Laparoscopic cholecystectomy in patients with empyematous cholecystitis: an outcome analysis

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Abstract

Background Laparoscopic cholecystectomy (LC), the procedure of choice for elective cholelithiasis, is now also used in the management of acute cholecystitis. Empyema of the gallbladder is unexpectedly encountered in a proportion of these patients. This paper describes our experience with LC in the treatment of patients with empyema of the gallbladder.

Methods From May 1992 to July 2007, 315 patients with a clinical diagnosis of acute cholecystitis underwent LC. Operative and histopathology reports were used to identify patients with empyema of the gallbladder, to which retrospective chart reviews were applied. Factors associated with conversion and complications were assessed to determine their predictive power.

Results Being male and having high levels of aspartate transaminase (AST), alanine transaminase (ALT), and white blood cells significantly influenced the prediction of empyema. The conversion rate was significantly higher for empyema and acute cholecystitis, but the complication rate did not differ significantly between these conditions. Previous abdominal surgery was an independent risk fac-

tor for conversion and complications. Also, temperature >37.5°C, AST >60 IU/l, and ALT >60 IU/l were associated with higher conversion rates. The hospital stay was longer in patients with empyema, while the operation time did not differ between the two groups.

Conclusion Empyema of the gallbladder can be encountered in patients with presumed acute cholecystitis. Preoperatively differentiating between simple acute cholecystitis and empyema is difficult, if not impossible. The conversion rate is expected to be higher when empyema is approached laparoscopically than for simple acute cholecystitis or symptomatic cholelithiasis.

Keywords Empyema · Acute cholecystitis · Laparoscopic cholecystectomy

Introduction

Laparoscopic cholecystectomy (LC) has become the treatment of choice for symptomatic cholelithiasis. Because of perceived difficulties in dissection and the premise of unacceptably high complication rates, the presence of acute cholecystitis was once considered a contraindication to performing LC. However, increasing experience with the procedure has led many centres to employ LC as the treatment of choice for acute cholecystitis [1–5], which is a severe form of symptomatic cholelithiasis in which empyema of the gallbladder is unexpectedly encountered in a proportion of cases. The lack of patient and laboratory data distinguishing empyema in patients with acute cholecystitis makes preoperative diagnosis elusive. A successful laparoscopic approach is associated with a better outcome

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[6]. Preoperative factors that could distinguish patients with empyema in whom LC is successful from those requiring conversion to an open cholecystectomy (OC) have not been clearly defined. In this study we retrospectively reviewed our experience with LC in the treatment of patients with empyema of the gallbladder.

Methods

From May 1992 to July 2007, a total of 2,412 consecutive patients underwent LC in the Second Department of Surgery at Democritus University of Thrace, Greece. Among these patients, 315 (13.1%) patients were admitted with a clinical diagnosis of acute cholecystitis. The diagnosis of acute cholecystitis was based on at least two of the following conditions being present: primarily, local pain and/or tenderness in the right upper quadrant, temperature higher than 37.5°C, and/or leucocytosis (white blood cell count $\geq 9 \times 10^9/l$), and ultrasonic evidence of acute cholecystitis (thickening of the gallbladder wall, distended gallbladder or fluid adjacent to the gallbladder, presence of gallstones) at the admission; and secondarily, operative and pathological confirmation of acute cholecystitis. The intraoperative findings in the acute group showed acute edematous cholecystitis in 137 (43.5%) patients, hydrops in 66 (21.0%) patients, and empyema in 112 (35.5%) patients. The diagnosis of empyema or hydrops of the gallbladder was based on evidence of pus or mucus in the gallbladder upon laparoscopic aspiration. Operative and histopathology reports were obtained and the subgroup with empyema of gallbladder identified. In the sequence, patients were divided into two groups, according to the absence (acute edematous cholecystitis, hydrops) or presence of empyema of the gallbladder, which was considered as more severe acute cholecystitis. A retrospective chart review of this subset of patients was then performed.

Data sheets of patients were generated that contained demographic data and preoperative, operative, and postoperative findings. Preoperative notes contained information on the presence of associated diseases (e.g. cardiovascular disease, hypertension, and diabetes), previous abdominal surgery, previous hospitalisation for acute cholecystitis or acute pancreatitis, body mass index (BMI), fever, and laboratory results of WBC count, serum bilirubin, aspartate transaminase (AST), and alanine transaminase (ALT), imaging studies (ultrasonographics findings as gallstones, gallbladder wall thickness, pericholecystic fluid) operative data, and outcome (morbidity, postoperative hospital stay). We also divided previous abdominal surgery into upper and lower abdominal surgery. BMI values were grouped as ≤ 24.9 , 25.0–29.9, ≥ 30 kg/m². All of the above independent factors were tested for their predictive value regarding conversion, morbidity and operative time in patients with empyema of gallbladder. All the resected specimens were examined histopathologically, which revealed correlations

between clinical diagnosis and histopathology of 83% for acute cholecystitis and 78.4% for empyema.

All operations performed by surgeons with a special interest in laparoscopy surgery. Patients were operated on within 72 hours after the onset of symptoms. A standard laparoscopic approach was used. Pneumoperitoneum was created using a veress needle except in a few patients who had previously undergone a midline incision and in those with suspected adhesions, in whom it was created using the Hasson technique. Intraoperative cholangiograms was not attempted. In patients with perioperative hyperbilirubinemia without biochemical evidence of common duct stones or ductal dilatation, the cholecystectomy alone was performed with postoperative endoscopic retrograde cholangiopancreatography (ERCP) being reserved for patients whose bilirubin levels failed to normalize following surgery ($n = 3$). In patients with elevated bilirubin and biochemical evidence of common duct stones or ductal dilatation ($n = 5$), a preoperative ERCP was performed.

A number of operative modifications were necessary to successfully complete the procedure. These included aspiration of the gallbladder, placement of cystic duct sutures, use of an endoscopic pouch to extract the gallbladder from the peritoneal cavity, enlargement of the incision, copious irrigation of the peritoneal cavity, and the placement of subhepatic drains. Operative time was calculated from the initiation of skin incision to the completion of skin closure. The hospital stay was calculated as the period from the admission day until discharge of hospital.

Statistical analysis of the data was performed using the Statistical Package for the Social Sciences (SPSS), version 11.0 (SPSS, Inc., Chicago, IL, USA). The Kolmogorov-Smirnov test for normality was performed. Normally distributed continuous variables were expressed as the mean $\pm$ standard deviation, while non-normally distributed variables were expressed as the median and range. Categorical variables were expressed as frequencies (and percentage). The Chi-square test was used to evaluate any potential association between two categorical variables. Mann-Whitney U-test and Kruskal-Wallis test were used to determine differences of operation time and hospital-stay between two or more groups of patients, respectively; post hoc analyses were performed using Bonferroni's correction. To assess the independent effect of empyematous cholecystitis on the outcome of LC, multivariate stepwise linear and logistic regression models were constructed, adjusted for all major confounders. The logarithmic transformation of operative time and hospital stay was used. Adjusted odds ratios (OR) and their 95% confidence interval (CI) were also calculated. Discriminant forward stepwise analysis was used to characterise patients with empyematous cholecystitis. All tests were two tailed and statistical significance was considered for p values less than 0.05.

Results

Preoperative status

The study population of 315 patients who underwent LC comprised 214 (67.9%) females and 101 (32.1%) males aged 56.67 ± 14.00 years (range, 19–86 years), of which 203 (64.4%) had acute cholecystitis (147 women and 56 men; Aged 56.04 ± 14.37 years, range 19–86 years) and 112 (35.6%) had empyema (67 women and 45 men; aged 57.81 ± 13.26 years, range 24–86 years). The demographic and preoperative data of patients with acute cholecystitis and empyema are compared in Table 1. In univariate analysis, only the frequency of being male was significantly higher ($p = 0.022$) in patients who presented with empyema than in those with acute cholecystitis, with there being no significant differences in age ($p = 0.926$), BMI ($p = 0.368$), or in the incidences of cardiovascular disease ($p = 0.761$), diabetes ($p = 0.136$), hypertension ($p = 0.203$), previous abdominal surgery ($p = 0.106$), or previous hospitalisation for acute cholecystitis or pancreatitis ($p = 0.683$). Clinical or laboratory signs of inflammation were observed in 170 (83.7%) patients with acute cholecystitis and in 111 (99.1%) patients with empyema. In particular, a WBC count $\geq 12 \times 10^9/l$ ($p < 0.001$), serum total bilirubin >1.2 mg/dl ($p = 0.009$), AST >60 IU/l ($p = 0.006$), and ALT >60 IU/l ($p < 0.001$)

were more common in empyema than in acute cholecystitis. The proportion of patients with temperature $>37.5^\circ\text{C}$ was the same in the two groups ($p = 0.346$). The most consistent clinical finding was the presence of right upper quadrant pain (109 of 112 patients, 97.3%). Leukocytosis (WBC count $\geq 12 \times 10^9/l$) was present in 108 of 112 patients (96.4%), and fever (temperature $>37.5^\circ\text{C}$) was present in 63 (56.3%) patients. Abnormalities of liver function were noted in several patients, and AST, ALT, and total bilirubin were elevated (>1.2 mg/dl) in 33%, 42%, and 67.9% of patients, respectively.

Real-time ultrasonography of the abdomen was the initial imaging modality of choice. Although gallstones were the most common finding (103 of 112 patients, 92%), gallbladder wall thickening and pericholecystic fluid were detected in 8 (7.1%) and 1 (0.9%) of the 112 patients, respectively. Discriminant forward stepwise analysis indicated that being male ($p < 0.001$) and high levels of AST ($p < 0.001$), ALT ($p < 0.001$), and WBCs ($p < 0.001$) significantly influenced the prediction of empyema of the gallbladder. These variables correctly classified 70% of the patients with signs of acute cholecystitis. The prediction model for empyema was as follows: empyema = $-2.033 + 0.697 \times (\text{being male}) + 1.931 \times (\text{WBC count} \geq 12 \times 10^9/l) + 0.755 \times (\text{AST} > 60 \text{ IU/l}) + 0.658 \times (\text{ALT} > 60 \text{ IU/l})$; where all variables were binary (no = 0 and yes = 1). Empyema of the gallbladder is expected to be

Table 1 Preoperative status of patients with acute cholecystitis and empyema

Preoperative factor	Acute cholecystitis	Empyema	<i>p</i> value
Number of patients	203	112	
Sex			0.022
Female	147 (72.4)	67 (59.8)	
Male	56 (27.6)	45 (40.2)	
Age			0.926
≤ 65 years	144 (70.9)	80 (71.4)	
> 65 years	59 (29.1)	32 (28.6)	
BMI			0.368
≤ 24.9	46 (22.7)	20 (17.9)	
25–29.9	102 (50.2)	54 (48.2)	
≥ 30	55 (27.1)	38 (33.9)	
Cardiovascular disease	11 (5.4)	7 (6.3)	0.761
Diabetes	38 (18.7)	29 (25.9)	0.136
Hypertension	24 (11.8)	19 (17.0)	0.203
Previous abdominal surgery			0.106
None	138 (68.0)	87 (77.7)	
Lower	58 (28.6)	20 (17.9)	
Upper	7 (3.4)	5 (4.5)	
Previous hospitalisation			0.683
None	142 (70.0)	75 (67.0)	
Acute cholecystitis	54 (26.6)	31 (27.7)	
Acute pancreatitis	7 (3.4)	6 (5.4)	
Temperature $>37.5^\circ\text{C}$	103 (50.7)	63 (56.3)	0.348
WBC count $>9 \times 10^9/l$	126 (62.1)	108 (96.4)	<0.001
Total bilirubine >1.2 mg/dl	107 (52.7)	76 (67.9)	0.009
AST >60 U/l	39 (19.2)	37 (33.0)	0.006
ALT >60 U/l	45 (22.2)	47 (42.0)	<0.001

BMI: Body Mass Index, WBC: White Blood Count, AST: aspartate transaminase, ALT: alanine transaminase

present in a particular case if the score of the above discriminant model is higher than 0.142. The positive predictive value, negative predictive value, sensitivity, and specificity of the model were 84%, 63%, 55%, and 88%, respectively.

Conversion and complications

The outcomes of LC in patients with acute and empyema of the gallbladder are presented in Table 2. Among the entire cohort, conversion to OC was necessary in 60 (19.0%) patients, while 18 patients (5.7%) presented perioperative complications; there was no operative mortality. The conversion rate was significantly higher in patients with empyema than in those with acute cholecystitis (28.6% vs 13.8%, $p = 0.001$); in contrast, the complication rate did not differ between these two conditions (8.0% vs 4.4%, $p = 0.187$). Conversion occurred in 13.9% and 13.6% of patients with acute edematous cholecystitis and hydrops, respectively, and complications developed in 4.4% and 4.5% of the cases; there were no significant differences between these two groups ($p = 0.964$ and $p = 0.957$, respectively). The presence of empyema remained a strong independent risk factor for conversion to OC (OR = 2.1, 95% CI=1.0–4.4, $p = 0.043$), even after adjusting for all major confounders in a multivariate logistic regression analysis.

Extensive inflammation, adhesions, and consequent inadequate recognition of the anatomy at Calot's triangle were the most common reasons for conversion in patients with acute cholecystitis. Other causes for conversion are listed in Table 3. The main difficulties encountered during surgery were adhesions of the gallbladder to surrounding structures and severe inflammation of the hepatic pedicle, which made dissection hazardous. The complications in patients with empyema of the gallbladder are summarized in Table 4. One case of transection of the common bile duct in a patient with empyema was confirmed 48 hours later, and a Roux-en-Y hepaticojejunostomy was performed.

The relations of conversion to OC and development of complications to the characteristics of patients with empyema of the gallbladder are presented in Table 5. Univariate analysis showed that the risk of conversion was significantly higher in patients with previous upper abdominal surgery ($p = 0.007$), temperature $>37.5^{\circ}\text{C}$ ($p < 0.001$), AST >60 IU/l ($p = 0.049$), and ALT >60 IU/l ($p = 0.018$). The combination of previous upper abdominal surgery and BMI ≥ 30 kg/m² further increased the risk of conversion (in 4 of 5 patients, 80.0%). Moreover, only previous lower or upper abdominal surgery ($p < 0.001$) was associated with higher complication rates. The presence of concomitant diseases contributed minimally to conversion to OC and the incidence of complications.

Multivariate logistic regression analysis showed that previous upper abdominal surgery and temperature $>37.5^{\circ}\text{C}$ were the strongest independent risk factors for conversion, with adjusted ORs of 9.6 and 8.3, respectively. AST >60 IU/l and ALT >60 IU/l also showed significant independent but clearly weaker associations with higher conversion rates. Previous abdominal surgery was the only independent risk factor for complications (OR=16.5, 95% CI=3.2–86.1, $p < 0.001$) in patients with empyema of the gallbladder who underwent LC (Table 6).

Operation time and hospital stay

For successfully completed LC procedures, the median operation time was 50 min (range, 20–225 min) and the median hospital stay was 4 days (range, 2–10 days). The hospital stay was significantly longer in patients with empyema of the gallbladder than in those with acute cholecystitis (5 days [range, 2–10 days] vs 4 days [range, 3–9 days], $p < 0.001$), while no significant difference in operation time was evident (50 min [range, 20–170 min] vs 50 min [range, 20–225 min], $p = 0.204$). Multivariate linear regression analysis including all major confounders indicated that the presence

Table 2 Comparison of LC outcome between patients with acute cholecystitis and empyema

Preoperative factor	Acute cholecystitis	Empyema of gallbladder	<i>p</i> value
Conversion rate (%)	28 (13.8)	32 (28.6)	0.001
Complication rate (%)	8 (3.9)	9 (8.0)	0.124
Operative time (min)*	50 (20–225)	50 (20–170)	0.204
Postoperative stay (days)*	4 (3–9)	5 (2–10)	<0.001

*Data are expressed as frequencies and percentages for qualitative variables and as medians and range for quantitative variables. Operation time and postoperative stay refer to successful LC only.

Table 3 Reasons for conversion in patients who underwent LC

Reasons for conversion	Acute cholecystitis	Empyema
Intraoperative bleeding	1	1
Injury of the CBD	0	1
Inadequate visualisation of structures	27	30
Total	28 (13.8%)	32 (28.6%)

CBD: common bile duct

Table 4 Complications in patients who underwent LC

Complications	Acute cholecystitis	Empyema
Injury of CBD	0	1
Intraoperative bleeding	1	1
Postoperative bleeding	0	1
Subhepatic accumulation	0	1
Perforation of the colon	1	0
Bile leakage	2	0
Spilled stone	0	1
Haematoma abdominal wall	2	0
Pneumonia	2	4
Mortality	0	0
Total	8 (3.9%)	9 (8.0%)

CBD: common bile duct

20–115 min) and 4 days (range, 3–9 days) in patients with hydrops. The operation time was significantly shorter in patients with acute edematous cholecystitis ($p = 0.050$), but the hospital stay did not differ significantly between the two conditions ($p = 0.349$).

Univariate analysis of patients with edematous cholecystitis, excluding converted cases, showed that the duration of surgery was significantly longer in patients with a temperature $>37.5^{\circ}\text{C}$ (65 min [25–170 min] vs 45 min [20–135 min], $p = 0.044$), cardiovascular disease (78 min [70–105 min] vs 50 min [20–170 min], $p = 0.009$), and hypertension (67.50 min [34–135 min] vs 20 min [20–170 min], $p = 0.039$). In multivariate linear regression analysis the presence of cardiovascular disease remained the only significant independent determinant of a longer duration of surgery ($p = 0.043$), explaining 6.5% of its variance. Furthermore, a

Table 5 Preoperative factors associated with conversion and complications among patients with empyema of the gallbladder (univariate analysis)

Preoperative factor	Conversion rate (%)	<i>p</i> value	Complication rate (%)	<i>p</i> value
Sex (female/male)	26.9/31.1	0.626	10.4/4.4	0.252
Age (≤ 65 / >65 years)	27.5/31.3	0.691	10.0/3.1	0.227
BMI (≤ 24.9 / 25.0 – 29.9 / ≥ 30.0 kg/m ²)	30.0/25.9/31.6	0.830	5.0/5.6/13.2	0.359
Cardiovascular disease (no/yes)	28.6/28.6	1.000	8.6/0.0	0.419
Diabetes (no/yes)	31.3/20.7	0.275	8.4/6.9	0.793
Hypertension (no/yes)	29.0/26.3	0.811	9.7/0.0	0.157
Previous abdominal surgery (none/lower/upper)	29.9/10.0/80.0	0.007	2.3/30.0/20.0	<0.001
Previous hospitalisation (none/cholecystitis/pancreatitis)	29.3/25.8/33.3	0.903	8.0/9.7/0.0	0.727
Temperature $>37.5^{\circ}\text{C}$ (no/yes)	8.2/44.4	<0.001	8.2/7.9	0.965
WBC count $>12 \times 10^9/\text{l}$ (no/yes)	25.0/28.7	0.872	50.0/6.5	0.002
Total bilirubine >1.2 mg/dl (no/yes)	33.3/26.3	0.443	13.9/5.3	0.117
AST >60 U/l (no/yes)	22.7/40.5	0.049	6.7/10.8	0.448
ALT >60 U/l (no/yes)	20.0/40.4	0.018	7.7/8.5	0.875
Conversion (no/yes)			8.8/6.3	0.660

BMI: Body Mass Index, WBC: White Blood Count, AST: aspartate transaminase ALT: alanine transaminase

Table 6 Independent factors associated with conversion and complications in patients with empyema (multivariate logistic regression analysis)

Independent factors	Dependent factors			
	Conversion		Complications	
	OR (95% CI)	<i>p</i> value	OR (95% CI)	<i>p</i> value
Previous upper abdominal surgery	9.6 (1.0–85.8)	0.043		
Temperature $>37.5^{\circ}\text{C}$	8.3 (2.5–28.1)	<0.001		
AST >60 U/l	4.1 (1.4–12.3)	0.010		
ALT >60 U/l	4.2 (1.5–12.2)	0.008		
Previous abdominal surgery			16.5 (3.2–86.1)	<0.001

AST: aspartate transaminase, ALT: alanine transaminase

of empyema remained a strong independent risk factor for a longer hospital stay ($p < 0.001$), and explained the largest proportion of its variance (6.6%). The median operation time and median hospital stay were 45 min (range, 20–225 min) and 4 days (range, 3–7 days), respectively, in patients with acute edematous cholecystitis, and 50 min (range,

longer postoperative hospital stay was significantly associated with high (>60 IU/l) AST (5 days [2–10 days] vs 4 days [2–7 days], $p = 0.053$) and ALT (5 days [3–7 days] vs 4 days [2–10 days], $p = 0.043$), associations which persisted in multivariate analysis, explaining 5.0% ($p = 0.041$) and 5.5% ($p = 0.036$) of its variance, respectively.

Discussion

Empyema of the gallbladder is an advanced form of acute cholecystitis. The etiology of empyema is uncertain, but it is believed to develop when intraluminal infection occurs with the formation of pus, and is usually associated with calculous obstruction of the cystic duct or Hartmann's pouch. It can occur in the absence of gallstones. It is thought that some cases develop in a similar fashion to acute cholecystitis with suppurative infection of bile, whereas in others empyema might manifest as infection of a mucocoele. Despite initial reservations regarding the feasibility and safety of the procedure in acute cholecystitis, LC is increasingly being successfully employed as the initial surgical approach in most of these patients.

The clinical presentation of empyema of the gallbladder – comprising right upper quadrant pain, fever, and leucocytosis – is indistinguishable from simple acute cholecystitis. Usually the diagnosis only becomes apparent at the time of cholecystectomy in a patient with suspected acute cholecystitis. The rate of gangrenous and empyema of the gallbladder has not been specified exactly in most randomised clinical trials. Consecutive clinical series have found that acute severe cholecystitis occurs in from 6% to 50% of all cases of acute cholecystitis [6–9]. The meta-analysis of Borzellino et al. [10] found that severe acute cholecystitis on average constitutes 27.6% of all acute cholecystitis cases. In our study empyema of the gallbladder was present in 35.5% of all cases of acute cholecystitis.

Several studies [6, 9, 11–15] have revealed how different forms of gallbladder inflammation influence the conversion of LC to OC, but little information is available regarding factors that influence and are associated with adverse outcomes of LC in patients with empyema of the gallbladder. Factors reportedly associated with severe acute cholecystitis are age, being male, cardiovascular-associated disease, diabetes, and delayed surgery [7, 16–19]. Eldar et al. [13] reported on the only study that has found that risk factors for empyema included a duration of complaint >48 hours and a palpable gallbladder. In the present study, being male, having high AST and ALT levels, and a higher WBC count significantly influenced the prediction of empyema of the gallbladder. Although being male was shown to be predictive for more severe acute cholecystitis, [9, 20, 21] the clinical outcome after LC did not differ with gender. The conversion rates of LC to OC for acute cholecystitis reported in the literature range from 3% to 35% [22–26]. This variability is at least partially influenced by the basic inflammatory diseases of the gallbladder, which may range from simple acute cholecystitis to more severe forms of acute cholecystitis such as gangrenous or empyema. However, most reports relate to patients with simple acute cholecystitis or gangrenous cholecystitis, with only a small subset of studies relating to patients with empyema of the gallbladder.

Previous studies show that conversion and morbidity rates were higher when applying laparoscopic approaches to gangrenous cholecystitis and empyema of the gallbladder [6, 14, 13, 10, 27]. Cox et al. [12] reported that the conversion rate to OC in LC for empyema of the gallbladder was 83.3%. In our study the conversion rate was higher for empyema than for acute cholecystitis (28.6% vs 13.8%, respectively), which was attributable to the combination of dense but friable adhesions to the gallbladder, and the thick, fibrous wall that made laparoscopic dissection and retraction of the gallbladder difficult.

Studies [28–30] on risk factors for conversion of LC to OC have been limited to cases of acute cholecystitis and gangrenous cholecystitis. Those factors included being male, older than 65 years, the severity of inflammation, longer delay between the onset of symptoms and surgery, a gallbladder wall thicker than 5 mm, and shorter laparoscopic experience of the surgeon [19, 22–27, 31, 32]. The preoperative factors for successful and unsuccessful LC in our series of patients with empyema of the gallbladder are presented in Table 5. The presence of empyema remained a strong independent risk factor for conversion to OC (OR=2.1, 95% CI=1.0–4.4, $p = 0.043$) even after adjusting for all major confounders in a multivariate logistic regression analysis. Others factors that increased the conversion rate were previous upper abdominal surgery, temperature >37.5°C, AST >60 IU/l, and ALT >60 IU/l. The combination of previous upper abdominal surgery and BMI ≥ 30 kg/m² further increased the risk of conversion (in 4 of 5 patients, 80.0%). Multivariate logistic regression analysis showed that previous upper abdominal surgery and temperature >37.5°C were the strongest independent risk factors for conversion, with adjusted ORs of 9.6 and 8.3, respectively.

The use of LC in the presence of an acutely inflamed gallbladder is a major concern, since this can increase the complication rate, particularly the occurrence of major duct injuries. In the present study, the complication rates did not differ significantly between empyema and acute cholecystitis (8.0% vs 4.4%, $p = 0.187$). The only independent risk factor for complications in patients with empyema of the gallbladder who underwent LC was previous abdominal surgery. The average postoperative stay was somewhat longer for empyema than for acute cholecystitis, but was shorter than that in those who required conversion to OC. This was not due to prolongation of the hospitalisation due to complications, but rather to intravenous antibiotics usually being continued for 48–72 hours postoperatively. Furthermore, all of our patients underwent drainage of the hepatorenal space, and usually the drain was not removed until the 2nd or 3rd postoperative day.

In conclusion, empyema of the gallbladder can be encountered in patients with presumed acute cholecystitis. Preoperatively differentiating simple acute cholecystitis and empyema is difficult, if not impossible. From the feasibility and safety of the laparoscopic approach, we can conclude that a higher conversion rate is to be expected when a severe acute cholecystitis is approached laparoscopically. In

the hands of an experienced laparoendoscopic surgeon, an initial attempt at LC is desirable as long as the prime importance of patient safety and a low threshold for conversion are maintained. The conversion rate is expected to be higher when empyema is approached laparoscopically than for simple acute cholecystitis or symptomatic cholelithiasis.

Conflict of interest The authors do not have any disclosable interest

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