Resident Training in Single-Incision Compared with Traditional Cholecystectomy

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ABSTRACT

Introduction: As attending surgeons’ comfort with single-incision laparoscopic surgery (SILS) grows, and with continued improvement in surgical instruments, advanced laparoscopic techniques are increasingly being incorporated into surgical training. The aim of our study was to evaluate resident performance and patient outcomes in patients undergoing resident-performed SILS versus a resident-performed traditional laparoscopic cholecystectomy (LC).

Methods: A retrospective case-control study of 80 patients undergoing elective surgical intervention with a resident-performed SILS (n = 20) or a resident-performed traditional LC (n = 60) for gallbladder disease over a 15-month period was performed. Surgical indications, common perioperative variables, complications, and length of stay were reviewed, and all variables were evaluated for statistical significance.

Results: Median operative times were similar for the resident-performed SILS cohort and the resident-performed traditional LC cohort (70.0 minutes and 66.0 minutes, respectively; P = .54). There were no complications in either the resident-performed SILS or resident-performed traditional LC groups. There was no difference in mean length of hospital stay between the resident-performed SILS group and resident-performed traditional LC group (0.95 days and 1.10 days, respectively; P = .50).

Conclusion: Our data strongly support the ability to train senior residents to complete a SILS technique safely and with the same efficacy as with traditional LC.

Keywords: Single-incision, Laparoscopic cholecystectomy, Resident training, Outcomes.

INTRODUCTION

After the widespread acceptance of laparoscopic cholecystectomy (LC) in 1991, the rate of LC in the United States increased by 30% to 60% to an estimated 600,000 operations performed annually.1–3 In September 1992, the National Institutes of Health (NIH) convened a Consensus Development Conference Panel, which endorsed LC as an effective and safe surgical treatment for gallbladder disease, equal in efficacy to open cholecystectomy.4 At the time of the NIH consensus statement, the panel emphasized that the outcome of laparoscopic cholecystectomy was greatly influenced by the training, experience, skill, and judgment of the surgeon and should only be performed by experienced surgeons.4 As surgical practices advance, so does the need for resident training. As such, at the time LC was gaining widespread acceptance, Deziel et al demonstrated the safety of incorporating LC into resident training programs.5 However, resident training in advanced laparoscopic surgical techniques was limited because of the cautious warning the NIH placed on adoption of LC.

More recently, single-incision laparoscopic surgery (SILS) has become a recognized and safe alternative to traditional laparoscopic surgery. Markar et al recently showed in a meta-analysis no significant difference in the incidence of postoperative complications, postoperative pain scores, or length of stay between patients undergoing SILS versus traditional LC.6 Markar et al concluded SILS to be a safe procedure for the treatment of uncomplicated gallstone disease.6 As SILS becomes a more frequently used surgical option for treatment of gallbladder disease, the technical demands and lack of surgical experience may limit a resident’s opportunity to be trained in this advanced laparoscopic technique, just as LC was 20 y earlier. As attending surgeons’ comfort with SILS grows, and with continued improvement in surgical instruments, these advance techniques are now increasingly being incorporated into surgical training. The aim of our study was to evaluate resident performance and patient outcomes in patients undergoing resident-performed SILS versus resident-performed traditional LC.
METHODS

A retrospective case-control study of 80 patients undergoing elective surgical intervention with a resident-performed SILS (n = 20) or a resident-performed traditional LC (n = 60) for gallbladder disease over a 15-month period at Rush University Medical Center was performed. Patients were excluded if they were younger than 18 years old or they were diagnosed with acute cholecystitis. An attending surgeon closely supervised all cases. A single surgeon supervised all SILS procedures. Each surgeon in this study had advanced minimally invasive fellowship training and had routinely performed the procedures in the study. Although a SILS-specific training protocol is not used at our institution, residents performing a SILS were expected to be proficient in traditional LC before training in advanced techniques. All residents in the study were currently in good standing at Rush University Medical Center and were distributed among all postgraduate years. Common patient demographics were compared. In addition, surgical indications, common perioperative variables, complications, and length of stay were reviewed for all patients enrolled in the study.

The operative approach for traditional LC consisted of the commonly described 4-trocar technique (1 umbilical, 1 subxiphoid, and 2 right lateral trocars). The operative approach for SILS consisted of 3 periumbilical trocars placed through a single umbilical skin incision and 3 separate fascial defects. One percutaneous suture was used for retraction of the gallbladder fundus. All variables were evaluated using Fisher exact analysis or Student t test when appropriate. Significance was defined as a P ≤ .05. The study was approved by the institutional review board at Rush University Medical Center.

RESULTS

The median age of patients undergoing SILS was 31.0 years old, which was significantly younger than patients undergoing traditional LC, 46.5 years old (P = .001). The median body mass index was comparable between cohorts: 29.3 kg/m² in SILS patients and 30.7 kg/m² in traditional LC patients (P = .06). Patient demographics are shown in Table 1. A more senior-level resident performed the SILS technique, with a mean postgraduate year (PGY) level of 4.85 compared with the residents performing the traditional LC technique, who had a mean PGY level of 3.35 (P < .001). Median operative times were similar for the SILS cohort and the traditional LC cohort (70.0 minutes and 66.0 minutes, respectively; P = .54). There were no

| Number | SILS | Traditional LC | P Value |
|--------|------|----------------|---------|
| Age (y)* | 31.0 | 46.5 | .001 |
| Male | 1 (5%) | 12 (20%) | .11 |
| Female | 19 (95%) | 48 (80%) | .11 |
| BMI (kg/m²) | 29.3 | 30.7 | .06 |
| Symptomatic cholelithiasis* | 17 (85%) | 33 (55%) | .03 |
| Gallstone pancreatitis* | 0 | 12 (20%) | .02 |
| Chronic cholecystitis | 0 | 6 (10%) | .17 |
| Biliary dyskinesia | 3 (15%) | 6 (10%) | .40 |
| Other | 0 | 3 (5%) | .42 |
| PGY 1 | 0 | 2 (3%) | .56 |
| PGY 2* | 0 | 25 (42%) | <.001 |
| PGY 3 | 1 (5%) | 0 | .25 |
| PGY 4* | 1 (5%) | 16 (27%) | .03 |
| PGY 5* | 18 (90%) | 17 (28%) | <.001 |

LC, Laparoscopic cholecystectomy; BMI, body mass index; PGY, postgraduate year.
*Denotes significance.
complications in either the SILS or traditional LC groups. There was no difference in mean length of hospital stay between the SILS group and the traditional LC group (0.95 days and 1.10 days, respectively; \( P = .50 \)). Results are shown in Table 2.

**DISCUSSION**

In addition to the Marker et al meta-analysis, a recent prospective trial by Lai et al showed no significant increase in operative time, estimated blood loss, or mean length of stay between patients undergoing SILS compared with traditional LC when performed by an attending surgeon. However, mean incision length was significantly shorter in the SILS group, as was the cosmetic score 3 months after surgery. As SILS becomes a more universally accepted alternative for surgical treatment of gallbladder disease, it will be crucial for surgical resident training to incorporate new, innovative, and advanced laparoscopic techniques.

Despite a younger patient population undergoing SILS compared with traditional LC, resident median operating time, complication rate, and mean length of stay were not significantly different. Similar nonsignificance when comparing SILS with traditional LC cases performed by the identical surgeon was evident. Despite the increased technical demand of the SILS technique, the median operation time was increased by only 4 minutes, and no additional complications were observed. In addition, the operative time for resident-performed SILS was 70.0 minutes, which was comparable with recently published data: 75 minutes by Gangl et al and 83 minutes by Roberts et al. However, some studies have shown operative times to be as low as 46 minutes. In addition, complication rate and mean length of stay of patients who underwent resident-performed SILS were similar to data currently available in the literature.

In addition to operative caseload, surgical residents at our institution are provided access to LC simulators. Although our institution does not provide SILS simulators, the program encourages the use of instructional multimedia to review the technical steps of a SILS operation. In addition, it is routine practice at our institution for the operating resident, before the case, to describe the steps of dissection of a SILS operation to the attending surgeon. As a result of the expectation that residents be proficient in traditional LC before performing a SILS, the comparable performance of a resident-performed SILS procedure with that of a traditional LC may be affected by the increased experience of the operating resident. The mean PGY level of residents performing a SILS procedure and a traditional LC procedure is 4.85 versus 3.35, respectively. However, in each case, the resident is being trained in a technique with which they are unfamiliar. At our institution, the cumulative mean number of LC cases performed by PGY 1 residents to PGY 4 residents is 1.2, 11.2, 45.0, and 67.8, respectively.

It cannot be definitively concluded the low complication rate and comparable patient outcomes between treatment groups were not affected by the minimally invasive experience gained by more senior residents performing SILS. However, the data strongly support the ability to train senior residents to complete a SILS technique safely and with the same efficacy as a traditional LC.

**CONCLUSION**

As demand for minimal incision surgery grows, the importance of surgical resident training to incorporate these advanced techniques into academic programs without negatively affecting patient outcomes will be crucial. Data support the ability to train senior residents to complete a SILS technique safely and with the same efficacy as a traditional LC.

|                      | Single-Incision Laparoscopic Cholecystectomy | Combined: Traditional Laparoscopic Cholecystectomy | \( P \) |
|----------------------|---------------------------------------------|--------------------------------------------------|-------|
| Mean PGY level*      | 4.85                                        | 3.35                                             | <.01  |
| Median OR time (min) | 70.0                                        | 66.0                                             | .54   |
| Mean LOS (d)         | 0.95                                        | 1.10                                             | .50   |
| Complications        | 0                                           | 0                                                | 1.00  |

LC, Laparoscopic cholecystectomy; BMI, body mass index; PGY, postgraduate year; OR, operating room; LOS, length of stay.

*Denotes significance.
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