

Intraoperative choledochoscopy in biliary stone surgery combined with laser lithotripsy at Hai Phong Medical University Hospital (2023 – 2025)

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ABSTRACT

Objectives: To review surgical outcomes of bile duct stone treatment combined with laser lithotripsy. **Methods:** Prospective study, clinical intervention on 28 patients undergoing surgery for cholangiolithiasis combined with laser lithotripsy in the treatment of gallstones from June 2023 to April 2025 at Hai Phong Medical University Hospital. **Results:** Through the study on 28 patients, we recorded the following results: The average age was $52.32 \pm 9,9$ (31 - 76) Female accounted for the majority 57.14%. The average surgery time was $98.18 \pm 21,1$ minutes. The average hospital stay was 11.93 ± 2.71 days. Complications encountered 6 patients (21.43%), and bile leakage accounted for the majority of 2 patients (7.14%). Evaluation of treatment results: Good 22 patients (78.57%). **Conclusion:** Surgery combined with laser biliary lithotripsy is an effective method, with fast lithotripsy and surgery time.

Keywords: Bile duct stones, laser lithotripsy.

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INTRODUCTION

Biliary stone disease is a relatively common surgical condition, with its prevalence increasing with age. Vietnam is located in an endemic region with one of the highest rates of biliary stones worldwide. A typical feature of biliary stone disease is its association with infection and high recurrence. Currently, several major treatment modalities for biliary stones are available, including open surgery, laparoscopic surgery, and endoscopic retrograde cholangiopancreatography (ERCP). Each method has its own advantages and limitations.

The integration of intraoperative choledochoscopy in biliary stone surgery has become a global trend. However, performing choledochoscopy with stone extraction using a Dormia basket and saline irrigation

alone is often insufficient. It is necessary to combine additional techniques such as electrohydraulic lithotripsy or laser lithotripsy to improve stone clearance rates. According to Patel et al., the intraoperative stone clearance rate was 97% [1]. In Vietnam, flexible choledochoscopy was first introduced in the early 2000s at Viet Duc Hospital, Ho Chi Minh City University of Medicine and Pharmacy Hospital, and the 108 Central Military Hospital. Results showed that biliary stone surgery combined with flexible choledochoscopy achieved satisfactory clearance rates, ranging from 54.8% to 93.5% [2]. To further evaluate the outcomes of biliary stone treatment in Hai Phong, we conducted the study “Intraoperative choledochoscopy in biliary stone surgery combined with laser lithotripsy at Hai Phong Medical University

Hospital, (2023–2025)” with the following objectives:

1. To describe some clinical and Paraclinical findings of patients with biliary stones who underwent surgery combined with laser lithotripsy at Hai Phong Medical University Hospital from June 2023 to April 2025.
2. To assess the treatment outcomes of this patient group.

MATERIALS AND METHODS

Study population

The study included 28 patients diagnosed with biliary stones who underwent surgery combined with laser lithotripsy from June 2023 to April 2025 at Hai Phong Medical University Hospital.

Inclusion criteria

- Patients who underwent open surgery with intraoperative flexible choledochoscopy combined with laser lithotripsy for biliary stone treatment between June 2023 and April 2025 at Hai Phong Medical University Hospital.
- Patients who consented to participate in the study.
- Complete medical records that met research criteria.

Exclusion criteria

- Patients with severe comorbid internal diseases or a history of abdominal surgery for malignancy.
- Patients with severe biliary stone-related conditions such as sepsis, septic shock, or cases requiring biliary stone surgery combined with treatment for other diseases.
- Incomplete medical records.

Research methods

Study design

A case series with both retrospective and prospective data collection.

Sample size and sampling method

Convenience sampling. All patients who met the inclusion criteria were enrolled in the study.

Data processing

- Data were analyzed using SPSS 26.0 statistical software.
- For quantitative variables: mean (\bar{X}), standard deviation (SD), maximum (Max), and minimum (Min) values were calculated.
- For qualitative variables: percentages were calculated. Pre- and postoperative differences in symptoms were analyzed using the χ^2 test and T-test. Statistical significance was defined as $p \leq 0.05$.

RESULTS

From June 2023 to April 2025, a total of 28 patients underwent open surgery combined with flexible choledochoscopy and laser lithotripsy for the treatment of biliary stones at Hai Phong Medical University Hospital.

Patient characteristics

Table 3.1. Age distribution

Age group	No. of patients (n=28)	Ratio (%)	Mean age (years)
< 40	3	10.71	
41 – 60	19	67.86%	52.32 ± 9.9
61 – 80	6	21.43%	(31 - 76)
Total	28	100%	

Comment: The mean age was 52.32 ± 9.9 years (range: 31 – 76). The 41 – 60 age group accounted for the majority (67.86%).

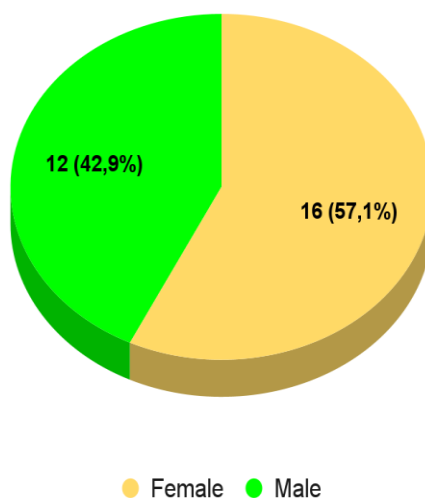


Chart 3.1. Gender distribution

Comment: Most patients were female: 16/28 (57.14%).

- Surgical history: 18 patients (64.29%) had a history of biliary stone surgery; 10 patients (35.71%) had undergone cholecystectomy.
- Medical history: 15 patients (53.57%) had associated internal medical conditions.

Clinical characteristics

Table 3.2. Clinical symptoms

Symptom	No. of patients (n=28)	Ratio (%)
Right upper quadrant pain	28	100
Fever	18	64.29
Jaundice	22	78.57
Digestive disorders	9	32.14
Charcot's triad	10	35.71

Comment: All patients (100%) presented with right upper quadrant pain. Charcot's triad was observed in 35.71% of cases.

Paraclinical findings

Table 3.3. Laboratory findings

Parameter Status	No. of patients (n=28)	Ratio (%)
White blood cells (G/L)	Normal	9 32.14
	Elevated	19 67.86
	Mean ± SD	13.53 ± 5.08

Total bilirubin (µmol/L)	Normal	6	21.43
	Elevated	22	78.57
	Mean ± SD	131.36 ± 180.82	
SGOT (U/L)	Normal	5	17.86
	Elevated	23	82.14
	Mean ± SD	96.2 ± 54.76	
SGPT (U/L)	Normal	6	21.43
	Elevated	22	78.57
	Mean ± SD	92.21 ± 58.46	
Prothrombin time (s)	Normal	18	64.29
	Reduced	10	35.71
	Mean ± SD	14.23 ± 2.3	

Comment: Leukocytosis was observed in 67.86% of patients. Total bilirubin was elevated in 78.57%, with a maximum value of 662 µmol/L. SGOT was elevated in 82.14% and SGPT in 78.57%. Prothrombin time was reduced in 35.71%.

Table 3.4. Preoperative CT characteristics

Parameter		No. of patients (n=28)	Ratio (%)
Common bile duct diameter (mm)	5–10	6	21.43
	> 10	22	78.57
	Mean ± SD	15.28 ± 6.89	
Stone location	Common bile duct (CBD) only	17	60.7
	Right liver + CBD	1	3.6
	Left liver + CBD	4	14.3
	Left liver only	2	7.1
	Left + right liver	1	3.6
	CBD + right + left liver	3	10.7
Number of stones	Few	5	17.86
	Multiple	23	82.14
Stone morphology	Discrete	13	46.43
	Cast-like	15	53.57
Gallbladder stones	Present	11	39.29
	Absent	17	60.71

Comment: The mean CBD diameter was 15.28 ± 6.89 mm (maximum 36 mm). The majority of stones were located in the CBD alone (60.7%). Cast-like stones were most common (53.57%).

Surgical outcomes

Intraoperative findings revealed peritoneal adhesions in 76.5% of cases.

Table 3.5. Stone location by choledochoscopy vs. CT

Stone location (n=28)	Choledochoscopy	CT scan
CBD	19 (67.87%)	17 (60.71%)
Left liver + CBD	1 (3.57%)	1 (3.57%)
Right liver + CBD	3 (10.71%)	4 (14.29%)
Left liver	1 (3.57%)	2 (7.15%)
Left + right liver	1 (3.57%)	1 (3.57%)
CBD + right + left liver	3 (10.71%)	3 (10.71%)

P = 0.95

Comment: CBD stones accounted for the majority (67.87%) on choledochoscopy. The difference between choledochoscopy and CT was not statistically significant (P>0.05).

Table 3.6. Stone clearance by choledochoscopy with laser lithotripsy

Outcome	No. of patients (n=28)	Ratio (%)	
Complete clearance	24	85.6	
Residual stones	Left liver (segment II/III)	1	3.6
	Segment IV	1	3.6
	Right liver	1	3.6
	Left + right liver	1	3.6

Comment: Complete stone clearance was achieved in 85.6% of patients.

- Mean operative time: 98.18 ± 21.1 minutes (range 59–152).

- Mean hospital stay: 11.93 ± 2.71 days (range 8–19).

Table 3.7. Early postoperative complications

Complication	No. of patients (n=28)	Ratio (%)
Biliary bleeding	1	3.57
Bile leakage	2	7.14
Kehr tube obstruction	1	3.57
Surgical site infection	2	7.14
None	22	78.57

Total	28	100%
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Comment: Early complications occurred in 6 patients (21.4%), most commonly bile leakage (7.1%). No complications were observed in 22 patients (78.57%).

Table 3.8. Treatment outcomes

Outcome	No. of patients (n=28)	Ratio (%)
Good	22	78.6
Fair	2	7.1
Poor	4	14.3

Comment: Treatment outcomes were rated good in 22 patients (78.6%).

DISCUSSION

Bile duct stones are a fairly common disease, with incidence increasing with age. In our study, the mean age was 52.32 ± 9.9 (range 31–76); the youngest was 31 and the oldest was 76 years. In Taiwan, Chang found that the age group 20 – 50 accounted for 84% of patients with intrahepatic bile duct stones. The majority of cases were female, with females accounting for 51.72% and males 48.28%. In our study, right upper quadrant pain was found in 100% of patients (58 cases), while Charcot’s triad was present in only 17.2%. Chufa Zheng et al., in a study of 123 patients with common bile duct stones aged 70 years and older, reported right upper quadrant pain in 95.9%, jaundice in 56.1%, fever in 19.5%, acute pancreatitis in 8.9%, and cholangitis in 56.9% [3].

The purpose of surgery for bile duct stones combined with laser lithotripsy is to completely remove stones and re-establish bile duct drainage to resolve biliary obstruction. To achieve this, it is necessary to accurately evaluate the biliary tract preoperatively, determine all stone locations and number of stones, thereby avoiding residual stones during surgery and selecting an appropriate treatment method. Ultrasound

cannot precisely identify stone location or biliary stricture. Computed tomography (CT) provides good images but requires intravenous contrast and cannot detect radiolucent stones. Choledochoscopy with a flexible scope allows direct visualization of stones regarding their location, number, and characteristics.

In our study selection, even cases with distal common bile duct (CBD) stones or cast stones were evaluated with flexible choledochoscopy combined with laser lithotripsy. Compared with reports by domestic authors, the distribution of intrahepatic bile duct stones was similar to our findings. Vo Dai Dung reported intrahepatic bile duct stones in both lobes in 54.3%, in the left lobe in 27.1%, and in the right lobe in 18.6% [4].

Our study achieved a stone clearance rate observed by choledochoscopy in 24 patients (85.7%). This result was higher than that of Vo Dai Dung, who reported intraoperative clearance of 39.5% [4].

In 4 cases of residual stones, we deliberately left them in place because strictures prevented the scope and lithotripsy probe from passing through, and attempts with basket dilation were ineffective. We found that a large stone burden and intrahepatic

stones reduce the accuracy of clearance assessment if relying solely on choledochoscopy.

Although choledochoscopy is considered the gold standard for diagnosis of bile duct stones, it is not sufficient alone to confirm stone clearance. Final confirmation requires choledochoscopic clearance in combination with ultrasound and cholangiography. Therefore, postoperative abdominal ultrasound remains necessary during follow-up.

The overall complication rate of choledochoscopy reported in the literature ranges from 5% to 54%, with an average of about 20–22%. In our study, 6 patients (21.4%) experienced postoperative complications. The most common was bile leakage in 2 patients (7.1%), compared with 5.8% in Su Quoc Khoi's report [5].

In our cases, 2 patients (7.1%) had bile leakage presenting as wet drainage dressings on day 5 postoperatively, which resolved by day 12 in one patient and by day 19 in another. According to Liu D et al., bile leakage is defined as drainage lasting more than 3 days with output greater than 100 ml/day [6].

Assessment of surgical outcomes combining bile duct exploratio and laser lithotripsy: Good in 22 patients (78.6%), Fair in 2 patients (7.1%) who had residual stones but no complications, and Poor in 4 patients (14.3%) who had residual stones and/or complications. These results are comparable to other authors, with the majority achieving good outcomes.

CONCLUSION

Surgery combined with laser lithotripsy for bile duct stones is an effective method, with short operative and lithotripsy times. The rate of intraoperative and postoperative

complications is low. The rate of stone clearance is high, and overall treatment outcomes are favorable.

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