Early Experience in Laparoscopic Common Bile Duct Evaluation

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Abstract
Aim: To evaluate the role of Laparoscopic exploration of common bile duct in the management of common bile duct stones and its effectiveness to clear the CBD stones. Patients and methods: This prospective study included 99 consecutive patients with calculic obstructive jaundice that were admitted to department of surgery Minia University Hospital between Jan 1992 and Jan 1993, all procedures were done with laparoscopic CBD exploration (LCBDE). Results: There was bile leak in 9 cases, residual stone in 2 cases, 9 case with wound infection, 9 case postoperative ileus, 9 case with bile duct injury and no mortality. Conclusion: Laparoscopic choledocholithotomy has been shown to be feasible, safe, and highly effective in the management of choledocholithiasis. The main advantage of this management strategy is a single hospital admission for the majority of patients with CBD stones and low morbidity and mortality rates, which both compare favorably with those of either open surgery or management of CBD stones with ERCP.

Key words: Laparoscopic, CBD and Evaluation

Introduction
The incidence of common bile duct stones among patients undergoing cholecystectomy is 1-2% and the incidence of common bile duct stones unsuspected on preoperative investigations but discovered at the time of routine intra-operative cholangiography is from 7% to 12%. Primary calculi originating inside the duct are uncommon. The majority of these stones is secondary calculus, having been produced in the gall bladder and migrates to the common bile duct. Many common bile duct stones are small and therefore can pass spontaneously into duodenum; the larger ones can be impacted in common bile duct due to narrowing in the ampulla of Vater and cause jaundice, cholangitis or biliary pancreatitis. 5% to 10% of asymptomatic cases may eventually develop symptoms and so this group will require treatment.

The modern era of common bile duct surgery started with Mirizzi, who introduced the intra-operative cholangiography in 1937. Intra-operative choledochoscopy had been developed as an adjunctive to intra-operative cholangiography, which helped to detect the common bile duct stones. Efforts have been exerted to treat patients with common bile duct stones in one session and avoid potential complications of endoscopic sphincterotomy.

Laparoscopic bile duct clearance, which was first carried out in April 1991, has since then been shown to be a potentially preferable option when compared with endoscopic retrograde cholangio-pancreatography (ERCP), allowing the surgeon to reclaim the treatment of common bile duct stones detected at routine intra-operative cholangiography.

Martine et al reported on 211 consecutive patients undergoing laparoscopic exploration of common bile duct suggesting that the procedure was an equally effective alternative to ERCP with the benefit of cost reduction by means of a single stage and avoidance of known morbidities associated with ERCP, the findings of decreased hospital stay associated with laparoscopic common bile duct exploration and correspondingly lower cost of treatment has
raised suggestions of superiority of single stage treatment\(^6\).

Recently, single stage laparoscopic cholecystectomy and laparoscopic exploration of common bile duct is the primary approach for patients with common bile duct stones, except in the presence of severe biliary sepsis\(^9\).

Any contemporary approach to the management of common bile duct stones must take into consideration the availability of local expertise and technology. An integrated health care team including surgeons, gastroenterologists and radiologists will help to decrease patient morbidity, enhance cost-effectiveness and optimize patients’ quality of life\(^5\).

**Patients and methods**

This study, was carried out in the department of General surgery, Minia university hospital during the period from Jan \(\gamma\) to Jan \(\gamma\). Eleven patients were subjected to laparoscopic exploration of CBD. Each patient was thoroughly evaluated by our surgery team.

Inclusion criteria were large or multiple CBD stones, concomitant gallstones and CBD stones in a young patient. Previously failed endoscopic removal of stones due to difficult cannulation or due to failed extraction of stones, recurrent pyogenic cholangitis combined with multiple extrahepatic stones which may require stone extraction with drainage.

Exclusion Criteria include Severe cardiac disease which carries anesthetic risks, severe coagulopathy, patients had small stone that can be removed using ERCP and presence of severe inflammation (as gangrenous cholecy-stitis or acute necrotizing pancreatitis, etc.) at the region of portahepatis making unsafe identification of CBD.

A written informed consent form patients was taken. The details of the study and the operation was explained for the patients. The patients were informed about the procedure and the possible risks and complications which may require reoperation as biliary leakage and also complications of the T-tube as biliary infection or migration of the tube causing biliary tract obstruction and also the possible bile duct leaks and peritonitis which may follow removal of the T-tube.

Data was collected by designed wall structured sheet. The aim of our study was explained to all patients. Full history, examination, laboratory and radiological investigations were done for patients. Diagnosis of CBD stones was based on clinical presentation, liver function tests, abdominal ultrasound, abdominal CT and cholangiography. The latter may include ERCP, percutaneous transhepatic cholangiography or magnetic resonance cholangiopancreatography (MRCP).

In general, ERCP was preferred in patients who had biliary sepsis (acute cholangitis or biliary pancreatitis), with exception of the patients with previous gastrectomy. Percutaneous transhepatic biliary drainage (PTD) was preferred for biliary decompression when ERCP had failed. MRCP was performed to assess biliary tree in stable, non-Septic patients. If endoscopic extraction was unsuccessful or was considered inappropriate, biliary stenting could be inserted and LECBD was performed 2 to 7 weeks later. Endoscopic extraction could be difficult in patients who had multiple and large CBD stones.

Patients with a history of previous upper abdominal surgery were excluded during the early period of the study. Correction of Prothrombin deficiency by Vitamin K administration. Antibiotic prophylaxis to guard against infection (third generation cephalosporin was the drug of choice). Adequate hydration by IV fluids to prevent possibility of renal failure and IV mannitol was prescribed if urine output is not satisfactory. Prevention of thromboembolism by the use of below knee elastic stockings or crepe bandage and early ambulation in the first postoperative day were the best prophylaxis for postoperative thromboembolism. Preoperative pulmonary functions studies were obtained for patients with respiratory illness. Patients with impaired lung functions were at risk for pulmonary complications especially during the first \(\gamma\) hours postoperatively. Treatment of airway diseases were necessary. Obtaining arterial
Early experience in laparoscopic common Bile duct evaluation

blood gases was important procedure. Preoperative anesthetic consultation was indicated for all patients to evaluate patient’s condition and evaluate the hepatic and renal functions

Surgery was performed under general anesthesia with the patient on supine position on X-ray table. All patients received routine prophylactic antibiotics. The patient lies in American position. Five trocars were used: Optical trocar was positioned in the umbilical area, with 1° degree scop. (Visera Pro OTV-S™), Operating trocars which were two trocars were used and were positioned in the epigastrum 1·0 mm and the right subcostal area 0 mm in the MCL. Retracting trocar 0 mm was positioned in the right subcostal area on the AXL and a fifth trocar 0 mm was positioned over the area of GB to introduce the instrument or the choledoscope into the common bile duct.

After routine abdominal exploration, we focused attention at the biliary tree and GB. Every important step in the surgery was adequate exposure of sub hepatic area. The patient was placed in steep-reverse trendelenburg position with slight tilt to the left, to facilitate the descend of organs toward the pelvis and to left. The duodenum was retracted caudally with the retractor. The GB was retracted upward laterally to ensure safe dissection and good exposure of anterior surface of Calot’s triangle. After adhesions to the GB were freed, Calot’s triangle was stretched open making retraction on the fundus of the GB superior and stretching on CBD Laterally to the right side by making retraction laterally on the Hartman’s pouch. The aim of this step was to isolate the biliary and vascular elements at the Calot’s triangle. The dissection was in close relation to the GB at the junction of the Hartman’s pouch and the CBD. The peritoneum over the neck of the GB was incised both posteriorly and anteriorly. Then skeletonization of the cystic pedicle was performed, the artery was clipped proximally and distally. The cystic duct was clipped close to junction with the GB. Then we open the anterior peritoneal layer which is along the free border of the Lesser omentum, hemostasis was done and the anterior surface of the CBD was exposed over length of about 1·0 mm to 1·0 mm. The anterior surface of the common bile duct may be cleared of the overlying fatty tissue near cystic duct-common duct junction. The choledochotomy was made vertically and long enough to allow insertion of the choledoscope and extraction of stones, with cautious not to tear the common bile duct. Longitudinal incision about 1 cm length or as long as the largest stone diameter.

Care was taken to avoid injury of posterior wall of CBD. This diminishes the time that may be spent in closing the choledochotomy. The choledochotomy was made longitudinally in the supraduodenal portion of CBD with retractile blades or scissors. It could be enlarged if necessary. It could be used for CBD measuring more than 1·0 mm in diameter. Access to the common bile duct was facilitated by retracting on the clipped cystic duct stump. Risks were posterior injury of the common duct and too short incision which lead to tear of the CBD during stone extraction and manipulation.

Results
Our study performed on 11 patients in general surgery department, Minia university Hospital. All of these patients had gallbladder stones with CBD stones as shown by abdominal ultrasound and CT. The study included 8 females (44%) and 2 males (11%). The age of the subjects ranged between 1·0 to 5·0 years (mean age 3·0 ± 3·1)

At initial presentation, the patients presented with biliary pancreatitis (n=1, 4%), obstructive jaundice with deranged liver function tests (n=1, 4%), acute cholecystitis (n=3, 17%) and biliary colic (n=4, 16%) as shown in table (1).
Table (1) : Initial presentation of patient

<table>
<thead>
<tr>
<th>Initial presentation of patients</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biliary colic</td>
<td>5 (4%)</td>
</tr>
<tr>
<td>Acute cholecystitis</td>
<td>3 (22%)</td>
</tr>
<tr>
<td>Obstructive jaundice</td>
<td>5 (18%)</td>
</tr>
<tr>
<td>Biliary pancreatitis</td>
<td>1 (6%)</td>
</tr>
</tbody>
</table>

Endoscopic retrograde cholangiopancreatography was attempted in six patients, but failed due to either difficult cannulation due to anatomical difficulties or due to failed extraction due to large size of stones.

Mean operation time was 11.0 ± 1.1 (range 9.0 - 13.0) min with a mean postoperative hospital stay of 17.3 ± 1.5 (range 12 - 21) days. There were no postoperative deaths. The mean intraoperative blood loss was 78.7 ± 3.5 (mL) and no patient required postoperative transfusion as shown in table (2).

Table (2): Operative time, intraoperative blood loss and postoperative hospital stay.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Range</th>
<th>Mean±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative time (min)</td>
<td>9.0 - 13.0</td>
<td>12.0 ± 1.1</td>
</tr>
<tr>
<td>Intraoperative blood loss (ml)</td>
<td>5.0 - 12.0</td>
<td>78.7 ± 3.5</td>
</tr>
<tr>
<td>Postoperative hospital stay (days)</td>
<td>10 - 19</td>
<td>17.3 ± 1.5</td>
</tr>
</tbody>
</table>

Table 2 is a summary of the mortality and morbidity in our patients undergoing LECBD. The patient with postoperative ileus recovered uneventfully with conservative treatment. The patient with wound infection was managed conservatively. There were no major complications related to T-tube insertion. The patient with a bile leak was successfully managed by Endoscopic stenting.

Complete ductal clearance was achieved in 5 patients (41%). Duct clearance was incomplete in two patients. The two patients underwent ERCP for extraction of impacted stone. It was thought the duct had been cleared laparoscopically, was found to have retained stones on T tube cholangiography at 14 day postoperative.

Table (3) : Postoperative morbidity and mortality of laparoscopic exploration of common bile duct.

<table>
<thead>
<tr>
<th>Morbidity/mortality</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bile leak</td>
<td>1 (9%)</td>
</tr>
<tr>
<td>Residual stones</td>
<td>3 (18%)</td>
</tr>
<tr>
<td>Wound infection/bleeding</td>
<td>1 (9%)</td>
</tr>
<tr>
<td>Bile duct injury</td>
<td>3 (18%)</td>
</tr>
<tr>
<td>Paralytic ileus</td>
<td>1 (6%)</td>
</tr>
<tr>
<td>Mortality</td>
<td>1 (9%)</td>
</tr>
</tbody>
</table>
In two patients the stones were extracted spontaneously when CBD is opened. The stones size is about \( \frac{3}{4} \) cm. In three patients stones were extracted by graspers. Stones that are easily accessible or visible through choledochotomy are extracted with non-traumatic graspers. Stones can be pushed out by exerting pressure with graspers on the surrounding CBD wall. Stones size are about \( \frac{7}{4} \) cm. In three patients stones were extracted by using Fogarty catheter. The catheter was guided into the common duct forceps. The balloon was inflated and the catheter was withdrawn. Stones retrieved can be removed with forceps introduced through the medial epigastric port. Care should be taken and gentle manipulations with the catheter in order to avoid perforation of the ductal system during these maneuvers. the stones size are about \( \frac{7}{4} \) cm.

In three patients stones are extracted by using Dormia basket. The basket was introduced into the choledochotomy. It was then opened and the basket was moved around slowly until the stone can be felt and pushed into the basket prior to closure and extraction. The stone size are about \( \frac{7}{4} \) cm.

Table 2: Show size of stones and method of stones extraction.

<table>
<thead>
<tr>
<th>Stones size</th>
<th>Method of extraction of stones</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{3}{4} ) cm</td>
<td>Spontaneous extraction</td>
<td>4 (( \frac{3}{4} ))</td>
</tr>
<tr>
<td>( \frac{7}{4} ) cm</td>
<td>Grasper</td>
<td>4 (( \frac{7}{4} ))</td>
</tr>
<tr>
<td>( \frac{7}{4} ) cm</td>
<td>Fogarty catheter</td>
<td>4 (( \frac{7}{4} ))</td>
</tr>
<tr>
<td>( \frac{7}{4} ) cm</td>
<td>Dormia basket</td>
<td>4 (( \frac{7}{4} ))</td>
</tr>
</tbody>
</table>

Discussion

Choledocholithiasis refers to the presence of one or more gallstones in the common bile duct. Usually, this occurs when a gallstone passes from the gallbladder into the common bile duct (\( \times \)).

Laparoscopic CBD exploration appears to be the most cost-effective method, it should be emphasized that this method is very challenging and it should be performed by a well-trained laparoscopic surgeon. CBD stones are suspected if there is a history of pancreatitis or cholangitis, or there is increased serum levels of conjugated bilirubin, SGPT, SGOT and alkaline phosphatase, or if there is dilatation of CBD more than 8 mm or stone in the CBD at abdominal ultrasonography or the presence of stone in the CBD at MRCP. Various short- and long-term complications of ERCP and ES have been
Laparoscopic exploration can effectively clear CBD stones, but is not without complications. In our series, laparoscopic stone clearance of the bile duct was successful in \( \frac{46}{92} \) of the patients, median length of hospital stay was \( \frac{1}{9} \) to \( \frac{1}{7} \) days, stone size measuring \( \frac{1}{9} \) to \( \frac{1}{1} \) mm in diameter, mean duration of surgery was \( \frac{9}{9} \) to \( \frac{1}{6} \) minutes, and no mortality. Most complications resolved with conservative treatment. Postoperative bile leak are most alarming, though most patients can be successfully managed by endoscopic stenting.

Moreover, adhesion formation may not be as good as after open surgery; the T-tube tract probably needs longer to mature before its removal. T-tube placement has also intrinsic problems (dislodgement, kinking, longer hospital stay to undergo a postoperative cholangiogram)\(^{(8)}\). All complications related to T-tube placement were managed by conservative treatment in our study.

In our study complete ductal clearance was achieved in \( \frac{46}{92} \) patients. The stone clearance rate is \( \frac{21}{116} \%. \) Duct clearance was incomplete in two patients. In the study done by Margert and John (\( \frac{1}{6} \) \( \frac{41}{202} \) patients), the stone clearance rate was \( \frac{8}{116} \%).

Duct clearance was incomplete in ten patients. In Tinoco et al. (\( \frac{21}{16} \) \( \frac{42}{1} \) patients) successful laparoscopic stone clearance was achieved in \( \frac{21}{16} \% \). An elective postsurgical endoscopic sphincterotomy were done on the \( \frac{21}{16} \% \) patients not cleared laparoscopically. Seven patients had unexpected retained stones.\(^{(1)}\)

In our study there was no death. In the study done by Tang, in Hong Kong (\( \frac{21}{6} \) \( \frac{42}{1} \) patients), one patient died due to multi organ failure following major bile leakage. In our study the mean postoperative hospital stay was \( \frac{1}{6} \) days, but in the study done by Tang (\( \frac{21}{6} \% \) patients), the mean postoperative hospital stay was \( \frac{1}{6} \) days. The mean intraoperative time in our study was \( \frac{1}{6} \) min. In the study done by Margert and John (\( \frac{1}{6} \) \( \frac{41}{202} \) patients), the mean intraoperative time was \( \frac{1}{6} \) min due to facilities and advanced medical equipment.

Exploration of the CBD is not an obsolete approach in the management of CBD stones. Laparoscopic exploration of the CBD is highly successful and can achieve satisfactory ductal clearance for ‘endoscopically irretrievable’ stones\(^{(8)}\).
Laparoscopic common bile duct exploration has a high success rate, with rates reported from 82% to 94% in recent years. The morbidity rate has been reported to be approximately 1-2%. Mortality rates are very low, at less than 1%.

Future increase in the number of patients and comparison between different modalities of CBD exploration is planned to be done.

References

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