

Early experience in single-site laparoscopic cholecystectomy

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INTRODUCTION Laparoscopic cholecystectomy is currently the gold standard for removal of symptomatic gallbladders. The push in recent years toward reducing the number of ports required to perform this surgery has led to the development of single-incision laparoscopic cholecystectomy (SILC). We report our early experience with SILC and assess its feasibility and safety.

METHODS A prospective study was conducted of the first 100 patients who presented with complaints of biliary colic and underwent laparoscopic cholecystectomy via the single-port technique at our institution. SILC was performed via a single-port device such as a flexible umbilical port that could accommodate up to three surgical instruments. The port was inserted into a transumbilical incision around 15–20 mm long. Data on operative details and postoperative outcomes were collected and evaluated.

RESULTS The mean operation time was 67.8 minutes. Six patients needed conversion, requiring extra 5-mm ports to complete the surgery. No serious intraoperative complications, such as bile duct injury or bile leakage, were encountered. Cosmesis from the scar hidden within the umbilical fold was excellent.

CONCLUSION Our initial results of single-port laparoscopic cholecystectomy are promising, with no complications being seen in this early series. However, the drawbacks include the higher cost of equipment and a steeper learning curve. Further evaluation is required to assess the risks and benefits of this approach when compared with conventional laparoscopic cholecystectomy.

Keywords: laparoscopic cholecystectomy, minimally invasive, SILC, single-incision surgery, single-port laparoscopy
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INTRODUCTION

Minimally invasive laparoscopic surgery is the current gold standard for the removal of symptomatic gallbladders. The benefits of this minimally invasive approach are now well-established, and patients are also more aware of such an option. To maximise the benefits of minimally invasive surgery, there has been a continued push to reduce the number of ports required to perform such procedures. In the last few years, a few centres in the world have reported successful attempts at performing laparoscopic cholecystectomy via a single site at the umbilicus.^(1,2) Preliminary results have indicated reduced postoperative pain, better cosmetic results and earlier return to normal activity.⁽²⁾ We report our early experience of the procedure and further assess the feasibility and safety of single-port laparoscopic cholecystectomy.

METHODS

The first single-incision laparoscopic cholecystectomy (SILC) was performed for a 62-year-old Chinese man at the National University Hospital (NUH), Singapore in April 2009, after obtaining informed consent. The procedure was video recorded and analysed extensively, and the SILC technique refined and improved. From April 2009 to August 2011, 100 patients underwent SILC. All 100 procedures were performed by the same surgeon.

SILC, being a fairly new technique, requires the use of newly developed devices, and therefore, approval was obtained from the institutional board of medical affairs for the use of these instruments. All patients who opted for the ‘scarless’ surgery were informed of the risks and benefits of the procedure in accordance with a standard care protocol, and informed consent was sought from all patients prior to surgery. Approval was obtained from the institutional ethics review board to conduct the prospective study. Standard clinical procedures were followed.⁽³⁾

Inclusion criteria were presentation with typical symptoms of biliary colic and cholelithiasis proven on ultrasonography. Patients suspected to have malignancies or peritonitis were excluded from the study. Information on demographics (age and gender), clinical parameters, operative technique, duration of operation and operative complications were collected and evaluated. Under general anaesthesia, a single, flexible umbilical port such as SILS™ port (Covidien, Dublin, Ireland) (Fig. 1a), which could accommodate up to three surgical instruments, was inserted via a 15–20 mm transumbilical incision using an open technique. A local anaesthetic was administered before incision to reduce postoperative pain. The pneumoperitoneum was created and maintained at a level of

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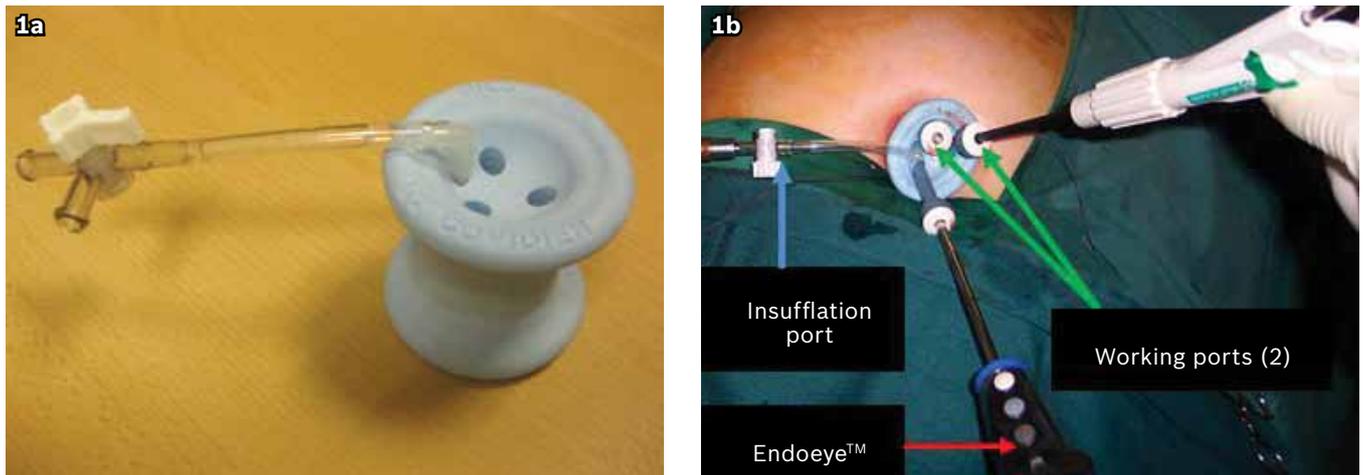


Fig. 1 Photographs show (a) the SILS™ port, a single flexible umbilical port; and (b) the port arrangements and orientation.

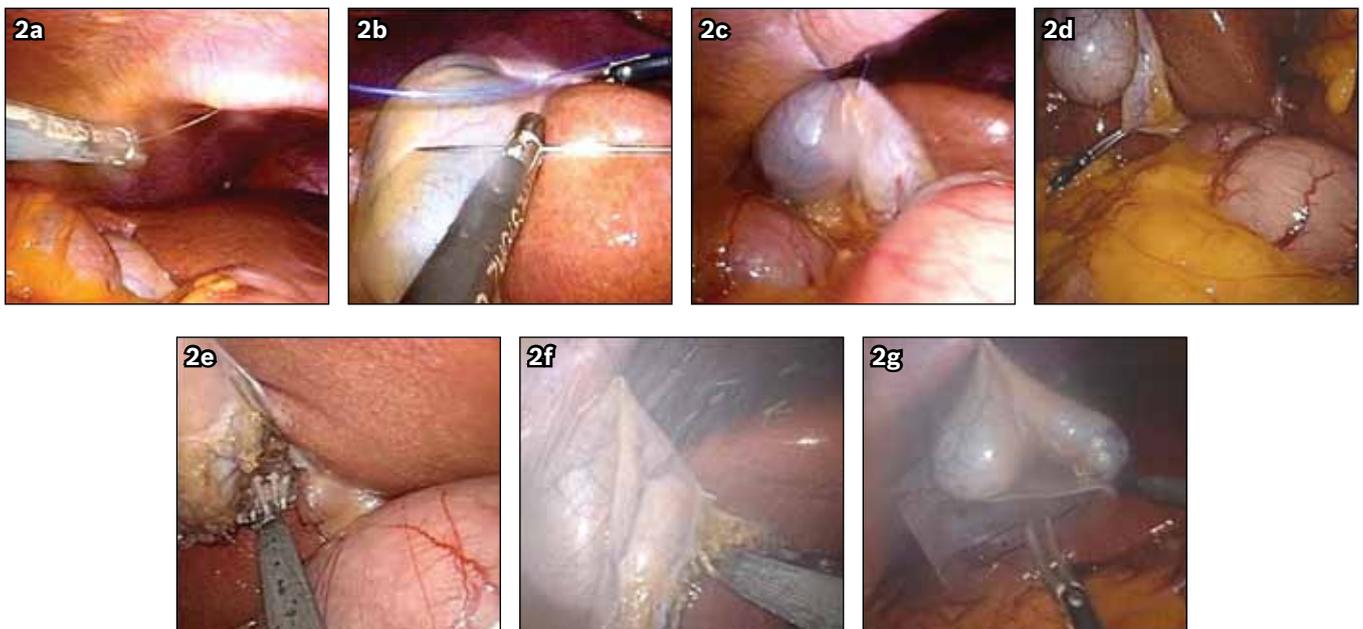


Fig. 2 Operative photographs show (a) transabdominal introduction of needle at the costal margin; (b) piercing of the gallbladder fundus through the serosa; (c) hitching up of the gallbladder anteriorly to the abdominal wall; (d) exposure of the Calot's Triangle; (e) division of the cystic artery and duct; (f) dissection of the gallbladder off the liver bed using hook cautery; and (g) bagging of the gallbladder.

12 mmHg. Three 5-mm wide ports, placed at differing depths to minimise collision during manipulation, were then introduced into the SILS™ port. The SILS™ port was oriented such that there were two working port channels superiorly and a single port channel for the 5-mm video telescope inferiorly (Fig. 1b). The insufflation port pointed laterally toward the patient's right. The 5-mm telescope (Endoeye™; Olympus, Philadelphia, PA, USA), which was found to be the most suitable video telescope system, was introduced via the inferior port.

Following a thorough diagnostic laparoscopy, needle suspension of the gallbladder was performed to allow visualisation of the Calot's Triangle. A prolene 3-0 suture with straight needle was introduced transabdominally at the costal margin (Fig. 2a). The needle was made to pierce through the serosa at the fundus of the gallbladder (Fig. 2b), and care was taken to ensure that the needle did not pass through the full thickness of the gallbladder to avoid bile leakage. The needle was

then pierced through the abdominal wall, thereby hitching the gallbladder up to the abdominal wall (Fig. 2c) and lifting the liver up simultaneously. The Calot's Triangle was visualised (Fig. 2d), and the cystic artery and duct dissected, clipped with haemolock and divided (Fig. 2e). The gallbladder was then dissected off the liver bed using hook cautery (Fig. 2f). The gallbladder was left hitched up to the anterior abdominal wall until it was ready to be 'dropped' into a bag that was opened and placed directly under it (Fig. 2g). The bag containing the gallbladder was retrieved out of the peritoneal cavity via the umbilical wound.

RESULTS

All 100 patients presented with complaints of biliary colic and did not have any significant comorbidities. The mean operation time was 67.8 (range 26–180) minutes. Six patients needed extra ports to complete the surgeries. The reasons for added difficulty in these six patients are tabulated in Table I.

Table I. Reasons for converting to surgery.

Patient no.	Reason for conversion	Type of conversion	Previous/ongoing acute cholecystitis	Previous abdominal surgery
1	Bile leak from cystic duct	1 x additional 5-mm port	No	Yes
2	Dense adhesion at Calot's triangle	1 x additional 5-mm port	No	No
3	Acute cholecystitis with dense adhesion at Calot's triangle and gallbladder bed bleeding	2 x additional 5-mm ports	Yes	No
4	Gallbladder densely adherent to liver	2 x additional 5-mm ports	No	No
5	Dense adhesion at Calot's triangle	1 x additional 5-mm port	No	No
6	Dense adhesion at Calot's triangle	1 x additional 5-mm port	No	No
	Bile leak from cystic duct	1 x additional 5-mm port	No	Yes

The technical success of SILC in our patient group was thus 94%. One patient who needed conversion required an extra 5-mm epigastric port to aid in the haemostasis of a bleeding posterior branch of the cystic artery. Two patients encountered minor tear of the cystic duct during dissection and required additional ports to complete the dissection. No serious intra-operative complications, such as bile duct injury or bile leakage, occurred in any of the patients. None of the patients' gallbladders showed any evidence of dysplasia or malignancy on pathological examination. Gallbladder inflammation was confirmed in all patients on histology. The patients remained well without complaints on follow-up. The single incisional scar healed well and was well hidden in the umbilical fold in all patients (Fig. 2b), proving the virtually 'scarless' benefits of SILC.

DISCUSSION

In recent years, a push toward minimising surgical access to capitalise on the benefits of minimally invasive surgery has motivated some surgeons to attempt cholecystectomy with fewer port incisions and even no abdominal incisions. Natural orifice transluminal endoscopic surgery (NOTES) is one such innovation. In NOTES, the surgeon accesses the peritoneal cavity via a natural orifice (such as orally or through the vaginal orifice), thus leaving no scar on the abdominal wall. SILC, on the other hand, is usually performed through the umbilicus, with the ports being placed in a single incision. Upon healing, the umbilicus heals into a scar not much different from its original appearance. Both NOTES and SILC are potential successors to the more traditional laparoscopic surgery.⁽⁴⁾ However, a majority of authors favour SILC, as the risks of viscus perforation, poor endoscopic view and difficulty in maintaining the pneumoperitoneum are associated with NOTES.⁽⁵⁾ Romanelli et al have even predicted that "single-port access surgery may be the next generation of minimally invasive surgery".⁽⁶⁾

Most research concurs that SILC holds exciting prospects for laparoscopic cholecystectomy. Chow et al reported that using SILC techniques reduced postoperative pain and encouraged early mobilisation while at the same time reducing complications such as incisional hernias and port-site haemorrhage.⁽¹⁾ There is also high patient satisfaction, decreased length of hospital stay and good cosmetic results from a 'scarless' surgery. However, the

procedure is not without its cynics. The popular introduction of laparoscopic cholecystectomy in the early 1990s was associated with a significant increase in the incidence of biliary tract injuries.⁽⁷⁾ It is possible that similar developments may unfold for SILC as well. SILC, being more technically demanding, has a higher learning curve and longer operation time. The 'chopsticks effect' due to clashing of three instruments entering through a single port, for instance, may also restrict the surgeon's hand movements.⁽⁸⁾ The technical difficulty of SILC does limit its applicability to a carefully selected pool of patients, and patient safety should remain the utmost consideration when embarking on such a surgery.

Mean operation time in our study (67.8 minutes) was comparable to international results (UK 142.9 minutes).⁽¹⁾ Intra-operative complication from a bleeding posterior branch of the cystic artery was seen in one patient in this series. However, it should be noted that such bleeding from the posterior branch of the cystic artery is uncommon, as anatomical variants of this artery are rare. Even for this patient, SILC was found to be safe, as additional ports could be inserted readily to complete the surgery without compromising the patient's safety or risking further serious complications, such as bile duct injury or biliary leakage. All patients reported good satisfaction at the outcome and cosmesis of the surgery.

Contraindications for SILC surgery include suspected biliary obstruction requiring confirmatory intra-operative cholangiogram and cholecystoenteric fistulae, which require careful division of the fistula and repair of the enteric perforation. Other relative contraindications include suspected malignancy, obesity and Mirizzi's syndrome. Appropriate imaging investigations and liver functions tests should be performed to exclude such indications. SILC is also more expensive than normal laparoscopic cholecystectomy. For example, the total cost of treatment by SILC at our institution (inclusive of hospital stay, surgery and other in-hospital treatment expenses) was 38% higher than that of conventional laparoscopic surgery. Most of this additional cost was due to the use of single-use, disposable SILC devices.

Our early experience shows that SILC is a safe and feasible option for laparoscopic cholecystectomy, and it is likely to gain popularity among patients and surgeons alike due to its many benefits. However, it is essential that careful patient

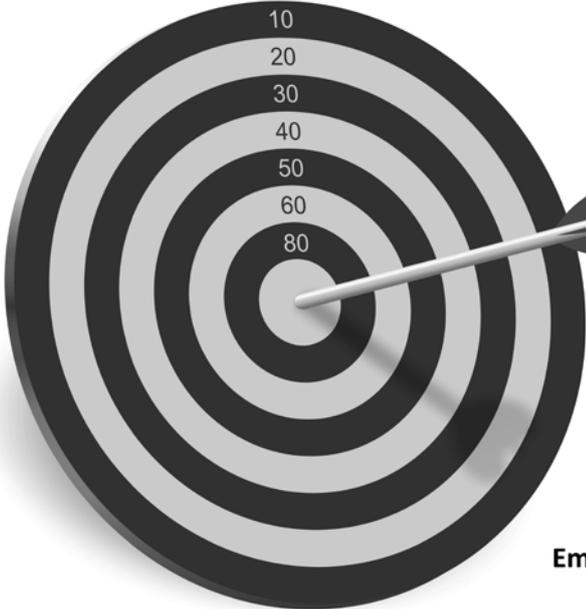
selection and adequate peri-operative patient education be exercised. Sound judgement will be required of an experienced surgeon on the need to place additional ports or to convert to open surgery, if needed. Future prospective randomised control trials that further evaluate the risks and benefits of SILC would be needed to cement its place as the approach of choice for minimally invasive laparoscopic cholecystectomy.

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