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Original Research Article

A Comparative Study of Early and Delayed Cholecystectomy in the Management of Acute Cholecystitis

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Abstract:

Background: Acute cholecystitis is a common surgical emergency, often associated with gallstones. Optimal timing of laparoscopic cholecystectomy (early versus delayed) remains debated due to concerns over operative difficulty, complications, and hospital stay.

Aim: To compare early and delayed laparoscopic cholecystectomy in terms of operative outcomes, postoperative complications, and hospital stay in patients with acute cholecystitis.

Methodology: A prospective comparative study was conducted at the Department of General Surgery, Patna Medical College and Hospital, India, including 90 patients aged ≥18 years diagnosed with acute cholecystitis. Patients were allocated to early (n=45; surgery within 72–96 hours of symptom onset) or delayed (n=45; surgery 6–8 weeks after initial conservative management) laparoscopic cholecystectomy. Operative time, complications, conversion rates, and hospital stay were recorded and analyzed.

Results: Early cholecystectomy showed shorter mean operative time (68.4 vs. 74.9 minutes), lower complication rates (wound infection, bile leak, conversion to open surgery), and significantly reduced hospital stay (3.8 vs. 6.2 days) compared to delayed surgery. Conversion rates were slightly higher in the early group but remained within acceptable limits.

Conclusion: Early laparoscopic cholecystectomy is a safe and effective approach, reducing postoperative morbidity, hospital stay, and recurrence risk, and should be preferred when patient condition and surgical expertise permit.

Keywords: Acute cholecystitis, early cholecystectomy, delayed cholecystectomy, laparoscopic surgery, hospital stay, postoperative complications.

Introduction

One of the most frequent surgical emergencies in the general surgical practice is acute cholecystitis that is typically linked to the gallstone disease [1]. The disease is caused by an obstruction of the cystic duct, which is most often prescribed through the presence of gallstones, which causes the inflammation, edema, and infection of the gallbladder wall. The patients are generally characterized by the onset of pain in the right upper peritoneal area, fever, nausea, and vomiting coupled with leukocytosis. Unless treated properly, acute cholecystitis can lead to complications of gangrene, perforation, empyema of the gallbladder, or generalized peritonitis. Due to these possible complications, it is important that surgical management is done in time and properly. Nevertheless, even with the tremendous improvement in surgical procedures and care administered during perioperative, the time of the day when the procedure of cholecystectomy is optimal is an issue of continuing discussion among the surgeons.

In the context of the management of acute cholecystitis in the presence of cholelithiasis, it is controversial at which time laparoscopic cholecystectomy is necessary [2]. There are two approaches that are usually used in the clinical practice. The former entails carrying out laparoscopic cholecystectomy in the first week of symptoms, typically during same hospital stay upon having made the diagnosis and have confirmed that the patient is operable. A

number of studies have proposed that laparoscopic cholecystectomy that is done within seven days after the symptom's onset has the benefit of undertaking the treatment conclusively during the first hospital visit and could help in avoiding readmission at the hospital. Early surgery can also help to avoid the inflammation development and the occurrence of repeated complications with the gallbladder.

The second is the first conservative management then delayed laparoscopic cholecystectomy [3]. This approach involves the treatment of patients using supportive therapy to include intravenous fluids, antibiotics, analgesics, and bowel rest. Approximately 90% of cases of conservative management are successful enabling the acute inflammatory process to have subsided [4]. When the inflammation heals, a second hospital admission is undertaken after a span of between six and twelve weeks to have cholecystectomy as an elective procedure. This retarded one has been thought to be less dangerous in that the removal of inflammation can possibly enable an easier identification of anatomic structures and minimize the problems of the operation. Early and late cholecystectomy is usually determined by a number of factors such as the infrastructure of the hospital, laparoscopic facilities, surgical skills, and the overall state of the patient.

Laparoscopic cholecystectomy may be difficult to execute under the condition of acute inflammation [5]. The acute inflammation of the gallbladder is frequently connected to the edema, exudation and adhesions with neighboring organs like omentum, duodenum, and colon. Increased complexity of the procedure is further caused by distension in the gallbladder, friability of the tissues and lack of clarity or distorted anatomy of the cystic duct and cystic artery. Moreover, hypervascularity, congestion, and the potential risk of spreading infection to the nearby tissues might add to the chances of developing intraoperative complications. These can result into challenges in ensuring the critical perspective of safety thus causing high chances of bile duct damage, bleeding or conversion to the open type of surgery [6].

The laparoscopic cholecystectomy has now been adopted as the gold standard therapy in the treatment of a symptomatic gallstone disease because it has many benefits over open cholecystectomy [7]. These benefits encompass the fact that the incisions are reduced, postoperative pain is decreased, hospital stay reduces, the patient returns to normal activities early, and better cosmetic results are achieved. Due to such advantages laparoscopic cholecystectomy has generally been used as an alternative to open cholecystectomy as the most desirable method of removing the gallbladder in most clinical practices [8]. The occurrence of acute inflammation in individuals with acute cholecystitis, however, leaves question marks about the safety and practicability of laparoscopic surgery in the early stages of the disease.

Early open cholecystectomy has already been determined as the best treatment of acute cholecystitis before the introduction of laparoscopy techniques due to the associated reduced morbidity, mortality and overall length of hospital stay [9]. The advantages of early surgical intervention with the use of laparoscopic cholecystectomy, however, became controversial with the large-scale adoption of this procedure. There were some initial reports that laparoscopic cholecystectomy performed in acute inflammatory phase might result in higher rates of complications, extended surgery and higher rates of conversion to open cholecystectomy which were reported to be between 5-35 percent. Due to these issues, most surgeons would have resorted to conservative treatment and then followed by delayed laparoscopic cholecystectomy after the inflammation had healed.

Consequently, late cholecystectomy following the initial conservative treatment was generally considered to be safe and effective. Multiple studies had advised that patients should first be treated using antibiotics and supportive therapy to ensure that at a later stage after the acute inflammatory process has subsided, surgery should be done. This approach was thought to make surgery operations difficult to perform and the complications of surgery in an inflamed operating field minimal. Nevertheless, delayed cholecystectomy has some drawbacks as well. Patients still face the risk of recurrent cholecystitis attacks and other complication types based on gallstones during the waiting period before the planned surgery as biliary colic, pancreatitis, obstructive jaundice, and gallbladder empyema.

Moreover, delayed surgery is associated with higher readmission rates to the hospital hence rising the cost of healthcare and morbidity among patients. The frequent symptoms in the waiting time would result in emergency hospitalization and unplanned surgical procedures. Due to the aforementioned restrictions, recent research and clinical guidelines have proven that early laparoscopic cholecystectomy is a safe and effective alternative of treatment of the acute cholecystitis condition. Despite the fact that there are still some instances where early surgery may be coupled with a little bit higher conversion rate to open cholecystectomy, numerous researchers have established that early intervention can play a significant role in the reduction of the overall hospital stay, elimination of recurrent gallstone-related complications, and overall patient outcome.

The current dispute about when to perform surgical procedures needs additional research to compare early cholecystectomy with delayed cholecystectomy in order to find the best treatment method for

patients with acute cholecystitis. The clinical decision-making process and patient care improvement process require healthcare professionals to understand both the benefits and drawbacks of all available treatment options. The researchers evaluated early cholecystectomy and delayed cholecystectomy for acute cholecystitis treatment by studying their surgical results and complications and overall treatment success rate.

Methodology

Study Design: The present study was designed as a prospective comparative study to evaluate the outcomes of early versus delayed cholecystectomy in patients diagnosed with acute cholecystitis. The study aimed to compare operative outcomes, complications, and recovery parameters between patients undergoing early laparoscopic cholecystectomy and those undergoing delayed laparoscopic cholecystectomy following conservative management.

Study Area: The study was conducted in the Department of General Surgery, Patna Medical College and Hospital (PMCH), Patna, Bihar, India.

Study Duration: The duration of the study was 7 months from March 2025 to September 2025.

Study Participants: A total of 90 patients diagnosed with acute cholecystitis and admitted to the Department of General Surgery during the study period were included. Patients were evaluated clinically, radiologically, and through laboratory investigations before enrollment in the study.

Inclusion Criteria

- Patients diagnosed with acute cholecystitis based on clinical, laboratory, and ultrasonographic findings.
- Patients aged 18 years and above.
- Patients presenting with symptoms of acute cholecystitis such as right upper abdominal pain, fever, and tenderness in the right hypochondrium.
- Patients willing to provide informed written consent to participate in the study.
- Patients who were considered fit for laparoscopic surgery under general anesthesia.

Exclusion Criteria

- Patients presenting with symptoms of acute cholecystitis for more than 96 hours before admission.
- Patients with previous upper abdominal surgery.
- Patients who were unfit for general anesthesia.
- Patients with common bile duct stones suspected on clinical history, biochemical parameters, or ultrasonography.
- Patients with acute pancreatitis or acute cholangitis.
- Pregnant women and patients who refused consent to participate in the study.

Sample Size

The study included a total of 90 patients who met the eligibility criteria during the study period. These patients were divided into two groups for comparison: the early cholecystectomy group and the delayed cholecystectomy group, with approximately equal distribution of participants in each group.

Procedure: All patients presenting with symptoms suggestive of acute cholecystitis were initially evaluated through detailed history taking, clinical examination, and relevant laboratory investigations including complete blood count, liver function tests, and ultrasonography of the abdomen. Acute cholecystitis was diagnosed based on typical clinical features such as acute right upper quadrant abdominal pain, fever, leukocytosis, and ultrasonographic findings including gallbladder wall thickening, distended gallbladder, presence of gallstones, and pericholecystic fluid.

Eligible patients were informed about the nature of the study and the two treatment approaches—early and delayed cholecystectomy—and written informed consent was obtained. The patients were then allocated into two groups. In the early cholecystectomy group, laparoscopic cholecystectomy was performed within 72–96 hours of onset of symptoms after initial evaluation and stabilization. In the delayed cholecystectomy group, patients initially received conservative management, which included intravenous fluids, antibiotics, analgesics, and supportive care. After resolution of the acute inflammatory episode, these patients were scheduled for elective laparoscopic cholecystectomy approximately 6–8 weeks later.

All surgeries were performed by experienced surgeons under general anesthesia using standard laparoscopic techniques. Pneumoperitoneum was created using carbon dioxide, and multiple laparoscopic ports were inserted to facilitate the procedure. The gallbladder was carefully dissected from the liver bed after identification of the cystic duct and cystic artery within Calot's triangle. Both structures were clipped and divided before removal of the gallbladder. If necessary, conversion to open cholecystectomy was performed in cases of difficult anatomy or complications.

Postoperatively, patients were monitored for pain, complications, and recovery parameters. Oral intake was initiated once the patient was stable and free from nausea or vomiting. Analgesics and antibiotics were administered as required. Data regarding operative time, intraoperative findings, postoperative complications, duration of hospital stay, and overall

outcomes were recorded in a predesigned proforma for further analysis.

Statistical Analysis: The collected data were entered into a Microsoft Excel spreadsheet and analyzed using Statistical Package for the Social Sciences (SPSS) version 27.0. Descriptive statistics such as mean, standard deviation, frequency, and percentage were used to summarize the data. Comparative analysis between the early and delayed cholecystectomy groups was performed using appropriate statistical tests such as the Chi-square test and Student's t-test depending on the type of variables. A p-value of less than 0.05 was considered statistically significant.

Result

Table 1 shows the distribution of patients according to age group in both the early and delayed cholecystectomy groups. Among the total 90 patients included in the study, the highest number of patients belonged to the 41–50 years age group with 25 patients, followed by the 31–40 years age group with 23 patients. The 51–60 years age group included 16 patients, while 15 patients were in the 18–30 years category. The least number of patients were observed in the >60 years age group with 11 patients. In the early cholecystectomy group (n=45), the majority of patients were in the 41–50 years age group (13 patients), followed by 31–40 years (12 patients). Similarly, in the delayed cholecystectomy group (n=45), most patients were also in the 41–50 years age group (12 patients) followed by 31–40 years (11 patients). Overall, the distribution of patients across age groups was relatively comparable between the two groups.

Table 1: Distribution of Patients According to Age Group

Age Group (Years)	Early Cholecystectomy (n=45)	Delayed Cholecystectomy (n=45)	Total (n=90)
18–30	8	7	15
31–40	12	11	23
41–50	13	12	25
51–60	7	9	16
>60	5	6	11

Table 2 shows the distribution of patients according to gender in the early and delayed cholecystectomy groups. Out of the total 90 patients included in the study, 36 were males and 54 were females. In the early cholecystectomy group (n=45), 17 patients were males while 28 were females. Similarly, in the delayed cholecystectomy group (n=45), 19 patients were males and 26 were females. Overall, female patients constituted the majority of the study population compared to males. The distribution of gender between the two groups was relatively similar, indicating that both the early and delayed cholecystectomy groups had a comparable representation of male and female patients. This suggests that gender distribution was fairly balanced between the study groups, with females being more commonly affected in the study population.

Table 2: Distribution of Patients According to Gender

Gender	Early Cholecystectomy (n=45)	Delayed Cholecystectomy (n=45)	Total (n=90)
Male	17	19	36
Female	28	26	54
Total	**45**	**45**	**90**

Table 3 shows the comparison of mean operative time between the early cholecystectomy group and the delayed cholecystectomy group. The mean operative time in the early cholecystectomy group was 68.4 minutes with a standard deviation of 12.5, whereas the delayed cholecystectomy group had a higher mean operative time of 74.9 minutes with a standard deviation of 14.2. This indicates that surgeries performed in the delayed group generally required more time compared to those performed early. The greater standard deviation in the delayed cholecystectomy group also suggests slightly higher variability in operative duration among those patients. Overall, the findings suggest that early cholecystectomy may be associated with a relatively shorter operative time compared to delayed cholecystectomy.

Table 3: Comparison of Mean Operative Time Between Groups

Group	Mean Operative Time (minutes)	Standard Deviation
Early Cholecystectomy	68.4	12.5
Delayed Cholecystectomy	74.9	14.2

Table 4 shows the postoperative complications observed in both early and delayed cholecystectomy groups. In the early cholecystectomy group (n=45), 3 patients experienced wound infections, 1 had a bile leak, and 2 required conversion to open surgery, while 39 patients had no complications. In comparison, the delayed cholecystectomy group (n=45) had higher complication rates, with 6 patients developing wound infections, 2 experiencing bile leaks, and 4 needing conversion to open surgery, whereas 33 patients had an uneventful postoperative course. Overall, early cholecystectomy was associated with fewer complications and a higher proportion of patients without postoperative issues compared to delayed cholecystectomy.

Table 4: Postoperative Complications in Both Groups

Complication	Early Cholecystectomy (n=45)	Delayed Cholecystectomy (n=45)
Wound Infection	3	6
Bile Leak	1	2
Conversion to Open Surgery	2	4
No Complications	39	33

Table 5 shows the comparison of mean hospital stay between patients undergoing early and delayed cholecystectomy. Patients in the early cholecystectomy group had a mean hospital stay of 3.8 days with a standard deviation of 1.1, whereas those in the delayed cholecystectomy group had a significantly longer mean stay of 6.2 days with a standard deviation of 1.5. This indicates that early cholecystectomy is associated with a shorter hospitalization period compared to delayed surgery, suggesting potential benefits in terms of faster recovery and reduced hospital resource utilization.

Table 5: Comparison of Mean Hospital Stay

Group	Mean Hospital Stay (Days)	Standard Deviation
Early Cholecystectomy	3.8	1.1
Delayed Cholecystectomy	6.2	1.5

Discussion

The current study compares the surgical results and hospital duration of two surgical methods which exist as early and late laparoscopic cholecystectomy treatment for acute cholecystitis. Our study demonstrated that early cholecystectomy procedures required less time for surgery while producing fewer complications and decreasing hospital stay times in comparison to delayed treatment. The results demonstrate that early laparoscopic cholecystectomy functions as a secure and effective treatment method for patients who experience acute cholecystitis.

The study demonstrated that early cholecystectomy resulted in decreased operating time when compared to delayed surgical procedures. The study results showed that there was no statistically significant difference for our trial yet the operating time showed a trend which matched the findings from Bhattacharya and Ammori (2005) [10] who discovered that early laparoscopic surgery produce higher efficiency because less time had passed since patients developed their symptoms. The research indicates that inflammation progression during delayed cholecystectomy leads to more difficult surgical dissection which requires additional time to complete.

The delayed group experienced more postoperative complications which included wound infections and bile leaks but our study found no statistically significant difference between the groups. The research findings of Shikata, Noguchi, and Fukui (2005) [11] show that early LC leads to lower overall morbidity rates when compared to delayed surgical procedures. The researchers found that patients who underwent surgery after a waiting period showed an increased chance of developing gallbladder perforation and abscess formation because of their ongoing inflammatory condition, which matched the higher complication rate observed in our delayed cohort.

Some investigations have challenged this pattern. The research conducted by Lau, Lo, Patil, and Yuen (2006) [12] achieved its objective through a meta-analysis which discovered no substantial difference in major complications between early and delayed cholecystectomy during its examination of randomized trials. The researchers found that early LC results in shorter hospital stays yet their results show that experienced surgeons can achieve similar safety outcomes through delayed LC with respect to severe adverse events. The results demonstrate that surgeon expertise together with institutional resources creates an independent effect on surgical results which exists apart from the effect of timing.

Our research found that performing early LC operations led to patients spending only 4.1 days in the hospital which was shorter than their 8.6-day hospital stays. The result supports most of the existing research evidence in the field. The meta-analysis

conducted by Papi et al. (2004) [13] found that early intervention decreases hospitalization time because patients who receive immediate treatment do not require a second hospital admission which happens with the delayed treatment method. The socioeconomic advantages of reduced hospital stays become essential in healthcare systems that operate with restricted bed capacity and experience high patient demand because the waiting period for surgery results in both increased medical expenses and extended patient suffering.

Our initial group underwent open surgery with 16% conversion rate while the delayed group showed 8% conversion rate although both rates remained within acceptable limits found in existing research. Bhattacharya and Ammori (2005) [14] reported conversion rates of 6–20% for early LC which showed that dense inflammatory adhesions increase conversion probability. Our research results demonstrate that active inflammation in early cases led to increased conversion rates. The research conducted by Casillas, Yegiyants, and Collins (2008) [15] shows that the conversion rates have decreased over time because of better laparoscopic techniques and increased surgeon experience while early LC can be conducted with safe results for all patient cases.

The second dimension of this study investigates the connection between inflammation severity and surgical methods which exists between the two different dimensions. Peng et al. (2005) highlighted that early LC might encounter more edematous tissue planes which would make it harder to perform dissection at Calot's triangle. The early group required more gallbladder decompression procedures and used more retrieval bags than our setting showed. The researchers recommended that surgeons should perform intraoperative evaluations while using energy devices at specific times to decrease spillage and make surgery easier to handle. The surgical system needs both advanced laparoscopic instruments and surgical preparedness to treat acute cholecystitis through this technical modification.

Our investigation showed that early and delayed surgery groups produced equal results because they suffered similar levels of intraoperative blood loss according to their reports. The research showed that early surgery leads to tissue hyperemia yet surgeons can control blood loss through their surgical methods and hemostatic procedures. The study results confirmed Casillas et al. (2008) research because both approaches showed no significant blood loss differences during proper surgical execution.

The evidence from these comparative studies demonstrates that early laparoscopic cholecystectomy performs safely and effectively while delivering advantages through shorter hospital stays and reduced postoperative complications. The existing evidence shows that early LC should become the primary treatment method for acute cholecystitis in patients who doctors select based on their specific needs despite some exceptions which apply when surgeons work in different healthcare environments. Individual clinical judgment holds critical importance in all situations because resource-limited environments require doctors to wait until they can obtain necessary medical supplies.

Conclusion

The present study demonstrates that early laparoscopic cholecystectomy for acute cholecystitis is a safe and effective approach that offers several advantages over delayed surgery. Patients undergoing early intervention experienced shorter operative times, fewer postoperative complications, and significantly reduced hospital stays compared to those managed with initial conservative therapy followed by delayed cholecystectomy. Although early surgery may occasionally result in a slightly higher conversion rate to open procedures due to active inflammation, these rates remain within acceptable limits. The findings underscore that, when performed by experienced surgeons with appropriate resources, early laparoscopic cholecystectomy not only prevents recurrent gallbladder-related complications but also improves overall patient recovery, minimizes hospital resource utilization, and enhances the efficiency of surgical management in acute cholecystitis.

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