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Original Research

# Single incision laparoscopic cholecystectomy: A single center experience

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ABSTRACT

*Introduction:* Single Incision Laparoscopic Surgery (SILS) is a variation in which trocar scars are hidden in the umbilicus. We sought to determine whether SILS cholecystectomy is a safe alternative to a conventional laparoscopic cholecystectomy.

*Methods:* We retrospectively reviewed our series of 205 SIL cholecystectomies (SILC) performed between May 2008–June 2010. The first 50 cases were done by initially insufflating the abdomen with a veress needle through the umbilicus and then placing 3, 5 mm ports in the umbilicus. The remaining cases were performed using a cut down approach at the umbilicus, followed by placement of a three-trocar SILS port under direct vision.

*Results:* Two hundred and five patients (M:F = 48:157) underwent SILC during the study period. Median age was 45 (range = 21–62). Mean BMI range was 35 (range = 21–44). Mean operative time was 60 min (range = 40–120 min) and a follow up period that ranges from 1 to 21 months. Patient pathologies included: Chronic cholecystitis (74%), Acute cholecystitis (17%), Choledocholithiasis (6.8%), Gallstone pancreatitis (2%) and gallbladder polyp (0.5%). An additional port was placed in the umbilicus in 3% of cases. No cases were converted to open. Complications occurred in 4% of cases including: 3 patients with retained stones, 2 patients with post-op wound infection, 2 patients with incisional hernias in the umbilical region and 1patient with a veress injury.

*Conclusion:* SIL cholecystectomy can be done safely. It offers a better cosmetic result, which may lead to greater patient satisfaction.



## 1. Introduction

Gallbladder disease represents a major cause of morbidity in Western societies. In the United States, the incidence of symptomatic cholelithiasis is 2.2/1000 people and accounts for 500,000 cholecystectomies each year.[1] Most of these cholecystectomies are performed laparoscopically. Transition from open cholecystectomy to laparoscopic cholecystectomy in the late 1980s represents one of the major changes in contemporary general surgery. This change has brought with its improvement in Optics and the understanding of the physics of laparoscopic technology such that almost all general surgical procedures are now amenable to laparoscopic surgery.

Disappointed with additional incisions required for port placement during conventional laparoscopic cholecystectomy, in 1997, marked the beginning of a new approach, which employs only one incision.[2] This technique initially failed to gain popularity, however, until it was re-introduced in 2007. Single incision laparoscopic cholecystectomy hoped to create faster recovery, better cosmetic result, enhanced patient's satisfaction as well as reduced post-operative pain. There is however, a growing concern for the development of incisional hernia and increased risk of infection among these patients. In this study, we retrospectively reviewed our experience over a 25 month period.

## 2. Aim

To retrospectively review our institutional experience with regards to safety, feasibility and short-term outcomes of Single Incision Laparoscopic Cholecystectomy and to compare our results with the national standard.

## 3. Patients and methods

This is a retrospective review of cholecystectomies performed via the SILS approach in a high volume tertiary center in New York conducted between May 2008 and June 2010. Data was recorded prospectively in an excel database. The dataset contains demographic variables, admission, discharge details, and outpatient clinic

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follow up. The study was approved by the Institutional Review Board (IRB) and Informed consent was obtained from all patients. The patients were initially carefully selected based on their basis of age, body mass index and history of previous abdominal surgery. After patient 50, all patients were sequentially offered a SILS approach. All patients had radiological evidence of gallstone.

### 3.1. Inclusion Criteria

- Age : 20–65
- Radiological evidence of gallstone
- Symptomatic disease

### 3.2. Exclusion Criteria

- History of umbilical hernia repair with mesh
- Previous laparotomy
- Pregnancy
- BMI > 44.

All procedures were performed by two senior attending surgeons with Fellowship training in advanced laparoscopy as well as formal training in single incision procedures.

In preparation, all patients were placed in supine position with a slight reverse Trendeleberg and 30° right side tilt. Sequential pneumatic compression stockings were applied to both legs. With the exception of patients with Penicillin allergy, all other patients received perioperative antibiotic (Cefoxitin®) and orogastric tube decompression of the stomach.

During the early stage of the study, a veress needle was inserted through the umbilical stalk to establish pneumoperitoneum. Once sufficient pneumoperitoneum was created, 2 or 3, 5 mm ports were placed in the umbilicus. In the later part of the study, this closed technique was replaced by an open 1–2 cm transumbilical cut-down approach, followed by placement of SILS™ Port Multiple Instrument Access Port (Covidien, Norwalk CT).

Once the SILS port was in place, a 5 mm 0° laparoscope was placed along with 2 further 5 mm ports. In order to expose Calot's triangle, the gallbladder was retracted cephalad with a 0 silk transabdominal suture introduced on a straight Keith needle. The suture was secured subcostally in the right upper quadrant.

Using a reticulating grasper (Covidien, Norwalk CT), the gallbladder was held laterally to allow for further exposure. Dissection was performed in a retrograde manner using a reticulating mariland dissector (Covidien, Norwalk CT). Once the cystic duct and artery were identified and a critical view obtained, these structures were individually clipped with a standard 5 mm clip (Endoclip® applier, Autosuture) and divided using standard endoshear.

The gallbladder was then dissected off its bed and extracted via the umbilical site.

After ensuring satisfactory hemostasis and pneumoperitoneum was evacuated, the SILS port was withdrawn. The fascial defect was closed using Polyglactin 910 (Vicryl®). The umbilicus was approximated to its near pre-surgical state using absorbable suture.

All patients were seen in the clinic at 1, 6 months and yearly thereafter. During visits, all patients were examined for the presence of incisional hernia and were specifically asked about cosmetic results and their overall satisfaction with the procedure.

## 4. Results

During the study period, we performed SILS cholecystectomies in 205 patients consisting of 157 females and 48 males. Median age was 45years (age range = 21–62). Mean BMI was 35 (range = 21–44). The mean operative time was 60 min (range between 40 and 120 min). During the initial 50 cases, the mean operative time was 90 min (range 85–120 min). The mean length of hospital stay was one day (range: 23–36 h). Follow up period ranges from 1 to 25 months (mean 14 months).

**Table 1**
Patient's demographics and variables.

| Patient's Characteristics | Sex | Mean | Range |
|---|---|---|---|
| Male : Female | 48:157 | | |
| Age | | 45 | 21–62 |
| BMI | | 35 | 21–44 |
| Operative time | | 60 | 40–120 |

The indications for surgery included: chronic cholecystitis (74%; $n = 151$), Acute cholecystitis (17%; $n = 35$), Choledocholithiasis (6.8%; $n = 14$), Gallstone pancreatitis (2%; $n = 4$) and gallbladder polyp (0.5%; $n = 1$).

In 3% of cases ($n = 6$), an additional port was placed in the SILS port by temporary replacing the insufflation tubing with an additional 5 mm port. No cases were converted to open. In 4% of cases ($n = 8$), complications occurred in the form of surgical site infection ($n = 2$), retained stone ($n = 3$), veress needle injury ($n = 1$), and incisional hernia ($n = 2$). Both incisional hernias occurred during the early part of the study.

Ninety six percent ($n = 197$) of the patients stated that they were satisfied with their cosmetic results, and also stated "if they have to do it again, they would". one patient with incisional hernia was dissatisfied with the cosmetic result (Tables 1 and 2).

## 5. Discussion

Currently, laparoscopic cholecystectomy represents the standard of care for the management of symptomatic gallbladder disease. In many centers across the United States, it is routinely performed as an outpatient procedure. Traditionally, this requires placement of 4 separate small incisions. Single incision or single access transumbilical surgery may provide less pain, scarring and may improve overall quality of patient's satisfaction.

Despite these benefits, there are growing concerns for increased risk of incisional hernia, trocar site infection, and bile duct injuries. Concern for the first two complications is based on the fact that the umbilicus represents the weakest part of the anterior abdominal wall and also has the least blood supply. Meanwhile, concern for the third complication (bile duct injury) results from the altered visualization of Calot's triangle created by in-line visualization and non-triangulation of ports.

In our series, we recorded a 4% complication rate. Specifically, our incisional hernia and trocar site infection rates were 1% each. This compares favorably with the published infection and incisional hernia rate of 2% and 5.2% respectively after traditional laparoscopic cholecystectomy.[3,4]In all patients, we routinely placed a suture through the gall bladder in order to obtain better expose. This practice, led to bile spillage. Others who had adopted a similar approach ours have recorded low infection. Although, this finding suggest that

**Table 2**
Patient's disease and indications for surgery.

| Disease | Number | Percentage |
|---|---|---|
| Cholecystitis | 186 | 91 |
| Choledocholithiasis | 14 | 6.8 |
| Biliary pancreatitis | 4 | 1.9 |
| Gall bladder polyp | 1 | 0.4 |
| Total | 205 | 100 |

surgical site infection rate in setting of infected bile may be low, it is our belief that the wound and peritoneal cavity must be thoroughly lavage and if possible the spillage must be avoided.

We had one incident of veress needle injury, which was recognized in a delayed manner. The injury in the Iliac artery was managed endovascularly. In a recent review of a pooled study of 252 SILS cholecystectomies performed worldwide, a complication rate of 2% was recorded for all comers. This rate is comparable with our rate. In the pooled study, the complications encountered consist of: subcutaneous hematoma {1}, mesenteric injury {1}, hepatic injury {1}, hepatic duct {1} and bile leak {1} but no incisional hernia was recorded in that study[2,5–24].

In a separate study by Ersin and colleagues,[5] of the 20 patients in the series, 19 underwent SILS cholecystectomies without any complication.

In our series, we had a 1% risk of incisional hernia in a mean follow up period of 14 months (range 1–25 months). Although this follow up period is short, we believe that this time is sufficient to detect early incisional hernia. This view is supported by a report by Mudge and colleagues who observed that 85% of all incisional hernia occurs within the first 5years of the initial surgery.[25]

Compared with conventional laparoscopic cholecystectomy, SILS cholecystectomy has limited access, which makes the procedure technically challenging. It is widely believed that this limitation lends the procedure to be more susceptible to conversion to the open approach. In our experience, to be proficient in Single incision laparoscopic cholecystectomy requires a minimum of 50 procedures. Of the 205 SILS cholecystectomies performed in our series, none was converted to an open approach. Others have reported similar results.[5,24] In two separate reports by Rao and Kuon, the conversion rates were 15% (20 patients) and 13.5% (37 patients) respectively.[11,23] The reasons given for conversion to conventional laparoscopic cholecystectomy appears to be multifactorial. Commonly, they include difficult anatomy, difficult dissection, inability to insert trocar, bleeding, body habitus, and crowding of instruments (sword fighting effect).

Six patients (3%) in our series required additional port placement to facilitate exposure but none of these patients required conversion to open cholecystectomy. Hodgett et al.[26] reported a similar result in 2 patients in their series.

In most published series of SILS cholecystectomy, the indication for surgery is commonly biliary colic. In our series, 92% of our patients had cholecystitis. Our mean operative time was 60 min. The average operative time is identical to Hodgett and Binenbaum[26,27] who separately reported a mean operative time of 74 and 149 min respectively. In a recent meta-analysis conducted by Antoniou et al.,[28] mean operative time was 70.2 min and mean adjusted hospital stay was 1.4days. This finding is consistent with the findings in conventional laparoscopic cholecystectomy. Analysis of outcome from that study indicated that age >45year, BMI > 30 Kg/M$^2$ and the presence of acute cholecystitis are associated with adverse effects and are often major factors for technical failure. In our series, of the 6patients that required additional port placement, 88% were clinically obese. Unlike Antoniou's review, we did not encounter any technical difficulty in patients with acute cholecystitis. We believe that SILS cholecystectomy with a well-choreographed series of steps has an operative time comparable with the standard laparoscopic approach.

This study has several limitations. Our follow up period is short and therefore unable to predict the likelihood of herniation in future, as several studies in the past have shown that the risk of incisional hernia formation increases over time. In order to effectively assess this outcome, a long follow up period of at least 5years are required. Furthermore, in most series, the number of cases of SILS cholecystectomies performed was small and therefore lacks the power to determine the true incidence of incisional hernia. To the best of our knowledge, this series represents the largest single institute series in the English-speaking world to be published.

## 6. Conclusion

SILS is technically challenging with a steep learning curve. Once mastered, operative time is comparable with conventional 4-port laparoscopic cholecystectomy. Early results indicate that it is cosmetically acceptable to patients and has high satisfactory index.

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None.

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