The THAI Journal of SURGERY 2022;43(2):78-85.
Official Publication of The Royal College of Surgeons of Thailand

Original Article

Comparison between Laparoscopic Subtotal Cholecystectomy and Open Conversion in Difficult Laparoscopic Cholecystectomy

Thamanit Worawanthanachai, MD

Division of Surgery, Phetchabun Hospital, Phetchabun, Thailand

Abstract

Objective: Laparoscopic subtotal cholecystectomy (LSC), without approaching Calot's triangle, is an acceptable option when standard laparoscopic cholecystectomy (LC) is not feasible. The aim of the present study was to verify the safety and efficacy of LSC as an alternative to open conversion (OC) in difficult LC, and to compare the clinical outcomes between LSC and OC in this setting.

Patients and Methods: From June 2011 to May 2021, there were 525 consecutive patients who underwent LC by the same surgeon. Three patients with suspected of gallbladder cancer were excluded. Open conversion was used in difficult cholecystectomy during the early period of LC, which will be called the "OC period". Since June 2017, LSC was used as an alternative to OC, and the latter period was named the "LSC period". The medical records of these 522 patients were analyzed retrospectively.

Results: There were 260 patients who underwent LC with 31 open conversion during the OC period and 262 patients underwent LC with 2 open conversion during LSC period. There were no differences in preoperative characteristics of patients between the two periods. The open conversion rate in the LSC period was significantly lower than that in OC period (0.8% versus 11.9%, respectively). Overall complication rates in LSC and OC periods were 1.6% and 5.4%, respectively. There was a significant difference in operative times (40.1 ± 16.0 versus 50.8 ± 22.7 minutes) and post-operative length of hospital stay (1.7 ± 1.2 versus 2.9 ± 2.5 days) between the LSC and OC periods, respectively. There was no significant difference in the 30-day readmission rates, and there was no 30-day mortality in the present study. All LSCs (n = 22) were completed without conversion to open surgery. Only one bile leakage (4.5%) and one case of retained common bile duct with retained remnant cystic duct stones was observed in these patients.

Conclusions: LSC as an alternative to OC in difficult LC has excellent clinical outcomes. LSC is a safe and effective alternative in the hands of experienced laparoscopic surgeons.

Keywords: Laparoscopic subtotal cholecystectomy, Laparoscopic cholecystectomy

Introduction

The standard management of gallbladder disease is laparoscopic cholecystectomy (LC).[1] However, the risk of damage to bile ducts and structures in the hepatic hilum during LC is increased when Calot's triangle cannot be safely dissected, particularly in the presence of severe inflammation or fibrosis,[2,3] Mirizzi syndrome, or anomalous biliary anatomy.[4,5] Conventionally, open conversion (OC) has been recommended in such difficult situations,[6] but it does not guarantee adequate identification of anatomical structures, and therefore does not eliminate the risk of injury to the bile ducts.[7,8] Furthermore, with open conversion, the advantages of laparoscopic surgery are lost.[9]

Received for publication 28 November 2021; Revised 27 May 2022; Accepted 2 June 2022

Corresponding author: Thamanit Worawanthanachai, MD, Division of Surgery, Phetchabun Hospital, Phetchabun, Thailand; Email: thamadent@hotmail.com

Subtotal cholecystectomy is a less than complete cholecystectomy that leaves behind a portion of the gallbladder in continuity with the cystic duct.[10] It was first described by Bornman and Terblanche in 1985,[11] and since 1993, the procedure has also been performed laparoscopically.[12] Laparoscopic subtotal cholecystectomy (LSC) that avoids hazardous dissection at the triangle of Calot has been advocated to be an alternative to open conversion in cases of complicated cholelithiasis.[13-16] Acceptable outcomes of LSC have been shown with lower rates of both open conversion and major inadvertent injuries, reported to be a safe and feasible alternative during difficult LC.[17,18] However, LSC has a 18% bile leak rate and 3.1% incidence of recurrent symptomatic gallbladder.[19]

Theoretically, LSC should remove nearly the entire gallbladder and should close the gallbladder mucosa or gallbladder remnant adjacent to cystic duct junction without vasculo-biliary injury. It was found, as might be expected, to reduce the incidence of postoperative bile fistula and retained stones.[19-21] There are still limited number of studies that compare outcomes in laparoscopic cholecystectomy between using LSC as an alternative versus open conversion (OC). The present study aimed to assess the effectiveness and safety of LSC, and to compare clinical outcomes between OC and LSC for difficult LC.

Patients And Methods

At Phetchabun Hospital, LC was performed only in the elective setting, in patients with gallstones, gallbladder polyps and those undergoing interval cholecystectomy after acute cholecystitis has subsided. Complicated cholecystitis not responsive to conservative treatment was managed by open surgery. Diagnostic procedures such as blood test, abdominal ultrasound and abdominal CT were performed in all patients at the initial consultation. Magnetic resonance cholangiopancreatography (MRCP) was performed when choledocholithiasis was suspected, such as when abnormal liver function test or bile duct dilatation from imaging studies were observed. If choledocholithiasis was confirmed, endoscopic retrograde cholangiopancreatography (ERCP) to remove the stones would be done prior to LC, which would be performed in a different setting.

From June 2011 to May 2021 patients who underwent LC by the author at the Department of General Surgery, Phetchabun Hospital were included in the study. Patients with suspected gallbladder cancer were excluded. Open conversion (OC) was used for difficult LC during an early period (from June 2011 to January 2017), named the "OC period". After the author had completed a 4-month Weary Dunlop-Boonpong Fellowship Program in minimally invasive surgery, obtaining the necessary skills in advanced laparoscopic techniques, LSC was considered as an alternative to OC. Since June 2017, LSC was mainly used for difficult LC, which was named the "LSC period". Data in the LSC period were prospectively collected. The electronic medical record for each of these patients was reviewed up to September 2021, to evaluate long term outcomes.

The medical records of all patients were retrospectively reviewed. Information obtained included demographic characteristics, preoperative history, and indication for surgery, time from diagnosis of acute cholecystitis to surgery, surgical technique, and reasons of conversion, operative time, complication, and post-operative length of stay, 30-day mortality, 30-day readmission and long term outcomes.

Quantitative variables were summarized as mean and standard deviation (SD) or median and range, while categorical variables were summarized as frequencies and percentages. The unpaired t-test was used to compare quantitative variables between two groups, while for comparison between three groups, the analysis of variance (ANOVA) was used. The Chi-square test and Fisher exact test were used to compare categorical variables. A p-value < 0.05 was considered statistically significant. All the analysis was carried out using SPSS 16.0 version. The study was approved by the institutional research ethics committee.

All procedures began with the standard 3-port LC with the initial purpose of total gallbladder removal, following the concept of critical view of safety (CVS). Open conversion or LSC technique was used when dense inflammation or fibrosis would resulted in hazardous entry into Calot's triangle. For LSC, another, 5-mm, 4th port was added for exposure. Two types of LSC were carried out when dealing with difficult LC's.

LSC Type 1: When the difficulty was associated with inadequate exposure of cystohepatic triangle, Hartmann's pouch or wall of gallbladder against the impacted stone was incised, followed by aspiration of bile, and removal of all stones into a collecting bag. Using this technique, it is possible to verify and identify the opening of the cystic duct. Then the incision was continued into the posterior wall under direct vision in circumferential fashion by vessel sealing device nearby the junction of gallbladder and cystic duct. The mucosa of remnant gallbladder was ablated by electrocautery. Interrupted simple or figure of eight polygalactin 3-0 sutures were used to close the flap.

LSC Type 2: When the risks were associated with both inadequate exposure of the cystohepatic triangle and the gallbladder bed, the gallbladder was transected to leave the smallest possible strip of the fused portion between the posterior gallbladder wall and the thickened cystic plate, avoiding hazardous dissection, which might injure the right hepatic duct and vessels. The gallbladder contents were evacuated, and the absence of stones in the gallbladder remnant was confirmed under direct vision. Residual gallbladder mucosa was ablated by cautery. Full thickness bite of anterior gallbladder wall was sutured interruptedly to the partial thickness of remnant posterior wall by intracorporeal technique, so as to diminish the inner cavity of the remnant gall bladder rather than to close the stump neatly.

After LSC, the operative field was washed copiously and subhepatic drain was often placed. Endoscopic stapler and the fundus-first technique were not used in the present study.

Results

There were 525 consecutive patients who underwent LC during the study period. Three patients with gall bladder cancer were excluded, leaving 522 patients in the analysis. Of these, 260 patients underwent LC with 31 open conversion during the OC period and 262 patients underwent LC with 2 open conversion during the LSC period (Figure 1).

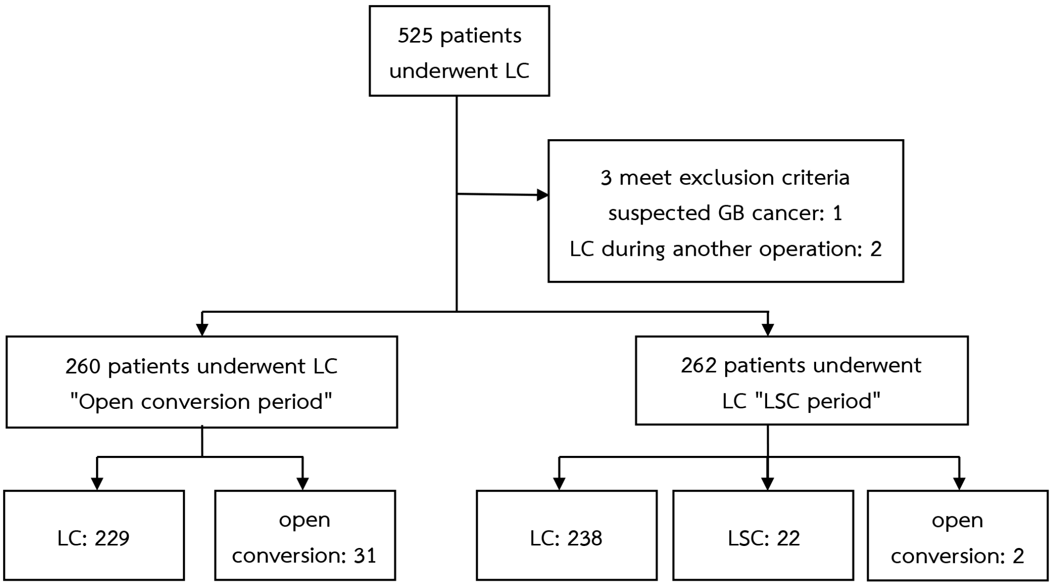

Figure 1 Flow diagram of patients in the study

There were no significant differences in age, sex, BMI, indication for LC and preoperative ERCP rates between the two periods. Interval LC constituted 49% of all LC's in OC period and 47% in the LSC period. The average time to surgery after acute cholecystitis was 8.7 weeks in the OC period and 12.8 weeks in the LSC period, a significant difference partly due to the hospital's policy to suspend elective surgery during the Covid-19 pandemic beginning in March 2020 (Table 1). Overall, patients were followed for of 57.6 months on average (range, 4 to 122 months). In OC period the mean follow-up time was 87.8 months, and in the LSC period, 27.3 months.

The open conversion rates in the LSC and OC periods were 0.8% and 11.9%, respectively. Not surprisingly, open conversion in LSC period was significantly lower than that in the OC period ($p < 0.001$). The overall complication rate was significantly lower in the LSC period, with rates 1.6% in LSC and 5.4% in OC periods ($p = 0.030$). There were also significant differences in the operative times and post-operative lengths of stay between the two periods. There was no significant difference in the 30-day readmission rate, and no 30-day mortality in the present study.

There were significant differences in long term outcomes between patients in the OC period and LSC period. In the OC period, 11 patients returned to the hospital with pancreatitis in 2, cholangitis in 5, and CBD stones in 4 patients. Of these 9 patients had findings of CBD stones and were treated by ERCP and stone retrieval. In LSC period, 3 patients returned to hospital with cholangitis in 2 and pancreatitis in 1 patient. One of these had findings of CBD stones with concomitant with remnant cystic duct stone, and ERCP was performed to remove CBD stones (Table 2).

Standard LC was completed in 88% and 91% of patients in the OC and LSC periods, respectively. Four ports were used 5% and 11% of patients in the OC and LSC periods, to enhanced exposure and control large cystic ducts by complex techniques such as extracorporeal or intracorporeal suture ligation. Five-port technique was used in one patient with a BMI of 30.1 kg/m^2 and a gallbladder embedded within the liver.

There were 31 patients who underwent open conversion in the OC period, including 24 open cholecystectomies, 4 open subtotal cholecystectomies, 1 open cholecystectomy with bile duct repair and 2 Roux-en-Y hepaticojejunostomies.

Table 1 Preoperative characteristics of patients.

	OC period (n = 260)	LSC period (n = 262)	*p*-value
Age (years): mean (range)	53.1 (10 - 85)	53.8 (19 - 81)	0.521
Women: n (%)	203 (78)	196 (75)	0.436
BMI (kg/m^2): mean (SD)	25.2 (4.2)	25.4 (4.3)	0.633
Setups for LC			
Elective LC: n (%)	132 (51)	139 (53)	0.664
Interval LC: n (%)	128 (49)	123 (47)	
Time to surgery (days): mean (SD)	61.4 (40.2)	90.2 (61.5)	< 0.001
Preoperative ERCP: n (%)	21 (8)	29 (11)	0.311

OC: open cholecystectomy; LSC laparoscopic subtotal cholecystectomy; LC: laparoscopic cholecystectomy; SD: standard deviation; ERCP: endoscopic retrograde cholangiopancreatography

Table 2 Operative outcomes

Outcomes	OC period (n = 260)	LSC period (n = 262)	*p*-value
Operative time (min): mean (SD)	50.8 (22.7)	40.1 (16.0)	< 0.001
Open conversion: n (%)	31 (11.9)	2 (0.8)	< 0.001
Length of hospital stay (days): mean (SD)	2.9 (2.5)	1.7 (1.2)	< 0.001
Complication: n (%)	14 (5.4)	4 (1.6)	0.030
Bile leak	3 (1.2)	2 (0.8)	
Iatrogenic bile duct injury	4 (1.5)	1 (0.4)	
Bowel injury	2 (0.8)	0	
Bleeding	4 (1.5)	1 (0.4)	
Surgical site infection	1 (0.4)	0	
30-day readmission rates (%)	1 (0.4)	0	0.498
Biliary tract symptoms: long term: n (%)			
No intervention	2 (0.8)	2 (0.8)	0.027
Require intervention	9 (3.5)	1 (0.4)	

OC: open cholecystectomy; LSC laparoscopic subtotal cholecystectomy; SD: standard deviation

There were 22 LSC in the LSC period (8.4%), and 2 open conversions, the latter including 1 open cholecystectomy and 1 bile duct repair (Table 3). Intraoperative cholangiography was rarely performed in these cases.

Reasons for conversion to open surgery in the OC period include unclear anatomy, unable to control cystic duct, uncontrolled bleeding, iatrogenic bile duct injury, and severe adhesions. In the LSC period reasons included uncontrolled bleeding and iatrogenic bile duct injury, and these were reactive conversions. There was no preemptive conversion (conversion due to unclear anatomy, adhesion or problems with management of the cystic duct) in the LSC period (Table 4).

To verify safety and efficacy of LSC as an alternative to open conversion, patients who underwent open conversion both in the OC and LSC periods (n = 33) and those who underwent LSC in the LSC period (n = 22) were compared. Patients were classified as being in the LSC group, the OC with preemptive conversion group, and OC with reactive conversion group, as shown in Table 5.[22] Almost all patients underwent interval LC, except one patient who had LC for symptomatic gallstone. There were no significant differences in patient characteristics among groups. While there were no significant differences in hospital stay, operative time, and complications between the LSC and preemptive OC groups, there were significant differences in these outcomes between the former groups and the reactive OC group (Table 5).

Table 3 Operative procedures

Procedures	OC period (n = 260)	LSC period (n = 262)	*P*-value
Standard LC: n (%)	229 (88.1)	238 (90.8)	< 0.001
LC 3 ports	215 (82.7)	210 (80.1)	
LC 4 ports	13 (5)	28 (10.7)	
LC 5 ports	1 (0.4)	0	
Laparoscopic subtotal cholecystectomy: n (%)	0	22 (8.4)	NA
LSC type 1		19	
LSC type 2		3	
Open cholecystectomy (OC): n (%)	24 (9.2)	1 (0.4)	
Open subtotal cholecystectomy: n (%)	4 (1.5)	0	
OC + Repair CBD/CHD: n (%)	1 (0.4)	1 (0.4)	
OC + Roux-en-Y hepaticojejunostomy: n (%)	2 (0.8)	0	

OC: open cholecystectomy; LSC laparoscopic subtotal cholecystectomy; LC: laparoscopic cholecystectomy; CBD: common bile duct CHD: common hepatic duct

Table 4 Reasons for conversion from laparoscopic to open cholecystectomy

Reasons	OC period (n = 260)	LSC period (n = 260)	*p*-value
Uncontrolled bleeding: n (%)	4 (1.5)	1 (0.4)	0.215
Iatrogenic bile duct injury: n (%)	4 (1.5)	1 (0.4)	0.215
Adhesion: n (%)	2 (0.8)	0	0.248
Unclear anatomy: n (%)	14 (5.4)	0	< 0.001
Uncontrolled cystic duct stump: n (%)	7 (2.7)	0	0.007

OC: open cholecystectomy; LSC laparoscopic subtotal cholecystectomy

Table 5 Patient characteristics and operative outcomes in each group of alternatives in difficult laparoscopic cholecystectomy

Characteristics	LSC (n = 22)	Preemptive OC (n = 23)	Reactive OC (n = 10)	*p*-value
Age (years): mean (SD)	53.3 (10.7)	52.6 (10.7)	47.3 (13.2)	0.355
Women: n (%)	15 (70)	17 (74)	7 (70)	0.926
BMI (kg/m²): mean (SD)	24.9 (4.4)	25.4 (4.1)	26.5 (4.1)	0.634
Setups for LC				0.999
Elective LC (%)	0	1 (4)	0	
Interval LC (%)	22 (100)	22 (96)	10 (100)	
Time to surgery (days): mean (SD)	99 (76)	64 (40)	70 (52)	0.142
Preoperative ERCP: n (%)	2 (9)	1 (4)	2 (20)	0.317
Operative time (min): mean (SD)	70 (15)	68 (16)	103 (51)	0.002
Drain placed: n (%)	21 (96)	8 (39)	7 (70)	< 0.001
Days in place: mean (SD)	4.2 (2.6)	6.3 (1.9)	5.9 (1.2)	< 0.001
Length of stay (days): mean (SD)	4.0 (1.9)	4.9 (1.8)	8.0 (7.8)	0.019
Overall complications: n (%)	1 (4)	1 (4)	10 (100)	< 0.001
Uncontrolled bleeding	0	0	5 (50)	
Iatrogenic bile duct injury	0	0	5 (50)	
Bile leakage	1 (4)	0	0	
Surgical site infection	0	1 (4)	0	
30-day readmission: n (%)	0	1 (4)	0	0.999
Biliary tract symptoms: n (%)				0.923
No intervention	1 (4)	1 (4)	1 (10)	
Require intervention	1 (4)	1 (4)	0	

OC: open cholecystectomy; LSC laparoscopic subtotal cholecystectomy; LC: laparoscopic cholecystectomy; SD: standard deviation; ERCP: endoscopic retrograde cholangiopancreatography

Discussion

While it is well-established that early cholecystectomy for acute cholecystitis is advantageous,[23-25] delayed surgery after an episode of acute cholecystitis is still widely prevalent.[26] In the present study all patients who presented with acute cholecystitis and responded to conservative treatment would later undergo interval LC. This was due to certain institutional limitations, making emergency LC infeasible. In contrast to the technical difficulty attributed to edema and acute inflammation when surgery was performed early, chronic inflammation and fibrosis were the main reasons in this series for the need for OC or LSC to avoid major injury. In the present study, interval LC, as compared with elective LC, was associated with higher conversion rates, at 12.7% and 0.4%, respectively ($p < 0.001$).

Overall complication rates between the two periods were statistically different. Iatrogenic bile duct injury (IBDI) is a serious complication in LC. IBDI occurred in 4 patients in OC period, 3 of which were detected and immediate repaired intraoperatively, 1 was detected in the early postoperative period and underwent Roux-en-Y hepaticojejunostomy. In the LSC period, only 1 patient had IBDI which was detected intraoperatively, and the procedure was converted to open cholecystectomy with common hepatic duct repair. This low incidence of IBDI in the LSC period is comparable to that of the literature.[27] There were 5 uncontrolled bleeding in the present study, requiring OC, but without needing blood transfusions. Four patients had uncontrolled bleeding in OC period and 1 patient in LSC period. Bleeding from liver bed is theoretically avoided in LSC by not removing the posterior gallbladder wall. In LSC group no uncontrolled bleeding was observed.

In the literature, bile leakage was the most common complication of LSC, with incidences between 10.6 and

18%.[16-18] Although bile leakage may resolve spontaneously or after ERCP and biliary stenting, it is better to prevent its occurrence. According to a systematic review by Henneman et al., bile leakage occurred in 5.6% of patients with closed gallbladder remnant compared with 16% of patients who had opened remnant gallbladder. In the 22 cases of LSC, only one (4.5%) bile leakage was observed in a patient with LSC type 2, where part of the posterior gall bladder wall was left in situ. The patient was discharged with drainage on post-operative day 4, and the drain was removed after 14 days without complications. In the present study a subhepatic drain was placed in almost all cases of LSC to detect leakage and remained in situ for a median of 3 days (range, 2 to 14 days).

The open conversion rates were 11.9% and 0.8% in the OC and LSC periods. Although increasing laparoscopic experience may have affected the difference in the open conversion rates, previous studies have reported that conversion due to unclear or obscure anatomy (preemptive conversion) does not diminish regardless of increased surgical experience and skill.[28] There was no preemptive conversion in the LSC period, and this could explain part of the difference, that LSC was effective in preventing preemptive OC. Also, there were only 2 reactive conversions in LSC period, performed to control bleeding and bile duct injury. If LSC were used at the right time, before proceeding to total cholecystectomy with subsequent injury, reactive open conversion could be avoided. This would explain the remaining difference in the OC rates. A recent meta-analysis of LC in the setting of severe gall bladder inflammation showed that a lower threshold of conversion seems to reduce local postoperative complications.[29] After the author became familiar with LSC, there was no OC in last 187 consecutive LCs. The 8.4% rate of LSC in the LSC period is comparable to that of the literature,[12] and was similar to the 8.8% preemptive OC in the present study, which showed that LSC was not overused in the present study.

A concern of LSC is that gallbladder cancer may unexpectedly coexist in 0.2-0.8% of patients undergoing LC.[30] The incidence of gallbladder cancer in this series was 0.4%. In gall bladder cancer, if the gallbladder wall is cut open, cancer dissemination may occur. LSC requires cutting through the gall bladder mucosa, with consequent intraabdominal leakage of gallbladder contents. Therefore, preoperative and intraoperative awareness of gallbladder cancer is very important.

In the present study, retained stones occurred in 1 (4.5%) of the 22 LSC, after a mean follow-up of 27.3 months. This is similar to the result of a systematic review, where 3.1% of patients had retained stones.[16] In our patient, CBD stones were detected concomitant with a remnant cystic duct stone. ERCP was performed to remove CBD stones while the remnant cystic duct stone was managed conservatively. Although the incidence of retained stones in LSC period was significantly lower than that in the OC period (0.4% vs 3.5%, p-value 0.027), the mean follow-up time in LSC period was shorter than that in OC period (27.7 vs 87.8 months, p-value < 0.001). Longer term of follow-up is needed.

Conclusions

LSC is a safe and effective alternative to open conversion. It seems that preemptive OC can be partly obviated by LSC, when dissection of Calot's triangle would be hazardous. Although reactive OC is also reduced, appropriate timing of or decision to perform preemptive OC may reduce reactive OC even further. More study is needed to clarify when this timing might be. However, the surgeons should never hesitate to do OC when he or she is in doubt of the risks of injuries. Experience of and mastery in LSC technique should enable surgeons to make better OC decisions during difficult LC.

References

1. Schirmer BD, Edge SB, Dix J, et al. Laparoscopic cholecystectomy. Treatment of choice for symptomatic cholelithiasis. Ann Surg. 1991;213:665-76.
2. Davidoff AM, Pappas TN, Murray EA, et al. Mechanisms of major biliary injury during laparoscopic cholecystectomy. Ann Surg 1992;215:196–202.
3. Mercado MA, Chan C, Orozco H, et al. Acute bile duct injury. The need for a high repair. Surg Endosc 2003;17:1351–5.
4. Gigot J, Etienne J, Aerts R, et al. The dramatic reality of biliary tract injury during laparoscopic cholecystectomy. An anonymous multicenter Belgian survey of 65 patients. Surg Endosc 1997;11:1171–8.
5. Rohatgi A, Singh KK. Mirizzi syndrome: laparoscopic management by subtotal cholecystectomy. Surg Endosc 2006;20:1477–81.
6. Borzellino G, Sauerland S, Minicozzi AM, et al. Laparoscopic cholecystectomy for severe acute cholecystitis. A meta-analysis of results. Surg Endosc 2008;22:8–15.
7. Sinha I, Smith ML, Safranek P, et al. Laparoscopic subtotal cholecystectomy without cystic duct ligation. Br J Surg 2007;94:1527-9.

8. Wolf AS, Nijsse BA, Sokal SM, et al. Surgical outcomes of open cholecystectomy in the laparoscopic era. Am J Surg 2009;197:781-4.
9. Michalowski K, Bornman PC, Krige JE, et al. Laparoscopic subtotal cholecystectomy in patients with complicated acute cholecystitis or fibrosis. Br J Surg 1998;85:904-6.
10. Shingu Y, Komatsu S, Norimizu S, et al. Laparoscopic subtotal cholecystectomy for severe cholecystitis. Surg Endosc 2016;30:526-31.
11. Bornman PC, Terblanche J. Subtotal cholecystectomy: for the difficult gallbladder in portal hypertension and cholecystitis. Surgery 1985;98:1–6.
12. Bickel A, Shtamler B. Laparoscopic subtotal cholecystectomy. J Laparoendosc Surg 1993;3:365–7.
13. Philips JA, Lawes DA, Cook AJ, et al. The use of laparoscopic subtotal cholecystectomy for complicated cholelithiasis. Surg Endosc 2008;22:1697–1700.
14. Tian Y, Wu SD, Su Y, et al Laparoscopic subtotal cholecystectomy as an alternative procedure designed to prevent bile duct injury: experience of a hospital in northern China. Surg Today 2009;39:510–3.
15. Kuwabara J, Watanabe Y, Kameoka K, et al. Usefulness of laparoscopic subtotal cholecystectomy with operative cholangiography for severe cholecystitis. Surg Today 2014;44:462-5.
16. Singhal T, Balakrishnan S, Hussain A, et al. Laparoscopic subtotal cholecystectomy: initial experience with laparoscopic management of difficult cholecystitis. Surgeon 2009;7:263-8.
17. Beldi G, Glattli A. Laparoscopic subtotal cholecystectomy for severe cholecystitis. Surg Endosc 2003;17:1437–9.
18. Chowbey PK, Sharma A, Khullar R, et al. Laparoscopic subtotal cholecystectomy: a review of 56 procedures. J Laparoendosc Adv Surg Tech A 2000;10:31–4.
19. Elshaer M, Gravante G, Thomas K, et al. Subtotal cholecystectomy for "difficult gallbladders": systematic review and meta-analysis. JAMA Surg 2015 Feb;150:159-68.
20. Henneman D, da Costa DW, Vrouenraets BC, et al. Laparoscopic partial cholecystectomy for the difficult gallbladder: a systematic review. Surg Endosc 2013;27:351-8.
21. Koo JGA, Chan YH, Shelat VG. Laparoscopic subtotal cholecystectomy: comparison of reconstituting and fenestrating techniques. Surg Endosc 2021;35:1014-24.
22. Manatakis DK, Papageorgiou D, Antonopoulou MI, et al. Ten-year audit of safe bail-out alternatives to the critical view of safety in laparoscopic cholecystectomy. World J Surg 2019;43:2728-33.
23. Chandler CF, Lane JS, Ferguson P, et al. Prospective evaluation of early versus delayed laparoscopic cholecystectomy for the treatment of acute cholecystitis. Am Surg 2000;66:896–900.
24. Gurusamy K, Samraj K, Glund C, et al. Metaanalysis of randomized control trials on the safety and effectiveness of early versus delayed laparoscopic cholecystectomy for acute cholecystitis. Br J Surg 2010;97:141–50.
25. Yamashita Y, Takada T, Strasberg SM, et al; Tokyo Guideline Revision Committee. TG13 surgical management of acute cholecystitis. J Hepatobiliary Pancreat Sci 2013;20:89-96.
26. Senapati PSP, Bhattarcharya D, Harinath G, et al. A survey of the timing and approach to the surgical management of cholelithiasis in patients with acute biliary pancreatitis and acute cholecystitis in the UK. Ann R Coll Surg Engl 2003;85:306–12.
27. McMahon AJ, Fullarton G, Baxter JN, et al. Bile duct injury and bile leakage in laparoscopic cholecystectomy. Br J Surg 1995;82:307-13.
28. Gökhan D, Fikret A. Single surgeon experience: intraoperative complications and conversion to open surgery in laparoscopic cholecystectomy, the fore and aft of 20 years' experience. Biomed Res 2017;28:6671-6.
29. Borzellino G, Sauerland S, Minicozzi AM, et al. Laparoscopic cholecystectomy for severe acute cholecystitis. A meta-analysis of results. Surg Endosc 2008;22:8–15.
30. Yamamoto H, Hayakawa N, Kitagawa, et al. Unsuspected gallbladder carcinoma after laparoscopic cholecystectomy. J Hepatobillary Pancreat Surg. 2005;12:391–8.