

Transcystic C-tube Drainage Following Laparoscopic Common Bile Duct Exploration

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At the beginning of laparoscopic surgery¹, common bile duct (CBD) stones were thought to be a contraindication for laparoscopic cholecystectomy (LC) in the treatment of gallstones. At present, well-trained surgeons remove these stones in relation to LC. CBD stones are often present during laparoscopic cholecystectomy and when these stones are removed choledochoscopically a T-tube has to be inserted. This approach to remove the CBD stones has been documented.^{2,3,4} Insertion of a T-tube into the CBD is a subject open to discussion, because of one disadvantage when the T-tube is inserted into the CBD, patients stay in the hospital for more than 2 to 3 weeks postoperatively.

Instead of the T-tube, we use a transcystic bile drainage tube (C-tube) inserted into CBD following common bile duct exploration during laparoscopic surgery. CBD is closed primarily after endoscopic removal of stones. Three days after surgery, this tube is pulled out and the cystic duct is ligated with an elastic thread placed during the laparoscopic surgery. With this tube,

hospital stay is greatly shortened and pain is minimum.

PATIENT SELECTION

The best candidates for C-tube drainage are those who require choledochotomy, because of large stones in CBD and no dilated cystic duct (Figure 1). In the patients treated with laparoscopic

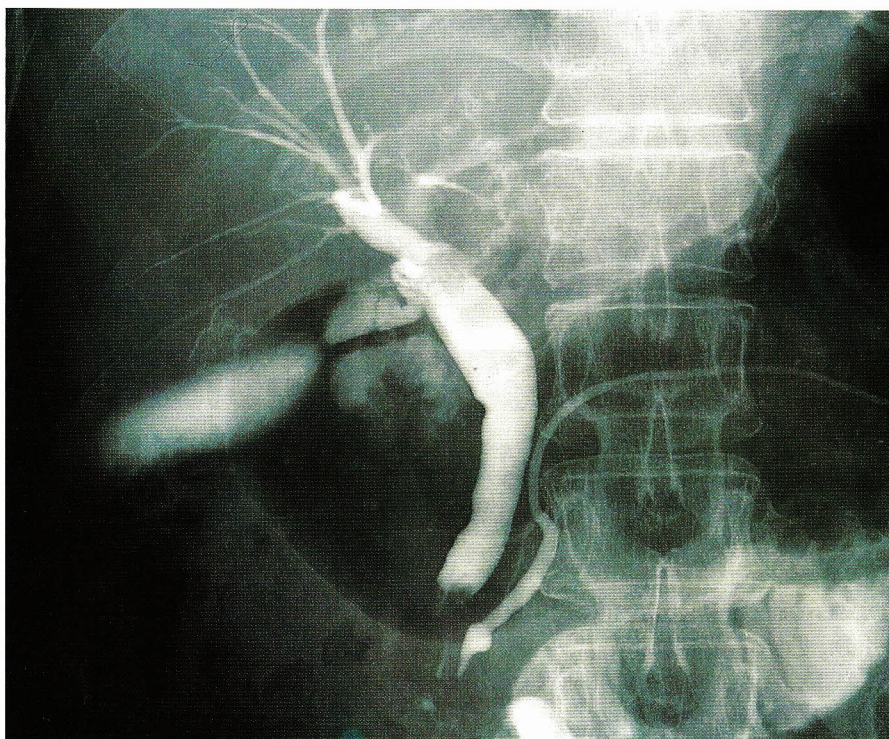


Figure 1. Preoperative ERCP photo showing filling defect in mid CBD.

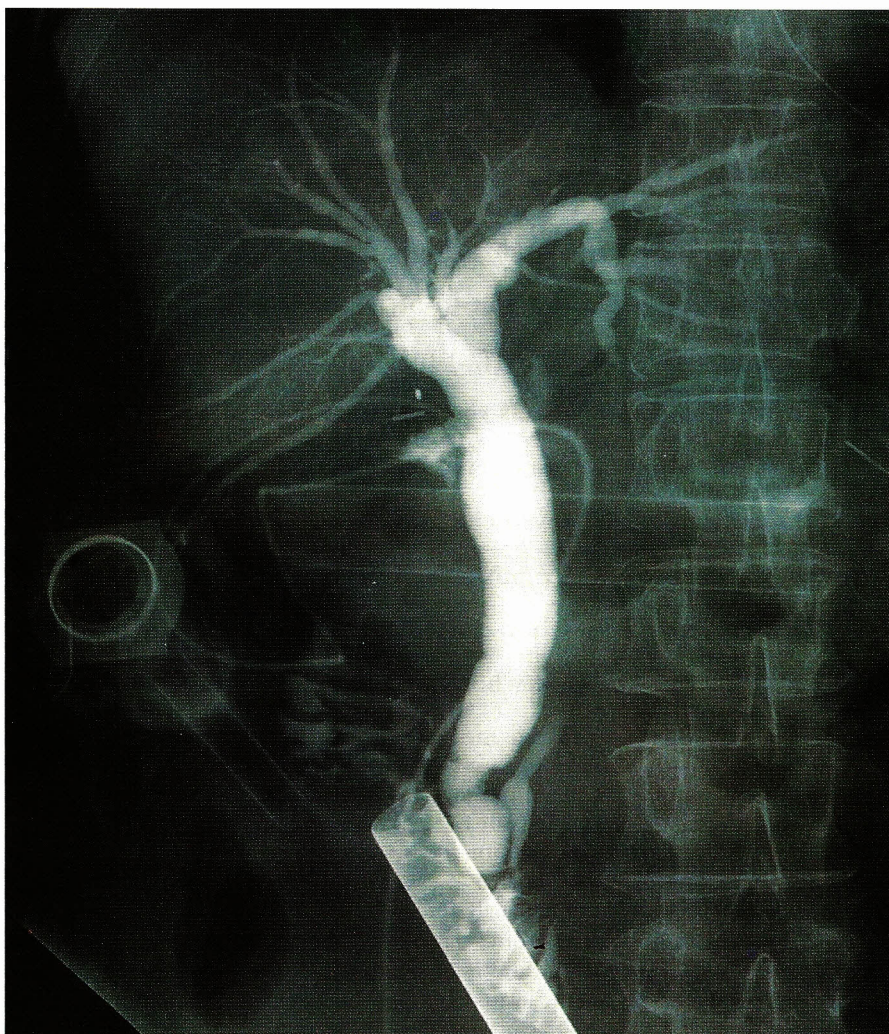


Figure 2. Operative cholangiogram.

CBD exploration, we were not satisfied with the results of T-tube placement, because the patients had to stay much longer than those who underwent LC. Therefore, we began to use a C-tube which can be readily pulled out with no bile leakage, as the cystic duct has been ligated automatically with an elastic thread placed at the time of laparoscopic surgery. Patient selection criteria for various forms of treatment of CBD stones in our institution are as follows:

- 1) Patients with multiple large stones (>1cm) are treated with choledochotomy and a C-tube placement.
- 2) Patients with CBD stones with dilated cystic duct and stones smaller than 1cm in diameter are treated with transcystic CBD exploration.
- 3) In cases of suspected residual CBD stones, a T-tube should be placed laparoscopically for postoperative stone removal.
- 4) If a patient has a marked adhesion around the cystic duct, laparoscopic assisted surgery is performed with use of abdominal wall lift technique.⁵

SURGICAL PROCEDURES

The routine four ports for performance of LC are placed at the subumbilical portion and right upper quadrant. The forward oblique viewing laparoscope is used to obtain a better field of vision of not only the posterior aspect of the cystic duct but also the anterior surface of CBD. After the cystic duct is isolated, the proximal part of the duct is clipped as closely as possible to the gallbladder. A small incision, 1cm away from the CBD junction, is made in the cystic duct using microscissors. A five Fr vinyl tube is forwarded into CBD through the cystic duct for intraoperative cholangiography (Figure 2). After completion of the cholangiogram, the cystic duct is ligated and CBD is exposed by excising the overlying peritoneum using an ultrasonic aspirator.

The anterior CBD wall is incised long enough to extract the stones (Figure 3). Choledochoscopy is then performed to remove the stones with a wire basket and to examine both the proximal and distal part of the bile duct (Figure 4, 5a and 5b).

The choledochotomy is closed with absorbable interrupted sutures tied extracorporeally or with a continuous suture tied intracorporeally (Figure 6). A five Fr vinyl tube is inserted through

the right subcostal trocar, which has been positioned for manipulating forceps. The distal end of this tube is pushed down into the CBD (Figure 7) so that the tip of this tube will be placed at the middle part of the CBD. Once the C-tube is in the correct position, the cystic duct is tied with the elastic thread to prevent bile leakage (Figure 8), and fibrin glue is applied in the site of the CBD incision (Figure 9).

A single Penrose drain is left in Morrison's pouch. When the postoperative cholangiogram shows no residual stones or bile leakage (Figure 10), this drain is removed within five days.

CLINICAL RESULTS

In our experience, thirty one patients with CBD stones were treated in conjunction with LC. Preoperative stone extraction following endoscopic sphincterotomy in nine patients, transcystic CBD exploration in five, T-tube insertion in ten and C-tube insertion in seven patients. In all patients undergone

transcystic C-tube drainage, preoperative ERCP revealed the presence of CBD stones and no dilated cystic duct. The C-tube can be rapidly and correctly positioned under laparoscopic surgery

with no untoward events. None of these patients had any bile leakage or residual stones. CBD exploration was completed laparoscopically via choledochotomy (Table 1). In all cases, a completed

Laparoscopic CBD exploration and transcystic bile drainage

Patients	Age	Sex	No of stones	Largest size of stone (cm)	Operative time (min.)
1.	58	Male	4	1.2	145
2.	67	Female	2	1.0	120
3.	63	Female	3	1.4	140
4.	72	Male	13	2.0	185
5.	55	Female	3	1.8	110
6.	60	Male	4	1.5	105
7.	66	Female	6	2.5	155

Table 1.

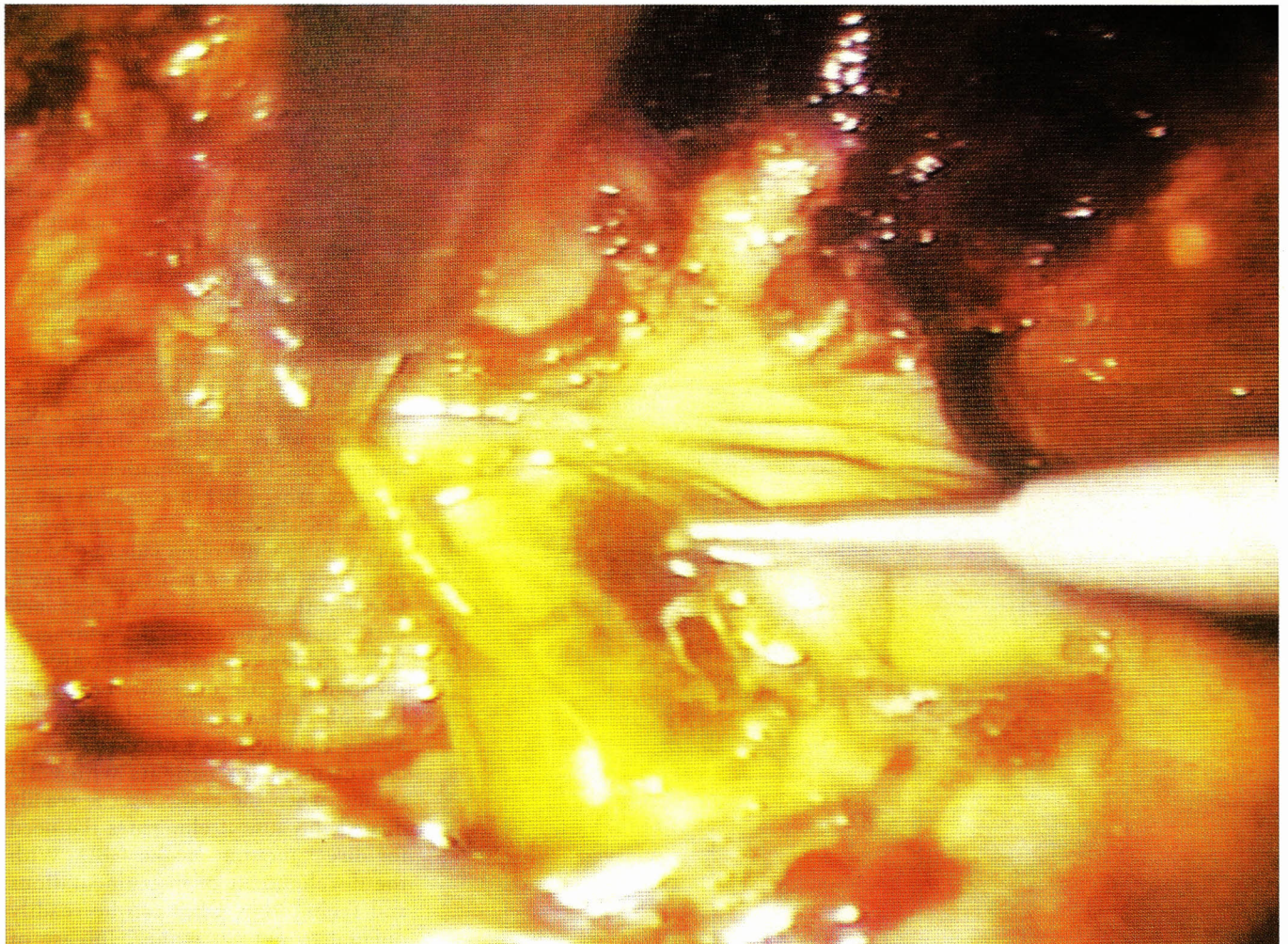


Figure 3. An opening is made at the anterior surface of the CBD with microscissors.

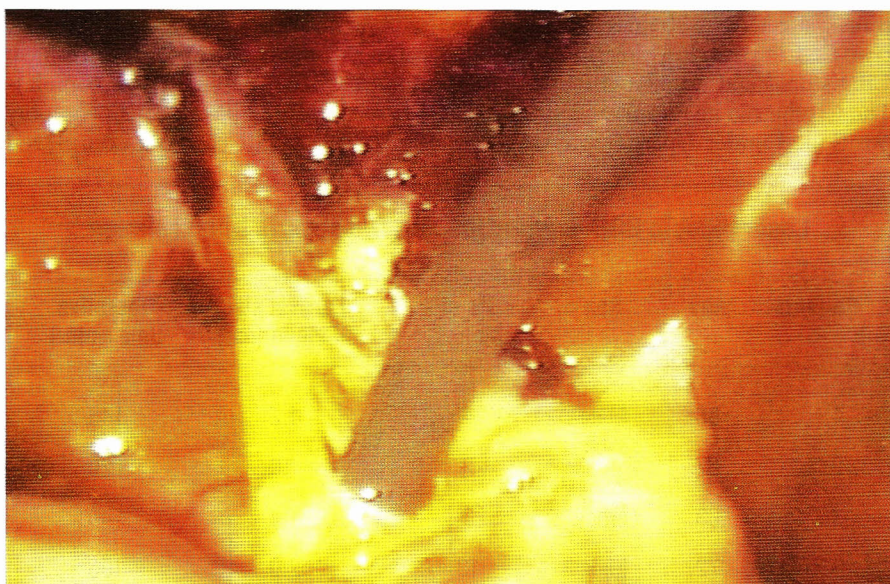


Figure 4. Intraoperative choledocscopy.

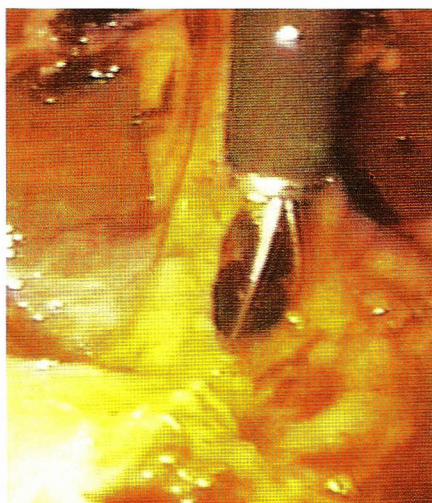


Figure 5. a and b: Stone extraction with a basket catheter.

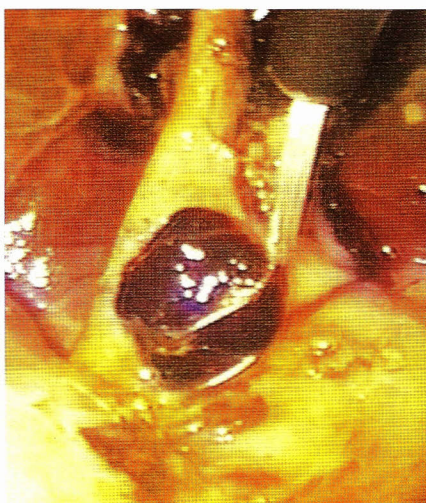


Figure 5b.

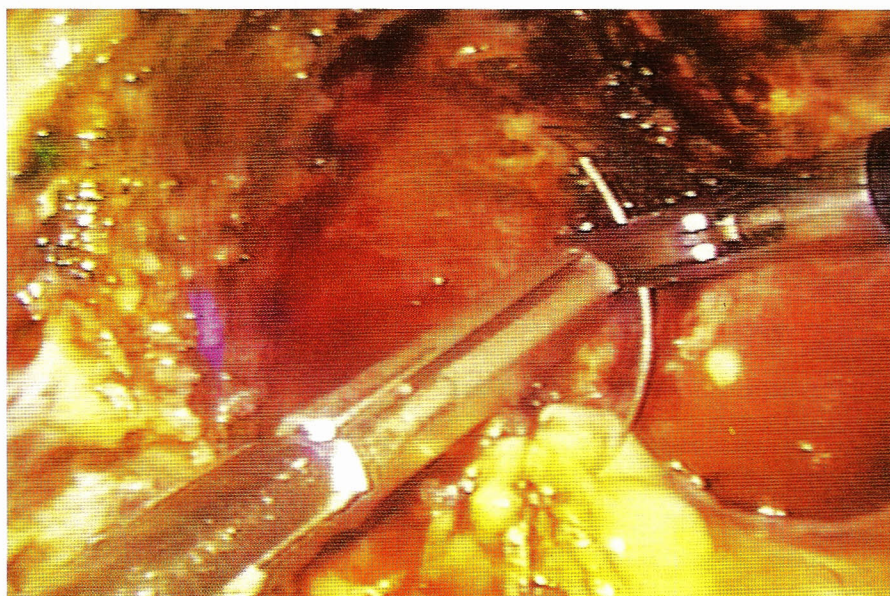


Figure 6. Choledochotomy is closed with absorbable threads.

cholangiogram was interpreted as normal.

The operative time varied from 105 to 185 minutes with a mean of 137 minutes. The average hospital stay was 6.7 days postoperatively. There was no mortality. Postoperative complications included trocar site infection (one), and postoperative mild amylaseemia (one). All seven patients remained asymptomatic over an average follow-up time of ten months.

DISCUSSION

There are several ways to treat patients with CBD stones. One approach is to carry out preoperative stone removal by means of endoscopy and/or endoscopic sphincterotomy.^{6,7,8} Aliperti et al.⁶ reported eighteen symptomatic patients with cholecystolithiasis and choledocholithiasis successfully treated with endoscopic sphincterotomy combined with LC. Recovery was rapid and pain was minimum as seen in cases of LC. However, the application of endoscopic sphincterectomy combined with LC for younger patients is controversial, because of post-sphincterectomy reflux and the following cholangitis.⁹ Another approach is to remove these stones through the dilated cystic duct during LC.^{10,11} Hunter¹² reviewed the results of transcystic CBD exploration for unsuspected stones found in 7 patients during LC in 150 consecutive patients. When the cholangiogram appeared to show CBD stones, a five Fr ureteral stone basket was passed through the cystic duct into the duodenum, opened, and trolled through the CBD. The conclusion was that this type of fluoroscopic CBD exploration was useful in clearing CBD in a small series of patients. However, a transcystic approach to CBD often fails due to the presence of large multiple stones, intrahepatic stones, or a wall-thickened cystic duct. Carroll et al.¹³ extracted CBD stones choledochoscopically through a cystic duct dilated with a balloon catheter. Choledochoscopy during LC might be a preferred choice of treatment for patients with CBD stones, when the cystic duct is readily dilated, because it eliminates the need for direct incision on the CBD. With the development of instrumentations and technology, CBD can be readily opened to extract stones. In case of CBD exploration, a T-tube is inserted

in the CBD.^{14,15,16} However, insertion of the T-tube lengthened the recovery. Patients with the T-tube have to stay at least for three weeks in the hospital. The alternative approach for biliary drainage is to insert a C-tube into CBD via cystic duct after CBD exploration and primary closure. With this technique, we can make an incision long enough to extract the large, multiple stones choledochoscopically. For patients with stones trapped in the CBD, open surgery may be necessary, if the impacted stones are difficult to remove through an endoscope inserted through a cannula under conditions of a pneumoperitoneum. Under such circumstances, one approach is to perform LC and CBD exploration under conditions of laparoscopy assisted surgery (LAS) using the abdominal wall lifting method.^{5,17} The usual operative procedures can be performed using surgical instruments, which most surgeons are familiar with, under a clear laparoscopic field of vision. A C-tube drainage can also be done with abdominal wall lifting much easier. To assess the efficacy, safety, and complications, a prospective, randomized trial is needed to compare T-tube with C-tube drainage following CBD exploration. **[81]**

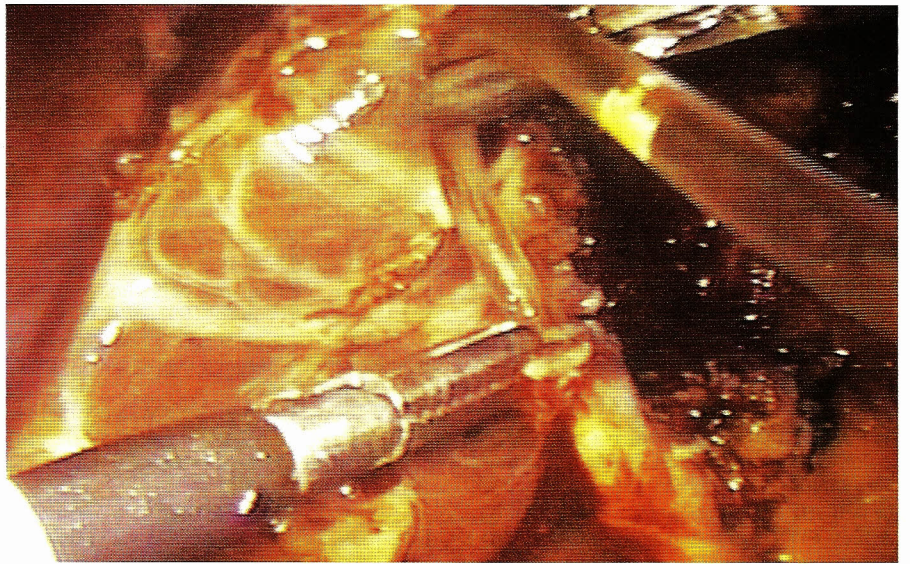


Figure 7. A vinyl tube (C-tube) is inserted into CBD via cystic duct for biliary drainage.

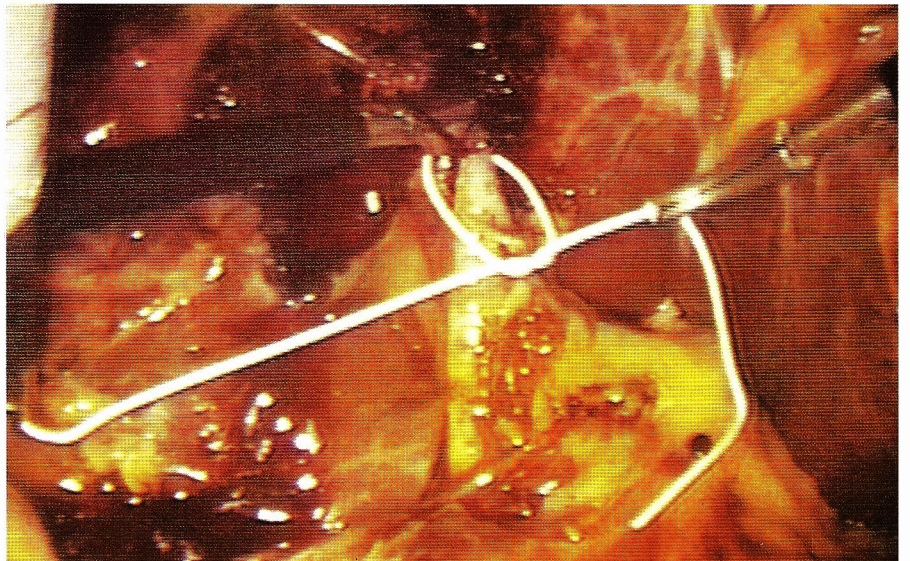


Figure 8. An elastic thread is applied around the cystic duct so that the C-tube can be removed with no bile leakage postoperatively.



Figure 10. Postoperative (3 days) cholangiogram through the C-tube: No residual stones or bile leakage.

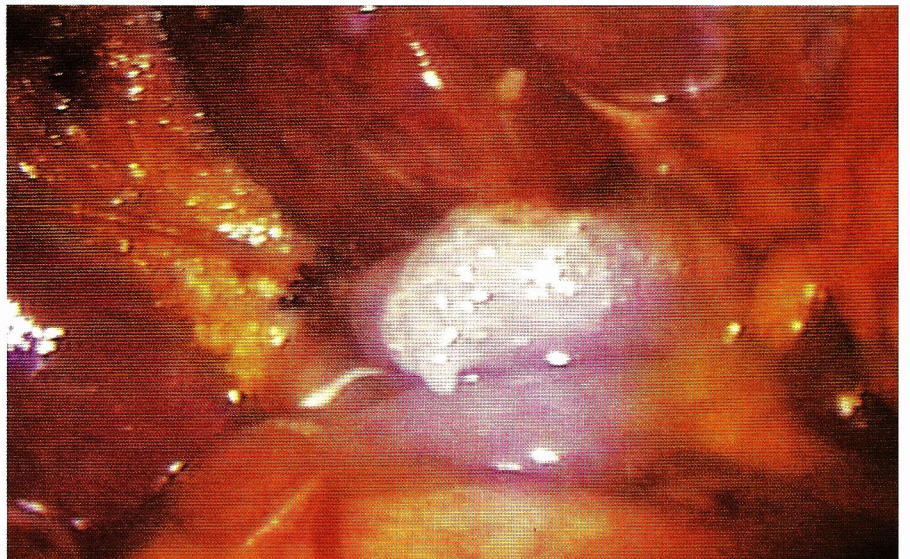


Figure 9. Fibrin glue is applied at the site of CBD exploration.

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