Original Article

Is Immediate Laparoscopic Cholecystectomy after ERCP a Safe Treatment for Gallstone Complications?

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Background: Laparoscopic cholecystectomy (LC) after endoscopic retrograde cholangiopancreatography (ERCP) is a standard treatment for patients with complicated cholelithiasis. Currently, there is no conclusion about the optimal interval between LC and ERCP, especially in the case of emergent ERCP.

Objective: The purpose of this study is to compare the outcome of patients treated with immediate, early, and delayed LC after ERCP.

Materials and Methods: A total of 198 patients who received LC and ERCP between July 2017 and June 2019 were retrospectively reviewed. Patients were divided into 3 groups: immediate (single-staged LC with ERCP – 109 patients), early (LC <72 hr after ERCP – 20 patients) and delayed (LC >72 hr after ERCP – 69 patients). Patient demographics and primary endpoints (conversion rate to open cholecystectomy (OC), blood loss, operative time, complications, mortality and length of hospital stay) were recorded. The secondary endpoint was to analyze factors that influence the conversion to OC.

Results: There were no statistical differences in the conversion rate (p=0.921) and major complications (p=0.548) between all three groups. However, the immediate group demonstrated shorter length of post-ERCP hospital stay than other groups (p=0.0001). The analysis of emergent ERCP cases showed no difference in the conversion rate and major complications (p=0.999 and 0.329). Patients with a history of previous ERCP tend to convert to OC but the difference was not statistically significant in the multivariate analysis (p=0.106).

Conclusion: Performing LC immediately after ERCP is safe, does not increase the conversion rate, and results in shorter hospital stays even in emergent ERCP cases.

Keywords: Laparoscopic cholecystectomy; Endoscopic retrograde cholangiopancreatography; LC; ERCP; Minimally invasive surgery

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Gallstones, also known as cholelithiasis, is the most common disease of the gallbladder. Gallstones have a prevalence of approximately 5% to 20% in Asian population(1). The overall cumulative incidence of gallstones is 0.60% per year(2). Approximately 20% of patients with gallstones develop symptoms(3).

Stones in the gallbladder can cause the symptom of abdominal pain, known as biliary colic. Symptomatic gallstones must be treated surgically, and the gold standard of treatment is laparoscopic cholecystectomy (LC). Laparoscopic cholecystectomy is the most common elective abdominal surgery performed in the US, with over 750,000 operations being performed annually(4).

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Gallstones can cause complications such as acute cholecystitis. In addition, impacted stones in the cystic duct or gallbladder neck can cause edema and compression of the adjacent common hepatic duct, which is called Mirizzi's syndrome(5). Mirizzi's syndrome is an uncommon complication that causes patients to have hospital admission with obstructive jaundice.

Another complication arising from gallstones is the occurrence of stones in the common bile duct (CBD), most commonly resulting from the passage of gallstones through the cystic duct into the CBD. Bile duct stones may lead to further complications including acute cholangitis and acute biliary pancreatitis.

Nowadays, minimally invasive surgery plays an important role in the treatment of gallstone complications. There are multiple minimally invasive approaches to gallstone complications and bile duct stones such as endoscopic retrograde cholangiopancreatography (ERCP) followed by LC, laparoscopic common bile duct exploration(6-9), and combined laparo-endoscopic Rendezvous technique(10-12). These approaches offer less postoperative pain, shorter hospital stays, and the ability to return to work faster. However, these procedures require advanced endoscopic or laparoscopic skills, except for the ERCP followed by LC option. The ERCP procedure can remove the bile duct stones while the LC procedure deals with the gallbladder and gallstones which is the source of complications. Both procedures can be performed in a single setting or over separate settings.

In the last two decades, there is no consensus about the best interval time of LC after ERCP. However, several studies have shown more benefits for performing early LC compare with delayed LC, including fewer complications[13], a decreased conversion rate to open cholecystectomy (OC)[13,14], reduced recurrence of bile duct stones[14], shorter hospital stays[15], and lower hospital costs[15].

The primary purpose of this study is to compare the treatment outcomes of patients who received LC at various intervals after ERCP. The measured treatment outcomes are conversion rate to OC, mortality rate, major complications, operative time, amount of blood loss, and length of hospital stay. The secondary purpose is to investigate the risk factors for converting to OC in patients who underwent LC after ERCP.

Materials and Methods

Study design

This is a retrospective study. All patients who underwent LC after ERCP at Ramathibodi Hospital, a tertiary care medical center between July 2017 and June 2019 were identified from a search by procedural codes. Patient data from electronic medical records were individually reviewed by the researchers.

The study was approved by the Human Research Ethics Committee, Faculty of Medicine Ramathibodi Hospital Mahidol University, Bangkok (No. MURA2019/719).

Patient selection and definition

Inclusion criteria were: 1) documented gallstones and bile duct stones (with or without clinical symptoms) or gallstones with acute complications (acute cholecystitis, acute cholangitis or acute pancreatitis), 2) the patient received ERCP and LC. The presence of stones was defined as stones seen in preoperative abdominal ultrasonography, computed tomography or magnetic resonance cholangiopancreatography. Exclusion criteria were: 1) age under 18 years, 2) American Society of Anesthesiologists (ASA) score higher than three, 3) unstable vital signs, 4) acute organ failure such as respiratory failure or acute renal failure, 5) previous percutaneous cholecystostomy, 6) concurrently undergoing additional irrelevant surgery and 7) those who refused LC after ERCP.

The primary outcome was analyzed in two populations: all ERCP settings (elective and emergent) and only the emergent ERCP setting. Patients who were admitted due to acute gallstone complications requiring ERCP within that admission were classified as emergent ERCP cases. Those who received ERCP as a scheduled admission were classified as elective ERCP cases.

ERCP was performed by either experienced surgeons or gastroenterologists. If ERCP was performed by surgeons and bile duct stones were eradicated successfully, the decision of when to perform LC was dependent on the individual surgeon's preference and operation room availability. In the situation where ERCP was performed by gastroenterologists, the attending gastroenterologist consulted the surgical team on the first postoperative (post-ERCP) day. The decision of when to perform LC was again dependent on the individual surgeon's preference and operation room availability. Both ERCP and LC were performed under general anesthesia.

Patients characteristics

Patients were classified into three groups according to the timing of LC: immediate (LC and ERCP was done in a single-staged setting), early (LC was done within 72 hours after ERCP) and delayed (LC was done later than 72 hours after ERCP). The collected patient characteristics consisted of age, sex, underlying disease, ASA classification, history of previous ERCP, preoperative laboratory investigation (white blood cells count, liver enzymes, serum bilirubin), CBD diameter, condition at admission (presence of any acute complications), ERCP setting (elective or emergent), and the presence of stone during ERCP (none, bile sludge, or stone).

Outcomes

The collected intraoperative and postoperative cholecystectomy outcomes were operative time, operative blood loss, conversion to OC, reason for conversion, major complications, and post ERCP length of hospital stay and 30-day mortality. Major complications were defined as complications with a Clavien-Dindo classification equal to or greater than 3[16].

Statistical analysis

Statistical analysis was performed using STATA version 14.2. Continuous variables were compared using a student t-test or Wilcoxon signed-rank test depending on the data distribution pattern. Categorical variables were described using frequencies and percentages and were analyzed using Chi-square test. Findings were considered statistically significant when the p-value was less than 0.05.

Results

All ERCP cases (elective and emergent)

A total of 198 patients (112 females and 86 males) were included in the study. There were 109 patients in the immediate group, 20 in the early group and 69 in the delayed group. The mean age was 62.4 years (SD 14.9 years). The median time to cholecystectomy after ERCP was 2 days for the early group, and 69 days for the delayed group. Preoperative characteristics and endoscopic findings are shown in Table 1. There were no statistically significant differences between the three groups in age, sex, underlying disease, ASA, history of previous ERCP, and preoperative

Table 1. Preoperative characteristics and endoscopic finding of all patients undergoing ERCP followed by LC

Parameter	Total (n=198)	Immediate group (n=109)	Early group (n=20)	Delayed group (n=69)	p-value
Age (years, mean±SD)	62.4±14.9	62.9±15.6	58.0±15.7	63.0±13.4	0.368
Sex, n (%)					0.057
Male	86 (43.4)	53 (48.6)	4 (20.0)	29 (42.0)	
Female	112 (56.6)	56 (51.4)	16 (80.0)	40 (58.0)	
Underlying disease, n (%)					
Diabetes mellitus	51 (25.8)	29 (26.6)	5 (25.0)	17 (24.6)	0.955
Hypertension	114 (57.6)	59 (54.1)	10 (50.0)	45 (65.2)	0.289
Cerebrovascular disease	11 (5.56)	5 (4.6)	2 (10.0)	4 (5.8)	0.477
ASA classification (mean±SD)	1.40±0.61	1.42±0.62	1.40±0.59	1.37±0.59	0.903
History of previous ERCP, n (%)	50 (25.2)	33 (30.3)	3 (15.0)	14 (20.3)	0.176
Laboratory before ERCP					
White blood cell (10^3/mm^3, mean±SD)	8.88±4.46	8.90±5.00	7.46±2.54	9.27±3.93	0.140
Aspartate aminotransferase (U/L, mean±SD)	162.8±244.8	128.6±188.6	225.6±213.0	195.5±316.4	0.053
Alanine aminotransferase (U/L, mean±SD)	187.7±269.5	141.5±194.4	263.0±303.4	238.8±341.8	0.025
Alkaline phosphatase (U/L, mean±SD)	176.5±133.0	163.9±124.9	213.1±158.6	185.9±136.7	0.251
Albumin (g/L, mean±SD)	35.87±4.66	36.13±4.75	34.87±4.03	35.75±4.72	0.525
Total bilirubin (mg/dL, mean±SD)	2.31±2.55	2.08±2.39	2.75±2.95	2.56±2.66	0.715
Direct bilirubin (mg/dL, mean±SD)	1.42±1.88	1.19±1.71	1.84±2.18	1.67±2.03	0.443
CBD diameter size (cm, mean±SD)	0.93±0.35	0.90±0.32	0.97±0.37	0.98±0.39	0.478
Intraductal findings, n (%)					0.102
Normal	70 (35.4)	47 (43.1)	3 (15.0)	20 (29.0)	
Bile sludge	29 (14.6)	14 (12.9)	4 (20.0)	11 (15.9)	
Stone	99 (50.0)	48 (44.1)	13 (65.0)	38 (55.0)	
ERCP Setting, n (%)					0.931
Elective	114 (57.6)	64 (58.7)	11 (55.0)	39 (56.5)	
Early/urgent	84 (42.4)	45 (41.3)	9 (45.0)	30 (43.5)	
Condition at admission, n (%)					
Acute cholecystitis	26 (13.1)	22 (20.2)	1 (5.0)	3 (4.4)	0.005
Acute cholangitis	67 (33.8)	32 (29.4)	9 (45.0)	26 (37.7)	0.280
Acute pancreatitis	20 (10.1)	11 (10.1)	1 (5.0)	8 (11.6)	0.690
Interval time of cholecystectomy, days (median, range)	4 (0 to 215)	0 (0 to 0)	2 (1 to 3)	69 (4 to 215)	<0.001

SD = standard deviation, ASA = American Society of Anesthesiologists

CBD diameter. There were no significant statistical differences in all laboratory investigation findings except serum aspartate aminotransferase (AST) level (p=0.025). The immediate group had a significantly higher percentage of patients with acute cholecystitis on admission than the other two groups (20.2% vs. 5% in early group and 4.4% in delayed group, p=0.005).

Operative outcomes are summarized in Table 2. The conversion rates in the immediate, early, and delayed group were 11.9%, 10.1% and 10.0% respectively, showing no significant difference (p=0.921). Other outcomes including operative time, major complications and 30-day mortality rate were not significantly different. The immediate group had slightly higher blood loss than the other two groups (median 30 ml vs. 20 ml in early group and 20 ml in delayed group, p=0.042). The mean total post-ERCP length of hospital stay in the immediate group was significantly less than the other two groups (3.2 days vs. 5.1 days in early group and 5.6 days in delayed group, p=0.0001).

There were three patients who developed acute cholecystitis while awaiting LC, all were in the delayed group. One was from the elective ERCP population and two were from the emergent ERCP population. All three patients underwent emergency cholecystectomy; two were done successfully laparoscopically but one patient was converted to open surgery.

Emergent ERCP cases

There were 84 patients with an emergent ERCP setting: 45 in the immediate group, 9 in the early group, and 30 in the delayed group. Patient characteristics and intraoperative findings are shown in Table 3. The median time to cholecystectomy was 2 days for the early group and 68 days for the delayed group. Statistically significant differences between the three groups were not found in age, sex, underlying disease, ASA, history of previous ERCP, liver enzymes level, serum bilirubin level, and preoperative CBD diameter. However, there was a significant difference in the white blood cell count (p=0.038). Most patients with acute cholecystitis were treated with immediate LC after ERCP.

The conversion rate of all 3 groups were similar at 11.1%, 11.1% and 10.0% for the immediate, early and delayed group respectively (p=0.999). Other postoperative outcomes were not significantly different (see Table 4). The mean total post-ERCP length of hospital stay was significantly different between groups (3.4, 5.2 and 7.2 days in the immediate, early and delayed group respectively, p=0.0001).

Factors for conversion to open cholecystectomy

Table 5 shows the univariate and multivariate analysis of the predicting factors for conversion to OC in patients who underwent LC after ERCP. In the univariate analysis, patients with a history of previous ERCP have a higher conversion rate than patients who did not (95% CI 1.140 to 7.040, p=0.025). Age, sex, ASA classification, underlying diseases, liver enzyme level and condition at admission (acute cholecystitis, acute cholangitis, and acute pancreatitis) were not significantly associated with conversion rate. However, in the multivariate analysis, history of previous ERCP was not significantly associated with conversion rate (95% CI 0.752 to 18.905, p=0.106).

Discussion

The primary purpose of this study was to compare the outcome of patients who received LC at various intervals

Table 2. Postoperative outcomes of all patients undergoing ERCP followed by LC

Parameter	Total (n=198)	Immediate group (n=109)	Early group (n=20)	Delayed group (n=69)	p-value
Conversion to open cholecystectomy, n (%)	22 (11.1)	13 (11.9)	2 (10.0)	7 (10.1)	0.921
Conversion due to					
Uncontrolled bleeding, n	3	1	-	2	
Visceral organ injury, n	2	1	-	1	
Poor vision or No progression, n	17	11	2	4	
Operative time LC, min (median, range)	70 (30 to 270)	60 (30 to 220)	60 (45 to 150)	75 (30 to 270)	0.993
Operative blood loss, ml (median, range)	20 (5 to 800)	30 (5 to 800)	20 (10 to 600)	20 (5 to 700)	0.042
Complication Clavien-Dindo grade ≥3, n (%)	6 (3.0)	2 (1.8)	1 (5)	3 (4.3)	0.548
Acute cholecysitis while awaiting LC, n (%)	3 (1.5)	0	0	3 (4.3)	0.105
Total post ERCP Hospital stay (days, mean±SD)	4.2±3.8	3.2±2.9	5.1±2.7	5.6±4.7	<0.001
30-day mortality, n (%)	1 (0.51)	0	1 (5.0)	0	0.101

SD = standard deviation

Table 3. Preoperative characteristics and endoscopic finding of patients undergoing emergency ERCP followed by LC

Parameter	Total (n=84)	Immediate group (n=45)	Early group (n=9)	Delayed group (n=30)	p-value
Age (years, mean±SD)	61.9±14.9	62.8±15.0	59.5±15.9	61.2±14.8	0.791
Sex, n (%)					0.138
Male	35 (41.7)	21 (46.7)	1 (11.1)	13 (43.3)	
Female	49 (58.3)	24 (53.3)	8 (88.9)	17 (56.7)	
Underlying disease, n (%)					
Diabetes mellitus	26 (30.9)	15 (33.3)	3 (33.3)	8 (26.7)	0.818
Hypertension	48 (57.1)	24 (53.3)	5 (55.6)	19 (63.3)	0.689
Cerebrovascular disease	6 (7.1)	2 (4.4)	1 (11.1)	3 (10.0)	0.373
ASA class (mean±SD)	1.44±0.58	1.46±0.58	1.44±0.72	1.40±0.56	0.869
History of previous ERCP, n (%)	10 (11.9)	8 (17.8)	0	2 (6.7)	0.175
Laboratory before ERCP					
White blood cell (10^3/mm^3, mean±SD)	11.60±5.33	12.08±6.21	8.08±3.05	11.94±3.99	0.038
Aspartate aminotransferase (U/L, mean±SD)	279.4±305.5	240.8±246.2	251.3±197.9	345.7±396.4	0.622
Alanine aminotransferase (U/L, mean±SD)	307.5±327.0	244.9±249.3	354.6±377.5	387.4±398.7	0.169
Alkaline phosphatase (U/L, mean±SD)	235.1±135.3	228.8±142.6	299.7±168.9	225.3±110.6	0.385
Albumin (g/L, mean±SD)	34.14±4.69	33.86±4.71	34.47±4.67	34.46±4.81	0.846
Total bilirubin (mg/dL, mean±SD)	3.49±2.72	3.45±3.16	2.98±2.64	3.72±1.99	0.285
Direct bilirubin (mg/dL, mean±SD)	2.36±2.03	2.22±2.28	2.43±2.36	2.54±1.52	0.377
CBD diameter size (cm, mean±SD)	0.90±0.30	0.85±0.25	1.13±0.40	0.91±0.32	0.119
Intraductal findings, n (%)					0.432
Normal	30 (35.7)	17 (37.8)	2 (22.2)	11 (36.7)	
Bile sludge	13 (15.5)	9 (20.0)	0 (0.0)	4 (13.3)	
Stone	41 (48.8)	19 (42.2)	7 (77.8)	15 (50.0)	
Complication at admission, n (%)					
Acute cholecystitis	26 (30.9)	22 (48.9)	1 (11.1)	3 (10.0)	0.001
Acute cholangitis	67 (79.7)	32 (71.1)	9 (100.0)	26 (86.7)	0.072
Acute pancreatitis	20 (23.3)	11 (24.4)	1 (11.1)	8 (26.7)	0.623
Interval time of cholecystectomy, days (median, range)	0 (0 to 213)	0 (0 to 0)	2 (1 to 2)	68 (4 to 213)	0.001

SD = standard deviation; ASA = American Society of Anesthesiologists

after ERCP. The result showed that there was no difference in major complications, mortality, and conversion to OC. In addition, those who received immediate LC after ERCP had shorter hospital stays which resulted in lower hospital costs.

The current study results aligned with previous studies. Wild et al retrospective reviewed 175 patients with choledocholithiasis and found that having ERCP and cholecystectomy done on the same day led to shorter hospital stay and lower hospital cost[17] Mallick et al reported in a retrospective study that hospitalization was shorter for the single-staged LC and ERCP group[18]. A study by Loor et al showed that single-staged ERCP and cholecystectomy reduced surgical site infection rate[19] Gaber et al conducted a prospective study of 25 patients with acute biliary pancreatitis and found that performing ERCP and LC within a single setting is a feasible option for managing early acute biliary pancreatitis[20]. Furthermore, a randomized controlled trial by Muhammedoglu et al recently reported that single-staged ERCP and LC is a safe and beneficial strategy[21]. It offered cost advantage, shorter hospital stays, and eliminated the risk of acute cholecystitis, which can occur from delayed cholecystectomy.

Table 4. Postoperative outcomes of patients undergoing emergency ERCP followed by LC

Parameter	Total (n=84)	Immediate group (n=45)	Early group (n=9)	Delayed group (n=30)	p-value
Conversion to open cholecystectomy, n (%)	9 (10.7)	5 (11.1)	1 (11.1)	3 (10.0)	0.999
Conversion due to					
Uncontrolled bleeding, n	2	1	-	1	
Visceral organ injury, n	1	-	-	1	
Poor vision or no progression, n	6	4	1	1	
Operative time LC, min (median, range)	75 (30 to 270)	75 (30 to 200)	90 (45 to 130)	75 (40 to 270)	0.914
Operative blood loss, ml (median, range)	20 (5 to 800)	40 (5 to 800)	20 (10 to 150)	20 (5 to 500)	0.087
Complication Clavien-Dindo grade ≥3, n (%)	2 (2.4)	0	0	2 (6.7)	0.329
Acute cholecysitis while awaiting LC, n (%)	2 (2.4)	0	0	2 (6.7)	0.329
Total post ERCP hospital stay (days, mean±SD)	4.9±6.7	3.4±1.4	5.2±3.8	7.2±6.7	0.001
30-Day mortality, n (%)	0	0	0	0	-

SD = standard deviation

Table 5. Predicting factors of conversion to open cholecystectomy

Parameter	Odds Ratio	95% CI	p-value
Univariate analysis			
Age	1.000	0.971 to 1.031	0.100
Sex	2.030	0.827 to 5.019	0.122
ASA classification	0.880	0.413 to 1.875	0.742
Diabetes mellitus	1.091	0.402 to 2.960	0.863
Hypertension	2.769	0.978 to 7.837	0.055
Cerebrovascular disease	0.790	0.096 to 6.488	0.827
History of previous ERCP	2.833	1.140 to 7.040	0.025
White blood cell	0.999	0.999 to 1.000	0.372
Aspartate aminotransferase	0.999	0.996 to 1.000	0.486
Alanine aminotransferase	0.999	0.996 to 1.001	0.396
Alkaline phosphatase	1.000	0.997 to 1.004	0.562
Albumin	0.985	0.896 to 1.083	0.759
Total bilirubin	0.996	0.835 to 1.188	0.971
Direct bilirubin	0.982	0.768 to 1.255	0.886
CBD size	2.120	0.684 to 6.574	0.193
Acute cholecystitis	2.170	0.725 to 6.497	0.166
Acute cholangitis	1.400	0.569 to 3.485	0.459
Acute pancreatitis	0.393	0.050 to 3.092	0.375
Multivariate analysis			
History of previous ERCP	3.772	0.752 to 18.905	0.106

When there is a time interval between ERCP and cholecystectomy, there is a risk of acute cholecystitis manifesting while the patient is waiting to undergo cholecystectomy since the gallbladder is still intact. Freemen et al reported a 0.5% (11 of 2,347 patients) incidence of acute cholecystitis within 16 days after endoscopic biliary sphincterotomy and of these 11 patients, 10 have gallstones[22] Cao et al reported a post-ERCP acute cholecystitis incidence rate of 1.35% (36 of 2,672 patients) within 2 weeks after ERCP, of which 29 from 36 patients have gallstones[23]. In the current study, the incidence of post-ERCP acute cholecystitis in those who received delayed cholecystectomy was 4.3% (3 of 69 patients). Therefore, the authors suggest that single-staged ERCP with LC is the preferred treatment option to avoid the risk of post-ERCP acute cholecystitis.

The current study also focused on patients in emergent ERCP settings, namely those requiring emergent ERCP due to gallstone complications. The results showed that even in the emergent ERCP setting, the conversion rate, major postoperative complications and 30-day mortality rate were not different between the single-staged and multi-staged approach.

The conversion rate from laparoscopic to open cholecystectomy varies between 2 to 20% depending on the medical center, country, and date of study[24-28]. In the current era of minimally invasive surgery, there are techniques and technologies to aid surgeons to safely and successfully perform LC in patients with difficult or inflamed gallbladder. Examples of such aids are the fundus down approach[29,30], the partial cholecystectomy technique[30,31], linear laparoscopic staplers[31] and robotic surgery[32]. The current study conversion rate falls within the aforementioned reported range. The conversion rate to OC for LC after ERCP was 11.1% for both elective and emergent ERCP, and 10.7% for emergent ERCP alone. The interval time between cholecystectomy and ERCP was not associated with the conversion rate. These results further support the implementation of immediate LC after ERCP in acute gallstone complication cases.

The predicting factor for conversion to OC was examined in the current study. A history of previous ERCP was shown to be the only significant factor in a univariate analysis. A study by Bostanci et al compared patients who had a single ERCP to patients who had multiple ERCPs before LC. Those who underwent multiple ERCPs experienced significantly more conversion to open surgery[33]. Cinar et al retrospectively reviewed 157 patients and found that the conversion rate was higher in patients who underwent two or more ERCP before surgery but the waiting time from ERCP to LC had no effect on the conversion rate[24]. A theoretical explanation could be that endoscopic sphincterotomy led to bacterial colonization of the common bile duct, inflammation and scarring of the hepatoduodenal ligament causing more difficulty during subsequent cholecystectomy[34]. It is recommended that LC performed after ERCP should be done by experienced surgeons[34,35].

Conclusion

Laparoscopic cholecystectomy performed immediately after ERCP is safe. It does not increase complications and conversion rate. It provides shorter hospital stay even in the case of emergent ERCP. And by removing the gallbladder immediately after ERCP, the risk of acute cholecystitis while awaiting the cholecystectomy procedure was eliminated.

Limitation

There are some limitations in the current study. The study population is from a single institution. In addition, the retrospective nature of the study can be inherent to selection and information biases. Future studies, especially large multi-institutional randomized controlled prospective trials, would provide a higher quality evidence to further support the practice of immediate LC after ERCP.

What this study adds?

Laparoscopic cholecystectomy immediately after ERCP is safe. It does not increase complications and conversion rate. It provides shorter hospital stay even in the case of emergent ERCP. And by removing the gallbladder immediately after ERCP, the risk of acute cholecystitis while awaiting the cholecystectomy procedure was eliminated.

What is already known on this topic?

The ERCP procedure can remove the bile duct stones while the LC procedure deals with the gallbladder and gallstones which is the source of complications. Both procedures can be performed in a single setting or over separate settings.

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Potential conflicts of interest

The authors declare no conflict of interest.

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