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Original Research

# Retrospective Analysis of Total Laparoscopic Hysterectomy Experience in a Single Center for Five Years

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**ABSTRACT**
**Objective:** To analyze the indications, complications, and clinical outcomes of total laparoscopic hysterectomies (LH) for benign diseases in a tertiary health care hospital over a period of five years.
**Methods:** This retrospective cohort study includes 151 patients that underwent total laparoscopic hysterectomy (TLH) for benign indications at a university hospital between 2013 and 2017.
**Results:** Abnormal uterine bleeding (44.4%) was the most common indication. The mean hospital stay, estimated blood loss, and operative time were 2.3±1.2 days, 159.5±87.8 mL, and 69.5±16.9 minutes. The learning curve in terms of average operative time during five years decreased from 82±18.5 minutes to 57.8±5.2 minutes. Total complication rate was 10.6% including 7.9% intraoperative and 2.6% postoperative. Total complication rate decreased from 20% in 2013 to 2.2% in 2017. Most ureteral injuries were diagnosed postoperatively. Especially we observed no ureteral injury between 2015 and 2017 and there was 5.9% and 13.3% ureteral injury rate in 2014 and in 2013; respectively. Conversion rate to laparotomy was 3.3%.
**Conclusion:** LH is a good alternative to abdominal hysterectomy wherever an advanced laparoscopic skilled surgeon can safely perform this procedure. Lower complication (especially urinary) rates can be expected with better handling of the uterus via manipulators, consideration of anatomical proximities, and always following safe dissection rules.
**Keywords:** Complication, total laparoscopic hysterectomy, urinary injury, benign indication, learning curve

## INTRODUCTION

Laparoscopic hysterectomy (LH) was first introduced in 1989 by Reich et al. (1). The most common indications for a hysterectomy include adenomyosis, abnormal uterine bleeding, symptomatic leiomyoma, endometriosis, and prolapse of the uterus (2), and the major determinants for the route of hysterectomy are the patient's choice, body mass index (BMI), weight and volume of the uterus, history of surgical intervention, and the surgeon's skill (3). For the treatment of benign diseases, LH is considered as an alternative to abdominal hysterectomy in cases for which vaginal surgery is contraindicated (4, 5). LH has numerous advantages, including shorter duration of hospital stay, earlier return to normal activity, less pain, low rate of infection or ileus, and magnified exposure of uterine vessels or ureter (6, 7); however, compared to the transabdominal route, it is generally associated with a longer operative time (8) and a higher rate of urinary tract complications (9-11).

The aim of this study was to analyze the indications, complications, and clinical outcomes of total laparoscopic hysterectomies (TLHs) for benign diseases in a tertiary health care hospital over 5 years.

## METHODS

This retrospective cohort study included patients who underwent TLH for benign indications at Department of Obstetrics and Gynecology of Gaziantep University Hospital between 2013 and 2017. The institutional review board of the hospital approved the study (approval number: 2017/415), and the written informed consent was obtained from all study participants. Demographic and clinical data were obtained for all patients. The indications for hysterectomy included abnormal uterine bleeding, leiomyoma uteri, endometrial hyperplasia, uterine prolapse, cervical intraepithelial neoplasia, benign adnexal mass, hermaphroditism, and chronic pelvic pain. Malignant cases were excluded from the study. Age, parity, menopausal status, and BMI were recorded in a scope of maternal characteristics. The type of surgery (TLH-bilateral salpingo-oophorectomy [TLH-BSO], TLH-unilateral salpingooophorectomy, or TLH), suture type used in the vaginal cuff, duration of hospital stay, uterine volume (depending on pathological reports), intraoperative blood loss (the level of blood remaining in the suction tube after subtracting the amount of the washes), need for blood transfusion, the date of surgery, operative time (time interval between umbilical incision and closure), difference between preoperative and postoperative hemoglobin

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levels, conversion to laparotomy, and intraoperative or postoperative complications were analyzed. The same gynecologic team performed all the operations included in the study. After a transumbilical vertical incision, the abdomen was accessed using the closed Veress needle entry technique, and insufflation of carbon dioxide gas up to 20 mmHg pressures was preferred for adequate pneumoperitoneum. We inserted a primary 12 mm trocar at the umbilical incision, in addition to 2 ipsilateral 5 mm and one contralateral 5-mm trocars (diamond-shaped) for surgery. A 10mm $0^0$ laparoscope and operating instruments were inserted through the trocars. We determined the site of the vaginal cuff incision by using different types of uterine manipulators (Clermont-Ferrand®, Karl Storz, Tuttlingen, Germany and VCare®, Conmed, New York, United States) and circumferentially incised the vaginal tissue using the monopolar needle diathermy or harmonic scalpel, Ethicon®. Surgical specimens were extracted from the vaginal cuff. All the patients were intravenously administered with cefazolin sodium 2 g as perioperative antimicrobial prophylaxis. Complications included ureter injury, bladder injury, hemorrhage requiring blood transfusion, vault infection, and conversion to laparotomy due to miscellaneous complications. In the last 2 years, we modified our routine practice and performed cystoscopy to ensure the patency of ureters at the end of the operation for all patients. All bladder injuries were intraoperatively restored by laparoscopic suturing. We placed a 16 F Foley catheter into the bladder for 10 days in the cases with a bladder injury. We evaluated patients with suspected ureteral injuries with a computed tomography (CT) scan if there was acute pelvic pain, abnormal distension, or an inflammatory reaction in the serum (elevated C-reactive protein and leukocytosis). In addition, we evaluated the presence and extent of the ureteral injury with intravenous pyelography unless kidney function tests were abnormal. Suspected ureteral injuries were intraoperatively or postoperatively repaired, and involved JJ stent placement, ureteroureterostomy, and ureteroneocystostomy.

### Statistical Analysis

The Shapiro-Wilk test was used to test the normality of distribution of continuous variables. The Student-T test and the Mann-Whitney U test were used for the comparison of 2 independent groups of variables with normal and non-normal distributions, respectively; whereas the ANOVA test and the Kruskal-Wallis test were used for the comparison of 3 independent groups of variables with normal and non-normal distributions, respectively. The Pearson test was used to assess the relation between parametric variables and Chi-square test for the relation between categorical variables. Descriptive statistic parameters were presented as frequency, percentage (%), and mean±standard deviation (mean±SD). Statistical analysis was performed using the Statistical Package for Social Sciences for Windows version 22.0 (IBM SPSS Corp.; Armonk, NY, USA), and a $p<0.05$ was considered statistically significant.

## RESULTS

A total of 151 patients were included in the study. General and surgical characteristics of patients are presented in Table 1. Conversion to laparotomy was required only in 5 cases (conversion rate 3.3%), which included partial ureteral injury, dense adhesion, intra-abdominal bleeding due to uterine artery injury, and manipulator discordance in a huge myoma uteri case. Furthermore, laparotomy had to be performed in only one case because of intra-abdominal hematoma in the early postoperative period. We observed a total of 16 (10.5%) complications during the intraoperative (12 [7.9%]) and postoperative (4 [2.6%]) period. Complications and their corresponding recognition times are summarized

**Table 1.** General characteristics and surgical outcomes of patients

| | |
|---|---|
| Age (years) * | 50±7.7 |
| Gravidity* | 5.2±2.4 |
| Parity* | 4.3±2 |
| BMI (kg/m$^2$)* | 30.3±3.5 |
| Uterine volume (mL)* | 211.4±123.5 |
| Duration of hospital stay (days)* | 2.3±1.2 |
| Operative time (minutes)* | 69.5±16.9 |
| Need for erythrocyte suspension (IU)** | 26 (17.2) |
| Blood loss (mL)* | 159.5±87.8 |
| Decrease in hemoglobin level (g/dL) * | 1±0.9 |
| **Menopausal status**** | |
| Premenopausal | 83 (55) |
| Postmenopausal | 68 (45) |
| **Type of vaginal cuff suture**** | |
| Polyglactin | 104 (68.9) |
| Barbed | 47 (31.1) |
| **Type of surgery*** | |
| TLH–BSO | 124 (82.1) |
| TLH | 16 (10.6) |
| TLH–USO | 11 (7.3) |
| **Indications**** | |
| Abnormal uterine bleeding resistant to medical therapy | 67 (44.4) |
| Endometrial hyperplasia | 31 (20.5) |
| Myoma uteri | 19 (12.6) |
| Cervical intraepithelial neoplasia | 14 (9.3) |
| Benign adnexal mass | 12 (7.9) |
| Decensus uteri | 5 (3.3) |
| Hermaphroditism | 2 (1.3) |
| Chronic pelvic pain | 1 (0.7) |

*Mean±standard deviation, **n (%). BMI: body mass index; TLH: total laparoscopic hysterectomy; BSO: bilateral salpingo–oophorectomy; USO: unilateral salpingo–oophorectomy; IU: international unit

**Table 2.** Characteristics of complications with their recognition time

| | Recognition time of complication (postoperative day) | Number of patients (%) |
|---|---|---|
| Intraoperative | | 12 (7.9) |
| Urinary tract injury | | 10 (6.6) |
| Bladder injury | 0 | 3 (2) |
| Ureter injury | | 7 (4.6) |
| Thermal injury | 0 and 30 | 2 (1.3) |
| Complete transection | 2, 4, and 45 | 3 (2) |
| Partial transection | 0 | 1 (0.7) |
| Ureteral kinking | 15 | 1 (0.7) |
| Uterine artery bleeding | 0 | 2 (1.3) |
| Postoperative | | 4 (2.6) |
| Respiratory distress | 2 | 1 (0.7) |
| Umbilical hernia | 45 | 1 (0.7) |
| Intra-abdominal hematoma | 1 | 1 (0.7) |
| Vaginal cuff cellulite | 45 | 1 (0.7) |

0 defines the intraoperative recognized complication

in Table 2. Ureteral injuries were restored through the abdominal route using ureteroureterostomy and ureteroneocystostomy in one and 2 cases, respectively. Ureteral stent application was required in three cases of ureteral injuries, including 2 thermal injuries and one ureteral kinking. All bladder injuries were at the dome and were restored intraoperatively through laparoscopic suturing. The data analyses of premenopausal and postmenopausal patients are shown in Table 3. The comparison of patients with and without complications is shown in Table 4. The operational data including operative time, estimated blood loss, and complications regarding the year of surgery are summarized in Figures 1 and 2, respectively. The total (intraoperative and postoperative) complication rate was 20% (9/45), 17.6% (3/17), 7.1% (1/14), 3.4% (1/29), and 2.2% (1/46) in 2013, 2014, 2015, 2016, and 2017, respectively. There were a total of 7 ureteral injuries, including one case in 2014 and 6 cases in 2013. Mean BMI of 5 patients who had and had not undergone conversion to laparotomy was 32.58±2.71 and 30.24±3.53, respectively (p=0.054). There was a positive correlation between decreased hemoglobin level or blood loss and operative time (r=0.171, p=0.036 and r=0.196, p=0.016, respectively).

## DISCUSSION

For benign diseases, the vaginal or laparoscopic route of hysterectomy is generally recommended in literature (4) and by the guidelines of American College of Obstetricians and Gynecologists or the American Association of Gynecologic Laparoscopists (AAGL) (12, 13). LH has become more popular with the development of

**Table 3.** Comparison of patients with respect to menopausal status

| | Premenopausal (n=83) | Postmenopausal (n=68) | p |
|---|---|---|---|
| Age (years)* | 45.24±5.67 | 55.9±5.65 | 0.001† |
| Gravidity* | 4.58±2.23 | 6.04±2.46 | 0.000† |
| Parity* | 3.88±1.78 | 4.87±2.15 | 0.002† |
| BMI (kg/m²)* | 30.52±3.7 | 30.08±3.32 | 0.443 |
| Uterine volume (mL)* | 235.08±126.7 | 182.56±113.97 | 0.009† |
| Hospital stay (days)* | 2.28±1.09 | 2.4±1.48 | 0.567 |
| Operative time (minutes)* | 67.4±16.45 | 72.22±17.32 | 0.082 |
| Need for erythrocyte suspension (IU)** | 19 (22.9%) | 7 (10.3%) | 0.041† |
| Blood loss (mL)* | 171.19±102.37 | 145.29±63.85 | 0.060 |
| Hemoglobin drop (g/dL) * | 0.97±0.8 | 1.14±0.92 | 0.247 |
| **Type of surgery*** | | | 0.001† |
| TLH-BSO | 57 (68.7%) | 67 (98.5%) | |
| TLH | 16 (19.3%) | 0 (0.0%) | |
| TLH-USO | 10 (12.0%) | 1 (1.5%) | |
| Complication** | 9 (10.8%) | 6 (8.8%) | 0.680 |
| Conversion to laparotomy** | 5 (6.0%) | 0 (0.0%) | 0.013† |

*Mean±standard deviation, **n (%), †p<0.05. BMI: body mass index; TLH: total laparoscopic hysterectomy; BSO: bilateral salpingo-oophorectomy; USO: unilateral salpingo-oophorectomy; IU: international unit

**Table 4.** Comparison of patients with respect to presence or absence of complications

| | Complication n=15 | Without complication n=136 | p |
|---|---|---|---|
| Age (years)* | 49.6±9.64 | 50.09±7.56 | 0.380 |
| Gravidity* | 5.07±2.02 | 5.26±2.49 | 0.811 |
| Parity* | 4.33±1.63 | 4.32±2.05 | 0.990 |
| BMI (kg/m$^2$)* | 32.25±4.94 | 30.11±3.29 | 0.028† |
| Uterine volume (mL)* | 245.67±121.91 | 207.65±123.59 | 0.200 |
| Hospital stay (days)* | 4±2.75 | 2.15±0.82 | 0.001† |
| Operative time (minutes)* | 89±23.86 | 67.43±14.64 | 0.001† |
| Need for erythrocyte suspension (IU)** | 8 (53.3%) | 18 (13.2%) | 0.001† |
| Blood loss (mL)* | 245.53±138.81 | 150.04±75.26 | 0.004† |
| Hemoglobin drop (g/dL)* | 1.31±092 | 1.02±0.85 | 0.132 |
| Type of surgery* | | | 0.311 |
| TLH-BSO | 10 (66.7%) | 114 (83.8%) | |
| TLH | 3 (20.0%) | 13 (9.6%) | |
| TLH-USO | 2 (13.3%) | 9 (6.6%) | |
| Menopausal status** | | | 0.680 |
| Premenopausal | 9 (60.0%) | 74 (54.4%) | |
| Postmenopausal | 6 (40.0%) | 62 (45.6%) | |
| Conversion to laparotomy** | 3 (20.0%) | 2 (1.5%) | 0.005† |

*Mean±standard deviation, **n (%), †p<0.05. BMI: body mass index; TLH: total laparoscopic hysterectomy; BSO: bilateral salpingo-oophorectomy; USO: unilateral salpingo-oophorectomy; IU: international unit

laparoscopic procedures in different countries, including 12% of all hysterectomies in the United States (US) in 2003 (14) and 36% in the Netherlands in 2012 (15). A nationwide study in the US regarding LH demonstrated that abnormal bleeding was the most common indication (53%), and the average duration of hospital stay was 1.65 days (16). Candiani et al. (17) and Morelli et al. (18) reported the average duration of hospital stay as 2.7 and 2.9 days, respectively. According to a recent meta-analysis, the average duration of hospital stay was 2.5 days shorter for TLH compared to total abdominal hysterectomy (19). Similarly, in the present study, abnormal uterine bleeding (44.4%) was the most common indication, and the average duration of hospital stay was found to be 2.3 days. The median range of estimated blood loss reported in randomized controlled trials for LH is between 156 and 568 mL (4), and that in the present study is 159 mL. However, lower amounts of blood loss between 84 and 119 mL have also been previously reported (17-19). One of the primary disadvantages of LH is the relatively long operative time. The mean operative time of TLH in 3 randomized controlled trials (17, 20, 21) was reported to be 112 minutes. Our institutional learning curve in terms of average operative time during 5 years is encouraging, as the mean operative time gradually decreased from 82 minutes to 58 minutes (average, 69.5 minutes; Figure 1). We believe that the advancement in the development of instruments (availability of different types of manipulators or bipolar technologies), standardization of operative techniques, more appropriate patient selection, and enhanced surgical experience may contribute to the shortening of operative time. Although LH is recommended for benign disease in obese patients (22), we demonstrated an association between BMI (average 30.2 kg/m$^2$) and operative time (p=0.028) or complications (p=0.028), which is similar to the data reported in another study (23). In contrast, previous studies have stated that there is no difference between the operative time among normal BMI, overweight, and obese patients (24). In our study, the mean BMI of the 5 patients who required conversion to laparotomy was higher than the mean BMI of those who did not require the conversion, but this effect was not statistically significant. BSO is crucial in perimenopausal and postmenopausal women because the removal of prophylactic adnexectomy precludes adnexal torsion, ovarian cancer, benign ovarian pathologies, and prolapsed salpinx (7.91%) (25, 26). We performed BSO in 82.1% (124/151) of all cases in the present study and up to 98.5% in postmenopausal patients. We demonstrated a significant difference between premenopausal and postmenopausal groups when age, gravidity, parity, uterine volume, need for erythrocyte suspension, type of surgery, and conversion to laparotomy were compared. As expected, we observed a greater decrease in hemoglobin level and more blood loss with increasing operative time.

Figure 1. Operational outcomes including the operative time and estimated blood loss over 5 years

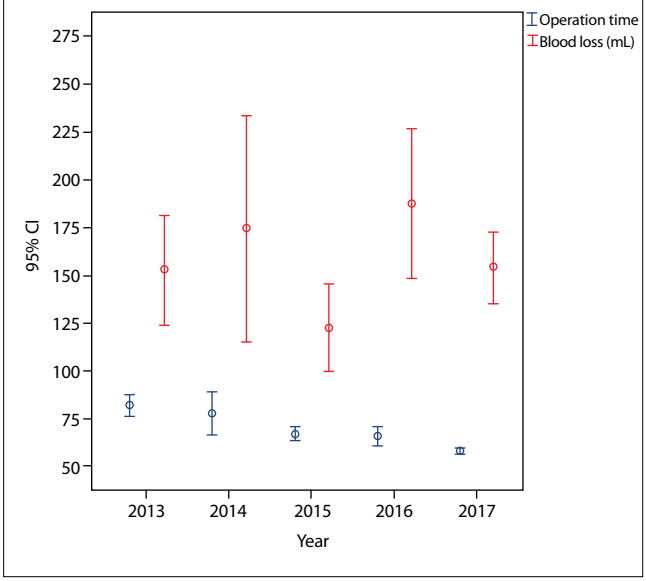
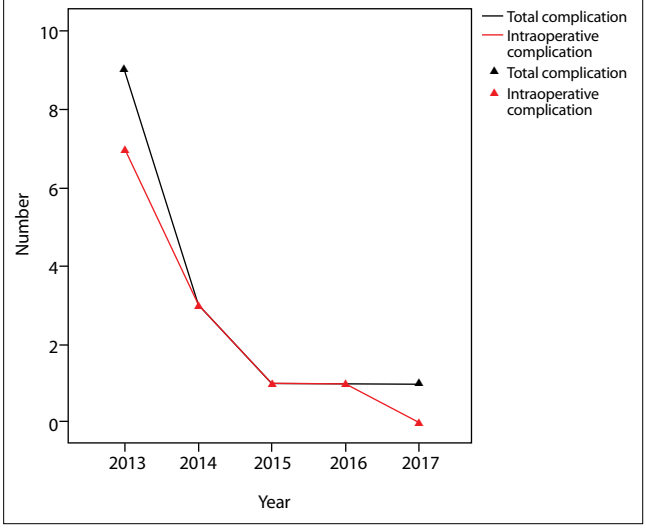



Figure 2. Total and intraoperative complications between 2013 and 2017




Other disadvantages of LH are the long learning curve and more frequent ureteric and hemorrhagic complications (8). However, there was no statistically significant difference in pooled urinary tract injury rates for LH compared with those for vaginal hysterectomy (27). A lower complication rate and shorter operative time can be accomplished by experienced surgeons (28). A large proportion of the major complications occur during the learning curve (29). Wattiez et al. (30) and Makinen et al. (31) suggested that the learning curve threshold should be at least 21 and 30 procedures, respectively.

Although there are low complication rates (between 0 and 1.4%) regarding LH have been reported (32, 33), high complication rates (between 9.8% and 11.1%) have also been reported by some authors (9-11). In the present study, the total complication rate (intraoperative and postoperative) was 10.6%. There was a significant difference between 2 groups (with or without complications) when we compared the BMI, duration of hospital stay, operative time, need for erythrocyte suspension, blood loss, and conversion to laparotomy. All of these parameters were found to be higher in the patients with complications. There was one patient with vaginal cuff cellulitis concurrent with ureteral injury diagnosed on the 45$^{th}$ day of TLH. Vault infection can be a result of a high-energy application during colpotomy, which induces thermal injury and decreases vascular blood flow to the vaginal cuff, ultimately hampering postoperative healing.

The anatomic relationship between ureters and pelvic genital organs may lead to unintentional ureteral injury during hysterectomy. The upward traction of the cervix with a uterine manipulator is an important step in moving the uterine artery away to avoid ureteral injury (30). In a recent systematic review, the incidence of lower urinary tract injury, primarily of the bladder and ureters, associated with LH for benign disease was 0.35 (416 patients among 117982 operations) (34). Studies have reported that urinary tract lesions occur more frequently during LH (3, 4, 28). If the patients who underwent LH present with fever, flank pain, or hematuria, the ureteral injury can occur. A CT scan with contrast medium may reveal the presence of urine in the peritoneal cavity (34). In our study, most ureteral injuries were diagnosed postoperatively (50%, 5/10), whereas all the bladder injuries were diagnosed intraoperatively.

Although the intraoperative diagnosis of urinary tract injuries is crucial to decrease the morbidity and AAGL recommended routine cystoscopy after laparoscopic hysterectomies in 2012 (35), there is no evidence that routine cystoscopy significantly increases the diagnosis rate of postoperative urinary tract injury ($p<0.054$ for ureter injury) (36). Ureteral transection and complete occlusion can be efficiently diagnosed by an experienced laparascopic surgeon on cystoscopy, unless the injury is partial (37). We performed cystoscopy to check bilateral ureteral efflux in suspected cases of ureteral injuries and to perform ureteral surgery in the early postoperative period in parallel with this finding. The ureter should be cautiously distinguished from the uterine vessels before the safe coagulation of the uterine vessels. In our study, we demonstrated that thermal diathermy led to ureteral injury in 2 patients. A multicenter Finnish retrospective study regarding LH (38) found that the rate of urinary tract injuries decreased from 1.4% to 0.7% and that of ureteral injuries decreased from 0.9% to 0.3% over 5 years. Our complication rate is an excellent reflection of the learning curve. The total (intraoperative and postoperative) complication rate decreased from 20% (9/45) in 2013 to 2.2% (1/46) in 2017. Particularly, we observed no ureteral injury between 2015 and 2017, and the rate of ureteral injury was 13.3% (6/45) and 5.9% (1/17) in 2013 and 2014, respectively. We can attribute this dramatic decrease in complications to the more effective utilization of uterine manipulators directed toward an upward fashion regardless of the assistant surgeon, use of better bipolar hemostasis instruments, and awareness of the possibility of such injuries.

A Finnish study reported that the rate of bladder injury was 6.9% in patients with LH (39). A recent review regarding urinary tract injuries in LH found that the rate of bladder injury (0.24%) was 3 times higher than that of ureteral injury (0.08%) (34). Bladder injuries most frequently result during the dissection of the vesicouterine peritoneum. Underreporting of the cases with urinary tract injuries may limit the real rate of urinary tract complications. In our study, all bladder injuries (3/151, 2%) were at the dome and restored intraoperatively by laparoscopic suturing. There was no bowel injury, and ureterovaginal or vesicovaginal fistula formation in our study.

The conversion rate to laparotomy varied as 2.7%-3.9% in previously reported studies (37). However, David-Montefiore et al. (40) reported the rate as 19%, which was related to surgical inexperience. The conversion rate to laparotomy was 3.3% in our study, which is consistent with other studies. The limitations of our study are its retrospective nature, small size, and lack of evaluation of the long-term effects, including vaginal vault prolapse, urinary incontinence, and sexual function.

## CONCLUSION

Laparoscopic hysterectomy has numerous beneficial advantages, including short postoperative time interval, limited loss of blood, relatively fewer complications, and good cosmetic view and is a suitable alternative to abdominal hysterectomy when it can be successfully performed by an advanced laparoscopy skilled surgeon. Lower complication (especially urinary) rates can be expected with better handling of the uterus via manipulators during surgery, consideration of anatomical proximities, and following safe dissection rules at all times.

**Ethics Committee Approval:** Ethics committee approval was received for this study from the Ethics Committee of Gaziantep University (Approval number: 2017/415).

**Informed Consent:** Written informed consent was obtained from patients who participated in this study.

**Peer-review:** Externally peer-reviewed.

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**Conflict of Interest:** The authors have no conflicts of interest to declare.

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