

Laparoscopic transcystic common bile duct exploration in the management of choledocholithiasis

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Background: Common bile duct (CBD) stones are identified in 10-15% of patients undergoing surgery for symptomatic cholelithiasis. When choledocholithiasis is suspected preoperatively, it is recommended that endoscopic retrograde cholangiography (ERC) be performed, and if the choledocholithiasis is confirmed, the patient should then undergo endoscopic sphincterotomy (ES). When CBD stones are discovered intraoperatively, the surgeon proceeds with laparoscopic common bile duct exploration (LCBDE), converts the case to open CBD exploration and choledocholithotomy, or leaves the stones in place for postoperative ES and stone extraction. We report here our initial results of laparoscopic transcystic CBD exploration (LTCBDE) in the management of patients with choledocholithiasis.

Patients and methods: From October 2009 to June 2012, we performed 320 laparoscopic cholecystectomies for symptomatic gallstone disease at Zagazig University Hospitals. In the present study, intraoperative cholangiography (IOC) was performed in 47 out of 320 (14.7%) patients. It was negative in 5 (10.6%) patients and suggestive of CBD stones in 42 (89.4%) patients. The incidence of choledocholithiasis in our study was 13.12% (42 from 320 patients). Three patients were converted to open surgery directly when CBD stones were detected, and two patients were referred for postoperative ERCP. Laparoscopic CBD exploration (LCBDE) was attempted in 37 patients. In 7 patients laparoscopic choledochotomy was done. In the remaining 30 patients (71.4%) LTCBDE was performed.

Results: LTCBDE was successful in 27 out of 30 patients (90%). In three patients, LTCBDE failed and were converted to open surgery. Causes of failure of TCBDE were numerous stones (> 8) in one patient, impacted stones at distal CBD in another patient and intrahepatic displacement of stones in the third patient. The mean operative time was 110 ± 30 minutes. Postoperative complications included pulmonary atelectasis in two elderly patients, deep vein thrombosis in one patient and ileus in one patient. The overall complication rate was 13.3%. There were no deaths. No bile leak was observed in any of our patients and all were discharged within the first 48 hours. The mean recovery time was 8 days (ranging from 7 to 10 days). Time to return to full physical activity was 14 ± 4 days. Follow-up for 6 months to 2 years was possible in 26 patients (86.7%), and no residual stones were found in any of them.

Conclusion: CBD stones still occur in about 10-15% of patients undergoing LC. 90% of these patients could be treated successfully using LTCBDE, with no increase in morbidity or mortality; it seems reasonable to remove stones during the laparoscopic procedure to avoid the possibility of postoperative ERCP or conversion to open surgery. The complications, length of hospital stay, and recovery time were similar to outcomes in patients who underwent LC only. We found that multiple or impacted stones are risk factors for conversion to open surgery. The benefits attained by minimally invasive surgery confirm that LTCBDE should become the primary strategy in the vast majority of patients harboring common bile duct stones.

Key words: Laparoscopic cholecystectomy, common bile duct stones, laparoscopic common bile duct exploration.

Introduction:

Laparoscopic cholecystectomy (LC) has become the gold standard for the treatment of symptomatic cholelithiasis and cholecystitis.¹ Common bile duct (CBD) stones are identified in 10 to 15 percent of patients undergoing surgery for symptomatic cholelithiasis. CBD stones require extraction to avoid complications, such as acute suppurative cholangitis, obstructive jaundice, hepatic abscess, and acute pancreatitis.² Prior to the development of LC, the management of these patients was CBD exploration at the time of cholecystectomy.³ Clearance rates of \pm 90% were accepted as the standard of care. Endoscopic retrograde cholangiography (ERC), with or without sphincterotomy and stone removal (ERC \pm ES), was employed only in cases where cholangitis was present preoperatively, or where patients were not considered candidates for general anesthesia, or where CBD stones were discovered postoperatively.⁴⁻⁶

Until recently it was generally agreed that if stones were detected in the CBD on preoperative imaging studies, or if they were suspected on the basis of abnormal liver function tests, it seemed reasonable to remove the stones prior to cholecystectomy by ERC \pm ES.⁷ Although ERC plus ES allows successful removal of more than 90% of CBD stones, consideration must be given to the extra expense and the potential complications associated with this procedure. Even in the hands of experienced surgeons, the rate of complications is reported to be in the range of 4% to 6%. These complications may include acute pancreatitis, bleeding, perforation, and cholangitis.⁸ These factors and the laparoscopist desire to achieve the level of surgical success in managing choledocholithiasis that existed in the prelaparoscopic era led to the development of new laparoscopic techniques of CBD exploration.⁹ Both transcystic (via the cystic duct) and transductal (via choledochotomy) approaches were developed. The characteristics of the transcystic method proved to be consistent with the goals of laparoscopic approach: minimal morbidity,

no T-tube, no drain, and a rapid return to normal activity in most cases. The transductal approach proved useful in cases where large stones, intrahepatic stones, or a small friable cystic duct precluded the use of the transcystic method. The latter approach, however, required the acquisition of suturing and knot-tying skills not necessary in the transcystic method.¹ We report here our initial results of laparoscopic transcystic CBD exploration (LTCBDE) in the management of patients with choledocholithiasis in terms of successful stone removal, operative time, morbidity and mortality, and length of hospital stay.

Patients and methods:

From October 2009 to June 2012, we performed 320 laparoscopic cholecystectomies for symptomatic gallstone disease at Zagazig University Hospitals. Our patients included 240 women (75%) and 80 men (25%). Median age was 45.6 years (range 23-72 years). All patients underwent preoperative abdominal ultrasound imaging, liver function tests, and they were also asked about any history of jaundice or pancreatitis. On the basis of elevated bilirubin, gamma-glutamyltransferase (GGT) and alkaline phosphatase levels, a history of pancreatitis or jaundice, or the presence of a dilated common bile duct or common bile duct stones on preoperative ultrasound examination, selective cholangiography was performed. These were all considered risk factors for CBD stones **Table (1)**.

For laparoscopic intraoperative cholangiography (IOC), a clip was applied proximally across the cystic duct once it was well dissected. An incomplete vertical ductotomy was created, taking care not to injure the posterior wall of the duct. A cholangiogram catheter (4 to 5 F) with a metal reinforced tip was inserted into the abdomen through a transabdominal 14-gauge angiocatheter that has been placed in the right upper quadrant. The catheter was manipulated into the cystic duct with laparoscopic instruments. A clip or a cholangiogram clamp was loosely applied around the duct with the catheter. Placement of a hydrophilic guide

wire through the cholangiogram catheter facilitates placement of instruments for CBD stone extraction and dilatation of the cystic duct with balloon catheters or mechanical dilators if necessary.

Findings on cholangiography that are suggestive of CBD stones include dilated bile ducts, filling defects, or failure of contrast flow into the duodenum **Figure (1)**. In the present study, IOC was performed in 47 patients. It was negative in 5 patients and suggestive of CBD stones in 42 patients. Three patients were converted to open surgery directly when CBD stones were detected, and two patients were referred for postoperative ERCP. A laparoscopic CBD exploration (LCBDE) was attempted in 37 patients. In 7 patients laparoscopic choledochotomy was done. Laparoscopic transcystic CBD exploration (LTCBDE) was attempted in the remaining 30 patients. Patients with large (>8mm), numerous (> 8) or intrahepatic stones and those with small friable cystic duct were excluded from LTCBDE.

When IOC revealed CBD stones, a fifth trocar with a long intraabdominal sheath was placed high and laterally under the right costal margin to get axial access to the cystic duct. A guide wire was placed through the cystic duct into the CBD. To facilitate passage, the incision in the cystic duct was made close to the CBD. A balloon catheter was placed over the guide wire to dilate the cystic duct, if necessary. Using the same guide wire a flexible bidirectional choledochoscope with working channel was introduced. Saline was flushed through the scope using a pressure irrigation device. When the first stone was identified, a four-wire, 2.4-Fr basket was inserted down the working channel, passed just beyond the stone, opened, withdrawn, and closed, capturing the stone **Figure (2,3)**. The stone and basket assemblage then was pulled up to the tip of the scope and withdrawn together. Choledochoscopy was continued until no stones were identified and the ampulla could be seen, but not necessarily transgressed. Care was taken to extract stones in the right order and thereby preventing a more peripherally placed stone to whirl up

into an intrahepatic position. When impacted stones were found a balloon, was used to free them but removal was preferably done with the basket. Small stones and fragments of stones were flushed into the duodenum after intravenous administration of glucagon. An intrahepatic choledochoscopy was performed when it was possible depending on the angle in which the cystic duct entered the common bile duct. A completion cholangiogram was obtained to ensure that no stones were left **Figure (4)**. The cystic duct was secured with double endoloops or with two clips.

Results:

In the present study, IOC was performed in 47 out of 320 (14.7%) patients. It was negative in 5 (10.6%) patients and suggestive of CBD stones in 42 (89.4%) patients. The incidence of choledocholithiasis in our study was 13.12% (42 from 320 patients). Three patients were converted to open surgery directly when CBD stones were detected, and two patients were referred for postoperative ERCP. A laparoscopic CBD exploration (LCBDE) was attempted in 37 patients. In 7 patients laparoscopic choledochotomy was done. In the remaining 30 patients (71.4%) LTCBDE was performed. It was successful in 27 patients (90%). In three patients, LTCBDE failed and were converted to open surgery. Causes of failure of TCBDE were numerous stones (> 8) in one patient, impacted stones at distal CBD in another patient and intrahepatic displacement of stones in the third patient **Table (2)**.

The mean operative time was 110 ±30 minutes. Postoperative complications included pulmonary atelectasis in two elderly patients, deep vein thrombosis in one patient and ileus in one patient. The overall complication rate was 13.3%. There were no deaths. No bile leak was observed in any of our patients and all were discharged within the first 48 hours. The mean recovery time was 8 days (ranging from 7 to 10 days). Time to return to full physical activity was 14 ± 4 days. Follow-up for 6 months to 2 years was possible in 26 patients (86.7%) and no residual stones were found in any of them.

These results were shown in **Table(3)**.

Discussion:

Choledocholithiasis is found in 10-15% of patients who present for cholecystectomy.² Definitive treatment of these patients includes not only cholecystectomy, but also clearance of the entire duct system. The best treatment of choledocholithiasis must be simple, reliable, readily available, and cost-effective.¹

When choledocholithiasis is suspected preoperatively, it is recommended that ERCP be performed, and if the choledocholithiasis is confirmed, the patient should then undergo ES.¹⁰ However, there are important variables to consider: first, ES allows successful removal of more than 90% of common bile duct stones in most series, but depends on the availability of an experienced and skilled endoscopist with a high success rate in achieving biliary cannulation and stone extraction. Another consideration is its high cost.¹¹ ERCP is a procedure with potential complications. Acute pancreatitis occurs in approximately 6% of patients who undergo ERCP, and when sphincterotomy for stone extraction is performed, another 4% of patients will have additional complications including bleeding, perforation, and cholangitis.⁸ Another issue is the potential risk of delayed stricture at the sphincter, which is something to be aware of in the long-term follow-up of younger patients.^{12,13}

In the early days of laparoscopic cholecystectomy, ERCP plus ES was usually recommended for any patient who had jaundice, recent pancreatitis, or a dilated bile duct on ultrasonography, but this approach led to a high incidence of normal ERCP findings ranging from 40% to 70%.⁷ At the present time, these indicators are considered minor risk factors for the presence of common bile duct stones in most patients.¹¹

When CBD stones are discovered intraoperatively, the surgeon either proceeds with LCBDE, converts the case to open CBD exploration and choledocholithotomy, or leaves the stones in place for subsequent ERC ± ES.^{5,14,15} Although any one of these alternatives is acceptable, the latter two

are more costly and are associated with increased morbidity. It would seem wise in most situations, therefore, to attempt LCBDE unless the patient's condition demands termination of the anesthetic as soon as possible. If LCBDE is unsuccessful or not attempted, then the decision regarding conversion to open CBD exploration vs. postoperative ERC ± ES will depend on the local availability of expert endoscopists.¹

In our series of 320 laparoscopic cholecystectomies, we found 42 patients with stones in the common bile duct, for an incidence of 13.1%. All of them were diagnosed during IOC, which was performed selectively in 47 patients. Three patients were converted to open CBD exploration, and two were referred for postoperative ERCP, with successful stone removal on all five patients. In 7 patients laparoscopic choledochotomy was done. In the remaining 30 patients (71.4%) with CBD stones, LTCBDE was performed. It was successful in 27 patients (90%). We found that multiple CBD stones (>8), intrahepatic displacement of stones, and stones impacted at the ampulla are risk factors for conversion. Three patients (10%) had to be converted because of these risk factors.

Mean operative time was 110 ± 30 minutes. The overall complication rate was 13.3%, and was related to pulmonary atelectasis in two elderly patients, deep vein thrombosis in one patient and postoperative ileus in one patient. There were no deaths. All patients were discharged from the hospital within the first 48 hours. We did not observe biliary fistulas in our patients, and this was attributed to secure clipping/ligation of the cystic stump in all cases. Recovery time was the same as in patients who underwent laparoscopic cholecystectomy only, and ranged from 7 to 10 days.

We have adopted the transcystic laparoscopic approach as the primary strategy for treating CBD stones found intraoperatively. Although we still rely on postoperative ERCP ± ES for high-risk patients, or patients with multiple stones who are not suitable for the transcystic extraction. Patients with multiple stones, large stones,

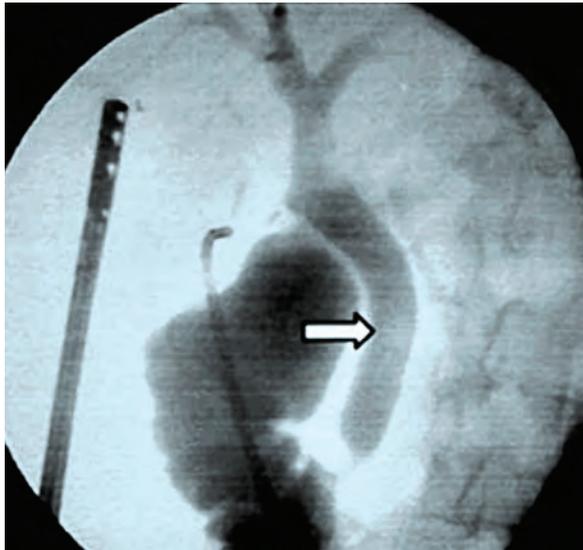


Figure (1): Intraoperative cholangiogram showing a distal CBD stone.



Figure (2): CBD stone as seen through choledochoscope.



Figure (3): 4-wire basket introduced through the choledochoscope to capture stone.



Figure (4): Completion cholangiogram.

Table 1: Risk factors for CBD stones

	Risk factor	No of patients
Abdominal U/S	CBD stones	25
	Dilated CBD	10
Liver function tests	Elevated bilirubin	20
	Elevated Alkaline Phosphatase	18
	Elevated GGT	23
History	Jaundice	3
	Pancreatitis	2

or stones in the hepatic ducts were treated by laparoscopic choledochotomy to avoid conversion. Open CBD exploration should be rarely needed at the present time. Our results

are similar to those reported by Ortega et al 2003, Lyass and Phillip 2006 and Stromberg et al 2008 in terms of success of stone removal, minimal complications, a short hospital stay,

Table 2: Results of LTCBDE in the present study.

	No	Percent
IOC	47/320	14.7%
CBD stones	42/320	13.1%
LTCBDE	30/42	71.4%
Success	27/30	90%
Failure:		
Total	3/30	10%
Causes:		
Numerous stones (>8)	1/30	3.3%
Impacted stones at ampulla	1/30	3.3%
Intrahepatic displacement of stones	1/30	3.3%

Table 3: Operative time, hospital stay, and outcomes after LTCBDE.

Mean operative time	110±30 minutes
Postoperative hospital stay	24-48 hours
Postoperative complications:	4/30 (13.3%)
Pulmonary atelectasis	2/30 (6.7%)
Deep vein thrombosis	1/30 (3.3%)
Ileus	1/30 (3.3%)
Recovery time	
Mean	8 days
Range	7-10 days
Return to full physical activity	14±4 days
Mortality	0/30 (0%)
Follow-up:	
Duration	6 months – 2 years
No. of patients	26/30 (86.7%)
Residual stones	0/26 (0%)

and rapid recovery time.^{11,16, 17}

The optimal management of choledocholithiasis remains unclear in the present laparoscopic era, but we encourage more surgeons to be trained in this technique because we are convinced that most patients with stones in the common bile duct can be managed by this gentle technique with good results. Management in one session is the optimal approach in terms of safety, patient satisfaction, and cost-effectiveness. It is now time to return the management of CBD stones to the surgeons as the standard of care in “minimally invasive treatments”.

Conclusion

CBD stones still occur in about 10-15% of patients undergoing LC. 90% of these patients could be treated successfully using LTCBDE, with no increase in morbidity or mortality; it seems reasonable to remove stones during the laparoscopic procedure to avoid the possibility of postoperative ERCP or conversion to open surgery. The complications, length of hospital stay, and recovery time were similar to outcomes in patients who underwent LC only. We found that multiple or impacted stones are risk factors for conversion to open surgery. The benefits attained by minimally invasive surgery confirm that LTCBDE should become the primary strategy in the

vast majority of patients harboring common bile duct stones.

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