

The Strategies for the Performance of Difficult Laparoscopic Cholecystectomies and the Management of Its Postoperative Complications

-With the Experience from 278 Cases

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Abstract

Background: Laparoscopic cholecystectomy (LC) remains the preferred method for treating benign gallbladder diseases. However, clinical presentations of cholecystitis vary widely. For severely inflamed cases, LC can be challenging. Objectives: This study aimed to explore intraoperative strategies and postoperative management of complications during difficult LC to further enhance its safety. Methods: We retrospectively analyzed data from difficult LC procedures performed by the same expert at our hospital between January 2016 and December 2022. The surgical approach, handling methods, operative time, and postoperative complications were evaluated. Results: Utilizing techniques such as thin-layer progressive dissection, suction and blunt dissection, reverse resection, partial cystectomy, we successfully completed difficult LC in 278 cases. All surgeries were accomplished under laparoscopy. Five cases (0.72%) experienced bile leakage which was managed through drainage tube fistula formation before removal; there were no incidences of hemorrhage, abdominal infection, or biliary tract injury. Conclusion: Our series showed that difficult LC had high safety and low rates of conversion to open surgery and complications. The safety of complex gallbladder removal is related to the surgeon's experience and proficiency in laparoscopic skills. Postoperative bile leakage can be effectively treated through drainage tube fistula formation.

Keywords

Difficult Laparoscopic Cholecystectomy, Operative Strategies, Cystic Duct Bile Leakage, Gallbladder Triangle

1. Introduction

LC is one of the most common operations in hepatobiliary surgery, yet difficult laparoscopic cholecystectomy, due to anatomical complexity and severe adhesions, significantly increases both difficulty and risk. There is no unified definition for "difficult" LC, generally encompassing conditions like acute inflammation, chronic inflammation, atrophic cholecystitis, Mirizzi syndrome, prior upper abdominal surgery history, markedly deformed Calot's triangle, significant difficulties, and higher complication rate [1]-[3]. Such operations pose significant challenges to surgeons. Whether successful or not, difficult gallbladder removal affects patient prognosis and quality of life, as well as the safety rate of hepatobiliary surgeons' cholecystectomies. Safety in difficult gallbladder removal is closely tied to the patient's abdominal condition and the surgeon's skill and experience. Here, we report some unique experiences gained in performing and managing these surgeries.

2. Data and Methods

2.1. Clinical Data

Retrospectively collected data from 278 difficult LC cases handled by the same expert at the Department of Hepatobiliary Surgery of Right Jiang National Medical College between January 2016 and December 2022. Among them, 218 males and 60 females, aged 24 - 71 years old (mean age 49 ± 13 years), included 238 cases of cholelithiasis with acute cholecystitis, 25 cases of cholelithiasis with chronic cholecystitis, and 15 cases of Mirizzi syndrome. Thirty-five patients had diabetes, 18 had liver cirrhosis, 13 had a history of upper abdominal surgery, three cases with duodenal ulcer perforation, one case undergoing long-term dialysis for nephrotic syndrome, while the rest had no notable comorbidities. Routine preoperative evaluations including chest radiographs, electrocardiograms, ultrasonography, CT or MR + MRCP imaging studies, biochemical tests, hepatic and renal function, electrolytes, coagulation profiles were conducted.

2.2. Surgical Method and Handling Techniques

Three-port or four-port approaches were typically used. Patients received general anesthesia via endotracheal intubation, and pneumoperitoneum was established. The gallbladder was lifted to expose the Calot's triangle. Ultrasonic scalpels or electrosurgical hooks dissected the Calot's triangle, separating the cystic duct and artery. The cystic duct and artery were ligated using absorbable hemoclips. After lifting the gallbladder base, the gallbladder bed was stripped in a retrograde manner using an ultrasonic scalpel or electrosurgical hook until only the cystic duct and artery remained attached. Following confirmation, they were cut separately, allowing complete gallbladder excision. If Calot's triangle presented with severe inflammatory adhesion making it hard to separate the cystic duct or if there was concern about potential biliary tract damage during separation, the operation could proceed without addressing the triangle and perform a retrograde removal of the gallbladder. Before retrograde separation, incisions could be made into the gallbladder to reduce pressure. If dense adhesion occurred between the gallbladder and duodenum, separation should follow the principle of "preserve the gallbladder rather than injure the intestine," leaving part of the gallbladder wall intact instead of risking duodenal injury. When the gallbladder tension was high, opening the gallbladder for decompression was possible simultaneously aspirating the gallbladder contents to facilitate dissection of the Calot's triangle. In difficult cases where Calot's triangle dissection proved challenging, a retrograde or partial cystectomy could be considered. For those undergoing partial cystectomy, Hartmann's pouch was resected and closed using absorbable sutures. Absence of bile leakage was confirmed before placing an abdominal drain externally. Antibiotics were administered against infections for 3-5 days, painkillers given for 3 days. Abdominal drains were removed based on postoperative drainage volume, with additional CT scans if necessary to check for fluid accumulation or sinus formation around the drain. Typically, patients were discharged after 5 - 7 days.

3. Results

Twenty-one cases required conversion to open surgery (six cases of Mirizzi syndrome, eight of atrophic cholecystitis, four of bowel injury during separation, three of severe adhesive denseness near the neck of the gallbladder); 257 cases underwent laparoscopic completion. Sixty-five cases underwent antegrade resection, 81 underwent retrograde resection, and 132 underwent partial cystectomy. The cystic duct could be isolated and ligated in 85 cases, while in 193 cases, the inability to isolate led to partial cystectomy. Two cases encountered frozen triangles with difficulties in hemostasis, one converted to open surgery but still suffered bile leakage afterward; another case used suture compression, partially preserving the posterior wall of the gallbladder and closing with 2-0 absorbable sutures close to Hartmann's pouch. Twenty cases of Mirizzi syndrome were resolved through partial cystectomy or blunt dissection of the cystic duct, successfully completing the surgery. Five cases experienced bile duct leakage all managed through external abdominal drains leading to sinus formation and subsequent removal. The 278 patients stayed in the hospital for 7 - 21 days, averaging (7.5 ± 2.5) days. Operation times ranged from 60 - 150 minutes, averaging (83.6 ± 13.1) minutes. Postoperative follow-up revealed no abnormalities.

4. Discussion

Unlike simpler cases of laparoscopic cholecystectomy (LC), difficult LC poses greater challenges due to increased surgical complexity and elevated risks, directly impacting the safety records of hepatobiliary surgeons performing laparoscopic gallbladder removals. Difficult LC frequently emerges in contexts such as acute cholecystitis [4], Mirizzi syndrome, certain cases of chronic granulomatous cholecystitis, or when coupled with conditions like liver cirrhosis, severe duodenal ulcers, among other medical comorbidities. Other factors include a history of pre-

vious upper abdominal surgery or long-standing health issues, requiring physicians to remain watchful.

As hepatobiliary specialists, for every LC procedure, a comprehensive review of multiple datasets should precede the operation to assess procedural difficulty. Factors to consider include CT or MR + MRCP examination results [5], frequency of acute cholecystitis attacks, gallbladder wall thickness, fibrinogen levels, neutrophil counts, and alkaline phosphatase levels [6] [7]. In male patients suffering acute cholecystitis, localized conditions tend to be more complex, with pronounced adhesions making surgery notably more demanding [6] [8].

Difficult LC can be classified into four main types based on intraoperative findings [9]: type one—adhesion of the omentum, transverse colon, and duodenum to the gallbladder; type two-adhesion and dissection difficulty in the Calot's triangle; type three—separation difficulty with the gallbladder bed; and type four extensive peritoneal adhesion, inclusive of technical factors. Technical and experiential considerations play pivotal roles when tackling complex gallbladders, specifically in the management of the Calot's triangle. Deciding whether to forcibly dissect the triangle or opt for retrograde resection significantly affects operating duration and complication incidence. For instance, when the Calot's triangle exhibits severe edema or fibrosis, forcefully dissecting it might induce bleeding or biliary tract damage, necessitating retrograde resection or ligation of the cystic duct. Managing complex gallbladders, we have integrated various methodologies such as thin-layer advancement, scraping, blunt dissection, retrograde resection, partial cystectomy, and subtotal cholecystectomy, accruing valuable insights along the way. Our approach to handling complex gallbladders is contingent upon situational assessment. For instances of densely adherent gallbladder to the duodenum, blunt dissection is initially attempted, avoiding forcible detachment to adhere to the principle of "preserve the gallbladder rather than harm the intestine." In our series, this methodology has been applied to twelve cases with favorable outcomes and absence of complications. ERCP aftermath often entails significant inflammation necessitating skilled physician intervention [10]. Fifteen cases in our cohort involved LC following ERCP, with primary surgical challenges centered around Calot's triangle anatomy.

Handling patients with frozen Calot's triangle remains contentious [11]. Once the gallbladder artery bleeds in these cases, hemostasis becomes arduous owing to reduced arterial contractility. Both cases we encountered exhibited difficulties in achieving hemostasis, one necessitated conversion to open surgery while the other relied on compression suturing. The challenge in managing the cystic duct in such instances lies in the fact that suturing cannot fully secure the cystic duct due to the impossibility of isolation, preventing clip application. One case required pursestring closure of the cystic duct post-conversion but still manifested bile leakage. Another retained a portion of the gallbladder posterior wall, with 2-0 absorbable sutures near Hartmann's pouch. Preoperative ERCP allows surgeons insight into the anatomical landscape, decreasing the likelihood of biliary damage in Mirizzi syndrome cases. Often, solitary cholecystectomy suffices, rarely requiring biliary reconstructive surgery. With over twenty cases of Mirizzi syndrome, we achieved success through partial cystectomy or blunt dissection of the cystic duct. Personally, partial cystectomy proves safer and less time-consuming in instances of tight adhesion between the cystic duct and right hepatic duct or common hepatic duct [12]. In partial cystectomy procedures, if the Calot's triangle allows cystic duct isolation, applying clips or stitching can suffice without sealing Hartmann's pouch [13]. Endoscopic staplers demonstrate utility in managing dilated cystic ducts [14]. In patients who undergo cholecystostomy and lack visual identification of the gallbladder due to adhesion, cholecystectomy can be completed through laparoscopic liver dissection guided by a cholecystostomy tube [15].

Regarding whether the gallbladder mucosa requires cauterization in partial cystectomy, though many experts advocate for it, we refrained from doing so in some cases, believing that the mucosa secretes mucus which post-surgery can be adequately absorbed by the peritoneum. Without cauterization, recovery proceeded smoothly for those patients with no evidence of effusion, fever, or abdominal pain throughout their follow-ups.

A peculiar complication in our series was bile leakage from the cystic duct in two patients after subtotal cystectomy. One case had previously undergone ERCP with nasobiliary drainage, but the nasobiliary catheter dislodged after three days. Since the abdominal drainage tube maintained patency and the patient lacked abdominal pain, we opted against reinsertion of an ERCP stent or drainage. Early observations indicated detectability of T-tube sinusoids via CT [16] [17], suggesting probable sinus formation around rubber drainage tubes, permitting direct tube removal once formed. After six weeks of monitoring, CT confirmed sinus formation around the drain tube, despite daily drainage of approximately 600 ml bile. Following a successful clamp test, we removed the tube, resulting in patient comfort and prevention of repeated interventions or numerous ERCP sessions. Similarly, another case of cystic duct leakage responded favorably to this approach. Hence, the placement of drainage tubes in partial cystectomy is critical, warranting careful control of side-hole size. Conventional management of cystic duct leaks involves 2 - 4 weeks of ERCP-guided nasobiliary drainage or internal stenting to ensure smooth bile flow into the duodenum, allowing gradual closure of the cystic duct. Rai V et al. [18] reported ineffectiveness of metal stenting and nasobiliary drainage post-laparoscopic subtotal cystectomy in addressing cystic duct leaks. Ultimately, via the sinusoid route, a coil embolization through the drainage tube sealed the leak, achieving cure after fifteen weeks and three ERCP sessions. Compared to theirs, our approach is simpler and scientifically sound.

5. Conclusion

In summary, the multifactorial nature of difficult LC, particularly the handling of Calot's triangle, necessitates personalized strategies incorporating techniques like thin-layer progression, blunt dissection, retrograde resection, and partial cystec-

tomy. Prompt conversion to open surgery when encountering intraoperative difficulties is advised. Limitations exist regarding standard surgical protocols for difficult gallbladders, underscoring the need for prospective investigations in this domain.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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