

Laparoscopic Subtotal Cholecystectomy: Conversion is wisdom, not failure in difficult cholecystectomy-It prevents disaster

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Abstract

Introduction: Laparoscopic cholecystectomy is commonly performed procedure in daily surgical practice worldwide in symptomatic gallbladder stone patients. During laparoscopic cholecystectomy, operating surgeons may encounter great difficulty during Calot's triangle dissection and not able to achieved critical view of safety to proceed safe dissection with preventing common bile duct injury. In that case, we need to identified preoperative risk factors in the form of patient's factor including comorbidity, no. of pain episode experience before current hospital admission, total number of hospital admission required for same complaints and radiological investigation including ultrasound abdomen-pelvis, CECT-A-P-T, MRCP which collectively indicate difficult cholecystectomy in preoperative periods. Intraoperative surgical findings may necessitate conversion into retrograde gallbladder dissection before doing unsafe calot's triangle dissection to avoid major catastrophe and performing subtotal cholecystectomy in the form of either fenestrating or reconstituting subtotal cholecystectomy depending upon the condition of cystic duct opening and observing postoperative short term and long-term morbidity.[1]

Methods: We retrospectively reviewed 25 patients who underwent subtotal cholecystectomy in a single unit at our institute during specific time period. Gathered all relevant preoperative, intra operative and post-operative information that predict difficult cholecystectomy during Preoperative as well as intra operative time and observed post operative short term and long term sequences(morbidity and mortality) in patients who underwent subtotal cholecystectomy

Results: We analysed 25 patients who underwent subtotal cholecystectomy using either fenestrating (n-9) or reconstituting (n-16) approaches with regards to post operative bile leak. Patient who underwent Fenestrating subtotal cholecystectomy was associated with higher rate of post operative bile leak as compared to reconstituting subtotal cholecystectomy. Post operative bile leak effectively managed either by conservative management with delayed drain removal or need of postoperative ERCP, USG guided pigtail insertion as well as re-laparoscopic peritoneal lavage with drain placement in a patient who developed signs of bile peritonitis.

Conclusions: Fenestrating subtotal cholecystectomy is associated with higher rate of postoperative bile leak as compared to reconstituting subtotal cholecystectomy but bile leak effectively managed non-operative or operative method. So, both approaches are safe in view of difficult cholecystectomy. We encourage the subtotal cholecystectomy approach in difficult cholecystectomy considering trends in improved short- and long-term outcomes.

Keywords: Difficult cholecystectomy; Fenestrating; Reconstituting; Subtotal cholecystectomy; Bailout procedure

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1. Introduction

Gall bladder stone disease is more prevalent in general population with symptomatic gallstone disease requiring intervention in the form of non-operative as well as operative management. Non-operative management is feasible in mild cases of acute cholecystitis, while moderate to severe cases of acute and chronic cholecystitis need definitive operative management in the form of most widely and worldwide accepted laparoscopic cholecystectomy. For completion of safe laparoscopic cholecystectomy, achievement of CVS-critical view of safety is crucial but in cases of 'Difficult gallbladder', further exploration to establish the critical view of safety may increase the risk of bile duct injury with short term as well as long term morbidity and mortality, hence laparoscopic subtotal cholecystectomy has been safest alternative option to "get out of jail" and prevent further injury.[2]

Laparoscopic subtotal cholecystectomy is safe approach in preventing bile duct injury but may increased post-operative complication like intra-abdominal infection due to infected bile spillage during cholecystectomy, bile leak, GB fossa collection, wound infection, radiologically guided pigtail insertion in collection, MRCP to identify bile duct injury, ERCP for management of bile duct injury and result in increased cost to the patients, unplanned prolonged hospital stay and stress to surgeon.[2]

Laparoscopic subtotal cholecystectomy carried out in the form of either "fenestrating" and "Reconstituting" type to prevent unsafe dissection in Calot's triangle. Fenestrating type of subtotal cholecystectomy is done by leaving behind remnant of part of gall bladder wall near to cystic duct with cauterisation of gall bladder wall mucosa but that leads to more chances of post-operative bile leak, bile collection and post-operative biliary fistula. Reconstituting type of subtotal cholecystectomy done by creating remnant pouch by suturing remnant of gall bladder wall that's reduced postoperative bile leak but active pathological mucosa in remnant pouch act as stone formation and recurrent biliary event.[3]

Three pillars of safety:

- Know your anatomy (CVS-Critical view of safety, is non-negotiable)
- Know your limits (Recognise difficult pathology early)
- Know when to stop (Conversion is a safe choice, not a failure)

Key Triggers:

Converts when:

- Anatomy unclear after 30 min.
- Bleeding obscures field
- CVS unachievable
- Suspected injury

Purpose of this study is to identify preoperative risk factors, intraoperative difficulty that predict difficult cholecystectomy and alternative safe approaches in the form of subtotal cholecystectomy in the presence of severe inflammation at hepatocystic triangle that leads to inadvertent bile duct injury causing significant post operative morbidity and mortality[4]

2. Material and Methods

This is the retrospective study of 25 patients who underwent subtotal cholecystectomy in a single unit at our institute during specific time period. Patients who are more than 18 year of age included in the study. Gathered all relevant preoperative, intra operative and post-operative information that predict difficult cholecystectomy during pre-operative as well as intra operative time and observed post operative short term and long termsequences(morbidity and mortality) in patients who underwent subtotal cholecystectomy.

Collected data consisted of demographic information including patient's diagnosis, chief complaints and preoperative assessment done by using different scoring system, radiological imaging and risk stratification by ASA class, age and comorbidities. We studied anthropometric data, comorbidities, preoperative as well as postoperative blood parameters, intra operative findings.

The primary goal to conduct this study was to check safety profile and good decision of subtotal Cholecystectomy and effectiveness of subtotal Cholecystectomy procedure in prevention of inadvertent bile duct injury, short term as well as long term complication.

All cases were performed by or under the supervision of an experienced laparoscopic surgeon. Subtotal Cholecystectomy is divided into two category:- 1) fenestrating type- remnant gallbladder left in situ after dissecting from liver bed without ligation of cystic duct orifice. 2) Reconstituting type- after removal of stone, remnant gall bladder stump closed by either suture material or by endo-stappler.[1]

During postoperative period, we looked for daily bile leak in either type of subtotal Cholecystectomy, amount of bile leak per day, average days required for complete stoppage of bile leak, need of ERCP/MRCP Procedure, intra-abdominal infection, need of re-intervention and long term morbidity. We analysed the result that mention below in table form.

3. Result

A Total 25 patients were enrolled into the retrospective study. Demographic information mentioned below.

Table 1 Demographic information of patients (n=25)

Demographic information	
Age(yr.) :-	45.16±15.04
Sex:- (n=25)	
Male	15(60%)
Female	10(40%)
Diagnosis:- (n=25)	
Acute calculous cholecystitis	9(36%)
Chronic calculous cholecystitis	7(28%)
Acute calculous cholecystitis with Rupture gallbladder	3(12%)
Acute calculous cholecystitis with choledocholithiasis	2(8%)
Acute calculous cholecystitis with gallstone induced pancreatitis	2(8%)
Acalculous cholecystitis with Gallbladder rupture	2(8%)
Chief complaints:- (n=25)	
Abdominal pain:-	
<5 Days	9(36%)
5-10 Days	8(32%)
>10 days	2(8%)
Long duration (in month)	6(24%)
Nausea	11(44%)
Vomiting	16(64%)
Fever	11(44%)
Dyspepsia	8(32%)
Others(generalized pruritus/back pain)	3(12%)

3.1. Preoperative Assessment

- Scoring System(e.g. Tokyo guidelines, CCI-Charlson Comorbidity Index)
- Imaging (Ultrasound of abdomen, MRCP, ERCP if needed)
- Risk Stratification (ASA class, Age, Comorbidities)

Anthropometric data and comparison of preoperative and post-operative blood investigations given in Table:-2:-

Table 2 Anthropometric parameters and blood investigations of patients (n=25)

Anthropometric parameters:- (n=25)	
Weight	65.02±17.47
Height	162.64±10.77
BMI	24.84±8.52
Blood investigations:	
Hemoglobin(gm/dl)	
Pre-op	11.27±2.24
Post-op	10.88±1.18
Total count(/cmm)	
Pre-op	11040±4770.66
Post-op	11916±3492.81
PT/INR	
Pre-op	1.25±0.40
Post-op	1.20±0.20
S.Creatinine (M-0.9-1.3,F-0.6-1.1)(mg/dl)	
Pre-op	1.05±0.44
Post-op	1.02±0.58
Total protein/S. Albumin (g/dl)	
Pre-op	6.26±0.72/3.48± 0.72
Post-op	5.52±0.87/3.16±0.87
TB/DB/IDB(<1.3/0.4/1.3)(mg/dl)	
Pre-op	1.4±1.61/0.92±1.38/0.66 ±1.04
Post-op	1.2±0.77/0.66±0.45/0.54±0.53
S.AST (<35)(U/L)	
Pre-op	49.87±49.27
Post-op	49.16±49.15
S.ALT (<45)(U/L)	
Pre-op	51.82±62.11
Post-op	43.94±35.93
S.ALP (42-128)(U/L)	
Pre-op	119.87±96.58
Post-op	85.08±34.96

S.AMYLASE (28-100)(U/L)	
Pre-op	205.56±601.99
Post-op	54.52±31.86
S.LIPASE (0-5)(U/L)	
Pre-op	5.31±9.41
Post-op	3.20±4.70

Pre-operative patient's factors and ultrasound parameters that predict difficult cholecystectomy mentioned in Table:-3

Table 3 Patient factors and ultrasound parameters (n=25)

Patient factors:- (n=25)	
Obesity	2(8%)
Comorbidity	9(36%)
H/O previous hospital admission for acute cholecystitis	16(64%)
H/O Previous abdominal surgery	3(12%)
Past H/O cholecystitis	23(92%)
History of multiple No. of pain attacks	23(92%)
Ultrasonographic parameters:- (n=25)	
Volume of GB	
<50 ml	16(64%)
50-100 ml	6(24%)
>100 ml	3(12%)
Pattern of GB wall thickening	
Diffuse	19(76%)
Irregular	6(24%)
GB wall thickness	
<3 mm	4(16%)
4-10 mm	18(72%)
>10 mm	3(12%)
Rupture and gangrenous gall bladder	5(20%)
Pericholecystic collection	13(52%)
Free fluid in GB fossa	6(24%)
Fibrotic GB	5(20%)
Distended GB	20(8%)
Impacted stone(at neck/cystic duct)	6(24%)
Single/multiple stone with sludge	2/23(8%/92%)
Dilated CBD	9(36%)
CBD stone	2(8%)

Liver-USG as well as intra OP status:-	
Fatty liver/scarring	7(28%)
Cirrhosis	2(8%)
Tokyo Guidelines grading	
Grade-1	4(16%)
Grade-2	20(80%)
Grade-3	1(4%)
ASA Class	
Class 1 /2	10(40%)
Class 3 /4	15(60%)

- Intraoperative Decision Points
- SAFE ZONE (Green Zone):-
 - 1-Clear anatomy+ Critical view of safety achievable
 - 2-Progressing Safely
- CAUTION ZONE (Yellow Zone):-
 - 1-Frozen Calot's Triangle-Unclear structures, Inflammation
 - 2-Emphyema/Gangrene of gallbladder
 - 3- Mirizzi syndrome suspected
 - 4- Moderate bleeding
 - 5-Difficult dissection
- DANGER ZONE (Red Zone):-
- Cirrhosis of liver- Check Child-Pugh Score-Score?(A
 - Compensated, B/C-Decompensated)
- Cannot achieved CVS(Critical view of safety)
- Uncontrolled Bleeding
- Suspected injury
- >2 hours without progression

Table 4 Intra-operative findings and indications of subtotal cholecystectomy (n=25)

Intraoperative findings:- (n=25)	
Degree of gall bladder inflammation:-	
Moderate	3(12%)
Severe	22(88%)
Dissection of GB wall	20(80%)
Presence of adhesion	22(88%)
Preserved Fat plan between GB and hepatoduodenal ligament	11(44%)
Wide and short cystic duct	19(76%)
Blocked cystic duct opening	4(16%)
Bile spillage	20(80%)
Stone spillage	17(68%)
Difficulty of GB extraction (piecemeal removal)	10(40%)
Anatomical variation(intra hepatic GB.cystic duct from right CHD,very low insertion of cystic duct in CBD)	3(12%)

Injury to cystic artery	4(16%)
Injury to bile duct identified	1(4%)
Operative time	3.34±0.92 hr.
Indication of subtotal cholecystectomy:- (n=25)	
Marked inflammation and fibrosis in hepatocystic triangle	24(96%)
Prior attempted Cholecystectomy	1(4%)
Previous H/O cholecystostomy tube insertion	0
Type:- (n=25)	
Reconstituting	16(64%)
Fenestrating	9(36%)

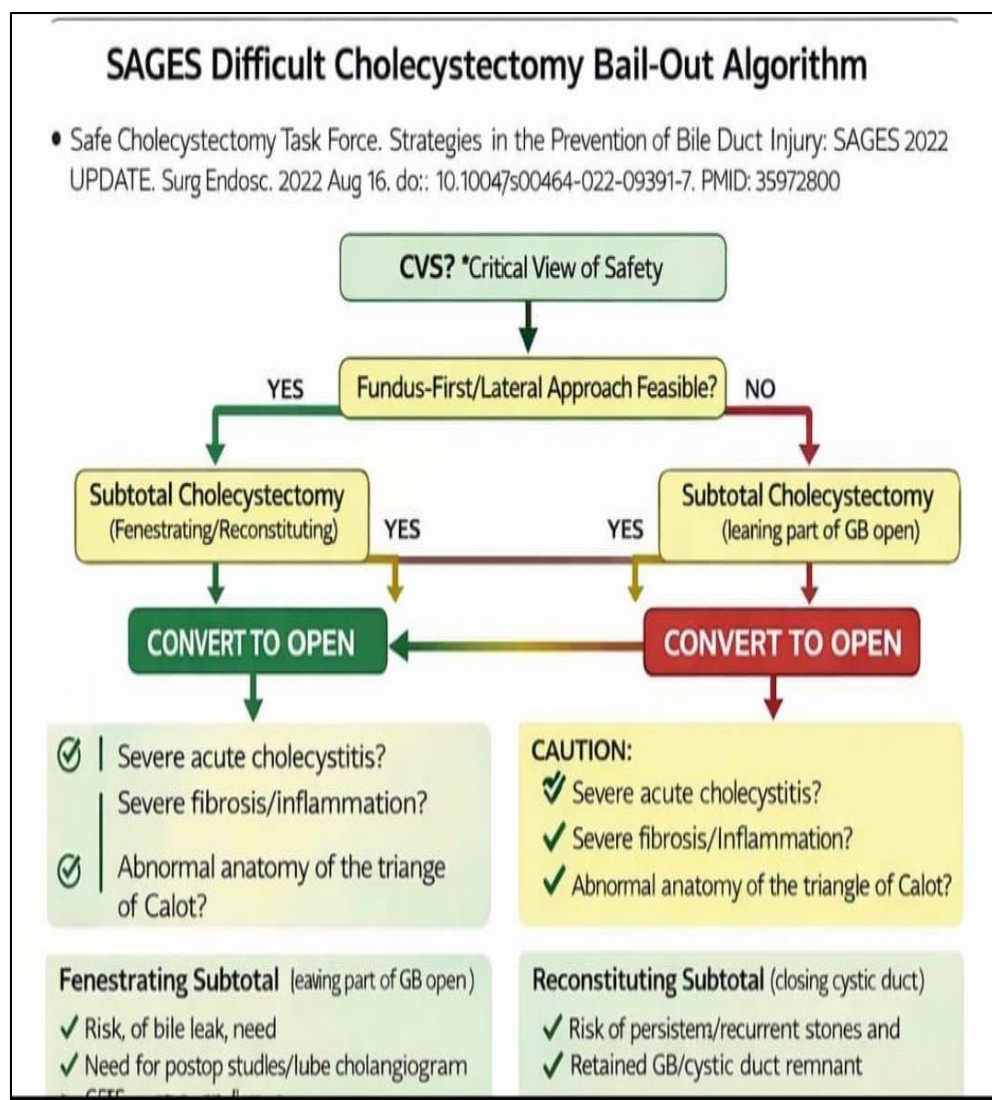


Figure 1 SAGES difficult cholecystectomy bail-out algorithm

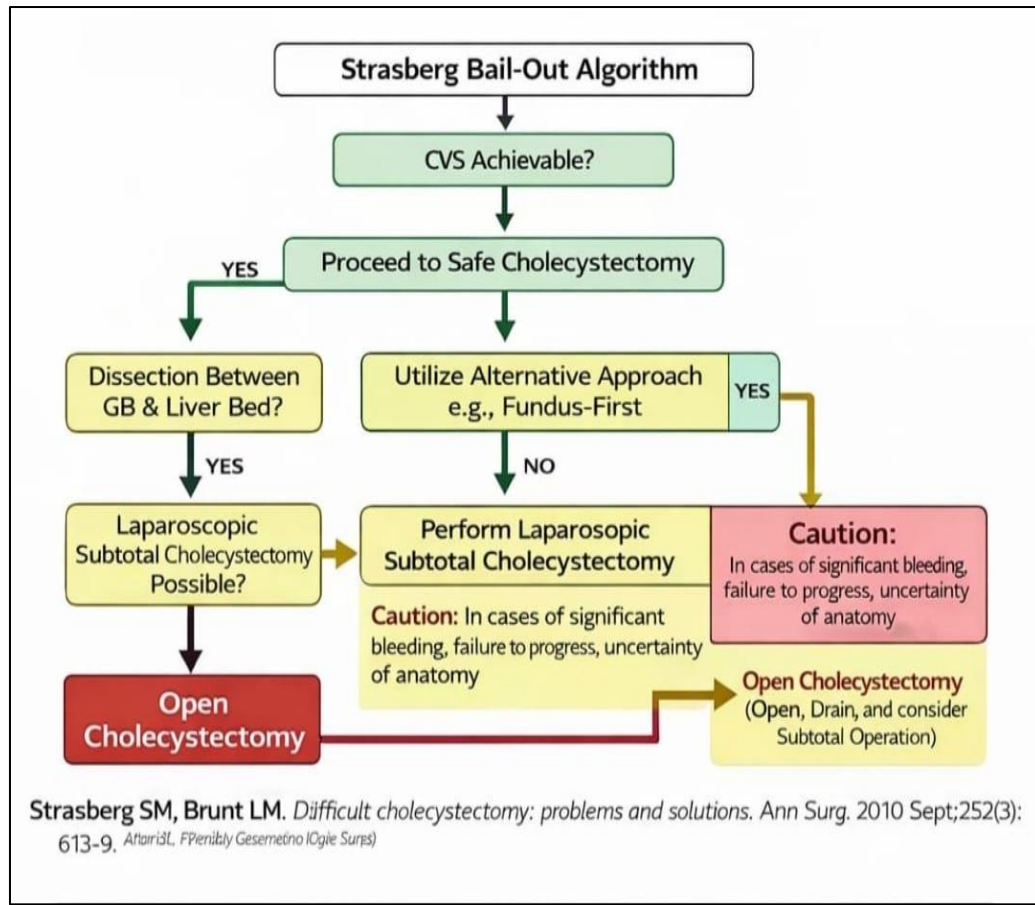


Figure 2 Strasberg Bail-out algorithm

Table 5 Short-term post-operative morbidity, Requirement for intervention for complications and other factors associated with surgery (n=25)

Short-term morbidity:- (n=25)	
Bile leakage	7(28%)
Reconstituting	2(8%)
Fenestrating	5(20%)
Amount of bile leaked/day	Average 30-40 ml/day
Complete stoppage of bile leak in days	11.75±4.17
Need for ERCP/MRCP:-	
Pre-operative	2
Post-operative	3
Intra abdominal infection	7
Requirement of reintervention:-	
USG guided drain insertion in GB fossa collection	2
Re-laparoscopy with lavage with drain insertion	1
Need of readmission	0
Local complication-port site infection	6

Long term morbidity:- (n=25)	
Bile duct stenosis	0
Recurrent biliary event	0
Recurrence of symptoms of cholecystitis	0
Result in: - (n=25)	
Increased cost to the patient	5(20%)
Unplanned prolonged hospital stay	13(52%)
For surgeon	12(48%)
Other factor: - (n=25)	
Operating surgeon's surgical experience: -	
Assistant professor	5(20%)
Associate professor	5(20%)
Additional professor	15(60%)
Low surgery case load	No
Requirement of blood/blood product	10
Day on drain removed	7.2±5.07

4. Discussion

Subtotal Cholecystectomy (STC) has emerged as a critical bail-out procedure in difficult cholecystectomies, particularly in the setting of severe inflammation, dense adhesions, or distorted biliary anatomy, where achieving the critical view of safety (CVS) is not feasible. With increasing emphasis on the prevention of bile duct injury, Subtotal Cholecystectomy represents a paradigm shift from “completion at all costs” toward a safety-first approach in hepato-biliary surgery.

The concept of Subtotal Cholecystectomy was first described as a damage-control strategy to avoid catastrophic bile duct injury in difficult gallbladders. With the widespread adoption of laparoscopic Cholecystectomy, the incidence of Bile duct injury initially increased, prompting renewed interest in alternative techniques such as Subtotal Cholecystectomy. Strasberg et al. emphasised the importance of the Critical view of safety in preventing Bile duct injury, but in cases where Critical view of safety cannot be safely obtained, Subtotal Cholecystectomy provides a rational alternative. [8,11]

Modern guidelines, including those from the Tokyo Guidelines 2018 (TG18), recognise Subtotal Cholecystectomy as an acceptable and often preferred option in “difficult gallbladder” scenarios, particularly in Grade II and III acute Cholecystitis.[9]

Fenestrating Subtotal Cholecystectomy reduces the risk of retained gallbladder but has higher rates of bile leak. Reconstituting Subtotal Cholecystectomy lowers bile leak incidence but carries a risk of recurrent gallstones and remnant cholecystitis.

The principal advantage of Subtotal Cholecystectomy is the significant reduction in Bile duct injury. Studies report near-zero rates of major Bile duct injury when Subtotal Cholecystectomy is employed appropriately in difficult cases.

Bile leak is the most common complication, with incidence ranging from 5–20%, particularly in fenestrating techniques. Most leaks are low-output and resolve with conservative management or endoscopic intervention (ERCP with stenting).[10]

Comparison with Total Cholecystectomy, Subtotal Cholecystectomy associated with high rate of Retained Stones and Recurrent Symptoms, Retained stones, Recurrent biliary colic, Remnant cholecystitis, Infective Complications, Subhepatic collections and abscesses may occur, especially in fenestrating STC, due to bile leakage or incomplete clearance.

In the Era of Laparoscopy and Advanced Techniques with advancements such as, Intraoperative cholangiography (IOC), Indocyanine green (ICG) fluorescence imaging, Advanced energy devices, the ability to safely perform difficult Cholecystectomy has improved. However, these adjuncts do not eliminate the need for Subtotal Cholecystectomy. Instead, Subtotal Cholecystectomy remains an essential component of the surgeon's armamentarium.

5. Conclusion

Subtotal cholecystectomy is a safe, effective and increasingly indispensable alternative bailout procedure by prioritising the prevention of inadvertent bile duct injury with possible short- and long-term morbidity and mortality over procedural completeness in the background of difficult Cholecystectomy. This required good learning curve and experienced laparoscopic surgeons to perform a subtotal cholecystectomy while preventing bile duct injury. Postoperative bile leak, intra-abdominal infection, bile collection and need of intervention is a worried concern in a patients especially who underwent for fenestrated type of laparoscopic subtotal Cholecystectomy as compared to reconstituted subtotal Cholecystectomy. So in our daily clinical practice in view of difficult hepato-cystic triangle visualisation, we should encourage the use of subtotal Cholecystectomy by experienced laparoscopic surgeon especially reconstituted subtotal Cholecystectomy to prevent bile duct injury and subsequent morbidity. Importantly, Subtotal Cholecystectomy should not be viewed as a complication but rather as a strategic decision to enhance patient safety.

Compliance with ethical standards

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Disclosure of conflict of interest

There are no conflicts of interest.

Statement of ethical approval

Institutional Review Board approval is not required.

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