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# Early Laparoscopic Cholecystectomy for Acute Cholecystitis in Accordance with the Tokyo Guidelines for the Management of Acute Cholangitis and Cholecystitis

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## Abstract

**Aims**: To determine if early laparoscopic cholecystectomy (LC) for acute cholecystitis, performed in accordance with the Tokyo Guidelines for the Management of Acute Cholangitis and Cholecystitis, was more effective than delayed LC.

**Methodology**: We compared surgical difficulties, clinical courses and complications between 32 patients undergoing delayed LC and 30 undergoing early LC.

**Results**: Delayed LC was associated with more surgical difficulties than early LC, including severe adhesion of the greater omentum (15/32 vs. 1/30), severe cicatrization of Calot's triangle (15/32 vs. 3/30), inability to identify or skeletonize the cystic duct (18/32 vs. 3/30), and severe cicatrization of the gallbladder bed (27/32 vs. 1/30). Delayed LC was also associated with longer operating times (163 vs. 93 minutes), more conversions to open surgery (7/32 vs. 0/30), more complications (3/32 vs. 1/30), and longer hospitalization (30.5 vs. 10.2 days). Most early LCs was performed during overtime.

**Conclusions**: Despite the retrospective nature of this study, the results demonstrated that changing treatment for acute cholecystitis from delayed to early LC, in accordance with the Tokyo Guidelines, could effectively reduce operation time, duration of symptoms and hospital stay, and thus be of significant benefit to patients. Further, prospective studies are needed to confirm these findings.

**Keywords:** Acute cholecystitis; Early laparoscopic cholecystectomy; Tokyo guidelines

## Introduction

Guidelines for the management of acute cholangitis and cholecystitis were published in Japan, ahead of the rest of the world, in September, 2005 [1]. An international conference was subsequently held in Tokyo, and the Tokyo Guidelines for the Management of Acute Cholangitis and Cholecystitis were adopted as international guidelines in January, 2007 [2]. According to these guidelines, "Cholecystectomy is preferable early after admission (recommendation A)", and "Laparoscopic cholecystectomy is preferable to open cholecystectomy (recommendation A)" for mild and moderate acute cholecystitis.

However, there are still few reports on how treatment has changed since publication of the guidelines. We performed 32 delayed laparoscopic cholecystectomy (LC) procedures for acute cholecystitis in mild or moderate cases, following antimicrobial therapy, prior to August 2006, but the results were not satisfactory. The rate of conversion to open surgery was 22% and the mean operation time was 163 ± 65 minutes Complications occurred in three cases (major bile duct injury, postoperative bleeding, and wound infection). The mean hospital stay was 38 ± 12 days. We therefore introduced the use of early LC for patients with acute cholecystitis, in accordance with the "Guidelines for the Management of Acute Cholangitis and Cholecystitis" introduced in August 2006. Our hospital is located in a relatively rural area and therefore does not experience a high volume of patients with cholecystitis; however, we have currently performed early LC in 30 cases to date. The purpose of this study was to determine if early LC, in accordance with the guidelines, was more effective than delayed LC for the treatment of acute cholecystitis in a municipal hospital.

## Methods and Materials

Between April 2002 and August 2006, 32 patients underwent delayed LC, and between September 2006 and September 2010, 30 patients underwent early LC. The diagnosis and severity assessment of acute cholecystitis were in accordance with the Tokyo guidelines [2]. Patients with severe complications, upper abdominal surgery, those receiving medical treatment to dissolve calculi, or patients with uncertain diagnoses of bile duct disease were not eligible for early surgery.

After admission, patients in both groups were nil by mouth, but received intravenous fluid infusion and antibiotics. Nine patients in the delayed LC group underwent percutaneous transhepatic gallbladder drainage (PTGBD) because they failed to improve after conservative treatment. Delayed LC patients underwent ultrasound (US) examinations, enhanced computed tomography (CT), drip infusion cholangiography-CT (DIC-CT), gastrointestinal endoscopy and fiber colonoscopy. LC was performed in this group after a mean interval of 26 days (range, 12-60 days). In the early LC group, surgery was performed as soon as possible, and within 72 hours of admission. Preoperative examinations included US, enhanced CT and magnetic resonance cholangiopancreatography. Gastrointestinal examinations were not performed. There were no age limits for the procedures.

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Delayed LC operations were performed by four surgeons, including residents, but most early LC operations were carried out by one surgeon, who had performed over 200 LC procedures, including delayed LC, in patients with acute cholecystitis. The guidelines recommend that early LC should only be performed by surgeons experienced in LC. The surgeon in this study had not previously performed early LC.

The laparoscopic procedure was the same in both groups. A laparoscopic cannula was inserted in the supraumbilical region, using an open method, for $CO_2$ insufflation, and a laparoscope was introduced through this cannula. Three other cannulas were inserted, according to the American technique. Aspiration of the gallbladder contents was performed when it was difficult to grasp the gallbladder, due to distension. Calot's triangle was identified and the cystic duct was dissected. Intraoperative cholangiography was carried out via the cystic duct in all patients. The cystic artery was identified and dissected, and the gallbladder was then dissected from the liver, from the neck to the fundus of the gallbladder.

We retrospectively compared the results of early and delayed LC, focusing on the operative difficulties, conversion to open surgery, operation time, the development of complications, the duration of symptoms, and the length of hospital stay.

Statistical analyses were performed using StatView 5.0J for Windows (SAS Institute, Inc., Cary, NC). Data are presented as mean ± standard deviation. Continuous variables were compared using Welch's *t*-test, and categorical variables were compared using Fisher's exact test. P values <0.05 were considered significant.

## Results

### Characteristics of patients

There were no significant differences in patient age, sex, or disease severity between the groups, though there was a significant difference in the interval between admission and surgery (Table 1). No patients in the delayed LC group required emergency surgery. Nine patients in the delayed LC group underwent percutaneous transhepatic gallbladder drainage before LC.

### Schedule for early LC

In all but two cases, early LC was performed during overtime, and involved overtime work by a total of three surgeons, one anesthesiologist, and two nurses.

### Surgical difficulties

In terms of surgical difficulties, we compared the occurrence of severe adhesion of the omentum or intestine, severe cicatrization of Calot's triangle, difficult dissection of the cystic duct, and severe cicatrization of the gallbladder. Early LC was associated with significantly fewer of all these difficulties (Table 2). One patient who had severe cicatrization of Calot's triangle and the gallbladder bed had previously received conservative treatment for acute cholecystitis.

| Characterristic | Delayed LC n=32 | Early LC n=30 | p |
|---|---|---|---|
| Age (years) | 63 ± 16 | 59 ± 11 | NS |
| Sex (M : F) | 24 : 8 | 23: 7 | NS |
| Disease severity* Severe :moderate :mild | 2 : 27 : 3 | 3 : 23 :4 | NS |

* Tokyo Guidelines for the management of acute cholangitis and cholecystitis

**Table 1:** Patient Characterristics.

| Reasons | Delayed LC (n=32) | Early LC (n=30) | P |
|---|---|---|---|
| Severe adhesion | 15 (47%) | 1 (3.3%) | <0.05 |
| Severe cicatrization of Calot`s triangle | 15 (47%) | 3 (10%) | <0.05 |
| Diffcult dissection of cystic duct | 18 (56%) | 3 (10%) | <0.05 |
| Severe cicatrization of gallbladder bed | 27 (84%) | 1 (3.3%) | <0.05 |

**Table2**. Operative Difficulties.

| | Delayed LC (n=32) | Early LC (n=30) | P |
|---|---|---|---|
| | PTGBD(+) 4 / 9 (44%) | | |
| | PTGBD(-) 3 / 23(13 %) | | |
| Total | 7 / 32 (22%) | 0 / 30(0%) | <0.05 |

Reasons for Conversion to Open Surgery

| Number of cases | | |
|---|---|---|
| PTGBD (+) | Major bile duct injury | 1 / 4 |
| | Severe cicatrization of Calot's triangle | 1 / 4 |
| | Difficult dissection of cystic duct | 1 / 4 |
| | Severe adhesion of duodenum | 1 / 4 |
| PTGBD (-) | Severe adhesion of greater omentum | 3 / 3 |

**Table 3.** Conversion to Open Surgery.

### Conversion to open surgery

The conversion rate to open surgery was significantly higher for delayed LC (22%) than for early LC (0%) (Table 3). The conversion rate was higher in patients requiring PTGBD (4/9, 44%) compared with those without PTGBD (3/23, 13%). Because PTGBD was performed in patients whose conditions deteriorated or were not improved by conservative treatment, gallbladders in patients undergoing PTGBD were more severely inflamed. The reasons for conversion to open surgery in the PTGBD group were: injury of the choledocus (1), severe cicatrization of Calot's triangle (1), difficult dissection of the cystic duct (1), and severe adhesion of the duodenum (1). In the non-PTGBD group, the reasons for conversion were severe adhesion of the great omentum in all cases.

### Intraoperative cholangiography

We performed intraoperative cholangiography through the cystic duct in all patients. Choledocal injury was demonstrated by cholangiography in one patient undergoing delayed LC, who was subsequently converted to open surgery. No abnormalities were demonstrated in the other patients. There were no complications related to intraoperative cholangiography.

### Complications

Complications developed in three patients (9.3%) in the delayed LC group and one patient (3.3%) in the early LC group. One intraoperative major bile duct injury, one postoperative bleeding event and one wound infection were recognized in the delayed LC group. The major bile duct injury case was converted to open surgery but the other cases were treated conservatively. In the early LC group, there was one instance of postoperative bile leak, which was resolved within 2 days. There were no reoperations and no hospital mortality (Table 4).

### Operating time

The mean operating time for early LC was 105 ± 20 minutes (range, 56–145 minutes), while that for delayed LC was 93 ± 26 minutes (range, 49-310 minutes). The mean operating time was significantly shorter in the early LC group (Table 4).

The longest delayed LC operation lasted >5 hours, but delayed

| | Delayed LC (n=32) | Early LC (n=30) | p |
|---|---|---|---|
| Operating Time | 163 ± 65 | 105 ± 20 | <0.05 |
| Intraoperaive Complication | 1*(major bileduct injury) | | |
| Postoperaive Complication | 2(bleeding1, wound infection1) | 1(bile leakage) | |
| Fasting Period | 8.5 ± 5.1 | 1.8 ± 0.8 | <0.05 |
| Interval between admission and surgery | 26 ± 12 | 1.7 ± 0.8 | <0.05 |
| Hospital Stay | 38 ± 12 | 10 ± 2.2 | <0.05 |
| Postoperative Hospital Stay | 12 ± 5.5 | 6.5 ± 2.3 | <0.05 |

*converted to open surgery

**Table 4:** Intra and Postoperative outcome.

LC operations were performed by four different surgeons, including residents, and some differences in operating times could be accounted for by inter-surgeon variations. In contrast, almost all the early LC operations were carried out by the same surgeon, who was experienced in LC, and the longest operating time for early LC was a little over 2 hours.

### Fasting period and hospital stay

Fasting periods were used as an index of recovery. The mean fasting period for early LC was 1.8 ± 0.8 days, which was significantly shorter than that for delayed LC (8.1 ± 5.1 days) (Table 4).

Hospital stay and postoperative hospital stay were also significantly shorter in the early LC group (Table 4).

## Discussion

Evidence-based guidelines have recently been drawn up covering various fields of medical care. They are used as references for the diagnosis and treatment of patients. Regarding acute cholecystitis, guidelines for the management of acute cholangitis and cholecystitis were published in Japan, ahead of the rest of the world, in September, 2005. Following an international conference in Tokyo, the Tokyo Guidelines for the Management of Acute Cholangitis and Cholecystitis were adopted as international guidelines in January, 2007 [2]. The relevant literature was taken into account when drawing up the guidelines. The usefulness of early open surgery for acute cholecystitis was reported prior to the advent of LC [3,4]. After the introduction of LC, it was initially contraindicated for acute cholecystitis because of the high conversion rate to open surgery and high mobidity [5], but increased experience and improvements in its application have shown LC to be safe and feasible in patients with acute cholecystitis [6], and LC has been shown to be preferable to open cholecystectomy [7]. In addition, studies comparing early and delayed LC concluded that early LC was the preferred treatment for acute cholecystitis [8,9]. However, few studies have reported on changes in treatment since the introduction of the guidelines. Although some studies on the use of early LC for acute cholecystitis were published by 2010, none mentioned the guidelines. This study investigated the changes in treatment outcomes for patients with acute cholecystitis in a rural municipal hospital before and after publication of the Tokyo guidelines, and the results indicated that treatment in accordance with the Tokyo guidelines could be highly beneficial to patients in such settings.

Following publication of the guidelines, we examined the outcomes of patients undergoing delayed LC in our hospital and concluded that the outcomes were not satisfactory. We therefore introduced early LC for acute cholecystitis, in accordance with the guidelines. Prior to that, many patients only underwent surgery after PTGBD or conservative therapy. After discussions with the internal physician, it was agreed that patients with acute cholecystitis should be treated as early as possible.

We have treated 30 cases with early LC to date. Compared with delayed LC, early LC for acute cholecystitis was associated with shorter operation times and reduced durations of symptoms and hospital stay, as described in the guidelines. A study quoted in the guidelines and a later study reported conversion rates to open surgery from early LC of 8% [10] and 21% [11], respectively, and complication rates of 4% [12] and 13% [8], respectively. In our study, we experienced no conversions and few complications. This was despite the fact that there were few mild cases in our study, and severe cases, such as those with abscesses, were also included. The reasons for the low conversion and complication rates associated with early LC in our study were a low incidence of adhesions of the omentum or neighboring internal organs, few cases of cicatrization of Calot's triangle, easy identification of the cystic duct, and easy dissection of the gallbladder bed. Although the timing of the delayed LC in the current study was not ideal [13,14], the conversion rate of 0% was still superior to those reported in other studies [13,14], suggesting a specific advantage of early LC. However, we gained the impression that more oozing occurred at blunt dissections, compared with during delayed LC, and it is necessary to control this oozing. The good results of our study could also be due to the fact that early LC was only performed by an experienced laparoscopic surgeon. All procedures complied with Japanese guidelines suggesting that early LC should only be performed by surgeons with the appropriate Institute of Laparoscopic Surgeons qualifications. Thus, although early LC is preferable to delayed LC, it cannot be implemented in all hospitals. An educational program is required to produce experienced laparoscopic surgeons.

Hospital stay tended to be shorter for all diseases, including cholecystectomy, during the course of this study. It is possible to reduce the hospital stay for delayed LC patients by discharging them after remission of their symptoms, but readmission may be necessary in some cases, such as the patient with PTGBD, who was unable to manage their catheter at home. Additionally, a critical pathway can be followed as an alternative to elective LC in our hospital, but not all the patients in the current study followed the critical pathway. In terms of early LC for acute cholecystitis, we believe that the results of the current study were also applicable to the critical pathway. The postoperative hospital stay was relatively long in our hospital, because the low patient volume made it possible to adjust the day of discharge to comply with patient wishes.

Although early LC appears to be a better treatment for acute cholecystitis, the ability to continue this treatment remains an issue. The question of why it has not been more widely adopted also exists. There are problems regarding manpower and resources, such as difficulties associated with the use of operating rooms or preoperative examinations. In Japan, guidelines recommending changes in the treatment for acute cholangitis and cholecystitis were published by the Japanese Society for Abdominal Emergency Medicine in March, 2008. The results of a questionnaire administered to members of a society related to cholecystitis showed that the guidelines had only been read by 61.3% of the respondents. Of these, doctors who showed guideline-influenced changes in their medical care accounted for 58.9% [15]. Another report showed that a policy of early cholecystectomy was adopted by 41.7% of surgeons before introduction of the guidelines, and this increased to 57.3% after their introduction, but this percentage was still relatively low [16].

The reasons that early surgery may not be practiced, despite being recognized as the preferred option, are as noted above: difficult access to operating rooms, and limited manpower [16]. Our hospital has a relatively low patient volume, and the associated flexibility meant that it was easier for us to accommodate early LC than it would be for hospitals with higher patient volumes. Even so, most of our early LC operations involved overtime work, and therefore relied on the motivation and understanding of the need for early LC by all the medical staff involved in the operation.

In conclusion, early LC for acute cholecystitis was more effective than delayed LC in reducing not only operation time, but also duration of symptoms and length of hospital stay, as described in the Tokyo guidelines. Implementation of early LC frequently required overtime work, but was highly beneficial to the patients. Although we did not compare the costs of early and delayed LC, a previous study reported reduced costs for early LC compared with open cholecystectomy [7]. Despite the retrospective nature of the current study, the results indicate that treatment of cholecystitis in accordance with the Tokyo guidelines was more effective than the previous treatments used in institutions such as rural municipal hospitals. Although further randomized controlled trials are needed to confirm these findings, we aim to perform early LC for patients with acute cholecystitis in the future.

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