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A Prospective Study of Complications of T-Tube Drainage of Common Bile Duct in The Management of Choledocholithiasis in The Tertiary Care Hospital of North India

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Abstract
Background*: Surgery for more than 100 years has been the standard mode of care for the treatment of diseases of the biliary tract. Cholecystostomy was the initial surgical treatment for gallstones. The rationale for use of T-tube is that it minimises the risk of leakage in the early postoperative period if there is persistent distal duct obstruction. It also allows further radiological examination and may facilitate removal of residual calculi.*
Material and Methods: *The study was a prospective study undertaken in the Postgraduate Department of Surgery, Government Medical College, Jammu. This study included 40 patients, who were subjected to open choledochotomy with T-tube drainage and aspiration of bile from common bile duct for culture. Postoperatively, the T-tube bile culture was taken on 5th postoperative day for culture sensitivity and all the patients were observed for the development of complications associated with the T-tube drainage of common bile duct and complications following T-tube removal.*
Results*:(i)Choledocholithiasis was more common in females than males. (ii)Age range of our patients was 22-67 years with mean age(± standard deviation) of 46.75 (± 8.63) years.(iii)Abdominal pain was the most common presenting symptom followed by fatty dyspepsia.(iv)Bactibilia was observed on bile culture in 25 patients (62.5%) with aerobes isolated in 23 (92%) out of 25 culture positive patients and anaerobes isolated in 5 patients (20%). Among the patients with positive bile culture, 2 patients were those who had previous ERCP.(v)E. coli was the most common organism isolated in 12 (48%) patients,followed by Enterococcus in 5 (20%) patients. Anaerobes mixed with aerobes were culture in 3 patients (12%).(vi)T-tube bile culture taken on 5th postoperative day showed increased incidence of bactibilia.(vii)Complication rate of T-tube drainage of CBD in our study was 25%.(viii)Most common complication was pain abdomen (10%), followed by wound infection and vomiting, 5% each.(ix)Complications of T-tube drainage of CBD were seen more commonly in patients having positive bile culture (32.14%) than bile culture negative patients (8.33%).*
Conclusion*:Persons with stones in the biliary tract harbour bacteria in bile.T-tube drainage of CBD carries risk of bactibilia.ERCP can result in increased incidence of long-term bactibilia.Patients with bactibilia are at high risk for development of complications associated with T-tube drainage of CBD.Cholangiogram is mandatory before removal of T-tube.Patients should be observed in hospital after T-tube removal for over a day.Majority of patients developing complications following T-tube removal can be managed conservatively*
Keywords: *Choledocholithiasis, bactibilia, complications of T-tube drainage, CBD,cholangiography.*

I. Introduction

Surgery has been the standard mode of care for the treatment of diseases of the biliary tract for more than 100 years. John S. Bobbs performed the first elective Cholecystostomy procedure on July 15, 1867, in Indiana [1] and in 1882, Langenbuch C completed the first cholecystectomy on a human.[2] The first successful choledochotomy was performed by Courvoisier on January 21, 1890 [3] .The rationale for use ofT-tube is that it minimizes the risk of leakage in the early postoperative period if there is persistent distal duct obstruction. It also allows further radiological examination and may facilitate removal of residual calculi.The use of a T-tube access to extract retained stones in the biliary ducts was first described in 1978 by Burhenne HJ [4] .A T-tube may be necessary in selected cases, such as in those who have had failed preoperative ERCP, in those in whom ductal clearance is not confirmed intraoperatively, and in those in whom access for ERCP may be very difficult (*e.g.*, after a Billroth II gastrectomy).

Despite these potential advantages, morbidity rates are high.The incidence of recurrent stones may be greater after T-tube drainage because the tube acts as a foreign body around which bile pigments and salts may precipitate . Significant bile leak after T-tube removal can occur in 1-30% of cases. Prolonged external loss of bile through the T-tube may lead to slow wound healing, anorexia, and constipation (post-choledochotomy acidotic syndrome) [5] . Beside this accidental displacement of the T-tube, failure to remove the T-tube, biliary leakage, duodenal erosion, persistent biliary fistula, biliary peritonitis, chronic discharging sinus, excoriation of the skin, bile duct stricture and cholangitis caused by micro-organisms migrating through the T-tube may prolong hospital stay and delay postoperative recovery .

Historically, a latex T-tube has always been used during open exploration, specifically to encourage a vigorous inflammatory reaction around it causing formation of a biliary fistula. This makes T-tube removal much safer by reducing the potential for intraperitoneal bile leak. The fistula closes rapidly after removal of the T-tube as long as there is no distal CBD obstruction. More recently, silicone-coated or polyethylene T-tubes have become available, but these are less irritant and the resulting fistula tends to be less mature, increasing the risk of a leak after T-tube removal **.** The present study was conducted to study various complications of T-tube insertion and analyze them in terms of early complications and, also to find out various factors to lower the complications following T-tube drainage of common bile duct in the management of choledocholithiasis.

Aims And Objectives

1. To study the complications of T-tube drainage of common bile duct and to analyze them in terms of early complications.
2. To find out various factors to lower the complications following T-tube drainage of common bile duct in the management of choledocholithiasis.

II. Material And Methods

Study Design

This study was conducted for a period of 1 year (Dec 2010 to Nov 2011) at Government Medical College, Jammu. A total of 40 patients with proven common bile duct (CBD) stones on preoperative workup or at the time of surgery in whom elective cholecystectomy with choledochotomy was planned were selected randomly, irrespective of their age, sex, built and socio-economic status. Patients with uncontrolled co-morbid medical conditions like hypertension, diabetes mellitus, bleeding disorders, pulmonary diseases, pancreatitis, malignancy were excluded. Thorough clinical assessment, pre-anesthetic checkup along with laboratory and radiological investigations were done .Ultrasonography abdomen were carried out in all the selected patients. Latex T-tube (14 Fr) and Vicryl 3.0'/4.0' suturing material was used in all the patients.

Exclusion Criteria

- Uncontrolled co-morbid medical conditions like hypertension, diabetes mellitus, bleeding disorders, pulmonary diseases
- Acute pancreatitis
- Malignancy

Methods

Thorough clinical assessment of the patients was done. Following investigations were carried out in all the patients. like Complete Blood Count, BT and CT, Blood grouping, Blood coagulation studies, Blood sugar, Complete Liver and Renal function tests, urine examination, X-ray chest, Electrocardiography and Ultrasonography abdomen.Preanaesthetic check-up of all the patients was done.Material used were Latex T-tube 14 Fr , Vicryl 3.0'/4.0 and Drainage bag

Operative Procedure

Abdomen was opened by right subcostal or RUQ transverse incision. cystic duct, cystic artery, CHD and CBD were identified. After doing cholecystectomy, bile from CBD was drawn in a syringe after puncturing it with needle. About 3-5 ml of bile was drawn in sterile syringe with needle, immediately capped and samples were sent to microbiological laboratory for culture and sensitivity testing. After stone retrieval from CBD and CBD clearance, a T-tube (14 Fr) was taken and to prevent proximal obstruction and distal entry into the duodenum. T-tube was introduced into the CBD using Desjardin's forceps. The T-tube was positioned and secured to abdomen wall with long limb emerging in the epigastrium. A tube drainage of hepatorenal space was employed in all the cases and abdominal wound closed in layers.All the patients in the study were given preoperative prophylatic antibiotics in the form of third generation cephalosporin at the time of induction of anaesthesia and antibiotics were modified postoperatively depending on the culture report.

Bile was allowed to drain freely into a bile bag to allow any spasm or edema of the sphincter to settle. The volume of bile drained progressively decreased over 4-5 days in all the cases. T-tube was clamped when the yield in the bile bag was <50 ml in 24 hours. Postoperative bile culture was repeated on 5^{th} postoperative day. Patient was put on oral antibiotics from 7^{th} postoperative day as per culture/sensitivity report giving cover for both aerobes and anaerobes. A T-tube cholangiogram was taken at about 10^{th} to 14^{th} day postoperatively and T-tube was removed in patients where cholangiogram was interpreted to be normal. A prophylactic antibiotic was given intravenous 1 hour before the removal of the T-tube. The patients in whom the post T-tube removal period was uneventful were discharged after about 8-10 hours of observation. The patients who had complications in

post T-tube removal period were admitted as inpatients for further management. These patients underwent CBC/LFT and USG abdomen as a part of investigations for management.

III. Results

The age of all the cases ranged between 22 to 67 years with majority (80%) being in their 4th and 5th decade. There was marked preponderance of female patients (95%) and only 2 (5%) patients were males[Table 1] . Common presenting complaints were pain off and on in the right hypochondrium (RHC) (80%), fatty dyspepsia (72.5%), vomiting (30%), fever with chills (15%) and jaundice (10%). On abdominal examination, tenderness was present in RHC in 22% and gall bladder was palpable in 20% cases. Pre-operative indications included: USG proven choledocholithiasis in 32 cases (80%) and cholelithiasis with history of jaundice in 4 patients (10%). Previous CBD stenting for choledocholithiasis with retained stones in CBD and intraoperative palpable stones in CBD accounted for CBD exploration in 2 cases each (5% each) [Table 2] . Regarding post operative complications following T tube removal, abdomen pain requiring admission for one day was noticed in 4 patients (10%), vomiting was noticed in 2 patients (5%) requiring intravenous supplementation and treatment for 2 days, wound infection requiring laying the wound open with daily dressings for two weeks followed by delayed suturing was observed in 2 patients (5%). The wound swab culture revealed *E. coli* in both the cases. Cholangitis was noticed in 1 patient (2.5%) who was managed conservatively. Peritonitis requiring laparotomy with lavage and drainage of peritoneal cavity was noticed in 1 patient (2.5%). The follow-up period of patient for 6 months following laparotomy was uneventful[Table 3]. 2 patients out of 25 cases (62.50%) who were culture positive had undergone ERCP previously and 28 patients (70%) turned out to be T-tube bile culture positive [Table 4] .Septic complications were found in 9 out of 28 patients with positive bile culture and 1out of 12 patients with negative bile culture[Table 5].

Table 1: Age and sex distribution of the patients

Age range (in years)	Male N (%)	Female N (%)	Total N (%)
21 – 30	–	2 (5.0)	2 (5.0)
31 – 40	–	4 (10.0)	4 (10.0)
41 – 50	2 (5.0)	22 (55.0)	24 (60.0)
51 – 60	–	8 (20.0)	8 (20.0)
61 – 70	–	2 (5.00)	2 (5.0)

Table 2: Clinical features and indication for CBD exploration:

Clinical features	N(%)
Pain (right hypochrondrium)	32 (80.0)
Fatty dyspepsia	29 (72.5)
Vomiting	12 (30.0)
Fever with chills	6 (15.0)
Jaundice	4 (10.0)
Clinical indications	
USG proven choledocholithiasis	32 (80.00)
Cholelithiasis with previous history of jaundice	4 (10.00)
Previous CBD stenting with retained stones	2 (5.00)
Intraoperative palpable stones in CBD	2 (5.00)

Table 3: Complications of T-tube drainage

Complications	N(%)
Pain abdomen	4 (10.0)
Vomiting	2 (5.0)
Wound infection	2 (5.0)
Cholangitis	1 (2.5)
Peritonitis requiring laparotomy	1 (2.5)

Table 4: Intra-operative bile culture and Postoperative T-tube bile culture results.

Postoperative T-tube bile culture	No. (%)
Positive	28 (70.0)
Negative	12 (30.0)
Intrao-perative Bile culture	
Positive	25 (62.5)
Negative	15 (37.5)

Table 5: Incidence of septic complications as per T-tube bile culture

Bile culture status	No. of patients	Septic complications N(%)
Positive	28	9(32.14)
Negative	12	1(08.33

IV. Discussion

Most of the patient in the present study were female (95%) with male accounting for the rest 5%. In a study by Naylor J, Donae WA and Barbara S, *et al.*[6] , 100 patients of common bile duct exploration were reviewed in which 66 were females and 34 were men with the age range of 19 to 84 years. This study indicates female preponderance as observed in the present study. Brown JE and Christensen C , 1967[7] , in their study on 104 patients who underwent a primary operation for biliary tract disease included 19 male patients and 85 female; females accounting for majority (85%), similar to current study.The clinical features in our study like pain in right hypochondrium (80%), fatty dyspepsia (72.5%), vomiting (30%), fever with chills (15%) and jaundice (10%) are in accordance with studies by Chetlin SH and Elliot DW ,1971 [8]andWells GR, Taylor EW, Lindsay G, *et al.* 1989[9] **.**In the present study, USG proven choledocholithiasis was the commonest indication for CBD exploration (80%), with cholelithiasis with previous history of jaundice (10%) as second most common symptom. Previous CBD stenting with retained stones (5%) and intraoperative palpable stones in CBD (5%) were other indications. In a study by Hampson LG, Fried GM, Stets JA, *et al.*,1981 [10], a retrospective review of 110 consecutive patients who had undergone common bile duct exploration for calcular biliary tract disease, showed that clinical conditions that most often associated with choledocholithiasis were cholangitis and clinically obvious jaundice. Intraoperative palpation of CBD stones, positive operative cholangiograms and dilated CBD were the other indications for CBD exploration.

In our study, complications of T-tube drainage after choledochotomy were noticed in 10 (25%) patients. Pain in abdomen, following T-tube removal, was noticed in 4 patients (10%), vomiting in 2 patients (5%), wound infection requiring dressings in 2 patients (5%), cholangitis in 1 patient (2.5%) and biliary peritonitis following T-tube removal requiring laparotomy was noticed in 1 patient (5%). In a study by Gillatt DA, May RE, Kennedy R, *et al.*,1985 [11], the complications associated with T-tube drainage following choledocholithiasis were noticed in 7 (19.4%) patients. 1 (2.7%) patient developed biliary peritonitis and required reoperation, 2 (5.5%) patients developed clinical peritonitis which was managed conservatively. Radiological leakage was noticed in total of 4 (11.1%) patients. Radiological leakage was noticed in total of 4 (11.1%) patients. In a study by LygidakisNJ ,1986 [12] on 105 patients of choledocholithiasis with T-tube drainage, 8 (7.6%) patients had severe pain abdomen following T-tube removal which was managed conservatively. Out of T-tube bile culture positive group of 28 patients, a total of 9 (32.14%) complications occurred with pain abdomen following T-tube removal as dominant (10.71%) complication, whereas in 12 culture negative patients, only 1 (8.33%) complication occurred. These findings are in close agreement with the findings ofBaddeley RM *et al* (1976); Chetlin SH and Elliott DW 1971[1];Mason GR 1968 [1];Keighley MRB, Burdon DW, andWolloch Y, Feigenberg ZV, Zer M, *et al.* 1977 [13-14]

Even in the era of laparoscopic and endoscopic interventions, a large number of patients in the Government Medical College & Hospital, Jammu are still subjected to open choledochotomy with T-tube drainage for the management of choledocholithiasis. With the help of our study we were able to study the variouscomplications of T-tube insertion and study them in terms of early complications along with the enlightening of various factors present to lower the complications following T-tube drainage of common bile duct in the management of choledocholithiasis.

V. Conclusion

The study thus conclude that patients with stones in the biliary tract harbour bacteria in bile.T-tube drainage of CBD carries risk of bactibilia.ERCP can result in increased incidence of long-term bactibilia and further these patients with bactibilia are at high risk for development of complications associated with T-tube drainage of CBD.Bile culture should be done routinely in all patients undergoing biliary surgery and antibiotics should be modified depending upon sensitivity report of culture.Every effort should be done to prevent internal spillage of bile during biliary surgery to prevent the development of postoperative sepsis.Cholangiogram is mandatory before removal of T-tube and patients should be observed in hospital after T-tube removal for over a day.Majority of patients developing complications following T-tube removal can be managed conservatively.

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