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Influence of previous abdominal surgery on clinical outcomes of patients undergoing total laparoscopic hysterectomy

Eun Seok Seo, Seung Ho Lee, Seung Joo Chon, Sun Young Jung, Yoon Jin Cho, Soyi Lim

Department of Obstetrics and Gynecology, Gil Medical Center, Gachon University, Incheon, Korea

Objective
To evaluate the potential effects of previous abdominal surgery on post-operative outcome and incidence of complications after total laparoscopic hysterectomy (TLH).

Methods
Between June 2008 and December 2016, 331 patients who underwent TLH were retrospectively reviewed. Participating patients were divided into 2 groups according to previous abdominal surgery. We compared the 2 groups based on estimated blood loss, operation time, hospital stay, surgery-related complications, and conversion to laparotomy rates.

Results
Group 1 included patients without a history of abdominal surgery (n=186), group 2 included patients with a history of abdominal surgery (n=145). The complication rate was 3.2% in group 1 and 2.8% in group 2. Other post-operative outcome and complications such as estimated blood loss, hospital stay and conversion to laparotomy rates did not differ significantly between groups. Adhesiolysis was significantly more common in group 2 (P<0.001) and operation time was significantly longer in the group 2 (P=0.004). The rate of conversion to laparotomy was higher in group 2, but this difference was not significant (P=0.115). Group 2 patients were divided into subgroups according to the number of surgery. In subgroups analysis of group 2, there were 70 patients who had one previous abdominal surgery and 75 patients who had 2 or more previous surgeries. Moreover, there were significant differences in adhesiolysis (P=0.004) and conversion to laparotomy (P=0.034). There were no significant differences in other complications observed upon subgroup analysis.

Conclusion
TLH can be conducted successfully regardless of previous abdominal surgery. Patients with previous abdominal surgery are suitable and feasible candidates for TLH.

Keywords: Laparoscopy; Hysterectomy; Postoperative complications

Introduction

Since the first total laparoscopic hysterectomy (TLH) reported by Reich [1] in 1989, TLH has been accepted as a safe, effective and acceptable alternative to standard abdominal hysterectomy [2,3]. The entire TLH procedure, including closure of the vaginal vault, is performed via the laparoscopic route. As a result, it is the most complicated type of laparoscopic hysterectomy and requires a high level of surgical expertise [4].

Although laparoscopic hysterectomy has the advantages of

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Corresponding author: Soyi Lim
Department of Obstetrics and Gynecology, Gil Medical Center, Gachon University, 21 Namdong-daero 774-beon-gil, Namdong-gu, Incheon 21565, Korea
E-mail: vclover@hanmail.net
https://orcid.org/0000-0001-8886-3107

blood loss, reduced hospital stays, less pain and less invasive surgery compared to abdominal hysterectomy [5-7], it can be converted to laparotomy if there is severe obesity, large size of leiomyoma or adhesion caused from previous abdominal surgery. The occurrence of intra-abdominal adhesions after laparotomic surgery ranges from 30% to 90% [8,9] and several studies have suggested that a history of surgery is most closely associated with the incidence of complications during laparoscopic surgery because of intra-abdominal adhesions [10,11]. Several recent studies have suggested that previous abdominal surgery is not associated with complication rates during TLH [12-14]; therefore, there is controversy regarding whether it is safe and feasible to perform TLH in patients who have undergone previous abdominal surgery. In the present study, we evaluated the influence of previous abdominal surgery on the safety and feasibility of TLH.

Materials and methods

1. Patients

All consecutive patients who underwent TLH from June 2008 to December 2016 were retrospectively evaluated. Additionally, all patients referred for hysterectomy with a benign condition and precancerous lesions (e.g., cancer *in situ*) were included in this study, while patients diagnosed with malignant tumors were excluded. The data were obtained from our departmental database and the information in the database was verified by a detailed medical record review of each patient. This study was approved by the Institutional Review Board of Gil Medical Center (No. GBIRB2017-390).

The patients were divided into 2 groups according to previous abdominal surgery. Group 1 included patients without a history of abdominal surgery and group 2 included patients with a history of abdominal surgery. Previous abdominal surgeries include laparoscopic or open surgery. Group 2 patients with a history of surgery were divided into subgroups of those who had received one surgery and those who had received 2 or more surgeries. We compared the 2 groups based on estimated blood loss, uterine weight, hospital stay, conversion to laparotomy rate and surgery-related complications. All surgeries were performed by a single surgeon (S. Lim).

2. Surgical techniques used for TLH

We used a 4-port technique, with a 12-mm trocar placed through umbilical incision, and two 5-mm trocars placed about 4–5 cm below the umbilicus in the right and left paramedian position. Additionally, a 5-mm trocar was inserted about 10 cm below the umbilicus in the midline. The uterus was removed vaginally and the vaginal vault was sutured laparoscopically with intra-coporeal ties or barbed sutures. In many cases, the uterus was removed intact vaginally, but when the uterus was large, it was incised using a scalpel prior to removal via the vagina. All patients received antibiotics 1 hour prior to surgery, as well as intra and post operatively. Foley catheters were usually removed on the first post-operative

Table 1. Clinical characteristics of patients undergoing total laparoscopic hysterectomy

Variables	Group 1 (n=186)	Group 2 (n=145)	*P*-value
Age (yr)	47.7±6.6	45.9±6.4	0.011
Parity	1.98±0.82	2.0±0.76	0.842
BMI (kg/m^2)	23.7±3.3	23.6±3.3	0.734
Indications for TLH			
Leiomyoma/adenomyosis	137 (73.7)	128 (88.3)	0.001
Bleeding	69 (50.3)	66 (51.6)	
Pelvic pain	47 (34.3)	53 (41.4)	
Pelvic pressure	4 (2.9)	4 (3.1)	
Size growth	38 (27.7)	37 (28.9)	
High grade CIN/CIS/AIS	37 (19.9)	10 (6.9)	0.001
EM hyperplasia/EM polyps	12 (6.4)	7 (4.8)	0.529

Values are presented as means±standard deviation or number (%).
TLH, total laparoscopic hysterectomy; BMI, body mass index; CIN, cervical intraepithelial neoplasia; CIS, carcinoma *in situ*; AIS, adenocarcinoma *in situ*; EM, endometrial.

day and a liquid diet was started on the first post-operative day.

3. Statistics analysis

Statistical analysis was performed using the two sample *t*-test, χ^2 test, and Fisher's exact test. A $P<0.05$ was considered statistically significant. All data were analyzed using SPSS version 18.0 (SPSS Inc., Chicago, IL, USA).

Table 2. Types of previous surgery

Variables	Group 2 (n=145)
Cesarean section	96 (66.2)
1	37 (25.5)
2	50 (34.4)
3	9 (6.2)
Appendectomy	26 (17.9)
Adnexal surgery, open	20 (13.7)
Adnexal surgery, scope	9 (6.1)
Myomectomy, open	4 (2.7)
Myomectomy, scope	4 (2.7)
Laparoscopic cholecystectomy	5 (3.4)
Others	4 (2.7)
Mean No. of previous surgeries	0.75±1.01
No. of previous surgery	
1	70 (48.3)
2	53 (36.6)
3	16 (11.0)
4	6 (4.1)

Values are presented as means±standard deviation or number (%).

Results

A total of 437 patients received TLH during the study period, of which 106 were excluded because of cancer and insufficient data; therefore, 331 patients participated in the study. Overall, there were 186 patients in group 1 and 145 in group 2. The characteristics of the patients and the indication for TLH are shown in Table 1. There were no significant differences in terms of parity and body mass index (BMI) between groups. The mean age was significantly younger in group 2 (P=0.011). The most frequent operative indications for hysterectomy were 73.7% and 88.3% leiomyoma/adenomyosis in group 1 and 2, respectively. There was a statistically higher incidence of leiomyoma/adenomyoma in group 2 (P=0.001) and a significantly higher incidence of high grade cervical intraepithelial neoplasia (CIN)/carcinoma *in situ* (CIS)/adenocarcinoma *in situ* (AIS) in group 1 (P=0.001).

The numbers and types of previous abdominal surgery are summarized in Table 2. Of the previous abdominal surgeries, cesarean section was the most common in 96 cases (66.2%), followed by appendectomy in 26 cases (17.9%). A total of 29 adnexal surgeries (20%) were performed, including 20 lapa-

Table 3. Comparison of outcomes and complications among groups after total laparoscopic hysterectomy

Variables	Group 1 (n=186)	Group 2 (n=145)	*P*-value
Estimated blood loss (mL)	209±139	224±170	0.370
Uterine weight (g)	276.7±183.0	279.2±169.0	0.898
Operation time (min)	94.9±32.7	105.5±32.1	0.004
Post-operative hospital stays (day)	4.26±1.70 (2–17)	4.09±1.31 (2–8)	0.316
Adhesiolysis	21 (11.3)	61 (42.1)	<0.001
Conversion to laparotomy	5 (2.7)	9 (6.2)	0.115
Transfusion	3 (1.6)	12 (8.3)	0.002
Complication			
Fever	4 (2.2)	0	0.134
Ureter injury	1 (0.5)	0	0.438
Vaginal cuff dehiscence/bleeding	0	2 (1.4)	0.191
Reoperation d/t bleeding	0	1 (0.7)	0.438
Readmission within 30 days	1 (0.5)	2 (1.4)	0.538

Values are presented as mean±standard deviation, number (range), or number (%).

Table 4. Comparison of complications between groups divided by number of surgeries

Variables	1 (n=70)	2 or more (n=75)	*P*-value
Adhesiolysis	21 (0.3)	40 (53.3)	0.004
Conversion to laparotomy	1 (1.4)	8 (10.7)	0.034
Transfusion	1 (1.4)	11 (14.7)	0.005
Complication			
Bleeding	0	1 (1.3)	1.000
Fever	0	0	NA
Ureter injury	0	0	NA
Vaginal cuff dehiscence/bleeding	0	2 (2.7)	0.497
Reoperation	0	1 (1.3)	1.000
Readmission within 30 days	0	2 (2.7)	0.497

Values are presented as number (%).
NA, not available.

Table 5. Reason for conversion to laparotomy

Variables	Group 1 (n=186)	Group 2 (n=145)	*P*-value
Pelvic adhesion	4	6	
Uterine size (inadequate visualization)	1	3	
Total	5 (2.7)	9 (6.2)	0.115

Values are presented as number (%).

rotomy surgeries (13.7%) and 9 laparoscopic surgeries (6.1%). Moreover, there were 8 cases (5.4%) of myomectomy, 5 cases (3.4%) of laparoscopic cholecystectomy and 4 cases (2.7%) of other operations. The mean number of previous surgeries was 0.75±1.01 times. Seventy patients underwent surgery once and 75 patients underwent 2 or more operations.

The overall complication rate was 3.0%, occurring in 6 patients (3.2%) in group 1 and 4 patients (2.8%) in group 2, which was not significantly different. There was more frequent adhesiolysis (P<0.001) and transfusion (P=0.002) in the group 2. Also, operation time was significantly longer in the group 2 patients with a history of surgery. One case of intra-abdominal bleeding was recognized on postsurgical day 1, for which transfusion and laparoscopic reoperation were required. However, there were no significant differences in estimated blood loss, post-operative hospital days, uterine weight, bleeding, ureter injury, and vaginal cuff dehiscence/bleeding (Table 3).

Group 2 patients with a history of surgery were divided into subgroups according to the number of operations. There were 70 patients (48.2%) who had previously undergone abdominal surgery and 75 patients (51.7%) who had 2 or more previous abdominal surgeries. Upon subgroups analysis of group 2, transfusion (P=0.005), adhesiolysis (P=0.004), and conversion to laparotomy (P=0.034) were all significantly more common. However, there were no significant differences in estimated blood loss, post-operative hospital days, uterine weight, bleeding, ureter injury, and vaginal cuff dehiscence/bleeding (Table 4).

A total of 14 cases (4.2%) were converted from TLH to laparotomy with 5 (2.6%) in group 1, and 9 (6.2%) in group 2. There was no significant difference between groups in conversion rate. In group 1, one case had severe adhesion because of severe endometriosis. This case showed dense adhesion between the uterus and left adnexa and sigmoid colon, in the right adnexa there was dense adhesion between the right lateral pelvic wall. Posterior cul-de-sac obliteration was completed and total score was 83 points, corresponding to the endometriosis stage IV. Because of the dense adhesion, the traction of the organ was limited and it was difficult to dissection using laparoscopic instrument and so converted to laparotomy. In 3 cases, adhesion was severe, but no specific cause was found, and one of these patients was converted because of inadequate visualization due to uterine size and myoma location in group 1. In group 2, 6 cases required conversion to laparotomy because of severe pelvic adhesion,

of which 5 cases had multiple previous abdominal surgeries (mean 2.8, range 2–4). Three patients required conversion because of inadequate visualization due to large uterine size rather than pelvic adhesion (Table 5).

Discussion

We compared complications and outcomes according to the history of abdominal surgery. In this study, the complication rates did not differ significantly between groups. Moreover, surgery-related complications such as fever, ureter injury, vaginal cuff bleeding and reoperation did not differ significantly between groups. Moreover, outcomes such as uterine weight, hospital stay, and estimated blood loss were not significantly different between groups. However, adhesiolysis and transfusion were significantly higher in group 2 (P<0.001, 0.002, respectively). Moreover, pelvic adhesion in group 2 was more common; therefore, adhesiolysis was performed more often and operation time was significantly longer in this group (P=0.004). In addition, 8 cases (66.7%) of transfusion in group 2 were caused by anemia due to heavy menstruation or vaginal bleeding that was not corrected before surgery. However, there was no significant difference in estimated blood loss between groups. Therefore, the transfusion in this study does not reflect the amount of bleeding in the actual operation, indicating that transfusion is not a complication associated with the surgery. We use transfusion strategy with a threshold hemoglobin (Hb) of 7 g/dL for most hemodynamically stable patient and we performed transfusion in all patients with Hb <10 g/dL in the presence of symptomatic anemia and persistent bleeding. Also, transfusion was not performed for the patients with Hb >10 g/dL. In these cases, we did not correct anemia before surgery because of the psychological rejection of transfusion by patients and concerns about fever and infection associated with the transfusion.

The overall complication rate of 3.0% in the present study was lower than in previously conducted studies (5.7%–19.0%) [13,15-18]. The reason for the relatively low complication rate in this study is presumably because an experienced surgeon performed TLH. Mäkinen et al. [17] reported a significant drop in the risk to the ureter when the surgeon has carried out a minimum of 30 operations. Therefore, in this study, surgeons who performed more than 30 TLHs are defined as experienced, and the surgeon involved in this study had sufficient experience. Another reason for the low complication rate observed in the present study is that the surgeon participating was experienced surgeon. As a result, the consistent technique and case selection may have reduced bias. Recently TLH has been utilized as a safe, effective and feasible method with many advantages over the abdominal approach in terms of blood loss, reduced hospital stays and better cosmetic results. However, TLH requires greater surgical expertise than other hysterectomy methods, and it is known that urinary tract injury is more likely [4,6]. In addition, surgeons may encounter challenges and potential risks when dealing with a large uterus (≥500 g), high BMI (≥30 kg/m^2) patients and patients with previous abdominal surgery [19,20]. Several studies have reported that intra-abdominal adhesions occur 30%–90% of patients after laparotomic surgery [8,9], and Sokol et al. [21] reported that pelvic adhesions and previous laparotomy were correlated with an increased risk of conversion to laparotomic surgery during gynecologic laparoscopy. Moreover, Wang et al. [13] suggested that major complications and conversion rate were associated with an increased number of cesarean sections. The main reason for conversion to laparotomy in the cesarean section patients was dense bladder or bowel adhesion. In the present study, the adhesion severity was graded from 0 to 3 as: 0, none; 1, filmsy and avascular; 2, dense and/or vascular; or 3, cohesive, all adhesiolysis cases were grade 2 or higher adhesion in the scoring system. Adhesiolysis was significantly more common in group 2 (11.3% vs. 42.1%, P<0.001), which had previously undergone abdominal surgery, and the conversion rate in group 2 was higher than in group 1 (2.6% vs. 6.2%, P=0.115). However, there was no significant difference in the conversion between the 2 groups. The present study differs from previous studies in that we showed adhesion was not statistically related to conversion rate in groups with or without previous abdominal surgery.

In subgroup analysis, we compared between patients who received surgery once to those who received 2 or more surgeries and found significant higher rates of conversion, adhesiolysis and transfusion among patients who had undergone more than 2 surgeries, but other complications did not differ significantly between the 2 groups. The most notable of these is the significant increase in conversion rate with increasing number of surgeries observed upon subgroup analysis. However, except for the conversion rate, other surgery related complications such as ureter injury, reoperation and vaginal cuff dehiscence did not differ significantly. Therefore, an increase in the conversion rate with an increase in the

number of previous abdominal surgeries does not indicate that TLH becomes less secure and less feasible as the number of previous abdominal surgeries increases. Selection of TLH as an approach to hysterectomy in patients who have had more than 2 abdominal surgeries is quite possible; however, if the number of operations is increased and the size of the uterus is large, great care should be taken when considering laparotomy during TLH. This selection can reduce unnecessary conversions by improving the case selection if conducted by an experienced surgeon. However, TLH can be performed with sufficient stability even when there is a history of surgery; therefore, there is no need to avoid TLH in such cases.

It should be noted that this study was limited based on its small number of patients relative to other studies. Moreover, investigations based on single surgeons may have a longer duration than those of other studies. Because we used data from a relatively long period of 8 years, we believe that there may have been bias caused by changes in surgical equipment, anti-adhesion agents, operating room environments and assistant's experience over time.

In conclusion, TLH can be performed successfully in most patients, and no significant differences were observed in post-operative hospital stay, blood loss, complication rate or conversion to laparotomy between patients with and without previous abdominal surgery. Thus, TLH can be considered for patients with a history of abdominal surgery.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

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