tolerated and effective technique with the modern laparoscopic instruments and the development of surgical techniques [3]. According to the results of the ACOG guideline, it was emphasized that laparoscopic hysterectomy could be applied when vaginal hysterectomy is contraindicated or inappropriate [2]. In each clinic, the first and most appropriate method is selected without harming the patient, with the effect of variables such as the surgeons' laparoscopy experience and the patient's characteristics [4]. This study aimed to retrospectively evaluate the clinical features and postoperative results of TLH cases in terms of uterine volume performed for benign reasons in our clinic. This was the first study comparing pre-operative estimated uterine volume by ultrasonography and TLH outcomes in the literature.

Materials and methods

This retrospective study included 252 women who underwent TLH with benign indications at the University of Health Science Adana City Training and Research Hospital between December 2017 and February 2020. The study's ethical approval was obtained from the local ethics committee of the University of Health Science Adana City Training and Research Hospital (872/2020). Demographic data of all patients were reviewed, including body mass index (BMI) and pre-operative uterine volumes, operation times (from the beginning to the awaking up from anesthesia), indications, pre-operative and postoperative hemoglobin differences, endometrial biopsies, complications, length of hospital stay, and final pathologies. The number of cesarean sections and history of lower abdominal operations were all recorded.

Pre-operative pelvic ultrasonographic measurements of each patient before hysterectomy were taken by at least two doctors. The patients were taken in lithotomy position with an empty bladder. Aloka ProSound Alpha 6 ultrasound with a 3–9 MHz transvaginal probe and a 2–6 MHz abdominal probe was utilized. The calculations of the uterine volume were performed by length (L), width (W), and anteroposterior (AP) diameters. AP length was obtained from a sagittal scan parallel to the midline axis of the body and length by measuring from the internal os of the cervix to the top of the fundus or mass in the same visualizing plane. Then, the vaginal probe is rotated parallelly to the coronal axis to visualize the widest transverse line and to find the width of the uterine corpus. A single expert physician performed all the examinations independently and performed three consecutive measurements during the scanning of individuals. The uterine volume was calculated by measuring the uterine corpus's maximum length, AP, and width measurements and using the formula for the volume of a prolate ellipsoid: $V = 0.52 \times (L \times AP \times W)$ [5]. The average dimensions of the normal uterus in women of reproductive age are approximately 8 cm long, 4 cm high, and 5 cm wide, while that of multiparous women is larger than in nulliparous women, by approximately 1 cm in each dimension [6]. Using these measurements, we calculated the normal uterine volume as 83.2 cm^3. The participants were divided into two groups according to uterine volume. Group 1 is patients with the uterine volume ≤83.2 cm^3 and Group 2 is the patients with uterine volume >83.2 cm^3. Surgical outcomes of patients were compared between groups.

General anesthesia was used in all surgeries with a pneumoperitoneum in the lithotomy position. An umbilical trocar (10 mm) and three 5-mm lower abdomen trocars (two ipsilateral ports and one assistant port) were inserted using the TLH port technique. Clermont Ferrand's uterine manipulator was inserted in all cases. After inspection of the abdominal and pelvic organs, a hysterectomy was started. The bladder peritoneum was dissected, and the infundibulo pelvic or ovarian ligaments were coagulated and cut. The uterine arteries were ligated. The uterosacral ligaments were coagulated and cut. The cardinal ligaments were coagulated and transected. Monopolar energy was used for colpotomy. Ligasure and bipolar energy were used for other sections.

After removing the uterus along the vagina, the vaginal cuff was sutured with laparoscopic suturing (Vicryl 1-0). After hemostasis was achieved, insertion sites of the trocars were sutured. Skilled laparoscopic gynecologic surgeons performed all surgeries. Written informed consent was taken one night before surgery, including antibiotic prophylaxis and bowel preparation.

Statistical analysis

The Kolmogorov-Smirnov test was used for the normality of variables. Normal variables were defined as the mean (standard deviation) and 95% confidence interval. The Spearman correlation test was used to find the relationship between continuous variables. Statistical Package for the Social Sciences, version 20 (SPSS Inc.), was used for the statistical analysis. *P*-values < 0.05 was considered statistically significant.

Results

The patients' clinical characteristics are shown in Table 1. Two-hundred-fifty-two patients were enrolled for this research. The mean age of participants was 49.26 (7.56) years, and the mean body mass index was 30.17 (5.33) kg/m^2. The mean gravida and parity were 4.11 (2.36) and 2.34 (1.94), respectively. Seventy-one women (28.2%) had one or more previous Caesarean sections, and 14 women (5.6%) had a previous laparotomy.

Table 1: Clinical characteristics of patients.

	n = 252
Age (years) mean (SD)	49.26 (7.56)
Gravida (n) mean (SD)	4.11 (2.36)
Parity (n) mean (SD)	2.34 (1.94)
Body mass index (kg/m^2) mean (SD)	30.17 (5.33)
Pre-operative hemoglobin (g/dl) mean (SD)	12.11 (1.45)
Postoperative hemoglobin (g/dl) mean (SD)	10.91 (1.51)
Previous low abdominal surgery, *n* (%)	14 (5.6)
Previous cesarean section, *n* (%)	71 (28.2)

SD: Standart deviation

Table 2 shows the Surgical outcomes of patients. Two-hundred-fifty-two TLH were performed with the indications as follows: myoma uteri (15, 6%), abnormal bleeding (160, 63.5%), endometrial hyperplasia (54, 21.4%), and others (23, 9.1%). Major complications were bladder injury in three women, bowel injury in one woman, stomach injury in one woman, and vascular injury in one woman. Conversion to laparotomy was performed in one patient due to vascular injury.

Table 2: Surgical outcomes of patients

	n = 252
Indications (n, %)	
Myoma uteri	15 (6)
Abnormal bleeding	160 (63.5)
Endometrial hyperplasia	54 (21.4)
Others	23 (9.1)
Endometrial biopsy (n, %)	
Normal	152 (60.3)
Myoma uteri	1 (0.4)
Endometrial polyp	51 (20.2)
Simple hyperplasia without atypia	32 (12.7)
Simple atypical hyperplasia	7 (2.8)
Complex hyperplasia without atypia	6 (2.4)
Complex atypical hyperplasia	3 (1.2)
Major complications (n, %)	
Bladder injury	3 (1.2)
Stomach injury	1 (0.4)
Bowel injury	1 (0.4)
Vessel injury	1 (0.4)
Conversion to laparotomy (n, %)	1 (0.4)
Final pathology (n, %)	
Normal	89 (35.3)
Myoma uteri	68 (27)
Endometrial polyp	43 (17.1)
Adenomyosis	41 (16.3)
Simple hyperplasia without atypia	8 (3.2)
Simple atypical hyperplasia	1 (0.4)
Complex hyperplasia without atypia	2 (0.8)

The mean uterine volume of 252 patients was 241.74 cm^3 (14.11). Compared with the uterine volume and operation time, there were no significant differences (116.65 [2.73] min, P = 0.644) and no significant differences were found between uterine volume and blood loss (1.2 [0.06] g/dl, P = 0.116) or postoperative hospital stay (3.31 [0.8] days, P = 0.813). The mean uterine volume of group 1 and group 2 were 53.66 cm^3 (2.25) and 296.33 cm^3 (16.25) ml, respectively. In group 1, the mean operation time was 111.14 (6) min and 118.2 (3.06) min in group 2; no significant difference was found (P = 0.164). The mean postoperative hospital stays of group 1 and 2 were 3.21 (0.15) and 3.34 (0.09) days respectively (P = 0.706). The mean blood loss values of groups were 1.34 (0.19) and 1.16 (0.06) g/dl, respectively. The surgical outcomes according to uterine volume cut-off are shown in Table 3.

Table 3: Surgical results according to uterine volume

	Group 1 n = 55	Group 2 n = 197	*P*-value
Operative time (min), mean (SD)	111.14 (6)	118.2 (3.06)	0.164
Postoperative hospital stay (days), mean (SD)	3.21 (0.15)	3.34 (0.09)	0.706
Blood loss (g/dl)	1.34 (0.19)	1.16 (0.06)	0.553

Blood loss: Difference of post- and pre-operative hemoglobin, SD: Standard deviation.

No cancer was detected in any of the pathology results of the cases.

Discussion

This study reports no significant difference between pre-operative uterine volume and TLH surgical outcomes, such as blood loss, operating time, and postoperative hospital stay. It was thought that patients with larger uteruses could have more risks. Since TLH allowed good image quality at large magnification and easy access to deep tissues with improved technology, no significant difference between groups was found. Our findings show that TLH is not a risk factor regarding uterus volume for surgical outcomes.

It was well known that increased uterus weight, high BMI, and history of abdominal surgeries, the increased risk of complications in TLH, similar to other types of surgery [7]. However, there were conflicting reports in the literature regarding technology improvement. Moreover, surgeons and skills differ in regions related to facilities.

Twinjstra et al. [8] aimed to estimate the various risk factors, like uterus weight, BMI, abdominal surgery history, laparoscopic hysterectomy types, and the number of surgeons for outcome in laparoscopic hysterectomy. It was a 1-year cohort analysis conducted with laparoscopist gynecologists. These authors reported that as experience increases, surgical time shortens, and blood loss and complications decrease. However, they also mentioned that there was not a guaranteed result because of variability in experience among individuals and independent surgical skills [8].

In a retrospective study, the authors evaluated TLH outcomes in 504 patients and compared the results to categorizing patients with or without previous cesarean sections [9]. These authors did not find any significant difference between the groups concerning parity, duration of operation, hospital stay, or pre and postoperative hemoglobin levels [9]. They concluded that TLH could be performed safely in the previous caesarean section (CS) group. However, Seo et al. [10] showed longer operating times and a higher rate of conversion to laparotomy in patients with a history of abdominal surgery. The results were explained by common adhesiolysis in that group of patients (145/331). Also, there were significant differences in two or more surgeries in adhesiolysis compared to one previous surgery.

A study evaluated the effect of BMI on TLH outcomes [11]. The authors divided the patients (183 total) according to the following BMI ranges: <18.5 kg/m^2 "underweight", 18.5-25 kg/m^2 "normal weight", 25–30 kg/m^2 "overweight", ≥30 "obese" kg/m^2, respectively. Also, they reported significantly longer operation times and more perioperative complications in obese patients. In our study, the mean BMI was 31 kg/m^2. Since obesity was common in our area, no difference was observed between the groups.

Multiple studies have investigated TLH results based on uterine dimensions (weight) [4, 12, 13]. In all studies, the uterus was weighted (without ovaries) after being removed vaginally before sending the pathology. Terzi et al. showed a cut-off value of 300 g for an increased operation time [13]. O'Hanlan et al. [4] divided the groups according to uterine weights (less or greater than 250 g). These authors reported that although operating times and blood loss increased significantly (but by a very modest amount) with the increasing size of the uterus, TLH was safe and applicable regardless of uterine weight.

Kung et al. [14] evaluated the uterine volume estimated by ultrasonographic uterine measurements (three dimension-ellipsoid formula) and compared the reported pathologic measurements. These authors showed that uterine volume could be converted to uterine weight *in vivo* before surgery. The measurements consisted of the length of the uterus from the dome to the cervix, width, and the largest cross-sectional anteroposterior diameter. The mean volume of the uterus was

302 cm^3, which referred to 271 g actual uterus weight. Uterus measurements were routinely measured by transvaginal ultrasonography in our clinic as ellipsoid formula (anteroposterior diameter × longitudinal diameter × transverse diameter × 0.5236) and recorded to files before surgery.

Gerges et al. [15] investigated the relationship between pre-operative uterine volume and prediction of morcellator usage in TLH. They used the ellipsoid formula and Virtual Organ Computer-aided AnaLysis (VOCAL™) for pre-operative measurements. They concluded that morcellation was not required in patients with uterus volumes less than 120 mL at 3D-US. We did not use morcellation in our clinic. Therefore, the mean volume of a normal uterus was selected as a cut-off.

Limitations and strengths

This study has some limitations. First, it was a retrospective study, and also we did not measure the vaginal volume which could affect the operation time by alternating the time for uterine removal from vagina. Second, depending on the surgeon's experience, the TLH preference in our clinic may have been performed in certain sizes of the uterus, in line with the habits.

The comparison of uterine volume estimated by ultrasonography and surgery outcomes was the major strength of our study. Further prospective studies addressing TLH outcomes, including pre-operative uterine size and vaginal measurement, should be planned.

Conclusion

In conclusion, TLH was performed safely in patients with larger than normal uteruses. Operating time, blood loss, and postoperative hospital stays did not differ significantly regarding uterine volume.

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