

Single-Incision Laparoscopic Cholecystectomy for Biliary Dyskinesia in Children: A Simple, Safe, and Inexpensive Technique

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Abstract

Purpose: To evaluate a low-cost technique for single-incision laparoscopic cholecystectomy (SILC) in children with biliary dyskinesia.

Patients and Methods: Eighteen children with biliary dyskinesia underwent SILC between March and September 2010. Two 5-mm trocars and a directly introduced grasper were inserted through a 2-cm vertical transumbilical incision. Instrument collisions were minimized by using low-profile trocars and a bariatric laparoscope with a right-angle light adaptor. An internally anchored retracting device suspended the gallbladder, obviating the need for an additional trocar. No other special equipment was used.

Results: There were 15 girls and 3 boys with a mean age of 15.9 years (range, 9–18 years). Sixteen (88.9%) underwent true SILC. One patient was converted to a four-port laparoscopic procedure because of uncertainty of ductal anatomy. Another required a 5-mm subxiphoid port for liver retraction. Mean operative time was 82 minutes (range, 42–105 minutes): 94 minutes (range, 75–105 minutes) for the first 6 patients, 85 minutes (range, 60–102 minutes) for the second 6, and 68 minutes (range, 42–90 minutes) for the last 6. Operative times between the first and last groups were significantly different ($P = .02$). Sixteen patients were discharged home the following day and the remaining 2 on the second postoperative day. There were no complications. The hospital costs of the disposable equipment needed to perform SILC at our institution was \$205.05 less than that needed for the four-port operation (\$516.32 versus \$721.37), a 28.4% savings.

Conclusions: SILC is safe and feasible in children with biliary dyskinesia. The operative time decreased with experience. The disposable equipment needed was less expensive than that used for the standard laparoscopic technique.

Introduction

BILIARY DYSKINESIA IS THE MOST COMMON indication for cholecystectomy in children.¹ In general, patients with an ejection fraction below 15% will have resolution of abdominal pain after cholecystectomy.² The gallbladder in biliary dyskinesia usually does not have inflammatory changes or scarring³; thus, the dissection is typically straightforward. For this reason, cholecystectomy in patients with biliary dyskinesia is relatively simple to perform using the SILC technique.

Several previous studies have shown that SILC is feasible using special equipment, often with increased expense.^{4–6} We present a technique that involves the use of standard laparoscopic instruments and the EndoGrab[®] device (Virtual Ports,

Richmond, VA) at a cost similar to the traditional laparoscopic approach.

Subjects and Methods

The SILC procedure was offered to all biliary dyskinesia patients who presented to the primary author from March to September 2010. Demographic data, operative times, need for additional ports, length of stay, complications, and equipment costs were analyzed.

Operative technique

The patient was placed in the supine position with both arms tucked. A 2-cm vertical skin incision was made through the center of the umbilicus. The umbilical stalk was divided

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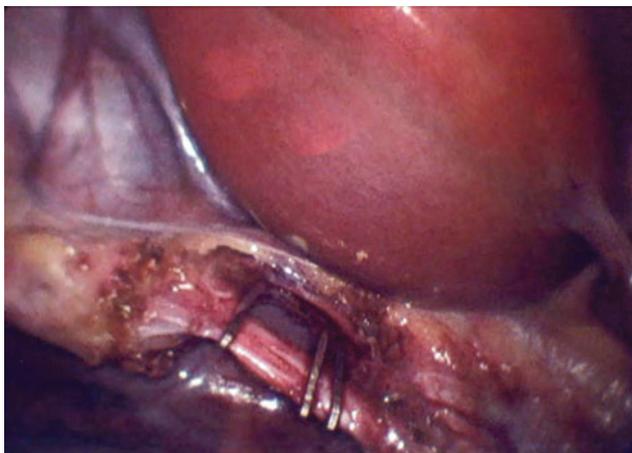


FIG. 1. Laparoscopic view showing the cystic duct dissected and clipped. The single-incision approach did not impair the quality of visualization.

sharply, and skin flaps were created. This provided access to a 3-cm-diameter section of fascia. The abdomen was insufflated with CO₂ using a Veress needle. The needle was removed, and two low-profile 5-mm trocars (Covidien, Mansfield, MA) were placed via separate fascial incisions in the midline. One trocar was placed more deeply than the other to avoid collision of trocar heads. The superior trocar was angled directly toward the gallbladder to facilitate the dissection. Typically, the 50-mm length was used; however, longer trocars were required for obese patients. An additional grasper was then placed directly through the fascia to the right of the trocars. Using separate fascial incisions greatly reduced the potential problem of CO₂ leakage.

A 30° laparoscope was inserted through the inferior trocar. In order to avoid external collisions with the other instruments, a bariatric scope with a right-angle light adaptor was used. The EndoGrab is a device with two grasping arms connected by a small wire. Gallbladder retraction was achieved by grasping the fundus with the larger arm and tethering it to the anterior/superior abdominal wall by the smaller arm. This device requires a 5-mm nondisposable instrument that only uses a trocar temporarily for purposes of deployment and retrieval. Thus, the trocar is free to be used for other instruments throughout the procedure.

The directly introduced grasper was used to retract the infundibulum to aid in the exposure of the triangle of Calot. A Maryland dissector and right-angle dissector were used to dissect the cystic artery and the cystic duct in order to obtain the critical view of the biliary anatomy (Fig. 1). The cystic duct

and cystic artery were divided between 5-mm clips (Ethicon Endo-Surgery, Cincinnati, OH).

The gallbladder was then dissected from the liver using electrocautery applied through an L-hook. The EndoGrab device was then retrieved. The superior trocar was removed, and the fascial defect was enlarged to accommodate a 10-mm EndoPouch® (Ethicon Endo-Surgery). The gallbladder was placed into the pouch using a scooping technique, and the pouch was removed. The fascial defects and skin were closed in standard fashion.

Statistical analysis

For purposes of analysis, the 18 patients were chronologically divided into three groups of 6 patients each. One-way analysis of variance was used to compare the characteristics of the three groups in regard to age, weight, and operative time. Student's *t* test was used to compare the difference in operative times between Group 1 (the first 6 patients) and Group 3 (the last 6 patients).

Results

There were no statistically significant differences among the groups with respect to age or weight (Table 1). In 1 patient with unclear ductal anatomy (the second case), the SILC technique was abandoned, and the operation was completed using the standard four-port laparoscopic technique. Another patient (the eighth case) required a 5-mm subxiphoid trocar for additional liver retraction. Mean operative time was 82 minutes (range, 42–105 minutes): 94 minutes (range, 75–105 minutes) in the first group, 85 minutes (range, 60–102 minutes) for the second group, and 68 minutes (range, 42–90 minutes) for the last group (Table 1). Operative times between the first and last groups were significantly different ($P = .02$). Sixteen patients were discharged home the following day. Two patients remained a second night: 1 for poor oral intake and the other for migraine headaches. Patients were evaluated in the clinic after 2–4 weeks. There were no complications or re-admissions. The hospital cost (not charges to the patient) of the disposable equipment needed to perform the SILC technique at our institution was \$205.05 less than that needed for the four-port operation (\$516.32 versus \$721.37), a 28.4% savings (Table 2).

Discussion

Cholecystectomy is one of the most common procedures performed in the United States and worldwide.⁷ In an attempt to move toward less invasive procedures, we have seen the introduction of mini-laparoscopy,⁸ Natural Orifice Transluminal Endoscopic Surgery (NOTES®; American Society for

TABLE 1. COMPARISON BETWEEN THE THREE STUDY GROUPS DIVIDED CHRONOLOGICALLY

	Group 1 (n=6)	Group 2 (n=6)	Group 3 (n=6)	P value
Mean (SD) age (years)	14.7 (3.01)	13 (3.46)	14.7 (2.58)	.561
Mean (SD) weight (kilograms)	70.8 (25)	62.2 (17.6)	92.3 (45.5)	.267
Mean (SD) operative time (minutes)	93.6 (12.5)	85 (19.86)	68 (18.5)	.055
Additional ports placed	3 (1 patient)	1	0	NA
Complications	None	None	None	NA

NA, not applicable.

TABLE 2. COMPARISON BETWEEN THE HOSPITAL COSTS FOR THE DISPOSABLE EQUIPMENT BETWEEN FOUR-PORT AND SINGLE-INCISION LAPAROSCOPIC CHOLECYSTECTOMY

Disposable equipment	Hospital costs (\$)	
	Standard four-port approach	SILS approach
Used in both approaches		
Ethicon insufflation needle	16.75	16.75
CO ₂ tubing	4.05	4.05
Ethicon Endopouch	78.77	78.77
Ethicon Ligaclip	160.29	160.29
Used in the four-port approach		
5-mm Covidien Innerdyne trocars ×3	312.87	
12-mm Covidien Innerdyne trocar	148.64	
Unique to the SILS approach		
Virtual ports EndoGrab device		150
Ethicon 5-mm (150-mm-length) trocar		52.91
Covidien 5-mm (50-mm-length) low-profile trocar		53.55
Total hospital costs for disposable equipment	721.37	516.32

SILC, single-incision laparoscopic cholecystectomy; SILS, single-incision laparoscopic surgery.

Gastrointestinal Endoscopy [Oak Brook, IL] and Society of American Gastrointestinal and Endoscopic Surgeons [Los Angeles, CA]),^{9,10} and SILC.^{4-6,9-14} The latter procedure recently provided the impetus for industry to develop a wide variety of new surgical tools and techniques.⁴⁻⁶

Minilaparoscopy⁸ uses the same triangulation principle used for the standard laparoscopic cholecystectomy while minimizing the scar because of smaller instruments. This technique requires the use of a smaller-diameter scope, which typically offers reduced image quality. The smaller instruments are also prone to bending and breaking. Although the incisions are smaller, they still exist and cause visible scars.

The NOTES technique is still experimental.^{9,10} If it does ultimately become popularized, it will require a great deal of specialized equipment and advanced endoscopic skills. The SILC technique, by comparison, is available today with equipment that is readily available to surgeons and results in virtually no visible scar.

Many techniques have been proposed for SILC,^{4-6,9-14} some of which use a variety of new instruments in order to overcome the technical difficulties. This raises obvious concerns regarding the cost of the procedure. Our technique did not use a port platform, articulating instrument, or deflectable-tip laparoscope. We used one additional instrument, the EndoGrab, a disposable device that is relatively inexpensive (\$150). The deployment and retrieval instrument for this device is reusable and costs about \$400. Instead of the EndoGrab, some surgeons have used a transabdominal suture that suspends the gallbladder to the anterior abdominal wall.¹⁵ This technique is limited by the fact that the suture can only be passed below the costal margin, whereas the EndoGrab can be attached more superiorly for improved retraction. It can also be adjusted to provide different angles of retraction during the operation. Suture holes can potentially cause leakage of bile from the

gallbladder. In our experience, this did not happen using the EndoGrab.

To be clear, the data listed in Table 2 represent the costs to our hospital for all of the disposable equipment used. It does not represent charges to the patient. In addition, it should be noted that we have not included any cost of additional operative time required to perform the SILC approach.

Conclusions

SILC is a simple, safe, and feasible procedure in children. After a short learning curve, the operation can be completed in about an hour. It can be done inexpensively, and most of the necessary equipment is already available in laparoscopic centers.

Disclosure Statement

No competing financial interests exist.

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