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Original Research Article

A prospective review of laparoscopic common bile duct exploration with nephroscope and primary closure without T tube

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ABSTRACT

Background: Here we present a pioneering laparoscopic method for common bile duct (CBD) stone management, evaluating its practicality, safety, and effectiveness when employing a nephroscope and omitting the placement of a T tube.
Methods: We have prospectively collected data from 100 patients who underwent exclusive CBD laparoscopic CBD exploration (LCBDE) along with/without laparoscopic cholecystectomy diagnosed to have Cholelithiasis with choledocholithiasis with a radiological CBD diameter of 10mm or more. Mortality, morbidity, hospital stay, and average duration of hospital stay were all assessed.
Results: In this prospective series 100 patients underwent the procedure, of which we had no mortality, of the 100 patients, 4 patients (4%) had bile leak i.e., bile output of more than 100 ml n drain, and 2 patients (2%) needed endoscopic retrograde cholangiopancreatography (ERCP) and stenting. The other 2 patient's leak settled by itself without any interventions. One patient (1%) was diagnosed to have sepsis post LCBDE which also required a prolonged stay of 7 days for antibiotics.
Conclusions: LCBDE offers good clinical outcomes in dealing with CBD stones. Surgeons experienced in laparoscopy can perform this procedure securely and efficiently.

Keywords: Laparoscopic, Choledocholithiasis, Cholelithiasis

INTRODUCTION

Common bile duct (CBD) stones can be seen in between 10% and 20% of patients with symptomatic gallstones and in about 5% of asymptomatic people with a normal-sized bile duct.[1] They can cause a variety of health issues, such as discomfort, jaundice, infection, and severe pancreatitis. Numerous imaging techniques can be used to diagnose the ailment, and the management of established cases of CBDS may include ERCP, surgery, and radiological techniques for stone extraction.

In the 1990s, with the introduction of laparoscopic cholecystectomy, many surgeons abandoned duct exploration and used ERC and endoscopic sphincterotomy as their only option in treating bile duct stones. For most general surgeons, CBDE appears an unduly complex and demanding procedure.[2]

The standard care for choledocholithiasis remains debatable. At present, ERCP with endoscopic sphincterotomy is considered a mainstream method for choledocholithiasis, literature suggests that LCBDE for

choledocholithiasis is more economical, equally effective, and associated with an identical rate of morbidity as ERCP followed by laparoscopic cholecystectomy.[3-5] In particular, as a one-stage procedure, LCBDE with bile duct primary closure (PC) also has the advantages of faster postoperative recovery, shorter hospital stay, and lower costs.[6-8]

While T tube drainage (TTD) has traditionally been employed in both laparoscopic and open choledochotomy to decompress the biliary tree, minimize the risk of bile leaks, and facilitate cholangiography for residual stone detection it also carries a complication rate of about 15% that can lead to extended hospital stays and higher costs.[9-11] Conversely, deciding whether to opt for TTD or PC after LCBDE merits careful consideration and discussion.

The objective of the study was to assess the feasibility of not placing a T tube while doing a laparoscopic CBDE and also to assess the efficacy and productivity of using a nephroscope while performing CBD exploration.

METHODS

We have prospectively collected data from 100 patients who underwent exclusive CBD LCBDE along with or without laparoscopic cholecystectomy and without the placement of a T tube, the patient collection pathway was as per Figure.[3] The data collection period was from September 2022 to September 2024 at prolife hospitals, Ludhiana. The selected patients were diagnosed with cholelithiasis with choledocholithiasis with a radiological CBD diameter of 10 mm or more. Mortality, morbidity, hospital stay, and average duration of hospital stay were all assessed. The study was presented in the hospital ethical committee and approval was taken for the same.

Inclusion criteria

All patients above the age of 18 years diagnosed with choledocholithiasis with or without cholelithiasis undergoing cholecystectomy with LCBDE. All patients above the age of 18 years diagnosed with primary choledocholithiasis undergoing LCBDE were included.

Exclusion criteria

All patients below the age of 16 years, all patients whose laparoscopic procedure was abandoned and converted to open and all patients where T tube was placed were excluded from study.

Sample size and statistics

Prospective analysis of all the patients under went LCBDE with or without cholecystectomy was included in study. The data collection period was from September 2022 to September 2024 at Prolife hospitals, Ludhiana. A total of 108 patients under went LCBDE during the study period and of which 8 patients were excluded due non matching of the inclusion criteria. The presentation of the categorical variables was done in the form of numbers and percentages (%). The data entry was done in the Microsoft excel spreadsheet and the final analysis was done with the use of statistical package for social sciences (SPSS) software, IBM manufacturer, Chicago,

RESULTS

The primary outcome assessed

Overall postoperative complications, postoperative biliary-specific complications (biliary peritonitis, biliary leak, retained stones, and postoperative CBD obstruction), re-intervention (radiology/endoscopy), re-intervention (surgery), and postoperative hospital stay.

Secondary outcomes assessed

Operating time, and other general complications not directly related to the techniques of bile duct closure (wound infection, pneumonia, deep vein thrombosis and internal hemorrhage).

Operative technique

All patients received prophylactic antibiotics and DVT prophylaxis according to the local policy. The procedure was done in a supine position with an adjustable operative bed. The OT setup was in such a way that two Laprascopic stacks were used one at the foot end of the patient and the other on right side of patient (Figure 1).

The tanycytic method is a much easier way, but it is restricted to a small group of cases, as it merely permits the removal of stones of small size, and the entrance to the common hepatic duct is inaccessible. In our approach, after successfully dissecting the Calots triangle, the cystic duct was isolated and clamped with an absorbable clip, which prevented the gallbladder stones from sliding into the CBD during the operation. Then, the CBD was fully exposed and a longitudinal choledochotomy was done, In all our cases the choledochotomy approach was used because it has the benefit of offering an unrestricted entrance to both the CBD and the common hepatic duct, allowing the removal of challenging stones.

After a longitudinal choledochotomy, a nephroscope was introduced into the CBD Via the epigastric 10 mm port, and an extra 5 mm port was placed in the right subcostal region (Figure 2). The stones were crushed and extracted via the nephroscope with the help of a saline irrigation system, after confirmation of clearance of the bile duct stones, the bile duct was closed with absorbable 3-0 PDS II sutures in continuous over-and-over locking fashion without a T-tube (Figure 4). After ensuring no bile leakage from the CBD incision, the gallbladder was removed routinely. A silicone drainage tube was regularly placed in the GB fossa.

Figure 1: Operation theater setup.

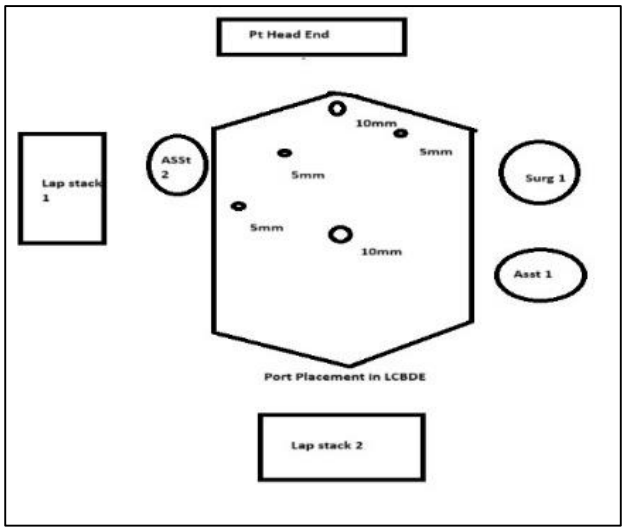

Figure 2: Pictorial representation of the working OT setup.

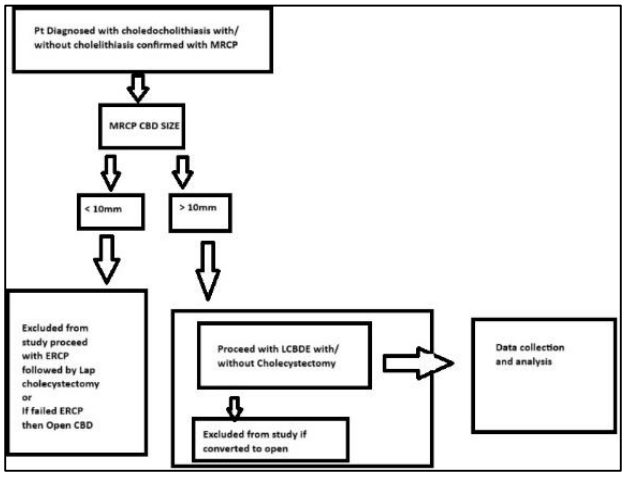

Figure 3: Strobe diagram; patient data collection pathway.

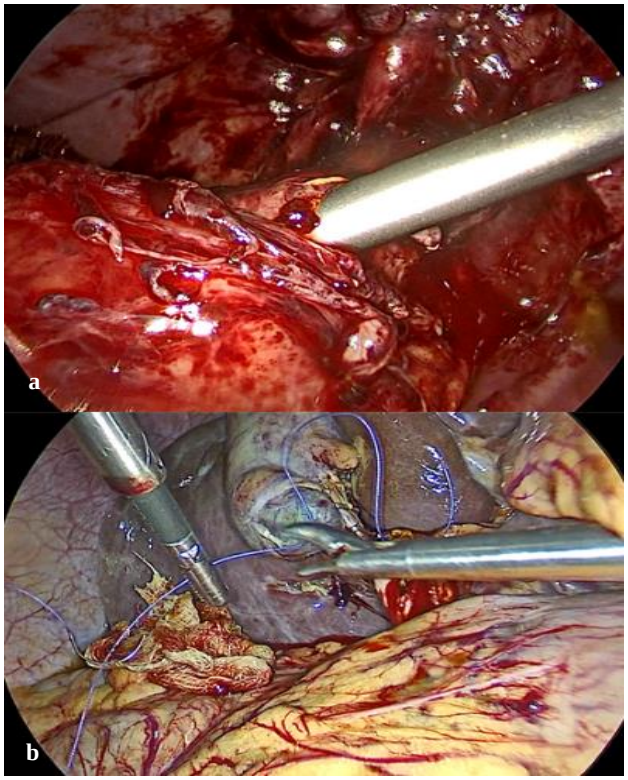

Figure 4 (a & b): Intra operative image.

RESULTS

During the study period, 104 individuals underwent LCBD exploration, four of whom were subsequently excluded from the study due to non-compliance with the inclusion criteria. For these included patients, demographic and clinical data were logged and the analyzed.

Of 100 patients, 72 (72%) were females. The mean age group of the patients undergoing lcbde was 38.4 years. Preoperative ultrasound was used to diagnose each of the 100 patients, and MRCP was performed on every patient scheduled for LCBD. When body weight and BMI were logged for analysis it was found that most patients could be classified as overweight to obese class 1 category with mean BMI of 30.742. ASA guidelines were used for the preoperative assessment of patients and 68% of these patients fall under ASA grade 1 (Table 1).

The most common symptoms presented were biliary colic (68%) followed by obstructive Jaundice (22%). Pre-operatively pancreatitis was diagnosed in 14 patients, but they were also considered for the surgery after fitness and adequate consent. In our series, the mean CBD diameter was 14.89 mm (Table 1).

Intraoperatively the average surgical time was 72 minutes with minimal blood loss and no intraoperative blood transfusion. We didn't experience any adverse events and abandonment of the procedure (Table 2).

In our series, there was no mortality. The most important complication noted was bile leak which was 4% and of the 4 patients 2% were referred to a medical gastroenterologist for ERCP and stenting and the other 2 patient's leak settled with conservative management. Pancreatitis, cholangitis, and postoperative obstruction were not reported in any of our patients.5 patients developed SSI-port site infection. 3.3 days was the average length of hospital stay (range: two to seven days), regarding other complications, of the 100 patients, Six patients (6%) needed prolonged hospital stay i.e. more than 7 days due to sepsis (1%), bile leak 4 patients (4%), and a total of 4 patients who had SSI, 1 patient, needed to stay in the hospital for a longer time. At an average 30-day follow-up, there were no incidences of retained stone. During our investigation, there were no significant complications or deaths. The complications was as per the Clavien Dindo classification (Table 3).

Table 1: Patients' characteristics and preoperative parameters, (n=100).

Variables	Mean
Age (in years)	38.4
Gender	
Female/male	70/30 (70%/30%)
Weight	78.7 kg
Height	160.4 cm
BMI	30.742
ASA	
ASA I	68 (68%)
ASA II	22 (22%)
ASA III	10 (10%)
Biliary pain	63 (63%)
Jaundice	22 (22%)
Pancreatitis	14 (14%)
Bilirubin	1.35 (0.3-3.2 mg)
ALP	145 (71-3 U)
ALT	246 (31-702 U)
ALT	112 (29-560 U)
CBD diameter	14.89 MM

ALP-alkaline phosphatase, ALT-Alanine transaminase, AST-Aspartate transaminase, ASA-American society of anesthesiologists

Table 2: Operative outcomes, (n=100).

Variables	Mean
Operative time	72 min
Mean no. of CBD stones	1.4
Mean size of stones	1.7 3 cm
Mean blood loss	55.9 ml
Blood transfusion	0
Conversion to open	2 (not included in the study data
Procedure abandoned	0

Table 3: Postoperative outcomes.

Variables	N (%)
Return to oral intake	2.3 days
Return to activity	12.4 days
Hospital stay	3.3 days
Mean postop. bilirubin	0.8 mg
Mean T-tube cholangiogram	18.3 days
Mean T-tube removal	21.3 days
Complications (Biliary specific)	
Biliary peritonitis/leak	4 (4%)
Retained stone	0
Post-op biliary obstruction	0
Prolonged hospital stays (>7 days)	6 (6%)
Biliary specific complications	
Pancreatitis (II)*	0
Cholangitis (II)*	0
General complications	
Wound infection (II)*	5 (5%)
DVT (II)*	0
Pneumonia (II)*	2 (2%)
Hollow viscus injury (II)*	0
Abdominal bleeding (II)*	0
Sepsis (II)*	1 (1%)
Re-intervention	
Radiology	0
Surgery	0
ERCP	2

ALP-Alkaline phosphatase, ALT-Alanine transaminase, AST-Aspartate transaminase, *Dindo-Clavien classificationable 3.

DISCUSSION

The current gold standard for surgical management of gallbladder stones is laparoscopic cholecystectomy and surgically for BDS, open CBD exploration was the preferred approach. When it came to treating CBD stones, ERCP became the go-to option. However, the search for a single stage of treatment and the advancement of laparoscopic surgeons' abilities have brought LCBDE into the spotlight. Where sufficient expertise is available, LCBDE is currently one of the treatment options for patients with choledocholithiasis with/without cholelithiasis.

A multitude of parameters, including surgical skill, proper equipment, biliary anatomy, and the number and size of CBD stones, must be addressed for the successful laparoscopic management of CBDS. In LCBDE, successful rates of stone clearance vary from 85% to 95%, with rates of morbidity ranging from 4% to 16% and mortality from 0% to 2%.[12] A global meta-analysis of 1762 LCBDE patients from 19 trials revealed an average duct clearance of 80%, along with an average morbidity of <10% (4-16%) and mortality of <1% (0-2.7%).[13]

Recently, with the advances in surgical instruments, technique, and knowledge, PC for CBD after LCBDE

was preferentially recommended.[14] The results from several studies demonstrated that LCBDE with PC is a safe and effective method with shorter operating time, lower medical expenses, shorter postoperative hospital stay, and fewer postoperative complications than TTD.[15-17] studies have demonstrated that LCBDE had a higher stone clearance rate, lower retained stone rate, lower lithiasis recurrence rate, shorter hospital stay and lower total charges than the ERCP procedure in these patients.[18]

We have adopted a trans choledochal approach as we used a nephroscope for the stone extraction, the advantage here being here is that a choledochal scope is very expensive and not available freely but many centers have a nephroscope and a nephroscope having an access channel has an advantage for ease retrieval of stones.

Our study has some limitations as the sample size of patients enrolled in this study is relatively small. This study represents our initial experience in performing LCBDE.

CONCLUSION

PC following LCBDE is safe and effective in patients with choledocholithiasis. There are a variety of disadvantages to T-tube drainages, such as longer operative time, longer postoperative stay, higher hospital expenses, and a higher recurrence rate. With practice, surgeons can successfully treat >90% of stones with LCBDE, avoiding ERCP or T-tube in the vast majority of cases. However, therapy of bile duct stones may vary globally, depending on local knowledge but LCBDE methods are relatively straightforward and a useful technique for biliary surgeons worldwide for achieving single-staged treatment for CBDS. The use of a nephroscope is a very good and cheaper alternative to a choledochoscope for achieving complete stone clearance.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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