

# Two-Incision Three-Port Laparoscopic Cholecystectomy. A Feasible and Safe Technique

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## SUMMARY

**Objective:** Conventional laparoscopic cholecystectomy (LC) involves the use of four ports, but the number of ports has gradually been reduced to one for cosmetic reasons. However, single-incision LC is technically demanding, and there is a substantial learning curve associated with its successful application. The aim of this clinical study was to evaluate the safety and feasibility of a less demanding alternative LC technique with a faster learning curve. **Methods:** This prospective descriptive study was performed from September 2009 to February 2011 at Sultanah Bahiyah Hospital in Kedah, Malaysia. A total of 58 patients underwent two-incision three-port laparoscopic cholecystectomy (TILC), which was performed by the senior consultant hepato-pancreato-biliary surgeon and two hepato-pancreato-biliary trainees. Study end points included operative time, postoperative pain, length of hospital stay and early postoperative complications. The follow-up period was 4 weeks. **Results:** The overall operative time taken was  $44 \pm 18$  minutes. None of the patients had major complication or incisional hernia postoperatively. All but one of the patients were discharged within 24 h. Non-steroidal anti-inflammatory drugs were the main postoperative analgesic used. **Conclusion:** TILC is feasible and safe cholecystectomy technique.

**KEY WORDS:** Two-incision, laparoscopic cholecystectomy, cholecystectomy, two-port technique

## INTRODUCTION

For decades, laparoscopic cholecystectomy (LC) was routinely performed using four ports. However, this approach was not ideal cosmetically because it resulted in multiple scars. Over time, improved operative techniques and devices, including single-incision laparoscopic surgery (SILS), single access site surgery (SAS), natural orifice transluminal endoscopic surgery (NOTES), single port access surgery (SPA), and laparoendoscopic single site surgery (LESS) have led to single port surgery, which leaves only one scar. However, these techniques require special single port devices and instruments and are technically more demanding than the conventional one. Herein, we propose the use of two-incision three-port laparoscopic cholecystectomy (TILC), which is an alternative LC method that uses conventional laparoscopic instruments and techniques and requires two incisions.

## METHODS

The primary objective of this study was to evaluate the feasibility and safety of the TILC technique by studying the

intra-operative time, early postoperative complications, length of hospital stay, and use of different types of postoperative analgesia. This prospective descriptive study, which was performed from September 2009 to February 2011 was approved by the Ethics Committee of Sultanah Bahiyah Hospital (SBH) in Kedah, Malaysia. There was no randomization and no control group was involved. The senior consultant hepato-pancreato-biliary (HPB) surgeon and two trainee HPB surgeons at the hospital attempted to perform TILC on 58 patients during this time period of the study.

Patients with symptomatic gallstone disease who planned to undergo LC were offered TILC. The study population was recruited from SBH, the local community, and referrals from other district hospitals. The purpose of the study, operative techniques, possibility of conversion to open surgery or additional ports, and potential complications were explained to the patients and informed consent was obtained from each patient prior to the surgery. All patients with illnesses such as hypertension, diabetes mellitus, ischemic heart disease, asthma and blood disorder were optimized prior to the surgery. Antiplatelet therapy was withheld for one week before the surgery.

The inclusion criteria were as follows: patients aged from 17 to 85 years with symptomatic gallstone disease; patients with optimized co-morbid illness (diabetes mellitus, hypertension, ischemic heart disease, asthma, blood disorder); and those with a history of acute gallstone pancreatitis and cholangitis who had been treated with endoscopic retrograde cholangiopancreatography (ERCP). Patients who had history of lower abdominal non-bowel surgeries such as caesarian section, tubal ligation, and non-complicated appendectomy or laparoscopic surgery, were included in the study. Patients who refused TILC, and had uncontrolled medical illness, American Society of Anesthesiologists (ASA) classification > 3, signs of acute cholecystitis, severe morbid obesity with the BMI > 35, and previous history of extensive laparotomy for bowel pathology were excluded from the study.

Statistical Package for Social Sciences (SPSS) version 18.0 (SPSS Inc., Chicago, IL, USA) was used for data entry and statistical analysis. Patient information was classified into demographic data (age, gender, race, co-morbidity, ASA classification) and clinical data (intraoperative time, early postoperative complications, length of hospital stay, and use of different types of postoperative analgesia). Descriptive analysis of the study was performed at the end of the study.

## Operative technique

TILC was performed under general anesthesia. A prophylactic

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**Table I: Patient Demographic and Clinical Characteristics**

Characteristics	Number (%)
Age, mean ( $\pm$ SD) (y)	48 $\pm$ 15
Gender	
Male	17 (35%)
Female	31 (65%)
Race	
Malay	34 (71%)
Chinese	9 (19%)
Indian	4 (8%)
Others	1 (2%)
ASA	
Class I	31 (65%)
Class II	17 (35%)
Co-Morbid	
No	24 (50%)
1	11 (23%)
2	10 (21%)
More than 2	3 (6%)

ASA, American Society of Anesthesiologists

**Table II: Overall Cases**

Overall cases	Number (%)
Attempted Cases	58 (100%)
Conversions	
Three-incision four-port LC	4 (7%)
Open cholecystectomy	6 (10%)
Successful TILC	48 (83%)

LC, laparoscopic cholecystectomy; TILC, two-incision three-port laparoscopic cholecystectomy

antibiotic was given on induction. A Ryle's tube was inserted after induction to decompress the stomach. The supine patient was placed in a split-leg position to allow the assistant to stand in between the patient's leg. The operating surgeon stood on the left of the patient, and the scrub nurse stood between the operating surgeon and the assistant. Only one monitor was required, and it was situated next to the patient's right shoulder facing the operative team. A 2 cm supra-umbilical incision was made, and dissection was carried out towards the linea alba. Once the fascia was identified, it was lifted superiorly and inferiorly using the artery forceps. The fascia was then cut transversely in between the forceps to allow a 5 mm port entry. The first 5 mm port was inserted, and this was followed by carbon dioxide insufflations to achieve an intra-abdominal pressure of 14 mmHg. Next, a 5 mm, 30 degree Olympus laparoscope was inserted through the port, and exploratory laparoscopy was performed. The patient was then placed in the reverse Trendelenburg position and tilted towards the operating surgeon to expose the gallbladder and its surrounding structures. A second incision was made at the epigastrium, approximately two finger breath below the xiphoid process to allow insertion of a second 5 mm port. The third 5 mm port was inserted approximately 1 cm away from and parallel to the first port within the supra-umbilical wound towards the

**Table III: Outcome Parameters**

Variables	Number (%)
Operative time, mean ( $\pm$ SD) (min)	44 $\pm$ 18
Early post operative complication	
TILC	1 (2%)
Conversions	0
Length of Hospital Stay	
Discharged within 12 h	27 (56%)
Discharged within 24 h	20 (42%)
Discharged after 24 h	1 (2%)
Postoperative analgesia	
NSAIDs	38 (80%)
Cox-2 Inhibitors	5 (10%)
Opioids	5 (10%)

TILC, two-incision three-port laparoscopic cholecystectomy

patient's left side. The third port was inserted under direct vision by placing the laparoscope through the second port. All ports used were ENDOPATH XCEL Bladeless Trocars (Johnson and Johnson, USA).

The surgeon used his left hand to insert a non-traumatic grasper through the third port to hold and manipulate the gallbladder. He used his right hand to introduce the Harmonic scalpel (Ethicon, Johnson and Johnson) through the second port (Fig. 1) to dissect the Calot's triangle and at the same time help to retract or push the liver away (using the shaft of the Harmonic scalpel). This technique did not require suturing of the gallbladder fundus or infundibulum or use of a curved instrument for retraction. Use of the atraumatic grasper, allowed the gallbladder to be flipped back and forth or up and down to provide a better view for safe dissection of the Calot's triangle. Both cystic artery and duct were identified. The artery was clipped and sealed in between the clips by the Harmonic scalpel. The cystic duct was doubly clipped proximally and singly clipped distally and later sealed using the Harmonic scalpel (Fig. 2). The gallbladder fossa, cystic duct stump, and dissection sites then were checked for any bleeding and bile leakage.

The laparoscope was shifted to the epigastric port and both 5 mm ports at the supra-umbilical wound were removed. A 12 mm port was inserted at the supra-umbilical wound for application of a 10 mm atraumatic grasper. The gallbladder then was retrieved through the supra-umbilical incision. An endopouch was not routinely used unless the gallbladder was perforated and posed the risk of bile leakage and wound infection. The supra-umbilical wound was closed using a J-needle, Vicryl 0 (Johnson and Johnson, USA). Skin was closed using a stapler (Fig. 3).

## RESULTS

Table I shows the demographic data for the patients in the study. TILC was successful in 48 (83%) of the 58 patients (Table II). Ten (17%) of the 58 were conversion cases: 4 patients (7%) had three-incision four-port LC and 6 patients (10%) underwent open cholecystectomy.



Fig. 1: Intraoperative view of TILC.



Fig. 2: Photograph of cystic duct clipping with gallbladder in traction.

The mean operative time for the successfully completed TILC procedure was  $44 \pm 18$  minutes. Of the 48 TILC patients, 1 bled from the skin edge of supra-umbilical wound; this was remedied by securing the skin with a stitch. None of the 10 conversion patients had any complications (Table III). At 1 month postoperative follow-up, no incidence of hernia was noted in any of the 58 patients.

Twenty-seven (56%) patients were discharged the same day as the surgery (i.e., within 12 h post-operatively). Another 20 (42%) patients were discharged within 24 h (i.e., the next day). Only one (2%) patient was discharged after 24 h. After surgery, more than two-thirds (80%) of the patients used non-steroidal anti-inflammatory drugs (NSAIDs), namely mefenamic Acid 500mg three times daily. Five patients (10%) used cox-2 inhibitors and opioids respectively (Table III).

## DISCUSSION

In previous studies of two-port LC<sup>1-11</sup> techniques and tools such as needlescopic cholecystectomy with 3 mm miniaturized instruments<sup>3</sup>, a modified laparoscope<sup>4,5</sup>, a microendoscope<sup>9</sup>, and gallbladder manipulation with traction suture<sup>8,10</sup> were described. In one study, ports were placed at the infra-umbilical and medial subcostal area<sup>11</sup>. In this study we used three ports placed through two incisions for gallbladder removal. The gallbladder did not need to be sutured or fixed so as to allow better dissection of the Calot's triangle. In addition, this method would also permit fundus first technique LC.



Fig. 3: Immediate post-TILC wound closure.

In this study, 48 out of 58 cases were successfully completed with TILC. The conversion rate was 17% and consisted of four cases (7%) of conversion to three-incision four-port LC and six cases (10%) of conversion to open cholecystectomy (Table II). For the former, an extra incision was made and a 5 mm port was inserted at the right hypochondriac area to aid in lysis of a dense adhesion around the gallbladder due to chronic cholecystitis and ERCPs. Of the six open surgeries, the first case was due to extensive adhesion between the hepatic flexure and the gallbladder. The others were due to a contracted thickened gallbladder with surrounding dense adhesion; an intrahepatic contracted and thickened gallbladder; Hartmann's pouch adherent to the common bile duct; failure to identify the cystic duct due to chronic inflammation at the Calot's triangle; and a huge right liver lobe (with bile leak from the cystic duct stump discovered upon conversion). The conversion rate was comparable to that of other two-port LC techniques. For examples, Leung *et al.* reported a conversion rate of 16%<sup>10</sup>, and others reported conversion rates ranging from 10% to 14%<sup>3,11</sup>.

The mean operative time was  $44 \pm 18$  min, which was in accordance with times reported in other studies of two-port LCs<sup>3-5,8</sup>. Poon *et al.* in his two consecutive studies showed an average operative time of 53 min in 2002 and  $54.6 \pm 24.7$  min in 2003<sup>4,5</sup>. Our operative time was also comparable with that reported in several single port studies<sup>12-14</sup>. In their study of LESS versus classic LC (i.e., three-port three incision technique), Aprea *et al.* reported median operative times of  $41.3 \pm 12$  min and  $35.6 \pm 5.8$  min respectively<sup>12</sup>. In another single-incision LC (SILC) study without intra-operative cholangiography (IOC), the average operative time was 49 min<sup>13</sup>.

In terms of the immediate postoperative complications, one patient (1.7%) in our study developed bleeding at the supraumbilical wound edge, and it was stopped with a stitch. At 1 month follow-up, no hernia noted from the supra-umbilical wounds was detected in any patient. Compared with the reported two-port series, our complication rate was low<sup>3,4</sup>. Poon *et al.* reported a 0% complication rate<sup>4</sup>, whereas 6% of patients had complications in Lee *et al.*'s study<sup>3</sup>. The complications documented in literature were intra-abdominal collection, umbilical port site infection, acute urinary retention, and postoperative deranged liver function test due to choledocholithiasis<sup>3</sup>. Bokobza *et al.* reported two cases of wound abscess and one case of hemoperitoneum in their study of single umbilical incision LC (SUILC)<sup>15</sup>.

Almost all patients were discharged within 24 h postoperatively. Twenty-seven (56%) patients went home within 12 h (i.e., the day of the surgery), whereas 20 (42%) patients were discharged the next day. Of the latter, two patients had uncontrolled blood pressure (not related to postoperative pain), one had hyperglycemia, two experienced vomiting post extubation, five had logistical problems, one was bleeding from the supra-umbilical wound, one with ischemic heart disease stayed for postoperative observation, one with valvular heart disease stayed to complete three doses of subacute bacterial endocarditis (SBE) prophylaxis, and one stayed for observation due to suspicion of drug allergy. Documentation for the six remaining cases was not complete, and we were unable to ascertain the cause of delayed discharge. Only one patient (2%) was discharged after 24 h due to a mild upper respiratory tract infection, which was treated with an oral antibiotic. The length of hospital stay in this study was short. In other studies of two-port LCs, the average postoperative stay also was 1-2 days<sup>3,4,8</sup>. In single port studies, the majority of patients post-SILC and post-LESS were discharged the same day, within 24 h or after slightly more than a day<sup>12-14,16</sup>.

To manage pain after the TILC procedure, most patients used NSAIDs. Thirty eight (80%) patients used mefenamic acid 500mg three times daily. Five (10%) of the patients used cox-2 inhibitors and the other five (10%) patients required opioids. Lee *et al.* used intramuscular pethidine (1mg/kg every 4 hours) and a dologesic (one tablet 4 times daily as necessary)<sup>3</sup>, and intravenous infusion of paracetamol intra-operatively and postoperatively was used in another study to manage pain for patients post-LESS and post-conventional three-incision LC<sup>12</sup>.

This study has several limitations. The sample size of the study was small. In addition, there was no control group and the study was not randomized. Certain parameters were not studied due to lack of documentation such as pain score and patient's wound appearance satisfaction. IOC is performed selectively in our center. In this study, none of the patient required IOC because 18 (35%) of the patients had undergone ERCP prior to TILC and those who did not require ERCP showed normal liver test results with no previous history of jaundice. In addition, the follow-up period in this study was short, so the postoperative wound complications may not have been assessed adequately.

In conclusion, TILC was relatively feasible and safe to be performed. The HPB trainees who were learning how to perform this procedure experienced a short learning curve and we did not encounter any major complications postoperatively. We believe that the epigastric port may provide the advantage of improved the intra-operative ergonomics. Surgeons who intend to employ this technique should be familiar with the three-port technique, and the assistant should be very familiar with the laparoscope and be able to get around the surgeon's left hand instrument to avoid the sword fighting phenomenon. The decision to convert is essentially the same for any LC technique. Nevertheless, more studies are needed to provide additional evidence to support the use of this method as an alternative treatment for gallstone disease.

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## CONFLICT OF INTEREST

The Authors declare that there is no financial support or relationships that may pose conflict of interest in the execution of this study.

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