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Management of cystic duct stone(s) during laparoscopic cholecystectomy

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Abstract

Background and objective: Although cholecystectomy relieves symptoms in the majority of cases, still a significant number of patients suffer from the post-cholecystectomy syndrome. Cystic duct remnant calculi is a causative factor of the post-cholecystectomy syndrome. Cystic duct stones are not infrequently encountered during laparoscopic cholecystectomies. This study aimed to present our experience of patients with calculi of the cystic duct that successfully dealt with laparoscopically.

Methods: This study was conducted on 4000 cases of chronic calculous cholecystitis at Rizgary Teaching Hospital from January 2010 to November 2020.

Results: Cystic duct stones were detected in 397 cases. A single stone was found within the cystic duct in 301 patients (75.8%) and multiple stones in 96 patients (24.2%). The cystic duct was reported to be wider than normal in 368 cases (92.7%) and near to normal in 29 cases (7.30%). We recorded two cases (0.5%) of concomitant common bile duct stones with cystic duct stones. Our procedure for dealing with cystic duct stone was successful in 372cases (93.7%). Milking the stone back to the gall bladder was successful in 15 cases (3.80%). In eight cases (2.00%), we were obliged to convert the procedure to open cholecystectomy. Since peroperative cholangiography and choledcoscopy are not available in our hospital, the associated common bile duct stone in two cases (0.50%) was postponed and dealt with later on. Post-operative recovery was uneventful, apart from one patient who developed features of acute cholangitis.

Conclusion: Cystic duct stones are not infrequent, as was believed earlier. Their preoperative detection may be difficult, but it can be detected easily peroperatively. Its detection and retrieval are mandatory to decrease the incidence of post-cholecystectomy phenomena.

Keywords: Gall bladder; Laparoscopy; Cholecystectomy; Cystic duct stones.

Introduction

Cholecystectomy is one of the most commonly performed abdominal operations. Worldwide, 90% of cases are done laparoscopically,[1] as there is less post-operative pain, and hospital stay is less than 24 hours, with full return to activity within one week compared with one month after open cholecystectomy.[2]

It has been confirmed that laparoscopic cholecystectomy alleviates the symptoms and signs of biliary calculi in more than 85% of the cases.[3] The rest (7-15%) continue to have the same complaints postoperatively, known as a post-cholecystectomy syndrome. Cystic duct remnant stone is one of the well-known etiology of this syndrome.[4]

Patients with post-cholecystectomy syndrome present with a complex heterogeneous complaint, including upper abdominal pain, dyspepsia, vomiting, and sometimes icterus with or without fever. Another serious complication may result from missed cystic duct stones, especially small ones. These stones can be mobilized

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after laparoscopic cholecystectomy causing pancreatic duct obstruction leading to pancreatic auto digestion followed by severe systemic inflammation that may end with systemic multi-organ failure.[5]

Obstructive jaundice is another complication of missed stone in the cystic duct or common bile duct after cholecystectomy.[6]

The normal caliber cystic duct is difficult to be visualized by ultrasound, axial CT scan, or by a direct cholangiography scan, whether percutaneous trans hepatic cholangiography (PTC) or endoscopic retrograde cholangiopancreatography (ERCP) preoperatively.[7]

Performing magnetic resonance cholangiography (MRC) from different angles of view makes visualization of the cystic duct course possible. Also, detecting cystic duct stones as a filling defect is feasible, but this is neither possible nor available in every case and requires a high suspicion index before the surgery.[8]

Regarding the classical anatomy of intra and extrahepatic biliary tree, both the right hepatic and left hepatic duct, after draining the biliary ducts of hepatic segments (I –VIII), join to form the common hepatic duct at the hepatic hilus. After the confluence of the cystic duct, the common bile duct is formed that drains the bile into the duodenum through the ampulla of vater.[9,10] This study aimed to present our experience of patients with cystic duct calculi that successfully dealt with laparoscopically.

Methods

This was a prospective case series study performed on 4000 laparoscopic cholecystectomy cases with confirmed cystic duct stones in 397 cases from January 2010 to November 2020. The study was performed at Rizgary Teaching Hospital, Erbil, Iraq. All cases included in this study were subjected to clinical evaluation (detailed history with complete physical examination).

All patients were fit for general anesthesia. Routine available preoperative investigations were done, including CBC, Blood group and RH typing, prothrombin time, liver function test including ALT, AST, ALP, GGT, TB, renal function test, virology screen, and recently COVID-19 PCR test, CXR,ECG and echocardiography for cases with comorbidity with an abdominopelvic ultrasound scan. Written informed consent was obtained from all patients.

The operation was done under general anesthesia with endotracheal intubation and CO2 insufflation, using a standard four -port technique. The visceral peritoneum was incised posteriorly above the Rouvier's sulcus groove of the liver. Calot's triangle was dissected from fibro-fatty tissues till the cystic duct and cystic artery were clearly identified. Unfortunately, both peroperative cholangiography and choledoscopy were not available in our center. Therefore, we were obliged to depend on naked eye visualization and palpation of the stone within the cystic duct by Maryland forceps during the operation.

Most of the time, we milked the stone, if possible, from the cystic duct back into the gall bladder. In our procedure, we first cleared the Calot's triangle from all the fibro-fatty tissue and leashes till two structure were identified and the gall bladder plate became clearly visible (Figure 1), obtaining a critical view of safety. In our procedure, it is mandatory to ligate the cystic artery at first so that you can make the gall bladder more mobile and not fixed in the gall bladder plate (Figure 2). After ligating the artery, we applied one clip on the gall bladder at the junction of the neck with the cystic duct (Figure 3). In nearly all cases, the cystic duct was elongated by the presence of stones within the duct. Also, the cystic duct was wide in the majority of the cases. Then, we divide the cystic duct just below the metallic clip allowing the stones within the cystic duct to be extruded to the outside and by milking the cystic duct in a retrograde direction from the common bile duct towards the neck of the

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gall bladder using Maryland forceps. In most cases, we cleared the cystic duct completely from stones, which is confirmed by the free flow of clear bile from the cystic duct stump (Figure 4). After confirming complete clearance, we applied two clips to the cystic duct remnant (Figure 5). Then the residual stone in the gall bladder bed was removed, and the area was cleared completely. In most cases, the tube drain was not inserted in the gall bladder bed, but the area was washed clearly by normal saline. In most cases, a gauze swab was used for collecting the stones and mopping any residual bile and blood clots. The gauze swab was removed through the xiphisternal port before removing the gall bladder through the same port.

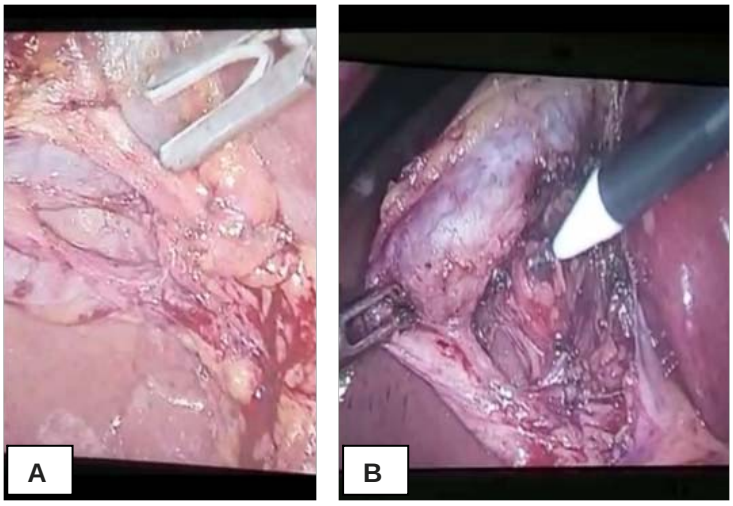

Figure 1 (A, B) Obtaining the critical view of safety with the identification of cystic duct and cystic artery

Figure 2 Applying 2 clips to the cystic artery in preparation for cutting the artery

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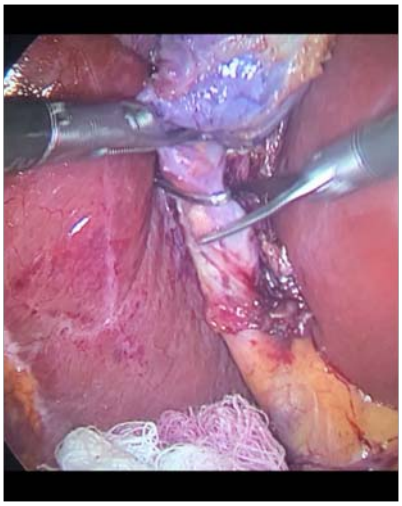

Figure 3 Cutting the cystic duct after application of the metallic clip to the duct

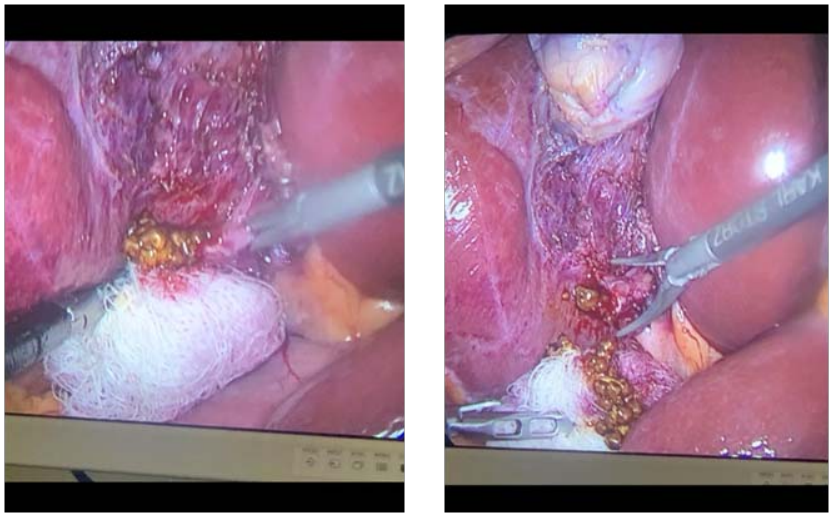

Figure 4 Clearing the cystic duct from the stones with the help of the Maryland forceps using a milking maneuver in a retrograde manner

Figure 5 Applying two metallic clips to the cystic duct remnant after clearance of the duct from the stones

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After removing the gall bladder through the xiphisternal port, we sent it for histopathological examinations. All cases were given a single injection of ceftriaxone peroperatively and were discharged on the same day. Post-operative recovery was uneventful for most cases, apart from one patient who developed cholangitis and required readmission to the hospital and conservative treatment.

Data analysis

The statistical package for the social sciences (SPSS, Chicago, IL, version 26) was used for data entry and analysis. Two approaches were used; descriptive and analytical. The descriptive approach included calculating frequencies, percentages, means, and SDs.

In the analytical approach, the Chi-square test of association was used to test the significant association between categorical variables. A *P* value of ≤0.05 was considered statistically significant.

Results

Of 4000 patients with laparoscopic cholecystectomy operations between 2010 and 2020, only 397 (9.92%) cases had cystic duct stone.

The mean age ± SD of patients was 38.98 ± 13.56, ranging from 17-80 years. About three quarters (75.1%) were females, and the others were males (24.9%). About 78% of patients were between 20 and 49 years old, and 119 (30%) patients had comorbidity (Figure 6).

Of 397 cystic duct stones, only 2 (0.5%) patients had common bile duct stones. Of the 397 cases, 76 (19.14%) had mild recent derangement of liver function test associated with acute right hypochondrial pain.

Of the 397 patients, 301 (75.8%) had a single cystic duct stone, and the remaining 96 patients (24.2%) had multiple stones. Regarding peroperative cystic duct diameter, most (92.7%) patients had dilated cystic duct diameter (Table 1).

Table 1 Frequency of cystic duct stones with peroperative cystic duct diameter

Variables	Frequency	Percentage (%)
Cystic duct stone		
Single	301	(75.8)
Multiple	96	(24.2)
Peroperative cystic duct diameter		
Normal	29	(7.30)
Dilated	368	(92.7)

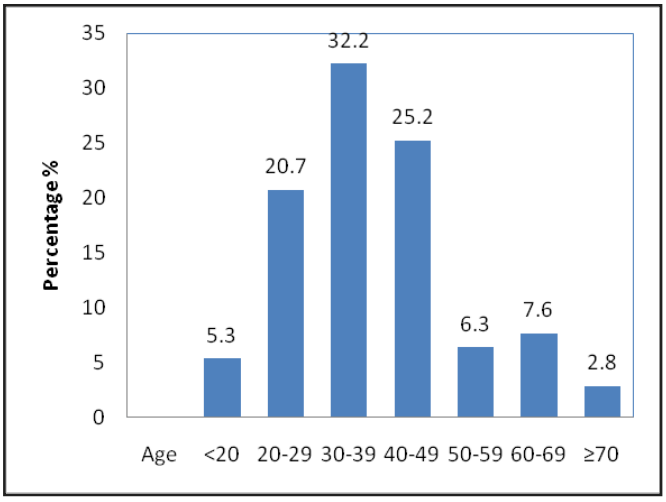

Figure 6 Age distribution of patients

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Table 2 shows the association between the number of cystic duct stones and certain variables. There was a statistically significant (*P* <0.001) association between the number of cystic duct stones and gender, in which all females in the study sample (n=298) had single stone versus three (3.0%) males. On the other hand, 97% of males had multiple stones versus 0% of females.

A statistically significant (*P* <0.001) association was found between comorbidity and the number of cystic duct stones, in which 65.5% of those with comorbidity had single cystic duct stone, and 100% of those with no comorbidity had single stones.

Table 2 Association between the number of cystic duct stones with certain variables

Variable	Total	Cystic duct stones				*P* value
		Single		Multiple		
		No.	(%)	No.	(%)	
Gender						
Male	99	3	(3.0)	96	(97.0)	<0.001
Female	298	298	(100.0)	0	(0.0)	
Age in years						
<20	21	15	(71.4)	6	(28.6)	0.963
20-29	82	60	(73.2)	22	(26.8)	
30-39	128	96	(75.0)	32	(25.0)	
40-49	100	79	(79.0)	21	(21.0)	
50-59	25	20	(80.0)	5	(20.0)	
60-69	30	23	(76.7)	7	(23.3)	
≥70	11	8	72.7	3	(27.3)	
Operation Type						
New technique	372	301	(80.9)	71	(19.1)	<0.001*
Milking	15	0	(0.0)	15	(100.0)	
Laparoscopic cholecystectomy_Open	8	0	(0.0)	8	(100.0)	
Tailored procedure	2	0	(0.0)	2	(100.0)	
Comorbidity						
Yes	278	182	(65.5)	96	(34.5)	<0.001
No	119	119	(100.0)	0	(0.0)	
Total	397	301	(75.8)	96	(24.2)	

*Fisher Exacts Test

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Figure 7 shows a statistically significant (*P* = 0.002) association between types of cystic duct stones and peroperative cystic duct diameter, in which 100% of multiple cystic duct stones had dilated peroperative cystic duct while 91%of single stones had peroperative dilated cystic duct.

This study revealed that our new technique for dealing with cystic duct stones was successful in 372 patients (93.7%) compared to only 25 cases (6.3%) in whom other procedures were used to manage cystic duct stones.

Discussion

Cystic duct stones encountered during laparoscopic cholecystectomy are not given the importance they are worth. Remnant cystic duct stones account for about 10-15% of postcholecystectomy syndrome cases, which is a great challenge for surgeons to resolve.[3] This group of patients is theoretically preventable by having a high index of suspicion, especially when the cystic duct is abnormally dilated. In our region, neither preoperative cholangiography nor choledocoscopy is available. These procedures are the desired tools worldwide for detecting cystic duct stones since they assist in changing a blind procedure to direct vision enabling retained stone(s) missing to almost zero rate.[4]

In this study, cystic duct stones were not detected in any case using an abdominal US scan. However, about 9.92% of patients had cystic duct stones (398 cases), which matches with Dave et al., who found that the incidence of cystic duct stones shown on On-table cholangiogram (OTC) during laparoscopic cholecystectomy was 20%.[2]

In another study, Kambal et al. (2014) stated that the incidence of cystic duct stones was about 19%.[8] Also, a prospective study from St James University Hospital (Leeds, UK) found sludge or cystic duct stones shown on table cholangiography during laparoscopic cholecystectomy at an incidence of about 20%.[2] Recurrent pain during the month preceding the surgery should alert the surgeon toward cystic duct stones.[8]

In the current study, there was a recent onset of mild transit liver function tests derangement associated with right

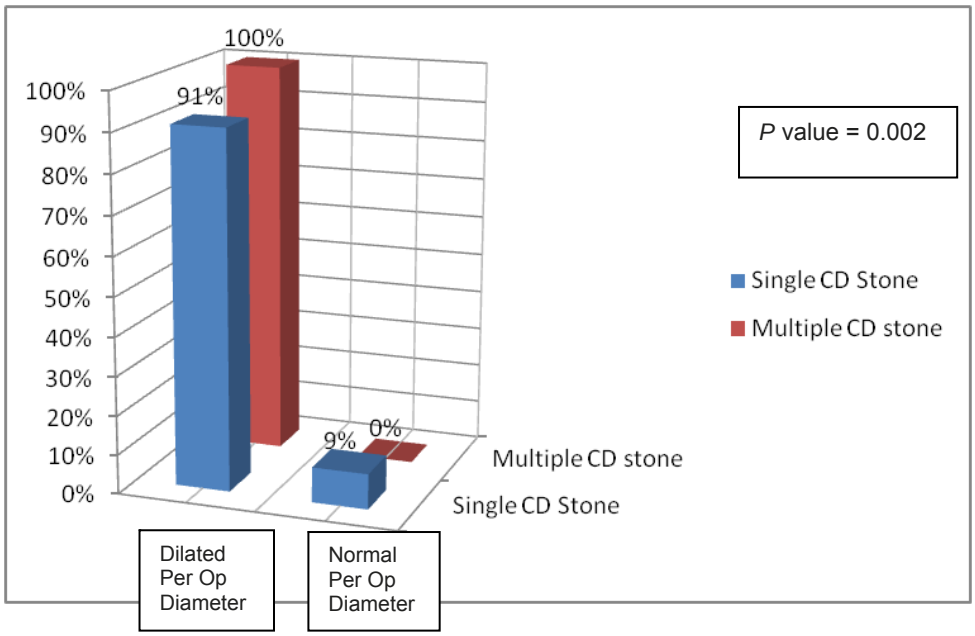

Figure 7 Association between the number of cystic duct stones (single and multiple) with per operative cystic duct diameter

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hypochondrial pain in 76 cases (19.14%) who were revealed to have cystic duct stones. This is consistent with the findings of Sezeur and Akel, where the liver profile was deranged more commonly in association with cystic duct stones (47.6% versus 24.5%; *P* <0.05).[11] Another study by Amir et al.,[12] found that there was a statistically positive association between the presence of cystic duct stones and abnormal liver function tests (*P* = 0.001). The sensitivity of the liver function test to detect cystic duct stones was 73%, and their specificity was 43%.

Common bile duct stones, which may be a cause of morbidity among patients with calculus gallbladder, were associated with cystic duct stones in 0.5% of the cases in our study. This explains the importance that should be given to the presence of cystic duct stones. Also, this finding matches the study of Kambal et al., which documented that the incidence was more common when cystic duct stone was present (50 versus 29%).[8] However, another study published by Sezeur and Akel[11] found that common bile duct stones are known to occur more frequently in association with cystic duct stones. The reported rates in the literature varied from 5.7% to 23.8% in the absence of cystic duct stones, while Elbalshy et al. reported a rate of 35.7% (10 cases).[6]

The current study revealed that a wide cystic duct was seen in 368 cases (92.7%), while Elbalshy et al. reported a rate of 10.7%.[6]

Regarding the options for the management of cystic duct stones peroperatively during laparoscopic cholecystectomy, the simplest one is milking the stone(s) upward by Maryland forceps. This was successful in our series in 15 cases (3.80%), while Elbalshy et al. reported a success rate of 18.7% (28 cases).[6]

The rate of conversion from laparoscopic procedure to open classical method in our study was 8 cases (2%), while Sakpal et al.,[13] reported an overall conversion rate of 4.9%.

In our series, the cystic duct opened below the cystic duct metallic clip, and the stone was extracted in 372 cases (93.7%), and none of them were detected preoperatively. In our operative procedures, we considered that stone might slip into the common bile duct during the retraction of Hartman's pouch. To avoid this, we used to ligate the cystic duct as soon as possible with minimal manipulation, especially if the ultrasound report showed multiple small stones. This practical point is similar to other surgical experience.[14]

Conclusion

Cystic duct stones are occasionally encountered during laparoscopic cholecystectomy. They can be removed by milking the cystic duct before clipping, especially if the cystic duct stone is a single stone, or using alternative procedures like cystic duct exploration to deal with the stone. The aim is to decrease the incidence of post-cholecystectomy pain, missed common bile duct stones, and pancreatitis with no increase in the time of procedure or risk to patients.

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Competing interests

The author declares that he has no competing interests.

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