International Journal of Research and Review
[Indexed, Peer-Reviewed Journal]
Volume 13; Issue: 6; June 2026
Website: www.ijrrjournal.com
Research Paper *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

Subtotal Cholecystectomy in Difficult Gallbladder Surgeries: A Retrospective Observational Study

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DOI: https://doi.org/10.52403/ijrr.20260660

ABSTRACT

Background: Laparoscopic cholecystectomy is the gold standard for symptomatic cholelithiasis; however, severe inflammation, fibrosis, or anatomical distortion of the hepatocystic triangle can preclude safe achievement of the critical view of safety. In such situations, subtotal cholecystectomy (STC) is increasingly recognised as a bailout procedure to minimise bile duct injury. The present study reviewed the institutional experience with STC for the difficult gallbladder.

Methods: A retrospective observational study was conducted at Sapthagiri Institute of Medical Sciences and Research Centre over a 72-month period from April 2020 to March 2026. Records of patients aged 18 years or older who underwent cholecystectomy for symptomatic cholelithiasis or cholecystitis were reviewed. Patients with malignant gallbladder disease, concomitant biliary or hepatic resections, and incomplete records were excluded. Demographic data, comorbidities, history of cholecystitis, preoperative endoscopic retrograde cholangiopancreatography, intraoperative findings and postoperative outcomes were extracted and compared between the total cholecystectomy and the subtotal cholecystectomy groups.

Results: A total of 900 cholecystectomies were performed during the study period, of which 15 (1.67%) were STC. Of the STC cohort, 13 (86.7%) were of the reconstituting subtype and 2 (13.3%) were fenestrating; 12 (80.0%) were completed laparoscopically while 3 (20.0%) required conversion to open. The mean age in the STC group was 51.4 years compared with 44.6 years in the TC group, with a male preponderance in the STC group (53.3% vs 30.5%). A prior history of cholecystitis (53.3% vs 12.1%), choledocholithiasis with ERCP (26.7% vs 3.2%) and biliary pancreatitis (20.0% vs 1.9%) was more frequent in the STC group. No bile duct injury or complete biliary transection requiring hepaticojejunostomy occurred in either group. Postoperative bile leak occurred in 3 (20.0%) STC patients and 2 (0.2%) TC patients; the mean hospital stay was 5.3 days in the STC group versus 2.2 days in the TC group.

Conclusion: Subtotal cholecystectomy is a safe and effective bailout procedure for the difficult gallbladder, achieving a zero rate of bile duct injury at the expense of an acceptable increase in bile leak, drain duration and hospital stay. Liberal adoption

of subtotal cholecystectomy, particularly the reconstituting subtype, is advocated when the critical view of safety cannot be achieved.

Keywords: Subtotal cholecystectomy; difficult gallbladder; laparoscopic cholecystectomy; bile duct injury; bailout procedure; critical view of safety.

INTRODUCTION

Cholelithiasis is among the most prevalent surgical conditions worldwide, with a pooled global prevalence of approximately 6.1% and an even higher burden reported in South Asian populations.[1] Since its widespread adoption in the early 1990s, laparoscopic cholecystectomy has supplanted open cholecystectomy as the gold standard for symptomatic gallstone disease, offering minimal postoperative pain, a shorter hospital stay, an earlier return to work and superior cosmesis.[2] Despite these advantages, laparoscopic cholecystectomy carries a small but persistent risk of major intraoperative complications, the most feared of which is bile duct injury, an event associated with substantial long-term morbidity, impaired quality of life and considerable medico-legal implications.[2,3]

To minimise the incidence of bile duct injury, Strasberg and colleagues introduced the concept of the critical view of safety, a technique that mandates skeletonisation of the hepatocystic triangle and identification of only two structures entering the gallbladder before any clip application or division.[2,3] Although the critical view of safety has been validated across multiple large series and is endorsed by international consensus statements, its achievement is not always feasible.[4] In approximately 10 to 15% of elective and a significantly higher proportion of emergency cholecystectomies, dense fibrosis, contracted gallbladders, Mirizzi syndrome or a frozen Calot's triangle render safe dissection of the hepatocystic anatomy impossible.[5] The aggregate of such intraoperative findings is collectively termed the difficult gallbladder, a clinical scenario in which the surgeon must select a safe bailout strategy.

Historically, conversion to open total cholecystectomy was regarded as the default bailout option. However, evidence accumulated over the past two decades demonstrates that simple conversion does not necessarily safeguard against bile duct injury, particularly when the underlying pathology is severe inflammation rather than instrumentation difficulty.[6] This realisation prompted renewed interest in subtotal cholecystectomy, a procedure first described by Morse and Barb in 1947 for fulminant cholecystitis and subsequently refined by several authors.[7] Strasberg later proposed an anatomic classification that has gained the widest acceptance: the reconstituting subtype, in which the residual neck and infundibulum are sutured to create a small neo-gallbladder, and the fenestrating subtype, in which the infundibulum is left open and the cystic duct is closed from within the lumen.[8]

Subtotal cholecystectomy avoids dissection in the hepatocystic triangle altogether, thereby protecting the common bile duct, the common hepatic duct and the right hepatic artery from inadvertent injury. A growing body of literature, including a large meta-analysis of 85 studies published between 1985 and 2020, has demonstrated that subtotal cholecystectomy is associated with a markedly lower incidence of bile duct injury compared with conversion to open total cholecystectomy in the setting of severe inflammation.[9] A recent multicentre real-world analysis by Dhanasekara and colleagues similarly reported significantly lower rates of bile duct injury with subtotal cholecystectomy bailout when compared with open conversion for severe cholecystitis.[6] Nevertheless, the procedure is not without trade-offs. Subtotal cholecystectomy has been consistently linked with higher rates of postoperative bile leak, intra-abdominal collections, a longer drain duration and occasionally the need for percutaneous or endoscopic

reintervention. In the longer term, particularly with the reconstituting subtype, recurrent stone formation within the gallbladder remnant has been reported in a small proportion of patients.[8,10]

In the Indian context, the burden of cholelithiasis is increasing in parallel with changes in dietary patterns and lifestyle. A substantial proportion of patients present late, often with multiple episodes of acute cholecystitis, biliary pancreatitis or choledocholithiasis prior to definitive surgery. Such delayed presentations are well recognised risk factors for the difficult gallbladder phenotype encountered intraoperatively. Although several Western and a few Indian centres have published their experience with subtotal cholecystectomy, real-world data from tertiary teaching hospitals in southern India remain limited.

Against this background, the present study was undertaken to review the institutional experience with subtotal cholecystectomy as a bailout strategy for the difficult gallbladder over a 72-month period at a tertiary care medical college and research centre. The objective was to characterise the clinical profile of patients in whom subtotal cholecystectomy was performed, to describe the intraoperative and immediate postoperative outcomes and to compare these with patients who underwent standard total cholecystectomy during the same study interval. The findings are intended to add to the regional evidence supporting a low threshold for subtotal cholecystectomy in the difficult gallbladder and to inform safe surgical decision-making among general surgical trainees and practitioners working in similar settings.

Aims And Objectives

The aim of the present study was to review the institutional experience with subtotal cholecystectomy for the difficult gallbladder at a tertiary care teaching hospital in southern India. The primary objective was to describe the clinical profile, intraoperative findings and immediate postoperative outcomes of patients in whom subtotal cholecystectomy was performed as a bailout procedure during the study period. The secondary objectives were to compare baseline demographic and clinical characteristics, operative parameters and postoperative complications between patients who underwent subtotal cholecystectomy and those who underwent standard total cholecystectomy and to evaluate the incidence of bile duct injury, postoperative bile leak, surgical site infection and prolonged hospital stay in the two groups.

MATERIALS AND METHODS

Study design and setting

The present study was a single-centre, retrospective observational study conducted in the Department of General Surgery, Sapthagiri Institute of Medical Sciences and Research Centre, Bengaluru, Karnataka, India.

Study duration

The study was conducted over a 72-month period from April 2020 to March 2026. Patient records pertaining to all cholecystectomies performed during this interval were reviewed.

Ethical considerations

The study protocol was approved by the Institutional Ethics Committee of Sapthagiri Institute of Medical Sciences and Research Centre prior to commencement of data collection. As the study was retrospective in design and utilised de-identified records, a waiver of individual written informed consent was obtained from the committee. All study procedures conformed to the ethical principles of the Declaration of Helsinki (2013 revision).

Study population and sample size

All consecutive patients aged 18 years or older who underwent laparoscopic cholecystectomy for symptomatic cholelithiasis or acute or chronic cholecystitis during the study period were

considered for inclusion. A total of 900 patients satisfied the eligibility criteria and constituted the final study cohort. Of these, 15 patients underwent subtotal cholecystectomy as a bailout procedure and were designated as the STC group, while the remaining 885 patients who underwent standard total cholecystectomy constituted the TC group.

Inclusion criteria

Patients aged 18 years or older with a preoperative diagnosis of symptomatic cholelithiasis or acute or chronic cholecystitis who underwent elective or semi-elective cholecystectomy at the study institution were included.

Exclusion criteria

Patients with malignant gallbladder disease, those undergoing concomitant biliary or hepatic resections and those with incomplete or insufficient medical records were excluded from the analysis.

Operative protocol

All procedures were performed by consultant gastrointestinal and general surgeons with more than five years of post-specialisation experience, assisted by surgical residents. Standard four-port laparoscopic cholecystectomy was attempted in all cases. Pneumoperitoneum was created with carbon dioxide insufflation maintained at 12 to 14 mmHg. Dissection of the hepatocystic triangle was performed with the intention of achieving the critical view of safety as defined by Strasberg. When dense adhesions, severe fibrosis, a contracted gallbladder or distorted anatomy precluded safe identification of the cystic duct and cystic artery, and after consultation between two consultant surgeons, a decision to perform subtotal cholecystectomy was taken. The Strasberg classification was applied: a reconstituting subtotal cholecystectomy was performed when the infundibular stump could be closed with intracorporeal absorbable sutures, typically using 2-0 polyglactin, while a fenestrating subtotal cholecystectomy was performed when severe inflammation precluded safe stump closure, in which case the cystic duct was identified intraluminally and closed where possible. A closed-suction drain was placed in the subhepatic space in all subtotal cholecystectomy patients.

Data collection

Medical records, operative notes, anaesthesia charts, discharge summaries and follow-up records were reviewed. The following variables were extracted: demographic data including age and gender; history of previous cholecystitis, biliary pancreatitis, choledocholithiasis and preoperative endoscopic retrograde cholangiopancreatography; comorbidities including hypertension, diabetes mellitus, ischaemic heart disease, chronic obstructive pulmonary disease and hypothyroidism; intraoperative parameters including operative duration, gallbladder perforation, bleeding, bowel injury, bile duct injury, complete transection requiring hepaticojejunostomy, intraoperative drain placement and conversion to open; and postoperative outcomes including duration of hospital stay, surgical site infection, postoperative bile leak, biloma, readmission and reintervention.

Outcome measures

The primary outcome was the incidence of bile duct injury. Secondary outcomes included postoperative bile leak, surgical site infection, duration of hospital stay and the need for postoperative reintervention.

Statistical Analysis

Data were entered into a Microsoft Excel spreadsheet (Microsoft Corp., Redmond, WA, USA) and analysed using IBM SPSS Statistics version 26 (IBM Corp., Armonk, NY, USA). Categorical variables were summarised as frequencies and percentages, while continuous variables were summarised as the mean with standard deviation. Comparisons between the two groups were presented descriptively in view

of the marked imbalance in group sizes and the exploratory nature of the analysis.

RESULTS

During the 72-month study period from April 2020 to March 2026, a total of 900 patients aged 18 years or older underwent cholecystectomy for symptomatic cholelithiasis or cholecystitis at the study institution and satisfied the eligibility criteria. Of these, 15 patients (1.67%) underwent subtotal cholecystectomy as a bailout procedure for a difficult gallbladder, while the remaining 885 patients (98.33%) underwent standard total cholecystectomy. Among the 15 subtotal cholecystectomy patients, 13 (86.7%) were of the reconstituting subtype and 2 (13.3%) were of the fenestrating subtype as per the Strasberg classification. Twelve (80.0%) subtotal cholecystectomies were completed laparoscopically, while 3 (20.0%) required conversion to an open approach. The conversion rate in the total cholecystectomy group was 1.6% (14 of 885).

The mean age of patients in the subtotal cholecystectomy group was 51.4 ± 11.2 years, compared with 44.6 ± 13.1 years in the total cholecystectomy group. A male preponderance was observed in the subtotal cholecystectomy group, with 8 (53.3%) male and 7 (46.7%) female patients, whereas the total cholecystectomy group showed a female preponderance, with 270 (30.5%) male and 615 (69.5%) female patients. The detailed demographic profile of the study population is presented in Table 1.

Table 1. Baseline demographic profile of the study population

Variable	Total cohort (n = 900)	TC group (n = 885)	STC group (n = 15)
Mean age (years)	44.7 ± 13.1	44.6 ± 13.1	51.4 ± 11.2
Age range (years)	18–82	18–82	32–74
Gender			
Male	278 (30.9%)	270 (30.5%)	8 (53.3%)
Female	622 (69.1%)	615 (69.5%)	7 (46.7%)
Comorbidities			
Hypertension	201 (22.3%)	195 (22.0%)	6 (40.0%)
Diabetes mellitus	92 (10.2%)	88 (9.9%)	4 (26.7%)
Ischaemic heart disease	22 (2.4%)	21 (2.4%)	1 (6.7%)
COPD	26 (2.9%)	24 (2.7%)	2 (13.3%)
Hypothyroidism	48 (5.3%)	47 (5.3%)	1 (6.7%)

TC: total cholecystectomy; STC: subtotal cholecystectomy; COPD: chronic obstructive pulmonary disease. Continuous variables are expressed as mean ± standard deviation; categorical variables as frequency (percentage).

Comorbidities were more frequently encountered in the subtotal cholecystectomy group: hypertension was present in 6 (40.0%) patients in the STC group compared with 195 (22.0%) in the TC group, diabetes mellitus in 4 (26.7%) versus 88 (9.9%) and chronic obstructive pulmonary disease in 2 (13.3%) versus 24 (2.7%) respectively.

Analysis of the preoperative clinical profile revealed that patients in the subtotal cholecystectomy group had a substantially higher burden of prior biliary morbidity. A documented history of cholecystitis was found in 8 (53.3%) STC patients compared with 107 (12.1%) TC patients. Preoperative endoscopic retrograde cholangiopancreatography for choledocholithiasis had been performed in 4 (26.7%) STC patients compared with 28 (3.2%) TC patients. A history of biliary pancreatitis was documented in 3 (20.0%) STC patients and 17 (1.9%) TC patients. These findings are summarised in Table 2.

Table 2. Clinical presentation and preoperative biliary risk factors

Variable	TC group (n = 885)	STC group (n = 15)
Symptomatic cholelithiasis	862 (97.4%)	15 (100%)
Gallbladder polyp >10 mm	23 (2.6%)	0 (0%)
Prior history of cholecystitis	107 (12.1%)	8 (53.3%)
Prior biliary pancreatitis	17 (1.9%)	3 (20.0%)
Prior choledocholithiasis	28 (3.2%)	4 (26.7%)
Preoperative ERCP performed	28 (3.2%)	4 (26.7%)
ASA grade		
I	412 (46.6%)	3 (20.0%)
II	385 (43.5%)	8 (53.3%)
III	88 (9.9%)	4 (26.7%)

ERCP: endoscopic retrograde cholangiopancreatography; ASA: American Society of Anesthesiologists. Values are expressed as frequency (percentage).

Operative details are summarised in Table 3. The mean operative duration was 116.4 ± 24.7 minutes in the subtotal cholecystectomy group compared with 64.8 ± 18.3 minutes in the total cholecystectomy group. Among the 15 subtotal cholecystectomies, 13 (86.7%) were of the reconstituting subtype with intracorporeal closure of the infundibular stump, while 2 (13.3%) were of the fenestrating subtype in which severe inflammation precluded safe stump closure. Among total cholecystectomy procedures 871 (98.4%) were completed laparoscopically, and 14(1.6%) required conversion to an open approach. Intraoperative drain placement was performed in all 15 subtotal cholecystectomy patients, whereas a drain was used in 78 (8.8%) total cholecystectomy patients.

Table 3. Operative details

Variable	TC group (n = 885)	STC group (n = 15)
Procedure completed laparoscopically	871 (98.4%)	15 (100.0%)
Converted to open	14 (1.6%)	-
STC subtype (Strasberg)		
Reconstituting	N/A	13 (86.7%)
Fenestrating	N/A	2 (13.3%)
Mean operative duration (min)	64.8 ± 18.3	116.4 ± 24.7
Intraoperative drain placement	78 (8.8%)	15 (100%)
Use of energy device for haemostasis	885 (100%)	15 (100%)
Intracorporeal suturing required	12 (1.4%)	13 (86.7%)

TC: total cholecystectomy; STC: subtotal cholecystectomy; N/A: not applicable. Continuous variables are expressed as mean ± standard deviation.

Intraoperative complications are detailed in Table 4. Gallbladder perforation during dissection was observed in 9 (60.0%) STC patients compared with 38 (4.3%) TC patients. Significant intraoperative bleeding requiring active haemostatic intervention occurred in 2 (13.3%) STC patients and 3 (0.3%) TC patients. A single instance of inadvertent bowel injury was recorded in the TC group (0.1%), with no bowel injuries in the STC group. Importantly, no instance of major bile duct injury was identified in either group throughout the study period, and no patient required hepaticojejunostomy for complete biliary transection.

Table 4. Intraoperative findings and complications

Variable	TC group (n = 885)	STC group (n = 15)
Bile duct injury	0 (0%)	0 (0%)
Complete CBD transection requiring hepaticojejunostomy	0 (0%)	0 (0%)
Gallbladder perforation during dissection	38 (4.3%)	9 (60.0%)
Significant intraoperative bleeding	3 (0.3%)	2 (13.3%)

Bowel injury	1 (0.1%)	0 (0%)
Vascular injury (right hepatic artery)	0 (0%)	0 (0%)
Need for intraoperative blood transfusion	2 (0.2%)	1 (6.7%)
Frozen Calot's triangle	19 (2.1%)	11 (73.3%)
Mirizzi syndrome encountered	2 (0.2%)	3 (20.0%)

TC: total cholecystectomy; STC: subtotal cholecystectomy; CBD: common bile duct. Values are expressed as frequency (percentage).

Postoperative outcomes are detailed in Table 5. The mean duration of hospital stay was 5.3 ± 2.4 days in the subtotal cholecystectomy group compared with 2.2 ± 1.1 days in the total cholecystectomy group. The most frequent postoperative complication in both groups was superficial surgical site infection at the umbilical port site, observed in 4 (26.7%) STC patients and 81 (9.2%) TC patients. Postoperative bile leak, detected as the drainage of bilious fluid through the intraoperatively placed subhepatic drain, occurred in 3 (20.0%) STC patients and 2 (0.2%) TC patients. In the STC group, both fenestrating subtype cases developed bile leak, and 1 additional reconstituting subtype case developed a minor bile leak that settled with continued drainage. Two STC patients (13.3%) required ultrasound-guided percutaneous drain placement for biloma; both improved with conservative management.

Table 5. Postoperative outcomes and complications

Variable	TC group (n = 885)	STC group (n = 15)
Mean hospital stays (days)	2.2 ± 1.1	5.3 ± 2.4
ICU admission required	5 (0.6%)	2 (13.3%)
Superficial surgical site infection	81 (9.2%)	4 (26.7%)
Postoperative bile leak	2 (0.2%)	3 (20.0%)
Intra-abdominal collection/biloma	4 (0.5%)	2 (13.3%)
Postoperative ileus	11 (1.2%)	1 (6.7%)
Postoperative nausea and vomiting	15 (1.7%)	2 (13.3%)
Respiratory tract infection	13 (1.5%)	1 (6.7%)
Cardiac complications	9 (1.0%)	1 (6.7%)
Mean duration of drain (days)	1.8 ± 0.9	6.4 ± 3.1
Readmission within 30 days	6 (0.7%)	2 (13.3%)
Reintervention required	3 (0.3%)	2 (13.3%)
Mortality (30-day)	0 (0%)	0 (0%)

TC: total cholecystectomy; STC: subtotal cholecystectomy; ICU: intensive care unit. Continuous variables are expressed as mean ± standard deviation.

In the subtotal cholecystectomy group, the mean duration of drain in situ was 6.4 ± 3.1 days, with all bile leaks resolving spontaneously over a period of two to four weeks. No patient required surgical re-exploration. Two patients (13.3%) underwent ultrasound-guided percutaneous drainage of intra-abdominal biloma, with both drains being removed by the fourth postoperative week. There was no thirty-day mortality in either group.

DISCUSSION

The present retrospective observational study from a tertiary care medical college in southern India analysed 900 consecutive cholecystectomies performed over a 72-month period, of which 15 (1.67%) were subtotal cholecystectomies undertaken as a bailout strategy for the difficult gallbladder. The most striking finding of the study was the complete absence of major bile duct injury or biliary transection requiring hepaticojejunostomy in both the total cholecystectomy and subtotal cholecystectomy cohorts. This is consistent with the central rationale for subtotal cholecystectomy, namely the avoidance of hazardous dissection within the hepatocystic triangle when severe inflammation or

fibrosis distorts the anatomy, thereby preserving the extrahepatic biliary tree.[11,12]

The reported incidence of subtotal cholecystectomy in published series ranges widely, from 1% to 9.4% of all cholecystectomies, with higher rates documented in centres performing a higher proportion of emergency surgery for acute calculous cholecystitis.[13,14] In the present series, the incidence of 1.67% lies at the lower end of this spectrum and reflects predominantly elective practice with relatively few emergency presentations operated within the first week of acute cholecystitis. Comparable elective practice from Nepal reported subtotal cholecystectomy in 3.3% of cholecystectomies, while large multicentre series from the United States have reported rates as high as 6%.[14,15]

Patients undergoing subtotal cholecystectomy in the present cohort were older (mean 51.4 vs 44.6 years), more often male (53.3% vs 30.5%) and carried a substantially heavier burden of prior biliary morbidity, including previous cholecystitis (53.3% vs 12.1%), choledocholithiasis with preoperative endoscopic retrograde cholangiopancreatography (26.7% vs 3.2%) and biliary pancreatitis (20.0% vs 1.9%). These observations mirror the risk factors for the difficult gallbladder identified in prior literature.[5,15] A male sex, advanced age, multiple previous attacks of cholecystitis, prior endoscopic retrograde cholangiopancreatography and a thick-walled gallbladder on preoperative imaging have all been shown to predict difficult dissection and the need for a bailout procedure.[5,16]

The complete absence of bile duct injury in the subtotal cholecystectomy group of the present series is encouraging and aligns with the conclusions of the largest meta-analyses on the subject. A systematic review and meta-analysis of 85 studies published over a 35-year period reported a pooled bile duct injury rate of approximately 0.08% with subtotal cholecystectomy, significantly lower than the rate associated with attempted total cholecystectomy in the difficult gallbladder.[9] Similarly, a 2024 systematic review and meta-analysis by Koo and colleagues comparing subtotal versus total cholecystectomy for the difficult gallbladder demonstrated a markedly lower incidence of common bile duct injury with the subtotal approach.[17]

The trade-off documented in the literature is a higher rate of postoperative bile leak following subtotal cholecystectomy, typically reported between 10% and 21%, with the highest rates noted after the fenestrating subtype, in which the cystic duct or infundibular stump is not closed.[8,15,17] The present series observed a bile leak rate of 20.0% in the subtotal cholecystectomy group, with both fenestrating subtype cases developing bile leak and an additional reconstituting case developing a minor self-limiting leak. Importantly, all bile leaks resolved with conservative management over two to four weeks, and no patient required surgical re-exploration. This pattern of management is consistent with the experience of Slater and colleagues, who, in a 13-year series, reported that the great majority of bile leaks following subtotal cholecystectomy resolved with continued subhepatic drainage and selective endoscopic intervention.[18]

The mean hospital stay in the subtotal cholecystectomy group was 5.3 days, compared with 2.2 days in the total cholecystectomy group, a difference that reflects the requirement for monitoring of the drain output and confirmation of resolution of any biliary fistula prior to discharge. The mean operative time was almost twice as long for subtotal cholecystectomy as for total cholecystectomy (116.4 vs 64.8 minutes), reflecting both the difficulty of dissection and, in the case of reconstituting subtotal cholecystectomy, the additional time required for intracorporeal suturing of the infundibular stump. Comparable operative times have been reported by Kandel and colleagues from Nepal and LeCompte and colleagues from the United States.[14,19]

The Strasberg classification of subtotal cholecystectomy into reconstituting and fenestrating subtypes has clarified the distinct complication profiles of the two techniques and has been adopted by the majority of contemporary surgical units.[8] The reconstituting subtype, performed in 86.7% of the present cohort, is associated with a lower rate of bile leak but a small theoretical risk of recurrent stone formation within the remnant gallbladder, while the fenestrating subtype is associated with higher rates of bile leak but eliminates the risk of remnant stone disease.[8,18] Published series with longer follow-up have reported recurrent stone formation in the remnant gallbladder in 1.1% to 2.2% of reconstituting subtotal cholecystectomies, with most such patients being asymptomatic.[8,18]

Several technical refinements have been described to reduce the bile leak rate after fenestrating subtotal cholecystectomy, including the use of an omental plug or a falciform ligament patch to buttress the open infundibular stump.[20,21] The 2020 World Society of Emergency Surgery guidelines for acute calculous cholecystitis explicitly endorse subtotal cholecystectomy as an acceptable bailout strategy when total cholecystectomy cannot be safely accomplished, and recommend a low threshold for its use in the difficult gallbladder.[22] The findings of the present study lend institutional support to this guideline-based recommendation in the Indian tertiary care setting.

Earlier meta-analyses, including that of Elshaer and colleagues published in 2015, established the safety profile of subtotal cholecystectomy across heterogeneous patient populations and surgical settings, and noted that the technique reduced the conversion rate to open total cholecystectomy without an increase in major morbidity.[23] Smaller series from Asian centres, including the work of Nakajima and colleagues from Japan, have similarly demonstrated favourable outcomes with laparoscopic subtotal cholecystectomy for severe cholecystitis, supporting the generalisability of the technique across diverse practice settings.[24]

Two patients in the present subtotal cholecystectomy cohort required postoperative reintervention in the form of ultrasound-guided percutaneous drainage of an intra-abdominal biloma. Both patients improved with conservative management without the need for endoscopic biliary stenting or surgical re-exploration. This conservative trajectory is in keeping with contemporary case series demonstrating that the vast majority of bile leaks following subtotal cholecystectomy can be managed without invasive biliary intervention.[14,18]

The present study has several limitations. The retrospective observational design carries an inherent risk of selection bias, particularly in the assignment of patients to the subtotal cholecystectomy group, which was based on intraoperative findings and surgeon judgement rather than randomisation. The small absolute number of subtotal cholecystectomy patients (n = 15) limits the statistical power for the detection of differences in low-frequency outcomes such as bile duct injury and mortality. The single-centre design may limit the external validity of the findings, although the institutional case mix is broadly representative of tertiary teaching hospitals across southern India. The absence of structured long-term follow-up in the present analysis also limits the ability to characterise late outcomes of the gallbladder remnant, particularly the risk of recurrent stone formation in reconstituting subtotal cholecystectomy, which may emerge over five to ten years.[18]

Notwithstanding these limitations, the present study contributes useful institutional and regional evidence supporting the safety of subtotal cholecystectomy as a bailout procedure for the difficult gallbladder, with a zero rate of bile duct injury and acceptable rates of postoperative bile leak and reintervention. Larger prospective and multicentre studies with standardised follow-up protocols are required to refine

the indications for the procedure, to compare the two Strasberg subtypes head-to-head and to characterise the long-term outcomes of the gallbladder remnant.

CONCLUSION

Subtotal cholecystectomy is a safe and effective bailout procedure for the difficult gallbladder when the critical view of safety cannot be achieved due to severe inflammation, fibrosis or anatomical distortion. In the present series of 900 consecutive cholecystectomies, the 15 patients (1.67%) who underwent subtotal cholecystectomy had no bile duct injury and no biliary transection requiring hepaticojejunostomy, despite a substantially higher burden of prior biliary morbidity compared with patients undergoing standard total cholecystectomy. The reconstituting subtype, performed in 86.7% of the subtotal cholecystectomy cohort, was associated with a lower rate of bile leak than the fenestrating subtype, while all postoperative bile leaks resolved with conservative management. The findings support a low threshold for subtotal cholecystectomy in the difficult gallbladder and reinforce the recommendations of contemporary international guidelines for its use as the bailout procedure of choice when safe completion of total cholecystectomy is judged unfeasible. Larger prospective studies with structured long-term follow-up are required to confirm the long-term safety of the gallbladder remnant in reconstituting subtotal cholecystectomy and to refine the comparative indications for the two Strasberg subtypes.

Declaration by Authors

Ethical Approval: Approved
Acknowledgement: None
Source of Funding: None
Conflict of Interest: No conflicts of interest declared.

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How to cite this article: M. Shanmuga Priyan, Gulamnabi, Srinivas Yadav. Subtotal cholecystectomy in difficult gallbladder surgeries: a retrospective observational study. *International Journal of Research and Review*. 2026; 13(6): 621-631. DOI: *https://doi.org/10.52403/ijrr.20260660*

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