



Long-term outcomes after subtotal reconstituting cholecystectomy: A retrospective case series

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ABSTRACT

Background: Subtotal cholecystectomy, where the gallbladder infundibulum is transected to avoid dissecting within the triangle of Calot, has been suggested to conclude laparoscopic cholecystectomy while avoiding common bile duct injury. However, some reports suggest the possibility of recurrent symptoms from a remnant gallbladder.

Methods: A retrospective database containing 900 randomly selected cholecystectomies occurring between 2009 and 2015 was reviewed for instances of subtotal cholecystectomy. All documentation for these patients was reviewed through 01/2018.

Results: Six patients who underwent subtotal cholecystectomy were identified. All six returned for care within our institution, with a median 76 months of follow-up. No patient had signs or symptoms indicating recurrent cholelithiasis or cholecystitis.

Conclusions: This series represents six cases of subtotal reconstituting cholecystectomy with no recurrent gallbladder symptoms on long-term follow-up. This may encourage surgeons who feel that subtotal reconstituting cholecystectomy is the safest way to proceed with cholecystectomy in the setting of severe inflammation.

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Introduction

Laparoscopic cholecystectomy (LC) is one of the most common surgical procedures in the United States, with over 700,000 performed per year. Despite the overall safety of a laparoscopic approach, serious complications still occur at higher rates than with open cholecystectomy. Common bile duct injury, one of the most devastating complications of cholecystectomy, has been observed at a rate of 0.1–0.25% in open surgery^{1,2}; however, after the advent of laparoscopic cholecystectomy, rates between 0.3% to as high as 2.6% have been documented.^{3–6} Given this difference in morbidity, various strategies have been introduced to reduce the risk of common bile duct injury during a laparoscopic approach.

The Critical View of Safety, which promotes correct identification of all structures within the triangle of Calot and that enter the gallbladder, is commonly endorsed as a way to prevent common bile duct injury. The Critical View is obtained when the cystic duct

and artery have been skeletonized, the bottom third of the gallbladder has been dissected free of the cystic plate of the liver, and only two structures can be visualized terminating in the gallbladder.^{7,8} If performed correctly, this strategy should prevent misidentification of the common bile duct; if the surgeon has significant difficulty achieving any of these steps, this should trigger a halt to the procedure. Options to safely complete the cholecystectomy at this point might include using cholangiography to identify anatomy; requesting a colleague's assistance; or converting the procedure to open.⁸ Recently, subtotal cholecystectomy was defined and emphasized as a bail-out procedure when the critical view cannot be obtained.⁹ In subtotal cholecystectomy, the gallbladder is transected above the infundibulum; this safely completes the procedure without pursuing further dissection or division of structures in an inflamed, adhered, or otherwise dangerous triangle of Calot. The remaining portion of gallbladder may be left open in subtotal fenestrating cholecystectomy (Fig. 1), or may be closed in subtotal reconstituting cholecystectomy (Fig. 2). As the term “reconstituting” suggests, the latter technique results in a gallbladder remnant. The terms “subtotal reconstituting” and “subtotal fenestrating” were proposed to replace the use of

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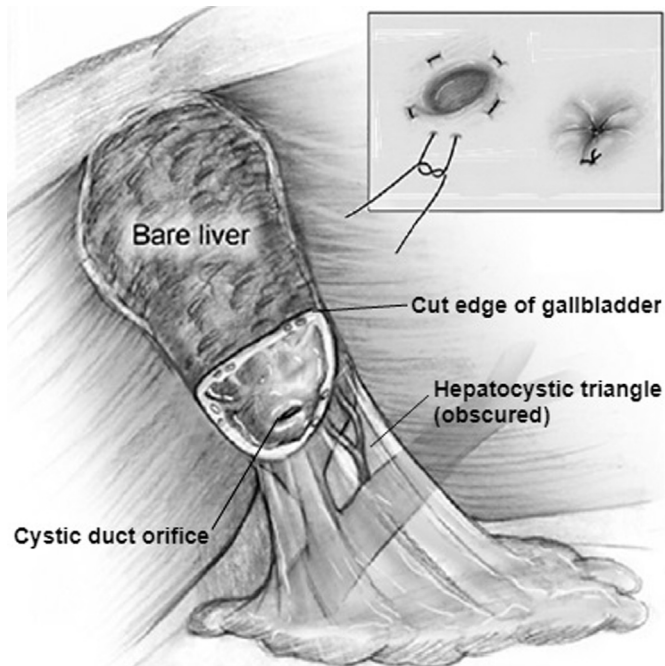


Fig. 1. Subtotal fenestrating cholecystectomy. By not excising the lowest portion of the gallbladder, accidental damage to the hepatocystic triangle during dissection is avoided. The cystic duct may be closed from the inside (inset). The posterior wall of the gallbladder may be fully retained or mostly removed. Reprinted from Journal of the American College of Surgeons, 222. Strasberg SM, Pucci MJ, Brunt LM, Deziel DJ, "Subtotal Cholecystectomy - "Fenestrating" vs "Reconstituting" Subtypes and the Prevention of Bile Duct Injury: Definition of the Optimal Procedure in Difficult Operative Conditions," pg. 89–96. Copyright 2016, with permission from Elsevier.

"partial" and "subtotal," which had previously been used in the literature and which did not provide adequate clarity about what anatomy remained at the end of the procedure.⁹

NorthShore University HealthSystem is an integrated network of four hospitals affiliated with many outpatient and primary care physicians. The system has a robust surgical practice, with approximately 500–600 cholecystectomies performed per year. These patients are frequently followed by multiple physicians within the system, permitting chart review for these patients after they no longer require follow-up with their surgeon. This study reports long-term follow-up in six patients who underwent cholecystectomy terminated in subtotal reconstituting cholecystectomy (SRC) within the NorthShore system.

Materials and Methods

After institutional review board approval, a retrospective database of 900 patients who underwent cholecystectomy at NorthShore University HealthSystem between 2009 and 2015 was reviewed.¹⁰ This database is comprised of a randomly selected sample of the total patient population for this time period, and comprises pre-, intra-, and postoperative data. All instances of subtotal reconstituting cholecystectomy were identified by reviewing operative notes. The full electronic medical record for each of these patients was then reviewed through 01/2018, including all available documentation from non-surgical providers.

Results

Six of 900 patients had documented subtotal cholecystectomy at NorthShore between 2010 and 2015, an incidence of 0.67%

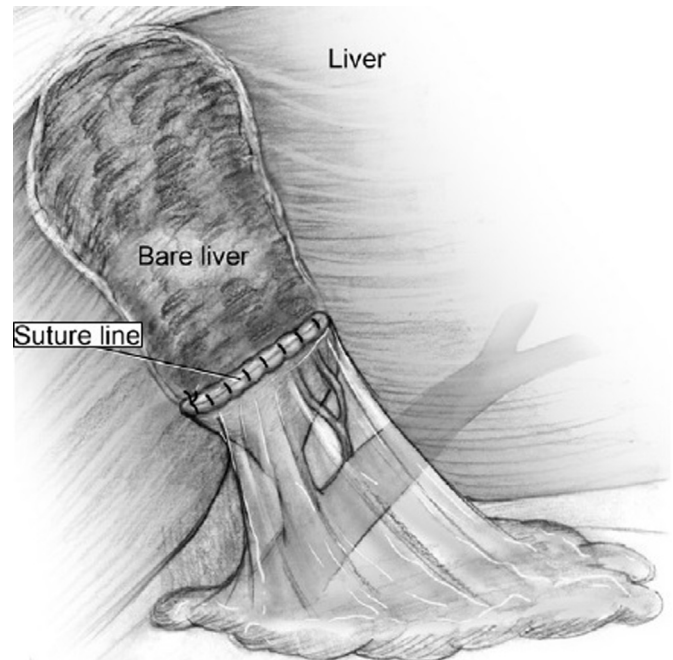


Fig. 2. Subtotal reconstituting cholecystectomy. Retaining the bottom portion of the gallbladder avoids dissection within the hepatocystic triangle. The remaining portion of the gallbladder is closed with sutures or staples, forming a new reconstituted gallbladder lumen. The posterior wall may be retained or removed. The existence of a closed remnant at the end of the procedure differentiates reconstituting from fenestrating cholecystectomy. Reprinted from Journal of the American College of Surgeons, 222. Strasberg SM, Pucci MJ, Brunt LM, Deziel DJ, "Subtotal Cholecystectomy - "Fenestrating" vs "Reconstituting" Subtypes and the Prevention of Bile Duct Injury: Definition of the Optimal Procedure in Difficult Operative Conditions," pg. 89–96. Copyright 2016, with permission from Elsevier.

(Table 1). These cases were performed by five different attending surgeons. All six subtotal cholecystectomies were reconstituting type, with no fenestrating procedures. Five patients were female, and one was male; the average age was 56.8 (standard deviation 22.5) years. Three patients had acute cholecystitis and two had choledocholithiasis; both patients with CBD stones underwent ERCP prior to surgery. Three of the surgeries were converted to open procedures. Average operative time was 147 (SD: 62.7) minutes. All six patients returned for postoperative follow-up within the NorthShore system, with a median 76 months of follow-up (range 10–91 months). After completing postoperative management for any sequelae of the initial cholecystectomy, no patient had recurrent RUQ pain, gallstones, or other medical signs indicative of recurrent cholelithiasis or cholecystitis. Patients were not followed with postoperative lab work or imaging for the purpose of identifying recurrent stones in the neo-gallbladder.

Patient 1

A 41-year-old woman without past medical or surgical history underwent elective four-port laparoscopic cholecystectomy for chronic cholecystitis in November 2010. Intraoperatively, she was found to have an absent cystic duct and suffered a lateral, Strasberg class D injury to the common bile duct; the surgery was converted to open and she underwent cholangiography and common bile duct exploration. The CBD injury was repaired with intraoperative T-tube placement. The gallbladder was then divided just above the CBD and closed with suture. A surgical drain was also placed and removed after 7 days. The patient was followed closely with drain

Table 1

Summary table of patients who underwent subtotal reconstituting cholecystectomy. LC: laparoscopic cholecystectomy; CBD: common bile duct.

PATIENT	PROCEDURE	OPERATIVE DURATION (min)	INTRAOPERATIVE FINDINGS	SUBTOTAL ANATOMY	POSTOPERATIVE COURSE	DURATION OF FOLLOW-UP (months)
41yoF with no relevant medical history	^a 4-port LC with cholangiography for chronic cholecystitis	173	Absent cystic duct Lateral CBD injury repaired with T-tube	Gallbladder divided just above T-tube, closed with suture	Drain removed POD 7 T-tube removed 7 weeks postop	83
68yoF with obesity, OSA	^a 4-port for acute cholecystitis	126	Severe inflammation Unable to dissect whole infundibulum	5 mm of infundibulum left in place; oversewn	Drain removed POD 3	69
31yoF with obesity	4-port for acute cholecystitis (with umbilical herniorrhaphy)	92	1 cm of medial gallbladder wall inflamed against CBD Stones removed from infundibulum	Divided with GIA stapler	Bile leak managed with ERCP and stent Drain removed POD 19	35
74yoM with obesity, CAD, CKD, HTN, remote hx tobacco use	4-port for acute cholecystitis	111	Intrahepatic gallbladder Dense adhesions	Divided at neck with GIA stapler	Abdominal pain due to retained CBD stones on POD #5 managed with ERCP	89
35yoF with morbid obesity	^b 4-port LC with attempted cholangiography for choledocholithiasis and cholangitis	275	Mirizzi syndrome Stone removed from infundibulum	Gallbladder transected above large stone; oversewn	Bile leak Drains x2 removed POD 8 and 9	10
92yoF with hx open splenectomy and remote hx tobacco use	^a ^b LC for chronic cholecystitis and choledocholithiasis (with small bowel enterotomy repair)	105	Small bowel enterotomy after trocar placement Gallbladder torn during dissection Cystic duct and artery not ID'd	Cystic duct occluded Infundibulum transected and oversewn	Bile leak Drain removed POD 42	91

^a Converted to open.^b pt had ERCP prior to surgery.

studies to monitor the T-tube; this remained patent and was removed approximately 7 weeks following surgery. Following removal of the T-tube, the patient had no abdominal pain or gastrointestinal complaints. Her last visit to a NorthShore provider was in October 2017, yielding 83 months of follow-up.

Patient 2

A 68-year-old woman with obesity, obstructive sleep apnea, and no history of abdominal surgery underwent four-port laparoscopic cholecystectomy for acute cholecystitis in August 2011. Due to severe inflammation, the procedure was converted to open. The surgeon was unable to dissect the last 5 mm of infundibulum; therefore, the gallbladder was transected and oversewn at this level. A surgical drain was placed and removed after 3 days. She had no abdominal pain or gastrointestinal complaints at any time following surgery. She was last seen in June 2017 at NorthShore, yielding 69 months of follow-up.

Patient 3

A 31-year-old woman with obesity and no history of abdominal surgery underwent four-port laparoscopic cholecystectomy for acute cholecystitis in August 2012. Intraoperatively, 1 cm of the medial wall could not be dissected due to inflammation against the bile duct; therefore, stones were removed from the infundibulum and the gallbladder was divided with a GIA stapler. An umbilical hernia was also closed during the procedure. A surgical drain was placed and removed after 19 days. The patient had a bile leak from the cystic duct stump/gallbladder remnant that was managed with ERCP and stent placement on POD 2, followed by EGD for stent removal. She had no further GI issues or abdominal pain and was last seen in August 2015 at NorthShore, yielding 35 months of follow-up.

Patient 4

A 74-year-old man with obesity, CAD, CKD, HTN, and a remote history of tobacco abuse, but without any history of abdominal surgery, underwent four-port laparoscopic cholecystectomy for acute cholecystitis in June 2010. The gallbladder was found to be intrahepatic. Due to dense adhesions, a GIA stapler was used to divide the gallbladder at the neck. No drains were placed. The patient was discharged postoperatively but returned through the ED on POD 5 for abdominal pain. He underwent MRCP followed by ERCP for retained choledocholiths and was also treated for fluid overload. There were no further incidents of abdominal pain or GI issues, and his most recent visit to NorthShore was December 2017, yielding 89 months of follow-up.

Patient 5

A 35-year-old woman with morbid obesity and no history of abdominal surgery presented acutely to the ED in November 2013 and underwent ERCP for choledocholithiasis, at which time she was found to have cholangitis. She then had four-port LC two days later and was found to have Mirizzi syndrome. Cholangiography was attempted but was unsuccessful. The gallbladder was transected above a large palpable stone in the infundibulum; the stone was removed, the gallbladder remnant was oversewn, and two surgical drains were placed. The postoperative course was complicated by a bile leak, which was expected given her diagnosis of Mirizzi syndrome; no further management was pursued, and the drains were removed after 8 and 9 days, respectively. The patient had no further issues after the drains were removed, and was last seen at NorthShore in August 2014, yielding 10 months of follow-up.

Patient 6

A 92-year-old woman with a remote history of tobacco use and history of open splenectomy presented to NorthShore in November

2009 with an acute GI bleed, at which time she was also found to have elevated LFTs. Workup revealed impacted CBD stones and possible Mirizzi syndrome. She underwent ERCP and was taken to the OR ten days later for management of chronic cholecystitis and choledocholithiasis. A laparoscopic approach was attempted, but a small bowel enterotomy was identified upon trocar placement. The procedure was converted to open and the enterotomy was repaired. The gallbladder was torn during dissection, and three stones were removed; the cystic artery and duct could not be identified, so the infundibulum was transected. The cystic duct was occluded, and the infundibulum was then oversewn. A surgical drain was placed, and the patient had bilious drainage for 11 days postoperatively. This resolved and the drain was removed after 42 days. She had no further GI issues or abdominal pain, and was last seen at NorthShore in June 2017, yielding 91 months of follow-up.

Discussion

In situations where inflammation, adhesions, or obscured anatomy make dissecting the triangle of Calot difficult or impossible, subtotal reconstituting cholecystectomy has been proposed as a safe option to complete the procedure without risking an injury to the common bile duct or other critical structures in the area. At NorthShore, surgeons have occasionally opted for this tactic under these circumstances. Fortunately, the robust provider network centered at this institution allowed for follow-up of these individuals, whether or not they needed to return to see their original surgeon.

Given that subtotal reconstituting cholecystectomy (SRC) is primarily used as an alternative strategy during laparoscopic cholecystectomy, no trials have been conducted to examine patient outcomes in SRC compared to total removal of the gallbladder. The majority of studies on partial or subtotal cholecystectomy have demonstrated the immediate safety of this procedure, but few have discussed long-term follow-up in detail.^{11–16} One meta-analysis reported four patients who had recurrent RUQ pain or symptomatic cholelithiasis after partial cholecystectomy; the three patients with recurrent symptomatic cholelithiasis presented within six months of the original surgery.¹⁷ A series of 26 patients required one subsequent completion LC, but the duration between the original surgery and the development of a recurrent gallstone was not described.¹⁸ A study of 46 patients undergoing “laparoscopic subtotal cholecystectomy” encompassed cases where the posterior wall was left on the liver bed, and only reported 12 cases where the infundibulum was left in situ; although this paper reports six patients with asymptomatic residual gallstones, it is unclear what postoperative anatomy these patients had.¹⁹ Another paper described 60 patients, none of whom had recurrent gallbladder symptomatology after subtotal cholecystectomy.²⁰ However, these studies are confounded by a lack of available detail; it is unclear whether the cases represented in these papers resulted in a reconstituted gallbladder remnant. The lack of clarity surrounding long-term outcomes of subtotal reconstituting cholecystectomy may make surgeons wary of using this procedure to safely terminate a difficult LC, if there is concern for recurrent symptoms from the neo-gallbladder.

With the exception of one patient who was lost to follow-up after 10 months, this case series presents several years of documented follow-up for patients who underwent subtotal reconstituting cholecystectomy at NorthShore University HealthSystem. After management of any complications or retained CBD stones in the immediate postoperative period, no patient returned to a NorthShore provider with recurrent cholecystitis, cholelithiasis, or choledocholithiasis. The absence of recurrent gallbladder symptoms in these patients, even years after undergoing subtotal

reconstituting cholecystectomy, may reassure surgeons that reconstituting cholecystectomy is not necessarily harmful to patients in the long run. From a surgical perspective, the lack of recurrent symptoms in these patients means that potentially dangerous reoperation in a scarred, obscured triangle of Calot is not essential.

This study is limited by its retrospective nature; it was not possible to follow these patients with bloodwork or imaging studies to identify possible asymptomatic recurrent gallstones. Ongoing work in this area would benefit from a prospective approach with serial imaging to evaluate the recurrence of gallstone disease in the neo-gallbladder. A larger patient population could identify additional patients who required a subtotal procedure, and even longer follow-up would provide further detail about the time point at which stones might reoccur.

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Declaration of competing interest

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