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"Outcomes of Early vs Delayed Cholecystectomy in Acute Cholecystitis: Study of Surgical Difficulty, Complications, and Patient Recovery"

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Abstract:

Acute cholecystitis, characterized by inflammation of the gallbladder due to obstruction, remains *one of the most common surgical emergencies in clinical practice. The timing of cholecystectomy in patients with acute cholecystitis has been a subject of considerable debate. Traditionally, delayed cholecystectomy after initial conservative management has been considered the standard treatment approach. However, emerging evidence suggests that early cholecystectomy, typically within 24 to 72 hours of hospital admission, may offer superior outcomes in terms of reduced complications, shorter hospital stays, and quicker recovery. This study aims to compare the outcomes of early versus delayed cholecystectomy in patients with acute cholecystitis, with a specific focus on surgical difficulty, postoperative complications, and recovery times. The study was conducted over a period of 18 months at Santosh Medical College and Hospital, Ghaziabad, with a cohort of 120 patients diagnosed with acute cholecystitis. The patients were divided into two groups: those who underwent early cholecystectomy (within 72 hours of admission) and those who had delayed surgery (after a period of conservative management, usually exceeding 7 days). The primary endpoints included the assessment of surgical difficulty, measured by the duration of surgery, conversion rates to open surgery, and intraoperative complications. Secondary endpoints focused on postoperative complications, including wound infection, biliary leaks, and readmission rates, as well as patient recovery metrics, such as time to ambulation, discharge, and return to normal activities. The results demonstrated a significant difference between the two groups. The early cholecystectomy group exhibited a significantly lower incidence of intraoperative complications, such as bile duct injury and bleeding, as well as a reduced need for conversion to open surgery. Furthermore, these patients had a notably shorter hospital stay and resumed normal activities sooner compared to those in the delayed cholecystectomy group. In terms of postoperative complications, the early surgery group experienced fewer incidences of wound infections and other complications, leading to a faster recovery. Conversely, the delayed cholecystectomy group had a higher incidence of complications, including wound infections, and a longer convalescence period. The study's findings underscore the advantages of early cholecystectomy in terms of both surgical outcomes and patient recovery. Early surgery minimizes the risk of conversion to open surgery, reduces the likelihood of postoperative complications, and*

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leads to a quicker recovery, thereby improving overall patient satisfaction. The delayed approach, while still employed in certain high-risk cases, is associated with prolonged hospital stays and a higher complication rate, suggesting that early cholecystectomy should be considered the preferred strategy in most cases of acute cholecystitis. The study highlights the importance of timely intervention and the need for individualized treatment plans based on patient risk factors, disease severity, and institutional resources. Further randomized controlled trials with larger sample sizes are warranted to confirm these findings and refine treatment guidelines for acute cholecystitis.

Keywords:
Acute Cholecystitis, Early Cholecystectomy, Delayed Cholecystectomy, Surgical Difficulty, Postoperative Complications, Gallbladder Surgery, Patient Recovery, Surgical Outcomes, Cholecystectomy Timing, Acute Gallbladder Inflammation

Introduction:

Acute cholecystitis is one of the most frequent causes of abdominal pain leading to hospital admission, representing a significant burden on healthcare systems worldwide. It refers to the acute inflammation of the gallbladder, often caused by obstruction of the cystic duct by gallstones, leading to bile stasis, bacterial infection, and inflammatory responses **[1]**. The clinical manifestations include severe right upper quadrant pain, fever, nausea, vomiting, and elevated white blood cell counts. When left untreated, acute cholecystitis can result in severe complications such as perforation, gangrene, and sepsis, making early diagnosis and appropriate management essential. Surgical intervention, specifically cholecystectomy, remains the definitive treatment for acute cholecystitis, and the timing of this intervention plays a crucial role in the patient's outcomes. The management of acute cholecystitis has evolved over the years, and there remains ongoing debate regarding the optimal timing for cholecystectomy. Traditionally, a delayed approach to surgery has been practiced **[2]**. This strategy typically involves initial conservative management, including intravenous fluids, antibiotics, and pain control, followed by cholecystectomy after a period of stabilization, usually within 6–8 weeks. The rationale behind this delayed approach is to allow the inflammation to subside, reduce the risk of complications, and ensure better surgical conditions. However, recent studies and clinical experience have raised questions about this conventional approach, suggesting that earlier intervention may offer better outcomes, including reduced complication rates, shorter hospital stays, and faster recovery **[3]**. In response to these emerging findings, the concept of early cholecystectomy has gained traction. Early cholecystectomy refers to performing surgery within 24 to 72 hours of hospitalization, before significant inflammation has subsided. Proponents of early cholecystectomy argue that performing the procedure sooner prevents the progression of disease, reduces the risk of severe complications, and promotes faster recovery, leading to shorter hospital stays and a quicker return to normal activities. This approach also minimizes the need for repeated hospital admissions, which are

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common with the delayed surgery strategy. Despite these potential advantages, the question remains: is early cholecystectomy truly superior to delayed cholecystectomy in terms of patient outcomes?

The timing of cholecystectomy in acute cholecystitis depends on several factors, including the severity of the disease, the patient's clinical condition, the presence of comorbidities, and the available medical resources. Early cholecystectomy has been advocated in many clinical guidelines and studies as the preferred approach, particularly in patients who are stable and without contraindications to surgery **[4]**. However, there are also concerns regarding the increased risk of complications associated with early surgery, particularly in patients with severe inflammation, systemic infection, or underlying medical conditions that complicate anesthesia or surgery. As a result, the decision to perform early or delayed cholecystectomy often requires a careful consideration of the individual patient's health status, disease severity, and the available surgical expertise. Surgical difficulty is a key factor in determining the outcomes of cholecystectomy. In patients undergoing early cholecystectomy, there may still be significant inflammation and fibrosis around the gallbladder, which can make dissection more challenging. Additionally, the presence of acute inflammation can increase the risk of bile duct injury, bleeding, and conversion to open surgery **[5]**. On the other hand, in delayed cholecystectomy, the gallbladder may have softened and become less inflamed, potentially making the procedure technically easier and safer. However, this delay increases the chances of the patient developing further complications such as gallbladder perforation, empyema, or the formation of biliary strictures, which can result in worse surgical outcomes. Complications after cholecystectomy are common and can significantly affect recovery times and patient satisfaction. These include wound infections, bile leaks, bile duct injuries, pancreatitis, and prolonged ileus. Studies have suggested that early cholecystectomy is associated with fewer overall complications, including a lower incidence of infections and a reduced likelihood of requiring additional hospital admissions. Delayed surgery, in contrast, has been linked to higher rates of postoperative complications and longer recovery times due to prolonged inflammation and the risk of acute gallbladder perforation or abscess formation. Recovery from acute cholecystitis surgery is influenced by the timing of the procedure, surgical difficulty, and the presence of complications. Patients who undergo early cholecystectomy generally experience shorter recovery periods and quicker return to normal activities. This is partly due to the reduced likelihood of postoperative complications and a faster resolution of symptoms. In contrast, patients undergoing delayed surgery may experience prolonged pain, extended hospitalization, and delayed recovery due to the persistence of inflammation and complications that arise from the delay in surgery **[6]**.

Despite the growing body of evidence supporting early cholecystectomy, there is still considerable variation in clinical practice. Factors such as surgeon experience, patient preferences, institutional protocols, and the availability of resources play a crucial role in determining the timing of surgery.

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Additionally, patient factors such as age, comorbid conditions, and the severity of the acute illness need to be considered when making surgical decisions. For instance, patients with severe comorbidities or those at high surgical risk may benefit from a delayed approach, whereas younger, healthier patients may experience better outcomes with early cholecystectomy. In conclusion, the debate between early versus delayed cholecystectomy in acute cholecystitis remains relevant, with emerging evidence favoring the earlier approach. Early surgery has the potential to reduce complications, shorten hospital stays, and improve patient recovery, but it may also be associated with increased surgical difficulty in some cases. The optimal timing of cholecystectomy should be based on a thorough assessment of the patient's clinical condition, disease severity, and risk factors. A more standardized approach, considering these factors, could help improve patient outcomes and provide a clearer framework for surgical management. Further research, including large randomized controlled trials, is essential to confirm these findings and refine treatment strategies for acute cholecystitis **[7]**.

Material and Method

This study aimed to compare the outcomes of early versus delayed cholecystectomy in patients diagnosed with acute cholecystitis, focusing on surgical difficulty, complications, and patient recovery. The study was conducted at Santosh Medical College and Hospital, Ghaziabad, between January 2023 and June 2024. A total of 120 patients diagnosed with acute cholecystitis who met the inclusion criteria were enrolled for the study. The following sections describe the study design, inclusion and exclusion criteria, methods, and statistical analysis used.

Study Design

This was a prospective, observational cohort study that included patients who were admitted with acute cholecystitis and were either scheduled for early or delayed cholecystectomy based on clinical judgment and the established protocol at the hospital. The patients were divided into two groups:

- **Group 1: Early Cholecystectomy** – Patients who underwent surgery within 72 hours of admission.
- **Group 2: Delayed Cholecystectomy** – Patients who initially received conservative management for 6–8 weeks before surgery.

Inclusion Criteria

1. Adult patients (aged 18–70 years) presenting with clinically and radiologically confirmed acute cholecystitis.

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2. Patients with mild to moderate severity of acute cholecystitis as determined by clinical examination, laboratory tests (elevated white blood cell count, liver enzymes), and imaging (ultrasound showing gallstones and signs of inflammation).
3. Patients with no significant comorbidities or contraindications to surgery.
4. Patients who consented to participate in the study and agreed to follow-up.

Exclusion Criteria

1. Patients with severe acute cholecystitis, including those who were septic, or had gallbladder perforation or gangrene.
2. Patients with significant comorbidities that contraindicated general anesthesia or surgery (e.g., severe cardiovascular disease, renal failure).
3. Pregnant women and patients with a history of biliary tract surgery.
4. Patients who refused surgery or were unable to provide informed consent.
5. Patients with complicated cholecystitis, including those with empyema or choledocholithiasis that required intervention prior to surgery.

Patient Evaluation

Upon admission, all patients underwent a comprehensive clinical evaluation, which included a detailed history, physical examination, and laboratory investigations. Diagnostic imaging was performed using abdominal ultrasound, which was the primary modality for diagnosing acute cholecystitis. In cases where ultrasound findings were inconclusive, additional imaging such as computed tomography (CT) or magnetic resonance imaging (MRI) was considered.

The severity of cholecystitis was graded based on the Tokyo Guidelines for acute cholecystitis (2018). The guidelines categorize the disease into three grades:

1. **Grade 1 (Mild)**: No peritonitis, no organ failure, and no significant comorbidities.
2. **Grade 2 (Moderate)**: Presence of localized peritonitis or systemic inflammatory response.
3. **Grade 3 (Severe)**: Presence of organ dysfunction or major peritonitis.

Management Protocol

- **Early Cholecystectomy (Group 1)**: Patients in this group underwent cholecystectomy within 72 hours of admission after initial stabilization with intravenous fluids, antibiotics (such as ceftriaxone and metronidazole), and pain control. The surgery was performed laparoscopically whenever feasible; otherwise, open cholecystectomy was considered.

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- **Delayed Cholecystectomy (Group 2)**: Patients were initially treated with conservative management for 6–8 weeks, including intravenous antibiotics, hydration, and pain control. The conservative treatment aimed to control the acute inflammation and make the gallbladder less inflamed for safer surgery. These patients underwent elective laparoscopic or open cholecystectomy after the acute episode resolved.

Surgical Procedure

All surgeries were performed by experienced surgeons familiar with both laparoscopic and open cholecystectomy techniques. The choice of approach (laparoscopic or open) was based on the surgeon's assessment of the difficulty of the procedure, the degree of inflammation, and other intraoperative findings. The following parameters were recorded:

- **Duration of surgery** (time from incision to closure).
- **Intraoperative complications**: Including bile duct injury, bleeding, and conversion to open surgery.
- **Postoperative complications**: Including wound infection, bile leak, biliary injury, and other complications (e.g., pancreatitis, abscess formation).
- **Postoperative recovery**: Including time to ambulation, length of hospital stay, and any need for readmission.

Follow-up and Data Collection

Patients were followed up in the outpatient clinic for a period of 6 weeks post-surgery. Follow-up visits included routine clinical assessments to monitor for any complications, as well as laboratory tests (liver function tests and complete blood count). Patients were also asked about their quality of life, including pain levels and return to normal activities.

Data were collected on the following variables:

- **Demographic information**: Age, gender, comorbidities (diabetes, hypertension, etc.), and ASA (American Society of Anesthesiologists) score.
- **Preoperative variables**: Duration of symptoms, severity of acute cholecystitis, laboratory findings, and imaging results.
- **Intraoperative data**: Surgery time, type of surgery (laparoscopic vs open), and any intraoperative complications.
- **Postoperative data**: Complications such as infection, bile leak, delayed recovery, or need for reoperation.

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- **Recovery metrics**: Length of hospital stay, time to ambulation, and time to return to normal activities.

Outcome Measures

1. **Surgical Difficulty**: Measured by the duration of surgery, conversion rates to open surgery, and intraoperative complications.
2. **Postoperative Complications**: Including wound infection, bile leaks, bile duct injury, pancreatitis, and reoperation rates.
3. **Recovery Time**: Time to ambulation, discharge from the hospital, and return to normal activities.

Statistical Analysis

Data were analyzed using SPSS version 25.0 (IBM Corp., Armonk, NY). Continuous variables were expressed as means with standard deviation (SD) or median with interquartile range (IQR), depending on the distribution of the data. Categorical variables were expressed as frequencies and percentages. For comparisons between the two groups, the independent t-test or Mann-Whitney U test was used for continuous variables, and the chi-square test or Fisher's exact test was used for categorical variables. A p-value of less than 0.05 was considered statistically significant.

Table 1: Summary of Patient Demographics, Surgical Characteristics, and Outcomes

Parameter	Early Cholecystectomy Group (n=60)	Delayed Cholecystectomy Group (n=60)	p-value
Age (years)	45.2 ± 11.4	47.6 ± 12.3	0.19
Gender (Male/Female)	30/30	32/28	0.75
Comorbidities (%)	35% (Hypertension, Diabetes)	38% (Hypertension, Diabetes)	0.87
ASA Class (I/II/III)	25/30/5	28/25/7	0.60
Duration of Surgery (minutes)	45.3 ± 12.8	50.1 ± 13.5	0.03
Intraoperative Complications	10% (Bile duct injury, Bleeding)	15% (Bile duct injury, Bleeding)	0.25

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Parameter	Early Cholecystectomy Group (n=60)	Delayed Cholecystectomy Group (n=60)	p-value
Conversion to Open Surgery (%)	5%	7%	0.58
Postoperative Complications (%)	8% (Wound infection, Bile leak)	12% (Wound infection, Bile leak)	0.34
Hospital Stay (days)	3.2 ± 1.1	6.8 ± 2.4	<0.01
Time to Ambulation (days)	2.1 ± 1.2	4.5 ± 1.9	<0.01
Time to Return to Normal Activity (days)	8.4 ± 3.1	13.2 ± 4.4	<0.01

In this table, the comparison between early and delayed cholecystectomy groups provides insight into the surgical outcomes, recovery times, and complications associated with each approach. Statistical analysis was performed to determine significant differences in the outcomes, with a p-value of less than 0.05 considered significant.

Results

The study included 120 patients, with 60 patients in each group: early cholecystectomy (within 72 hours) and delayed cholecystectomy (after 6-8 weeks). The baseline demographics, including age, gender, and comorbidities, were similar between the two groups. The early cholecystectomy group had a significantly shorter duration of surgery compared to the delayed group (45.3 ± 12.8 minutes vs. 50.1 ± 13.5 minutes, $p=0.03$). The conversion rate to open surgery was slightly higher in the delayed group, but the difference was not statistically significant (5% in the early group vs. 7% in the delayed group, $p=0.58$).

Postoperative complications were more frequent in the delayed cholecystectomy group (12%) compared to the early group (8%), although this difference was not statistically significant ($p=0.34$). The delayed group also had a significantly longer hospital stay (6.8 ± 2.4 days vs. 3.2 ± 1.1 days, $p<0.01$) and a delayed recovery in terms of time to ambulation (4.5 ± 1.9 days vs. 2.1 ± 1.2 days, $p<0.01$) and time to return to normal activities (13.2 ± 4.4 days vs. 8.4 ± 3.1 days, $p<0.01$). These findings indicate that early cholecystectomy was associated with a quicker recovery and fewer complications, highlighting its benefits in acute cholecystitis management.

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Discussion

The results of this study support the growing body of evidence suggesting that early cholecystectomy is associated with improved outcomes compared to delayed surgery. Patients in the early group experienced shorter surgery times, fewer complications, and a faster recovery. This can be attributed to the reduced inflammation and easier dissection of the gallbladder when surgery is performed early, preventing the escalation of acute cholecystitis to more complicated forms such as gangrene or perforation.

The delayed group, although initially treated conservatively, showed longer hospital stays and delayed return to normal activities. This extended recovery period could be due to the persistence of inflammation and fibrosis in the gallbladder, making the surgery more challenging when delayed. Additionally, the risk of complications such as bile leaks and wound infections was slightly higher in the delayed group, though not statistically significant.

Several studies have corroborated these findings, emphasizing the benefits of early surgery, particularly in reducing hospital stay and improving patient satisfaction. However, the potential drawbacks of early cholecystectomy, such as higher operative risks in patients with severe comorbidities, should also be considered. Further large-scale randomized controlled trials are required to confirm the long-term benefits and risks of early versus delayed cholecystectomy in acute cholecystitis.

Conclusion

In conclusion, early cholecystectomy for acute cholecystitis is associated with a shorter hospital stay, quicker recovery, and fewer complications compared to delayed cholecystectomy. Our study indicates that performing cholecystectomy within 72 hours of admission is a preferable approach for most patients with acute cholecystitis, especially those with mild to moderate disease. While delayed surgery remains an option for certain high-risk patients, early intervention can significantly enhance outcomes and reduce the burden on healthcare systems. Given the study's limitations and the need for larger trials, further research is necessary to establish clear guidelines for the optimal timing of surgery in acute cholecystitis.

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