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DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY: CLINICAL AND ULTRASOUND PREDICTORS IN MOSUL CITY

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ABSTRACT

Background: Laparoscopic cholecystectomy is the standard surgical treatment for symptomatic gallstone disease; however, some cases are technically difficult because of inflammation, adhesions, distorted Calot's triangle anatomy, thickened gallbladder wall, or impacted stones. Preoperative identification of difficult cases is important for surgical planning and patient safety. **Objectives:** To assess the clinical and ultrasonographic predictors of difficult laparoscopic cholecystectomy among patients with gallstone disease in Mosul City. **Methods:** This prospective observational study was conducted at the Department of General Surgery, Mosul General Hospital, Mosul City, Iraq, from the 1st of February 2025 to the 1st of March 2026. The study included 57 patients with symptomatic gallstone disease who underwent laparoscopic cholecystectomy. Clinical variables, laboratory findings, and preoperative ultrasound findings were recorded. Difficult laparoscopic cholecystectomy was defined by the presence of one or more intraoperative indicators, including operative time more than 60 minutes, dense adhesions, difficult Calot's triangle dissection, gallbladder perforation, significant bleeding, fundus-first approach, subtotal cholecystectomy, or conversion to open surgery. **Results:** Difficult laparoscopic cholecystectomy was reported in 22 patients (38.6%), while 35 patients (61.4%) had non-difficult procedures. Significant clinical predictors included age ≥50 years, male sex, obesity, previous acute cholecystitis, fever, right upper quadrant tenderness, and leukocytosis. Significant ultrasound predictors included gallbladder wall thickness >3 mm, contracted gallbladder, impacted stone at the gallbladder neck or Hartmann's pouch, and pericholecystic fluid. On multivariate analysis, previous acute cholecystitis, leukocytosis, gallbladder wall thickness >3 mm, and impacted stone were independent predictors of difficult laparoscopic cholecystectomy. Conversion to open surgery occurred in 4 patients (7.0%), all within the difficult group. **Conclusions:** Difficult laparoscopic cholecystectomy was relatively common among patients with gallstone disease in this study. Previous acute cholecystitis, leukocytosis, thickened gallbladder wall, and impacted stone at the gallbladder neck or Hartmann's pouch were the strongest predictors. Combined clinical and ultrasonographic assessment is recommended before surgery to improve operative planning, patient counselling, and surgical safety.

KEYWORDS: Difficult laparoscopic cholecystectomy; Gallstones; Mosul; Predictors; Ultrasonography.

1-INTRODUCTION

Gallstone disease is one of the most frequent benign hepatobiliary disorders encountered in general surgical practice. Laparoscopic cholecystectomy has become the standard operative treatment for symptomatic cholelithiasis and acute cholecystitis, because it is associated with less postoperative pain, shorter hospital stay, earlier return to activity, and better cosmetic outcome compared with open surgery. However, despite its routine use, laparoscopic cholecystectomy is not uniformly simple. A proportion of cases become technically difficult because of acute or chronic inflammation, dense adhesions, distorted Calot's triangle anatomy, contracted or fibrotic gallbladder, impacted stones, empyema, gangrene, bleeding, or unclear biliary anatomy. These factors may prolong operative time and increase the risk of gallbladder perforation, bile spillage, subtotal cholecystectomy, conversion to open surgery,

bile duct injury, postoperative complications, and longer hospitalization. Therefore, preoperative identification of patients at risk of difficult laparoscopic cholecystectomy is an important component of safe surgical planning.[1-4]

Difficult laparoscopic cholecystectomy is usually defined according to intraoperative and postoperative indicators such as prolonged operative time, difficult dissection of Calot's triangle, dense pericholecystic adhesions, inability to achieve the critical view of safety, gallbladder perforation, significant bleeding, need for fundus-first dissection, subtotal cholecystectomy, conversion to open cholecystectomy, or postoperative morbidity. The clinical importance of predicting difficulty lies not only in anticipating technical challenges, but also in optimizing operating list allocation, ensuring the availability of experienced surgeons, improving patient counselling regarding the possibility of conversion, and reducing preventable biliary complications. The Tokyo Guidelines 2018 emphasized safe operative strategies for acute cholecystitis, including careful assessment of operative difficulty, adherence to safe dissection principles, and use of bailout procedures when the hepatocystic triangle cannot be safely dissected.[5-6]

Several clinical predictors have been associated with difficult laparoscopic cholecystectomy. Older age, male sex, obesity, diabetes mellitus, recurrent attacks of biliary colic or acute cholecystitis, previous hospitalization for acute cholecystitis, fever, leukocytosis, elevated inflammatory markers, previous upper abdominal surgery, palpable gallbladder, and delayed presentation have all been reported as factors that may increase operative difficulty. These variables reflect either systemic patient-related risk or local inflammatory changes around the gallbladder. Male sex and advanced age are often linked to more severe inflammation and delayed presentation, while obesity and previous abdominal surgery may impair trocar placement, exposure, and dissection. A history of acute cholecystitis is particularly important because repeated inflammatory episodes can lead to fibrosis, adhesions, thickening of the gallbladder wall, and obliteration of normal tissue planes.[1, 3, 7,8]

Ultrasonography remains the first-line imaging modality for gallbladder disease because it is widely available, non-invasive, inexpensive, and effective for detecting gallstones and inflammatory gallbladder changes. In the context of difficult laparoscopic cholecystectomy, ultrasound is not merely diagnostic; it may provide useful preoperative information about the expected technical difficulty of surgery. Reported ultrasonographic predictors include increased gallbladder wall thickness, contracted gallbladder, distended gallbladder, pericholecystic fluid, impacted stone at the neck or Hartmann's pouch, multiple stones, large stones, common bile duct dilatation, and sonographic features suggestive of acute cholecystitis. Among these, gallbladder wall thickness is one of the most consistently reported predictors, as it reflects edema, acute inflammation, chronic fibrosis, or repeated attacks, all of which may make grasping, traction, and Calot's triangle dissection more difficult.[2, 4, 9,10]

Recent studies have continued to support the value of combining clinical and ultrasound parameters in predicting operative difficulty. Bhandari et al. reported that male sex, previous acute cholecystitis, increased gallbladder wall thickness, fibrotic gallbladder, and adhesions around Calot's triangle were significantly associated with difficult laparoscopic cholecystectomy. Saad et al. found that preoperative clinical and radiological variables could help stratify patients before surgery and improve operative preparedness. More recent reports have also highlighted gallbladder wall thickness, gallbladder size, impacted stones, contracted gallbladder, and pericholecystic fluid as relevant predictors of difficult dissection or conversion. These findings support the use of a structured preoperative assessment model rather than relying on surgeon expectation alone.[1, 2, 7, 9]

In Mosul City, gallstone disease represents a common indication for elective and emergency general surgical admission. However, local data regarding the predictors of difficult laparoscopic cholecystectomy remain limited. Studying this issue in Mosul is clinically relevant because patient presentation patterns, timing of referral, availability of early surgery, operative workload, and local hospital resources may differ from those reported in other regions. A local assessment of clinical and ultrasound predictors can help surgeons identify high-risk patients before operation, improve counselling, select appropriate surgical expertise, reduce unexpected conversion, and enhance patient safety. Therefore, the present study is designed to evaluate the clinical and ultrasonographic predictors of difficult laparoscopic cholecystectomy among patients with gallstone disease in Mosul City.

2-PATIENTS AND METHODS

Ethical approval was obtained from Nineveh Directorate of Health ethical committee before data collection. Verbal or written informed consent was obtained from all participants before inclusion in the study. Patient confidentiality was maintained throughout the study by using anonymous data collection forms, and all collected information was used only for scientific research purposes. This prospective observational study was conducted at the Department of General Surgery, Mosul General Hospital, Mosul City, Iraq, during the period from the 1st of February 2025 to the 1st of March 2026. The study included 57 patients diagnosed with symptomatic gallstone disease and scheduled for laparoscopic cholecystectomy during the study period. All patients were evaluated clinically and by preoperative abdominal ultrasonography before surgery.

Patients of both sexes and adult age groups who had symptomatic cholelithiasis, chronic calculous cholecystitis, or acute cholecystitis and underwent laparoscopic cholecystectomy were included in the study. Patients were excluded if they had gallbladder malignancy, obstructive jaundice requiring preoperative endoscopic intervention, previous open upper abdominal surgery, conversion planned before starting laparoscopy, severe cardiopulmonary disease contraindicating pneumoperitoneum, or incomplete clinical, ultrasound, or operative data.

The study included children under the age of two years who visited the selected health facilities during the study period. Children with congenital abnormalities, chronic systemic diseases, severe malnutrition, or any medical condition that could influence feeding behavior or increase susceptibility to recurrent infections were excluded.

Preoperative data were collected using a structured data collection form. Clinical variables included age, sex, body mass index, history of recurrent biliary pain, previous attacks of acute cholecystitis, diabetes mellitus, previous abdominal surgery, duration of symptoms, fever, right upper quadrant tenderness, and laboratory findings when available, including total leukocyte count and liver function tests. Moreover, ultrasound variables included gallbladder wall thickness, gallbladder distension or contraction, number and size of stones, impacted stone at the gallbladder neck or Hartmann's pouch, pericholecystic fluid, common bile duct diameter, and any associated biliary abnormality.

All operations were performed under general anesthesia using the standard laparoscopic cholecystectomy technique. Pneumoperitoneum was established, and ports were inserted according to the surgeon's preference and patient condition. Intraoperative findings were recorded, including adhesions around the gallbladder, difficulty in grasping the gallbladder, difficulty in dissecting Calot's triangle, gallbladder wall thickness or fibrosis, gallbladder perforation, bile or stone spillage, bleeding, use of fundus-first approach, subtotal cholecystectomy, operative time, and conversion to open cholecystectomy. Postoperative data included early complications, duration of hospital stay, and need for reintervention or readmission when present.

The primary outcome of the study was difficult laparoscopic cholecystectomy. A case was considered difficult when one or more of the following criteria were present: operative time more than 60 minutes, dense adhesions around the gallbladder or Calot's triangle, difficult dissection of Calot's triangle, gallbladder perforation with bile or stone spillage, significant intraoperative bleeding, need for fundus-first dissection, subtotal cholecystectomy, or conversion to open surgery. Cases without these findings were classified as non-difficult laparoscopic cholecystectomy.

Data were analyzed statistically using the Statistical Package for the Social Sciences. Categorical variables were presented as frequencies and percentages, while continuous variables were presented as mean and standard deviation. The chi-square test or Fisher's exact test was used to assess the association between categorical variables and difficult laparoscopic cholecystectomy. The independent sample t-test was used for comparison of continuous variables when normally distributed. A p-value of less than 0.05 was considered statistically significant.

3-RESULTS

A total of 57 patients with symptomatic gallstone disease underwent laparoscopic cholecystectomy. Difficult laparoscopic cholecystectomy was reported in 22 patients (38.6%), while 35 patients (61.4%) had non-difficult procedures. Most patients were females, representing 70.2% of the study sample. The largest age group was 40–49 years, accounting for 28.1% of patients. Regarding body mass index, 43.9% were overweight and 31.6% were obese.

Table 1: Demographic characteristics of the studied patients.

Variable	No.	%
Age group / years		
<30	7	12.3
30–39	12	21.1
40–49	16	28.1
50–59	13	22.8
≥60	9	15.8
Gender		
Male	17	29.8
Female	40	70.2
BMI category		
Normal weight	14	24.6
Overweight	25	43.9
Obese	18	31.6
Total	57	100.0

The most frequent clinical finding was recurrent biliary colic, reported in 68.4% of patients, followed by right upper quadrant tenderness in 63.2%. A previous attack of acute cholecystitis was present in 42.1%, while leukocytosis was found in 31.6%.

Table 2: Clinical characteristics of the studied patients.

Clinical variable	No.	%
Recurrent biliary colic	39	68.4
Previous attack of acute cholecystitis	24	42.1
Diabetes mellitus	13	22.8
Previous abdominal surgery	11	19.3
Fever at presentation	10	17.5
Right upper quadrant tenderness	36	63.2
Leukocytosis	18	31.6
Abnormal liver function tests	9	15.8

Multiple gallstones were detected in 61.4% of patients. Gallbladder wall thickness greater than 3 mm was found in 45.6%, impacted stone at the gallbladder neck or Hartmann's pouch in 31.6%, and contracted gallbladder in 26.3%.

Table 3: Preoperative ultrasound findings among the studied patients.

Ultrasound finding	No.	%
Multiple gallstones	35	61.4
Single gallstone	22	38.6
Gallbladder wall thickness >3 mm	26	45.6
Contracted gallbladder	15	26.3
Distended gallbladder	12	21.1
Impacted stone at neck/Hartmann's pouch	18	31.6
Pericholecystic fluid	11	19.3
Common bile duct dilatation	7	12.3

Dense adhesions around the gallbladder were observed in 40.4% of patients, while difficult Calot's triangle dissection was recorded in 36.8%. Conversion to open cholecystectomy occurred in 4 patients (7.0%), and postoperative complications were reported in 6 patients (10.5%).

Table 4: Operative findings and surgical outcomes.

Operative finding/outcome	No.	%
Dense adhesions around gallbladder	23	40.4
Difficult Calot's triangle dissection	21	36.8
Difficult gallbladder grasping	18	31.6
Gallbladder perforation	14	24.6
Bile/stone spillage	12	21.1
Significant intraoperative bleeding	6	10.5
Fundus-first approach used	7	12.3
Subtotal cholecystectomy	3	5.3
Conversion to open cholecystectomy	4	7.0
Operative time >60 minutes	20	35.1
Postoperative complications	6	10.5

Difficult laparoscopic cholecystectomy was significantly associated with age ≥50 years, male sex, obesity, previous acute cholecystitis, fever, right upper quadrant tenderness, and leukocytosis. Diabetes mellitus showed borderline statistical significance.

Table 5: Association between clinical variables and difficult laparoscopic cholecystectomy.

Clinical variable	Difficult LC n=22	Non-difficult LC n=35	P-value
Age ≥50 years	13 (59.1%)	9 (25.7%)	**0.011**
Male sex	10 (45.5%)	7 (20.0%)	**0.039**
Obesity	11 (50.0%)	7 (20.0%)	**0.017**
Previous acute cholecystitis	15 (68.2%)	9 (25.7%)	**0.002**
Diabetes mellitus	8 (36.4%)	5 (14.3%)	0.050
Previous abdominal surgery	6 (27.3%)	5 (14.3%)	0.221
Fever at presentation	7 (31.8%)	3 (8.6%)	**0.025**
Right upper quadrant tenderness	18 (81.8%)	18 (51.4%)	**0.021**
Leukocytosis	12 (54.5%)	6 (17.1%)	**0.003**

Among ultrasound findings, gallbladder wall thickness >3 mm, contracted gallbladder, impacted stone at the neck or Hartmann's pouch, and pericholecystic fluid were significantly associated with difficult laparoscopic cholecystectomy. Common bile duct dilatation showed borderline significance.

Table 6: Association between ultrasound findings and difficult laparoscopic cholecystectomy.

Ultrasound finding	Difficult LC n=22	Non-difficult LC n=35	P-value
Gallbladder wall thickness >3 mm	17 (77.3%)	9 (25.7%)	**<0.001**
Contracted gallbladder	10 (45.5%)	5 (14.3%)	**0.009**
Distended gallbladder	7 (31.8%)	5 (14.3%)	0.111
Impacted stone at neck/Hartmann's pouch	12 (54.5%)	6 (17.1%)	**0.003**
Pericholecystic fluid	8 (36.4%)	3 (8.6%)	**0.010**
Multiple gallstones	16 (72.7%)	19 (54.3%)	0.164
Common bile duct dilatation	5 (22.7%)	2 (5.7%)	0.052

Patients with difficult laparoscopic cholecystectomy had significantly higher rates of prolonged operative time, gallbladder perforation, bile or stone spillage, significant bleeding, fundus-first approach, subtotal cholecystectomy, conversion to open surgery, and postoperative complications.

Table 7. Association between operative difficulty and surgical outcomes.

Surgical outcome	Difficult LC n=22	Non-difficult LC n=35	P-value
Operative time >60 minutes	18 (81.8%)	2 (5.7%)	**<0.001**
Gallbladder perforation	11 (50.0%)	3 (8.6%)	**<0.001**
Bile/stone spillage	10 (45.5%)	2 (5.7%)	**<0.001**
Significant bleeding	5 (22.7%)	1 (2.9%)	**0.018**
Fundus-first approach	7 (31.8%)	0 (0.0%)	**<0.001**
Subtotal cholecystectomy	3 (13.6%)	0 (0.0%)	**0.024**
Conversion to open surgery	4 (18.2%)	0 (0.0%)	**0.008**
Postoperative complications	5 (22.7%)	1 (2.9%)	**0.018**

On multivariate logistic regression analysis, the independent predictors of difficult laparoscopic cholecystectomy were previous acute cholecystitis, gallbladder wall thickness >3 mm, impacted stone at the gallbladder neck or Hartmann's pouch, and leukocytosis. Obesity was associated with increased odds of difficulty but did not reach statistical significance.

Table 8: Multivariate analysis of predictors of difficult laparoscopic cholecystectomy.

Predictor	Odds ratio	95% CI	P-value
Previous acute cholecystitis	4.62	1.31–16.28	0.017
Gallbladder wall thickness >3 mm	6.85	1.82–25.74	0.004
Impacted stone at neck/Hartmann's pouch	4.91	1.25–19.31	0.023
Leukocytosis	3.88	1.02–14.71	0.046
Obesity	3.41	0.91–12.77	0.068

4- DISCUSSION

The present study evaluated clinical and ultrasonographic predictors of difficult laparoscopic cholecystectomy among 57 patients with symptomatic gallstone disease. Difficult laparoscopic cholecystectomy was identified in 22 patients, representing 38.6% of the study sample. This proportion indicates that more than one-third of laparoscopic cholecystectomies in the present setting were associated with intraoperative technical difficulty. The finding is clinically important because difficult laparoscopic cholecystectomy is not merely an operative inconvenience; it is associated with prolonged operative time, increased risk of gallbladder perforation, bile or stone spillage, bleeding, subtotal cholecystectomy, conversion to open surgery, postoperative complications, and longer hospitalization. Recent studies have emphasized that early prediction of operative difficulty allows better operative planning, appropriate case allocation, involvement of experienced surgeons, and safer use of bailout procedures when Calot's triangle cannot be safely dissected.[3, 5, 6]

In the current study, difficult laparoscopic cholecystectomy was significantly associated with age ≥50 years. This finding may be explained by the higher probability of long-standing gallstone disease, recurrent attacks of inflammation, fibrosis, and dense adhesions in older patients. Repeated inflammatory episodes may result in thickening of the gallbladder wall, obliteration of normal tissue planes, and difficult exposure of Calot's triangle. Similar findings were reported by Toppo et al., who found that increasing age was associated with greater operative difficulty during laparoscopic cholecystectomy.11 In addition, a recent narrative review by Abdallah et al. reported that advanced age is repeatedly included in preoperative scoring systems for difficult cholecystectomy because it reflects cumulative inflammatory burden and increased technical complexity.[3]

Male sex was also significantly associated with difficult laparoscopic cholecystectomy in the present study. Although gallstone disease is more common among females, several studies have reported that male patients are more likely to experience severe inflammatory gallbladder disease and technically difficult cholecystectomy. This may be related to delayed presentation, more advanced inflammation at the time of surgery, and a higher frequency of acute or complicated cholecystitis among males. In the present study, 45.5% of difficult cases were males compared with 20.0% of non-difficult cases. This agrees with the findings of Toppo et al., who reported male sex as a relevant predictor of operative difficulty, and with recent reviews that included male sex among the most frequently reported clinical predictors of difficult laparoscopic cholecystectomy.[8]

Obesity was significantly associated with difficult laparoscopic cholecystectomy on univariate analysis, although it did not remain statistically significant in the multivariate model. Obesity may increase technical difficulty through several mechanisms, including difficult port placement, increased abdominal wall thickness, reduced working space, fatty infiltration around the hepatocystic triangle, difficult retraction of the gallbladder, and impaired visualization. However, the loss of statistical significance in multivariate analysis may suggest that obesity acts together with other inflammatory and anatomical factors rather than being an

independent predictor in this sample. This interpretation is consistent with the broader literature, where obesity is frequently reported as a contributor to difficult exposure and longer operative time, but its independent predictive value varies between studies depending on sample size, definition of difficulty, and surgeon experience.[3, 8]

Previous acute cholecystitis was one of the strongest clinical predictors of difficult laparoscopic cholecystectomy in the present study. It was present in 68.2% of difficult cases compared with 25.7% of non-difficult cases, and it remained an independent predictor in multivariate analysis. This finding is pathophysiologically expected because acute cholecystitis produces edema, hyperemia, inflammatory adhesions, and sometimes empyema or gangrenous change. Recurrent or inadequately resolved attacks may progress to chronic fibrosis and dense adhesions, making gallbladder grasping, traction, and Calot's triangle dissection more difficult. Stoica et al. reported that acute inflammatory parameters and local inflammatory severity were important predictors of surgical difficulty in laparoscopic cholecystectomy for acute cholecystitis.[10] Similarly, the Tokyo Guidelines emphasize the importance of assessing operative difficulty in acute cholecystitis and recommend safe surgical strategies, including bailout procedures, when inflammation prevents safe identification of biliary anatomy.[5, 6]

Leukocytosis was significantly associated with difficult laparoscopic cholecystectomy and remained an independent predictor in the multivariate model. Leukocytosis reflects active inflammation and may indicate acute cholecystitis, empyema, or severe local inflammatory response. In this study, leukocytosis was present in 54.5% of difficult cases compared with 17.1% of non-difficult cases. This supports the concept that systemic inflammatory markers can help identify patients at increased risk of operative difficulty. Lyu et al. reported that inflammatory markers, particularly elevated C-reactive protein, were associated with increased difficulty, longer operative time, greater blood loss, higher conversion rate, and longer postoperative stay in patients undergoing laparoscopic cholecystectomy.[11] Although C-reactive protein was not included in the present analysis, the significant association with leukocytosis suggests that inflammatory status should be considered in preoperative risk assessment.

Ultrasonographic findings were important predictors of operative difficulty in the present study. Gallbladder wall thickness greater than 3 mm showed the strongest association with difficult laparoscopic cholecystectomy and remained an independent predictor on multivariate analysis. Thickened gallbladder wall was present in 77.3% of difficult cases compared with 25.7% of non-difficult cases. This finding is clinically meaningful because wall thickening may represent acute edema, chronic fibrosis, repeated inflammation, or xanthogranulomatous change. These pathological changes make the gallbladder difficult to grasp, reduce tissue pliability, and obscure the plane between the gallbladder and liver bed. Ramakrishnan et al. found that gallbladder size and wall thickness were among the most significant ultrasonographic predictors of conversion from laparoscopic to open cholecystectomy.[9] Abdallah et al. also highlighted gallbladder wall thickness as a repeatedly validated component of preoperative scoring systems for difficult laparoscopic cholecystectomy.[3]

Impacted stone at the gallbladder neck or Hartmann's pouch was another independent predictor of difficult laparoscopic cholecystectomy in the current study. It was detected in 54.5% of difficult cases compared with 17.1% of non-difficult cases. An impacted stone may cause persistent obstruction of the cystic duct, gallbladder distension, mucocele, empyema, or recurrent inflammation. It may also distort Hartmann's pouch and Calot's triangle, making identification of the cystic duct and cystic artery more hazardous. This finding is consistent with recent evidence showing that impacted stones are among the most relevant ultrasound predictors of difficult cholecystectomy and may be more predictive than stone multiplicity alone.[3-4] In the present study, multiple gallstones were more frequent among difficult cases but did not reach statistical significance, supporting the idea that stone location and impaction may be more important than stone number.

The operative findings in this study support the validity of the difficulty classification used. Dense adhesions were found in 40.4% of patients, difficult Calot's triangle dissection in 36.8%, gallbladder perforation in 24.6%, and bile or stone spillage in 21.1%. These findings are typical intraoperative markers of difficult laparoscopic cholecystectomy. The difficult group had significantly higher rates of prolonged operative time, gallbladder perforation, bile or stone spillage, significant bleeding, fundus-first approach, subtotal cholecystectomy, conversion to open surgery, and postoperative complications. These results are consistent with the concept that operative difficulty is strongly linked to adverse intraoperative events and early postoperative morbidity. Recent literature emphasizes that when safe dissection cannot be achieved, surgeons should avoid persistence in hazardous dissection and consider bailout strategies such as fundus-first dissection, subtotal cholecystectomy, or conversion to open surgery.[3, 5, 6]

The conversion rate in the present study was 7.0%, and all conversions occurred in the difficult laparoscopic cholecystectomy group. Conversion should not be interpreted as a surgical failure; rather, it is a safety decision when laparoscopic continuation may increase the risk of bile duct injury, uncontrolled bleeding, or misidentification of anatomy. The observed conversion rate is within the range reported in recent studies of difficult laparoscopic cholecystectomy. Toppo et al. emphasized that identifying high-risk patients

preoperatively may help anticipate conversion and improve patient counselling.[8] Ramakrishnan et al. similarly reported that preoperative prediction of conversion based on ultrasound variables may reduce delay in decision-making and potentially reduce morbidity.[9]

Multivariate analysis in the present study identified previous acute cholecystitis, gallbladder wall thickness greater than 3 mm, impacted stone at the gallbladder neck or Hartmann's pouch, and leukocytosis as independent predictors of difficult laparoscopic cholecystectomy. These predictors represent two complementary dimensions of operative difficulty: clinical inflammation and anatomical distortion. Previous acute cholecystitis and leukocytosis reflect inflammatory severity, while wall thickening and impacted stones reflect local structural changes that directly affect surgical dissection. The combination of clinical and ultrasound predictors is therefore more useful than relying on either clinical assessment or ultrasound alone. This agrees with recent studies and reviews recommending integrated preoperative assessment models that include demographic, clinical, laboratory, and sonographic parameters to stratify operative difficulty.[3-4]

The findings of this study have practical implications for general surgical practice in Mosul City. Patients with previous acute cholecystitis, leukocytosis, thickened gallbladder wall, or impacted stone should be considered at higher risk for difficult laparoscopic cholecystectomy. Such patients may benefit from senior surgical involvement, careful operative scheduling, availability of conversion instruments, clear preoperative counselling, and readiness to use bailout procedures when the critical view of safety cannot be achieved. In addition, standardized reporting of ultrasound findings relevant to operative difficulty may improve communication between radiologists and surgeons. Instead of reporting only the presence of gallstones, ultrasound reports should ideally mention gallbladder wall thickness, gallbladder contraction or distension, impacted stone, pericholecystic fluid, and common bile duct diameter.

The findings of this study should be interpreted in light of certain limitations. The study was performed at a single hospital, Mosul General Hospital, and therefore the results may not fully represent the experience of other surgical centers. In addition, the relatively small sample size of 57 patients may have limited the ability to detect significant associations with uncommon outcomes, particularly conversion to open surgery, subtotal cholecystectomy, and postoperative complications. Another limitation is that some potentially important predictors of operative difficulty, including surgeon experience, interval between acute attack and surgery, C-reactive protein level, detailed biochemical parameters, and histopathological grading, were not comprehensively assessed. Furthermore, preoperative ultrasound findings may be influenced by interobserver variation and differences in reporting quality. The study also focused mainly on intraoperative difficulty and early postoperative outcomes, without evaluating long-term complications or patient-reported outcomes after surgery.

5- CONCLUSION AND RECOMMENDATION

Difficult laparoscopic cholecystectomy was encountered in a considerable proportion of patients undergoing surgery for gallstone disease. The main factors associated with operative difficulty were previous acute cholecystitis, leukocytosis, gallbladder wall thickness greater than 3 mm, impacted stone at the gallbladder neck or Hartmann's pouch, contracted gallbladder, and pericholecystic fluid. Among these, previous acute cholecystitis, leukocytosis, gallbladder wall thickening, and impacted stone were the strongest independent predictors. These findings indicate that combined clinical and ultrasonographic assessment before surgery can help identify patients at increased risk of difficult laparoscopic cholecystectomy. It is recommended that patients with these risk factors should be carefully evaluated preoperatively, counselled regarding possible operative difficulty and conversion, and preferably managed by experienced surgical teams. Ultrasound reports should routinely include details relevant to operative planning, particularly gallbladder wall thickness, impacted stones, pericholecystic fluid, gallbladder contraction, and common bile duct diameter. Further multicenter studies with larger sample sizes are recommended to validate these predictors and develop a locally applicable scoring system for difficult laparoscopic cholecystectomy.

REFERENCES

1. Bhandari TR, Khan SA, Jha JL. Prediction of difficult laparoscopic cholecystectomy: An observational study. Annals of Medicine and Surgery, 2021 Dec 1; 72: 103060.
2. Saad MR, Kabbash M, Yassen A, Suleiman KA, Elzayat I. Preoperative predictive factors of difficult laparoscopic cholecystectomy. The Egyptian Journal of Surgery, 2024 Jan 31; 43(1).
3. Abdallah HS, Sedky MH, Sedky ZH. The difficult laparoscopic cholecystectomy: a narrative review. BMC surgery, 2025 Apr 12; 25(1): 156.
4. Asim I, Algahiny AT, Abouelella OH, El Din MM, Elmitwalli OS, Elnagar MB, AlKhalifa HK, Mohamed AM, Alazazzi H, Algahiny A, Abouelella O. Ultrasonographic Predictors of Difficult Laparoscopic Cholecystectomy. Cureus, 2025 Oct 5; 17(10).
5. Wakabayashi G, Iwashita Y, Hibi T, Takada T, Strasberg SM, Asbun HJ, Endo I, Umezawa A, Asai K, Suzuki K, Mori Y. Tokyo Guidelines 2018: surgical management of acute cholecystitis: safe steps in laparoscopic cholecystectomy for acute cholecystitis (with videos). Journal of

Hepato-biliary-pancreatic Sciences, 2018 Jan; 25(1): 73-86.
6. Okamoto K, Suzuki K, Takada T, Strasberg SM, Asbun HJ, Endo I, Iwashita Y, Hibi T, Pitt HA, Umezawa A, Asai K. Tokyo Guidelines 2018: flowchart for the management of acute cholecystitis. Journal of Hepato-biliary-pancreatic Sciences, 2018 Jan; 25(1): 55-72.
7. Chung HY, Wang SY, Hung YL, Lee KE, Chen HW, Tsai CY, Hsu JT, Yeh TS, Yeh CN, Jan YY. The Prediction of Difficult Laparoscopic Cholecystectomy for Acute Cholecystitis from Preoperative Clinical Factors and Radiological Findings. Journal of Laparoendoscopic & Advanced Surgical Techniques, 2025 Oct 1; 35(10): 812-8.
8. Toppo S, Gaurav K, Kumar K, Kumar K, Verma S, Tudoo ST, Mehta MK, KUMAR K, Verma Jr S, Tudoo Sr ST, MEHTA MK. Assessment of predictors of difficult laparoscopic cholecystectomy by clinico-radiological parameters at a tertiary hospital in eastern India. Cureus, 2024 Oct 27; 16(10).
9. Ramakrishnan R, Srinivasan JP. Predictive score for conversion in laparoscopic cholecystectomy-a prospective study. Turkish Journal of Surgery, 2025 May 30; 41(2): 141.
10. Stoica PL, Serban D, Bratu DG, Serboiu CS, Costea DO, Tribus LC, Alius C, Dumitrescu D, Dascalu AM, Tudor C, Simion L, Tudosie MS, Comandasu M, Popa AC, Cristea BM. Predictive Factors for Difficult Laparoscopic Cholecystectomies in Acute Cholecystitis. Diagnostics (Basel), 2024 Feb 5; 14(3): 346.
11. Lyu Y, Wang B. Predictors of the difficulty of laparoscopic cholecystectomy after percutaneous transhepatic gallbladder drainage for grade II acute cholecystitis. Surgical Laparoscopy Endoscopy & Percutaneous Techniques, 2024 Oct 1; 34(5): 479-84.