LESS

Original Article

Laparosc Endosc Surg Sci 2025;32(4):234-239
DOI: 10.14744/less.2025.24022

Preoperative ultrasonographic predictors of conversion from laparoscopic to open cholecystectomy

Yunus Yaşar,[1] Mustafa Demir,[1] Muhammed Taha Demirpolat,[2] Hüseyin Kerem Tolan[2]

[1]Department of Radiology, University of Health Sciences, Ümraniye Training and Research Hospital, İstanbul, Türkiye
[2]Department of General Surgery, University of Health Sciences, Ümraniye Training and Research Hospital, İstanbul, Türkiye

ABSTRACT

Introduction: Laparoscopic cholecystectomy (LC) is the gold standard for treating symptomatic gallbladder disease. However, conversion to open cholecystectomy (OC) is sometimes necessary and is associated with increased morbidity and healthcare costs. Identifying preoperative predictors of conversion is crucial for surgical planning and patient counseling. This study aimed to describe the preoperative radiological features in a series of patients who required conversion from LC to OC.

Materials and Methods: We conducted a retrospective, single-center descriptive study at a tertiary training and research hospital. All patients (n=104) who underwent conversion from LC to OC between January 2020 and May 2025 were included. Preoperative ultrasonography (USG) findings, along with demographic, clinical, and intraoperative data, were systematically analyzed.

Results: The most prevalent preoperative radiological findings were a hydropic gallbladder, identified in 59 patients (56.7%), gallbladder wall thickening (>4 mm) observed in 68 patients (65.4%), and pericholecystic fluid, observed in 55 patients (52.9%). The primary intraoperative reason for conversion was dense adhesions, reported in 62 patients (59.6%).

Conclusions: Preoperative USG findings of a hydropic gallbladder and pericholecystic fluid are common in patients requiring conversion to OC and serve as important "warning signs" for a difficult procedure. These features, indicative of severe inflammation leading to adhesions, should prompt careful preoperative planning, patient counseling, and consideration of safe bailout strategies to maximize patient safety.

Keywords: Conversion, laparoscopic cholecystectomy, open cholecystectomy, ultrasonography

Received: 22.09.2025 **Revision:** 26.12.2025 **Accepted:** 30.12.2025

Correspondence: Yunus Yaşar M.D., Department of Radiology, University of Health Sciences, Ümraniye Training and Research Hospital, İstanbul, Türkiye
e-mail: dryunusysr@gmail.com

Introduction

Laparoscopic cholecystectomy (LC) is firmly established as the gold standard surgical treatment for symptomatic cholelithiasis.[1] Its widespread adoption is due to well-documented advantages over traditional open cholecystectomy (OC), including reduced postoperative pain, shorter hospital stays, a faster return to daily activities, and improved cosmetic outcomes.[1,2] Consequently, a vast majority of cholecystectomies today are initiated via this minimally invasive approach.[3]

Despite its high success rate, conversion to an open procedure remains a critical intraoperative decision in a subset of patients. The reported rate of conversion varies in the literature, generally ranging from 1% to 15%.[3,4] Conversion is not considered a complication but rather an exercise of surgical judgment to ensure patient safety, often prompted by severe inflammation, dense adhesions, or unclear anatomy in the Calot's triangle.[5] Nevertheless, conversion is associated with increased operative time, higher postoperative morbidity, prolonged hospitalization, and higher healthcare costs.[2]

To mitigate these outcomes, extensive research has focused on identifying preoperative risk factors. Established clinical predictors include advanced age, male gender, obesity (BMI >30), a diagnosis of acute cholecystitis, and a history of previous upper abdominal surgery.[6–8]

In addition to clinical parameters, ultrasonography (USG) findings have emerged as crucial predictors. Thickened gallbladder wall (>4 mm), pericholecystic fluid, impacted stone at the gallbladder neck, and a dilated common bile duct (CBD) are strongly associated with difficult dissection and increased probability of conversion.[9] A systematic review confirmed wall thickness as one of the most significant predictors of a difficult cholecystectomy.[4]

Therefore, this study aimed to describe the preoperative radiological findings in patients requiring conversion from laparoscopic to open cholecystectomy at our institution.

Materials and Methods

Study Design

This retrospective descriptive study was conducted at the General Surgery Clinic of a tertiary referral hospital between January 1, 2020, and May 31, 2025. The study population comprised all patients whose laparoscopic cholecystectomy required conversion to open surgery during this period.

Patient Selection

Eligible patients were identified via a systematic review of the hospital's electronic health record system and surgical database. Inclusion criteria were adults (≥18 years) undergoing conversion from laparoscopic to open cholecystectomy with available preoperative imaging. Exclusion criteria included patients younger than 18 years, those with incomplete or missing medical records, patients with preoperative or final histopathological diagnoses of gallbladder cancer, and cases where open cholecystectomy was planned as the primary procedure.

Data Collection and Variables

Using a standardized data extraction form, information was collected from medical records, operative reports, and the hospital's PACS. The collected variables were categorized as follows:

1. Demographic and Clinical Data: Age, sex, ASA (American Society of Anesthesiologists) score, and surgery type (emergency vs. elective).

2. Preoperative Radiological Data: All patients received preoperative abdominal ultrasonography performed by certified radiologists. Reviewed radiological parameters included:

- Gallbladder wall thickness: Maximal thickness at the thickest point.
- Hydropic gallbladder: Defined as short-axis diameter >4 cm and long-axis diameter >8 cm, aligning with published USG criteria.[10]
- Pericholecystic fluid: Noted as present or absent.
- Common bile duct (CBD) diameter: Measured in millimeters.
- Impacted stone: Located at Hartmann's pouch or the gallbladder neck.
- Suspicion of Mirizzi syndrome: Documented when present.

All ultrasonographic examinations were performed by experienced, board-certified radiologists in accordance with standardized institutional imaging protocols. Due to the study's retrospective design, formal interobserver agreement analysis was not performed.

3. Intraoperative Data: Reasons for conversion were extracted from operative reports dictated immediately

post-surgery, describing intraoperative challenges that necessitated open conversion. Although a formal grading system for difficult cholecystectomy was not prospectively applied, the intraoperative reasons for conversion described in operative reports are consistent with established definitions of surgical difficulty outlined in standardized classification systems such as the Tokyo Guidelines 2018 and the Parkland Grading System.[11]

Statistical Analysis

Analyses were performed using SPSS for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were tested for normality using the Shapiro–Wilk test and are reported as mean ± standard deviation (SD) with minimum and maximum values. Categorical variables are presented as counts (n) and percentages (%). Due to the lack of a non-converted control group, only descriptive statistical analyses were performed.

Ethical Approval

The study protocol was reviewed and approved by the Scientific Research Ethics Committee of Ümraniye Training and Research Hospital (No: B.10.1.TKH.4.34.H.GP.0.01/167, Date: 09/05/2025). The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Given the retrospective design, the ethics committee waived the requirement for individual informed consent.

Results

Patient Demographics and Clinical Characteristics

A total of 104 patients who required conversion from laparoscopic to open cholecystectomy were included in the analysis. The mean age was 57.0±14.1 years (range: 18–85 years). Of these, 67 patients (64.4%) were male, and 36 (34.6%) were female. About surgical timing, 41 procedures (39.4%) were performed on an emergency basis, whereas 62 (59.6%) were elective. The mean ASA score was 1.5±0.7. Body mass index (BMI) data were not available in the dataset (Table 1).

Radiological Findings

Preoperative imaging revealed that the most frequent findings in patients requiring conversion were hydropic gallbladder, gallbladder wall thickening, and pericholecystic fluid. A hydropic gallbladder was observed in 59 patients (56.7%), gallbladder wall thickening greater than 4 mm was present in 68 patients (65.4%), and pericholecystic fluid was seen in 55 patients (52.9%). The mean common bile duct (CBD) diameter was 6.6±2.7 mm (range:

Table 1. Clinical, radiological, and surgical characteristics of conversion patients (n=104)

Category	Parameter	Value
Demographic & Clinical	Age (years, mean ± SD)	57.0±14.1
	Sex (Male, n (%))	67 (64.4)
	Sex (Female, n (%))	36 (34.6)
	Surgery type (Emergency, n (%))	41 (39.4)
	Surgery type (Elective, n (%))	62 (59.6)
	ASA score (mean ± SD)	1.5±0.7
Radiological	Hydropic gallbladder (n, %)	59 (56.7)
	Wall thickness >4 mm (n, %)	68 (65.4)
	Pericholecystic fluid (n, %)	55 (52.9)
	CBD diameter (mm, mean ± SD)	6.6±2.7
	Impacted stone (n, %)	17 (16.3)
	Suspected Mirizzi syndrome (n, %)	3 (2.9)
	Perforated cholecystitis	3 (2.9%)
Surgical Reasons	Dense adhesions (n, %)	~62 (59.6)
	Failure of dissection (n, %)	~17 (16.3)
	Other causes (edema, perforation, fistula, injury, etc.)	each <5%

1.1–15.0 mm). An impacted stone in the Hartmann's pouch or gallbladder neck was detected in 17 patients (16.3%). Suspicion of Mirizzi syndrome was reported in 3 patients (2.9%). Additionally, perforated cholecystitis was diagnosed in 3 patients (2.9%) based on preoperative imaging findings (Table 1) (Fig. 1).

Reasons for Conversion

Analysis of operative notes demonstrated that the leading cause of conversion was dense adhesions, reported in approximately 62 patients (59.6%). Inability to achieve adequate exposure or safe dissection was the second most common reason, observed in 17 patients (16.3%). Other less frequent causes included tissue edema and severe inflammation (4–5%), gallbladder perforation (~3%), suspected cholecystoenteric fistula (2%), and bile duct or vascular injury (2%). Rarely, conversion was necessitated by anatomical variations, suspected gallbladder mass, or intraoperative equipment failure, each accounting for approximately 1% of cases (Table 1).

Discussion

This study described the clinical and radiological profile of patients who required conversion from laparoscopic to open cholecystectomy. The most frequent preoperative radiological signs were gallbladder wall thickening, a hydropic gallbladder, and pericholecystic fluid, correlating with the leading intraoperative cause of conversion: Dense adhesions.

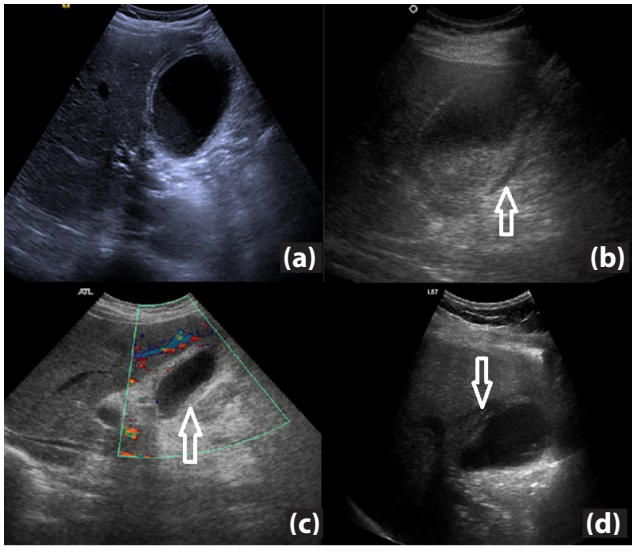

Figure 1. Representative preoperative ultrasound images of patients converted from laparoscopic to open cholecystectomy. Panels show a hydropic gallbladder with echogenic sludge **(a)**, a hydropic gallbladder with pericholecystic fluid collection (arrow) **(b)**, diffuse gallbladder wall thickening greater than 4 mm (arrow) **(c)**, and a perforated gallbladder with focal discontinuity of the anterior wall and adjacent fluid collection (arrow) **(d)**.

Gallbladder wall thickening (65.4%), hydropic gallbladder (56.7%), and pericholecystic fluid (52.9%) were highly prevalent, all indicators of significant inflammation.[9,12] Pericholecystic fluid is a reliable sign of acute cholecystitis and consistently predicts a difficult dissection and conversion.[9,13] A hydropic gallbladder, caused by prolonged cystic duct obstruction, leads to distension and inflammation, complicating dissection.[14] Our results also confirm that marked gallbladder wall thickening is frequently encountered in these patients, further supporting its role as a predictor of challenging surgery. Our findings align with previous studies highlighting these sonographic features as predictors of a difficult LC.[15,16]

Intraoperatively, dense adhesions (59.6%) were the leading cause of conversion, consistent with literature linking inflammation to obscured anatomy and surgical risk.[5,6] The correlation between preoperative USG (wall thickening, hydrops, fluid) and intraoperative findings supports the predictive value of imaging.

Additionally, three patients (2.9%) had perforated cholecystitis on preoperative imaging. Perforation is a well-known marker of severe inflammation and correlates with a high likelihood of conversion to open surgery. Its presence underscores the need for early recognition and surgical preparedness, as these cases carry an elevated risk of complications and challenging dissection.

Male predominance (64.4%) was evident, as often reported[7,8], likely due to later presentation with advanced disease.[8,15] Mean CBD diameter (6.6±2.7 mm) was at the upper standard limit, suggesting chronic inflammation or intermittent obstruction.[17]

Ashfaq et al.[18] also emphasized that no single finding is absolute, and difficult cases usually present with a constellation of signs. Our data support this observation, as wall thickening, hydrops, and pericholecystic fluid were frequently observed together in patients who required conversion. This highlights the importance of integrating multiple sonographic findings rather than relying on a single predictor for preoperative risk assessment.[12,19]

These predictors have clinical implications. Identifying high-risk patients preoperatively enables better planning,

including the involvement of experienced surgical staff and effective patient counseling. When difficult dissection is anticipated, safe bailout options such as subtotal cholecystectomy should be considered.[20,21]

Limitations include a retrospective, single-center design and the absence of a non-conversion control group, restricting causal inference. Additionally, body mass index (BMI) data were unavailable in our dataset, which precluded assessing obesity as a potential contributor to conversion from laparoscopic to open cholecystectomy.

Conclusion

In conclusion, this study demonstrates that patients who require conversion from laparoscopic to open cholecystectomy frequently present with distinct preoperative ultrasound findings, including gallbladder wall thickening, hydropic gallbladder, and pericholecystic fluid. These features appear to be strong indicators of the severe inflammation that leads to dense intraoperative adhesions—the primary driver for conversion in our series. Perforated cholecystitis, although less frequent, was also observed and represents a critical preoperative "red flag." Surgeons should recognize these radiological "warning signs" as reliable predictors of a difficult dissection. Preoperative awareness of these findings is crucial for optimizing surgical planning, enhancing patient counseling, and improving intraoperative decision-making to maximize patient safety and surgical outcomes.

Disclosures

Ethics Committee Approval: The study protocol was reviewed and approved by the Scientific Research Ethics Committee of Ümraniye Training and Research Hospital (No: B.10.1.TKH.4.34.H.GP.0.01/167, Date: 09/05/2025).

Peer-review: Externally peer-reviewed.

Conflict of Interest: None

Funding: None

Authorship Contributions: Concept – Y.Y., M.D.; Design – Y.Y., M.D.; Supervision – Y.Y., H.K.T.; Materials – M.T.D., H.K.T.; Data Collection – Y.Y., M.D.; Analysis and/or interpretation – Y.Y., M.T.D.; Literature Search – Y.Y., M.D.; Writing – Y.Y., M.D.; Critical Review – M.T.D., H.K.T.

References

1. Keus F, de Jong J, Gooszen HG, Laarhoven CJ. Laparoscopic versus open cholecystectomy for patients with symptomatic cholecystolithiasis. Cochrane Database of Syst Rev 2006;4:CD006231.
2. Coccolini F, Catena F, Pisano M, Gheza F, Fagiuoli S, Di Saverio S, et al. Open versus laparoscopic cholecystectomy in acute cholecystitis. Systematic review and meta-analysis. Int J Surg 2015;18:196–204.
3. Sakpal SV, Bindra SS, Chamberlain RS. Laparoscopic cholecystectomy conversion rates two decades later. JSLS 2010;14(4):476–83.
4. Philip Rothman J, Burcharth J, Pommergaard HC, Viereck S, Rosenberg J. Preoperative risk factors for conversion of laparoscopic cholecystectomy to open surgery - A systematic review and meta-analysis of observational studies. Dig Surg 2016;33(5):414–23.
5. Hussain A. Difficult laparoscopic cholecystectomy. Surg Laparosc Endosc Percutan Tech 2011;21(4):211–7.
6. Warchałowski Ł, Łuszczki E, Bartosiewicz A, Dereń K, Warchałowska M, Oleksy Ł, et al. The analysis of risk factors in the conversion from laparoscopic to open cholecystectomy. Int J Environ Res Public Health 2020;17(20):7571.
7. Al-Mulhim A. Male gender is not a risk factor for the outcome of laparoscopic cholecystectomy: A single surgeon experience. Saudi J Gastroenterol 2008;14(2):73.
8. Sapmaz A, Serdar Karaca A. Risk factors for conversion to open surgery in laparoscopic cholecystectomy: A single center experience. Turk J Surg 2021;37(1):28–32.
9. Daradkeh SS, Suwan Z, Abu-Khalaf M. Preoperative ultrasonography and prediction of technical difficulties during laparoscopic cholecystectomy. World J Surg 1998;22(1):75–7.
10. Mencarini L, Vestito A, Zagari RM, Montagnani M. New developments in the ultrasonography diagnosis of gallbladder diseases. Gastroenterol Insight 2024;15(1):42–68.
11. Yokoe M, Hata J, Takada T, Strasberg SM, Asbun HJ, Wakabayashi G, et al. Tokyo guidelines 2018: Diagnostic criteria and severity grading of acute cholecystitis (with videos). J Hepatobiliary Pancreat Sci 2018;25(1):41–54.
12. Agrawal N, Singh S, Khichy S. Preoperative prediction of difficult laparoscopic cholecystectomy: A scoring method. Niger J Surg 2015;21(2):130.
13. Borzellino G, Massimiliano Motton A, Minniti F, Montemezzi S, Tomezzoli A, Genna M. Sonographic diagnosis of acute cholecystitis in patients with symptomatic gallstones. J Clin Ultrasound 2016;44(3):152–8.
14. Sharma R, Stead TS, Aleksandrovskiy I, Amatea J, Ganti L. Gallbladder Hydrops. Cureus 2021;13(9):e18159.
15. Al Masri S, Shaib Y, Edelbi M, Tamim H, Jamali F, Batley N, et al. Predicting conversion from laparoscopic to open cholecystectomy: A single institution retrospective study. World J Surg 2018;42(8):2373–82.
16. Badawy A, Samer B, Sabra T. Analysis of the sonographic predictors of difficult laparoscopic cholecystectomy in symptomatic cholelithiasis. Asian J Endosc Surg 2024;17(2):e13300.
17. Park JS, Lee DH, Jeong S, Cho SG. Determination of diameter and angulation of the normal common bile duct using multidetector computed tomography. Gut Liver 2009;3(4):306–10.

18. Ashfaq A, Ahmadieh K, Shah AA, Chapital AB, Harold KL, Johnson DJ. The difficult gall bladder: Outcomes following laparoscopic cholecystectomy and the need for open conversion. Am J Surg 2016;212(6):1261–4.
19. Ochoa-Ortiz LI, Cervantes-Pérez E, Ramírez-Ochoa S, Gonzalez-Ojeda A, Fuentes-Orozco C, Aguirre-Olmedo I, et al. Risk factors and prevalence associated with conversion of laparoscopic cholecystectomy to open cholecystectomy: A tertiary care hospital experience in Western Mexico. Cureus 2023;15(9):e45720.
20. Sugrue M, Coccolini F, Bucholc M, Johnston A. Intra-operative gallbladder scoring predicts conversion of laparoscopic to open cholecystectomy: An WSES prospective collaborative study. World J Emerg Surg 2019;14(1):12.
21. Ramírez-Giraldo C, Monroy DC, Isaza-Restrepo A, Ayala D, González-Tamayo J, Vargas-Patiño AM, et al. Subtotal laparoscopic cholecystectomy versus conversion to open as a bailout procedure: A cohort study. Surg Endosc 2024;38(9):4965–75.