

T-Tube Drainage of Common Bile Duct after Open CBD Exploration for Choledocholithiasis

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ABSTRACT

Background:- CBD stones once confirmed need extraction and conventionally T-tube is used for decompression of CBD after open choledocholithotomy. [3]

Aim:-To observe clinical outcome in patients of choledocholithiasis undergoing CBD exploration using T-tube as a decompression procedure.

Design and Place:-This was a prospective observational study where 30 patients were admitted in Post Graduate Department of Surgery Government Medical College, Jammu over a period of one year *w.e.f.* November 2016 to October 2017 with diagnosis of choledocholithiasis.

Method:- Patients underwent closure of choledochotomy over a T-tube after open CBD exploration for Choledocholithiasis.

Result:- T-Tube drainage of CBD after choledochotomy is a safe procedure with lesser mortality and morbidity.

Conclusion:- T-Tube drainage of CBD after choledochotomy is a modality of treatment with good results where facility of endoscopic / laparoscopic procedures is either not available nor such interventions are not feasible.

Keywords: Choledocholithiasis, T-Tube drainage, CBD

INTRODUCTION

Common bile duct stones are predominantly secondary stones (85%), having formed in the gallbladder and migrated along the biliary system from the gallbladder. Primary stones are the ones which form in the bile duct (15%) itself.

CBD stones require extraction to avoid complications, such as biliary colic, suppurative Cholangitis, Obstructive jaundice, Hepatic Abscess and Pancreatitis. In patients who have gallstones, and in whom cholecystectomy is considered, common bile duct stones can be detected preoperatively, intraoperatively or postoperatively. 10% to 15% of patients undergoing a cholecystectomy will be found to have choledocholithiasis at some point during their treatment. [9,12,18,22] In approximately one third of these patients stones may spontaneously pass down the common bile duct within 2 months without the need of any intervention. [1] However remaining will require an intervention to relieve the obstruction, because at this time, it is impossible to predict which group a patient will fall, and it is generally accepted that in all situations where common bile duct stones are either suspected or confirmed, extraction should be performed.

Choledocholithiasis may be silent and discovered only by imaging at the time of a routine cholecystectomy for chronic calculous cholecystitis. Alternatively, the stones may cause an acute cholangitis.

The goals of operation for choledocholithiasis are the detection and extraction of all stones and avoid unnecessary choledocholithotomy. Recent advances in non operative removal of retained stones have greatly reduced the need for re-exploration. However, these procedures still entail significant expertise, expense, time and risk to the patient.

Once CBD stones are confirmed, they have to be extracted to prevent the complications related to them. Now days with advanced laparoscopic and endoscopic techniques available for removal of CBD stones, open exploration has become less common.

Choledochotomy for CBD stones was first suggested by Langenbach in 1884 and first open common bile duct exploration was performed in 1889 by Robert Abbe, a New York surgeon.

Open CBD exploration is performed in situations [19]

In centres where advance laparoscopic equipment and expertise are not available

ERCP services may at times be limited or unavailable

c) In patients who are undergoing open cholecystectomy for one reasons or the other.

d) In patients who had failed endoscopic or laparoscopic removal of CBD stones.

e) In patients who suffer injury to CHD/CBD during open or laparoscopic cholecystectomy

Prior to 1889, CBD stones were either milked back into the gallbladder or crushed through an intact common bile duct. In 1889, Thorton and Abbe reported their experiences with incisions in the CBD to remove calculi.

Standard management of CBD stone includes choledochotomy in the supra-duodenal part [16] followed by stone extraction with confirmation of CBD clearance by passing soft catheter or dilator proximally and distally. [15] Clearance of the CBD is also confirmed by completion cholangiography or choledochoscopy. Every precaution is taken after CBD exploration to ensure that the duct is clear of stones and sludge. The traditional practice of T-tube drainage after CBD exploration was first described by Deaver in 1904. It is obligatory to perform a postoperative cholangiography which confirms that the CBD is clear. Later on if residual stones are present, T-tube

allows access for percutaneous manipulations and extraction of stones.

Indications for T-tube drainage:

1. Significant trauma to the duct wall during stone removal.

2. Extensive manipulation and trauma to the head of pancreas or ampulla while removing an impacted stone.

3. Pancreatitis at the time of operation.

4. Transduodenal canalization of pancreatic duct is performed.

5. Narrowing of lower end of CBD due to fibrotic or spastic sphincter of Oddi.

Advantages of T-tube drainage:

1. It avoids collection of bile in the peritoneal cavity.

2. To prevent stasis of bile.

3. The drainage in turn may help to prevent ascending infection by decompressing the liver.

4. Post operative cholangiography can be performed.

5. Residual stones can be removed from the T-tube tract avoiding a re-exploration.

Removal of retained stone from the biliary duct using T-Tube tract was first described in 1978 by Burhenne HJ. Abbe R reported use of a T-tube to drain the common duct following choledochotomy in 1892 and later Robson M(1902) recommend its use whenever distal obstruction was suspected.

Disadvantages of T-tube drainage:

Conventionally T-tube is used for decompression of CBD after open choledocholithotomy which has its own share of complications. [3] These include: inconvenience, discomfort, longer hospital stay, mechanical problems (dislodgement of T-tube, etc), duct stenosis after T-tube removal and risk of cholangitis from an external source via the T-tube.

The entero-hepatic circulation of bile salts ceases for a week or more until the T-tube is clamped off or removed. Removal or clamping of an intraductal drain before a week may cause biliary peritonitis. The absence of bile in the alimentary canal postoperatively may result in slow wound

healing, anorexia and constipation. The passage of bile through and around the horizontal limb of a T-tube would allow appreciable quantities of bile to escape into the intestine.^[21]

The irritant foreign body reaction of a T-tube in the CBD and the infection associated with its presence may in some cases tend to increase bile drainage and may lead to severe electrolyte loss and to a persistent biliary fistula when the tube is removed. The T-tube may break off within the CBD or may be accidentally pulled out before sufficient time has elapsed for the T-tube tract to be sealed off from the peritoneal cavity or matured. Occasionally a secondary haemorrhage may arise from the CBD due to intraductal drainage.

MATERIAL AND METHOD

This prospective observational study was conducted on 30 patients undergoing open CBD exploration in the Department of Surgery, Government Medical College Jammu from 1st November 2016 to 31st October 2017. Patients underwent closure of choledochotomy over a T-tube after open CBD exploration for CBD stone.

INCLUSION CRITERIA

- All patients undergoing elective open choledocholithotomy

EXCLUSION CRITERIA

- Age > 70years
- Previous history of choledocholithotomy
- Deranged coagulation profile
- Severe respiratory illness

Details of the study were told to the patient and informed consent was taken. After obtaining consent, the patient underwent procedure as per the study design.

Preoperative evaluation:

Pre-operatively detailed clinical history with physical examination was done. Biochemical and radiological evaluations like Ultrasound Abdomen, Magnetic Resonance Cholangiopancreatography (MRCP) for confirmation of the ultrasound

findings were done pre-operatively and meticulously recorded.

Patients presenting with cholangitis were managed conservatively with intravenous fluids and antibiotics and were planned for surgery after resolution of cholangitis. Patients with jaundice or deranged PT received Injection Vitamin K preoperatively. Prophylactic antibiotics were administered at the time of induction. The anaesthetist in all cases noted the operation time from skin incision to the application of the last stitch.

Surgical procedure

CBD exploration in all the patients was done through supraduodenal part of CBD. Cystic duct was ligated prior to exploration so as to obviate the risk that manipulation of gall bladder would force small stones down the cystic duct and into the common duct after the latter has been explored.

Common bile duct was opened between two stay sutures above the duodenum and stones extracted. Completion of Stone retrieval was confirmed by cholangiogram or choledochoscopy, after which patient underwent T-tube drainage. The choledochotomy was closed after inserting a No.12 F/14 F gauge T-tube with the "T" lying along the length of the duct, shortening the limbs to 2.5cm in either direction and splitting the horizontal limb along its length opposite the vertical tube. A bile-tight closure of the CBD over a T-tube was accomplished using a continuous or interrupted suture of No. 3-0 polygalactin on an atraumatic needle. Care was taken to include only the adventitia and outer coats of the duct. The free edge of the gastrohepatic omentum was placed over the suture line.

Suctioning of irrigation fluid from the peritoneal cavity and cholecystectomy was performed. Drain of size 32 Fr was placed in all the patients in the vicinity of the duct but not in actual contact with the duct wall. T-Tube and drain were brought out to the exterior through separate stab

wounds and left in situ till drain output becomes nil.

Postoperative evaluation:

Patients were kept nil per oral and on parenteral fluids till their bowel activity recovered. The patients were observed for complications, if any including acute pancreatitis or severe dehydration due to electrolytes imbalance or increased T-tube output. Serum amylase was done on the first postoperative day and LFT on second postoperative day. The subhepatic drain was removed once its drainage had reduced to a negligible amount. The stitches were removed on the 10th to 12th post-operative day.

Follow up

The T-tube was removed on the 14th post operative day if post exploratory cholangiography done on 10th post operative day showed clearance of the common duct. Before discharge ultrasound of the abdomen was done in all patients to rule out any biliary leak, subphrenic collection, residual stones or any other complication.

OBSERVATION

The study was conducted in the Department of Surgery, Government Medical College Jammu from 1st November 2016 to 31st October 2017. A total of 30 patients were included in the study who underwent open CBD exploration followed by closure over T-tube.

1.AGE/SEX DISTRIBUTION

There were 20%(n=6) males and 80%(n=24) females. Age of the patients varied from 22-70 years.

TABLE 1: Age/ Sex distribution of patients with CBD stones.

Age Group(in years)	Males	Females
20-35	1	6
36-50	3	11
51-65	2	4
>65	0	3
TOTAL	6(20%)	24(80%)

2. SIZE OF CBD/NUMBER OF STONES ON USG ABDOMEN

30 patients were evaluated for number of CBD stones on USG abdomen,

out of which 21 showed single stone while 5 showed multiple stones. 4 patients did not show any stone on USG abdomen. The mean CBD diameter on USG abdomen was 11.9mm. MRCP was done in 6 patients. The CBD diameter on MRCP varied from 10mm to 17.6mm with mean CBD diameter of 13.43mm.

3. COMPLICATIONS

1(3.33%) patient had biliary peritonitis after T-tube removal. 3(10%) patients had T-tube wound infection in postoperative period. 1(3.33%) patient had retained CBD stone which needed re-operation.

1 patient had wound hematoma and 2 patients had wound dehiscence. 4 patients were readmitted;1 with retained stone and 3 with post T-tube removal pain and vomiting and were managed conservatively.4(13.3%) patients had main wound infection which was managed with daily dressings and antibiotics.

Table 2 : Distribution of patients according to complications (n=30)

Complications	Number of patients	Percentage
Bile leak/biliary peritonitis	1	3.33%
T-Tube Wound infection	3	10.00%
Retained CBD stone	1	3.33%
Wound dehiscence	2	6.66%
Wound Haematoma	1	3.33%
Intra-abdominal abscess	1	3.33%
Re-admission	4	13.33%
Re-operation	1	3.33%
Main wound infection	4	13.33%

4. T-TUBE REMOVAL

In 1 patient, T-tube was removed on 14th POD while in 29 patients, T-tube was removed after 14th POD.

5. POST OPERATIVE STAY

The post operative stay in hospital for patients ranged from 6 to 16 days with a mean of 9.5 days.

DISCUSSION

T-tube has been the method of choice for CBD decompression following choledochotomy for years. Although it is true that the T-tube has been used and proven to be a safe and effective method for postoperative biliary decompression, it is

not exempted from complications, which are present in upto 10% of patients. [11]

This study was conducted to evaluate the safety and feasibility of T-tube drainage after open CBD exploration. There were 80% females and 20% males in this study. This sex distribution is similar to that study by **Parez et al**, [13] the incidence of CBD stone being higher in females. The age of the patients in this study varied from 22 to 70 years. Patients in this study were found to be similar to various published series of the western world, most of which have reported an older average age group of patients. [8]

It must not be assumed that the common duct may be closed without fear in every case following choledochal exploration. Following investigations were, therefore, performed preoperatively to confirm the absence of residual stones before doing primary closure:

1. Intraoperative choledochoscopy.
2. Irrigation with feeding tube of the CBD and hepatic ducts.
3. Passing of bougies.

Choledochotomy in a CBD of diameter less than 5mm has been associated with stricture formation and In the present study, the CBD diameter varied from 9 to 15 mm (mean 11.9mm).

The proponents of routine T-tube drainage have stated that if calculi are overlooked, the situation is easier to manage if a tube has been left in the duct. As per our study it is difficult to see how the drainage tube can be of much benefit. Additional surgery is frequently necessary to obtain relief. The dilatation of the papilla of Vater is effective in discharging any small residual common duct stones since it leaves the papillary muscle flaccid for an undetermined period of time. Sawyers, Herrington and Edwards do not agree with this view. It has also been stated that postoperative cholangiograms may be performed through the T-tube to check for residual stones. However, according to Edwards and Herrington, [4] cholangiograms made during the convalescent period are of

little value, since in the majority of cases, well established clinical signs and symptoms will usually make the diagnosis of retained common duct stones and the presence of a T-tube is not necessary to arrive at this conclusion.

In certain specific situations, observed per operatively, T-tube drainage of CBD is a safer procedure. These are:

1. Whenever there has been significant trauma inflicted upon the duct wall during stone removal.
2. When extensive manipulation and trauma to the pancreas or ampulla occur during the removal of impacted stones for which transduodenal sphincteroplasty also may have to be done.
3. A T-tube is used to drain the common duct after transduodenal sphincteroplasty since pancreatitis has been encountered often after this procedure. [20] Postoperative pancreatitis was not seen in any case.
4. Drainage is also indicated if there is suppurative cholangitis and when the CBD wall is extensively oedematous and surrounded by an acute inflammatory reaction. Reinhoff felt that if CBD is filled with sludge or bile stained mud like material, then T-tube drainage is needed. [14]

Broadly, the indications for closure of common bile duct are:

- a. When a negative exploration is performed on an otherwise normal appearing duct or even a duct that is dilated.
- b. When stones are removed from the CBD without manipulation or traumatising of the walls or lumen of the duct.
- c. When the duct wall is slightly thickened but not oedematous or acutely inflamed.

Drain placement in the subhepatic space was not necessary in all, yet it was preferred by most of the surgeons performing CBD Exploration. In our study, subhepatic drain was kept in most of the

patients and removed once output was minimal.

Postoperative morbidity is related to the complications which range from wound infection to life threatening biliary peritonitis. 10% cases of T-tube drainage in our study had post-operative T-Tube wound infection and 13.3% cases had main wound infection, whereas studies by **Lygidakis** [10] (reported as 77%), **Keighley** (reported as 73%) and **Parez et al** (reported 11%). It appears reasonable that T-tube drainage, requiring the introduction of a foreign body, provokes exogenous acquisition of environmental microorganisms. Apparently ascending cholangitis leads to bacteremia and distant infective complications.

It was found in our study that the patients' stay in hospital was 9.5 days. This finding is in agreement with **Parez et al** (T-tube 6.8 ± 4.7 days). [13] T-tube drainage places an increased demand on the nursing personnel. This becomes an important consideration with the problems of hospital bed shortage and increasing costs. The drainage apparatus also adds to the patient's psychic trauma. The benefits of a shorter postoperative stay to the patient as well as the hospital are well documented. With the ever-rising patient load there is an increasing pressure for rapid patient turnover and hence a shorter hospital stay.

Residual calculi were found one case (3.3%) of T-tube drainage detected on post-operative T-tube cholangiography. The incidence of residual stones detected on T-tube cholangiography in our study was comparable to studies by Way et al (7%), Sawyers et al (1.6%), Gillatt et al (5%), Herrington et al (5.5%), Chande et al (4.7%). [2,7,10,17]

T-tube removal leads to minor reactions in the form of pain and discomfort in most of the cases in our study. Biliary peritonitis at this time was reported in one case. The patient was diagnosed by symptoms of abdominal pain, tenderness and guarding. On USG abdomen minimal free fluid was present in the peritoneal cavity. Patient was managed conservatively.

Severe reaction at the time of T-tube removal has been reported by **Lygidakis et al**. [10]

No serious postoperative procedure related complications such as postoperative acute pancreatitis, severe dehydration and bowel perforation occurred during the course of the study. There was no mortality in this study.

Readmission (13.3%) and reoperation rate (3.33%) in this study were comparable to the study conducted by **Parez et al**. [13]

CONCLUSION

Preoperative endoscopic retrograde cholangiopancreatography with sphincterotomy became the preferred approach for patients with suspected CBD stones who were to undergo laparoscopic cholecystectomy (LC) during the early phase of LC. [5] The CBD calculi could be removed endoscopically and subsequently only a cholecystectomy needed to be performed which could be done laparoscopically. However several studies have shown that preoperative endoscopic retrograde cholangiopancreatography with sphincterotomy followed by cholecystectomy is not superior to open cholecystectomy and CBD Exploration in surgically low risk patients. [6] Furthermore, since the preoperative prediction of CBD stones (based on clinical and biochemical parameters) is less than desired, preoperative ERCP would result in many negative and thus unnecessary endoscopic procedures and associated complications as well as increase in cost. So, T-Tube drainage of CBD after choledochotomy is a modality of treatment with good results where facility of endoscopic / laparoscopic procedures is either not available nor such interventions are not feasible.

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