Research Article

Comparison of Secondary Non-Critical Acute Cholangitis After Phase I Laparoscopic Common Bile Duct Exploration and Endoscopic Stone Therapy for Common Bile Duct

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ABSTRACT

Objective: To compare the clinical effect of phase I laparoscopic cholecystectomy combined with laparoscopic common bile duct exploration (LC+LCBDE) and cndoscopic retrograde cholangiopancreatography combined with laparoscopic cholecystectomy (ERCP+LC) on non-severe acute cholangitis secondary to common bile duct stones.

Methods: The clinical data of 132 cases of non-acute acute cholangitis secondary to common bile duct stones treated in the Second Affiliated Hospital of Fujian Medical University from January 2014 to December 2016 were retrospectively analyzed. The patients were divided into two groups according to different surgical methods: ERCP+LC group with 65 patients and LC+LCBDE group with 67 patients. The relevant clinical indicators of the two groups were compared. Results: There was no statistical difference in the other general data between the two groups (p>0.05), except for that the mean age of the ERCP+LC group was greater than that of the LC+LCBDE group (p=0.000) and the ERCP+LC group had a higher proportion of concomitant diseases than the LC+LCBDE group (p=0.000). There was no significant difference in postoperative complication rate, residual rate of stone, mean surgical blood loss and postoperative gallbladder pathological type between the two groups (p>0.05). The incidence of postoperative cholecosis in the LC+LCBDE group was significantly higher than that in the ERCP+LC group. There was no significant difference in postoperative pancreatitis and incidence of pulmonary infection (p>0.05). Compared with the LC+LCBDE group, the operative time of the ERCP+LC group (p=0.000) and postoperative peritoneal drainage time (p=0.000) was shorter, there was no significant difference in postoperative hospital stay (p>0.05).

Conclusion: The first-stage of LC+LCBDE is safe and effective in the treatment of non-acute cholangitis secondary to common bile duct stones, which is the same as staging ERCP+LC, thus the individual treatment options can be selected according to the patient's condition.

Keywords: Common bile duct stones; Laparoscopic common bile duct exploration; Endoscopic retrograde cholangiopancreatography; Acute cholangitis

Introduction

Most of the acute cholangitis occur on the basis of bile duct obstruction caused by stones [1,2]. It has the characteristics of rapid onset, rapid development, and many complications. Common bile duct stones are a common cause of acute cholangitis [3,4]. The current guidelines (Tokyo Guidelines, TG13) prefer to recommend Endoscopic Papillary Incision (EST) or Endoscopic Nasal Biliary Drainage (ENBD) for the biliary tract drainage of acute cholangitis after common bile duct stones [5].

With the development of medical and laparoscopic techniques, LC+LCBDE has been widely used in the treatment of quiescent common bile duct stones [6]. In recent years, some scholars [7,8] have applied LC+LCBDE in the treatment of acute cholangitis secondary to common bile duct stones, but relatively few have been reported. Currently, both endoscopic stone removal [9-11] and laparoscopic exploration [12,13] of the common bile ducts do not show absolute superiority in the treatment of common bile duct stones. We retrospectively analyzed

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the clinical data of non-acute acute cholangitis secondary to common bile duct stones treated by the first phase of LCBDE and staged endoscopic stone removal in our hospital. The results are reported below.

Materials and Methods

■ General information

The patients who were admitted to the Second Affiliated Hospital of Fujian Medical University from January 2014 to December 2016 and met the inclusion criteria were included in 132 cases of non-acute acute cholangitis secondary to common bile duct stones. They were divided into two groups according to different surgical methods. group of ERCP+LC (65 cases), group of LC+LCBDE (67 cases). Retrospective analysis of their clinical data was performed. Inclusion criteria:

- At least two imaging studies including preoperative ultrasound, MRCP, or CT identify common bile duct stones
- Tolerating ERCP and general anesthesia
- Common bile duct stones with a diameter of ≤ 2 cm
- The diagnostic and grading criteria for acute cholangitis are based on the 2013 Tokyo Guideline [14]

Exclusion criteria:

- Severe acute cholangitis
- Acute severe pancreatitis, acute suppurative, gangrenous cholecystitis
- Suspected gallbladder, common bile duct malignancy, intrahepatic bile duct stones
- Severe merger cardiopulmonary diseases cannot tolerate surgery or ASA (American anaesthetist-assisted) grade>3;
- common bile duct diameter <8 mm
- Patients with previous history of open biliary exploration or history of laparoscopic surgery

There was no significant difference in gender, clinical manifestations, preoperative tests, common bile duct diameter, and number of common bile duct stones between the two groups **(Tables 1 and 2)**. The patient admitted to hospital with the common bile duct stones secondary to acute cholangitis was treated intravenously with gram-negative bacteria anti-infection, water, electrolytes, liver protection, pain relief and the relevant preoperative preparation was improved. The dynamic evaluation of acute cholangitis severity was performed every 24 hours. The patients with acute cholangitis diagnosed on the hospital within 48 hours were performed endoscopic or laparoscopic surgery by the same surgeon who had extensive laparoscopic and endoscopic surgical experience. This study was approved by the Ethics Committee of the hospital. Patients and their families can understand the surgical procedure and obtain consent.

■ Surgical methods

LC+LCBDE: Four-hole LC+LCBDE was performed to dissect the gallbladder triangle. Then the confirming Hem-o-lok clipping was done after cystic duct, but not cutting off temporarily in order for traction. After confirming the common bile duct, approximately 0.8 cm-1.5 cm of the anterior wall of the common bile duct was incised longitudinally at the upper end of common bile duct, and a choledochoscope was placed to determine the location, size, and number of stones. Thereafter a stone basket was placed for stone removal. After the biliary tract is washed with saline, the common T-type drainage tube is placed at the common bile duct incision site, and the anterior wall of the common bile duct is sutured on the entire layer using the 4-0 absorbable suture. After the suture is completed, the saline is injected from the T-tube to determine the circumference of the T tube. No obvious leakage was found. The long arm of the T-tube was pulled out through the Torcar hole, and a drainage tube was placed in the Wen's hole. Generally, 3-5 days after surgery, the abdominal drainage tube was removed if no bile leakage. The T tube was indwelled for 6 weeks and the previous T-tube angiography was removed.

■ ERCP+LC surgery

An intramuscular injection of anisodamine 10 mg, pethidine hydrochloride 50 mg 30 minutes before surgery, the ERCP surgery was performed under throat anesthesia using lidocaine gel. Then the peroral duodenoscopy was inserted to find the duodenal papilla and

the intubated cholangiography was done. The common bile duct stones were confirmed, and the size, location, and number of stones were detected. The microsurgical duodenal papillotomy or endoscopic papillary balloon dilatation (according to the patient's coagulation function, age, stone size, etc.) was performed to remove stones using stone ball or stone baskets. And then the angiography was performed again to determine whether the stones were removed clearly. After that the routine indwelling Endoscopic Nasal Bile Duct Drainage (ENBD) was set to remove duodenoscope. LC surgery was usually performed 2-5 days after the ERCP operation, and the ENBD tube was removed after 2 days of LC imaging.

■ Analysis index

The preoperative clinical features of the two groups of patients with different surgical methods were analyzed. Intraoperative conditions: operation time, intraoperative blood loss, residual rate of stones. Postoperative conditions: postoperative hospital days and major postoperative complications (main bile duct injury, cholesterol, pulmonary infection, postoperative pancreatitis, postoperative hyperamylasemia, etc.).

■ Related definitions

The diagnostic criteria for postoperative ERCP pancreatitis was used as proposed by previous studies [15,16]. There are pancreatitis-related clinical symptoms accompanied by a 3-fold increase in serum amylase above the upper limit of normal within 24 h after surgery. After 24 hours, serum amylase>3 times of normal limit, but patients were diagnosed as hyperamylasemia after ERCP without clinical symptoms. Cholera was defined as: bile drainage>50 ml/d, lasting more than 3 days. Postoperative complications were graded according to the Clavien-Dindo criteria.

■ Data analysis and data statistics

Complete records of hospitalization and follow-up data were analyzed using the SPSS 12.0 statistical software. The measured data were expressed as mean ± standard deviation ($x \pm s$), t-test was used. The counting data were analyzed using $\chi 2$ test or the method of Fisher's exact probability. $p<0.05$ was considered statistically significant.

Results

■ Comparison of preoperative general data and preoperative laboratory data between the two groups

The mean age of the ERCP+LC group was greater than that of the LC+LCBDE group (64.29 ± 10.94 years vs. 54.31 ± 10.63 years, p=0.000). The ERCP+LC group had a higher proportion of concomitant diseases than the LC+LCBDE group (p=0.032); There was no significant difference between the two groups in terms of clinical manifestations, grades of acute cholangitis, diameter of common bile duct, and number of common bile duct stones (p>0.05) **(Table 1)**, which were comparable. There was no statistically significant difference between the two preoperative groups in terms of White Blood Cells (WBC), Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), Total Bilirubin (T-Bill), Glutamyl Transpeptidase (GGT), Alkaline Phosphatase (ALP), etc (p>0.05) **(Table 2).**

■ Comparison of two group under the intraoperative conditions

The operation time of ERCP+LC group was ERCP operation time plus LC operation time. The total operation time of ERCP+LC group was significantly shorter than that of LC+LCBD group (92.17 ± 11.01 min vs. 103.51 ± 12.34 min, p=0.000); There was no significant difference in postoperative bleeding volume (26.62 ± 6.74 ml vs. 27.94 ± 5.86 ml) and postoperative gallbladder pathological type (p>0.05) **(Table 3).**

■ Comparison of two groups under the postoperative conditions

There were no deaths in both groups during the hospitalization period, and there were no major complications of bile duct injury. The postoperative complication rates in the ERCP+LC group and LC+LCBD group were 29.23% (14/65) and 29.85% (17/67), respectively. The difference was not statistically significant (p>0.05). In the ERCP+LC group, there was no postoperative biliary fistula, but 2 cases (3.08%) of acute pancreatitis, 7 cases (10.77%) of hyperamylasemia after operation, and 6 cases (9.23%) of pulmonary infection. In LC+LCBD group, there were 6 cases (8.96%) of transient cholangiia, 1 case of acute pancreatitis (1.49%), 1 case of high amylaseemia (1.49%),

Table 1: Comparison of general data between two groups of patients.

Clinical features	ERCP+LC group (n=65)	LC+LCBDE group (n=67)	p
Age (year, $\bar{x} \pm s$)	64.29 ± 10.94	54.31 ± 10.63	0.000
Gender			
Male	26	29	>0.05
Female	39	38	
Clinical manifestations			
Stomach ache	61	63	>0.05
Jaundice	45	44	>0.05
Fever/shiver	36	34	>0.05
Acute cholangitis			
Mild	33	36	>0.05
Moderate	32	31	
Concomitant diseases			
no	29	42	0.000
1 kind	13	16	
2 kinds	16	6	0.032
3 kinds and more	7	3	
Number of common bile duct stones			
<3	39	34	>0.05
≥ 3	26	33	
Common bile duct diameter （mm, x ± s）	12.04 ± 3.15	11.88 ± 2.94	>0.05

Table 2: The laboratory examination data preoperation of the two groups (x ± s).

Indexes	ERCP+LC group (n=65)	LC+LCBDE group (n=67)	p
WBC (× 109)	13.16 ± 5.11	12.39 ± 4.64	>0.05
ALT (U/L)	112.65 ± 53.13	120.84 ± 56.71	>0.05
T-Bil (umol/L)	79.95 ± 42.51	84.33 ± 38.64	>0.05
GTT (IU/L)	234.66 ± 89.71	219.79 ± 79.35	>0.05
ALP (IU/L)	179.32 ± 85.31	160.76 ± 64.60	>0.05

Table 3: Comparison of surgery in the two groups.

Indexes	ERCP+LC group (n=65)	LC+LCBDE group (n=67)	p
Surgery time (min, x ± s)	92.17 ± 11.01	103.51 ± 12.34	0.000
The amount of blood loss (ml, x ± s)	26.62 ± 6.74	27.94 ± 5.86	>0.05
Gallbladder pathological type			
Acute cholecystitis	26	25	>0.05
Chronic cholecystitis	39	42	

and 11 cases of lung infection (16.42%). The incidence of hyperamylasemia after cholestasis and postoperative hyperemia was statistically significant (p values 0.028 and 0.016, respectively). The cholesterol, postoperative pancreatitis, postoperative hyperamylasemia were all mild-moderate symptom, but were cured after conservative treatment such as fasting, drainage, anti-infection, and nutritional support. 2 cases of common bile ducts residual were found in both groups after operation. But there was no significant difference in the residual rate of stones (3.08% and 2.99%) (p>0.05). In the ERCP+LC group, the residual stones in 2 patients were cured by ERCP again, and the residual stones in the LC+LCBD group were cured by T-tube sinus stones. Compared with the LC+LCBDE group, the postoperative peritoneal drainage time (2.78 ± 0.82 d vs. 5.69 ± 1.22 d, p=0.000) was shorter in the ERCP+LC group, but there was no statistically significant difference in the two groups for postoperative hospital stay (9.91 ± 1.23 d vs. 9.48 ± 1.62 d) (p>0.05) **(Table 4)**.

Table 4: Conditions of two groups postoperation.

Indexes	ERCP+LC group (n=65)	LC+LCBDE group (n=67)	p
Complication postoperation N (%)	14 (29.23%)	17 (29.85%)	>0.05
Timid	0	6 (8.96%)	0.028
Bile duct injury	0	0	-
Postoperative pancreatitis	1 (1.49%)	1 (1.49%)	>0.05
Postoperative hyperamylasemia	7 (10.77%)	1 (1.49%)	0.032
lung infection	6 (9.23%)	11 (16.42%)	>0.05
Death number	0	0	-
Postoperative hospital stay (d, x ± s)	9.91 ± 1.23	9.48 ± 1.62	>0.05
Postoperative abdominal drainage time (d, x ± s)	2.78 ± 0.82	5.69 ± 1.22	0.000
Stone residual	2 (3.08%)	2 (2.99%)	>0.05

Discussion

With the development of laparoscopic techniques and the deepening of the minimally invasive concept, the surgical approach for common bile duct stones has been transitioned from the traditional open laparotomy to common bile duct exploration to the current exploration of endoscopic stones or laparoscopic common bile duct exploration [7,17,18]. The key technique for the treatment of acute cholangitis is effective biliary drainage. The endoscopic biliary drainage has been used in the treatment of acute cholangitis, thus the mortality rate of acute cholangitis has gradually decreased from more than 30% to 2.7%-10% [19]. Endoscopic stone extraction combined with laparoscopic cholecystectomy (ERCP+LC) has been widely used in the treatment of common bile duct stones. The Grand Center reported that the success rate of ERCP stone extraction exceeded 95% [20]. In this study, 2 cases of common bile duct stones were found in the ERCP+LC group, and the success rate was 96.9%, which is similar to the literature [20]. Compared with traditional open surgery, ERCP has the advantages of minimal invasion, quick recovery, and few complications in the treatment of common bile duct stones [21]. For biliary drainage therapy of acute cholangitis secondary to common bile duct stones, especially in patients with acute severe cholangitis, the current guidelines still recommend the preferred drainage method under ERCP [5]. However, ERCP is also insufficient. It may be secondary to short-term complications such as acute pancreatitis, hemorrhage, perforation, postoperative hyperamylasemia, etc, and long-term complications such as reflux of intestinal fluid due to the damage of Oddi's sphincter and recurrence of stones. In the ERCP+LC group of this study, there was 1 case of postoperative pancreatitis and 7 cases of postoperative hyperamylasemia, but all were non-severe complications. After conservative treatment, the associated complication rate after ERCP was 12.26% without operative deaths, which was similar to the literature [6].

The LC+LCBDE technique has been widely recognized by scholars at home and abroad in recent years [6]. The surgical technique can solve the problems of gallstones and common bile duct stones at the same time. It is more in line with minimally invasive and the accelerated healing concepts. However, most surgical procedures are for elective surgery, while the current guideline does not clearly recommend laparoscopic treatment for the treatment of acute cholangitis secondary to common bile duct stones. In recent years, some scholars [22] have attempted to apply LC+LCBDE in the treatment of acute non-severe cholangitis secondary to common bile duct stones. It has the same surgical safety and effectiveness compared with elective LC+LCBDE. In this study, 67 cases of acute non-severe cholangitis secondary to common bile duct stones were treated with LC+LCBDE in the early stage (within 48 hours). No major surgical-related complications occurred, and no major bile duct injury and perioperative death occurred. The rate of surgical complications (29.23% vs. 29.85%) and residual rate of postoperative calculi (3.08% vs. 2.99%) were not statistically significant. LC+LCBDE and ERCP+LC had similar safety and efficacy. In this study, patients with acute cholangitis were selected, and biliary tract drainage was the key their treatment. Therefore, the indwelled T-tubes after LC+LCBDE surgery is a routine method without first-stage common bile duct suture.

The operation time was significantly longer than that of ERCP+LC group. In this study, although the average age and concomitant disease rate were higher in the ERCP+LC group, the total surgical complications, lung infection, and postoperative total hospital stay were similar to those in the LC+LCBDE group. The following reasons may be considered: 1) In the ERCP+LC group, although the operation was performed in two steps, there was no general anesthesia during the ERCP operation. The time of recovery within 3-5 days was favorable for the control of the concomitant diseases; 2) The anesthesia time and operation time during the second phase of the LC operation are short, thus lowing the risk of surgery) not necessary to cut the anterior wall of the common bile duct, indwelling T-tube, less surgical trauma, thus the abdominal drainage tube can be removed early after surgery.

A previous study [23] found that a laparoscopic common bile duct exploration for the treatment of quiescent common bile duct stones and staging of ERCP stones had the advantages of shorter hospital stay and faster postoperative recovery. Our study found that a laparoscopic common bile duct exploration showed absolute advantages for treating common bile duct with secondary acute cholangitis. LC+LCBDE is more suitable for non-severe cholangitis patients with relatively young age and less concomitant diseases. While ERCP+LC is more suitable for patients with acute cholangitis who have more basic diseases and high risk of anesthesia.

Conclusion

Our study found that LC+LCBDE is safe and effective in the treatment of non-acute acute cholangitis secondary to common bile duct stones and staging of ERCP+LC. With the continuous improvement endoscopic techniques, laparoscopic techniques, and medical care, choosing the right surgical method according to the patient's condition seems to be more consistent with the concept of precision minimally invasive surgery and rapid recovery.

References

1. Palazzo M, Arvanitakis M, Delhaye M, et al. Acute suppurative cholangitis due to an impacted pancreatic stone: A rare adverse event in the setting of chronic calcified pancreatitis. Gastrointest Endosc 87, 618-619 (2018).
2. Ito K, Okano N, Igarashi Y. Can endoscopic stone retraction be carried out even in cases with severe acute cholangitis? Dig Endosc 29, 100-101 (2017).
3. Ramchandani M, Pal P, Reddy DN. Endoscopic management of acute cholangitis as a result of common bile duct stones. Dig Endosc 29, 78-87 (2017).
4. Suzuki A, Uno K, Tanaka K. Is addition of endoscopic sphincterotomy before endoscopic biliary drainage necessary for acute cholangitis as a result of common bile duct stones? Dig Endosc 2, 100 (2017).
5. Itoi T, Tsuyuguchi T, Takada T, et al. TG13 indications and techniques for biliary drainage in acute cholangitis (with videos). J Hepatobiliary Pancreat Sci 20, 71-80 (2013).
6. Rogers SJ, Cello JP, Horn JK, et al. Prospective randomized trial of LC+LCBDE *vs* ERCP/S+LC for common bile duct stone disease. Arch Surg 145, 28-33 (2010).
7. Zhu B, Li D, Ren Y, et al. Early versus delayed laparoscopic common bile duct exploration for common bile duct stone-related nonsevere acute cholangitis. Sci Rep 5, 11748 (2015).
8. Aawsaj Y, Light D, Horgan L. Laparoscopic common bile duct exploration: 15-year experience in a district general hospital. Surg Endosc 30, 2563-2566 (2016).
9. Hein S, Schoeb DS, Grunwald I, et al. Viability and biocompatibility of an adhesive system for intrarenal embedding and endoscopic removal of small residual fragments in minimally-invasive stone treatment in an in vivo pig model. World J Urol 36, 673-680 (2018).
10. Yamamiya A, Kitamura K, Ishii Y, et al. Feasibility of initial endoscopic common bile duct stone removal in patients with acute cholangitis. World J Clin Cases 5, 280-285 (2017).
11. Jinfeng Z, Yin Y, Chi Z, et al. Laparoscopic management after failed endoscopic stone removal in nondilated common bile duct. Int J Surg 29, 49-52 (2016).
12. Dimov RS, Kantchev RI, Boev BG, et al. Laparoscopic exploration of bile ducts in patients with calculosis. Indications, methods and first results. Folia Med 55, 33-38 (2013).
13. Niu J, Shou NH, Forbes JF, et al. Laparoscopic exploration of intra-and extrahepatic bile ducts and T-tube drainage. Aust N Z J Surg 65, 189-193 (1995).
14. Kiriyama S, Takada T, Strasberg SM, et al. TG13 guidelines for diagnosis and severity grading of acute cholangitis (with videos). J Hepatobiliary Pancreat Sci 20, 24-34 (2013).
15. Oliveira-Cunha M, Dennison AR, Garcea G. Late complications after endoscopic sphincterotomy. Surg Laparosc Endosc Percutan Tech 26, 1-5 (2016).
16. Cotton PB, Lehman G, Vennes J, et al. Endoscopic sphincterotomy complications and their management: An attempt at consensus. Gastrointest Endosc 37, 383-393 (1991).
17. Liu WS, Zou Y, Yang B, et al. Laparoscopic exploration can salvage recurrent common bile duct stone after cholecystectomy. Am Surg 83, 1343-1346 (2017).
18. Paik KY, Kim EK. Laparoscopic common bile duct exploration after unsuccessful endoscopic stone removal. J Laparoendosc Adv Surg Tech A 23, 137-140 (2013).
19. Sun Z, Zhu Y, Zhu B, et al. Controversy and progress for treatment of acute cholangitis after Tokyo Guidelines (TG13). Biosci Trends 10, 22-26 (2016).
20. Kim SB, Kim KH, Kim TN. Comparison of outcomes and complications of endoscopic common bile duct stone removal between asymptomatic and symptomatic patients. Dig Dis Sci 61, 1172-1177 (2016).
21. Arregui ME, Davis CJ, Arkush A. Laparoscopic cholecystectomy combined with endoscopic sphincterotomy and stone extraction or laparoscopic choledochoscopy and electrohydraulic lithotripsy for management of cholelithiasis with choledocholithiasis. Surg Endosc 6, 10-15 (1992).
22. Zhu B, Wang Y, Gong K, et al. Comparison of emergent versus elective laparoscopic common bile duct exploration for patients with or without nonsevere acute cholangitis complicated with common bile duct stones. J Surg Res 187, 72-76 (2014).
23. Bansal VK, Misra MC, Rajan K, et al. Single-stage laparoscopic common bile duct exploration and cholecystectomy versus two-stage endoscopic stone extraction followed by laparoscopic cholecystectomy for patients with concomitant gallbladder stones and common bile duct stones: a randomized controlled trial. Surg Endosc 28, 875-885 (2014).