Original Article

Risk Factors for Conversion to Open Surgery in Patients With Acute Cholecystitis Undergoing Interval Laparoscopic Cholecystectomy

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Abstract

Introduction: Laparoscopic cholecystectomy for acute cholecystitis is associated with higher rate of conversion to laparotomy. The value of several factors that might influence the rate of conversion is analysed. Materials and Methods: In a retrospective analysis of a prospective database, the medical records of patients who underwent laparoscopic cholecystectomy from May 1998 to June 2004 were reviewed. Patients who had acute cholecystitis and had undergone interval laparoscopic cholecystectomy were included in this study. Results: Out of 1000 laparoscopic cholecystectomies, 201 were operated on for acute cholecystitis. One hundred and forty-five patients (72.3%) underwent succesful laparoscopic cholecystectomy and 56 patients (27.7%) needed conversion to open cholecystectomy. Patient's age (*P* = 0.031), total white cell count (*P* = 0.014), total bilirubin (*P* = 0.002), alkaline phosphatase (*P* = 0.003) and presence of common bile duct stone (*P* = 0.001) were found to be independently associated with conversion. Conclusion: Laparoscopic cholecystectomy can be performed safely for acute cholecystitis. Predictors of conversion will be helpful when planning the laparoscopic approach and for counselling patients preoperatively.

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Key words: Acute cholecystitis, Laparoscopic cholecystectomy, Risk factors

Introduction

Laparoscopic cholecystectomy has become a routine surgical procedure in general surgical units all over the world. Its implementation has expanded dramatically and is considered a feasible and safe approach even for acute cholecystitis.[1,2] Laparoscopic management of acute cholecystitis may still be associated with increased risks of complications such as bile duct injury and abscess formation.[3] The conversion rate to open cholecystectomy is also higher compared to elective cases.[4]

As such, there is a need to identify potential risk factors in patients with acute cholecystitis and stratify them accordingly. This will assist surgeons in choosing the best approach for cholecystectomy in these patients and hopefully reduce the complication rates associated with interval laparoscopic cholecystectomy for acute cholecystitis.

In our study, possible risk factors that may correlate with conversion to open surgery are identified. This helps us in our assessment preoperatively and in providing relevant information to our patients. It thus allows our patients to prepare themselves mentally and make the necessary adjustments for the recuperation period.

Materials and Methods

Study Group

This study reviewed all laparoscopic cholecystectomies performed from May 1998 till June 2004 in Changi General Hospital. It was a retrospective analysis of a prospective database. There were 1000 laparoscopic cholecystectomies performed during this period, of which 201 cases (20.1%) were that of previously treated acute cholecystitis. All these patients were admitted on an emergency basis with a diagnosis of acute cholecystitis; defined as: (1) positive Murphy's sign, (2) fever and/or leukocytosis, (3) positive ultrasound (U/S) or computed tomography (CT) findings consistent with acute cholecystitis (thickened gallbladder wall, gallstones, and pericholecystic fluid collection). Once diagnosis was confirmed, patients were fasted and started on intravenous antibiotics and analgesia. Feeds were resumed when there was clinical improvement (resolving

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right hypochondrial pain and fever). Our unit's practice on timing for cholecystectomy is somewhat variable. In general, our department practices interval cholecystectomy for most of our patients. Early cholecystectomy is performed when conservative management with intravenous antibiotics fails, when there is gallbladder perforation or gangrene on radiological investigation, or upon patient's request. Patients who underwent emergency cholecystectomy were excluded from this study.

Operative Technique

The standard four-trocar technique is used for all laparoscopic cholecystectomy. First port (10-mm Hasson's cannula) is inserted via open method at subumbilical region. Three 5-mm ports are inserted along the subcostal margin under direct vision at midline, midclavicular and anterior axillary line. Dissection of the Calot's triangle and gallbladder from the liver bed is accomplished by using monopolar electrocautery. Gallbladder is retrieved in an endoscopic bag and extracted through the subumbilical port site. When conversion is required, Kocher's incision is made. Decision for conversion is based on surgeon's clinical judgement. All laparoscopic cholecystectomies were performed by qualified surgeons. They were divided into 2 groups: registrars (trainee surgeons who have done less than 200 laparoscopic cholecystectomies) and consultants (who have done more than 200 laparoscopic cholecystectomies).

Endoscopic retrograde cholangiopancreaticography (ERCP) is indicated for patients with elevated liver enzymes or with choledocholithiasis evident on radiological investigation (U/S or CT scan). ERCP is performed under sedation by consultant endoscopists. All biliary stones are removed prior to surgery. Biliary stones are removed using a Dormia basket or a Fogarty balloon with or without lithotripsy.

Data Collection

Patient's data sheets containing demographic data and preoperative, operative and postoperative information were generated. Demographic data such as age, sex, race and associated comorbidities and duration of symptoms to surgery were recorded. Pertinent laboratory markers such as total white blood cell count, total bilirubin, alkaline phosphatase (ALP), aspartate aminotransferase (AST), and alanine aminotransferase (ALT) were also collected. Other preoperative data of concern were the presence of common bile duct stones, and the removal of biliary stones during ERCP. Postoperative notes of interest were rate and reasons for conversion, postoperative complications and length of stay. The collected information was entered into a database as either continuous or categorical variables for statistical analysis.

Statistical Analysis

Statistical analysis was performed using SPSS (SPSS 12.0.1 for Windows) software. For comparison of the 2 groups, chi-square analysis or Fisher's exact test were used when appropriate for qualitative data, and Student's *t*-test for quantitative data. For multivariate analysis, multiple logistic regression analysis with stepwise options was applied. $P < 0.05$ was considered statistically significant.

Results

There were 1000 laparoscopic cholecystectomies performed in our unit from May 1998 to June 2004. Of these 1000 laparoscopic cholecystectomies, there were 201 patients with acute cholecystitis (n = 201). One hundred and forty-five patients (72.3%) were operated on successfully using the laparoscopic method while 56 patients (27.7%) required conversion to laparotomy. The most common reason for conversion was inability to display the anatomy safely. Other common reasons were adhesions around the gallbladder and uncontrolled bleeding (Table 1).

Basic Demographics

There is a significantly higher rate of conversion from laparoscopic to open cholecystectomy among older age group patients ($P = 0.012$). The gender distribution between the 2 groups is shown in Table 2. Of interest, male gender was not found to have significant risk on conversion ($P = 0.214$). Similarly, the race distribution between the 2 groups showed no differences ($P = 0.124$).

Preoperative Parameters

Patients with elevated total white blood cell count, total bilirubin and alkaline phosphatase were found to have a higher risk of conversion (Table 3). Other liver enzymes were not found to be significantly different between the 2 groups. A correlation was noted between patients with common bile duct stones and conversion rate ($P < 0.005$).

Preoperative ERCP

There were a total of 44 patients in the whole series that had preoperative ERCP. Twenty-six of them were from the converted group and 18 were from the laparoscopic group. Fourteen patients (53.8%) from the converted group were found to have choledocholithiasis and had stones removed during ERCP compared to only 2 patients from the laparoscopic group. This was found to be statistically significant.

Duration of Symptoms and Timing of Surgery

The duration of symptoms is calculated from the day the patient had the onset of symptoms to the day he or she had surgical intervention. The mean duration of symptoms in

Table 1. Reasons for Conversion (n = 56)

Inability to display anatomy safely	26 (46.4%)
Bleeding	10 (17%)
Adhesions around gallbladder	20 (35.8%)

Table 2. Demographic Data of the Laparoscopically Operated (LC) and Converted Groups (LC to OC)

	LC (n = 145)	**LC to OC (n = 56)**	***P* value**
Age (y)	42.5 ± 10.1	55.8 ± 9.8	**0.012**
Sex			
Male	62	20	
Female	83	36	0.214
Race			
Chinese	105	38	
Malay	35	11	0.214
Indian	8	6	
Others	2	1	

LC: laparoscopic cholecystectomy; OC: open cholecystectomy
Significance is highlighted in bold

Table 3. Comparison of Preoperative Data for the Laparoscopically Operated (LC) and Converted Groups (LC to OC)

	LC (n = 145)	**LC to OC** (n = 56)	***P* value**
Bilirubin (umol/L)	22 ± 1.5	40 ± 2.5	**<0.0025**
Alkaline phosphatase (U/L)	145 ± 14	255 ± 20	**<0.0015**
AST (U/L)	33.2 ± 10.1	29.2 ± 9.5	0.415
ALT (U/L)	21.5 ± 9.8	23.5 ± 1.5	0.615
Total white count (U/L)	13.5 ± 0.15	18.5 ± 0.5	**<0.005**
ERC (n = 44)	18 (12.4%)	26 (46.4%)	**<0.001**
CBD stone removed preoperatively	2 (11.1%)	14 (53.8%)	**<0.025**
Duration of symptoms (days)	40.7 ± 10.71	49.0 ± 7.05	**<0.05**
Diabetes mellitus	25 (16.6%)	11 (19.6%)	0.105

ALT: alanine aminotransferase; AST: aspartate aminotransferase; CBD: common bile duct; ERC: endoscopic retrograde cholangiogram; LC: laparoscopic cholecystectomy; OP: open cholecystectomy
Significance is highlighted in bold.

the converted group was 49.0 ± 70.5 days, which was significantly longer compared to the laparoscopic cholecystectomy group (P <0.001).

There were 35 (17.4%) patients with a history of diabetes mellitus in the whole series. There was no significant difference in the distribution of diabetics between the 2 groups of patients.

Table 4. Comparison of Grade of Surgeons in Laparoscopically Operated (LC) and Converted (LC to OC) Groups

	LC (n = 145)	**LC to OC** (n = 56)	***P* value**
Consultant	107	34	
Registrar	38	22	0.069

LC: laparocopic cholecystectomy; OP: open cholecystectomy
Significance is highlighted in bold

Table 5. Complication Rates and Length of Stay for Laparoscopically Operated (LC) and Converted (LC to OP) Groups

	LC (n = 145)	**LC to OC** (n = 56)	***P* value**
Wound infections	1	6	
Incisional hernia	0	3	
Total complications	1	9	**<0.001**
Length of stay (days)	3.45 ± 2.45	9.15 ± 10.75	**<0.001**

Significance is highlighted in bold.

LC: laparoscopic cholecystectomy; OP: open cholecystectomy

Table 6. Multiple Logistic Regression with Stepwise Analysis for Different Variables

Variables	**Odds ratio**	**95% CI**	***P* value**
Age	1.35	1.05-1.65	**0.031**
Sex	0.59	0.42-0.84	0.104
Total white count	1.67	1.34-2.96	**0.014**
Total bilirubin	1.8	1.45-2.01	**0.002**
ALP (U/L)	1.21	1.1-1.7	**0.003**
ERC performed	1.71	1.3-1.9	**0.005**
CBD stone removed	1.4	1.02-1.6	**0.001**
Duration of symptoms	0.91	0.65-1.01	0.124

ALP: alkaline phosphatase; CBD: common bile duct; ERC: endoscopic retrograde cholangiogram
Significance is highlighted in bold

Grade of Surgeons

A total of 141 cases of acute cholecystitis were operated on by consultants and 34 patients (24%) required conversion while registrars operated on 60 cases and 22 (36%) needed conversion (Table 4). This did not reach statistical significance (P = 0.069).

Morbidity

There were no bile duct injuries sustained in the whole series and there were no 30-day mortalities. Ten patients had other complications (Table 5). There were, not surprisingly, more complications in the converted group as compared to those who had successful laparoscopic

cholecystectomy. The length of stay for the converted group was also significantly longer.

Table 6 presents factors that are independently associated with conversion of laparoscopic cholecystectomy to open cholecystectomy for acute cholecystitis. Patient's age, total white blood cell count, total bilirubin, alkaline phosphatase, and the presence of common bile duct stones were found to be independently associated with a higher conversion rate to open cholecystectomy.

Discussion

Laparoscopic cholecystectomy is now one of the most common laparoscopic surgeries performed in a general surgical unit. It is considered the standard operation for patients with gallstone disease owing to its perceived efficacy with both cosmesis and rapid recovery.[5] Acute cholecystitis was once considered a contraindication to laparoscopic cholecystectomy. Currently, laparoscopic cholecystectomy has been accepted as a safe and feasible approach to acute cholecystitis in the hands of experienced surgeons. The performance of laparoscopic cholecystectomy for acute cholecystitis is technically more demanding than in elective cases. Extensive inflammation, increased bleeding and adhesions around the Calot's triangle obscure the anatomy, making dissection difficult and hazardous. Conversion may be required if the anatomy cannot be defined, if the operation progresses poorly or if complications arise. Studies have shown that conversion from laparoscopic to open cholecystectomy results in significant change in outcome for the patient as it has higher postoperative complications and requires longer hospital stay.[5] In addition, the attempt for laparoscopic cholecystectomy involves substantial extra costs, including both equipment and operation time.[5] However, conversion of laparoscopic to open surgery should not be regarded as a complication but as an attempt to prevent complications.

In this study, we retrospectively analysed 201 patients who were operated laparoscopically for acute cholecystitis. There were 56 patients (27.7%) who required conversion to open surgery. Various factors have been reported to predict the severity of acute cholecystitis, which is associated with increased risk of conversion. Eldar et al,[6-8] in a series of articles, reported that a higher conversion rate occurred with age over 50, 60 or 65 years, with total white count over 13,000/mL or 15,000/mL, male gender and history of biliary disease. In our current study, we identified the patient's age, total white count, total bilirubin and alkaline phosphatase as independent factors associated with increased risk of conversion. Our findings are similar to those in the literature.[6-9]

In addition, we found that the presence of choledocholithiasis increases the risk of conversion. Forty-four patients in our series underwent preoperative ERCP. Fourteen patients (25%) from the converted group had common bile duct stones compared with 2 patients (1.3%) from the laparoscopic group (Table 3). When a gallstone gets impacted on Hartmann's pouch, or is passed into the biliary tract (cystic duct or common bile duct), it may cause obstruction, inflammation or distortion of anatomy at Calot's triangle. Successful laparoscopic cholecystectomy requires clear recognition of the anatomy. Effects of inflammatory and fibrotic changes around the cystic duct and artery as well as the common bile duct become significant because of the concern about common bile duct injury. Furthermore, we postulate that injection of contrast into the biliary system during ERCP may trigger an inflammatory reaction in the biliary tree and Calot's triangle. This inflammation eventually leads to scarring and fibrosis. This is the reason why patients with acute cholecystitis and concomitant common bile duct stones have a higher risk of conversion.

Conversion rates in the literature range from 6.5% to 35%.[2] In our series, the conversion rate is 27.7%. Although our conversion rate is favourable when compared with the figures quoted from the literature, it is still rather high. Conversion from laparoscopic cholecystectomy to laparotomy should not be seen as a complication, but as an attempt to prevent complications. In our series, there was not a single case of bile duct injury. This result may account for the higher rate of conversion. The willingness to convert to open surgery is aimed at preventing morbidity, and therefore can be considered good operative practice.

The technical difficulty of a laparoscopic cholecystectomy is largely related to the operative findings (i.e., adhesions, fibrosis, and bleeding at the Calot's triangle), although the experience of a surgeon may adversely affect the conversion rate. As laparoscopic surgery has become an integral part of general surgery, a formal and well structured training programme is important. Our department has done an audit on our training programme on laparoscopic cholecystectomy. This study has shown that our training programme for laparoscopic cholecystectomy effectively allows junior surgeons to learn the procedure without putting our patients at increased risk of its potentially serious complications.[10]

Laparoscopic cholecystectomy is the ideal treatment for acute cholecystitis. Those with successful laparoscopic cholecystectomy have less postoperative pain and postoperative complications. They are also able to ambulate earlier and have shorter hospital stay.[5,11] Many authors advocate early laparoscopic cholecystectomy for acute cholecystitis.[2,3,7,12,13] All of them reached the same conclusion: When experienced surgeons with appropriate support is available, early laparoscopic cholecystectomy can be " better therapy". There is still no consensus on the

definition of "early". For most, laparoscopic cholecystectomy should be performed within 48 hours and no later than 96 hours after hospital admission.[2,3,7,12] Our department practices interval cholecystectomy. We will look into the feasibility of performing early laparoscopic cholecystectomy for acute cholecystitis in our surgical unit.

In conclusion, we found that advanced age, elevated total white blood cell count, bilirubin and alkaline phosphatase were independent factors associated with higher conversion rate. In addition, we also noted that patients who had choledocholithiasis and underwent ERCP preoperatively also had an increased risk of conversion. The number in our series is still too small for us to draw final conclusions. Larger study groups will enable us to evaluate these predictors of conversion in acute cholecystitis more accurately.

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