ORIGINAL ARTICLE

Outcome of Bailout Techniques in Non-achievement of Critical View of Safety during Laparoscopic Cholecystectomy

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ABSTRACT

Background: Laparoscopic cholecystectomy (LC) is one of the most commonly performed surgical procedures. It has become the gold standard treatment for gall bladder diseases. But with the growing number of surgeries chances of intraoperative complications increase. Unfortunately, since the widespread use of the laparoscopic technique, the incidence of bile duct injury remains 0.3 -- 0.8%, compared to 0.2% in open operations. This leads to different types of bailout surgeries for the safety of patients. This study is done to evaluate the outcome of bailout techniques used in difficult laparoscopic cholecystectomies when critical view of safety (CVS) cannot be achieved.

Methods: This was an observational study conducted in General Surgery Department of Kathmandu Model Hospital and Kirtipur Hospital, Kathmandu, Nepal. All participants admitted for laparoscopic cholecystectomy were included in this study. Participants who had difficult laparoscopic cholecystectomy (DLC) were identified based non achievement of CVS. Demographic profile, indications, risk factors, intraoperative findings and bailout techniques were evaluated.

Results: A total of 273 cases were included and analyzed in the study. The incidence of difficult LC was 41(15.01%). Types of Bailouts out techniques done were Fundus First, Sub-total cholecystectomy and open cholecystectomy. An overall conversion rate of LC to open cholecystectomy in difficult LC was seen in 3 (1.09%) of the cases. Intraoperative complications were not seen in 87.8% of the patients. All the patients with bailout techniques had excellent outcomes. The mean duration of hospital stay in difficult LC cases was five days.

Conclusion: Different bailout techniques during difficult Laparoscopic Cholecystectomy have excellent outcomes and are recommended to practice.

Keywords: Acute cholecystitis; bailout techniques; bile duct injuries; difficult laparoscopic cholecystectomy

INTRODUCTION

Laparoscopy has become the gold standard approach.[1] Despite many advantages in LC there are still many cases of difficult LC leading to Bile Duct Injury (BDI) 0.1% to 1.5%.[2] In order to avoid BDI, Critical View of Safety (CVS) was introduced in 1995.[3] The CVS has 3 principles: First, the triangle of Calot must be cleared of fat and fibrous tissue. The second, requirement is that the lower one third of the gallbladder is separated from the liver to expose the cystic plate. The third, requirement is that only 2 structures (cystic duct, cystic artery), should be seen entering the gallbladder.[4] If the CVS is not achieved then the bailout surgeries are performed. It may be laparoscopic or open depending on the difficulty. It might be Fundus first technique, sub-total cholecystectomy, tube-cholecystectomy.[5] Sometimes due to intraoperative complications it is

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converted to open cholecystectomy. This study was undertaken to evaluate the outcomes of different bailout techniques used when the Critical View of Safety cannot be achieved during laparoscopic cholecystectomy.

METHODS

This is an observational study conducted at the department of General Surgery Department of Kathmandu Model Hospital Institute of Health Sciences and Kirtipur Hospital during the period of six months from December 2025 to November 2026. Ethical approval was taken from the Institutional Review Committee. Written informed consent was taken. Privacy and confidentiality were maintained. The sample size for the study was calculated based on the incidence of DLC in a study conducted by Bhandari et. al.[6] The incidence of DLC 15.4%, 95% confidence and 12% margin of error, sample calculated was 34. All patient with DLC was included in the study. DLC was defined based on non-achievement of critical view of safety. The study analyzed participants demographic profile, risk factors associated, radiological findings of these participants, intraoperative finding and bailout techniques used. All data were entered in SPSS version 20. The variables like age, gender, BMI, co- morbidities, indications of LC, radiological findings, intraoperative findings and bailout techniques were evaluated using frequency and percentage.

RESULTS

Total number of Laparoscopic surgeries conducted during the study period was 273. Out of all the laparoscopic surgery, difficult laparoscopic cholecystectomy (DLC) was 15.01% (n=41)). Our study showed, the age of the patients ranged from 25 to 80 years, with mean of 42.4 ± 11.4 years.

Out of 41 DLC patients majority of participants were female 30 (73.1%) and male patients were 11 (26.8%). Most of the patients were non obese 9 (70.7%) and obese patients were 12 (29.2%). Participants with Diabetes mellitus were 13 (31.7%), hypertension were 5 (12.1%) and cardiovascular disease in 3 (7.3%). 20 (48.78%) of participants who had DLC had previous history of cholecystitis. (Table 1)

Table 1: Demographic details of Difficult DLC

Variables		Difficult LC (n=41)
Age		42.4 ± 11.4
Gender	Male	11 (26.8%)
	Female	30 (73.1%)
BMI	Obese	12 (29.2%)
	Non-obese	29 (70.7%)
Past history of cholecystitis	Yes	20 (48.78%)
	No	21 (51.2%)
Comorbidities	Diabetes Mellitus	13 (31.7%)
	Hypertension	5 (12.1%)
	Cardiovascular disease	3 (7.3%)
	None	20 (48.7%)

Most common indication of Cholecystectomy was Chronic Calculous cholecystitis 15 (36.6%), acute calculous cholecystitis was 12 (29.3%), acute biliary pancreatitis was 5 (12.2%), Mucocele of gall bladder was 3 (7.3%), Empyema gall bladder was 2 (4.9%), Polyp gall bladder 3 (7.3%). (Table 2)

Table 2: Indication of LC in cases with DLC (n=41)

Indications	Number of DLC
Chronic Calculous cholecystitis	15 (36.6%)
Acute calculous cholecystitis	12 (29.3%)
Acute biliary pancreatitis	5 (12.2%)
Mucocele of gall bladder	3 (7.3%)
Empyema gall bladder	2 (4.9%)
Polyp gall bladder	3 (7.3%)
Biliary colic	1 (2.4%)

Participants who had DLC had Gall bladder distension in 29 (70%), GB wall thickness >4mm in 27(65.85%) participants, fibrotic changes in 21(51.2%), impacted stone in the neck of GB in 7 (17%) and multiple GB stones in 25(60.9%). (Table 3)

Table 3: Radiological findings of DLC (N=41)

Variables	Difficult LC
GB distention	29 (70%)
GB wall thickness >4mm	27 (65.85%)

Fibrotic changes	21 (51.2%)
Impacted stone in the neck of GB	7 (17%)
Multiple GB stones	25 (60.9%)

All participants who had DLC underwent open Hasson's technique for primary port entry. 48.7%(n=4) had grade IV cholecystitis according to Parkland classification. All DLC cases took more than 20 minutes to dissect Callot's triangle. 11 cases needed larger clip to clip cystic duct, 5 cases underwent suture tying. (Table 4)

Table 4: Intraoperative findings of DLC (n=41)

Variables		Difficult LC
Access	Hasson Technique	41 (100%)
	Veress needle technique	0
Parkland classification of cholecystitis	Grade III	13 (31.7%)
	Grade IV	20 (48.7%)
	Grade V	8 (19.5%)
Calot's triangle dissection time	>20min	41 (100%)
Duct clipping	Larger clip	11 (26.8%)
	Suture	2 (4.8%)
	Tie	3(7.3)

Bail out technique were performed in 11(26.8%) DLC. Fundus-first technique was done in 5 (12.2%) cases, sub-total cholecystectomy in 3(7.3%) and conversion to open cholecystectomy was done in 3(7.3%). Remaining 30 (73.17%) DLC were completed by the senior consultant surgeons with more than 10 years of experience. (Table 5)

Table 5: Types of Bailout Procedures performed(n=41)

Name of Bailout procedure in DLC	Number of cases
Fundus first	5 (12.19%)
Subtotal cholecystectomy	3 (7.3%)
Open Bailout	3 (7.3%)
Taken over by senior consultant	30 (73.17%)

During the surgery, most common intraoperative complication encountered was iatrogenic perforation of GB in 24(58.5%), gall stones were spilled in 21(51.2%), lesion of the omentum in 7(17.1%), cystic artery bleeding 2(4.9%). We had no injury of CBD and bleeding from ligaments of liver. (Table 5)

Table 6: Intraoperative complications of DLC (n=41)

Intraoperative complications	Number of cases
Iatrogenic perforations of GB	24 (58.5%)
Spilled gallstones	21 (51.2%)
Cystic artery bleeding	2 (4.9%)
Common bile duct injury	0 (0%)
Bleeding from the ligaments of liver	0 (0%)
Lesion of the omentum	7 (17.1%)

DISCUSSION

In our study out of 273 patients, 15.01% (n=41) were classified as difficult laparoscopic cholecystectomy and conversion to open cholecystectomy was in 3(7.3%) while in Bhattarai et. al., 17.8% and in 1.3% respectively.[7] We observed that specific radiological and clinical indicators were highly predictive of surgical challenge. In our study, Gallbladder wall thickness >4 mm was present in 27 of the 41 DLC cases. In the study conducted by Nidoni et. al., GB wall thickness of >3mm and pericholecystic collection were all statistically significant for predicting the difficult LC and its conversion.[8] In our study fibrotic changes and gallbladder distention were noted in 21(51.2%) and 29 (70%) cases respectively. Similarly impacted stone in the neck of GB was in 7 (17%) cases. Karim et. al. in their study found that palpable GB, GB wall thickness ≥4 mm, pericholecystic collection and impacted stone were significant factors to predict difficult LC preoperatively.[9]

The majority of our DLC cases were classified as Parkland Grade IV (n=20) or Grade V (n=8), indicating severe inflammation or a "frozen" Calot's triangle where anatomical landmarks were significantly distorted.[10] These findings suggest that surgeons should maintain a high index of suspicion for DLC when preoperative imaging reveals significant wall thickening or acute distention. We followed "salvage technique", aiming to

complete the cholecystectomy without bile duct injury while ensuring an optimal patient outcome. The core of our study focused on the management of the 27 cases where CVS could not be safely achieved.

Fundus-First (Dome-Down) Technique was done in 5 cases, this allowed for the identification of cystic structures from a superior-to-inferior direction, bypassing the distorted anatomy at the cystic pedicle. Subtotal Cholecystectomy performed was in 3 cases. 30 Cases needed help from another surgeon. Koirala et al and The SAGES Safe cholecystectomy Program with strategies for minimizing bile duct injuries: adopting universal culture of safety in cholecystectomy also mentioned this approach as a safe alternative bailout in difficult laparoscopic cholecystectomy.[11,12] This technique effectively avoided the "zone of death" near the common bile duct in patients with severe Grade V inflammation. Open conversion rate was remarkably low at 1.09% (n=3) in Our study. This suggests that proficient use of laparoscopic bailout techniques can safely rescue a procedure that might otherwise have required an immediate open incision.

A significant highlight of our results was the zero-percent (0%) rate of common bile duct injuries (BDI) and no mortality. Iatrogenic gallbladder perforation (8.79%) and stone spillage (7.69%) were documented in our study but these did not lead to long-term complications or a change in the clinical outcome, as all patients achieved full recovery. Additionally, the two cases of cystic artery bleeding were managed successfully via laparoscopy, demonstrating that surgical difficulty does not necessitate an automatic conversion if it can be managed laparoscopically.

The clinical impact of a difficult procedure was reflected in the postoperative length of stay. Patients in the DLC group had a mean stay of 5 days, compared to 3 days in the standard group. This extended stay in DLC cases is likely attributable to the management of higher-grade inflammation (Parkland III-V) and the need for closer monitoring following subtotal or fundus-first procedures. However, the successful discharge of all patients and no complications on follow-up validates the efficacy of these intraoperative decisions. We propose that the use of the Hasson technique for access—used in all 41 of our difficult cases—provides a safe and controlled entry point in patients with suspected inflammatory adhesions.

The strengths of this study include a well-defined cross-sectional study. The consistent surgical technique, and procedures performed by experienced surgeons, which enhances internal validity. Limitations of our study include the observational design, relatively small number of DLC cases, and lack of long-term follow-up for late complications related to gallstone spillage or subtotal cholecystectomy. Additionally, outcomes were not compared with a matched non-DLC group, which would have strengthened the comparative analysis.

CONCLUSION

This study demonstrates that the Critical View of Safety remains the definitive benchmark for safety in laparoscopic cholecystectomy, yet its achievement is not always feasible in the presence of severe inflammation or anatomical distortion. The transition to bailout techniques, specifically the fundus-first approach, subtotal cholecystectomy, seeking help from another surgeon are critical decision-making steps that prioritizes patient safety over procedural completion.

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