Laparoscopic management of large common bile duct stones via choledochotomy

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Received 14 June 2018
Accepted 1 August 2018

The Egyptian Journal of Surgery 2019, 38:58–62

Introduction
Choledocholithiasis is a common complication of cholecystolithiasis. Treatment is advisable to prevent further complications. The optimal treatment for common bile duct (CBD) stones is still unclear, but with advances in laparoscopic instrumentation and acquisition of advanced laparoscopic skills, laparoscopic common bile duct exploration (LCBDE) for choledocholithiasis is increasing in popularity among surgeons worldwide. LCBDE can be performed transcystic or by direct choledochotomy. Laparoscopic transcholedochal CBD exploration is preferable since it provides complete access to the ductal system.
The aim
The aim of this clinical study is to assess the feasibility, advantages, and complication of laparoscopic management of large CBD stones via choledochotomy.
Patients and methods
This study included 20 cases with large CBD stones of 10 mm or more. LCBDE transcholedochotomy was done in all cases.
Results
Twelve cases were closed over T-tube, six cases were closed primarily, and bilioenteric anastomosis was done in one case. The mean operative time was122.5±28.2 min and the mean postoperative hospital stay was 6.30±3.7. Conversion occurred in one case.
Conclusion
LCBDE transcholedochotomy is a feasible, safe, and cost-effective procedure in patients with large CBD stones.

Keywords:
common bile duct stone, choledochotomy, laparoscopic exploration

Egyptian J Surgery 38:58–62

1110-1121

Introduction

Choledocholithiasis is the presence of calculi within the common bile duct (CBD), regardless of the coexistence of stones within the gallbladder [1]. It is the second most frequent complication of gallstone disease [1].

Despite the recent advances, the optimal approach for the management of CBD stones remains controversial. The current available treatment options include preoperative endoscopic retrograd cholangiopancreatography (ERCP) followed by LC, LC followed by postoperative ERCP, intraoperative laparoendoscopic 'rendezvous' technique, laparoscopic antegrade sphincterotomy, laparoscopic transcystic CBD exploration, laparoscopic choledochotomy, and open CBD exploration with or without transduodenal papillotomy [2,3]. Many recent large studies performed have reported that laparoscopic common bile duct exploration (LCBDE) for CBD stones, as a single-stage procedure, is feasible, safe, effective, cost-effective, and provides success and complication rates equivalent to those of a sequential (two-stage) approach but with significantly lower cost, shorter hospital stay, and lower morbidity [4,5]. Laparoscopic CBD exploration can be achieved either through the cystic duct (transcystically) or through a choledochotomy incision (transcholedochal) [6].

It has been argued that laparoscopic transcholedochal CBD exploration is preferable over the transcystic route and should even be used routinely since it provides complete access to the ductal system especially that proximal to the insertion of the cystic duct offering a chance of easier stone retrieval and optimal stone clearance [7]. It is indicated whenever the CBD is 9 mm or more in diameter [8]. After radiological assessment of clearance of the CBD from stones, the choledochotomy opening can be managed by either of the following methods: closure over a draining T-tube, primary closure of the CBD with or without biliary decompression, or bilioenteric

 DOI: 10.4103/ejs.ejs_111_18

anastomosis [9]. Conversion to open CBD exploration should not be considered a 'failure' in cases of unsuccessful LCBDE [10].

Patients and methods

The study was carried out on 20 patients having CBD stones of 10 mm or more in size with or without gallbladder stones. The study approved by ethical committee of research in Alexandria Universityconsent for intervention was taken from all patients. They were 14 women and six men with an age range of 24–54 years.

All of them were subjected to detailed history taking, physical examination, and routine investigations. Further dedicated laboratory investigations and imaging studies for choledocholithiasis were done for all the patients including total serum bilirubin, direct bilirubin, serum alkaline phosphatase, transabdominal ultrasound, and magnetic resonant cholangiopancreatography (MRCP).

A five-port access was used with the initial four ports placed in the typical American configuration for standard laparoscopic cholecystectomy. The additional 5-mm port was used in some cases in the highest point in the epigastric region just below the costal margin to help in liver retraction and facilitate suturing. The procedure started by dissection of the Calot's triangle to identify the cystic duct and cystic artery and achieve the critical view of safety, then clipping and dividing of cystic artery and duct. The gallbladder was left in place at this step to aid in liver retraction and to expose the CBD.

A longitudinal choledochotomy incision of about 1 cm in length was done on the anterior surface of the supraduodenal portion of the CBD using scalpel or endoknife for opening and laparoscopic scissors to extend choledochotomy (Fig. 1). Stone extraction was done by either milking of the CBD from below upwards using two blunt atraumatic graspers, irrigation of the CBD with saline or by the use of Fogarty balloon catheters (Figs 2 and 3). The clearance of the CBD was confirmed by choledochoscopies and/or intraoperative cholangiography (Fig. 4). Choledochotomy was closed either over T-tube, primary closure or bilioenteric anastomosis according to the diameter of CBD and presence of distal stricture or intrahepatic stones (Fig. 5).

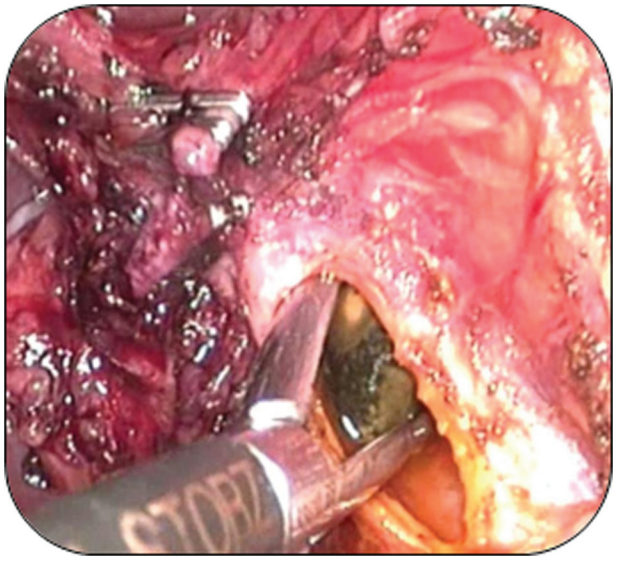
Results

Twenty patients fulfilled the criteria of enrollment in this study. They were 14 women and six men. Their age ranged from 24 to 54 years with a mean age of 40.10 ±10.70 years. Acute attack of cholangitis was reported in one case and acute attack of pancreatitis in another case. All cases complained of obstructive jaundice. Twelve cases had single CBD stones, while eight cases had multiple CBD stones. The diameter of CBD was ranging from 8 to 23 mm with a mean of 14.5±4.88 mm. The operative time ranged from 80 to 170 min with a mean operative time of 122.5±28.2 min

Figure 1

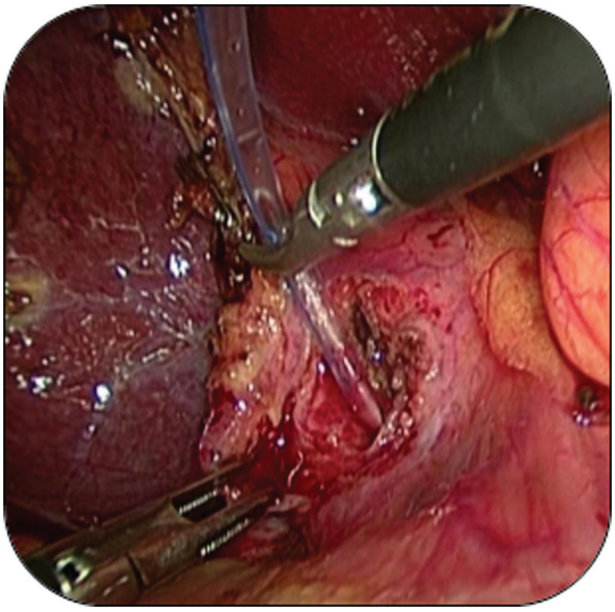
Choledochotomy incision.

Figure 2



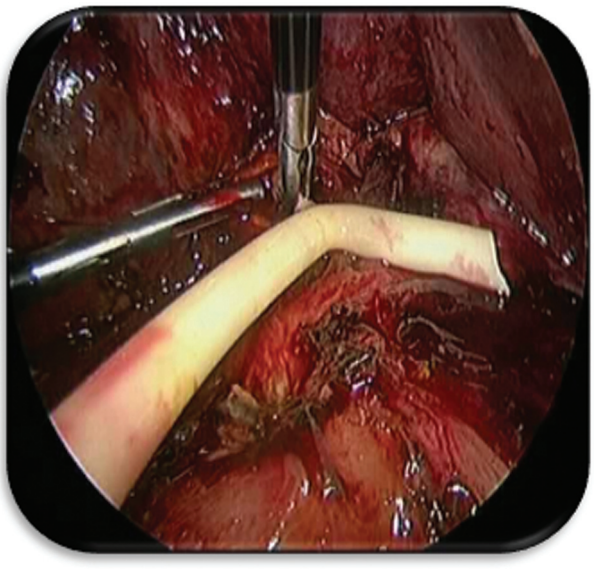
Extraction of stones via ductomy.

Figure 3



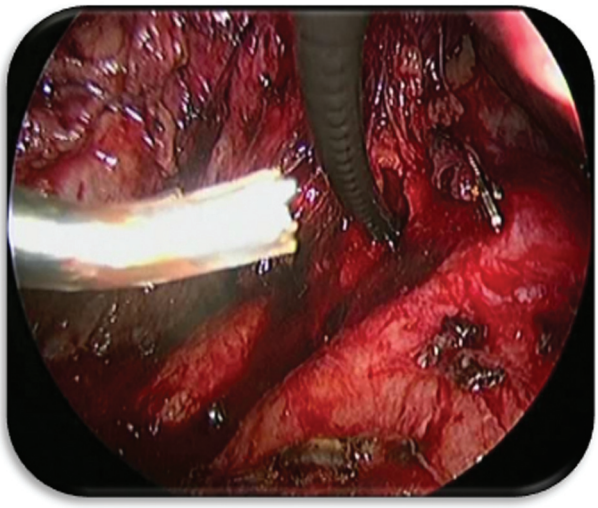
Irrigation of the CBD. CBD, common bile duct.

Figure 4



Inserting T-tube in the CBD. CBD, common bile duct.

Figure 5



Introduction of choledochoscope in CBD. CBD, common bile duct.

Table 1 Operative time and intraoperative mishaps

	n (%)
Operative time (min)	
Minimum–maximum	80.0–170.0
Mean±SD	122.5±28.2
Median	130.0
Intraoperative mishaps	
No	14 (70.0)
Bleeding	2 (10.0)
Adhesions	4 (20.0)

(Table 1). The choledochotomy incision in 12 cases were closed over T-tube and six cases were closed primarily, while choledochodudonostomy was done in one case (Table 2). Nineteen cases underwent completed laparoscopic while one case was converted to open CBD exploration due to impacted stone with failure of extraction by the laparoscopic approach. The postoperative hospital stay of the cases was ranging from 2 to 10 days with a mean of 6.3±3.7 days. Within the postoperative period one case suffered from fever controlled by antipyretics, one case with intraabdominal minimal collection (bile leakage) by ultrasound abdomen and was managed conservatively (Table 3).

Discussion

Laparoscopic choledochotomy has emerged recently as a single-stage surgical option for direct ductal exploration and usually performed when transcystic stone extraction is not feasible. It provides complete access to the ductal system and was expected to provide optimal clearance [8].

Topal *et al.* [11] reported that LCBDE with stone extraction can be performed with high efficiency, minimal morbidity, and without mortality and choledochotomy should be restricted to large bile duct stones that cannot be extracted through the cystic duct. The use of a flexible choledochoscope is preferable to fluoroscopic guidance. Zhang *et al.* [12] concluded that in cases requiring LCBDE, LTSE should be the first choice, whereas LC may be restricted to large, multiple stones. LC with primary closure without external drainage of the CBD stone is

Table 2 Type of common bile duct closure and conversion rate

	n (%)
Closure of choledochotomy	
Primary	6 (30.0)
T-tube	12 (60.0)
Choledochodudonostomy	2 (10.0)
Conversion	
No	18 (90.0)
Yes	2 (10.0)

Table 3 Postoperative complication and hospital stay

	n (%)
Complications	
No	16 (80.0)
Fever	2 (10.0)
Collection (bile leakage)	2 (10.0)
Bleeding	0 (0.0)
Jaundice	0 (0.0)
Cholangitis	0 (0.0)
Pancreatitis	0 (0.0)
Hospital stay (days)	
Minimum–maximum	2.0–10.0
Mean±SD	6.30±3.7
Median	6.0

as effective and safe as the T-tube insertion approach. Cai *et al.* [13] reported that laparoscopic primary closure of the CBD is safe and successful for the management of CBD stones. Primary closure can increase the quality of life and avoid the complications specifically associated with the use of a T-tube for biliary drainage. It is a better option, however, only if the indications are strictly followed.

Khaled *et al.* [14] conducted a study that included 120 cases and concluded that LCBDE with primary duct closure is a safe and effective approach to the management of choledocholithiasis that offers a single-stage treatment, a low morbidity rate, short operating time, and short postoperative hospital stay. The safety and effectiveness of LCBDE are affected by the laparoscopic experience of the operating surgeon as well as a policy of prompt reintervention for postoperative bile leak when clinically warranted. Leida *et al.* [15] studied 80 cases and the results confirm the safety and feasibility of choledochotomy for LCBDE and primary duct closure after laparoscopic choledochotomy. In effect, primary closure avoids the disadvantages associated with the use of the T-tube. Therefore, they recommended performing primary duct closure in suitable patients after laparoscopic choledochotomy. Tekin and Ogetman [16] also reported that laparoscopic exploration of the CBD via choledochotomy with the use of a choledochoscope is a safe and effective procedure. It can achieve high rates of stone clearance with minimal complications in patients in whom endoscopic removal of CBD stones is unsuccessful.

Conclusion

In this study after successful extraction of large CBD stones by laparoscopic choledochotomy in 20 cases, we concluded that LCBDE via the transcholedochal approach for managing choledocholithiasis is safe and feasible under the following circumstances; patients having CBD stones of 10 mm or more in size and a CBD diameter of more than 8 mm, preoperative MRCP was done to determine the stone load within the CBD and to give a road map about the anatomy of the biliary tree and finally the presence of an expert laparoscopic surgeon and the availability of a high quality laparoscopic set.

The availability of intraoperative cholangiogram and flexible choledochoscope is preferable for the process of LCBDE in the presence of multiple CBD stones in a CBD of 8 mm or more in diameter; however, large studies are needed to assess the long-term complication and to compare different options used to manage choledochotomy incision.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

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