J Surg Med. 2026;10(11):e8530.
https://doi.org/10.28982/josam.8530

JOSAM

Research Article
https://jsurgmed.com/

Journal of Surgery and Medicine
e-ISSN: 2602-2079

Laparoscopic Management of Symptomatic Remnant Gallbladder

José Rubén Varela, María Cristina du Plessis, Enrique Juan Petracchi, Nicolás Francisco Baglietto, Bernabé Matías Quesada, Guadalupe Frias Mena, Oriana Beatriz Comodo, María Julieta Ymaz, Carlos Manuel Canullan, Hugo Israel Zandalazini

Division of General Surgery, Cosme Argerich Hospital, Autonomous City of Buenos Aires, Buenos Aires, Argentina

ORCID of the author(s)
JRV: https://orcid.org/0000-0003-3860-235X
MCdP: https://orcid.org/0000-0001-8867-8331
EJP: https://orcid.org/0000-0002-2575-4656
NFB: https://orcid.org/0000-0003-4906-6361
BMQ: https://orcid.org/0000-0002-3094-0031
GFM: https://orcid.org/0000-0001-6743-8566
OBC: https://orcid.org/0009-0006-6511-4203
MJY: https://orcid.org/0009-0007-3315-5534
CMC: https://orcid.org/0000-0002-5755-0367
HIZ: https://orcid.org/0000-0001-7655-2416

Corresponding Author
María Cristina du Plessis
Cosme Argerich Hospital, Pi y Margall 750, C1155AHD, Autonomous City of Buenos Aires, Buenos Aires, Argentina
E-mail: mcristinaduplessis@gmail.com

Ethical Approval
The protocol was approved by the Research Ethics Committee of Hospital General de Agudos 'Dr. Cosme Argerich,' Buenos Aires, Argentina, on December 23, 2025 (PRIISA.BA registration number 18184). The study was conducted in accordance with the Declaration of Helsinki.

Informed Consent
The requirement for informed consent was waived by the Research Ethics Committee owing to the retrospective nature of the study.

Conflict of Interest
No conflict of interest was declared by the authors.

Financial Disclosure
The authors declared that this study received no financial support.

CRediT Author Statement
José Rubén Varela: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft, Writing – review & editing, Supervision. María Cristina du Plessis: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft, Writing – review & editing, Supervision. Enrique Juan Petracchi: Writing – original draft, Writing – review & editing, Supervision. Nicolás Francisco Baglietto: Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Supervision. Bernabé Matías Quesada: Writing – review & editing, Supervision. Guadalupe Frias Mena: Investigation, Data curation, Writing – review & editing. Oriana Beatriz Comodo: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft. María Julieta Ymaz: Formal analysis, Writing – original draft. Carlos Manuel Canullan: Writing – review & editing, Supervision. Hugo Israel Zandalazini: Writing – review & editing, Supervision.

Use of AI Statement
The authors declare that no generative artificial intelligence or AI-assisted technologies were used in the preparation of this manuscript.

Data Availability
The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Published
2026 November 7

Abstract

Background/Aim: Symptomatic remnant gallbladder (SRG) is an uncommon but clinically relevant cause of postcholecystectomy syndrome. It is characterized by residual gallbladder or cystic duct tissue containing stones after incomplete or subtotal cholecystectomy, often following a technically difficult operation. Diagnosis may be challenging, and treatment is primarily surgical. This study aimed to analyze a case series of laparoscopic management of SRG in a general surgery department.

Methods: A case series analysis was conducted using a prospectively maintained surgical database at Cosme Argerich Hospital. Patients who underwent laparoscopic management of SRG between January 2019 and March 2025 were included.

Results: Eleven patients with SRG were identified. All had a history of open cholecystectomy or laparoscopic cholecystectomy converted to an open approach. All patients underwent an initial laparoscopic approach to completion surgery; one required conversion to open surgery. Postoperative morbidity was 9%, with no mortality. During follow-up, all patients experienced symptomatic improvement.

Conclusion: SRG should be considered in the differential diagnosis of postcholecystectomy syndrome, particularly in patients with a history of difficult cholecystectomy. A laparoscopic approach is feasible, and successful treatment depends on accurate identification and appropriate management of the cystic duct.

Keywords: laparoscopic cholecystectomy, postcholecystectomy syndrome, cystic duct, remnant gallbladder, completion cholecystectomy

Creative Commons Attribution (CC BY 4.0)
Copyright © 2026 by Author(s). Published by Journal of Surgery and Medicine (JOSAM).
This work is licensed under a Creative Commons Attribution 4.0 International License.
To view a copy of this license, visit https://creativecommons.org/licenses/by/4.0/

How to cite: Varela JR, du Plessis MC, Petracchi EJ, Baglietto NF, Quesada BM, Mena GF, Comodo OB, Ymaz MJ, Canullan CM, Zandalazini HI. Laparoscopic Management of Symptomatic Remnant Gallbladder. J Surg Med. 2026;10(11):e8530.

Introduction

Laparoscopic cholecystectomy (LC) is the standard treatment for symptomatic gallstones. Although generally considered a safe and effective procedure, it can lead to early postoperative complications such as hemorrhage, bile leak, choleperitoneum, and bile duct injury (BDI) [1], as well as late complications, including residual choledocholithiasis [2] and symptomatic remnant gallbladder (SRG) [3]. In addition, a variety of nonspecific clinical manifestations may occur following cholecystectomy [4]. The onset or persistence of gastrointestinal symptoms, such as right upper quadrant pain, biliary colic, dyspepsia, nausea, or vomiting, is defined as postcholecystectomy syndrome (PCS) [4-6]. Its incidence varies from 5% to 47% [7], and symptoms may occur either in the early postoperative period or years after the procedure. Most cases are attributable to nonbiliary conditions [4, 5], including esophagitis, gastritis, peptic ulcer disease, irritable bowel syndrome, and hepatitis. Nevertheless, biliary etiologies such as choledocholithiasis, biliary strictures, and SRG must be considered in the differential diagnosis [6].

SRG is defined as the persistence of biliary symptoms after cholecystectomy associated with stones located within a residual portion of the gallbladder or cystic duct (CD) [3, 8]. This condition is often related to bail-out procedures, such as subtotal cholecystectomy, performed in the setting of severe inflammation or fibrosis of the gallbladder hilum when safe completion of a total cholecystectomy is not feasible [3, 8, 9]. In this context, a remnant gallbladder often reflects a deliberate safety decision during a difficult cholecystectomy rather than a technical oversight. When hepatocystic anatomy is distorted and the critical view of safety cannot be achieved, surgeons may avoid hazardous dissection in the hepatocystic triangle and perform a subtotal cholecystectomy or leave a long cystic duct stump as a bail-out strategy. Although this approach reduces the immediate risk of major BDI, it may create a substrate for recurrent stones, inflammation, and late biliary symptoms.

SRG is initially suspected based on the clinical presentation and ultrasonographic findings and is confirmed by magnetic resonance cholangiography (MRC), which is considered the preferred modality for diagnosis and preoperative planning [3, 9]. Management is primarily surgical [3, 8].

This study aimed to analyze a case series of laparoscopic management of SRG in a general surgery department.

Materials and methods

Study Design and Patient Selection

A case series analysis was conducted using a prospectively maintained database of surgeries performed in the General Surgery Department. Patients who underwent laparoscopic management of SRG between January 2019 and March 2025 were included.

SRG was defined as PCS associated with stones located within a residual portion of the gallbladder or the CD, confirmed by MRC. All procedures were performed by surgeons from the Biliary Surgery Unit of the General Surgery Department.

Surgical Technique

Pneumoperitoneum was established using a Veress needle. Four ports (two 10-mm and two 5-mm ports) were placed using the American technique, as in standard LC (Figure 1). Adhesiolysis of the gallbladder bed was performed using monopolar electrocautery and an ultrasonic scalpel until the remnant gallbladder or CD was identified above Rouvière's sulcus. Dissection was performed close to the remnant gallbladder wall, avoiding blind traction and excessive use of energy near the hepatoduodenal ligament. Intraoperative cholangiography (IOC) was performed systematically.

Figure 1. Port Placement and Prior Cholecystectomy Scar in a Patient With a Remnant Gallbladder



When CD stones were present, they were extracted using laparoscopic forceps or a Dormia basket. When common bile duct (CBD) stones were present, they were managed during the same procedure using transcystic exploration or intraoperative endoscopic retrograde cholangiopancreatography (ERCP) with a rendezvous technique. The CD was closed using titanium clips, an extracorporeal ligature, or sutures at the surgeon's discretion. The specimen was removed in a retrieval bag, and a Jackson-Pratt-type subhepatic drain was placed.

Intraoperative Cholangiography Technique

When the CD was clearly identified, cholangiography was performed routinely by inserting a cholangiography catheter. When the CD could not be identified, cholangiography was performed by direct puncture of the remnant gallbladder using a winged infusion set (butterfly needle).

Fluorescence Cholangiography Technique

A 25-mg ampoule of indocyanine green (GreenBAC®) diluted in 10 mL of distilled water was used. A dose of 2.5 mg was administered 45 minutes before the procedure according to recommendations of the International Society for Fluorescence-Guided Surgery (ISFGS) [10]. This technique was not part of the standard protocol throughout the entire study period and was used selectively after its recent introduction at our institution.

Study Variables

Preoperative variables included age, sex, American Society of Anesthesiologists (ASA) classification, origin of the index cholecystectomy (our institution or another center), and reason for referral. The approach used for the index cholecystectomy (laparoscopic or open) and the need for conversion to open surgery were recorded. A history of difficult cholecystectomy was defined as an open approach, conversion to open surgery, or emergency surgery. PCS was defined as the onset or persistence of gastrointestinal symptoms after cholecystectomy, including right upper quadrant pain, biliary colic, dyspepsia, nausea, or vomiting. The interval between the index cholecystectomy and SRG surgery was recorded in years.

This work is licensed under a Creative Commons Attribution 4.0 International License.
To view a copy of this license, visit https://creativecommons.org/licenses/by/4.0/

Preoperative imaging included abdominal ultrasonography and MRC, and the presence of CBD stones diagnosed by MRC was documented. The remnant was classified according to Gupta et al. as type 1A (gallbladder pouch attached to the liver and cystic duct), type 1B (long cystic duct without residual gallbladder), or type 2 (sessile gallbladder with complete obliteration of the plane between the medial gallbladder wall and bile duct) [8].

Intraoperative variables included surgical approach, conversion to open surgery, operative time, CD stones and CBD stones detected by IOC, the method used for CBD stone clearance, and successful identification of the CD. Postoperative variables included length of hospital stay, complications and their severity according to the Clavien-Dindo classification, presence and type of BDI, histopathological findings, surgery-related readmissions, symptomatic improvement, and follow-up duration.

Ethical Considerations

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. The protocol was approved by the Research Ethics Committee of Hospital General de Agudos 'Dr. Cosme Argerich,' Buenos Aires, Argentina, on December 23, 2025 (PRIISA.BA registration number 18184).

Statistical Analysis

Data were extracted from a prospectively collected database of the General Surgery Division. Continuous variables were expressed as median and interquartile range or range, as applicable, and categorical variables were expressed as absolute numbers and percentages. Percentages were rounded to the nearest whole number; therefore, totals may not equal exactly 100%. No inferential statistical testing was performed; therefore, no *P*-values or prespecified significance threshold were applicable. Data were analyzed using IBM SPSS Statistics, version 27 (IBM Corp., Armonk, NY, USA).

Results

During the study period, 11 patients with SRG were included. Preoperative variables are presented in Table 1, and intraoperative and postoperative variables are presented in Table 2.

All 11 patients underwent an initial laparoscopic approach with routine IOC (Figure 2) and resection of the SRG (Figure 3). Fluorescence cholangiography was used in one case. One patient required conversion to open surgery.

The CD was successfully identified and treated in 10 (91%) patients. In the remaining patient, identification was not feasible because of severe inflammatory and fibrotic changes involving the gallbladder hilum. Stones were extracted by opening the remnant gallbladder, which was subsequently closed with 3-0 polypropylene sutures. This patient developed a postoperative external bile leak through the drain, classified as a BDI suspected to originate from the cystic duct stump and consistent with a Strasberg type A injury. The bile leak was managed conservatively without reintervention. The patient was discharged on postoperative day 3 without bile leakage and after drain removal (Clavien-Dindo grade I).

The conversion to open surgery was required because of complex biliary anatomy, characterized by a long, beaded posterior cystic duct draining to the left of the CBD and containing an impacted stone, which precluded safe laparoscopic extraction.

Table 1. Preoperative Variables of Patients Who Underwent Laparoscopic Management of SRG

Preoperative variable	Category/summary	n (%) or value
Sex	Women	10 (91)
	Men	1 (9)
Age (years)	Median (IQR)	51 (9)
ASA classification	II	11 (100)
Origin of index cholecystectomy	Our hospital	0 (0)
	Another center	11 (100)
Reason for referral	Pancreatitis	1 (9)
	Residual choledocholithiasis	1 (9)
	Abscess	1 (9)
	SRG	4 (36)
	PCS	4 (36)
Index cholecystectomy approach	Open	9 (82)
	Laparoscopic	2 (18)
Conversion to open surgery at index cholecystectomy		2/2 (100)
History of difficult cholecystectomy		11 (100)
PCS		11 (100)
Interval between cholecystectomy and SRG surgery (years)	Median (range)	7 (1-32)
Preoperative imaging	Abdominal ultrasonography	11 (100)
	MRC	11 (100)
CBD stones diagnosed by MRC		3 (27)
Type of remnant (Gupta)	Type 1A	11 (100)

Abbreviations: ASA: American Society of Anesthesiologists, SRG: symptomatic remnant gallbladder, PCS: postcholecystectomy syndrome, CBD: common bile duct, MRC: magnetic resonance cholangiography, IQR: interquartile range. The conversion rate was calculated among index cholecystectomies initiated laparoscopically.

Table 2. Intraoperative and Postoperative Variables of Patients Who Underwent Laparoscopic Management of SRG

Variable	Category/summary	n (%) or value
Initial surgical approach	Laparoscopic	11 (100)
Conversion to open surgery		1 (9)
Operative time (min)	Median (IQR)	107 (45)
CD stones detected by IOC		0 (0)
CBD stones detected by IOC		3 (27)
Method of CBD stone clearance	Transcystic instrumentation	2 (67)
	Rendezvous	1 (33)
CD identification		10 (91)
Length of hospital stay (days)	Median (range)	2 (1-5)
Complication		1 (9)
Clavien-Dindo grade	I	1 (9)
BDI		1 (9)
Type of BDI	Strasberg A	1 (9)
Histopathology	Chronic cholecystitis	8 (73)
	Acute-on-chronic cholecystitis	2 (18)
	Adenocarcinoma	1 (9)
Readmission		0 (0)
Symptomatic improvement		11 (100)
Follow-up (months)	Median (range)	18 (9-24)

Abbreviations: CD: cystic duct, CBD: common bile duct, IOC: intraoperative cholangiography, BDI: bile duct injury, IQR: interquartile range.

One patient with adenocarcinoma initially presented with PCS and fever. Computed tomography showed a fluid collection in the cholecystectomy bed, which was managed with percutaneous drainage. Fistulography subsequently raised suspicion of a remnant gallbladder, and the diagnosis was confirmed by MRC. Repeat imaging demonstrated a cystic structure in the gallbladder bed with focal wall thickening and contrast enhancement, associated with a pericholecystic abscess and surrounding inflammatory changes. Surgical resection of the remnant gallbladder was performed without preoperative suspicion of malignancy. Histopathological examination revealed a moderately differentiated biliary-type adenocarcinoma infiltrating the remnant gallbladder, with positive resection margins and perineural invasion but no lymphovascular invasion. Pathological staging was at least pT2a pN1 according to the AJCC Cancer Staging Manual, 8th edition, with regional lymph node involvement confirmed histopathologically. Postoperative staging showed no evidence of distant metastasis, and the patient was referred for adjuvant treatment. Combined chemoradiotherapy with capecitabine and three-dimensional conformal radiotherapy to the gallbladder bed and regional lymphatic drainage was initiated.

This work is licensed under a Creative Commons Attribution 4.0 International License.
To view a copy of this license, visit https://creativecommons.org/licenses/by/4.0/

In one patient, a rendezvous procedure with intraoperative ERCP was performed together with SRG resection because the stone diameter exceeded the cystic duct diameter, making transcystic instrumentation unfeasible.

Figure 2. Intraoperative Cholangiography of the Remnant Gallbladder

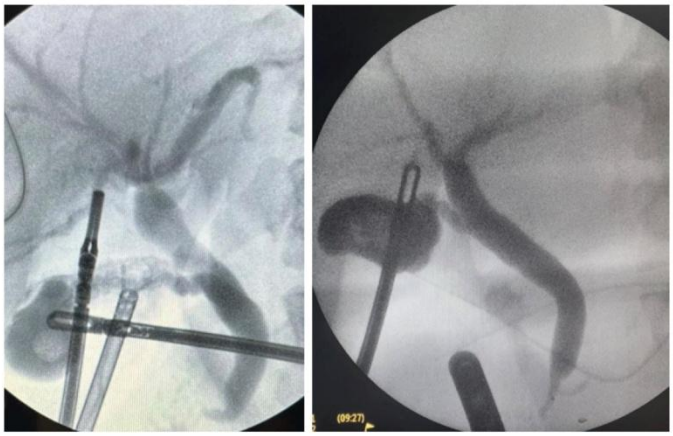
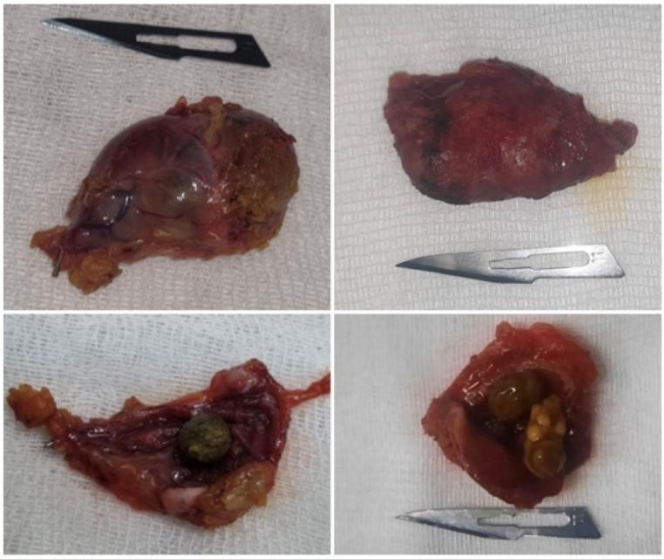


Figure 3. Remnant Gallbladder With Stones



Discussion

Laparoscopic treatment of SRG was feasible in this series, with morbidity comparable to that reported in the literature [3, 8, 11-19].

Remnant gallbladder is a recognized cause of PCS, with clinical resolution reported in 86-100% of cases after complete resection [3, 11, 12, 14-16, 18]. In contrast to series in which a substantial proportion of procedures were performed through an open approach [3, 18] or laparoscopic procedures required conversion [3, 8, 13, 18], all patients in our series were initially approached laparoscopically and only one required conversion. Morbidity was comparable to previous reports [3, 8, 11, 19], and no deaths occurred [3, 11-19].

The diagnosis of SRG is often challenging because symptoms are frequently attributed initially to nonbiliary causes [5, 7]. A history of difficult cholecystectomy in a patient presenting with PCS should raise suspicion of this diagnosis [6, 8, 9, 12, 14, 17, 18]. Although abdominal ultrasonography is typically the initial imaging modality [4, 5, 7], MRC is considered the preferred diagnostic method because of its ability to identify remnant stones and CD anatomy and facilitate treatment planning [3].

In our series, all patients had a history of open cholecystectomy or LC converted to an open approach. According to the literature, only approximately 5% of elective cholecystectomies require conversion to open surgery, typically because severe inflammation and adhesions prevent safe dissection and favor bail-out procedures such as subtotal cholecystectomy [9, 18, 20, 21]. Subtotal cholecystectomy has been described as a safe alternative when a critical view of safety cannot be achieved, thereby reducing the risk of major BDI [18, 20, 21]. However, complications associated with this technique include bile leakage and symptomatic remnant gallbladder [18, 20, 21].

Definitive management is surgical [8], not only to improve symptoms but also to prevent stone-related complications such as remnant cholecystitis, pancreatitis, choledocholithiasis, cholangitis, abscess formation, or malignancy [3, 8, 11-19]. In our series, one patient was referred for pancreatitis, another for residual choledocholithiasis, and another for an abscess adjacent to the remnant gallbladder.

Surgery for SRG can be technically challenging because of fibrosis, adhesions, and anatomical distortion [3, 12, 19]; therefore, it should be performed by surgeons experienced in biliary surgery [12, 13, 15, 16, 19].

In 10 of the 11 patients in our series, the CD was successfully identified and treated without postoperative morbidity. The one patient in whom the CD could not be identified developed a postoperative bile leak. These findings suggest that accurate identification and control of the CD are important components of successful treatment [19, 22, 23]. Consistent with previous reports, completion surgery may carry a risk of BDI; in our cohort, the event was a cystic duct stump leak consistent with a Strasberg type A injury [3, 8, 11, 19].

The risk of CBD stones in patients with SRG varies across reports but may be higher than that in patients with uncomplicated symptomatic cholelithiasis [22]. In our series, three patients had CBD stones confirmed by IOC, and all were treated during the same surgical procedure. This finding suggests that concurrent management of SRG and CBD stones is feasible in a single intervention, similar to the management of symptomatic cholelithiasis with associated CBD stones [13].

A previous report described gallbladder carcinoma arising in a gallbladder remnant four years after subtotal cholecystectomy [8]. In our series, one patient had adenocarcinoma of the remnant gallbladder. Although the incidence is uncertain, chronic stone-related inflammation may represent a potential concern.

The literature on indocyanine green fluorescence for remnant gallbladder surgery is limited [24, 25]. In our series, indocyanine green was used in one patient because the technology had only recently been introduced at our institution. Although fluorescence provided adequate visualization of the biliary anatomy, it did not offer a clear additional advantage in this single case because the remnant could also be identified with conventional laparoscopic vision. Accordingly, fluorescence cholangiography has not been adopted as a standard component of our operative strategy.

The main technical lesson from this series is that successful laparoscopic management of SRG may depend less on

This work is licensed under a Creative Commons Attribution 4.0 International License.
To view a copy of this license, visit https://creativecommons.org/licenses/by/4.0/

aggressive adhesiolysis than on controlled dissection close to the remnant gallbladder. Safe anatomical orientation using fixed landmarks such as Rouvière's sulcus, together with systematic IOC, may help reduce the risk of BDI. When the CD cannot be identified, cholangiography by direct puncture of the remnant gallbladder using a winged infusion set can provide biliary mapping and guide intraoperative decision-making. In a frozen hepatocystic triangle, attempts at complete ductal dissection may be hazardous. Opening the remnant gallbladder to achieve stone clearance may be an alternative, although the Strasberg type A bile leak observed in our series illustrates that failure to achieve secure CD control can result in postoperative leakage.

This study has several limitations. Its retrospective, single-center design introduces potential selection and information bias. The small sample size reflects the low incidence of SRG but limits statistical power and generalizability. In addition, the definition of difficult cholecystectomy was based on surrogate markers such as an open approach, conversion, or emergency surgery, which may not accurately capture the technical complexity of the index procedure. Follow-up was relatively short for assessing late biliary complications or long-term oncological outcomes. Finally, all procedures were performed by surgeons experienced in biliary surgery, which may limit applicability to centers with less specialized expertise.

Conclusion

Symptomatic remnant gallbladder should be considered in the differential diagnosis of postcholecystectomy syndrome, particularly in patients with a history of difficult cholecystectomy. A laparoscopic approach with systematic IOC is feasible and was associated with acceptable morbidity in this series. Successful treatment depends on accurate identification and appropriate management of the remnant cystic duct. Concomitant treatment of remnant gallbladder and CBD stones was achievable.

References

1. Wong GYM, Wadhawan H, Roth Cardoso V, Bravo Merodio L, Rajeev Y, Maldonado RD, et al. 30-day morbidity and mortality after cholecystectomy for benign gallbladder disease (AMBROSE): a prospective international collaborative cohort study. Ann Surg. 2025;281(2):312-21. https://doi.org/10.1097/SLA.0000000000006236.
2. Cox MR, Budge JP, Eslick GD. Timing and nature of presentation of unsuspected retained common bile duct stones after laparoscopic cholecystectomy: a retrospective study. Surg Endosc. 2015;29:2033-8. https://doi.org/10.1007/s00464-014-3907-x.
3. Singh A, Kapoor A, Singh RK, Prakash A, Behari A, Kumar A, et al. Management of residual gall bladder: a 15-year experience from a north Indian tertiary care centre. Ann Hepatobiliary Pancreat Surg. 2018;22(1):36-41. https://doi.org/10.14701/ahbps.2018.22.1.36.
4. Rahman KR, Fatima R, Zeenat M, Williams C, Khatun A, Yangibaev O. Evaluation of postcholecystectomy syndrome in patients with gallstone disease: a critical appraisal. Cureus. 2025;17:e90965. https://doi.org/10.7759/cureus.90965.
5. Shirah BH, Shirah HA, Zafar SH, Albeladi KB. Clinical patterns of postcholecystectomy syndrome. Ann Hepatobiliary Pancreat Surg. 2018;22(1):52-7. https://doi.org/10.14701/ahbps.2018.22.1.52.
6. Schofer JM. Biliary causes of postcholecystectomy syndrome. J Emerg Med. 2010;39:406-10. https://doi.org/10.1016/j.jemermed.2007.11.090.
7. Nam C, Lee JS, Kim JS, Lee TY, Yoon YC. Clinical perspectives on postcholecystectomy syndrome: a narrative review. Ann Med. 2025;57:2496408. https://doi.org/10.1080/07853890.2025.2496408.
8. Gupta V, Sharma AK, Kumar P, Gupta M, Gulati A, Sinha SK, et al. Residual gall bladder: an emerging disease after safe cholecystectomy. Ann Hepatobiliary Pancreat Surg. 2019;23(4):353-8. https://doi.org/10.14701/ahbps.2019.23.4.353.
9. Ibrahim R, Abdalkoddus M, Mahendran B, Mownah OA, Nawara H, Aroori S. Subtotal cholecystectomy: is it a safe option for difficult gall bladders? Ann R Coll Surg Engl. 2023;105:455-60. https://doi.org/10.1308/rcsann.2021.0291.
10. International Society for Fluorescence Guided Surgery. Dosing & timing chart on how to use indocyanine green by procedure. Available from: https://isfgs.org/component/content/article/710-dosing-chart?catid=60 Accessed October 2, 2026.
11. Fassari A, Rosso E, Mohamed-Wais M, Lakshmi Anafack J, Ursino S, De Blasi V. Back to the battlefield: minimally invasive management of postcholecystectomy remnants: a systematic appraisal of safety and efficacy. Surg Today. 2026;56(1):6-16. https://doi.org/10.1007/s00595-025-03143-6.
12. Zhu A, Benedek L, Deng S, Tsang M, Bubis L, Habbel C, et al. Resection of the remnant gallbladder after subtotal cholecystectomy: an institutional experience. Surgery. 2025;178:108871. https://doi.org/10.1016/j.surg.2024.09.028.
13. Sahoo MR, Panigrahi S, Sethi MK, Kumar BA. Laparoscopic remnant cholecystectomy with CBD exploration: a tertiary center experience. Surg Laparosc Endosc Percutan Tech. 2021;32:96-100. https://doi.org/10.1097/SLE.0000000000001009.
14. Ben Zvi A, Dagan A, Freund MR, Yellinek S, Ben-Haim M, Boaz E. Remnant gallbladder cholecystitis after subtotal cholecystectomy: management and outcome. Am Surg. 2025;91:1006-9. https://doi.org/10.1177/00031348251328493.
15. Xu A, Hu H, Zhao G, Jiao L. How to successfully manage residual gallbladders laparoscopically following open techniques? Surg Laparosc Endosc Percutan Tech. 2017;27:e92-5. https://doi.org/10.1097/SLE.0000000000000436.
16. Ahmed HV, Sherwani AY, Aziz R, Shera AH, Sheikh MR, Lone SN, et al. Laparoscopic completion cholecystectomy for residual gallbladder and cystic duct stump stones: our experience and review of the literature. Indian J Surg. 2021;83(4):944-9. https://doi.org/10.1007/s12262-020-02559-3.
17. Nafea MA, Elshafey MH, Hegab A, Seleem A, Rafat W, Khairy M, et al. Open versus laparoscopic completion cholecystectomy in patients with previous open partial cholecystectomy: a retrospective comparative study. Ann Med Surg (Lond). 2024;86(10):5688-95. https://doi.org/10.1097/MS9.0000000000002428.
18. Concors SJ, Kirkland ML, Schuricht AL, Dempsey DT, Morris JB, Vollmer CM, et al. Resection of gallbladder remnants after subtotal cholecystectomy: presentation and management. HPB (Oxford). 2018;20:1062-6. https://doi.org/10.1016/j.hpb.2018.05.005.
19. Smith NJ, Lai SD, Windsor JA, Wells CI. Completion cholecystectomy: a meta-analysis of indications, techniques and outcomes. HPB (Oxford). 2026;28(2):143-53. https://doi.org/10.1016/j.hpb.2025.11.013.
20. Lim PW, Tan PH, Lillemoe KD, Nelson MH, Johnston PF, Jorge IA, et al. A 10-year real-world assessment of longitudinal outcomes following bailout procedures for severe cholecystitis. Ann Surg. 2025;282:553-62. https://doi.org/10.1097/SLA.0000000000006799.
21. Nzenwa IC, Mesri M, Lunevicius R. Risks associated with subtotal cholecystectomy and the factors influencing them: a systematic review and meta-analysis of 85 studies. Surgery. 2021;170:1014-23. https://doi.org/10.1016/j.surg.2021.03.036.
22. Burckhardt O, Peisl S, Rouiller B, Colinet E, Egger B. Length of the remnant cystic duct and bile duct stone recurrence: a case-control study. J Gastrointest Surg. 2023;27:1122-9. https://doi.org/10.1007/s11605-023-05607-x.
23. Joo SH, Kim KH, Yun EJ, Lee S, Kim JS. Laparoscopic removal of a retained gallbladder with remnant cystic duct calculi. Korean J Hepatobiliary Pancreat Surg. 2006;10:47-51.
24. Matsudaira S, Fukumoto T, Yarita A, Hamada J, Hisada M, Fukushima J, et al. A patient with cystic duct remnant calculus treated by laparoscopic surgery combined with near-infrared fluorescence cholangiography. Surg Case Rep. 2020;6:146. https://doi.org/10.1186/s40792-020-00909-7.
25. van Manen L, Tummers QRJG, Inderson A, Bhalla A, Vahrmeijer AL, Bonsing BA, et al. Intraoperative detection of the remnant cystic duct during robot-assisted surgery using near-infrared fluorescence imaging: a case report. BMC Surg. 2019;19:104. https://doi.org/10.1186/s12893-019-0567-8.

Disclaimer/Publisher's Note: The statements, opinions, and data presented in publications in the Journal of Surgery and Medicine (JOSAM) are exclusively those of the individual author(s) and contributor(s) and do not necessarily reflect the views of JOSAM, the publisher, or the editor(s). JOSAM, the publisher, and the editor(s) disclaim any liability for any harm to individuals or damage to property that may arise from implementing any ideas, methods, instructions, or products referenced within the content. Authors are responsible for all content in their article(s), including the accuracy of facts, statements, and citations. Authors are responsible for obtaining permission from the previous publisher or copyright holder if re-using any part of a paper (e.g., figures) published elsewhere. The publisher, editors, and their respective employees are not responsible or liable for the use of any potentially inaccurate or misleading data, opinions, or information contained within the articles on the journal's website.

This work is licensed under a Creative Commons Attribution 4.0 International License.
To view a copy of this license, visit https://creativecommons.org/licenses/by/4.0/