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ORIGINAL ARTICLE

Clinical Effect Analysis of Three-Port Laparoscopic and Choledochoscopic Common Bile Duct Exploration without T-Tube in the Treatment of Emergency Cholecystolithiasis Combined with Common Bile Duct Stones

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ABSTRACT

Background: To investigate the clinical application value of three-port laparoscopy combined with choledochoscopic common bile duct exploration without T tube in the treatment of emergency patients with choledocholithiasis.

Methods: From December 2023 to July 2024, the clinical data of 103 patients with emergency cholecystolithiasis complicated with common bile duct stones in the Department of General Surgery, Beijing Fengtai Youanmen Hospital were collected. Among them, 44 patients underwent three-port laparoscopy combined with choledochoscopy for common bile duct exploration without T-tube operation, and 59 patients underwent four-port laparoscopy combined with choledochoscopy for common bile duct exploration with T-tube drainage. The preoperative, intraoperative and postoperative indexes of the two groups were compared.

Results: There was no significant difference in preoperative general data between the two groups (all $P > 0.05$). Three-port laparoscopic T-tube-free method was better than four-port laparoscopic T-tube method in postoperative pain, removal of abdominal drainage tube and length of hospital stay (all $P<0.05$). There was 1 case of pancreatitis in each group. There was no conversion to open surgery, no residual stones, no hemobilia and no biliary stricture in both groups. There was 1 case of bile leakage after four-hole T-tube placement and 1 case of bile leakage after T-tube removal.

Conclusion: Three-hole laparoscopy combined with choledochoscopy for common bile duct exploration without T-tube in emergency patients is safe and feasible. Compared with T-tube group, T-tube-free method is more consistent with the concept of rapid recovery.

INTRODUCTION

The annual increase in the incidence of gallstone disease within our population is noteworthy. Common bile duct stones often result from the passage of gallstones into the biliary system, leading to acute onset inflammation, severe infection, compromised hepatic function, and pancreatitis—posing significant risks to patient well-being. The approach towards managing concurrent cholecystolithiasis combined with choledocholithiasis has evolved from conventional open procedures to minimally invasive laparoscopic interventions coupled with choledochoscopy. Surgeons strive to minimize patient morbidity while facilitating expedited recuperation. Our institution endorses the concept of fast-track surgery and assesses the viability and safety profile of a three-port laparoscopic approach integrated with choledochoscopy for emergent cases without T-tube insertion on the basis of traditional four-port laparoscopic techniques involving T-tube placement during common bile duct exploration.

MATERIALS AND METHODS

General data

This retrospective study analyzed the clinical data of 103 patients with acute cholecystolithiasis combined with choledocholithiasis who were admitted to the General Surgery Department of Beijing Fengtai Youanmen Hospital from December 2023 to July 2024. Among them, 44 patients underwent laparoscopic cholecystectomy and common bile duct exploration using a three-port laparoscope and endoscopic biliary scope without T-tube drainage. This group comprised 34 males and 10 females, with an average age of (65.8±12.5) years and BMI of (23.8±2.9) kg/m². Additionally, there were 59 patients who underwent laparoscopic cholecystectomy and common bile duct exploration using a four-port laparoscope and endoscopic biliary scope with T-tube drainage. This group included 48 males and 11 females, with an average age of (63.1±11.2) years and BMI of (23.4±2.6) kg/m².

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There were no significant differences between the two groups in terms of gender, age, BMI, preoperative duration of symptoms, TBIL, DBIL, ALT, AST, AMY, WBC, ALB, CRP, PCT, common bile duct diameter, preoperative pain level, and preoperative comorbidities (P>0.05), as indicated in Table 1. All the patients or their family members signed the informed consent before surgery, and the patients and their family members voluntarily chose the two surgical methods.

Surgical methods

Both groups were performed by the same qualified and skilled surgical team.

Three-port laparoscopy without T-tube group

Create a 10mm incision above the belly button (observing port, A port) and establish a CO2 pneumoperitoneum at a pressure of 14mmHg before inserting a trocar. Introduce a laparoscope to explore the abdomen, then make incisions (B and C ports) 2cm below the xiphoid process and 2cm below the costal margin on the right upper abdomen along the midclavicular line, respectively, using 10mm and 5mm trocars. Proceed to isolate and expose the gallbladder, including its triangle; identify and secure the gallbladder artery with a hem-o-lock clamp then cut off the distal end by electrocoagulation. Subsequently isolate the gallbladder neck canal, dissecting the gallbladder cystic duct towards the common bile duct; apply hem-o-lock clamps at both ends before cutting it in between. Extract and place excised gallbladder in disposable specimen bag within perihepatic space. Thoroughly dissecting of common bile duct and making longitudinal incision approximately 6mm long for exploration by implantation of choledochoscopy. A disposable stone basket was used to remove the stones in the common bile duct. After confirming no stones or lesions from further exploration of both ends of common bile duct as well as hepatic ducts, close incision with absorbable surgical sutures (SXMD1B405Angiotech). No obvious bile leakage was observed after compression with gauze. Finally remove specimens through B port, flush abdomen with warm saline, and insert negative pressure drainage tube.

Four-port laparoscopic T-tube placement group

The positions of holes A, B and C were the same as those of the three-port laparoscopy, and hole D was located 1cm above the umbilicus on the right midclavicular line. The operation process was roughly the same as that of the three-port method. The difference is that a T-shaped drainage tube is placed in the incision of the common bile duct through hole B, and a subhepatic drainage tube is placed through hole D.

Table-1: Preoperative general clinical data of the two groups

Project	Non-T-tube group (n=44)	T tube group (n=59)	Statistic	P
Gender (cases)			χ^2=0.259	0.611
Male	34	48		
Female	10	11		
Age（years, x ± s）	65.8±12.5	63.1±11.2	t=1.157	0.25
BMI	23.8±2.9	23.4±2.6	t=0.612	0.542
Course of disease（d）	3.3±1.6	3.3±1.6	t=-0.013	0.99
TBIL(μmol/L)	44.0±21.3	46.7±18.6	t=-0.688	0.493
DBIL(μmol/L)	20.3±9.9	23.1±8.8	t=-1.472	0.144
ALT（U/L)	56.0±26.2	54.8±21.2	t=0.263	0.793
AST（U/L)	64.2±27.0	63.9±25.4	t=0.040	0.968
AMY（U/L)	65.7±30.3	65.9±27.8	t=-0.030	0.976
WBC (109/L)	11.8±4.3	12.6±4.2	t=-0.954	0.342
ALB (g/L)	38.4±4.7	36.9±4.4	t=1.621	0.108
CRP (mg/L)	43.0±23.0	45.6±19.4	t=-0.626	0.533
PCT (ng/ml)	2.4±1.1	2.4±1.0	t=0.223	0.824
Diameter of common bile duct(mm)	11.6±2.1	11.6±2.3	t=-0.161	0.872
Preoperative pain score（NRS）	4.6±1.8	4.4±1.7	t=0.798	0.427
Comorbidity			χ^2=0.428	0.513
Yes	21	32		
No	23	27		

Outcome measures

The operation time, intraoperative blood loss, the number of common bile duct stones, the maximum diameter of common bile duct stones, postoperative pain score, the first postoperative exhaust time, the time of abdominal drainage tube removal, hospital stay, conversion to open surgery, hemobilia, biliary stricture, biliary fistula, and postoperative pancreatitis were observed and recorded.

Statistical analysis

IBM SPSS statistics 23 software was used for statistical analysis. For the measurement data, first of all, normality test was performed to meet the normality and homogeneity of variance between the two groups, and two-sample t test was used for comparison between the two groups. The χ^2 test was used for comparison of count data, and $P<0.05$ was considered statistically significant.

RESULTS

Three-port laparoscopic combined with choledochoscope common bile duct exploration without T-tube had less postoperative pain, shorter removal time of abdominal drainage tube and shorter hospital stay, and the differences were statistically significant ($P<0.05$). There were no significant differences in operation time, intraoperative blood loss, number of common bile duct stones, maximum diameter of common bile duct stones, and time to first flatus after operation between the two groups ($P > 0.05$). Indicated in Table 2. One patient in each group developed pancreatitis after operation and was discharged after conservative treatment. There was 1 case of postoperative bile leakage in the four-hole T-tube group, and the patient was discharged after conservative treatment, and the T-tube was removed successfully 2 months later. One patient in the four-port T-tube group had bile leakage after removal of the T-tube, and was successfully discharged after re-laparoscopic exploration. There was no conversion to laparotomy, no residual stones, no hemobilia, and no biliary stricture in the two groups.

DISCUSSION

The methods of relieving biliary stone obstruction include endoscopic sphincterotomy (EST), percutaneous transhepatic lithotomy and surgery. EST can damage the sphincter of Oddi and destroy the physiological anatomy of the duodenal papilla, with a high incidence of complications and easy recurrence of stones Haseeb et al. (2019). Percutaneous transhepatic lithotomy has not been popularized due to technical and equipment reasons. All patients with choledocholithiasis should undergo elective lithotomy Manes et al. (2019), Kadah et al. (2020). No matter with or without symptoms or complications, surgical treatment is the mainstream method for choledocholithiasis. Removal of stones, removal of obstruction and unobstructed bile drainage are the most effective treatment. Surgical methods are also undergoing a transformation from laparotomy to laparoscopic minimally invasive surgery, and laparoscopic common bile duct exploration (LCBDE) has become more and more prominent in the treatment of common bile duct stones Kim et al. (2020). The study in our center shows that three-port laparoscopic common bile duct exploration combined with choledochoscopy without T-tube operation is safe and effective in the treatment of emergency choledocholithiasis and cholecystolithiasis with acute cholecystitis, which is summarized as follows.

This study showed that the T-tubeless group had less postoperative pain in the surgical area (3.5±0.8 vs. 4.0±0.6, $P<0.001$), earlier removal of abdominal drainage tube (3.8±0.4 d vs. 4.8±0.5 d, $P<0.001$) and shorter length of hospital stay (6.1±0.5 d vs. 6.9±0.6 d, $P<0.001$) than the T tube group. In terms of complications, there was one case of pancreatitis and no bile leakage in the non-T-tube group. This study is basically consistent with Guangming et al. (2024) and Wanliang et al. (2023), the T-tubule-free group has fewer complications and faster recovery.

There was no conversion to laparotomy, no residual stones, no hemobilia, and no biliary stricture in the two groups.

Table-2: Comparison of intraoperative and postoperative indexes between the two groups

Project	Non-T-tube group（n=44）	T tube group (n=59)	t	P
operative time（min）	67.1±13.1	69.0±11.6	-0.778	0.438
Intraoperative blood loss（ml）	31.5±10.7	35.1±10.9	-1.681	0.096
Number of common bile duct stones (number)	4.9±2.4	5.1±2.4	-0.25	0.803
Maximum diameter of common bile duct stones（mm）	2.7±0.9	2.9±0.7	-0.864	0.39
Postoperative Pain Score（NRS）	3.5±0.8	4.0±0.6	-3.871	<0.001
Postoperative exhaust time（d）	1.2±0.3	1.2±0.3	-0.656	0.513
Time to remove abdominal drainage tube（d）	3.8±0.4	4.8±0.5	-10.381	<0.001
Length of stay（d）	6.1±0.5	6.9±0.6	-7.5	<0.001

The experience was summarized as follows: 1. The patient took the position of head up, foot down and right high, made full use of his own gravity, and made the transverse colon and greater omentum move down to expose the gallbladder triangle. 2. The main operating hole is located 2cm below the xiphoid process, and the secondary operating hole is located 2cm below the costal margin of the right midclavicular line. In three-port laparoscopy, there is no assistant to assist in exposing the gallbladder triangle. The triangular area is often covered by the antrum of the stomach and the sagging liver, and the position of the Trocar hole is relatively high. Therefore, the liver can be lifted up by the lever of the operating forceps or the electric hook itself, which is conducive to the exposure of the operation area. 3. The electric hook was used to make a longitudinal incision in the anterior wall of the junction of the cystic duct and the common hepatic duct, and then the scissors were used to expand the incision to avoid the damage of energy equipment to the bile duct wall.

The incision should not be too large, and the choledochoscope could be inserted and the stones could be removed smoothly. It is appropriate to suture the bile duct incision needle distance and edge distance of 1.5mm.

During the operation, normal saline was used to wash the operation area repeatedly to ensure a clear vision, to ensure that there was no bile leakage, to avoid excessive margins, and to avoid postoperative bile duct stenosis. The occurrence of postoperative bile leakage is not only closely related to the skill of the surgeon Liu et al. (2017), but also to the thickness of the edema of the bile duct wall. The incidence of bile leakage is higher in patients with common bile duct stones with a diameter of common bile duct ≤1 cm Yiqing et al. (2023), Tanaka et al. (2021).

The results of this study showed that for patients with acute cholecystitis and choledocholithiasis, one-stage laparoscopic choledocholithotomy without T-tube had more advantages in postoperative pain, abdominal drainage tube removal time and hospital stay than T-tube placement, and the differences were statistically significant ($P<0.05$). The short-term efficacy of one-stage laparoscopic choledocholithotomy without T-tube in emergency patients is safe and reliable, which is worthy of popularization and application.

Due to the small sample size of this study, further prospective randomized controlled trials with large samples are needed to verify its clinical safety and long-term efficacy.

DECLARATIONS

Ethical statement

The data collection protocol was reviewed and approved by the Ethics Committee of Beijing Fengtai Youanmen Hospital (Ref: 2023.12.26/1.0). All study participants provided written informed consent and obtained consent from patients and family members prior to study enrolment.

Conflicts of interest

All the authors declare that there is no conflict of interest

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