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# The effect of experience on the outcomes of total laparoscopic hysterectomy surgery: 1295 cases

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## ABSTRACT

**Objectives:** To reveal the effect of surgeon's experience on the outcomes of the total laparoscopic hysterectomy (TLH) surgery.

**Material and methods:** Design: Retrospective case series. Setting: A tertiary university hospital. Patients: 1295 cases with indication for hysterectomy. Interventions: Total laparoscopic hysterectomy.

**Results:** All cases were grouped according to the surgeon's experience. For 30 different surgeons, their first 20 operations constituted Group A, 21$^{st}$–50$^{th}$ operations Group B, 51$^{st}$–100$^{th}$ operations Group C, and their operations after the 100$^{th}$ surgery Group D. Demographic data and post-operative results were compared between the groups. There were no statistical differences in terms of demographic data and major complications. A statistically significant decrease was observed in the post-operative hemoglobin drop and the duration of hospitalization in the groups with increased experience ($p = 0.021$, $p < 0.001$, respectively). There was no increase in uterine specimen weight with increased experience ($p = 0.267$).

**Conclusions:** We obtained that the peak value in the learning curve could not be evaluated according to the operation time or complication rates. Although the complication rate seems unaffected by surgical experience, concerns about complications may decrease as experience increases. As the trend of minimally invasive surgery will continue to increase in the next century due to higher patient comfort, all gynecologists should gain competence in endoscopic surgery.

**Key words:** complications; hysterectomy; laparoscopy; learning curve; outcomes

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## INTRODUCTION

Hysterectomy is the most common gynecological surgery after cesarean section. There are three main surgical approaches: total abdominal hysterectomy (TAH), vaginal hysterectomy (VH), and total laparoscopic hysterectomy (TLH). Indications for hysterectomy in benign cases include myoma uteri (uterine fibroid), abnormal uterine bleeding, endometriosis, pelvic organ prolapse, and other causes of chronic pelvic pain [1].

Hysterectomy types have certain advantages over each other. Postoperative pain and infection are less common in TLH, but the operative time is longer than in TAH [2]. A wide viewing angle can be obtained in TLH. Shorter operation time and less pain are observed in VH [3]. VH is the most cost-effective type among all operation types [4]. In TAH, the operation time is shorter and although a good visual angle can be achieved thanks to the incision made, post-operative pain and length of hospitalization are increased [2]. Although VH may be considered preferable, the vaginal capacities of the patients and the uterine mass size determine the limits of surgery. The general approach of surgeons when choosing the operation type is the method of hysterectomy that is suitable for the patient's current condition and in which clinicians have more experience.

Major complications of hysterectomy are genitourinary injury, gastrointestinal injury, bleeding more than 1000 mL, wound dehiscence, sepsis, and anesthesia related complications. The trend towards minimally invasive surgery, especially because of the lower rates of major complications, has changed the trend worldwide from abdominal hysterectomy to vaginal hysterectomy and then to laparoscopic hysterectomy. [5, 6]. Although there has been a decrease

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in TLH operation rates after the U.S. Food and Drug Administration mentioned the drawbacks of using morcellators in large mass surgery in USA, minimally invasive surgery reduces the morbidity of patients [7]. In Turkey, there is an increase in TLH surgeries that do not require morcellation [6].

Laparoscopic hysterectomy is dependent on technology and affected by the economic power of the countries. The difficulties in this regard make the training of gynecological endoscopists more difficult. The ability to achieve precision in movements required in minimally invasive surgery is highly influenced by the experience of the surgeon.

In this study, it was aimed to classify 1295 TLH operations performed by surgeons in our tertiary referral hospital according to the experience of surgeons and to investigate how the operation outcomes were affected by experience.

## MATERIAL AND METHODS

A total of 1523 patients who underwent total laparoscopic hysterectomy in our tertiary referral hospital between January 2013 and July 2019 were retrospectively examined. Patients who underwent TLH surgery with or without salpingo-oophorectomy were included in the study. Patients who underwent another operation (sling procedures, Burch, perineorrhaphy etc.) and those who were operated due to a malignant indication were excluded from the study. The study continued with the remaining 1295 cases. Ethical approval was obtained from the institutional ethics committee.

Demographic data such as the patients' age, body mass index (BMI), history of abdominal surgery were reviewed using the hospital archives. Patient diagnosis, duration of the operation (time between the beginning and end of anesthesia), the weight of the removed specimen (g), whether adnexectomy was performed, major complications observed during the surgery, drop of hemoglobin (Hb) level and duration of hospital stay were recorded. Complications were classified into massive hemorrhage (more than 1000 mL), ureteral injury, bladder injury, and intestinal injury (full thickness damage) as major peroperative complications. Patients who underwent laparotomy due to inadequate uterine manipulation, uncontrolled bleeding and complication management were determined.

The operations performed by 30 different surgeons were listed in order of surgeons' experience. The first 20 operations of the surgeons were included in Group A, 21$^{st}$ to 50$^{th}$ operations were included in Group B, 51$^{st}$ to 100$^{th}$ operations were included in Group C, and operations after the 100$^{th}$ were included in Group D. While 30 surgeons were included in Group A, only five surgeons were included in Group D. With this arrangement, Group A consisted of 339 cases, Group B 312, Group C 421, and Group D 223 cases. All variables were compared between these groups and the effect of experience on the surgical outcomes was evaluated.

Statistical analysis: Means were expressed as mean (± SD). The number of subjects and rates were given as n (%). Descriptive statistics were applied to all data. All variables between the groups were evaluated in terms of normality and homogeneity. Kruskall Wallis test was performed for non-parametric continuous variables, and Anova test was performed for parametric continuous variables. Statistically, $p < 0.05$ was considered significant. In post-hoc analysis, Bonferroni test was performed for variables that were homogeneously distributed, and Tamhane test was performed for variables that were not homogeneously distributed. Chi-Square test was performed for categorical variables. Statistical analysis was performed with SPSS 22.0 Edition (Chicago, Ill).

## RESULTS

A total of 228 out of 1523 patients who underwent additional procedures or had gynecological malignancies were excluded from the study. The mean age of 1295 patients was 50 ± 7 years, and their BMI was 25 ± 7.

The three most common reasons for performing TLH in the patients were fibroids (34.2%), endometrial hyperplasia (27.7%), and abnormal uterine bleeding (19.3%), respectively. Of all patients, 178 (13.7%) had a history of abdominal surgery (Tab. 1). The mean operative time was 130 ± 50 minutes in all patients. Adnexectomy was performed in 1090 (84.2%) of the patients. The mean decrease in the hemoglobin level was 1.8 ± 0.8 mg/dL. The weight of uterus removed during hysterectomy was 172 ± 95 g. Duration of hospitalization after surgery was 2.4 ± 1.1 days.

Major complications occurred in 45 (3.5%) of the patients. Massive hemorrhage occurred in 16 (1.2%) patients. Intestinal injury was detected in five (0.4%) patients. Bladder injury was observed in 17 (1.3%) patients, and ureteral injury was detected in seven (0.5%) patients. Laparotomy was performed in 15 (1.2%) patients for management of complications or due to insufficient operative capability.

**Table 1.** Operation indications of 1295 cases with TLH performed

| Indication | n (%) |
|---|---|
| Fibroid | 443 (34.2%) |
| Endometrial hyperplasia | 358 (27.7%) |
| Abnormal uterine bleeding | 250 (19.3%) |
| Adnexal mass | 108 (8.4%) |
| Uterine prolapse | 44 (3.4%) |
| Cervical intraepithelial neoplasia | 42 (3.2%) |
| Chronic pelvic pain | 23 (1.8%) |
| Endometrial polyp | 15 (1.2%) |
| Endometriosis | 8 (0.6%) |
| Pelvic abscess | 4 (0.3%) |

The operations performed by surgeons were arranged based on their experience, and the demographic data were compared between the four groups. No statistically significant difference was found in terms of age, BMI, or history of abdominal surgery (p = 0.082, p = 0.059, p = 0.464, respectively) (Tab. 2).

The most common indication for operation was fibroids in each group. There was no statistically significant difference between adnexectomy rates (p = 0.784). A statistically significant difference was found between the groups in terms of the decrease in hemoglobin level (p = 0.021). The mean decrease in hemoglobin values were 1.95 ± 0.81, 1.92 ± 0.87, 1.88 ± 0.83, and 1.74 ± 0.73 mg/dL in groups A, B, C, and D, respectively. When the post hoc analysis was performed, a statistically significant decrease was found only between groups A and D (p = 0.017). Mean operative times were 138 ± 47, 123 ± 44, 135 ± 56, and 122 ± 48 minutes in groups A, B, C, and D, respectively, and the difference was statistically significant (p < 0.001). In post hoc analysis, a statistically significant decrease was found between A–B, A–D, B–C, and C–D (p < 0.001, p = 0.001, p = 0.009, p = 0.014, respectively). Mean length of hospital stay was 2.6 ± 1.1, 2.6 ± 1.2, 2.3 ± 1, 2.2 ± 1 in groups A, B, C, and D, respectively, and a statistically significant difference was found (p < 0.001). A statistically significant decrease was found between A–C, A–D, B–C, and B–D in post hoc analysis (p = 0.001, p < 0.001, p = 0.004, p < 0.001) (Tab. 3). There was no statistical difference between uterine specimen weights after TLH procedure (p = 0.267). There was no statistically significant difference between the groups in the rates of major complications related to the surgery (p = 0.075). Major hemorrhage occurred in 4 (1.2%), 7 (2.2%), 3 (0.3%), and 2 (0.9%) patients in groups A, B, C, and D, respectively. Bladder injury was detected in 3 (0.9%), 5 (1.6%), 4 (1%), and 5 (2.2%) patients in groups A, B, C, and D, respectively. While ureteral injury did not occur in group A, it occurred in 3 (1%), 2 (0.5%), and 2 (0.9%) patients in groups B, C, and D, respectively. While no intestinal injury was observed in group A, it occurred in 1 (0.3%), 2 (0.5%) and 2 (0.9%) patients in groups B, C and D, respectively. Laparotomy was performed during the operation in 5 (1.5%), 4 (1.3%), 4 (1%), 2 (0.9%) patients in groups A, B, C, and D, respectively.

## DISCUSSION

According to our study, it was observed that the results of TLH surgeries performed in our tertiary hospital were affected by experience only in some areas. A statistically significant decrease was observed in the hemoglobin drop especially after the 100$^{th}$ operation. There was no increase in the hysterectomy material size as experience increased. Length of hospital stay decreased statistically significantly after the 50$^{th}$ operation.

When the major complications were examined, no ureteral and intestinal injury was detected among the first 20 TLH operations. We believe that in our hospital's protocol, performing the first surgeries under the control of professional endoscopists prevents significant complications. Effective bleeding control improved with experience. Rates of major hemorrhage, ureteral and intestinal injury were less than one percent after the 50$^{th}$ surgery. It was observed that the need for laparotomy decreased with increased experience. Bladder injury was found to be increased especially after the 100$^{th}$ operation. This may be due to the increase in surgical self-confidence. Although the total complication rate seems unaffected by surgical experience, concerns about complications may decrease as experience increas-

**Table 2.** Demographic data and operational outcomes in all groups

| | All case (n = 1295) | Group A (n = 339) | Group B (n = 312) | Group C (n = 421) | Group D (n = 223) | p-value |
|---|---|---|---|---|---|---|
| Age (year) | 50 ± 7 | 49 ± 7 | 50 ± 8 | 49 ± 7 | 50 ± 8 | 0.082 β |
| BMI [kg/m$^2$] | 25 ± 7 | 25 ± 5 | 25 ± 4 | 25 ± 5 | 26 ± 6 | 0.059 β |
| History of abdominal surgery | 178 (13.7%) | 38 (11.2%) | 47 (15.1%) | 61 (14.5%) | 32 (14.3%) | 0.464 × |
| Operation duration (min) | 130 ± 50 | 138 ± 47 | 123 ± 44 | 135 ± 56 | 122 ± 44 | < 0.001 α |
| Hemoglobin drop [mg/dL] | 1.8 ± 0.8 | 1.95 ± 0.81 | 1.92 ± 0.87 | 1.88 ± 0.83 | 1.74 ± 0.73 | 0.021 β |
| Adnexectomy | 1090 (84.2%) | 291 (85.8%) | 259 (83%) | 353 (83.8%) | 187 (83.9%) | 0.784 × |
| Uterine specimen (g) | 172 ± 95 | 163 ± 85 | 166 ± 92 | 178 ± 97 | 183 ±112 | 0.267 α |
| Hospital stay (day) | 2.4 ± 1.1 | 2.6 ± 1.1 | 2.6 ± 1.2 | 2.3 ± 1 | 2.2 ± 1 | < 0.001 α |
| Major complication | 45 (3.5%) | | | | | 0.075 × |
| Major hemorrhage | 16 (1.2%) | 4 (1.2%) | 7 (2.2%) | 3 (0.3%) | 2 (0.9%) | N/A |
| Bladder injury | 17 (1.3%) | 3 (0.9%) | 5 (1.6%) | 4 (1%) | 5 (2.2%) | N/A |
| Ureteral injury | 7 (0.5%) | – | 3 (1%) | 2 (0.5%) | 2 (0.9%) | N/A |
| Intestinal injury | 5 (0.4%) | – | 1 (0.3%) | 2 (0.5%) | 2 (0.9%) | N/A |
| Transition to laparotomy | 15 (1.2%) | 5 (1.5%) | 4 (1.3%) | 4 (1%) | 2 (0.9%) | N/A |

α = Kruskal Wallis; β = Anova; × = Pearson Chi-Square; N/A — not applicable

**Table 3.** Post hoc analysis

| | A–B | A–C | A–D | B–C | B–D | C–D | p-value |
|---|---|---|---|---|---|---|---|
| Operation duration | < 0.001 μ | 0.955 μ | 0.001 μ | 0.009 μ | 1 μ | 0.014 μ | < 0.001 α |
| Hemoglobin drop | 1 Ω | 1 Ω | 0.017 Ω | 1 Ω | 0.082 Ω | 0.228 Ω | 0.021 β |
| Hospital stay | 1 μ | 0.001 μ | < 0.001 μ | 0.004 μ | < 0.001 μ | 0.501 μ | < 0.001 α |

α = Kruskal Wallis; β = Anova; μ = Tamhane; Ω = Bonferroni

es. The ability to complete the operation laparoscopically increases in parallel with experience.

The literature was reviewed about when the plateau in the TLH learning curve is reached. There are authors who have argued that this plateau occurs in the 20$^{th}$, 25$^{th}$, or 75$^{th}$ patients [2, 8, 9]. We classified our groups according to similar values. In the literature, when evaluating the time to reach the plateau of the learning curve, the reduction in the operation time or a decrease in complications has been taken into account. Since we could not observe a homogeneous and normal distribution in our study, it was not possible to create a learning curve based on the decrease in complication rates. The rate of major complications observed in TLH surgeries in the literature varies between 1% and 11.1% [8, 10–12]. In the present study, we found this rate to be 3.5%.

We could not create a learning curve based on the reductions in operative time either, because there was no steady decrease. As in a study by Mavrova et al. [8], increases and decreases can be observed in the duration of surgery regardless of experience. Despite the increasing level of experience in their study, the mean operative time was 136, 118 and 122 minutes, respectively. Similar results were obtained in our study. We do not find it appropriate to determine the plateau time in the learning curve according to this parameter, which is affected by individual surgical skills and surgical instruments.

There is a need for rapid circulation of patients in our clinic, and thus we prefer laparoscopic and vaginal hysterectomies to reduce the length of hospital stay. When Walsh et al. [13] examined the results of TAH and TLH surgeries in a meta-analysis, it was found that the duration of hospital stay was reduced in laparoscopic hysterectomies and the operating time was 22 minutes longer in TLH. In our clinic, patients who underwent TLH are discharged on the second postoperative day and the operation takes an average of two hours, including anesthesia. Primary findings for discharge; general condition of the patient, vital stability, and normalization of bowel and urinary functions.

In the literature, the most common indications for TLH are fibroids and abnormal uterine bleeding as they usually occur together [14]. The most common TLH indication was fibroids in each group in our study.

One of the problems in laparoscopic surgery is taking the uterine specimen out of the abdomen. The most important method for gynecologists to avoid this problem is to remove the specimen from the vagina. It is difficult to remove masses over 10 cm in diameter through the vagina after hysterectomy. In these cases, it is necessary to remove the mass by reducing it with a cold scalpel via vaginal orifice or to perform morcellation in an endobag. We do not use the morcellator in our clinic due to the possibility of pathological implantation.

A study by Cianci et al. [15], evaluated the outcomes of TLH operation performed by surgeons with an experience of at least 100 TLH surgeries using a morcellator for uteruses larger than 300 g. They found the mean uterine size to be 622 (301–3882) g, and the major complication rate was 3.5%. When they divided the cases according to the experience of the surgeons, they found that experience did not affect the rate of major complications. Transition to laparotomy was required in 9.8% of the cases [15]. In our study, when the operation outcomes of surgeons with an experience of more than 100 TLH surgeries were evaluated, the rate of major complications was 0.05%, and the rate of transition to laparotomy was 0.9%. We consider that the reason for the lower rate of complications compared with the study by Cianci et al. [15] is directly related to the size of the uterine mass. In addition, we think that it is the main reason for transition to laparotomy. We hypothesise that it is necessary to pay attention to eligibility of the patients for TLH in order to reduce morbidity. In our group consisting of surgeons who were specialized in TLH and performed more than 100 operations, the mean uterine mass size was 183 (range: 60–740) g.

In our clinic, cystoscopy is not routinely performed after TLH operation. We perform it after selected procedures. We prefer to perform it in patients who underwent incontinence surgery, prolapse surgery, and in patients with large cervical myoma. In the series of Vakili et al. [16] consisting of 471 cases, urinary system injuries were detected at a rate of 4.8% after TLH, and the injury was detected without performing cystoscopy in 35.3% of bladder injuries and in only 12.5% of ureteral injuries. There are also articles arguing that not performing routine cystoscopy may delay

the diagnosis of urinary tract injuries for two to 20 days [17]. Visco et al. [18] investigated the cost-effectiveness of performing cystoscopy and it was found to be cost-effective when the rate of urinary tract injury was above two percent in TLH patients.

Laparoscopic surgery is currently very popular in malignant indications as well as benign indications. There are clinics that accept it as a safe approach especially in obese patients with endometrial carcinoma. Due to the requirement of lymph node sampling, a longer operative time is observed in malignant indications compared to TLHs performed due to benign indications [19]. In patient groups undergoing laparoscopic surgery, especially longer operative time, shorter hospital stay, and less wound infections have been detected compared with those undergoing laparotomic surgery [20]. In a study examining the outcomes of TLH operation in obese and non-obese patients, complication rates were found to be similar [12]. We believe that TLH is the primary procedure, especially in cases of increased risk of wound infection, such as diabetes, inadequate self-care, and obesity.

## CONCLUSIONS

The strength of our study was the large patient series consisting of 1295 cases in which the same surgical technique was applied in a single center, and its limitation was that we had insufficient data on post-operative long-term complications, because it was a retrospective data search. In addition, differences in surgical skills and periodic surgical instrument changes caused inconsistency in the results for operative time.

As the trend of minimally invasive surgery will continue to increase in the next century due to higher patient comfort, all gynecologists should gain competence in endoscopic surgery.

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### *Statement of ethics*

Local ethics committee approval was obtained.

This study was carried out in consensus with our university´s ethics guidelines.

### *Conflict of interest*

The authors declare that they have no conflict of interest.

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