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A PROSPECTIVE OBSERVATIONAL STUDY OF LAPAROSCOPIC COMMON BILE DUCT EXPLORATION AS A SALVAGE PROCEDURE IN FAILED ENDOSCOPIC RETROGRADE CHOLANGIO PANCREATICOGRAPHY CASES : A SINGLE SURGEON EXPERIENCE.

Hepatobiliary Surgery

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ABSTRACT

Introduction : Laparoscopic cholecystectomy has superseded open cholecystectomy as preferred approach but one limitation lies in dealing with common bile duct (CBD) stones. With the advent of laparoscopic cholecystectomy, the conventional treatment approach of choledocholithiasis is pre-operative endoscopic retrograde cholangiopancreaticography (ERCP) with endoscopic stone extraction followed by laparoscopic cholecystectomy. Occasionally gastroenterologists fail in either cannulating the common bile duct or removing the stone by ERCP. However, should endoscopic stone retraction fail, patient is usually subjected to an open CBD exploration as in the literature laparoscopic common bile duct exploration after failed ERCP is technically more challenging due to local inflammatory changes.

Objectives: The purpose of this study was to present our early experience of laparoscopic CBD exploration with special emphasis on the utility of laparoscopic CBD exploration as a salvage procedure for failed ERCP. The secondary end point was to examine the short term outcome of laparoscopic CBD exploration. Through this study certain factors that are in favor and those that are not in favor of performing Laparoscopic CBD exploration as a salvage procedure in failed ERCP cases have been identified.

Materials And Methods: In Sawai Mansingh Medical college and hospital, a tertiary care institute, we conducted a hospital-based prospective observational study from May 2019 to December 2021 on 28 patients with choledocholithiasis. The study population included only the patients diagnosed with choledocholithiasis (stone in common bile duct) who had single or multiple attempt at endoscopic stone extraction by ERCP but had failed ductal clearance i.e all the failed ERCP cases. Failed ERCP cases also include those in whom CBD was either cannulated and stenting was done.

Results: In this study 28 patients were included, out of which 24 patients (85.71%) were females and the rest were males .The average diameter of CBD ranged from 11-15 mm (39.28%) whereas the average diameter of the CBD calculus also ranged from 11-15mm. The calculus was impacted in CBD in around 17.85% of the cases and in 75% of cases stones were lodged in the middle one third of CBD. The average operating time in the present study was around 61-80 minutes and majority (92.85%) of the study population had no complications except for 3.57% of cases had inadvertent injury to the aberrant right hepatic artery and in 3.57% of cases the stone was missed. 3.57 % of cases later developed biliary peritonitis.

Conclusion: Laparoscopic CBD Exploration has proven to be safe, reliable and effective treatment for CBD stone and has gained wider acceptance with its added advantage of being a single stage procedure. Through this study certain factors that are in favor and those that are not in favor of performing Laparoscopic CBD exploration as a salvage procedure in failed ERCP cases have been identified.

KEYWORDS

Laparoscopic common bile duct exploration, Failed endoscopic retrograde cholangio pancreaticography, Common bile duct.

INTRODUCTION:

Choledocholithiasis or in simple words, common bile duct (CBD) calculi have been a challenge to surgeons since time immemorial. CBD is explored in approximately 15% of all cholecystectomies and stones are removed in 65% of these explorations. The incidence of concomitant CBD stones varies between 8% to 20%.[1,2,3,4,5,6,7,8] Laparoscopic cholecystectomy has superseded open cholecystectomy as preferred approach but one limitation lies in dealing with CBD stones. There is also possibility of incidental detection of CBD stone during elective laparoscopic cholecystectomy. With the advent of laparoscopic cholecystectomy, the conventional treatment approach of CBD stone is pre-operative endoscopic retrograde cholangiopancreaticography (ERCP) with endoscopic stone extraction (ESE) followed by laparoscopic cholecystectomy.

Occasionally gastroenterologists fail in either cannulating the CBD due to presence of hostile periampullary anatomy or removing CBD stone which may have been impacted in the CBD, by ERCP. In the second case, a biliary stent is often positioned to allow the decompression of the biliary tree.[9,10] Repeated endoscopic manipulation of the ampulla and CBD and the positioning of a biliary stent may result in increased local inflammation and fibrosis. However, should endoscopic stone retraction fail, patient is usually subjected to an open CBD exploration as in the literature laparoscopic CBD exploration (LCBDE) after failed ERCP is technically more challenging due to local inflammatory changes.[11,12,13]

The purpose of this study was to present our early experience of laparoscopic CBD exploration (LCBDE) with special emphasis on the utility of laparoscopic CBD exploration as a salvage procedure for failed ERCP. The secondary end point was to examine the short term outcome of laparoscopic CBD exploration.

METHODS :

In Sawai Mansingh Medical college and hospital, a tertiary care institute, we conducted a hospital-based prospective observational study from May 2019 to December 2021 on 28 patients with choledocholithiasis out of which 24 patients (85.71%) were females and the rest were males. 21.4% of patients belonged to age group 51-60 years followed by equal distribution of patients (17.8%) in 31-40, 41-50 and 61-70 age groups. The study population included only the patients diagnosed with choledocholithiasis (stone in common bile duct) who had single or multiple attempt at endoscopic stone extraction by ERCP but had failed ductal clearance i.e all the failed ERCP cases. Failed ERCP cases also include those in whom CBD was either cannulated and stenting was done.

Routine standard investigation protocol ,i.e., complete blood count, liver function test, renal function test, ultrasonography of abdomen, urine routine examination, electrocardiograph, chest xray were performed.

Inclusion criteria includes all the patients diagnosed with choledocholithiasis who had single or multiple attempt at endoscopic stone extraction by ERCP but had failed ductal clearance i.e all the failed ERCP cases. The ultrasonography (USG) or Magnetic resonance cholangio pancreaticography (MRCP) of the patients included in the study showed a single stone in upper or mid CBD. Patient should have atleast an ultrasonography report as base line investigation commenting on the CBD stone but USG may or may not

comment on the size of the stone.

Patient who have preoperative investigations (USG or MRCP) suggestive of multiple calculi in CBD or calculi impacted in either of right or left hepatic ducts were excluded from the study. Patients belonging to the pediatric age group i.e. <14 years ,very obese patients, pregnant females, patients with bleeding diathesis, patient who also had features of acute pancreatitis or severe acute cholangitis, patient with history of previous abdominal surgeries and patients with severe cardiovascular or respiratory system compromise were also not included in the study.

Operative Technique And Staggering Improvisations:

After the study population was selected as per inclusion and exclusion criteria, a single staged laparoscopic common bile duct exploration was planned for these patients. All these patients were declared fit for surgery after due opinion were received from cross specialities as advised by team of anesthesiology. Pre operative antibiotics and vitamin K injections were administered to all the patients.

In the surgery standard 4 port technique as employed in laparoscopic cholecystectomy was used. No separate port for introducing choledochoscope was made. The procedure began in the same way as in standard laparoscopic cholecystectomy. The fundus of gall bladder was retracted towards the right shoulder of the patient and the Hartman's pouch was given traction downwards and outwards towards right hip. Calot's triangle was identified and dissected after 'critical view of safety' was obtained. The cystic artery was clipped and divided. Then the cystic duct was milked towards the gall bladder in order to squeeze out any small calculi or sludge in the cystic duct .A clip was applied to the gall bladder side and cholecystectomy was done. Now CBD was identified and dissected carefully. Choledochotomy was performed by a longitudinal incision of around 1cm depending on the size of the stone with the help of endoscopic knife, just below the insertion of the cystic duct into the CBD, as close to the stone as possible (Figure1).

Figure 1 Common Bile Duct Calculus

Stone extraction was performed by Desjardins forceps which was an unique improvisation employed in the study. Desjardins forceps is an instrument routinely used in open CBD exploration but in this study it was used in tandem with other laparoscopic instruments. Desjardins forceps was introduced through the epigastric port site and was used to retrieve the stone keeping the intra abdominal pressure at a lower level.The stent which was used to cannulate the CBD was also removed (Figure 2).

Figure 2 Removal of CBD stent

Soon after the removal of stone, flexible choledochoscopy was performed via the epigastric port to visualise the CBD status and ensure complete ductal clearance. A T-tube was placed inside the lumen of CBD (Figure 3) with its tail end exiting the abdomen from the port site in the right mid axillary line.

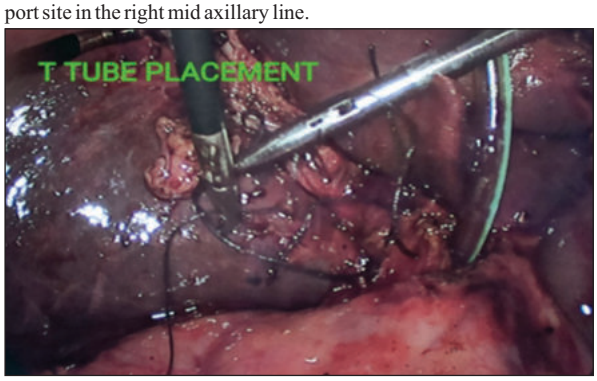

Figure 3 T-Tube Placement

Thorough flushing and irrigation of the CBD lumen and duodenum was done through the T tube. CBD closure was done by Polyglactin 3-0 interrupted sutures, by endoscopic suturing. Intra-abdominal drain was also placed in Morrison's space. Drain was removed on the post operative day 3 if drain output was insignificant. A T-tube cholangiogram was performed between post op day 5-day 8 and if the T-tube cholangiogram was found normal patients were discharged and asked to return between post –op day 10-day 14 for T - tube removal in the follow up.

OBSERVATIONS AND RESULTS:

In this study 28 patients were included, out of which 24 patients (85.71%) were females and the rest were males. 21.4% of patients belonged to age group 51-60 years followed by equal distribution of patients (17.8%) in 31-40, 41-50 and 61-70 age groups. In the present study, around 39.28% (11 out of 28 patients) had diameter of common bile duct ranging in between 11-15 mm; 25% (7 out of 28 patients) had CBD diameter ranging in between 16-20 mm. Around 21.4% (6 out of 28) had CBD diameter ranging in between 6-10 mm. 2 out of 28 had CBD diameter ranging in between 21-25mm taking it to 7.14%. 1 out of 28 patients had CBD diameter in ERCP ranging in 26-30mm and 1 patient had CBD diameter ranging from 31-35mm compounding it to 3.57% each. It is shown in table 1, figure 4.

Table 1 Distribution Of Diameter Of CBD In ERCP In Study Subjects

CBD DIAMETER (in mm)	NUMBER OF PATIENTS	PERCENTAGE OF PATIENTS
6-10	6	21.4
11-15	11	39.28
16-20	7	25
21-25	2	7.14
26-30	1	3.57
31-35	1	3.57

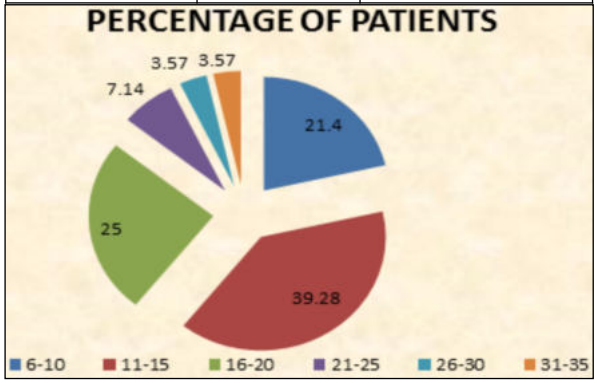

Figure 4 Distribution Of Diameter Of CBD In ERCP In Study Subjects

Around 17.85% (5 out of 28 patients) of the study population had stone in the common bile duct that was impacted whereas, rest 82.14% had a non-impacted stone (Figure 5).

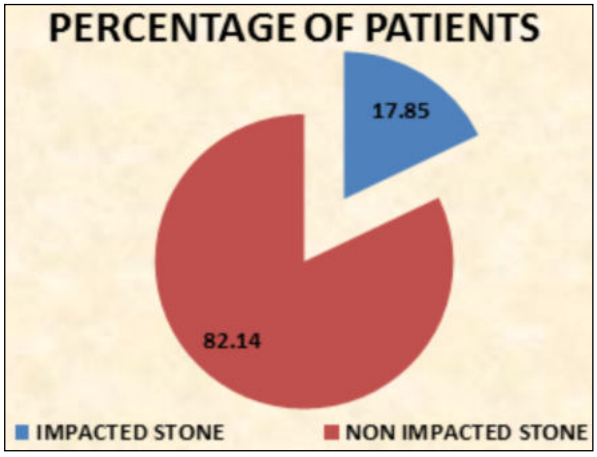

Figure 5 Distribution Of Subjects With Impacted Stones In CBD

Around 75% (21 out of 28 patients) of study subjects had calculus in mid of common bile duct whereas, only around 25% (4 out of 28 patients) had calculus in upper portion of common bile duct (Figure 6).

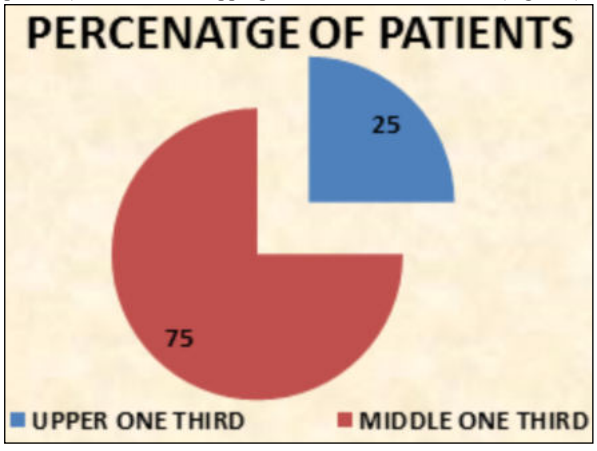

Figure 6 Distribution Of Location Of Calculus In CBD (intra op)

In the study, 28.57% (8 out of 28 patients) of the study subjects had thickened gall bladder; 17.85% (5 out of 28 patients) of them had contracted gall bladder; 14.28% (4 out of 28 patients) had Mirizzi syndrome and only 7.14% (2 out of 28 patients) of the study subjects had soft omental adhesions. Whereas majority of them 32.14% (9 out of 28 patients) had no other pathology of biliary tract noted intraoperatively (Figure 7).

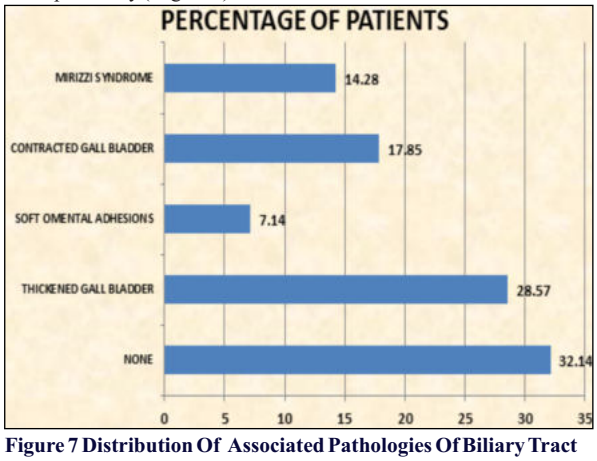

Figure 7 Distribution Of Associated Pathologies Of Biliary Tract

Almost majority of the study population , around 92.85% (26 out of 28 patients) had no intra operative complications. Complications were observed only in 2 patients. Inadvertent injury to the aberrant right hepatic artery which led to excessive bleeding was seen in 1 out of 28 patients amounting to 3.57% whereas missed stone was also seen in 1 patient (3.57%) (Figure 8).

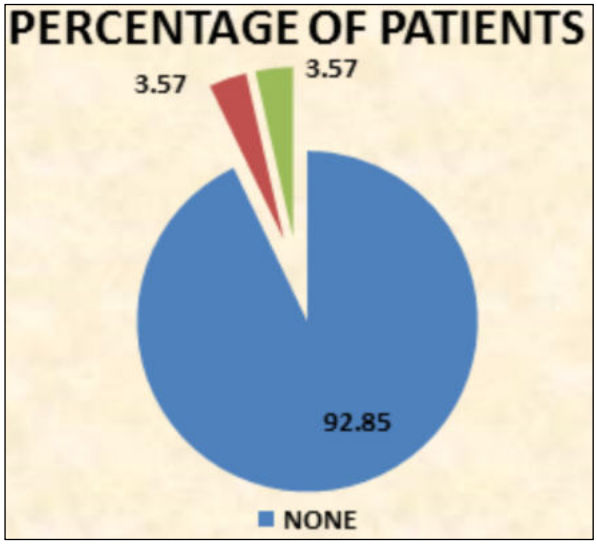

Figure 8 Distribution Of Complications Of Surgery In The Patients

26 out of 28 patients (approx. 92.86%) stayed in hospital post surgery for 5-10 days. 1 patient (out of 28, 3.57% of study population) stayed in hospital post surgery for 11-15 days. 1 patient (out of 28, 3.57% of study population) stayed in hospital post surgery for 21-25 days.Post op T- Tube cholangiogram was normal in almost all of the study subjects (27 out of 28 patients, 96.43%) except for 1 patient (3.57%) in whom there was a filling defect visble in the post -op T-Tube cholangiogram (Figure 9).

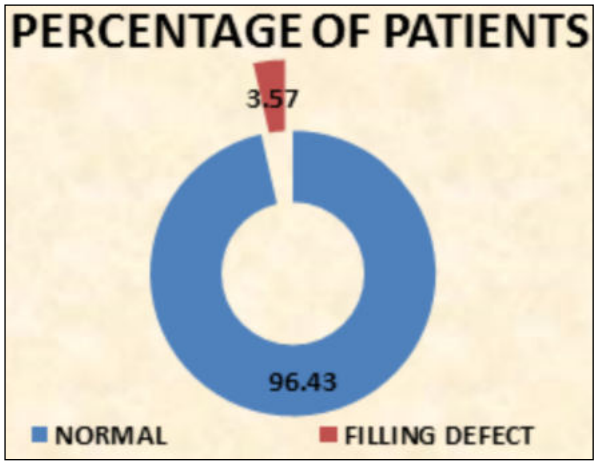

Figure 9 Distribution Of Post Op T-tube Cholangiogram Study

Almost all of the study subjects were relieved by surgery (27 out of 28 patients, 96.43%), except for 1 patient (out of 28,3.57%) who developed biliary peritonitis.

DISCUSSION:

Failure of endoscopic stone extraction by ERCP demands the use of the single-stage approach.[14]About 10% of patients with cholelithiasis present with CBD stone, particularly with increasing patient age. Hence, it is important that expertise in dealing with CBD stone is routinely available. CBD stone are commonly managed by endoscopic stone extraction, followed by laparoscopic cholecystectomy (two-stage approach). The safety and efficacy of the two-stage approach have been proven, and its long-term results have been shown to be satisfactory. The risks associated with ERCP and the morbidity associated with open surgery have paved the way for considering laparoscopic CBD exploration. This was supported with technological advancement.

ERCP has been a valuable tool for the management of CBD stone. However, with the advent of magnetic resonance cholangiopancreaticography and endoscopic ultrasonography, the role of **diagnostic ERCP has become obsolete**. Even when the pre-operative diagnosis of CBD stone is confirmed radiologically, the routine use of ERCP has

several disadvantages, including significant short-term risks such as bleeding, pancreatitis, cholangitis and perforation. The long-term risk of ERCP includes stenosis of sphincter of Oddi, reflux of duodenal contents into the common bile duct, with bactibilia and ascending cholangitis and possible cholangiocarcinoma.

The purpose of this study was to present our early experience of laparoscopic CBD exploration (LCBDE) with special emphasis on the utility of Laparoscopic CBD Exploration as a salvage procedure for failed ERCP. The secondary end point was to examine the short term outcome of Laparoscopic CBD Exploration. As a part of the study, all those patients who had choledocholithiasis in either USG or MRCP were first asked to undergo ERCP and have an attempt at endoscopic stone extraction. Only those patients who had a failed attempt at endoscopic stone extraction by ERCP were included in the study. In the present study, 28 patients belonging to age group 11-80 years were included out of which 21.4% belonged to the age group of 51-60 years. 85.71% were females and 14.28% were males. Most of them (71.43%) had no comorbidities whereas hypertension and type 2 DM had equal distribution (10.71%) in the study population.

Vishal.G Shelat et al had conducted a similar study in 2006, where they had included 43 patients who had undergone Laparoscopic CBD Exploration. Of these, 29 were female (67.4%) and 14 were male (32.6%), with a median age of 61 (range 27−85) years. Out of the 43 patients, 26 had at least one co-morbid condition. Four patients had previous abdominal surgery, including one patient with a previous laparoscopic cholecystectomy. A total of 22 patients opted for single-stage Laparoscopic CBD Exploration, while therapeutic endoscopic stone extraction was attempted in the remaining 21 patients. Out of these 21 patients, four were cleared of CBD stone and no evidence of ductal stones on ERCP was found in two patients. Interestingly, in these six patients, subsequent intra-operative cholangiogram (IOC) detected the presence of CBD stone, which then required Laparoscopic CBD Exploration to be performed. Of the 15 patients who failed endoscopic stone extraction, endoscopic sphincterotomy and stenting were performed in four patients, sphincterotomy alone in two patients and stenting alone in one patient. These 15 patients were offered Laparoscopic CBD Exploration as a salvage procedure.

In the present study transcholedochal route was the preferred route and in some instances Desjardins forceps was used for stone retrieval. The average diameter of CBD ranged from 11-15 mm (39.28%) whereas the average diameter of the CBD calculus also ranged from 11-15mm. The calculus was impacted in CBD in around 17.85% of the cases and in 75% of cases stones were lodged in the middle one third of CBD. The average operating time in the present study was around 61-80 minutes and majority (92.85%) of the study population had no complications except for 3.57% of cases had inadvertent injury to the aberrant right hepatic artery and in 3.57% of cases the stone was missed. 3.57 % of cases later developed biliary peritonitis. The average duration of stay in hospital of the patients in the post operative period ranged from 5-10 days. The outcome was very much satisfactory in most of the cases as 96.43% of cases were relieved.

Whereas in the study by Vishal. G Shelat et al, transcystic exploration was attempted in nine patients and laparoscopic choledochotomy was performed in six patients. The median operating time for these 15 patients was 250 (range 140–465) minutes. There was one complication. The patient developed a bile leak that resolved spontaneously with observation and was discharged on the fourth day with a drainage tube in situ.

Higher rate of complications were observed in the present study when compared to that of the study by Vishal.G Shelat et al. The reason behind this finding could be the higher incidence of impacted stones and presence of other associated biliary tract pathologies such as thickened gall bladder (28.57%), contracted gall bladder (17.85%), Mirizzi syndrome (14.28%) and soft omental adhesions (7.14%) in the present study when compared to none in study by Vishal.G Shelat et al.

In another similar study conducted by Pradeep Panwar et al on 40 patients who had undergone ERCP and had atleast a single failed attempt at endoscopic stone extraction by ERCP, were selected out of which 24 patients were male and 16 were female. Out of these 40 patients 5% had history of acute pancreatitis while 75% had history of biliary colic. Transcholedochal approach was used in all cases, as all the cases were of failed ERCP due to large stone. Of the 40 patients who underwent surgery stone couldnot be removed by Laparoscopic CBD Exploration in 2 patients and it had to be converted to open surgery due to dense adhesions around CBD and difficult anatomy of Calot's triangle. Post op complications that were observed by Pradeep Panwar et al were vomiting (20%), fever (12.50%), bile leak (7.50%), intestinal obstruction (5%), surgical site infection (5%), and pancreatitis (2.50%). When we compare the present study to that done by Pradeep Panwar et al, we observe a higher rate of complications in study by Pradeep Panwar et al. This might be due to higher sample size (40 patients) when compared to present study (n=28). Also, pre operative selection of patients with history of pancreatitis (5%) and biliary colic (75%) who were included in the study population of Pradeep Panwar et al may also have contributed to higher rate of complications in their study. In both the studies duration of stay in hospital for majority of the study population remained the same, around 5-10 days.

There was another similar study condcuted by Asaad F. Salama et al on 36 patients. Successful laparoscopic CBD Exploration and stone clearance was achieved in 34 of 36 patients, whereas treatment failure occurred in the other two patients because of instrument failure–balloon ruptured and basket broken. The duration of the operation in the 34 of 36 patients with successful laparoscopic CBD stone clearance was 126 min (range 102–140 min), and was similar in both transcystic and choledochotomy techniques. Open CBD exploration was performed successfully in the two of 36 patients in whom failure occurred in the same session. No bile leakage, hemobilia, abdominal bleeding,or pancreatitis occurred in this study. Transient colic pain occurred in two patients and was treated conservatively. The patients were discharged home on day 3–4 postoperatively once we completely ensured that the operation was successful and no complications had occurred.

When compared to the present study, the study by Asaad F. Salama et al had better results; lesser complication rates and lesser duration of stay in hospital. The reason behind this could be due to the higher incidence of impacted stones and presence of other associated biliary tract pathologies such as thickened gall bladder (28.57%), contracted gall bladder (17.85%), Mirizzi syndrome (14.28%) and soft omental adhesions (7.14%) in the present study when compared to none in study by Asaad F. Salama et al.

CONCLUSION:

Laparoscopic CBD Exploration has proven to be safe, reliable and effective treatment for CBD stone and has gained wider acceptance with its added advantage of being a single stage procedure where Laparoscopic CBD exploration and cholecystectomy are performed simultaneously. Laparoscopic CBD exploration is time consuming, needs more hard ware, is an intensive procedure, has steep learning curve and risks of injury to CBD. But through this study certain factors that are in favor and those that are not in favor of performing Laparoscopic CBD exploration as a salvage procedure in failed ERCP cases have been identified. Laparoscopic CBD exploration has lower risks and complication rates when the patient is young lean female ;CBD diameter is more than 10mm; the stone is not impacted in CBD ;stone is lodged in upper or mid CBD; and anatomy of Calot's triangle is favourable i.e, without omental adhesions, thickening of gall bladder, Mirizzi syndrome and contracted gall bladder. In instances where choledochoscope is not available, improvisations with help of Desjardins forceps can be used to retrieve CBD stone. Post op T-Tube cholangiogram is needed to evaluate the effectiveness of Laparoscopic CBD exploration.

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