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EARLY VERSUS DELAYED CHOLECYSTECTOMY FOR ACUTE CALCULOUS CHOLECYSTITIS: A COMPARATIVE STUDY OF SURGICAL OUTCOMES AND POSTOPERATIVE COMPLICATIONS AT AL SALAM TEACHING HOSPITAL, MOSUL

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ABSTRACT

Background: Acute cholecystitis is one of the most common surgical emergencies and laparoscopic cholecystectomy remains the definitive treatment. However, the optimal timing of surgery continues to be debated, with ongoing discussion regarding the benefits and risks of early versus delayed cholecystectomy. **Objectives:** To compare the surgical outcomes and postoperative complications of early versus delayed cholecystectomy in patients with acute calculous cholecystitis treated at Al Salam Teaching Hospital, Mosul. **Methods:** A retrospective comparative study was conducted at Al Salam Teaching Hospital, Mosul, Iraq, between July 2024 and May 2026. A total of 200 patients diagnosed with acute calculous cholecystitis were included and divided into two groups according to the timing of surgery: early cholecystectomy (n=100) and delayed cholecystectomy (n=100). Demographic characteristics, operative outcomes, postoperative complications, length of hospital stay, readmission rates, and overall surgical outcomes were analyzed. Statistical analysis was performed using SPSS version 27, and a P value of less than 0.05 was considered statistically significant. **Results:** The mean age of the patients was 46.0 ± 12.9 years, and females represented 60.5% of the study population, with a female-to-male ratio of 1.53:1. The mean operative time was significantly shorter in the early cholecystectomy group compared with the delayed group (68.4 ± 18.7 vs. 79.6 ± 22.3 minutes; P = 0.001). Overall postoperative complications occurred in 10.0% of patients undergoing early surgery and 20.0% of those undergoing delayed surgery (P = 0.046). The mean hospital stay was significantly shorter in the early group (3.1 ± 1.2 days) than in the delayed group (5.6 ± 2.1 days) (P < 0.001). Readmission rates were also significantly lower among patients undergoing early cholecystectomy (3.0% vs. 15.0%; P = 0.003). Multivariate logistic regression analysis identified delayed surgery (OR = 2.89, P = 0.014) and diabetes mellitus (OR = 2.11, P = 0.047) as independent predictors of unfavorable postoperative outcomes. **Conclusions:** Early cholecystectomy was associated with shorter operative time, reduced hospital stay, lower readmission rates, fewer postoperative complications, and better overall surgical outcomes compared with delayed cholecystectomy. Delayed surgery and diabetes mellitus were significant predictors of unfavorable postoperative outcomes. Early laparoscopic cholecystectomy should therefore be considered the preferred treatment strategy for suitable patients with acute calculous cholecystitis.

KEYWORDS: Acute calculous cholecystitis, Cholecystectomy, Early cholecystectomy, Hospital stay, Postoperative complications, Readmission.

1-INTRODUCTION

Acute cholecystitis is one of the most common surgical emergencies encountered worldwide and represents a significant cause of hospital admissions related to biliary tract disease. It is an acute inflammatory condition of the gallbladder that most commonly results from obstruction of the cystic duct by gallstones, leading to gallbladder distension, inflammation, ischemia, and, in severe cases, necrosis or perforation. Acute cholecystitis accounts for approximately 20% of complications associated with gallstone disease and remains a major healthcare burden due to its high incidence and associated morbidity.[1]

Gallstone disease affects approximately 10–20% of the adult population, although only a minority of patients develop symptomatic complications requiring surgical intervention. Acute cholecystitis is characterized clinically by right upper quadrant abdominal pain, fever, nausea, vomiting, and localized tenderness, often accompanied by laboratory and radiological evidence of inflammation. Ultrasonography remains the first-line imaging modality for diagnosis because of its accessibility, high sensitivity, and ability to identify gallstones, gallbladder wall thickening, pericholecystic fluid, and a positive sonographic Murphy's sign.[2]

Laparoscopic cholecystectomy is currently considered the gold standard treatment for acute cholecystitis. Since its introduction, laparoscopic surgery has largely replaced open cholecystectomy because of its association with reduced postoperative pain, shorter hospital stay, earlier return to normal activities, lower wound complication rates, and improved cosmetic outcomes. Nevertheless, the optimal timing of surgery in patients presenting with acute cholecystitis continues to be a subject of clinical debate.[3]

Traditionally, delayed cholecystectomy was recommended following initial conservative management with antibiotics, analgesics, and supportive care. This approach aimed to allow resolution of inflammation before surgery, theoretically reducing operative difficulty and complication rates. Delayed cholecystectomy is usually performed several weeks after the acute episode, often between 6 and 12 weeks following hospital discharge. However, this strategy may expose patients to recurrent attacks of cholecystitis, biliary colic, pancreatitis, cholangitis, repeated hospital admissions, and increased healthcare costs during the waiting period.[4]

In contrast, early cholecystectomy, typically performed during the index admission and within 72 hours to one week of symptom onset, has gained increasing acceptance. Several studies have suggested that early surgical intervention may reduce overall hospital stay, prevent recurrent biliary events, decrease treatment costs, and improve patient satisfaction without increasing operative morbidity or mortality. Furthermore, advances in laparoscopic techniques, perioperative care, and surgeon experience have contributed to improved outcomes following early intervention.[5]

Recent international guidelines, including the Tokyo Guidelines, recommend early laparoscopic cholecystectomy whenever feasible in patients with acute cholecystitis who are fit for surgery. Nevertheless, concerns remain regarding operative difficulty, conversion to open surgery, bile duct injury, operative time, and postoperative complications in the setting of acute inflammation. Consequently, conflicting evidence continues to exist regarding the relative benefits and risks of early versus delayed cholecystectomy.[6]

Several randomized controlled trials and meta-analyses have compared early and delayed cholecystectomy in patients with acute cholecystitis. While many studies have demonstrated shorter total hospital stay and lower recurrence rates with early surgery, differences in complication rates, conversion rates, and operative outcomes remain subjects of ongoing investigation. The variability in patient characteristics, disease severity, healthcare resources, and surgical expertise across different institutions may contribute to these inconsistencies.[7]

In Iraq, and particularly in northern Iraq, data regarding the outcomes of early versus delayed cholecystectomy remain limited. Evaluating local experiences is essential for determining the most effective management strategy and optimizing patient outcomes. Understanding the impact of surgical timing on perioperative outcomes may help guide clinical decision-making and improve the quality of care provided to patients with acute cholecystitis. Therefore, this study aims to compare the surgical outcomes and postoperative complications of early versus delayed cholecystectomy among patients with acute cholecystitis and to determine the effect of surgical timing on operative and postoperative outcomes.

2-PATIENTS AND METHODS

Ethical approval was obtained from Nineveh Directorate of Health ethical committee before data collection. Verbal or written informed consent was obtained from all participants before inclusion in the study. Patient confidentiality was maintained throughout the study by using anonymous data collection forms, and all collected information was used only for scientific research purposes. This retrospective comparative study was conducted at Al Salam Teaching Hospital, Mosul, Nineveh Governorate, Iraq, to compare the surgical outcomes and postoperative complications of early versus delayed cholecystectomy among patients diagnosed with acute cholecystitis. The study period extended from July 1, 2024, to May 31, 2026. A total of 200 patients who underwent cholecystectomy for acute calculous cholecystitis during the study period were included in the study. Patients were identified through a review of hospital medical records, operative reports, laboratory investigations, radiological findings, anesthesia records, and postoperative follow-up documentation.

The study population was divided into two groups according to the timing of surgery. The early cholecystectomy group included patients who underwent surgery during the index admission within seven days of symptom onset, whereas the delayed cholecystectomy group included patients who initially received conservative treatment and subsequently underwent elective cholecystectomy at least six weeks after resolution of the acute episode.

Patients aged 18 years and older with a clinical, laboratory, and ultrasonographic diagnosis of acute calculous cholecystitis were eligible for inclusion. Patients with acalculous cholecystitis, gallbladder malignancy, concomitant common bile duct stones requiring additional intervention, severe medical conditions precluding surgery, previous biliary surgery, or incomplete medical records were excluded from the study.

Data were collected using a structured data collection form. Demographic variables included age and sex. Clinical variables included presenting symptoms, comorbidities, laboratory findings, and ultrasonographic characteristics. Operative variables included timing of surgery, operative duration, type of procedure, conversion to open surgery, and intraoperative complications. Postoperative outcomes included surgical site infection, bile leak, postoperative hemorrhage, length of hospital stay, readmission, and mortality when applicable.

The primary outcome measure was the comparison of postoperative complications between early and delayed cholecystectomy groups. Secondary outcomes included operative duration, conversion to open surgery, length of hospital stay, and overall surgical outcomes.

Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) version 27. Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were presented as frequencies and percentages. Comparisons between the two groups were performed using the independent samples t-test for continuous variables and the Chi-square test or Fisher's exact test for categorical variables when appropriate. A P value of less than 0.05 was considered statistically significant.

3-RESULTS

A total of 200 patients diagnosed with acute calculous cholecystitis were included in this study. Patients were divided into two groups according to the timing of surgery. The early cholecystectomy group included 100 patients who underwent surgery during the index admission, whereas the delayed cholecystectomy group included 100 patients who underwent elective surgery after initial conservative management.

Table 1 presents the demographic characteristics of patients included in the study. The mean age of patients in the early cholecystectomy group was 45.2 ± 13.1 years compared with 46.8 ± 12.7 years in the delayed cholecystectomy group. Male patients represented 38.0% of the early group and 41.0% of the delayed group, while females accounted for 62.0% and 59.0%, respectively. Overall, females constituted 60.5% of the study population, whereas males represented 39.5%, with a female-to-male ratio of 1.53:1. No statistically significant differences were observed between the two groups regarding age or sex distribution (P > 0.05), indicating that both groups were comparable and that demographic factors were unlikely to influence the comparison of surgical outcomes.

Table 1: Demographic characteristics of the studied patients (n=200).

Variable	Early (n=100)	Delayed (n=100)	P value
Mean age (years)	45.2 ± 13.1	46.8 ± 12.7	0.381
Male	38 (38.0%)	41 (41.0%)	0.664
Female	62 (62.0%)	59 (59.0%)	

Table 2 demonstrates the operative outcomes among patients undergoing early and delayed cholecystectomy. The mean operative time was significantly shorter in the early cholecystectomy group (68.4 ± 18.7 minutes) compared with the delayed cholecystectomy group (79.6 ± 22.3 minutes) (P = 0.001). Conversion from laparoscopic to open surgery was required in 7.0% of patients in the early group and 14.0% of patients in the delayed group. Although the conversion rate was approximately twice as high in the delayed group, the difference did not reach statistical significance (P = 0.102). These findings suggest that early surgical intervention may facilitate operative dissection and reduce operative difficulty.

Table 2: Operative outcomes among the studied patients (n=200).

Variable	Early	Delayed	P value
Operative time (minutes)	68.4 ± 18.7	79.6 ± 22.3	**0.001**
Conversion to open surgery	7 (7.0%)	14 (14.0%)	0.102

Table 3 summarizes the postoperative complications observed following cholecystectomy. Surgical site infection occurred in 3.0% of patients in the early group compared with 6.0% in the delayed group. Bile leak was reported in 2.0% and 4.0% of patients in the early and delayed groups, respectively, while postoperative bleeding occurred in 1.0% and 3.0% of patients. Chest infection was also less frequent among patients who underwent early surgery (4.0%) than among those who underwent delayed surgery (7.0%). Overall postoperative complications occurred in 10.0% of patients in the early group compared with 20.0% of patients in the delayed group, and this difference was statistically significant (P = 0.046). These findings indicate that early cholecystectomy may reduce postoperative morbidity.

Table 3: Postoperative complications among the studied patients (n=200).

Complication	Early n (%)	Delayed n (%)	P value
SSI	3 (3.0%)	6 (6.0%)	0.307
Bile leak	2 (2.0%)	4 (4.0%)	0.682
Postoperative bleeding	1 (1.0%)	3 (3.0%)	0.621
Chest infection	4 (4.0%)	7 (7.0%)	0.347
Total complications	10 (10.0%)	20 (20.0%)	**0.046**

Table 4 presents the duration of hospitalization following surgery. Patients who underwent early cholecystectomy had a mean hospital stay of 3.1 ± 1.2 days, whereas those who underwent delayed cholecystectomy had a mean hospital stay of 5.6 ± 2.1 days. The difference of approximately 2.5 days was highly statistically significant (P < 0.001). This finding suggests that early cholecystectomy may contribute to faster recovery, earlier discharge, and reduced healthcare costs.

Table 4: Length of hospital stay among the studied patients (n=200).

Variable	Early	Delayed	P value
Mean hospital stay (days)	3.1 ± 1.2	5.6 ± 2.1	**<0.001**

Table 5 illustrates the frequency of hospital readmission among the study groups. Readmission occurred in only 3.0% of patients who underwent early cholecystectomy compared with 15.0% of patients who underwent delayed surgery. Conversely, 97.0% of patients in the early group and 85.0% in the delayed group remained free from readmission. The difference was statistically significant (P = 0.003), indicating that delayed surgery was associated with a greater risk of recurrent biliary symptoms, recurrent attacks of cholecystitis, or other complications requiring hospital readmission before or after surgery.

Table 5: Readmission rates among the studied patients (n=200).

Readmission	Early n (%)	Delayed n (%)	P value
Yes	3 (3.0%)	15 (15.0%)	**0.003**
No	97 (97.0%)	85 (85.0%)	

Table 6 shows the overall surgical outcomes among the study population. Favorable outcomes were achieved in 90.0% of patients undergoing early cholecystectomy compared with 80.0% of those undergoing delayed surgery. Unfavorable outcomes were observed in 10.0% and 20.0% of patients in the early and delayed groups, respectively. The difference was statistically significant (P = 0.046), indicating that patients undergoing early cholecystectomy experienced better overall outcomes and fewer adverse events than those managed with delayed surgery.

Table 6: Overall surgical outcomes among the studied patients (n=200).

Outcome	Early n (%)	Delayed n (%)	P value
Favorable	90 (90.0%)	80 (80.0%)	**0.046**
Unfavorable	10 (10.0%)	20 (20.0%)	

Table 7 presents the results of multivariate logistic regression analysis performed to identify independent predictors of unfavorable postoperative outcomes. Delayed cholecystectomy was associated with a 2.89-fold increased risk of unfavorable outcomes (OR = 2.89, 95% CI: 1.24–6.75, P = 0.014), making it the strongest predictor identified in the study. Diabetes mellitus was also found to be a significant predictor, increasing the risk of adverse outcomes by approximately twofold (OR = 2.11, 95% CI: 1.01–4.41, P = 0.047). In contrast, age ≥60 years and male sex were not significantly associated with unfavorable postoperative outcomes (P > 0.05). These findings highlight the importance of timely surgical intervention and optimal management of comorbid conditions to improve postoperative outcomes.

Table 7: Multivariate logistic regression analysis of predictors of unfavorable postoperative outcomes (n=200).

Variable	OR	95% CI	P value
Delayed surgery	**2.89**	**1.24–6.75**	**0.014**
Age ≥60 years	1.57	0.72–3.44	0.257
Male sex	1.19	0.56–2.54	0.647
Diabetes mellitus	**2.11**	**1.01–4.41**	**0.047**

4- DISCUSSION

The present study findings demonstrated that early cholecystectomy was associated with improved operative and postoperative outcomes, including shorter operative time, reduced hospital stay, lower readmission rates, and fewer postoperative complications.

Females constituted the majority of the study population, accounting for 60.5% of patients, with a female-to-male ratio of 1.53:1. This finding reflects the well-established predominance of gallstone disease among women, which is largely attributed to hormonal influences on bile composition and cholesterol metabolism. Similar observations were reported by **Ambe *et al*.** and **Noubani *et al*.**, who found that female patients represented the majority of individuals undergoing cholecystectomy for acute cholecystitis.[8-9]

The mean age of patients in the current study was approximately 46 years, with no significant difference between the early and delayed surgery groups. This finding is comparable to that reported by **Søreide *et al***., who observed that acute cholecystitis occurs predominantly among middle-aged adults. Likewise, **van Dijk *et al*.** highlighted that the incidence of gallstone-related complications increases progressively with age, leading to a greater need for surgical intervention in this population.[10-11]

One of the principal findings of the present study was the significantly shorter operative time observed among patients undergoing early cholecystectomy. The mean operative duration was 68.4 ± 18.7 minutes in the early group compared with 79.6 ± 22.3 minutes in the delayed group. This difference may be explained by the fact that surgery performed during the acute phase is often undertaken before the development of dense fibrosis and adhesions around the gallbladder. Similar findings were reported by **Wakabayashi *et al***., who concluded that early surgical intervention may facilitate dissection and reduce operative difficulty.[12]

Although conversion to open surgery occurred less frequently in the early cholecystectomy group, the difference did not reach statistical significance. This finding suggests that early laparoscopic cholecystectomy can be safely performed without increasing the likelihood of conversion when undertaken by experienced surgeons. Comparable results were reported by **Søreide *et al*.**, who found no significant difference in conversion rates between early and delayed surgery in contemporary surgical practice.[10]

The overall postoperative complication rate was significantly lower among patients undergoing early cholecystectomy. Surgical site infection, bile leak, postoperative bleeding, and chest infection were all less frequent in the early surgery group. These findings support the concept that early removal of the inflamed gallbladder may prevent disease progression and reduce postoperative morbidity. Similar observations were reported by Noubani et al., who demonstrated lower complication rates following early intervention. Furthermore, Wakabayashi et al. emphasized that early cholecystectomy reduces recurrent inflammatory episodes and contributes to improved postoperative outcomes.[9,12]

A highly significant difference was observed regarding the duration of hospital stay. Patients undergoing early cholecystectomy had a mean hospital stay of 3.1 ± 1.2 days compared with 5.6 ± 2.1 days among patients managed with delayed surgery. Shorter hospitalization is an important advantage because it reduces healthcare costs and improves hospital bed availability. Similar findings were reported by **Ambe *et al***., who demonstrated that early surgery substantially decreases total hospitalization time. Likewise, **van Dijk *et al*.** reported that early intervention is associated with more efficient utilization of healthcare resources.[8,11]

Readmission rates were significantly lower among patients treated with early cholecystectomy. Only 3.0% of patients in the early group required readmission compared with 15.0% in the delayed group. This difference may be attributed to the increased risk of recurrent biliary symptoms and repeated attacks of cholecystitis among patients awaiting delayed surgery. Similar findings were reported by **Søreide *et al***. and **Noubani *et al***., who observed higher rates of recurrent admissions among patients managed conservatively before definitive surgical treatment.[9-10]

The overall surgical outcome was significantly more favorable among patients undergoing early cholecystectomy. Favorable outcomes were achieved in 90.0% of patients in the early group compared with 80.0% in the delayed group. This finding further supports the benefits of early intervention in patients with acute cholecystitis. Comparable results were reported by **Wakabayashi *et al***. and **Al-Jubouri *et al***., who concluded that early laparoscopic cholecystectomy provides superior clinical outcomes and should be considered the preferred treatment strategy whenever feasible.[12,14]

Multivariate logistic regression analysis identified delayed surgery and diabetes mellitus as independent predictors of unfavorable postoperative outcomes. Patients who underwent delayed cholecystectomy had approximately three times greater odds of adverse outcomes, while diabetes mellitus increased the risk by approximately twofold. Similar observations were reported by **Ahmed *et al***., who identified delayed intervention as a significant determinant of postoperative morbidity. In addition, **Gupta *et al***. highlighted the negative impact of diabetes mellitus on wound healing, infection risk, and postoperative recovery.[13,15]

Age and sex were not found to be significant predictors of unfavorable outcomes in the present study. Although older patients tended to experience slightly higher complication rates, the differences did not reach statistical significance after adjustment for confounding factors. Similar findings were reported by **Gupta *et al*.** and **Ahmed *et al***., who concluded that operative timing and associated comorbidities exert a greater influence on postoperative outcomes than demographic variables alone.[13,15]

This study has several limitations that should be considered when interpreting its findings. The retrospective design depended on the accuracy and completeness of medical records, which may have resulted in missing or inconsistently documented clinical information. In addition, the study was conducted at a single tertiary care center, which may limit the generalizability of the results to other healthcare settings. Although the sample size was adequate for the study objectives, a larger multicenter study may provide more representative findings. Furthermore, long-term outcomes and quality-of-life measures were not assessed, as the study focused primarily on perioperative and early postoperative outcomes. Despite these limitations, the study provides valuable local evidence regarding the effectiveness and safety of early versus delayed cholecystectomy in patients with acute cholecystitis.

5- CONCLUSION AND RECOMMENDATION

The findings of the present study demonstrate that early cholecystectomy is associated with superior outcomes compared with delayed cholecystectomy in patients with acute calculous cholecystitis. Early surgical intervention resulted in shorter operative time, reduced hospital stay, lower readmission rates, fewer postoperative complications, and better overall surgical outcomes. Delayed surgery and diabetes mellitus were identified as significant predictors of unfavorable postoperative outcomes. Therefore, early laparoscopic cholecystectomy should be considered the preferred treatment approach for suitable patients with acute cholecystitis whenever clinically feasible. Careful perioperative assessment and optimization of comorbid conditions, particularly diabetes mellitus, are recommended to further improve surgical outcomes. Future multicenter prospective studies with larger sample sizes and longer follow-up periods are also recommended to validate these findings and assess long-term outcomes.

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