Korean J Hepatobiliary Pancreat Surg 2012;16:29-36

Original Article

Clinical review of laparoscopic cholecystectomy in acute cholecystitis

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Backgrounds/Aims: Laparoscopic cholecystectomy is the best treatment choice for acute cholecystitis. However, its higher conversion rate and postoperative morbidities remain controversial. The purpose of this retrospective study is to evaluate the clinical significance of laparoscopic cholecystectomy that is performed at our institution in patients with acute cholecystitis. **Methods:** Between January 2003 and December 2009, a retrospective study was carried out for 190 cases of acute cholecystitis undergoing laparoscopic cholecystectomy at our institution. They were divided into 2 groups, based on the time of operation from the onset of the symptom and other previous abdominal operation history. These groups were compared in the conversion rate and perioperative clinical outcomes, such as sex, age, accompanied disease, operation time, complications, postoperative hospital stay, total hospital stay and total costs. **Results:** We compared the two groups based on the timing of laparoscopic cholecystectomy and history of previous abdominal operation. There were no significant differences in the open conversion rate, postoperative complications and postoperative hospital stay, total hospital stay and total costs. The sex ratio, female in the previous abdominal operation group, was larger than the non-previous abdominal operation group (70.2% vs. 43.2%, p=0.003, OR=0.32 [95% CI, 0.15-0.70]). Early operation group was larger than delayed operation group, at previous abdominal operation history (26.1% vs. 13.3%, p=0.026, OR=0.43 [95% CI, 0.20-0.91]) and closed suction drain use (79.3% vs. 66.3%, p=0.044, OR=0.51 [95% CI, 0.27-0.99]). **Conclusions:** Although this study was limited, early laparoscopic cholecystectomy for acute cholecystitis with previous abdominal operation history seems to be safe and feasible for patients, having a benefit of decrease in total hospital stay. **(Korean J Hepatobiliary Pancreat Surg 2012;16:29-36)**

Key Words: Acute cholecystitis; Laparoscopic cholecystectomy

INTRODUCTION

Since the introduction of laparoscopic cholecystectomy, with the accumulation of experiences and the advances in the instruments, laparoscopic cholecystectomy has been expanding its indications, thus becoming a standard surgical method of cholecystectomy, due to its advantages as a non-invasive procedure.[1-6] For acute cholecystitis, however, the use of laparoscopic cholecystectomy has been controversial up until recently, because of the high open conversion rate and the high incidence of postoperative complications.[7-10] Nevertheless, the 2006 Tokyo Guidelines recommended laparoscopic cholecystectomy as the first option for the treatment of acute cholecystitis.[11]

We analyzed the clinical patterns and surgical outcomes of 190 patients who had received laparoscopic cholecystectomy for acute cholecystitis, during the period from 2003 to 2009 retrospectively. Utilizing their medical records, we observed the clinical significance of laparoscopic cholecystectomy as a treatment method of acute cholecystitis.

METHODS

Subjects

The subjects of this study included the 190 patients (11.7%) with acute cholecystitis from the 1621 patients who had received laparoscopic cholecystectomy at the Department of Surgery, Kyung Hee University Medical Center, during the period from January 2003 to September 2009.

Patients were diagnosed with acute cholecystitis when they had pain, tenderness or rebound tenderness in the up-

Received: November 1, 2011; **Revised:** November 10, 2011; **Accepted:** November 25, 2011
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per right abdomen or the epigastric region, fever, leukocytosis (>10,000/mm^3), and showed the symptoms of acute cholecystitis in abdominal ultrasonography or abdominal computed tomography (CT). Such symptoms included gallbladder wall thickening (>4 mm), fluid collection around the gallbladder, and inflammatory thickening of the gallbladder.[11]

If common bile duct stone was suspected, preoperative magnetic resonance cholangiopancreatography or endoscopic retrograde cholangiopancreatography was performed; if bile duct stones were observed, they were removed through endoscopy; and then on the following day, laparoscopic cholecystectomy was performed. For patients to whom preoperative cholangiography was not applicable, intraoperative cholangiography was performed. If bile duct stones were found they were removed through laparoscopic common bile duct exploration.

Laparoscopic cholecystectomy was performed by two experienced surgeons, with more than 500 cases in laparoscopic cholecystectomy. In all the cases, general anesthesia was applied, and 3-hole or 4-hole laparoscopic cholecystectomy was performed depending on the surgeons' preference. For patients having a history of upper abdominal surgery, however, an umbilical trocar was inserted through open surgery, and if trocar insertion into the usual site was impossible due to adhesion, the position of trocar insertion was changed according to the position or severity of adhesion. Adhesiolysis was performed first, and then the trocar was inserted at a position appropriate for cholecystectomy and surgery was performed. A Jackson-Pratt (JP) type drain was installed after bile duct stones were removed and T-tubes were then inserted when gallbladder inflammation was severe.

Table 1. Sex and age distribution of the patients with acute cholecystitis

Age	Male	Female	Total (%)
<19	2	0	2 (1.1)
20-29	4	5	9 (4.7)
30-39	9	11	20 (10.5)
40-49	7	9	16 (8.4)
50-59	16	15	31 (16.3)
60-69	35	19	54 (28.4)
70-79	19	29	48 (25.3)
>80	6	4	10 (5.3)
Total	98 (51.6)	92 (48.4)	190 (100)

We analyzed the patients retrospectively in terms of age and gender distribution, concurrent diseases, history of abdominal surgery, duration of surgery, postoperative hospital stay, complications, open conversion, pathologic findings, etc.

Statistical analyses were performed using SPSS Version 18.0 through Student *t*-test and chi-squared test. The statistical significance of the differences was significant when *p*-value was <0.05.

RESULTS

Patient demographics

Of the patients, 98 were male and 92 were female. Hence, the sex ratio was 1 : 0.94. The mean age was 59.1±16.0 years (range: 15-87) and the largest age groups were the 60s (28.4%) and the 70s (25.3%) (Table 1).

In 108 cases (56.8%), other diseases were accompanied. Of them, hypertension was most frequent, as found in 80 cases (42.1%), followed by diabetes in 38 cases (20%), other cerebral vascular diseases, heart diseases, etc. (Table 2). In addition, 39 patients (20.5%) had two accompanying diseases and 5 cases (2.6%) had three.

History of abdominal surgery

Of the patients, 37 cases (19.5%) had a history of abdominal surgery. Among them, appendectomy was most frequent as found in 15 cases (7.9%), followed by abdominal hysterectomy, Cesarean section, etc. (Table 3). In addition, 10 cases (5.3%) had received two or more types of surgery.

We divided the patients into those with a history of ab-

Table 2. Associated diseases of the patients with acute cholecystitis

Disease	n=190 (%)
Hypertension	80 (42.1)
Diabetes	38 (20)
Cerebrovascular disease	16 (8.4)
Cardiac disease	11 (5.8)
Hepatitis	3 (1.6)
Pulmonary tuberculosis	3 (1.6)
Parkinsonism	2 (1.1)
Liver cirrhosis	2 (1.1)
Chronic renal failure	1 (0.5)
Asthma	1 (0.5)
Total	108 (56.8)

dominal surgery and those without, and compared several clinical patterns between the two groups. The two groups were not significantly different in age, accompanying diseases, duration of surgery, abdominal opening, JP use, and complication. However, in regards to gender, the group with a history of surgery (M : F = 1 : 2.4) showed a significantly higher percentage of women than the group without (M : F = 1 : 0.76) (p=0.003, OR=0.32 [95% CI, 0.15-0.70]). The period from admission to surgery was 3.1±0.5 days in the group without a history of surgery and 1.2±0.2 days in the group with a history of surgery, showing a statistical significance (Table 4).

Table 3. History of previous operations in the patients with acute cholecystitis

Operation name	n=190 (%)
Appendectomy	15 (7.9%)
Transabdominal hysterectomy	6 (3.2%)
Cesarean section	6 (3.2%)
Tubal ligation	5 (2.6%)
Subtotal gastrectomy	5 (2.6%)
Ectopic pregnancy	4 (2.1%)
Miles' operation	1 (0.5%)
Nephrectomy*	1 (0.5%)
Small bowel resection	1 (0.5%)
Inguinal hernia repair†	1 (0.5%)
Laproscopic cholecystectomy	1 (0.5%)
Total	37 (19.5%)

*due to renal cell carcinoma, †transabdominal preperitoneal approach

Timing of surgery

The mean period from the appearance of symptoms to surgery was 6.5±0.6 days (range: 0-65) and the mean period from admission to surgery was 2.4±0.2 days (range: 0-25). In 4 patients in whom surgery was delayed, after percutaneous gallbladder drainage, the mean period from the appearance of symptoms to the percutaneous gallbladder drainage was 2.3 days (range: 0-5) and the mean period from cholecystostomy to surgery was 29 days (range: 9-61). Moreover, 18 patients (9.5%) received endoscopic retrograde cholangiopancreatography, and the mean period from the appearance of symptoms to endoscopic retrograde cholangiopancreatography was 5.2 days (range: 0-18) and the mean period from endoscopic retrograde cholangiopancreatography to surgery was 4.4 days (range: 0-13) (Table 5).

According to the period from the appearance of symptoms to surgery, the subjects were divided into those who had surgery early, within 3 days, and those whose surgery

Table 5. Time intervals of the patients with acute cholecystitis

	Average intervals (days)
Symptom to operation	6.5
Admission to operation	2.4
Symptom to PTGBD	2.3
PTGBD to operation	29
Symptom to ERC	5.2
ERC to operation	4.4

PTGBD, percutaneous transhepatic gallbladder drainage; ERC, endoscopic retrograde cholangiography

Table 4. Clinical characteristics of the patients with previous abdominal operation

	NPAOG (n=153, 80.5%)	PAOG (n=37, 19.5%)	Univariate (p-value)	Multivariate (p-value)
Age (years)	58.5±1.3	61.6±2.1	0.216	
Sex (M : F)	87 : 66	11 : 26	0.003	0.004
Medical history	85 (55.6%)	23 (26.4%)	0.467	
Sx-to-Op interval (days)	7.0±0.7	5.1±1.0	0.186	
Adm-to-Op interval (days)	3.1±0.5	1.2±0.2	0.000	0.022
Operation time (m)	96.2±3.1	90.1±5.4	0.374	
Open conversion	2 (1.3%)	1 (2.7%)	0.480	
Jackson-Pratt drain	108 (70.6%)	30 (81.1%)	0.199	
Complication	4 (2.6%)	2 (5.4%)	0.332	
Post-op hospital stay (days)	4.5±0.4	4.5±1.0	0.949	
Total hospital stay (days)	7.5±0.6	5.7±1.1	0.181	
Cost (10,000 won)	466.1±19.1	418.2±24.8	0.242	

NPAOG, non-previous abdominal operation group; PAOG, previous abdominal operation group; Sx-to-Op, symptom to operation; Adm-to-Op, admission to operation

was delayed to the 3rd day or later, after the appearance of symptoms. Clinical patterns were then compared between the two groups. The two groups were not different in gender, age, accompanying disease, the period from admission to surgery, duration of surgery, abdominal opening, complication, postoperative hospital stay, total hospital stay, and total medical cost. However, significant differences were observed between the two groups in the history of abdominal surgery (p=0.026, OR=0.42 [95% CI, 0.20-0.91]), the period from admission to surgery (p=0.000) and JP drain use (p=0.044, OR=0.51 [95% CI, 0.27-0.99]) (Table 6).

Duration of surgery

The mean duration of surgery in 187 cases was 93±30 minutes (range: 45-190) except 3 patients who had open surgery. Of the patients, 91 cases (48.7%) took 60-90 minutes, 19 (10.2%) shorter than 60 minutes, and 2 (1.1%) longer than 180 minutes (Table 7).

The patients were divided into two groups based on similar mean operation time, of 90 minutes, and their clinical patterns were then compared. The two groups were not significantly different in gender, age, accompanying disease, history of abdominal surgery, period from the appearance of symptom to surgery, period from admission to surgery, open conversion, complication, postoperative hospital stay, total hospital stay, and total medical cost. However, the group under 90 minutes (68 cases, 61.3%) used JP drain significantly less frequently than those in the group over 90 minutes (70 cases, 88.6%) (p=0.000, OR=4.92, [95% CI, 2.23-10.86]) (Table 8).

Hospital stay

The mean postoperative hospital stay was 4.5 days (range: 1-43), and 117 cases (61.6%) stayed in hospital for 3-5 days after surgery. The mean total hospital stay was 7.2 days (range: 1-69) and 117 cases (61.6%) stayed in hospital for 4-7 days (Table 9).

Postoperative complications

Complications occurred in 6 cases (3.2%), which were bile leak, wound infection, paralytic ileus, pleural exudate, neurogenic bladder, and acute renal failure, respectively (0.5% each), but they were all improved through conservative treatment (Table 10).

Open conversion

In 3 cases (1.6%), laparoscopic cholecystectomy was converted to open surgery because of intraoperative bleeding, gallbladder cancer diagnosis, and common bile duct

Table 7. Operation time of the patients with acute cholecystitis

Operation time (minutes)	n=187 (%)
30-60	19 (10.2)
60-90	91 (48.7)
90-120	46 (24.6)
120-150	19 (10.2)
150-180	10 (5.3)
180-210	2 (1.1)
Average	93±29

Table 6. Comparison of early operation group and delayed operation group according to the time from symptom onset to operation

	Early group (≤3 days, n=92, 48.4%)	Delayed group (>3 days, n=98, 51.6%)	Univariate (p-value)	Multivariate (p-value)
Age (years)	59.6±1.5	58.7±1.8	0.717	
Sex (M : F)	51 : 41	47 : 51	0.303	
Medical history	54 (58.7%)	20 (55.1%)	0.617	
Previous abdominal operation	24 (26.9%)	13 (13.3%)	0.026	0.062
Adm-to-Op interval (days)	2.2±0.7	3.2±0.3	0.230	
Operation time (minutes)	89.9±2.8	99.8±4.5	0.064	
Open conversion	2 (2.2%)	1 (1.0%)	0.611	
Jackson-Pratt drain	73 (79.3%)	65 (66.3%)	0.044	0.020
Complication	2 (2.2%)	4 (4.1%)	0.683	
Post-operative hospital stay (days)	4.4±0.4	4.5±0.5	0.901	
Total hospital stay (days)	6.7±0.9	7.7±0.6	0.335	
Cost (10,000 won)	449.1±26.9	464±18.8	0.645	

Adm-to-Op, admission to operation

Table 8. Comparison of the patients with acute cholecystitis between two groups whether the operation time is over 90 minutes or not

	Op. time ≤90 min (n=111, 59.4%)	Op. time >90 min (n=76, 40.6%)	Univariate (*p*-value)	Multivariate (*p*-value)
Age (years)	57.5±1.6	61.5±1.7	0.087	0.983
Sex (M : F)	61 : 50	37 : 42	0.270	
Medical history	60 (54.1%)	48 (60.8%)	0.358	
Previous abdominal operation	24 (21.6%)	13 (16.5%)	0.375	
Sx-to-Op interval l (days)	6.1±0.6	7.4±1.2	0.295	
Adm-to-Op interval (days)	2.6±0.3	2.8±0.8	0.819	
Open conversion	1 (0.9%)	2 (2.5%)	0.571	
Jackson-Pratt drain	68 (61.3%)	70 (88.6%)	0.000	0.000
Complication	3 (2.7%)	3 (3.8%)	0.694	
Post-op hospital stay (days)	4.1±0.5	5.0±0.5	0.218	
Total hospital stay (days)	6.7±0.6	7.8±1.0	0.334	
Cost (10,000 won)	433.9±18.3	488±29.0	0.093	0.103

Sx-to-Op, symptom to operation; Adm-to-Op, admission to operation

Table 9. Hospital stay of the patients with acute cholecytitis

Hospital stay (days)	Postoperative n=190 (%)	Total n=190 (%)
1	21 (11.1)	2 (1.1)
2	21 (11.1)	16 (8.4)
3	50 (26.3)	10 (5.3)
4-5	67 (35.3)	69 (36.3)
6-7	16 (8.4)	48 (25.3)
8-10	8 (4.2)	22 (11.6)
11-14	2 (1.1)	7 (3.7)
15-21	1 (0.5)	10 (5.3)
>21	4 (2.1)	6 (3.2)
Average	4.5	7.2

Table 10. Postoperative complications of the patients with acute cholecystitis

Complication	n=190 (%)
Bile leakage	1 (0.5)
Wound infection	1 (0.5)
Paralytic ileus	1 (0.5)
Pleural effusion	1 (0.5)
Neurogenic bladder	1 (0.5)
Acute renal failure	1 (0.5)
Total	6 (3.2)

injury, respectively (0.5% each) (Table 11).

Pathologic findings

The most common pathologic diagnosis was acute cholecystitis as found in 93 cases (48.9%), which was followed by chronic cholecystitis in 62 (32.6%), gangrenous cholecystitis in 13 (6.8%), empyema of gallbladder in 12 (6.3%) (Table 12).

Table 11. Conversion to open cholecystectomy of the patients with acute cholecytitis

Cause	Case (%) (n=190)
Bleeding	1 (0.5)
Bile duct injury	1 (0.5)
Diagnosis of gallbladder cancer	1 (0.5)
Total	3 (1.6)

Table 12. Pathologic diagnosis of the patients with acute cholecystitis

Diagnosis	Cases (%)
Acute cholecystitis	93 (48.9)
Chronic cholecystitis	62 (32.6)
Gangrenous cholecystitis	13 (6.8)
Empyema	12 (6.3)
Xanthogranulomatous cholecystitis	7 (3.7)
Adenocarcinoma	2 (1.1)
Infarction	1 (0.5)
Total	190 (100)

DISCUSSION

Since laparoscopic cholecystectomy was performed first by Mouret in 1987, around 20% of patients in need of cholecystectomy have been treated through laparoscopic cholecystectomy that reduces open conversion and shortens hospital stay, but its role has been controversial due to its instability and many complications.[12-15] In case of open conversion, the incidence of postoperative complica-

tions goes up to 71%[3] and even mortality caused by open surgery has been reported to be 3.4%.[16] Further, there is a disagreement on the optimal time of surgery for acute cholecystitis.[17] But laparoscopic cholecystectomy is now acknowledged as a standard procedure for acute cholecystitis, due to the advancements of operative techniques, accumulated experience and the development of equipment and instruments,[11] and its application is expanded to the aged patients and patients having a history of abdominal surgery.[1-6]

Thus, laparoscopic cholecystectomy is performed after preoperative percutaneous gallbladder drainage in order to reduce open conversion or serious complications such as bile duct injury when acute cholecystitis has severe inflammation and is accompanied by complications in aged patients.[18-22] Such action is reported to have advantages such as the avoidance of emergency operation, early relief of pain, sufficient time for detecting and treating accompanying internal diseases, and the prevention of postoperative complications and open conversion.

In our study, although fewer cases are difficult to compare, percutaneous gallbladder drainage was performed in 4 cases, respectively, on day 0 (2 cases), 4 and 5 from the onset of the symptoms. The duration of surgery was 75, 85, 120 and 135 minutes (mean 103.8 minutes), respectively. None of them had open conversion or complication. In addition, postoperative hospital stays were 3 days in 1 patient and 4 days in 3 patients, being a mean of 3.3 days. Moreover, there were 18 patients who received endoscopic retrograde cholangiopancreatography as the accompaniment of bile duct stones. In all the cases, endoscopic retrograde cholangiopancreatography within 3 days from admission, and surgery was also performed within 3 days from cholangiopancreatography, which followed the time trends with other reports.[23-25]

It was reported that the incidence of abdominal adhesion is 75-93% in patients with a history of abdominal surgery.[26,27] Abdominal adhesion may cause complications such as small bowel obstruction, and is a major factor increasing postoperative complications, such as abdominal organ injury and intestinal perforation.[26,28] Abdominal adhesion is known to obstruct the progression of surgery, after the initial trocar insertion, particularly when laparoscopic surgery is performed.[29] The open conversion rate in patients with a history of abdominal surgery is reported to be as high as 25%.[20-32] Besides, delayed postoperative recovery and increased hospital stay have been reported.[30] If there was a history of upper abdominal surgery, laparoscopic cholecystectomy was influenced on perioperative morbidity. At other reports, operative time, hospital stay, use of drainage tube showed differences, but open conversion, complication didn't show differences.[33-36]

In our study, the patients with a history of abdominal surgery (n=153) and the patients without a history of abdominal surgery (n=37) were divided into two groups. Univariate analysis and multivariate analysis using the clinical characteristics were analyzed upon the division of the groups. Age, history of abdominal surgery, duration of surgery, open conversion, use of drainage tube, complications, and postoperative hospital stay, and the total hospital stay were not significantly different. However, the gender and period from admission to surgery showed a significant difference. This result showed the same results in multivariate analysis. The causes of this gender difference are due to the fact that surgeries only a woman can receive were also included in the history of previous surgery (hysterectomy, Cesarean section, tubal ligation, ectopic pregnancy operation). In addition, the period between admission and the surgery were short in the group who had history of abdominal surgery. The reason for this was due to abrupt changes of clinical symptoms from postoperative adhesion.

Then, this study subdivided the group within a history of abdominal surgery, into those with a history of upper abdominal surgery and those without, and compared their clinical patterns. In the results, no significant difference was observed in gender, age, period from the onset of symptom to surgery, complication, drain use, and postoperative hospital stay. In the duration of surgery, there was no statistical difference (113.3 min vs. 85.6 min, p=0.059), however, the duration of surgery for a history of upper abdominal surgery subgroup appeared to be longer than the duration for the without subgroup.

Many discussions have been made and several reports have been published on the optimal time of laparoscopic cholecystectomy. According to previous reports, if the surgery is performed within 72 hours from the onset of the symptoms, operation is easier, open conversion rate is lower, duration of surgery is shorter, and recovery is faster.[26] Thus, we compared between patients within 3

days from the onset of the symptoms to surgery (early surgery group) and patients who did not (delayed surgery group). The period from the onset of the symptoms to surgery, duration of surgery, open conversion, complications, postoperative hospital stays, and total hospital stays were not different between the two groups. The drain tubes were used more frequently in the early surgery group. These results were considered because severe inflammation was associated with frequent use of JP drain. In our study, unlike other studies,[8,9,12,15,17] the period from the admission to surgery, total hospital stays, and total medical costs did not show significant differences. The causes of these results included many cases of drainage and antibiotic treatment in the department of internal medicine then discharged, and at which point in time, operation schedule is set for readmission.

The mean duration of surgery was 93 minutes at our study. Therefore, we divided the patients into two groups, benchmark was the duration of surgery under or over 90 minutes, and compared clinical patterns of the two groups.[9,12,13,37] In the results, no significant difference was observed in gender, age, accompanying disease, history of abdominal surgery, waiting period before surgery, open conversion, the incidence of complications, and total hospital stay. But JP drain insertion was less frequent in the group under 90 minutes.

The authors analyzed a number of factors that may affect open conversion and the incidence of complications in laparoscopic cholecystectomy for acute cholecystitis, but found that factors such as the history of abdominal surgery, time of operation, and duration of surgery did not have a significant effect on open conversion and the incidence of complications. However, considering that the duration of surgery, hospital stays, and total medical costs showed no differences between patients with a history of abdominal surgery and patients without a history of abdominal surgery. Laparoscopic cholecystectomy could tell that it is not contraindication. Also, concerning the discussion about the early operation on acute cholecystitis patients, the authors believe that early operation is the treatment method that should be considered as a primary option, since there were no significant differences in the rate of open conversion and complication, hospital stay, and total cost from that of the delayed operation. In addition, according to our study, the difference in the operation time was only a matter of convenience. It did not have any effect on the rate of open conversion and complication, nor the length of hospital stay. However, the limitations of this study were as follows: small number of cases, lack of data comparing cases of laparoscopic cholecystitis performed for other causes, and the fact that many of the volunteers had poor general condition and combined underlying diseases. We believe a larger randomized clinical study is required in the future.

Despite the limitations of this study, we think that early laparoscopic cholecystectomy for acute cholecystitis with previous abdominal operation history seems to be a safe and a feasible option for patients since it has the benefit of decrease in total hospital stay.

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