Clinical evaluation of laparoscopic exploration of the common bile duct

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Abstract

Although laparoscopic cholecystectomy has became the gold standard for the management of gallstone disease, the application of laparoscopic common bile duct exploration (LCBE) for the treatment of choledocholithiasis has been slower.The aim of this study is to determine the feasibility and effectiveness of (LCBE).

Method: This study was carried out from October 2005 to March 2008 in Zagazig University Hospital on 32 patients (21 female 65.6% and 11 male 34.4%) with CBD and gallbladder stones who have undergone laparoscopic cholecystectomy and CBD exploration. Transcholedochal laparoscopic common bile duct exploration was used in all patients with placement of T-tube in 17 patients and primary closure of CBD in 11 patients after assessing the clearance of CBD by choledochoscope.

Results: Mean operative time was 128 ± 31.2 minutes. The mean postoperative hospitalization was 2.2 ± SD 0.5 days, range 2-4 days in the patients with primary closure of CBD, but in the patients in whom the choledochotomy was closed over T-tube, the mean postoperative hospitalization was 5.4 ± SD 1.2 days, range 3-8 days (significant difference P<0.05). Conversion of the laparoscopic procedure to conventional open CBD exploration occurred in 4 patients (12.5%); due to sever adhesions present in the Calots triangle and the bile duct could not be visualized properly in 2 patients and due to impacted stones in the other 2 patients. Biliary leakage after surgery occurred in 3 patients (17.6%) after removal of T-tube who were treated conservatively for 4 to 5 days, and biliary leakage occurred only in one patient (9%) with primary closure of CBD and were treated by ERCP and billiary stent. Minor wound infection occurred in 2 (11.7%) of the patients in whom the choledochotomy was closed over T-tube, but such complications did not occurr in patients with primary closure of CBD. Mean time to return to normal activity was 9.2 ± 2.5 days in patients with primary closure of CBD, but 15.4 ± 3.5 days in patients where the choledochotomy was closed over T-tube (significant difference P<0.05). No stone recurrence was detected after a mean follow up period of 21 months ± 8.7, range 6-29 months.

Conclusion: Laparoscopic exploration of the CBD is highly successful, safe, feasible and single stage option for management of calcular cholecystitis with CBD stones, it also has the advantage of leaving the sphincter of Oddi anatomically intact. Primary closure after CBD exploration is as safe as T-tub drainage.

Key words: Laparoscopic - Common bile duct exploration.

Introduction:

The management of CBD stones has traditionally required open laparotomy and bile duct exploration. Since the introduction of endoscopic retrograde cholangiopancreatography (ERCP), preoperative clearance of common bile duct (CBD) stones prior to cholecystectomy has been widely adopted.[1]

However, in the present laparoscopic era, the best treatment for patients with choledocholithiasis is a matter of debate and the management of choledocholithiasis continues to evolve. If the stones are found by intraoperative cholangiography during laparoscopic cholecystectomy(LC), the surgeon may either do the LC and refer the patient to endoscopic sphincterotomy(ES) postoperatively,or he may convert to open CBD exploration or in the current times he may do laparoscopic CBD exploration (LCBDE).[2]

Laparoscopic bile duct exploration has become one of the main options for treatment of choledocholithiasis associated with cholelithiasis.[3]

Difficult choledocholithiasisis is defined as failure of endoscopic stone retrieval for the following reasons: Access and cannulation difficulty, the difficult nature of common bile duct stones, and the presence of ERCP-related complications.[1,3,4]

The aim of the work is to evaluate the role of laparoscopic exploration of the common bile duct in the management of common bile duct stones.

Patients and methods:

This study was carried out from October 2005 to March 2008 in Zagazig University Hospital on 32 patients (21 females 65.6% and 11 males 34.4%) who have undergone (LCBE). Diagnosis of CBD stones is based on clinical presentation, liver function tests, abdominal ultrasound and ERCP. Endoscopic sphincterotomy and stone extraction remain the mainstay treatment for CBD stones except in difficult choledocholithiasis.

Technique:

The standard 4-port configuration for laparoscopic cholecystectomy was used. A fifth port was made inbetween the right midclavicular and epigastric port just below the subcostal margin for inserting the choledochoscope.The fundus of the gall bladder was retracted towards the right shoulder and the Hartman's pouch was retracted downwards and outwards toward the right hip. Dissection began on to the neck of the gall bladder and continued proximally until the junction of gall bladder with the cystic duct was clearly defined. Dissection was continued proximally on to the cystic duct until there was an adequate length. Then the cystic duct was milked towards the gall bladder to dislodge any cystic duct stone into the gall bladder. A clip was applied on the gall bladder side to prevent any back slippage of gallstones into the CBD.

The CBD was localized by aspiration of bile using a long spinal needle directly through the anterior abdominal wall. The needle was grasped intraperitoneally 5mm from the tip before localization, thus minimizing the risk of puncture of the posterior CBD wall by excessive pressure.

After opening up of the Calot's triangle, the anterior surface of the CBD was dissected carefully and choledochotomy was performed by a longitudinal incision with the help of endoscopic scissor and hook **Figure(1,2,3)** just below the insertion of the cystic duct into the bile duct. The stones were retrieved by spontaneous evacuation while incising the bile duct, blunt instrumental pressure with atraumatic forceps **Figure(4)**, Dormia basket, Fogarty balloon catheter **Figure(5)** or irrigation and suction. Completion choledochoscopy was performed to assess the completeness of the procedure.

Choledochotomy was closed over a T-tube **Figure(6)** in 17 patients with interrupted 3/0 vicryl suture and we did primary vertical closure of CBD **Figure(7)** in 11 patients after assessing the clearance of the CBD by choledochoscopy. After CBD closure, cholecystectomy was performed in the usual manner. We placed an infrahepatic tube drain in all patients which was usually removed on third to fourth postoperative day as output decreased below 30 ml/day.

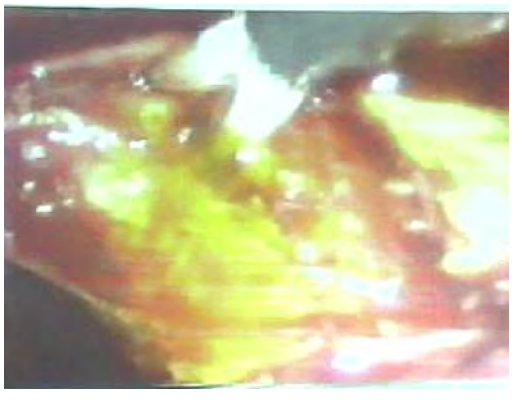

Figure (1): Open the CBD with scissor.

Figure (2): Open the CBD with hook.

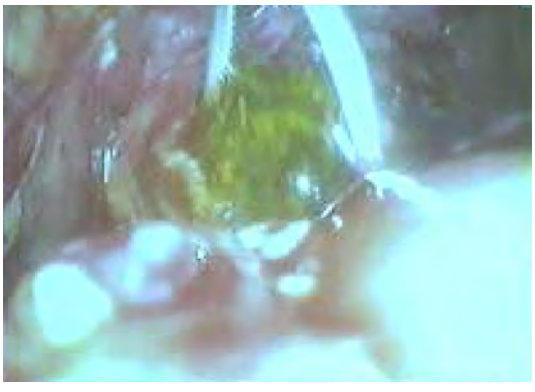

Figure (3): Extraction of the stone by forceps.

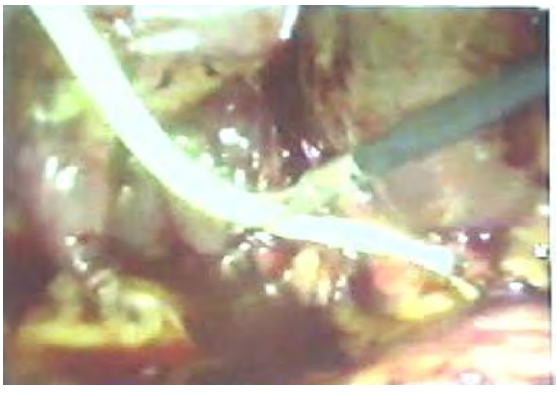

Figure (4): Extraction of the stone with balloon catheter.

Figure (5): Choledochotomy closed over T-tube.

Figure (6): Primary closure of CBD.

Results:

Between October 2005 and March 2008, 32 patients were included in the study.They were 21 females (65.6%) and 11 males (34.4%), The age range of the patients was 30 to 56 years with the mean age 48 ± 16.4 year.

Mean operative time was 128 ± 31.2 minutes (range from 95 to 161 min.). At the beginning of the study the duration was longer as we gained confidence and surgical experience, the operative time became shorter and slightly shorter in duration in patient with primary closure of CBD.

The postoperative hospitalization was shorter (range from 2 to 4 days). The mean postoperative hospitalization was 2.2 ± 0.5 SD days in patients with primary closure of CBD, but in patients where the choledochotomy was closed over T-tube the postoperative hospitalization ranged from 3 to 8 days with the mean of 5 days, with a significant difference ($P<0.05$). The patients with T-tube were allowed to go home with the tube clamped and returning on day eight for out patient removal after T-tube cholangiography.

We had to convert the laparoscopic procedure to conventional open CBD exploration in 4 patient (12.5%) due to severe adhesions present in the Calots triangle , the bile duct could not be visualized properly in 2 patients and due to impacted stones in other 2 patients.

Biliary leakage after surgery occurred in 3 patients (17.6%) after removal of T-tube. They were treated conservatively for 4 to 5 days. Biliary leakage occurred only in one patient (9%) with primary closure of CBD, was treated by ERCP and billiary stent that was removed after 6 months.

Minor wound infection occurred in the form of erythema and serous collection at the port site in 2 (11.7%) of the patients where the choledochotomy was closed over T-tube .But such complications did not occurr in patients with primary closure of CBD.

Mean time of return to normal activity was 9.2 ± 2.5 days (range from 7 to 12 days) in patients with primary closure of CBD, but was 15.4 ± 3.5 days in patients where the choledochotomy was closed with T-tube (range from 10 to 18 days), with a significant difference $P<0.05$.

Patients were followed up in the out - patient clinic at 3 months intervals. Liver function tests and abdominal ultrasound were performed to exclude CBD stone recurrence. No stone recurrence was detected after a mean follow up period of 21 months, range 6 to 29 months SD ± 8.7.

Table (1): Post-operative comparison of patients with inserted T-tube versus patients with primary closure of CBD. (total n=28)

Items	T-tube group (N=17)	Primary closure group (N=11)	P value **	Statistical test
Biliary leakage N(%)	3(17.6%)	1(9.1%)	1.00	Fisher exact test
Wound infection N (%)	2(11.8%)	0(0.0)	0.50	
Hospitalization days range mean +SD	3-8 5 ± 1.2	2-4 2.2 ± 0.5	0.007**	Student's T- test
Return to normal activities needed days mean + SD	15.4 ± 3.5	9.2 ± 2.5	0.0000**	

*** Significant results (P<0.05).*

Discussion:

Laparoscopic CBD exploration provides an alternative therapeutic approach which permits early recovery with a reduced period of disability.[2]

The mean operative time was 128 ± 31.2 min. this is nearly the same as Arfa et al[9] and Tang et al[10] who reported that operative time was120 min and 129 min respectively. But Jameel et al,[5] Topal et al,[6] Kanamaru et al[7] and Mandry et al[2] reported 95.92 min, 75min, 80 min and 68 min respectively. On the other hand, Rojas et al[8] reported long operative time, 180 min, this was due to additional procedures including laparoscopic operative cholangiography, laparoscopic billiary by-passes and adhesiolysis in patients with previous upper gastrointestinal surgery.

In this study 4 patients (12.5%) were converted to conventional open exploration of CBD. This is hand by hand with Punett and Bhartia,[3] Tang et al[10] and Arfa et al[9] (15%, 11%, 20% respectively), but Tan et al[11] and Aroari and Bell[4] reported no conversion to open exploration of CBD. On the other hand, Jameel et al,[5] Kanamaru et al,[7] Taylor et al[12] and Lien et al[13] reported lower incidence of conventional open exploration of CBD: 7%, 2.2%, 4% and 7% respectively.

The mean postoperative hospital stay, in patients with primary closure of CBD was 2.2 days. This is in agreement with Topal et al,[6] Gurusamy and Samraj[14] and Rojas et al[8]: 2days, 1.8 days and 2.3 days respectively. But in patients where the choledochotomy was closed over T-tube, in our study, the mean postoperative hospital stay was 5 days. This is nearly the same as reported by Gurusamy and Samraj,[14] Lien et al,[13] and Kanamaru et al[7]: 7 days, 8.5 days and 6.2 days respectively.

In our study, postoperative biliary leakage occurred in 17.6% in patients where the choledochotomy was closed over T-tube. This is slightly higher than reported by Kanamaru et al,[7] Taylor et al,[12] Liu et al[15] and Lien et al[13]: 12%,8.9%,13% and 9.5%respectively. But in patients with primary closure of CBD, biliary leakage occurred only in one patient (3.1%) in this study. On the other hand, Gurusamy and Samraj[14] and Rojas et al[8] reported no biliary leakage after primary closure of CBD.

Postoperative wound infection occurred in 11.7%, only with patients where the choledochotomy was closed over T-tube. This is slightly lower than that reported by Gurusamy and Samraj,[14] Arfa et al[9] and Taylor et al[12]: 15.8%,17% and 15.9%respectively.

Time to return to normal activity in patients with primary closure of CBD was 9.2 ± 2.5 days. This is nearly the same as reported by Rojas et al,[8] Tang et al[10] and Gurusamy and

Samraj[14]: 7 days, 6.8 days and 7.1 days respectively. But in patients where the choledochotomy was closed over T-tube, the mean time to return to normal activity in our study was 15.3 ± 3.5 days. This is the same as reported by Rojas et al[8] and Gurusamy and Samraj[14]: 15.3 and 13.9 days respectively.

No stone recurrence was detected after a mean follow up period of 21 ± 8.7 months, range 6-29 months. Our results are similar to the published data as regard stone recurrence: Puneet and Bhartia[3] reported no recurrent stone while Tang et al[10] reported 4% stone recurrence rate.

Conclusion:

Laparoscopic CBD exploration should be performed for clearance of the common bile duct stones because it is safe, feasible and single stage option. It also has the advantage of leaving the sphincter of Oddi intact but it requires specific equipment and surgical experience. Primary closure after CBD exploration is as safe as T-tube drainage.

References:

1- Anupam DMS, Kamal S, Wynne M, Adrian M, Harris M: Laparoscopic management of difficult recurrent choledocholithiasis. *J Laparoendosc Surg* 2007; 11: 161-164.

2- Mandry AC, Bun M, Ued ML, Iovaldi ML, Capitanich P: Laparoscopic treatment of common bile duct lithiasis associated with gallbladder lithiasis. *Cir Esp J* 2008; 83(1): 28-32.

3- Puneet AS, Gupta V K, Bhartia SD: Laparoscopic management of common bile duct stones: Our experience. *Indian J Surg* 2005; 67 (2): 94-99.

4- Aroari S, Bell JC: Laparoscopic managment of common bile duct stones: Our initial experience. *Ulster Med J* 2002; 71(1): 22-25.

5- Jameel M, Baker AL, Darmas B: Trend towards primary closure following laparoscopic exploration of the common bile duct. *Ann Coll Surg* 2008; 90 (1): 29-35.

6- Topal B, Aerts R, Penninckx F: Laparoscopic common bile duct stone clearance with flexible choledochoscopy. *Surg Endosc* 2007; 21(12): 2317-21.

7- Kanamaru T, Sakata K, Nakamura Y, Yamamoto M, Ueno N, Takeyama Y: Laparoscopic choledochotomy in management of choledocholithiasis. *Surg Laparosc Endosc* 2007; 17(4): 262-266.

8- Rojas OS, Arizpe BD, Marine LE, Cesin SR, San Roman GR: Exploration of biliary tracts for laparoscopy for treatment of choledocholithiasis. *Gastroenterol* 2004; 69 (3): 112-116.

9- Arfa MN, Ben Abid S, Gharbi L, Mannai S, Haoues N, Miloudi N, Guilani M, Ghariani B, Mestiri H, Khalafallah MT: Results of laparoscopic treatement of common bile duct lithiasis. Report of 30 cases. *English Tunis Med* 2006; 84(12): 786-789.

10-Tang CN, Tsui KK, Ha JP, Siu WT, Li MK: Laparoscopic exploration of the CBD: 10-year experience of 174 patients from a single centre. *Hong Kong Med J* 2006; 12(3): 191-196.

11-Tan TW, Khor CJL, Chang SKY: Stenting before laparoscopic common bile duct exploration: A helpful strategy. *Singapore Med J* 2007; 48(8): 224-6.

12-Taylor CJ, Kong J, Ghusn M, White S, Crampton N, Layani L: Laparoscopic bile duct exploration: Results of 160 consecutive cases with 2-year follow up. *J Surg* 2007; 77(6): 440-445.

13-Lien HH, Huang CC, Huang CS, Shi MY, Chen DF, Wang NY, Tai FC: Laparoscopic common bile duct exploration with T-tube choledochotomy for management of choledocholithiasis. *Lapar Adv Sur* 2005; 15(3): 298-302.

14-Gurusamy KS, Samraj K: Primary closure versus T-tube drainage after open common bile duct exploration. *Cochrane Database Syst* 2007; 24(1): 5640-5645.

15-Liu CZ, Hu SY, Wang L, Zhang GY, Chen B, Zhang HF, Wang KX: Clinical evaluation of laparoscopic common bile duct exploration in 587 cases. *Zhonghua Wai Ke Za Zhi* 2007; 1:45(3): 189-191.