Original Research

A COMPARATIVE STUDY ON LAPAROSCOPIC COMMON BILE DUCT EXPLORATION VERSUS ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY IN THE MANAGEMENT OF CHOLEDOCHOLITHIASIS

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ABSTRACT

Introduction: Choledocholithiasis occurs in 8-20% of patients with symptomatic gallstones, with increased incidence in older adults and those with recurrent biliary symptoms. The clinical presentation of choledocholithiasis ranges from asymptomatic cases, often detected incidentally on imaging, to severe manifestations, including acute cholangitis and gallstone pancreatitis, which require urgent intervention. Treatment modalities include Laparoscopic common bile duct exploration (LCBDE) and endoscopic retrograde cholangio-pancreatography (ERCP) Materials & methods: This is a Comparative Cross-sectional study conducted in Department of Surgery, in Thoothukudi. Study was done for a period of 18 months including 12 months for patient recruitment and treatment, and 6 months for follow-up. This includes 60 patients, with 30 patients in each group (LCBDE+LC and ERCP+LC) Results: The mean age of study participants was 44 years. Females were predominantly affected than males. Jaundice prevalence: 23.3% in ERCP and 20% in LCBDE. Mean procedure time and Overall complication rate were 180 minutes, 26.7% for ERCP and 170 minutes, 16.7% for LCBDE respectively. Conclusion: Both ERCP and LCBDE were shown to be effective and safe in treating choledocholithiasis, with comparable procedure duration and complication profiles. The choice between ERCP and LCBDE may depend on institutional expertise, patient-specific factors, and resource availability

Keywords: Choledocholithiasis, Gall stones, Jaundice, LCBDE, ERCP

INTRODUCTION

Choledocholithiasis, defined as the presence of gallstones in the common bile duct (CBD), is a common complication of gallstone disease, affecting 10-20% of patients with cholelithiasis(1). This condition presents significant clinical challenges due to its potential to cause obstructive jaundice, cholangitis, acute pancreatitis, and, in severe cases, life-threatening sepsis. Effective management of choledocholithiasis is essential to alleviate symptoms, prevent complications, and improve patient quality of life. Over the past few decades, advancements in minimally invasive techniques have revolutionized the treatment landscape, with laparoscopic common bile duct exploration (LCBDE) and endoscopic retrograde cholangiopancreatography (ERCP) emerging as the primary modalities for CBD stone management(2). LCBDE extends the principles of laparoscopic cholecystectomy to manage CBD stones in a single-stage procedure but it requires advanced laparoscopic expertise, specialized equipment, and intraoperative imaging, which may limit its feasibility in resource-constrained settings. ERCP has become a cornerstone for managing choledocholithiasis, particularly in patients unsuitable for surgery or those with retained stones post cholecystectomy. While ERCP is highly effective, with stone clearance rates of 90-98%, it carries risks of complications, including post-ERCP pancreatitis, bleeding, perforation, and cholangitis. Additionally, ERCP requires a multidisciplinary team increasing procedural complexity and costs (3).

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Aim: This study aims to compare the effectiveness and safety of LCBDE and ERCP in the management of choledocholithiasis.

MATERIALS & METHODS

Study Design:

A Longitudinal Cross-sectional study

Study Setting: Department of General Surgery, Thoothukudi Medical College and Hospital, a tertiary care public institution in Tamil Nadu

Study Duration: Total duration of 18 months, including 12 months for patient recruitment and treatment, and 6 months for follow-up.

Methodology: Patients are randomly allocated into two groups LCBDE+LC or ERCP+LC using computer-generated random number tables.

Sample Size: 60 patients, with 30 patients in each group (LCBDE+LC and ERCP+LC). It was calculated based on expected difference in stone clearance rates (90% for ERCP vs. 85% for LCBDE), with 80% power, 5% significance level, and 10% dropout rate.

Inclusion Criteria: 1.Patients aged 18–70 years diagnosed with choledocholithiasis, confirmed by imaging (ultrasound, MRCP, or CT abdomen).

2. Presence of concomitant gallbladder stones requiring cholecystectomy.

3. American Society of Anaesthesiologists (ASA) grade I–III, fit for general anaesthesia or sedation.

4. Willingness to participate and provide informed consent.

Exclusion Criteria: 1. Patients with previous cholecystectomy done 2. Altered biliary anatomy (e.g., Roux-en-Y gastric bypass, Billroth II gastrectomy) precluding standard LCBDE or ERCP.

3. Severe comorbidities (ASA grade IV–V) unfit for surgery or endoscopy.

4. Suspected or confirmed malignancy of the biliary tract or pancreas.

5. Acute severe pancreatitis requiring intensive care management. Screening Process: All patients presenting to the General Surgery outpatient department or emergency ward with suspected choledocholithiasis are screened. Initial evaluation includes history, physical examination, Liver function tests, and abdominal ultrasound. Confirmatory imaging (MRCP preferred, CT if MRCP unavailable) is performed to verify CBD stones.

Group A: LCBDE + Laparoscopic Cholecystectomy:

Preoperative Preparation: Patient was advised fasting for 6 hours prior to surgery. Prophylactic antibiotics (ceftriaxone 1 g IV) was administered 30 minutes before incision. Procedure: The procedure was performed under general anesthesia in the operating theater. Standard four-port laparoscopic cholecystectomy setup (10 mm umbilical, 10 mm epigastric, two 5 mm right subcostal ports) was used. Intraoperative cholangiography (IOC) performed via cystic duct to confirm CBD stones and anatomy. Transcystic Approach was preferred for stones <8 mm, non-dilated CBD). Flexible choledochoscope (3–5 mm) inserted through cystic duct. Stones extracted using Dormia baskets or balloon catheters. Saline flushing or glucagon used to dislodge small stones. Choledochotomy Approach was done for stones >8 mm or dilated CBD >8 mm.Longitudinal CBD incision made, stones removed with choledochoscope or baskets. CBD closed with absorbable sutures (e.g., 4-0 PDS) or T-tube placed if high risk of bile leak.Completion IOC confirms stone clearance and duct patency. Gallbladder removed, and ports closed with sutures.

Postoperative Care: Monitored in surgical ward for 24–48 hours for bile leak, pain, or infection. Oral fluids started 6 hours post-procedure, progressing to regular diet by day

1. Analgesics (paracetamol, tramadol) provided for pain control. T-tube, if placed, removed after 2–4 weeks following cholangiogram. Discharge planned on day 2–4 if no complications.

Group B: ERCP + Laparoscopic Cholecystectomy:

Preoperative Preparation: Patient advised fasting for 6 hours prior to ERCP. Prophylactic antibiotics (ceftriaxone 1 g IV) and rectal indomethacin (100 mg) to prevent PEP. Baseline LFTs, CBC, and coagulation profile assessed. ERCP Procedure: Performed under moderate sedation (midazolam, fentanyl) in the endoscopy suite. Side-viewing duodenoscope advanced to the second part of duodenum to locate papilla of Vater. Selective CBD cannulation using sphincterotome, guided by fluoroscopy with contrast injection. Endoscopic sphincterotomy performed to facilitate stone extraction. Stones removed using Dormia baskets or balloon catheters. Mechanical lithotripsy used for stones >10 mm. Biliary stent placed if incomplete clearance or high cholangitis risk. Procedure duration typically 30–60 minutes. Post-ERCP Care: Monitored for 4–6 hours for PEP, bleeding, or perforation. Oral fluids started 4 hours post-procedure if no complications. Discharge planned on day 1–2 if stable.

Laparoscopic Cholecystectomy: Performed within 2–4 weeks post-ERCP under general anesthesia. Standard four-port technique, as described for LCBDE group. Gallbladder removed, and patients discharged on day 1–2 post-LC. Postoperative Care: Similar to LCBDE group, with monitoring for pain, infection, or delayed complications.

Ethical Considerations: Ethical approval was obtained from the Institutional Ethics Committee, Thoothukudi Medical College, and Hospital.

Written informed consent obtained from all participants in Tamil or English, explaining procedures, risks, and benefits.

Statistical Analysis: The collected data were analysed with IBM.SPSS statistics software 25.0

Version. Results: 60 patients participated in the study. Table-1 shows age distribution of the participants. Mean age of the participants was 44 years where the ERCP group had a mean age of 45.2 years, and the LCBDE group averaged 42.8 years (p=0.48), indicating no significant age difference. In Fig-1 Females comprised 66.7% of the ERCP group and 63.3% of the LCBDE group, reflecting the higher prevalence of gallstone disease in women, likely due to oestrogen's role in bile cholesterol saturation. The various other parameters like complaints and comorbidities among the two groups has been described in Table-3.

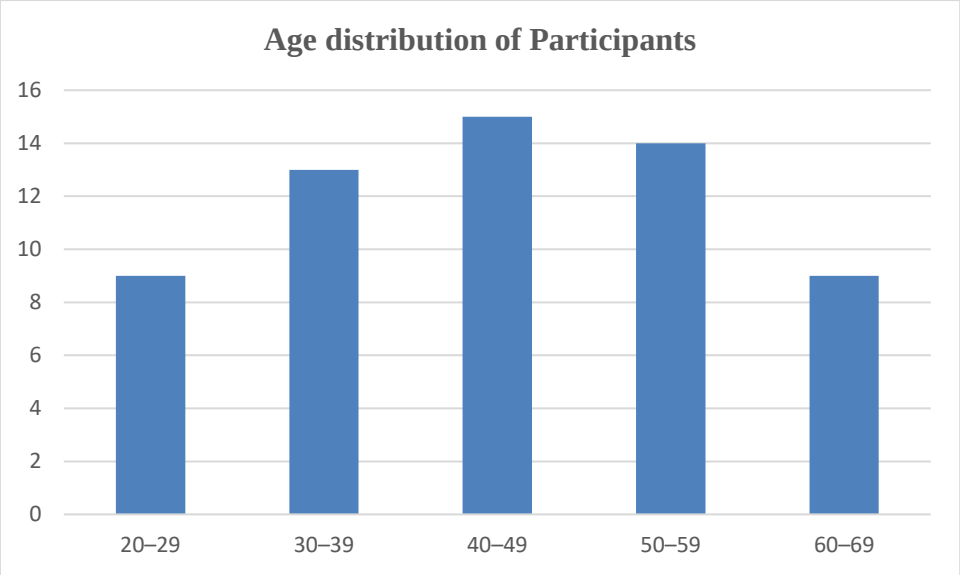

Fig -1 Age Distribution of Participants

Table -1: Statistical Findings in Age Distribution

Parameter	Mean (SD)	Median	Minimum	Maximum
Age	44 (12)	44	20	68

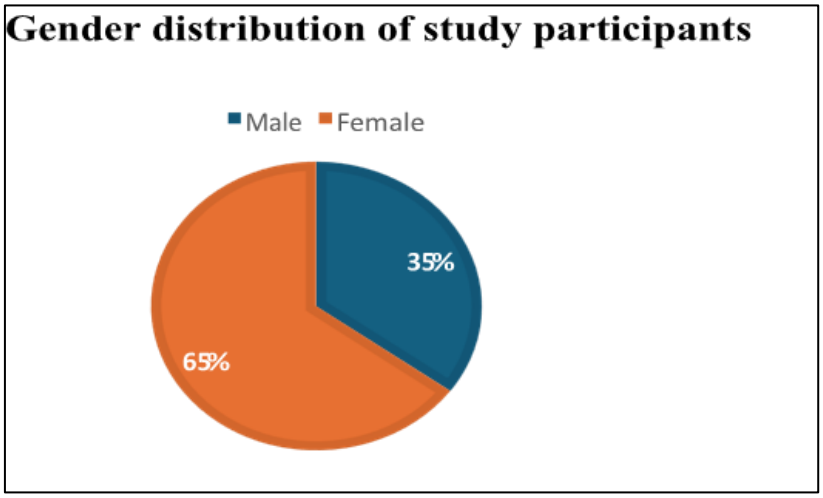

Fig - 2 Gender Distribution of Study Participants

Table -2: Distribution of Parameters among Study Groups

Parameter	Category	ERCP	LCBDE	P value
Gender	Male	10 (33.3%)	11 (36.7%)	0.79
	Female	20 (66.7%)	19 (63.3%)	

Complaints	Right Upper Quadrant Pain	26 (86.7%)	25 (83.3%)	0.74
	Epigastric Pain	22 (73.3%)	20 (66.7%)	0.60
	Nausea/Vomiting	21 (70.0%)	19 (63.3%)	0.58
	Biliary Colic	15 (50.0%)	18 (60%)	0.44
	Clinical Pancreatitis	10 (33.3%)	9 (30.0%)	0.79
Jaundice	Present	7 (23.3%)	6 (20%)	0.75
	Absent	23 (76.7%)	24 (80%)	
Comorbidity	Diabetes Mellitus	6 (20.0%)	5 (16.7%)	0.74
	Hypertension	8 (26.7%)	7 (23.3%)	0.77
	Cardiovascular Disease	3 (10.0%)	2 (6.7%)	0.64
	Chronic Liver Disease	2 (6.7%)	1 (3.3%)	0.55
	No Comorbidities	15 (50.0%)	16 (53.3%)	0.80

The mean procedure time was 180 minutes for ERCP (range: 110–270 min) and 170 minutes for LCBDE (range: 80–380 min), with no significant difference. The wide ranges reflect variability in case complexity (e.g., stone size, number) or operator experience, yet the lack of statistical difference suggests operational equivalence in this setting. The similarity in procedure time is notable, as LCBDE's surgical nature might be expected to require more time than ERCP's endoscopic approach. The various complications for the two procedures are compared in Table -4. The post-operative complications were followed up in less than a week, 1 to 4 weeks, 1 to 6 months, and more than 6 months. Most patients experienced no complications: at <1 week, 73.3% in ERCP (22/30) and 83.3% in LCBDE (25/30), p=0.49; at 1–4 weeks, 80.0% vs. 86.7%, p=0.52; at 1–6 months, 86.7% vs. 93.3%, p=0.55; at >6 months, 90.0% vs. 96.7%, p=0.31. No major complications reported after 6 months. There is no statistically significant differences in demographics, procedure time, or complications (p-values >0.05), indicating comparable outcomes between ERCP and LCBDE

Table -3: Time Taken for Procedure

Group	Mean, (SD) min		Median, min	Minimum, min	Maximum, min	P Value
ERCP	180 (35)		175	110	270	0.39
LCBDE	170 (40)		165	80	380	

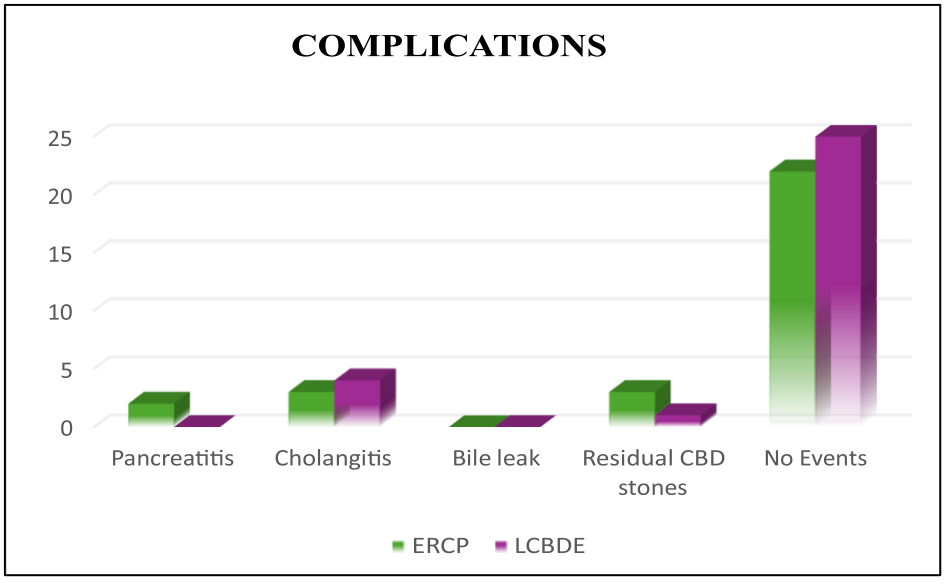

Fig 3: Comparison of Complications across Study Groups

Table -4: Comparison of Post-Operative Events among ERCP and LCBDE Group

Event	ERCP No. (%)	LCBDE No. (%)	P Value
Post-operative events at <1 week			
Cholangitis	3 (10.0%)	4 (13.3%)	0.69
Pancreatitis	1(3.3%)	0 (0%)	0.12

Bile leak	0 (%)	0 (0%)	0
Residual CBD stones	3 (10%)	1 (3.3%)	0.52
No Events	22 (73.3%)	25 (83.3%)	0.49
Post-operative events at 1 – 4 weeks			
Cholangitis	2 (6.7%)	3 (10.0%)	0.64
Pancreatitis	1 (3.3%)	0 (0%)	0.12
Residual CBD stones	3 (10%)	1 (3.3%)	>0.99
Bile leak	0 (0%)	0 (0%)	0
No Events	24 (80.0%)	26 (86.7%)	0.52
Post-operative events at 1 to 6 months			
Minor Complications (e.g., recurrent pain)	1 (3.3%)	1 (3.3%)	>0.99
Pancreatitis	0 (0%)	0 (0%)	0
Residual CBD stones	3 (0%)	1 (3.3%)	0.31
Bile leak	0 (0%)	0 (0%)	0
No Events	26 (86.7%)	28 (93.3%)	0.55
Post-operative events at >6 months			
Minor Complications (e.g., recurrent pain)	0 (0%)	0 (0%)	0
Major Complications (e.g., stricture, cholangitis)	0 (0%)	0 (0%)	0
Residual Stone Detected	3(10%)	1 (3.3%)	0.31
Readmission	0 (0%)	0 (0%)	0
No Events	27 (90%)	29 (96.7%)	0.31

DISCUSSION

In this study, the age group of participants were middle-aged cohort in majority aligns with the typical demographic for choledocholithiasis, where gallstone disease peaks due to metabolic changes and dietary factors. Similar findings were found in Bansal et al (4) and Zhu et al studies(5). Meta-analysis of 5 RCTs (6) found comparable overall complication rates (ERCP: 7.5%, LCBDE: 7.2%), aligning with our study's lack of significant difference in early complications (e.g., cholangitis: p=0.69, pancreatitis: p=0.12). A study done by Rogers et al. a prospective RCT in USA reported stone clearance rates of 92% for ERCP and 88% for LCBDE (p=0.09) and found higher complications for ERCP (14%, PEP: 10%) than LCBDE(7). ERCP achieved a higher clearance rate (98% vs. 88.6%, p=0.01) in a study done by Al-Musawi et al.(8). ERCP had a higher success rate (94.3% vs. 88.9%, p=0.04), contrasting with our trend favouring LCBDE for residual stones in a study done by Li et al(9). LCBDE was more effective for large stones (>15 mm), aligning with our study's context of pigment stones in India. Bansal et al.(4) conducted in a similar resource-constrained setting, this RCT emphasized LCBDE's cost-effectiveness and lower PEP risk (7.1% vs. 3.3% in our study), aligning with our trend of no pancreatitis in LCBDE (p=0.12). Lyu et al. conducted a meta-analysis of 11 RCTs found LCBDE superior in complications (8.7% vs. 13.2%) and hospital stay (shorter by 1.2 days)(10). The focus on single-stage management reflects the need for efficient resource use in Indian public hospitals, where cost is a critical factor.

CONCLUSION

This cross-sectional study demonstrated that ERCP and LCBDE are both effective and safe for managing choledocholithiasis, with no significant differences in patient demographics, procedure times, or overall complication rates. Trends suggested a higher incidence of residual stones and pancreatitis in the ERCP group and cholangitis in the LCBDE group, but these were not statistically significant. The choice between ERCP and LCBDE may thus depend on institutional expertise, patient-specific factors, and resource availability, particularly in resource-constrained settings.

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