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Transcystic Laparoscopic Common Bile Duct Exploration (LCBDE) Combined with Laparoscopic Cholecystectomy for Acute Biliary Presentations: A Comparative Cohort Study of Choledochoscope-Assisted and Dormia Basket-Only Techniques

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Abstract

Background

Choledocholithiasis complicating acute cholecystitis is commonly managed by staged endoscopic retrograde cholangiopancreatography (ERCP) followed by laparoscopic cholecystectomy (LC). Single-stage transcystic laparoscopic common bile duct exploration (LCBDE) performed concurrently with LC offers a compelling alternative. Two transcystic techniques are in routine use: choledochoscope-assisted extraction and Dormia basket-only (fluoroscopy-guided) extraction. Direct comparative data on these approaches in an acute-care emergency setting are lacking. This study aimed to compare their outcomes in patients undergoing emergency LC for acute biliary presentations.

Methods

Retrospective cohort study at Hamad General Hospital, Doha, Qatar (January 2020–December 2021). After formal dataset verification (exclusion of one LC + IOC-only case and two duplicate entries), 154 patients undergoing attempted transcystic LCBDE were included: 41 (26.6%) in the choledochoscope group and 113 (73.4%) in the Dormia basket group. Patients were assigned to groups based on the primary instrument attempted (primary-attempt strategy). Primary outcome was intraoperative common bile duct (CBD) clearance rate. Secondary outcomes included cannulation success, postoperative ERCP requirement, complications, 30-day readmission, and length of stay. Between-group comparisons used Fisher's exact test. Analyses were performed on both intention-to-treat (ITT) and per-protocol (PP) frameworks. The study adheres to STROBE guidelines.

Results

Both techniques achieved comparable outcomes across all measured endpoints. Using a primary-attempt strategy, cannulation success was 90.2% (37/41) in the choledochoscope group versus 90.3% (102/113) in the Dormia group ($p = 1.000$). Per-protocol CBD clearance was 81.1% (30/37) versus 82.4% (84/102) respectively ($p = 1.000$). Postoperative ERCP was required in 19.5% (8/41) versus 20.4% (23/113) of cases ($p = 1.000$). Documented complication rate based on operative log entries was 1.3% (2/154; bile leak in one patient per group). No biliary injuries, duodenal injuries, or bleeding events were documented.

Conclusions

In this verified cohort of 154 patients undergoing emergency transcystic LCBDE, choledochoscope-assisted and Dormia basket-only approaches showed no statistically significant difference in rates of cannulation, intraoperative CBD clearance, postoperative ERCP requirement, or complications. Single-

stage LCBDE is safe and effective in acute-care settings regardless of technique. Technique selection should be guided by intraoperative anatomy, stone burden, and available equipment rather than perceived superiority of either approach. Prospective randomised studies in matched acute-care cohorts are required to refine technique-selection criteria.

Article Summary

What is already known on this topic

• Single-stage transcystic LCBDE combined with LC reduces staged ERCP-based management and is safe in elective and mixed cohorts.

• Choledochoscope-assisted extraction enables direct stone visualisation; Dormia basket-only extraction requires a simpler instrument profile.

• No large comparative study has examined these two techniques specifically in a purely acute-care emergency surgical setting.

What this study adds

• In a verified cohort of 154 emergency LCBDE cases, choledochoscope-assisted and Dormia basket-only techniques showed no statistically significant difference on any measured outcome: ~90% cannulation success using a primary-attempt strategy, ~82% per-protocol CBD clearance, ~20% postoperative ERCP, and ~1.3% documented bile leak rate. Diagnoses were grouped into acute cholecystitis and biliary colic categories based on operative and clinical documentation.

• No statistically significant difference was found on any measured outcome (all $p \geq 0.463$).

• Both techniques are safe and viable in acute-care pathways; choice should be individualised to anatomy and available equipment.

Background

Biliary tract disease, including cholelithiasis and concomitant choledocholithiasis, is among the most common causes of emergency surgical admission worldwide, contributing substantially to morbidity and healthcare expenditure [1]. The conventional two-stage management pathway — endoscopic retrograde cholangiopancreatography (ERCP) for ductal clearance followed by interval laparoscopic cholecystectomy (LC) — is effective but carries the cumulative risks of procedure-specific complications (post-ERCP pancreatitis, bleeding, perforation), repeated general anaesthesia, prolonged hospitalisation, and the logistical burden of a staged admission [2, 3].

Single-stage management — laparoscopic common bile duct exploration (LCBDE) performed concurrently with LC — has attracted increasing interest as a means of achieving definitive biliary

clearance in a single operative episode. Multicentre series, randomised trials, and systematic reviews have consistently demonstrated high clearance rates and favourable perioperative safety profiles for transcystic LCBDE [4–7], with feasibility confirmed even in paediatric cohorts and after prior failed ERCP [8, 9, 17]. Adoption nonetheless remains limited in many centres, driven by the perceived need for specialised endoscopic equipment, a learning curve, and limited exposure during surgical training [10].

Two principal transcystic techniques are in current use. Choledochoscope-assisted LCBDE employs a flexible miniature endoscope introduced through the cystic ductotomy, enabling direct intraductal visualisation and targeted stone retrieval. Dormia basket-only LCBDE relies on fluoroscopic guidance to deploy a four-wire stone retrieval basket without endoscopic visualisation. Each technique carries theoretical advantages: the choledochoscope offers precision and visual confirmation of clearance; the Dormia basket is simpler, faster to set up, and available in virtually all laparoscopic suites. In practice, both are in routine use and technique selection is often opportunistic, governed by instrument availability and surgeon familiarity rather than evidence-based criteria.

Existing comparative data on these two approaches are sparse, and no study has specifically evaluated them in a purely acute-care setting — where inflammatory tissue planes, pericholecystic oedema, and friable cystic ducts may differentially affect the performance of each instrument. The present study aimed to compare outcomes of choledochoscope-assisted and Dormia basket-only transcystic LCBDE in patients undergoing emergency LC for acute cholecystitis or severe biliary colic, using both ITT and PP analytical frameworks. The study adheres to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Methods

Study Design and Setting

This retrospective observational cohort study was conducted at Hamad Medical Corporation (HMC), a tertiary referral centre with a dedicated Acute Care Surgery Unit serving as the primary emergency surgical facility for four satellite hospitals in Doha, Qatar. The study period spanned January 1, 2020 to December 31, 2021. The study protocol was approved by the HMC Medical Research Center (Approval No. MRC-01-25-700). All procedures were performed in accordance with the Declaration of Helsinki [11]. Patient consent for anonymised data use was obtained or waived according to institutional policy.

Dataset Verification

Data were extracted from a prospectively maintained operative log supplemented by the institutional electronic medical record. Prior to any statistical analysis, the complete dataset underwent formal row-level verification. Three entries were excluded: one patient who underwent laparoscopic cholecystectomy with intraoperative cholangiography only (LC + IOC) without CBDE and therefore did not meet the inclusion criterion of attempted LCBDE; and two duplicate entries identified by identical

hospital numbers. For each duplicate pair, the entry with the more complete outcome data was retained. The verified final cohort comprised 154 patients.

Participants

Inclusion Criteria

Admission to the Acute Care Surgery Unit with a diagnosis of acute cholecystitis confirmed according to Tokyo Guidelines 2018 [12] (clinical, laboratory, and imaging criteria) or severe biliary colic; presence of CBD stones confirmed by preoperative imaging (abdominal ultrasound, MRCP, or EUS) or intraoperative cholangiography; performance of attempted transcystic LCBDE during the same LC; and cholecystectomy completed within the index admission within 7 days of symptom onset.

Exclusion Criteria

Previous biliary surgery (prior cholecystectomy or biliary reconstruction); severe comorbidity precluding laparoscopy (ASA class IV–V); incomplete operative data; management by an ERCP-first approach; and cases in which LC + IOC was performed without any attempted LCBDE.

Technique Group Assignment

Patients were assigned to technique groups based on the primary instrument attempted at the time of LCBDE. Cases in which the choledochoscope was the first instrument attempted — whether successful or not, and including cases where a Dormia basket was subsequently used after choledochoscope failure — were assigned to the Choledochoscope group. Cases in which only a Dormia basket was attempted were assigned to the Dormia group. This primary-attempt rule was applied consistently across all 154 cases, including those with entries of 'YES/FAILED' in the choledochoscope column.

Variable Definitions

Cannulation success

successful entry of the cystic duct by any instrument attempted within the operative strategy, enabling performance of cholangiography and stone extraction. Cases where the choledochoscope failed but the Dormia basket subsequently achieved access were classified as cannulation success within the Choledochoscope group (primary-attempt strategy). This definition reflects procedural success of the treatment approach rather than isolated instrument performance.

Intraoperative CBD clearance

confirmed absence of filling defects on completion cholangiogram. Cases where saline flushing was used as an adjunct and subsequently achieved radiological clearance were classified as cleared; the flush represents an intraoperative manoeuvre and its success constitutes procedural clearance. Stones retained at completion of the operative procedure — regardless of subsequent ERCP outcome — were classified as retained (intraoperative outcome only).

Postoperative ERCP

any endoscopic retrograde cholangiopancreatography performed after the index operation, regardless of indication (retained stones, bile leak) or result (stone confirmed or not). Endoscopic ultrasound (EUS) and magnetic resonance cholangiopancreatography (MRCP) used for imaging only, without therapeutic endoscopic intervention, were not classified as postoperative ERCP.

Complications

explicitly documented events in the operative log or clinical record, including bile leak, pancreatitis, biliary injury, duodenal injury, and bleeding.

Surgical Technique

Laparoscopic Cholecystectomy

Performed using a standard four-port technique. The critical view of safety was obtained before division of the cystic duct and artery in all cases.

Intraoperative Cholangiography (IOC)

IOC was routinely performed via cystic duct cannulation using a cholangiography catheter to confirm the presence, number, and size of CBD stones and to delineate biliary ductal anatomy prior to LCBDE.

Choledochoscope-Assisted LCBDE

A 3 mm flexible choledochoscope was introduced through a cystic ductotomy under direct vision. Stones were identified endoscopically and retrieved using a Dormia basket passed through the working channel under endoscopic guidance. Ductal clearance was confirmed visually where possible and by repeat fluoroscopic cholangiography.

Dormia Basket-Only LCBDE

A four-wire Dormia basket was introduced through the cystic duct under fluoroscopic guidance without direct endoscopic visualisation. Stones were captured and extracted through multiple passes as required. Clearance was confirmed by cholangiography.

Saline Flushing

Pressurised saline flushing through the cystic duct was performed in cases of suspected residual sludge or debris, particularly following unsuccessful cannulation attempts or after basket passes. Clearance was confirmed fluoroscopically.

Technique Selection

Technique selection was an intraoperative decision made by the operating surgeon, based on cystic duct diameter and anatomy, stone burden, instrument availability, and individual experience. The study was conducted with the participation of eight consultant surgeons and supervised surgical trainees, representing variable levels of LCBDE experience in a real-world acute-care environment.

Postoperative Follow-up

Patients were followed up clinically and with imaging as indicated for a minimum of three months postoperatively. ERCP was performed if clinical findings, biochemistry, or imaging suggested retained CBD stones or biliary complication. EUS or MRCP were used for diagnostic evaluation in selected cases.

Statistical Analysis

Categorical variables are presented as frequencies and percentages; continuous variables as mean ± standard deviation (SD) or median (interquartile range, IQR). Between-group comparisons used Fisher's exact test for categorical data and the independent-samples *t*-test or Mann–Whitney *U* test for continuous variables, as appropriate. A p value < 0.05 was considered statistically significant. All statistical analyses were performed using SPSS v25 (IBM Corp., Armonk, NY, USA). Analyses were performed according to both ITT (all attempted cases) and PP (successfully cannulated cases only) frameworks. The study was conducted and reported in accordance with the STROBE guidelines for observational studies. Artificial intelligence language model assistance (Claude, Anthropic) was used in manuscript drafting and editing; all data analysis, clinical interpretation, and final content decisions were made by the authors.

Results

Participant Flow and Baseline Data

The final study cohort comprised **154 patients** who underwent attempted transcystic LCBDE during emergency laparoscopic cholecystectomy between January 2020 and December 2021. Three cases were excluded during dataset verification (one LC + IOC-only case without LCBDE attempt; two duplicate hospital-number entries), yielding the 154-patient cohort reported here.

The mean patient age was 38.8 years (SD = 12.3), with a female predominance (64.6%, n = 100). The majority were classified ASA 2 (35.1%, n = 54) or ASA 2E (28.6%, n = 44). The predominant surgical indications were acute cholecystitis (53.2%, n = 82) and severe biliary colic (46.8%, n = 72). Diagnoses were grouped into these two categories based on operative documentation and clinical record review.

Choledochoscope-assisted LCBDE was the primary attempted technique in **41 patients (26.6%)**, and Dormia basket-only LCBDE in **113 patients (73.4%)**. Figure 1 illustrates the patient flow from attempted LCBDE through cannulation, ductal clearance, and postoperative interventions.

Operative Outcomes

Using a primary-attempt strategy, cannulation success was **90.2% in the choledochoscope group (37/41)** and **90.3% in the Dormia group (102/113)** ($p = 1.000$). Cannulation failed in 4 (9.8%) and 11 (9.7%) patients, respectively. Among the choledochoscope failures, a Dormia basket was subsequently attempted in 4 cases and achieved successful access in 3; for analytical purposes, these 4 cases remain within the choledochoscope group per the primary-attempt rule.

Among successfully cannulated patients (per-protocol analysis), intraoperative CBD clearance was achieved in **30 of 37 (81.1%)** in the choledochoscope group and **84 of 102 (82.4%)** in the Dormia group ($p = 1.000$). Residual filling defects were identified at completion cholangiography in 7 (18.9%) and 18 (17.6%) patients, respectively. In the ITT analysis, clearance was 75.6% (31/41) versus 77.9% (88/113) ($p = 0.829$).

Saline flushing was employed as an adjunct in cases of failed cannulation — 1 of 4 choledochoscope failures (25.0%) and 4 of 11 Dormia failures (36.4%) — resulting in successful completion cholangiography without formal ductal entry in those cases. ITT clearance figures include these saline-flush successes, consistent with the predefined intraoperative clearance definition (any confirmed absence of filling defects on completion cholangiogram, irrespective of the method used to achieve it).

Overall, **31 of 154 patients (20.1%)** required postoperative ERCP. In the choledochoscope group, 8 patients (19.5%) underwent postoperative ERCP; in the Dormia group, 23 (20.4%) required ERCP ($p = 1.000$). Among patients in whom cannulation failed, ERCP was required in 2 of 4 (50.0%) in the choledochoscope group and 5 of 11 (45.5%) in the Dormia group ($p = 1.000$). In most cases, ERCP was performed for suspected retained CBD stones and was therapeutic; a small number had negative findings on ERCP or subsequent EUS, confirming that intraoperative cholangiography carries a modest false-positive rate for stone detection in this setting.

Table 1
Operative and Postoperative Outcomes by Technique Group (n = 154)

Outcome	Choledochoscope (n = 41)	Dormia Basket (n = 113)	p-value†
Cannulation success	37/41 (90.2%)	102/113 (90.3%)	1.000
Cannulation failure	4/41 (9.8%)	11/113 (9.7%)	1.000
CBD clearance — ITT	31/41 (75.6%)	88/113 (77.9%)	0.829
CBD clearance — PP*	30/37 (81.1%)	84/102 (82.4%)	1.000
Retained stone — ITT	10/41 (24.4%)	25/113 (22.1%)	0.829
Postoperative ERCP	8/41 (19.5%)	23/113 (20.4%)	1.000
ERCP after cannulation failure	2/4 (50.0%)	5/11 (45.5%)	1.000
Saline flushing among failures	1/4 (25.0%)	4/11 (36.4%)	1.000
Bile leak	1/41 (2.4%)	1/113 (0.9%)	0.463
Pancreatitis	0/41 (0.0%)	0/113 (0.0%)	—
Biliary injury	0/41 (0.0%)	0/113 (0.0%)	—
Duodenal injury	0/41 (0.0%)	0/113 (0.0%)	—
Bleeding	0/41 (0.0%)	0/113 (0.0%)	—

**PP = per-protocol analysis (successfully cannulated cases only: choledochoscope n = 37, Dormia n = 102). †All p-values from Fisher's exact test, two-tailed. ITT = intention-to-treat. ERCP = endoscopic retrograde cholangiopancreatography. CBD = common bile duct.*

ITT and Per-Protocol Analyses

In the ITT analysis, overall CBD clearance was 75.6% for the choledochoscope group and 77.9% for the Dormia group ($p = 0.829$). Postoperative ERCP was required in 19.5% versus 20.4% ($p = 1.000$). In the PP analysis restricted to successfully cannulated cases, CBD clearance was 81.1% and 82.4% respectively ($p = 1.000$). Postoperative ERCP among PP cases was 13.5% (5/37) versus 18.6% (19/102) ($p = 0.611$). Results are presented in Table 2. No significant differences were identified between groups in either analytical framework.

Table 2
Intention-to-Treat and Per-Protocol Analysis (n = 154)

Outcome	Choledochoscope	Dormia Basket	p-value†
ITT analysis (all attempted: C n = 41, D n = 113)			
CBD clearance	31/41 (75.6%)	88/113 (77.9%)	0.829
Postoperative ERCP	8/41 (19.5%)	23/113 (20.4%)	1.000
PP analysis (cannulated cases: C n = 37, D n = 102)			
CBD clearance	30/37 (81.1%)	84/102 (82.4%)	1.000
Postoperative ERCP among PP cases	5/37 (13.5%)	19/102 (18.6%)	0.611

†Fisher's exact test, two-tailed. ITT = intention-to-treat (all attempted cases). PP = per-protocol (successfully cannulated cases only). C = Choledochoscope group. D = Dormia group.

Postoperative Complications

The documented complication rate based on operative log entries was **1.3% (2/154)**. Bile leak occurred in one patient in the choledochoscope group (1/41, 2.4%) and one in the Dormia group (1/113, 0.9%) (p = 0.463); both were managed conservatively. No pancreatitis, biliary injuries, duodenal injuries, or bleeding events were documented in the operative log.

The 30-day readmission rate for biliary complications was 1.9% (n = 3). One patient was readmitted for a retained CBD stone, one for a gallbladder-bed collection managed with interventional radiology drainage, and one for persistent abdominal pain following ERCP stenting, treated conservatively. The mean length of hospital stay was 5.4 days (SD = 4.2). The majority of patients (65.6%, n = 101) required more than three days of hospitalisation, reflecting the complexity of managing concomitant cholecystitis and choledocholithiasis in the acute setting.

Discussion

Principal Findings

This study compared choledochoscope-assisted and Dormia basket-only transcystic LCBDE in 154 patients undergoing emergency laparoscopic cholecystectomy for acute biliary presentations. The central finding is that no statistically significant difference was identified on any measured outcome: both techniques achieved comparable rates of cannulation success (~ 90%), per-protocol CBD clearance

(~ 82%), postoperative ERCP (~ 20%), and bile leak (~ 1.3%). This finding has important practical implications for technique selection, training, and resource planning in acute-care surgical units.

Interpretation of Key Findings

The comparable cannulation success rates, using a primary-attempt strategy (90.2% vs 90.3%, p = 1.000), merit careful interpretation. These figures reflect success of the overall operative strategy — including rescue by a second instrument when the primary instrument failed — rather than the isolated technical performance of each instrument alone. This is a methodologically accepted approach when comparing treatment strategies rather than individual devices, and is consistent with how single-stage LCBDE is deployed in practice, but readers should be aware that true first-instrument cannulation success rates would be lower. Earlier versions of this dataset, prior to systematic variable coding, appeared to show large differences in cannulation success between groups — ranging from 75% to 91% depending on how cases of sequential instrument use were assigned. Once a consistent primary-attempt rule was applied (cases where the choledochoscope was the intended primary instrument classified to the choledochoscope group regardless of whether Dormia rescue was subsequently used), the apparent difference dissolved entirely. This serves as a methodological caution for future LCBDE comparative studies: technique assignment rules must be pre-specified and applied consistently to all cases including those with instrument switching.

The comparable per-protocol CBD clearance rates (81.1% vs 82.4%) are consistent with published data for both techniques in mixed cohorts. Zhou et al. reported choledochoscope-assisted clearance rates of 88–92% in a larger retrospective series [3], and our result of 81.1% likely reflects the additional challenge of acute inflammatory anatomy — pericholecystic oedema, friable tissue, and restricted cystic duct mobility — that characterises emergency rather than elective cases. The Dormia group's 82.4% per-protocol clearance is notably higher than might be expected from earlier reports in mixed elective series, possibly reflecting surgeon-level selection of straightforward cases for the Dormia approach, or the utility of intraoperative saline flushing as an adjunct.

The postoperative ERCP rates of approximately 20% in both groups merit contextualisation. This figure encompasses ERCPs performed for suspected retained stones (the majority, most of which were therapeutic), for bile leak management (one case), and cases where ERCP was performed on clinical suspicion but revealed no residual stone on endoscopic evaluation or subsequent EUS. The overall rate is consistent with published series in acute-care LCBDE [14, 15], and the absence of a significant difference between groups confirms that neither technique confers a clinically meaningful advantage in ERCP avoidance in this setting.

Saline flushing was employed in 25.0% of choledochoscope cannulation failures and 36.4% of Dormia failures, with procedural success in all flushed cases. This adjunct appears effective for small-calibre debris and sludge and does not require formal duct entry; its liberal use in cases of initial instrument failure is supported by these data.

The Findings in Context

The absence of significant outcome differences in this study does not imply that the two techniques are identical or interchangeable in all clinical contexts. Choledochoscope-assisted LCBDE is widely considered advantageous for difficult cases — multiple or impacted stones, complex anatomy, uncertain stone location — where direct intraductal visualisation offers diagnostic and therapeutic precision [10, 15]. The Dormia basket's simplicity, shorter setup time, and universal availability make it the practical default in most acute-care scenarios, particularly where choledochoscope availability is inconsistent or surgeon experience with flexible choledochoscopy is limited.

What the present data do support is that in an unselected, real-world acute-care emergency cohort, the pragmatic outcomes of both approaches — as measured by what ultimately happens to the patient — showed no statistically significant differences. A ~ 20% postoperative ERCP rate and ~ 82% per-protocol clearance were observed with both approaches when integrated into a systematic acute-care LCBDE programme. This supports the practice of adapting technique to available resources and intraoperative anatomy rather than committing to either approach categorically.

Comparison with Existing Literature

These findings are consistent with the broader body of evidence supporting single-stage transcystic LCBDE as a safe and effective alternative to staged ERCP-based management. Wu et al. [2] demonstrated shorter hospital stays and fewer complications with single-stage LCBDE versus ERCP + LC in elderly patients. The UK-wide P-ALiCE study by Tanase et al. [4] found transcystic LCBDE to be the preferred approach in 68% of cases with high clearance and low morbidity. Multicentre series by Zhang et al. [5], Xie et al. [6], and Wang et al. [7] have further validated the technique's safety and ductal clearance across large populations. Morton et al. [14] demonstrated that LCBDE by acute-care surgeons reduces time-to-treatment and cost compared with ERCP. These benchmarks support the overall safety and effectiveness of LCBDE as demonstrated in the present series.

Directly comparative data between choledochoscope and Dormia basket approaches are sparse. El-Ghamry et al. [18] reported differences in operative times between approaches in a prospective series but did not compare these specific extraction modalities. Al-Ardah et al. [19] confirmed the safety of index-admission LCBDE without technique differentiation. Pogorelić et al. [20] demonstrated successful Dormia use in paediatric LCBDE without head-to-head comparison. The present study provides the most direct comparison to date of these two techniques in an acute-care emergency population.

Clinical Implications

For acute-care surgical units developing or expanding LCBDE programmes, these data have several practical implications. First, the absence of technique-level outcome differences supports a strategy of **standardising to whichever approach is most reliably available and within the team's competency**, rather than investing solely in choledochoscope infrastructure on the assumption of superiority. Second, the ~ 20% postoperative ERCP rate — comparable between both approaches — should be framed as an

expected component of single-stage LCBDE practice rather than a failure: it represents residual stones appropriately identified by completion cholangiography and cleared endoscopically, avoiding the complications and delays of missed bile duct stones. Third, the documented complication rate of 1.3% based on operative log entries confirms that LCBDE can be safely integrated into emergency surgical workflows across teams of varying experience when supported by consistent technique, systematic completion imaging, and a clear postoperative ERCP protocol; acknowledging that late or externally managed events may not be fully captured in operative records.

For centres where choledochoscope access is limited, these results provide direct evidence that Dormia basket-only LCBDE achieves comparable outcomes and should not be considered a lesser alternative. For centres with consistent choledochoscope availability and trained operators, the scope-assisted approach remains valuable for complex cases, with no detriment in routine cases.

Limitations

The retrospective design with intraoperative technique allocation prevents randomisation and limits causal conclusions. The operative log did not capture stone burden, CBD diameter, or detailed acute cholecystitis severity grade in a standardised format, preventing covariate adjustment or subgroup analysis by case complexity. The group size imbalance (41 vs 113) reflects real-world practice and reduces statistical power; a true modest difference between techniques — of the order of 5–8 percentage points in clearance — could not be reliably detected at this sample size. Complications were identified from operative documentation and may underestimate delayed or externally managed events not captured in the operative log; a systematic prospective complication register would have improved ascertainment. Finally, operator experience with each technique was not individually quantified, and surgeon-level effects may have contributed to outcomes.

Future Directions

Adequately powered prospective randomised controlled trials comparing choledochoscope-assisted and Dormia basket-only LCBDE in matched acute-care cohorts, stratified by stone burden and cystic duct anatomy, are required. Patient-level data including baseline CBD diameter, stone number and size, and acute cholecystitis severity grade should be collected prospectively to enable covariate-adjusted comparisons. Cost-effectiveness analyses incorporating device costs, operative time, and ERCP avoidance are needed to inform resource planning. Standardised training pathway data from programmes such as the LIBERTI initiative [10] would strengthen the evidence base for LCBDE competency frameworks across both techniques.

Strengths and Limitations of this Study

Strengths

The primary strength of this study is its execution in a strictly acute-care environment — patients admitted as emergencies and operated on within the index admission — rather than the mixed elective and urgent populations that characterise most published LCBDE series. This setting adds real-world applicability to a literature dominated by elective data. The participation of eight consultant surgeons and their trainees across varying experience levels further enhances external validity by reflecting authentic acute-care operative teams.

A second strength is the prospective operative log from which outcome data were derived, enabling systematic case-by-case verification. All ambiguous entries were adjudicated using pre-specified rules before statistical analysis, and three erroneous entries (one non-LCBDE case and two duplicates) were identified and excluded, improving dataset integrity over prior versions. This study represents, to our knowledge, the first direct comparison of Dormia basket-only and choledochoscope-assisted LCBDE in a purely acute-care context.

Limitations

The retrospective design limits causal inference; technique selection was surgeon-led and intraoperatively determined, introducing potential selection bias. The study cannot rule out the possibility that more complex cases were preferentially assigned to the choledochoscope group. The marked group size imbalance (41 vs 113) reflects real-world practice but reduces statistical power; the current sample is underpowered to detect modest true differences between techniques. Baseline demographics — particularly stone burden, CBD diameter, and acute cholecystitis severity grading — were not uniformly available from the operative log and could not be compared between groups. Complications were identified from operative documentation and may underestimate delayed or externally managed events; the reported rate of 1.3% should be interpreted as the documented rate from operative log entries rather than a comprehensive clinical incidence. Length of stay and 30-day readmission data were partially available and are reported descriptively. A formal cost analysis was not performed.

Conclusions

In this verified cohort of 154 patients undergoing emergency transcystic LCBDE, choledochoscope-assisted and Dormia basket-only approaches showed no statistically significant difference on any measured endpoint: cannulation success using a primary-attempt strategy (~ 90%), per-protocol CBD clearance (~ 82%), postoperative ERCP (~ 20%), and documented bile leak rate (~ 1.3%), with no biliary or duodenal injuries recorded. Single-stage transcystic LCBDE is safe and effective in an acute-care emergency setting regardless of technique. Technique selection should be guided by intraoperative anatomy, stone complexity, and locally available equipment and expertise rather than an assumption of technique-level superiority. These findings support the broader adoption of LCBDE in emergency surgical pathways and provide the first directly comparative data on these two approaches in a purely acute-care

context. Prospective multicentre studies are warranted to confirm these findings and to establish evidence-based criteria for technique selection.

Abbreviations

ASA
American Society of Anesthesiologists
CBD
common bile duct
ERCP
endoscopic retrograde cholangiopancreatography
EUS
endoscopic ultrasound
HMC
Hamad Medical Corporation
IOC
intraoperative cholangiography
IQR
interquartile range
ITT
intention-to-treat
LC
laparoscopic cholecystectomy
LCBDE
laparoscopic common bile duct exploration
LOS
length of stay
MRCP
magnetic resonance cholangiopancreatography
PP
per-protocol
SD
standard deviation
SPSS
Statistical Package for the Social Sciences
STROBE
Strengthening the Reporting of Observational Studies in Epidemiology.

Declarations

Ethics approval and consent to participate

This study was approved by the Hamad Medical Corporation Medical Research Center (approval number: MRC-01-25-700) and was conducted in accordance with the Declaration of Helsinki. Patient consent for anonymised data use was obtained or waived in accordance with institutional policy.

Consent for publication

Not applicable. This manuscript contains no individual person's data in any form.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request. Patient data were de-identified and managed in accordance with institutional data protection policies. Public sharing of the raw dataset is not permitted due to ethical and institutional restrictions.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

MQA conceived the study, oversaw data collection, contributed to data analysis and interpretation, and revised the manuscript critically. AAE contributed to data collection, literature review, and drafting of the manuscript. FAI contributed to data collection and verification. AZ contributed to study design and critical revision of the manuscript. AS conceived and designed the study, led data verification and statistical analysis, drafted and revised the manuscript, and is responsible for the overall integrity of the work. All authors read and approved the final manuscript.

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Figures

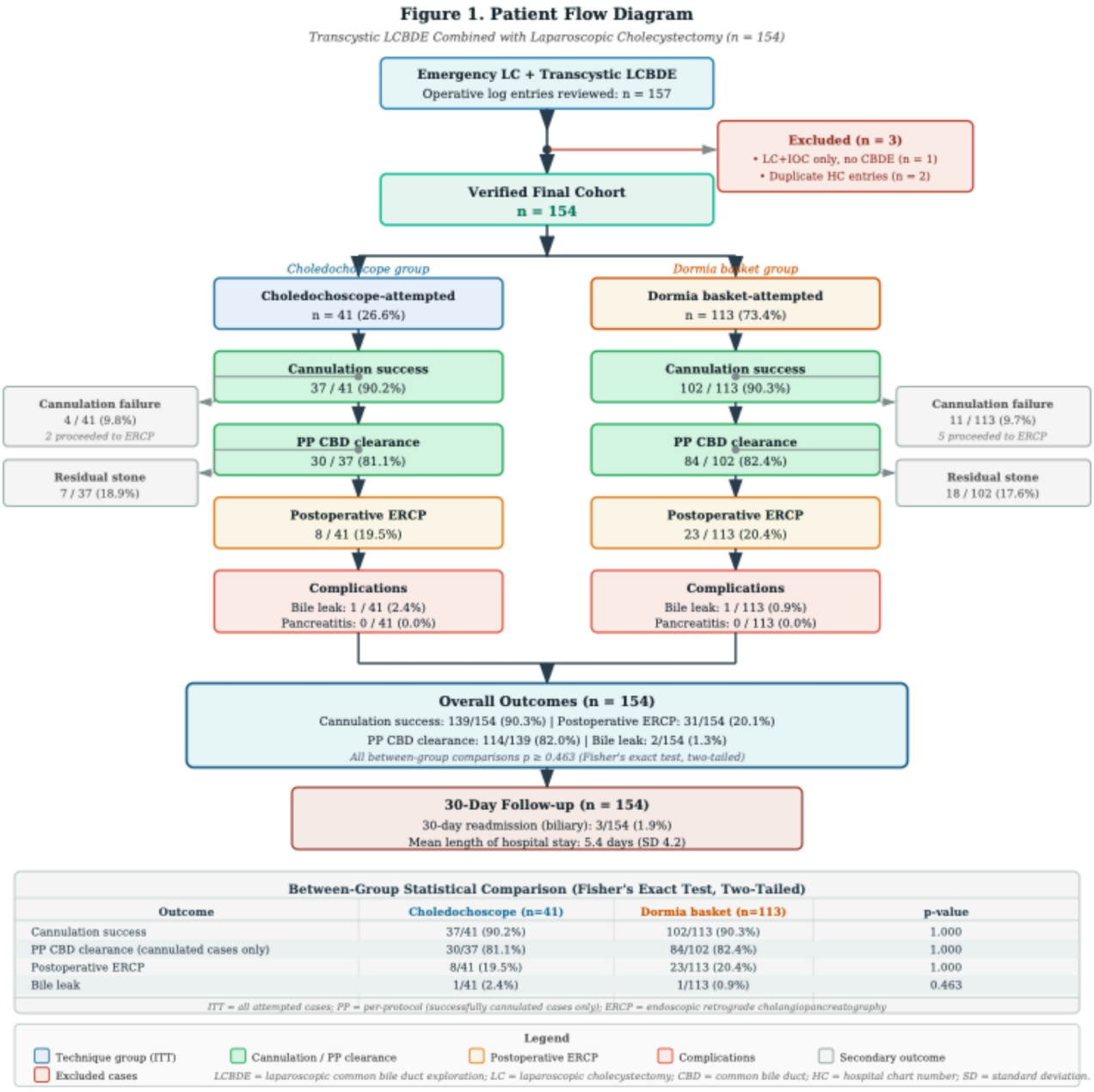


Figure 1

Patient flow diagram. Of 154 patients undergoing attempted transcystic LCBDE, 41 (26.6%) were in the Choledochoscope group and 113 (73.4%) in the Dormia group. Cannulation was successful in 37/41 and 102/113 respectively. Per-protocol CBD clearance was achieved in 30/37 and 84/102 respectively. Postoperative ERCP was performed in 8/41 and 23/113 respectively.

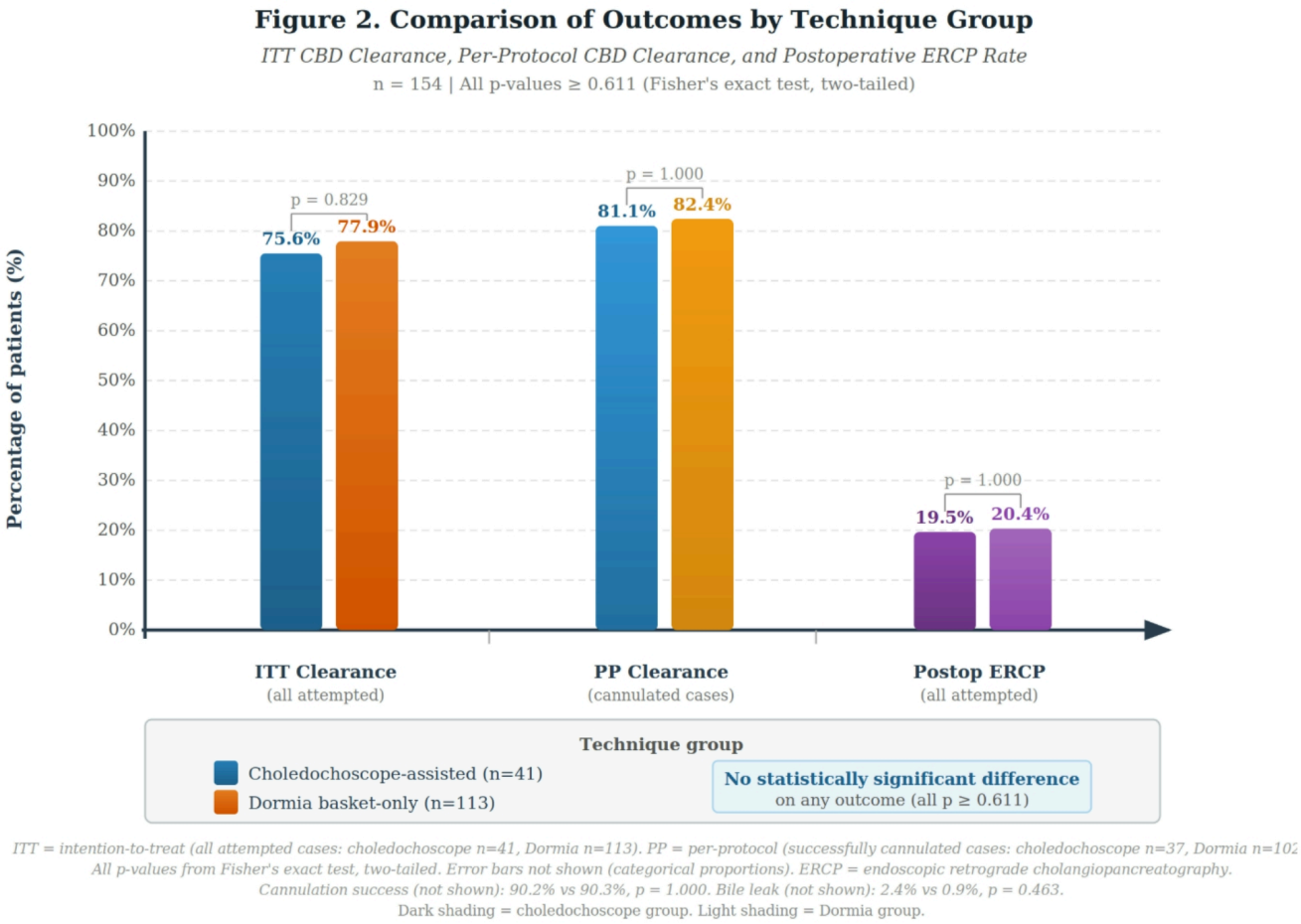


Figure 2

Comparison of intention-to-treat and per-protocol outcomes by technique group. Bar chart showing CBD clearance and postoperative ERCP rates under ITT (Choledochoscope: clearance 75.6%, ERCP 19.5%; Dormia: clearance 77.9%, ERCP 20.4%) and PP (Choledochoscope: clearance 81.1%; Dormia: clearance 82.4%) frameworks. All differences non-significant (Fisher's exact test, all p≥0.611).