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ASSESSMENT OF OPERATIVE DIFFICULTY AND POSTOPERATIVE OUTCOMES IN LAPAROSCOPIC CHOLECYSTECTOMY

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Abstract

Background: Gallstone disease is a common surgical condition, and laparoscopic cholecystectomy is the standard treatment. However, operative difficulty may increase complications, conversion to open surgery, and hospital stay.

Aim of the study: This study aimed to assess operative difficulty and early postoperative outcomes in patients undergoing laparoscopic cholecystectomy.

Methods: This prospective observational study included 420 adult patients undergoing laparoscopic cholecystectomy. The study was conducted at Prime Hospital, Dubai, UAE, from 2020 to 2024. Clinical, ultrasonographic, intraoperative, and early postoperative data were recorded. Operative difficulty was graded as easy, mild, moderate, severe, or very severe. Data were analyzed using SPSS version 26.0, and $p<0.05$ was considered statistically significant.

Results: Among 420 patients, the mean age was 47.8±12.6 years, and most were female (302; 71.9%). Right upper abdominal pain was the commonest symptom (392; 93.3%), and multiple gallstones were found in 298, 71.0%. Moderate to very severe operative difficulty was observed in 152 (36.2%). Laparoscopic cholecystectomy was completed in 400 (95.2%), while conversion to open surgery occurred in 20 (4.8%). Postoperative complications occurred in 65 (15.5%). Moderate to very severe difficulty was significantly associated with longer operative time, higher conversion rate, and more postoperative complications ($p<0.001$).

Conclusion: Laparoscopic cholecystectomy was successfully completed in most patients with a low conversion rate. Moderate to very severe operative difficulty was significantly associated with longer operative time, higher conversion rate, increased postoperative complications, and longer hospital stay. Early recognition of difficult cases may improve surgical planning and patient outcomes.

Keywords: Laparoscopic cholecystectomy; Operative difficulty; Gallstone disease; Conversion to open surgery; Postoperative complications.

Introduction:

Gallstone disease is a common hepatobiliary disorder and a major cause of surgical consultation worldwide. Symptomatic cases may present with biliary colic, dyspepsia, cholecystitis, obstructive jaundice, cholangitis, or gallstone pancreatitis [1]. In the United Arab Emirates, gallstone disease is particularly relevant due to the high burden of metabolic risk factors, including obesity, overweight, diabetes, and dyslipidemia, all of which are associated with gallstone formation and complicated biliary disease [2–5].

Laparoscopic cholecystectomy is currently considered the standard treatment for symptomatic gallstone disease and benign gallbladder pathology. Compared with open cholecystectomy, it offers several advantages, including a smaller incision, less postoperative pain, shorter hospital stay, earlier return to daily activities, better cosmetic outcomes, and lower overall morbidity [6,7]. In the UAE, laparoscopic cholecystectomy is widely practiced within modern surgical services. A retrospective matched-cohort study from Abu Dhabi involving 280 patients treated between January 2019 and December 2022 compared conventional four-port laparoscopic cholecystectomy with a modified Emirate laparoscopic technique and reported comparable perioperative outcomes, a shorter hospital stay, and no conversions to open surgery or major biliary complications in either matched group [8]. However, despite being a routinely performed procedure, laparoscopic cholecystectomy is not always technically simple. Operative difficulty may arise from dense pericholecystic adhesions, repeated attacks of inflammation, thickened or fibrotic gallbladder wall, contracted gallbladder, distended gallbladder, empyema, impacted stone at Hartmann's pouch, obscured Calot's triangle, bleeding during dissection, and distorted biliary anatomy [9,10].

Assessment of operative difficulty is clinically important because a difficult laparoscopic cholecystectomy is associated with adverse intraoperative and postoperative outcomes. Patients with difficult surgery may experience prolonged operative time, gallbladder perforation, bile spillage, excessive bleeding, need for drain placement, subtotal cholecystectomy, conversion to open surgery, postoperative infection, bile leakage, intra-abdominal collection, readmission, reoperation, and longer hospital stay [9–11]. Conversion to open surgery should not be regarded as a surgical failure; rather, it is an important safety decision when the anatomy cannot be clearly defined or when laparoscopic continuation increases the risk of major bile duct injury. Nevertheless, conversion may increase postoperative pain, recovery time, hospital cost, and resource utilization [7,1]. Several preoperative and intraoperative factors have been identified as predictors of difficult laparoscopic cholecystectomy. These include older age, male sex, obesity, diabetes mellitus, previous acute cholecystitis, elevated inflammatory markers, a thick-walled gallbladder, a contracted gallbladder, pericholecystic fluid, common bile duct dilatation, and an impacted stone at the gallbladder neck [10–12]. Intraoperative grading systems, including the Nassar operative difficulty scale, have been proposed to standardize assessment of surgical difficulty and to improve operative documentation, communication, training, audit, and outcome comparison across institutions [9,10]. However, despite these tools, evidence remains limited on how operative difficulty is distributed in UAE patients and how it relates to early postoperative outcomes.

There is a need for local evidence to evaluate the pattern of operative difficulty during laparoscopic cholecystectomy and to determine how increasing difficulty affects early postoperative outcomes. Such evidence can help surgeons identify high-risk patients, improve preoperative counseling, optimize operative planning, prepare for possible bailout procedures, reduce complications, and improve patient safety in a multiethnic, high-metabolic-risk healthcare setting. Therefore, this study was conducted to assess operative difficulty and early postoperative outcomes among patients undergoing laparoscopic cholecystectomy and to evaluate their association.

Methods

This hospital-based prospective observational study was conducted at Prime Hospital, Dubai, UAE. The study population included adult patients diagnosed with symptomatic gallstone disease, chronic cholecystitis, or selected cases of acute cholecystitis who were planned for laparoscopic cholecystectomy. A total of 420 patients were included by consecutive sampling during the study period of 4 years, from 2021 to 2024. Patients aged 18 years or above who provided informed written consent and had complete preoperative, intraoperative, and postoperative records were included. Patients with suspected gallbladder malignancy, common bile duct stones requiring intervention, obstructive jaundice, pregnancy, severe cardiopulmonary disease unfit for general anesthesia, planned open cholecystectomy, or incomplete records were excluded.

All patients underwent detailed history taking, clinical examination, routine laboratory investigations, liver function tests, coagulation profile, electrocardiography where indicated, and abdominal ultrasonography. Baseline variables included age, sex, body mass index, residence, comorbidities, previous acute cholecystitis, clinical presentation, and ultrasonographic findings. Intraoperative variables included dense adhesion, difficult Calot's triangle dissection, thick or fibrotic gallbladder, distended or contracted gallbladder, impacted stone, gallbladder perforation, bile spillage, bleeding, difficult extraction, operative time, drain placement, subtotal cholecystectomy, and conversion to open surgery.

Laparoscopic cholecystectomy was performed under general anesthesia using the standard four-port technique by experienced surgeons or under consultant supervision. The critical view of safety was attempted in all cases before clipping and division of the cystic duct and artery. Drain placement, subtotal cholecystectomy, or conversion to open surgery was performed when required for patient safety.

Operative difficulty was assessed intraoperatively using predefined operative findings and classified as easy, mild, moderate, severe, or very severe. For comparison, patients were grouped into easy or mild difficulty and moderate-to-very-severe difficulty. Early postoperative outcomes included postoperative pain, fever, port-site infection, bile leakage, intra-abdominal collection, readmission, reoperation, overall complications, and hospital stay.

Data were collected using a structured data collection sheet from patient interviews, clinical records, investigation reports, operative notes, and postoperative follow-up records. Data were analyzed using SPSS version 26.0. Categorical variables were expressed as frequency and percentage, while continuous variables were expressed as mean±SD. Chi-square test or Fisher's exact test was used for categorical variables, and independent-samples t-test or Mann–Whitney U test was used for continuous variables. A p-value <0.05 was considered statistically significant. Ethical approval was obtained from the institutional review committee, and confidentiality was maintained throughout the study.

Results

Among 420 patients, the largest proportion was in the 41–50 years age group (116; 27.6%), followed by the 31–40 years age group (107; 25.5%). The mean age was 47.8±12.6 years. Female patients were predominant (302; 71.9%). Most patients were overweight (174; 41.4%) and from urban areas (282; 67.1%). Hypertension was present in 102 (24.3%) of patients with diabetes mellitus, in 74 (17.6%) of patients with a history of acute cholecystitis, and in 128 (30.5%) of patients with a history of acute cholecystitis.

Variables	Frequency (n)	Percentage (%)
Age group (years)		
≤30	43	10.2
31–40	107	25.5
41–50	116	27.6
51–60	94	22.4
>60	60	14.3
Mean ± SD	47.8±12.6	
Sex		
Male	118	28.1
Female	302	71.9
BMI category		
Normal	158	37.6
Overweight	174	41.4
Obese	88	21
Residence		
Urban	282	67.1
Rural	138	32.9
Comorbidities and history		
Diabetes mellitus	74	17.6
Hypertension	102	24.3
Previous acute cholecystitis	128	30.5

Table 1. Sociodemographic and baseline clinical characteristics of patients (N=420)

Right upper abdominal pain was the most common symptom, observed in 392 patients (93.3%), followed by nausea or vomiting in 214 (51.0%) and dyspepsia in 176 (41.9%). Fever was present in 48 (11.4%), and jaundice in 22 (5.2%). Ultrasonography showed multiple gallstones in 298 patients (71.0%). Thick-walled gallbladder was found in 156 (37.1%), impacted stone at Hartmann's pouch in 96 (22.9%), and pericholecystic fluid in 52 (12.4%).

Variables	Frequency (n)	Percentage (%)
Right upper abdominal pain	392	93.3
Nausea or vomiting	214	51
Dyspepsia	176	41.9
Fever	48	11.4
Jaundice	22	5.2
Single gallstone	122	29
Multiple gallstones	298	71
Thick-walled gallbladder	156	37.1
Contracted gallbladder	64	15.2
Impacted stone at Hartmann's pouch	96	22.9
Pericholecystic fluid	52	12.4

Table 2. Clinical presentation and preoperative ultrasonographic findings (N=420)

A thick or fibrotic gallbladder was the most frequent finding (156; 37.1%), followed by dense adhesions around the gallbladder (142; 33.8%) and difficult gallbladder extraction (130; 31.0%). Difficult Calot's triangle dissection was observed in 116 patients (27.6%). Bile spillage occurred in 108 (25.7%), gallbladder perforation in 90 (21.4%), and bleeding during dissection in 50 (11.9%).

Intraoperative findings	Frequency (n)	Percentage (%)
Dense adhesion around gallbladder	142	33.8
Difficult Calot's triangle dissection	116	27.6
Thick or fibrotic gallbladder	156	37.1
Distended gallbladder	72	17.1
Contracted gallbladder	64	15.2
Impacted stone at gallbladder neck	96	22.9
Gallbladder perforation	90	21.4
Bile spillage	108	25.7
Bleeding during dissection	50	11.9
Difficult gallbladder extraction	130	31

Table 3. Intraoperative findings and operative difficulty parameters (N=420)

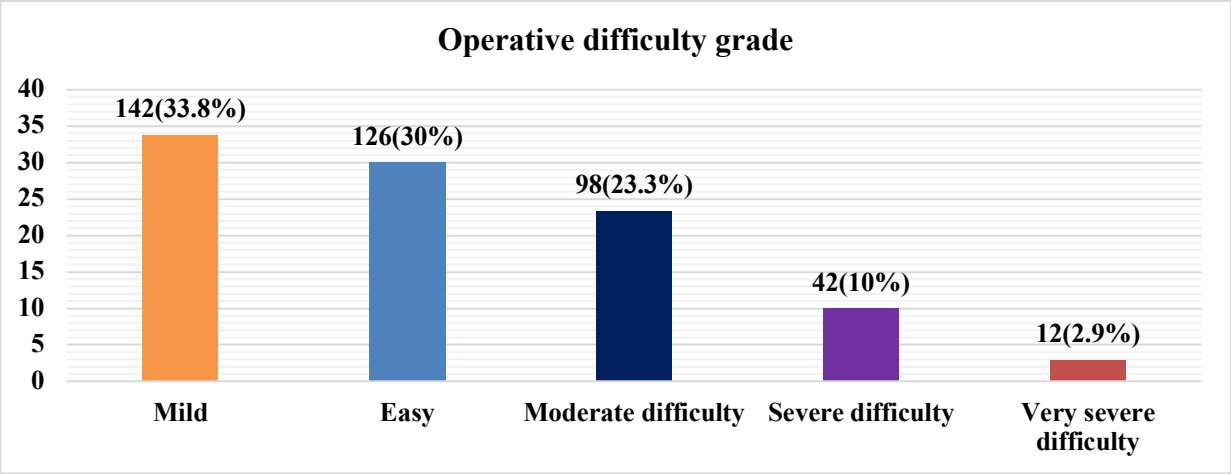

Figure 1. Distribution of patients according to operative difficulty grade (N=420)

Mild difficulty was the most common grade, observed in 142 patients (33.8%), followed by easy surgery in 126 (30.0%). Moderate difficulty was found in 98 patients (23.3%), severe difficulty in 42 (10.0%), and very severe difficulty in 12 (2.9%). Overall, 152 patients (36.2%) had moderate to very severe operative difficulty.

The mean operative time was 58.2±20.2 minutes, with a range of 25–140 minutes. Laparoscopic cholecystectomy was completed successfully in 400 (95.2%) of patients, while conversion to open surgery was required in 20 (4.8%). Drain placement was performed in 91 (21.7%), and subtotal cholecystectomy in 14 (3.3%). Postoperative complications occurred in 65 patients (15.5%). Postoperative pain was the most common complication, with 112 cases (26.7%), followed by fever (35 cases, 8.3%) and port-site infection (28 cases, 6.7%). The mean hospital stay was 2.8±1.4 days.

Outcomes	(n) / Mean ± SD	(%) / Range
Operative time (minutes)	58.2±20.2	25–140
Completed laparoscopically	400	95.2
Conversion to open surgery	20	4.8
Subtotal cholecystectomy	14	3.3
Drain placement	91	21.7
Bile duct injury	2	0.5
Postoperative pain	112	26.7
Fever	35	8.3
Port-site infection	28	6.7
Bile leakage	6	1.4
Intra-abdominal collection	8	1.9
Readmission	10	2.4
Reoperation	3	0.7
Any postoperative complication	65	15.5
Hospital stays (days)	2.8±1.4	1–8

Table 4. Operative and early postoperative outcomes (N=420)

Patients with moderate to very severe difficulty had significantly longer operative time than those with easy or mild difficulty: 76.8±18.7 minutes versus 47.6±12.4 minutes ($p<0.001$). Conversion to open surgery was also higher in the moderate-to-very severe group (18; 11.8%) than in the 2 (0.7%) group, $p<0.001$. Drain placement, gallbladder perforation, bile spillage, postoperative complications, and hospital stay were all significantly higher among patients with greater operative difficulty. Postoperative complications occurred in 41 patients (27.0%) with moderate to very severe difficulty, compared with 24 (9.0%) among those with easy or mild difficulty ($p<0.001$).

Outcomes	Easy or mild difficulty (n=268)	Moderate to very severe difficulty (n=152)	p-value
	(n) % / Mean ± SD		
Mean operative time (minutes)	47.6±12.4	76.8±18.7	<0.001
Conversion to open surgery	2 (0.7)	18 (11.8)	<0.001
Drain placement	21 (7.8)	70 (46.1)	<0.001
Gallbladder perforation	32 (11.9)	58 (38.2)	<0.001
Bile spillage	41 (15.3)	67 (44.1)	<0.001
Postoperative complication	24 (9.0)	41 (27.0)	<0.001
Mean hospital stays (days)	2.1±0.8	4.0±1.5	<0.001

Table 5. Association between operative difficulty and postoperative outcomes

Discussion

The present study assessed operative difficulty and early postoperative outcomes among 420 patients undergoing laparoscopic cholecystectomy. The mean age was 47.8±12.6 years, and females predominated (302; 71.9%), which is consistent with Trehan et al., who reported a mean age of 46.47±15.07 years and female predominance (64.2%) among patients undergoing laparoscopic cholecystectomy [13]. Multiple gallstones were found in 71.0%, a thick-walled gallbladder in 37.1%, an impacted stone at Hartmann's pouch in 22.9%, and pericholecystic fluid in 12.4%, supporting previous studies that identified gallbladder wall thickening, impacted stone, and pericholecystic collection as important markers of difficult laparoscopic cholecystectomy [13-16].

In this study, operative difficulty was easy or mild in 63.8% of patients and moderate to very severe in 36.2%. This proportion is higher than the 22.2% difficult or extreme cases reported in the WSES G10 prospective collaborative study of 504 patients [17], but comparable with studies using broader criteria for difficult dissection, longer operative time, bile spillage, adhesions, and conversion [13,18,19]. The difference may be due to variations in case selection, the inclusion of patients with prior acute cholecystitis, and differences in operative difficulty grading systems.

The mean operative time was 58.2±20.2 minutes, which was shorter than in the WSES study, where the mean operative time was 78.7 minutes [17], but close to that reported by Liu et al., who reported 48±24.85 minutes in 261 laparoscopic cholecystectomy cases [19].

Importantly, operative time increased significantly with difficulty grade in our study, from 47.6±12.4 minutes in easy or mild cases to 76.8±18.7 minutes in moderate to very severe cases ($p<0.001$). Similar trends were reported by Griffiths et al. using the Nassar operative difficulty scale and by Madni et al. using the Parkland grading scale, in which higher grades were associated with longer operation, partial or open cholecystectomy, and bile leak [9,20].

The conversion rate in the present study was 4.8%, which is comparable to Trehan et al. (3.3%) and Liu et al. (0.4%), but lower than the WSES G10 study (14.1%) [13,17,19]. In the current analysis, conversion was markedly higher in the moderate-to-very-severe group than in the easy or mild group (11.8% versus 0.7%; $p<0.001$). This is consistent with Rothman et al. and Hu et al., who reported that male sex, advanced age, acute cholecystitis, a thick-walled gallbladder, a contracted gallbladder, and inflammatory adhesions increase the risk of conversion [21,22]. Nassar et al. also showed that older age, male sex, higher ASA class, cholecystitis, thick-walled gallbladder, CBD dilatation, ERCP, and non-elective surgery independently predicted difficult laparoscopic cholecystectomy, with an externally validated AUC of 0.789 [10].

Postoperative complications occurred in 15.5% of patients and were significantly more frequent in moderate-to-very-severe cases than in easy or mild cases (27.0% versus 9.0%; $p<0.001$). Gallbladder perforation (38.2% versus 11.9%), bile spillage (44.1% versus 15.3%), and drain placement (46.1% versus 7.8%) were also higher among difficult cases. These findings support the observations of Madni et al., Liu et al., and Asuri et al., who showed that increasing intraoperative grade is associated with increased morbidity and worse operative outcomes [19,20,23]. The mean hospital stay was also significantly longer in difficult cases, 4.0±1.5 days versus 2.1±0.8 days ($p<0.001$), reflecting the effects of difficult dissection, bile spillage, drain placement, and postoperative complications.

Clinically, these findings emphasize the importance of structured preoperative risk stratification and intraoperative grading. Patients with a thick-walled gallbladder, impacted stone, previous acute cholecystitis, contracted gallbladder, or dense adhesions should be counseled about longer surgery, drain placement, complications, and possible conversion. The strong association between operative difficulty and adverse outcomes supports the use of standard safety strategies, including achieving the critical view of safety, early senior assistance, intraoperative imaging when the anatomy is uncertain, subtotal cholecystectomy, and timely conversion when required. These approaches are consistent with Tokyo Guidelines 2018 and multi-society safe cholecystectomy recommendations, which prioritize prevention of bile duct injury over persistence with unsafe dissection [7,24]. Overall, operative difficulty grading is not only a descriptive tool but also a practical method for risk prediction, operative planning, quality audits, and improving patient safety in laparoscopic cholecystectomy.

Limitations of the study: This study was conducted in a single center with a hospital-based sample, which may limit generalizability. Only early postoperative outcomes were assessed, and long-term complications were not evaluated. Operative difficulty grading may also have some observer variation among surgeons.

Conclusion

This study concluded that laparoscopic cholecystectomy was successfully completed in most patients, with a low conversion rate of 4.8%. Operative difficulty was moderate to very severe in 36.2% of cases and was significantly associated with longer operative time, higher conversion rate, increased drain placement, gallbladder perforation, bile spillage, postoperative complications, and longer hospital stay. Preoperative and intraoperative recognition of difficult cases may help improve surgical planning, patient counseling, and postoperative outcomes.

Recommendations

Preoperative risk assessment should be done for all patients undergoing laparoscopic cholecystectomy. Difficult cases should be managed by experienced surgeons, with routine documentation of operative difficulty. Early subtotal cholecystectomy, drain placement, or conversion should be considered when dissection is unsafe. Further multicenter studies with long-term follow-up are recommended.

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