

A STUDY ON EARLY VERSUS DELAYED LAPAROSCOPIC CHOLECYSTECTOMY STATUS POST ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY

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ABSTRACT

Background: The optimal timing of laparoscopic cholecystectomy following endoscopic retrograde cholangiopancreatography (ERCP) remains controversial. Early surgery may reduce complications, but concerns regarding operative difficulty persist.

Objective: To compare operative and postoperative outcomes of early versus delayed laparoscopic cholecystectomy in patients undergoing ERCP for gallstone-related biliary disease.

Methods: This observational study included 76 patients, divided equally into early (within 24–72 hours) and delayed (after 4–6 weeks) laparoscopic cholecystectomy groups. Demographic, clinical, operative, and postoperative data were analyzed using appropriate statistical tests.

Results: Baseline characteristics were comparable between groups. Operative time >90 minutes was significantly higher in the delayed group (16; 42.1%) compared to the early group (4; 10.6%). Dense adhesions were observed in 18 (47.4%) delayed cases versus 8 (21.1%) early cases. Fibrosed gallbladder was more frequent in delayed surgery (16; 42.1%) compared to early (6; 15.8%). Conversion to open cholecystectomy occurred in 5 (13.2%) delayed cases and 1 (2.6%) early case. Postoperative complications were higher in the delayed group (12; 31.6%) compared to the early group (4; 10.5%). A greater proportion of early group patients had no complications (34; 89.5%) compared to delayed (26; 68.4%). Hospital stay ≤5 days was observed in 22 (57.9%) early cases versus 10 (26.3%) delayed cases.

Conclusion: Early laparoscopic cholecystectomy following ERCP is associated with improved surgical outcomes, reduced complications, and shorter hospital stay, supporting its role as the preferred management strategy.

INTRODUCTION

Gallstone disease is one of the most common gastrointestinal disorders encountered worldwide and represents a significant cause of morbidity requiring surgical intervention. Cholelithiasis affects approximately 10–20% of the adult population, and a considerable proportion of these patients develop complications such as choledocholithiasis, acute cholecystitis, biliary pancreatitis, and obstructive jaundice, which often necessitate timely intervention [1,2].

Choledocholithiasis occurs in nearly 10–15% of patients with gallstones and is associated with potentially serious complications including cholangitis and pancreatitis [3]. Endoscopic retrograde cholangiopancreatography (ERCP) with or without endoscopic sphincterotomy has become the preferred modality for the diagnosis and management of common bile duct stones due to its high success rate and minimally invasive nature [4]. ERCP effectively achieves biliary decompression and ductal clearance, thereby stabilizing patients and reducing acute biliary obstruction.

Following successful ERCP, laparoscopic cholecystectomy (LC) is recommended to eliminate the gallbladder as the source of stones and to prevent recurrent biliary events. Multiple studies have demonstrated that leaving the gallbladder in situ after ERCP is associated with a higher incidence of recurrent biliary symptoms, cholangitis, and pancreatitis [5,6]. Hence, definitive surgical management with laparoscopic cholecystectomy is considered an essential component of treatment in patients with gallstone disease and choledocholithiasis.

Despite widespread agreement on the necessity of cholecystectomy following ERCP, the optimal timing of laparoscopic cholecystectomy remains controversial. Early laparoscopic cholecystectomy, usually defined as surgery performed within 24–72 hours after ERCP, has been advocated to reduce recurrent biliary complications, minimize hospital readmissions, and shorten the overall treatment course [7]. Early surgery is also thought to prevent the formation of dense inflammatory adhesions around Calot's triangle, thereby facilitating safer dissection.

Conversely, delayed laparoscopic cholecystectomy, typically performed several weeks after ERCP, is often preferred by some surgeons to allow resolution of local inflammation and edema, potentially reducing operative difficulty and intraoperative complications. However, postponing surgery exposes patients to the risk of recurrent biliary colic, cholangitis, pancreatitis, and repeated hospital admissions during the waiting period [8,9].

Several randomized controlled trials and observational studies have attempted to compare early and delayed laparoscopic cholecystectomy following ERCP, yielding variable results. A recent systematic review and meta-analysis by Qi et al. demonstrated that early laparoscopic cholecystectomy (≤ 3 days after ERCP) was associated with significantly lower conversion rates to open surgery, shorter operative time, and fewer postoperative complications compared to delayed surgery [10]. These findings support the growing body of evidence favoring early surgical intervention.

However, most available data originate from Western and East Asian populations, and there is limited evidence from Indian tertiary care centers. Differences in patient demographics, disease severity, healthcare access, and institutional practices may influence surgical outcomes. Therefore, there is a need for region-specific data to evaluate the impact of timing of laparoscopic cholecystectomy after ERCP on operative and postoperative outcomes.

The present study aims to compare early versus delayed laparoscopic cholecystectomy following ERCP in terms of operative parameters and postoperative complications in patients treated at a tertiary care teaching hospital. The findings of this study are expected to contribute to existing literature and aid in establishing evidence-based recommendations regarding the optimal timing of laparoscopic cholecystectomy after ERCP in the Indian clinical setting.

MATERIALS AND METHODS

Study Design

This study was designed as an observational comparative study aimed at evaluating the outcomes of early versus delayed laparoscopic cholecystectomy in patients who had previously undergone endoscopic retrograde cholangiopancreatography (ERCP). The study adopted a prospective analytical approach, enabling systematic comparison between two groups based on the timing of surgical intervention. The primary objective was to assess whether early surgical intervention following ERCP offers advantages in terms of operative and postoperative outcomes when compared to delayed surgery.

Study Setting

The study was conducted in the Department of General Surgery at Sree Balaji Medical College and Hospital, a tertiary care teaching hospital located in Chennai. The institution provides comprehensive surgical care and caters to a large volume of patients with hepatobiliary disorders, making it an appropriate setting for evaluating outcomes following ERCP and laparoscopic cholecystectomy.

Study Duration

The study was carried out over a period of 12 months. This duration allowed for adequate patient recruitment, follow-up, and comparison of outcomes between early and delayed intervention groups within a defined timeframe.

Study Population

The study population comprised patients aged 18 years and above who had undergone ERCP for gallstone-related biliary pathologies and were subsequently planned for laparoscopic cholecystectomy. These conditions included choledocholithiasis, acute cholecystitis, and biliary pancreatitis. Only patients who met the inclusion criteria and provided informed consent were enrolled in the study. This ensured a clinically relevant population in whom the timing of cholecystectomy could be meaningfully evaluated.

Sample Size and Grouping

A total of 76 patients were included in the study. The sample was divided equally into two groups of 38 patients each, based on the timing of laparoscopic cholecystectomy following ERCP.

Patients in the early group underwent laparoscopic cholecystectomy within 24–72 hours after ERCP, while those in the delayed group underwent surgery after an interval of 4–6 weeks. This stratification enabled direct comparison between early and delayed surgical management strategies.

Inclusion Criteria

Patients were included in the study if they fulfilled the following criteria: age 18 years or older; presence of gallstone-related complications such as choledocholithiasis, acute cholecystitis, or biliary pancreatitis requiring ERCP; successful completion of ERCP with clearance of bile duct stones or adequate biliary decompression; fitness for elective laparoscopic cholecystectomy based on clinical and anesthetic evaluation; and scheduling for surgery either within 72 hours (early group) or after 4–6 weeks (delayed group) following ERCP.

Exclusion Criteria

Patients were excluded if ERCP was unsuccessful or resulted in incomplete clearance of bile duct stones. Additional exclusion criteria included the presence of significant comorbid conditions such as uncontrolled diabetes mellitus or advanced cardiopulmonary disease, severe complications like gallbladder perforation, generalized peritonitis, or hemodynamic instability, chronic biliary disorders such as primary sclerosing cholangitis or biliary strictures, contraindications to laparoscopic surgery, and pregnancy. These exclusions were necessary to minimize confounding factors and ensure patient safety.

Data Collection

Data were collected from patients meeting the eligibility criteria as well as from hospital records obtained through the Medical Records Department. A structured data collection format was used to ensure uniformity.

Demographic data included age, sex, body mass index, and presence of comorbidities. Clinical data included duration of symptoms and vital parameters at presentation. Laboratory investigations recorded included serum bilirubin, amylase, lipase, C-reactive protein levels, and total leukocyte count. Imaging findings, particularly evidence of biliary obstruction or choledocholithiasis, were also documented.

Operative details such as duration of surgery, intraoperative complications, and conversion to open cholecystectomy were recorded. Postoperative outcomes, including bile duct injury, surgical site infection, and postoperative bleeding, were systematically documented during the follow-up period.

Outcome Measures

The primary outcome measures of the study included duration of surgery, intraoperative complications, and conversion to open cholecystectomy. These parameters were chosen to assess the technical difficulty and intraoperative safety of the procedure.

Secondary outcomes included postoperative complications such as bile duct injury, surgical site infection, and postoperative bleeding. These outcomes provided insight into the safety and effectiveness of early versus delayed surgical intervention.

Data Analysis

All collected data were entered into Microsoft Excel and subsequently analyzed using SPSS Statistics. Categorical variables were expressed as frequencies and percentages, while continuous variables were summarized using mean and standard deviation. Comparative analysis between the early and delayed groups was performed using appropriate statistical tests. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Ethical Committee of Sree Balaji Medical College and Hospital prior to commencement. Written informed consent was obtained from all participants after explaining the nature, purpose, and potential risks of the study. Confidentiality of patient information was strictly maintained throughout the study.

Quality Assurance

To ensure consistency and reliability of data, all aspects of the study—including patient evaluation, data collection, laboratory parameter recording, and data entry—were carried out by the principal investigator. This minimized interobserver variability and enhanced the overall quality and accuracy of the study findings.

RESULTS

Table 1. Baseline Demographic and Clinical Characteristics of Study Participants (n = 76)

Variable	Early LC (n=38)	Delayed LC (n=38)	Total (n=76)
Age (Mean ± SD)	46.2 ± 11.4	48.6 ± 12.1	47.4 ± 11.8
18–30 years	6 (15.8%)	5 (13.2%)	11 (14.5%)
31–50 years	18 (47.4%)	17 (44.7%)	35 (46.1%)
>50 years	14 (36.8%)	16 (42.1%)	30 (39.4%)
Male	16 (42.1%)	17 (44.7%)	33 (43.4%)
Female	22 (57.9%)	21 (55.3%)	43 (56.6%)
BMI (Mean ± SD)	25.1 ± 3.2	25.6 ± 3.5	25.4 ± 3.3
Diabetes Mellitus	10 (26.3%)	11 (28.9%)	21 (27.6%)
Hypertension	12 (31.6%)	13 (34.2%)	25 (32.9%)

Baseline characteristics were comparable between early and delayed groups. Mean age was similar (46.2 ± 11.4 vs. 48.6 ± 12.1 years), with most patients in the 31–50 years group (35; 46.1%). Females predominated (43; 56.6%). Comorbidities such as diabetes (21; 27.6%) and hypertension (25; 32.9%) showed similar distribution, indicating well-matched groups.

Table 2. Clinical Presentation and Indications for ERCP Among Study Participants (n = 76)

Parameter	Early LC	Delayed LC	Total
Abdominal pain	38 (100%)	38 (100%)	76 (100%)
Jaundice	22 (57.9%)	24 (63.2%)	46 (60.5%)
Fever	10 (26.3%)	12 (31.6%)	22 (28.9%)
Nausea/Vomiting	18 (47.4%)	20 (52.6%)	38 (50.0%)
Choledocholithiasis	18 (47.4%)	20 (52.6%)	38 (50.0%)
Acute cholangitis	8 (21.1%)	9 (23.7%)	17 (22.4%)
Biliary pancreatitis	12 (31.6%)	9 (23.7%)	21 (27.6%)
CBD stone clearance	30 (78.9%)	31 (81.6%)	61 (80.3%)

Clinical presentation was similar across groups. Abdominal pain was universal (76; 100%). Jaundice was present in 46

patients (60.5%) and fever in 22 (28.9%). Choledocholithiasis was the most common indication (38; 50.0%). ERCP was primarily performed for CBD stone clearance (61; 80.3%), confirming comparable baseline disease severity.

Table 3. Operative and Intraoperative Outcomes in Early versus Delayed Laparoscopic Cholecystectomy (n = 76)

Parameter	Early LC	Delayed LC	Total
Operative time <60 min	14 (36.8%)	6 (15.8%)	20 (26.3%)
60–90 min	20 (52.6%)	16 (42.1%)	36 (47.4%)
>90 min	4 (10.6%)	16 (42.1%)	20 (26.3%)
Mean operative time	68.4 ± 18.6	89.7 ± 24.3	79.1 ± 23.5
Dense adhesions	8 (21.1%)	18 (47.4%)	26 (34.2%)
Fibrosed gallbladder	6 (15.8%)	16 (42.1%)	22 (28.9%)
Bile spillage	5 (13.2%)	11 (28.9%)	16 (21.1%)
Intraoperative bleeding	3 (7.9%)	8 (21.1%)	11 (14.5%)
Conversion to open	1 (2.6%)	5 (13.2%)	6 (7.9%)

Operative outcomes were clearly worse in the delayed group. Prolonged operative time (>90 min) was significantly higher in delayed LC (16; 42.1%) compared to early LC (4; 10.6%). Dense adhesions (47.4% vs. 21.1%) and fibrosed gallbladder (42.1% vs. 15.8%) were more common in delayed cases. Conversion to open surgery was also higher in delayed LC (5; 13.2%) compared to early LC (1; 2.6%).

Table 4. Postoperative Outcomes and Duration of Hospital Stay in Early versus Delayed Laparoscopic Cholecystectomy (n = 76)

Parameter	Early LC	Delayed LC	Total
Surgical site infection	2 (5.3%)	6 (15.8%)	8 (10.5%)
Postoperative bleeding	1 (2.6%)	3 (7.9%)	4 (5.3%)
Bile leak	0 (0%)	1 (2.6%)	1 (1.3%)
Pancreatitis	1 (2.6%)	2 (5.3%)	3 (3.9%)
No complications	34 (89.5%)	26 (68.4%)	60 (78.9%)
Hospital stay ≤5 days	22 (57.9%)	10 (26.3%)	32 (42.1%)
>10 days	2 (5.3%)	10 (26.3%)	12 (15.8%)
Mean stay (days)	5.2 ± 1.8	8.6 ± 3.1	6.9 ± 2.9

Postoperative complications were higher in the delayed group. Surgical site infection occurred in 6 patients (15.8%) in delayed LC compared to 2 (5.3%) in early LC. Overall complication-free recovery was higher in early LC (34; 89.5%) than delayed LC (26; 68.4%). Hospital stay was significantly shorter in early LC (mean 5.2 days vs. 8.6 days).

DISCUSSION

The present study evaluated the impact of timing of laparoscopic cholecystectomy following endoscopic retrograde cholangiopancreatography (ERCP) on operative and postoperative outcomes. A total of 76 patients were included, equally divided into early and delayed cholecystectomy groups, allowing a balanced comparison. The baseline demographic and clinical characteristics between the two groups were comparable, minimizing selection bias and strengthening the validity of outcome comparisons.

The demographic profile observed in this study is consistent with existing literature. The mean age of patients was 47.4 ± 11.8 years, with the majority belonging to the 31–50 years age group. Similar age distributions have been reported in studies by Reinders et al. [11] and El Nakeeb et al. [12], confirming that gallstone-related biliary disease predominantly affects middle-aged individuals. Female predominance (56.6%) observed in this study aligns with established epidemiological patterns attributed to hormonal and metabolic factors influencing gallstone formation [13,14]. Importantly, there was no statistically significant difference in age, gender, or body mass index between the early and delayed groups, ensuring that observed outcome differences were attributable primarily to the timing of surgery rather than confounding baseline variables.

The clinical presentation of patients in this study was typical of gallstone-related biliary disease. Abdominal pain was universal (100%), while jaundice was present in 60.5% and fever in 28.9% of patients. These findings are consistent with prior studies where abdominal pain and obstructive jaundice constitute the predominant clinical features [11,13]. Choledocholithiasis was the most common indication for ERCP (50%), followed by biliary pancreatitis (27.6%) and acute cholangitis (22.4%), paralleling patterns reported in earlier studies [11, 15]. ERCP was primarily performed for bile duct clearance in 80.3% of patients, reinforcing its established role as the standard intervention for biliary decompression.

Biochemical parameters in the present study reflected a cholestatic pattern of liver injury, with elevated serum bilirubin, alkaline phosphatase, and transaminases. These findings are consistent with those reported in previous studies evaluating patients with biliary obstruction undergoing ERCP [11, 12]. Elevated inflammatory markers further indicated the presence of infection or systemic inflammatory response in a subset of patients, particularly those with cholangitis or pancreatitis. The timing of laparoscopic cholecystectomy after ERCP remains a subject of ongoing debate. In the present study, early cholecystectomy was defined as surgery performed within 24–72 hours after ERCP, while delayed surgery was performed

after 4–6 weeks. This classification is consistent with definitions used in major studies and meta-analyses [11, 16-18]. Early surgery was performed following clinical stabilization and successful biliary decompression, whereas delayed surgery was scheduled after resolution of inflammation.

A key finding of this study was the shorter operative time in the early cholecystectomy group compared to the delayed group. The mean operative time was 68.4 ± 18.6 minutes in the early group versus 89.7 ± 24.3 minutes in the delayed group. This difference reflects increased technical difficulty encountered during delayed surgery, likely due to the development of fibrosis and dense adhesions following inflammatory processes. Similar findings have been consistently reported in studies by Reinders et al. [11], Salman et al. [15], and El Nakeeb et al. [12], all of which demonstrated prolonged operative duration in delayed cholecystectomy.

Intraoperative findings in the present study further support this observation. Dense adhesions and fibrosed gallbladder were significantly more common in the delayed group, whereas an edematous gallbladder was more frequently observed in early cases. These findings indicate that delayed surgery is associated with chronic inflammatory changes leading to distortion of anatomy and increased surgical complexity. Previous studies have similarly attributed increased operative difficulty in delayed cholecystectomy to fibrosis and altered tissue planes [19,20].

Conversion to open cholecystectomy is an important indicator of surgical difficulty and safety. In the present study, the conversion rate was higher in the delayed group (13.2%) compared to the early group (2.6%). This finding is consistent with earlier studies that have reported higher conversion rates in delayed cholecystectomy due to dense adhesions and unclear anatomy [8, 21-23]. Early surgery, performed before the establishment of fibrosis, facilitates easier dissection and reduces the likelihood of conversion.

Postoperative complications were also more frequent in the delayed group. Surgical site infection was the most common complication, followed by postoperative bleeding and pancreatitis. The overall complication rate was lower in the early group, which is consistent with findings from previous studies demonstrating reduced morbidity with early cholecystectomy [10, 17, 24, 25]. Notably, no bile duct injuries were observed in either group, indicating that both approaches are safe when performed by experienced surgeons. However, the increased complication rate in delayed surgery reflects the impact of prolonged operative time and difficult dissection.

Length of hospital stay is a critical outcome parameter reflecting both clinical recovery and healthcare resource utilization. In the present study, the mean hospital stay was significantly shorter in the early group (5.2 ± 1.8 days) compared to the delayed group (8.6 ± 3.1 days). These findings are consistent with previous studies, including those by Reinders et al. [11] and El Nakeeb et al. [12], which have demonstrated reduced hospital stay with early cholecystectomy. Early surgery allows definitive management during the same admission, avoiding repeated hospital visits and complications during the waiting period.

The overall findings of this study suggest early laparoscopic cholecystectomy following ERCP as the preferred approach. Early surgery was associated with shorter operative time, fewer intraoperative difficulties, lower conversion rates, reduced postoperative complications, and shorter hospital stay. These advantages are clinically significant and have important implications for patient outcomes and healthcare resource utilization. Similar conclusions have been drawn in studies including that by Qi et al. [10] and Gurusamy et al [26], which demonstrated improved outcomes with early cholecystectomy.

This study has certain limitations. The relatively small sample size and single-center design may limit the generalizability of the findings. The observational nature of the study introduces the possibility of selection bias. Long-term follow-up outcomes were not assessed, and recurrence of biliary events could not be evaluated. Additionally, surgeon-related factors and variability in operative expertise were not formally analyzed.

Despite these limitations, the study provides strong evidence favoring early laparoscopic cholecystectomy after ERCP. Early intervention reduces operative difficulty, minimizes complications, and shortens hospital stay, thereby improving overall patient outcomes. These findings support the adoption of early cholecystectomy as standard clinical practice whenever feasible. Future multicentric randomized controlled trials with larger sample sizes are warranted to further validate these results and establish definitive clinical guidelines.

CONCLUSION

The present study demonstrates that early laparoscopic cholecystectomy following ERCP is associated with significantly better operative and postoperative outcomes compared to delayed surgery. Early intervention resulted in shorter operative time, lower incidence of intraoperative difficulties such as dense adhesions and fibrosed gallbladder, reduced conversion to open surgery, fewer postoperative complications, and shorter hospital stay. Although baseline demographic and clinical characteristics were comparable between groups, delayed surgery was consistently associated with increased technical complexity and morbidity. These findings support early laparoscopic cholecystectomy within 24–72 hours after ERCP as a safe and effective approach that improves patient outcomes and reduces healthcare burden.

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