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Original research

Single-incision laparoscopic cholecystectomy for acute cholecystitis: A retrospective cohort study of 52 consecutive patients

Norihiro Sato*, Shiro Kohi, Toshihisa Tamura, Noritaka Minagawa, Kazunori Shibao, Aiichiro Higure

Department of Surgery 1, School of Medicine, University of Occupational and Environmental Health, Kitakyushu 807-8555, Japan

HIGHLIGHTS

- The role of single-incision laparoscopic cholecystectomy (SILC) in acute cholecystitis remains controversial.
- We reviewed our clinical experience of SILC in 52 patients with acute cholecystitis.
- Difficulties of SILC for acute cholecystitis are associated with the timing of operation and the grade of acute cholecystitis.

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ABSTRACT

Background: Single-incision laparoscopic cholecystectomy (SILC) has become increasingly popular but its role in acute cholecystitis remains controversial.
Methods: We compared the clinical features and outcomes of SILC procedures between 52 patients with acute cholecystitis (the AC group) and 308 patients without acute cholecystitis (the NAC group). We also analyzed clinical variables to identify factors affecting difficulties associated with SILC for acute cholecystitis.
Results: The patients in the AC group were significantly older than those in the NAC group (72 vs. 61 years, median, $P = 0.0005$). The preoperative levels of white blood cell counts were significantly higher in the AC group than in the NAC group (6600 vs. 5500/μL, $P = 0.0004$). The operative time was significantly longer in the AC group than in the NAC group (188 vs. 135 min, $P < 0.0001$). The volume of intraoperative blood loss was significantly larger in the AC group than in the NAC group (20 vs. 5 mL, $P < 0.001$). Furthermore, additional trocar insertion was required in 12% in the NAC group, whereas it was required in 60% in the AC group ($P < 0.0001$). Regarding the difficulties of SILC for acute cholecystitis, delayed operation (after 72 h from the onset) was significantly associated with a prolonged operative time, while a higher grade of acute cholecystitis (grade II or III) was significantly associated with an increased blood loss during surgery.
Conclusions: These findings suggest that when compared to SILC for gallbladder diseases without acute inflammation, SILC for acute cholecystitis was associated with a longer operative time, increased blood loss, higher rate of additional trocar requirement, higher rate of postoperative complications, and longer hospital stay. The difficulties associated with SILC for acute cholecystitis were affected by the timing of surgery and the grade of inflammation.

1. Introduction

Acute cholecystitis is a disease frequently encountered in daily surgical practice worldwide. In Japan, the number of cases with acute cholecystitis has increased from 3.9 million in 1979 to over 10 million in 1993 [1]. Surgical management of acute cholecystitis includes open or laparoscopic cholecystectomy and percutaneous cholecystostomy in high-risk patients [2]. Although acute cholecystitis was initially considered a contraindication for laparoscopic cholecystectomy, this procedure is now accepted as a standard treatment for acute cholecystitis [3].

In recent years, single-incision laparoscopic cholecystectomy

* Corresponding author.
E-mail address: norisato@med.uoeh-u.ac.jp (N. Sato).

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(SILC) has been developed to further minimize the invasiveness of laparoscopic cholecystectomy. Several randomized controlled trials have shown that SILC is a safe procedure with better cosmetic results as compared to conventional laparoscopic cholecystectomy [4–9]. In early reports, the indication of SILC was limited to optimal cases of uncomplicated cholelithiasis without acute inflammation. However, with increasing numbers of SILC procedures reported, this technique has been applied to cases with acute cholecystitis [10,11]. A retrospective comparative study of SILC vs. multi-port LC for acute cholecystitis showed that the complication rate is comparable between these procedures, concluding that SILC is feasible even for patients with acute cholecystitis [10]. A recent study comparing the clinical outcomes of SILC and three-incision laparoscopic cholecystectomy (3ILC) for acute cholecystitis demonstrated that the postoperative length of hospital stay was significantly shorter in the SILC group than the 3ILC group [12]. On the other hand, SILC for acute cholecystitis has been associated with an increased operative time, an increased frequency of additional port requirement, and a higher likelihood of conversion to multiport LC [11,13]. Based on these previous reports, applying SILC to complicated cholelithiasis suffering from acute inflammation remains controversial and factors affecting the difficulty of SILC in this setting are unknown.

In the present study, we reviewed our initial experiences with SILC for acute cholecystitis of various degrees of severity. We also analyzed factors associated with a prolonged operative time and increased blood loss during SILC for acute cholecystitis.

2. Patients and methods

2.1. Patients

Between September 2009 and December 2013, SILC was attempted in 360 patients with gallbladder diseases at the University of Occupational and Environmental Health (Kitakyushu, Japan). In our institution, SILC is considered as the first approach for all cases that require cholecystectomy, and there are no selection/exclusion criteria. Of these 360 patients, those who had a diagnosis of acute cholecystitis before surgery were selected for further analysis.

In all patients, the diagnosis of acute cholecystitis was made preoperatively according to the Tokyo guidelines [14], based on the local and/or systemic signs of inflammation, as well as diagnostic imaging, and was confirmed by intraoperative features and postoperative pathological examinations. The severity of acute cholecystitis is classified into three grades, mild (grade I, acute cholecystitis in a patient with no organ dysfunction and limited disease in the gallbladder), moderate (grade II, acute cholecystitis associated with no organ dysfunction but there is extensive disease in the gallbladder), and severe (grade III, acute cholecystitis with organ dysfunction) [14]. Percutaneous transhepatic gallbladder drainage (PTGBD) was performed in some patients with acute cholecystitis of a moderate or severe degree (grade II or III) according to the discretion of the attending physicians/surgeons. Our treatment strategy for acute cholecystitis is either early surgery (in the emergency setting) if the duration from symptom onset is within 72 h or late surgery (in the elective setting) following medical treatment, such as antibiotics and gallbladder drainage, if the duration is over 72 h. Delayed (or elective) surgery was also planned in patients in whom emergency cholecystectomy was not able to be done for several reasons (such as septic shock or regular use of anticoagulant).

2.2. Operative procedures

Under general anesthesia, patients were placed in the supine position with their legs apart. The operator stood between the patient's legs. A single 2.5-cm vertical incision was made directly on the umbilicus, through which a 5-mm trocar (Endopath Xcel, Ethicon Endo-Surgery, Cincinnati, OH, USA) was introduced for pneumoperitoneum. An initial assessment of the abdominal cavity was done using a 5-mm flexible scope (EndoEye camera system, Olympus Medical System, Tokyo, Japan). After exposing the abdominal fascia under the skin flap of the umbilical incision, a grasper for gallbladder retraction and two 5-mm trocars (Endopath Xcel, Ethicon Endo-Surgery, or EZ trocar, Hakko Co., Nagano, JAPAN) for operator's manipulation were then inserted into the abdominal cavity.

In some cases, a small wound retractor (Alexis wound retractor, Applied Medical, Rancho Santa Margarita, CA, USA) and a surgical glove or a minilaparotomy wound protector (Lap-Protector, Hakko) and a silicon rubber cap (EZ Access, Hakko) were attached to the umbilical incision and used as a multichannel port.

Our initial attempt was to perform all procedures using the two trocars and a grasper via the single umbilical incision. However, in cases with difficult gallbladder retraction and exposure, additional one or two ports were placed as appropriate in the right lateral and/or subcostal region.

If the gallbladder is severely distended and is difficult to grasp, aspiration of bile was done through a needle. Dissection of Calot's triangle was performed carefully according to the critical view of safety approach. After confirming that the cystic artery and cystic duct are the only two tubular structures remaining between the gallbladder and the hepatoduodenal ligament, an intraoperative cholangiography (IOC) was routinely attempted. In most cases, IOC was performed using the Kumar cholangiography system (Nashville Surgical Instruments, Nashville, USA) [15], as previously described [16].

After completion of IOC, the cystic duct and cystic artery were doubly clipped with a 5-mm disposable clip applier and then divided. The gallbladder was then dissected from the liver bed using a hook electrocautery or Harmonic ACE (Johnson & Johnson, Cincinnati, OH, USA) and was collected in a bag and removed through the umbilical incision. An intraperitoneal drainage tube was placed in the infrahepatic space in selected cases at high risk of postoperative bleeding and/or bile leakage based on the operator's discretion.

The fascial defect in the umbilicus was closed using absorbable monofilament suture and the skin was closed subcuticularly with a 4-0 absorbable monofilament suture. The operative time was defined as a time from skin incision to closure.

Prophylaxis of venous thromboembolism was done using a protocol of early mobilization and, in moderate- or high-risk patients, intermittent pneumatic compression.

Postoperative complications, including bile duct injuries, bile leakage, biliary collection or abscess, retained choledocholithiasis, port-site bleeding, and wound complications, were recorded.

2.3. Assessment of difficulty of SILC for acute cholecystitis

Difficulties of SILC for acute cholecystitis was assessed by the duration of the operative procedure and the amount of intraoperative blood loss. Factors analyzed for difficulty of SILC included age (<75 years/≥75 years), gender, body mass index (BMI) (<25 kg/m^2/≥25 kg/m^2), presence or absence of comorbid diseases, history of prior abdominal surgery, preoperative white blood counts (<10,000/μl/≥10,000/μl), severity of acute cholecystitis (grade I/grade II and III), PTGBD before surgery, operator (surgical residents/senior staffs), and timing of operation (early vs. delayed).

2.4. Statistical analysis

All statistical analyses were done using JMP 10 software (SAS