E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/16.01.573

**Research Article**

# Anatomical Challenges Associated With Conversion of Laparoscopic Cholecystectomy to Open Surgery

**Tahira Mehreen[1], Saira Mahmood[2*], Malik Muhammad Wasif Khalid[3], Kanwar Mueez Ali[4], Fasih Ur Rehman[5], Khalid Shehzad[6]**

[1]Pakistan Health Services Authority, Peshawar, Pakistan.

[2*]Assistant Professor, Department of General Surgery, Rawal Institute of Health Sciences, Islamabad, Pakistan.

[3,5]House Officer, Department of General Surgery, Rawal Institute of Health Sciences, Islamabad, Pakistan.

[4]Post Graduate Student (MPhil Anatomy), Department of Anatomy, Al-Nafees Medical College, Isra University, Islamabad, Pakistan.

[6]Lecturer, Department of Anatomy and Histology, College of Medicine, Qassim University, Kingdom of Saudi Arabia.

**Corresponding Author:** Saira Mahmood

Assistant Professor, Department of General Surgery, Rawal Institute of Health Sciences, Islamabad, Pakistan.

**Email:** drsairan@yahoo.com

Received: 16.03.2026, Revised: 24.05.2026, Accepted: 03.06.2026

**ABSTRACT**

**Background:** Laparoscopic cholecystectomy is the recommended surgery for symptomatic gallstone disease and cholecystitis, due to diminished postoperative pain, reduced hospital stay and quicker recovery. But, if anatomical distortion, inflammation, or adhesions or unclear biliary anatomy is present, laparoscopic dissection may be impossible, and conversion to open cholecystectomy may be necessary.

**Objective:** To determine the anatomical factors associated with conversion from laparoscopic to open cholecystectomy among patients undergoing cholecystectomy.

**Methods:** The descriptive cross sectional study was carried out in the department of surgery at Rawal Institute of Health Sciences, Islamabad from January 2025 to January 2026. Through non-probability consecutive sampling, 72 patients who were given a diagnosis of symptomatic gallbladder disease and were undergoing laparoscopic cholecystectomy were included. Data on a structured proforma were collected on the following: demographic data, clinical presentation, ultrasound data, and anatomical factors during surgery, conversion status, and postoperative outcomes. The patients were divided into a completed laparoscopic surgery group and a converted open surgery group. The data were analyzed on SPSS version 25. Analyses of a categorical variable were conducted using the chi-square (or Fisher's exact) test, and analyses of continuous variables were conducted using the independent sample t-test. A P value of $< 0.05$ was defined as statistically significant.

**Results:** Out of 72 patients, laparoscopic cholecystectomy was completed successfully in 61 (84.7%) patients, while 11 (15.3%) required conversion to open surgery. Dense adhesions were observed in 72.7% of converted cases compared with 19.7% of completed laparoscopic cases. Other significant anatomical factors included frozen Calot's triangle, difficult identification of the cystic duct and artery, impacted Hartmann's pouch stone, contracted or fibrosed gallbladder, empyema, gangrenous gallbladder, bleeding from the cystic artery or liver bed, and failure to achieve the critical view of safety. The converted group also had longer operative time and hospital stay.

**Conclusion:** Conversion from laparoscopic to open cholecystectomy was mainly associated with difficult anatomy and inflammatory distortion around the gallbladder and Calot's triangle. Dense adhesions, frozen Calot's triangle, impacted Hartmann's pouch stone, contracted gallbladder, and failure to achieve the critical view of safety were the most important factors. Early conversion should be considered a safe surgical decision when laparoscopic dissection becomes hazardous.

**Keywords:** Laparoscopic Cholecystectomy, Open Cholecystectomy, Conversion, Calot's Triangle, Dense Adhesions, Gallbladder, Critical View of Safety.

## INTRODUCTION

Gallstone disease is a common problem of the biliary tract and is a common surgical admission worldwide. The most common clinical features of symptomatic cholelithiasis and cholecystitis are right upper quadrant abdominal pain, nausea, vomiting, dyspepsia, fever, and recurrent biliary colic. If symptoms recur or they are complicated by inflammation, laparoscopic cholecystectomy is recommended as the preferred surgical procedure. It is replacing the classical open cholecystectomy in most clinical scenarios due to its improved cosmetic outcomes, reduced postoperative pain, decreased length of hospital stay, early mobilization and quicker return to normal activities (1-3).

Even with these benefits, however, in certain patients these anatomical variations, chronic inflammation, dense adhesions, distorted Calot's triangle, empyema, gangrene and impacted stones at the neck of the gallbladder can make laparoscopic cholecystectomy difficult. In these instances, the usual relationship of the cystic duct, cystic artery, common hepatic duct, common bile duct and gall bladder can be confused. If safe dissection is not possible, open cholecystectomy may need to be performed. It is not laparoscopy failure but a simple precaution to avoid severe laparoscopy complications like bile duct damage, uncontrolled bleeding, bowel damage, and vascular damage (4-6).

Laparoscopic cholecystectomy is a difficult procedure because of anatomical factors. The key operative area is Calot's triangle in which the cystic duct and cystic artery can be located and then be clipped and divided. The region may be hidden and make it difficult to visualize the biliary structures because of other complications such as inflammation, fibrosis, edema, adhesions, and impacted stones. Another complication that may result from repeated attacks of cholecystitis is the development of dense adhesions around the gallbladder that can make traction, dissection and separation from the liver bed difficult. Likewise, it can be challenging to grasp a contracted or fibrosed gallbladder and bleeding may be more likely during dissection of an intrahepatic gallbladder (6-8).

One of the most important safety principles in laparoscopic cholecystectomy is the achievement of the critical view of safety. This involves complete clearance of hepatocystic triangle, separation of the lower portion of the gallbladder from the lower portion of the liver bed, and confirmation that there are only two structures entering the gallbladder before it is divided, namely the cystic duct and the cystic artery. This is also challenging to obtain and is highly correlated with the risk of biliary injury if it is not achieved. If this can't be accomplished because of inflammation or anatomical deformity, the surgeon might opt for subtotal cholecystectomy, fundus-first dissection or conversion to open surgery (9, 10).

Preoperative ultrasound may be helpful to identify a patient who has a high risk for difficult laparoscopic cholecystectomy. Thickening of the gallbladder wall, contraction of the gallbladder, pericholecystic fluid, impacted stone in Hartmann's pouch and dilated common bile duct may be associated with inflammation and/or with a change in the biliary anatomy. Many anatomical challenges will only be uncovered at the time of surgery, however. So it is important to make a correct decision during the operation: to proceed laparoscopically or switched to laparotomy (11, 12).

The conversion rates from laparoscopy to laparotomy for cholecystectomy vary in different studies due to differences in patient selection, timing of surgery, severity of cholecystitis, surgeon experience, and institutional protocols. Several studies report that male gender, older age, obesity, acute cholecystitis, gallbladder wall thickening, previous abdominal surgery, adhesions, unclear Calot's triangle anatomy and impacted stones are associated with increased conversion rates. The most direct causes, however, are typically anatomical and inflammatory in nature and are seen during surgery (13).

Gall bladder disease is very common in surgical practice in Pakistan; laparoscopic cholecystectomy routinely performed in the public and private hospitals. Local data is still relevant in relation to anatomical factors which contribute to conversion, however, as patient presentation, disease chronicity, resources for early surgery and operative resources may differ between settings. Knowing common anatomical predictors of conversion will result in better pre-operative counselling, operative planning, preparedness for the difficult case and minimise avoidable complications (14).

Therefore, the present study was conducted to determine the anatomical factors associated with conversion from laparoscopic to open cholecystectomy among patients undergoing

surgery at Rawal Institute of Health Sciences, Islamabad. The study focused on intraoperative factors such as dense adhesions, frozen Calot's triangle, difficult cystic duct and artery identification, impacted Hartmann's pouch stone, contracted or fibrosed gallbladder, empyema, gangrenous gallbladder, bleeding, and failure to achieve the critical view of safety. The findings may help improve surgical decision-making and patient safety during laparoscopic cholecystectomy.

## METHODOLOGY

This study was designed as a descriptive cross-sectional study to determine the anatomical factors associated with conversion from laparoscopic to open cholecystectomy. The study was conducted at the Department of Surgery, Rawal Institute of Health Sciences, Islamabad, from January 2025 to January 2026. A total of 72 patients undergoing laparoscopic cholecystectomy for symptomatic gallstone disease or cholecystitis were included in the study. The purpose of the study was to identify preoperative and intraoperative anatomical findings that contributed to difficulty during laparoscopic cholecystectomy and resulted in conversion to open surgery.

The patients were collected by non-probabilistic consecutive sampling technique. All the patients who met the inclusion criteria throughout the study period were recruited up to the target sample of 72. Patients were included who were aged 18 years or older, and were planned for elective or emergency laparoscopic cholecystectomy due to symptoms of cholelithiasis, acute cholecystitis, chronic cholecystitis, mucocele or empyema of the gall bladder. Patients with clinical and/or operative data incomplete, patients with severe coagulopathy, patients already planned for open cholecystectomy, and patients who were not fit for general anesthesia or had been suspected of having gallbladder malignancy were excluded from the study.

A detailed demographic and clinical data of the patients was collected before surgery, including age, gender, BMI, presenting symptoms, duration of symptoms, history of fever, history of nausea, vomiting, jaundice, previous history of attacks of biliary colic, previous admission to hospital for cholecystitis, previous abdominal surgery and comorbidities including diabetes mellitus and hypertension. Preoperatively, gallbladder wall thickness, number and size of stones, contracted or distended gallbladder, impacted stone at Hartmann's pouch, pericholecystic fluid, and common bile duct dilatation were also noted. These findings were utilized to determine the potential to be anatomical difficulties prior to surgery.

Surgical team performed laparoscopic cholecystectomy under general anesthesia with the traditional 4-port approach in all patients. Intraoperative findings were carefully recorded on a structured proforma. The main anatomical abnormalities evaluated at the time of surgery were dense adhesions around the gallbladder, frozen Calot's triangle, inability to clearly visualize the cystic duct and cystic artery, short or wide cystic duct, impacted stone at Hartmann's pouch, contracted or fibrosed gallbladder, intrahepatic gallbladder, empyema, gangrenous gallbladder, Mirizzi syndrome, bleeding from the cystic artery or liver bed, gallbladder perforation, and failure to achieve the critical view of safety. Conversion to open cholecystectomy was considered to be any case where the laparoscopy was discontinued and performed through an open right subcostal or appropriate abdominal incision.

When the laparoscopy method was not seen as a safe alternative, the surgeon decided to switch to an open cholecystectomy. Conversion was not deemed a complication but was seen as a safeguard against major bile duct injury, uncontrolled bleeding or injury to surrounding structures. In each instance the reason for the conversion was documented; these included dense adhesions, inability to gain critical view of safety, empyema, gangrenous gall bladder, bleeding or impacted stone of the Hartmann's pouch.

Information pertaining to postoperative period such as operative time, placement of a drain, hospital stay, fever, wound infection, bile leak, bleeding, re-exploration, mortality were also collected. Patients were subdivided into two groups for analysis: patients who successfully completed laparoscopic cholecystectomy and patients who needed conversion to open cholecystectomy. The two groups were compared on the basis of anatomical factors to determine variables having significant association with conversion.

The data were coded and analyzed in SPSS version 25. The mean and SD were used to present quantitative variables like age, BMI, operative time, and hospital stay. The qualitative data (gender, ultrasound findings,

anatomical factors, conversion status, and postoperative complications) were presented as frequency and percentage. Association between the categorical anatomical factors and conversion to open surgery was evaluated with the chi-square test or Fisher's exact test. Continuous variables were compared across the two groups (completed laparoscopic group vs converted group) using independent sample t-test. A p value <0.05 was deemed significant.

## RESULTS

In total, 72 patients who received a laparoscopic cholecystectomy were studied. The mean age of the patients was 43.6 ± 12.4 years, with 41–50 years being the highest age group. There were 50 females (69.4%) and 22 males (30.6%) patients, indicating a predominance of female patients. The mean body mass index was 27.1 ± 3.8 kg/m². Fourteen (19.4%) patients had diabetes mellitus, 16 (22.2%) patients had hypertension and 9 (12.5%) patients had previously undergone abdominal surgery.

Table 1. Demographic and Baseline Characteristics of Patients Undergoing Laparoscopic Cholecystectomy

| Variable | Frequency / Mean | Percentage |
|---|---|---|
| Total patients | 72 | 100 |
| Mean age | 43.6 ± 12.4 years | — |
| 20–30 years | 12 | 16.7 |
| 31–40 years | 18 | 25.0 |
| 41–50 years | 24 | 33.3 |
| >50 years | 18 | 25.0 |
| Male | 22 | 30.6 |
| Female | 50 | 69.4 |
| Mean BMI | 27.1 ± 3.8 kg/m² | — |
| Diabetes mellitus | 14 | 19.4 |
| Hypertension | 16 | 22.2 |
| Previous abdominal surgery | 9 | 12.5 |

In 72 patients, a successful laparoscopic cholecystectomy was performed in 61 (84.7%) and open cholecystectomy was performed in 11 (15.3%) patients. The most common ultrasound finding preoperatively was multiple gallstones which was seen in 48 (66.7%) patients. In 26 (36.1%) patients, the gallbladder wall thickness was >3 mm, impacted stone at Hartmann's pouch was noted in 13 (18.1%) patients, contracted gallbladder was noted in 12 (16.7%) patients while in 9 (12.5%) patients pericholecystic fluid was noted.

Table 2. Clinical and Ultrasound Findings among Study Participants

| Variable | Frequency | Percentage |
|---|---|---|
| Right upper quadrant pain | 72 | 100 |
| Fever | 18 | 25.0 |
| Nausea/vomiting | 41 | 56.9 |
| Jaundice | 6 | 8.3 |
| Acute cholecystitis | 24 | 33.3 |
| Chronic cholecystitis | 48 | 66.7 |
| Multiple gallstones | 48 | 66.7 |
| Single gallstone | 24 | 33.3 |
| Gallbladder wall thickness >3 mm | 26 | 36.1 |
| Contracted gallbladder | 12 | 16.7 |
| Distended gallbladder | 10 | 13.9 |
| Pericholecystic fluid | 9 | 12.5 |
| Impacted Hartmann’s pouch stone | 13 | 18.1 |
| Dilated common bile duct | 7 | 9.7 |

There was a significant association between laparoscopic to open cholecystectomy and anatomical difficulty during surgery. Dense adhesions around the gall bladder were noted

in 20 (27.8%) patients, and in the converted group 8/11 (72.7%) vs the completed laparoscopic group 12/61 (19.7%), and there was a significant association (p = 0.001). Frozen Calot's triangle was found in 9 (12.5%) patients and was also significantly more common in the patients who needed conversion (p < 0.001). The difficulty to identify the cystic duct and artery was noted in 10 (13.9%) patients and was significantly associated with conversion (p < 0.001).

Table 3. Anatomical Factors Associated With Conversion from Laparoscopic to Open Cholecystectomy

| Anatomical factor | Completed laparoscopic surgery n=61 | Converted to open surgery n=11 | Total n=72 | p-value |
|---|---|---|---|---|
| Dense adhesions around gallbladder | 12 (19.7%) | 8 (72.7%) | 20 (27.8%) | 0.001 |
| Frozen Calot's triangle | 3 (4.9%) | 6 (54.5%) | 9 (12.5%) | <0.001 |
| Difficult cystic duct/artery identification | 4 (6.6%) | 6 (54.5%) | 10 (13.9%) | <0.001 |
| Short or wide cystic duct | 5 (8.2%) | 3 (27.3%) | 8 (11.1%) | 0.048 |
| Impacted Hartmann's pouch stone | 7 (11.5%) | 6 (54.5%) | 13 (18.1%) | 0.002 |
| Contracted/fibrosed gallbladder | 7 (11.5%) | 5 (45.5%) | 12 (16.7%) | 0.006 |
| Empyema of gallbladder | 4 (6.6%) | 4 (36.4%) | 8 (11.1%) | 0.008 |
| Gangrenous gallbladder | 2 (3.3%) | 3 (27.3%) | 5 (6.9%) | 0.011 |
| Mirizzi syndrome | 1 (1.6%) | 2 (18.2%) | 3 (4.2%) | 0.027 |
| Intrahepatic gallbladder | 2 (3.3%) | 1 (9.1%) | 3 (4.2%) | 0.354 |
| Bleeding from cystic artery/liver bed | 3 (4.9%) | 3 (27.3%) | 6 (8.3%) | 0.022 |
| Failure to achieve critical view of safety | 4 (6.6%) | 7 (63.6%) | 11 (15.3%) | <0.001 |

Failure to clearly define the anatomy of Calot's triangle was the most common reason for conversion, occurring in 7 (63.6%) of the 11 cases converted. These included dense adhesions in 6 (54.5%), impacted Hartmann pouch stone in 5 (45.5%) and bleeding from cystoartery or liver bed in 3 (27.3%) patients. All of them were converted to convert the structure and avoid bile duct injury and any uncontrolled intra-operative complication.

Table 4. Reasons for Conversion to Open Cholecystectomy among Converted Cases

| Reason for conversion | Frequency n=11 | Percentage |
|---|---|---|
| Failure to identify safe Calot's triangle anatomy | 7 | 63.6 |
| Dense adhesions | 6 | 54.5 |
| Impacted stone at Hartmann's pouch | 5 | 45.5 |
| Contracted/fibrosed gallbladder | 4 | 36.4 |
| Empyema or severe inflammation | 4 | 36.4 |
| Bleeding from cystic artery/liver bed | 3 | 27.3 |
| Suspected Mirizzi syndrome | 2 | 18.2 |

Patients converted to open surgery actually had a longer mean operative time than those where the laparoscopy was able to be completed successfully (92.8 ± 18.6 minutes vs. 54.7 ± 14.2 minutes). It also took 4.8 ± 1.3 days for the converted group versus 2.1 ± 0.8 days for the laparoscopic group to stay in the hospital. There were 9 (12.5%) patients with postoperative complications. The frequency of wound infection was higher in the converted group and bile leak was rare and was treated conservatively.

Table 5. Operative and Postoperative Outcomes

| Outcome | Completed laparoscopic surgery n=61 | Converted to open surgery n=11 | p-value |
|---|---|---|---|
| Mean operative time | 54.7 ± 14.2 minutes | 92.8 ± 18.6 minutes | <0.001 |
| Drain placement | 12 (19.7%) | 8 (72.7%) | 0.001 |
| Mean hospital stay | 2.1 ± 0.8 days | 4.8 ± 1.3 days | <0.001 |
| Postoperative fever | 4 (6.6%) | 2 (18.2%) | 0.184 |
| Wound infection | 2 (3.3%) | 3 (27.3%) | 0.011 |
| Bile leak | 1 (1.6%) | 1 (9.1%) | 0.190 |
| Mortality | 0 | 0 | — |

Overall, the conversion rate in this study was 15.3%. Factors that were found to be associated with the conversion significantly were dense adhesions, frozen Calot's triangle, cystic duct and artery being difficult to identify, impacted Hartmann's pouch stone, contracted gallbladder, fibrosed gallbladder, empyema, gangrenous gallbladder, bleeding and failure to reach the critical view of safety. Difficult biliary anatomy and inflammatory changes of Calot's triangle were the primary factors responsible for the conversion from laparoscopic to open cholecystectomy.

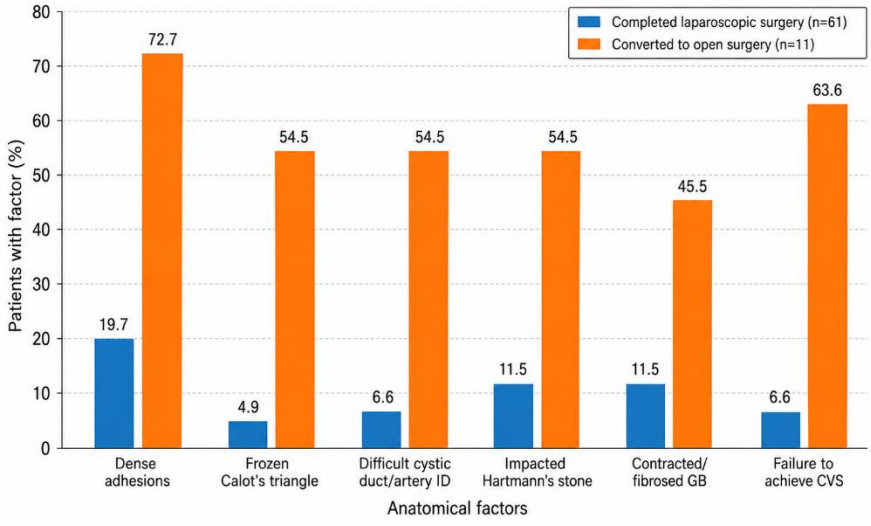


Figure 1. Major Anatomical Factors Associated With Conversion from Laparoscopic to Open Cholecystectomy

The figure shows that dense adhesions, frozen Calot's triangle, difficult identification of cystic duct/artery, impacted Hartmann's pouch stone, contracted/fibrosed gallbladder, and failure to achieve the critical view of safety were more frequent among patients converted to open cholecystectomy compared with patients in whom laparoscopic cholecystectomy was completed successfully.

## DISCUSSION

The present study evaluated anatomical factors associated with conversion from laparoscopic to open cholecystectomy among 72 patients at Rawal Institute of Health Sciences, Islamabad. In this study, laparoscopic cholecystectomy was completed successfully in 61 patients, while 11 patients required conversion to open surgery, giving a conversion rate of 15.3%. This finding shows that although laparoscopic cholecystectomy remains the preferred approach for gallbladder disease, conversion is still required in a selected group of patients when safe dissection cannot be achieved. Previous studies have reported variable conversion

rates depending on patient selection, severity of inflammation, surgeon experience, and operative difficulty, with dense adhesions and unclear anatomy of Calot's triangle repeatedly described as common reasons for conversion (15, 16).

The presence of dense adhesions around the gallbladder was one of the most significant anatomical factors of this current study for conversion. Adhesions were more dense in cases converted than in cases that were successfully completed laparoscopically (72.7% vs. 19.7%). The most frequent cause of adhesions is a history of repeated episodes of acute cholecystitis, inflammation and scarring of the gallbladder. They make it difficult to make a traction and dissection and obscure the gall bladder neck and heighten the chance of bleed or harm to the bile duct. These results were obtained in previous studies, which indicated that the adhesions of the gall bladder and the area around Calot's triangle were among the major causes of conversion from laparoscopy to laparotomy(15, 17).

The other important finding was the considerable correlation between frozen Calot's triangle and the inability to identify cystic duct or cystic artery, as these were all tied to conversion. Frozen calot's triangle (54.5%) and difficult identification of cystic duct and artery (54.5%) were observed in our study. Clinically important findings because correct identification of the cystic duct and cystic artery before clipping and division is needed to have a safe laparoscopic cholecystectomy. If these structures cannot be clearly defined due to inflammation, fibrosis, edema or distortion, the risk of injury to the common bile duct may be increased if the dissection of the laparoscope progresses. At present, the surgical literature focuses on the need to adopt a safer surgical technique if the critical view of safety cannot be obtained, e.g., subtotal cholecystectomy, the "fundus-first" approach or open surgery (18, 19).

In this study, impacted stone in Hartmann's pouch was also found to be much more prevalent among converted cases. A stone in the neck of the gallbladder can cause the junction of the neck and cystic duct to become distorted, lead to inflammatory thickening and could render dissection around Calot's triangle more difficult. This can also occur with Mirizzi syndrome relating to the compression of the common hepatic duct or common bile duct by an impacted stone. In this study, the incidence of Mirizzi syndrome was low and there was a strong relationship between conversion and Mirizzi syndrome. These results corroborate the hypothesis that stones in the neck of the gallbladder or in the Hartmann's pouch should be regarded as a sign of potential problematic laparoscopic cholecystectomy (20).

However, in this study, contracted gb, fibrosed gb and empyema were also significant related to conversion. A contracted gallbladder is generally hard to grasp and retract, and fibrosis makes separation with the liver bed more challenging. Severe inflammation and tissue friability is suggested by the presence of empyema and gangrenous changes and can lead to gallbladder perforation, bleeding, and contamination with bile. Research on challenging laparoscopic cholecystectomy has also shown that increased gallbladder inflammation, thickened gallbladder wall, adhesion, and anatomic difficulty all are associated with an increased risk of conversion (16, 17).

Failure to achieve the critical view of safety was one of the most important operative findings in the converted group. 63.6% of converted patients failed to become the "critical view of safety," 6.6% of the patients with whom the laparoscopic surgery was completed. This discovery should not be seen as a surgical failure, but rather a safe and responsible choice in the face of unclear anatomy. It is commonly accepted that the critical view of safety is a safe technique used in laparoscopic cholecystectomy. If the cystic duct and cystic artery are not readily identifiable, early conversion will minimize the risk of major complications (18, 19).

The converted group also had an increased frequency of wound infection, longer operative time, more drain placement, and longer hospital stay, when compared to the completed laparoscopic group. These results are not surprising as converted cases are typically more complicated, have more inflammation and more manipulation of the operative field. But, in certain tough situations, there is a chance of serious complications like major bile duct damage, heavy bleeding, and damage to other organs. The conversion should therefore be individualized and dependent on safety while operating instead of upon a specific operative time and/or pressure to perform the procedure laparoscopically.

This study confirms the significance of thorough pre-operative evaluation and surgical decision making during the laparoscopic cholecystectomy. Preoperative ultrasound characteristics of a thickened gallbladder wall, impacted stone in Hartmann's pouch, contracted gallbladder and pericholecystic fluid may indicate problems prior to surgery. The final decision to convert is typically made intraoperatively, however, and depends largely on the presence of dense adhesions, frozen Calot's triangle, poor visualization of the cystic duct, bleeding, and lack of the critical view of safety. Adequate identification of high-risk anatomical factors may assist the surgeon to inform patients of the risks before surgery, to guide surgical approach, and to minimize unnecessary postoperative complications.

## CONCLUSION

This study concluded that conversion from laparoscopic to open cholecystectomy was mainly associated with difficult anatomical and inflammatory conditions around the gallbladder and Calot's triangle. The overall conversion rate was 15.3%. The most important factors associated with conversion were dense adhesions, frozen Calot's triangle, difficult identification of the cystic duct and cystic artery, impacted Hartmann's pouch stone, contracted or fibrosed gallbladder, empyema, gangrenous gallbladder, bleeding, and failure to achieve the critical view of safety.

Conversion to open surgery should be considered a safe surgical decision rather than a complication or failure. Early conversion is justified when laparoscopic dissection becomes unsafe, particularly when biliary anatomy is unclear or the risk of bile duct injury is high. Careful preoperative imaging, identification of high-risk cases, experienced surgical judgment, and strict adherence to the critical view of safety can help improve patient outcomes during laparoscopic cholecystectomy.

## REFERENCES

1. 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. 2020;17(20):7571.
2. Magnano San Lio R, Barchitta M, Maugeri A, Quartarone S, Basile G, Agodi AJIJoER, et al. Preoperative risk factors for conversion from laparoscopic to open cholecystectomy: a systematic review and meta-analysis. 2022;20(1):408.
3. Chin X, Arachchige SM, Orbell-Smith J, Wysocki AP, Orbell-Smith JLJC. Preoperative and intraoperative risk factors for conversion of laparoscopic cholecystectomy to open cholecystectomy: a systematic review of 30 studies. 2023;15(10).
4. Morales-Maza J, Rodríguez-Quintero J, Santes O, Aguilar-Frasco J, Romero-Vélez G, García-Ramos ES, et al. Conversion from laparoscopic to open cholecystectomy: Risk factor analysis based on clinical, laboratory, and ultrasound parameters. 2021;86(4):363-9.
5. Özdemir A, Karakaya A, Pergel AJDvKTD. Conversion from laparoscopic cholecystectomy to open surgery: Reasons and possible risks: A single center experience. 2022;39(3):781-5.
6. Sapmaz A, Karaca ASJTJoS. Risk factors for conversion to open surgery in laparoscopic cholecystectomy: a single center experience. 2020;37(1):28.
7. Moger J, Badiger SJISJ. Factors affecting conversion rates in laparoscopic cholecystectomy: a single surgeon study. 2020;7(6):1746.
8. Saeed A, Salim M, Kachhawa DS, Chaudhary RJISJ. Intra-operative factors responsible for conversion of laparoscopic cholecystectomy to open cholecystectomy in a tertiary care center. 2020;7(5):1467-72.
9. López-Espinosa G, Paipilla-Monroy OA, López-Gómez SL, González-Ramírez RSJCG. Risk factors associated with conversion from laparoscopic to open cholecystectomy in a Major Outpatient Surgery Unit over a five-year period. 2021;42(3):191-6.
10. Payá-Llorente C, Domingo-del Pozo C, Gonzálvez-Guardiola P, Santarrufina-Martínez S, Pareja-

Ibars E, Martínez-Pérez AJH. Conversion to open surgery during
11. exploration: predictive factors and impact on the perioperative outcomes. 2022;24(1):87-93.
12. Krishna S, Yalla P, Shenoy RJWJoLS. Factors Affecting Conversion of Laparoscopic Cholecystectomy to Open Surgery in a Tertiary Healthcare Center in India. 2022;15(1):1-7.
13. Ábrahám S, Németh T, Benkő R, Matuz M, Váczi D, Tóth I, et al. Evaluation of the conversion rate as it relates to preoperative risk factors and surgeon experience: a retrospective study of 4013 patients undergoing elective laparoscopic cholecystectomy. 2021;21(1):151.
14. Khakimov M, Karimov R, Sabanovic J, Patel BJHSR. "Intraoperative reasons for conversion of laparoscopic cholecystectomy to open surgery systematic review" systematic review. 2022;4:100035.
15. Salem MMA-H, Salah EM, Abdel-Hady WA, Abdallah ESJTEJoHM. Assessment of risk factors for conversion from laparoscopic cholecystectomy to open cholecystectomy. 2023;91(1):4821-7.
16. Rashid T, Naheed A, Farooq U, Iqbal M, Barakat NJJoAMCA. Conversion of laparoscopic cholecystectomy into open cholecystectomy: an experience in 300 cases. 2016;28(1):116-9.
17. Chin X, Mallika Arachchige S, Orbell-Smith J, Wysocki AP. Preoperative and Intraoperative laparoscopic common bile duct

Risk Factors for Conversion of Laparoscopic Cholecystectomy to Open Cholecystectomy: A Systematic Review of 30 Studies. Cureus. 2023;15(10):e47774 DOI: 10.7759/cureus.47774.
18. Harish Nandagopal J, Janugade HB, Katkar AJAP, Journal P. Exploring Factors Influencing the Transition from Laparoscopic to Open Cholecystectomy. 2023;22:15-7.
19. Alius C, Serban D, Bratu DG, Tribus LC, Vancea G, Stoica PL, et al. When Critical View of Safety Fails: A Practical Perspective on Difficult Laparoscopic Cholecystectomy. Medicina (Kaunas, Lithuania). 2023;59(8)DOI: 10.3390/medicina59081491.
20. Manatakis DK, Antonopoulou M-I, Tasis N, Agalianos C, Tsouknidas I, Korkolis DP, et al. Critical View of Safety in Laparoscopic Cholecystectomy: A Systematic Review of Current Evidence and Future Perspectives. World Journal of Surgery. 2023;47(3):1 DOI: https://doi.org/10.1007/s00268-022-06842-0.
21. Rangel-Olvera G, Alanis-Rivera B, Trejo-Suarez J, Garcia-Martin del Campo JN, Beristain-Hernandez J-LJSE. Intraoperative complexity and risk factors associated with conversion to open surgery during laparoscopic cholecystectomy in eight hospitals in Mexico City. 2022;36(12):9321-8.