Case Report

INTERNATIONAL JOURNAL OF SURGERY CASE REPORTS

OPEN

Mucosal stripping cholecystectomy as a novel bailout procedure when subtotal cholecystectomy is not feasible: a case report

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Introduction: Subtotal cholecystectomy is recommended when the critical view of safety cannot be achieved; however, in some "extremely difficult gallbladder" cases, dense adhesions make even subtotal resection unsafe. In such situations, few safe operative options exist. We report a case in which laparoscopic mucosal stripping cholecystectomy was performed as a bailout option.
Presentation of case: A 72-year-old man receiving prednisolone for IgG4-related disease presented with recurrent cholecystitis. Preoperative computed tomography revealed gallbladder distension and marked wall thickening, suggesting a difficult gallbladder. Intraoperatively, dense adhesions between the anterior wall of the gallbladder and the hepatoduodenal ligament prevented safe neck dissection and limited the feasibility of standard subtotal cholecystectomy. After fenestration of the fundus, gentle traction allowed continuous stripping and removal of the gallbladder mucosa up to the neck. The residual gallbladder wall was coagulated, and a drain was placed. The postoperative course was uneventful, and no recurrence was observed for more than 2 years.
Discussion: Subtotal cholecystectomy aims to eliminate gallbladder function rather than its anatomical presence. As gallbladder physiology is primarily mediated by its mucosal lining, mucosal removal can be considered the true operative endpoint. Residual mucosa has been associated with postoperative biliary events and reintervention in subtotal cholecystectomy. Therefore, mucosal stripping offers a minimal yet sufficient approach when safe dissection planes are lost.
Conclusion: Mucosal-stripping cholecystectomy may serve as a simple, safe, and effective bailout procedure when even subtotal cholecystectomy is technically difficult.

Keywords: bailout, mucosal stripping, remnant cholecystitis, subtotal cholecystectomy

Introduction

Subtotal cholecystectomy is an established strategy to avoid bile duct injury when the critical view of safety cannot be achieved. In this procedure, incision of the anterior gallbladder wall and removal of stones are essential steps[1]. However, in certain "extremely difficult gallbladder" cases, dense adhesions between the gallbladder and adjacent organs make even subtotal cholecystectomy unsafe or technically impossible. In such situations, few safe operative options remain. We report a case in which laparoscopic mucosal stripping cholecystectomy was successfully performed as a safe bailout procedure. This case report has been prepared in line with the SCARE checklist[2].

HIGHLIGHTS

- Mucosal stripping enables bailout when subtotal cholecystectomy is not feasible.
- The technique allows the complete elimination of gallbladder mucosa.
- It may prevent remnant cholecystitis by abolishing mucosal function.
- This approach expands surgical options in extremely difficult gallbladders.

Case presentation

A 72-year-old man receiving prednisolone (10 mg/day) for IgG4-related disease was scheduled for laparoscopic cholecystectomy due to recurrent cholecystitis. Preoperative contrast-enhanced computed tomography revealed gallbladder distension, marked wall thickening, and a suspected pericholecystic abscess, suggesting that subtotal cholecystectomy would likely be required (Fig. 1).

Intraoperatively, after adhesiolysis between the gallbladder fundus and the transverse colon, the gallbladder was opened at the fundus. However, the duodenum and the hepatoduodenal ligament were densely adherent to the anterior gallbladder wall, and safe dissection of the neck was deemed impossible. Further extension of the incision toward the neck was hindered by marked wall thickening, resulting in an almost obliterated

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Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

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International Journal of Surgery Case Reports (2026) 138:2988–2991

Received 24 April 2026; Accepted 12 June 2026

Supplemental Digital Content is available for this article. Direct URL citations are provided in the HTML and PDF versions of this article on the journal's website, journals.lww.com/ijscr/pages/default.aspx.

Published online 3 July 2026

http://dx.doi.org/10.1097/RC9.0000000000000653

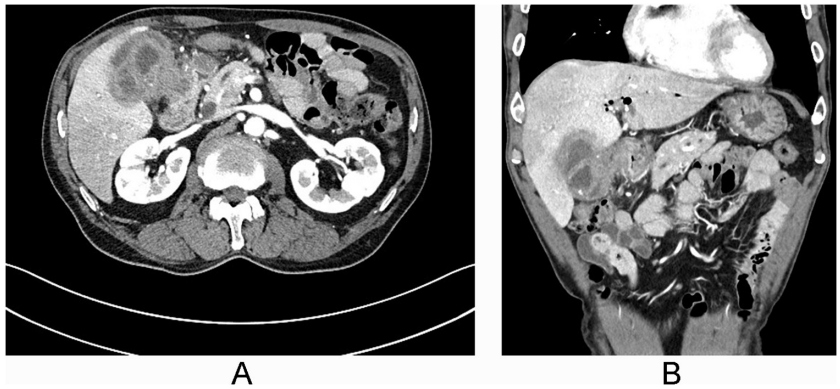


Figure 1. Preoperative contrast-enhanced computed tomography. Axial and coronal images show marked gallbladder distension with wall thickening and surrounding inflammatory changes, suggesting pericholecystic abscess formation.

lumen. The entire inner surface of the gallbladder could not be visualized, making mucosal ablation infeasible. In such situations, even fenestrating subtotal cholecystectomy may not be safely feasible. Although we initially attempted to create a traction handle on the gallbladder wall to continue anterior wall dissection, the wall was too thick for secure grasping, and dense fibrous adhesions made the maneuver extremely challenging. While attempting further adhesiolysis and continuation of anterior wall dissection, the mucosa was incidentally grasped and found to separate bluntly from the underlying layer. Gentle traction subsequently allowed continuous stripping and removal of the mucosal layer up to the neck. After complete mucosal removal, the gallbladder lumen became clearly visible. The remaining gallbladder tissue was coagulated, a drain was placed beneath the liver, and the procedure was completed successfully (Fig. 2). The operative time was 1 hour and 37 minutes, and the estimated blood loss was 50 ml. The surgical procedure is also demonstrated in the Supplemental Digital Content video, available at: http://links.lww.com/IJSCR/A75 (E-component).

The postoperative course was uneventful, without any bile leakage, and the patient has remained free of complications for more than 2 years.

Discussion

The clinical objective of cholecystectomy for benign disease is either the treatment of cholecystitis or the prevention of

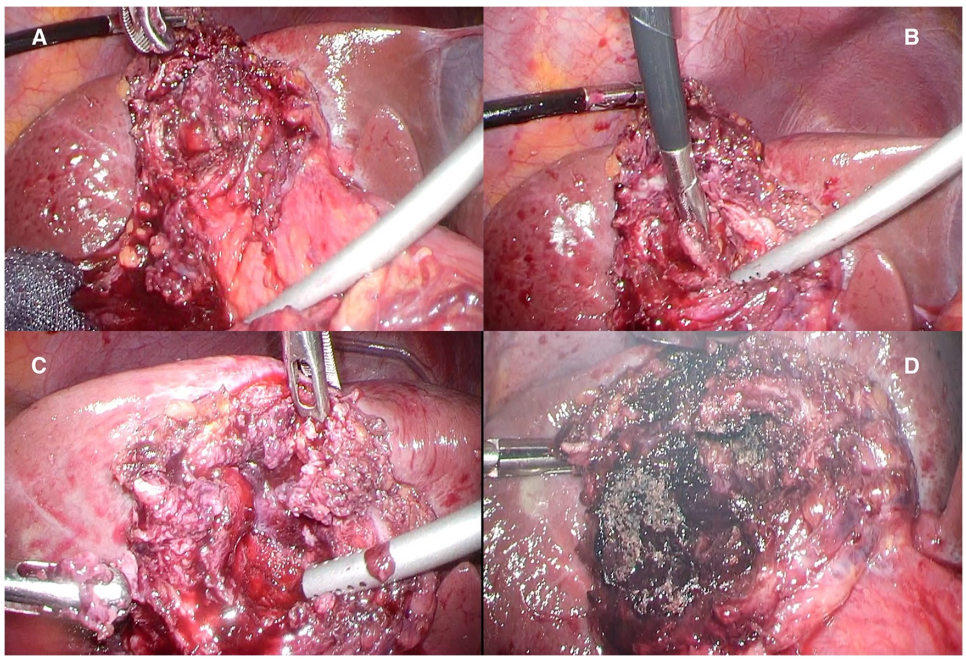


Figure 2. Schematic illustration of laparoscopic mucosal stripping cholecystectomy. (A) Dense adhesions between the gallbladder and adjacent structures prevent a safe anterior wall incision. (B) Gentle traction allows for blunt separation and continuous stripping of the mucosal layer. (C) The gallbladder lumen becomes clearly visible after the complete removal of the mucosa. (D) The residual gallbladder wall is coagulated to prevent bile stasis or recurrence.

gallstone-related complications. Traditionally, the surgical goal was complete anatomical removal of the gallbladder; however, subtotal cholecystectomy has been increasingly adopted in recent years to reduce the risk of bile duct injury. This shift suggests that the true endpoint of surgery is the elimination of gallbladder function rather than anatomical removal. Several surgical textbooks and reports describe mucosal ablation as a component of subtotal cholecystectomy[1,3–5]. The rationale is that, even if part of the gallbladder wall or the cystic duct remains, the absence of mucosa prevents bile stasis and abscess formation, allowing the remnant cavity to close through the natural healing process. Thus, the physiological function of the gallbladder is fundamentally attributable to its mucosal lining, and mucosal removal can be considered the essential operative step. However, some textbooks do not explicitly mention mucosal ablation[6,7], suggesting limited awareness of its importance.

A recent meta-analysis comparing fenestrating and reconstituting subtotal cholecystectomy included five studies evaluating remnant cholecystitis and completion cholecystectomy[8]. Among the included studies, Van Dijk[9] reported that the fenestrating group demonstrated a significantly lower recurrence of biliary events (9% vs. 18%), whereas no significant difference was observed in reintervention rates (32% vs. 26%) after a median follow-up of 6 years. Importantly, both groups exhibited notable rates of biliary events and reintervention. Mucosal coagulation was documented in only 17.6% of cases in the fenestrating group and in none of the reconstituting cases. These findings collectively suggest that inadequate mucosal ablation in both groups may have contributed, at least in part, to these unfavorable outcomes.

Loh *et al*[10] did not specify whether mucosal ablation was performed in either technique. However, regarding the reconstituting approach, they stated: "The gallbladder remnant is closed with sutures or a stapler as permitted by anatomy, followed by dissection of the fundal remnant off the liver. This leaves a functional gallbladder remnant in situ." Notably, all four cases (16.7%) of remnant cholecystitis occurred after reconstituting procedures (4/24), whereas none were observed in the fenestrating group (0/108). No completion cholecystectomy was performed.

Yoon *et al*[11] described their procedure as laparoscopic partial resection rather than subtotal cholecystectomy; however, the operative details suggest that it is equivalent to subtotal cholecystectomy. There was no description of mucosal ablation. One case of remnant cholecystitis requiring completion cholecystectomy was reported, but this was associated with the development of a cholecystocutaneous fistula. It is likely that persistent residual mucosa led to fistula formation, which failed to close spontaneously and ultimately required surgical intervention.

In the report by Purzner *et al*[12], neither the surgical technique nor the outcomes included any description of mucosal ablation, yet no cases of remnant cholecystitis were observed.

LeCompte *et al*[13] clearly defined mucosal ablation as part of their surgical technique, and no cases of remnant cholecystitis were reported.

Overall, in studies reporting remnant cholecystitis, mucosal ablation was either not described or performed at a low rate. In contrast, studies that explicitly incorporated mucosal ablation into the procedure did not report remnant cholecystitis. These findings underscore the critical importance of eliminating the gallbladder mucosa.

Accordingly, adequate mucosal ablation is essential during subtotal cholecystectomy to ensure complete loss of gallbladder function. Mucosal stripping cholecystectomy, therefore, represents a minimal yet sufficient "cholecystectomy" to eliminate gallbladder function when anatomical resection cannot be safely performed. We subsequently applied this technique for another patient who required conversion to open surgery due to severe adhesion of the transverse colon, and no postoperative recurrence was observed. In this second case, the procedure was intentionally performed as mucosal stripping based on our prior experience. The mucosal layer could be grasped and stripped with the same dissection plane and tissue resistance as in the first case, and coagulation of the residual seromuscular layer was similarly achievable, suggesting that the technique is reproducible.

Furthermore, open conversion and the fundus-first technique – often regarded as bailout procedures[14] – may not always function as true bailout strategies. The fundus-first approach, also referred to as the dome-down or fundus-down technique, is fundamentally a traditional open method. When conversion to open surgery occurs, it simply becomes part of that operative approach. Although it can sometimes be completed laparoscopically, the risk of vascular injury due to misidentification of the dissection plane during separation from the fundus toward the neck has been reported. In particular, in cases of severe chronic inflammation with extensive fibrosis and adhesions around the biliary tract, serious vascular injury may occur. To avoid this risk, surgeons ultimately need to stay away from dangerous areas, which often leads to performing a subtotal cholecystectomy instead. Although conversion to open surgery may facilitate handling of these hazardous areas, a comparative study reported that open cholecystectomy is associated with significantly higher rates of common bile duct injury (3.98% vs. 0.44%), as well as increased bleeding, intestinal injury, and wound infection compared with subtotal cholecystectomy[15]. Therefore, in clinical practice, subtotal cholecystectomy has remained the only practical bailout procedure when safe identification of anatomical structures is impossible. In this context, we believe that mucosal stripping cholecystectomy may represent a novel bailout strategy that expands the range of available surgical options when even subtotal cholecystectomy is not feasible. This technique may be considered novel from both conceptual and technical perspectives. Conceptually, it isolates the essential component of subtotal cholecystectomy – elimination of gallbladder mucosal function – while omitting non-essential steps. Technically, it differs from conventional fenestrating subtotal cholecystectomy in that only limited fundus fenestration is performed, without full-thickness excision of the anterior gallbladder wall, followed by mucosal stripping under traction.

The limitation of this report is the small number of cases, making it difficult to define precise indications. In our experience, common features included: (1) dense adhesions preventing anterior wall incision and (2) severe mucosal thickening precluding ablation from inside the lumen. Thus, this technique is not intended for cases where conventional subtotal cholecystectomy is feasible but may serve as a valuable salvage option in cases where even subtotal cholecystectomy is technically prohibitive.

Although no major postoperative complications were observed in the present cases, potential risks inherent to this technique may include bile leakage, residual mucosal regrowth, and remnant cholecystitis. However, these complications may

also occur after conventional subtotal cholecystectomy, and their incidence is expected to be comparable.

Because this technique avoids dissection near critical structures, the risk of major bile duct or duodenal injury may theoretically be reduced. On the other hand, bleeding during mucosal stripping near the cystic duct may be difficult to control because secure suturing or direct repair can be technically challenging in this region.

Further accumulation of cases and long-term follow-up are required to clarify the safety, reproducibility, and appropriate indications for this bailout procedure.

Conclusion

In situations where subtotal cholecystectomy cannot be safely performed due to dense adhesions or loss of anatomical planes, mucosal stripping cholecystectomy may serve as a simple, safe, and effective bailout procedure for eliminating gallbladder function while minimizing the risk of bile duct injury.

Ethical approval

Ethical approval was not required for this case report in accordance with the institutional policy of Higashi-Saitama General Hospital.

Consent

Written informed consent was obtained from the patient for the publication of this case report and the accompanying images. A copy of the written consent is available for review from the editor of the journal upon request.

Sources of funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflicts of interest disclosure

The authors declare they have no competing interests.

Author contributions

K.N. collected patient data, conducted the literature review, designed the case report, and drafted the manuscript. Y.T., Y. K., and E.M. contributed to the conception and design of the study. T.K. supervised the clinical management and critically revised the manuscript. All authors have read and approved the final manuscript.

Research registration unique identifying number (UIN)

Not applicable.

Guarantor

Kazuhiro Nishida.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Data availability statement

Not applicable.

Use of Artificial Intelligence (AI) and AI-assisted technologies

The authors used an artificial intelligence tool for language editing and translation to improve clarity and readability. All content was reviewed and approved by the authors.

Acknowledgements

Not applicable.

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