

Various Surgical Management of Post-ERCP Retained CBD Stones

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Abstract: **Introduction:** The presence of a stone or stones within the common bile duct (CBD) is known as choledocholithiasis. The incidence of choledocholithiasis in <60 years of age is 8-15% when compared with 15-60% in >60 years of age. ERCP remains the first line of management for CBD stones followed by Lap cholecystectomy. But “difficult CBD stones” may get retained following single or multiple sessions of ERCP due to the impaction of large stones or because of their location above the stricture of the duct. In our institution, open CBD exploration along with primary closure or choledochenterostomies or T-tube drainage is done for ERCP failed CBD stones. **Objectives:** 1) To study the outcome, morbidity and mortality of surgical management of post ERCP CBD stones. 2) To study the factors predisposing to failure of ERCP stone removal. **Materials and Methods:** This is a prospective and a retrospective observational study of patients admitted with common bile duct stones in Institute of General surgery, RGGGH. Patients were subjected for ERCP initially and in those with post ERCP retained CBD stones, open or laparoscopic CBD exploration were done depending upon the need and or the indications. All patients were monitored closely for post-surgical complications. **Results:** Large, impacted stone was the most common factor causing ERCP failure. Multiple, large (1.5-2cms), distal CBD stones were the most common to get retained post ERCP stenting. Upon comparing primary closure with T-tube drainage during OCBDE, there was a significant correlation between the primary closure and shorter operative time and hospital stays with comparable complication rates.

Keywords: Post ERCP stenting, CBD stones, T tube, Primary closure of CBD, CDJ

1. Introduction

The presence of a stone or stones within the common bile duct (CBD) is known as choledocholithiasis. Choledocholithiasis is often asymptomatic. 7-20% of patients with symptomatic cholelithiasis planned for cholecystectomy are diagnosed with choledocholithiasis on their workup. Studies on Acute biliary pancreatitis show that about 90% of gallstones pass through CBD and then into feces and, stones <3 mm, pass unnoticed without causing pancreatitis. Incidence of choledocholithiasis increases with an increase in age and an increase in the duration of gallstone disease. The incidence of choledocholithiasis in <60 years of age is 8-15% when compared with 15-60% in >60 years of age. In cholecysto-choledocholithiasis, clearance of CBD stones along with cholecystectomy is imperative as CBD stones may present with biliary colic, obstructive jaundice, cholangitis, acute pancreatitis, biliary fibrosis, and choledochoduodenal fistula. The management of CBD stone has greatly evolved over the past decade. Initially, CBD exploration with T-tube was the preferred treatment for CBD stones. Then in a conference held in Frankfurt in October 1975, a list of indications for endoscopic papillotomy was devised in cooperation between German endoscopists and surgeons. In that endoscopic papillotomy was advised in cases of isolated papillary stenosis, CBD stones that were missed on one or more surgical procedures, and CBD stones with symptoms of obstruction in patients at high surgical risk. A nationwide study from Sweden showed the so-called “paradigm shift” from choledochotomy to endoscopic sphincterotomy from 1988 to 2006. With the advancement in minimally invasive techniques such as endoscopy and laparoscopy, different methods were reported for the management of CBD stones which include one or two staged procedures. Two-stage procedures involve pre- or post-laparoscopic cholecystectomy - ERCP. The single-stage procedure involves open or laparoscopic CBD exploration. ERCP remains the first line of management for CBD stones. But

“difficult CBD stones” may get retained following single or multiple sessions of ERCP due to the impaction of large stones or because of their location above the stricture of the duct. In such cases, ERCP stenting for biliary drainage followed by open or laparoscopic CBD exploration is done. In our institution, open CBD exploration along with primary closure or choledochenterostomies or T-tube drainage is done for ERCP-failed CBD stones.

2. Patients and Methods

First thirty patients who underwent surgical management for CBD stones after ERCP failure in the Institute of General Surgery, Rajiv Gandhi Government General Hospital, Chennai from the beginning of January 2022 to December 2022 were included in our study. This is an observational study which is a single institution retrospective analysis of prospectively collected data and a prospective analysis that assessed various surgical management of CBD exploration after ERCP failure in the period from the beginning of January 2022 to September 2022, where patients were observed from POD1 until the end of December 2022 with a median follow up period of 7.5 months (range 3-12 months). The study was approved by Institutional Ethics Committee, Madras Medical College, Chennai.

The data was collected from our records in our Institute of General Surgery and Department of Medical Gastroenterology where informed consents were obtained from patients regarding procedures, surgeries, and researchers.

The recorded data included patient demographics, pre-ERCP main presentation, number of ERCP sessions, reasons for ERCP failure, stone site (proximal, mid and distal CBD), stone size (small <1.5cm, large 1.5-2 cm and very large >2cm), number of ERCP sessions (single or multiple), CBD diameter per mm, Operative procedure (OCBDE + primary closure, OCBDE + CDJ, OCBDE + T-tube),

operative time per minutes, post operative complications (wound infection, chest infection, missed stone, biliary stricture, bile leak), and post operative hospital stay per days.

The ERCP procedures were performed by the medical gastroenterologists with a side viewing scope. Selective cannulation of the bile duct was achieved using a wire-guided sphincterotome. After successful cannulation, a contrast dye was injected to confirm the presence of CBD stone. Stones were extracted with the help of Dormia basket or balloon after performing endoscopic sphincterotomy. A check cholangiogram was performed to confirm the clearance of the common bile duct. All cases with successful cannulation but retained calculi due to large, impacted stone or benign stricture of distal CBD were managed with CBD stent of 7-10 Fr diameter and 7-10 cm length.

2.1 The Surgical Techniques

OCBD exploration

Following open cholecystectomy, identification of CBD done. Kocherisation of duodenum done to palpate the retroduodenal and intrapancreatic CBD. Then two stay sutures were placed on the duct at the right and left side. The anterior wall of the supraduodenal part of CBD was opened. Then the exploration of CBD was done first proximally and then distally with Desjardin's forceps and the visible stones were extracted. The proximal and distal CBD was then irrigated with saline using a soft catheter. Once the CBD stones were cleared, one of the following procedures was done.

Primary closure

For primary closure of CBD, the following requirements are important: (1) patency of Vater's papilla; (2) complete removal of all intraductal calculi; (3) a normal pancreas, and (4) a perfect suture of the duct. When we were satisfied with CBD clearance by stone number and by using intraoperative ultrasound, interrupted 3'0 vicryl sutures were applied. A subhepatic drain was kept.

T-tube drainage

T-tube was inserted into CBD. A subhepatic drain was kept. T-tube cholangiography was done on the seventh postoperative day. Once the patency of CBD was confirmed and there was a free flow of dye, intermittent clamping of T-tube was done and the T-tube was removed on the twelfth postoperative day.

Choledochojejunostomy

We commonly perform an end-to-side anastomosis of the biliary duct to jejunum using interrupted monofilament absorbable sutures. An enterotomy on the antimesenteric side of the jejunum with the removal of excess mucosa is created with cautery and sized to the calibre of the bile duct. Corner sutures are placed on the right and the left side of the bile duct incorporating at least 3 mm of the bile duct wall and minimal mucosa on the jejunal side. A posterior row of interrupted sutures is evenly spaced and tied when the row is complete. The anterior row of interrupted sutures is placed with knots fashioned on the outside. Finally, all the anterior

row including the corner sutures is tied. A subhepatic drain was kept in all the patients.

The outcome and follow-up

Patients were followed up daily during their post operative hospital stay till they were discharged and then every third month until the end of follow-up period for the detection of post operative complications such as chest infection, wound infection, missed stones, bile leak and CBD stricture. Clinical assessment, Liver function tests, USG and MRCP (if needed) were done in the follow-up. Comparison between the groups OCBDE + primary closure, OCBDE + T-tube and OCBDE + CDJ was done.

Statistical technique

The collected data were analyzed with IBM SPSS Statistics for Windows, Version 23.0. (Armonk, NY: IBM Corp). To describe about the data descriptive statistics frequency analysis, and percentage analysis was used for categorical variables, and the mean & S.D were used for continuous variables. To find the significant difference in the multivariate analysis the Kruskal Walli's test was used. To find the significance in qualitative categorical data Chi-Square test was used similarly if the expected cell frequency is less than 5 in 2x2 tables then Fisher's Exact was used. In all the above statistical tools the probability value .05 is considered a significant level.

3. Results

3.1 Characteristics of patients regarding demographics and ERCP

They were classified as 16(53.3%) in female and 14(46.7%) in male; incidence of CBD stones was greater among the age group 51-60 years which was 63.3% followed by 41-50 years which was 20%. Biliary colic (100%) and jaundice (93%) were the main pre-ERCP presentation. Out of 30 sample population, 27 underwent single ERCP sessions while 3 underwent ERCP sessions twice. The causes of ERCP failure in the study population were impacted stone in 19 (63.3%) and benign stricture of distal CBD in 11(36.7%). Large(1.5-2cm), multiple, mixed, distal CBD stones were the most common to get retained after ERCP.

Table 1: Age distribution

Age distribution		
	Frequency	Percent
Up to 40 yrs	3	10.0
41 - 50 yrs	6	20.0
51 - 60 yrs	19	63.3
61 - 70 yrs	2	6.7
Total	30	100.0

Table 2: Gender distribution

Gender distribution		
	Frequency	Percent
Female	16	53.3
Male	14	46.7
Total	30	100.0

3.2 Comparison between OCBDE+ Primary closure, OCBDE+ T-tube and OCBDE+ CDJ:

Out of 30 sample population, 15 (50%) underwent primary closure, 13 (43.3%) underwent CDJ and 2 (6.7%) underwent T-tube drainage.

In OCBDE+ Primary closure group (15 patients)

They were classified as 7 (23%) male and 8 (26%) female; their mean age was 51.7 years. 3 (10%), 3 (10%), and 9 (30%) of patients had stones in their proximal CBD, mid-CBD, and distal CBD respectively. The mean CBD diameter was 12mm. Based on stone size, small (<1.5cm), and large (1.5 - 2cm) were found in 4(13.3%), and 11(36.7%) respectively. Single stones were found in 9 (30%) and multiple stones were found in 6(20%). The mean operating time was 154 min. There were no postoperative complications in all 15 patients who underwent primary closure. The mean postoperative hospital stay was 6.8 days.

In OCBDE+ CDJ group (13 patients)

They were classified as 7 (23%) male and 6 (20%) female; their mean age was 51.6 years. All 13 (43.3%) patients had stones in their distal CBD. The mean CBD diameter was 13mm. Based on stone size, small (<1.5cm), large (1.5 - 2cm), and very large (>2cm) were found in 2(6.7%), 8(26.7%), and 3(10%) respectively. Single stones were found in 3 (10%) and multiple stones were found in 10(30%). The mean operating time was 216.2 min. Out of 13 patients, 1 patient (7.7%) had postoperative complication which was due to Chest infection 1 (3%) .The mean postoperative hospital stay was 9.3 days

In OCBDE+ T-tube group (2 patients)

Both the patients were female 2 (6.7%); their mean age was 58 years. 1 (3%), and 1 (3%) of patients had stones in their mid-CBD, and distal CBD respectively. The mean CBD diameter was 13.5mm. Based on stone size, small (<1.5cm) and large (1.5 - 2cm) were found in 1(3%), and 1(3%) respectively. Multiple stones were found in 2(6.7%). The mean operating time was 190 min. The mean postoperative hospital stay was 6.8 days. Regarding postoperative complications, Chest infection was found in 1 (50%), missed stones were found in 1 (50%), mortality was found in 1 (50%). The complication rate was 50%.

Table 3: Surgery with Complications distribution

		Wound infection	Chest infection	Missed stones	Mortality
Surgery	OCBDE +T tube	0	1	1	1
	OCBDE + PC	0	0	0	0
	OCBDE + CDJ	0	1	0	0
Total		0	2	1	1

Table 4: Comparison of Surgery duration with Surgery by Kruskal-Wallis test

		N	Mean	SD	KW Chi-value	p-value
Surgery duration	OCBDE +T tube	2	190.0	14.1	24.297	0.0005 **
	OCBDE + PC	15	154.0	6.3		
	OCBDE + CDJ	13	216.2	11.2		
** Highly Statistical Significance at p < 0.01 level						

Table 5: Comparison of Hospital stay with Surgery by Kruskal-Wallis test

		N	Mean	SD	KW Chi-value	p-value
Hospital stay	OCBDE +T tube	2	14.0	0.0	24.715	0.0005 **
	OCBDE + PC	15	6.8	0.6		
	OCBDE + CDJ	13	9.3	0.5		
** Highly Statistical Significance at p < 0.01 level						

4. Discussion

Cholelithiasis can be managed with various procedures like ERCP, open CBD exploration, and laparoscopic CBD exploration. Laparoscopic cholecystectomy following ERCP is the most preferred method for the management of cholelithiasis with choledocholithiasis. And it is the preferred method in our institute.

Post-ERCP retained CBD stones may be due to failed cannulation or failed extraction. Failure in cannulation can occur due to Juxta-papillary diverticulum, intra-diverticular papilla or small papilla. The failed extraction occur with difficult stones (i.e. Mirizzi's syndrome, stricture of the lower CBD, impacted, large (< 15 mm), multiple (< 3), or intrahepatic duct/cystic duct stones), especially when using standard methods (balloon or basket after ES or endoscopic papillary balloon dilatation (EPBD)).

In our study, large (>1.5cm), single, distal CBD stones were the causes of ERCP failure. On the other hand, in Emad Hamdy Gad et al., 2019 study, failed cannulation, very large (< 2 cm), multiple large, and/or impacted large stones were the causes of ERCP failure. In Bansal et al., 2014 study, the failure was due to the inability to identify the papilla, unsuccessful cannulation, impacted stones, and duodenal perforation. However, previous operations, anatomic abnormalities and stone impaction were the causes of ERCP failure in Karaliotas et al., 2008 study.

For post ERCP retained CBD stones, temporary stenting can be done for preventing stone impaction and cholangitis by relieving biliary obstruction and ensuring biliary drainage for further planned endoscopic stone removal or operation. And, biliary stenting has some therapeutic benefit in case of difficult stones (I.e., difficult stones become smaller, fragmented and easier to remove at repeat ERCP or even absent after a period of stenting).

Likewise, in our study, all cases with failure of stone extraction after successful cannulation were managed with CBD stents put beside stones for drainage and possible stone fragmentation till further planned endoscopic or surgical extraction.

After ERCP failure, the treatment options are either open or laparoscopic CBD exploration. In our institute, laparoscopic CBD exploration is not done. Hence all the patients with post ERCP retained CBD stones were managed with Open CBD exploration and primary closure/ T-tube drainage / choledochostomies. Furthermore, they can be performed in the complex, and recurrent CBDS, because repeated ERCP has increased complication rate.

The success rate of OCBDE ranges from 89% to 97%. Similarly, it reached 96.6% in our study. On the other hand, the complication rate after those procedures may reach 11-14%. However, it was 8%, 11.7% and 19% in Neoptolemos et al., 1987, Emad Hamdy Gad et al., 2019 study and Kapoor et al., 1996 [76] studies respectively. In another line, the OCBDE performed after ERCP failure had 27% complication rate in Jalal et al., 2018 study. In our study the complication rate was 6.67% with 3.3% mortality

The retained stone rate after OCBDE ranges from 1% to 8%. It was 3.3% in our series, however, Şahiner and Kendirci, 2017 did not detect any retained stones after their OCBDE.

OCBDE followed by T-tube placement for stones was the traditional method for decompression of the CBD and extraction of residual stones through the T-tube tract. However, OCBDE with T-tube is associated with complications such as wound infection, bile leakage, persistent biliary fistula, cholangitis, prolonged hospital stays, and CBD stenosis. So, primary closure of CBD after OCBDE is supported by some authors Seale and Ledet, 1999. It can be done with a normal duct when the surgeon is satisfied with CBD clearance and has experienced hands. Similarly, we performed primary closure after OCBDE when we were satisfied with CBD clearance by stone number and by using intraoperative ultrasound. There was a significant correlation between our primary closure of CBD and single stones.

Upon comparing primary closure with T-tube drainage during OCBDE, there was a significant correlation between the primary closure and shorter operative time and hospital stays with comparable complication rates. Also, Williams et al., 1994 detected similar findings, while Yamazaki et al., 2006 found a significant reduction in postoperative hospital stay with primary closure when compared with T-tube with comparable complication rate.

5. Conclusion

The treatment for choledocholithiasis depends upon the need of each patient. In case of complete stone clearance, favorable CBD diameter (>8mm), and patent distal CBD, primary closure of CBD is the ideal management followed in our institute. In case of doubtful retained stones and unfavourable CBD diameter T-tube is deployed. For distal CBD stricture, bilioenteric anastomosis are done.

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