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Review Article

Subtotal Cholecystectomy for Acute Calculus Cholecystitis: An Update: Review Article

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Abstract: Subtotal cholecystectomy is considered a contingency procedure during cholecystectomy when the critical view of safety cannot be achieved due to inflammation, posing a risk of bile duct injury if the operation proceeds. Laparoscopic subtotal cholecystectomy is the predominant technique employed for this procedure. Subtotal cholecystectomy can be executed using either a fenestrating or reconstituting approach. The most prevalent complications include bile leakage, recurrent stone formation, inflammation of the stump, and a high conversion rate. In this review, we will explore the role of subtotal cholecystectomy in the management of acute calculus cholecystitis, examining the various approaches and the long- and short-term outcomes associated with this procedure.

Keywords: Acute Calculus Cholecystitis, Laparoscopic Subtotal Cholecystectomy, Subtotal Cholecystectomy, Complication, Fenestrating, Reconstituting, Recurrence.

INTRODUCTION

Acute calculus cholecystitis represents the most prevalent complication associated with gallstone disease, occurring in up to 25% of individuals presenting with symptomatic gallstones. Clinically, it manifests as pain in the right upper quadrant of the abdomen, accompanied by nausea and vomiting. Physical examination typically reveals a positive Murphy's sign, and laboratory investigations often indicate leukocytosis. Ultrasound imaging is instrumental in identifying gallbladder inflammation and the presence of gallstones (Chung & Duke, 2018; Schuld & Glanemann, 2015). Initial management of acute calculus cholecystitis involves the administration of intravenous antibiotics and analgesics, followed by cholecystectomy, which is currently performed using laparoscopic techniques. The timing of laparoscopic cholecystectomy, whether early or delayed, is determined based on the patient's clinical presentation (Bagla *et al*., 2016; Gomes *et al*., 2017; Mencarini *et al*., 2024).

Subtotal cholecystectomy is regarded as a bailout procedure for challenging gallbladder cases, wherein a portion of the gallbladder is excised due to inflammation at Calot's triangle, complicating the identification of the cystic duct. Proceeding with a full cholecystectomy under these circumstances poses a risk of injury to the common bile duct or adjacent vascular structures. The incidence of subtotal cholecystectomies ranges from 4% to 10%, and they can be executed laparoscopically. Strasberg *et al*., have classified subtotal cholecystectomy into fenestrating and reconstituting types. In the fenestrating type, the gallbladder remnant is left open, with or without closure of the cystic duct. Conversely, the reconstituting type involves the closure of the gallbladder remnant using sutures or staplers. Common complications associated with subtotal cholecystectomy include bile leakage, peritonitis, and recurrent stones and cholecystitis from the gallbladder remnant(Abdallah *et al*., 2025; Fernando Santos *et al.,* 2017; Katsohis *et al*., 1996.; Hussain, 2011; Ramírez-Giraldo *et al*., 2023; Seshadri & Peitzman, 2024; Tang *et al*., 2021). The World Society of Emergency Surgeons (WSES) guidelines for managing acute calculus cholecystitis recommend performing an open or laparoscopic subtotal cholecystectomy if there is difficulty in identifying the structures at Calot's triangle, and continuing the surgery would entail a risk of iatrogenic injury(Ansaloni *et al*., 2016; Pisano *et al*., 2020).

This review will explore the role of subtotal cholecystectomy in the management of acute calculus cholecystitis. We will analyze various techniques for performing a subtotal cholecystectomy and discuss potential complications. A comprehensive literature review was conducted using PubMed, the Cochrane Database of Clinical Reviews, and Google Scholar, focusing on clinical trials, observational studies, cohort studies, systematic reviews, and meta-analyses published between 1990 and 2025. The search employed the following keywords: "Acute calculus cholecystitis," "laparoscopic subtotal cholecystectomy," "Subtotal cholecystectomy," "fenestrating," "reconstituting," "complications," and "recurrence." Only articles in the English language were considered. Additional articles were identified through manual cross-referencing of the literature. Case reports and studies with fewer than 10 patients, as well as editorials, were excluded. The study included adult male and female patients, while pregnant and pediatric patients were excluded.

DISCUSSION

Subtotal Cholecystectomy-Open and Laparoscopic Methods

Shingu *et al.,* conducted an assessment of laparoscopic subtotal cholecystectomy in cases of severe cholecystitis. In this study, 110 patients underwent the procedure, with no conversions to open cholecystectomy, and a wound infection rate of 9.1%. The follow-up period averaged 30.7 months, during which a recurrence rate of 2.7% was observed(Shingu *et al*., 2016). Eishaer *et al.,* performed a systematic review and meta-analysis on subtotal cholecystectomy for challenging gallbladder cases, incorporating 30 articles with a total of 1231 patients. Of these, 898 underwent laparoscopic subtotal cholecystectomy, while 234 underwent open subtotal cholecystectomy. The study reported a morbidity rate of 2.9% and a mortality rate of 0.5%. Laparoscopic subtotal cholecystectomy was found to be associated with reduced subhepatic collection, mortality, and wound infection rates, although it exhibited a higher rate of bile leakage compared to open subtotal cholecystectomy(Elshaer *et al*., 2015). Aloraini *et al*., conducted a systematic review and meta-analysis comparing laparoscopic subtotal cholecystectomy and open total cholecystectomy for difficult gallbladder cases. This study included 11 studies with a total of 1429 patients, and it was determined that laparoscopic subtotal cholecystectomy was associated with reduced postoperative complications, bile duct injury, and length of hospital stay(Aloraini *et al*., 2024).

Nzenwa *et al*., conducted a systematic review and meta-analysis to assess the risks associated with subtotal cholecystectomy. The analysis included 85 studies encompassing 3,645 patients, of whom 2,918 underwent the laparoscopic approach and 727 underwent the open approach. The reconstituting method emerged as the most frequently performed surgical technique, accounting for 74.6% of cases, with a bile leak rate of 13.9%. The open subtotal cholecystectomy was linked to higher mortality and wound infection rates.(Nzenwa *et al*., 2021). In a separate systematic review and meta-analysis, Koo *et al*., compared subtotal and total cholecystectomy for challenging gallbladder cases. This analysis incorporated 10 studies with a total of 1,911 patients, where 626 underwent subtotal cholecystectomy and 1,285 underwent total cholecystectomy. Subtotal cholecystectomy was associated with increased rates of bile leakage, bile duct injury, and reoperation compared to total cholecystectomy(Koo *et al*., 2024).

Subtotal Cholecystectomy: The Fenestrating and Reconstituting Subtypes

Subtotal cholecystectomy is a surgical procedure employed when the secure identification of the cystic duct and associated structures is impeded by inflammation at Calot's triangle, rendering further dissection likely to cause injury to the biliary structures. This procedure can be categorized into two types: fenestrating subtotal cholecystectomy, which involves excising the anterior portion of the gallbladder while leaving the posterior segment attached to the liver. After stone removal, the cystic duct may be internally closed, leaving the gallbladder remnant open. The reconstituting subtotal cholecystectomy entails the excision of both the anterior and posterior layers of the gallbladder, followed by closure of the gallbladder remnant using sutures or staplers(Strasberg *et al*., 2016). Ibrahim *et al*., conducted a retrospective study to evaluate the safety of subtotal cholecystectomy. In this study, 97 patients underwent laparoscopic subtotal cholecystectomy, with a complication rate of 45.4% and a conversion rate of 48.8%. No significant differences were observed between the fenestrating and reconstituting subtotal cholecystectomy in terms of bile leakage(Ibrahim *et al*., 2023).

Aloraini *et al.,* conducted a retrospective study examining the outcomes of fenestrating and reconstituting laparoscopic subtotal cholecystectomy. The study involved 46 patients, with 26 undergoing fenestrating and 20 undergoing reconstituting subtotal cholecystectomies. Both procedures exhibited similar complication rates, although the fenestrating type was associated with a marginally higher incidence of bile leakage and drain placement(Aloraini *et al*., 2025). Van Dijk *et al*., investigated the short- and long-term outcomes of these procedures in a cohort of 191 patients, comprising 102 who underwent fenestrating and 73 who underwent reconstituting subtotal cholecystectomies. The incidence of bile leakage was higher in the fenestrating group (18% vs. 7%), whereas the recurrence rate was elevated in the reconstituting group (18% vs. 9%). The reintervention rate was comparable between the groups(van Dijk *et al*., 2017). A retrospective study by Yildirim *et al*., comparing fenestrating and reconstituting subtotal cholecystectomy reported no significant differences in complications and outcomes(Yildirim *et al*., 2022).

A systematic review conducted by Toro *et al*., examined the optimal method for performing a subtotal cholecystectomy laparoscopically. This study included a total of 678 patients, with bile leakage observed in 12.2% of cases, and the fenestrating type was associated with the highest rate of bile leakage at 69.9%(Toro *et al*., 2021). Ravendran *et al*., conducted a systematic review and meta-analysis comparing fenestrating and reconstituting subtotal cholecystectomy. This analysis included five studies with 552 patients, of whom 363 underwent the fenestrating subtotal cholecystectomy and 189 underwent the reconstituting subtotal cholecystectomy. The incidence of bile duct injury was higher in the reconstituting subtotal cholecystectomy group (2% vs. 0%), while the incidence of bile leakage was higher in the fenestrating subtotal cholecystectomy group (20.8% vs. 12.3%) (Ravendran *et al*., 2024). Hajibandeh *et al*., conducted a meta-analysis comparing fenestrating and reconstituting subtotal cholecystectomy in the management of the difficult gallbladder. This study included seven studies with 590 patients, of whom 353 underwent the fenestrating approach and 237 the reconstituting approach. The fenestrating approach was associated with a higher rate of bile leakage; however, there were no significant differences in bile duct injury, postoperative complications, and conversion rates between the two approaches(Hajibandeh *et al*., 2024).

Loh *et al*., investigated the short- and long-term outcomes of laparoscopic fenestrating and reconstituting subtotal cholecystectomy for the treatment of acute cholecystitis. The study involved 132 patients, with 108 undergoing the fenestrating approach and 24 undergoing the reconstituting approach. The findings indicated a higher rate of bile leakage associated with the fenestrating approach, while the reconstituting approach was linked to increased morbidity(Loh *et al*., 2022).

Table ৸

Outcome / Feature	Fenestrating Subtotal Cholecystectomy	Reconstituting Subtotal Cholecystectomy	Evidence Source
Bile Leak Rate	Higher bile leak incidence: 20.8% in several pooled analyses.	Lower bile leak incidence: 12.3%, significantly lower in some meta-analyses (OR ~0.29).	Hajibandeh *et al*., Ravendran *et al*.,
Bile Duct Injury (BDI)	Reported 0% in some analyses (236 pts), lower than reconstituting in certain datasets.	Up to 2% BDI in some studies.	Hajibandeh *et al*., Ravendran *et al*.,
Postoperative ERCP Requirement	Higher requirement for ERCP after fenestrating STC.	Lower ERCP requirement in comparison.	Hajibandeh *et al*.,
Recurrence of Gallbladder Symptoms	Lower long-term recurrence (no remnant pouch).	Higher recurrence risk from remnant gallbladder (potential for recurrent stones).	Hajibandeh *et al*., Ravendran *et al*.,

Table showing the bile leakage, bile duct injury, postoperative ERCP requirement, and recurrence rate between the fenestrating and reconstituting subtotal cholecystectomy.

The Outcomes of Subtotal Cholecystectomy

The early and long-term outcomes of subtotal cholecystectomy were evaluated in a retrospective study conducted by Tay *et al*., A cohort of 168 patients underwent laparoscopic subtotal cholecystectomy, with a follow-up period of 29 months. The conversion rate was reported at 16.3%, the complication rate at 2.4%, and the bile leakage rate at 0.6%(Tay *et al*., 2020). In a separate study, Gross *et al*., followed 218 patients who had undergone subtotal cholecystectomy over 63 months. Of these, 51.8% underwent a fenestrating subtotal cholecystectomy, while 48.2% underwent a reconstituting subtotal cholecystectomy. The incidence of bile leakage was 10%, and the bile duct injury rate was 1%(Gross *et al*., 2025). Acar *et al*., investigated the safety and feasibility of subtotal cholecystectomy in managing acute cholecystitis. This retrospective study included 57 patients, with a follow-up duration of 49 months, revealing a bile leakage rate of 21.1% and a surgical site infection rate of 14%(Acar *et al*., 2021). A similar retrospective study by Acar *et al*., examined the outcomes and complications following subtotal cholecystectomy, reaching similar conclusions(Al-Asadi *et al*., 2025). Additional retrospective studies by Bodla *et al*., and Bairoliya *et al*., also assessed the short- and long-term safety and efficacy of subtotal cholecystectomy, arriving at comparable conclusions.(Bairoliya *et al*., 2020; Bodla *et al*., 2023).

Shin *et al*., examined the clinical outcomes associated with performing a subtotal cholecystectomy on patients with challenging gallbladders. The study included 49 patients, with a mean operative time of 70 minutes, a complication rate of 9%, and an average hospital stay of 5 days(Shin *et al*., 2016). Jeong *et al*., evaluated the efficacy and feasibility of laparoscopic subtotal cholecystectomy, finding that patients in this group experienced fewer complications and no bile duct injuries, along with a reduced length of hospital stay(Oh Jeong *et al*., 2011). Chavez-Villa *et al*., conducted a retrospective study to determine the safety and effectiveness of subtotal cholecystectomy as a bailout procedure. Among the 115 patients who underwent the procedure, the bile leakage rate was 21%, and the bile duct injury rate was 0.9%. Patients were followed for an

average of 3.8 years, during which no complications were reported. Chávez-Villa *et al*., 2021). Roesch-Dietlen *et al*., also assessed the safety of laparoscopic subtotal cholecystectomy in cases of acute cholecystitis, noting that while complications did occur, there were no bile duct injuries(Roesch-Dietlen *et al*., 2019).

Lidsky *et al*., evaluated the efficacy of subtotal cholecystectomy in cases of a hostile gallbladder and determined that failure to control the cystic duct is correlated with increased morbidity. Among the 65 patients who underwent laparoscopic subtotal cholecystectomy, 55.6% required conversion to open cholecystectomy. Additionally, there was an observed increase in surgical site infection rates and prolonged hospital stays(Lidsky *et al*., 2017). Retrospective studies on subtotal cholecystectomy for severe acute cholecystitis conducted by Beldi *et al*., LeComple *et al*., and Chowbey *et al*., also concluded that the procedure is safe and associated with reduced complications*(Ann Liebert et al*., 2000; Beldi & Glättli, 2003; LeCompte *et al.,* 2021).

CONCLUSION

The subtotal cholecystectomy is an important operation for general surgeons when encountering a difficult gallbladder and can be an alternative to converting to an open cholecystectomy. Subtotal cholecystectomy is a valuable surgical technique for managing challenging gallbladder cases, with laparoscopic subtotal cholecystectomy being the most prevalent due to its minimally invasive nature. The procedure can be executed using either the fenestrating or reconstituting methods for addressing the gallbladder stump. However, the fenestrating approach is associated with a heightened risk of bile leakage, whereas the reconstituting method may lead to the recurrence of gallstones and inflammation of the gallbladder remnant. Subtotal cholecystectomy serves as a crucial option for general surgeons when confronted with a difficult gallbladder and offers an alternative to converting to an open cholecystectomy.

Conflict of Interest: There is no conflict of interest

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