Original paper

Evaluation of affecting factors for conversion to open cholecystectomy in acute cholecystitis

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Abstract

Introduction: Laparoscopic cholecystectomy has become the gold standard for the surgical treatment of gallbladder disease. Severe inflammation makes laparoscopic dissection technically more demanding in acute cholecystitis. Conversion to open cholecystectomy due to adverse conditions is still required in some patients.

Aim: To evaluate predictive risk factors associated with conversion to open cholecystectomy in acute cholecystitis.

Material and methods: A retrospective analysis was performed on 165 patients who underwent a laparoscopic cholecystectomy for acute cholecystitis in our clinic. Patients who completed laparoscopic cholecystectomy and required conversion to open cholecystectomy were compared in terms of age, sex, fever, laboratory and USG findings, operation timing, complications, and duration of hospital stay.

Results: There were 53 (32%) male and 112 (68%) female patients; the mean age was 52.4 ±12.5 years. Forty-six (27.9%) of the 165 patients were converted to open cholecystectomy. Male sex of the patients who underwent conversion (47.1%) was found to be statistically significant ($p < 0.001$). Preoperative white blood count, blood glucose and amylase values, morbidity rate, and hospital stay were raised in patients who underwent conversion, and all were found to be statistically significant ($p < 0.05$).

Conclusions: Male sex, blood leucocyte, glucose, and raised amylase emerged as the effective factors for conversion cholecystectomy in our study. These factors should help the clinical decision-making process when planning laparoscopic cholecystectomy in acute cholecystitis. By predicting these risk factors for conversion, preoperative patient counselling can be improved.

Introduction

Although more than 70% of acute cholecystitis responds to medical treatment in the first 24–48 h, laparoscopic cholecystectomy has become the method of choice in the treatment of symptomatic gallstone disease and its complications. The advantages of the laparoscopic approach include a shorter hospital stay and recovery time, reduced postoperative pain, and better cosmetic results [1–3]. However, for various reasons there is a risk of conversion to open cholecystectomy in some patients. The most common reason for conversion is the disability to correctly identify the anatomy of Calot's triangle as a result of inflammation in the area around the gallbladder. It is important for the surgeon to understand that conversion to laparotomy is neither a failure nor a complication, but is an attempt to ensure patient safety. Initially, laparoscopic cholecystectomy was contraindicated in patients with acute cholecystitis because of the fear of increased morbidity and high rates (60%) of conversion to open surgery [3]. Most of surgeons agreed that conservative treatment with antibiotics followed by interval elective operation several weeks after the acute inflammation subsides may result in a safer operation with a lower conversion rate [4]. For several years after laparoscopic cholecystectomy had been introduced, some authors continued to suggest that acute cholecystitis is a contraindication for the laparoscopic approach [5–7]. However, with experience and increased skills in laparoscopic techniques, acute cholecystitis, excluding its gangrenous form, ceased to avoid LC [6, 8–10]. Patients with acute cholecystitis are usually informed of the potential for conversion to open cholecystectomy when they have possible risk factors for conversion cholecystectomy. A conversion may prevent a severe complication such as injury to the biliary tree.

Aim

The purpose of this study was to determine predictive risk factors of conversion in patients undergoing laparoscopic cholecystectomy for acute cholecystitis.

Material and methods

The study was conducted at the General Surgery and Gastroenterology Surgery department of Izmir Bozyaka Research and Training Hospital between January 2012 and August 2013. All acute cholecystitis patients admitted to the emergency unit were hospitalised. This retrospective analysis of a prospective database was designed to compare laparoscopic cholecystectomy and required conversion to open cholecystectomy for acute cholecystitis performed in 165 patients who underwent operation for acute cholecystitis. Patients who completed laparoscopic cholecystectomy and required conversion to open cholecystectomy were compared in terms of age, sex, fever, laboratory and USG findings, operation timing, complications, and duration of hospital stay.

Patient's data sheets containing demographic data and preoperative, operative, and postoperative information were generated. The data were prospectively entered into a standardised form. Demographic data such as age, sex, race, comorbid disease (such as hypertension, coronary diseases, etc.), and duration of symptoms to surgery were recorded. Laboratory tests such as haemoglobin level, white blood cell count, glucose, urea, total bilirubin, amylase, aspartate aminotransferase (AST), and alanine aminotransferase (ALT) were also collected. Postoperative notes of interest were recorded about the rate and reasons for conversion, postoperative complications, and length of stay. The collected information was entered into a database as categorical variables for statistical analysis.

The diagnosis of acute cholecystitis was based on the presence of at least two of the following criteria: acute upper abdominal pain and Murphy's sign, fever (> 38.2°C) and white blood cell count > 10×10^9/l and ultrasound findings of thick-walled (> 4 mm) gallbladder, ultrasound Murphy's sign, and pericholecystic fluid, in the presence of gallstones. Exclusion criteria included patients who had no gallstones, those who had no complete data, those who had an open cholecystectomy to start with, and co morbid diseases. The severity of acute cholecystitis was assessed according to Tokyo Guidelines [11].

Cholecystectomies were performed by experienced surgeons in the standard four-port technique, who had performed at least two hundred laparoscopic cholecystectomies prior to the study. The first port (10-mm cannula) is inserted in the subumbilical region. Three 5–10 mm ports are inserted along the subcostal margin under direct vision at midline, midclavicular, and anterior axillary line. Dissection of Calot's triangle and the gallbladder from the liver bed is accomplished by using monopolar electrocautery. The gallbladder is retrieved in an endoscopic bag and extracted through the subumbilical port site. Conversions were performed by median or subcostal laparotomy according to each patient's condition and the surgeon's decision.

Statistical analysis

Statistical analysis was performed using SPSS (SPSS 21.0 for Windows) software. For comparison of the two groups, χ^2 analysis or Fisher's exact test were used when appropriate for qualitative data, and Student's *t*-test was used for quantitative data. For statistical analysis, continuous variables were expressed as standard deviations, and categorical variables as frequencies and percentages. Value of $p < 0.05$ was considered statistically significant.

Results

Totally 165 patients with acute cholecystitis were included in this study. There were 53 (32%) male and 112 (68%) female patients and the mean age was 52.4 ±12.5 years. Conversion to open cholecystectomy was seen in 46 (27.9%) patients overall. The mean operation time was 109.3 ±23.7 min (range: 45 to 175) in all operated patients. There were 21 (12.7%) complications in both of groups. The mean postoperative stay was 2.2 ±1.6 days (range: 1 to 16 days), and the mean total hospital stay was 5.9 ±3.2 days (range: 2 to 18 days) for all patients. No mortalities occurred in this study. Patient demographics and preoperative findings of both groups in acute cholecystitis are shown in Table I.

The ratio of male patients who underwent conversion was 47.1% whereas it was 18.7% in female patients, and it was found to be statistically significant ($p < 0.001$). No statistically significant difference was found between groups in terms of age ($p > 0.05$). Fever (> 38.2°C) was seen in 50 (42%) patients in the laparoscopic cholecystectomy group whereas it was seen in 16 (34%) patients in the conversion to open cholecystectomy group. Murphy sign was found to be positive in 110 (92%) patients in the laparoscopic cholecystectomy group and in 44 (95%) patients in the conversion group. No statistically significant difference was found between groups in terms of fever, Murphy sign, and ultrasound findings ($p > 0.05$).

Patients with elevated total white blood cell count, glucose, and amylase were found to have a higher risk of conversion. White blood count (WBC > 10×10^9/l) was seen in 78 (65%) patients in the laparoscopic cho-

Table I. Patients demographics and preoperative findings of laparoscopic cholecystectomy for acute cholecystitis

Patients characteristics	Laparoscopic cholecystectomy (*n* = 119)	Conversion cholecystectomy (*n* = 46)	Value of *p*
Age [years]	52.0 ±13.2	53.5 ±10.9	0.47
Gender (M : F)	28 : 91	25 : 21	< 0.001
Fever (> 38.2°C), *n* (%)	50 (42)	16 (34)	0.47
WBC > 10 × 10^9/l, *n* (%)	78 (65)	41 (89)	0.002
Haemoglobin	12.9 ±1.3	13.0 ±1.8	0.69
Glucose level	109.7 ±28.8	133.5 ±52.7	< 0.001
BUN level	28.3 ±10.5	27.6 ±9.7	0.69
Amylase level	92.2 ±116.8	224.6 ±665.2	0.037
AST level	57.0 ±91.4	64.8 ±103.5	0.64
Bilirubin level	0.82 ±0.90	1.04 ±1.14	0.26
Murphy's sign, *n* (%)	110 (92)	44 (95)	0.73
Thick-wall gallbladder, *n* (%)	101 (92)	43 (93)	0.19
Pericholecystic fluid, *n* (%)	22 (18)	13 (28)	0.20
Previous surgery in the upper abdomen	19 (16)	6 (13)	0.81
Timing of operation, *n* (%):			
Early LC (in the first 72 h)	65 (54)	18 (39)	0.08
Late LC (72 h later)	54 (45)	28 (60)	
Morbidity, *n* (%)	11 (10)	10 (22)	0.03
Postoperative hospital stay [days]	1.75 ±0.87	3.39 ±2.38	< 0.001

lecystectomy group whereas it was seen in 41 (89%) patients in the conversion to open cholecystectomy group, and a statistically significant difference was found ($p = 0.002$). Blood glucose and amylase level at admission were significantly high in conversion to open cholecystectomy group ($p < 0.05$). Other liver enzymes were not found to be significantly different between the two groups.

In the converted to open surgery group 18 (39%) patients had been operated in the first 72 h and 28 (61%) patients had been operated later than 72 h after initial admission. No statistically significant difference was found between groups in terms of timing of operation ($p = 0.07$). Previous surgery in the upper abdomen occurred in 6 patients (13%) in the converted group and in 19 patients (16%) in the laparoscopic cholecystectomy group. This was not a statistically significant cause of conversion ($p = 0.810$).

The reasons for conversion to open cholecystectomy were as follows: inability to define anatomy in 21 patients, which including contracted or fibrotic gallbladder and cystic duct; dense adhesions of the gallbladder to either the duodenum or the common bile duct in 18 patients; haemorrhage in three patients; Mirizzi syndrome in 3 patients; and bile duct injury in 1 patient (Table II). Complications developed in 11 patients (10%) in the laparoscopic cholecystectomy group and in 10 (22%) patients in the conversion to open cholecystec-

Table II. Underlying causes of conversion to open cholecystectomy

Causes of conversion cholecystectomy	*N* (%)
Difficulty identifying anatomy (inflammation, biliary or vascular anomalies etc.)	21 (45.6)
Adhesions (previous operation, fibrosis of Calot's triangle, etc.)	18 (39.1)
Haemorrhage	3 (6.5)
Common bile duct adherent to gallbladder (Mirizzi syndrome)	3 (6.5)
Bile duct injury	1 (3)
Total	46 (100)

Table III. Cause of morbidity in laparoscopic cholecystectomy for acute cholecystitis

Complications	Laparoscopic cholecystectomy (n = 119)	Conversion cholecystectomy (n = 46)	Value of p
Wound site infection, n (%)	6 (2.4)	4 (9.7)	
Pulmonary complication, n (%)	2 (1.2)	1 (3.6)	
Biliary leakage, n (%)	2 (2.4)	1 (1.2)	
Bleeding, n (%)	–	3 (1.2)	
Bile duct injury, n (%)	–	1 (1.2)	
Intra-abdominal fluid collection, n (%)	1 (1.2)	–	
Total, n (%)	11 (10%)	10 (22%)	0.03*

**Statistically significant.*

tomy group. It was found to be statistically significant (p = 0.03). The causes of morbidity in the two groups are listed in Table III. There were a total of eight patients in all of the groups who had preoperative endoscopic retrograde cholangiopancreatography (ERCP) due to common bile duct stones. Three of them were from the converted group and five were from the laparoscopic group. This was not found to be statistically significant (p > 0.05).

The mean operative time was 107.3 ±24.8 min in the laparoscopic cholecystectomy group whereas it was 114.9 ±19.9 min in the converted to open surgery group. This was not found to be statistically significant (p > 0.05). The mean postoperative hospital stay was 1.75 ±0.87 days in the laparoscopic cholecystectomy group and 3.39 ±2.38 days in the converted to open surgery group. A statistically significant difference was found between the groups (p < 0.001).

Discussion

Laparoscopic cholecystectomy, which is the treatment of choice for gallbladder disease, is one of the most common laparoscopic surgeries performed in a general surgical unit. It has many advantages compared to the open procedure. In the early years of laparoscopic surgery, acute cholecystitis was considered a relative contraindication to laparoscopic cholecystectomy. Recently, it has been shown that laparoscopic cholecystectomy is feasible and safe for acute cholecystitis [12]. Nevertheless, laparoscopic cholecystectomy for acute cholecystitis may still be associated with morbidity and conversion to laparotomy. Laparoscopic cholecystectomy for acute cholecystitis is technically more difficult than in elective cases. Extensive inflammation and adhesions around Calot's triangle hide the anatomy, thus making dissection difficult and hazardous. If the anatomy cannot be defined and complications occur, conversion to open surgery may be required. Conversion from laparoscopic to open cholecystectomy results in significant changes in outcome for the patient as it has higher postoperative complications and requires longer hospital stay. In addition, the attempted laparoscopic cholecystectomy involves substantial extra costs, including both equipment and operation time [13].

We retrospectively analysed 165 patients who were operated laparoscopically for acute cholecystitis in this study. There were 46 patients (27.9%) who required conversion to open surgery. Many factors that are associated with increased risk of conversion have been reported in the literature. The conversion rate and complications associated with laparoscopic cholecystectomy mainly depend on the experience of the surgeon and on the surgery, which can be affected by factors such as a history of previous abdominal surgery, recurrent attacks of acute cholecystitis, advanced age of the patient, or male gender [14, 15].

Eldar *et al*. [16] 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. Lim *et al*. [17] showed the patient's age, total white count, total bilirubin, and alkaline phosphatase as independent factors associated with increased risk of conversion. Dominguez *et al*. [18] identified that previous ERCP, leucocytes, age > 70 years, and male gender were predictive factors and converted patients had a higher morbidity rate, more further operations, and longer hospital stays. Similarly in our current study, we identified male gender and elevated WBC to be associated with increased risk of conversion. Complications developed in 11 patients (10%) in the laparoscopic cholecystectomy group whereas this was only 10 (22%) in the conversion to open cholecystectomy group. The mean postoperative hospital stay was significantly longer in the converted to open surgery group. All were found to be statistically significant (p < 0.05). Many other parameters such as diabetes mellitus, body mass index, duration of symptoms, history of biliary disease such as cholangitis, history of pan-

creatitis, and preoperative ERCP have been researched in other studies [16, 17, 19]. In addition, we found that the presence of elevated blood glucose and amylase levels increases the risk of conversion to open surgery.

The main reason for conversion is failure of anatomical identification of Calot's triangle structures because of severe inflammation caused by recurrent attacks of cholecystitis. 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 [17]. In our study, the most frequent reasons for conversion to open cholecystectomy were an inability to define anatomy and dense adhesions, respectively.

Although all studies have reported that laparoscopic cholecystectomy is a safe and effective treatment for acute cholecystitis, optimal timing for the procedure is still a matter of debate. The feasibility and safety of early laparoscopic cholecystectomy for acute cholecystitis have been reported in several randomised and non-randomised studies [20, 21]. In the converted to open surgery group 18 (39%) patients had been operated in the first 72 h, and no statistically significant difference was found between the groups in terms of timing of operation ($p = 0.07$).

Previous upper abdominal operations are not a contraindication to a safe laparoscopic cholecystectomy but are associated with an increased need for adhesiolysis and a higher open conversion rate [22, 23]. Ercan *et al*. [14] investigated the effects of previous abdominal surgery on the conversion rate in a series of 2963 attempted laparoscopic cholecystectomies. They found a 4% conversion rate, and among patients with conversion to open cholecystectomy, 37.2% had a history of previous abdominal operation. In the present study, previous surgery in the upper abdomen had only occurred in 6 patients (13%) in the converted group, and therefore, this was not a significant cause of conversion ($p > 0.05$).

Conclusions

Male sex, blood leucocyte, and raised glucose and amylase have emerged as the effective factors for conversion cholecystectomy in our study. These factors should inform the clinical decision-making process when planning laparoscopic cholecystectomy in acute cholecystitis. By predicting these risk factors for conversion, preoperative patient counselling can be improved.

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