Journal of Experimental and Clinical Medicine
https://dergipark.org.tr/omujecm

Research Article

J Exp Clin Med
2022; 39(3): 781-785
doi: 10.52142/omujecm.39.3.36

Conversion from laparoscopic cholecystectomy to open surgery reasons and possible risks: A single center experience

Ali ÖZDEMİR*, Ahmet KARAKAYA, Ahmet PERGEL

Department of General Surgery, Faculty of Medicine, Recep Tayyip Erdoğan University, Rize, Turkey

Received: 29.03.2022 • **Accepted/Published Online:** 30.06.2022 • **Final Version:** 30.08.2022

Abstract

Laparoscopic cholecystectomy has grown in popularity since its introduction and has become the gold standard surgical method for treating cholelithiasis. It has several advantages over open surgery, including less postoperative pain, a shorter hospital stay, a faster return to normal activities, and better cosmetic results. Converting from laparoscopic to open surgery may be necessary in some cases, either to prevent or treat difficulties. The current conversion rate from laparoscopic to open surgery is between 2 and 15%. Open surgery may be required due to advanced age, male gender, acute cholecystitis, anatomical alterations of the gallbladder or biliary system, obesity, bleeding, adhesions, and biliary tract injuries. Our study aimed to determine the risk factors that influence the conversion to open surgery. Between January 2018 and December 2021, we analyzed 921 cholecystectomy cases retrospectively at the Recep Tayyip Erdogan University Training and Research Hospital. We excluded twenty-three of these patients from the study once it was revealed that they had undergone direct open surgery or an open cholecystectomy while undergoing another operation. Twenty-eight patients had a laparoscopic cholecystectomy but had to convert to open surgery due to difficulties. We obtained the demographic and clinical information about the patients from hospital records. We analyzed whether these characteristics had a significant impact on the conversion from laparoscopic to open surgery by comparing the data of an equal number of randomly selected laparoscopic completed patients. The most common reason for conversion from laparoscopic to open cholecystectomy was adhesion due to inflammation, which accounted for 3.04 percent of conversions. In our study, cholecystitis symptoms, including multiple calculi on ultrasonography and increased wall thickness, and raised GGT and ALP levels, all affected the decision to convert to open surgery. We discovered no significant associations between gender, pancreatitis, cholangitis, stone size, and ASA score. The duration of hospitalization was considerably longer in the group that converted to open surgery. Increased rates of conversion to open surgery are associated with advanced age, obesity, previous episodes of cholecystitis, and adhesions due to previous abdominal incisions, presence of cholecystitis findings such as multiple calculi on ultrasonography, increased wall thickness and high GGT and ALP values. The most influential factor in converting to open surgery appears to have previously had cholecystitis. A preoperative patient examination can aid in predicting the risk of exposure.

Keywords: Open cholecystectomy, laparoscopic cholecystectomy, risk factors, surgery

1. Introduction

Mouret was the first to use laparoscopic surgery for cholecystectomy in 1987, and it has since become widely used for gynecological procedures (1). Its use has grown in popularity over time, and it is now the gold standard for surgical cholelithiasis treatment. In gallbladder diseases, laparoscopic surgery is most usually favored, and research shows that 85 percent of cholecystectomy cases are performed laparoscopically (1-3). Laparoscopic cholecystectomy has several advantages over open cholecystectomy, including less postoperative pain, a shorter hospital stay, a faster return to normal activities, and better cosmetic results (3, 4).

Despite its reputation as a safe surgical operation, laparoscopic cholecystectomy can cause bile duct and intestine damage and hemorrhage, which can cause severe morbidity and mortality (4). The purpose of converting to open surgery is to reduce complications. Conversion to open surgery is a method performed to ensure surgical safety, not a consequence. As a result, it is crucial to know when to convert from laparoscopic to open surgery. The rate of conversion from laparoscopic to open surgery is currently between 2% and 15% (3, 5).

The literature has shown that advanced age, male gender, acute cholecystitis, structural alterations of the gallbladder or biliary system, obesity, bleeding, adhesions, and biliary tract injuries are all efficient in converting to open surgery (6-8).

During the preoperative evaluation phase of patients

*Correspondence: paravol1@hotmail.com

planned for laparoscopic cholecystectomy, a good review of demographic, biochemical, and radiological results can predict the risk of conversion to open surgery. Variable risk factors among these anticipated risk parameters can aid in determining whether surgery is necessary. As a result, an appropriate operation schedule plan may be established, lowering the rate of difficulties and opening. The goal of our research was to identify the risk factors that influence the conversion to open surgery.

2. Materials and methods

2.1. Patients and data collections

Between January 2018 and December 2021, we retrospectively evaluated 921 cholecystectomy cases in the General Surgery Clinic of Recep Tayyip Erdogan University Training and Research Hospital (Ethics Committee of Recep Tayyip Erdogan University Training and Research Hospital, issued March 24, 2022, and numbered 2022/72.)

We found that open cholecystectomy was performed in 51 of these patients. In 23 of 51 patients, open cholecystectomy was started either immediately or during another procedure; we excluded these patients from the research. We assessed patients' age, gender, weight, and height, besides previous procedures, comorbidities, cholecystopathy-related laboratory test values, and ultrasonography (US) findings. Our hospital records also revealed a clinical history of acute cholecystitis, the presence of interventional procedures such as cholecystostomy or endoscopic retrograde cholangiopancreatography (ERCP), surgical findings, and the American Society of Anesthesiologists' Physical Health classification (ASA) score (9) and length of stay.

We also collected the data of 28 patients randomly selected from 921 patients who had gallbladder surgery and had it finished laparoscopically and statistically compared to see if there was a significant effect on the conversion to open surgery.

2.2. Statistical analysis

We analyzed the data with the IBM SPSS Statistics for Windows (Armonk, NY, USA, IBM Corp.) software. We presented categorical data as numbers and percentages and numerical data with mean and standard deviation values. We used the chi-square test and Fisher's Exact Test for categorical variables to determine the factors associated with conversion from laparoscopy to open cholecystectomy. We determined the distribution characteristics of continuous variables by the Shapiro Wilk and Kolmogorov-Smirnov tests and evaluated the relationships of these variables with the exposure state with the Mann Whitney U test. We accepted the statistical significance level as $p<0.05$ in all analyses.

3. Results

Between January 2018 and December 2021, we retrospectively evaluated 921 cholecystectomy cases in the General Surgery Clinic of Recep Tayyip Erdogan University Training and Research Hospital. We excluded twenty-three of these patients because they received an open cholecystectomy as part of another operation or had direct open surgery. The remaining 898 patients underwent laparoscopic cholecystectomy; however, 28 required open cholecystectomy due to various factors. In this regard, we calculated our hospital's rate of conversion to open during laparoscopic cholecystectomy as 3.04 percent.

The most prevalent reason for conversion from laparoscopic to open surgery was adhesion owing to inflammation, which accounted for 53.6 percent of the cases, followed by inability to visualize the gallbladder hilum, adhesions from prior procedures, peroperative bleeding, and further organ injury (Table 1).

Table 1. Reason for conversion to open surgery

Reason for conversion to open surgery	n	%
Adhesion due to inflammation	15	53.6
İnability to see the hilum	6	21.4
Adhesions due to previous Operations	4	14.3
Hemorrhage	2	7.1
0rgan injury	1	3.6

Patients receiving open surgery had an average age of 59, while patients undergoing laparoscopic surgery had an average age of 48, which was statistically significantly higher ($p=0.006$) (Mann Whitney U test) (Table 2).

In overweight or obese patients, the conversion rate to open surgery was 60.9 percent, whereas the rate of cases done laparoscopically was 39.1 percent, with a statistically significant difference (Mann Whitney U test, $p<0.001$). (Table 2).

Table 2. Age and BMI information of the patients

	Conversion group	Laparoscopic group	p
The average age (±SD)	59 (±14)	48 (±17)	**p<0.05**
The average BMI (kg/m^2) (±SD)	30.25 (±3.68)	25.65 (±2.28)	**p<0.001**

BMI: Body mass index, SD: Standard deviation

Males accounted for 41.1 percent (n=23) of the 56 patients enrolled in the study (28 open and 28 laparoscopic procedures completed), while females accounted for 58.9% (n=33). There was no statistically significant difference between patients who had open surgery and those who had laparoscopic surgery in terms of the male and female gender (Table 3).

Table 3. Gender and medical characteristics of patients

		Conversion group		Laparoscopic group		Total group		p
		n	%	n	%	n	%	
Gender	Male	13	56.5	10	43.5	23	41.1	**>0.05**
	Female	15	45.5	18	54.5	33	58.9	
Cholecystitis history	Yes	21	70	9	30	30	53.6	**<0.001**
	No	7	26.9	19	73.1	26	46.4	
Pancreatitis history	Yes	3	77	1	25	4	7.1	**>0.05***
	No	25	48.1	27	51.9	52	92.9	
Cholangitis history	Yes	0	0.0	2	100.0	2	3.6	**>0.05***
	No	28	51.9	26	48.1	54	96.4	
Percutaneous Cholecystostomy	Yes	2	100	0	0.0	2	3.6	**>0.05***
	No	26	48.1	28	51.9	54	96.4	
Stone size	millimetric	17	50.0	17	50.0	34	60.7	**>0.05**
	>1cm	11	50.0	11	50.0	22	39.3	
Stone number	single	3	17.6	14	82.4	17	30.4	**<0.001**
	Multiple	25	64.1	14	35.9	39	69.6	
Gallbladder wall thickness	>3 mm	19	76.0	6	24.0	25	44.6	**<0.001**
	<3 mm	9	29.0	22	71.0	31	55.4	
Priorabdominaloperation	Yes	7	58.3	5	41.7	12	21.4	**>0.05**
	No	21	47.7	23	52.3	44	78.6	

***Fisher's Exact Test is used.**

We assessed cholecystitis, pancreatitis, and cholangitis attacks for cholelithiasis consequences. In patients who had an incident of cholecystitis, we found conversion to open and laparoscopic completion as 70% and 30%, respectively, and this difference was statistically significant (Chi-square test, $p<0.001$). Furthermore, our study revealed the rate of gallbladder opening to be statistically substantially greater in patients with a gallbladder wall thickness of 3 mm or more on preoperative ultrasonography (Chi-square test, $p<0.001$) (Table 3).

This study examined whether having a cholecystectomy catheter due to pancreatitis, cholangitis, or acute cholecystitis affects the conversion to open surgery. We conducted the Fisher Exact test due to the small number of patients in this group analysed in the study and identified no statistical significance (Table 3).

While the stone size evaluation had no statistical significance, the study revealed the opening rate to be statistically high in cases with several stones (Table 3).

With a prevalence of 14.3 percent, we revealed adhesions from previous abdominal operations to be the reason for conversion to open surgery in our study. We found no statistically significant difference when comparing the incision kinds of these surgeries (Table 3).

The patients' ASA scores were largely ASA 1 and 2, and there was no statistically significant difference between the groups in terms of ASA scores ($p>0.05$) (Table 4).

We used the Mann Whitney U test to evaluate the high levels of Gamma Glutamyl Transferase (GGT), Alkaline Phosphatase (ALP), and direct bilirubin, which are among the biochemical tests performed in the preoperative period. We found all three parameters to be statistically significant in open surgery patients. ($p<0.001$) (Table 4).

Table 4. ASA score, hospitalization time (day) and biochemical parameters

	Conversion group	Laparoscopic group	p
ASA score (±SD)	3 (±1)	2 (±1)	**>0.05**
ALP (±SD)	55.8 (±25.2)	72.43 (±16.7)	**<0.001**
GGT (±SD)	59.53(±49.6)	30.3(±23.7)	**<0.001**
Direct bilirubin	5.6(±7.62)	0.2(±0.2)	**<0.001**
Hospitalization time(day)	7(±4.9)	1.8(±0.8)	**<0.001**

SD: Standard deviation
ALP: alkaline phosphatase, GGT: Gamma-glutamyl transferase

The open group's average hospital stay was 7.0 days, while the laparoscopic group's average was 1.75 days, significantly longer in the open group. (Mann-Whitney U test, $p<0.001$) (Table 4).

4. Discussion

It is impossible to determine when a laparoscopic cholecystectomy will be converted to open surgery. Although numerous risk analysis scales for conversion to open surgery have been advocated in the literature, no evaluation approach has been widely employed (2, 6).

Sutcliffe et al. (2) developed a risk score system (CLOC score) for laparoscopic to open cholecystectomy conversion, which uses the patient's age, gender, surgical indication, ASA score, gallbladder wall thickness, and common bile duct diameter to create the grading system. This system considered patients with a total score of 6 or less as low-risk candidates for conversion from laparoscopic to open surgery, whereas it considered those with a score of 6 or more as high-risk candidates. (2). The conversion rate from laparoscopic cholecystectomy to open surgery has been reported to range between 1.3 percent and 24 percent in the literature, with inflammation and fibrosis in the Callot triangle being the most common reason for conversion to open surgery (3, 6, 10).

In the UK database, Sutcliffe et al. (2) discovered a rate of conversion to open surgery of 3.4 percent in 8.820 patients across 11 investigations. The most prevalent reasons for conversion to open surgery, according to this study, were difficulty in getting crucial safe vision as well as intraoperative complications such as intestine perforation, hemorrhage, or biliary tract injury (2). Acehan et al. reported a 3.7 percent conversion rate to open surgery in 2.373 patients. Their study identified male gender, advanced age, diabetes, presence of supraumbilical median incision, multiple millimetric calculi on US, and cholecystitis signs such as increased wall thickness as factors influencing conversion to open surgery. They reported that the most common reason for these patients' conversion to open surgery was difficulty establishing safe vision due to fibrosis and inflammation in the Callot's triangle, which developed following acute

cholecystitis (3).

Our study found conversion to open surgery during laparoscopic cholecystectomy as 3.04 percent, consistent with the literature. Adhesions due to inflammation were the most common reason for open surgical conversion in our study, accounting for 53.6 percent. Other causes included an inability to visualize the gallbladder's hilum, adhesions from a previous operation, hemorrhage, and secondary organ injury. These findings are consistent with previous studies. (3,10, 11).

Although the male gender has been identified as a risk factor for conversion to open surgery (12, 13), our analysis observed no statistically significant differences in terms of gender.

Many studies have found that advanced age increases the likelihood of converting from laparoscopic to open surgery (14). The mean age in our study was 59 in the open group and 48 in the laparoscopic group, with the open group having a considerably higher mean age. Elderly patients are likely to have had more attacks with a more severe course and a higher number of comorbidities (15).

Obesity was a risk factor for conversion from laparoscopic to open surgery in various studies (5, 12); many studies have identified it as a risk factor (15, 16). Beksaç et al., on the other hand, found obesity not to be a risk factor for conversion to open cholecystectomy (6). Nevertheless, the conversion rate to overweight or obese patients was statistically significant in our study. According to the literature, the presence of pericholecystic fluid or a gallbladder wall thickness of more than 3 mm, which is accepted as an indicator of cholecystitis in preoperative ultrasonography and in patients who had had a cholecystitis attack, is a risk factor for conversion to open surgery, (15-18). Gallbladder wall thickening and fibrosis due to recurrent inflammatory attacks cause difficult dissection and therefore an increase in conversion to open surgery. In our research, individuals with cholecystitis attacks and patients with greater preoperative gallbladder wall thickness had high conversion rates to open surgery.

Fibrosis may develop in the surgical field in cases of pancreatitis and cholangitis caused by cholelithiasis, and this can be a factor determining the conversion to open surgery (19). However, there was no statistically significant difference between these conditions in our investigation. While there was no statistically significant difference in the appraisal of stone size, we found the rate of conversion to open surgery in instances with several stones statistically high.

According to studies, previous abdominal surgeries are not a barrier to laparoscopic surgery, but they are a risk factor for conversion to open surgery (3,5,6). It appeared to be a conversion factor to open surgery due to previous surgeries in our study, but we observed no statistically significant difference assessing it in terms of incision kinds. There was no significant relationship between incision styles and conversion to open surgery in Bourgouin's study (20).

Various studies have looked into whether the ASA score used to assess preoperative anesthetic risk impacts the conversion to open surgery. Our investigation identified no significant influence on the ASA score in the conversion to open surgery, as reported by Bourgouin et al. (20) and Rosen et al. (21). Among the biochemical tests performed in the preoperative period, high levels of GGT and ALP may indicate the need for open surgery (20,22). Bourgouin et al. discovered a link between GGT increase and the likelihood of undergoing open surgery (20). In patients with increased GGT and ALP, Licciardello et al. discovered a significant rate of conversion to open surgery (22). Beksac's study determined high ALP levels as a risk factor while establishing no significant relationship between ALT, AST, GGT, and T. Bilirubin values and conversion to open surgery (6). Our research discovered a relationship between high GGT, ALP, and direct bilirubin levels and the need for open surgery.

In treating cholelithiasis, laparoscopic surgery has established itself as the gold standard. Even at the best centers, conversion from laparoscopic surgery to open surgery can be inevitable despite technical breakthroughs and the development of surgical procedures and skills. Conversion to open surgery is a surgical procedure done to prevent or eliminate a potential problem.

It is challenging to anticipate which patients may require open surgery. Advanced age, obesity, past bouts of cholecystitis, adhesions related to previous abdominal incisions, presence of cholecystitis symptoms such as multiple calculi on ultrasonography and increased wall thickness, and high GGT and ALP values all influenced conversion to openness in our study. We revealed previous cholecystitis attacks as the most critical factor.

Modifiable factors can be determined in the preoperative phase by establishing the factors increasing the likelihood of conversion to open surgery. Changeable risk factors among these projected risk factors can help determine when surgery should be performed. As a result, a proper operation scheduling plan may be devised, and the rate of problems and openings can be reduced.

More experienced surgeons and centers can be referred for risk patients after identifying patients with a high risk of conversion to open surgery. Due to its many advantages, laparoscopic cholecystectomy, a gold standard approach, should be considered the first choice for individuals who are considered too risky for open surgery.

Conflict of interest

The authors declared no conflict of interest.

Funding

No funding was used for the study.

Acknowledgments

We performed this research with the Recep Tayyip Erdoğan University, Faculty of Medicine, Department of General Surgery, Rize, Turkey.

Authors' contributions

Data curation (equal), formal analysis (equal), investigation (equal), software (equal), writing-review and editing (equal), supervision (equal), validation (equal): A.Ö., conceptualization (equal), methodology (equal), project administration (equal), writing-original draft (equal), writing-review and editing (equal), visualization (equal), validation (equal): A.K., conceptualization (equal), methodology (equal), project administration (equal), writing-original draft (equal), writing-review and editing (equal), visualization (equal), validation (equal): A.P.

References

1. Soper, Nathaniel J., L. Michael Brunt, and Kurt Kerbl. "Laparoscopic general surgery." New England Journal of Medicine 330.6 (1994): 409-419.

2. Sutcliffe R, Hollyman M, Hodson J, et al. Preoperative risk factors for conversion from laparoscopic to opencholecystectomy: a validated risk scorederived from a prospective U.K. database of 8820 patientsHPB (Oxford). 2016 Nov; 18(11): 922–928

3. Acehan T, and Kose E. Risk Factors Effecting Conversion from Laparoscopic Cholecystectomy to Open Surgery. Bagcilar Medical Bulletin 6.3 (2021): 280-287.

4. Litwin, Demetrius EM, and Mitchell A. Cahan."Laparoscopic cholecystectomy." Surgical Clinics of North America 88.6 (2008): 1295-1313.

5. Ekici Uğur, Faik Tatlı, and Murat Kanlıöz. "Preoperative and postoperative risk factors in laparoscopic cholecystectomy converted to opensurgery." Advances in Clinical and Experimental Medicine 28.7 (2019): 857-860.

6. Beksac K, Turhan N, Karaagaoglu E. Risk Factors for Conversion of LaparoscopicCholecystectomy to Open Surgery: A New Predictive Statistical Model, J of Lap & Adv SurgTechVol. 26, Num 9, 2016.

7. DiBuono, G., Romano, G., Galia, M. et al. Difficult laparoscopiccholecystectomy and preoperativepredictivefactors. SciRep 11, 2559 (2021). https://doi.org/10.1038/s41598-021-81938-6

8. Gupta N, Ranjan G, Arora MP, Goswami B, Chaudhary P, Kapur A, et al. Validation of a scoring system to predict difficult laparoscopiccholecystectomy. Int J Surg 2013; 11(9):1002-1006.

9. ASA Physical Status Classification System, American Society of Anesthesiologists, Approved by the ASA House of Delegates on October 15, 2014, and last amended on December 13, 2020. Available from: https://www.asahq.org/standards-andguidelines/asa-physical-status-classification-system

10. Atmaram DC, Lakshman K. Predictivefactors for conversion of laparoscopiccholecystectomy. Indian J Surg 2011; 73(6):423-426.

11. Vaccari S, Cervellera M, Lauro A, Palazzini G, Cirocchi R, Gjata A, et al. Laparoscopiccholecystectomy: which predictingfactors of conversion? Two Italiancenter's studies. MinervaChir 2020; 75:141-52. DOI: 10.23736/S0026-4733.20.08228-0

12. Radunovic, Miodrag, et al. "Complications of laparoscopic cholecystectomy: our experience from a retrospective analysis." Open access Macedonian journal of medical sciences 4.4 (2016): 641.

13. Kaafarani, Haytham MA, et al. "Trends, outcomes, and predictors of open and conversion to open cholecystectomy in Veterans Health Administration hospitals." The American Journal of Surgery 200.1 (2010): 32-40.

14. Warchałowski, Łukasz, et al. "The analysis of risk factors in the conversion from laparoscopic to open cholecystectomy." International Journal of Environmental Research and Public Health 17.20 (2020): 7571.

15. Güngör B, Bal A, Polat C, ve ark. Laparoskopik kolesistektomide açığa geçiş endikasyonları: Bir üniversite hastanesinin uzun dönem deneyimleri, Ege Journal of Medicine 50 (4): 243-246, 2011.

16. Amin A, Haider M, Aamir I S, et al. (August 20, 2019) Preoperative and Operative Risk Factors for Conversion of Laparoscopic Cholecystectomy to Open Cholecystectomy in Pakistan. Cureus 11(8): e5446.doi:10.7759/cureus.5446)

17. Lipman, Jeremy M., et al. "Preoperative findings predict conversion from laparoscopic to open cholecystectomy." Surgery 142.4 (2007): 556-565.

18. S. Sözen , S. Emir and İ. Bali , "Laparoskopik Kolesistektomiden Açık Ameliyata Geçme Nedenleri", International Journal of Basic and Clinical Medicine, vol. 2, no. 1, pp. 8-13, Oct. 2015

19. Kwon YH, Cho CM, Jung MK, Kim SG, Yoon YK. Risk factors of open converted cholecystectomy for cholelithiasis after endoscopicremoval of choledocholithiasis. DigDisSci 2015; 60(2):550-556.

20. Bourgouin S, Mancini J, Monchal T, et al. How to predıctdıfficultlaparoscopıc cholecystectomy? Proposal for a sımplepreoperatıvescorıng system.Am J Surg 2016 Nov 1; 212(5):873-881.

Rosen M, Brody F, Ponsky J, Predictive factors for conversion of laparoscopic cholecystectomy, The American Journal of Surgery 184 (2002) 254–258 Licciardello, A., Arena, M., Nicosia, A., DiStefano, B., Cali, G., Arena, G., &Minutolo, V. (2014). Preoperative risk factors for conversion from laparoscopic to open cholecystectomy. EurRevMedPharmacolSci, 18(2 Suppl), 60-8.