

Timing of percutaneous transhepatic gallbladder drainage in elective laparoscopic cholecystectomy for acute cholecystitis

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Introduction: The Tokyo Guidelines 2018 (TG18) developed from TG13 provides a simple criteria and management strategy for acute cholecystitis. The influence of the timing of percutaneous transhepatic gallbladder drainage (PTGBD) in elective laparoscopic cholecystectomy (LC) for acute cholecystitis on surgical outcome has not been clarified.

Methods: 45 patients who underwent PTGBD followed by LC for moderate to severe acute cholecystitis were enrolled in this study. Patients were divided into two groups according to the timing of PTGBD. Group I patients underwent PTGBD within 72 hours of symptoms (n = 28), whereas group II patients underwent PTGBD at more than 72 hours of symptoms (n = 17).

Results: Operation time was longer in group II (median 112 versus 146 min) (P = 0.04). The rate of postoperative complications was significantly higher in group II (0 versus 3 cases) (P = 0.05).

Conclusions: Patients underwent PTBD at more than 72 hours of symptoms showed higher difficulty in LC. We recommend that PTBD within 72 hours of symptoms for the elective LC is performed in patients with acute cholecystitis.

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Key words: Acute cholecystitis; Elective laparoscopic cholecystectomy; Percutaneous transhepatic gallbladder drainage; Timing of PTGBD; Tokyo Guideline 2018

Introduction

The Tokyo Guidelines 2018 (TG18), which is updated from TG13, provides a simple criteria and management strategy for acute cholecystitis (1, 2). TG18 recommends that it is preferable to perform laparoscopic cholecystectomy (LC) soon after admission if the patient is determined to be safe for LC, particularly when less than 72 hours have passed since the onset of symptoms (2). On the other hand, in the patients with moderate or severe acute cholecystitis, who suffers severe local inflammation, immediate gallbladder drainage such as percutaneous transhepatic gallbladder drainage (PTGBD) is often indicated, and then, medical treatments and delayed elective cholecystectomy are performed. In the gallbladder drainage, TG18 shows three techniques of biliary drainage for acute cholecystitis, including PTGBD,

percutaneous transhepatic gallbladder aspiration, and endoscopic gallbladder drainage. Among the three techniques, PTGBD is a safe, feasible, and standard drainage method for severe local inflammation of the gallbladder due to the acute cholecystitis in surgically high-risk patients with severe comorbidities (2-4). TG18 on the basis of the evidence from retrospective multi-center analyses are very useful and helpful for the management of acute cholecystitis using severity assessment criteria, clinical flowcharts, and many new diagnostic and therapeutic modalities (1). However, the effect of the timing of PTGBD in elective LC for acute cholecystitis on surgical outcome has not been clarified. Therefore, we aimed to investigate the optimal timing of PTGBD in patients with acute cholecystitis on elective LC.

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Patients and Methods

Patients

This retrospective analysis was undertaken in the patients with LC for moderate to severe acute cholecystitis in the National Hospital Organization Nagasaki Medical Center between January 2015 and December 2019. The severity grading of acute cholecystitis was based on TG18 (1). In this period, 406 patients were diagnosed as acute cholecystitis, among them, 45 patients with grade II (moderate) or grade III (severe) who underwent elective LC following PTGBD were enrolled in this study. Our standard management for the patients with grade I acute cholecystitis is elective LC following antibiotics therapy, whereas PTGBD is indicated for the patients with grade II or grade III acute cholecystitis, or the patients with grade I acute cholecystitis who are unresponsive to conservative treatments. Those patients with PTGBD undergo elective and scheduled LC. Ultrasonography (US), computed tomography scan (CT), and magnetic resonance cholangiopancreatography (MRCP) were performed for all patients in the present study. Informed consent was obtained from all patients, and the study protocol was approved by the Ethics Committee of National Hospital Organization Nagasaki Medical Center.

Study group

Patients were divided into two groups according to the timing of PTGBD: patients in group I underwent PTBD within 72 hours of symptoms ($n = 28$), whereas group II patients underwent PTBD at more than 72 hours of symptoms ($n = 17$).

Percutaneous transhepatic gallbladder drainage

PTGBD was performed according to the TG18 (4), which was performed using US under local anesthesia. After US guided transhepatic gallbladder puncture was performed with an 18-gauge needle, a 7-Fr drainage catheter was placed in the gallbladder using guidewire technique under fluoroscopy. Cholangiogram was taken to confirm that the drainage catheter was in the correct position within the gallbladder.

Operative technique

All LCs were performed by fixed members including expert biliary surgeons. LC was performed using four-trocar technique under general anesthesia. The patients were placed in the supine position. The PTGBD catheter was removed just

before operation. The first 12-mm laparoscopic trocar was inserted at the umbilicus using an open technique, and pneumoperitoneum was set at 8 mm Hg. The maximum intra-abdominal pressure was 12 mm Hg. Three additional trocars were inserted: two 5-mm trocars levels with the right subcostal area, one 12-mm trocar level with the subxiphoid. First, we dissected the junction between the neck of the gallbladder and the cystic duct at the inferior margin of the gallbladder. After dissection of the triangle of Calot, the cystic duct and the cystic artery were exposed and clipped and then divided with laparoscopic scissors. The gallbladder was dissected from the liver bed using a regular hook electrocautery device. When it was extremely difficult to expose and dissect the triangle of Calot or the neck of the gallbladder due to severe inflammation, the laparoscopic subtotal cholecystectomy was performed (5). The infundibulum of the gallbladder was transected by a laparoscopic stapler in subtotal cholecystectomy. A disposable retrieval bag was inserted directly, and the gallbladder was then extracted. No intraperitoneal drainage tube was placed.

Data collection and statistical analysis

The preoperative clinical status was examined by age, gender, comorbidity, severity of acute cholecystitis, laboratory findings such as leukocyte count and CRP, and wall thickness of the gallbladder on CT imaging. The perioperative characteristics was examined by interval from PTGBD to LC, operative time, intraoperative blood loss, open conversion, postoperative complications, and hospital stay. Numerical data were shown as the median and range, and evaluated using Mann-Whitney *U*-test. Statistical analysis was carried out using SSPS version 23 (SSPS, Chicago, IL). $P < 0.05$ was considered statistically significant.

Results

Preoperative characteristics

Preoperative clinical characteristics of two groups were shown in Table 1. The median age of the patients of two groups were 70.5 and 62.0 years, respectively. 18 patients (64.3%) were male in group I, and 11 patients (64.7%) were male in group II. There was no significant difference in age and gender proportion between the two groups. Comorbidity did not differ significantly between two groups. The severity grading of acute cholecystitis of patients in two groups were grade II in 27 and 14 patients, and grade III in 1 and 3 patients, respectively. Preoperative WBC were 14,050 and 13,900,

and CRP were 17.19 and 23.22. Median gallbladder wall thickness on CT imaging were 4 and 7 mm, respectively. No significant differences were found between group I and group II in severity grading of acute cholecystitis, WBC counts, CRP level and gallbladder wall thickness. In group I, two patients (7%) were not discharged and underwent elective LC with PTGBD catheters. In group II, six patients (35%) were not discharged and underwent elective LC with PTGBD catheters. Other patients in the group I and group II discharged without the PTGBD catheters and thereafter underwent elective LC.

Comparison between of the two groups in perioperative characteristics

Perioperative characteristics of patients in the two groups were shown in Table 2. There was no significant difference in the interval period from PTGBD to LC between the two

groups. In group I, two patients (7%) were not discharged and underwent elective LC with PTGBD catheters. In group II, six patients (35%) were not discharged and underwent elective LC with PTGBD catheters. Other patients in the group I and group II discharged without the PTGBD catheters and thereafter underwent elective LC. Operation time was longer in group II (median 112 versus 146 min) ($P = 0.04$). There was no significant difference in the intraoperative blood loss, rate of conversion to open cholecystectomy, or postoperative hospital stay between the two groups. However, there was significant difference in the postoperative complications between two groups. Five patients (18%) in group I and three patients (18%) in group II who underwent laparoscopic subtotal cholecystectomy due to extreme difficulty in exposure and dissection of the triangle of Calot. In group II, 2 patients had minor bile leakage and 1 patient had minor postoperative bleeding. There was no mortality in the both groups.

Table 1. Preoperative characteristics of patients of the two study groups.

Characteristics	Group I (n=28)	Group II (n=17)	P value
Age [years] (median, range)	70.5(34-90)	62.0 (38-84)	0.17
Gender			0.62
male	18	11	
femal	10	6	
Comorbidity			0.401
Cardiovascular disease	5	4	
Diabetes mellitus	2	3	
Pulmonary disease	2	2	
Chronic liver disease	3	0	
Tokyo Guidelines 2018			0.14
grade II (moderate)	27	14	
grade III (severe)	1	3	
WBC on admission [count/mL] (median, range)	14,050 (7,400-22,400)	13,900 (6,500-20,800)	0.48
CRP on admission [mg/dl] (median, range)	17.19 (0.30-33.56)	23.22 (1.68-28.42)	0.19
Gallbladder wall thickness using CT [mm] (median, range)	4 (2-13)	7 (2-10)	0.9

Table 2. Comparison between of the two study groups in perioperative characteristics

Characteristic	Group I (n=28)	Group II (n=17)	P value
Interval from PTGBD to LC [days] (median, range)	42 (25-78)	38 (12-58)	0.08
Operation time [min] (median, range)	112 (60-197)	146 (89-260)	0.04
Intraoperative blood loss [g] (median, range)	5 (0-80)	10 (0-1010)	0.22
Open conversion	2 (7.1%)	1 (5.9%)	0.68
Postoperative complications*	0 (0%)	3 (17.6%)	0.05
Bile leakage (grade IIIa)	0	2	
Postoperative bleeding (grade I)	0	1	
Hospital stay [days] (median, range)	4 (4-13)	5 (4-15)	0.21

PTGBD, percutaneous transhepatic gallbladder drainage.

LC, laparoscopic cholecystectomy.

* Complications graded according to the Clavien-Dindo classification.

Discussion

TG18 recommends that it is preferable to perform LC soon after admission if the patients are determined to be safe for LC, particularly when less than 72 hours have passed since the onset of symptoms (2), whereas in the patients who are determined to be unable to tolerate for emergent operation due to problematic complications or comorbidities, elective LC after medical treatments and gallbladder drainage including PTGBD should be considered. There were several reports about the optimal timing of the LC after PTGBD (6-10). However, the influence of the timing of PTGBD for elective LC for acute cholecystitis on surgical outcome has not been reported. In the present study, patients who underwent PTGBD at more than 72 hours of symptoms showed higher difficulty in LC compared to patients who underwent PTGBD within 72 hours of symptoms. Severe fibrosis and contraction of the gallbladder due to the inflammation of cholecystitis at the time of cholecystectomy increase intraoperative complications including hemorrhage and bile duct injury. In the most patients of acute cholecystitis, the obstruction at the neck or cystic duct of the gallbladder by gallstone induces the inflammation of cholecystitis. Pathological classification of the acute cholecystitis has been proposed following three stages: first stage, edematous cholecystitis (2-4 days); second stage, necrotizing cholecystitis (3-5 days); third stage, suppurative cholecystitis (7-10 days) (11). The first stage of acute cholecystitis shows that the gallbladder tissue is intact histologically, with edema in the subserosal layer. These pathological findings confirm that early LC within 72 hours

of the onset of acute cholecystitis is recommended. Similarly, it is important to perform PTGBD early within first edematous stage for preventing the inflammation of the gallbladder and the adhesion with surrounding tissues. The most important things for the safe elective LC for acute cholecystitis is to evaluate the severity criteria according to TG18 and the patient's condition including comorbidities, and to perform PTGBD within 72 hours of symptoms in the selective patients.

Our previous report described that PTGBD improved moderate or severe local inflammation of the gallbladder, the complication rate of which was 5% (12). In addition, several comorbidities were found such as cardiovascular disease, and 4 patients (19%) were receiving antithrombotic therapy. No hemorrhagic complication by PTGBD occurred. Thus, PTGBD is a feasible, effective, and relatively safe procedure, which can reduce the difficulty and morbidity of LC, especially, in high-risk patients with acute cholecystitis.

In conclusions, elective LC following PTGBD within 72 hours of symptoms is an effective treatment strategy for the patients with moderate or severe acute cholecystitis and several comorbidities.

Acknowledgment

The authors have no conflicts of interest to disclose.

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