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Original Article

Primary Closure versus T-tube Drainage in laparoscopic Choledocholithotomy

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Abstract

Introduction: Choledocholithotomy followed by T-tube has long been a standard surgical treatment for choledocholithiasis. It is still a preferred choice in many hospitals where minimally invasive procedures are not feasible. The use of T-tube is not without complications. To avoid complications associated with T-tube, we have performed primary closure of the common bile duct (CBD) after exploration. This pilot study assessed the safety of primary closure of CBD, which would help form a basis for implementation on a wider scale.

Aim of the study: To compare the outcome in primary closure of the common bile duct and T-tube drainage after choledocholithotomy.

Methods: This cross-sectional study was conducted in the Department of Surgery at IBNSina Medical College &Hospital, Dhaka, and Delta Medical College& Hospital, Dhaka Bangladesh; from January 2021 to December 2022. A total of 80 patients were selected purposively, and were randomly divided into two groups: The t-tube drainage group and the primary closure group. Each group consisted of 40 patients. Data were entered and analyzed using SPSS software. Ethical clearance was obtained from the hospital's ethical review committee.

Result: The most common presentation in the primary closure group was jaundice with 18 patients (45%) but most of the patients in the T-tube group presented with acute cholecystitis with 21 patients (52.5%).In primary closure patients the mean operating time was observed to be 60±15mins while that in the case of T-tube drainage patients was 90±10 mins. The total duration of hospital-stay in primary closure patients ranged from 6-10 days with an average duration of 8 days which was much shorter than that of T-tube drainage patients which ranged from 10-16 days with an average of 13 days.

Conclusion: Primary closure following laparoscopic CBD exploration is safe and feasible for selected patients with choledocholithiasis.

Key words: Choledocholithotomy, Primary Closure, T-tube Drainage, Common bile duct

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Introduction

Obstruction of the common bile duct as a result of the presence of stones has historically been corrected by opening the common bile duct and removing the stones. Choledocholithiasis has an incidence of 1–15% and is present in 5–29% of patients with cholelithiasis [1]. Choledocholithiasis can lead to obstructive jaundice, biliary pancreatitis, and even acute obstructive suppurative cholangitis, which may be life-threatening; thus, timely and effective surgical treatment is required [2, 3].Primary common bile duct closure using modern operative techniques can be as safe as primary common bile duct

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closure using a T tube. The conventional treatment for choledocholithiasis is T-tube drainage (this is a tube put into the bile duct after surgery. It's shaped like the letter T. It helps to drain bile while the duct is healing) following open common bile duct (CBD) exploration. In recent decades, laparoscopy and choledochoscopy have become increasingly popular, and laparoscopic suturing and knotting techniques are being constantly improved. T-tube drainage following laparoscopic CBD exploration has therefore become an essential treatment for choledocholithiasis with advantages such as a small wound, rapid postoperative recovery, and a high success rate [4-7]. The T tube is placed in the common bile duct, anchored to the abdominal wall, and connected to a closed drainage system. T-tube drainage appears to result in significantly longer operating time and hospital stay as compared with primary closure without any evidence of benefit after laparoscopic common bile duct exploration. The T-tube is usually removed 2 weeks after it was placed. There have been numerous reports of bile leaks following T-tube removal in the literature. These leaks can result in bile ascites, biloma, or bile peritonitis. Despite its advantages, an indwelling T-tube may lead to T-tube displacement, water–electrolyte disorders, and extension of the postoperative recovery time, all of which affect patients' quality of life. In particular, biliary peritonitis develops in a small number of patients after T-tube removal and requires reoperation. The complication rate of indwelling T-tubes can reach 10.5–20.0% [8-11]. Primary closure following laparoscopic CBD exploration can avoid the limitations of an indwelling T-tube; closure of the common bile duct is a safe, effective, and less expensive means of handling stones in the common bile duct. It requires a shorter hospital stay and is notably less expensive. Many patients return to work within 5 to 10 days. However, the problems of bile leakage, residual CBD stones, and stricture still require clinicians' attention. Therefore, this treatment remains controversial. Retrospective studies have shown that primary closure following laparoscopic CBD exploration can shorten the hospital stay and reduce the development of postoperative complications [12, 13]. Bile leakage is determined according to the definition and grading of severity by the International Study Group of Liver Surgery [14]. Consequently, some surgeons have recommended primary closure of the common bile duct to reduce the risk of T-tube-related complications, and also to facilitate early discharge, early return to normal activity, and fewer hospital expenses [15-17].

OBJECTIVE

General Objective

- To compare the outcome in primary closure of the common bile duct and T-tube drainage after choledocholith otomy.

Specific Objectives

- To relate the consequences of primary closure with T-tube drainage after choledocholithotomy.

To assess operating time, duration of hospital stay in the study population.

Materials and Methods

This cross-sectional study was conducted in the Department of Surgery at IBN Sina Medical College & Hospital, Dhaka, and Delta Medical College &Hospital, Dhaka Bangladesh; from January 2021 to December 2022. Purposive sampling technique was followed for a total of 80 subjects in this study. The patients were randomly divided into two groups: The t-tube drainage group and the primary closure group. Each group consisted of 40 patients. Routine investigations were performed for all patients including complete blood count, liver function tests, serum amylase, blood urea nitrogen, serum creatinine, and abdominal ultrasonography. After completion of intraoperative cholangiography (IOC), patients were randomized to two groups of primary duct closure and T-tube drainage. In the primary closure group, the choledochotomy was closed primarily with interrupted 4-0 absorbable sutures (4-0 PDS), whereas in the T-tube drainage group, a latex rubber T-tube of appropriate size (14-16 French size) was inserted into the CBD and CBD incision was closed using interrupted sutures (4-0 PDS). Patients were followed up after (controlled)

2 weeks, 1 month, and 3 months following discharge. Patient demographics (age, gender), operative time, duration of hospital stay, comorbidities, number of CBD stones, CBD diameter, clinical presentation, and postoperative complications; including minor (200ml in 24 hours); bile leakage, and intra-abdominal collection were recorded. All data were collected through a semi-structured questionnaire and analyzed by SPSS version 20.0 software. Informed written consent was taken from all patients and all data were kept confidential. Ethical clearance was obtained from the hospital's ethical review committee.

Inclusion Criteria

- Patients with choledocholithiasis with or without presence of jaundice.
- Patients who had given consent to participate in the study

Exclusion Criteria

- Patients with acute pancreatitis.
- Patients older than 80 years of age.
- Patients with a history of heart failure.

Patients who did not give consent to participate in the study.

Results

Table 1: Age distribution of patients (N=80)

Age (years)	n	%
20-39	5	6.25
40-59	44	55.00
60-79	21	26.25
>80	10	12.50
Total	80	100.00

The modal age was in the 40 to 59 years range (55%). There were the least patients within 20 to 39 years with 6.25% of total patients only. [Table 1]

Table 2: Sex distribution of the primary closure and T-tube drainage group (N=80)

Gender	Primary Closure		T-tube Drainage	
	Frequency (n)	Percent (%)	Frequency (n)	Percent (%)
Male	12	30.00	9	22.50
Female	28	70.00	31	77.50
Total	40	100.00	40	100.00
Male-Female Ratio	1:2.33		1:3.44	

CBD exploration was performed in 80 patients, out of which 40 had primary closure of CBD after stone removal and a T-tube drain was placed in the remainder. There were 12 males (30%) and 28 females (70%) in the primary closure group (where M:F was 1:2.33) and 9 males (22.5%) and 31 females (77.5%) in the T-tube group (where male: female was 1:3.44). [Table 2]

Table 3: Operative findings of CBD diameter (N=80)

CBD Diameter	Primary Closure (n=40)	T-tube Drainage (n=40)
Minimum CBD Diameter	12±3	10±3
Maximum CBD Diameter	18±2.6	15±2.6

Preoperative abdominal ultrasound showed the diameter (maximum diameter was measured around 18±2.6 and minimum was around 12±3 for the primary closure group whereas 15±2.6 was measured as maximum and 10±3was measured as a minimum for the T-tube drainage group) of CBD, which was confirmed during the operation. [Table 3]

Table 4: Clinical Presentation of patients (N=80)

Clinical Presentation	Primary Closure		T-tube Drainage	
	Frequency (n)	Percent (%)	Frequency (n)	Percent (%)
Acute Cholecystitis	5	12.50	21	52.50
Biliary Colic	7	17.50	11	27.50
Dyspepsia	10	25.00	6	15.00
Jaundice	18	45.00	2	5.00
Total	40	100.00	40	100.00

The most common presentation in the primary closure group was jaundice with 18 patients (45%) but most of the patients in the T-tube group presented with acute cholecystitis with 21 patients (52.5%). [Table 4]

Table 5: Post-operative outcomes in the study population (N=80)

Parameters	Primary Closure (n=40)	T-tube Drainage (n=40)
Mean Operating Time (min)	60±15	90±10
Duration of Hospital Stay (days)	8±2	13±3
No. of Patients with Post-operative Complications	2	4

For primary closure patients, the mean operating time was observed to be 60±15mins while that in the case of T-tube drainage patients was 90±10 mins. The total duration of hospital stay in primary closure patients ranged from 6-10 days with an average duration of 8 days which was much shorter than that of T-tube drainage patients which ranged from 10-16 days with an average of 13 days. [Table 5]

Discussion

Out of 80 patients, there were two groups: The t-tube drainage group and the primary closure group. Each group consisted of 40 patients.The modal age was in the 40 to 59 years range (55%). There were least patients within 20 to 39 years with 6.25% of total patients only which also indicates the mean age tendency. In another study,the mean age of patients in primary closure was 42.1 years and that of the T-tube group was 40.1 which shows similar age ranges. [18] CBD

exploration was performed in 80 patients, out of which 40 had primary closure of CBD after stone removal and a T-tube drain was placed in the remainder. There were 12 males (30%) and 28 females (70%) in the primary closure group (where M:F was 1:2.33) and 9 males (22.5%) and 31 females (77.5%) in the T-tube group (where M:F was 1:3.44).The previously mentioned study also found three males (20%) and 12 females (80%) in the primary closure group (where M:F was 1:4), and four males (26.7%) and 11 females (73.3%) in the T-tube group (where M:F was 1:3.75). This is very close to our study. [18]In a different study(n = 16), the mean age of patients who had primary closure done was 46.0 ± 16.8 and there were two (12.5%) males and 14 (87.5%) females. [19]Preoperative abdominal ultrasound showed the diameter (maximum diameter was measured around 18±2.6 and minimum was around 12±3 for the primary closure group whereas 15±2.6 was measured as maximum and 10±3was measured as a minimum for the T-tube drainage group) of CBD, which was confirmed during the operation. Others found that the CBD diameter was from 11 to 17 for the primary closure group whereas 10-15 was measured for the T-tube drainage group which is relatable to our study. [18]The most common presentation in the primary closure group was jaundice with 18 patients (45%) but most of the patients in the T-tube group presented with acute cholecystitis with 21 patients (52.5%). In a different study, the most common presentation in the primary closure group was jaundice but most of the patients in the T-tube group presented with acute cholecystitis as our study population. [18]For primary closure patients, the mean operating time was observed to be 60±15mins while that in the case of T-tube drainage patients was 90±10 mins. The total duration of hospital stay in primary closure patients ranged from 6-10 days with an average duration of 8 days which was much shorter than that of T-tube drainage patients which ranged from 10-16 days with an average of 13 days. In a study with 40 patients, the mean operating time was observed to be 65±14.05 mins in primary closure patients while that in the case of T-tube drainage patients was 95.25±9.66 mins. The average duration of hospital stay in primary closure was 8.2 days which was much shorter than that of T-tube drainage patients which were of 15.7 days. The post-operative complication was observed in 1 patient of primary closure while postoperative complication occurred in 3 patients of T-tube drainage. This also reflects our study. [20]

Limitations of the Study

The study was conducted in two hospitals with a small sample size. So, the results may not represent the whole community.

Conclusions

Primary closure following laparoscopic CBD exploration is safe and feasible for selected patients with choledocholithiasis. However, the safety and feasibility of this treatment require further verification by large sample, multicenter, and prospective studies.

RECOMMENDATIONS

Primary closure of CBD after open choledochotomy is feasible and is as safe as T-tube insertion. In effect, primary closure avoids T-tube insertion and disadvantages associated with the use of T-tube. Primary closure can be recommended for selected patients with choledocholithiasis. Moreover, further studies should be conducted involving a large sample size and multiple centers.

Conflict of interest: None declared

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