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Research Article

Early Versus Delayed Cholecystectomy in Mild Gallstone Pancreatitis: An Updated Meta-Analysis of Randomized Controlled Trials

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Abstract

Background: Mild gallstone pancreatitis is one of the most common surgical causes of hospital admission and carries a significant risk of recurrent biliary events if definitive treatment is delayed. Although most major guidelines recommend same-admission cholecystectomy, the ideal timing of surgery remains debated in clinical practice.

Methods: A systematic review and updated meta-analysis of randomized controlled trials was performed comparing early laparoscopic cholecystectomy, defined as surgery within 72 hours of admission, with delayed cholecystectomy in patients with mild gallstone pancreatitis. MEDLINE, PubMed, and the Cochrane Library were reviewed. The primary outcome was recurrent biliary complications. Secondary outcomes included conversion to open surgery, intraoperative complications, postoperative complications, and length of hospital stay.
Results: Nine randomized controlled trials involving 1,046 patients were included in the primary analysis. Early cholecystectomy significantly reduced recurrent biliary complications compared with delayed surgery (OR 0.17, 95% CI 0.10-0.29; p<0.00001). There were no significant differences in conversion to open surgery, intraoperative complications, or postoperative complications between groups. More recent prospective studies and updated randomized evidence continue to support early surgery, demonstrating shorter hospital stay and no increase in operative morbidity.

Conclusions: In patients with mild gallstone pancreatitis, cholecystectomy performed within 72 hours appears safe and significantly decreases recurrent biliary complications. Cholecystectomy within 72 hrs of admission should be considered as the preferred treatment strategy in appropriately selected patients.

Introduction

Gallstone pancreatitis remains one of the most common causes of acute pancreatitis worldwide and accounts for a substantial proportion of gastrointestinal hospitalizations. While most cases are mild and improve with supportive care, patients remain at risk for recurrent biliary events until definitive gallbladder removal is performed. Recurrent pancreatitis, biliary colic, acute cholecystitis, and cholangitis can occur during the waiting period if surgery is delayed, often leading to repeat emergency department visits, readmissions, and increased healthcare utilization. For many years, surgeons traditionally delayed cholecystectomy because of concerns regarding active inflammation, technical difficulty, increased adhesions, and possible perioperative complications. However, growing evidence suggests that these concerns may be overstated in patients with mild disease. Multiple randomized studies have demonstrated that early laparoscopic cholecystectomy during the index admission is both feasible and safe, while also reducing recurrent biliary complications [1]. Despite this evidence,

practice patterns remain variable [2]. Definitions of "early" surgery differ across studies and institutions, ranging from surgery within 24 hours to surgery later during the same admission. This variability has contributed to ongoing uncertainty regarding the ideal timing of intervention. The aim of this updated meta-analysis was to evaluate outcomes of early cholecystectomy performed within 72 hours of admission compared with delayed cholecystectomy in patients with mild gallstone pancreatitis. Outcomes of interest included recurrent biliary complications, operative outcomes, perioperative morbidity, and updated evidence from recently published studies [3,4].

Methods

Search Strategy and Eligibility

A systematic search was performed using MEDLINE, PubMed, and the Cochrane Library. The search was updated with recently indexed literature through online database searches. Search terms included gallstone pancreatitis, acute biliary pancreatitis, mild acute pancreatitis, early cholecystectomy, delayed cholecystectomy, laparoscopic cholecystectomy, randomized controlled trial, and meta-analysis. Studies were eligible for the quantitative RCT synthesis if they: (1) enrolled adult patients with mild gallstone or biliary pancreatitis; (2) compared early cholecystectomy within 72 hours of admission with delayed cholecystectomy; (3) were randomized controlled trials; and (4) reported at least one outcome of interest. Severe pancreatitis, necrotizing pancreatitis, pediatric studies, case reports, editorials, reviews, and studies without extractable timing or outcome data were excluded from quantitative pooling. Recently published prospective or observational studies were not combined with the RCT meta-analysis, but were included in an updated narrative evidence table when clinically relevant [5-9].

Outcomes

The primary outcome was recurrent biliary complications, including recurrent pancreatitis, biliary colic, acute cholecystitis, cholangitis, jaundice, or recurrent biliary obstruction. Secondary outcomes included conversion to open cholecystectomy, intraoperative complications, postoperative complications, readmission, reoperation, mortality, operative time, and hospital length of stay..

Statistical Analysis

The original pooled analysis used Review Manager (RevMan) version 5.4. Odds Ratios (ORs) with 95% Confidence Intervals (CIs) were calculated using Mantel-Haenszel methods. Heterogeneity was assessed using the I2 statistic. In the updated search, newly identified randomized trials were reviewed for event-level data. Trials with zero events in both study arms were retained in the qualitative RCT synthesis but do not contribute to pooled OR estimation for that outcome using standard Mantel-Haenszel methods.

Results

Study Selection and Updated Evidence Base

The original search identified 163 references, of which 45 were selected for full review. Nine randomized trials met inclusion criteria for the initial analysis. The original manuscript reported 1,046 patients; for the primary biliary-complication outcome, 993 patients contributed analyzable event-level data. An updated search identified one additional randomized trial published online in HPB by Zhou et al., which randomized 120 patients with mild acute biliary pancreatitis to early laparoscopic cholecystectomy within 72 hours versus delayed surgery. Several newer prospective or observational studies were also identified and are summarized narratively [5].

Primary Outcome

Recurrent Biliary Complications

In the original event-level RCT analysis, early cholecystectomy significantly reduced recurrent biliary complications. There were 15 events among 500 patients in the early group and 80 events among 493 patients in the delayed group. The pooled OR was 0.17 (95% CI 0.10-0.29; $p<0.00001$), favoring early cholecystectomy. Heterogeneity was low-to-moderate ($Chi2=11.51$, $df=7$, $p=0.12$; $I2=39\%$).The newly identified Zhou et al. RCT reported no recurrent biliary events in either arm. Therefore, it supports the safety of early surgery but does not mathematically change the pooled OR for recurrent biliary complications under standard Mantel-Haenszel methods because zero-event studies in both arms are non-informative for relative odds estimation [5].

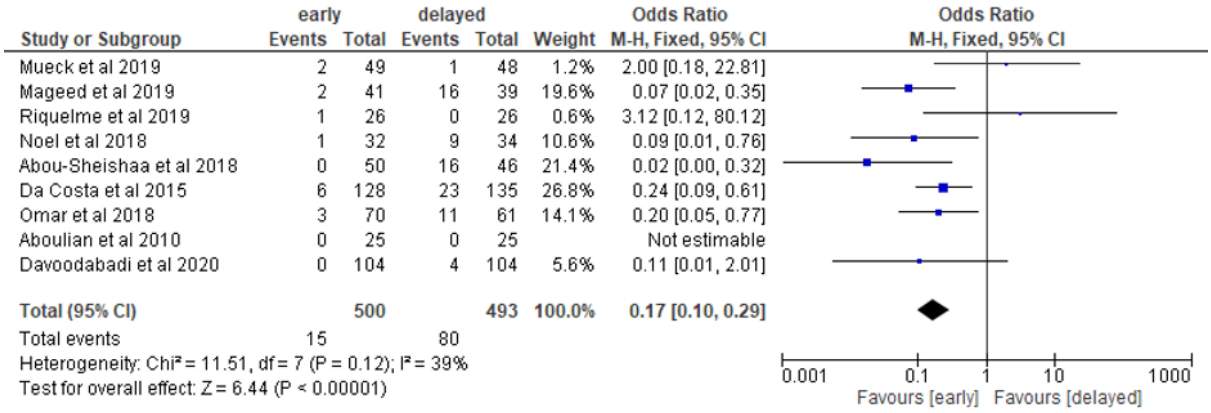
Secondary Outcomes

Early cholecystectomy was not associated with a statistically significant increase in conversion to open cholecystectomy, intraoperative complications, or postoperative complications. In the original analysis, conversion to open cholecystectomy was similar between groups (OR 1.27, 95% CI 0.63-2.58; $p=0.50$). Intraoperative complications were also similar (OR 0.64, 95% CI 0.18-2.28; $p=0.49$), as were postoperative complications (OR 0.73, 95% CI 0.40-1.32; $p=0.30$).Zhou et al. reported no increase in overall complication rate with early surgery (10.0% vs 8.3%; $p=0.752$), no significant difference in conversion to open surgery (3.3% vs 5.0%; $p=1.00$), no postoperative readmissions, no reoperations, and no deaths. Early surgery was associated with shorter procedure time and shorter hospital length of stay (Tables 1-3) (Figure 1).

Study	Year	Design	Early group	Delayed group	Key notes
Mueck et al.	2019	RCT	49	48	Included in original RCT analysis.
Mageed et al.	2019	RCT	41	39	Included in original RCT analysis.
Ricciume et al.	2019	RCT	26	26	Included in original RCT analysis.
Noel et al.	2018	RCT	32	34	Included in original RCT analysis.
Abou-Sheishaa et al.	2018	RCT	50	46	Included in original RCT analysis.
da Costa et al. (PONCHO)	2015	RCT	128	135	Large multicenter RCT; supports same-admission surgery.
Omar et al.	2018	RCT	70	61	Included in original RCT analysis.
Aboulian et al.	2010	RCT	25	25	Earlier RCT supporting early index-admission surgery.
Davoodabadi et al.	2020	RCT	104	104	Included in original RCT analysis.
Zhou et al.	2025/2026	RCT	60	60	New RCT; no recurrent biliary events in either group; shorter LOS and operative time with early LC.

Outcome	Original RCT pooled result	Updated interpretation after newer evidence
Recurrent biliary complications	OR 0.17; 95% CI 0.10-0.29; p<0.00001; I2=39%	Primary pooled estimate remains unchanged because Zhou et al. reported zero recurrent biliary events in both arms; overall evidence continues to favor early surgery.
Conversion to open surgery	OR 1.27; 95% CI 0.63-2.58; p=0.50	No signal that early surgery increases conversion risk; Zhou et al. reported 3.3% vs 5.0% conversion, p=1.00.
Intraoperative complications	OR 0.64; 95% CI 0.18-2.28; p=0.49	No consistent evidence of increased intraoperative risk with early surgery.
Postoperative complications	OR 0.73; 95% CI 0.40-1.32; p=0.30	No consistent increase in postoperative complications; Zhou et al. reported no readmissions, reoperations, or deaths in either arm.
Length of stay	Not consistently pooled in original abstract	Newer RCT and prospective data support shorter length of stay with early surgery.
Operative time/ procedural difficulty	Not consistently pooled in original abstract	Zhou et al. reported shorter procedure time and fewer adhesions with early surgery; recent prospective studies do not show increased operative difficulty.

Study	Year	Design	Sample	Main finding
Zhou et al.	2025/2026	Randomized controlled trial	120	Early LC within 72 hours reduced hospital length of stay and procedure time without increasing complications, conversion, readmission, reoperation, or mortality.
Jaiswal et al.	2024	Prospective comparative study	38	Early LC reduced recurrent biliary events and hospital stay without increasing conversion or perioperative complications.
Raj et al.	2024	Prospective study	100	Early LC for mild biliary pancreatitis was associated with favorable perioperative outcomes and no clear increase in complications.
El Sayed et al.	2021	Comparative study	Not pooled	Index-admission LC was reported as safe and feasible with fewer recurrent biliary problems.
Alburakan et al.	2023	Retrospective comparative study	Not pooled	Early cholecystectomy was associated with shorter hospital stay compared with delayed surgery.



The original pooled RCT analysis demonstrated significantly fewer biliary complications with early cholecystectomy within 72 hours.

Figure 1: Original Forest Plot for Biliary Complications.

Discussion

This updated analysis reinforces the central finding that early cholecystectomy within 72 hours is beneficial for patients with mild gallstone pancreatitis. The most clinically important advantage is prevention of recurrent biliary events. In the original randomized evidence base, the delayed group had more than five times as many recurrent biliary events as the early group. This difference is clinically meaningful because recurrent pancreatitis, biliary colic, cholecystitis, cholangitis, and recurrent obstruction may lead to repeat emergency department visits, readmissions, additional imaging, ERCP, antibiotics, and further delays in definitive care. A major historical argument against early cholecystectomy has been concern for increased operative difficulty. This concern is not supported by the available randomized data. The original pooled analysis showed no statistically significant increase in conversion to open surgery, intraoperative complications, or postoperative complications. The newly identified Zhou et al. randomized trial adds contemporary evidence showing that early surgery did not increase overall complications or conversion to open surgery and was associated with shorter length of stay and shorter procedure time. These findings align with the practical concept that mild gallstone pancreatitis is different from severe or necrotizing pancreatitis. In mild disease, once the patient is clinically improving and there is no persistent organ failure, infected necrosis, uncontrolled cholangitis, or unresolved biliary obstruction requiring separate management, definitive cholecystectomy during the index admission is generally safe. By contrast, patients with severe pancreatitis, necrosis, or major organ failure were not the target population of this analysis, and conclusions should not be extrapolated to those groups [10-12].

The updated evidence also has implications for hospital systems. Delayed cholecystectomy may appear logistically convenient, but it shifts risk into the waiting period. Recurrent events before interval surgery can result in unplanned readmission, repeat diagnostic testing, additional procedures, and increased cost. Early same-admission surgical pathways may therefore improve both patient outcomes and resource utilization, provided patients are appropriately selected and surgical resources are available. Several limitations should be acknowledged. First, although this update identified newer studies, not all were randomized, and not all provided extractable event-level data for every outcome. For this reason, recent prospective and observational studies were summarized narratively rather than combined with RCTs in the pooled effect estimate. Second, the original included studies varied in definitions of early and delayed surgery, definitions of biliary complications, and timing of follow-up. Third, many trial populations were relatively young and medically fit, which may limit generalizability to frail elderly patients or those with substantial comorbidity. Finally, zero-event trials, such as the newly identified Zhou et al. RCT for recurrent biliary events, support safety but do not alter relative odds estimates using standard Mantel-Haensxel methods. Despite these limitations, the consistency of evidence across randomized and recent prospective studies supports a clear clinical message: early cholecystectomy within 72 hours for mild gallstone pancreatitis prevents recurrent biliary events without increasing operative morbidity.

Conclusion

Early cholecystectomy within 72 hours of admission for mild gallstone pancreatitis significantly reduces recurrent biliary complications and does not increase conversion to open surgery, intraoperative complications, or postoperative complications. Updated evidence, including a recent randomized trial, further

supports early same-admission laparoscopic cholecystectomy as the preferred strategy for appropriately selected patients.

Conflicts of Interest: The authors declare no conflicts of interest.

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Data Availability: Data used for this analysis were extracted from published studies. Additional extraction sheets are available from the corresponding author upon reasonable request.

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