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Original Research Article

Postoperative pain, hospital stay and patient satisfaction following open choledocholithotomy with versus without T-tube drainage: a quasi-experimental study

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ABSTRACT

Background: T-tube drainage has traditionally been performed following common bile duct exploration to provide biliary decompression and postoperative access to the duct. However, external drainage may contribute to postoperative discomfort, prolonged hospitalization and inconvenience to patients. Objectives were to compare postoperative recovery and patient satisfaction following open choledocholithotomy with and without T-tube drainage.
Methods: This quasi-experimental study was conducted in the Department of Surgery, Rajshahi Medical College Hospital, Bangladesh, from January to December 2023. Ninety-two patients undergoing open choledocholithotomy were enrolled using purposive sampling and divided into a T-tube group (n=46) and a no-T-tube group (n=46). Postoperative pain, duration of hospital stay and patient satisfaction constituted the principal recovery outcomes. Biliary leakage and superficial wound infection were assessed as safety outcomes.
Results: Baseline age and sex distributions were comparable between groups. Postoperative pain differed significantly (p=0.001); 54.3% of patients without a T-tube were pain-free compared with 15.2% receiving T-tube drainage. Mean hospital stay was significantly shorter without a T-tube (8.17±1.79 vs 14.65±2.05 days; p<0.001), and 95.7% of these patients were discharged within 10 days. Satisfaction was higher in the no-T-tube group (95.7% vs 80.4%; p=0.024). Biliary leakage (4.3% vs 8.7%; p=0.398) and superficial wound infection (10.9% vs 19.6%; p=0.246) showed no statistically significant differences.
Conclusions: In selected patients undergoing open choledocholithotomy, omission of T-tube drainage was associated with less postoperative pain, shorter hospitalization and greater patient satisfaction without evidence of increased early biliary leakage or wound infection in this sample.

Keywords: Choledocholithiasis, Choledocholithotomy, T-tube drainage, Postoperative pain, Hospital stay, Patient satisfaction, Primary closure

INTRODUCTION

Common bile duct stones occur in approximately 10-20% of patients with symptomatic gallstone disease and may result in biliary obstruction, cholangitis and acute pancreatitis.[1] Endoscopic stone extraction is currently central to management, while magnetic resonance cholangiopancreatography and endoscopic ultrasonography are important diagnostic modalities in appropriately selected patients.[2,3] Nevertheless, surgical

common bile duct exploration remains relevant when endoscopic clearance fails, difficult or impacted stones are present, or appropriate endoscopic or laparoscopic resources are unavailable.

Following choledochotomy, T-tube drainage has historically been used to decompress the biliary tree, facilitate postoperative cholangiography and provide access for residual stone management. Its use is not without disadvantages. Wills et al documented tube-related complications including pain, sepsis, electrolyte disturbance, dislodgement and bile leakage, while Sheen-Chen and Chou reported greater discomfort and inconvenience among patients managed with T-tubes.[4,5] Primary duct closure has consequently been explored as an alternative intended to avoid the physical burden and prolonged postoperative management associated with external drainage.

Although comparative surgical studies have increasingly investigated primary duct closure, the available medical literature has predominantly centered upon technical surgical complications, while patient-centered recovery endpoints-most notably postoperative pain burden, duration of hospital stay, and patient satisfaction-remain less frequently highlighted, particularly in resource-constrained surgical environments. The present study therefore compared postoperative pain, duration of hospitalization and satisfaction following open choledocholithotomy with versus without T-tube drainage in a tertiary-care hospital in Bangladesh, while biliary leakage and superficial wound infection were evaluated as complementary safety outcomes.

METHODS

Study design and setting

This prospective quasi-experimental study was conducted in the Department of Surgery, Rajshahi Medical College Hospital, Rajshahi, Bangladesh, from January to December 2023. The study evaluated patients undergoing open choledocholithotomy for choledocholithiasis to compare early postoperative recovery and safety outcomes between those managed with conventional T-tube drainage and those managed with primary common bile duct closure without external drainage.

Study population and selection criteria

Patients aged 18 years or older with clinically and radiologically documented choledocholithiasis scheduled for open surgical exploration were eligible for inclusion. Exclusion criteria comprised patients with associated biliary tract malignancies, concomitant severe acute suppurative cholangitis requiring emergency decompression, severe coagulopathy, intrahepatic biliary calculi, and severe systemic comorbidities precluding standard surgical intervention or informed evaluation. Complete ductal clearance was an essential prerequisite for primary closure.

Surgical procedures and group allocation

A total of 92 patients were enrolled using purposive sampling and allocated into two equal groups of 46 patients each: the T-tube group (n=46) and the without T-tube (primary closure) group (n=46). All operations were carried out through a right subcostal or upper midline laparotomy. Choledochotomy was performed, and calculus extraction was accomplished using stone-grasping forceps, saline irrigation, and gentle instrumentation. Distal patency of the ampulla of Vater into the duodenum was verified mechanically or with saline flush. In the T-tube group, an appropriately sized latex T-tube (14–16 Fr) was placed within the common bile duct, and the choledochotomy was closed around the limb using 3-0 or 4-0 absorbable sutures. In the without T-tube group, primary duct closure was executed using interrupted 3-0 or 4-0 absorbable sutures. A subhepatic drain was placed routinely in all patients.

Study variables and outcome definitions

The primary outcomes evaluated were patient-centered recovery indicators: (1) Postoperative pain, evaluated during the first 48 hours using a standardized 4-tier pain category (pain-free, mild, moderate, severe); (2) Duration of hospital stay, recorded in days from surgery until formal hospital discharge; and (3) Patient satisfaction, assessed at hospital discharge using a structured questionnaire categorized as satisfied or unsatisfied. Secondary safety outcomes included postoperative biliary leakage from the subhepatic drain and superficial surgical site wound infection.

Statistical analysis

Data were entered, cleaned, and analyzed using IBM SPSS Statistics for Windows. Categorical variables were expressed as frequencies and percentages, and comparisons between the two groups were performed using the Chi-square test or Fisher's exact test where expected cell frequencies were less than 5. Continuous variables were expressed as mean ± standard deviation (SD) and compared using the independent Student's t-test. A two-tailed $p<0.05$ was considered statistically significant.

Ethical considerations

The study protocol was reviewed and granted ethical approval by the Ethical Committee of Rajshahi Medical College. Administrative permission was obtained from the Department of Surgery prior to study commencement. Informed written consent was obtained from each patient or their legal guardian prior to enrollment, following thorough explanation of the study objectives and surgical options.

RESULTS

The two groups contained 46 patients each and demonstrated broadly similar baseline demographic characteristics (Table 1). The age distribution spanned from under 30 years to over 60 years, with the majority of patients in both the with T-tube and without T-tube cohorts aged between 30 and 59 years. Female patients predominated in both treatment arms (60.9% in the T-tube group and 65.2% in the without T-tube group). No statistically significant differences were observed between the cohorts regarding age or sex distribution.

A clear difference in postoperative pain distribution was observed between the two treatment approaches (Table 2 and Figure 1). More than half of the patients managed without external T-tube drainage (54.3%, n=25) were categorized as pain-free, whereas only 15.2% (n=7) of patients in the T-tube group attained pain-free status (p=0.001). Conversely, mild postoperative pain was documented in 67.4% (n=31) of T-tube patients compared with 37.0% (n=17) of patients in the primary closure group. Moderate pain occurred in 13.0% and 8.7% of patients, respectively, while severe pain was observed exclusively in 4.3% (n=2) of patients with T-tube drainage.

Hospitalization was substantially longer among patients receiving T-tube drainage (Table 3). Nearly all patients managed without a T-tube (95.7%, n=44) were discharged within 10 days of surgery, whereas every patient in the T-tube group (100.0%, n=46) required 10 or more days of hospital admission (p<0.001). Quantitative comparison of length of stay confirmed that mean hospitalization was significantly shorter in the without T-tube group (8.17±1.79 days) compared with the T-tube group (14.65±2.05 days; p<0.001) (Table 7).

Patient satisfaction differed significantly between the two postoperative management approaches (Table 4). Overall, 95.7% (n=44) of patients treated without T-tube drainage reported complete satisfaction with their postoperative course, compared with 80.4% (n=37) of patients managed with a T-tube (p=0.024). Dissatisfaction was reported by 19.6% (n=9) of patients in the T-tube group versus only 4.3% (n=2) in the primary closure cohort.

The principal recovery indicators consistently favored the group managed without external T-tube drainage (Table 5). Both the proportion of pain-free patients (54.3% vs. 15.2%, p=0.001) and early hospital discharge within 10 days (95.7% vs. 0.0% and p<0.001) demonstrated substantial statistical significance favoring primary duct closure.

Biliary leakage and superficial wound infection were evaluated to provide clinical safety context for the recovery findings (Table 6). Postoperative biliary leakage occurred in 4 patients (8.7%) in the T-tube group and 2 patients (4.3%) in the without T-tube group; all cases resolved spontaneously with conservative drainage management, showing no statistically significant difference between groups (p=0.398). Superficial surgical site wound infection developed in 9 patients (19.6%) with a T-tube and 5 patients (10.9%) without a T-tube, which also did not attain statistical significance (p=0.246).

Figure 1 illustrates the distribution of postoperative pain according to T-tube use. The proportion of pain-free patients was considerably higher in the without T-tube group (54.3%) than in the with T-tube group (15.2%). Mild pain was more common among patients with T-tube placement (67.4%) compared with those without T-tube placement (37.0%), while moderate pain was reported in 13.0% and 8.7% of patients, respectively. Severe pain was observed in 4.3% of patients with T-tube placement, whereas no patients in the without T-tube group experienced the severe pain (p=0.001 and Fisher's exact test).

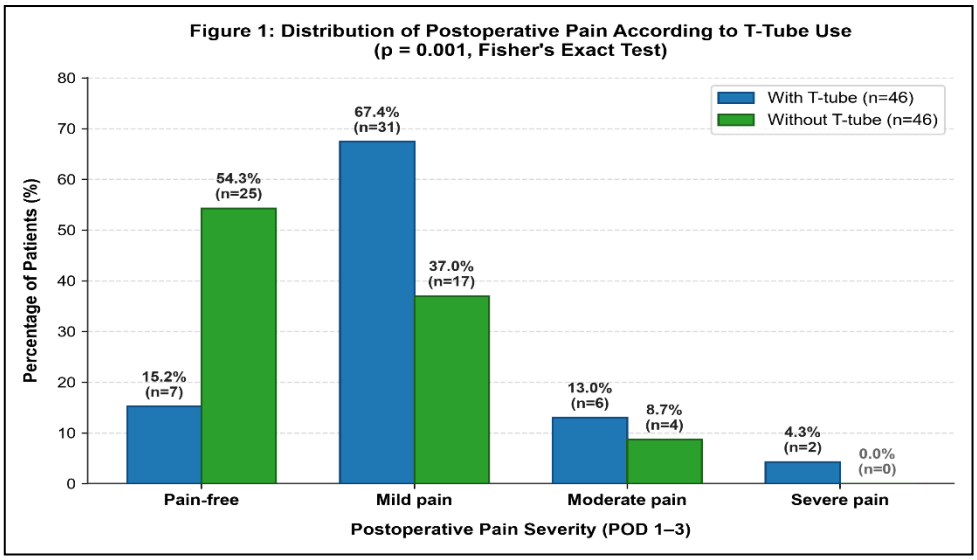


Figure 1: Distribution of postoperative pain according to T-tube use.

Table 1: Baseline demographic characteristics of the participants.

Characteristics	With T-tube, (n=46)	Without T-tube, (n=46)	P value
Age (in years)			
<30	2 (4.3%)	3 (6.5%)	-
30-45	37 (80.4%)	33 (71.7%)	-
>45	7 (15.2%)	10 (21.7%)	-
Mean±SD	40.63±9.21	43.30±11.74	0.228*
Sex			
Male	15 (32.6%)	17 (36.9%)	0.662**
Female	31 (67.4%)	29 (63.1%)	0.662**

*Independent t-test, **Chi-square test; p<0.05 considered statistically significant.

Table 2: Distribution of postoperative pain between treatment groups.

Postoperative pain	With T-tube, (n=46)	Without T-tube, (n=46)	P value*
Pain-free	7 (15.2%)	25 (54.3%)	0.001
Mild	31 (67.4%)	17 (37.0%)	0.001
Moderate	6 (13.0%)	4 (8.7%)	0.001
Severe	2 (4.3%)	0 (0.0%)	0.001

*Fisher's exact test; p<0.05 considered statistically significant.

Table 3: Duration of hospital stay according to treatment group.

Duration of hospital stay	With T-tube, (n=46)	Without T-tube, (n=46)	P value
<10 days	0 (0.0%)	44 (95.7%)	<0.001*
≥10 days	46 (100.0%)	2 (4.3%)	<0.001*
Mean±SD, days	14.65±2.05	8.17±1.79	<0.001**

*Fisher's exact test, **Independent Student's t-test; p<0.05 considered statistically significant.

Table 4: Patient satisfaction following open choledocholithotomy.

Satisfactions	With T-tube, (n=46)	Without T-tube, (n=46)	P value*
Satisfied	37 (80.4%)	44 (95.7%)	0.024
Unsatisfied	9 (19.6%)	2 (4.3%)	0.024

*Fisher's exact test; p < 0.05 considered statistically significant.

Table 5: Summary of major patient-centered recovery outcomes.

Recovery indicators	With T-tube, (n=46)	Without T-tube, (n=46)	P value
Pain-free	7 (15.2%)	25 (54.3%)	0.001*
Hospital stay<10 days	0 (0.0%)	44 (95.7%)	<0.001**
Satisfied	37 (80.4%)	44 (95.7%)	0.024*

*Fisher's exact test, **Chi-square test; p<0.05 considered statistically significant.

Table 6: Early postoperative safety outcomes according to treatment group.

Postoperative outcome	With T-tube, (n=46)	Without T-tube, (n=46)	P value
Biliary leakage	4 (8.7%)	2 (4.3%)	0.398*
No biliary leakage	42 (91.3%)	44 (95.7%)	0.398*
Superficial wound infection	9 (19.6%)	5 (10.9%)	0.246**
No superficial wound infection	37 (80.4%)	41 (89.1%)	0.246**

*Fisher's exact test, **Chi-square test; p<0.05 considered statistically significant.

Table 7: Comparison of mean duration of hospital stay.

Treatment groups	Mean hospital stay (days)	SD	P value*
With T-tube, (n=46)	14.65	2.05	<0.001
Without T-tube, (n=46)	8.17	1.79	<0.001

*Independent Student's t test; p<0.05 considered statistically significant.

DISCUSSION

The present study demonstrated a more favourable early recovery profile among patients undergoing open choledocholithotomy without T-tube drainage, characterized by less postoperative pain, shorter hospitalization and greater patient satisfaction. Similar clinical advantages of avoiding routine T-tube drainage have been described following open choledochotomy by Ambreen et al, Seervi et al, Pattanshetti et al and Jan et al.[6-9] These studies also suggest that primary duct closure can reduce postoperative burden in selected patients after duct clearance has been confirmed.

Postoperative pain showed one of the most pronounced differences in the present study, with 54.3% of patients without T-tube drainage being pain-free compared with 15.2% of T-tube recipients. This observation is biologically and clinically plausible because an external tube traversing the abdominal wall can cause localized discomfort, restrict mobility and require ongoing tube care. Earlier clinical reports by Wills et al and Sheen-Chen and Chou specifically documented localized pain, discomfort, and physical restriction in patients managed with T-tubes.[4,5] Ha et al similarly emphasized the inconvenience of carrying an external T-tube, and Chen et al described discomfort as an important disadvantage of conventional drainage.[10,11]

Mean hospital stay was 14.65 days with T-tube drainage compared with 8.17 days without it. The direction of this difference is consistent with the randomized trial of Williams et al the trial of Zhang et al comparative work by Cai et al and Dong et al and meta-analyses by Zhu et al, Wu et al and Gurusamy et al.[12-18] In the present study, T-tubes were kept until satisfactory cholangiography before removal, so the difference in hospitalization may partly reflect the local T-tube management protocol rather than recovery alone.

Patient satisfaction was also significantly higher without T-tube drainage. Although satisfaction has been less consistently measured as a formal endpoint in previous studies, reductions in external-tube burden, hospital stay, costs and postoperative complications provide a reasonable clinical context for this finding. Systematic reviews by Podda et al, Deng et al, Zhu et al and Ma and Cai consistently reported recovery advantages with primary closure.[19-22] Rudiman et al likewise found shorter hospitalization with alternative biliary drainage, while the updated meta-analysis by Delgado et al found a reduction of approximately 2.2 postoperative hospital days with primary closure.[23,24]

Limitations

This study has several important limitations that should be acknowledged when interpreting the results. First, treatment allocation was quasi-experimental and determined according to surgeon judgment and patient preference rather than strict randomized allocation, introducing the potential for selection bias and unmeasured residual confounding. Second, the study was conducted at a single tertiary-care surgical center in Bangladesh with a modest cohort size (n=92), which may restrict the generalizability of our findings to healthcare centers with differing laparoscopic infrastructure or differing home nursing support. Third, follow-up was confined to the immediate postoperative and hospitalization period, precluding long-term assessment of delayed biliary complications such as benign common bile duct stricture, late biliary fistula, or recurrent choledocholithiasis. Finally, patient satisfaction was evaluated using a structured categorical Likert questionnaire, which inherently carries subjective recall variability. Despite these constraints, this study provides pragmatic, real-world comparative evidence from a developing healthcare setting demonstrating the clinical feasibility, marked pain reduction, and expedited recovery associated with avoiding routine T-tube drainage in carefully selected patients.

CONCLUSION

Open choledocholithotomy without T-tube drainage was associated with less postoperative pain, substantially shorter hospitalization and higher patient satisfaction than treatment with T-tube drainage in this study. Early biliary leakage and superficial wound infection did not differ significantly between groups. These findings support selective avoidance of routine external T-tube drainage when complete duct clearance and distal patency have been established. Larger randomized multicentre studies using validated patient-reported outcome measures and longer follow-up are required to confirm these recovery benefits.

Recommendations

In appropriately selected patients with confirmed complete common bile duct clearance and satisfactory distal patency, primary duct closure without routine T-tube drainage should be considered to reduce postoperative discomfort and prolonged hospitalization. Postoperative assessment after common bile duct exploration should incorporate standardized pain scores and validated patient-satisfaction or quality-of-life instruments in addition to conventional surgical complications.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Williams E, Beckingham I, El Sayed G, Gurusamy K, Sturgess R, Webster G, et al. Updated guideline on the management of common bile duct stones (CBDS). Gut. 2017;66(5):765-82.

2. Buxbaum JL, Fehmi SMA, Sultan S, Fishman DS, Qumseya BJ, Cortessis VK, et al. ASGE guideline on the role of endoscopy in the evaluation and management of choledocholithiasis. Gastrointest Endosc. 2019;89(6):1075-1105.e15.
3. Manes G, Paspatis G, Aabakken L, Anderloni A, Arvanitakis M, Ah-Soune P, et al. Endoscopic management of common bile duct stones: European Society of Gastrointestinal Endoscopy (ESGE) guideline. Endoscopy. 2019;51(5):472-91.
4. Wills VL, Gibson K, Karihaloo C, Jorgensen JO. Complications of biliary T-tubes after choledochotomy. ANZ J Surg. 2002;72(3):177-80.
5. Sheen-Chen SM, Chou FF. Choledochotomy for biliary lithiasis: is routine T-tube drainage necessary? A prospective controlled trial. Acta Chir Scand. 1990;156(5):387-90.
6. Ambreen M, Shaikh AR, Jamal A, Qureshi JN, Dalwani AG, Memon MM. Primary closure versus T-tube drainage after open choledochotomy. Asian J Surg. 2009;32(1):21-5.
7. Seervi M, Verma D, Chand N, Sharma S. Primary closure of common bile duct versus T-tube placement after open choledocholithotomy. Int Surg J. 2020;7(6):1951-5.
8. Pattanshetti SA, Mahalmani VM, Rao KN. Comparison of primary closure and T-tube drainage of the common bile duct after choledochotomy. Int J Surg Sci. 2021;5(1):623-5.
9. Jan Y, Hussain M, Aman Z, Neelma N. Primary closure vs T-tube drainage following open choledochotomy for CBD (common bile duct) stones. Cureus. 2023;15(3):e35846.
10. Ha JPY, Tang CN, Siu WT, Chau CH, Li MKW. Primary closure versus T-tube drainage after laparoscopic choledochotomy for common bile duct stones. Hepatogastroenterology. 2004;51(60):1605-8.
11. Chen CC, Wu SD, Tian Y, Zeng XT, Siwo EA, Xian GZ. The fading role of T-tube in laparoscopic choledochotomy: primary choledochorrhaphy and over pigtail J and endonasobiliary drainage tubes. J Laparoendosc Adv Surg Tech A. 2010;20(10):807-11.
12. Williams JA, Treacy PJ, Sidey P, Worthley CS, Townsend NC, Russell EA. Primary duct closure versus T-tube drainage following exploration of the common bile duct. Aust N Z J Surg. 1994;64(12):823-6.
13. Zhang WJ, Xu GF, Wu GZ, Li JM, Dong ZT, Mo XD. Laparoscopic exploration of common bile duct with primary closure versus T-tube drainage: a randomized clinical trial. J Surg Res. 2009;157(1):e1-5.
14. Cai H, Sun D, Sun Y, Bai J, Zhao H, Miao Y. Primary closure following laparoscopic common bile duct exploration combined with intraoperative cholangiography and choledochoscopy. World J Surg. 2012;36(1):164-70.
15. Dong ZT, Wu GZ, Luo KL, Li JM. Primary closure after laparoscopic common bile duct exploration versus T-tube. J Surg Res. 2014;189(2):249-54.
16. Zhu QD, Tao CL, Zhou MT, Yu ZP, Shi HQ, Zhang QY. Primary closure versus T-tube drainage after common bile duct exploration for choledocholithiasis. Langenbecks Arch Surg. 2011;396(1):53-62.
17. Wu X, Yang Y, Dong P, Gu J, Lu J, Li M, et al. Primary closure versus T-tube drainage in laparoscopic common bile duct exploration: a meta-analysis of randomized clinical trials. Langenbecks Arch Surg. 2012;397(6):909-16.
18. Gurusamy KS, Koti R, Davidson BR. T-tube drainage versus primary closure after open common bile duct exploration. Cochrane Database Syst Rev. 2013;2013(6):CD005640.
19. Podda M, Polignano FM, Luhmann A, Wilson MSJ, Kulli C, Tait IS. Systematic review with meta-analysis of studies comparing primary duct closure and T-tube drainage after laparoscopic common bile duct exploration for choledocholithiasis. Surg Endosc. 2016;30(3):845-61.
20. Deng Y, Tian HW, He LJ, Zhang Y, Gu YH, Ma YT. Can T-tube drainage be replaced by primary suture technique in laparoscopic common bile duct exploration? A meta-analysis of randomized controlled trials. Langenbecks Arch Surg. 2020;405(8):1209-17.
21. Zhu T, Lin H, Sun J, Liu C, Zhang R. Primary duct closure versus T-tube drainage after laparoscopic common bile duct exploration: a meta-analysis. J Zhejiang Univ Sci B. 2021;22(12):985-1001.
22. Ma X, Cai S. The outcome and safety in laparoscopic common bile duct exploration with primary suture versus T-tube drainage: a meta-analysis. Appl Bionics Biomech. 2023;2023:7300519.
23. Rudiman R, Hanafi RV, Almawijaya, Halim F. Complications of biliary stenting versus T-tube insertion after common bile duct exploration: a systematic review and meta-analysis. PLoS One. 2023;18(1):e0280755.
24. Delgado LM, Pompeu BF, Pasqualotto E, Martins GHA, Moraes CJ, Guedes LSSP, et al. Primary closure versus T-tube drainage on common bile duct exploration for choledocholithiasis: an updated systematic review and meta-analysis. J Laparoendosc Adv Surg Tech. 2025;35(6):463-75.

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