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Original Article

Analysis of Causes and Risk Factors for Conversion from Laparoscopic to Open Cholecystectomy

Ahmet Başkent,[1] Gökay Çetinkaya,[1] Mehmet Furkan Başkent,[1] Mertcan Tekneci,[2] Hasan Fehmi Küçük[1]

[1]Department of General Surgery, Kartal Dr. Lutfi Kirdar City Hospital, Istanbul, Türkiye
[2]Department of General Surgery, Uzunkopru State Hospital, Edirne, Türkiye

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Correspondence: Gökay Çetinkaya, Istanbul Kartal Dr Lütfi Kirdar City Hospital, Istanbul, Türkiye
E-mail: gokaycetinkayam@gmail.com

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ABSTRACT

Objective: This study aimed to identify the causes of conversion from laparoscopic cholecystectomy (LC) to open cholecystectomy (OC) and to determine the demographic characteristics, conversion rate, and associated risk factors.

Methods: A total of 4,165 patients who underwent cholecystectomy for symptomatic cholelithiasis at our institution between January 2016 and December 2021 were retrospectively analyzed. Demographic characteristics, indications for conversion, and conversion rates were evaluated in 74 patients who required conversion from LC to OC.

Results: Among the 4,165 patients, 74 (1.8%) required conversion from LC to OC. Of these, 33 (44.6%) were female and 41 (55.4%) were male. The mean age was 56 years (40–82), and the mean BMI was 30 kg/m² (25–43). Comorbidities were present in 44 patients (59.4%). The main reasons for conversion were adhesions and fibrosis due to prior surgery (n=41, 55.4%), acute cholecystitis (n=19, 25.7%), inability to clearly identify Calot's triangle (n=3, 4.1%), bleeding from the cystic artery or gallbladder bed/liver (n=4, 5.4%), luminal organ injury (n=4, 5.4%), and biliary tract injury (n=3, 4.1%). Intraoperative complications occurred in 11 patients (14.9%), while postoperative complications occurred in 8 patients (10.2%). No patient required reoperation, and no mortality was observed. The mean length of hospital stay was 2.2 days (1–12).

Conclusion: LC remains the preferred surgical approach for symptomatic gallstones. However, in patients with significant risk factors, persistent attempts to complete the procedure laparoscopically may increase morbidity. Timely conversion to OC and increasing surgical experience may help reduce complication rates.

INTRODUCTION

Gallbladder surgery for cholelithiasis is among the most frequently performed procedures in general surgery. Since the 1980s, laparoscopic cholecystectomy (LC) has largely replaced open cholecystectomy (OC) and is now widely used worldwide.[1,2] LC has become the gold standard in the surgical management of gallbladder diseases due to its well-established advantages, including reduced postoperative pain, quicker return to daily activities, and superior cosmetic outcomes.[3] Many of the factors previously considered absolute contraindications to LC have become relative with advances in surgical techniques and improved understanding of laparoscopic anatomy.

The most common indications for conversion from LC to OC are dense peritoneal adhesions and acute cholecystitis.[4,5] Additionally, the psychomotor skills and level of surgical experience of the operating surgeon may also contribute to the likelihood of conversion.[6,7] Reported conversion rates in the literature range between 2% and 15%, and conversion is associated with prolonged hospitalization as well as increased morbidity and mortality.[8-10]

The risk of bile duct injury is higher during LC compared to OC. Previous studies report bile duct injury rates of 0.4–0.6% following LC and 0.1–0.2% following OC.[11,12] Although accumulated surgical experience and technological advances have reduced bile duct injury rates in LC over time, they still remain higher than those observed with OC.[13,14]

In this study, we aimed to identify the causes of conversion from LC to OC, describe the demographic characteristics of patients requiring conversion, and determine the conversion rate and associated risk factors.

MATERIALS AND METHODS

The medical records of 74 patients who required conversion from laparoscopic cholecystectomy (LC) to open cholecystectomy (OC), out of a total of 4,165 patients who underwent cholecystectomy in the General Surgery Clinic of our hospital, were retrospectively reviewed. The study protocol was approved by the institutional ethics committee (Decision No: 2020/514/180/12; Date: 26/06/2020) and conducted according to the Declaration of Helsinki.

A total of 4,165 patients who underwent surgery between January 2016 and December 2021 were evaluated. The study included 74 patients who required conversion from LC to OC. Patients with symptomatic cholelithiasis, a history of previous abdominal surgery, those whose cholecystectomy was initiated laparoscopically, those who underwent LC following acute biliary pancreatitis, and those who underwent LC after endoscopic retrograde cholangiopancreatography (ERCP) for choledocholithiasis were eligible for inclusion. Acute cholecystitis was defined according to the Tokyo Guidelines 2018 (TG18). Surgeries performed at least three weeks after hospitalization for acute cholecystitis were considered elective cholecystectomies and were included.

Demographic characteristics, indications for conversion, conversion rate, intraoperative findings, and additional procedures performed during OC were recorded for patients who required conversion. Postoperative complications in patients who underwent OC were also documented. All patients underwent routine preoperative evaluation, including biochemical liver function tests and abdominal ultrasonography of the hepatobiliary system.

Patients who underwent emergency or early cholecystectomy (defined as cholecystectomy during the index admission for acute cholecystitis) were excluded. Additional exclusion criteria included hepatobiliary malignancy, gallbladder polyps, cholecystectomy performed concurrently with other abdominal procedures, prior upper abdominal surgery requiring a primary open approach, inability to tolerate pneumoperitoneum, and elective cholecystectomies initiated as open procedures.

All LC procedures were performed by general surgeons in our clinic under general anesthesia, using a standard four-port technique, with pneumoperitoneum maintained at 12–14 mmHg.

Statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS) version 24.0. Continuous variables such as age and length of hospital stay were analyzed using the Mann–Whitney U test. Categorical variables were compared using the chi-square test. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for all variables. A p value of <0.05 was considered statistically significant.

RESULTS

Of the 4165 patients who underwent cholecystectomy for symptomatic cholelithiasis, 74 (1.8%) were switched from LC to OC. Of the total 4165 LC, 2915 (70%) were female and 1250 (30%) were male. The conversion rate was determined as 1.8%. Of the patients who were switched from LC to OC, 33 (44.6%) were female and 41 (55.4%) were male. OC was passed in 33 (1.13%) cases out of 2915 LC in women and in 41 (3.28%) cases out of 1250 LC men. The mean age of all exposed patients was 56(40-82) years. While the average age of men was 60 (45-82) years, it was determined that women were 53 (40-76) years. The mean BMI was 30 (25-43) kg/m2. (Table 1)

Of the patients, 21 (28.3%) had hypertension, 16 (21.6%) had diabetes mellitus (DM), 7 (9.5%) had chronic obstructive pulmonary disease (COPD). Comorbidity was present in a total of 44 (59.4%) cases. It was determined that 3 (4.1%) patients had colon, 5 (6.75%) stomach, 1 (1.4%) small intestine and 4 (5.4%) gynecological operations. When the size of the stones was examined on USG, it was smaller than 1 cm (millimetric and multiple) in 51 (68.9%) patients, between 1-3 cm in 24 (32.9%) patients,

Table 1. Demographic characteristics of patients

	n (AC)	n (LC-OC)	% (Incidence)	p value
Total	4165	74	1.8	
Female	2915	33	1.13	<0.001
Male	1950	41	2.10	
Age (mean) (year, min-max)		56 (40-82)		<0.001
Female (year, min-max)		53 (40-76)		
Male (year, min-max)		60 (45-82)		
BMI (kg/m^2) (min-max)		30 (25-43)		=0.64 (NS)
Female (SD)		30.29±6.56		
Male (SD)		29.70±6.10		

min: Minimum; max: Maksimum; BMI: Body Mass Index; sd: standart deviation; AC: All Cholecyscetctomies; LC-OC: Conversion from Laparoscopic Cholecystectomy to Open Cholecystectomy; NS: non-significant.

Table 2. Preoperative risk factors and previous surgeries

Preoperative comorbidities	**n (%)**
HT	21 (28.3)
DM	16 (21.6)
COAH	7 (9.5)
Total	44 (59.4)
Previous surgeries	n (%)
Gastric	5 (6.75)
Gynecologic	4 (5.4)
Colon	3 (4.1)
Intestine	1 (1.4)
Total	13 (17.65)
Stone size (Usg)	n (%)
0-1 cm (multiple-mm)	51 (68.9)
1-3	24 (32.9)
Greater than 3 cm	9 (12.2)
Total	74 (100)
Additional pathologies	**n (%)**
ABP	6 (8.1)
ERCP	5 (6.75)
ERCP+ABP	2 (2.5)

HT: Hypertension; DM: Diabetes Mellitus; COAH: Chronic Obstructive Lung Disease; USG: Ultrasound; ABP: Acute Biliary Pankreatitis; ERCP: Endoskopik Retrograt Kolanjiyo Pankreatikografi.

Table 3. Conversion reasons and intraoperative complications

Reasons	**n (%)**
Adhesions due to previous surgeries or fibrosis	41 (55.4)
Acute cholecystitis attack	19 (25.7)
Luminal organ injury	4 (5.4)
Bleeding due to cystic artery or liver bed	4 (5.4)
Calot triangle abnormalities	3 (4.1)
Bile duct injury	3 (4.1)
Total	74 (100)
Intraoperative Complications	n (%)
Luminal organ injury	4 (5.4)
Bleeding due to cystic artery or liver bed	4 (5.4)
Bile duct injury	3 (4.1)
Total	11 (14.9)

Table 4. Postoperative complications

Complication	**n (%)**
Bile leak	3 (4.05)
Pulmonary complications	3 (4.05)
Surgical site infection	2 (2.7)
Total	8 (10.8)

and over 3 cm in 9 (12.2%) patients. It was determined that 5 (6.75%) of the patients underwent ERCP and 6 (8.1%) patients underwent ABP. Two (2.7%) of the patients had both ABP and ERCP. (Table 2)

The main reasons for conversion to open surgery in 74 cases are as follows. Adhesions or fibrosis due to previous surgery (n=41, 55.4%), cholelithiasis acute cholecystitis attack (n=19, 25.7%), inability to reveal anatomy due to adhesions in Calot's triangle (n=3, 4.1%), cystic artery or gallbladder bed were bleeding from the liver (n=4 5.4%), luminal organ damage (n=4, 5.4%), and biliary tract injury (n=3, 4.1%). (Table 3)

In the retrospective analysis of 74 cases, intraoperative complications were found in 11(14.9%) patients. Bile duct injury in 3(4.05%) cases, luminal organ injury in 4(5.4%) cases, and bleeding from the cystic artery or gallbladder bed liver in 4 (5.4%) cases were detected. (Table 3)

As a postoperative complication; Bile leakage was observed in 3 (4.05%) cases, pulmonary complications in 3 (4.05%) cases, and surgical site infection in 2 (2.7%) cases. The cases with bile leakage were controlled with ERCP and stenting. The morbidity rate was 10.8% (8 cases), and none of the patients who developed complications required reoperation and were treated with conservative methods. There was no mortality in any of the patients in the postoperative period. (Table 4) The mean hospital stay was 2.2 (1-12) days.

DISCUSSION

Laparoscopic cholecystectomy (LC) is widely accepted as the gold standard treatment for symptomatic gallstones.[15] As a minimally invasive technique, LC is preferred over open cholecystectomy (OC) worldwide, including in our country, due to its safety profile, reduced postoperative pain, faster recovery, and shorter hospital stay.[16] Nevertheless, conversion to OC remains necessary in certain clinical circumstances.[9,17] In our series of 4,165 patients operated for symptomatic gallstones over a five-year period, the conversion rate was 1.8%. Rosen et al.[18] reported a conversion rate of 5.3%, whereas a systematic review by Hu et al.[19] reported rates ranging from 1% to 15%.

Advanced age (>65 years) and male sex are recognized predictors of conversion. Sippey et al.[20] identified age as a significant risk factor. In a retrospective analysis by Genç et al.,[21] which included 5,164 LC cases, conversion rates were 2.25% in females and 5.65% in males ($p<0.001$), demonstrating a significant sex-based difference. Several studies have similarly reported that male sex and age over 50–65 years are associated with a two- to four-fold increased risk of conversion.[22-24] In our study, the mean age of converted patients was 56 years (40–82), and conversion was significantly more common in males. This may be attributable to the higher incidence of complicated cholecystitis and comorbidities among older patients.[25]

Recurrent episodes of acute cholecystitis can lead to gallbladder wall thickening, fibrosis, and adhesions, which may obscure anatomical landmarks and complicate dissection. Variations in biliary anatomy or increased adipose tissue in Calot's triangle may further contribute to operative difficulty. In our study, adhesions and bleeding in Calot's triangle were among the leading causes of conversion. Kaushik et al.[26] similarly reported that adhesions and common bile duct injuries were the most frequent indications for conversion. The reported rate of conversion due to intraoperative bleeding ranges from 0% to 1.9%, and Shurkalin et al.[27] recorded bleeding in 0.7% of patients, often related to vascular anatomical variations.

Kama et al.[9] identified male sex, previous upper abdominal surgery, gallbladder wall thickening, age >60 years, and acute cholecystitis as factors increasing the likelihood of conversion. Prior upper abdominal surgery is an important risk factor, as dense adhesions may hinder safe laparoscopic dissection. Akyürek et al.[28] reported significantly higher conversion rates in such patients. Consistent with these findings, previous abdominal surgery and related adhesions were notable contributors to conversion in our cohort.

Only a limited number of studies have assessed the effect of prior abdominal surgery and preoperative ERCP on conversion risk.[29-31] Karayiannakis et al.[29] demonstrated that prior upper abdominal surgery was associated with higher conversion rates and longer operative times due to the need for adhesiolysis. Sarli et al.[30] reported a conversion rate of 8.3% after ERCP compared with 3.4% in primary LC cases, while Ammori et al.[31] likewise suggested increased technical difficulty in patients with a history of ERCP.[30]

Intraoperative complications constitute another major indication for conversion. Historically, acceptable conversion rates for elective LC were reported as 3–5%; today, rates of 0–1% are reported in experienced centers. Bile duct injury rates during LC-to-OC conversion vary between 0% and 0.7%, compared to 0.2–1.4% for LC overall.[32-35] Although rare, prompt recognition and intraoperative repair offer the best outcomes. Hollow viscus injuries also occur during LC, with reported incidences up to 0.9%.[35] Careful pneumoperitoneum creation and meticulous use of electrocautery are essential in minimizing these risks. In our study, bile duct injury occurred in 3 patients (0.072%) and luminal organ injury in 4 patients (0.096%), consistent with published rates. Additionally, bile leakage was observed in 3 patients (4.1%) after conversion, all of which were successfully managed with ERCP.

Deizel et al.[36] reported intestinal perforation as a leading cause of mortality following laparoscopic procedures. Although intestinal perforation occurred in 4 patients (5.4%) in our study, no mortality was observed. Trocar- and Veress needle–related complications have also been described in the literature; major retroperitoneal vascular injuries occur in approximately 0.05% of cases and carry a mortality rate of 8.3%.[36]

Postoperative complications following conversion from LC to OC vary widely in the literature. Kaafarani et al.[37] reported wound infection, dehiscence, and deep vein thrombosis, whereas Ashfaq et al.[38] documented wound infection, postoperative bleeding, subhepatic collections, and bile leakage. In our study, postoperative complications—including wound infection, pulmonary complications, and bile leakage—were consistent with the morbidity patterns reported previously. Likewise, the observed length of hospital stay was similar to that described in other studies.

Our study has two notable strengths: First, it presents data from a high-volume single center; second, all procedures were performed by experienced surgeons with 20–25 years of laparoscopic expertise. However, the study has limitations. Its retrospective nature introduces inherent biases, and emergent cholecystectomies for acute cholecystitis were excluded because these procedures were performed in a separate emergency surgery unit. As a result, our conversion rate is among the lower rates reported in the literature.

CONCLUSION

In conclusion, male sex, advanced age, and a history of previous upper abdominal surgery were identified as significant risk factors for conversion from LC to OC. Patients presenting with one or more of these factors should be informed preoperatively about the increased likelihood of conversion and should preferably be managed by experienced laparoscopic surgeons. Despite these considerations, LC remains the first-line surgical approach for symptomatic cholelithiasis. With increasing surgical experience and improvements in laparoscopic techniques, both conversion and complication rates are expected to further decline, even in high-risk patient groups.

Ethics Committee Approval

Ethical approval for the study was granted by the Institutional Review Board of the Kartal Lütfi Kırdar City Hospital Clinical Research Ethics Committee (Date: 26.06.2020, Decision No: 2020/514/180/12).

Informed Consent

The requirement for informed consent was waived due to the retrospective nature of the study.

Peer-review

Externally peer-reviewed.

Authorship Contributions

Concept: A.B., H.F.K.; Design: A.B., M.F.B.; Supervision: G.C., A.B., M.T.; Fundings: A.B., M.T., H.F.K.; Materials: G.C., M.T.; Data: G.C., A.B., M.F.B.; Analysis: G.C., M.F.B.; Literature search: G.C., A.B., M.T.; Writer: G.C.; Critical Review: A.B., H.F.K.

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Conflict of Interest

The authors declare no conflicts of interest.

Presentation Statement

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Laparoskopik Kolesistektomiden Açık Cerrahiye Dönüşün Nedenleri ve Risk Faktörlerinin Analizi

Amaç: Bu çalışma, laparoskopik kolesistektominin (LK) açık kolesistektomiye (AK) dönüş nedenlerini belirlemeyi ve dönüş oranı ile ilişkili demografik özellikleri ve risk faktörlerini değerlendirmeyi amaçlamaktadır.

Gereç ve Yöntem: Ocak 2016–Aralık 2021 tarihleri arasında kurumumuzda semptomatik kolelitiazis nedeniyle kolesistektomi yapılan toplam 4,165 hasta retrospektif olarak analiz edildi. LK'dan AK'ye dönüş gerektiren 74 hastada demografik özellikler, dönüş endikasyonları ve dönüş oranları değerlendirildi.

Bulgular: Çalışmaya dahil edilen 4,165 hastanın 74'ünde (%1.8) LK'dan AK'ye dönüş gerekti. Bu hastaların 33'ü (%44.6) kadın, 41'i (%55.4) erkekti. Ortalama yaş 56 (40–82) yıl, ortalama vücut kitle indeksi 30 (25–43) kg/m² idi. Hastaların 44'ünde (%59.4) komorbidite mevcuttu. Dönüşün başlıca nedenleri; önceki cerrahiye bağlı adezyon ve fibrozis (n=41, %55.4), akut kolesistit (n=19, %25.7), Calot üçgeninin net olarak ortaya konamaması (n=3, %4.1), sistik arter veya safra kesesi yatağı/karaciğerden kaynaklanan kanama (n=4, %5.4), lümen organ yaralanması (n=4, %5.4) ve biliyer trakt yaralanması (n=3, %4.1) olarak belirlendi. İntraoperatif komplikasyonlar 11 hastada (%14.9), postoperatif komplikasyonlar ise 8 hastada (%10.2) görüldü. Hiçbir hastada yeniden ameliyat gereksinimi ve mortalite saptanmadı. Ortalama hastanede kalış süresi 2.2 gündü (1–12).

Sonuç: LK, semptomatik safra taşı hastalığında tercih edilen cerrahi yaklaşım olmaya devam etmektedir. Bununla birlikte, belirgin risk faktörlerine sahip hastalarda işlemi ısrarla laparoskopik olarak tamamlama çabası morbiditeyi artırabilir. Uygun zamanda açık cerrahiye dönüş ve artan cerrahi deneyim komplikasyon oranlarının azaltılmasına katkı sağlayabilir.

Anahtar Sözcükler: Açık kolesistektomi; dönüş kolelitiazis; laparoskopik kolesistektomi.