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A COMPARATIVE STUDY OF PRIMARY CBD CLOSURE AND T-TUBE DRAINAGE FOLLOWING CBD EXPLORATION

General Surgery

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ABSTRACT

Background: Common bile duct (CBD) exploration is performed to remove stones that cannot be extracted by endoscopic retrograde cholangiopancreatography (ERCP). Traditionally, a T-tube is used to prevent bile leakage following the procedure; however, T-tube placement is associated with significant morbidity, leading to prolonged postoperative discomfort and the need for extended care. In addition, T-tube insertion increases operative time during laparoscopic procedures and is technically demanding. **Methods:** Cases undergoing open cholecystectomy with primary closure of the common bile duct (CBD) without T-tube insertion (n = 50; Group A) were compared with cases managed with T-tube placement (n = 50; Group B). All procedures were performed at the same center between January 2024 and June 2025. Patients in both groups were followed for one and half Year, with outcomes assessed using biochemical investigations, ultrasonography and/or computed tomography, along with evaluation of postoperative complications. **Results:** During the follow-up period, Group A (primary CBD closure; n = 50) had two cases of bile leakage, three cases of recurrent stones, and two cases of obstructive jaundice (total complications, n = 7). In comparison, Group B (T-tube placement; n = 50) experienced three cases of biliary peritonitis, two cases of residual stones, and two case of pancreatitis (total complications, n = 7). There was no statistically significant difference in the overall complication rates between the two groups (p = 0.63). **Conclusion:** Multiple recent studies support common bile duct exploration with primary closure without T-tube placement as a safe and effective surgical option.

KEYWORDS

Choledocholithiasis, ERCP, T-tube, Choledochotomy

INTRODUCTION

Choledochotomy for the removal of common bile duct (CBD) stones is generally performed when endoscopic retrograde cholangiopancreatography (ERCP) with endoscopic sphincterotomy (EST) is unsuccessful or contraindicated. Traditionally, a T-tube is inserted through the choledochotomy at the end of the procedure. The T-tube provides external drainage of bile, allows postoperative cholangiography to detect and manage residual stones, and may help reduce the risk of CBD stricture. However, T-tube insertion and removal carry risks, including bile leakage leading to biliary peritonitis, along with patient discomfort and prolonged hospitalization . Furthermore, performing laparoscopic choledochotomy with T-tube placement is technically demanding, which limits the widespread use of this approach.

More recently, several techniques have been explored to avoid the use of a T-tube, including single-stage laparoscopic cholecystectomy with choledochotomy without ERCP , the use of pigtail catheters, preoperative placement of an endoscopic naso-biliary drainage (ENBD) tube, and transcystic approaches to the CBD. In our institution, patients are typically managed with laparoscopic cholecystectomy following ERCP-mediated bile duct stone removal, while open cholecystectomy with choledochotomy is reserved for cases in which endoscopic clearance is unsuccessful.

Here we present the comparative study between clinical outcomes of 50 cases of open choledochotomies and primary closure of CBD without T-tube placement with 50 instances of choledochotomy closure over a T-tube from JAN 2024 to June 2025 .

METHODS

Patient profiles

This was a prospective study involving 100 patients who underwent open cholecystectomy and choledochotomy. Patients were divided into two groups: Group A (n = 50), in which antegrade CBD clearance was performed followed by check endoscopy, without T-tube insertion; and Group B (n = 50), in which a T-tube was placed, particularly in patients with recurrent stones or complications. In Group A, stent removal was performed at one month, and postoperative evaluation with CT scan or ERCP was conducted as needed. All patients were followed for one 6 months.

All procedures were performed by the same surgeon, who alternated the choledochotomy closure method via chit systems . Among the 50 patients with CBD stones, two cases in Group B were managed with laparoscopic cholecystectomy, while the remaining cases were treated via open laparotomy.

Table 1.

Variable	Group A (n=50)	Group B (n=50)
Patient number	50	50
Median Age (years)	64.5	66.4
Hospital stay (days)	5.3 ± 1.4	5.8 ± 1.5
1st Follow-up (days)	7.0 ± 1.1	7.3 ± 1.9
ERCP after operation	**5**	**2**

Patients were followed up using liver function tests, abdominal ultrasonography, and CT or ERCP when indicated. Postoperative complications assessed during follow-up included recurrent stones, biliary peritonitis, obstructive jaundice, wound infection, pancreatitis, and CBD strictures.

Laparotomy was performed through a right subcostal incision, followed by a longitudinal choledochotomy at the most accessible area near the origin of the cystic duct. Through this opening, stones were extracted, and intraoperative choledochoscopy was performed when required. Stone removal was achieved using stone forceps and saline irrigation , and CBD patency to the duodenum was verified.

Choledochotomy was closed by 5-0 Vicryl by continuous suturing in group A patients (n=50) primarily, and T-tube was inserted in group B patients (n=50) using the same suture size and material. A suction drain was left in the operative area to observe any bile leak and was usually removed around the 7th postoperative day. Staples were removed on the postoperative 8th day.

Postoperative Follow-up Management

Postoperatively, patients were advised to attend monthly follow-up visits, which included routine laboratory tests and abdominal ultrasonography for the first three months, followed by annual outpatient evaluations. In Group B, the T-tube was removed on the 12th postoperative day in the outpatient clinic after confirming stone clearance with a T-tube cholangiogram. In patients managed with an antegrade , follow-up endoscopy which was performed at one month. CT or ERCP was carried out when recurrent stones or complications were suspected.

Statistical Analysis
Data was analysed by chi-square test, giving statistical significance when $p<0.05$.

RESULTS

The demographic characteristics of patients were comparable between the two groups. Hospital stay was also similar, indicating no significant difference in postoperative recovery time. The indications for surgery included failure of CBD stone extraction by ERCP , a history of gastric resection with Billroth II anatomy preventing endoscopic access to the CBD, and refractory cholangitis or pancreatitis unresponsive to antibiotics, leading to septic conditions.

The postoperative complication rates were compared between Group A and Group B, with 12 and 10 cases, respectively ($p = 0.63$), as shown in Table 3. This difference was not statistically significant, indicating that the overall complication rates were comparable between patients undergoing primary choledochotomy closure and those with T-tube insertion.

In Group A, two patients required immediate postoperative ERCP due to jaundice and suspected residual CBD stones, whereas no such cases occurred in Group B. Additionally, one patient in Group A underwent ERCP more than six months postoperatively for suspected recurrent CBD stones.

Table 2

Condition	Group A (n=50)	Group B (n=50)
Cholangitis	**30**	**23**
Acute pancreatitis	**5**	**7**
Obstructive jaundice	**12**	**13**
Acute cholecystitis	**3**	**7**

Recurrent stones were identified in three patients in Group A and two patient in Group B. In Group A, one case was managed with re-exploration surgery and the others with ERCP, while the patient in Group B was treated successfully with re-exploration surgery.

Postoperative biliary peritonitis occurred in two patient in Group A and three patients in Group B. In Group A, the bile leak resulted from separation of the upper edge of the closed choledochotomy. Cases in Group B were successfully managed with ultrasound-guided drain placement.

Table 3

Complication	Group A (n=50)	Group B (n=50)	P-value
Recurrent stone	3	2	
Bile peritonitis	2	3	
Obstructive jaundice	2	2	
Wound infection	3	2	
Pancreatitis	2	2	
Total complications	**12**	**10**	**0.63**

Wound infection occurred in three patients in Group A and two patient in Group B, all of whom were successfully treated with dressings and antibiotics. Obstructive jaundice was observed in two patient in Group A, caused by pancreatic edema without evidence of pancreatitis, and resolved within ten days postoperatively. Postoperative pancreatitis in one patient from each group was managed conservatively, with full recovery.

DISCUSSIONS

The necessity of T-tube placement at the end of choledochotomy, whether open or laparoscopic, has been increasingly questioned in light of recent advances in perioperative diagnostic tools, surgical instruments, and operative techniques.

The technically demanding nature and prolonged operative time associated with T-tube insertion have led to the adoption of alternatives such as primary closure, pigtail catheter placement, and laparoscopic approaches, which have demonstrated favorable outcomes in facilitating postoperative CBD decompression.

Recently, numerous reports have documented successful primary closure of choledochotomy sites without T-tube placement, in both open and laparoscopic procedures.

Preoperatively, the pattern and location of biliary stones are usually well-defined. With careful operative techniques emphasizing complete CBD clearance and ensuring ductal patency, the likelihood of retained stones is minimal. This raises questions about the necessity of T-tube insertion and whether external bile drainage genuinely aids the healing of choledochotomy wounds. Additionally, primary closure may reduce postoperative patient discomfort and offer potential financial benefits by shortening hospital stay and associated care costs.

We reviewed 50 cases of primary choledochotomy closure without T-tube (Group A) and 50 cases with T-tube placement (Group B) over a one and half year period. The results showed no significant difference in overall complication rates, with bile leakage occurring less frequently in the primary closure group (2 cases in Group A versus 3 cases in Group B).

In Group A, antegrade stenting of the ampulla of Vater was performed at the end of choledochotomy in cases with suspected retained CBD stones. Although no stones were ultimately found, the stenting facilitated effective immediate postoperative bile drainage, which may support choledochotomy wound healing according to traditional principles.

In Group B, the presumed benefit of T-tube bile drainage for decompression and facilitation of choledochotomy wound healing-by lowering intraluminal CBD pressure-was not clearly observed. In Group A, among 50 patients with successful primary closure, 8 were drained via antegrade stenting and 6 underwent EST, while the remaining patients had an intact ampulla of Vater, maintaining normal CBD physiology and intraluminal pressures. Neither EST nor the absence of drainage appeared to affect wound healing in primarily closed choledochotomies. Similarly, T-tube–drained patients in Group B also demonstrated uneventful choledochotomy wound healing, suggesting that intraluminal pressure does not significantly impact the recovery of CBD incision sites.

Unexpected bile peritonitis occurred in relatively young patients in Group B, aged. All cases were successfully managed with drainage and supportive care. Notably, the ampulla of Vater remained intact in both patients perioperatively.

While T-tubes are useful for detecting residual stones postoperatively, they appear to play a limited role in promoting choledochotomy wound healing through decompression. In cases where residual stones are suspected at the end of surgery, leaving an internal antegrade stent in place may provide a route for subsequent endoscopic stone removal. Recent studies on laparoscopic choledochotomy with primary closure suggest that this approach is a feasible and acceptable treatment option.

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