RESEARCH PAPER

Perioperative Management of Choledocholithiasis: A Narrative Review of Pharmacological Strategies and Findings from a Prospective Comparative Study of LCBDE and ERCP

S Aun Ali Mehdi[1*], Afzal Anees[2], Meraj Ahmed[3], Md Fariduddin[4], Zeeshan Jafar[5]

[1]Resident Doctor, Department of Surgery, Jawaharlal Nehru Medical College and Hospital, Aligarh Muslim University, Aligarh, Uttar Pradesh, India.
ORCID ID: 0009-0004-8209-3913
[2]Professor, Department of Surgery, Jawaharlal Nehru Medical College and Hospital, Aligarh Muslim University, Aligarh, Uttar Pradesh, India.
[3]Assistant Professor, Department of Surgery, Jawaharlal Nehru Medical College and Hospital, Aligarh Muslim University, Aligarh, Uttar Pradesh, India
[4]Resident Doctor, Department of Surgery, Jawaharlal Nehru Medical College and Hospital, Aligarh Muslim University, Aligarh, Uttar Pradesh, India ORCID ID: 0009-0002-1892-7085
[5]Resident Doctor, Department of Surgery, Era's Lucknow Medical College and Hospital, Lucknow, Uttar Pradesh, India. ORCID ID: 0009-0005-0757-8344
Corresponding Author: S Aun Ali Mehdi Email: saamehdi.co@amu.ac.in
Received: 20th Sep, 2026; revised: 10th oct, 2026; Accepted: 15th October 2026; Available Online: 28th October 2026

ABSTRACT:

Choledocholithiasis is treated with ERCP, LCBDE, or both, but comparative studies focus on technique and rarely examine the perioperative drugs that also shape outcomes.

Purpose of review: Comparative studies focus on technique, yet perioperative drugs also shape outcomes. This review summarizes the pharmacological evidence along the perioperative pathway and identifies where it is strong, weak, or absent.

Sources of information: Targeted PubMed searches and guideline bodies (ASGE, ESGE, Tokyo Guidelines, PROSPECT, British Society of Gastroenterology), prioritizing guidelines, randomized trials, and meta-analyses. A prospective single-center cohort (25 LCBDE, 29 ERCP; 2024–2026) illustrated the clinical context.

Methods: Sources were selected by the authors' judgement (SANRA-referenced) and synthesized narratively by phase of care: antimicrobials, antithrombotics and cholestasis, sedation, PEP prevention, and analgesia. Each strategy was graded according to the type of evidence behind it. The cohort was analyzed descriptively and not used to test drug effects.

Key findings: The evidence is strongest for rectal NSAIDs (indomethacin or diclofenac 100 mg) to prevent PEP and for tailored antibiotics in cholangitis (4–7 days after source control). Recommendations: routine rectal NSAIDs, wire-guided cannulation, and selective pancreatic stenting in ERCP; restrictive prophylaxis without cholangitis; individualized antithrombotic interruption; vitamin K if INR is prolonged; multimodal opioid-sparing analgesia (extrapolated from cholecystectomy). PEP prophylaxis is unnecessary after LCBDE. No recommendation is possible on antibiotic prophylaxis or duration for choledochotomy, LCBDE-specific analgesia, thromboprophylaxis timing, or LCBDE adjuncts. In the cohort, LCBDE patients had greater baseline severity (bilirubin 3.63 vs. 1.70 mg/dL). Clearance was 100% vs. 93.1%; surgical-site infection (24% vs. 0%) and early pain and hospital stay (4.3 vs 1.6 days) were higher after LCBDE; PEP occurred in 2 of 29 ERCP patients.

Limitations: This was a non-systematic review without a risk-of-bias assessment. The cohort is small, single-centre, effectively non-randomised and imbalanced; drug regimens were too poorly recorded to attribute outcomes to pharmacology, so no causal inference is made.

Keywords: choledocholithiasis; ERCP; post-ERCP pancreatitis; antibiotic prophylaxis; perioperative analgesia

How to cite this article: S Aun Ali Mehdi, Afzal Anees, Meraj Ahmed, Md Fariduddin, Zeeshan Jafar ,"Perioperative Management of Choledocholithiasis: A Narrative Review of Pharmacological Strategies and Findings from a Prospective Comparative Study of LCBDE and ERCP.". Int J Drug Deliv Technol. 2026;16(89s): 730-745; DOI: 10.25258/ijddt.16.89s.79

1. INTRODUCTION

Gallstone disease affects approximately one in ten adults worldwide, and common bile duct (CBD) stones are found in 10–18% of patients undergoing cholecystectomy for symptomatic stones [1,2]. Untreated choledocholithiasis can cause cholangitis, pancreatitis, and secondary biliary cirrhosis. Two minimally invasive routes dominate contemporary practice: ERCP with sphincterotomy and stone extraction, usually followed by laparoscopic cholecystectomy, and single-stage LCBDE with cholecystectomy, by the transcystic route or by choledochotomy [2–4]. Randomized trials and meta-analyses show broadly equivalent duct clearance, with differences in hospital stay, procedure count, and complication profile [5–8].

These comparisons largely treat the intervention as the only variable. In practice, outcomes depend on a layer of pharmacology that surrounds it: whether and how antibiotics are administered, how anticoagulants are handled, how sedation or general anesthesia is delivered, whether pancreatitis prophylaxis is used, and how pain is controlled afterwards. These choices differ between the endoscopy suite and the operating theatre, are governed by different guideline bodies, and are seldom reported in comparative studies.

This review aimed to synthesize the pharmacological evidence along the perioperative pathway of choledocholithiasis, identify where evidence is strong or absent, and illustrate the clinical context with observations from a single-centre comparative cohort of LCBDE and ERCP. The cohort is descriptive and used to frame questions, not to test drug effects.

2. METHODS

2.1 Review methodology

This is a narrative review prepared with reference to the SANRA quality criteria [9]. Sources were identified through targeted searches of PubMed and the websites of guideline bodies (ASGE, ESGE, the Tokyo Guidelines group, PROSPECT, and the British Society of Gastroenterology), using combinations of the terms choledocholithiasis, common bile duct stones, ERCP, laparoscopic common bile duct exploration, antibiotic prophylaxis, post-ERCP pancreatitis, indomethacin, sedation, and postoperative analgesia. Priority was given to current guidelines, randomized trials, systematic reviews, and meta-analyses. Case series and cohort studies were used only where higher-level evidence was absent. Selection was made by the authors' judgement, and no formal risk-of-bias assessment was performed. Where a recommendation rests on expert practice rather than trial data, this is stated.

2.2 Comparative cohort

This prospective comparative study was conducted in the Department of Surgery, Jawaharlal Nehru Medical College, Aligarh Muslim University, from February 2024 to February 2026, and reported with reference to the STROBE statement [10]. Patients over 14 years old with symptomatic primary, secondary, or recurrent CBD stones were included, and those who converted to open surgery were excluded. Fifty-four patients were analyzed: 25 underwent LCBDE, and 29 underwent ERCP. Written informed consent was obtained, and the study was approved by the institutional ethics committee.

LCBDE was performed under general anesthesia using a four-port technique, using the transcystic route when feasible and choledochotomy otherwise, with choledochoscopy, basket extraction, electrohydraulic lithotripsy where required, and a subhepatic drain in all cases. ERCP was performed under conscious sedation (intravenous midazolam 2–5 mg with fentanyl 50–100 µg) or propofol-based anaesthetist-led sedation, with wire-guided cannulation, sphincterotomy, and balloon or basket extraction. Postoperative antibiotics were piperacillin-tazobactam 4.5 g three times daily or cefoperazone-sulbactam 1.5 g twice daily for 24–48 hours, longer in cholangitis. Complications were graded within 30 days, and pancreatitis was defined using the cotton criteria [11]. Pain was recorded on a visual analog scale (VAS) at 1, 6, 12, and 24 hours. Continuous variables are given as mean ± standard deviation, and categorical variables were compared using Fisher's exact test. The recorded perioperative analgesic and pancreatitis-prophylaxis regimens were incomplete and could not be analyzed.

3. PHARMACOLOGICAL STRATEGIES ACROSS THE PERIOPERATIVE PATHWAY

Figure 1 summarizes the pathway, and Table 1 lists the principal strategies with the strength of supporting evidence.

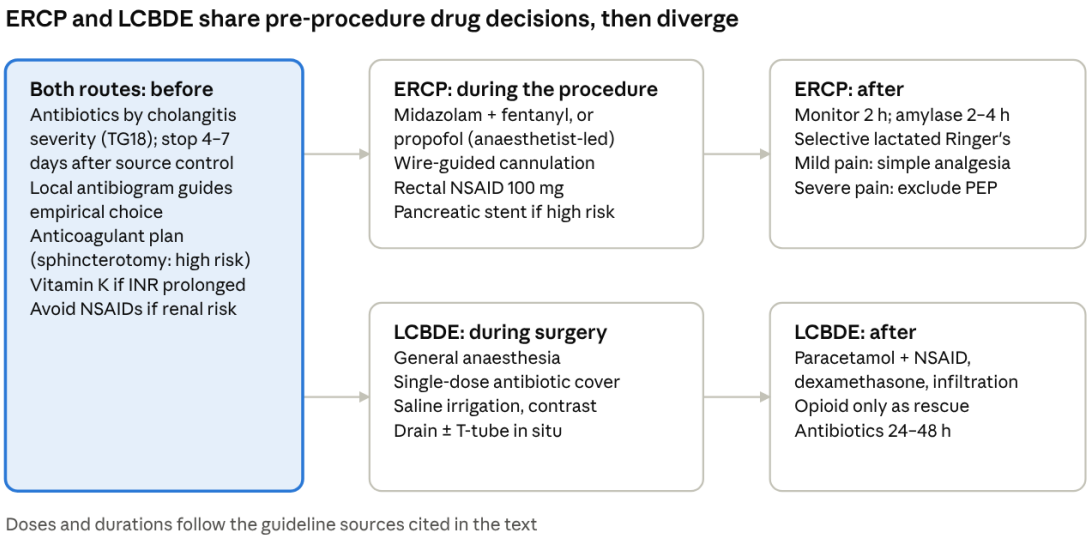


Figure 1. Perioperative pharmacological decisions in choledocholithiasis by route and phase. [PEP, post-ERCP pancreatitis; TG18, Tokyo Guidelines 2018].

Table 1. Principal perioperative pharmacological strategies in choledocholithiasis and strength of supporting evidence

Strategy	Typical agent or approach	Setting	Evidence
Antibiotics for cholangitis	β-lactam/β-lactamase inhibitor tailored to severity; 4–7 days after source control	ERCP and LCBDE	Guideline (TG18) [12]
Prophylaxis without cholangitis	Not routine in low-risk cholecystectomy; targeted when drainage may be incomplete	ERCP and LCBDE	Moderate [14, 4]
Antithrombotic management	Individualised interruption; sphincterotomy is high bleeding risk	ERCP and LCBDE	Guideline [16]
Vitamin K in obstructive jaundice	Parenteral vitamin K if INR is prolonged	ERCP and LCBDE	Expert practice
Sedation or anaesthesia	Midazolam with fentanyl or propofol (ERCP); general anaesthesia (LCBDE)	ERCP and LCBDE	Guideline [17]
Rectal NSAID	Indomethacin or diclofenac 100 mg	ERCP	High: RCT and guidelines [18–20]
Aggressive lactated Ringer's	Bolus then infusion where tolerated	ERCP	Mixed; no added benefit over NSAID in one trial [19,21]
Pancreatic duct stent	After difficult cannulation or other high-risk features	ERCP	Guideline [19]
Multimodal analgesia	Paracetamol, NSAID, dexamethasone, local infiltration; opioid for rescue	LCBDE	Extrapolated from cholecystectomy [22,23]
LCBDE-specific adjuncts	Irrigation, drain or T-tube strategy, antibiotic duration	LCBDE	Low: case series, opinion [4,24]

3.1 Antimicrobial therapy

Bile in choledocholithiasis is frequently colonized, most often by Enterobacterales, and obstruction raises the risk of cholangitis. The Tokyo Guidelines 2018 (TG18) recommend antimicrobial therapy tailored to severity and community- or healthcare-associated onset, with prompt biliary drainage in moderate and severe cholangitis, and a duration of four to seven days once the source is controlled [12,13]. Broad-spectrum β-lactam/β-lactamase inhibitor combinations are standard choices for non-mild disease. Local antibiograms matter: in settings with high rates of extended-spectrum β-lactamase-producing organisms, empirical choices may need to be broader, and bile culture, when obtained at drainage or surgery, should be used to de-escalate. Prolonged courses beyond source control add resistance pressure without proven benefit; therefore, stopping rules should be explicit in both endoscopic and surgical protocols.

For patients without cholangitis, the evidence supports a restrictive approach. A Cochrane review found no clear benefit of routine prophylaxis in low-risk elective laparoscopic cholecystectomy [14], but patients with CBD stones, jaundice, or biliary instrumentation are not low-risk and were largely outside that evidence. For ERCP, ASGE guidance reserves prophylaxis for situations where complete drainage is unlikely, such as hilar obstruction or primary sclerosing cholangitis, and for specific host factors [15]. A single dose at induction is usual for LCBDE with choledochotomy, although no trial has specifically tested the duration in this setting. This is a clear evidence gap, because choledochotomy exposes the wound and peritoneum to bile.

3.2 Antithrombotic therapy and cholestasis-related derangements

Sphincterotomy is a high-bleeding-risk endoscopic procedure, whereas diagnostic ERCP and stent placement without sphincterotomy carry lower risk. ASGE guidelines recommend individualized interruption of anticoagulants and P2Y12 inhibitors, weighing the thrombotic against hemorrhagic risk, with aspirin generally continued [16]. LCBDE similarly requires interruption in line with the surgical bleeding risk. Prolonged obstruction impairs absorption of vitamin K, and parenteral vitamin K to correct a prolonged INR before sphincterotomy or surgery is established practice, although supported by little trial evidence. Jaundiced patients are also vulnerable to acute kidney injury and perioperative infection; therefore, volume status and nephrotoxic drugs, including NSAIDs, need attention.

3.3 Sedation and anaesthesia

ERCP is performed under moderate sedation, propofol-based deep sedation, or general anesthesia. Current guidelines support the use of anaesthetist-administered propofol for prolonged or complex procedures and for patients with significant comorbidities or high risk of airway compromise, with benzodiazepine-opioid regimens remaining acceptable in selected low-risk patients [17]. LCBDE requires general anesthesia, with its attendant effects of pneumoperitoneum and positioning. Therefore, the choice of anesthetic differs systematically between the two arms of any comparison, and it influences recovery, early pain, and length of stay, a point rarely adjusted for in comparative studies. Contrast medium is a further drug exposure unique to the endoscopic and cholangiographic steps. Low-osmolar non-ionic agents are standard, and minimizing pancreatic duct opacification and injection pressure lowers the risk of pancreatitis [19]. Intraoperative cholangiography during LCBDE exposes the biliary tree to contrast in the same way, although the consequences are less studied.

3.4 Prevention of post-ERCP pancreatitis

Post-ERCP pancreatitis (PEP) is the most common serious complication of ERCP, and its prevention is the most developed area of pharmacology in this field. The ESGE and ASGE guidelines recommend routine rectal NSAIDs, indomethacin or diclofenac 100 mg, for most patients without contraindication [18,19]. The foundational randomized trial reported PEP in 9.2% of patients given indomethacin against 16.9% given placebo in a high-risk population [20]. Wire-guided cannulation is preferred to contrast-guided cannulation, and prophylactic pancreatic duct stenting is advised after difficult cannulation, repeated pancreatic duct access, precut sphincterotomy, or ampullectomy [19].

Aggressive hydration with lactated Ringer's solution reduces PEP in some settings, and the ASGE guideline suggests an initial bolus followed by sustained infusion in patients who can tolerate the volume, avoiding it in heart failure, kidney disease, and advanced liver disease [19]. However, a multicenter trial found that adding aggressive hydration to rectal NSAIDs gave no significant additional benefit [21]. Therefore, prophylaxis is primarily based on rectal NSAIDs, with stenting and selective hydration added by risk. Because LCBDE avoids papillary manipulation, PEP prophylaxis is not required after surgical exploration, and this is one pharmacological advantage of the surgical route. In regions where rectal indomethacin is expensive or unavailable, access to prophylaxis can itself influence the choice of treatment.

3.5 Postoperative analgesia

Procedure-specific guidance for laparoscopic cholecystectomy recommends a multimodal regimen: paracetamol and an NSAID, with dexamethasone, local anesthetic wound infiltration, and opioids reserved for rescue [22,23]. The most recent PROSPECT update advises against several agents because their side effects outweigh gains, namely gabapentinoids, intravenous lidocaine, ketamine, and dexmedetomidine, and positions erector spinae or transversus abdominis plane blocks as second-line options for patients at higher risk of severe pain [23].

These recommendations are derived from uncomplicated cholecystectomy. LCBDE adds a choledochotomy or cystic duct dilatation, an additional port, and often a T-tube and drain, and may generate more pain; however, no analgesic trials exist for this population. NSAID use must be balanced against renal risk in jaundiced patients and against bleeding after sphincterotomy or ductal surgery. Pain after ERCP is usually mild and short-lived, and severe pain should prompt evaluation for pancreatitis or perforation rather than escalation of analgesia.

3.6 Pharmacology specific to LCBDE

Beyond antibiotics and analgesia, pharmacological adjuncts specific to LCBDE are poorly studied. Saline irrigation during choledochoscopy, intraoperative sphincter-relaxing agents, and local drainage strategies are used according to surgeon preference and rest mainly on case series and expert opinion [4,24]. Bile leak, the characteristic complication of choledochotomy, is managed by drainage and, if persistent, by endoscopic stenting. The transcystic route is associated with fewer bile leaks and shorter stay than choledochotomy in meta-analysis [25]. Perioperative venous thromboprophylaxis should follow individual risk, balanced against bleeding after sphincterotomy or choledochotomy, and no trial has addressed timing in this group. Continuing antibiotics for as long as a T-tube or drain remains in situ has no supporting evidence, and it adds resistance pressure. Taken together, the choice of route may influence the need for postoperative drug and drain management as much as any drug choice.

4. OBSERVATIONS FROM THE COMPARATIVE COHORT

4.1 Baseline characteristics

The mean age was 44.8 ± 11.7 years in the LCBDE group and 41.5 ± 15.8 years in the ERCP group, and women predominated in both groups (84% and 72.4%). Patients in the LCBDE group had greater baseline severity (Table 2, Figure 2). Jaundice was more frequent (68% vs. 37.9%, p = 0.033), total bilirubin was higher (3.63 ± 1.77 vs. 1.70 ± 1.14 mg/dL), as were alkaline phosphatase (532.6 ± 286.3 vs. 376.4 ± 224.4 IU/L), CBD diameter (12.0 ± 2.6 vs. 10.65 ± 2.1 mm) and stone size (11.1 ± 2.8 vs. 7.3 ± 3.3 mm). Comorbidities were similar. This confounding by indication is the main limitation of any comparison, and it is relevant to pharmacology because jaundice and larger stones raise infection and bleeding risk independently of the procedure.

Table 2. Baseline characteristics and outcomes of LCBDE (n = 25) and ERCP (n = 29)

Variable	LCBDE (n = 25)	ERCP (n = 29)	p
Age, years	44.76 ± 11.65	41.45 ± 15.76	0.39
Female, n (%)	21 (84.0)	21 (72.4)	0.35
Jaundice, n (%)	17 (68.0)	11 (37.9)	0.033
Fever, n (%)	3 (12.0)	4 (13.8)	1.00
Total bilirubin, mg/dL	3.63 ± 1.77	1.70 ± 1.14	<0.001
Alkaline phosphatase, IU/L	532.60 ± 286.26	376.41 ± 224.36	0.03
CBD diameter, mm	12.00 ± 2.61	10.65 ± 2.07	0.04
Stone size, mm	11.12 ± 2.84	7.27 ± 3.27	<0.001
Two or more stones, n (%)	14 (56.0)	13 (44.8)	0.59
Procedure duration, min	122.92 ± 8.48	57.69 ± 11.17	<0.001
Complete clearance, n (%)	25 (100)	27 (93.1)	0.49
Postoperative pain, n (%)	25 (100)	7 (24.1)	<0.001
Surgical-site infection, n (%)	6 (24.0)	0	0.007

Variable	LCBDE (n = 25)	ERCP (n = 29)	p
Bile leak, n (%)	3 (12.0)	0	0.09
Bleeding, n (%)	2 (8.0)	0	0.21
Post-ERCP pancreatitis, n (%)	0	2 (6.9)	0.49
Perforation, n (%)	0	0	not applicable
Hospital stay, days	4.32 ± 1.10	1.62 ± 0.72	<0.001

Values are mean ± SD or n (%). Continuous-variable p values are those from the original analysis (t-test).

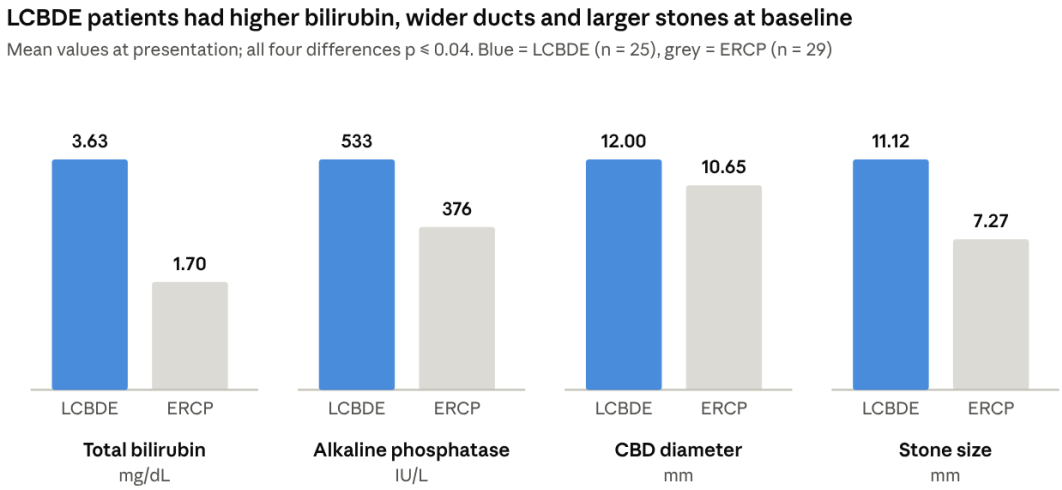


Figure 2. Baseline disease severity in the LCBDE and ERCP groups

4.2 Efficacy and procedure characteristics

Duct clearance was achieved in 25 of 25 patients (100%) after LCBDE and in 27 of 29 (93.1%) after ERCP (p = 0.49), with two residual stones in the ERCP group. The mean operative time was 122.9 ± 8.5 minutes for LCBDE and 57.7 ± 11.2 minutes for ERCP. In the ERCP group, cannulation was difficult in 14 of 29 (48.3%), sphincterotomy was performed in 24 (82.8%), and stenting in 22 (75.9%); a guidewire was used in all procedures. No perforation occurred, and there was no mortality.

4.3 Adverse events and drug-relevant outcomes

Adverse events differed in character (Table 2, Figure 3). Surgical-site infection (SSI) occurred in 6 of 25 LCBDE patients (24%) and in none of 29 ERCP patients (p = 0.007); all were superficial and healed with dressings. Bile leak occurred in 3 of 25 LCBDE patients (12%) and in none after ERCP (p = 0.09), all managed conservatively. Bleeding affected 2 of 25 LCBDE patients (8%) and none after ERCP (p = 0.21), without the need for reintervention. PEP developed in 2 of 29 ERCP patients (6.9%) and in none after LCBDE (p = 0.49). These two patients had markedly elevated enzymes (amylase 1078 and 514 U/L; lipase 13,780 and 17,856 U/L), which inflated the ERCP group mean. The median amylase and lipase values were actually lower in the ERCP group (56 and 90 U/L) than in the LCBDE group (73 and 111 U/L); therefore, mean enzyme comparisons should not be interpreted as a group effect.

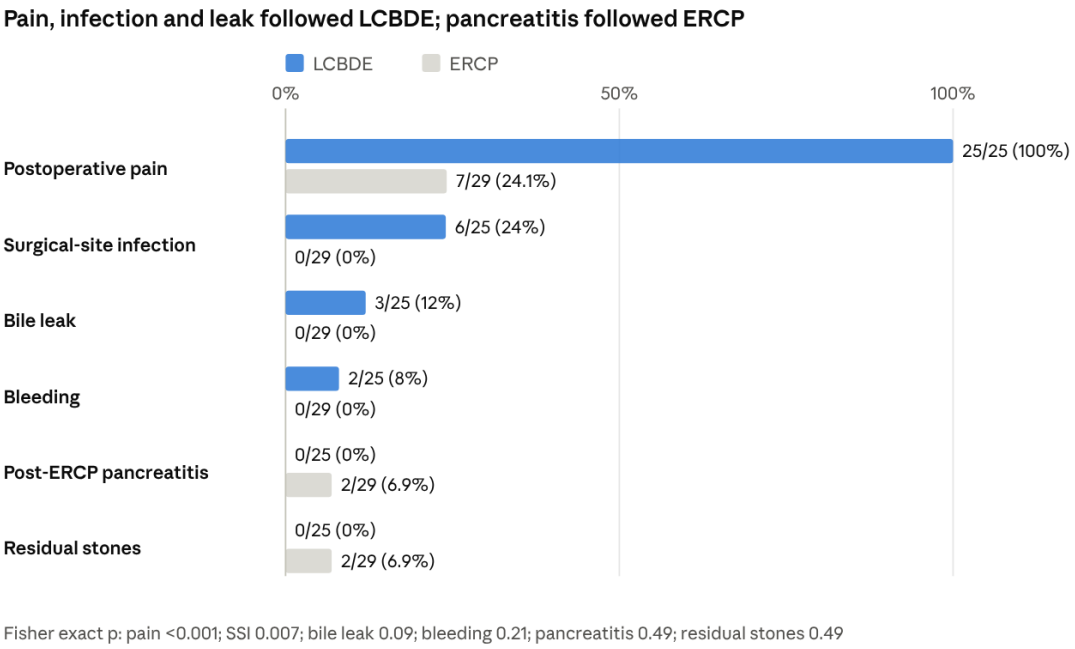


Figure 3. Adverse events and residual stones by group. [shown as n/N (%)] SSI, surgical site infection].

Postoperative pain was reported by all LCBDE patients and by seven of 29 ERCP patients (24.1%; $p < 0.001$). VAS scores were higher after LCBDE at every time point (Figure 4): 6 ± 1.3 vs. 4 ± 0.8 at one hour, 3 ± 0.8 vs. 2 ± 0.1 at six hours, 1.8 ± 1.1 vs. 0.41 ± 0.06 at twelve hours, and 0.17 vs. 0 at twenty-four hours. The median hospital stay was shorter after ERCP (1.62 ± 0.72 vs. 4.32 ± 1.10 days). The analgesic regimen was not recorded in a form that allows analysis of opioid use or timing. The reported incidence of pain after ERCP (seven of 29) and the group mean VAS values are not easily reconciled in the source tables; therefore, the scores should be interpreted cautiously.

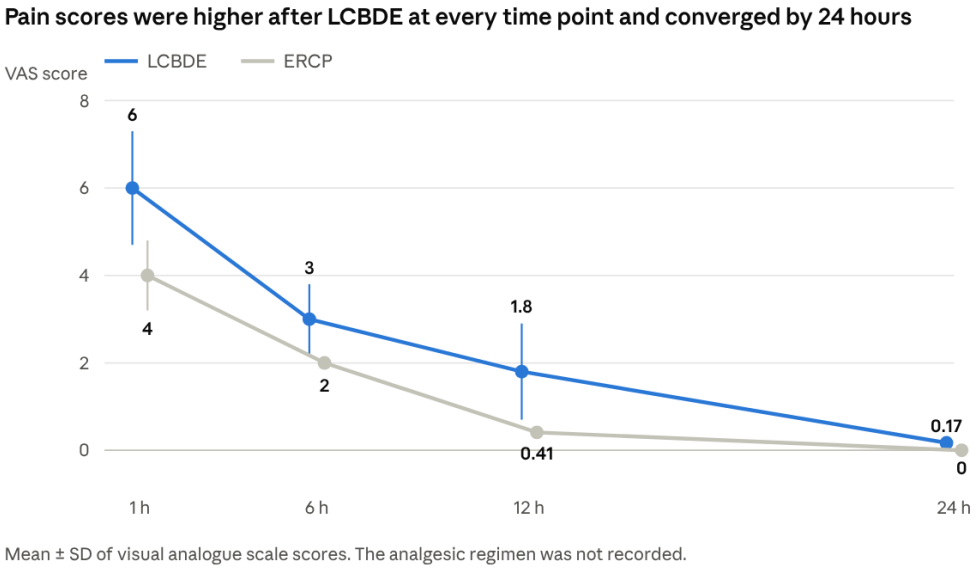


Figure 4. Postoperative pain (VAS) at 1, 6, 12, and 24 hours after LCBDE and ERCP

5. DISCUSSION

5.1 Principal observations

Three patterns in the cohort map onto the pharmacological themes above. First, SSI was confined to the surgical arm, even though a protocolised β-lactam regimen was used. This is more plausibly a consequence of surgical access to a colonized biliary tract in jaundiced patients, which the cohort cannot separate from antibiotic choice, timing, or dose, than evidence that the regimen was deficient. However, this underlines the absence of trial data on prophylaxis for choledochotomy. Second, PEP occurred in 6.9% of ERCP patients, within the range reported in contemporary series [26], despite difficult cannulation in nearly half. Whether rectal NSAIDs or hydration were administered was not recorded, and this is the most important pharmacological omission, because rectal indomethacin is recommended for nearly all patients [18,19]. Third, pain was universal after LCBDE and tracked the greater tissue injury of surgery, which is consistent with the case for an explicit multimodal protocol rather than ad hoc analgesia. Because pain scores fell to near zero by 24 hours in both groups, the practical gain from a protocol would lie mainly in the first 12 hours, where opioid-sparing combinations and local infiltration have the most to offer, and in reducing the delay to discharge that unrelieved pain can cause.

5.2 Interpretation in context

Our clearance rates (100% vs. 93.1%) are consistent with meta-analyses reporting equivalent efficacy [5,7,8], and our finding that LCBDE patients had larger stones and more jaundice agrees with the usual pattern of selecting more complex diseases for surgery [27]. The longer stay after LCBDE is commonly reported, although single-stage management reduces the total hospital days relative to ERCP followed by interval cholecystectomy, which is a comparison that our cohort did not capture [7]. The bile leak and bleeding differences were not statistically significant on exact testing and should be regarded as hypotheses, particularly given the small numbers.

5.3 Implications for practice

For ERCP, rectal NSAID prophylaxis, wire-guided cannulation, and selective pancreatic stenting should be routine and documented. For LCBDE, a standardized protocol covering antibiotic timing and duration, antithrombotic interruption, multimodal opioid-sparing analgesia, and drain management is warranted. Where both modalities are available, the choice should rest on stone burden, fitness for anesthesia, presentation, and local expertise, with pharmacological risk (renal function, bleeding, and infection) considered explicitly. A simple checklist at the multidisciplinary meeting could prompt the relevant questions: Is the patient anticoagulated? Is there cholangitis or a high risk of incomplete drainage? Can NSAIDs be given safely? Is the antibiotic cessation date defined? Is an opioid-sparing analgesic plan in place? Such documentation costs little and would make future audit and comparative research far more informative, especially in resource-limited settings where heterogeneity of practice is greatest.

5.4 Limitations

The review is narrative, and the selection of sources was not systematic. The cohort is small, single-centre, and non-randomized in effect, with substantial baseline imbalance, and it was not powered to detect differences in rare complications. Drug regimens were incompletely recorded, follow-up was short, and no adjustment for confounders was possible. Reported data inconsistencies in the source dataset were reconciled to the master-chart denominators, and the cohort findings should be read as hypothesis-generating. Finally, the cohort was not designed to isolate pharmacological effects, and no causal inference about any drug is made.

6. CONCLUSIONS

Pharmacology shapes the outcomes of both ERCP and LCBDE, but is reported far less rigorously than the technique. Evidence is strongest for guideline-based antibiotic use in cholangitis and rectal NSAIDs to prevent pancreatitis and weakest for antibiotic duration, analgesia, and adjuncts specific to LCBDE. Our cohort showed excellent clearance with both approaches, a surgical profile of infection, bile leak, and pain, and an endoscopic profile of pancreatitis risk. Future comparative trials should prespecify and report perioperative drug regimens to separate the contribution of pharmacology from that of the procedure.

Declarations

Ethics approval and consent: This cohort study was approved by the Institutional Ethics Committee of Jawaharlal Nehru Medical College, Aligarh Muslim University. Written informed consent was obtained from all participants.

Conflicts of interest: None

Funding: None

REFERENCES

1.Stinton LM, Shaffer EA. Epidemiology of gallbladder disease: Cholelithiasis and cancer. Gut and Liver [Internet]. 2012 Apr 15 [cited 2026 Oct 27];6(2):172–87. Available from: https://openurl.ebsco.com/contentitem/doi:10.5009%2Fgnl.2012.6.2.172?sid=ebsco:plink:crawler&id=ebsco:doi:10.5009%2Fgnl.2012.6.2.172

2.Williams E, Beckingham I, El Sayed G, Gurusamy K, Sturgess R, Webster G, et al. Updated guideline on the management of common bile duct stones (CBDS). Gut. 2017 Jan 25;66(5):765–82.

3.Manes G, Paspatis G, Aabakken L, Anderloni A, Arvanitakis M, Ah-Soune P, et al. Endoscopic management of common bile duct stones: European Society of Gastrointestinal Endoscopy (ESGE) guideline. Endoscopy. 2019 Apr 3;51(05):472–91.

4.ASGE STANDARDS OF PRACTICE COMMITTEE. The role of endoscopy in the bariatric surgery patient. Surgical Endoscopy. 2015 Feb 28;29(5):1007–17.

5.Dasari BV, Tan CJ, Gurusamy KS, Martin DJ, Kirk G, McKie L, et al. Surgical versus endoscopic treatment of bile duct stones. Dasari BV, editor. Cochrane Database of Systematic Reviews. 2013 Dec 12;.

6.Bansal VK, Misra MC, Rajan K, Kilambi R, Kumar S, Krishna A, et al. Single-stage laparoscopic common bile duct exploration and cholecystectomy versus two-stage endoscopic stone extraction followed by laparoscopic cholecystectomy for patients with concomitant gallbladder stones and common bile duct stones: A randomized controlled trial. Surgical Endoscopy. 2013 Oct 26;28(3):875–85.

7.Singh AN, Kilambi R. Single-stage laparoscopic common bile duct exploration and cholecystectomy versus two-stage endoscopic stone extraction followed by laparoscopic cholecystectomy for patients with gallbladder stones with common bile duct stones: Systematic review and meta-analysis of randomized trials with trial sequential analysis. Surgical Endoscopy. 2018 Mar 30;32(9):3763–76.

8.Chaouch MA, Ben Jemia S, Krimi B, Lippai D, Chahed M, Gouader A, et al. Meta-analysis of randomized controlled trials comparing single-stage laparoscopic versus two-stage endoscopic management followed by laparoscopic cholecystectomy of preoperatively diagnosed common bile duct stones. Medicine. 2025 Mar 14;104(11):e41902.

9.Baethge C, Goldbeck-Wood S, Mertens S. SANRA—A scale for the quality assessment of narrative review articles. Research Integrity and Peer Review [Internet]. 2019 Mar 26 [cited 2026 Oct 27];4(1). Available from: https://doi.org/10.1186/s41073-019-0064-8

10.von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The strengthening the reporting of observational studies in epidemiology (STROBE) statement: Guidelines for reporting observational studies. PLoS Medicine [Internet]. 2007 Oct 16 [cited 2026 Oct 27];4(10):e296. Available from: https://doi.org/10.1371/journal.pmed.0040296

11.Cotton PB, Lehman G, Vennes J, Geenen JE, Russell RCG, Meyers WC, et al. Endoscopic sphincterotomy complications and their management: An attempt at consensus. Gastrointestinal Endoscopy. 1991 May;37(3):383–93.

12.Miura F, Okamoto K, Takada T, Strasberg SM, Asbun HJ, Pitt HA, et al. Tokyo guidelines 2018: Initial management of acute biliary infection and flowchart for acute cholangitis. Journal of Hepato-Biliary-Pancreatic Sciences [Internet]. 2018 Jan [cited 2026 Oct 27];25(1):31–40. Available from: https://www.researchgate.net/publication/320005035_Tokyo_Guidelines_2018_initial_management_of_acute_biliary_infection_and_flowchart_for_acute_cholangitis?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6Il9kaXJlY3QiLCJwYWdlIjoiX2RpcmVjdCJ9fQ

13.Okamoto K, Suzuki K, Takada T, Strasberg SM, Asbun HJ, Endo I, et al. Tokyo guidelines 2018: Flowchart for the management of acute cholecystitis. Journal of Hepato-Biliary-Pancreatic Sciences [Internet]. 2017 Dec 20 [cited 2026 Oct 27];25(1):55–72. Available from: https://pure.teikyo.jp/en/publications/tokyo-guidelines-2018-flowchart-for-the-management-of-acute-chole/

14.Acosta RD, Abraham NS, Chandrasekhara V, Chathadi KV, Early DS, Eloubeidi MA, et al. The management of antithrombotic agents for patients undergoing GI endoscopy. Gastrointestinal Endoscopy. 2016 Jan;83(1):3–16.

15.Early DS, Lightdale JR, Vargo JJ, Acosta RD, Chandrasekhara V, Chathadi KV, et al. Guidelines for sedation and anesthesia in GI endoscopy. Gastrointestinal Endoscopy [Internet]. 2018 Feb [cited 2026 Oct 27];87(2):327–37. Available from: https://www.asge.org/docs/default-source/education/practice_guidelines/piis0016510717321119.pdf?sfvrsn=4

16.Dumonceau JM, Kapral C, Aabakken L, Papanikolaou I, Tringali A, Vanbiervliet G, et al. ERCP-related adverse events: European Society of Gastrointestinal Endoscopy (ESGE) guideline. 2019 [cited 2026 Oct 27];. Available from: https://www.esge.com/assets/downloads/pdfs/guidelines/2019_a_1075_4080.pdf

17.Gellért B. Update in preventing post-endoscopic retrograde cholangiopancreatography pancreatitis. Annals of Gastroenterology. 2024;.

18.Elmunzer BJ, Scheiman JM, Lehman GA, Chak A, Mosler P, Higgins PD, et al. 720 A randomized controlled trial of rectal indomethacin for the prevention of Post-ERCP pancreatitis. Gastrointestinal Endoscopy. 2012 Apr;75(4):AB161.

19.Weiland CJS, Smeets XJNM, Umans DS, Drenth JPH, van Geenen EJM. Aggressive hydration and post-ERCP pancreatitis–authors' reply. The Lancet Gastroenterology & Hepatology. 2021 Sept;6(9):686–7.

20.Barazanchi AWH, MacFater W, Rahiri JL, Tutone SD, Hill AG, Joshi G. Evidence-based management of pain after laparoscopic cholecystectomy: A PROSPECT review. Journal of the American College of Surgeons. 2018 Oct;227(4):e133.

21.Bourgeois C, Oyaert L, Van de Velde M, Pogatzki-Zahn E, Freys SM, Sauter AR, et al. Pain management after laparoscopic cholecystectomy. European Journal of Anaesthesiology. 2024 Sept 3;41(11):841–55.

22.Overby DW, Apelgren KN, Richardson W, Fanelli R. SAGES guidelines for the clinical application of laparoscopic biliary tract surgery. Surgical Endoscopy. 2010 Aug 13;24(10):2368–86.

23.Zheng B, Lu Y, Li E, Bai Z, Zhang K, Li J. Comparison of the efficacy of LTCBDE and LCBDE for common bile duct stones: A systematic review and meta-analysis. Frontiers in Surgery. 2025 Jan 8;11.

24.Özcan Ö, Arikan S. Determining the risk factors of complications due to endoscopic retrograde cholangiopancreatography. Cureus [Internet]. 2024 Jan 4 [cited 2026 Oct 27];. Available from: https://www.cureus.com/articles/214406-determining-the-risk-factors-of-complications-due-to-endoscopic-retrograde-cholangiopancreatography.

25.Amaravadi S, Challagundla NN. A clinico-etiology and an outcome analysis of surgical management of choledocholithiasis. Cureus. 2025 Sept 11.