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Original Research Article

A comparative study between short term outcome of choledocholithotomy with and without T-tube

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ABSTRACT

Background: Management of common bile duct is challenging especially closure of common bile duct (CBD) after removal of stones. The main aim of this study was to find out the outcome of choledocholithotomy with and without tube placement.
Methods: This descriptive observational type of study was conducted in the Department of Surgery Sher-E-Bangle Medical College Hospital, Barishal, Bangladesh from December, 2017 to November 2018. A total number of 50 patients were enrolled in the study. The patients were divided into two groups; each group included 25 patients. Group A consisted of the patients who had primary closure while group-B included the patients who had T-tube closure.
Results: The mean ages of group A and B were 43.75±2.76 (range: 29-63) years and 45.77±3.19 (range: 28-69) years respectively. Most of the patients were male in both groups (72% versus 80%). Diabetes mellitus was the major co-morbidity in both groups (32% versus 28%). Mean operating time significantly higher in open choledocholithotomy with T-tube insertion than open choledocholithotomy with primary closure (p=0.001). Additionally, mean hospital stay was also longer in T-tube insertion group rather than primary closure group which statistically the difference was significant (p=0.001). Wound infection (16% versus 36%) biliary fistula (4% versus 20%) subphrenic abscess (2% versus 0%), biliary leakage (4% versus 12%), jaundice % versus 8%) and retained stone (0% versus 4%) were the observed complications in primary closure group and t-tube closure group patients respectively. Postoperative complications were relatively higher in t-tube closure group though it was not statistically significant (p≥0.05).
Conclusions: Both primary closure of CBD and T-tube drainage after CBD exploration are equally good procedures for the treatment of uncomplicated choledocholithiasis. However, primary closure of CBD is having significantly lower operating time and less duration of stay at hospital.

Keywords: Short term outcome, Choledocholithotomy, Primary closure, T-tube

INTRODUCTION

Gall stone disease affects people from every society, race, gender and age group. More than 95% of biliary tract disorders are related to gallstones.[1] Most bile duct stones are stones that have passed into bile duct from the gallbladder. Choledocholithiasis means stones in the common bile duct (CBD). Sludge is suspension of cholesterol monohydrate crystals, calcium bilurubinate granules, and or other calcium salts with or without

microlithiasis of gall bladder mucus. Sludge is a form of gall stone disease and may predispose to macroscopic stones or directly cause pancreatitis and other morbidity.[2]

Stones may occur in gallbladder or in the CBD or common hepatic or right or left hepatic duct. About 15% of people with gallstone will eventually develop stones in the CBD and in our country one of the common cause of bile duct stone is biliary ascariasis.[3] The goal of the treatment is to relieve the obstruction. In case of smaller stones endoscopic retrograde cholangiopancreatography (ERCP) is suggested. But as we have no facility for ERCP in our hospital, we do open choledocholithotomy with primary closure or with T-tube closure.

After the CBD exploration, stones are removed; the choice lies between primary duct closure and T- tube drainage. The purpose of using T-tube drainage after open CBD exploration are post-operative drainage of the bile duct to reduce edema and to reduce intra luminal pressure of CBD, to visualize and extract any retained bile duct stones. But potential complication exists with this therapeutic modality.[4] These include bacteraemia, dislodgement of tube, obstruction and/or fracture of tube. Leakage of bile may be encountered after removal of tube. Prolonged hospital stay is another complication as patient has to carry t-tube for several weeks before removal. Currently, primary closure of CBD is considered safe and effective. But some complication like bile leakage, subphrenic abscess, wound infection are reported in some studies.[5,6] Some authors found no significant difference in the morbidity or mortality between primary closure and T-tube drainage, others found higher morbidity in terms of more biliary infections, discomfort from tube, delayed hospital discharge.[7]

Despite good surgical techniques, about 8% to 16% of patients have retained stones in common bile duct after conventional choledocholithotomy.[8] Common bile duct stone is defined as retained if they are discovered within two years of cholecystectomy or recurrence if they are detected more than two years after cholecystectomy.

As early study in 1917, Halsted described primary closure of common bile duct that was drained using tube through cystic duct stump.[8] Later closure was done using only a penrose drain in the hepatorenal recess. Mayo, Kirschner, Mirrizzi, Edward and Herrington et al have written articles supportive closure of CBD without T-tube.[9]

The traditional surgical management of CBD stones consists of a supra-duodenal choledocotomy and insertion of a T-tube. The duration of T-tube drainage is variable and can range from 7-45 day depending on individual preference. A T-tube cholangiogram is usually performed postoperative look for residual stones or biliary leakage. The role of T-tube has been challenged since many authors had described regarding primary duct closure after CBD exploration more than a century ago. Others also challenged the utility of a T-tube, and three randomized trials have shown benefit of primary over T-tube insertion. Continuous external drainage of bile can lead to fluid and electrolytes imbalance and nutritional disturbances. T-tube drainage is associated with an increased bacteraemia and wound infection.[10] Significant bile leak after T-tube removal can occur in certain cases. Complications like dislodgement of tube, obstruction and/or fracture of tube, increased difficulty in removal also have been described.[11] As patient has to carry t-tube for several days it also increases hospital stay and treatment cost.[12]

However, primary closure is considered safe and effective as primary it needs shorter operation time, less duration of stay at hospital, and is devoid of complications like tube dislodgement, and fracture. But some complications like bile leakage, subphrenic abscess, and wound infections can occur in primary closure of CBD.

The main aim of this study was to find out the outcome of choledocholithotomy with and without tube placement.

METHODS

This descriptive observational type of study was conducted in the Department of Surgery Sher-E-Bangle Medical College Hospital, Barishal, Bangladesh from December 2017 to November 2018. All patients of surgical ward who admitted with larger stones in CBD causing obstruction were included in the study after fulfilling the exclusion and inclusion criteria. All the patients were divided into two groups - group A: patients who had primary closure without T-tube, and group-B: patients who had T-tube placement.

Convenient sampling method was used. An ethical clearance was taken from Ethical Clearance Committee of Sher-E-Bangle Medical College Hospital to conduct the study. An informed written consent was obtained from all the participants regarding the study procedure.

Inclusion criteria

Clinically and sonologically diagnosed cases of biliary obstruction due to stone in CBD were included.

Exclusion criteria

Preliminary clinically suspected case of biliary obstruction due to non-stone obstruction like cholangiocarcinoma, and biliary ascariasis; stone in common hepatic duct, left and right hepatic duct; and patients aged less than 18 years and more than 80 years old were excluded.

To determine the patient's overall fitness, a thorough history and clinical examination with pertinent investigations were conducted prior to surgery. Just before to the incision, a prophylactic intravenous antibiotic was given. Every patient had surgery under general anaesthesia. Following surgery, all patients underwent daily routine checkups, which included query about

abdominal pain or discomfort, fever, tenderness in abdomen, jaundice status, T tube bag collection, subhepatic collection, wound checking, etc. Postoperative treatment was administered in accordance with the department's standards and guiding principles as well as the results of the clinical evaluation. Death, postoperative complications, and other issues were assessed.

Data were analyzed using statistical package for the social sciences (SPSS) version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as mean and standard deviation. Categorical variables were presented as frequencies and percentages. Comparisons between groups were made using the Chi-square test or Fisher's exact test for categorical variables and student's t-test or Mann–Whitney U test for continuous variables. A p value <0.05 was considered statistically significant.

RESULTS

This study was conducted in the Department of Surgery Sher-E-Bangle Medical College Hospital, Barishal, Bangladesh. A total number of 50 patients were enrolled in the study. The patients were divided into two groups; each group included 25 patients. Group A consisted of the patients who had primary closure while group-B included the patients who had T-tube closure.

The mean ages of group A and B were 43.75±2.76 (range: 29-63) years and 45.77±3.19 (range: 28-69) years respectively (Table 1). The primary closure group had 18 (72%) male and 7 (28%) female patients whereas in t-tube closure 20 (80%) male and 5 (2%) female patients. The male to female ratio in primary closure group was 2.51:1 and in t-tube closure group, in was 4:1.

Table 1: Age distribution of the patients.

Age group (in years)	Group-A (n=25), N (%)	Group-B (n=25), N (%)	Total (n=50), N (%)
≤30	1 (4)	2 (8)	3 (6)
31-40	6 (24)	3 (12)	9 (18)
41-50	14 (56)	17 (68)	31 (62)
51-60	1 (4)	2 (8)	3 (6)
>60	3 (12)	2 (8)	5 (10)
Mean±SD	43.75±2.76	45.77±3.19	44.69±4.51

Diabetes mellitus was the major co-morbidity in both groups (32% versus 28%) followed by hypertension and ischemic heart disease respectively.10(40%) patients had previous history of cholecystectomy in group-A while 8 (32%) patients had cholecystectomy in group-B (Table 2).

Mean operating time significantly higher in open choledocholithotomy with T-tube insertion than open choledocholithotomy with primary closure (p=0.001). Additionally, mean hospital stay was also longer in T-tube insertion group rather than primary closure group which statistically the difference was significant (p=0.001) (Table 3).

Table 2: Co-morbidity of the patients.

Comorbidity	Group-A (n=25), N (%)	Group-B (n=25), N (%)
Diabetes mellitus	8 (32)	7 (28)
Hypertension	5 (20)	3 (12)
Ischemic heart disease	3 (12)	6 (24)
Chronic kidney disease	1 (4)	3 (12)
Chronic liver disease	2 (8)	4 (16)
Others	2 (8)	1 (4)
History of previous cholecystectomy	10 (40)	8 (32)

Table 3: Operating time and duration of hospital stay of the patients.

Variables	Group-A (n=25)	Group-B (n=25)	P value
Mean operating time (mins)	65±14.05	95.39±10.57	0.001
Mean duration of hospital stay (days)	8±11.31	14.75±2.75	0.001

Postoperative complications were relatively higher in t-tube closure group though it was not statistically significant (p≥0.05). Wound infection (16% versus 36%) biliary fistula (4% versus 20%) subphrenic abscess (2% versus 0%), biliary leakage (4% versus 12%), jaundice % versus 8%) and retained stone (0% versus 4%) were the observed complications in primary closure group and t-tube closure group patients respectively (Table 4).

Table 4: Complication rate of the two groups.

Complication	Group-A (n=25), N (%)	Group-B (n=25), N (%)	P value
Wound infection	4 (16)	9 (36)	0.132
Jaundice	1 (4)	2 (8)	0.461
Biliary fistula	1 (4)	5 (20)	0.826
Bile duct injury	1 (4)	3 (12)	0.472
Subphrenic abscess	2 (8)	4 (16)	0.221
Retained stone	1 (4)	5 (20)	0.082

DISCUSSION

After extraction of stone from CBD and cleansing the duct by vigorous normal saline wash there are 2 methods of choice of closure CBD. Firstly, the primary closure and secondly, the closure with T-tube insertion. It is a logic here to keep a T-tube in situ as instrumentation of the CBD and maneuvers for stone extraction by Desjardin's

choledocholithotomy forceps may cause edema of papilla that leads to an increase intraluminal pressure. To minimize the pressure, temporary diversion of bile is chosen by inserting a T-tube. Here, the protagonists argue that it allows spasm or edema of sphincter to settle after the trauma of the exploration.[13,14]

Post-operative T-tube drainage has been used to prevent bile stasis, decompress the biliary tree, and minimize the risk of bile leakage. A T-tube has also provided an easy percutaneous access for cholangiography and extraction of retained stones.[15]

Still though the morbidity rate related to T-tube have been reported to be at a rate of 4% to 16.4%, T-tube-related complications include accidental T-tube displacement leading to CBD obstruction, bile leakage, persistent biliary fistula, and excoriation of the skin, cholangitis from exogenous sources through the T-tube have been observed in many studies.[15,16] Additionally, CBD stenosis has been reported as a long term complication after T-tube removal.[17] After discharge, indwelling T-tube becomes uncomfortable, requiring continuous management, thus restricting patient's activity because of the risk of dislodgement.

For the above-mentioned disadvantages of T-tube use, a second option for choledochotomy closure, primary closure of choledochotomy with placement of biliary endoprosthesis was proposed. Biliary endoprosthesis, as with a T-tube, achieves biliary decompression and published results have suggested that this leads to lower morbidity, shorter post-operative hospital stay, less post-operative discomfort, and earlier return to full activities, compared to T-tube placement.[18]

Moreover, the presence of the endoprosthesis in the duodenal lumen makes post-operative ERCP easier, in the presence of residual CBD stones. However, the use of biliary endoprosthesis is not devoid of complications such as duodenal erosion, stent occlusion, ampullary stenosis, and distant stent migration, causing intestinal or colonic perforation.[19] Moreover, removal of biliary endoprosthesis requires second stage endoscopic extraction. A third option for choledochotomy closure is primary closure without the use of T-tube or biliary endoprosthesis. Favorable short-term and long-term results have been published with this technique. This option avoids the morbidities related to the use of T-tube or biliary stents.[20] In this study, no post-operative mortality occurred. The post-operative hospital stay and the operation time were shorter.

In this study, the mean age of primary closure group and t-tube closure group patients revealed that 43.75±2.76 (age range: 29-63) years and 45.77±3.19 (age range: 28-69) years respectively. The majority patients in both groups belonged to 41-50 years age group (56% versus 68% respectively).

In this study, male patients were higher in both primary closure group and t-tube closure group. Male patients were observed 72% and 80% in primary closure group and t-tub closure group respectively. On the contrary, the female respondents were 28% and 20% primary closure group and t-tube closure group respectively. The male to female ratio primary closure group and t-tube closure group were 2.57:1 and 4:1 respectively.

In this study the preoperative injury to CBD and CHD occurred 4% versus 16% and 4% versus 12 in primary closure group and t-tube closure group respectively. It was observed here when surgeon faced difficulties during surgery or any unintentional iatrogenic injury occur they certainly went for T-tube insertion as no surgeon wants to take over enthusiastic risk.

In this study, mean operation time in primary closure group and t-tube closure group were 65±14.05 minutes and 95.39±10.67 minutes respectively which was similar to the previous report. This observation is comparable to study performed by Zhu et al who found value of $p<0.0001$ in case of operating time in their study.[21] Postoperative stay was significantly delayed in those with T-tube drainage (p value=0.0001). This observation comparable to study performed by Ambreen et al.[22] None of our case required immediate re-exploration.

In our study, wound infection was present in only 16% cases in primary closure gr whereas, it was 36% in t-tube closure group. This result is nearly comparable to the study performed by Zhu et al who noticed 28.6% of complications rate associated with T-tube in contrast to 11.1% in whom primary repair was performed.[23]

Limitations

The present study had some limitations. It was a single centre study with a small sample size. Besides randomization was not done. The study period was also very short. Further large scale multicenter study should be advocated to obtain a better result.

CONCLUSION

Open choledocholithotomy followed by primary closure without external drainage is feasible, and cost-effective. After ensuring CBD clearance, the duct can be closed primarily without the use of T-tube. Both primary closure of CBD and T-tube drainage after CBD exploration are equally good procedures for the treatment of uncomplicated choledocholithiasis. However, primary closure of CBD is having significantly lower operating time and less duration of stay at hospital.

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