A Comparative Analysis: SILS over Conventional Laproscopic Procedures

S. Pradhaban

Assistant Professor, Department of General Surgery, Pondicherry Institute of medical Sciences, Pondicherry, INDIA.

Corresponding Address:

drpradhabansurgery@gmail.com

Research Article

Abstract: **Objectives**: To report our experience with single-incision laparoscopic surgery (SILS) and to perform a comparison with conventional laparoscopic surgeries. **Study Design**: Data were prospectively collected for all patients undergoing SILS(n = 23) and compared with data of those undergoing conventional laparoscopic procedures (n = 42) at Lifeline Hospital, Perungudi, Chennai. This included patient demographic data and intraoperative and postoperative outcomes. **Interventions:** conventional laparoscopic surgeries and SILS. **Main Outcome measures:** Operative time, conversion to open operation, and length of hospital stay. **Results**: Operative time was longer with SILS compared with conventional laparoscopic surgeries (P < .001). A correlation was seen between reducing SILS operative time and increasing experience (Pearson's correlation coefficient, –0.27). Two patients in the SILS group required the addition of extra laparoscopic ports. No patients in the SILS group required conversion to open surgery compared with 4 patients in the standard laparoscopic group. Patients stayed an average of 0.67 days following SILS and 1.62 days following conventional laparoscopic procedures. **Conclusions:** Single-incision laparoscopic surgery may be equal to conventional laparoscopic surgeries in terms of safety and efficacy. Further randomized studies are required to investigate any significant advantages of this new and attractive technique.

Keywords: single-incision laparoscopic surgery (SILS), Laproscopic Procedures.

Introduction

Minimally invasive surgery allows us to undertake complicated surgical procedures with minimal surgical trauma. Uptake of laparoscopic techniques has been rapid despite initial reservations, with laparoscopic approaches now being thought of as the gold standard in surgical conditions such as gallstone disease and benign and a significant proportion of malignant colorectal pathological conditions. Laparoscopic surgery has been demonstrated to be safe and effective[1] and leads to reduced postoperative pain, shortened hospital stay, faster recuperation, and earlier return to normal function[2]. This is combined with an improved cosmetic result, leading in many cases to improved patient satisfaction. Recently, surgeons have begun performing laparoscopic surgery through a single umbilical incision. The potential benefits of this method include reducing port-site complications owing to the reduced number of incisions required. This may also lead to reduced postoperative pain and earlier return to normal function. Added to this is the prospect of virtually scarless surgery as the surgical incision can be almost completely hidden within the umbilicus. Although several groups advocate the feasibility of single-incision laparoscopic surgery (SILS) for a number of procedures including appendectomy[3-4], cholecystectomy[5-7], sleeve gastrectomy[8], gastric banding[9], colectomy[10], and nephrectomy[11], this does not in itself justify its use. The benefits of this new technique have yet to be proven, and at present there is little evidence comparing conventional laparoscopy with the SILS approach.

Data Collection

Data were prospectively collected for all patients undergoing SILS for various surgeries at Lifeline Hospital, Chennai - n = 23 patients between 2011-2012 and compared with data for those who had undergone conventional laparoscopic surgeries n = 42 during the same period. Collected data included patient demographic characteristics, preoperative investigations, intraoperative data (intraoperative complications, conversion to open surgery, and duration of surgery), and postoperative data (including length of stay and early complications within 28 days of surgery. Patients were analyzed on an intention-to-treat basis. All patients awaiting surgery underwent full preassessment including imaging by ultrasonographic scanning or magnetic resonance imaging.

Data Analysis

Data were analyzed with SPSS 16 package. The Pearson's correlation was used to investigate any relationship between operative time and experience. Significant differences between groups were investigated using the t test.

SILS Technique for Various Surgeries

In summary, the operation is performed under general anaesthesia with the patient positioned in the modified Lloyd-Davies position. The umbilicus is everted with a Littlewoods Forcep and 2-0 Prolene stay sutures (Ethicon, Inc, New Brunswick, New Jersey) inserted. An incision is

made between the stay sutures. For the best cosmetic result, it is important that the incision does not breach the umbilical ring. Dissection is continued, followed by a fascial incision with the peritoneum opened under direct vision. A blunt 10-mm trocar (Covidien, Mansfield, Massachusetts) is inserted and the pneumoperitoneum is established. Laparoscopy can proceed with a 5-mm-diameter, 30° laparoscope. Thereafter, the canula is inserted at varying levels (to avoid sword fighting) and 5mm or 10mm telescope used depending on the cases.

- For gall bladder one or two additional 5-mm Dexide ports (Covidien) are inserted through the fascia adjacent to the 10-mm port.

The Calot triangle is then dissected in the standard manner using standard straight or roticulator instruments (Covidien). However, in our experience, using supporting stitches to maneuver the gallbladder can aid in retraction and improve visualization of the Calot triangle. It is very important to achieve the critical view of safety to correctly identify the cystic duct.12 - 13 A 1 Prolene suture (Ethicon, Inc) on a straight needle is passed into the abdomen under direct vision in the right subcostal region. This is passed through the gallbladder fundus before being pushed out of the abdominal cavity again. This can be used as a pulley to elevate the fundus ventrally. A second suture can be placed from the subxiphoid position and inserted through the Hartmann pouch, exiting the abdominal cavity through the right lateral abdominal wall. Placement of titanium clips on the suture using the Endo Clip device (Covidien) on either side of the Hartmann pouch allows the gallbladder to be pulled from side to side by traction on the sutures. Once the cystic artery and duct have been exposed, they are clipped using a 10-mm clip (Endo Clip; Covidien) and divided. The gallbladder is then dissected off the liver bed with diathermy and removed.

- For sleeve gastrectomy –Either veress needle or external suture is passed into the left crus and brought out to the right of falciform ligament.
- For hysterectomy-we rely heavily on the side to side movement of the cervix and uterus by CCL, an instrument that holds the lips of the fornix in all hysterectomies we chose to close the vault from below in order to shortened anaesthetic time.

The main ergonomic difference between SILS and routine lap is lack of triangulation and the chopsticking of instrument. This is overcome by using the reticulation to create a pseudo triangulation and by crossing hands.

5mm clip application, 5mm ligature and telescopes with coaxil optics are great adjuncts that facilitate better surgical performance.

Suturing-The endostitch TM trade mark by Covidenwith T shaped needle that is transferred from one haw to another, made a significant difference to crural suturing, fundowrap and over sewing the sleeve gastrectomy.

Results

- The standard laparoscopic group consisted of 17 women and 25 men, and the SILS group consisted of 11 women and 12 men. The patients undergoing standard laparoscopic surgery were significantly older than those undergoing SILS (mean age, 50.9 vs 43.3 years, respectively; P = .02). Operative time was longer with SILS compared with conventional laparoscopy (P < .001).

Table 1: No of cases for comparison of Single-Incision Laparoscopic Surgery vs Standard Laparoscopic surgeries

Surgeries	SILS	Conventional laproscopy
Cholecystectomy	11	14
Appendicectomy	6	12
Sleeve gastrectomy	3	9
Hystrectomy	1	4
Colectomy	1	2
Ruptured ovarian cyst	1	1

A correlation was seen between reducing SILS operative time and increasing experience (Pearson's correlation coefficient, −0.27). Three patients in the SILS for cholecystectomy group required the addition of extra laparoscopic ports. No patients in the SILS group required conversion to open surgery compared with 4 patients in the standard laparoscopy group.

- Patients stayed an average of 0.78 days following SILS and 1.63 days following conventional laparoscopic surgeries.

Table 2: Comparison of Single-Incision Laparoscopic Surgery vs Standard Laparoscopic surgeries

Characteristics	SILS group	Standard Laproscopy
Age	45.3(16.6)	52.9(16.2)
Male/female no.	11/12	17/25
Operative time(sd),min	127.2(41.2)	93.5(34.1)
Length of stay(sd),days	0.67(0.98)	1.62(2.43)
Conversion to open procedure	0	4

Operative Course

Of the SILS group, 3 patients required the addition of extra laparoscopic ports. Two patients required a standard 4-port laparoscopy, and 1 patient required a single port to be added in the epigastrium (cholecystectomy). The need for insertion of additional ports was owing to technical difficulty with failure to adequately expose the Calot triangle secondary to extensive adhesions. There were no conversions to open surgery in the SILS group. In the standard laparoscopic group, 4 patients required

conversion to open surgery. All of these cases required conversion owing to technical difficulty resulting from scarring or abnormal anatomy. The first SILS performed took 202 minutes to perform, with the most recent case taking 75 minutes, demonstrating a 63% reduction in operating time over 23 cases. There was a correlation of reduced SILS operative time with increasing experience, with a Pearson's correlation coefficient of –0.29. Overall, SILS for varied procedures took longer to perform than standard laparoscopic surgeries (mean [SD], 127.2 [41.2] vs 93.5 [34.1] minutes, respectively; $P < .001$). If patients with a history of acute conditions were excluded from the analysis, the mean operative times were 120.3 and 91.1 minutes, respectively.

Postoperative Course

Patients stayed in the hospital for a mean of 0.67 days following SILS and 1.62 days following standard laparoscopic surgeries. Although this demonstrates a trend toward a reduced postoperative stay following SILS, this difference did not reach statistical significance ($P = .07$). The first patient underwent standard laparoscopic cholecystectomy that was converted to open surgery owing to multiple adhesions. Endoscopic retrograde cholangiopancreatography revealed persistent biliary leakage from the cystic duct remnant. This patient required transfer to our hepatobiliary unit. The second patient underwent SILS for cholecystectomy. Postoperatively, she was found to have biliary leakage from an accessory duct of Lushka. This settled with percutaneous drainage and endoscopic management. One patient in the standard laparoscopic group had a postoperative intra-abdominal hemorrhage forming a large hematoma which was treated conservatively and did not require reoperation. One patient in the standard laparoscopic hystrectomy had a minor wound infection. There were no other early postoperative complications in either group.

Discussion

In this study, we have performed a comparative analysis of our experience of SILS vs standard laparoscopy. There are several limitations to the study. Study groups were not sufficiently powered to detect differences of rare complications such as a biliary leak in case of cholecystectomy. Study groups were not matched or randomized and were taken from separate periods. These issues may well have affected our results. Analysis of patient demographic characteristics has demonstrated that although patient groups were similar in terms of BMI, patients undergoing standard laparoscopic surgeries were significantly older than patients undergoing SILS. This indicates that patient groups were not well matched. These caveats must be kept in mind while interpreting results. At present, the operating time for SILS is significantly longer than for standard laparoscopy, with an average difference of approximately 30 minutes. Analysis with Pearson's correlation has demonstrated a relationship between reduction in operating time and increasing experience. Similarly, the last 5 cases took significantly less time to perform than our initial 5 cases. This demonstrates the learning curve required when using a new technique such as SILS. The surgical team is still early in the learning curve for this procedure, and we fully expect operating times for SILS to continue to improve in the future. This may be aided by the development of new instrumentation specifically for SILS. It may also be possible to reduce the effect of the learning curve by simulator-based training, which has been demonstrated to improve performance during real laparoscopic procedures in terms of operative time and surgical error[14 - 15.] Introduction of a virtual reality training curriculum for laparoscopic procedures has been considered recently,[16] and it may be beneficial for the SILS technique to be included in this program. Single-incision laparoscopic surgery was performed successfully in patients with BMIs ranging from 18 to 42, indicating that morbid obesity is not a contraindication to this technique. Also, 2 patients in the SILS group had undergone previous midline laparotomy, indicating that previous abdominal surgery is also not a contraindication to SILS. Postoperative length of stay was found to be shorter in the SILS group compared with the standard laparoscopic group, but this did not reach statistical significance. Although this is an encouraging finding that may imply reduced pain postoperatively, we must be careful not to draw firm conclusions. This study did not measure pain scores objectively, and multiple administrative and hospital protocol-related factors. Similarly, the fact that our patient groups were not matched, with patients undergoing standard laparoscopy being older than those undergoing SILS, may explain this apparent difference. Currently, many laparoscopic surgeries are being performed in the day surgery setting, with patients expected to go home within 23 hours of operation. In this setting, this analysis would not be expected to demonstrate a reduced postoperative time course following SILS. It may, however, demonstrate that SILS has not led to longer postoperative stay compared with standard laparoscopic procedures.

Postoperative complications occurred in both surgical groups. Although the numbers in this study are far too few to detect significant differences in rare complications such as biliary leakage, it is encouraging to note that at present there is no trend to suggest that SILS may increase operative risk. In the case of intraoperative difficulty, we advocate the addition of extra laparoscopic

ports to improve surgical dexterity. Additional ports can be added with ease to convert SILS to a 2-, 3-, or 4-port laparoscopic surgeries. It is important to realize that the addition of further ports should be thought of not as a failure of the SILS technique but as the correct action for a difficult case. It is the practice of our department to consent patients for a laparoscopic procedure with the use of a single incision to 4 incisions depending on the level of surgical difficulty. Single-incision laparoscopic surgery has the potential of further minimizing the trauma associated with surgical access. In addition to improved patient cosmesis and satisfaction, there may be a reduction in the number of port-site complications such as port-site hernias, which have been reported in up to 5.2% of patients undergoing laparoscopic procedures.[7,18] However, SILS does have several obstacles that need to be addressed. Single-incision laparoscopic surgery is not ergonomic for the surgeon, who must adapt to a new method of positioning and instrumentation. As the camera and instruments are introduced through the same port, the traditional laparoscopic principal of triangulation is lost. The operator often works in positions where his or her right hand is controlling the left-sided instrument on screen and vice versa. This reversed view can make movements less intuitive than in conventional laparoscopic surgery, leading to the need for increased concentration. Accurate communication between operator and assistant is vital as movements of the camera can easily impede the operating surgeon. Instruments often interfere with each other within the abdomen and extracorporeally, where attachments such as the camera light lead often restrict movement. These difficulties may be partially alleviated by instruments such as in-line laparoscopes with a longer shaft to allow the assistant to position his or her hands away from those of the operating surgeon. The advent of laparoscopic surgery is an example of a technology that has significantly changed the way surgeons operate today. In its infancy, laparoscopy was beset with numerous obstacles to its progress. Concerns regarding costs, operating times, and possible increased risks of complications such as bile duct leakage in cholecystectomy have been mostly resolved, although there is still a significantly higher risk of bile duct injury following the laparoscopic approach.[19 - 22] Today the laparoscopic approach is the gold standard of treatment for various diseases.[2 ,23] Although SILS is not as revolutionary a concept as the initial forays into laparoscopy, it is still beset with numerous concerns regarding higher costs, longer operating time, and, among many, a feeling of disbelief regarding its potential advantages. It is important that new surgical techniques are supported by strong evidence to demonstrate their benefits to the patient. In the case of SILS, studies so far have demonstrated that it is a safe and efficacious method of surgery. Further clinical trials are now needed to demonstrate the advantages of this new and attractive technique. This study adds to a growing number of publications demonstrating SILS to be a feasible and safe approach to surgical procedures. Although the small number of patients in the study precludes us from drawing firm conclusions, we can at least infer that SILS may at least be equal to standard laparoscopy in terms of efficacy and patient safety. Future development of specific instrumentation for SILS will help to overcome ergonomic obstacles to this technique, which may in turn help to reduce the currently prolonged operating time. Large, randomized, prospective studies will be required in the future to investigate the potential benefits of the SILS technique such as reduced port-site complications, reduced postoperative pain, improved cosmesis, and improved patient satisfaction. Only then will we be able to justify the use of this technique in general surgical practice.

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