Choledechoduodnostomy is an Optional Management for Choledocholithiasis; a Single Center Experience

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Background: Endoscopic interventions are the mainstay treatment for choledocholithiasis. However, failure of stone extraction could be encountered in some cases. Also, some patients may have recurrent stones after previous endoscopic duct clearance. Choledechoduodenostomy (CDD) may be a good option for these patients. Herein, we present our experience regarding the safety and efficacy of CDD in the management of such patients.

Patients and methods: We retrospectively reviewed the data of 30 consecutive patients who underwent the previous procedure in our tertiary care setting. Our main outcome was the incidence of short- and intermediate-term complications. Patients were followed for a minimum of 18 months after the operation.

Results: Twenty-five patients were performed via the open approach, while the remaining five were performed by laparoscopy. The majority of cases (93.3%) had a side-to-side anastomosis, while only two cases had an end-to-side anastomosis. Laparoscopy was superior to the open approach in blood loss and hospital stay. However, it was associated with a significantly prolonged operative time. Regarding postoperative complications, wound infection was the most common one (33.3%). Other early complications included abdominal collection (10%), bile leakage (6.7%), ileus (6.7%), and pulmonary embolism (3.3%). Late complications included cholangitis (6.7%), which responded to medical treatment. No patients with sump syndrome or anastomotic stenosis were encountered throughout the follow-up period.

Conclusion: Apart from high wound infection rates, CDD is a feasible and effective procedure for the management of patients with choledocholithiasis, especially after the failure of the endoscopic methods.

Key words: Choledechoduodnostomy, choledocholithiasis, outcomes.

Introduction

Gall bladder stones, or cholelithiasis, is a common surgical problem with a high prevalence reaching up to 15% in the general population, and that risk increases with advancing age.[1] Some of these cases (3%-33%) might have concomitant common bile duct (CBD) or choledocholithiasis, stones at the time of presentation.[2]

Although endoscopic interventions, like endoscopic retrograde cholangiopancreatography (ERCP), have replaced surgery in the management of CBD stones,[3,4] surgery remains the main option if there is failure or difficulty in performing these endoscopic approaches.[5] Creating a bypass between the CBD and the small bowel could be a potential option for these patients, and it is crucial for the general and hepatobiliary surgeon to be aware of these bilio-enteric bypass procedures as recommended by the American College of Surgeons.[5]

Choledechoduodenostomy (CDD), which entails the creation of an anastomosis between the CBD and the duodenum, was firstly described by Bernhard Riedel in the 19th century.[6] It is currently indicated for patients with the previous failure of endoscopic clearance, biliary sludge, recurrent stones, or benign ampullary stenosis.[7] This operation is performed by creating an anastomosis between the CBD and the duodenum, which lie in close proximity to each other, decreasing the risk of anastomotic tension. Also, it is an easy and straightforward procedure with rapid relief of patient manifestations.[1]

Nonetheless, there is an ongoing debate among general and hepatobiliary surgeons regarding its postoperative consequences, as many of them believe that it is associated with recurrent reflux cholangitis, alkaline biliary reflux, and sump syndrome.[7,8]

Herein, we present our experience regarding the safety and efficacy of CDD in the management of patients with choledocholithiasis during the short- and intermediate-term follow-up.

Patients and methods

The current retrospective study was conducted at Al-Rajhy Hospital, Assiut University. The study was designed for patients who underwent open or laparoscopic CDD during the period between January 2018 and July 2020. We retrospectively reviewed the data of these patients from their files kept on our online data system. Indications of the

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previous procedure were failed previous ERCP stone extraction, recurrent stones after the previous ERCP, or choledocholithiasis with concomitant benign distal CBD stricture. All patients had CBD diameter > 1.2 cm. On the other hand, we did not enroll patients with CBD diameter < 1.2 cm, acute cholangitis, or suspected CBD malignancy for this operation.

The study was conducted after gaining approval from the local ethical committee of our medical school, and all patients signed written consent after explaining the benefits and possible complications of the surgical intervention, which is routinely performed in our center.

The collected preoperative data included patient age, gender, presentation (Jaundice, pain, or both), associated medical comorbidities, previous biliary intervention, preoperative laboratory workup (Including CA-19-9 for patients with concomitant strictures), number of stones, and CBD diameter measured by magnetic resonance cholangiopancreatography (MRCP).

Regarding the surgical procedure, it was performed when the patient was in a supine position with extended arms. Abdominal access was done via the right subcostal incision. Cholecystectomy was performed if the gall bladder was still in place after identification, ligation, and division of both cystic duct and artery, followed by dissection of the gall bladder from its bed in the liver. The anterior peritoneum covering the lower part of the free edge of the lesser omentum was incised, and the CBD was identified. In patients with side-to-side anastomosis, two stay sutures were applied to the anterior wall of the CBD just above the duodenum, followed by a longitudinal opening (About 2 cm long) of the anterior CBD wall by a scalpel or scissors. The stones were extracted via the stone forceps, and a Nelaton catheter (8 or 10 Fr) was inserted into the CBD with good washing of its content to wash out any missed small stones or debris. Continuous washing was done till it became clear. In most cases with no distal stricture, we tried to pass the catheter through the duodenal papilla and feel it in the third duodenal part after cranial traction of the transverse colon to exclude the presence of impacted stone at the papillary region. In patients with end-to-side anastomosis, the CBD was divided just above the duodenum, and the same previous steps were done, followed by the closure of its distal part by continuous PDS sutures (3/0). We preferred to incise the CBD in either anastomotic techniques as close to the duodenum to create a tension-free anastomosis without the need for extensive duodenal kocherization.

After proper cleaning of the CBD, the duodenum was opened longitudinally in the first part. The anastomosis was done in either side-to-side or end-to-side fashion according to the method of CBD opening. Two PDS 3/0 or 2/0 sutures were taken at the angles of the anastomosis **(Fig. 1A),** followed by continuous closure of the posterior wall **(Fig. 1B)**. The two knots of both angles were kept outside the anastomosis. Regarding the anterior wall, it was performed in an interrupted **(Fig. 1C)** or continuous fashion according to the surgeon's preference, using the same thread used in the posterior wall. After proper peritoneal wash and hemostasis, a drain was inserted into the Morrison pouch for prophylactic drainage. Finally, the abdominal wall was closed in layers over a subcutaneous drain.

In the laparoscopic procedure **(Fig. 1D),** it was performed in the same position as the open one. After abdominal insufflation, the ports were inserted as follows; a periumbilical one for the telescope, two working ports, one at the epigastrium, and one at the right midclavicular line just below the costal margin, in addition to one assistant port at the right anterior axillary line, and an additional one for liver retraction. The same steps were applied as the open procedures, and the anterior wall of the anastomosis was often closed in a continuous manner. After creating the anastomosis and insertion of the drain, the abdominal ports were closed. Blood loss and operative time were collected and recorded.

Patients were kept NPO for at least three days, and oral intake was allowed on the fourth postoperative day unless complications were encountered. The following postoperative data were collected; duration of hospitalization and incidence of early complications, including bile leakage, abdominal collections, ileus, wound infection, bile leakage, and pulmonary embolism. Patients were followed for at least 24 months after the operation. The incidence of late complications like reflux cholangitis, anastomotic strictures, sump syndrome, and recurrent stones was also collected.

Cholangitis was established if the patient met the criteria of Tokyo guidelines for its diagnosis,[9] whereas bile leakage was established when the drained fluid through the surgical drain had a high bilirubin level (> 3 times compared to serum levels) on the third postoperative day or later.[10] Wound infection was defined as discharge of purulent fluid from the surgical incision,[11] while ileus was established when two of the following five parameters were noted on the fourth postoperative day; distension, food intolerance for the previous 24 hours, nausea and vomiting, no fecal or flatus passage, and radiological evidence of ileus.[12]

The anastomotic stricture was defined as the presence of choledochoduodenal anastomotic narrowing presenting with cholangitis,[7] whereas sump syndrome was defined as recurrent cholangitis

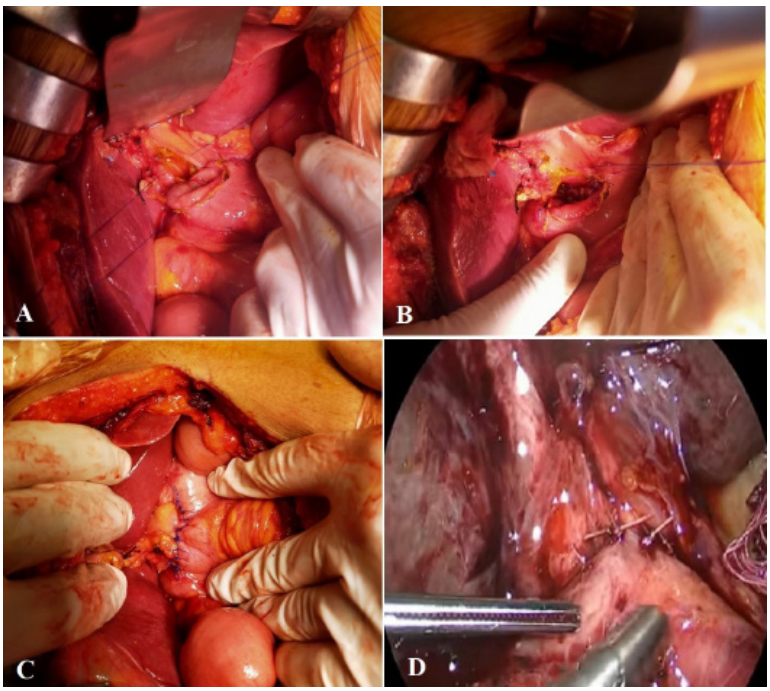

Fig 1: (A) Taking two angle bites at the CBD and duodenal opening before the anastomosis. (B) After finishing the posterior wall. (C) After finishing the anterior wall with interrupted sutures. (D) After finishing the anastomosis in the laparoscopic approach.

and hepatic abscess secondary to the accumulation of food debris in the CBD.[13]

The collected data were tabulated and analyzed via the SPSS software for Windows 11. Categorical data were expressed as numbers and percentages. Regarding numerical or quantitative data, it was expressed as mean and standard deviation or median and range.

Results

The age of the 30 patients included in this study ranged between 41 and 65 years (Mean = 51.9 years). Most of the included participants were women (63.3%), whereas the remaining patients were men. Regarding the existing medical comorbidities, hypertension was the most common one (33.3%), followed by diabetes mellitus (20%).

Jaundice was detected in nine patients (30%), while abdominal pain was described by another six (20%). Both of the previous presentations were present in the remaining patients (50%). As regards previous interventions for the CBD stones, failed ERCP was reported by twelve patients (40%). Previous cholecystectomy was done in seven cases (23.33%). The previous demographic and clinical data are described in **(Table 1).**

The preoperative laboratory workup is shown in **(Table 2).** Serum albumin ranged between 3.2 and 4.3 gm/dl (Mean = 3.76), while total serum bilirubin ranged between 0.5 and 12.5 mg/dl (Mean = 3.74). Direct bilirubin had a mean value of 3.38 mg/dl (Range, 0.3 – 12).

CBD diameter had mean values of 17.27 and 20.13 mm by ultrasound and MRCP, respectively. The included participants had either one or two stones in their biliary ducts. A distal benign stricture was detected in thirteen patients (43.3%), and all of them turned out to have a normal CA 19-9 level **(Table 3).**

As illustrated in **(Table 4),** most patients were performed through the open approach (83.3%), versus only five cases that were performed by laparoscopy. The anastomosis was created in a side-to-side fashion in 28 patients (93.3%), whereas only two patients had an end-to-side anastomosis. The duration of the operation ranged between 70 and 150 minutes (Mean = 90), while intraoperative blood loss ranged between 50 and 150 ml (Mean = 115.5). The duration of hospitalization ranged between four and eight days (Mean = 6.57 days).

When comparing the open with laparoscopic approaches, operative time showed a significant increase in the laparoscopic group. Nonetheless, laparoscopy was associated with a significant decline in intraoperative blood loss and the duration of hospitalization, as shown in **(Table 5).**

Wound infection was the most common complication, as it was detected in ten cases (33.3%), followed by abdominal collection, which was encountered in three patients (10%). These three collections were detected in the pelvis, not near the operative field, and it was managed by either ultrasound-guided

pigtail catheter insertion (Two patients) or near-total aspiration (one patient).

Two patients had postoperative bile leakage (6.7%). One patient had a duct of Luschka that was discovered and repaired intraoperatively, and we think it was the main source of the leak after the operation. The second one had minor bile leakage through the drain. Both patients were managed conservatively, and the leakage ceased on the fourth postoperative day, with no further complications.

Ileus was noted in two patients (6.7%), and it was managed by bowel rest, IV fluids, and prokinetics with spontaneous resolution. Pulmonary embolism was encountered only in one patient (3.3%) who reported pleuritic chest pain and dyspnea, and he was managed by anticoagulation and oxygen supplementation without mortality.

Regarding delayed complications, two patients (6.7%) were readmitted after one attack of cholangitis that resolved with IV fluids and antibiotics. We did not encounter any patients with stenosed stoma or sump syndrome during the scheduled follow-up period **(Table 6).**

Table 1: Demographic and clinical parameters of the included cases

	Total number = 30		
	Mean ± SD	**Median**	**Range**
Age (Years)	51.9 ± 5.96	50	(41 - 65)
Sex			
Males		11 (36.7%)	
Females		19 (63.3%)	
Presentation			
Pain		6 (20%)	
Jaundice		9 (30%)	
Pain & Jaundice		15 (50%)	
Associated chronic diseases			
Diabetes mellitus		6 (20%)	
Hypertension		10 (33.3%)	
Preoperative ERCP			
Done and failed		12 (40%)	
Not done		18 (60%)	
Previous cholecystectomy		7 (23.33%)	

Table 2: Preoperative laboratory workup in the study cases

	Total number = 30		
	Mean ± SD	**Median**	**Range**
Albumin (gm/dl)	3.76 ± 0.30	3.8	(3.2 - 4.3)
Total bilirubin (mg/dl)	3.74 ± 2.72	3.45	(0.50 - 12.5)
Direct bilirubin (mg/dl)	3.38 ± 2.67	3.1	(0.30 - 12)
SGOT (IU/l)	56.57 ± 52.03	34	(14 - 258)
SGPT (IU/l)	58.37 ± 52.89	35	(20 - 245)

Table 3: Preoperative radiological parameters in the study cases

	Total number = 30		
	Mean ± SD	**Median**	**Range**
US CBD Size (cm)	17.27 ± 5.67	19	(1.8 - 23)
MRCP CBD Size (cm)	20.13 ± 185	20	(17 - 24)
Stone number (by MRCP)	1.83 ± 0.38	2	(1 - 2)
Distal stricture (in MRCP)		13 (43.3%)	

Table 4: Operative data and hospital stay in the study cases

	Total number = 30		
	Mean ± SD	**Median**	**Range**
Operative time (min)	90 ± 20.68	85	(70 - 150)
Blood loss (ml)	115.5 ± 32.97	120	(50 - 150)
Hospital stay (days)	6.57 ± 1.14	7	(4 - 8)
Technique			
Side to side		28 (93.3%)	
End to side		2 (6.7%)	

Table 5: Operative time, intraoperative blood loss, and duration of hospitalization in open and laparoscopic cases

	Open (n = 25)	**Laparoscopic (N = 5)**	**Test of Significance**
Operative time (min)	81.60 ± 7.32	132 ± 11.51	< 0.001
Blood loss (ml)	126.60 ± 22.95	60 ± 10	< 0.001
Hospital stay (days)	6.96 ± 0.73	4.60 ± 0.55	< 0.001

Table 6: Postoperative complications in the study cases

Complications	**Total number = 30**
Early complications	
Wound infection	10 (33.3%)
Ileus	2 (6.7%)
Abdominal collection	3 (10%)
Bile leak	2 (6.7%)
Pulmonary embolism	1 (3.3%)
Delayed complications	
Cholangitis	2 (6.7%)
Sump syndrome	0 (0%)
Stenosed stoma	0 (0%)
Recurrent stones	0 (0%)

Discussion

Despite the advances in the endoscopic CBD interventions and its great success in achieving CBD clearance, surgical CBD bypass (Or drainage) still has a crucial role in patients with choledocholithiasis, especially in the absence of an experienced endoscopist, presence of abnormal anatomy, or failed endoscopic intervention.[14-16] This was evident in our study, as 40% of its participants had a previous failure of ERCP and stone extraction.

The female gender was more prevalent in our study compared to men. The female gender is known to be a significant risk factor for biliary lithiasis, and this was also evident in the study conducted by Kays et al., who reported that women represented 72.22% of the included sample (13 out of 18 patients).[5]

In the current study, the included patients had CBD ranging between 17 and 24 mm based on MRCP findings. Other authors reported that the mean values of CBD diameters were 14.8 and 16 mm for the end-to-side and side-to-side groups, respectively.[7]

Another study reported successful CDD with lower CBD diameters, as the authors reported that the CBD diameter had a median value of 10 mm (Interquartile range, 9 – 13).[5] Although making an anastomosis with these smaller diameters could be challenging, the previous authors performed all of their cases by laparoscopy. Using the magnification power of laparoscopy, the creation of an anastomosis with small ducts would be easier.

In our study, the duration of operation showed more prolongation in association with laparoscopy (132 vs. 81.6 minutes in the open approach). It is expected for this parameter to decrease with the enhanced learning curve with the performance of more patients via laparoscopy. This concept must

be encouraged, especially with the benefits of minimally invasive approaches that were evident in blood loss and hospitalization period.

In a previous study that evaluated 18 patients who underwent laparoscopic CDD, operative time had a median value of 165.5 minutes (Interquartile range, 127.0–195.3).[5] It is expected to find some differences in the operative duration between studies based on surgical expertise, previous cholecystectomy, and intraoperative adhesions.

Our findings showed a significant decline in hospital stay when laparoscopy was used (4.6 vs. 6.96 days in the open cases). This is in agreement with multiple studies that highlighted the beneficial impact of laparoscopy on patient recovery following hepatobiliary procedures, including earlier mobilization, earlier return of bowel function, and shortened hospitalization period.[17,18] Kays et al. reported that the median duration of hospitalization was four days after laparoscopic CDD,[5] which is near to ours reported in the laparoscopic cases.

In our study, postoperative wound infection was the most common complication, as it was encountered in 33.3% of cases. Another study also reported a high rate of the same complication (20%),[8] but it was still lower than ours. Luu et al. reported that the same complication was noted in 22% of their participants.[19] Perhaps, patient criteria, including preexisting comorbidities along with perioperative care, could explain the previous findings.

In the current study, we encountered only two patients with bile leakage (6.7%) who were managed conservatively with spontaneous resolution of their leak with no need for radiological or surgical interventions. Another study reported that the incidence rate of the same complication was 3.8%.[20] Leppard et al. reported that the same complication was encountered in two cases (13%).[8]

Our findings showed the occurrence of pelvic collection in three cases (10%). As this collection was far from the operative bed, we think that it might have been caused by missed biliary collection in the pelvis during the operation. These cases required radiological guided intervention with no further complications. Other authors reported an incidence near to ours (11.5%).[20]

In the previous study by Kays and his associates, only one patient developed an intraabdominal abscess that required percutaneous drainage (5.56%).[5] Another study reported a higher rate for the same complication that was noted in 26% of the included cases.[8]

Ileus was encountered in 6.7% of the included cases in our study. Studies handling that complication after CDD are rare, and one previous similar study reported an incidence rate of 2% for the same complication.[19]

In the current study, two patients (6.7%) presented with cholangitis at the follow-up, and both of them were managed conservatively with the resolution of their manifestations. This is near to two previous studies that reported incidences of 5.6%,[21] and 6.4%,[22] for the same complication. On the other hand, El Nakeeb et al. reported a 0% incidence of the same complication,[23] while Panis et al. reported a 10.3% incidence rate.[24] The former study is lower than our rate, whereas the latter is higher than it. The difference in follow-up periods, anastomotic diameters, and configuration could explain the previous heterogenicity.

Sump syndrome occurs secondary to the accumulation of food debris inside the infra-anastomotic CBD with subsequent bacterial overgrowth.[25] Although its incidence was thought to decrease with end-to-side anastomosis,[5] we did not encounter any patients with that complication despite the majority of our patients being performed in the side-to-side fashion. The incidence of this syndrome ranged between 0% and 5.2%, according to previous studies,[19,23,24,26] and other studies denied the incidence of this complication, even with a longer follow-up period compared to ours.[8,13,27]

We did not encounter any patients with anastomotic strictures in our study, and that coincides with Cuschieri et al., who reported the same findings at a five-year follow-up.[28] Other studies reported the incidence of that complication, which ranged between 0.7% and 6.4%.[19,21,22,27]

No patients developed recurrent CBD stones in our study, and that agrees with Okamoto et al., who denied the occurrence of that complication with either the side-to-side or end-to-side techniques.[7] This highlights the fact that the creation of a wide stoma between the bile duct and the duodenum and bypassing the duodenal sphincter could be protective against future stones, even in the presence of lithogenic bile. Additionally, if stones are formed, the wide anastomosis created should be enough for its passage to the alimentary tract.

Our study has some limitations manifested in the small sample of patients collected from a single hepatobiliary center. Also, the number of laparoscopic procedures was not enough to make a full comparison between the two groups. The upcoming studies should cover the previous drawbacks.

Conclusion

Apart from high wound infection rates, CDD is a feasible and effective procedure for the management of patients with choledocholithiasis, especially

after the failure of the endoscopic methods. The laparoscopic CDD procedure should be encouraged over the open approach to decrease postoperative hospitalization.

Conflict of interest: Nil.

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