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Early vs. Delayed Laparoscopic Cholecystectomy for Acute Cholecystitis – A Single Center Study

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Abstract **Original Research Article**

Introduction: Laparoscopic cholecystectomy is regarded as the gold standard for the treatment of acute cholecystitis; however the timing of the procedure is controversial. There exist studies that support both early and delayed laparoscopic cholecystectomy. ***Aim*****:** The aim of the study is to determine which modality: early or delayed laparoscopic cholecystectomy is the preferred timing in the treatment of acute cholecystitis by examining: duration of hospitalization, conversion rate, duration of surgery and intraoperative, postoperative complications. ***Materials and Methods*****:** This was a retrospective study of 300 patients. Laparoscopic cholecystectomy was performed within 72 hours of admission for patients in the Early LC Group. Patients in the Delayed LC group were treated conservatively and discharged They were readmitted 6-12 weeks later for elective laparoscopic. ***Results*****:** The mean operating time was 83.55 mins vs. 60.72 mins in the delayed group, conversion rate in Early LC Group was 5.3% vs. 8.0 % in the delayed LC group. The mean postoperative hospital stay was 1.98 days in the earlier group and 3.35 days in the delayed group. Overall mortality was zero. ***Conclusion*****:** Early laparoscopic cholecystectomy within 72 hours of symptom onset offers both medical and economic benefits and should be the preferred method for patients treated by surgeons with adequate laparoscopic cholecystectomy experience.

Keywords: Cholecystitis; Cholelithiasis; Gall Stones; Gall Bladder; Cholecystectomy; Laparoscopic Cholecystectomy; Early versus Delayed Cholecystectomy.

INTRODUCTION

Gallstone disease (cholelithiasis) is one of the most commonly encountered diseases of the digestive tract. The prevalence of gallstones is related to many factors, including diet, age, gender, BMI, and ethnic background [1]. Gallstone disease is up to three times more common in women than men and first-degree relatives of patients with gallstones have a two-fold greater prevalence, possibly indicating a genetic predisposition [2]. With advancing age, prevalence increases from 4% in the third decade of life to 27% in the seventh decade of life [3].

Acute cholecystitis is a major complication of gallstones counting for 15%-26% of all complications in patients with symptomatic cholelithiasis [4]. In the last few decades, studies has been conducted to develop less aggressive and less costly methods such as oral desaturation agents, contact dissolution agents, and extracorporeal shock wave lithotripsy, but these are limited by stone structure, size, and number. These nonsurgical methods are inadequate for a large number of patients and cannot contribute to adequate healing [5]. Elective laparoscopic cholecystectomy has become the gold standard for treatment of symptomatic gallstones [6]. However, in the early days, acute cholecystitis was a contraindication of laparoscopic cholecystectomy, and surgeons preferred to treat patients conservatively with medical treatment and discharged on the assumptions that inflammatory tissue is more vulnerable to surgical interventions and leads to an increased risk of surgical complications like common bile duct lesions, and the related high conversion rate led the surgeons to introduce delayed laparoscopic cholecystectomy. Patients were readmitted after 6-8 weeks from onset of symptoms in order to have elective surgery performed for the definitive treatment [7-12].

There is no consensus at our institution on the usual surgical therapy of acute cholecystitis, and the two techniques are chosen based on the surgeon's discretion. The purpose of this study is to evaluate the results of early LC versus delayed LC for the treatment of acute cholecystitis in terms of surgical time,

intraoperative and postoperative complications, length of postoperative stay, and overall hospital stay.

Patients and Methods

A retrospective analysis of all patients affected by acute cholecystitis and admitted in the Unit of General Surgery at the Hera General Hospital in Makkah, KSA from January 2021 to December 2022, was performed. The acute cholecystitis was defined clinically by the presence of fever (> 38°C), painful upper abdomen, and radiological signs of inflammation (US, MRCP). Patients diagnosed with Acute Pancreatitis, Cholangitis, and Choledocholithiasis were excluded. Patients with symptoms for longer than 72 hours prior to the surgery, patients with obstructive jaundice, malignancy, preoperatively diagnosed Biliary pancreatitis, previous upper abdominal surgery, significant medical comorbidities making them unfit for laparoscopic surgery, and those who refused to undergo laparoscopic surgery, were excluded from the study.

At admission, a thorough medical history was obtained. Every patient had a thorough general physical examination and systemic evaluation. Relevant tests were performed, including a full hemogram, urine analysis, blood urea, serum creatinine, blood sugar, serum electrolytes, liver function test, serum amylase, and lipase where necessary, in addition to a chest X-ray, ECG, and US abdomen. The definition of an early cholecystectomy is a procedure performed within 72 hours after the onset of symptoms. The definition of delayed cholecystectomy is surgery performed during a second hospitalization at least six weeks following the beginning of symptoms. On emergency admission, broad-spectrum intravenous antibiotics were administered to all patients. It was left to the surgeon in charge of the patient to decide whether to perform an early LC for acute cholecystitis or a delayed LC following conservative therapy.

Surgeons experienced in laparoscopy performed the laparoscopic surgeries while positioned on the right side of the patient. The patients were administered general anesthesia and positioned supine on the surgical table. To decompress the stomach a nasogastric tube was placed. To create pneumoperitoneum, a Veress needle was inserted blindly via a supraumbilical incision. Two 10-millimeter (mm) ports and two 5-millimeter (mm) ports were utilized. As deemed necessary by the surgeon, a number of adjustments were made intraoperatively. These included gallbladder decompression, management of the cystic duct with sutures, and insertion of a closed suction drain in the subhepatic region. Intravenous fluids, antibiotics, and analgesics were administered to postoperative patients as necessary. Feeding was resumed as early as tolerated and IV medications were replaced with oral antibiotics. Post-operatively, patients were followed up for one month.

Patients were divided into two groups: Group A “EARLY LC” and Group B “DELAYED LC”. Demographic and clinical data as gender, age and outcome data as operative time, rate of conversion to open cholecystectomy, reason of conversion, rate of major and minor complications both intraoperative and postoperative, length of postoperative hospitalization, and length of post-operative analgesia were collected and compared between the two groups.

Statistical Analysis

All data obtained were entered into the database and analyzed by means of Statistical Package for Social Sciences (SPSS) software using appropriate statistical tests like Fisher’s exact test or paired t-test as and when needed. A *p-value* of less than 0.05 was considered significant.

Results

A total of 605 patients underwent laparoscopic cholecystectomy for acute cholecystitis from January 2021 to December 2022. 386 patients underwent a delayed LC and 219 patients underwent Early LC. During the study period, a total of 300 patients, 150 patients in each group were selected by simple random sampling and were evaluated. There were 116 females and 34 males in the Early LC group and 102 females with 48 males in the Delayed LC Group. The mean age in the Early LC group was 42.2±12.25 and 42.18±12.43 in the Delayed LC group. The mean operative time was 83.55 mins in the early group versus 60.72 mins in the delayed group. The mean duration of postoperative analgesic requirement was 2.38±1.66 days in the earlier group and 3.54±0.57 days in the delayed group (Table 1).

Table 1: Summary of Demographic and Clinical Data

PARAMETER	EARLY LC	DELAYED LC
TOTAL PATIENTS	150	150
MALES	34	48
FEMALES	116	102
AGE	42.2±12.25	42.18±12.43
OPERATIVE TIME	83.55±9.30	60.72±9.71
POST OPERATIVE HOSPITAL STAY	1.98±1.05	3.35±0.95
POST OPERATIVE ANALEGSICS	2.38±1.66	3.54±0.57

The overall conversion rate was 6.66% (20 on 300 patients). A conversion from laparoscopic to open cholecystectomy was required in 8 patients in the early LC group, and in 12 patients in the delayed LC group, with a rate of conversion of 5.3% and 8.0% respectively. However, this difference was not statistically significant. (p=0.5). In the early LC group, the reasons for conversion were the presence of acute inflammatory changes (gangrene, phlegmon or empyema) that made it difficult to identify the structures of the Calot's triangle (5 patients), Common Bile Duct Injury (1 patient) and the presence of extensive intra-abdominal adhesion secondary to previous abdominal operation (2 patients). In the delayed LC group, the reasons for conversion were acute inflammatory changes (2 patients), the inability to define the anatomy of the Calot's triangle due to fibrosis (5 patients), intra-abdominal adhesion (2 patients), and common bile duct injury (3 patients) (Table 2).

Table 2: Reasons for Conversion from Laparoscopic to Open Cholecystectomy

PARAMETER	EARLY LC	DELAYED LC
TOTAL CONVERSIONS	8	12
ACUTE INFLAMMATORY CHANGES	5	2
ADHESIONS	2	2
CBD INJURY	1	3
FIBROSIS OF TRIANGLE OF CALOT	0	5

In total, 42 complications occurred (Early LC = 19, Delayed LC = 23) in our series. The overall complication rate was 14%. The intraoperative complications that occurred in the both Early and delayed LC group includes Common Bile duct Injuries and Bile Leak. Post-Operative complications included wound infections, Sub-hepatic collection, Chest infections, Retained CBD Stone and Urinary Tract Infections. No mortality and 30 days re-admissions were recorded. Table 3 shows the summary of complications.

Table 3: Summary of Comlications

	EARLY LC	DELAYED LC	p-value
INTRAOPERATIVE			
CBD INJURY	1	3	0.31
BILE LEAK	2	1	0.56
POST-OPERATIVE			
WOUND INFECTION	5	6	0.75
SUB-HEPATIC COLLECTION	4	5	0.73
CHEST INFECTIONS	3	4	0.70
RETAINED CBD STONE	3	2	0.65
URINARY TRACT INFECTIONS	1	2	0.56
MORTALITY	0	0	1.0
TOTAL COMPLICATIONS	19	23	

DISCUSSION

Gallstone disease (cholelithiasis) is one of the most prevalent gastrointestinal issues. Between 10% and 15% of individuals, according to autopsy studies, have gallstones [1]. Since 1882, when Carl Langenbuch conducted the first successful open cholecystectomy, it had been the conventional therapy for more than a century. Flies conducted the first laparoscopic cholecystectomy in 1985; the paper was presented before the German Society of Surgeons in 1986. Reddick and Olsen developed the present method in September 1988 [13]. Laparoscopic cholecystectomy is currently regarded as the procedure of choice due to its faster recovery time and lower treatment expenses. In the past, acute cholecystitis was considered a relative contraindication for laparoscopic cholecystectomy due to the inflammatory changes that decrease tissue quality and make it difficult to precisely view anatomical features, hence increasing intraoperative complications and morbidity. In order to allow resolution of the acute inflammation of the gallbladder, the optimal period was formerly believed to be between 6 and 8 weeks following the acute phase [14]. Currently, Laparoscopic cholecystectomy treats both chronic and acute forms of cholecystitis as a result of improvements in surgical performance that have accompanied technical advancements.

Although the timeline for managing acute cholecystitis is highly controversial, numerous reports, including meta-analyses, recommend early cholecystectomy. One very notable meta-analysis of randomized trials, published in 2013 by the Cochrane Collaboration [15], found no notable distinction among early LC and delayed LC in terms of bile duct injuries, other major complications, conversion rate, and operative time, with an early group hospitalization period 4 days lesser than a delayed group. On the basis

of these findings, several expert groups recommend early LC [16, 17], even though the actual trend varies considerably.

In a retrospective study of 100 patients, Ohta *et al*., [18] compared 4 timing groups of laparoscopic cholecystectomies and determined that the optimal timing for laparoscopic cholecystectomy for acute cholecystitis is within 72 hours, which results in the shortest total hospitalization particularly in comparison to operations performed later. Falor *et al*., [19] concluded that early laparoscopic cholecystectomy is safe, resulting in a shorter hospital stay and reduced use of ERCP without any increased morbidity or mortality. Early laparoscopic cholecystectomy (<24 hours) was observed to reduce morbidity during the waiting period for elective laparoscopic cholecystectomy, the rate of conversion to open cholecystectomy, operating time, and hospital stay in a randomized, controlled trial of 75 patients [20]. Another study that analyzed 92 papers (meta-analyses, randomized controlled trials, prospective controlled studies, and retrospective cohort studies) determined that Early LC is favorable in terms of hospitalization duration without rise in morbidity or mortality [21]. In a large 2014 study with 14,220 patients, de Mestral *et al*., reported that the early group's hospital stay was 1.9 days shorter than the delayed group [22]. In a 2015 study with 502 participants, Pisano et al. concluded that the early group had a hospital stay that was 2.5 days shorter, with no surgical problems [23]. Similar to the aforementioned clinical research, we found that hospitalization was considerably shorter with early laparoscopic cholecystectomy versus delayed laparoscopic cholecystectomy for acute cholecystitis.

Early laparoscopic cholecystectomy was shown to be longer than delayed laparoscopic cholecystectomy in terms of operating time. The discrepancy might be explained by variety of factors like the need for decompression due to the presence of a swollen and edematous gallbladder, increased vascularity around the gallbladder, and adhesions in the Calot's triangle and omental tissue that necessitated delicate and meticulous dissection. Comparable rates of complications were observed in the Early LC and Delayed LC groups. In the present study, an increase in intraoperative and postoperative problems were seen in the Delayed LC group compared to Early LC group, but the difference was statistically insignificant. Given the decreased incidence of complications in the early laparoscopic cholecystectomy group and the shorter length of hospitalization, early laparoscopic cholecystectomy is preferable to delayed surgery. The increased risk for common bile duct injury is a significant issue regarding the application of LC to treat acute cholecystitis, considering it is a predisposing factor for iatrogenic CBD injury [18, 24]. Achieving the critical view of safety (CVS) is essential in order to reduce the risk of bile duct damage [25]. Some observational studies have shown that early surgery leads to a higher frequency of injuries [26, 27]. On the contrary, one recent Canadian population-based analysis revealed that early LC was linked with a 0.53-fold decreased incidence of significant bile duct damage than delayed LC [28]. In our series, iatrogenic bile duct damage was more frequent in the delayed LC group. In our opinion, after the remission of the initial inflammatory phases of cholecystitis, the formation of fibrosis in and around Calot's triangle is a plausible pathophysiological explanation for the greater incidence in the delayed group.

In acute cholecystitis, the higher rate of conversion from laparoscopic to open cholecystectomy is another factor to consider. Acute cholecystitis is regarded as an independent conversion risk factor [29, 30]. Conversion is related with a prolonged operative duration and hospitalization, as well as an increase in morbidity [31]. In the early years of the laparoscopic era, conversion rates of up to 35% were observed for early LC [6], hence, it was suggested that delayed surgery may be a more effective modality for acute cholecystitis. Previous studies have not substantiated this notion, revealing no significant difference in conversion rate between the two approaches. In the current study, the delayed LC group had a greater conversion rate (8.0%) than the early LC group (5.3%), although the difference was not statistically significant. The conversion rate was 6.6% overall. However, the causes for conversion were distinct. In the early LC group, acute inflammatory gallbladder changes were the most common cause of conversion, making it difficult to acquire a clear Critical View of Safety (CVS). In the group with delayed LC, fibrosis was the most common reason for the inability to identify the anatomy of the triangle of Calot.

CONCLUSION

Considering comparable operative duration, major and minor complication rates, and postoperative stay, both early and delayed laparoscopic cholecystectomy can be considered safe treatments for the treatment of acute cholecystitis. Early laparoscopic cholecystectomy has fewer intraoperative and postoperative complications, a relatively short post-operative hospital stays, and is thus less expensive. Early LC also correlated with fewer Common Bile Duct injuries and reduced rates of conversion to open surgery. As a result, we recommend that a laparoscopic cholecystectomy be performed within 72 hours after admission. Delayed LC would only be recommended in situations when Biliary pancreatitis, CBD Stones, or Cholangitis cannot be ruled out and in patients where co-morbidities and other factors make anesthetic risk intolerable at the time of initial presentation.

Conflict of Interest: The authors declare that there is no conflict of interests regarding the publication of this paper.

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ABBREVIATIONS:

ERCP: Endoscopic retrograde cholangiopancreatography
MRCP: Magnetic Resonance cholangiopancreatography
LC: Laparoscopic Cholecystectomy
CBD: Common Bile Duct
CVS: Critical View of Safety
US: Ultrasound
ECG: Electrocardiogram
KSA: Kingdom of Saudi Arabia

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