

## Clinical Trials Study

## Intraoperative endoscopic retrograde cholangio-pancreatography: A useful tool in the hands of the hepatobiliary surgeon

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patients with gall bladder stones (GS) and common bile duct stones (CBDS).

**METHODS:** Patients treated for GS with CBDS were included. LC and intraoperative transcystic cholangiogram (TCC) were performed in most of the cases. Intraoperative ERCP was done for cases with proven CBDS.

**RESULTS:** Eighty patients who had GS with CBDS were included. LC was successful in all cases. Intraoperative TCC revealed passed CBD stones in 4 cases so intraoperative ERCP was performed only in 76 patients. Intraoperative ERCP showed dilated CBD with stones in 64 cases (84.2%) where removal of stones were successful; passed stones in 6 cases (7.9%); short lower end stricture with small stones present in two cases (2.6%) which were treated by removal of stones with stent insertion; long stricture lower 1/3 CBD in one case (1.3%) which was treated by open hepaticojejunostomy; and one case (1.3%) was proved to be ampullary carcinoma and whipple's operation was scheduled.

**CONCLUSION:** The hepatobiliary surgeon should be trained on ERCP as the third hand to expand his field of therapeutic options.

**Key words:** Obstructive jaundice; Endoscopic retrograde cholangio-pancreatography; Gall stones

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### Abstract

**AIM:** To evaluate the efficacy of intraoperative endoscopic retrograde cholangio-pancreatography (ERCP) combined with laparoscopic cholecystectomy (LC) for

**Core tip:** The incidence of common bile duct stones (CBDS) in patents with gall bladder stones (GS) varies between 7% and 20%. Management of CBDS is

changing with advances in endoscopic techniques in many regards. Laparoscopic cholecystectomy is the gold standard in treating GS. This has created controversies in the management of CBDS. The hepatobiliary surgeon should be trained in endoscopic retrograde cholangio-pancreatography as the third hand to expand his field of therapeutic options.

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## INTRODUCTION

The incidence of common bile duct stones (CBDS) in patients with gall bladder stones (GS) is 7 to 20%<sup>[1,2]</sup>. Laparoscopic cholecystectomy (LC) is the gold standard in treating GS (3). This has produced debates in the treatment of CBDS<sup>[3,4]</sup>. Many authors have tried to find an optimal option to manage combined CBDS and GS. Different options are available. All CBDS existing at the time of cholecystectomy should be extracted, since residual stones in the common bile duct (CBD) may cause subsequent hepatobiliary and pancreatic complications<sup>[4]</sup>.

There are different options that exist for removal of CBDS, including preoperative endoscopic retrograde cholangiopancreatography (ERCP) before LC, laparoscopic common bile duct exploration, open CBD exploration and postoperative ERCP<sup>[2,5,6]</sup>. The use of preoperative ERCP has been argumentative<sup>[4]</sup>. Many studies found that 40%-90% performed a useless procedure due to passed stones, failed clearance of CBD, and retained stones despite its complications<sup>[7-13]</sup>. Postoperative ERCP avoids unnecessary examination but has a failure rate of 7%-14%<sup>[2,8,10]</sup>. LC with intraoperative ERCP and endoscopic sphincterotomy (ES) is an alternative technique for management of GS and CBDS<sup>[2,11,14]</sup>.

Laparoscopic common bile duct exploration (LCBDE) is successful in removing the CBD stones in 80%-95% of cases but it is time consuming with a morbidity rate about 4%-16%<sup>[15,16]</sup>. However, the limitation of this technique is when there are multiple large or impacted ductal stones. It needs more laparoscopic skill and a longer learning curve is required for LCBDE<sup>[17-21]</sup>.

ERCP is done mainly by physicians and radiologists, and rarely by surgeons. The wide use of laparoscopic surgery and the advances in technology and training made ERCP and intraoperative US important aids in the hands of experienced hepatobiliary surgeons<sup>[1-3]</sup>. The optimal treatment of CBDS is dependent on the skills of the surgical team and the availability of instruments and endoscopies at the hospital. The single procedure has advantages over the two step procedure<sup>[2]</sup>.

This study was planned to evaluate intraoperative ERCP combined with LC for patients with GS and CBDS as regards the success rate and safety, and to show the importance of ERCP for the hepatobiliary surgeon.

## MATERIALS AND METHODS

### Patients

Consecutive patients with GS and CBDS at the Gastroenterology Surgical Center, Mansoura University, Mansoura, Egypt, during the period from August 2011 through April 2013, were managed by a single step treatment combining laparoscopic cholecystectomy and intraoperative ERCP. After completion of LC in the same set, exclusion criteria included age older than 80 years, pregnancy, previous history of gastrectomy, or coagulopathy.

Informed consent was obtained from all patients to be included in the study, after explanation of the nature of the disease and possible treatment. The study was approved by the local ethical committee of our hospital.

### Study procedure

All patients were subjected to careful history taking, clinical examination, and laboratory investigation including total serum bilirubin, aspartate aminotransferase (AST), alanine aminotransferase (ALT). Abdominal ultrasound was done for all cases to assess GB and CBD dilation and stones. Magnetic resonance cholangiography (MRCP) was done in some cases where US could not confirm the diagnosis. A preoperative and intraoperative prophylactic antibiotic (cefotax 1 g, iv) was given to all patients. Somatostatin was given routinely to all patients one hour before surgery (1 mL, sc) to prevent development of post ERCP pancreatitis.

Laparoscopic cholecystectomy was started in all cases using the standard 4-ports technique under general anesthesia. Intraoperative cholangiogram was performed by the transcystic route in all cases. When laparoscopic cholecystectomy was finished, we temporarily put in an intraabdominal drain and closed the ports and prepared for ERCP. ERCP was performed in the supine position or the semiprone position. Endoscopic sphincterotomy was done in all cases using an endoflex type double lumen sphincterotomy and both Terumo and Hydraxag wires. Removal of stones was done by balloon, dormia basket or mechanical lithotripsy in difficult cases. A completion cholangiogram was done to confirm freedom of the CBD from stones. Electrocautery probes were used to ensure haemostasis if there was suspicion of bleeding from the papillotomy.

### Assessment

The following items were recorded: difficulty of cannulation of the biliary tract using Freeman score [1 = one to five attempts (easy), 2 = six to 15 attempts (moderate difficult), 3 = more than 15 attempts (difficult), 4 = failed]<sup>[22]</sup>; the need for precut for cannulation; total

**Table 1** Demographic data

Variables	Data
Age (yr)	32 (18-59)
Sex	
Male	20 (25)
Female	60 (75)
Bilirubin (mg)	3.8 (0.4-10)
AST (IU)	99 (21-468)
ALT (IU)	93 (24-1000)
CBD diameter (mm)	11 (6-15)
Size of stones in CBD	
Mean size (mm)	8 (5-17)

Data are expressed as absolute numbers (percentage) or median (range). CBD: Common bile duct stone.

**Table 2** Results

Variables	Data
Duration of operation (min)	95 (75-200)
Hospital stay (h)	19 (18-24)
Time to reach papilla (s)	25 (20-45)
ERCP done	76 (95)
ERCP not done (passed stone by TCC)	4 (5)
Difficulty in cannulation	
Grade 1	50/76 (65.8)
Grade 2	24/76 (31.58)
Failure of cannulation	2 (2.6)
Precut papillotomy	8/76 (10.52)
Results	
ERCP with stone extraction	64 (84.2)
Passed stone	6 (7.9)
Short stricture lower end CBD with stone ES with stent	2 (2.6)
Long stricture lower 1/3 CBD...treated by open hepaticojejunostomy	1 (1.3)
Filling defect at the lower end biopsied... adenocarcinoma	1 (1.3)
Failure of cannulation	2 (2.6)
Method of stone extraction	
Balloon	52/66 (78.8)
Basket	4/66 (6.1)
Combined basket and balloon	8/66 (12.1)
lithotripsy	2/66 (3.1)

Data are expressed as absolute numbers (percentage) or median (range). ERCP; Endoscopic retrograde cholangio-pancreatography; CBD: Common bile duct stone; TCC: Transcystic cholangiogram.

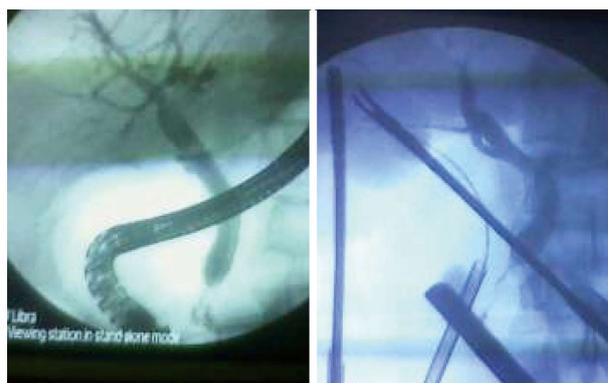
operative time; hospital stay; and cost. Any complications of the procedure were assessed using Cotton's criteria: mild (2-3 d spent in hospital); moderate (4-10 d in hospital); or serious (more than 10 d in hospital or need surgical or radiological interference)<sup>[23]</sup>.

### Follow up

The patients were followed up on postoperative day 7, and then at 1 mo and 3 mo after the operation. Patients were also seen at our clinic if they developed symptoms between follow-up visits. Follow up was done by clinical examination, serum bilirubin and abdominal ultrasound.

### Statistical analysis

Statistical analysis of the data in this study was performed



**Figure 1** Short stricture at lower third common bile duct stone with small stone above the stricture.

using SPSS software, version 17. For continuous variables, descriptive statistics were calculated and were reported as median. Categorical variables were described using frequency distributions

## RESULTS

### Preoperative data

Eighty patients seen during the recruiting period, (20 men and 60 women) were eligible and entered the study. The median age was 32 years. All patients presented with abdominal pain and jaundice. The median preoperative bilirubin was 3.8 (range 0.4-10) mg (Table 1).

Abdominal ultrasound revealed the presence of multiple GS in all patients. The median diameter of the CBD was 11 (6-15) mm (Table 1).

### Operative data

Laparoscopic cholecystectomy was successful in 79/80 cases (98.8%). Intraoperative transcystic cholangiogram (IOTC) was performed in 78 cases. IOTC was not performed in two cases due to failure of cannulation of the narrow cystic duct. It showed passed stones in four cases so ERCP was unnecessary for these cases.

ERCP was performed in 76 cases and was successful in 74 cases (97.3%). Failure of cannulation occurred in two cases (one case due to atrophic papilla, and another one due to juxta-diverticulum papilla). The cannulation was easy in 50/76 cases (65.8%) while precut was needed in 8 cases (10.5%) (Table 2).

Intraoperative ERCP showed a dilated CBD with stones in 64 cases (84.2%) where removal of stones were successful. Six cases (7.9%) showed passed stones. A short lower end stricture with small stones presented in 2 cases (2.6%) who were treated by removal of stones with stent insertion and follow up CT (Figure 1). Postoperative CT was free and removal of the stent was done 1 mo later. Long stricture lower 1/3 CBD was found in 1 case (1.3%) and treated by open hepaticojejunostomy (Figure 2), and 1 case (1.3%) was proved to be ampullary carcinoma and whipple's operation was scheduled (Figure 3, Table 2). Failure of cannulation occurred in 2 cases, (1 case due to atrophic papilla, and another case due to



Figure 2 Long stricture at lower third common bile duct stone (Open hepaticojejunostomy was done).

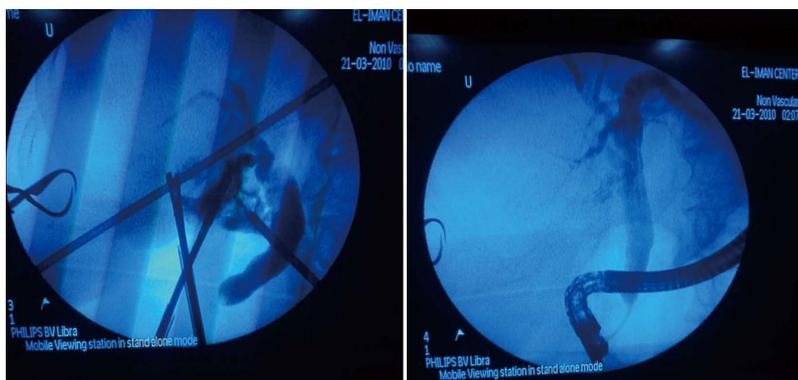


Figure 3 Filling defect in lower part of common bile duct stone. Biopsied-Ampullary carcinoma.

juxta-diverticulum papilla) and the decision was made to complete the two cases by laparoscopic CBD exploration.

Stone extraction was done by balloon in 56/66 cases (78.8%), by basket in 4/66 cases (6.1%), by combined balloon and basket in 8/66 cases (12.1%), and mechanical lithotripsy was needed in 2 cases (3.1%) that had large hard stones.

The median operative time was calculated for both maneuvers and found to be 95 (75-200) min. The postoperative course was smooth in all cases with no mortality. Melena occurred in 1 case due to peptic ulcer.

**Postoperative data**

The complication rate after ERCP was 5/76 (6.6%) and took the form of bleeding papillotomy in 2 cases managed by side view endoscopy using electrocautery probe, hyperamylasemia in 2 cases and passed conservatively, and pancreatitis in 1 patient which was managed conservatively

The median hospital stay was 19 (18-24) h. The average net cost was \$850 (\$700-1350) for both maneuvers (Table 2).

**Follow up**

All patients were followed up on postoperative day 7, 1 mo, and 3 mo postoperatively. No recurrent or residual stones were detected at these times.

**DISCUSSION**

The most popular methods of detecting CBDS include intraoperative cholangiography (IOC), intraoperative ultrasonography, ERCP, endoscopic ultrasonography, and MRC<sup>[4]</sup>. ERCP had its beginning in the late 1960s, with its introduction in the United States by McCune<sup>[24]</sup>. Endoscopic papillotomy and stone removal is successful in more than 90% of cases, with 5% morbidity and less than 1% mortality rate in expert hands<sup>[25]</sup>. Preoperative ERCP and ES is an effective option for removing CBDS in most cases, but only 10%-60% of patients will have stones on ERCP<sup>[1,6,8,9,26]</sup>. Even with strict selection criteria more than 10% of the preoperative ERCP are normal, and the possibility of occurrence of post-ERCP pancreatitis varies between 1%-13.5%<sup>[10,27-30]</sup>. Post-operative ERCP avoids undue trial but has a failure rate of 7%-14%<sup>[2,8,10]</sup>.

Up till now ERCP has been mastered by either physicians or radiologists. The hepatobiliary surgical teams in our center have mastered ERCP, with more than 7000 procedures performed since 1991. So, we continuously have the availability to perform intraoperative ERCP (IO-ERCP) maneuvers.

ElGeidie *et al*<sup>[11]</sup> reported that LC and IO-ERCP is an available treatment for managing CBDS but it needs a well equipped hospital as regards endoscopies and a

skillful surgical team. The success rate for IO-ERCP was 97.8%, the mean surgical time was 112 min, postoperative stay was 1.3 d and the morbidity rate was 4.5%.

LC and IO-ERCP is a single procedure for management of CBDS that decreases the hospital stay and costs. It also reduces unnecessary ERCP and decreases the need to return to the operating room following technical failure of ERCP. Ghazal *et al.*<sup>[2]</sup> performed a study of 45 cases with GS and with a suspected or confirmed CBDS. Cholecystectomy was completed laparoscopically in 44 patients. The conversion rate was 1/45 due to marked adhesions at the Calot's triangle. IOC was done in all cases and revealed CBDS in 36 cases. IO-ERCP with ES was performed successfully in 73.2% of patients. The mean surgical time was 119 min (ranging from 100 to 150 min). There was no postoperative morbidity related to the procedure and no evidence of retained CBDS on follow up<sup>[2]</sup>.

DePalma *et al.*<sup>[31]</sup> reported a 100% success rate in stone clearance with IO-ERCP in 15 cases, with a mean surgical time of  $97.7 \pm 30.4$  min<sup>[31,32]</sup>. However, it needs organization to overcome the technical problems and to encourage the spread of this single procedure LC/ERCP<sup>[33]</sup>. It is difficult to assure the immediate availability of an endoscopist if stones are detected unexpectedly on IOC. This situation is time consuming and prolongs the operative times. The technical difficulties of the combined approach are related to both the supine position as more experience is required for successful cannulation of the papilla, and insufflation of gases<sup>[33]</sup>.

In the present study the authors are surgeons who are experienced in both laparoscopy and ERCP; thus it is easy to secure an endoscopist if stones are detected unexpectedly on IOC immediately so the operative time in our study was shorter than other studies. Patients in our study were discharged after a mean hospital stay of 19 h (range 18-120 h). Williams and Vellacot<sup>[8]</sup> reported a hospital stay of 2.5 d, ranging from 1 to 5 d. Ghazal *et al.*<sup>[2]</sup> reported that the mean hospital stay was  $2.55 \pm 0.89$  d.

In our study some settings had been performed to solve the difficulties of IO-ERCP. It is technically more difficult to do ERCP in the supine position but it improves fluoroscopic visualization of hilar anatomy. We found that the position of the endoscope required for facing the papilla in the duodenum was somewhat different and was overcome by using specific techniques, such as clockwise rotation of the head of the endoscope or clockwise body rotation. To overcome the issue of intestinal distension, we perform LC and IOC first then after completion of LC we perform ERCP.

Single-stage LC/ERCP provides effective management for CBDS and may be helpful in selected patients who may not afford a second anesthetic maneuver<sup>[7]</sup>. Also, to increase the success rate of IO-ERCP, various rendezvous techniques were developed through the cystic duct<sup>[34]</sup>. Rabago *et al.*<sup>[35]</sup> presented a prospective randomized study of LC with two different approaches: preoperative ERCP *vs* IO-ERCP for CBDS. Intraoperative ERCP was

performed using a rendezvous technique.

A Swedish registry shows successful bile duct cannulation was achieved in 92% of the ERCPs performed. The presence of CBDS was seen in 36.8% of examinations. Perioperative and postoperative morbidities were 2.5% and 9.8%, respectively. The rate of ERCP-induced pancreatitis was 2.7%, and the hospital mortality rate was 5.9%<sup>[36]</sup>.

In conclusion, hepatobiliary surgery is an expanding field of surgery. The hepatobiliary surgeon should be acquainted with operative ultrasound, endoscopy and ERCP as the third hand to expand his field of therapeutic options. This will limit the time loss in difficult biliary situations.

## COMMENTS

### Background

Surgeons have tried to find an optimal option to manage combined common bile duct (CBD) stones and gall bladder stones (GS). Different options are available. All CBD stones (CBDS) present at the time of cholecystectomy should be removed, since residual stones in the CBD may cause subsequent hepatobiliary and pancreatic complications. There are different options exist for removal of CBDS, including preoperative endoscopic retrograde cholangio-pancreatography (ERCP) before laparoscopic cholecystectomy (LC), laparoscopic common bile duct exploration, open CBD exploration and postoperative ERCP.

### Research frontiers

ERCP is performed mainly by physicians and radiologists, and rarely by surgeons. The wide use of laparoscopic surgery and the advances in technology and training make ERCP and intraoperative US important aids in the hands of the experienced hepatobiliary surgeon.

### Innovations and breakthroughs

The optimal treatment of CBDS is dependent on the skills of the surgical team and availability of instruments and endoscopies at the hospital. There is no doubt that the single procedure has advantages over the two step procedure. This study was planned to evaluate intraoperative ERCP combined with LC for patients with GS and CBDS as regards the success rate and safety, and to show the importance of ERCP for the hepatobiliary surgeon.

### Applications

The hepatobiliary surgeon should be trained in ERCP as the third hand to expand his field of therapeutic options.

### Peer review

This manuscript of "Intraoperative endoscopic retrograde cholangio-pancreatography, a useful tool in hands of hepatobiliary surgeon" is well written.

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