

# Management of cholecysto-choledocholithiasis by laparoendoscopic rendezvous: A single-center series of 80 patients

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**Abstract.** Laparoendoscopic rendezvous (LERV) is a single-stage technique increasingly used for the treatment of cholecysto-choledocholithiasis, aiming to reduce morbidity compared to conventional two-stage approaches. The present study aimed to assess the safety, efficacy and specific clinical characteristics of LERV. For this purpose, 80 patients undergoing LERV between May, 2018 and February, 2025 were retrospectively analyzed. The technique included laparoscopic cystic duct cannulation, antegrade guidewire passage, endoscopic sphincterotomy and laparoscopic cholecystectomy. Primary outcomes were common bile duct clearance, morbidity and mortality. The LERV procedure was successfully implemented in 79 of 80 patients (98.7%), with no open conversions. The initial success rate was achieved in 97.5%. The median operative time was 115 min, and the median hospital stay was 3 days. Post-operative complications occurred in 8.8% of patients, predominantly mild; no mortality was recorded. Post-procedural pancreatitis occurred in 6.3% of patients. LERV was effective in complex cases, including pediatric patients (6.3%), post-bariatric surgery (7.5%) and periampullary diverticulum (3.8%). In the whole, the present study demonstrates that LERV is a safe and effective single-stage approach for the management of cholecysto-choledocholithiasis, with particular advantages in anatomically or technically

challenging cases. Its application, despite requiring coordinated multidisciplinary expertise, is increasingly supported by growing evidence.

## Introduction

Cholelithiasis remains a highly prevalent condition, accounting for ~1 million hospitalizations and >700,000 surgical procedures annually in the USA (1,2). Choledocholithiasis, characterized by the presence of gallstones within the common bile duct (CBD), is observed in 10 to 18% of patients with cholelithiasis, with almost one-quarter of these individuals experiencing disease-related complications including acute cholangitis, biliary pancreatitis, obstructive jaundice (2,3). The reported prevalence of choledocholithiasis varies considerably depending on geographic region and study methodology, ranging from 4% to ~12% in European populations (4), 1 to 20.9% in South American cohorts (5) and 1 to 15% among patients with gallstones in the USA (6). Although choledocholithiasis is not inherently life-threatening, it significantly diminishes the quality of life of patients, typically manifesting with pain and biliary obstruction. Moreover, if left untreated, it may lead to severe complications, such as acute cholangitis, resulting from bacterial biofilm formation and potentially progressing to life-threatening sepsis, as well as gallstone pancreatitis secondary to distal CBD obstruction at the level of the pancreaticobiliary junction (7).

The primary approach for the management of choledocholithiasis involves the surgical or endoscopic extraction of stones from the common bile duct. The conventional strategy typically comprises two distinct procedures: Endoscopic retrograde cholangiography (ERC) with sphincterotomy for stone removal from the common bile duct (first stage), followed by laparoscopic cholecystectomy (LC) for the treatment of cholelithiasis as a second stage (8,9). It has been proposed that laparoscopic cholecystectomy should be performed promptly after the first stage; however, the optimal timing between these interventions remains a subject of discussion (6,10,11).

Although this two-stage strategy consisting of endoscopic stone extraction (ERC with sphincterotomy) followed by laparoscopic cholecystectomy remains the most widely employed approach for the management of cholecysto-choledocholithiasis, it is associated with substantial complications, the

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*Abbreviations:* LERV, laparoendoscopic rendezvous; LC, laparoscopic cholecystectomy; ERC, endoscopic retrograde cholangiography; ERCP, endoscopic retrograde cholangiopancreatography; PEP, post-ERCP pancreatitis; CBD, common bile duct; MRCP, magnetic resonance cholangiopancreatography; PAD, periampullary diverticulum

*Key words:* cholecysto-choledocholithiasis, laparoendoscopic rendezvous, laparoscopic cholecystectomy, ERCP

majority of which are related to the endoscopic intervention. The most common of these is post-endoscopic retrograde cholangiopancreatography (ERCP) pancreatitis (PEP) (12), which is associated with prolonged hospitalization and increased healthcare costs. Reported rates of PEP vary between 2 and 15%, with severe pancreatitis occurring in 0.3 to 0.8% of cases and a mortality rate of ~0.2% (12,13). Identified risk factors for PEP include operator-, patient- and procedure-related elements, such as the experience of the endoscopist, a history of recurrent or prior ERCP-induced pancreatitis, difficult biliary cannulation, inadvertent pancreatic duct cannulation or contrast injection and pancreatic sphincterotomy (14). The primary pathophysiological mechanisms implicated in PEP are mechanical and hydrostatic injuries. Moreover, individual patient characteristics, multiple cannulation attempts and procedure-specific factors further increase the risk; thus, comprehensive risk assessment is essential for minimizing the occurrence of this complication (15). Following the endoscopic clearance of CBD stones, LC should be performed following appropriate patient recovery (16). However, as these represent two separate procedures with distinct timelines, they result in two hospitalizations with prolonged rehabilitation and increased stress for the patient, as well as an increased financial burden, typically borne by the patient (16).

The laparo-endoscopic rendezvous (LERV) technique is a single-stage approach that combines LC with intraoperative endoscopic stone extraction, providing the potential to reduce complication rates, shorten periods of hospitalization and decrease overall healthcare costs. First introduced toward the end of the 20th century (17), LERV has been proposed as a favorable alternative to the conventional two-stage strategy of preoperative endoscopic intervention followed by LC. Several advantages have been attributed to LERV, including a reduced overall morbidity and shorter periods of hospitalization (18). Additional benefits include diminished patient stress, decreased surgical expenses (11,19), the convenience of a single hospital admission and a single anesthesia exposure. Moreover, compared with the traditional endoscopic-first approach, LERV may reduce the risk of inadvertent contrast injection into the pancreatic duct, thereby lowering the incidence of post-ERCP pancreatitis (20). Nevertheless, limitations of the LERV technique include prolonged operative times and the requirement for specialized expertise and close coordination between the laparoscopic surgeon and the endoscopist (18,20).

The present study aimed to assess the safety and efficacy of the single-stage LERV technique in the management of cholecysto-choledocholithiasis. The findings are discussed in light of outcomes reported in large-scale studies.

## Patients and methods

*Study design and patient selection.* A retrospective review of medical records was conducted from patients who underwent the LERV procedure at Innova Medical Center, Tbilisi, Georgia, between May, 2018 and February, 2025. This technique has been established as standard clinical practice since 2018, and all patients diagnosed with cholecysto-choledocholithiasis have been managed using the LERV approach. Data extraction and collection from medical records were conducted between March 10 and April 26, 2025. The study

included 80 consecutive patients who underwent either elective or urgent LERV based on clinical indications and individualized treatment decisions. The study cohort comprised 28 male and 52 female patients, with ages ranging from 12 to 87 years (median age, 51.5 years). Patient hospitalization, diagnosis and all procedures were carried out at Innova Medical Center. The diagnosis of cholecysto-choledocholithiasis was established based on clinical presentation and imaging findings, including abdominal ultrasound, computed tomography, magnetic resonance cholangiopancreatography (MRCP), or intraoperative trans-cystic cholangiography (the latter was used in 3 cases with moderate predictors of common bile duct stones that were not visualized on preoperative ultrasound and where MRCP could not be performed). All procedures were performed by the surgical team, led by L.K., a surgeon with 16 years of laparoscopic surgical experience and 14 years of endoscopic practice, and O.K., with 43 years of surgical experience and 40 years of endoscopic practice. The study was approved by the Ethics Committee of the Innova Medical Center (Approval no. 239, issued on March 3, 2025).

*Surgical technique.* Standard laparoscopic techniques were used to dissect and mobilize the cystic duct. A small incision was made in the cystic duct to facilitate catheter insertion for intraoperative cholangiography. A standard endoscopic guidewire was advanced through the catheter into the duodenum, visualized endoscopically and retrieved through the working channel of the duodenoscope. Under guidewire assistance, direct biliary cannulation and sphincterotomy were performed. The CBD stone(s) were extracted using a Dormia basket and/or stone extraction balloon. Following duct clearance, the endoscope was withdrawn and laparoscopic cholecystectomy was completed.

*Study endpoints.* The primary endpoint of the present study was the efficacy of the LERV procedure in achieving complete CBD stone clearance. Secondary endpoints included morbidity, mortality, operative time and the duration of hospitalization. Complications were categorized as intraoperative, early post-operative (within 30 days), or late post-operative (beyond 30 days). The mean follow-up duration was 32.8 months. The severity of complications was classified according to the Dindo-Clavien classification system for surgical complications (21).

*Statistical analysis.* Statistical analyses and graphical presentations were performed using GraphPad Prism 5 (Dotmatics). Data distribution was assessed using the Shapiro-Wilk normality test. Continuous variables are presented as median and interquartile range (IQR) apart from the event when only the range is available. Differences between groups were analyzed using the non-parametric Mann-Whitney U test. A value of  $P < 0.05$  was considered to indicate a statistically significant difference.

## Results

*Patients and outcomes.* A total of 80 patients diagnosed with cholecysto-choledocholithiasis underwent treatment during the study period. The demographic and clinical characteristics of the study population are summarized in Table I. The LERV

Table I. Patient demographics and outcomes.

Metric	Value
Male patients	28 (35%)
Female patients	52 (65%)
Age, years; median (range)	51.5 (12-87)
Elective surgery	44 (55.0%)
Urgent surgery	36 (45.0%)
Operation time, min; median (range)	115 (55-310)
Duration of hospitalization, days; median (range)	3 (1-24)
History of pancreatitis (prior to LERV)	10 (12.5%)
Complications following LERV	7 (8.8%)
Successful cannulation	79 (98.7%)
Successful clearance of CBD stones	77 (97.5%)
CBD exploration/choledochotomy or conversion to open surgery	0

LERV, laparoendoscopic rendezvous; CBD, common bile duct.

procedure was successfully performed in 79 patients (98.7%) with no conversions to open surgery (0%). The initial success rate was achieved in 97.5% (77 patients out of 79 successful LERV). The mean follow-up was 32.8 months.

Of the patients, 44 (55%) patients underwent elective procedures, and 36 (45%) patients underwent urgent interventions. Successful laparoscopic antegrade trans-cystic cannulation of the CBD with a cholangiography catheter was achieved in 79 patients (98.7%). In 1 case (1.3%), catheterization was not feasible due to complete cystic duct obstruction caused by severe inflammation. In this instance, a standard endoscopic intervention was performed under the same anesthesia following laparoscopic cholecystectomy, without any complications.

A total of 6 patients (7.5%) had a history of bariatric surgery, and 5 patients (6.3%) were pediatric cases. In total, 10 patients (12.5%) presented with a pre-existing history of biliary pancreatitis, including 2 cases of mild biliary pancreatitis at the time of hospitalization.

The median operative time across the cohort was 115 min (range, 55-310 min), with a mean of 118.9 min ( $\pm$  standard deviation, 42.5 min), reflecting variability based on procedure complexity. The association between urgent/elective intervention and operative time is depicted in Fig. 1. Operation times in the urgent group (n=36) were significantly more variable and exhibited a non-normal distribution ( $P < 0.001$ ), whereas the elective group (n=44) did not deviate from normality ( $P = 0.068$ ). The median operation time was 120 min (IQR, 100-134 min) for the urgent cases and 110 min (IQR, 80-137 min) for the elective cases. Comparisons between the groups revealed no statistically significant difference ( $P = 0.139$ ) (Fig. 1). The median duration of hospitalization was 3 days (range, 1-24 days) (Table I).

No mortality was observed. A total of 7 patients (8.8%) developed post-operative complications, which were classified according to the Dindo-Clavien system (21) and are presented in Table II. Among these, 5 patients experienced acute pancreatitis.

Table II. Complications graded according to the modified Dindo-Clavien classification (21).

Complication/condition	No. (%)	Grade I-II	Grade III
Post-LERV pancreatitis	5 (6.3)	5	-
Residual CBD stones	2 (2.5)	-	2
Total	7 (8.8)		

LERV, laparoendoscopic rendezvous; CBD, common bile duct.

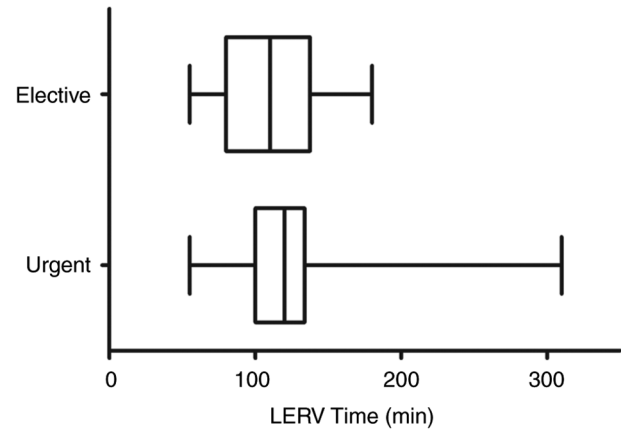


Figure 1. Operative time (duration of LERV) stratified by intervention type (elective vs. urgent). Box-and-whisker plots illustrate the distribution of operative times for each group. The box represents the interquartile range, and the line inside the box indicates the median. Whiskers extend to the minimum and maximum values. The median operative time was 110 min (range, 55-180 min) for elective cases (n=44) and 120 min (range, 55-310 min) for urgent cases (n=36). Differences between the groups (elective vs. urgent) were assessed using the Mann-Whitney U test ( $P = 0.139$ ). LERV, laparoendoscopic rendezvous.

Notably, 2 of these 5 patients had a prior history of pancreatitis. The remaining 2 patients had complications related to residual CBD stones; the majority of post-operative complications were mild, with 71.4% graded as Dindo-Clavien Grade I or II.

**Post-LERV additional interventions.** Additional interventions were required in 2 cases due to residual CBD stones. Of note, 1 patient underwent the successful endoscopic extraction of residual stones, while another patient required a repeat LERV due to biliary hyperpressure caused by a residual CBD stone, clip dislodgement from the cystic duct, and biliary leakage. Of note, both cases occurred during the early learning curve of the surgical team (i.e., within the first 15 procedures) and involved particularly complex choledocholithiasis (characterized by multiple common bile duct stones of varying sizes and morphologies).

**Discussion**

The present retrospective study evaluated the outcomes of the LERV technique in 80 patients with cholecysto-choledocholithiasis, achieving a high initial success rate (97.5%) with no conversions to open surgery. The findings confirm that LERV

is a highly effective and safe single-stage approach for the simultaneous management of gallbladder and CBD stones. The low morbidity rate (8.8%) and absence of mortality in the present study cohort align with the results reported in other large-scale studies (20,22), supporting the utility of the LERV procedure as a viable alternative to the traditional two-stage strategy. Additionally, the majority of post-operative complications were mild (Dindo-Clavien Grade I-II), and the need for additional interventions was limited to early cases, likely reflecting the impact of the learning curve on initial outcomes.

In the present study cohort, the initial success rate of LERV was 97.5%, with no conversions to open surgery. This aligns favorably with the results reported in the study by La Barba *et al* (20), who described a success rate of 95% and a 3% conversion rate in their large series involving 200 patients. The overall post-procedural complication rate in the present study was 8.8%, aligning with the 9% reported in the study by La Barba *et al* (20) and lower than the 14.5% observed in the study by Qian *et al* (22). Notably, in the present case series, post-procedural pancreatitis occurred in 6.3% of patients, slightly higher than the 2.4-3% typically reported for LERV in large series, yet still favorable compared to the higher rates associated with the traditional two-stage approach (8-10%) (20,22). In the present study, the median operative time (115 min) was more or less similar to that of other studies [La Barba *et al* (20), 120 min; Qian *et al* (22), ~140 min], reflecting the technical complexity and experience-gaining phase of LERV. Additionally, the average period of hospitalization of 3 days (range, 1-24 days) in the present case series was in line with the previous research (4-5 days) (20), yet considerably shorter than the prolonged stays associated with two-stage approaches, and consistent with the trend toward faster recovery reported in prior studies (22). These findings further reinforce LERV as a safe, efficient, and complication-sparing approach for managing cholecysto-choledocholithiasis, particularly when considering the long-term reduction of biliary complications noted in one-stage strategies.

It should be mentioned that in the present study cohort, the LERV technique was successfully applied in specific challenging clinical scenarios, including patients with a history of bariatric surgery, pediatric patients, and those with periampullary diverticulum (PAD), providing insight into its applicability and technical advantages in anatomically and clinically complex situations. In patients with a history of bariatric surgery, particularly Roux-en-Y gastric bypass, conventional ERCP often poses substantial technical challenges. Accessing the papilla typically requires a transgastric approach assisted by laparoscopy, and the altered anatomy results in a tangential view of the papilla with the patient in a supine position, making cannulation highly complex. In such cases, LERV can simplify biliary access by providing antegrade guidewire passage, facilitating easier cannulation. This is consistent with the findings of the study by Voermans *et al* (23), who demonstrated the feasibility, but recognized the technical difficulties of laparoscopic-assisted ERCP in post-bariatric patients. Similarly, anatomical variations, such as PAD or atypical papillary morphology [e.g., type 2 or 3/small or protruding papillae, as described by Chen *et al* (24)] can hinder successful cannulation during conventional ERCP. In the present study cohort, 3 patients with PAD underwent successful biliary access using the LERV technique without the need for advanced cannulation maneuvers. The guidewire-assisted

method thus provides a safer and more predictable approach in the presence of anatomical abnormalities. Furthermore, pediatric patients may particularly benefit from LERV. The rarity of choledocholithiasis in the pediatric population limits the experience of pediatric endoscopists with standard ERCP, increasing the risk of failed cannulation or post-ERCP complications (25). By allowing controlled antegrade guidewire passage, LERV enhances procedural safety and reduces the technical burden in this vulnerable group. Taken together, these observations suggest that LERV is not only an effective alternative, but may be the preferred first-line strategy in selected high-risk populations, warranting further prospective validation.

Despite its advantages, the LERV technique is associated with several limitations that should be considered. One of the primary challenges lies in the organizational and logistical requirements: Successful LERV demands close coordination between an experienced laparoscopic surgeon and a skilled endoscopist, both available simultaneously during the procedure. In centers where surgical and endoscopic expertise are compartmentalized or scheduling resources are constrained, implementing LERV may prove difficult. Furthermore, the learning curve for mastering LERV may be significant, necessitating additional training and experience for both teams to ensure procedural safety and efficiency. In addition, several methodological constraints should be acknowledged. The present study was a retrospective, single-center study performed under the supervision of a single surgical leadership, which may limit the generalizability of the findings to other clinical settings or surgical teams with varying levels of expertise. Moreover, although the sample size of 80 consecutive patients is adequate for a focused institutional experience, it may lack the statistical power to detect less frequent adverse events in specific patient subgroups.

In conclusion, the findings of the present study demonstrate that the LERV technique is a safe, effective and efficient single-stage approach for the management of cholecysto-choledocholithiasis, achieving high success rates with low morbidity. LERV proved particularly beneficial in complex scenarios, such as pediatric patients, post-bariatric surgery cases and patients with anatomical abnormalities, such as PAD. While the technique requires substantial coordination, expertise and logistical support, its advantages over conventional two-stage approaches are increasingly evident and support its broader adoption in clinical practice.

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#### Availability of data and materials

The data generated in the present study are not publicly available due to patient confidentiality but can be provided in an anonymized form by the corresponding author upon reasonable request.

## Authors' contributions

All authors (LK, OK, DA, LM, SG and IA) contributed to the conception and design of the study. LK, OK, DA and SG conducted patient management and performed all clinical manipulations. Data collection and analysis were performed by LK, IA and LM. The first draft of the manuscript was written by LK, and all authors commented on previous versions and approved the final manuscript. IA and LK confirm the authenticity of all the raw data.

## Ethics approval and consent to participate

The study was approved by the Ethics Committee of the Innova Medical Center, Tbilisi, Georgia (Approval no. 239, issued on March 3, 2025). The requirement for informed consent was waived due to the retrospective design of the study. However, consent had been obtained from all patients and parents of the under-age patients prior to performing the surgeries.

## Patient consent for publication

Not applicable.

## Competing interests

The authors declare that they have no competing interests.

## Use of artificial intelligence tools

During the preparation of this work, AI tools were used to improve the readability and language of the manuscript or to generate images, and subsequently, the authors revised and edited the content produced by the AI tools as necessary, taking full responsibility for the ultimate content of the present manuscript.

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