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**Current management of concomitant cholelithiasis and common bile duct stones**

Concomitant cholelithiasis and choledocholithiasis

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## **Abstract**

The management policy is based on a one- or two-stage procedure. It basically includes either laparoscopic cholecystectomy (LC) with laparoscopic CBD exploration (LCBDE) in the same operation or LC with preoperative, postoperative, and even intraoperative endoscopic retrograde cholangiopancreatography-endoscopic sphincterotomy (ERCP-ES) for stone clearance. The most frequently used worldwide option is preoperative ERCP-ES and stone removal followed by laparoscopic cholecystectomy, preferably on the next day. In cases where preoperative ERCP-ES is not feasible, the proposed alternative of intraoperative rendezvous ERCP-ES simultaneously with LC has been advocated. The intraoperative extraction of CBD stones is superior to postoperative rendezvous ERCP-ES. However, there is no consensus on the superiority of laparoendoscopic rendezvous (LERV). This is equivalent to a traditional two-stage procedure. Endoscopic papillary large balloon dilation reduces recurrence. Laparoscopic CBDE and intraoperative ERCP have similar good outcomes. The risk of recurrence after ERCP-ES is greater than that after LCBDE. Laparoscopic ultrasonography may delineate the anatomy and detect CBD stones. The majority of surgeons prefer the transductal instead of the transcystic approach for CBDE with or without T-tube drainage, but the transcystic approach must be used where possible. LCBDE is a safe and effective choice when performed by an experienced surgeon. However, the requirement of specific equipment and advanced training are drawbacks. The percutaneous approach is an alternative when ERCP fails. Surgical or endoscopic reintervention for retained stones may be needed. For asymptomatic CBD stones, ERCP clearance is the first-choice method. Both one-stage and two-stage management are acceptable, and can ensure improved quality of life.

**Key Words:** Biliary diseases; Cholelithiasis; Choledocholithiasis; Gallstones; Endoscopic management; Laparoscopic management

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**Core Tip:** One- or two-stage management of concurrent cholelithiasis and choledocholithiasis is safe and acceptable and does not show significant differences. Current diagnostic tools and interventional techniques can offer the optimal outcome, especially in difficult cases or recurrent stones. The relevant training and gained expertise play an essential role in performing the kind of available and acceptable method of minimally invasive treatment.

## INTRODUCTION

Cholelithiasis is a common disease affecting up to 20% of the adult population in Western countries but is usually asymptomatic. Common bile duct (CBD) stones are secondary in the vast majority of cases coexisting with cholelithiasis (10-15%) originating from the gallbladder through the cystic duct. Its incidence increases with advancing age. Primary or native stones are relatively rare [1-5].

One-stage or two-stage management continues to be controversial, but both provide equivalent outcomes [4,6].

Patients with symptomatic cholelithiasis have a 10% possibility of concomitant CBD stones without causing symptoms. A study from the USA found that laparoscopic cholecystectomy accompanied by routine intraoperative cholangiography, in cases of symptomatic cholelithiasis with asymptomatic choledocholithiasis, was better than preoperative MRCP (magnetic resonance cholangiopancreatography) in terms of effectiveness and cost analysis [7]. However, the latter is the preferred method in clinical practice in symptomatic cases with transient obstructive jaundice or elevated liver function tests and previous episodes of acute pancreatitis [8]. A debate still exists about the routine or selective use of intraoperative cholangiography [9], but the latter seems more reasonable in the era of MRCP availability based on well-defined indications [10]. A recent study from the USA has demonstrated advantages of intraoperative

cholangiography compared to preoperative ERCP [11]. A recent meta-analysis showed that prophylactic cholecystectomy after ERCP-ES CBD stone clearance has been proven better than the wait-and-see policy. It was associated with fewer complications (acute cholecystitis, acute cholangitis, acute pancreatitis and biliary colic) [12]. However, it should be considered particularly in extremely elderly patients with limited life expectancy or unfit frail patients. A recent controversy has emerged about the role of routine prophylactic cholecystectomy after ERCP, postulating that it must be re-evaluated given the low risk of the above complications [13].

A previous nationwide study from the USA found a conversion rate from laparoscopic to open cholecystectomy of between 5-10%; major conversion factors were recognized as acute cholecystitis, choledocholithiasis, male sex and obesity [14]. However, since then, much progress has been made in the laparoscopic management of choledocholithiasis.

The most widely used approach for concomitant gallbladder and CBD stones is ERCP-ES then laparoscopic cholecystectomy, followed by simultaneous laparoscopic cholecystectomy and CBD exploration, and intraoperative ERCP-ES and LC [6,15-17]. A recent survey among surgeons from the UK showed that for suspected choledocholithiasis, MRCP was the preferred first choice by the vast majority (80%) and intraoperative imaging was preferred by the remaining minority (14.4%). Intraoperative cholangiography (83%) prevailed over intraoperative ultrasound (17%). ERCP-ES followed by LC (two-stage procedure, 62.1%) prevailed over LC and LCBDE (one-stage procedure, 33.4%). For LCBDE, the preferred route was through the CBD (62.5%) using T-tube drainage selectively. The requirement of specific equipment and advanced training are drawbacks for LCBDE [8].

Laparoscopic CBDE and intraoperative ERCP have similar good outcomes [18].

A previous similar scoring system was proposed [19], but the guidelines of <sup>2</sup>ASGE (American Society for Gastrointestinal Endoscopy) and SAGES (Society of American Gastrointestinal and Endoscopic Surgeons) for the management of suspected choledocholithiasis have defined several graded predictors. They include the following:

**1**  
a. very strong (CBD stone on ultrasound, bilirubin >4 mg/dL), b. strong (CBD > 6 mm, bilirubin 1.8-4 mg/dL), and c. moderate (abnormal liver function tests other than bilirubin, age >55 years, previous acute biliary pancreatitis) [20]. For suspected choledocholithiasis in acute cholecystitis, a model consisting of three preoperative predictive factors (increased SGPT or ALT more than threefold, elevated alkaline phosphatase and CBD diameter more than 6 mm) was defined. When 0-1 factors exist, the possibility of CBD stone absence will be 98.6%, but when all three factors exist, the risk of CBD stones will be 77.8% [21].

The recurrence after successful CBD stone clearance reaches up to 8.4% within a median time of 2.5 years, and it is more often found after ERCP-ES than after LCBDE [18,22]. This is particularly related to some morphological subtypes (S and polyline type) of CBD [23], and regular follow-up is necessary in cases with risk factors [24].

In this MiniReview, we evaluated the current management options of concomitant gallbladder and CBD stones, highlighting the updated knowledge by selection and focusing on the most relevant articles from PubMed.

## **Management**

### **One-stage procedure**

#### *Rendezvous technique*

This technique is a well-established method for the management of CBD stones that combines ERCP-ES stone clearance and laparoscopic cholecystectomy in the same operation with the patient under general anesthesia [1,6,25]. It is feasible, safe and effective not only in elective but also in emergency cases, as shown in a recent study including 61 cases and 120 cases, respectively [26]. In addition, the method has applications in pediatric patients with excellent results [27].

A recent comparative study found that this intraoperative application of ERCP-ES was superior to its postoperative application regarding, on the one hand, the better success rate and, on the other hand, the decrease in postoperative acute pancreatitis, hospitalization and financial cost [28].

The Swedish National Registry for Gallstone Disease and ERCP included 1770 cases of rendezvous ERCP-ES, either intraoperative ( $n = 1205$ ) or postoperative ( $n = 565$ ). Comparison between the two groups found a higher rate of retained stones (5.5% vs. 0.6%) and overall complications in the postoperative group (19.7% vs. 14%). The main complications included <sup>3</sup> post-ERCP acute pancreatitis (6.4% vs. 3.2%) and postoperative infections (4.4% vs. 2.3%). All these differences were statistically significant ( $p < 0.005$ ) [29]. Therefore, the postoperative rendezvous ERCP-ES has been limited enough but is still an acceptable alternative method when relevant equipment is unavailable [25].

A recent systematic review and meta-analysis including 1,061 patients (542 with intraoperative rendezvous and 519 with two-stage preoperative ERCP and subsequent LC) found that no differences existed regarding stone clearance and postoperative bleeding, cholangitis or bile leak and conversion rate. However, the intraoperative rendezvous group had a longer operative time but less postoperative pancreatitis, morbidity and hospitalization [30]. A recent retrospective study from Italy demonstrated that laparoscopic rendezvous shortened the endoscopic time and may be a reasonable alternative to intraoperative ERCP [31].

Balloon sphincteroplasty by a transcystic wire balloon catheter to dilate the sphincter of Oddi and saline flushing may facilitate stone passage in 75% of cases [32]. Intervention *vs* surveillance to clear CBD stones during LC is better and has been recommended [33].

#### *LC and LCBDE*

This approach has all the benefits of a minimally invasive operation and ensures the resolution of concomitant gallbladder and CBD stones in a single session, as does traditional open CBD exploration [34], thus avoiding any complications of preoperative ERCP-ES (pancreatitis, cholangitis, bleeding, duodenal perforation) [35,36]. However, it requires specific equipment and advanced training that encourage the vast majority of surgeons to prefer the two-stage procedure by preoperative ERCP-ES [5]. Subsequently, the one-stage LC and LCBDE is a safe and cost-effective choice but only where expertise and equipment are available [37].



Severe ischemic heart disease, ASA III or IV score (American Society of Anesthesiologists) is not contraindication for LC and LCBDE. However, its safe performance requires both surgical and anesthesiological experience, continuous intraoperative monitoring and low-pressure pneumoperitoneum of 10-12 mmHg. After the latter's abolition, the patient's condition will be better because of the minimal invasiveness application [38].

A recent study from the UK including 311 cases of LCBDE, the most emergency procedure (66%), showed laparoscopic ultrasound as the main diagnostic tool (73%), completion rate 94%, route through choledochotomy (56%) or transcystic (44%), bile leak 4.2%, retained stones upon 3 mo 3.9% and mortality 0.66% [39]. Laparoscopic ultrasound instead of intraoperative cholangiography is a reasonable alternative performed during laparoscopic cholecystectomy because it may delineate the anatomy and detect CBD stones [40].

Another recent retrospective multicenter study including 3,950 cases of LCBDE showed a prevalence of the transcystic approach (63.11%), failure 4% and morbidity 13.6%. However, most importantly, a survey defined a high rate (82.4%) of poor or very poor current training [41].

For primary CBD stones without cholelithiasis, LCBDE preserving the gallbladder has been recently reported [42].

A recent study from Scotland including 1,318 LC and LCBDE among 5,739 total LC performed (23%) showed a rate of intraoperative cholangiography 98%, transcystic approach 66%, conversion 2.1%, retained stones 2.1%, morbidity 18.7% and mortality 0.2% [37].

A recent systematic review and meta-analysis found that LC and LCBDE, after previous ERCP-ES failed CBD clearance, had acceptable results and constituted a reliable alternative choice after endoscopic failure [43].

A recent retrospective study from the UK found that the transcystic or transductal approach for LCBDE had similar results regarding stone clearance, conversion to open



surgery and mortality, but morbidity and complications were higher in the transductal route [44].

For LCBDE, an impacted stone may have more difficult extraction, and multiple CBD stones are associated with a higher complication risk [45].

Primary closure of the CBD without T-tube placement after LCBDE has been proposed as a safe and feasible choice even in patients equal to or more than 70 years old [46] and in cases of acute cholangitis [47].

In patients over 75 years old, one-stage LC and CBDE were found to be better than two-stage ERCP-ES and LC. However, for multiple stones, a choledocho-duodenal anastomosis may be an acceptable choice [48].

Choledochoscopic CBD exploration at the time of LC *vs* ERCP has been proposed with a stone clearance success rate of 84% and a risk of recurrence of 2% [49].

### **Two-stage procedure**

ERCP-ES and subsequent LC, the most preferred method worldwide [4,17,50], is a safe management process even in patients with cardiovascular disease [51].

A randomized controlled study showed that routine nasobiliary tubes after endoscopic CBD stone clearance can facilitate subsequent LC by the ability of the IOC and ensure the anatomical integrity of the CBD [52].

In the USA, 10-15% of ERCP CBD stone-clearance cases are difficult or complex [53]. In difficult CBD stones, step-by-step management is indicated. ES and large balloon dilation is the initial approach. Mechanical lithotripsy or preferably cholangioscopy-assisted lithotripsy are alternative options, but the latter may be used soon as the initial step [54,55]. Additionally, fully covered metal stents are safe and may be useful when they remain for more than one month, especially in mails and stone sizes less than 2 cm [56].

A national survey from South Korea on the management of difficult CBD stones (above 15-20 mm in size) showed the following findings: a. in the vast majority (74.4%), a large balloon dilation after ES was the followed method or alone in cases of bleeding predisposition; b. double wire use in periampullary diverticulum and cannulation

difficulty; and c. PTCS (percutaneous transhepatic cholangioscopy) or cap-fitted endoscopy in cases of previous gastrectomy [57].

A recent large study from China found differences between two expertise centers in choledocholithiasis characteristics and ERCP stone clearance with emphasis on the presence of periampullary diverticulum. After ERCP, the complications and residual stones did not differ between patients with or without a periampullary diverticulum, but the diameter of the CBD was wider in those with it than those without it [58].

A recent randomized controlled trial from China showed that CBD stone recurrence and rerecurrence after ERCP were reduced efficiently by endoscopic papillary large balloon dilation at a median follow-up of 56 mo [59].

A recent study determined predictive factors of ERCP-ES failure for stone clearance by multivariate analysis. They include previous biliary exploration, advanced age, intrahepatic stones, elevated serum total bilirubin, stones in the cystic duct or Mirizzi syndrome, CBD dilatation and the need for suprapapillary opening [60]. After ERCP-ES failure, LCBDE is feasible and safe [61].

In selected cases of cholelithiasis and choledocholithiasis, EUS-GBD (endoscopic ultrasound-guided gallbladder drainage) combined with ERCP-ES is a reasonable modern approach that can manage the disease by endoscopic means [62].

When ERCP-ES is not possible for various reasons, a reliable alternative will be the percutaneous management of CBD stones that is feasible and safe [3].

Reinterventions in stone recurrence, mainly ERCP or surgical (laparoscopic or open), may be needed [63].

For asymptomatic CBD stones, ERCP-ES is the first choice of recommended management despite the higher complication rate, especially of acute pancreatitis, than that of symptomatic cases. However, it is not yet clear by evidence-based data that this approach is justifiable [50]. The opposite point of view postulates by assessing the natural history that while early endoscopic removal of silent stones does not absolutely prevent further biliary complications, it has the risk of post-ERCP severe pancreatitis

(5.2%). Therefore, wait-and-see management has been considered as the best choice for asymptomatic CBD stones [64].

In patients with acute cholecystitis and CBD stones, early management either by preoperative ERCP-ES followed by LC or LC and LCBDE is acceptable for both, with similar results [65].

In cases of severe acute biliary pancreatitis, CBD stenting by preventing stone passage reduces the risk of recurrence from the recommended delayed cholecystectomy [66].

The assessment of quality of life showed similar satisfaction by improvement between preoperative ERCP-ES followed by LC or LC and LCBDE [67].

The experience of general surgery residents on CBD exploration has been decreased very much by the application of ERCP-ES. This training deficiency should be managed effectively [68].

## **CONCLUSION**

Much progress has been made in the current management of concomitant gallbladder and common bile duct stones in recent years. Preoperative ERCP-ES followed by laparoscopic cholecystectomy is the most commonly used method in clinical practice. Laparoscopic CBD exploration is a safe and effective choice when it is performed by an experienced surgeon and the required equipment with all facilities is available. The rendezvous technique ensures a single intervention combining ERCP-ES and laparoscopic cholecystectomy. Both one-stage and two-stage management have equivalent results. In difficult or recurrent cases, advanced endoscopic, radiologic, and minimally invasive techniques are in use but require expertise. The surgeon must choose the most appropriate intervention for accurate diagnosis and the best management based on his or her own experience, the preoperative assessment and intraoperative findings.

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