



## Combined Laparoscopic Cholecystectomy and Transcystic Common Bile Duct Exploration for Choledocholithiasis

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**Background:** There is no consensus on the ideal approach for managing patients with common bile duct (CBD) stones. The combined approach is less popular, possibly due to the complexity of the surgical technique and the availability of choledochoscope. **Aim:** We aim to assess the safety and feasibility of transcystic (TC) CBD exploration using the flexible bronchoscope for choledocholithiasis. **Methods:** Forty patients with symptomatic calculus gallbladder with concomitant CBD stones were randomized into two groups. Single-session laparoscopic cholecystectomy (LC) and laparoscopic TC CBD exploration were performed for one group using the flexible bronchoscope. Endoscopic retrograde cholangiopancreatography followed by LC after 4–6 weeks was conducted for the other group. **Results:** Twenty patients were randomized to each group. The clearance rate of CBD stones was significantly higher in the single-session Group A (95%) than in the two-session Group B (70%). Group B was associated with a significantly prolonged operative ( $P = 0.01$ ). The total hospital stay and operative time were significantly longer in Group B than in Group A ( $P = 0.004$ ). There was no significant difference between both groups regarding the intraoperative or postoperative complications. **Conclusion:** Combined LC and TC CBD exploration is a safe and feasible approach and is associated with significantly shorter operative time and length of hospital stay.

**Key words:** Choledocholithiasis, laparoscopic cholecystectomy, laparoscopic common bile duct exploration

### INTRODUCTION

Gallstones within the common bile duct (CBD) is a relatively common disease with an incidence ranging from 10% to 15% of patients with gallstone disease which may result in extremely serious complications. Therefore, it is crucial to properly clear the CBD on time to avoid the possible complications.<sup>1</sup>

CBD stone clearance can be done via endoscopic retrograde cholangiopancreatography (ERCP) which is usually followed by laparoscopic cholecystectomy (LC). However, ERCP is associated with many complications due to the destruction of the sphincter of Oddi by sphincterotomy such as recurrence of CBD stones, recurrent cholangitis, and predisposition of biliary malignancy, in addition to pancreatitis, bleeding, and perforation that may complicate ERCP.<sup>2</sup>

Single-session laparoscopic CBD exploration (LCBDE) and LC have been associated with similar stone clearance rates when compared with ERCP and avoid the drawbacks of two

staged procedures such as prolonged hospital stay and higher costs. Furthermore, the single-stage procedure preserves the sphincter of Oddi and avoids the disadvantages of ERCP.<sup>3</sup>

LCBDE can be performed through the cystic duct (CD), the transcystic (TC) approach, or choledochotomy. However, the TC approach is associated with a shorter operative time, lower blood loss, and overall complications.<sup>4-6</sup>

### MATERIALS AND METHODS

Forty patients with symptomatic calculus gallbladder and concomitant CBD stones were included in this study. The patients were randomized into two equal groups; single-session LC and laparoscopic TC CBD exploration will be performed for patients in Group A, while ERCP followed by LC after 4–6 weeks will be performed for Group B.

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Randomization was done using computer-generated random number sequences in concealed envelopes with a block randomization design. Informed consent was obtained from those who met the inclusion criteria for this study.

Preoperative laboratory studies, abdominal ultrasonography, and magnetic resonance cholangiopancreatography are done for all patients.

Exclusion criteria include anatomical aberrations of the CD, preoperative CD diameter <4 mm, CBD that is <8 mm to allow the introduction of the TC endoscope, Mirizzi syndrome, intrahepatic stones, preoperative cholangitis, and suspected or confirmed biliary cancer.

The observations to be studied include patient demographic characteristics, American Society of Anesthesiologists class, laboratory tests and CBD stone clearance rate, operative time, intra-operative bleeding, and postoperative complications (bleeding, surgical site infection, bile leak and postoperative pain), in addition to hospital stay and mortality. The patients were followed up for 3 months after surgery.

This study is approved by General Organization for Teaching Hospitals and Institutes, Cairo, Egypt. (IRB approval number: HD000198, approval date: May 15, 2024). The study was conducted in accordance with the Declaration of Helsinki.

Written informed consent was taken from all patients included in this study.

### Operative techniques

LCBDE and LC were carried out as a single-session TC approach. We used four ports and a 30° telescope. First, Calot's triangle was dissected till achieving the critical view of safety. Then a transverse incision was made in the CD [Figure 1a] to introduce a 3.9 mm bronchoscope (PENTAX®, EB11-J10, Europe GmbH, Germany) to explore the distal and proximal bile duct [Figure 1b]. Stone retrieval was done by Dormia basket introduced through

the working channel of the bronchoscope [Figure 1c] ensuring no retained stones or fragments. Finally, LC was performed after double clipping or ligation of CD according to the situation.

### Analysis of results

Data were fed to the computer and analyzed using STATA version 17.0 (Stata Corp (2017) Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC.).

Qualitative data were described using numbers and percentages. The quantitative data were described using range (minimum and maximum), mean, standard deviation, and median. The results were considered statistically significant if  $P < 0.05$ . The Chi-square test, Fisher's exact test, and Student's *t*-test were used to compare the two studied groups.

## RESULTS

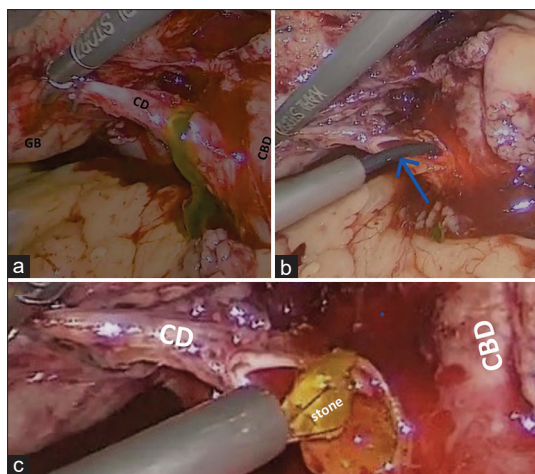
Forty patients were enrolled in the study, 52.5% were females ( $n = 21$ ) and 47.5% were males ( $n = 19$ ) with a mean age of  $52.4 \pm 12.9$ . The patients were randomized to each group. There was no difference between the studied groups regarding age and sex. The demographic and other preoperative variables are shown in [Table 1]. We found that the success rate of stone clearance was significantly higher in LCBDE and LC arm (group A) than in group B (95% versus 70% respectively,  $P = 0.03$ ). Meaningly, Group A was associated with approximately 30% higher rate of successful stone clearance than Group B (risk ratio = 1.35). Only one case was converted to open surgery in Group A while LC was completed none in Group B because of the inability to identify key structures to the point of absolute certainty due to extensive adhesions at Calot's triangle.

In Group B, the operative time (the sum of both ERCP and LC in minutes) was associated with a significantly prolonged operative time than Group A with a mean of  $117.3 \pm 14.9$  and  $100.6 \pm 27.01$  min, respectively ( $P = 0.01$ ). Similarly, the total hospital stay (the length of postoperative stay after ERCP and LC) in Group B was associated with longer total hospital stay (compared to Group A with a mean of  $5.05 \pm 2.9$  and  $3.1 \pm 1.1$ , respectively;  $P = 0.004$ ) [Table 2].

The postoperative pain was also significantly more severe, on the Numerical Rating Scale, in Group B (post-LC) than for Group A with a mean of  $5.75 \pm 2.4$  and  $3.4 \pm 1.8$ , respectively ( $P < 0.001$ ).

Post-ERCP bleeding and perforation were reported once in Group B versus none in Group A. Pancreatitis was reported in 10% of patients in Group B compared to none in Group A.

Postoperative bile leak was observed in three patients (15%) in Group A and one patient (5%) in Group B. Superficial surgical site infection was observed in two patients (10%) in each group. Finally, the two-stage group had a two-fold higher risk of overall complications than the single-stage group (odds



**Figure 1:** (a) Transverse incision of CD, (b) introduction of the bronchoscope (arrow), (c) retrieval of CBD stone via basket. CBD: Common bile duct

Table 1: Demographic and preoperative variables

| Variables                                           | Group A (n=20) | Group B (n=20) |
|-----------------------------------------------------|----------------|----------------|
| Age, mean±SD                                        | 51.25±12.4     | 53.5±13.6      |
| Sex (male/female)                                   | 11/9           | 8/12           |
| ASA (I, II, III, IV)                                | 9/7/4/0        | 7/5/8/0        |
| Bilirubin (mg/dL), mean±SD                          | 4.4±3.3        | 3.8±3.07       |
| Temperature (°C), mean±SD                           | 37.2±0.6       | 36.9±0.5       |
| Leukocytosis ( $\times 10^3/\mu\text{L}$ ), mean±SD | 9.9±2.2        | 7.5±2.3        |

SD=Standard deviation; ASA=American Society of Anesthesiologists

Table 2: Outcome variables and their significance

| Outcome                              | Group A (n=20), n (%) | Group B (n=20), n (%) | P       |
|--------------------------------------|-----------------------|-----------------------|---------|
| Stone clearance                      | 19 (95)               | 14 (70)               | 0.03*   |
| Bile leak                            | 3 (15)                | 1 (5)                 | 0.29    |
| Conversion to open                   | 0                     | 1 (5)                 | 0.3     |
| Bleeding                             | 0                     | 1 (5)                 | 0.3     |
| Perforation                          | -                     | 1 (5)                 | 0.3     |
| Pancreatitis                         | 0                     | 2 (10)                | 0.14    |
| Wound infection                      | 2 (10)                | 2 (10)                | 1       |
| Operative time (min), mean±SD        | 100.6±27.01           | 117.3±14.9            | 0.01*   |
| Postoperative pain (NRS), mean±SD    | 3.4±1.8               | 5.75±2.4              | <0.001* |
| Total hospital stays (days), mean±SD | 3.1±1.1               | 5.05±2.9              | 0.004*  |
| Overall complications                | 5 (25)                | 8 (40)                | 0.3     |

\*=Statistically significant. SD=Standard deviation; NRS=Numerical Rating Scale

ratio = 2). During the follow-up 3 months, there was no reported mortality in the current study.

## DISCUSSION

Concomitant CBD stones are encountered in up to 19% of patients with symptomatic gallstone disease. Two options are available for managing these CBD stones: combined LCBDE with LC or ERCP and interval LC. Although extensively studied, the ideal procedure remains uncertain.<sup>6</sup>

In the current study, we compared these two options. We use a flexible bronchoscope to explore the CBD and retrieve the stones, which was introduced as a new technique for CBD exploration by Aawsaj *et al.* and Riojas-Garza *et al.*<sup>7,8</sup> In addition to the flexible bronchoscopy, a flexible ureteroscope, as well, is a beneficial alternative to lack of availability of the choledochoscope.<sup>9</sup>

It provides a good alternative and a feasible option for CBD exploration to overcome the lack of a choledochoscope which may help to improve LCBDE popularity. Although LCBDE plus LC is associated with an increased risk for overall morbidity, the difference between the two interventions is insignificant.

These findings concord with Donkervoort *et al.*, who demonstrated no significance between the two arms regarding

the overall complication.<sup>10-12</sup> In a systematic review and meta-analysis study, Singh and Kilambi found no significant differences in the overall complication rates.<sup>13</sup>

In the current study, there was a significant difference between the two groups in stone clearance rate, which is the primary outcome, as LCBDE was associated with a higher rate of successful clearance of stones.

This is correlated with Singh and Kilambi, who demonstrated significantly lower rates of failure of stone clearance in the LCBDE arm.<sup>13</sup>

It is also correlated with many studies conducted by Lv *et al.*, and Koc *et al.*, whereas the success rate of the combined LCBDE and LC group was found to be higher than for the ERCP + LC group.<sup>14,15</sup>

Furthermore, the higher rates of postoperative pancreatitis, bleeding, and post-ERCP perforation in the two-session group and the higher rate of postoperative bile leak in the LCBDE + LC arm are found to be statistically insignificant. Similarly, the two groups did not differ in wound infection or conversion to open.

The operative time in the two-session group is significantly longer than the single-session group. Similarly, the length of total hospital stay is significantly shorter in the LCBDE group. This is consistent with many previous studies that reported single-stage LCBDE is associated with significantly shorter hospital stays. Koc *et al.* reported significantly longer mean operative time with ERCP + LC and a shorter overall hospital stay.<sup>15</sup> Rogers *et al.*, also, demonstrated that overall hospital stays were shorter for LCBDE, but the differences were insignificant.<sup>16</sup>

These findings are correlated with recent studies; a network meta-analysis conducted by Mohseni *et al.* reported that the one-stage approach was associated with a decrease in the length of hospital stay compared with the two-stage arm. The overall risk of complications was lower in LCBDE compared with ERCP + LC.<sup>17</sup>

Similarly, a systematic review conducted by Manivasagam *et al.* demonstrated a higher rate of stone clearance and a shorter length of stay in the LCBDE approach compared to the two-stage arm.<sup>18</sup> Cawich *et al.* concluded that LCBDE yields better results in stone extraction rate than preoperative ERCP and is associated with minor morbidity.<sup>19</sup>

## CONCLUSION

The TC LCBDE for choledocholithiasis is safe and feasible and is comparable with the two-stage procedure in terms of overall morbidity. Despite being a demanding procedure requiring sound laparoscopic skills and special expensive equipment like a choledochoscope, LCBDE can be safely achieved using a flexible bronchoscope. LCBDE with LC is superior in the clearance of the stones. It reduces the hospital stay, avoids readmission, and avoids ERCP-related complications.

The ethics committee of the General Organization for Teaching Hospitals and Institutes approved this study and the use of clinical data.

# Data availability statement

The data that support the findings of this study are available from the corresponding author, Wael A. El-Dawy , upon reasonable request.

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Nil.

# Conflicts of interest

There are no conflicts of interest.

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