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ORIGINAL ARTICLE

Longitudinal analysis of laparoendoscopic single-site adrenalectomy and conventional laparoscopic adrenalectomy regarding patient-reported satisfaction and cosmesis outcomes

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Summary *Background/Objective:* To compare longitudinal patient-reported cosmesis of laparoendoscopic single-site adrenalectomy (LESS-A) to that of conventional laparoscopic adrenalectomy (CLA).
Methods: A total of 23, 15, and 9 patients underwent transumbilical LESS-A (TU-LESS), subcostal LESS-A (SC-LESS), and CLA, respectively. A questionnaire was administered asking the patient to assess wound pain (0: not painful to 10: very painful), satisfaction (0: not satisfied to 10: very satisfied), and cosmesis (0: very ugly to 10: very beautiful) on the basis of a visual analogue scale. We mailed questionnaires to all patients who received LESS-A and CLA at postoperative 1, 3, 6, 9, and 12 months.
Results: No significant differences were observed in the pain scores between TU-LESS, SC-LESS, and CLA at every time point. In the CLA group, the cosmesis and satisfaction scores were significantly lower at postoperative 3 months ($p = 0.0033$, 0.0130). There were no significant inter-group differences in the cosmesis score between the three groups after postoperative 6 months. However, the satisfaction score of SC-LESS decreased after postoperative 3 months and was significantly lower at postoperative 9 and 12 months ($p = 0.0333$, 0.0160). The difference between the satisfaction scores of each procedure gradually increased after postoperative 6 months.
Conclusion: This study is the first comprehensive longitudinal analysis of patient-reported satisfaction and cosmesis outcomes between LESS-A and CLA. The resulting data provide important insights into the improvement in satisfaction in patients who underwent TU-LESS.

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These findings can facilitate the treatment decision-making process for patients who are considering laparoscopic adrenalectomy.

1. Introduction

Since the early 1990s, laparoscopic adrenalectomy has been a standard procedure for patients with benign adrenal disease.[1] In recent years, there has been a paradigm shift in the field of minimally invasive surgery as laparoscopy progresses toward scarless techniques.[2] Since the first report of urologic laparoendoscopic single-site (LESS) surgery, the number of LESS surgeries has significantly increased.[3,4] There has been increasing enthusiasm for and growing interest in this novel minimally invasive surgical technique over the last few years.[5] Following advancements in laparoscopic instrumentation, LESS surgery has been introduced as a novel urologic surgical procedure that is expected to minimize postoperative pain and improve cosmetic outcomes.[6]

LESS surgery is expected to be suitable for adrenalectomy because it requires no surgical incision lengthening for specimen extraction.[6] In a previous study, we focused on patients undergoing LESS adrenalectomy (LESS-A) and presented the patient-reported satisfaction and cosmesis outcomes in patients with LESS-A compared to those of conventional laparoscopic adrenalectomy (CLA). Young patients and female patients who had undergone LESS-A were more satisfied with the scar outcomes than those who had undergone CLA. This study suggested that this patient subset most values the cosmetic benefits of LESS-A. However, we acknowledge that our study was a cross-sectional study, so the mean follow-up time after surgery was significantly shorter for LESS-A than for CLA, which is a major limitation. Further evaluation was needed in a longitudinal study to clarify whether the LESS-A or CLA procedure is superior regarding satisfaction and cosmesis outcomes.[2]

Awareness of satisfaction and cosmesis outcomes is paramount when surgeons are discussing surgical options with patients, particularly when comparing surgical procedures with similar efficacy and survival. The present study is the first comprehensive longitudinal analysis of patient-reported satisfaction and cosmesis outcomes in patients with benign adrenal disease who underwent LESS-A compared to those who underwent CLA.

2. Patients and methods

2.1. Patients

Between November 2011 and December 2014, 38 patients with an adrenal tumor (20 with primary aldosteronism, six with preclinical Cushing's syndrome, four with Cushing's syndrome, four with pheochromocytoma, and four with non-functional adenoma) underwent transperitoneal LESS-A performed by a single surgeon at Hiroshima University Hospital. We mailed all patients who underwent LESS-A a questionnaire and stamped return envelope 1, 3, 6, 9, and 12 months after their operation. Our questionnaires asked the patient to assess wound pain (0: not painful to 10: very painful), satisfaction (0: not satisfied to 10: very satisfied), cosmesis (0: very ugly to 10: very beautiful), and concern regarding surgical scar (0: not concerned to 10: very concerned) on the basis of a visual analogue scale.

In the study, we performed a general subcostal LESS-A (SC-LESS) on male patients and a transumbilical LESS-A (TU-LESS) on female patients. Exceptions included one male patient on whom the TU-LESS was performed because he was relatively young (49 years old) and one female patient on whom the SC-LESS was performed because she was quite old (78 years old). In the LESS-A cases, a total of 23 and 15 patients underwent TU-LESS and SC-LESS, respectively. For the purpose of setting a control group, the same surgeon performed CLA on 9 patients over a period between February 2012 and September 2013. The study protocol to evaluate longitudinal patient-reported cosmesis of laparoscopic adrenalectomy was approved by the institutional review board of Hiroshima University Hospital (IRB No. 448). Informed consent was confirmed (or waived) by the IRB.

2.2. Surgery

Under general and epidural anaesthesia, the patients were placed in the 60° modified flank position and the surgeon stood facing the abdomen. An open laparotomy procedure was performed, with access to the surgical field made by a 2-cm skin incision. A single-port device was used, which consisted of a hand-made multichannel access port constructed using a wound retractor (Lap Protector, Hakko Co. Ltd., Tokyo, Japan) and a size 7 1/2 surgical glove. Lap Protector was inserted into the incision site and the wound retractor ring was covered with a powder-free surgical glove. Three 5-mm trocars (EZ Trocar, Hakko Co. Ltd.) were attached to part of the finger in the surgical glove. A flexible 5-mm 0° high-definition laparoscope (Olympus, Tokyo, Japan) was effective in minimizing instrument conflict. Pneumoperitoneum was induced by CO_2 gas insufflation to 12 mmHg.

The surgical procedure followed our previously reported LESS-A procedure.[7] In detail, the Toldt line and the typical vascular landmarks (inferior vena cava and renal vein for right- and left-side adrenal tumors, respectively) were dissected and exposed using straight standard instruments and a bent laparoscopic instrument (Roticulator Endo Dissect, Covidien, Mansfield, MA, USA). For the right-side adrenal tumor, the right liver lobe was retracted using a

snake retractor in the CLA procedure. A 2.3-mm needlescopic device (MiniLap, Stryker, San Jose, CA, USA) was used in the LESS-A procedure. This needlescopic device protectively retracted the liver on the right side and the spleen on the left side of the adrenal tissue by grasping the endoscopic surgical spacer (Securea, Hogy Medical Co., Ltd., Tokyo, Japan) to avoid a traumatic procedure and provide cushioning during retraction. The adrenal veins were exposed, clipped with two 5-mm polymer locking clips (Hem-o-lok, Teleflex Medical, Research Triangle Park, NC, USA), and then cut. A 5-mm sealing device (LigaSure, Covidien) was used to complete the adrenal tissue dissection. After haemostasis was ensured, the entire adrenal tissue was freed within the surgical field. In all cases, the adrenal tissue was retrieved through the Lap Protector without lengthening the skin incision. A surgical suction drain was indwelled through the surgical port. Both the LESS-A and CLA procedures were successfully performed for all patients.

2.3. Statistical analysis

The survey data were analysed for each procedure by the qui-square test, the Mann–Whitney U test, and one-way analysis of variance (ANOVA) analysis. Each analysis was two-tailed; in all tests, p values < 0.05 were considered to be statistically significant. All values were expressed as the mean and the results were analysed using the Mann–Whitney U test and one-way ANOVA analysis. Analyses were performed using the JMP version 10 statistical software package (SAS Institute Inc., Cary, NC, U.S.A.).

3. Results

3.1. Demographics

There were no conversions to open surgery in any of the patients who underwent LESS-A and CLA. However, one LESS-A case was changed to a CLA case because three additional trocars were placed due to an inferior vena cava injury. Therefore, this case was excluded from the study. For the remaining 38 patients, LESS-A was completed successfully without any intraoperative complications. Of the 47 enrolled subjects, 47, 43, 39, 36, and 35 patients completed the questionnaires at 1, 3, 6, 9, and 12 months, respectively, which corresponds to response rates of 100%, 91%, 83%, 77%, and 74%, respectively. There were no complications with a Clavien-Dindo grade of more than 3 in all the cases.

The patient demographics and surgical outcomes are listed in Table 1. All patients were divided into three groups: TU-LESS, SC-LESS, and CLA. The mean patient age was 51.6, 54.7, and 57.1 years and the mean operative time was 106.5, 128.3, and 127.3 min in TU-LESS, SC-LESS, and CLA, respectively. There were no significant differences in age, laterality, operative time, or estimated blood loss between the groups. The ratios of female patients were 95.6% in the TU-LESS and 6.7% in the SC-LESS. There were significant differences in gender ($p = 0.0001$) and body mass index (BMI; $p = 0.0005$).

Table 1 Patient characteristics.

	TU-LESS	SC-LESS	CLA	p value
Case	23	15	9	
Age, mean (years)	51.6	54.7	57.1	0.6938
Gender (male:female)	1:22	14:1	4:5	0.0001
BMI, mean (kg/m^2)	21.5	25.6	25.4	0.0005
Laterality (right:left)	13:10	6:9	5:4	0.6852
Tumor size (mm)	23.0	37.5	29.7	0.0972
Operative time (minutes)	106.5	128.3	127.3	0.0889
Estimated blood loss (mL)	24.8	37.0	32.1	0.2106
Length of stay (days)	6.2	6.8	6.4	0.8939
Preoperative diagnosis				
Primary aldosteronism	13	7	3	
Preclinical Cushing's syndrome	3	3	0	
Pheochromocytoma	3	1	3	
Nonfunctional adenoma	3	1	2	
Cushing's syndrome	1	3	1	

TU-LESS = transumbilical laparoendoscopic single-site adrenalectomy, SC-LESS = subcostal laparoendoscopic single-site adrenalectomy, CLA = conventional laparoscopic adrenalectomy, BMI = body mass index.

3.2. Cosmesis and satisfaction outcomes between CLA and LESS-A (Figs. 1 and 2)

Overall, no significant differences were observed in the pain scores between TU-LESS, SC-LESS, and CLA at every time point. In the CLA group, the cosmesis and satisfaction scores were significantly lower at postoperative 3 months ($p = 0.0033$, 0.0130). The cosmesis and satisfaction scores in the CLA group were gradually elevated after postoperative 6 months, so these scores were equivalent to those in the TU-LESS group at postoperative 12 months. There were no significant inter-group differences in the cosmesis score between the three groups after postoperative 6 months. However, the satisfaction score of SC-LESS decreased after postoperative 3 months and was significantly lower at postoperative 9 and 12 months ($p = 0.0333$, 0.0160).

In the LESS-A group, there were no significant inter-group differences in the pain or cosmesis scores between TU-LESS and SC-LESS at every point. However, the satisfaction score of TU-LESS was significantly higher than that of SC-LESS at postoperative 9 and 12 months (9.28 ± 0.59 vs. 7.14 ± 0.67; $p = 0.0236$, 9.17 ± 0.72 vs. 5.79 ± 0.82; $p = 0.0043$). Interestingly, the difference between the satisfaction scores of each procedure gradually increased after postoperative 6 months.

3.3. Concern regarding surgical scar outcomes classified by gender (Fig. 3)

Overall, the female patients were significantly more concerned about their surgical scar than the male patients at every time point. The difference of the concern scores between both groups was almost zero until postoperative 12 months (2.00 ± 0.81 vs. 4.77 ± 0.71; $p = 0.0014$).

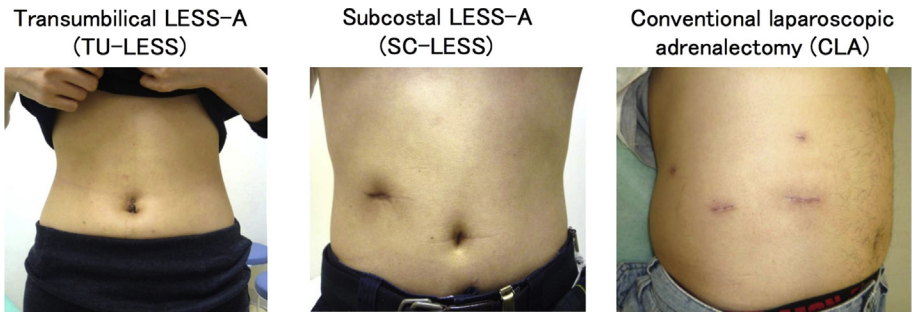

Figure 1 Representative pictures in postoperative appearance of patient's abdomen. LESS-A = laparoendoscopic single-site adrenalectomy, * = $p < 0.05$.

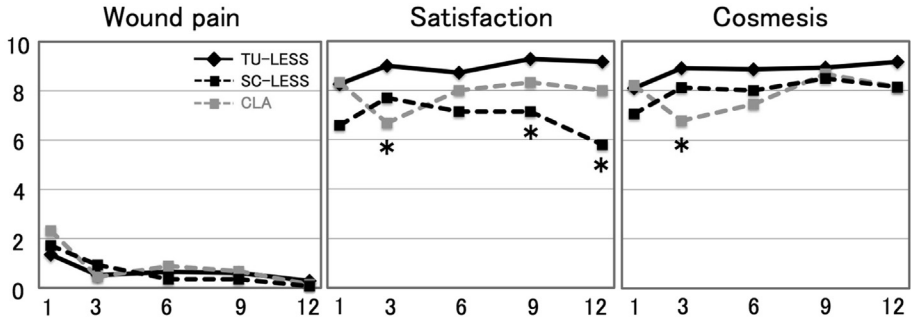

Figure 2 Overall mean scar ratings according to surgical procedure. TU-LESS = transumbilical laparoendoscopic single-site adrenalectomy, SC-LESS = subcostal laparoendoscopic single-site adrenalectomy, CLA = conventional laparoscopic adrenalectomy, * = $p < 0.05$.

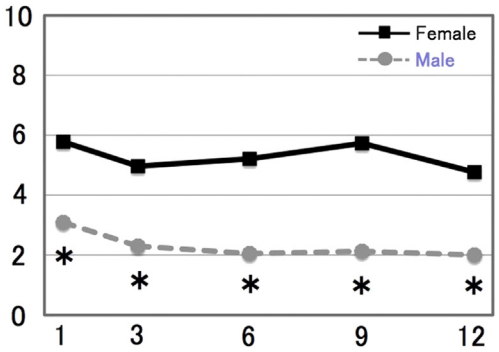

Figure 3 Results of mean ratings of concern in surgical scar according to gender. * = $p < 0.05$.

4. Discussion

We performed a longitudinal study to clarify whether the LESS-A or CLA procedure is superior regarding satisfaction and cosmesis outcomes. To the best of our knowledge, the present study is the first comprehensive longitudinal analysis of patient-reported satisfaction and cosmesis outcomes in patients with benign adrenal disease undergoing LESS-A or CLA. Rather, previous publications have praised the cosmetic advantages of the LESS procedure without objectively studying cosmesis outcomes.[5,8–11]

Laparoscopic adrenalectomy has become the gold standard for the treatment of adrenal tumors, and various procedures have been designed for it.[12] Many investigators have reported techniques to decrease the number of ports required to perform safe laparoscopic surgery.[13] Following advancements in laparoscopic instrumentation, LESS surgery has been introduced as a novel urologic surgical procedure that is expected to minimize postoperative pain and improve cosmetic outcomes. LESS surgery is suitable for adrenalectomy because it requires no surgical incision lengthening for specimen extraction.[6]

Our previous study compared patient-reported satisfaction and cosmesis outcomes in patients undergoing LESS-A and CLA. Young patients and female patients who had undergone LESS-A surgery were more satisfied with the scar outcomes than those patients who had undergone CLA, which suggests that this patient subset most values the cosmetic benefits of LESS-A. However, this study had some shortcomings, mainly that the mean follow-up times after adrenalectomy were significantly shorter for LESS-A than for CLA.[2] We therefore performed a longitudinal study to clarify whether LESS-A was superior to CLA in terms of satisfaction and cosmesis.

Lucas et al reported that patients who underwent laparoscopy for urologic diseases were predominantly concerned with complications, success, convalescence, and wound pain and were less concerned with cosmesis. However, female patients, young patients, and patients who were treated for benign diseases had an increased concern in cosmesis.[14] Generally, men and older adults assigned much less importance to body dissatisfaction than women and young people.[15] Our previous study reported that preference for the transumbilical procedure was

significantly higher for young female respondents in urologic minimally invasive surgery.[16] In addition to this, our longitudinal study suggests that male patients are significantly less concerned in their surgical scar than female patients at every time point, so the difference of the concern scores between each group was almost nil until postoperative 12 months. These findings may affect the appropriate selection of patients for LESS-A. In other words, female patients anticipated that CLA was a surgical procedure with high satisfaction and cosmesis. Contrary to their expectations, our resulting data showed that CLA was not the preferred procedure for them.

The results of our current study demonstrate that in female patients, satisfaction and cosmesis scores were significantly higher in the TU-LESS group than in the CLA group at postoperative 3 months. TU-LESS had high satisfaction, especially in female patients. This result suggests that female patients complained about CLA and wished for a novel procedure to be developed, thus predisposing them to the idea of TU-LESS.

Historically, patients have been known to evaluate cosmetic outcomes more favourably than their clinicians, which is possibly due to a range of psychology factors; not wanting to displease their clinicians is a common factor. In this study, we mailed all patients undergoing adrenalectomy a questionnaire along with a stamped return envelope at five different time points after the adrenalectomy.

The most common position for access in LESS surgery has been the umbilicus because an umbilical scar is only slightly visible (cosmetic benefit). However, many studies reported that TU-LESS was extremely challenging due to the angle of the procedure and difficult organ retraction. Besides, because the distance from the umbilical access port to the adrenal glands is longer than in the subcostal procedure, the transumbilical procedure becomes more tangential in direction in LESS-A. Actually, as the target area of dissection becomes more cranial, the difficulty of dissection increases extremely when using the transumbilical procedure. This raises the question of whether TU-LESS provides more benefits and safety than SC-LESS. Our study indicates that the operative time was significantly shorter in TU-LESS than in SC-LESS, contrary to our prediction. No significant differences were observed between each procedure in terms of estimated blood loss, and there were no complications in either procedure in LESS-A. In addition, the difference of satisfaction scores between each procedure gradually increased after postoperative 6 months. We assume this is because the umbilical scar shrank and was only barely visible as time went by.

We acknowledge a few limitations in this longitudinal study to evaluate cosmesis comparing LESS-A and CLA in patients with benign adrenal disease. First, our research was performed with a very small sample. Second, this study was a prospective study, but the patients were not randomized. There was a large bias for selecting the transumbilical procedure. The ratios of female patients were 95.6% in TU-LESS and 6.7% in SC-LESS in LESS-A. It cannot be denied that our previous study, in which young female patients preferred the transumbilical procedure, contributed to a large bias for selecting the transumbilical procedure. Third, we did not perform surveillance using a photo-series questionnaire (PSQ). The PSQ comprises three questions: first, patients are asked to score their own scars, then, they are asked to rate photographs of the scars, and finally, they are asked to re-score their own scars after viewing photographs of alternative scars.[17] It has been reported that with a more complete knowledge of cosmesis outcomes for the different surgical procedures, LESS scar outcomes were preferred and that satisfaction with patients' own scars after LESS was higher than that for alternative surgical procedures.[18] In contrast, in our study, TU-LESS kept high satisfaction scores until postoperative 12 months, even though the patients had not seen photographs of other procedures (such as open and laparoscopic surgery). Finally, in this study we used a non-validated questionnaire. Despite these limitations, our longitudinal investigation provides meaningful insights into the satisfaction scores of female patients who underwent TU-LESS.

A major strength of the current longitudinal study is the prospective collection of patient-reported cosmesis and satisfaction at multiple, prespecified time points. The resulting data have provided important insights into the improvement in cosmesis and satisfaction in patients with benign adrenal disease, and cosmetic satisfaction may be affected by both the port insertion sites and the number of port scars. We believe that LESS technology will be further developed by persistent innovation and advances in the near future.[19]

5. Conclusion

Our longitudinal evaluation using a patient-reported questionnaire after surgery showed that satisfaction and cosmesis scores were higher for TU-LESS than for CLA. Moreover, TU-LESS had higher satisfaction scores than SC-LESS. The results did show substantial nuances between the two subgroups of the LESS-A, with the satisfaction and some cosmesis perception of the SC-LESS group even worse than that of the CLA group. We should not mix the data of these two subgroups together for comparisons or discussions. TU-LESS is a safe technique resulting in improved cosmetic and satisfaction outcomes. These findings can facilitate the treatment decision-making process for patients who have benign adrenal disease and must undergo laparoscopic adrenalectomy.

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Conflicts of interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.asjsur.2018.10.002.

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