# Management of residual gallbladder and cystic duct stump stone after cholecystectomy: a retrospective study

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# Purpose

There is no doubt that cholecystectomy relieves presurgical symptoms of gallbladder (GB) disease. The persistence of symptoms following cholecystectomy is termed as postocolecystectomy syndrome, the incidence of which ranges from 10 to 30%. The present study was conducted to evaluate patients who had a residual GB stone/cystic duct stump stone after cholecystectomy, and to study the surgical outcomes.

## Patients and methods

This retrospective study was conducted on 21 cases with residual GB/cystic duct stump stone. The diagnosis was guided by ultrasound and magnetic resonance cholangiopancreatography. All the cases were managed by using completion cholecystectomy – either open or laparoscopic. All preoperative, operative, and postoperative data were collected.

## Results

Preoperative endoscopic retrograde cholangiopancreatography and papillotomy were required in nine cases that presented with obstructive jaundice. Laparoscopic completion cholecystecomy was feasible in 14 cases. The conversion rate was 1/14 cases. The mean operative time was 127 $\pm$ 31.3?min and the mean blood loss was 165 $\pm$ 74.5?ml. Intraoperative minor biliary injury occurred in one case. The mean hospital stay was 3.1 $\pm$ 1.8 days (1–9 days). All patients were reported to be symptom-free at the follow-up after surgery.

# Conclusion

Residual GB/cystic duct stump stone is a preventable and correctable cause of postocolecystectomy syndrome. Completion cholecystectomy is a proven treatment of choice to relieve symptoms and avoid complications, and, furthermore, it can be carried out laparoscopically.

#### Keywords:

 $cys\bar{t}ic$  duct stump stone, endoscopic retrograde cholangiopancreatography, gall stone, postocolecystectomy syndrome

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# Introduction

Laparoscopic cholecystectomy (LC) is the gold standard management of gallbladder (GB) stone disease. LC is associated with minimal morbidity and rapid improvement for most of the patients [1–3]. There is no doubt that the use of cholecystectomy relieves presurgical symptoms of GB disease in 70–90% of the patients. Persistent symptoms following cholecystectomy in the form of recurrent upper abdominal pain, dyspepsia, jaundice, pancreatitis, and discomfort is termed as postocolecystectomy syndrome (PCS), the incidence of which varies largely in different studies, ranging from 10 to 30% of the patients, and its onset may range from a few days to 20 years after surgery [2–4].

The causes of PCS are often nonbiliary due to peptic ulcer, esophageal reflux, irritable bowel syndrome, liver disease, pancreatic diseases, and coronary artery disease, or are biliary like gall stone in a remnant GB/cystic duct stump, common bile duct stones (CBDS), biliary stricture, and spasm of the sphincter of Oddi. The pathogenesis and the risk of biliary causes of PCS are still not well known [3–5].

The incidence of residual GB stone after cholecystectomy is less than 2.5%. This problem may arise as a result of improper dissection of Calot's triangle especially at the hand of inexperienced surgeons, leaving too long a cystic duct to avoid injury to common bile duct (CBD) or a partial cholecystectomy in a patient with unclear anatomy, Mirizzi syndrome, inflammation at Calot's triangle, low insertion of cystic duct, parallel cystic duct, tissue friability, cirrhotic liver, junior/

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inexperienced surgeons carrying out the surgery [5–8]. In the era of laparoscopy, partial cholecystectomy was advisable in situations (complex acute cholecystitis, cirrhosis with portal hypertension, Mirizzi syndrome) that would make the dissection of the Calot's triangle very difficult and dangerous to decrease the incidence of conversion rate, but this may increase the incidence of cystic duct stump stone/residual GB stone [9–12].

Diagnosis of residual GB stone/cystic duct stump stone is not easy. The evaluation of patients with PCS should include an abdominal ultrasound (US), upper gastrointestinal endoscopy, magnetic resonance cholangiopancreatography (MRCP), endoscopic ultrasound (EUS), and endoscopic retrograde cholangiopancreatography (ERCP) to diagnose the biliary causes [5–8,13,14].

This study was carried out to evaluate patients with a residual GB stone/cystic duct stump stone after cholecystectomy, and to study the outcomes and feasibility of laparoscopic completion cholecystectomy.

# Patients and methods

The present study involved a retrospective analysis of all patients who underwent completion cholecystectomy at Gastrointestinal Surgical Center, Mansoura University, Egypt, between January 2010 and February 2015. The indications for completion cholecystectomy were residual GB stone or cystic duct stump stone. Fourteen patients had undergone initial cholecystectomy outside our center. The Institutional Review Board (IRB) approval was obtained for this study.

Patient data were recorded in a prospectively maintained database for all patients undergoing cholecystectomy in our center since 2000.

Patients with postcholecystectomy symptoms including pain, dyspepsia, jaundice, pancreatitis, and discomfort were investigated by laboratory investigations (liver function, serum amylase), abdominal US, and upper gastrointestinal endoscopy. MRCP was used to determine the cause of PCS. ERCP was carried out for patients with CBDS secondary to residual GB stone or cystic duct stump stone (Figs 1–3).

Patients with residual GB stump or cystic duct stump stone underwent completion cholecystectomy – either open or laparoscopic.

Prophylactic antibiotic was given to all patients preoperatively. Pneumoperitonium was created by

## Figure 1



Magnetic resonance cholangiopancreatography cystic duct parallel to common bile duct.

#### Figure 2



Transcystic cholangiogram cystic duct parallel to common bile duct with multiple stones.

using the open technique method, and then, under vision, the standard ports for LC were inserted. Adhesiolysis was performed by blunt, sharp dissection and by using harmonic scalpel and the GB fossa exposed. The GB remnant or cystic duct stump was identified and dissected carefully. Calot's triangle was dissected cautiously to avoid iatrogenic



Magnetic resonance cholangiopancreatography revealing residual gallbladder after cholecystectomy.

injury to CBD or the right duct. After identification and milking of cystic ducts using gentle pressure at its junction with CBD, intraoperative cholangiogram (IOC) was carried out in most cases to delineate the anatomy, to detect any residual stone, and to detect CBDS, and then clipping of both cystic duct and artery and division were carried out (Figs 2, 4). Dissection of remnant GB from the liver bed by harmonic. Abdominal drain in the Morrison pouch was placed.

# Data collected

Degree of adhesion, conversion rate, intraoperative visceral injury bleeding, total operative time, blood transfusion, length of postoperative stay (days), time to resume oral intake, postoperative morbidities, biliary leakage, internal hemorrhage, pulmonary complications, postoperative pathology, and re-exploration were recorded for each patient.

#### Figure 4



Operative photo revealing residual gallbladder with dissection of Calot's triangle.

Statistical analysis of the data was performed using the SPSS software, version 20 (SPSS Inc., Chicago, Illinois, USA). Descriptive data were expressed as mean (SD). Categorical variables were expressed as percentages.

# **Results**

In the period between January 2010 and February 2015, at Gastrointestinal Surgical Center, Mansoura University, Egypt, we performed 5820 LC; 155 of them were open cholecystectomy. Twenty-one patients were treated in our center as having residual GB stone/cystic duct stump stone by using completion cholecystectomy during this period. The mean age was 50±15.43 years (26–78 years). Sixteen patients were women and five were men. Eleven patients (52.4%) had undergone initial open cholecystectomy (Table 1).

Clinical presentation is summarized in Table 2. The time interval between initial cholecystectomy and diagnosis of retained residual GB stone/cystic duct stone ranged from 2 to 100 months (the mean was 66.5 months). Initial partial cholecystectomy was performed due to acute cholecystitis in nine cases (42.9%), Mirizzi GB in four cases (19.05%), cirrhotic patients in five cases (23.8%), parallel low insertion cystic duct in two cases (9.5%), and one case was operated upon by an inexperienced surgeon (4.8%).

The diagnoses of all cases with residual GB stone/cystic duct stump stone were carried out by using abdominal US and MRCP. MRCP was accurate in detecting cystic duct stump stone in all cases and US was accurate in 15 cases (71.4%). ERCP and papillotomy were carried out before completion of cholecystectomy

Table 1	Primary	procedures
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Variable	n (%)
Laparoscopic cholecystectomy	10 (47.6)
Open cholecystectomy	11 (52.4)

#### Table 2 Demographic data

Variable	
Age (mean) (years)	50±15.43 (26-78)
Sex [n (%)]	
Male	5 (23.8)
Female	16 (76.2)
BMI	22.5±6.1 (19–33)
Clinical presentation [n (%)]	
Recurrent biliary colic	20 (95.2)
Fever	5 (23.8)
Jaundice	9 (42.9)
Pancreatitis	1 (4.8)
Cholangitis	4 (19)
Interval of cholecystectomy	66.47±33.47 (2-100)
Serum bilirubin (mg%)	1.7±1.9 (0.4–7.9)
Serum SGPT (IU)	84.23±116.1 (20-470)
WBCs count	6.34±1.86 (3.9-9.8)
Serum amylase	100.8±87.67 (36-423)
CBD diameter by US (mm)	9.8±2.7 (4-14)
Residual gallbladder stone [n (%)]	
Single	4 (19)
Multiple	17 (81)
Preoperative ERCP [n (%)]	9 (42.9)

CBD, common bile duct; ERCP, endoscopic retrograde cholangiopancreatography; SGPT, serum glutamate-pyruvate transaminase; US, ultrasound; WBC, white blood cell.

in nine cases (42.9%) and CBD was cleared in all cases. Cystic duct cannulation was difficult to do and trial stone extraction from cystic duct stump failed in all cases by ERCP.

Open completion cholecystectomy was performed in nine cases (42.9%) and laparoscopic completion cholecystectomy was completed successfully in 11 cases (52.4%), and conversion was needed in one case due to marked adhesion and distorted anatomy. There was marked adhesion in the majority of the cases between colon, duodenum abdominal wall, and liver. Blood loss was less than 500 ml and none of the patients required blood transfusion. The mean operative time was 127 min (60–180 min). Lateral right hepatic duct biliary injury occurred in one case; it was about 3 mm in size and was managed intraoperatively by primary closure by proline 5/0 without T tube. Duodenal injury occurred in one case about 4 mm in size and was treated with vicryl 3/0 Table 3.

The mean hospital stay was 3.2 days (1–9 days). Abdominal collection developed in three cases and

Table 3	Operative	data
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Variable	n (%)
Grade of adhesions	
1	0
2	1 (4.8)
3	8 (38.1)
4	11 (52.4)
Laparoscopic cholecystectomy	14/21 (66.7)
Open cholecystectomy	7 (33.3)
Conversion rate	1/14 (7.1)
Intraoperative cholangiogram	15 (71.4)
Length of cystic duct remnant (cm)	6.3±3.5 (3–10)
Presence of GB remnant stone	8 (38.1)
Presence of cystic duct stone only	13 (61.9)
CBD injury	1 (4.8)
Duodenal injury	1 (4.8)
Blood loss (ml)	165±74.5 (100–300)
Operative time (min)	127±31.32 (60–180)

CBD, common bile duct; GB, gallbladder.

## Table 4 Postoperative data

Variable	
Serum bilirubin POD1	1.4±0.59 (0.5–2.5)
WBC POD1	12.7±2.4 (8–17)
SGPT POD1	38.1±30.4 (20-60)
Serum bilirubin POD7	0.79±0.27 (0.5–1.5)
WBC POD7	6.05±1.08 (4.8-8.1)
SGPT POD7	27.2±27.03 (20-55)
Bile leakage	0
Abdominal collection (cm) [n (%)]	3 (14.3)
<5	2 (9.5)
>5	1 (4.8)
Drain amount (ml)	104.23±123.94 (10-440)
Drain removal	3±1.41 (1-6)
Hospital stay (days)	3.2±1.8 (1–9)

POD, postoperative day; SGPT, serum glutamate-pyruvate transaminase; WBC, white blood cell.

was managed conservatively by antibiotic and followup US (Table 4). All patients were asymptomatic at 3 months' follow-up.

# Discussion

Persistent symptoms following cholecystectomy raises nonbiliary causes being the source of preoperative original pain [2–5]. The majority of these cases are diagnosed as PCS [5–8]. The etiology of PCS are often nonbiliary, such as peptic ulcer, gastroesophageal reflux disease, irritable bowel syndrome, pancreatic diseases, hepatitis, cirrhosis, and cardiac problem. However, in some patients the cause may be biliary like CBDS, bile duct stricture and/or injury, spasm of the sphincter of Oddi, or residual GB/cystic duct stump stone. PCS has been reported in 10–40% of patients after cholecystectomy [5–9,13,14]. Patients with biliary colic and obstructive jaundice must be investigated for residual GB or cystic duct stump stone. The causes of residual stump may be fear of bile duct injury (BDI) (intentional) in cases with difficult Calot's triangle-like severe inflammation, long low inserted CBD, Mirizzi syndrome, increased fat, cirrhosis, or mistaken (unintentional) waist between Hartman's pouch and the body of GB especially by an inexperienced surgeons [5–9]. The time interval between initial cholecystectomy and biliary symptoms relapse varies from a few days to 20 years [15–18].

Laparoscopic partial cholecystectomy has been indicated in certain situations especially in cirrhotic patients and in emergency acute cholecystitis as an alternative to conversion to open cholecystectomy. This allows the removal of difficult GB without the dissection of Calot's triangle, thus decreasing the incidence of BDI [9-12]. The incidence of residual GB in this situation ranges between 0 and 16% [5-7,15]. Palanivelu et al. [16] reported that the incidence of cystic duct stump stone in cases who underwent laparoscopic subtotal cholecystectomy was 4.19%, and 0.02% in patients who underwent conventional cholecystectomy. Rozsos et al. [17] found that the cause of PCS was cystic duct stump stone in 16% of the patients. In the era of laparoscopy, long cystic duct stump is increased, especially by inexperienced surgeons fearing BDI [6-10].

Partial cholecystectomy has received some criticism because of the risk for residual GB stone but the data on incidence of this complication are still unknown. In a study by Chowbey et al. [18], 59 patients who underwent partial cholecystectomy were reported to have developed recurrent or residual stones. Beldi and Glättli [19] reported residual GB stones in six out of 46 patients who underwent partial cholecystectomy. In era of laparoscopy, laparoscopic partial cholecystectomy to mange difficult GB (acute cholecystitis, Mirazzi GB, cirrhotics) to reduce the incidence of conversion rate to open surgery will increase the number of cases of residual stones in GB remnant. The time interval between partial excision of GB and development of PCS symptoms varies largely from a few days to years [9-12,16,20,21].

Diagnosis of residual GB stone/cystic duct stone is not easy but recent progress in radiology has improved the accuracy in diagnosing the etiology of PCS. US, computed tomography, MRCP, EUS, an ERCP are all effective in diagnosing residual GB or cystic duct stump stone. EUS could be valuable to detect small GB remnant with stone [5–8,13,14]. It is difficult to differentiate dilated cystic duct stump from true GB remnant even on histopathological bases. Any length of cystic duct more than or equal to 1 cm is considered as a cystic duct remnant [9,10,14]. In our study, MRCP was accurate in detecting cystic duct stump stones in all cases and US was accurate in the diagnosis of 15 cases (71.4%). Palanivelu *et al.* [16] showed that MRCP was accurate in 92% of the cases and US was accurate in 60% of the cases. Parmar *et al.* [8] found that MRCP accuracy in deselecting cystic duct stump stone was 94% and US accuracy was 64%. MRCP provides a good anatomical and pathological image for biliary tree in these cases as it is noninvasive and safe.

Once patients were diagnosed with residual GB stone/ cystic duct stump stone, completion cholecystectomy of residual GB stone or of cystic duct stump stone must be carried out to relieve symptoms and to avoid complications (recurrent obstructive jaundice, cholangitis, pancreatitis, mucocele, carcinoma) [5–9,15,19–23].

Stones in the cystic duct stump are usually difficult to extract by means of ERCP, which depends on anatomical factors, diameter of the cystic duct, position of the stone in the duct, degree of impaction of stones, the number of valves, size of the stone, and the angle between the cystic duct and CBD [5,8,15]. Preoperative ERCP is valuable in the extraction of CBDS secondary to cystic duct stone. ERCP is a valuable tool in the hands of surgeons for preoperative, intraoperative, and postoperative management of biliary obstruction [24]. In the present study, nine cases (42.9%) were subjected to a preoperative ERCP, and CBD was cleared in all cases. Carrying out cystic duct cannulation was difficult, and, also, trial stone extraction from the cystic duct stump failed in all cases.

After partial cholecystectomy, the cystic duct stump and Calot's triangle are usually embedded in inflamed dense adhesion [8,17]; it was thought that there was a high risk in these cases when re-operated laparoscopically. With advancement in laparoscopic instruments and sealing devices, although laparoscopic completion cholecystectomy is difficult and risky, it is not impossible. Now, it has been found that LC is safe and feasible in excising residual GB/cystic duct stump.

At first, open completion cholecystectomy was considered as the procedure of choice in our center due to marked visceral adhesion and embedded cystic duct to avoid visceral injury (duodenum and colon) and BDI. The first laparoscopic completion cholecystectomy was performed by Gurel *et al.* [22], followed by many other surgeons. Tantia et al. [21] performed laparoscopic completion cholecystectomy for seven cases. Chowbey et al. [6] studied 26 cases with remnant GB stone/cystic duct stump stone. Laparoscopic completion cholecystectomy was successful in all cases. The mean operative time was 62 min and the mean blood loss was 50 ml. Postoperative biliary leak occurred in two patients for 9 and 11 days, respectively. The mean hospital stay was 2.6 days (2-12 days). All patients became symptoms free on the follow-up after surgery. Clemente et al. [20] concluded the feasibility of laparoscopic removal of residual GB/cystic duct stump stone. In their study, Parmar et al. [8] described the feasibility of laparoscopic completion cholecystectomy in 40 cases managed initially by using open cholecystectomy. The mean operative time was 102.4 min, and the hospital stay was 2-4 days. The conversion rate was two cases (9.5%) due to dense adhesion. BDI occurred in one case only.

Residual GB remnant or cystic duct stump stone is a preventable condition and every effort must be made to minimize its incidence by proper traction; meticulous dissection of the cystic duct up to CBD; defining the stone junction; palpating the cystic duct by using a dissector; trial genital milking of the cystic duct toward the GB before clipping especially in patients with a history of calcular obstructive jaundice and pancreatitis; and by carrying out an IOC. In cases with long parallel low insertion, the cystic duct exploration and stone removal were carried out using stone forceps, balloon, and dormia basket till free flow of normal bile was observed. The cystic duct stump should not be more than 5 mm long[5–8,21–23].

# Conclusion

Residual GB/cystic duct stump stone should always suspected in patients complaining of PCS. Partial cholecystectomy is advisable in certain situations for safety, but that may increase the incidence of cystic duct stump stone/residual GB stone. Residual GB remnant or cystic duct stump stone is a preventable condition and every effort must be made to minimize its incidence. Diagnosis of residual GB stone/cystic duct stone is not easy but recent progress in radiology has improved the accuracy in its diagnosing. Completion cholecystectomy of residual GB stone or cystic duct stump stone must be performed to relieve symptoms and to avoid complications. Laparoscopic completion cholecystectomy is safe and feasible; however, it requires an expert laparoscopic surgeon and a wellequipped hospital (IOC, harmonic, ERCP, balloon and basket).

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# **Conflicts of interest**

There are no conflicts of interest.

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