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Intraoperative Difficulties in Laparoscopic Cholecystectomy and Tricks & Tips to Overcome

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Abstract | **Original Research Article**

Background: Laparoscopic cholecystectomy (LC) is the gold standard treatment for gallstone disease worldwide. Despite being a routine operation for most surgeons, it can become technically challenging because of dense adhesions, abnormal biliary anatomy, or gallbladder inflammation. Meticulous dissection is required to establish critical view of safety. Safe dissection is the key to complete laparoscopic cholecystectomy successfully and to prevent complications, such as bile duct injury. This study aimed to identify the intraoperative difficulties encountered during LC and describe the effective techniques employed to overcome them. ***Methods:*** This retrospective study was conducted at a tertiary hospital over a period of 12 months (October 2020 to October 2021). All patients underwent a standard four-port laparoscopic cholecystectomy. Various intraoperative difficulties were identified and overcome using different techniques. ***Results:*** Of the 27 laparoscopic cholecystectomies performed, 12 (44.44%) were smooth and 15 (55.55%) were difficult. However, none of the patients required conversion to open surgery. Various difficulties encountered were: problem in creating pneumoperitoneum in one (3.7%) patient, dense adhesion in seven (25.93%) patients, abnormal Callot's anatomy and difficult cystic duct and artery skeletonization in three (11.11%) patients, inability to grasp the fundus of the gallbladder in two (7.41%) patients, difficulty in separating the gallbladder in one (3.7%) patient, and difficult extraction of the gallbladder containing multiple large stones through the umbilical port in one (3.7%) patient. ***Conclusion:*** Early identification of Rouviere's sulcus, precise posterior dissection, and careful handling of the cystic duct and artery are critical for managing intraoperative complications. Adherence to these technical refinements ensures safety and reduces the need for conversions.

Keywords: Laparoscopic cholecystectomy, intraoperative difficulty, critical view of safety.

INTRODUCTION

Laparoscopic cholecystectomy (LC) has become the standard of care for symptomatic gallstone disease since its widespread adoption in the early 1990s. It is favored over open cholecystectomy because of its minimally invasive nature, reduced postoperative pain, shorter hospital stays, and faster recovery [1,2]. Despite being considered a routine surgical procedure, LC can present significant intraoperative challenges, even in experienced hands. Factors such as dense adhesions, acute inflammation, distorted anatomy of Calot's triangle, or variations in the cystic duct and artery can make dissection technically demanding and increase the risk of bile duct injury [3,4].

The reported incidence of bile duct injury during LC is approximately 0.3–0.6%, but this risk increases up to threefold in technically difficult cases [5]. Inflammation, previous upper abdominal surgery, or congenital biliary anomalies may obscure the surgical landmarks, making the identification of the cystic duct–common bile duct junction difficult. Establishing the critical view of safety (CVS), introduced by Strasberg, remains the most reliable method to prevent bile duct injury [6]. However, achieving CVS can be challenging in inflamed or fibrotic gallbladders where the anatomy is distorted [7].

The Rouviere's sulcus, an anatomic cleft located on the liver's posterior surface, has emerged as a dependable landmark that guides safe dissection in the

hepatocytic triangle. Studies have shown that maintaining dissection ventral to this sulcus markedly reduces the risk of injury to the common bile duct [8,9]. The Tokyo Guidelines 2018 further emphasize careful dissection along anatomical landmarks and avoidance of blind clipping in unclear anatomy [10].

Various operative techniques have been developed to overcome intraoperative difficulties, including the fundus-first (dome-down) approach, subtotal cholecystectomy and retro infundibular dissection. These methods aim to control dissection in high-risk cases and ensure completion of the procedure without conversion to open surgery [11,12]. Nevertheless, there is still no universal consensus on the best intraoperative approach when LC becomes difficult.

This study was designed to identify the intraoperative difficulties encountered during LC in a tertiary hospital setting and to describe the specific surgical strategies employed to overcome them. By focusing on practical intraoperative problem-solving rather than preoperative predictors, this study aims to contribute to safer laparoscopic practices and reinforce the importance of anatomical orientation and surgical adaptability in challenging cases.

METHODOLOGY & MATERIALS

This retrospective observational study was conducted at the Department of Surgery, Green Life Medical College, Dhaka, Bangladesh, from October 2020 to October 2021. A total of 27 patients who underwent elective or emergency laparoscopic cholecystectomy for gallstone disease during this period were included. The study was designed to identify intraoperative challenges and document the specific technical maneuvers used to overcome them.

Sample Selection

Inclusion Criteria:

- Adult patients (≥18 years) undergoing LC for symptomatic gallstone disease.
- Both elective and emergency cases are included.
- Cases completed laparoscopically.

Exclusion Criteria:

- Patients with morbid obesity (BMI >35).
- Known coagulation disorders.
- Liver cirrhosis or portal hypertension.

Study Procedure

All patients underwent a standard preoperative assessment, including blood tests and ultrasonography. After the induction of general anesthesia, four-port LC was performed using a standard setup. Pneumoperitoneum was created using an open infraumbilical approach. The umbilical port (10 mm) was used for the laparoscope and gallbladder retrieval, and the epigastric and right subcostal ports were used for dissection and retraction. Intraoperative findings were meticulously recorded, including the type and site of the difficulties. Techniques for overcoming difficulties, such as adhesiolysis, posterior dissection guided by Rouviere's sulcus, gallbladder decompression, and careful skeletonization of the cystic duct and artery, were applied as appropriate. Data were analyzed using Microsoft Excel and were summarized descriptively. The frequencies and percentages were calculated for each intraoperative challenge. No inferential statistical tests were performed. The data are presented in tabulated and narrative forms for clarity and interpretability. Informed consent was obtained from all participants. Confidentiality was maintained throughout the study period.

RESULTS

A total of 27 laparoscopic cholecystectomies were performed during the study period from October 2020 to October 2021. Among these, 12 cases (44.44%) were smooth and uneventful, while 15 cases (55.55%) presented intraoperative difficulties. None of the procedures required conversion to open cholecystectomy. The intraoperative difficulties encountered and their frequencies are summarized in Table 1.

Table 1: Intraoperative Difficulties Encountered during Laparoscopic Cholecystectomy (n = 27)

Type of Difficulty	Number of Patients	Percentage (%)
Difficulty in creating pneumoperitoneum	1	3.7
Dense adhesions	7	25.93
Abnormal Calot's anatomy and difficult skeletonization of cystic duct and artery	3	11.11
Inability to grasp the fundus of gallbladder	2	7.41
Difficulty in separation of gallbladder from liver bed	1	3.7
Difficulty in extraction of gallbladder through umbilical port	1	3.7

1. Difficulty in Creating Pneumoperitoneum

This was observed in 1 patient (3.7%), caused by omental adhesion to the inner surface of the anterior abdominal wall. The difficulty was managed by gentle finger adhesiolysis through a small infra-umbilical incision, followed by controlled enlargement of the linea alba using a needle holder to introduce the first port.

Persistent gas leakage was controlled by placing a skin suture around the cannula.

2. Dense Adhesions

The most frequent intraoperative challenge was dense pericholecystic adhesion, encountered in 7 patients (25.93%). These adhesions were carefully released using bipolar diathermy and blunt dissection. Dissection of Calot's triangle was delayed until the anatomy was clearly visualized to avoid bile duct injury.

3. Abnormal Calot's Anatomy and Difficult Skeletonization

Abnormal Calot's anatomy with difficult skeletonization of the cystic duct and artery was found in 3 patients (11.11%). In these cases, establishing the critical view of safety (CVS) was technically demanding due to fibrosis and distorted anatomy. Dissection was guided by the identification of Rouviere's sulcus, beginning posteriorly and proceeding anteriorly to stay in the safe zone ventral to the sulcus. In one case, the cystic duct was unusually short, requiring careful clip application.

4. Inability to Grasp the Fundus of the Gallbladder

This occurred in 2 patients (7.41%) with distended or thick-walled gallbladders. Decompression was achieved by aspirating gallbladder contents with a fine aspiration needle, allowing easier grasping and retraction of the collapsed gallbladder fundus.

5. Difficulty in Separation of the Gallbladder from the Liver Bed

One case (3.7%) involved a fibrotic, thick-walled intrahepatic gallbladder, leading to troublesome dissection and minor bleeding from the liver bed. The correct adventitial plane was identified and followed with gentle dissection and bipolar cautery to minimize bile or stone spillage. Careful traction and counter-traction were employed to delineate tissue planes.

6. Difficulty in Gallbladder Extraction through Umbilical Port

In 1 patient (3.7%), gallbladder extraction through the umbilical port was difficult due to multiple large calculi. The umbilical incision was extended inferiorly to facilitate removal. When the gallbladder became impacted at the port site, it was partially incised, and the stones were removed using stone-holding forceps before final extraction.

DISCUSSION

Laparoscopic cholecystectomy remains one of the most commonly performed operations worldwide; however, even with decades of refinement, intraoperative challenges continue to test the surgeon's expertise. The present study analyzed 27 LC cases, identified a range of technical difficulties, and detailed the maneuvers used to overcome them. Despite more than half of the procedures being classified as difficult (55.55%), none required conversion to open surgery, underscoring the effectiveness of precise anatomical orientation and adaptive surgical techniques.

The most frequent intraoperative difficulty in this series was dense pericholecystic adhesion, observed in 25.93% of cases. This finding parallel results from Gupta *et al.,* and Bat, who reported adhesions as the leading cause of difficult LC [4,13]. Adhesions distort normal anatomy and increase the risk of iatrogenic injury during initial access and Calot's dissection. Adhering to the principle of "safe exposure before dissection," as advocated in the Tokyo Guidelines, significantly reduces such risks [10]. In our series, adhesiolysis was performed meticulously using bipolar diathermy and blunt dissection, ensuring that Calot's triangle was not approached until the anatomic relationships were clear.

Abnormal Calot's anatomy and difficult cystic duct skeletonization were encountered in 11.11% of cases. Anatomic variations in the cystic duct or artery are a well-recognized source of bile duct injury. Strasberg et al. emphasized achieving the critical view of safety (CVS) by isolating the cystic structures completely before clipping or transection [6]. However, as noted by Henneman et al., severe inflammation or scarring can obscure tissue planes, making CVS difficult to achieve [7]. In such instances, the use of Rouviere's sulcus as an orientation landmark has proven invaluable. Singh and Prasad and Jha et al. demonstrated that dissection kept ventral to the sulcus markedly decreases bile duct injury risk [8,9]. This principle was effectively applied in the present study, where posterior dissection guided by the sulcus ensured safe delineation of cystic structures.

Difficulty in grasping the gallbladder fundus occurred in 7.41% of patients, often due to a distended or thickened gallbladder. Controlled decompression using a fine aspiration needle allowed safe handling and improved visibility. This simple yet effective method aligns with Haribhakti and Mistry, who highlighted decompression as a practical technique to manage edematous gallbladders [14].

Intrahepatic or fibrotic gallbladders were rare (3.7%) but particularly challenging. Bleeding from the liver bed and loss of dissection planes were potential complications. Our strategy—identifying the loose adventitial plane and maintaining gentle traction—was consistent with the recommendations of Elshaer *et al.,* who advocated careful subserosal dissection to avoid bile spillage [15]. While subtotal cholecystectomy has been recommended as a bailout procedure in such situations, none of our cases required it due to careful technique [12].

Extraction of the gallbladder through the umbilical port posed difficulty in 3.7% of cases, particularly with multiple large stones. The challenge was addressed by extending the umbilical incision or

partially evacuating stones. Similar approaches were described by Majid *et al.,* who demonstrated that partial decompression and controlled extraction reduce the risk of spillage without increasing infection rates [16].

Notably, none of the patients in this series required conversion to open surgery or sustained a bile duct injury. This success rate compares favorably with international series, where conversion rates range between 5–15% depending on case complexity [17,18]. The findings suggest that a systematic and patient approach, grounded in anatomical orientation and flexibility of technique, can effectively manage intraoperative adversity.

Overall, this study reinforces the importance of adhering to fundamental safety principles: achieving CVS, using Rouviere's sulcus as a constant landmark, and avoiding blind clipping or coagulation. Future studies with larger cohorts could help develop standardized intraoperative difficulty classifications and validate these strategies in diverse clinical settings. Until then, meticulous dissection, anatomical awareness, and respect for safety landmarks remain the cornerstones of successful laparoscopic cholecystectomy.

Limitations of the study

This study was limited by its small sample size and retrospective design, which may limit the generalizability of the findings. Additionally, no preoperative difficulty scoring system was used, as the focus remained on intraoperative management.

CONCLUSION

Although routine, laparoscopic cholecystectomy often presents intraoperative challenges that require vigilance and adaptability. Identification of Rouviere's sulcus, precise posterior dissection, and thorough skeletonization of the cystic duct and artery are key to overcoming these technical difficulties. Adhering to these principles allows for the safe completion of surgery without conversion or complications. This study reinforces that structured intraoperative strategies, rooted in anatomical landmarks and careful technique, remain central to achieving the critical view of safety and minimizing the risk of bile duct injury.

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Conflicts of interest

There are no conflicts of interest.

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