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Intraoperative Predictive Factors Responsible for Difficult Laparoscopic Cholecystectomy

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ABSTRACT

Background: Although LC is a safe operation with a less than 5% major problems rate, in challenging circumstances, it may be necessary to switch from a laparoscopic procedure to an open cholecystectomy in order to effectively complete the procedure and avoid major complications. The objectives of our study were to determine the various intraoperative predictive factors responsible for difficult laparoscopic cholecystectomy in a tertiary care hospital. **Methodology:** This analytical cross sectional study was conducted at the Department of Surgery, Shaheed Mohtarma Benazir Bhutto Medical University Larkana for the period of 06 months from July 2024 to December 2024 after approval from CPSP. Sample size was calculated by taking prevalence of difficult LC 25%, margin of error 10% and confidence level at 95%. All 67 patients, age between 18 to 60 years (both genders) admitted for laparoscopic cholecystectomy was included. Gallbladder operative score (G10) was used to assess severity of intraoperative cases. **Results:** Mean age of the participants was 38.44 ± 7.96 years, mean body mass Index (BMI) was 26.53 ± 3.58 Kg/m2 , mean Gallbladder operative score (G10) score was 3.89 ± 1.28, according to the score frequency of mild score was 23 (34.3%), moderate score was 35 (52.2%) and severity score was 9 (13.5%). Using gallbladder operative score (G10) score as a good intraoperative indicator for difficult LC, and it was noted that moderate score was in 35 cases and out of them 6 were converted for open surgery, and very difficult score was in 9 cases and 5 of them were converted to open surgery (p-value 0.001). Incidence of intra operative conversion of patients from difficult LC to open cholecystectomy due to all factors was 11 (16.4%) out of 67 patients. Common factors responsible for difficult LC and leading to or open cholecystectomy, according to our study were, appearance of GB having 50% adhesions (p-value 0.032), access of >30 Kg/m2 body mass index (p-value 0.013), Contracted or distended GB that cannot be grasped without decompression (p-value 0.012), Sepsis and Complications (p-value <0.001), time to identify cystic artery and duct in > 90 minutes (p-value 0.001) and history of past abdominal surgery (p-value 0.041). **Conclusion:** There are many intraoperative factors that a patient will experience difficult LC. Surgeons can sort hazards, make decisions, and get patients ready for counseling by recognizing these indicators.

INTRODUCTION

Laparoscopic cholecystectomy (LC) is now gold standard for treating symptomatic cholelithiasis. Compared to conventional cholecystectomy, laparoscopic cholecyste-ctomy has the following advantages: minor postoperative discomfort, quicker recovery, earlier return of bowel function, early recovery and return to physical activity, superior cosmetic results, and a shorter hospital stay [1,2]. Since its inception in 1987, LC has taken the place of the traditional open technique and is now the preferred method for routinely removing the gallbladder from its bed. The laparoscopic cholecystectomy procedure is referred to as "difficult cholecystectomy" when it is not possible to guarantee its safe completion, leading to cholecystoenteric fistula, fibrotic and contracted gallbladder, acutely inflamed or gangrenous gallbladder, and dense adhesions at the calot's triangle [3].

Although LC is a safe surgery with a <5% major complications risk, in challenging instances, it may be required to switch from a laparoscopic operation to an open cholecystectomy in order to effectively complete the procedure and avoid major difficulties [4]. Due to a variety of challenges encountered during the operation, between 2 and 15% of attempted LC must be changed to an open procedure [5]. Numerous circumstances, such as obesity, prior surgery in that area, many stones that could cause

the stone to leak into the common bile duct, gall bladder wall thickness greater than 4 mm, and the presence of pericholecystic fluid, make laparoscopic operation challenging [6]. Gallbladder wall thickening, C-reactive protein levels, body temperature, age, BMI, and prior abdominal surgery are preoperative characteristics linked to longer operating times and conversion rates, according to research findings [7]. The most important predictive factor of preoperative adhesion formation is previous abdominal surgery accounting 67-93% [8]. Hence, operative grading system for laparoscopic cholecystectomy and scoring system "Operative classifications" was proposed classify the difficult Cholecystectomy from mild to extreme on the basis of intraoperative predicators [9].

According to a study conducted in Pakistan found that intraoperative factors responsible for difficulty in performing LC are contracted gall bladder, obesity, stone size ≥ 1 cm, history of previous surgery and pus collection [10]. Another study observed that intraoperative factors associated with difficult LC among patients are obesity, hypertension, diabetes mellitus, and history of acute cholecystitis, history of abdominal surgery, presence of multiple stones, presence of impacted stones, presence of pericholecystic collection and presence of contracted gall bladder [11]. The present study aimed to determine the intraoperative predictive factors that make difficult LC and converted to open surgery. Results of this study will be particularly beneficial to not only to set appropriate management plan but also to assemble available resources to defy difficult laparoscopic cholecystectomy.

MATERIALS & METHODS

This analytical cross sectional study was conducted in the department of Surgery at Shaheed Mohtarma Benazir Bhutto Medical University Larkana for the period of 06 months from July 2024 to December 2024 after ethical approval from concerned (Vide letter No. CPSP/REU/SGR-2022-221-13869 dated May 31, 2024). 67 participants, age ranging from 18 to 60 years (both genders) were selected by taking prevalence of difficult LC 25%, with margin of error 10% and confidence level at 95% using Cochrane sample size formula using non-probability consecutive sampling technique.

Data Collection Procedure

After approval from CPSP, patients meeting the eligibility criteria were enrolled. Written informed consent was obtained from all of the patients in the study after explaining the purpose and procedure of laparoscopic cholecystectomy, possible complications and possibility of conversion of LC to open procedure. Demographic details were taken from all the patients like age, gender, height, weight, BMI (kg/m^2), duration of symptoms, detail clinical examination of the patients and routine investigations were done. Screening for patients with gallstones presenting with upper abdominal pain, vomiting, fever or dyspepsia (pain or burning in the stomach) were performed using preoperative abdominal ultrasonography by radiologist. Surgical procedure was performed and observed. The timing was noted from the first port site incision till the last ports closure. Intraoperative factors such as contracted gallbladder, stone size ≥ 1cm, history of abdominal surgery, history of acute cholecystitis, obesity, hypertension, diabetes mellitus, multiple stones, impacted stones, pericholecystic collection and outcome variable i.e. difficult LC was noted on pre-designed proforma. Intra-operatively all patients were evaluated using the new scoring system. Five factors were included in the grading system: the gallbladder's (GB) appearance and adhesion, its degree of distension or contracture, accessibility, any local or septic problems, and the amount of time needed to identify the cystic artery and duct [12].

Data Analysis Procedure

Data was entered and analyzed by using SPSS version 26.0 Shapiro–Wilk test were applied to check the normality of quantitative data like age, BMI, duration of symptoms and operative time. Mean and standard deviation were calculated for quantitative variables. Frequencies and percentages were reported for categorical variables like gender, and mode of admission. Effect modifiers will be controlled through stratification with respect to age, gender, BMI, duration of symptoms and mode of admission were done. Post stratification chi-square was applied at < 0.10 margin of error.

RESULTS

Table 1

Characteristics of the study participants (n = 67)

Sr. No.	Characteristics	Frequency (%)
1	**Age Categories**	
	18 to 32 years	12 (17.9)
	33 to 46 years	30 (44.8)
	47 to 60 years	25 (37.3)
2	**Gender**	
	Male	29 (43.3)
	Female	38 (56.7)
3	**Socioeconomic status**	
	Poor Class	27 (40.3)
	Middle Class	34 (50.8)
	Upper Class	6 (8.9)
4	**Co-morbidities**	
	No	38 (56.7)
	Hypertension	12 (17.9)
	Diabetes	17 (25.4)
5	BMI Classification	
	Under weight	6 (8.9)
	Normal	29 (43.3)
	Over weight and obese	32 (47.8)

Table 2

Mean Age, BMI, mean GB operative score and severity score of the participants.

Sr. No.	Characteristics	Mean & Standard Deviation
1	Age (years)	38.44 ± 7.96
2	Body Mass Index (Kg/m^2)	26.53 ± 3.58
3	Gallbladder operative score (G10) score	3.89 ± 1.28
3.1	Case converted to open surgery	7.03 ± 1.19
3.2	Case not converted to open surgery	2.38 ± 0.49
4	**Severity Score**	
4.1	Mild	23 (34.3%)
4.2	Moderate	35 (52.2%)
4.3	Severe	9 (13.5%)
4.4	Extreme	0 (0%)

Mean age of the participants was 38.44 ± 7.96 years, mean body mass Index (BMI) was 26.53 ± 3.58 Kg/m^2 , mean

Gallbladder operative score (G10) score was 3.89 ± 1.28, and frequency of severity score was assessed, mild score was 23 (34.3%), moderate score was 35 (52.2%)and severity score was 9 (13.5%).

Table 3

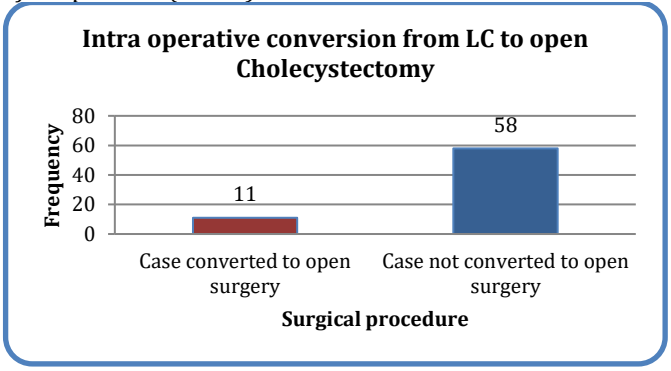
Comparison of Intraoperative groups of the patients converted to open and those not converted to open cholecystectomy using Gallbladder operative score (G10) scoring system.

Sr. No.	Intra Operative Scores/ Categories	Case converted to open surgery (n = 11)	Case not converted to open surgery (n = 58)	Total	p-value
	Gallbladder operative score (G10) score	**7.53 ± 1.69**	**3.78 ± 0.39**		
1	**Categories**				
1.1	Less than 2 (Mild)	0 (0%)	23 (39.5%)	23 (34.3%)	0.001
1.2	2 – 4 (Moderate)	6 (62.5%)	29 (50.0%)	35 (52.2%)	
1.3	5 – 7 (Very difficult)	5 (37.5%)	4 (10.5%)	9 (13.5%)	
1.4	8 – 10 (Extreme)	0 (0%)	0 (0%)	0 (0%)	

Gallbladder operative score (G10) score is a good intraoperative indicator for difficult LC conversion to open surgery. According to our study data moderate score was in 35 cases and out of them 06 were converted for open surgery, and very difficult score was in 9 cases and 5 of them were converted to open surgery.

Figure 1

Intra operative conversion from LC to open Cholecystectomy of the patients (n = 67).



According to our study incidence of intra operative conversion of patients from difficult LC to open cholecystectomy due to all factors was 11 (16.4%) out of 67 patients as shown in figure 01.

Table 4

Intra operative predictive factors responsible for difficult cholecystectomy in patients who are converted from laparoscopic cholecystectomy (n1 = 11, n2 = 58)

Sr. No.	Intra Operative Findings	Case converted to open surgery (n1 = 11)	Case not converted to open surgery (n2 = 58)	P-value
1	**Appearance**			
	Gallbladder has less than 50% adhesions	1 (9.1%)	43 (74.1%)	**0.032**
	Gallbladder has more than 50% adhesions but is buried	9 (81.2%)	15 (25.9%)	
	Gallbladder (GB) is completely buried	1(9.1%)	0 (0)	
2	**Access**			
	> 30kg/m² body mass index	11 (100%)	45(77.6%)	
	Presence of gallbladder adhesions due to previous surgery that limit current surgery	0 (0%)	22 (22.4%)	**0.013**
3	**Contraction/Distension**			
	Gallbladder cannot be grasped without decompression	7 (63.6%)	35 (60.3%)	
	Distended/contracted gallbladder	2 (18.2%)	20 (34.5%)	**0.012**
	Impacted stone of more than 1cm in size that is stuck in "Hartmann's pouch"	2 (18.2%)	3 (5.5%)	
4	**Sepsis and Complications**			
	Presence of pus or bile outside the GB	11 (100)	32 (55.2%)	**< 0.001**
	Fistula	0 (0)	26 (44.8%)	
5	**Time to identify cystic artery and duct >90 minutes**			
	Yes	9 (75)	21 (36.2%)	**0.001**
	No	2 (25)	37 (63.8%)	
6	**History of past abdominal surgery**			
	Yes	4 (36.4%)	13 (22.4%)	0.041
	No	7 (63.6%)	45 (77.6%)	

Common factors responsible for difficult or open cholecystectomy from LC according to our study were, appearance of GB having 50% adhesions (p-value 0.032), access of >30 Kg/m² body mass index (p-value 0.013), Contracted or distended GB that cannot be grasped without decompression (p-value 0.012), Sepsis and Complications (p-value <0.001), time to identify cystic artery and duct in > 90 minutes (p-value 0.001) and history of past abdominal surgery (p-value 0.041).

DISCUSSION

As the population ages and obesity rates rise across all age groups, cholelithiasis is becoming more common. Cholelithiasis problems can now be more successfully treated because to the development of laparoscopic cholecystectomy. National and international guidelines have determined the best time for laparoscopic surgery by considering the natural history of cholelithiasis, the risks of additional admissions and surgical complications, length of stay, and economic costs. This is because gallstone disease has a significant impact on the patient's health care budget [13].

When predicting the difficulties of cholecystectomy and the conversion of laparoscopic to open cholecystectomy, the Gallbladder Operating Score (G10) is useful. According to a research by Umer W. et al., patients' median G10 scores ranged from 1.00 to 8.00. There were nine (8.10%) conversions from laparoscopic to open cholecystectomy overall. G10 was statistically significant (p=0.003) between research participants who underwent conversion from laparoscopic to open cholecystectomy

and those who underwent laparoscopic cholecystectomy [14]. The mean G10 score, based on the data from our investigation, was 2.89 ± 0.28 (p = 0.001).

In another study conducted by Nida H, et al analyzed BMI distribution and revealed that a significant number of participants, who were classified as overweight were 38.4%, comprising both males and females, and were diagnosed with cholelithiasis and cholecystitis [15]. According to our study data 47.8% participants were overweight and obese who were diagnosed cholelithiasis and underwent surgery. This is in accordance with our study as well.

Common factors responsible for difficult or open cholecystectomy from LC according to our study were, appearance of GB having 50% adhesions (p-value 0.032), access of >30 Kg/m^2 body mass index (p-value 0.013), Contracted or distended GB that cannot be grasped without decompression (p-value 0.012), Sepsis and Complications (p-value <0.001) and time to identify cystic artery and duct in > 90 minutes (p-value 0.001). In a study conducted by Handaya AY et al. concluded that gallbladder adhesion comprising of 61/157 (38.9%) with <50% adhesion and 20/157 (12.7%) 50%-buried GB [16].

In our study 11 (16.4%) patients out of 67 patients who were selected for LC under gone open cholecystectomy were converted from LC to open surgery. Topno N, et al. in their study also defined that The mean operating time for all LC cases was used to determine the time restriction, and 41 LCs were categorized as difficult and 59 as non-DLC (NDLC). Seven of the forty-one challenging LCs needed to be converted to open cholecystectomy (OC). Male gender, body mass index (BMI), number of previous attacks, and prior abdominal surgery were among the patient's characteristics. Calculi size, quantity, impaction, and a thick gallbladder (GB) wall were all considered USG variables. Pericholecystic adhesions, Calot's triangle dissection, GB mobilization from the liver bed, and GB specimen extraction were among the intraoperative factors [17]. In a different study, 9.5% of patients who had laparoscopic cholecystectomy ended up having an open procedure instead [18].

In another study, author conducted that of the 72 patients, 24 (33.3%) experienced problematic LC. Patients who were ≥ 50 years old (18 (75.0%), had obesity 14 (58.3%) and a history of abdominal surgery (11 (45.7%), had undergone ERCP (6 (25.0%), and had gallbladder thickening (17 (70.8%) and CBD dilatation (6 (25.0%) were the factors that had the biggest predictive effects. More challenging cases had longer procedures (mean 95.3 ± 20.1 min versus 54.7 ± 15.6 min; p<0.001), more open conversions (6 (25.0 %) versus 0 (0%); p<0.001), and greater problems after surgery [19]. The results of the study are in consistence with our study.

CONCLUSION

There are many intraoperative factors, such as appearance, obesity, contracted GB, complications, sepsis, time to identify artery and duct and past abdominal history of surgery give hints that a patient will suffer from difficult LC. By identifying these signs, surgeons can prepare patients for counseling, sort risks, and make decisions.

Study limitations

Our study limitations were poor follow up response from the participants.

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