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CASE REPORT

Transumbilical Single-Incision Laparoscopic Cholecystojejunostomy Using Conventional Instruments: The First Two Cases

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Abstract
Background/Aim Optimization of quality of life is an important goal in the management of patients with unresectable peri-ampullary cancer. Herein, we share our two cases to demonstrate the feasibility of scarless transumbilical single-incision laparoscopic cholecystojejunostomy using conventional instruments in the management of unresectable peri-ampullary cancer.
Cases and Methods Two 58-year-old patients (one male) underwent transumbilical single-incision laparoscopic cholecystojejunostomies: The male and female patients were diagnosed with duodenal papillary carcinoma and pancreatic cancer, respectively. The hepatocystic junction was confirmed patent preoperatively in both patients. A 2-cm periumbilical incision was made for the placement of three trocars. Conventional rigid laparoscopic instruments were solely used throughout the procedure, and operative techniques were carried out in the same fashion as for conventional laparoscopic cholecystojejunostomy.
Results The procedures were completed uneventfully in 190 and 155 min, respectively, with no complications, and the blood loss was estimated at 80 and 20 ml, respectively. Postoperative pain scores on postoperative day 1 were 4/10 and 3/10. The patients were discharged from the hospital on postoperative days 3 and 5 with resolving jaundice.
Conclusions Transumbilical single-incision laparoscopic cholecystojejunostomy appears to be a technically feasible alternative to standard laparoscopic procedure and can be performed using conventional laparoscopic instruments.

Keywords Laparoscopy · Single-incision surgery · Cholecystojejunostomy

Introduction

Surgical resection is generally accepted as having beneficial effects on the survival for patients with peri-ampullary carcinoma.[1] When curative treatment is unfeasible, careful selection of optimal palliation becomes of central importance in the management of peri-ampullary cancer. Furthermore, in contemporary management, optimization of quality of life in patients with unresectable disease is the most important goal.

Laparoscopic biliary bypass is associated with low operative risk, devoid of the hazards of endoscopic or radiologic stent placement, and allows for combination of staging and palliation in patients diagnosed with unresectable disease at laparoscopy.[2] Single-incision laparoscopic operations have recently emerged as a less invasive alternative to conventional laparoscopy.

The aim of this study was to describe our initial experience with single-incision laparoscopic cholecystojejunostomy in two patients with unresectable peri-ampullary cancer by using conventional instruments while leaving virtually no scars both physically and psychologically. To our knowledge, our report on the two cases of single-incision laparoscopic cholecystojejunostomy is the pioneer of its kind. We describe here the challenges we confronted and the details of our operative technique.

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Patients and Methods

Patients

Case 1 A 58-year-old man presented with a 4-week history of jaundice and loss of appetite. His past medical history was significant for congestive heart failure and chronic renal failure (End-Stage Renal Disease), which was unstable for curative managements. On physical examination, he had normal vital signs, and his abdominal examination was unremarkable. His body mass index was 25.5 kg/m^2. The relevant laboratory readings were significantly deranged as shown in Table 1. A computed tomography (CT) scan of the abdomen revealed a mass in the peri-ampullary region. There was no periportal lymphadenopathy. Magnetic resonance cholangiopancreatography (MRCP) and endoscopic retrograde cholangiopancreatography (ERCP) also confirmed these findings. Biopsies were determinate for malignancy.

Case 2 A 58-year-old woman presented with a 3-month history of weight loss and a 2-week history of jaundice. Her body mass index was 27.5 kg/m^2, and the laboratory readings were also significantly deranged (Table 1). A CT scan of the abdomen revealed a mass in the pancreatic head and two metastatic foci of the liver. There was no periportal lymphadenopathy, and MRCP and ERCP have confirmed these findings.

From the imaging studies, we were able to confirm the patency of the hepatocystic junction in both patients, and the junction of the cystic duct with the common hepatic duct was more than 1 cm away from the proximal extent of the tumors. A preoperative nasobiliary drainage tube was installed endoscopically in each patient for early palliation of jaundice.

Due to both patients' medical history and disease status, palliative surgical protocols were scheduled. The patients and next of kin were informed in detail of the nature of the surgical procedure and risks involved before consents were obtained.

Table 1 Preoperative and Postoperative Laboratory Readings for the Two Patients

	Case 1	Case 2
Liver function tests		
Total bilirubin (μmol/L); range 3.4~20.5	270.6 (140.3)	151.9 (52.6)
Direct bilirubin (μmol/L); range 0~8.6	220.3 (116.7)	125.2 (46.3)
Alkaline phosphatase (U/L); range 40~150	679 (208.0)	749 (323.6)
γ-Glutamyltransferase (U/L); range 9~64	1,266 (225.0)	1,014 (383.2)
Tumor marker		
CA19-9 XR (U/L); range 0~37	416.0	>1,000.0

Postoperative day5 values in parentheses

Operative Technique

The procedures were performed under general anesthesia with the patients in the reverse Trendelenburg's position at a 15° tilt to the left. The team set up as shown in Fig. 1. Pneumoperitoneum was established by using closed Veress needle technique through the umbilicus. After insufflation of CO_2 and maintaining the pressure at 13 mmHg, a 2-cm periumbilical incision was made for trocar access. Conventional trocars were used, including a 5-mm, a 10-mm standard trocar and an unbladed trocar (Xcel B12LT; Ethicon Endo-Surgery, Inc., US). The three ports were placed within the umbilical incision in an inverted equilateral triangular configuration, 1-cm apart, with the camera placed at the apex (Fig. 2). A 30° 10-mm rigid laparoscope (Stryker Endoscopy, US) was used throughout the procedures.

The procedure began with a general exploration of the abdomen, particularly to confirm the radiologically patent hepatocystic junction. The intention of the operative procedure was the same as with conventional laparoscopy: to create a surgical bypass for the management of biliary tract obstruction. A simple side-to-side cholecystoenterostomy was performed 40 cm from the ligament of Trietz using a laparoscopic intracorporeal stapler-cutting device (ATW45; Ethicon Endo-Surgery, Inc., US) with the stapler

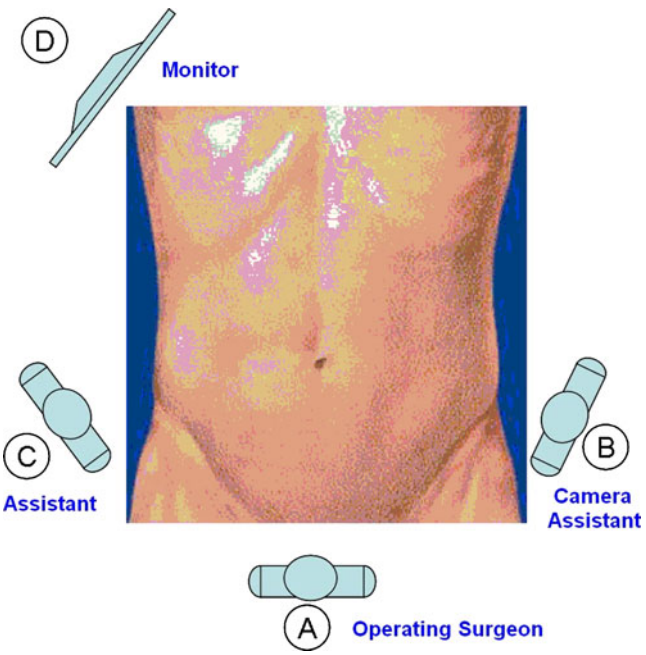

Fig. 1 The team setup.

Fig. 2 The three ports placed within the umbilical incision in an inverted equilateral triangular configuration.

insertion sites made on the fundus of the gallbladder and jejunum, and the insertion openings were laparoscopically closed and tied in an intracorporeal fashion using simple running 3/0 absorbable Vicryl sutures (Ethicon, USA; Fig. 3a). This was followed by a side-to-side Braun's enteroenterostomy performed using intracorporeal linear stapler-cutting device (ATB45; Ethicon Endo-Surgery, Inc., US) with the stapler insertion sites made on the proximal and distal jejunal segments; finally, the insertion openings were also closed laparoscopically. The most challenging aspect of this technique was operating with the instruments that were crossing-over and clashing with each other. The three-port inverted triangular setup was the most ideal arrangement allowing for adequate range of motion for the 10-mm laparoscope to navigate between the work ports either inferiorly or superiorly.

Two percutaneous transfascial retraction sutures (3/0 Prolene; Ethicon, US) were placed at the right and left costal margins to achieve adequate exposure not only to facilitate anastomosis but also throughout the whole procedure. One suture was placed at one end of the anastomotic line between the fundus of the gallbladder and intestine (Fig. 3c), and the other was at one end of the anastomotic line between the two segments of the intestine (Fig. 3d). Completed anastomoses were inspected, and the abdomen was irrigated in the usual fashion. A 22-French sub-hepatic drainage tube was placed through the umbilicus (Fig. 4), and enlarged umbilical incision was closed under local anesthesia with 3/0-Vicryl sutures (Ethicon, US) after the drainage had been removed.

Results

The operations lasted 190 and 155 min, with a blood loss of 80 and 20 ml. No intraoperative complications had occurred. Both patients resumed oral diet 24 h after surgery at which they were also able to mobilize. The sub-hepatic drainage was removed on postoperative day2 for both patients, and patients were discharged from the hospital on

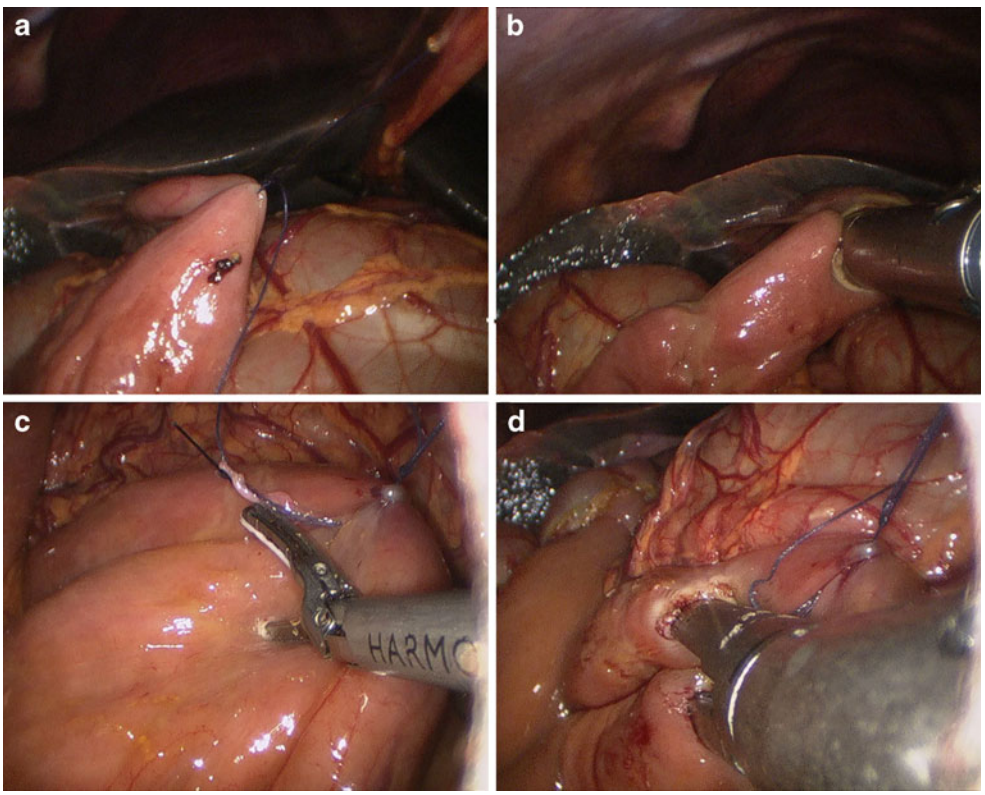

Fig. 3 **a** A simple intracorporeal, stapled, side-to-side cholecystoenterostomy was performed using a laparoscopic intracorporeal linear stapler-cutting device. **b** Intracorporeal, stapled, side-to-side Braun's enteroenterostomy was performed using intracorporeal linear stapler-cutting device. **c** One transfascial retraction suture was placed at one end of the anastomotic line between the fundus of the gallbladder and intestine to achieve adequate anastomotic region retraction. **d** One transfascial retraction suture was placed at one end of the anastomotic line between the two segments of intestine to achieve adequate anastomotic region retraction.

Fig. 4 A sub-hepatic drainage tube was placed through the umbilicus.

postoperative days 3 and 5. Postoperative pain was assessed by visual analog scale.[3] The postoperative pain scores of the patients on day 1 were 4/10 and 3/10 (Table 2). Liver function tests on postoperative day 5 showed trends of improvement (Table 1). The follow-up period for the two patients was 4–5 months; until now, no significant complication was reported.

Discussion

Laparoscopic surgery is a well-established alternative to open surgery across various disciplines. The evolution of minimally invasive techniques has further encouraged the surgical community to reduce the invasiveness of laparoscopic surgery. To this end, two recent innovations are being developed: natural orifice translumenal endoscopic surgery (NOTES™), which promises to eliminate abdominal incisions completely, and transumbilical single-incision or single-port laparoscopic surgery, which limits the number of abdominal incisions.[4] Transumbilical laparoscopic surgery can either be performed with three separate ports introduced through the same umbilical incision or one port having three working channels. The former technique is entitled single-incision laparoscopic surgery (SILS™), while the latter has been termed single-port access (SPA™).[5] The fundamental idea of SILS™ is to have all the work ports entering the abdominal cavity through the umbilicus, an embryonic natural orifice, wherein the surgical scar is virtually concealed. Potential benefits of SILS™ over conventional laparoscopy include less incisional pain with lower postoperative narcotic requirements, shorter hospital stays, faster return to work and routine activity, improved cosmesis, and ultimately higher patient satisfaction. This is similar to the anticipated benefits of NOTES™ procedures.[6] In contrast with NOTES™ and SPA™ procedures, SILS™ may use conventional laparoscopic instrumentation; it does not add any substantial increase in cost, making technical adaptation and mainstream acceptance more likely. To date, however, experience with SILS™ is still in its infancy, with a small amount of published cases reported for all indications and no cholecystojejunostomy cases.

The first reports of successful laparoscopic cholecystojejunostomy in unresectable peri-ampullary cancer appeared in 1992;[7–9] the three-port laparoscopic approach remains most favorable with minimal invasiveness. This study has shown that laparoscopic cholecystojejunostomy can be done using commercially available instruments without sacrificing the standard principles of cholecystojejunostomy, through a single umbilical incision. It appears to provide outcomes similar to standard laparoscopic cholecystojejunostomy. It remains to be proven if SILS™ will become a frequently chosen option for cholecystojejunostomy in selected patients. To our knowledge, this is the first SILS™ cholecystojejunostomy case reported in literature.

There were a few cautionary observations in this initial experience. SILS™ cholecystojejunostomy is technically more challenging than conventional laparoscopic procedure. The major drawback to such a surgical approach is that the concept of "triangulation" to which laparoscopic surgeons have grown accustomed to in terms of both the instruments and scope is compromised. All instruments are closely packed together, and clashing of instruments and the laparoscope are common. It will have a unique learning curve, principally in navigating the instruments within limited space, and needs significant coordination between the surgeon and the camera holder. The surgeon also has to adapt to counterintuitive movements due to frequent crossing of the instrument shafts at the point of entry into the abdominal cavity. In contrast to our expectation, these particular patients showed a trend toward a more severe, not less incisional pain (Table 2); this might be explained

Table 2 Comparison of Postoperative Pain Scores

Postoperative day	1	2	3	4	5
Case 1	4	5	3	–	–
Case 2	3	4	2	2	0
Conventional laparoscopic procedure[a]	2.2 ± 0.45	2.0 ± 0.71	2.6 ± 0.55	1.2 ± 0.45	0.25 ± 0.50

[a] Conventional laparoscopic procedure: a retrospective analysis of the postoperative pain scores of the last five non-complicated cases undergone conventional three-trocar laparoscopic cholecystoenterostomy dated before 1 Dec 2009

by the close placement of trocars in a confined space and stress exerted on the tissue by surgical instruments and laparoscope during the procedure. Also, a negative aspect of the single-incision technique is to have patients endure additional intervention of closing umbilical fascia under local anesthesia at the time of drainage removal, which may be of significant discomfort to the patients. In addition, the operative duration was longer than conventional laparoscopic procedure, which should however improve with further experience and advanced instrumentation.

New improvements in operative technique and instrumentation might facilitate SILS™ in the future. Novel single-port working platforms are being developed, such as the GelPort (Applied Medical), double-channel trocar (Applied Medical), Unix-X (Pnavel Systems), TriPort (Advanced Surgical Concepts), R-port (Advanced Surgical Concepts), or SILS™ port (Covidien). Merchant and colleagues[10] recently reported a novel technique of "flexible fulcrums" using the Gelport access device with conventional laparoscopic instruments and ports, which they have successfully applied to several laparoscopic procedures. This technique allows insertion and manipulation of up to four trocars with minimal clashing of instruments as it maintains pneumoperitoneum. New optical sources, such as the deflectable tip video laparoscope (Olympus) and the EndoEye laparoscope (Olympus), might improve visualization in a limited operative field. Elazary and colleagues[11] recently reported the use of a flexible therapeutic endoscope (Karl Storz) for successful SILS™ cholecystectomy in a porcine model. Use of the endoscope allowed for flexible visualization and the ability to use the endoscopic working port for retraction.

In conclusion, SILS™ cholecystojejunostomy appears to be a technically feasible alternative to standard laparoscopic procedure and can be performed with conventional laparoscopic instruments. However, increased incisional pain for the patients and technical difficulty of the procedure for the surgeons may argue otherwise to the application of the single-incision technique. Large randomized controlled trials are recommended to determine the true benefits of SILS™ cholecystojejunostomy compared to conventional laparoscopic approach.

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