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Comparative Study Between Early and Interval Surgical Laparoscopic Intervention of Acute Cholecystitis

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Abstract

Acute calculous cholecystitis (ACC) is one of the most common emergencies in general surgery. In the past, acute cholecystitis was a contraindication of laparoscopic cholecystectomy, and patients with acute cholecystitis were managed conservatively and readmitted for elective laparoscopic cholecystectomy (LC) after 6-8 weeks. With the increased experience in laparoscopy, surgeons started to attempt early laparoscopic cholecystectomy for acute cholecystitis. This work aims to compare intraoperative and postoperative outcomes of early versus interval cholecystectomy in Acute cholecystitis. Our study was conducted on 100 patients divided into two groups of 50 each to compare the results of early surgery with delayed surgery. The correlation between the two groups showed that there is a statistically significant difference in favour of group (A) denoting that surgery in the early group is more economical because of less hospital stay. Total hospital stays in group (A) ranged from 3.5 to 6 days with a mean of 4.8 ± 0.91 days. While total hospital stays in the group (B) (including the number of days spent till the resolution of the acute attack of cholecystitis along with the number of days spent after readmission for laparoscopic cholecystectomy) ranged from 7 to 12 days with a mean of 9.2 ± 1.61 days. The conversion rate from laparoscopic cholecystectomy to open cholecystectomy between the two groups is not significantly different and the overall post-operative complication rate. However, operative time in group (A) ranged from 55 to 140 minutes, with a mean operative time of 100.3 ± 14.75 minutes. For the cases which were converted to open cholecystectomy the operative time ranged from 112 to 140 minutes with a mean of 125.6 minutes. While operative time in group (B) ranged from 45 to 106 minutes and the mean operative time was 80.3 ± 12.4 minutes. For the cases which were converted to open cholecystectomy the operative time ranged from 95 to 106 minutes with a mean of 101.75 minutes. The correlation between the two groups showed that there is statistically significant difference in favor of group (B) and this is due to difficult dissection at Calot's triangle in early lap. cholecystectomy. From our study, we can conclude that the laparoscopic cholecystectomy in early cholecystectomy up to 96 hr from the starting of acute symptoms was found to be more economical with less total hospital stay and less total cost of the therapy than interval cholecystectomy in acute cholecystitis.

Keywords: Acute cholecystitis. Cholecystectomy. Laparoscopy. comparisons. Quality.

1. Introduction

The gallbladder is a small pouch that sits just under the liver. The gallbladder stores bile produced by the liver. After meals, the gallbladder is empty and flat, like a deflated balloon. Before a meal, the gallbladder may be full of bile and about the size of a small pear [1]. Gallstones are the most common biliary pathology. It is estimated that gallstones affect 10–15% of the population in Western societies. They are asymptomatic in the majority of cases (>80%) the prevalence of gallstones Pigment stone is the name used for stones containing <30% cholesterol. There are two types: black and brown **[2].** Acute cholecystitis is the most common cause of hospitalization for gastrointestinal disease. Although cholecystectomy is the definitive management. Biliary colic is typically present in 10–25% of patients [3]. On examination, the patient is usually febrile with tenderness and rigidity in the right upper quadrant with mid-inspiratory arrest "positive Murphy's sign" [4]. Ultrasound scanning is the investigation of choice in patients suspected of having acute cholecystitis and the method of choice for the detection of gallstones, offering several advantages: high sensitivity and accuracy (95%), and non-invasiveness. It is cost-effective and accurate [5]. Laparoscopic cholecystectomy (LC) has the advantages of less pain, shorter hospital stays, early return to work, and minimal invasiveness compared with laparotomy [6]. Early laparoscopic cholecystectomy offers definitive treatment during the same hospital admission and avoids problems of a failed conservative treatment, recurrence of acute illness after discharge from hospital that needs readmission and gallbladder stone related complications such as obstructive jaundice and biliary pancreatitis, furthermore, a reduction in the total hospital stay may be a major economic benefit to the patients of a poor country [6]. Tokyo Guidelines 2018 propose a modified flowchart based on recent recommendations in the clinical setting regarding severity assessment and plan of treatment [7].

2. Patients and Methods

This is a prospective randomized study conducted on (100) patients presenting to surgical department in Al-Zahraa University Hospital, faculty of medicine for Girls Al-Azhar University, with acute calcular cholecystitis done by a team of surgeons starting from November 2019 to November 2021.

Included patients will be randomized by opening one of two (2) sealed envelopes at the time of admission. Patients will be divided into two groups, fifty (50) patients each:

- **Group A**: will undergo laparoscopic cholecystectomy during (1st 48-96 hours from acute attack).
- **Group B**: will undergo laparoscopic cholecystectomy after 6 to 10 weeks (after complete resolution of the acute attack).

An informed consent will be taken from all the patients sharing in the study about the procedure they will have.

2.1 Inclusion Criteria

Adult patients (males and females) Irrespective of their age and sex. Randomization of patients was done on admission, Symptoms and signs of acute cholecystitis.

2.2 Exclusion Criteria

Unfit for general anesthesia, Pregnant females during their third trimester, Patients with previous major abdominal surgeries or midline exploratory surgeries, Pyocele, Coexisting common bile duct (CBD) stones, Jaundice, Ultrasonographic evidence of CBD stones, or pancreatitis or Post ERCP infected GB.

2.3 Pre-Operative Assessment

Good history taking (including the history of previous attacks of acute cholecystitis

and history of jaundice), together with full general and local examination.

2.4 Clinical Assessment

A full general examination was done for all patients, focusing on:
Vital data (Fever), Complexion (Jaundice), Cardio-vascular fitness and Respiratory fitness.
Full local abdominal examination was done for all patients focusing on Right hypochondrial tenderness, Scars of previous operations (mainly in the upper abdomen), and Abdominal wall hernias.

2.5 Imaging Investigations

A pelviabdominal ultrasound will be needed for diagnosis, and MRCP will be used in certain cases. General preoperative imaging as chest x-ray, ECG and echocardiogram (if needed).

2.6 Laboratory Investigations

Complete blood count, coagulation profile (PT, PTT, INR), kidney function tests (BUN, serum creatinine), liver function tests (ALT, AST), total bilirubin, direct bilirubin, alkaline phosphatase and gamma-glutamyl transferase (if needed).

2.7 Operative Technique (Laparoscopic Cholecystectomy)

The patient is placed in supine position with the left arm tucked under general anesthesia. With the surgeon standing to the left of the patient and first assistant standing on the patient's right side, abdominal access is obtained, and pneumoperitoneum is established. In our practice, we generally perform an open cut-down technique and Hasson cannula placement at the umbilicus.
Umbilical or (camera) port 10 mm firstly inserted to introduce camera & evaluate liver, gall bladder & abdomen. Then, epigastric 10mm port, rt. sub costal 5mm port & last port 5mm just to rt. edge of the falciform ligament were inserted. With insufflation rate about 16mm.

The gallbladder is retracted over the liver with cephalic traction while inferior-lateral traction on the neck of the gallbladder is applied through the midclavicular port site. The assistant can usually maintain constant tension on this retractor unless adjustments are required for changes in visualization.
If adhesions are present, these are taken down bluntly or with monopolar energy on both sides to open up the hepatocystic triangle. This can be carried up posteriorly along the wall of the gallbladder at its interface with the liver. A combination of blunt dissection and judicious use of cautery are needed with a goal of clearing the triangle of fat and fibrous tissue.
Establishing the critical view of safety by hepatocyte (calot) triangle defined as the triangle formed by the cystic duct, the common hepatic duct, and the inferior edge of the liver.
The cystic artery and cystic duct are clipped and divided. Following the division of the cystic duct, retrograde dissection of the gallbladder from the liver bed is performed. In our institution, we use an L-hook monopolar energy device to dissect the gallbladder off the liver. For the difficult gallbladder in the setting of acute cholecystitis, an advanced energy device such as an ultrasonic coagulator may maintain hemostasis basis better and produce less smoke plume, which makes the dissection easier and more efficient.
Just prior to complete disassociation of the gallbladder from its bed, the last attachment should be left in place to allow for retraction of the liver cephalad and clear visualization of the cystic plate to allow for any needed hemostasis Then, insertion of subhepatic tube drain finally was done to assess post-operative bile leak or bleeding.
The liver bed is irrigated and any blood or bile or aspirated from the field. The gallbladder is then placed in an entrapment bag and removed at the 10–12 mm port site. Once the specimen is removed, all ports are vented to eliminate any residual CO2 gas. The fascia at the extraction port site should be closed with 0-Vicryl or similar suture

and the skin closed with an absorbable monofilament subcuticular suture.
In this study, when conversion to open cholecystectomy was necessary (due to difficult dissection at Calot's triangle) a right subcostal incision was performed, the area was isolated with packs, the neck of the gallbladder was grasped with sponge-holding forceps, the cystic artery was divided between ligatures, the cystic duct was then ligated and divided, the gallbladder was dissected from its liver bed, then was removed, hemostasis assured, and the abdominal wall was closed in layers.

2.8 Post-Operative Workup and Follow-up

All patients received intra-venous fluids for only 12 hours followed by oral fluids and soft diet intake in cases of laparoscopic Cholecystectomy.
In cases of open Cholecystectomy: still NPO on intra-venous fluids until restoring intestinal movement.
All Patients received intravenous 1g third generation cephalosporin induced pre anesthesia for 1 day postoperatively every 12 hours.
The patients were discharged after removal of the drain and when they were open bowel and tolerating oral intake.
The patients were followed during the hospital stay then regularly until complete recovery for signs of post-operative complications as intra-peritoneal bleeding or biliary injury (including tachycardia, hypotension, jaundice and gallbladder bed collection detected by follow-up abdominal ultrasound).
All patients were followed by a visit 1 week later for follow up to detect of any complications as (wound infection or leakage). Then after 1 month and 6 months for late complications as (2ry suturing or Hernia).
The post-operative outcome of the surgery on both groups of patients will be evaluated.

3. Results

In group (A) there were thirty females and twenty male patients, while in group (B) there were thirty-six females and fourteen male patients.
The age of patients in group (A) was ranging from 18 to 55 years with a mean age of 47.8 ± 11.46 years. While in group (B) the age of the patients was ranging from 20 to 60 years with a mean age of 48.9 ± 10.67 years.
The ranges of age of both groups are nearly close to each other and there is no significant difference between the two groups.
In group (A) there were two patients having diabetes mellitus, while in group (B) there were also two diabetic patients all of them was type II DM and they were on insulin treatment regularly.
There were five patients in group (A) having hypertension and their blood pressure was controlled before surgery while in group (B) there were six patients having hypertension.
In group (A) ten patients gave a history of previous attacks of biliary colic while in group (B) seven patients gave a history of previous attacks of biliary colic.

Table (1): Male & Female Ratio of group (A) and group (B).

Sex (M: F)	Group (A)		Group (B)		P Value
	N	%	N	%	
Male	20	40	14	28	0.439
Female	30	60	36	72	

Table (2): Comparison between patient's criteria and co-morbidities of group (A) and group (B)

	Group (A)	Group (B)	P Value
Age (years)	47.8 ± 11.46	48.9 ± 10.67	0.788
D.M.	2	2	1.000
Hypertension.	5	6	0.704

Table (3): Comparison of APRI and FIB-4 scores among studied groups.

		Group I	Group II	Group III	Test value	P- value	Sig.
		No.= 30	No.= 30	No.= 30			
APRI	Mean ± SD	0.21 ± 0.10	0.26 ± 0.11	0.24 ± 0.08	2.106•	0.128	NS
	Range	0.07 – 0.47	0.11 – 0.62	0.11 – 0.42			
FIB-4	Mean ± SD	0.69 ± 0.29	0.89 ± 0.36	0.77 ± 0.31	2913•	0.060	NS
	Range	0.25 – 1.41	0.4 – 1.5	0.02 – 1.34			

Table (4): History of biliary colic in both groups.

Biliary colic in history		Groups					
		Group A		Group B		Total	
		N	%	N	%	N	%
No		40	80	43	86	83	83
Yes		10	20	7	14	17	17
Total		50	100	50	100	100	100
Chi-square	X^2	0.240					
	P-value	0.624					

Duration of acute symptoms in group (A) was ranging from 16 to 54 hours with a mean of 35.6 ± 11.17 hours. While the duration of acute symptoms in group (B) was ranging from 12 to 60 hours with a mean of 36.6 ± 14.38 hours and the correlation between the results of the two groups is not significant. Concerning preoperative laboratory investigations white blood cell count more than 11.000/ml was found in thirty-three patients in group (A), while WBC count more than 11.000/ml was found in twenty-seven patients in group (B) and the difference between the two groups is not significant.

N.B: In group A: All patients selected with normal liver functions, patients present by elevated liver function are excluded from early intervention due to higher risk of more conversion rate e.g. stone CBD, pancreatitis, etc. When in group B: liver functions were normal in patients prepared for elective surgery. Regarding abdominal ultrasound findings in group (A), a thickened gallbladder wall was present in 33 cases & 17 cases with normal GB wall thickening, distended gallbladder in 43 cases & 7 cases not distended and pericholecystic fluid collection was found in 7 cases & 43 cases had no pericholecystic fluid collection. While abdominal ultrasound findings in group (B) were thickened gallbladder wall in 30 cases& 20 cases of normal GB wall thickening, distended gallbladder in 37 cases13 cases not distended and pericholecystic fluid collection was found in 7 cases only & 43 cases had no pericholecystic fluid collection. The correlation between the two groups showed that 66% of cases of group (A) had thick gallbladder wall, while 60% of cases of group (B) had thick gallbladder wall and the difference between them is not significant. The distended gallbladder was found in 86% of cases in group (A) and

72% of cases in group (B) and the difference between the two groups is not significant. Finally, pericholecystic fluid collection was found in 14% of cases in group (A) and also in 14 % of cases in group (B). Operative time in group (A) ranged from 55 to 140 minutes, with a mean operative time 100.3 ± 14.75 minutes. For the cases which were converted to open cholecystectomy the operative time ranged from 112 to 140 minutes with a mean of 125.6 minutes. While operative time in group (B) ranged from 45 to 106 minutes and the mean operative time was 80.3 ± 12.4 minutes. For the cases which were converted to open cholecystectomy the operative time ranged from 95 to 106 minutes with a mean of 101.75 minutes. The correlation between the two groups showed that there is statistically significant difference in favor of group (B) and this is due to difficult dissection at Calot's triangle in early lap. Cholecystectomy. The conversion rate from laparoscopic cholecystectomy to open cholecystectomy in group (A) was 6% (3 patients over 50). While conversion rate from laparoscopic cholecystectomy to open cholecystectomy in group (B) was 14% (7 patients over 50) and the difference between the two groups favor to group (B).

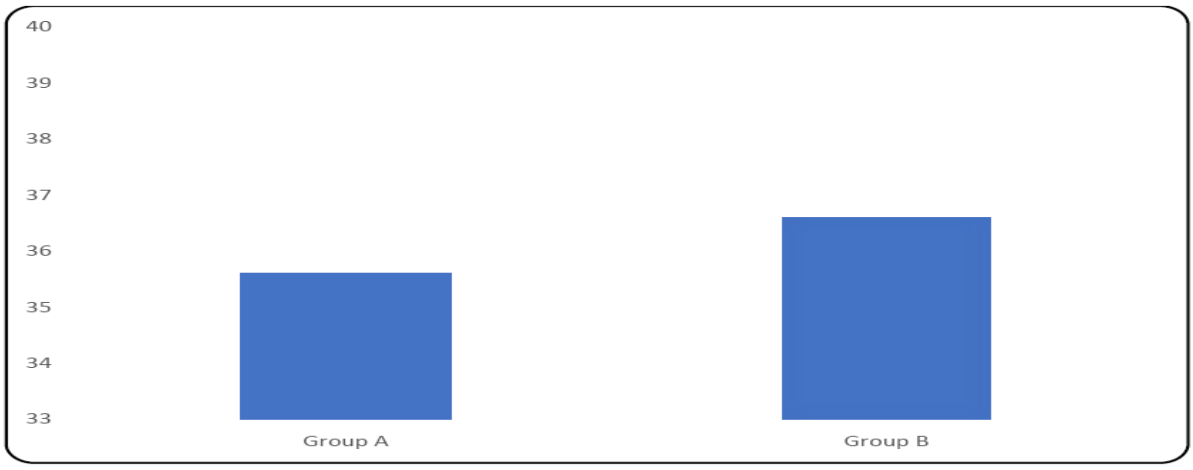

Figure (1): The mean of duration of acute symptoms in group (A) & group (B).

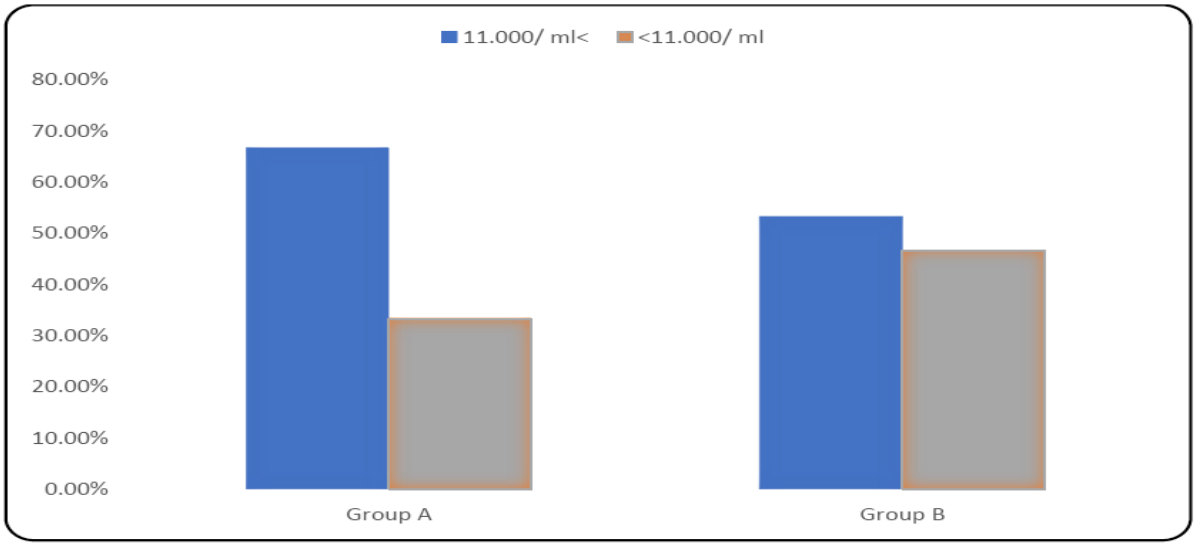

Figure (2): The percent of patients with WBC count more than 11.000/ ml in both groups..

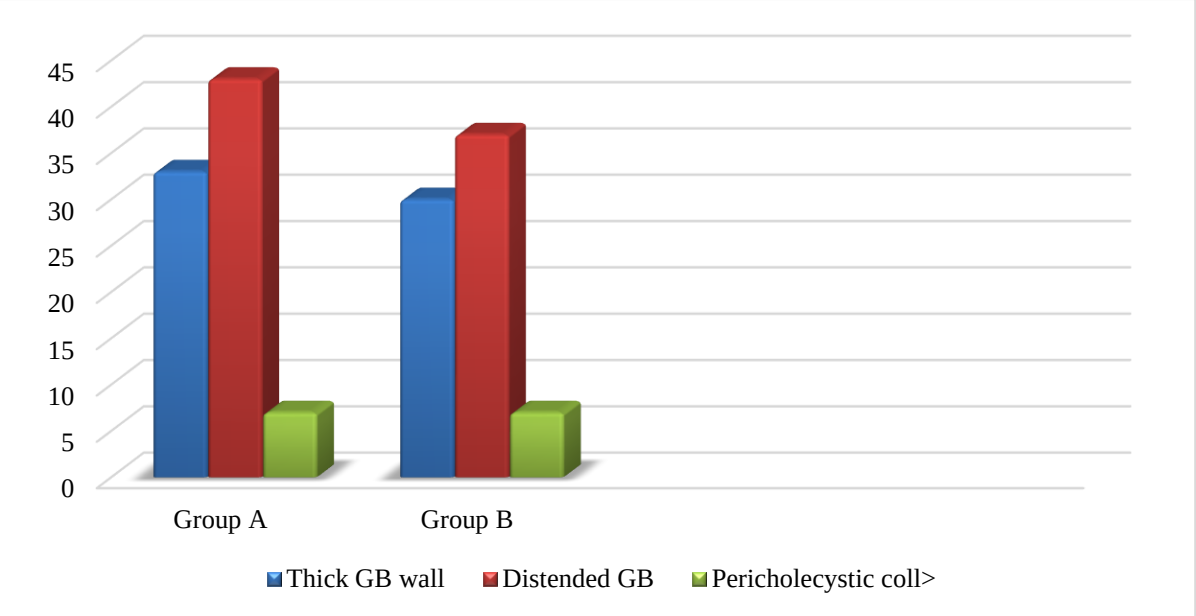

Figure (3): Ultrasonic finding in our study in group (A) & group (B).

Table (5): Comparison between lab. Investigations and U/S findings in group (A) and group (B).

	Group (A)		Group (B)		P value
	Number of patients.	%	Number of patients.	%	
WBC >11.000/ml	33	66	27	54	0.456
Thick GB wall	33	66	30	60	0.704
Distended GB	43	86	37	72	0.361
Pericholecystic collection	7	14	7	14	1.000

Table (6): Mean operative time in both groups.

Group	Number (No.)	Mean	P value
Group A	55-140 mints	±14.75	**0.601**
Group B	45-106 mints	±12.4	

Table (7): The rate of conversion to open cholecystectomy in group (A) & group (B).

Sex (M: F)	Group (A)		Group (B)		P Value
	N	%	N	%	
Lap	47	94	43	86	0.543
Conversion	3	6	7	14	

As regards intraoperative modifications in group (A), gallbladder decompression was done in 11 cases and widening of epigastric port during extraction of the gallbladder was performed in 2 cases. For modifications in group (B), gall bladder decompression was done in 3 cases and widening of epigastric port during extraction of the gallbladder was performed in 2 cases. The correlation between the two groups showed that there is statistically significant difference in favor of group (B) as regard gallbladder decompression and there is no difference as regard widening of the epigastric port. Intraoperative and postoperative complications in group (A) & group (B). Total hospital stays in group (A) ranged from 3.5 to 6 days with a mean of 4.8 ± 0.91 days. While total hospital stays in group (B) (including the number of days spent till the resolution of the acute attack of cholecystitis along with the number of days spent after readmission for laparoscopic cholecystectomy) ranged from 7 to 12 days with a mean of 9.2 ± 1.61days. The correlation between the two groups showed that there is statistically significant difference in favor of group (A) denoting that surgery in the early group is more economic because of less hospital stay **.**

4. Discussion

In this prospective, randomized study, we confirmed that early laparoscopic cholecystectomy has the advantage of shorter hospital stay and lower cost compared with delayed laparoscopic cholecystectomy for the treatment of acute cholecystitis due to gallstones. In the past, the optimal timing for laparoscopic cholecystectomy for patients with acute cholecystitis had generally been considered to be 6 to 8 eight weeks after the acute phase to allow for the resolution of the acute inflammation of the gallbladder. (Özkarde et al, 2014)**.**

However, several clinical trials—albeit mostly small and retrospective studies—proved that early laparoscopic cholecystectomy is safe and shortens hospital stay, with morbidity and mortality similar to those of elective delayed cholecystectomy. (Okamoto et al, 2018)**.**

In a prospective randomized study, Özkarde et al compared 2 timing groups of laparoscopic cholecystectomies (24_72 hours and 6-12weeks after onset of symptoms) and found that the best timing for laparoscopic cholecystectomy for acute cholecystitis is within 72 hours, which provides the shortest total hospital stay versus operations performed later**.**

Similar to the above clinical studies, we found that early laparoscopic cholecystectomy (24–96 hours of onset) provides benefit over delayed laparoscopic cholecystectomy (6–10 weeks later) in terms of total hospital stay, and the difference between the two groups is not significant results on conversion rates and postoperative complications. Several clinical trials proved that early laparoscopic cholecystectomy is safe and shortens hospital stay with morbidity and mortality similar to those of elective delayed cholecystectomy. In addition to the clinical studies, the meta-analyses of randomized clinical trials in the literature demonstrated that early LC provides benefit over delayed LC in terms of total hospital stay, with conflicting results on conversion rates and postoperative complications. Some reported shorter hospital stay and longer operation time in early LC, but they found no significant difference in conversion rates between early and delayed LC and all agreed that early LC for acute cholecystitis is advantageous in terms of the length of hospital stay without increases in morbidity or mortality. Although the operating time at the beginning of LC can be longer, the incidence of serious complications was found to be comparable to the delayed LC. (Murray et al, 2018)**.**

Similar to the above clinical studies, we found that hospital stay was significantly shorter and treatment-related costs were lower in group A than group B patients.

Furthermore, operation time and conversion rate were comparable between groups. Preoperative clinical and radiologic characteristics of patients in both groups were similar in our study. In the present study, analogous to the findings of studies showing a high rate of wound infections and complications with early laparoscopic cholecystectomy**.**

In cases of acute cholecystitis: a distended and edematous gallbladder is commonly seen, and early intraoperative decompression of the gallbladder should be done to facilitate better grasping and retraction of the gallbladder. In our study decompression of GB was required in 11 patients (22%) in group A and 3patients (3%) in group B. We used a subhepatic drain **.**

Slapped stone during extraction due to multiple stones was founded in one case in both group (A& B) which also were needed for widening of epigastric port. The postoperative pain scores and analgesia requirements were similar in the two groups. Longer operation time was required in group A than in group B. We believe that inflammation associated with acute cholecystitis creates an edematous plane around the gallbladder, thus facilitating its dissection from the surrounding structures. Maturation of the surrounding inflammation, and thus organization of the adhesions, leading to scarring and contraction, occurs during the cool-down period. Few recent studies have compared the costs of early and delayed laparoscopic cholecystectomy. In a decision-tree model on the cost-utility of early versus delayed laparoscopic cholecystectomy for acute cholecystitis, Singh et al showed that early laparoscopic cholecystectomy is less costly and results in better quality of life. In the present study, we showed that treatment-related costs were lower in the early laparoscopic cholecystectomy group. However, this may be due to a shorter hospitalization duration and lack of conservative treatment in early laparoscopic cholecystectomy**.**

5. Conclusion

The present study confirms the hypothesis that immediate cholecystectomy performed within 24 h of admission up to 96 h from attack more economical with less total hospital stay and less total cost of the therapy than interval cholecystectomy in acute cholecystitis and the overall post-operative complication rate is not significant**.**

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Conflicts of interest: No competing interests **.**

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