

SINGLE-STEP LAPAROSCOPIC CHOLECYSTECTOMY AND ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY IN PATIENTS WITH CHOLECYSTO-CHOLEDOCHOLITHIASIS

Tran Bao Long^{1,2}, Trinh Quoc Dat^{1,2}, Le Quang Hung²

Tran Duy Hung² and Nguyen Duc Anh^{1,2,✉}

¹Hanoi Medical University

²Hanoi Medical University Hospital

Current treatment of complicated calculous biliary disease typically involves a two-step procedure consisting of pre- or post-operative endoscopic retrograde cholangiopancreatography (ERCP) followed by laparoscopic cholecystectomy (LC). This practice creates drawbacks as there is the need for two anesthesia inductions and longer hospital stay. The combination of LC and ERCP (LC + ERCP) for patients with cholecysto-choledocholithiasis has shown safety advantages, reducing anesthesia inductions and bringing high efficiency. This is a retrospective case series implemented at the Department of General Surgery - Hanoi Medical University Hospital between March 2020 and July 2022. In total, 44 patients met the criteria of this study. The average age of the cohort was 55.43 ± 18.12 years. The mean operating times of ERCP and LC were 58.05 ± 20.10 min and 54.09 ± 23.80 min, respectively. There was one intra-operative adverse event and no conversion. The mean hospital stay was 3.95 ± 2.28 days, and the rate of stones clearance was 100 per cent. LC combine ERCP in a single setting is a safe, effective procedure in treating cholecysto-choledocholithiasis.

Keywords: choledocholithiasis, gallbladder stones, laparoscopic, endoscopic-retrograde cholangiopancreatography.

I. INTRODUCTION

Gallstones exist in 15% of the population and can eventually lead to serious complications such as cholecystitis, choledocholithiasis, and pancreatitis. In patients who require cholecystectomy for cholecystitis, 10 - 18% will also exhibit choledocholithiasis.¹

The gold standard for treating acute or chronic cholecystitis is laparoscopic cholecystectomy. As noted previously, a significant portion of these patients will also exhibit common bile duct stones; thus, a therapeutic plan must be

made for this subset of patients. No single method or algorithm is superior to others when treating the obstructing complications of the calculous biliary disease, including jaundice, pancreatitis, cholangitis, and asymptomatic choledocholithiasis.² Traditionally, this treatment involves what is known as a two-step procedure, consisting of pre- or post-operative ERCP followed by LC.

Progress made in the last two decades has completely changed surgical approaches, especially with the advent of endoscopic and laparoscopic surgery. Today, the treatment of gallstone disease often requires a multidisciplinary approach involving a surgeon, an endoscopist, and a radiologist. The United States nationwide assessment for the treatment

Corresponding author: Nguyen Duc Anh

Hanoi Medical University

Email: ducanhnguyen14hmu@gmail.com

Received: 19/08/2022

Accepted: 15/12/2022

of common bile duct CBD stone (CBDS) showed a drastic increase in the use of ERCP+LC from 52.8% to 85.7% ($p < 0.001$) and a decrease in the trend of open CBD exploration (CBDE) (30.6% vs 5.5%; $p < 0.001$) and laparoscopic CBDE (9.2% vs 3.0%; $p < 0.001$).³ In a prospective randomized controlled clinical trial including 300 patients with CBDS, Cuschieri et al.⁴ compared the conventional two-step procedure (preoperative ERCP followed by LC) with a single-step approach (LC with simultaneous laparoscopic ductal stone clearance). They found that the efficiency of the laparoscopic single-step procedure was equal to preoperative ERCP and LC but had the advantage of lower morbidity and a shorter hospital stay. However, this technique has not been widely mentioned in prestigious recommendations worldwide nor applied in domestic hospitals. One of the biggest obstacles is the setting of equipment and facilities materials.⁵

Therefore, we conducted this study to evaluate the short-term outcomes of this technique on patients with CBDS associated with gallbladder stones with a high success rate, low morbidity, and short hospital stay...

II. METHOD

This is a retrospective case series implemented at the Department of General Surgery - Hanoi Medical University Hospital between January 2020 to July 2022. All patients diagnosed with concomitant CBDS and gallstones based on clinical findings, confirmed by preoperative computed tomography (CT) scanner and/or magnetic resonance cholangiopancreatography (MRCP) and laboratory results, underwent one-stage LC + ERCP. Perioperative features included ages, sexes, clinical and paraclinical findings, and surgical and interventional characteristics.

All patients had a standard approach, pre- or

post-operative ERCP followed by LC in single general anesthesia. We performed LC by three or four trocars, upstream or downstream, and controlled the cystic duct with suture or hem-o-lok clips. ERCP procedures are performed by experienced endoscopists from the gastroenterology department, using a retrieval balloon (8.5 or 11.5 mm) or a stone retrieval basket to remove the stone with or without a sphincterotomy. If the selection cannulated of the CBD could not be done, either a temporary endobiliary stent was left, or laparoscopic/open CBD explorer could be performed with or without T-tube drainage. Complications, conversion to open surgery, failure to remove stones, and early postoperative results were recorded.

All calculations were performed using commercial statistics software (SPSS 20.0). Quantitative data are presented as mean and standard deviation (SD), and qualitative data are described as frequencies and percentages.

III. RESULTS

In total, 44 patients met the criteria of this study, of which males and females accounted for 47.7% and 52.3%, respectively. The average age of the cohort was 55.43 ± 18.12 (ranging from 23 - 89 years old). Clinically, 88.6% of the patients had a symptom of right upper quadrant pain.

On the preoperative CT scanner or MRCP, the average CBD diameter was 9.89 ± 2.86 mm (range, min - max), and the average size of CDB stones was 6.58 ± 2.79 mm (range, min - max). Preoperative blood studies showed that 33.3% had abnormal total leucocyte counts (< 4 or > 10 G/L), and 55.6% had increasing serum amylase levels.

100% of patients had surgery according to the program, of which 45.5% had ERCP



Figure 1. The setting of equipment and facilities material in our operation room

before LC. The mean durations of surgery for ERCP first followed by LC and LC were 113.74 ± 24.85 min (range, min - max) and 110.63 ± 38.12 min (range, min - max) respectively ($p > 0.05$). The incidence of difficulty in LC was

significantly higher in the ERCP-first group (85.0% vs. 37.5%, $p = 0.002$). In one case (3.7%), a choledochotomy was performed laparoscopically to safely remove the stones with T-tube drainage left in place.

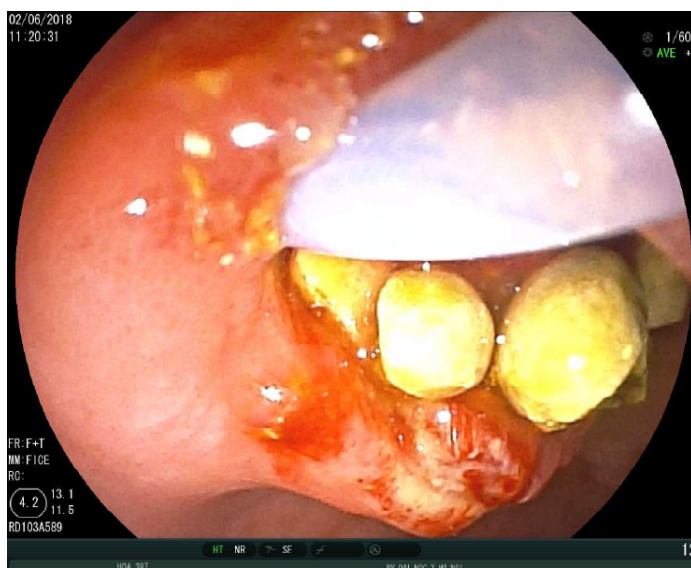


Figure 2. Intraoperative removal of CBD stones by ERCP (using a retrieval balloon)

The average time to remove the nasogastric tube and return to eating was 1.83 ± 1.29 days

(range, min - max). A postoperative increase in serum amylase and/or lipase levels was

evident in 27.3% of the patients. Two patients (4.55%) developed clinical pancreatitis that was treated medically. No patient had postoperative complications requiring intervention or reoperation. Postoperative trans-abdominal

ultrasound showed CBD stones clearance rate of 100%. There was one perioperative mortality in this study. The mean hospital stay was 3.95 days (rang, 1 - 14 days).

Table 1. Summary of single-stage LC+ ERCP studies

Author	Year	n	Successful ductal clearance (%)	Mortality (%)	Morbidity (%)	Length of stay (days)
Ghazal et al. ⁶	2009	45	97.7	0	0	2.55
Liverani et al. ²	2013	108	87.0	0	3.7	4.7
Pokhrel N et al. ⁷	2018	83	96.3	0	8.4	3.92
This study	2022	44	100 (n = 14)	2.27	0	3.95

IV. DISCUSSION

Progress in recent decades has completely changed surgical approaches, especially with the advent of endoscopic and laparoscopic surgery. Today, the treatment of gallstone disease often requires a multidisciplinary approach involving a surgeon, an endoscopist, and a radiologist. Several problems arise with the 2-stage process. Firstly, the treatment decision in this 2-stage approach commonly debated is the timing of the LC after the ERCP. Recommendations across different literatures range from 24 to 72h up to 6 weeks, and this delay leads to a 10% risk of recurrent CBD stones in these patients. Secondly, disadvantages are increased hospital stay and costs (sometimes two hospital admission), loss of compliance, and increased conversion rate for LC (20%).⁸ Moreover, different studies have shown that LC is more difficult after POES due to disruption of Oddi's Sphincter and bacterial colonization of the biliary tract leading to inflammation and scarring of hepatoduodenal ligament hindering dissection of Calot's triangle.⁹

This led us to the possible advantages of the one-stage approach in managing CBD stones. The expanding skills in laparoscopic surgery have made it possible to treat gallbladder and bile duct stones in a single step. In recent years, this method has attracted considerable attention. In Hanoi Medical University Hospital, during the past three years, we performed a one-step procedure on total of 44 patients with concomitant CBD stones and gall stones. The average diameters of CBD and CBD stone measured on CT/-MRI of the study group were $9.98 \pm 2.69\text{mm}$ and $6.39 \pm 2.60\text{mm}$, in which the largest stone was 14 mm in size. Many studies also suggest that when the CBD is dilated from 10mm or more and the stone size is less than 10mm, the ERCP process will be more favourable for the removal of CBD stones.¹⁰ In addition, abnormal duodenal D2 is also a disadvantage for ERCP that needs to be evaluated preoperatively.¹⁰

Whether or not to perform ERCP before LC is controversial. Traditionally, doctors choose

to do ERCP to remove CBD stones first. This is because they believe that if the clearance of CBD stones by ERCP could not be done, it would be possible to remove them by laparoscopic or open CBD exploration. However, in some cases, when the CBD is not increased in size, it is difficult to open the CBD for stones removal. In addition, intestinal distention after ERCP can also interfere with LC, specifically increasing the number of trocars to be placed or increasing the operating time.⁸ In our study, 24 patients underwent LC before ERCP, the mean operative time between the two groups was not significantly different (110.63 minutes and 113.74 minutes). However, the group that did the ERCP first had a higher intraoperative difficulty rate than the LC-first group ($p = 0.002$). This result suggested that LC before ERCP would be more convenient for the surgeon in laparoscopic manipulation. However, choosing the order still depends mainly on the habits of each surgeon, and our research data is still too small to draw further conclusions.

The most common post-ERCP complication is acute pancreatitis, which is reported to occur in 2 - 10% of patients.⁹ In this study, high postoperative serum amylase and lipase levels appeared in 27.3% asymptotically, of which two patients (4.55%) met the criteria of mild acute pancreatitis¹¹. All these patients did not require intervention or reoperation, and the number of hospital stays in this group was not different from that of the group with normal amylase after surgery. In their study on 108 patients who underwent one-step LC and ERCP, Liverani et al. reported the rate of acute post-operative pancreatitis to be 1.8%.²

To facilitate cannulation and reduce the post-operative acute pancreatitis rate, Cavina et al. introduced a technique through which a Dormia basket was passed into the duodenum

through the cystic duct; with a "rendezvous" procedure, it retrieved the sphincterotome from the duodenoscope and guided it into the bile duct. This technique was used in 15 patients and had a CBD stone clearance rate of 100 per cent and a mean length of postoperative hospitalisation of 4 days.¹² Unfortunately, we have not been able to develop this technique due to limited equipment.

In our study, the success rate of stone clearance was 100% ($n = 14$) which is comparable to a study done by several authors where success rate of stone clearance ranged from 87% to 100%.^{2,7,8} The careful pre-operative evaluation and selection of patients, along with the coordination between the surgeon, endoscopist, and radiologist, will help bring many benefits as well as reduce risks for the patients.

V. CONCLUSION

In conclusion, endoscopic stone extraction and LC performed in the same setting are feasible and safe in patients with gallstones and concomitant, CBD stones. However, the methods used require specific technical skills that cannot be extended to all centers without proper training. Therefore, the best treatment choice for any patient with CBD stone must be based on locally available expertise and resources.

Abbreviations

Provenance and peer review.

Not commissioned, externally peer-reviewed.

REFERENCES

1. Jones M, Johnson M, Samourjian E, et al. ERCP and laparoscopic cholecystectomy in a combined (one-step) procedure: a random comparison to the standard (two-step)

procedure. *Surg Endosc.* 2013;27(6):1907-1912. doi:10.1007/s00464-012-2647-z

2. Liverani A, Muroli M, Santi F, et al. One-step Laparoscopic and Endoscopic Treatment of Gallbladder and Common Bile Duct Stones: Our Experience of the Last 9 Years in a Retrospective Study. *The American Surgeon.* 2013;79(12):1243-1247. doi:10.1177/000313481307901213

3. Wandling MW, Hungness ES, Pavey ES, et al. Nationwide Assessment of Trends in Choledocholithiasis Management in the United States From 1998 to 2013. *JAMA Surg.* 2016;151(12):1125. doi:10.1001/jamasurg.2016.2059

4. Cuschieri A, Lezoche E, Morino M, et al. E.A.E.S. multicenter prospective randomized trial comparing two-stage vs single-stage management of patients with gallstone disease and ductal calculi. *Surg Endosc.* 1999;13(10):952-957. doi:10.1007/s004649901145

5. Tan C, Ocampo O, Ong R, et al. Comparison of one stage laparoscopic cholecystectomy combined with intra-operative endoscopic sphincterotomy versus two-stage pre-operative endoscopic sphincterotomy followed by laparoscopic cholecystectomy for the management of pre-operatively diagnosed patients with common bile duct stones: a meta-analysis. *Surg Endosc.* 2018;32(2):770-778. doi:10.1007/s00464-017-5739-y

6. Ghazal AH, Sorour MA, El-Riwini M, et al. Single-step treatment of gall bladder and bile duct stones: A combined endoscopic–

laparoscopic technique. *International Journal of Surgery.* 2009;7(4):338-346. doi:10.1016/j.ijssu.2009.05.005

7. Pokhrel N, Katwal G. Single Setting ERCP and Laparoscopic Cholecystectomy is a Safe Procedure in Patients with Cholecysto-Choledocholithiasis: A Prospective Study in a Peripheral-Level Hospital. *Nep Med Coll J.* 2020;22(1-2):73-81. doi:10.3126/nmcj.v22i1-2.30038

8. Lau JYW, Leow C, Fung TMK, et al. Cholecystectomy or Gallbladder In Situ After Endoscopic Sphincterotomy and Bile Duct Stone Removal in Chinese Patients. *Gastroenterology.* 2006;130(1):96-103. doi:10.1053/j.gastro.2005.10.015

9. Thaker AM, Mosko JD, Berzin TM. Post-endoscopic retrograde cholangiopancreatography pancreatitis. *Gastroenterology Report.* 2015;3(1):32-40. doi:10.1093/gastro/gou083

10. Williams E, Beckingham I, El Sayed G, et al. Updated guideline on the management of common bile duct stones (CBDS). *Gut.* 2017;66(5):765-782. doi:10.1136/gutjnl-2016-312317

11. Banks PA, Bollen TL, Dervenis C, et al. Classification of acute pancreatitis—2012: revision of the Atlanta classification and definitions by international consensus. *Gut.* 2013;62(1):102-111. doi:10.1136/gutjnl-2012-302779

12. Borzellino G, Saladino E, Lombardo F, et al. Rendez-vous Technique. In: *Biliary Lithiasis.* Springer Milan; 2008:351-356. doi:10.1007/978-88-470-0763-5_26