International Surgery Journal
Annareddy DR et al. Int Surg J. 2022 Feb;9(2):336-344
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20220321

Original Research Article

Surgical management of choledocholithiasis: a single institutional experience

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Received: 06 January 2022
Accepted: 21 January 2022

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ABSTRACT

Background: Choledocholithiasis is the 2nd most common complication of gallbladder stone disease and its incidence increases with age. There are different modalities of treatment ranging from endoscopic techniques to open and minimally invasive surgery. However, the single best modality has remained a point of major speculation. This study was undertaken to evaluate various modalities of surgical treatments undertaken at our institute.
Methods: A retrospective analysis of all the patients who underwent surgery for common bile duct stones during the study period was done. The parameters analyzed were epidemiological data, clinical parameters, surgical details and any complications.
Results: A total of 50 patients were included in the study with a M:F ratio of 1:1. The most common presenting complaint was pain abdomen and the majority, were post ERCP failure cases. The common cause for failure was multiple or impacted stones. Majority of the patients underwent an open surgery and a drainage procedure in the form of choledochoduodenostomy was added. Laparoscopic exploration showed advantage in form of shorter hospital stay, early return to activity. There were no instances of retained or missed stones and the complications were limited to wound complications.
Conclusions: In the era of advanced endoscopy, surgery still holds an eminent place in the management of choledocholithiasis. With growing expertise, the complication and clearance rates are better than endoscopy. Laparoscopic exploration can be the single best treatment for patients with both cholelithiasis and choledocholithiasis.

Keywords: Cholelithiasis, Choledocholithiasis, Endoscopic retrograde cholangiopancreaticogram, Laparoscopic surgery, Choledochotomy

INTRODUCTION

Gall stone disease has been one of the most commonly diagnosed abdominal condition worldwide in recent times. It is the leading cause for hospital admissions related to gastrointestinal problems. Around 50% patients with gall stones become symptomatic over a period of time. The mortality rate is relatively low at around 0.6%. Choledocholithiasis is the 2nd most common complication of gallbladder stone disease and its incidence increases with age. The incidence of common bile duct stones (CBDS) in patients with symptomatic cholelithiasis varies widely in the literature between 5% and 33% according to age.[1,2]

Around 3-5% of patients with ductal stones are asymptomatic and spontaneous passage through the papilla has been reported, however this may not be without risk of complications. The European association for endoscopic surgery (EAES) recommends all patients

with symptomatic gallstones should be assessed for the presence of CBD stones and treated based on the patient's risk classification.[3,4]

Trans-abdominal ultrasound (US) and magnetic resonance cholangiopancreatography (MRCP) are the most common non-invasive pre-operative imaging modalities for detection of CBDS. However, endoscopic retrograde cholangiopancreatography (ERCP) is the most common invasive tool for their detection. Treatment is advisable to prevent further complications such as obstructive jaundice, acute cholangitis and pancreatitis.[5,6] There are different modalities of treatment ranging from endoscopic techniques to open and minimally invasive surgery. However, the single best modality has remained a point of major speculation over a period with each modality having its merits depending on the patient presentation.

The present study was a retrospective study conducted in our institute to evaluate presentations, various surgical treatments and outcomes of the patients presenting with choledocholithiasis.

Aims and objectives

The aims and objectives were to assess the varied presentations of CBDS and to assess the various modalities of surgical treatment for CBDS.

METHODS

Source of data

All the patients who underwent surgical treatment for CBDS in the department of surgical gastroenterology during the study period were included in the study.

Study period

The study period was for 2 years from March 2018 to March 2020.

Study design

The study design was a retrospective study.

Inclusion criteria

All patients above 18 years undergoing surgical treatment for choledocholithiasis during the study period were included in the study.

Exclusion criteria

Patients below 18 years; patients who had bile duct surgery for any other indication than choledocholithiasis were excluded.

Methodology

The medical records of all the patients who underwent surgical treatment for choledocholithiasis were collected after applying the inclusion and exclusion criteria. The demographic, epidemiological data were collected and a thorough search to delineate the presenting symptoms, course of treatment, complete details of surgery and post-operative morbidity and mortality if any was made.

The recorded data included patient demographics, pre-ERCP main presentation, number of ERCP sessions, reasons for ERCP failure, post-ERCP complications, stone site (ampullary, distal CBD, mid CBD or common hepatic duct (CHD), size (small <1.5 cm, large 1.5-2 cm, or very large <2 cm) and number of stones (single or multiple), CBD diameter per mm, operative details including: type of operation: laparoscopic CBD exploration LCBDE, laparoscopic choledochotomy (LCD) or OCBDE (supraduodenal open choledochotomy (OCD) and follow up data.

Operative procedure

Open CBD exploration

All the patients were operated under a combined general and epidural anaesthesia. The patient was placed in supine position and abdomen opened through a right subcostal (Kochers) incision. After an initial inspection of the abdomen, the CBD was identified and its medial border and lateral border were defined. As an initial step, we always started with Calot's dissection whenever possible and the cystic duct and artery identified and ligated separately. Kocherization of the duodenum was done. A vertical choledochodotomy was made not less than 1.5 cm in length as close to the duodenal margin as possible. The stones were extracted through the choledochotomy and a Fogarty's catheter was passed both proximally into the right and left hepatic ducts and distally across the ampulla. We planned for a drainage procedure whenever the dilated CBD was >2.5 cm and our preference was a single layered, side to side choledocho-duodenostomy. In ducts less than 1.5 cm our preference was a Kehr's t tube which was removed after 2 weeks with a prior cholangiogram showing no signs of obstruction or calculi. After definitive procedure, gall bladder was dissected out from its bed and removed. A 28F abdominal drain placed in the Morrison's pouch and abdomen closed in layers.

Laparoscopic CBD exploration

All the patients were operated in a combined general an epidural anaesthesia. The patient was placed in supine position and the ports were placed as shown in Figure 2. The right hand port was placed at a lower level and more towards left so that it aided in comfortable suturing. The initial steps were same as in open exploration. After choledochotomy a rigid ureteroscope was passed into the

proximal and distal common bile duct and the stones were removed through a grasper or basket. A single layer side to side choledocho-duidenostomy was done in continuous fashion. Drains were placed.

Post-operative analgesia was given through the epidural catheter and the patient was encouraged to ambulate at the earliest.

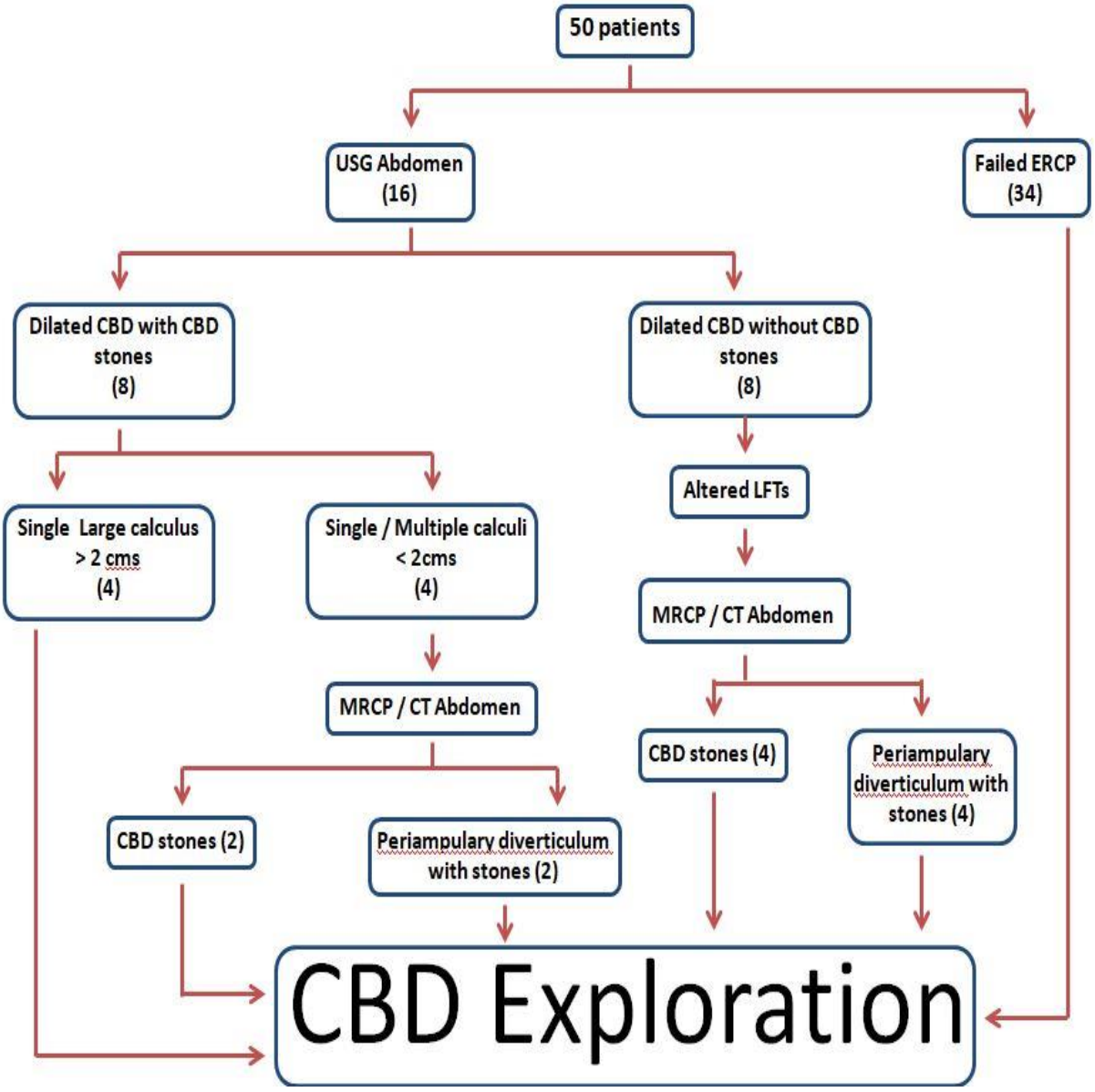

Figure 1: Study flow chart.

RESULTS

A total of 50 patients met the criteria for inclusion in the study. There were 26 males and 24 females and majority of the patients were in 45-60 years age group (Table 1). The complete history, clinical findings, investigations and course of treatment were retrieved. The most common presenting complaint was pain abdomen, followed by obstructive jaundice, cholangitis and pancreatitis. Around 34 patients presented after a failed ERCP (Table 2). A few of them underwent multiple sessions of ERCP, the reasons for failure ranged from large stones to difficult cannulation. Four patients had an history of previous laparoscopic cholecystectomy.

Abnormal liver function tests (LFTs) were seen in 42 patients, neutrophilic leucocytosis was seen in 10 patients. In suspected or previously undiagnosed cases of CBD calculi, the initial imaging modality of choice was USG abdomen. USG identified a dilated CBD in 16 cases and stones in 8 patients. MRCP was performed in all these patients that in turn confirmed the diagnosis.

In the total of 50 patients, 42 patients underwent open exploration, while 8 patients underwent laparoscopic

exploration. A drainage procedure in the form of choledochoduodenostomy was done in all the patients who underwent laparoscopic exploration and in 38 patients who underwent open exploration (Figure 3-5). In 4 patients who underwent open exploration, a T tube was placed that was left in place for atleast 14 days. The main indication for T tube drainage was comparatively small size of the CBD. Usually, the drain output of the T tube decreased within the first 2-3 days as the distal obstruction was relieved. Our protocol was to discharge the patient with the tube once the drain output decreased and to get a tube cholangiogram after 2 weeks to reaffirm and then remove the tube in outpatient department.

Table 1: Epidemiological and clinical parameters.

Variables	Number/percent
Total number of patients	50
M:F	1:1
Mean age (in years)	55.4
Clinical presentation	
Asymptomatic	16
Abdominal pain	36
Obstructive jaundice	20
Cholangitis	16
Pancreatitis	12
Predictors of biliary stones	
Bilirubin >4 mg/dl	8
Bilirubin 1.8 to 4 mg/dl	42
Cholangitis	8
CBD Stones on USG	8
Dilated CBD on USG	34
Age >55 years	26
Gallstone pancreatitis	6

Table 2: Characteristics of patients with regard to prior ERCP.

Variables	Number (N)
Number of ERCP sessions	
Single	20
Multiple	14
Reason for ERCP failure	
Very large stones	4
Multiple stones	12
Impacted stones	10
Failed cannulation	8
Post ERCP complications	
Pancreatitis	4

The duration of surgery was longer in laparoscopy group owing to the learning curve and the expertise required. The patients were started on oral feeds within 48 hours of completion of surgery. The drain placed in the Morrisons pouch was removed within seven days. The patients who underwent laparoscopy were discharged within a week while those who underwent open surgery had a longer hospital stay. The patients who underwent laparoscopy also had faster return to normal activity.

Post-operative complications were minimal in our study and were limited to wound complications. Wound infection was seen in four patients who underwent open surgery and among these two patients had a T tube placement. In our study, we have not observed any post-operative complications in the laparoscopy group. There was no observed mortality in the present study. There were no incidents of residual or leftover stones in either group.

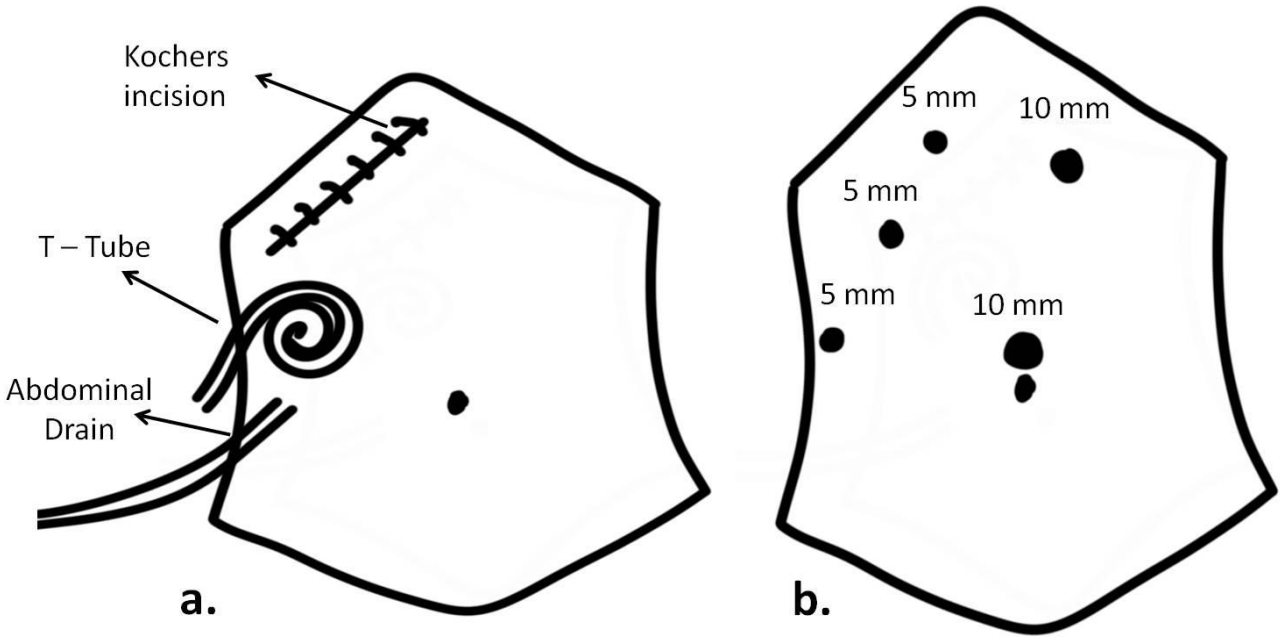

Figure 2: (a) Incision in open surgery; (b) port positions in laparoscopic surgery.

Table 3: Operative data.

Surgery	Open CBD exploration+ Choledochoduodenostomy	Open CBD exploration+ T tube drainage	Laparoscopic CBD exploration+ Choledochoduodenostomy
No. of cases	38	4	8
Mean duration of surgery (mins)	120	100	220
Drain removal (days)	7	7	5
Duration of hospital stay (days)	10	7	5
Return to normal activity (days)	30	25	15
Wound infections	2	2	-

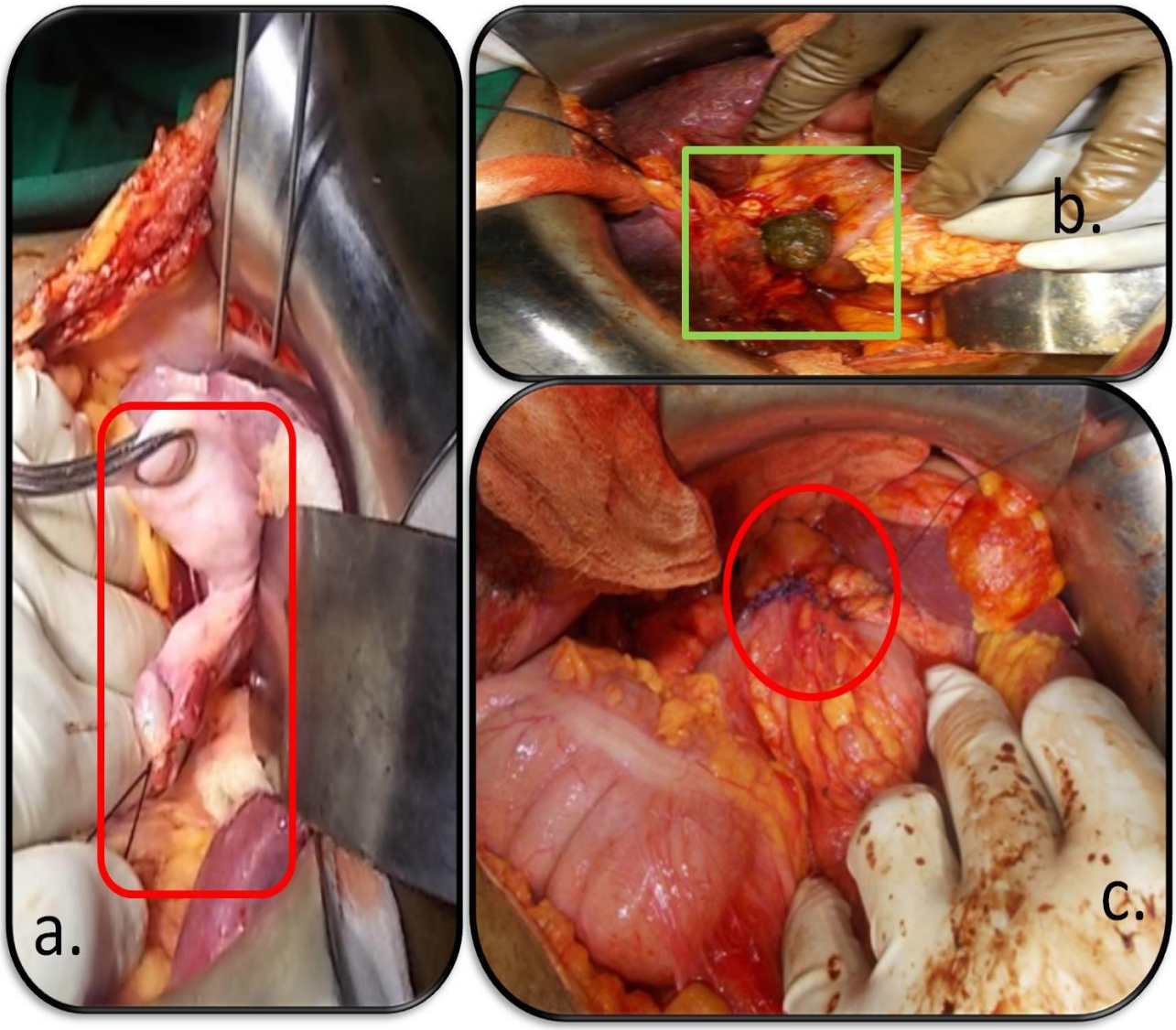

Figure 3: (a) Calot's and gall bladder dissection from liver bed; (b) large single stone removal; (c) open choledochoduodenostomy.

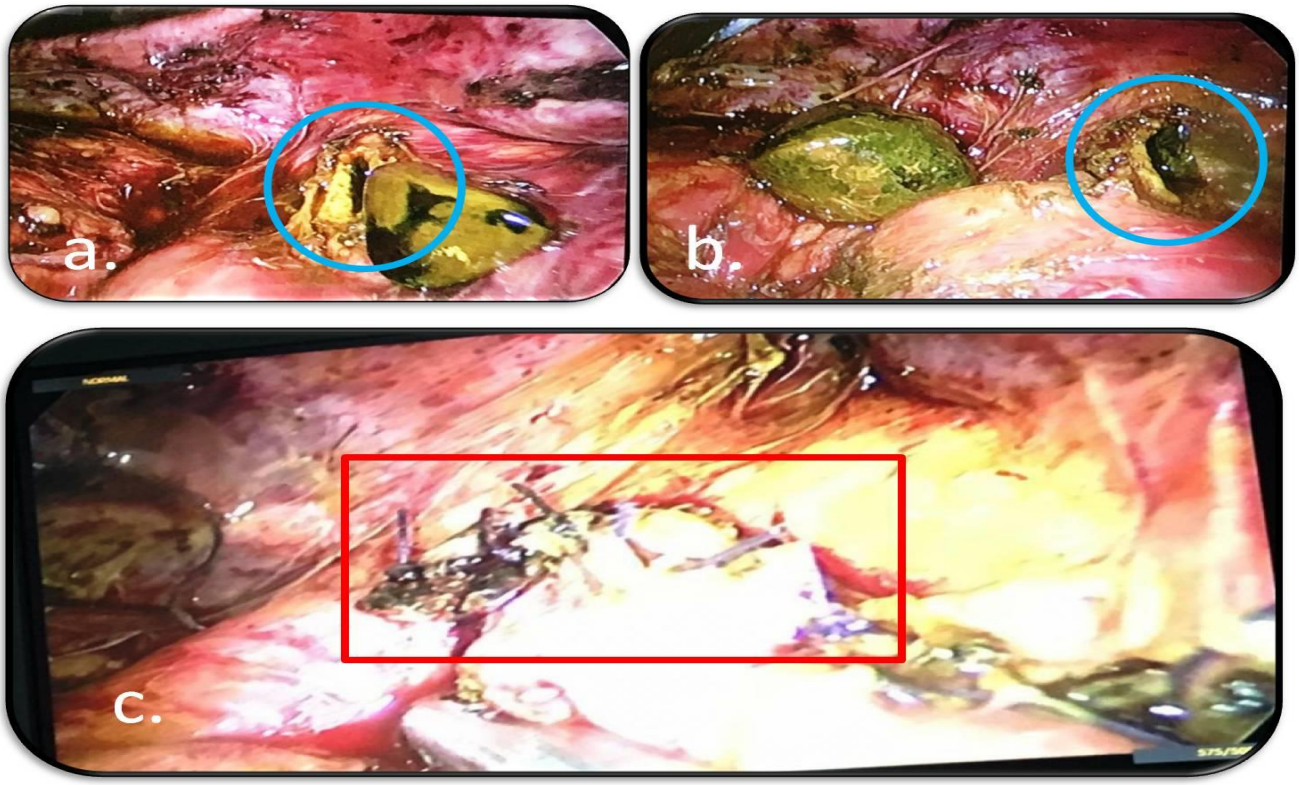

Figure 4: (a and b) Laparoscopic choledochotomy with stone; (c) laparoscopic choledochoduodenostomy.

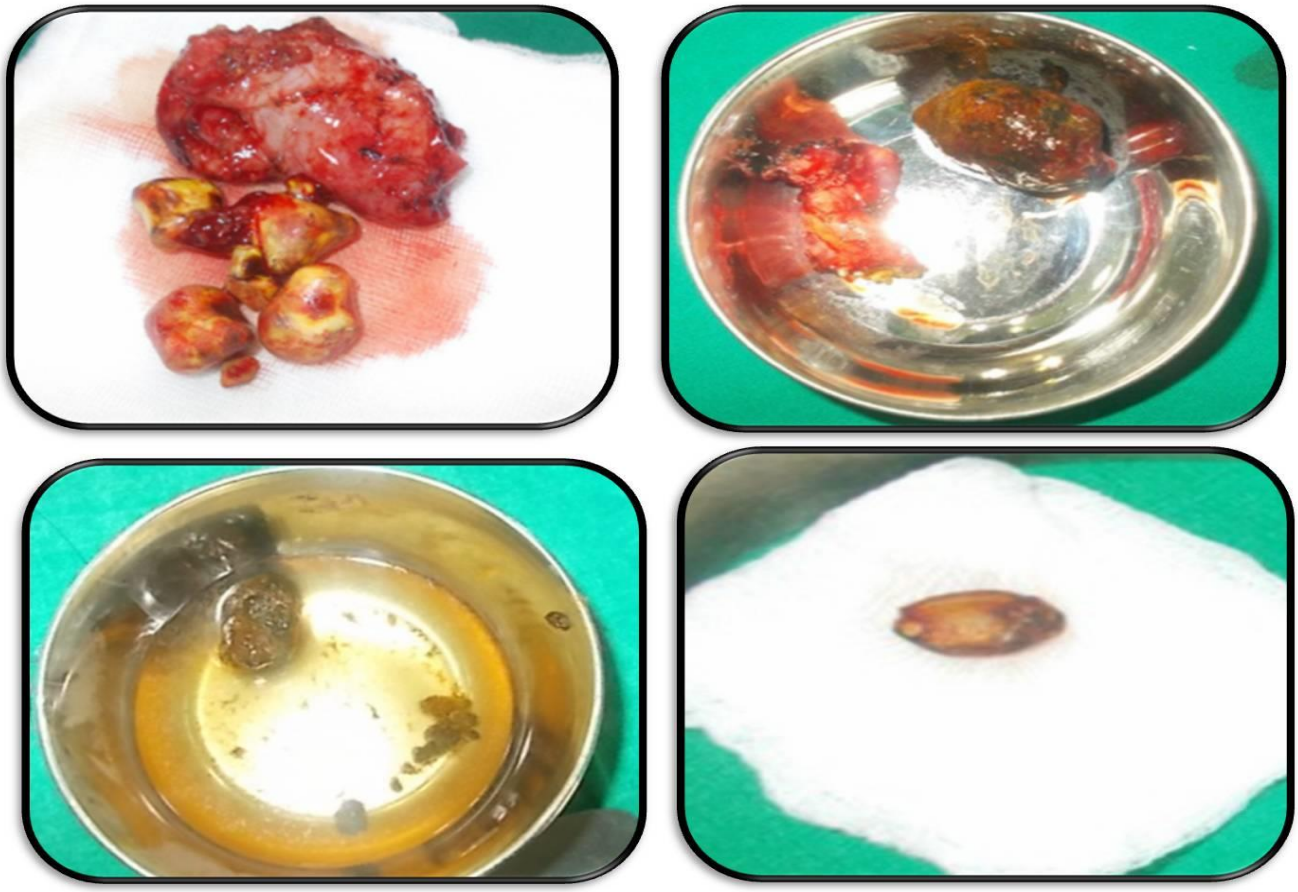

Figure 5: Various stones removed from CBD.

DISCUSSION

Common bile ducts are usually treated by ERCP with or without sphincterotomy. As any other procedure, ERCP also has its set of limitations and complications. ERCP failure to extract stones may be due to failed cannulation (Juxta-papillary diverticulum, intra-diverticular papilla or small papilla) or failed extraction.[7,8] The failed extraction occured with difficult stones (Mirrizi'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 sphicterotomy or endoscopic papillary balloon dilatation (EPBD)). Post ERCP complications vary widely in the literature between 5 and 38%; due to pancreatitis, duodenal perforation, bleeding, cholangitis and papillary stenosis.[9] It had been reported that sphincterotomy may cause recurrent ductal stones, stenosis of the papilla with cholangitis and late development of bile duct cancer, which was a cause of concern particularly in younger patients.[10]

The treatment options for failed ERCP included surgical interventions either open or laparoscopic. Open CBD exploration had been the standard of care since very long. Cochrane database review published in 2006 had suggested that ERCP was less successful than open surgery in CBD stone clearance and was associated with a higher mortality.[11] There was also an increased recurrence rate of CBD stones following endoscopic removal.[12] Campagnacci et al reported the retained stones percentage after ERCP was 9% and 13.5% respectively.[13] When ductal clearance was unsuccessful, temporary stenting can serve as a bridge preventing stone impaction and cholangitis by relieving biliary obstruction and ensuring biliary drainage for further planned endoscopic stone removal or operation. Furthermore, biliary stenting had some therapeutic benefit in case of difficult stones (difficult stones became smaller, fragmented and easier to removed at repeat ERCP or even absent after a period of stenting).[8,14]

In our study, majority of the patients were post failed ERCP. Majority were after a single session while 14 patients had multiple sessions of ERCP.[20] The most common cause for failed ERCP in our study was multiple or impacted stones followed by failed cannulation and very large stones. The post procedure complications were limited to pancreatitis in two patients.

For decades, open exploration was the standard of care, with clearance rates around 95% to 97%. It had its set of complications, morbidity and mortality. Laparoscopic surgery for CBDS was first described in 1991. Ever since, the technique, equipment and expertise have evolved leaps and bounds. Laparoscopic common bile duct exploration (LCBDE) had become the main treatment for CBD stones associated with cholelithiasis.[15] The UK guidelines recommended LCBDE as the treatment of choice for patients with CBD stones undergoing laparoscopic cholecystectomy.[16]

The ductal stone clearance rate was approximately 85% to 97.3% and had an associated mortality rate of 0.3% to 0.8% and morbidity of 3.7% to 33%. The overall length of stay was shorter in LCBDE compared with the 2-stage approach, that was, ERCP followed by laparoscopic cholecystectomy.[17] LCBDE was associated with a shorter hospital stay, lesser cost, no manipulation of the sphincter of Oddi resulting in less bacterial colonization, less risk of cholangitis, less risk of malignant transformation and pancreatitis.[18]

The role of intra-operative cholangiogram had been controversial. CBD stones have been shown to be present on intraoperative cholangiography at the time of laparoscopic cholecystectomy in up to 13% of patients who had preoperative ERCP, due to interval passage of stones or to false-negative completion cholangiogram after ERCP.[19] Puhalla et al stated that intraoperative cholangiography was a fundamental prerequisite of LCBDE, recommending routine intraoperative cholangiography allowing the surgeon to verify bile duct anatomy and thereby guiding the surgical approach to bile duct exploration and preventing bile duct injury.[20] It also allowed the evaluation of the size of the CBD and stone location. Collins et al found a 25% false-positive rate of CBD stones at intraoperative cholangiography and persistent CBD stones likely to cause morbidity postoperatively in 2.5% of patients only.[3] One major advantage of using IOC routinely was that the sensitivity (97%) and negative predictive value (99%) were high. Therefore, if CBD stones were present they should be detected on IOC and a normal IOC almost always meant that the CBD was clear. A negative IOC can prevent patients from undergoing unnecessary attempted at CBD clearance and patients can be reassured that the risk of complications from retained CBD stones was extremely low.[21]

There were two approaches for LCBDE, the transcystic approach (LTCE) and the trans choledochal approach (LCD). The choice of the approach was made according to the number, size, location of stones, cystic duct and CBD diameters and anatomy of the cystic duct-CBD junction. LCD was used in case of difficult, impacted, large and/or multiple stones and failed LTCE.[9] Transcystic approach was through the cystic duct stump and was preferred approach which can be successful in upto 50% of cases. For the post ERCP failure cases, LCBDE via a choledochotomy was the preferred approach. It provided unrestricted visualization of the biliary system, allowed retrieval of difficult stones located in the extra-hepatic or intra-hepatic biliary tree and carried a higher clearance rate than the trans-cystic approach. The success rate of bile duct clearance of choledochotomy was higher than the transcystic approach (93.3-97.1% versus 63-84%).[22]

In our study, most of the patients underwent open exploration, as we gained more expertise we initiated LCBDE and we took a choledochotomy approach, as all were post ERCP failure. We have done a chodocho-duodenostomy in all the cases undergoing LCBDE. Another area of conflict was primary closure or T tube drainage of the choledochotomy. In 1965, Sawyers et al documented the advantages of primary closure of the CBD and recommended that routine use of a T tube following CBD exploration be abandoned.[23] A meta-analysis by Guruswamy et al in 2007 showed no statistically significant difference in any of the outcomes between T tube and primary closure of choledochotomy, apart from the hospital stay which was significantly lower in the primary closure group.[24] Current literature only supported placement of T tubes in case of pronounced CBD inflammation.[25] In a single-center retrospective study by Hua et al additional indications for T tube placement were inflammatory stricture of the sphincter of Oddi and unremovable small mural stones.[26]

A recent 12 year follow up study found that the diameter of the dilated CBD returned to preoperative normal or near normal values in 75% of the patients after surgical exploration of the CBD and extraction of the stones.[27] A meta-analysis of 1762 patients who underwent LCBDE from 19 studies worldwide showed a mean duct clearance of 80% with average morbidity of <10% (4-16%) and mortality of <1% (0-2.7%).[24] The most common post procedural complications were bile leak, retained stones and biliary stricture apart from wound complications. In the present study, till our last follow up we have just seen around four patients with wound related complications.

The recent data were in favor of a single stage LCBDE over a two stage ERCP followed by laparoscopic cholecystectomy. Tranter et al reported the combined morbidity rate for ERCP with ES followed by LC was from 1% to 19% (median, 13%) and from 2% to 17% (median, 8%) for LCBDE.[28] The National institute of health (NIH) expert consensus published in 2002 and the British gastroenterology association recognized that both approaches have a similar rate of effectiveness.[29] Williams et al in their updated guidelines for CBD stones stated that the one-step treatment, however, led to a reduction in expenses and better patient compliance; thus, it was indicated as the preferable one, when technically and medically possible.[30]

The retained stone rate in open surgery usually ranged between 1-8%. Bile leak was also more common in patients who had a prior ERCP. The clearance rate above 90% had been the standard of care in LCBDE. Fortunately, in our study we have not had any cases with retained or missed stones and bile leaks. We did not find any difference between LCBDE and OCBDE regarding intra-operative bleeding or post-operative complications, while patients who underwent laparoscopy had lesser hospital stay and had an earlier return to normal activity.

CONCLUSION

In the era of advanced endoscopy, surgical management of common bile duct stones still holds pivotal in selected cases especially in areas with no access to advanced care. We presented our experience with surgical management of stones in CBD over a period of two years. Both laparoscopy and open surgery are equally effective with respect to surgical outcomes, while laparoscopy has shown benefit in reducing the hospital stay, costs and early return to normal activity. LCBDE is the standard of care whenever the expertise and equipment are available.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Annareddy DR, Thota A. Surgical management of choledocholithiasis: a single institutional experience. Int Surg J 2022;9:336-44.