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Original Research Article

Comparison of Clinical Outcome, Safety and Feasibility of Early versus Delayed Laparoscopic Cholecystectomy in Acute Cholecystitis

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ABSTRACT

Background: There is ongoing debate on the best time to do a laparoscopic cholecystectomy in cases of acute calculous cholecystitis. While delayed treatment allows acute inflammation to go away, early surgery may shorten hospital stays and prevent recurrent gallstone-related problems. The purpose of this study was to evaluate the safety, practicality, and clinical results of early versus delayed laparoscopic cholecystectomy.

Methods: A prospective, randomized comparative study was conducted in the Department of General Surgery, KIMS Medical College, Bhubaneswar, Odisha, from March 2021 to March 2022. Fifty patients diagnosed with acute calculous cholecystitis were randomly allocated into two groups: early laparoscopic cholecystectomy (ELC, n=25), performed within 72 hours of symptom onset, and delayed laparoscopic cholecystectomy (DLC, n=25), performed six weeks after initial conservative management. Intraoperative parameters, postoperative complications, duration of surgery and hospital stay were compared. Statistical significance was set at $p<0.05$.

Results: The mean operative duration was significantly longer in the ELC group compared to the DLC group (68.48 ± 20.04 versus 57.36 ± 14.09 minutes; p=0.026). The conversion rate was 8% in the ELC group and 4% in the DLC group (p=1.000). Bile or stone spillage occurred in 20% and 16% of patients, respectively (p=1.000). No common bile duct injuries or postoperative complications were recorded in either group. The mean postoperative hospital stay was comparable (1.72 ± 0.98 versus 1.44 ± 0.65 days; p=0.240). However, the total hospital stay was significantly shorter in the ELC group (2.72 ± 0.98 versus 4.04 ± 0.68 days; $p<0.001$).

Conclusion: Early laparoscopic cholecystectomy performed within 72 hours is a safe and feasible treatment option for uncomplicated acute calculous cholecystitis. It considerably lowers overall hospital stays without raising conversion rates or surgical problems, even if the procedure takes longer.

Keywords: Acute Calculous Cholecystitis, Early Laparoscopic Cholecystectomy, Delayed Laparoscopic Cholecystectomy, Operative Outcomes, Hospital Stay.

INTRODUCTION

One of the most prevalent surgical conditions, cholelithiasis affects between 10% to 15% of adults in Western nations.[1] In the United States, nearly 20 million individuals (10–20% of adults) are estimated to have gallstones.[2] Although its prevalence is comparable across Western populations, it is relatively lower in Asian and African countries.[2] According to a gallstone survey, North Indians were seven times more likely than South Indians to have gallbladder stones.[3] The reported prevalence of gallstones in North India is 6.12%.[4]

Gallstones may remain asymptomatic or present with various complications, including biliary colic, acute or chronic cholecystitis, mucocele, empyema, gangrenous cholecystitis, gallbladder perforation and gallstone pancreatitis. The most effective treatment for symptomatic

gallstone disease is now laparoscopic cholecystectomy.[5]

In the past, acute cholecystitis was thought to be a relative contraindication to laparoscopic cholecystectomy due to the possibility that inflammation and oedema would make the procedure technically difficult, which could lengthen the procedure and increase conversion rates. Consequently, patients were often managed conservatively, with surgery planned after the acute inflammatory phase had subsided.[6,7] However, delaying surgery may expose patients to recurrent or unresolved cholecystitis and other gallstone-related complications, such as common bile duct stone migration, obstructive jaundice, cholangitis and pancreatitis, resulting in additional hospital admissions.[8]

Early laparoscopic cholecystectomy can save hospital stays and treatment costs without appreciably raising morbidity or mortality when compared to delayed surgery, according to a number of randomised controlled trials and meta-analyses.[9-11] Nevertheless, the optimal timing of surgery remains a matter of debate.[12] With advances in laparoscopic techniques and increasing surgical experience, early laparoscopic cholecystectomy has gained acceptance; however, it is still performed by only a minority of surgeons.[13,14]

Aim and Objectives

In patients with acute cholecystitis, the current study compares the clinical results, safety, and viability of early versus delayed laparoscopic cholecystectomy. In particular, the study assesses and contrasts the two groups' overall hospital stay, postoperative complications, conversion rate to open cholecystectomy, gallbladder perforation, common bile duct injury incidence, and length of surgery.

MATERIALS AND METHODS

Study Design

The present study was a prospective, randomized, comparative study conducted in the Department of General Surgery, KIMS Medical College, Bhubaneswar, Odisha, over a period of one year, from March 2021 to March 2022. The study population comprised patients admitted to the surgical inpatient department with acute cholecystitis who fulfilled the predefined inclusion criteria.

Inclusion and Exclusion Criteria

Patients aged 18–60 years, irrespective of gender, diagnosed with acute cholecystitis based on four diagnostic parameters, namely acute upper abdominal pain with a positive Murphy's sign, fever above 37.5°C, leukocytosis greater than 10,500/mm³, and ultrasonographic evidence of acute cholecystitis (gallbladder wall thickening or oedema, presence of gallstones and pericholecystic fluid collection), with an onset of symptoms within 72 hours, were included in the study. Patients with an ASA grade greater than III, acute acalculous cholecystitis, onset of symptoms more than 72 hours, common bile duct stones, acute pancreatitis, moderate or severe acute cholecystitis, or a history of previous abdominal surgery were excluded.

Data Collection Procedure

After obtaining informed written consent, eligible patients underwent detailed history-taking, general physical and systemic examinations, and relevant laboratory and radiological investigations, including a complete haemogram, urine examination, blood urea, serum creatinine, blood glucose, serum electrolytes, liver function tests, serum amylase and lipase when indicated, chest X-ray, electrocardiography and ultrasonography of the abdomen. Patients were randomly allocated to either the early or delayed laparoscopic cholecystectomy group using the closed-envelope method. Patients in the early group (n=25) received initial conservative management and underwent laparoscopic cholecystectomy within 72 hours of symptom onset, while those in the delayed group (n=25) received intravenous fluids, antibiotics and analgesics and, following complete resolution of symptoms, were discharged and readmitted for surgery after six weeks. All procedures were performed under general anaesthesia by the same consultant surgeon, who had more than 15 years of experience in laparoscopic cholecystectomy, using a standard four-port technique. Intraoperative parameters recorded included the requirement for gallbladder decompression, bile or stone spillage, common bile duct injury, conversion to open cholecystectomy, requirement for drainage and duration of surgery. Postoperative assessment included pain scoring using the visual analogue scale at 12 hours, 24 hours and one week, analgesic requirement, postoperative complications such as bile leak and wound infection, duration of postoperative hospital stay and total hospital stay. The same surgical technique and postoperative assessment protocol were followed in both groups, and the collected data were compared to evaluate the clinical outcomes, safety and

feasibility of early versus delayed laparoscopic cholecystectomy.

Statistical Analysis

SPSS software for Windows, version 17.0, was used to evaluate all of the data that had been gathered and enter it into a master chart. While categorical data were shown as frequencies and percentages, continuous variables were given as mean ± standard deviation (SD). Prior to statistical analysis, the normality of continuous variables was evaluated. The unpaired Student's t-test was utilised to compare regularly distributed continuous variables, whereas the Mann-Whitney U test was employed for non-normally distributed data. When applicable, the chi-square test or Fisher's exact test was used to assess categorical variables. For every statistical test, a p-value of less than 0.05 was deemed statistically significant.

RESULTS

The study was conducted in the Department of General Surgery, Ispat General Hospital, Rourkela, Odisha. There were fifty patients with acute cholecystitis in all, twenty-five of whom underwent ELC (Early Laparoscopic Cholecystectomy) and twenty-five of whom underwent DLC (Delayed Laparoscopic Cholecystectomy). Statistical significance was defined as a p value of less than 0.05.

Parameter	Category	Early LC (n=25)	Delayed LC (n=25)	P value
Age group (in years)	18 – 25	3 (12.0%)	2 (8.0%)	0.223
	25 – 34	12 (48.0%)	7 (28.0%)	
	36 – 44	9 (36.0%)	11 (44.0%)	
	45 – 54	1 (4.0%)	5 (20.0%)	
	Total	**25 (100%)**	**25 (100%)**	
Age (years)	Mean ± SD	33.08 ± 7.22	36.52 ± 7.54	0.103
Sex	Female	23 (92.0%)	23 (92.0%)	1.000
	Male	2 (8.0%)	2 (8.0%)	
	Total	**25 (100%)**	**25 (100%)**	
BMI (kg/m²)	15 – 19.9	12 (48.0%)	6 (24.0%)	0.174
	20 – 24.9	9 (36.0%)	15 (60.0%)	
	25 – 29.9	4 (16.0%)	4 (16.0%)	
	Total	**25 (100%)**	**25 (100%)**	
BMI (kg/m²)	Mean ± SD	21.21 ± 2.77	21.82 ± 2.51	0.417

Table 1: Baseline Demographic Characteristics of the Two Groups

LC = laparoscopic cholecystectomy; GB = gallbladder; Values are n (%) unless stated otherwise

Table 1 illustrates the baseline demographic profile of the 50 patients with acute cholecystitis (25 in the early and 25 in the delayed laparoscopic cholecystectomy group). In the ELC group, 48% of patients were aged 25–34 years and 36% were aged 36–44 years, whereas in the DLC group 44% were aged 36–44 years and 28% were aged 25–34 years; the mean age was 33.08 ± 7.22 years in ELC and 36.52 ± 7.54 years in DLC, with no significant difference (p = 0.103). Females constituted 92% of both groups (p = 1.000). The majority of ELC patients (48%) had a BMI of 15–19.9, while most DLC patients (60%) had a BMI of 20–24.9; mean BMI was 21.21 ± 2.77 and 21.82 ± 2.51 respectively (p = 0.417). The two groups were therefore comparable at baseline.

Parameter	Category	Early LC (n=25)	Delayed LC (n=25)	P value
Time of presentation	12 hr	7 (28.0%)	9 (36.0%)	0.558
	24 hr	13 (52.0%)	9 (36.0%)	
	48 hr	5 (20.0%)	6 (24.0%)	
	72 hr	0 (0.0%)	1 (4.0%)	
	Total	**25 (100%)**	**25 (100%)**	
TLC	< 10,500	6 (24.0%)	24 (96.0%)	< 0.001
	> 10,500	19 (76.0%)	1 (4.0%)	
	Total	**25 (100%)**	**25 (100%)**	

ALP	Mean ± SD (Median; Min–Max)	132.68 ± 44.19 (112; 98–270)	109.64 ± 15.61 (109; 86–143)	0.018

Table 2: Time of Presentation and Laboratory Findings

LC = laparoscopic cholecystectomy; GB = gallbladder; Values are n (%) unless stated otherwise

Table 2 observes the time of presentation and laboratory parameters. In the ELC group 28% of patients presented within 12 hours, 52% within 24 hours and 20% within 48 hours, while in the DLC group 36% presented within 12 hours, 36% within 24 hours, 24% within 48 hours and 4% within 72 hours; this difference was not significant (p = 0.558). Total leucocyte count showed a marked difference: 76% of ELC patients had a TLC above 10,500 compared with only 4% of DLC patients (p < 0.001). Similarly, the mean alkaline phosphatase level was significantly higher in the ELC group (132.68 ± 44.19) than in the DLC group (109.64 ± 15.61) (p = 0.018). Haemoglobin, platelet count, renal and liver function tests were normal in all patients.

Parameter	Category	Early LC (n=25)	Delayed LC (n=25)	P value
Thickened oedematous GB	No	0 (0.0%)	19 (76.0%)	< 0.001
	Yes	25 (100.0%)	6 (24.0%)	
	Total	**25 (100%)**	**25 (100%)**	
Distended GB	No	11 (44.0%)	20 (80.0%)	0.009
	Yes	14 (56.0%)	5 (20.0%)	
	Total	**25 (100%)**	**25 (100%)**	
Pericholecystic fluid	No	6 (24.0%)	23 (92.0%)	< 0.001
	Yes	19 (76.0%)	2 (8.0%)	
	Total	**25 (100%)**	**25 (100%)**	

Table 3: Ultrasonographic Findings

LC = laparoscopic cholecystectomy; GB = gallbladder; Values are n (%) unless stated otherwise

Table 3 depicts the ultrasonographic findings in the two groups. A thickened oedematous gallbladder was present in all (100%) ELC patients compared with 24% of DLC patients (p < 0.001). A distended gallbladder was seen in 56% of the ELC group and 20% of the DLC group (p = 0.009), and pericholecystic fluid was seen in 76% of ELC patients against 8% of DLC patients (p < 0.001). All three ultrasonographic features of acute inflammation were thus significantly more frequent in the early group.

Parameter	Category	Early LC (n=25)	Delayed LC (n=25)	P value
Gallbladder decompression required	Yes	11 (44.0%)	3 (12.0%)	0.011
	No	14 (56.0%)	22 (88.0%)	
	Total	**25 (100%)**	**25 (100%)**	
Bile or stone spillage	Yes	5 (20.0%)	4 (16.0%)	1.000
	No	20 (80.0%)	21 (84.0%)	
	Total	**25 (100%)**	**25 (100%)**	
Bile duct injury	Yes	0 (0.0%)	0 (0.0%)	—
	No	25 (100.0%)	25 (100.0%)	
	Total	**25 (100%)**	**25 (100%)**	

Table 4: Intraoperative Findings and Complications

LC = laparoscopic cholecystectomy; GB = gallbladder; Values are n (%) unless stated otherwise

Table 4 examines the intraoperative events. Gallbladder decompression was required in 44% of ELC patients against 12% of DLC patients, a statistically significant difference (p = 0.011). Bile or stone spillage occurred in 20% of the ELC group and 16% of the DLC group, which was not significantly different (p = 1.000). No bile duct injury was recorded in either group.

Parameter	Category	Early LC (n=25)	Delayed LC (n=25)	P value
Conversion to open	Yes	2 (8.0%)	1 (4.0%)	1.000
	No	23 (92.0%)	24 (96.0%)	
	Total	**25 (100%)**	**25 (100%)**	
Drain placement	Yes	7 (28.0%)	5 (20.0%)	0.508
	No	18 (72.0%)	20 (80.0%)	
	Total	**25 (100%)**	**25 (100%)**	
Duration of surgery (min)	Mean ± SD (Median; Min–Max)	68.48 ± 20.04 (63; 43–120)	57.36 ± 14.09 (55; 36–100)	0.026
Table 5: Conversion Rate, Drain Requirement and Duration of Surgery				
LC = laparoscopic cholecystectomy; GB = gallbladder; Values are n (%) unless stated otherwise				

Table 5 compares the operative outcomes of the two groups. Conversion to open cholecystectomy was required in 8% of ELC patients and 4% of DLC patients (p = 1.000), and a drain was placed in 28% and 20% respectively (p = 0.508); neither difference was significant. However, the mean duration of surgery was significantly longer in the ELC group (68.48 ± 20.04 minutes) than in the DLC group (57.36 ± 14.09 minutes) (p = 0.026).

Parameter	Category	Early LC (n=25)	Delayed LC (n=25)	P value
VAS at 12 hr	Mean ± SD (Median; Min–Max)	6.56 ± 0.58 (7; 5–7)	6.32 ± 0.99 (6; 4–8)	0.302
VAS at 24 hr	Mean ± SD (Median; Min–Max)	3.52 ± 0.82 (3; 3–6)	3.76 ± 0.83 (4; 3–6)	0.310
VAS at 1 week	Mean ± SD (Median; Min–Max)	1.12 ± 0.33 (1; 1–2)	1.24 ± 0.44 (1; 1–2)	0.279
Analgesic 1	Required	25 (100.0%)	25 (100.0%)	—
Analgesic 2	Required	10 (40.0%)	6 (24.0%)	0.225
Analgesic at 1 week	Required	0 (0.0%)	0 (0.0%)	—
Table 6: Postoperative Pain (VAS) and Analgesic Requirement				
LC = laparoscopic cholecystectomy; GB = gallbladder; Values are n (%) unless stated otherwise				

Table 6 shows postoperative pain and analgesic requirements. VAS scores were similar in both groups at every interval: at 12 hours 6.56 ± 0.58 (ELC) versus 6.32 ± 0.99 (DLC), at 24 hours 3.52 ± 0.82 versus 3.76 ± 0.83, and at one week 1.12 ± 0.33 versus 1.24 ± 0.44, with no significant difference at any time point. All patients in both groups needed analgesia within 12 hours; a second analgesic dose was required in 40% of ELC and 24% of DLC patients (p = 0.225), and no patient required analgesia at one week.

Parameter	Category	Early LC (n=25)	Delayed LC (n=25)	P value
Postoperative stay (days)	Mean ± SD (Median; Min–Max)	1.72 ± 0.98 (1.00; 1–4)	1.44 ± 0.65 (1.00; 1–3)	0.240
Total hospital stay (days)	Mean ± SD (Median; Min–Max)	2.72 ± 0.98 (2.00; 2–5)	4.04 ± 0.68 (4.00; 3–5)	< 0.001
Table 7: Postoperative and Total Hospital Stay				
LC = laparoscopic cholecystectomy; GB = gallbladder; Values are n (%) unless stated otherwise				

Table 7 summarises the duration of hospital stay. The mean postoperative stay was 1.72 ± 0.98 days in the ELC group and 1.44 ± 0.65 days in the DLC group, which was not significantly different (p = 0.240). In contrast, the mean total hospital stay was significantly shorter in the ELC group (2.72 ± 0.98 days) than in the DLC group (4.04 ± 0.68 days) (p < 0.001). No postoperative chest infection or wound infection was recorded in either group.

DISCUSSION

The most common laparoscopic surgery carried out globally is laparoscopic cholecystectomy, which is considered the gold

standard for gallstone disease.[15] However, due to the possibility of serious complications and a high conversion rate during the phase of acute inflammation, acute cholecystitis was initially thought to be a contraindication to the laparoscopic method (Cuschieri et al.,[16] Kum et al.[17,18]). Laparoscopic cholecystectomy is a safe and effective treatment for acute cholecystitis, with no appreciable increase in mortality or morbidity, according to later research by Chang et al.[9] Macafee et al.[10] Gurusamy et al.[11] Falor et al.[13] and Sankarankutty et al.[14] However, its clinical usage is still debatable, most likely due to issues with conversion and consequences. Therefore, the purpose of the current study was to evaluate the safety, viability, and results of DLC, which is carried out after six weeks of initial conservative therapy, with ELC, which is carried out within 72 hours of the beginning of symptoms.

The two groups were comparable with respect to age, sex and BMI. Contrary to the earlier belief that gallstones are more common in obese individuals, most patients in both groups had a normal BMI (mean 21.21 vs. 21.82).

Several technical points must be kept in mind when operating for acute cholecystitis. Early decompression of the gallbladder allows better grasping and retraction and therefore better exposure of Calot's triangle. In the present study, a distended and oedematous gallbladder was encountered in 56% (14/25) of patients in the early group, which made grasping and retraction difficult and obscured Calot's triangle. Decompression was performed in 44% (11/25) of ELC patients to visualise the anatomy, and was also required in 12% (3/25) of patients in the delayed group. These proportions were lower than those reported by Kolla et al.,[19] (80% vs. 5%) and Agarwal et al.,[20] (64% vs. 12%).

Bile or stone spillage occurred in 20% (5/25) of the early group and 16% (4/25) of the delayed group in the present study, and retrieval bags were used to remove the gallbladder in these cases. This rate was higher than that reported by Saber et al.,[21] (6.7% vs. 3.4%) and Agarwal et a**l.,[20]** (4% vs. 0%), which suggests that more meticulous surgical technique is needed to reduce spillage.

Bile duct injury is an important point of comparison between the two strategies. None of our patients in either group sustained a bile duct injury, in keeping with several other studies. Minutolo et al.,[22] reported a single common bile duct injury in the delayed group, which may have been due to fibrosis in and around Calot's triangle after resolution of the initial acute inflammation. Menahem et al.[23] reported rates of minor and major bile duct injury of 0.1–1.7% and 0.1–0.9% respectively (2/247, 0.8% vs. 2/223, P = 0.950), and identified obesity, perioperative bleeding and local inflammation secondary to pancreatitis or acute cholecystitis as the main causes.

In the present study, 8% (2/25) of the early group were converted to open surgery, one because of excessive bleeding and one because of difficult anatomy around Calot's triangle. In the delayed group, 4% (1/25) were converted because of dense adhesions around Calot's triangle. The difference was not statistically significant (p = 1.000). Minutolo et al.,[22] Menahem et al.,[23] Kolla et al.,[19] and Agarwal et al.,[20] likewise reported a higher conversion rate in the early group without statistical significance, and identified unclear, distorted ductal and vascular anatomy caused by dense adhesions, oedema and exudate as the most common reason for conversion. Kolla et al.,[19] found equal conversion rates in the two groups (5/20 vs. 5/20), whereas Gul et al.,[24] found a higher rate in the delayed group (3/30 vs. 4/30, p = 1.000). In the series of Gul et al.,[24] conversion in the early group was due to a friable, oedematous gallbladder that tore when grasped, while in the delayed group it was due to difficult exposure and dense adhesions obscuring Calot's triangle. In our opinion, conversion to open cholecystectomy should not be regarded as a complication, but as a wise decision taken by the surgeon at the right time to prevent morbidity.

In the present study, a drain was required in 28% (7/25) of the early group and 20% (5/25) of the delayed group (p = 0.508), and was used for excessive intraoperative bleeding, oozing from the gallbladder fossa or intraoperative bile leak. Gul et al.,[24] used a subhepatic drain in 63.3% (19/30) of the early group and 30% (9/30) of the delayed group (p = 0.019), and Agarwal et al.,[20] in 28% (7/25) and 8% (2/25) respectively (p = 0.138).

The duration of surgery in the present study was significantly longer in the early group (68.48 vs 57.36 minutes, p = 0.026). Gul et al.,[24] similarly found a significant difference (98.83 vs. 80.67 minutes, P < 0.05), and Menahem et al.,[23] reported a comparable trend (105 vs. 91 minutes; P = 0.09). Saber et

al.,[21] Minutolo et al.,[22] Menahem et al.,[23] and Agarwal et al.,[20] however, found no significant difference in operative time between the groups. The time required to separate inflammatory pericholecystic adhesions, intraoperative gallbladder decompression, and a steeper learning curve related to operating in acute cholecystitis are potential causes of the longer procedure in the early group.

In the present study, postoperative pain scores were comparable between the groups (p = 0.302 at 12 hours, 0.310 at 24 hours and 0.279 at 1 week), whereas Kolla et al.,[19] found a significant difference in pain score on postoperative day 1. The early group in our study required more analgesics (40% vs. 24%), although the difference was not statistically significant (p = 0.225). In a similar vein, Kolla et al.[19] discovered that the early group had a higher mean duration of postoperative analgesic demand (5.3 vs. 4.8 days, p = 0.812).

In the current trial, neither group experienced a bile leak or postoperative wound infection, and there was no death. On the other hand, although the differences were not statistically significant, Sabre et al.[21] found that the early group had greater rates of biliary leakage (3/120 vs. 2/120) and wound infection (3/120 vs. 2/120). Each group had one wound infection, and the early group had one bile leak (p = 1.000), according to Gul et al.[24] The early group had a greater rate of wound infection (24% vs. 4%, p = 0.084), according to Agarwal et al.[20] According to Kolla et al.[19] there was only one instance of postoperative cholangitis in the two groups (p = 0.456), wound infection was more common in the delayed group (1/20 vs. 2/20), and there was no significant difference in postoperative complications (20% vs. 15%).

The early group in the current study had a considerably lower overall hospital stay (2.72 vs. 4.0 days, p < 0.001). Kolla et al.[19] Chang et al.[10] Gul et al.[24] Ozkardes et al.[25] Minutolo et al.[22] Menahem et al.[23] and Agarwal et al.[20] have likewise observed a considerably shorter overall hospital stay in the early group. The need for two readmissions-one for conservative care and the other for final treatment-explains the longer stay in the delayed group. No patient in the delayed group in our series needed to be admitted due to conservative care failing.

CONCLUSION

Early laparoscopic cholecystectomy performed within 72 hours is a safe and feasible approach, with no significant increase in the risk of bile duct injury, gallbladder perforation, conversion to open surgery, or postoperative complications compared to delayed surgery. Although early surgery may involve a longer operative time, it significantly reduces the total duration of hospital stay, making it a more cost-effective approach. Furthermore, it minimizes the risk of persistent or recurrent symptoms and associated complications such as pancreatitis and common bile duct stones. Therefore, early laparoscopic cholecystectomy is a preferable approach to delayed surgery.

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