

Comparison between Laparoendoscopic Single-Site and Conventional Laparoscopic Surgery in Mature Cystic Teratoma of the Ovary

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Abstract

Objective: The objective of the study is to compare the intra- and post-operative outcomes of laparoendoscopic single-site surgery (LESS) and conventional laparoscopic surgery (CLS) in mature cystic teratoma (MCT) of the ovary.

Methods: We reviewed 254 patients who underwent surgery (cystectomy) for ovarian MCT from March 1, 2014, to August 31, 2016. During the study period, 216 patients underwent LESS and 38 patients underwent CLS. The outcome measures included operation time, estimated blood loss, changing hemoglobin (Hb) level, postoperative pain, and complications. Statistical analysis was performed using SPSS 24.

Results: There was no statistically significant difference in age, body mass index, sexual experience, cyst size, operative time, adhesiolysis, preoperative Hb, Hb changes, postoperative pain scores (visual analog scale), hospital days, and complications between the two groups. In emergent situation, the frequency of CLS was high as three cases (7.9%) versus one case (0.5%, $P=0.007$) with LESS. As the year progressed, the frequency of LESS increased. There were one case of re-operation for bleeding control and transfusion, one case of postoperative peritonitis and transfusion, and one case of postoperative transfusion in LESS. During LESS, additional port(s) was/were created in 13 cases (6.0%, $P=0.249$).

Conclusions: LESS is not inferior to CLS in MCT surgery, and LESS is useful for the surgery of MCT. Our study demonstrates that LESS confers feasibility, convenience, and safety regarding cystectomy of MCT.

Keywords: Cystectomy, laparoscopic single site surgery, LESS, mature cystic teratoma, single port access, SPA

INTRODUCTION

Mature cystic teratoma (MCT) of the ovary has a wider age distribution than other ovarian germ cell tumors, but more than 80% of MCTs develop during the reproductive period. Approximately 25% of maximal MCTs occur in the postmenopausal women but can also occur in newborns.^[1] Because the preservation of fertility is important, ovarian cystectomy is the desired treatment for ovarian conservation. Ovarian cystectomy is almost always possible even if only a small amount of ovarian tissue remains.

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Since the 1980s, laparoscopic techniques have increasingly been used in gynecologic surgery. Laparoscopic techniques have become popular alternatives to laparotomic surgery because of many advantages such as pain relief, short hospital stay, excellent cosmetic benefits, and reduced intra-abdominal adhesions. Currently, many benign diseases requiring gynecologic surgery are primarily treated by laparoscopic surgery.^[2]

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In 2008, gynecologic laparoendoscopic single-site surgery (LESS) was introduced.^[3-5] LESS has been implemented in many institutions since then, and related studies have also been published. LESS appears to be less invasive than conventional laparoscopic surgery (CLS) and seems to have several advantages, such as easy specimen removal which is highly convenient in operating MCT. LESS has been widely implemented at Samsung Medical Center (Sungkyunkwan University School of Medicine, Korea) since 2008.^[6] However, there have been few studies on the comparative validity of LESS and CLS for the surgical treatment of MCT. The purpose of this study was to compare the operative outcomes of LESS versus CLS in ovarian cystectomy for MCT.

METHODS

We reviewed 254 patients who underwent surgery (cystectomy) for ovarian MCT from March 2014 to August 2016 (30 months). During the study period, 216 patients underwent LESS and 38 patients underwent CLS by nine physicians (6 faculty members – TJ Kim, DS Bae, BG Kim, JW Lee, CH Choi, and YY Lee, and 5 clinical fellows). The outcome measures included operation time, estimated blood loss (EBL), change in hemoglobin (Hb) level, postoperative pain, and complications. We also analyzed the trend of LESS for MCT in Samsung Medical Center. Statistical analysis was performed using SPSS 24 software (SPSS Inc., Chicago, IL, USA). The Samsung Medical Center has approved human experimentation. Institutional Review Board Project #SMC 2019-07-186-001 was obtained on 9-Aug-2019.

The age of the patient was measured at the time of admission for surgery. The hospital stay was defined as the number of days from surgery to discharge. Patients were divided according to the history of adhesiolysis and sexual intercourse. Patients were also divided based on elective or emergent surgery. The frequency and operative time of LESS and CLS cases were examined according to the period by about 10 months.

The size of the cyst (in mm) was measured by magnetic resonance imaging (MRI), computed tomography (CT), and ultrasonography. When a patient had more than one cyst, the biggest size of the cyst was indicated. CT or MRI measurements were used when ultrasonography, CT, or MRI was performed together. Hb (g/dL) was measured up to 1 month before surgery and again the day after surgery. EBL (in mL) was measured during surgery. Pain scores were based on the visual analog scale (VAS) and ranged from 0 to 10 points. Scores were measured once before surgery, immediately after surgery, 6 h after surgery, and 12 h after surgery. Comparisons were made based on the time of measurement, and scores

were added together. The operation time was measured in minutes. Postoperative complications, including transfusion, were investigated.

Women with sexual experience were operated on using a vaginal manipulator, while women without sexual experience did not use a vaginal manipulator. Moreover, the difference in operation time was investigated.

RESULTS

There was no difference in age, body mass index, coitus history (sexual experience), previous operative history, or preoperative Hb level between the LESS and CLS groups [Table 1]. The size of the cysts and previous operative history were not different between the two groups.

There was no difference in hospital stay as a result of the surgical procedure. The hospital stay was 2.7 days for CLS and 2.4 days for LESS, and most of them were discharged the next day after surgery.

There were no significant differences between the two groups in adhesiolysis, EBL, Hb change, and total operation time [Table 2]. Regardless of coitus experience, there was no statistical difference in operation time. In the absence of sexual experience in each surgical procedure, the operation

Table 1: Preoperative characteristics of patients

	Conventional (n=38)	LESS (n=216)	P
Age, mean (range)	31.6 (10-47)	29.2 (8-49)	0.135
BMI (kg/m ²), mean (range)	22.7 (17.2-31.5)	21.5 (14.3-38.4)	0.038
Coitus history, n (%)			1.000
No	6 (15.8)	34 (15.7)	
Yes	32 (84.2)	182 (84.3)	
Size (mm), mean (range)	75.1 (34.0-178.0)	72.2 (13.0-677.0)	0.660
Location of cysts, n (%)			0.079
Unilateral	28 (73.7)	184 (85.2)	
Bilateral	10 (26.3)	32 (14.8)	
Previous operative history, n (%)			0.135
Cesarian section	1 (2.6)	5 (2.3)	
Laparoscopic adnexal surgery	0 (0.0)	6 (2.8)	
Laparoscopic other (myomectomy)	1 (2.6)	0 (0.0)	
Laparotomy adnexal surgery	2 (5.3)	6 (2.8)	
Laparotomy appendectomy	1 (2.6)	3 (1.4)	
Laparotomy other (hysterectomy)	1 (2.6)	1 (0.5)	
None	32 (84.2)	195 (90.3)	
Pre-Op Hb (g/dL), mean (range)	12.9 (9.8-14.7)	13.1 (8.8-15.5)	0.131

BMI: Body mass index, Pre-Op Hb: Preoperation haemoglobin, LESS: Laparoendoscopic single-site

time was slightly longer but not significant. (77.9 min vs. 93.3 min in CLS [$P = 0.352$] and 78.0 min vs. 85.7 min in LESS [$P = 0.125$]).

The preoperative VAS score and postoperative VAS score showed no significant difference between the two groups.

The operative time was 80.3 (39.0–198.0) min in CLS and 79.2 (34.0–184.0) min in LESS ($P = 0.856$). There was no significant difference between the two groups. Of the 38 CLS, 3 (7.9%) were emergency operations [Table 3]. Of the 216 LESS surgeries, 1 (0.5%) was an emergency operation ($P = 0.007$). In emergency, there is a tendency to prefer CLS than LESS. From March to December 2014, LESS was performed in 77.3% (75/total 97). During the next two 10 months, 92.9% (65/total 70) and 87.4% (76/total 87), respectively. There was no significant difference in operation time between CLS and LESS during each study period.

There happened three complications (1 case of transfusion, 1 case of re-operation and transfusion, and 1 case of peritonitis and transfusion) in LESS although there was no statistical difference [Table 4]. There were no cases of conversion to laparotomy, wound hernia, wound dehiscence, or re-admission within 90 days. Thirteen cases (6.0%) required additional port(s) during LESS. Three patients in LESS showed cyst recurrence during the follow-up period. All these cysts are 1–3 cm in size and are not indicated for surgery.

DISCUSSION

In this study, we retrospectively analyzed cases of LESS and CLS in MCT patients. An advantage of our study was that 254 subjects were enrolled from a single center. During the study period, there was no fundamental difference between patients who underwent LESS and CLS. Furthermore, there was no significant difference in postoperative complications between these two groups.

The patients who took laparoscopic adnexal surgery are discharged the next day after surgery in Samsung Medical Center according to the hospital policy.

LESS has fewer ports than CLS. Therefore, postoperative pain is thought to be less. However, the pain felt by individual patients is very subjective and difficult to objectify because the patient can experience only one approach from LESS or CLS. Of note is that LESS has a postoperative pain score of 0 points more than CLS.

After LESS surgery, there were one case of transfusion, one case of re-operation and transfusion, and one case of peritonitis and transfusion. One case involved a 30-year-old unmarried woman with sexual experience who underwent

Table 2: Surgical outcomes of conventional laparoscopic surgery and laparoendoscopic single-site

	Conventional (<i>n</i> =38)	LESS (<i>n</i> =216)	<i>P</i>
Hospital stay (day), mean (range)	2.7 (1-7)	2.4 (1-4)	0.109
Adhesiolysis, <i>n</i> (%)	5 (13.2)	24 (11.1)	0.929
Post-Op Hb (g/dL), mean (range)	11.5 (7.7-12.7)	11.5 (7.2-13.3)	0.975
Hb changes (g/dL), mean (range)	1.4 (0.1-5.5)	1.7 (0.1-5.0)	0.054
EBL (mL), mean (range)	110.5 (10.0-950.0)	72.1 (10.0-410.0)	0.140
VAS, mean (range)			
Preoperative	0.4 (0-7)	0.0 (0-3)	0.089
Postoperative			
0 h	3.7 (2-8)	3.7 (0-10)	0.974
6 h	2.8 (1-6)	2.8 (0-8)	0.982
12 h	1.9 (1-3)	2.0 (0-4)	0.578
Sum	8.9 (4-14)	8.6 (1-15)	0.522
Operation time (min), mean (range)	80.3 (39.0-198.0)	79.2 (34.0-184.0)	0.856
Coitus history: Yes	32 77.9 (39-198)	182 78.0 (34-184)	0.988
Coitus history: No	6 93.3 (52-155)	34 85.7 (44-162)	0.567

Hb: Haemoglobin, Post-Op Hb: Postoperation Hb, EBL: Estimated blood loss, VAS: Visual analogue scale, LESS: Laparoendoscopic single-site

Table 3: Comparison of conventional laparoscopic and laparoendoscopic single-site surgery by year and operation type

	Conventional (<i>n</i> =38)	LESS (<i>n</i> =216)	<i>P</i>
Operation type, <i>n</i> (%)			
Elective	35 (92.1)	215 (99.5)	0.007
Emergent	3 (7.9)	1 (0.5)	
Period, <i>n</i> (%)			
March 2014 - December 2014	22 (22.7)	75 (77.3)	0.016
January 2015 - October 2015	5 (7.1)	65 (92.9)	
November 2015 - August 2016	11 (12.6)	76 (87.4)	
Operation time by the period			
March 2014 - December 2014	80.4 (39.0-198.0)	84.7 (34.0-164.0)	0.560
January 2015 - October 2015	80.4 (56.0-113.0)	76.6 (34.0-133.0)	0.700
November 2015 - August 2016	80.3 (51.0-175.0)	76.0 (34.0-184.0)	0.669

LESS: Laparoendoscopic single-site

cystectomy for a 69.0 mm left ovarian cyst. Hb level in this patient was 13.0 g/dL before operation and 9.2 g/dL after operation. Hb level was 7.9 g/dL on the 2nd postoperative day, and a small amount of hemoperitoneum was observed. Thus, transfusion was performed. The patient was discharged

Table 4: Comparison of conventional laparoscopic and laparoendoscopic single-site surgery pre- and post-operative complications

	Conventional (n=38), n (%)	LESS (n=216), n (%)	P
Blood transfusion	0	3 (1.4)	1.000
Re-operation for bleeding control	0	1 (0.5)	1.000
Chemical peritonitis	0	1 (0.5)	1.000
Conversion to laparotomy	0	0	
Re-admission within 90 days	0	0	
Wound hernia	0	0	
Wound dehiscence	0	0	
Additional port (LESS)	N/A	13 (6.0)	0.249
Recurred ovarian cyst	0 (0.0)	3 (2.0)	1.000

LESS: Laparoendoscopic single-site surgery

after transfusion. The second transfusion case involved a 26-year-old unmarried woman with sexual experience who underwent elective cystectomy for a 101.0 mm left ovarian cyst, performed by a clinical fellow. The clinician's proficiency in LESS was lacking, and an additional port was installed on the suprapubic area. The total operation time was 94 min, and Estimated Blood Loss (EBL) was 410 ml. Immediately after the operation, the patient was stable. However, 4 h after the operation, the patient's blood pressure was gradually lowered, abdominal distension was found, and intraperitoneal hemorrhage was suspected by abdominal ultrasonography. As a result, re-operation was performed. Active bleeding was detected at the site of ovarian cystectomy, and hemostasis was performed. A Hb level was 7.2 g/dL after operation, and blood transfusion was performed. The patient was discharged on the 3rd postoperative day. The third case involved a 27-year-old unmarried woman with sexual experience who had an 83.0 mm left ovarian cyst. During the operation, the contents of the cyst flowed into the abdominal cavity. The total operation time was 113 min. Preoperative Hb was 12.6 g/dL and postoperative 1-day Hb was 7.9 g/dL. Abdominal ultrasonography revealed hematoma around the left ovary and small fluid collection in the posterior cul-de-sac. The patient received transfusion because of Hb change and hematoma. The patient had fever, and peritonitis was suspected. The cause of peritonitis was not clear. However, there are two assumptions. The first is due to intra-abdominal hemorrhage, and the second is due to rupture of the cyst during surgery. Although the abdominal cavity has been thoroughly washed, peritonitis due to cyst contents cannot be ruled out. The patient improved after conservative treatment and was discharged on the 3rd postoperative day.

During LESS, there were 13 cases which additional port(s) were installed. Of these, 10 (76.9%) were performed by a

clinical fellow who lacked LESS experience, and the remaining 3 (23.1%) were from LESS experienced faculty (two cases by JW Lee, one case by CH Choi). A similar feature was found in the installation of three additional ports from the LESS conducted by different staff. All three cases were teenage girls who had no sexual experience and had a large cyst of 20–35 cm. In patients without sexual experience, the uterine manipulator could not be installed, making surgery difficult. Additional ports were installed to prevent rupture of the cysts and minimize ovarian injury.

MCT occurs mainly in young women. Therefore, special attention should be paid to surgical techniques. Clinicians should preserve ovaries as well as cosmetic aspects. Although pain is subjective, CLS is reported to be more painful than LESS.^[7] In one study, however, patients reported more shoulder pain with LESS than with CLS; LESS may also require a longer operation time.^[8] Unlike endometriosis, MCT is generally characterized by good enucleation. Therefore, LESS can be performed without opening the MCT capsule. In another study, learning curves showed that a clinician's experience in cystectomy of endometriosis did not determine proficiency. In contrast, proficiency developed rapidly with experience in cystectomy of MCT.^[9] With the clinician experience, the operation time for cystectomy of MCT becomes shorter than that for cystectomy of endometriosis. For these reasons, LESS is ideal for MCT and should be fully implemented in educational institutions.

In 2008, LESS was introduced at Samsung Medical Center (Sungkyunkwan University School of Medicine, Korea), where it became mainstream practice in only a few years. Of the 254 patients in our study, 216 (85.0%) underwent LESS. Only 38 patients (15.0%) underwent CLS. This imbalance represents a weakness in our study. Nevertheless, LESS had become the preferred surgical method at Samsung Medical Center during the study period. Accordingly, CLS decreased over this time frame.

In emergent situation, LESS was performed in only one case (0.5%), whereas three cases (7.9%) of emergent surgery involved conventional laparoscopic techniques. Because Samsung Medical Center is a tertiary medical and educational institution, young physicians under training tend to choose CLS when emergency surgery is required.

When performing cystectomy of MCT, removing resected tissue might be time-consuming procedure.^[10] It is not easy to remove resected tissue through a conventional trocar. Extending trocar opening is often needed to remove a cyst completely. With LESS, tissue removal could be easier through a 2.5–3 cm incision on the umbilicus. In most cases, it takes only a few minutes to remove resected tissue. This advantage alone justifies using LESS for cystectomy of MCT.

CONCLUSION

To conclude, our study demonstrate that LESS is not inferior to CLS in MCT surgery, and LESS is useful for the surgery of MCT and LESS confers feasibility, convenience, and safety regarding cystectomy of MCT of ovary.

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Conflicts of interest

There are no conflicts of interest.

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