

# Factors causing conversion in laparoscopic cholecystectomy

## Laparoskopik kolesistektomide konversiyona neden olan faktörler

Recep Çağlar

Mersin City Training and Research Hospital, Mersin, Turkey, rcaglarr@gmail.com, 0000-0003-0987-9202

### ABSTRACT

**Introduction and Purpose:** Laparoscopic Cholecystectomy (LC) is the most widely performed, gold standard surgical procedure for the treatment of gallbladder disease. The turning from laparoscopic cholecystectomy to open cholecystectomy (conversion) is not a failure or complication as it is necessary to provide patient safety and prevent complications. We aimed to investigate intraoperative and preoperative factors causing conversion in patients who underwent laparoscopic cholecystectomy. **Materials and Methods:** LC is performed on 4433 patients with cholelithiasis-cholecystitis detected by abdominal ultrasonography were retrospectively analyzed. The patients were grouped on the basis of age, gender, length of hospitalization, history of preoperative Endoscopic Retrograde Cholangiopancreatography (ERCP), Diabetes Mellitus (DM), chronic fibrotic cholecystitis, gall bladder polyps and urgent-elective surgery. The rate and causative factors of conversion were investigated. Statistical analyses were carried out using IBM SPSS for Windows, version 17.0 software package. **Result:** As a result of our study, we found the Conversion Rate (CR) to be 0.85%. According to the results of our study; statistically significant risk factors for conversion were found to be male gender, advanced age, prolonged hospital stay, presence of preoperative ERCP history, having performed emergency surgery and presence of chronic fibrotic cholecystitis. DM had no effect on conversion. **Conclusion:** Conversion should not be considered as a complication, but should be considered a necessary condition for safe cholecystectomy. Identifying critical risk factors in patients who may require conversion may significantly reduce the complications of the laparoscopic procedure. In this way, identifying patients who may require conversion may help revise the surgical strategy and obtain better results in this patient group.

#### Key Words:

Conversion, Cholecystitis, Cholelithiasis, Laparoscopic Cholecystectomy, Risk Factors

#### Anahtar Kelimeler:

Konversiyon, Kolesistit, Kolelitiazis, Laparoskopik Kolesistektomi, Risk Faktörleri

#### Corresponding Author/Sorumlu

Yazar:  
Department of General Surgery/  
Gastroenterological Surgery, Mersin  
City Training and Research Hospital,  
Mersin, Turkey, rcaglarr@gmail.  
com, 0000-0003-0987-9202

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### Öz

**Giriş ve Amaç:** Laparoskopik kolesistektomi, safra kesesi hastalığının tedavisi için en yaygın uygulanan, altın standart cerrahi prosedürdür. Laparoskopik kolesistektomiden açık kolesistektomiye geçiş (konversiyon) bir başarısızlık ve bir komplikasyon değildir. Sadece hasta güvenliğini sağlamak ve komplikasyonlardan kaçınmak için atılan bir adımdır. Çalışmamızın amacı laparoskopik kolesistektomi yapılan hastalarda konversiyon sıklığı ve neden olan faktörler neden olan intraoperatif ve preoperatif faktörleri araştırmaktır. **Gereç ve Yöntem:** Hastanemizde kolelitiazis-kolesistit belirtileri ve semptomları olan ve batin ultrasonografisi ile teşhis konulan 4433 hastaya yapılan laparoskopik kolesistektomi vakaları retrospektif olarak incelendi. Hastalar yaş, cinsiyet, hastanede yatış süresi, önceden Endoskopik Retrograd Kolanjiopankreatikografi (ERCP) yapılan, Diabetes Mellitus (DM), kronik fibrotik kolesistit, safra kesesi polipi, acil-elektif cerrahi olarak gruplara ayrıldı. Hastalarda konversiyon oranı ve neden olan faktörler araştırıldı. İstatistiksel testler için IBM SPSS for Windows, version 17,0 programı kullanıldı. **Bulgular:** Çalışmamızda konversiyon oranı % 0,85 bulundu. Erkek cinsiyet, uzamış hastanede yatış süresi, önceden ERCP uygulanması, acil cerrahi uygulanması ve kronik fibrotik kolesistit gibi durumlar konversiyon grubu lehine istatistiksel olarak anlamlı oranda farklı saptandı. DM'nin konversiyon üzerine etkisine yönelik anlamlı ilişkisi bulunmadı. **Sonuç:** Konversiyon bir komplikasyon olarak değil, güvenli kolesistektomi için gerekli bir koşul olarak değerlendirilmelidir. Konversiyon gerektirebilecek hastalarda kritik risk faktörlerinin belirlenmesi, laparoskopik işlemin komplikasyonlarını önemli ölçüde azaltabilir. Bu sayede konversiyon gerektirebilecek hastaların belirlenmesi, bu hasta grubunda cerrahi stratejinin gözden geçirilmesine ve daha iyi sonuçlar alınmasına yardımcı olabilir.

## INTRODUCTION

Cholecystectomy is the most commonly performed treatment modality in symptomatic gallbladder disease and biliary tract pathology, and LC is the most widely performed, gold standard surgical procedure for the treatment of gallbladder disease (Hori-Oike and et al., 2016). LC is more advantageous than traditional open cholecystectomy such as less postoperative pain, better cosmetic results, shorter hospital stay and faster recovery,

which are considered to be the classical advantages of laparoscopy (Bittner, 2006).

Difficulties in access and dissection are sometimes encountered during LC, and a laparoscopic procedure that may not be completed safely is considered "difficult". Conversion may be needed when the regional anatomy cannot be clearly defined, the procedure progresses too slowly, and complications arise (Henneman-Costa and et al., 2013). Conversion from LC to open cholecystectomy

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should not be considered as a complication, but should be considered a necessary condition for safe cholecystectomy (Gómez-Zapatier and et al., 2006).

We aimed to investigate the intraoperative and preoperative factors that cause conversion in patients who underwent LC and to contribute to awareness of intraoperative difficulties.

### Materials And Methods

LC procedures performed in XXXXXX City Training and Research Hospital between January 2017-October 2020 on 4433 patients with cholelithiasis-cholecystitis who were diagnosed with abdominal ultrasonography were retrospectively reviewed. The patients were grouped on the basis of age, gender, length of hospitalization history of pre-op ERCP, DM, chronic fibrotic cholecystitis, gall bladder polyps and urgent-elective surgery. Patients in the laparoscopically completed cholecystectomy group were defined as 'Group 1' and those in the conversion group as 'Group 2'. The CR and predictive factors of conversion were investigated.

### Ethical Aspect of Research

Ethical consent: 09/06/2021-422, Mersin University Ethics Committ.

### Statistical Analysis

Statistical tests were performed using IBM SPSS for Windows version 17.0 software package. Kolmogorov Smirnov test was used for data distribution. Categorical variables were expressed as number (n) and percentage (%). Continuous variables were expressed as mean  $\pm$  standard deviation or median range (Maximum-Minimum). Student's t-test was used to compare group pairs depending on data distribution. Pearson and Spearman correlation analysis were used to determine

which factors had an effect on the conversion. Then, univariant and multivariant regression analyses were used to calculate the correlated parameters' contribution to conversion and their relative risks. Areas under the curves (AUC) were reported at a confidence interval (CI) of 95%. A 'p value' of ' $< 0.05$ ' was considered statistically significant.

### RESULTS

Out of 4433 patients who underwent laparoscopic cholecystectomy, the procedure was completed laparoscopically in 4395 patients 'Group 1' while a conversion was made to open surgery in 38 (0.85%) patients 'Group 2'. The mean age, number of males, length of hospitalization, number of patients with a history of preoperative ERCP, number of patients who underwent an urgent procedure, number of patients with DM was higher in 'Group 2' (Table 1).

Male gender, advanced age, longer hospitalization, higher preoperative ERCP history, higher rate of chronic fibrotic cholecystitis and higher rate of emergency surgery (acute-hydropsic cholecystitis) were found to be significantly higher in 'Group 2'. (Table 1).

The rate of conversion was 0.85% (Table 2), and it was found to be higher in patients with a history of ERCP, presence of chronic fibrotic cholecystitis and undergoing urgent operation (respectively;  $r:0.421$  ( $p<0.001$ ),  $r:0.220$  ( $p=0.015$ ), and  $r:0.341$  ( $p=0.007$ )).

The binary logistic regression analysis of the parameters correlated to conversion revealed that the history of ERCP made an approximately 200-fold contribution to conversion (OR 209.02 95% CI (71.317-612.635),  $p<0.001$ ); chronic fibrotic cholecystitis was another variable that made a significant contribution to conversion (OR 7.52, 95% CI (3.402-16.627),  $p<0.001$ ) (Table 3).

Table 1. Demographic Variables

	Group 1 (n=4395)	Group 2 (n=38)	p
Age (years)	48.74 $\pm$ 14.87	58.50 $\pm$ 12.82	<0.001
Gender male n,%	1180 (23.7%)	18 (25.5%)	0.006
Hospitalization (Day)	2.08 $\pm$ 2.38	7.63 $\pm$ 5.06	<0.001
ERCP n,%	9 (0.2%)	12 (31.6%)	<0.001
Hospitalization (Emergency-acute)n,%	270 (6.1%)	35 (92.1%)	<0.001
DM positive n%	451 (10.3%)	8 (21.1%)	0.042
Chronic fibrotic cholecystitis n,%	3157 (71.8%)	23 (60.5%)	<0.001
Gallbladder polyp n,%	55 (1.2%)	0 (0%)	0.623

Data are expressed as the mean  $\pm$ SD. Unless otherwise noted Student's t-test

**Table 2.** Conversion rate (CR) and Factors Causing

	Conversion % 0.85	
	r	p
ERCP	0.421**	<0.001
Chronic fibrotic cholecystitis	0.220*	0.015
Hospitalization (Emergency-acute)	0.341**	0.007

\*Correlation is significant at the 0.05 level (2-tailed).

\*\*Correlation is significant at the 0.01 level (2-tailed).

ERCP, Endoscopic Retrograde Cholangiopancreatography

**Table 3.** Correlation analysis relationship in conversion

Variables	OR (95% CI)	p
ERCP	209.02 (71.317-612.635)	<0.001
Chronic fibrotic cholecystitis	7.52 (3.402-16.627)	<0.001
Hospitalization (Emergency-acute)	2.75 (0.943-8.018)	0.064
Adjusted R <sup>2</sup> = 0.443 / p-value of the model's ANOVA <0.001		

CI, Confidence Interval; OR; Odds Ratio

## DISCUSSION

LC is used to be performed more frequently than classical cholecystectomy in many centers due to the classical advantages of laparoscopy, such as being minimally invasive, faster recovery and short hospital stay (Tazuma-Unno and et al., 2017). However, the need to conversion from a LC may still be necessary due to challenging factors (Albrecht-Franke and et al., 2016).

LC-related causes of conversion include complications, surgeon's experience, difficulty of surgery, history of abdominal surgery (adhesion), recurrent episodes of cholecystitis and biliary pancreatitis, history of preoperative ERCP, advanced age, and male gender. Conversion should not be considered as a complication; rather, it may help prevent potential complications associated with LC, which include bleeding, gall bladder perforation, bile leak, biliary tract injury, hepatic artery injury, and visceral organ injury (Ercan-Bostanci and et al., 2009).

Recent studies have reported a wide range of CR, ranging between 1.5% and 19% (Livingston and Rege, 2004). A study that reviewed 43,821 LC procedures performed at British Hospitals between 2005 and 2006 reported a general CR of 5.2% (for elective and urgent procedures were 4.6% and 9.4%, respectively) (Ballal-David and et al., 2009). Genç et al. reviewed 5164 LC procedures and reported a CR of 3.16% (Genc-Sulaimanov and et al., 2011). The CR was reported 5% by Wagih et al.

(Ghnam-Malek and et al., 2010). Other researchers who investigated the risk factors of conversion have stressed the important roles of equipment-related surgical factors and surgical (Lee-Collins and et al., 2012, Yang-Guo and et al., 2014). Our study revealed a CR of 0.85%. This rate was close to that reported by Kuldip and Ashish but lower than those reported by others. Although some meta-analyses have reported that male gender increases the CR in LC (Ballal-David and et al., 2009, Teng-Fei and et al., 2014), many other meta-analyses have refused its role as a significant risk factor (Botaitis-Pitiakoudis and et al., 2012, Yajima-Kanai and et al., 2014). The number of males in our study group was 18 (25.5%), which was statistically significant (p<0.006).

Advanced age (60-65) has been shown to be significantly correlated to the conversion risk in many meta-analyses (Botaitis-Pitiakoudis and et al., 2012, Coelho-Dalledone and et al., 2019, Domínguez-Rivera and et al., 2011). Kanaan SA et al. all reported that male gender and advanced age were significant preoperative risk factors for conversion (Kanaan-Murayama and et al., 2002). In our study, the mean age of 'Group 2' was statistically significant (58.50 ± 12.82 years, p<0.001).

History of preoperative ERCP was a significant risk factor for conversion in this study (p<0.001). Similarly, Domínguez et al. (CR: 13,8%) and Ercan et al. (CR: 5.0%) reported that a history of ERCP was significantly correlated to conversion (Domínguez-Rivera and et al., 2011, Ercan-Bostanci and et al., 2010). On the contrary,

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a metaanalyses by Teng Fei Yang et al. reported that preoperative ERCP and the gallstone pancreatitis were not significantly associated with conversion (all  $P > 0.05$ ) (Teng-Fei and et al., 2014).

Studies reported by Ercan et al. have demonstrated that fibrotic gall bladder was a risk factor for conversion (Ercan-Bostanci and et al., 2010). Similarly, our study demonstrated that fibrotic gall bladder was a significant risk factor for conversion ( $p < 0.001$ ). Although several studies have reported that DM increases the risk of gangrenous cholecystitis and conversion (Ganapathi-Speicher and et al., 2015, Stanisic-Milicevic and et al., 2014), there were also studies ((Botaitis-Pitiakoudis and et al., 2012, Sultan-El Nakeeb and et al., 2013) reporting that DM was not a significant risk factor for conversion. Similarly, our study found no correlation between DM and conversion.

Many studies have shown that acute cholecystitis is one of the most important risk factors for conversion (Ibrahim- Hean and et al., 2006, Yajima-Kanai and et al., 2014). In a study involving 346 patients, Steeg Van der HJJ et al. reported that conversion was needed in 17.2% of hydropic gall bladder cases (Steeg-Alexander and et al., 2011). In the study of Turgut et al., the CR was reported as 30.9% in patients with acute cholecystitis (Turgut and Kahramanca, 2017). Similarly, as a result of our study; showed that urgent surgery (acute cholecystitis, hydropic cholecystitis) was significantly more frequent in the conversion group ( $p < 0.001$ ).

Conversion of laparoscopic surgery to open surgery causes an increase in mortality and morbidity rates as well as prolongation of postoperative hospital stay (Wolf-Nijse and et al., 2009). Likewise, in our study, the duration of hospitalization was found to be significantly increased in the conversion group ( $7.63 \pm 5.06$  days,  $p < 0.001$ ).

### Conclusion and Recommendations

Predicting the factors that may require conversion in patients planned for LC may be helpful in identifying high-risk patients and reviewing the surgical strategy to be applied to this patient group. Thus, the negative effects of laparoscopic intervention can be significantly minimized.

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