CLINICAL SCIENCE

What necessitates the conversion to open cholecystectomy? A retrospective analysis of 5164 consecutive laparoscopic operations

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OBJECTIVE: Laparoscopic cholecystectomy (LC) has become the gold standard for the surgical treatment of gallbladder disease, but conversion to open cholecystectomy is still inevitable in certain cases. Knowledge of the rate and impact of the underlying reasons for conversion could help surgeons during preoperative assessment and improve the informed consent of patients. We decided to review the rate and causes of conversion from laparoscopic to open cholecystectomy.

METHOD: This study included all laparoscopic cholecystectomies due to gallstone disease undertaken from May 1999 to June 2010. The exclusion criteria were malignancy and/or existence of gallbladder polyps detected pathologically. Patient demographics, indications for cholecystectomy, concomitant diseases, and histories of previous abdominal surgery were collected. The rate of conversion to open cholecystectomy, the underlying reasons for conversion, and postoperative complications were also analyzed.

RESULTS: Of 5382 patients for whom LC was attempted, 5164 were included this study. The overall rate of conversion to open cholecystectomy was 3.16% (163 patients). There were 84 male and 79 female patients; the mean age was 52.04 years (range: 26–85). The conversion rates in male and female patients were 5.6% and 2.2%, respectively (p<0.001). The most common reasons for conversion were severe adhesions caused by tissue inflammation (97 patients) and fibrosis of Calot's triangle (12 patients). The overall postoperative morbidity rate was found to be 16.3% in patients who were converted to open surgery.

CONCLUSION: Male gender was found to be the only statistically significant risk factor for conversion in our series. LC can be safely performed with a conversion rate of less than 5% in all patient groups.

KEYWORDS: Laparoscopic Cholecystectomy; Acute Cholecystitis; Gallbladder; Conversion; Laparoscopy.

INTRODUCTION

Gallstone disease is a global health problem. Most patients are asymptomatic, and gallstones are generally detected with ultrasonography during the evaluation of unrelated medical conditions. Over the past two decades, laparoscopic cholecystectomy (LC) has become the gold standard for the surgical treatment of gallbladder disease. A shorter hospital stay (and, thus, a more rapid return to normal activity and work), less postoperative pain, a faster recovery, better cosmesis, and lower cost are some of the advantages of LC over open surgery.[1,2]

Several complications related to anesthesia, peritoneal access, pneumoperitoneum, surgical exploration, and thermocoagulation have been reported during LC, and these complications and several other factors can necessitate the conversion from LC to open cholecystectomy (OC). Conversion should not be considered a technical failure but, rather, accepted as a better surgical practice by the patient and surgeon when indicated. Although there are several studies reporting various rates of the causes of this worldwide medical problem, every institution must have a thorough understanding of the rate and causes of conversion to open surgery based on culture and geography, in addition to an understanding of conversion within the institution. We decided to retrospectively review our series and to compare our results with those reported in the literature.

MATERIALS AND METHODS

We evaluated the medical records of patients with gallstone disease who underwent LC in the Surgery Department of Ankara University Medical Faculty over the past 10 years.

Preoperative data, including patient demographics, mode of admission (elective or emergency), indications for cholecystectomy, concomitant disease (diabetes mellitus, obesity, hematological disorder, cardiovascular disease, or respiratory disease), and the existence of previous upper abdominal incisions, were collected. The conversion rate to OC, the underlying reasons, and postoperative complications were recorded. Patients with pathologically detected malignancies or gallbladder polyps were excluded from the study.

Statistical analyses were performed using SPSS (Statistical Packages for Social Sciences) 11.5 software. The chi-squared test was used for comparisons of categorical variables. A value of $p < 0.05$ was accepted as statistically significant.

RESULTS

Of 5382 LC patients, 5164 were included this study. Patients with pathologically proven gallbladder polyps (n = 202) or malignancies (n = 16) were excluded. A routine preoperative assessment, including biochemical liver assessment and abdominal ultrasonography of the hepatobiliary system, was performed for all patients before surgery. Patients were classified as having acute or chronic cholecystitis based on clinical, ultrasound, operative, and pathologic findings. All operations were performed by senior surgeons or trainees under supervision, using the standard four-port, two-hand technique.[3] Intraoperative cholangiograms and drains were used when necessary.

The demographic data and preoperative history of patients, including gallbladder and concomitant diseases, are shown in Table 1. Of 5164 patients with gallbladder disease, 163 patients (3.16%) were converted to OC.

Table 1 - Characteristics of the patients in both groups.

Data	Converted (n = 163)	Laparoscopic (n = 5001)	p value
Age (mean ± SD), years	49.34 ± 9.86	52.05 ± 11.46	NS
Gender (female/male), n (%)	79 (49.5) / 84 (51.5)	3515 (70.29) / 1486 (29.71)	<0.001
Mode of admission, n (%)			NS
Elective	132 (80.98)	4350 (86.98)	
Emergency	31 (19.02)	651 (13.02)	
Indication for LC, n (%)			NS
Acute cholecystitis	26 (15.95)	691 (13.82)	
Chronic cholecystitis	137 (84.05)	4310 (86.18)	
Comorbid disease, n (%)	36 (22.08)	964 (19.28)	NS
Diabetes mellitus		6	201
Cardiovascular	15	386	
Respiratory	3	91	
Hematological disorder	1	36	
Obesity, (BMI >30)	16	238	
Morbidly obese, (BMI ≥40)	1	12	
Previous upper abdominal surgery, n (%)	3 (1.84)	111 (2.21)	NS

SD: Standard deviation, LC: Laparoscopic cholecystectomy, BMI: Body mass index (kg/m²), NS: not significant. Values in parentheses are percentages.

Whereas there were 3515 females (70.3%) and 1486 males (29.7%) in the laparoscopic group, there were 79 females (49.5%) and 84 males (51.5%) in the converted group. The conversion rates in female and male patients were 2.25% and 5.65%, respectively ($p < 0.001$). Although the mean age of the patients in the laparoscopic group was 49.34 years (range: 16–89), that of patients in the converted group was 52.05 years (range: 26–85) (p = 0.642). The rates of emergency admission and acute cholecystitis (AC) were similar between the two groups. Although the rate of comorbid diseases in the converted group was higher than that in the laparoscopic group, no statistically significant difference was found. Previous surgery in the upper abdomen had occurred for 3 patients (1.84%) in the converted group and 111 patients (2.21%) in the laparoscopic group (p = 0.746).

The most common reasons for conversion were severe adhesions caused by tissue inflammation (97 patients) and fibrosis of Calot's triangle (12 patients) (Table 2). When complications arising during the creation of pneumoperitoneum were analyzed, colon perforation caused by trocar injury occurred in only 1 case. Apart from this case, no other major complication requiring conversion to OC was encountered during trocar insertion.

Conversion to OC due to intraoperative hemorrhage occurred in 14 patients (0.27%); the hemorrhage was due to tangential side lesions of the cystic artery in 2 cases, the gallbladder bed in 11 cases, and the hepatic artery in 1 case. In cases with bleeding from the gallbladder bed (11 cases), AC was noted in 6 cases and cirrhosis was noted in 5 cases. In all of the patients, the hemorrhage was controlled with thermocoagulation and/or suturing. Conversion to OC caused by injury of the bile ducts occurred in 6 patients (0.12%), and all of the injuries were

Table 2 - Underlying causes of conversion to open cholecystectomy.

	No. of patients	Percentage
Visceral injury		
Duodenal perforation	1	0.02
Colon perforation	1	0.02
Intraoperative hemorrhage		
From cystic artery	2	0.04
From gallbladder bed	11	0.21
From hepatic artery	1	0.02
Bile duct injuries		
Right hepatic duct lesions	1	0.02
Common bile duct partial lesions	3	0.06
Common bile duct total section	2	0.04
Bile leakage from the gallbladder bed	1	0.02
Adhesions		
Caused by previous operations	9	0.17
Caused by severe tissue inflammation	97	1.88
Fibrosis of Calot's triangle	12	0.23
Cholecystoduodenal fistula	4	0.08
Stones in common bile duct	1	0.02
Buried gallbladder	5	0.1
Thickened gallbladder wall	6	0.11
Spillage of stones into the peritoneal cavity	5	0.1
Suspicion of malignancy	1	0.02
Total	163	3.16

Table 3 - Literature review of reported series of patients requiring conversion to open cholecystectomy.

First author	Year	No. of patients with attempted converted to LC, n	No. of patients OC, n (%)	Conversion rate by gender, male/female, %	Rate of acute operation in conversion to OC, n (%)	Presence of previous Main reason for conversion upper abdominal surgery, n (%)	
Pavlidis (14)	2007	1263	98 (7.7)	11.6 / 6.3	20 (20.4) ⁗	0 ˣ	Unclear anatomy due to previous inflammation
Shamiyeh (15)	2007	4505	245 (5.4)	9.1 / 3.9	178 (73)	83 (36)	Acute cholecystitis
Georgiades (12)	2008	2184	110 (5)	6.5 / 4.3	51 (46.4) ⁗	31 (28)	Presence of inflammation
Zhang (9)	2008	1265	94 (7.4)	11.6 / 5.3	39 (42)	22 (23.4)	Inability to correctly identify anatomy
Ballal (10)*	2009	39418	2036 (5.2)	9.8 / 3.8	422 (20.7)‡	ND	Emergency admission and increased disease severity
Avgerinos (11)	2009	1046	27 (2.6)	ND	9 (33.3)	3 (11.1)	Hemorrhage in the surgical field
Ghnman (13)	2010	340	17 (5)	46 / 1.6	10 (58.8)	ND	Unclear anatomy (acute cholecystitis)
Ercan (16)	2010	2015	101 (5)	6.4 / 4.3	ND	23 (22.7)	Intra-abdominal and perihepatic adhesions

ND: No data, OC: Open cholecystectomy.
*Multicenter study.
‡Defined only as ''emergency admission''; no data related to acute operation were included.
⁗Defined only as ''with inflammation''; no data related to acute operation were included.
ˣAll patients with previous upper abdominal surgery were excluded from laparoscopic procedures.

identified intraoperatively. In 4 of the 6 cases of injury, the anatomy was obscured by adhesions caused by severe tissue inflammation, and the other cases occurred in patients with fibrosis of Calot's triangle. In 4 patients, insertion of a T-tube drain was sufficient, and in the other 2 cases, bile flow was established by Roux-en-Y hepatico-jejunostomy. Cholecystoduodenal fistula occurred in 4 patients (0.08%), and all were converted to open surgery; the defects were repaired by sutures. When the reasons for conversion in the converted and laparoscopic groups were compared, bile duct injuries (p<0.001) and chole-cystoduodenal fistula (p<0.001) were found to be impor-tant factors for conversion, but there was no significant difference related to adhesions, fibrosis of Calot's triangle, or intraoperative hemorrhage between the two groups.

When the postoperative complications were examined in patients requiring conversion to OC, the overall post-operative morbidity rate was found to be 16.3% (10 patients); morbidity included suppuration at the umbilical trocar site in 2 cases, intraabdominal abscess in 1 case, atelectasis in 4 cases, incisional hernia in 2 cases, and deep venous thrombosis in 1 case.

DISCUSSION

Currently, the majority of cholecystectomies are per-formed laparoscopically. The conversion from LC to OC results in a significant change in outcome for the patient because of the higher rate of postoperative complications and the longer hospital stay.[4] The conversion rate and complications associated with LC depend on the experience of the surgeon and the degree of difficulty faced during surgery, which can be affected by factors such as a history of previous abdominal surgery, recurrent attacks of cholecys-titis, AC, advanced age of the patient, or male gender.[4-6] Despite better training for surgeons, better laparoscopic tools, and endoscopic camera equipment, the conversion rate has remained relatively stable over time. Conversion

should not be viewed as a complication. The true complica-tions of LC are hemorrhage, gallbladder perforation, bile leakage, bile duct injury, perihepatic collection, and visceral injury. Conversion may be required in certain situations and could help prevent these possible complications. Furthermore, some rare complications including external biliary fistula, wound sepsis, hematoma, foreign body inclusions, and adhesions have also been reported.[7,8]

There are many studies in the literature concerning the conversion rate for LC and the reasons for conversion. According to published studies in recent years, the conver-sion rates vary widely (range: 2.6% to 7.7%) (Table 3).[9-16] In this study, the conversion rate was determined to be 3.16%, which compares favorably with the rates reported in the literature. It appears that previous history and/or new inflammation (i.e., AC) are two of the most frequent situations carrying an increased operative risk and are the main reasons for conversion to the open procedure, as was also shown in the present study. Pericholecystitis makes laparoscopy challenging, changes the local anatomy, and increases the difficulty of identifying the Calot's triangle and common bile duct. Pericholecystitis can also predispose the patient to hemorrhage more easily from the gallbladder bed or cystic artery, and it causes an increased risk of gallbladder perforation and, thus, spillage of gallstones into the peritoneal cavity during dissection of the gallbladder.[17] Thus, conversion rates in cases with AC were reported in the literature to reach up to 27.7%.[18] Other situations associated with increased difficulty of cholecystectomy are adhesions caused by previous operations, cirrhosis, obesity, cholecystoduodenal fistula, stones in the common bile duct, buried gallbladder, and a thickened gallbladder wall. We found the main reason for conversion to be the failure of anatomical identification of Calot's triangle structures because of severe inflammation caused either by AC or by dense adhesions caused by recurrent attacks of cholecystitis. Nevertheless, we determined that bile duct injuries and cholecystoduodenal fistula were important factors that lead

to conversion, but there was no significant difference related to adhesions, fibrosis of Calot's triangle, or intraoperative hemorrhage between the converted and laparoscopic groups.

Previous abdominal operations, even in the upper abdomen, are not a contraindication to a safe LC. However, previous upper abdominal surgery is associated with an increased need for adhesiolysis and a higher open conversion rate.[19,20] Ercan et al.[5] investigated the effects of previous abdominal surgery on the conversion rate in a series of 2963 attempted LCs. They found a 4% conversion rate; among patients with conversion to OC, 37.2% had a history of previous abdominal operation. In the present study, previous surgery in the upper abdomen had only occurred for 3 patients (1.84%) in the converted group, and therefore, this was not a significant cause of conversion (p = 0.746).

Most studies have shown that male gender is a significant factor for conversion to OC.[9,10,12-15] This association may be due to the increased severity of gallstone disease in men.[21] The present findings revealed that the conversion rate was 2.5-fold higher in men than in women (5.6% vs. 2.2%, respectively; p<0.001). When gender difference in comorbid diseases was investigated along with the high conversion rate in males, comorbid disease was found in 20.23% of males and 24.05% of females, respectively (p = 0.558). When the gender distribution according to AC rates was investigated, 17 (20.24%) male patients and 9 (11.39%) female patients were determined to have AC (p = 0.123). Increased disease activity (adhesions and fibrosis of Calot's triangle) occurred in 69 (82.14%) male patients and 40 (50.63%) female patients (p<0.001). These data may explain the cause of the significant differences between gender distributions and conversion rates.

In our study, we defined possible risk factors that may correlate with conversion to open surgery in a large series of 5164 attempted LCs. There are only a few single-center studies in the literature that include a large number of cases. Male gender was found to be the only significant cause of conversion among the possible causes investigated in this study.

ACKNOWLEDGMENTS:

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