

Laparoscopic Cholecystectomy in the Treatment of Acute Cholecystitis: Prospective Study of Outcomes and Costs Between Early and Delayed Cholecystectomy

Pankaj Kumar Porwal¹, Devendra Saini², Shashwat Vyas³, Shubham Jain⁴, Laxman Agarwal⁵

¹Assistant Professor, Department of General Surgery, SMS Medical College and Hospital, Jaipur

²Assistant Professor, Department of General Surgery, SMS Medical College, Jaipur, Rajasthan.

³Senior Resident, Department of General Surgery, SMS Medical College and Hospital, Jaipur, Rajasthan.

⁴Senior Resident, Department of General Surgery, SMS Medical College and Hospital, Jaipur, Rajasthan.

⁵Senior Professor, Department of General Surgery, SMS Medical College and Hospital, Jaipur, Rajasthan.

Received: 18-01-2023 / Revised: 22-02-2023 / Accepted: 20-03-2023

Corresponding author: Dr. Shashwat Vyas

Conflict of interest: Nil

Abstract:

Background: Acute cholecystitis, the inflammation of gall bladder is usually managed by delayed cholecystectomy in the past in view of increased risk of post-surgical complications due to the start of the era of minimally invasive surgery. But as the learning into this field has progressed it was found that early cholecystectomy also has better results in terms of reduced complications. The outcomes along with the cost benefit of each approach is to be considered in management of acute cholecystitis.

Methods: The study was carried out on 100 patients which were equally divided into 50-50 in each group, Group A (Early cholecystectomy) and Group B (Delayed cholecystectomy). The variables which were assessed are duration of surgery, intraoperative findings, intraoperative difficulty in form of Calot's dissection time, postoperative complications, duration of hospital stay.

Results: It was found that mean duration of Surgery was 55.5 ± 10.74 min in group A and 66.58 ± 12.47 min in group B. Duration of surgery was comparatively more in group B than group A. Due to inflammation in the wall of gall bladder, wall thickness was found to be more in group B (4.75 ± 1.28 mm) compared to mean thickness in Group A (4.19 ± 1.18 mm). Mean time taken for Calot's dissection was more in group B (23.74 ± 6.23 min) as compared to group A (16.5 ± 4.76 min). Post-operative complications were seen in the patients of both groups and results were statistically insignificant. The length of hospital stay was comparatively less for group A patients than the group B with a mean value of 5.03 ± 0.93 days whereas for group B 7.66 ± 1.61 days which in turn reflect the better cost benefit of Group A compared to group B.

Conclusion: The outcomes of early cholecystectomy in management of acute cholecystitis are comparatively better than delayed cholecystectomy making early cholecystectomy a better option of management in terms of operative time, complications and cost benefit in this present era of minimally invasive surgeries.

Keywords: Acute cholecystitis, Laparoscopic cholecystectomy, Outcome assessment, Cost and cost analysis.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Acute cholecystitis involves inflammation of the gallbladder and presents with symptoms such as fever associated with intense pain in the upper right quadrant of the abdomen, while biliary colic does not involve inflammation of the gallbladder. It is a pathology of inflammatory origin, usually associated with cholelithiasis and the other risk factors including immunocompromised states, sepsis, diabetes, and prolonged total parenteral nutrition. Acute cholecystitis is a major complication of gallstones. Acute cholecystitis was traditionally treated with antibiotics and supportive treatment and cholecystectomy was performed after 6 weeks of the acute episode.[1,2,3,4] In the past several decades, research has been conducted along several avenues to develop less invasive, less painful, and less expensive methods of gallstone treatment. Such methods like oral desaturation agents, contact dissolution agents, and extracorporeal shock wave lithotripsy, are limited by stone content, size, and number. In addition, they leave an intact gallbladder already known to harbor lithogenic bile. Thus, these nonoperative methods are inadequate for a large proportion of gallstone patients and cannot promise a permanent cure from gallstone disease.[5] The traditional treatment (initial) of acute calculus cholecystitis includes bowel rest, intravenous hydration, correction of electrolyte abnormalities, analgesia, and intravenous antibiotics. Following this treatment, patients with uncomplicated disease are managed on an out-patient basis and are called for laparoscopic cholecystectomy after a period of 6–8 weeks. Currently, there are three attitudes towards this disease. The first which is the oldest, is an elective surgery after an initial

medical treatment allowing the cooling down of the inflammatory phenomenon, during a second hospitalization. The second is a delayed cholecystectomy scheduled during the same hospitalization. The third is an early cholecystectomy, as soon as possible after admission.[6,7] Hence, cholecystectomy remains the treatment of choice for gallstone disease. Laparoscopic cholecystectomy was thus performed as an elective procedure and achieves the goal of shorter recovery time, decreased expense, less postoperative pain, and improved cosmesis.[8]

In the early years of minimally invasive surgery, acute cholecystitis was considered to be a relative contraindication to laparoscopic cholecystectomy because of inflammatory changes making dissection difficult and because of friability of tissues and ill-defined surgical planes. As laparoscopy became the gold standard treatment for chronic cholecystitis with cholelithiasis, and the surgeons excelled in performing the surgery, even acute cases were considered for laparoscopy. The acute inflammation associated with acute cholecystitis creates an edematous plane on liver bed. The edema may spread into the triangle of Calot or it may stop at the fundus of gall bladder, leaving Calot's triangle reasonably free of inflammation. When acute inflammation matures to chronic inflammation, neovascularity, fibrosis, and contraction makes laparoscopic cholecystectomy substantially more difficult and potentially more dangerous. As a general rule, with patients who have acute cholecystitis, laparoscopic cholecystectomy should be performed as soon as convenient, within the first 72 hours, with an advantage to decrease the morbidity and mortality of patients due to

complications who would otherwise need repeated admissions for recurrent symptoms. There is no benefit in attempting to 'cool off' the gallbladder before proceeding to the operating room. Laparoscope or no laparoscope, the message remains the same: For acute cholecystitis, get it while it is hot.[9] Laparoscopic cholecystectomy for acute cholecystitis has still not become routine because the timing and approach to the surgical management in patients with acute cholecystitis is still a matter of controversy.[10] There are two surgical therapeutic options: Early cholecystectomy [EC] during the same admission or delayed cholecystectomy [DC] during a later admission after conservative treatment. Early cholecystectomy performed within 2 to 3 days of presentation is preferred over interval or delayed cholecystectomy that is performed 6 to 10 weeks after initial admission or before the end of the planned cooling off period. Surgeons have opted for interval cholecystectomy after a period of 6-8 weeks. Large surgical centres have published their successful management of acute cholecystitis with early laparoscopic cholecystectomy.[11] The first studies assessed EC as a treatment for acute cholecystitis date back to the 1950s. In 1970, the first controlled study was published by Vander linden and Sunzel demonstrating better morbidity and shorter average hospital stay after EC. The exponential development of laparoscopic surgery occurred during 1990's. Since last 20 years, increasing number of surgeons has favoured a policy of early surgery. Several randomized studies in the early 1980 has shown that performing early cholecystectomy for acute cholecystitis was better than delayed cholecystectomy in terms of operative feasibility, post-operative complications and shorter hospital stay.[12, 13,14] In spite of many publications that suggest benefits in favour of EC, there is still controversy regarding the time to perform cholecystectomy.

Although literature favours laparoscopic EC, most evidence comes from prospective studies specifically designed to prove this particular aspect. Initially laparoscopic cholecystectomy was contraindicated in acute cholecystitis because of the fear of increased morbidity and high rates [60%] of conversion to open cholecystectomy. Bile duct injury during laparoscopic cholecystectomy was a major concern.[15,16,17,18] The present study is an endeavour to find out the intraoperative as well as post-operative morbidity in early cholecystectomy for cholecystitis and its benefit over traditional interval cholecystectomy conducted in our hospital with a sample size of 50 in both early [EC] and delayed groups [DC].

The aim of this study is to compare the outcome and cost benefit between early vs delayed cholecystectomy.

Methods and Materials

A Hospital Based Prospective Study done under Department of General Surgery, SMS Hospital with 50 subjects were taken for each group. Group A had patients who underwent early cholecystectomy and Group B with delayed cholecystectomy which were based on inclusion and exclusion criteria.

Inclusion criteria:

1. Those patients who have given written and informed consent.
2. Age group (18 – 85 years) and either sex.
3. Patients coming to the Emergency/Outpatient Department of SMS with acute symptoms and diagnosed as a case of acute cholecystitis on the basis of clinical and laboratory investigations.
4. Confirmed cases of acute cholecystitis by: Ultrasonography (USG) / Computerised Tomography (CT) / Magnetic Resonance Cholangio-pancreaticography (MRCP).

Exclusion criteria:

1. History of bleeding disorders.
2. USG or CT evidence of cirrhosis, intrahepatic gall bladder, liver mass or abscess or periampullary neoplasm.
3. Clinical or USG evidence of suppurative or necrotizing cholecystitis, gall bladder empyema, or perforation.
4. Multiple prior laparotomies.
5. Morbid obesity.
6. Pregnancy
7. Severe systemic organ dysfunction (chronic liver, renal or heart diseases).

Methodology**Variables:**

Duration of surgery, preoperative findings, intraoperative findings, intraoperative complications, intraoperative as well as post-operative conditions, and duration of hospital stay were taken as variables.

All patients were subjected to preoperative clinical and laboratory assessment. USG /CT / MRI were done as per the indication.

Division of Groups**Group 1- Early LC**

Early laparoscopic cholecystectomy was defined as an operation performed within 72 hours after the onset of the symptoms.

Group 2- Delayed LC

1. In the delayed group conservative management with intravenous fluids and antibiotics was done. Patients who responded to the conservative management underwent an elective laparoscopic cholecystectomy after 72 hours of onset of symptoms.
2. All patients were treated with broad-spectrum intravenous antibiotics therapy on emergency admission.
3. Choice of early or delayed LC was done after taking informed consent from patient.

Statistical analysis:

1. Qualitative data was expressed in the form of proportion.
2. Quantitative data was expressed in mean \pm SD (complications).
3. Qualitative data was compared by Chi square test.
4. Unpaired t test was used to infer the difference in means.
5. For significance, following at the level of "p" value was taken: $P > 0.05$ = Not significant $P = 0.05$ = Just significant $P < 0.05$ = Significant $P < 0.001$ = highly significant.

Result**Table 1: Distribution of cases according to Time taken for complete surgery.**

Parameter	Group A		Group B		P-Value
	Mean	SD	Mean	SD	
Duration of Surgery	55.5	10.74	66.58	12.47	<0.0001

From the table it is observed that the mean Duration of Surgery was 55.5 ± 10.74 in group A and 66.58 ± 12.47 in group B. Duration of surgery was comparatively more in group B than group A. The result was statistically significant as the p value is < 0.05 .

Table 2: Number of cases having GB Wall thickness more than 3mm.

GB Wall Thickness (in mm)	Group A		Group B	
	No. of Patients	Percentage	No. of Patients	Percentage
<3	7	14	3	6
3-5	29	58	22	44
>5	14	28	25	50
Total	50	100	50	100
Mean±SD	4.19±1.18		4.75±1.28	
P-Value	0.02			

From the table it is inferred that majority of the patients in both groups had GB wall thickness in the range of 3-5mm but with time, due to inflammation in the wall of gall bladder, wall thickness increases in group B. In group A 58% of the patients had GB wall thickness between 3- 5mm, 28% patients had above 5mm and 14% had <3mm. Mean

thickness was found to be 4.19 ± 1.18 in group A. In group B 44% of the patients had GB wall thickness between 3-5mm, 50% patients had above 5mm and 6% had <3mm. Mean thickness was found to be 4.75 ± 1.28 in group B. The result was statistically significant as the p value is <0.05.

Table 3: Calot's dissection time.

Parameter	Group A		Group B		P-Value
	Mean	SD	Mean	SD	
Calot's dissection time	16.5	4.76	23.74	6.23	<0.0001

From the table it is observed that the mean time taken for Calot's dissection time was 16.5 ± 4.76 in group A and 23.74 ± 6.23 in group B. The result was statistically significant as the p value is <0.05.

Table 4: Post-operative Complications.

Post-Operative Complications	Group A		Group B		P Value
	No. of Patients	Percentage	No. of Patients	Percentage	
Bile Leak	0	0	5	10	0.02
Wound Infection	1	2	5	10	0.09
Sub-hepatic Collection	1	2	5	10	0.09
Bowel Herniation at Port Site	0	0	1	2	0.31

Post-operative Complications were seen in the patients of both groups. In group A wound infection (2%) sub-hepatic collection (2%) were seen in patients whereas more complications were seen in groups B with Bile Leak (10%), Wound Infection (10%), Sub-hepatic Collection (10%) and Bowel Herniation at Port Site (2%). The result was statistically insignificant as the p value is >0.05.

Table 5: Study of secondary outcome measures.

Secondary Outcome Measures	Group A		Group B		P-Value
	Mean	SD	Mean	SD	
Length of Hospital Stay	5.03	0.93	7.66	1.61	<0.0001
Return to Full Activity	11.82	2.31	15.7	3.84	<0.0001

From the study it is observed that length of hospital stay was comparatively less for group A patients than the group B with a mean value of 5.03 ± 0.93 days whereas for group B 7.66 ± 1.61 days. The time taken to return to full activity was less for group A with mean value of 11.82 ± 2.31 while for group B it is 145.7 ± 3.84 .

Discussion

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 resolution of the acute inflammation of the gallbladder.[19] Cholecystectomy is considered the treatment of choice for acute cholecystitis. The timing of operative intervention in acute cholecystitis has long been a source of debate. In the past, many surgeons advocated for delayed cholecystectomy, with patients managed nonoperatively during their initial hospitalization and discharged home with the resolution of symptoms. An interval cholecystectomy was then performed at approximately 6 weeks after the initial episode. Recent

studies have demonstrated that early in the disease process (within the 1st week), the procedure can be performed laparoscopically with equivalent or improved morbidity, mortality, and length of stay as well as a similar conversion rate to delayed cholecystectomy.[20] A review of the literature over the past decade shows that early and delayed LC for acute cholecystitis are safe with similar conversion rates, and overall complications.[21,22,23,24] However, early LC might be associated with lower hospital costs, fewer workdays loss, and greater patient satisfaction.[25] Although technically more demanding and time-consuming, early LC has shown to reduce the risk of repeat cholecystitis.[26] This approach of early LC is well supported by an international consensus published as Tokyo Guidelines.[27] With increased laparoscopic experience, improved skills, and new instruments, the pitfalls of early LC for acute cholecystitis like high rates of conversion to open cholecystectomy, prolonged operation time, and increased risks, particularly CBD injury, have been dramatically reduced. A gripping proposition favoring early LC for acute cholecystitis is that of morbidity in view of readmissions pertaining to recurrent attacks of cholecystitis and escalating expenses of prolonged waiting time for surgery following conservative treatment at index admission.[28,29,30] In our study the cases were divided based on early and delayed cholecystectomy. There were 50 (50%) patients in group A (early hours) and 50 (50%) patients in group B (delayed hours) from a total number of 100 patients.

The mean Duration of Surgery was 55.5 ± 10.74 in group A and 66.58 ± 12.47 in group B. Duration of surgery was comparatively more in group B than group A. The result was statistically significant as the p value is <0.05 . A study by Vishweshwara et al [31] found that the mean duration of surgery was 71.09 min in Group A and 84.82 min in Group B ($P < 0.05$). Verma S et al [32] found that mean

operating time was 65.78 min in the early group and 56.83 min in the delayed group. The difference in operation time was statistically significant (value: 0.046). Chhajed R et al [33] found that the duration of surgery was $108.5 (\pm 16.9)$ minutes in delayed laparoscopic cholecystectomy group as compared to $69.3 (\pm 15.3)$ minutes early laparoscopic cholecystectomy group which was statistically significant. Jarrar MS et al reported that duration of surgery was significantly longer for delayed laparoscopic cholecystectomy group as compared to early laparoscopic cholecystectomy group (97 minutes versus 82.17 minutes, $p = 0.003$).[34] Uysal E et al reported that there was no statistically significant difference in the duration of operation among the groups whereas Chang TC et al reported that patients undergoing early laparoscopic cholecystectomy had significantly longer operation time as compared to delayed laparoscopic cholecystectomy group (109 ± 37.59 minutes versus 77 ± 25.65 minutes, $p < 0.001$).[35,36]

In our study the mean time taken for Calot's dissection time was 16.5 ± 4.76 in group A and 23.74 ± 6.23 in group B. The result was statistically significant as the p value is <0.05 . A similar study by Asoglu O et al. [37] found no statistically significant difference in the Calot's triangle dissection times between the groups ($p = 0.122$ and $p = 0.075$, respectively).

Post-operative Complications were seen in the patients of both groups. In group A wound infection (2%) sub-hepatic collection (2%) were seen in patients whereas more complications were seen in groups B with Bile Leak (10%), Wound Infection (10%), Sub-hepatic Collection (10%) and Bowel Herniation at Port Site (2%). The result was statistically insignificant as the p value is >0.05 . Ozkardes A B et al [38] found that recorded Intraoperative and postoperative complications in 8 patients in the early laparoscopic cholecystectomy group,

whereas no complications occurred in the delayed laparoscopic cholecystectomy group ($P = 0.002$). Of these complications, 3 were intraoperative—bile duct injury, bleeding, and gallbladder perforation—and 5 were postoperative—lung infection, atelectasis, surgical site infection, bleeding from umbilical trocar site, and leakage from a Luschka canal. Vishweshwara, et al [31] found that there were no complications in both groups. Bile duct injury/cystic duct leak or retained CBD stone or hepatic/bowel injury were not observed. There were no admissions to high dependency/intensive care unit, or no mortality occurred. The length of hospital stay was comparatively less for group A patients than the group B with a mean value of 5.03 ± 0.93 days whereas for group B 7.66 ± 1.61 days. The time taken to return to full activity was less for group A with mean value of 11.82 ± 2.31 while for group B it is 15.7 ± 3.84 . Verma S et al [32] found that the mean duration of postoperative stay in the early group was 1.67 days as compared to 1.47 days in the delayed group. The difference was statistically insignificant. (p value: 0.379). Vishweshwara, et al [31] found that the mean total hospital stay was 7.34 days in Group A compared to 13.40 in Group B ($P < 0.05$). Chhajed R et al [33] concluded that there was a statistically significant difference in mean duration of hospital stay and mean days to return to the full activities in both the groups. Delayed laparoscopic cholecystectomy group had longer duration of hospital stay and longer duration of return to full activities as compared to early laparoscopic cholecystectomy group. Similar results were reported by various studies. Various studies depicted that mean days of hospital stay for early laparoscopic cholecystectomy was significantly less as compared to delayed laparoscopic cholecystectomy. Present study substantiates the findings of these studies. There was increased post-operative stay because of the complications most of which were managed conservatively.

Conclusion

As the growing field of minimally invasive surgery is progressing, the management of acute cholecystitis has also been changed drastically over the decades, ranging from open surgery to laparoscopic surgery and subsequently from delayed cholecystectomy to early cholecystectomy in order to improve the outcome of patient along with the cost efficacy.

References

1. Cuschieri A. Approach to the treatment of acute cholecystitis: open surgical, laparoscopic or endoscope? *Endoscopy*. 1993; 25:397-8.
2. Järvinen HJ, Hästbacka J. Early cholecystectomy for acute cholecystitis: a prospective randomized study. *Ann Surg*. 1980; 191:501.
3. Siddiqui T, MacDonald A, Chong PS, Jenkins JT. Early versus delayed laparoscopic cholecystectomy for acute cholecystitis: a meta-analysis of randomized clinical trials. *Am J Surg*. 2008; 195:40-7.
4. Takada T, Kawarada Y, Nimura Y, Yoshida M, Mayumi T, Sekimoto M, et al. Background: Tokyo guidelines for the management of acute holangitis and cholecystitis. *J Hepato-Biliary-Pancreatic Sci*. 2007; 14:1-0
5. Graves HA Jr, Ballinger JF, Anderson WJ. Appraisal of laparoscopic cholecystectomy. *Ann Surg*. 1991; 213:655-64.
6. Chandler CF, Lane JS, Ferguson P, et al. Prospective evaluation of early versus delayed laparoscopic cholecystectomy for treatment of acute cholecystitis. *Am Surg*. 2000;66 (9):896-900.
7. Serralta AS, Bueno JL, Planells MR, et al. Prospective evaluation of emergency versus delayed laparoscopic cholecystectomy for early cholecystitis. *Surg Laparosc Endosc Percutan Tech*. 2003;13 (2):71-5.
8. Shirmer BD, Edge SB, Dix J, Hyser MJ, Hanks JB. Treatment of choice for

- symptomatic cholelithiasis. *Ann Surg.* 1991; 213:665-8.
9. Strasberg SM, Clavien PA. Overview of therapeutic modalities for the treatment of gallstone diseases. *American Journal of Surgery.* 1993; 165(4):420–6.
 10. Hunter JG. Acute cholecystitis revisited; Get it while it is hot. *Ann Surg.* 1998; 227:468-9.
 11. Yamashita Y, Takada T, Kawarada Y, Nimura Y, Hirota M, Miura F, et al. Surgical treatment of patients with acute cholecystitis: Tokyo Guidelines. *J Hepatobiliary Pancreat Surg.* 2007; 14:91-7
 12. Gurusamy KS, Samraj K. Early versus delayed laparoscopic cholecystectomy for acute cholecystitis. *Cochrane Database Syst Rev.* 2006; (4): CD005440.
 13. Mulholland JH, Ellison EH, Friesen SR. Delayed operative management of acute cholecystitis. Current surgical management. Philadelphia, Pa, USA: Saunders. 1957.
 14. Ellison EH, Miholland JH, Friesen SR. Early operation for acute cholecystitis. Current surgical management. Philadelphia, Pa, USA: Saunders. 1957
 15. Pines B, Rabinovitch J. Perforation of the gallbladder in acute cholecystitis. *Ann Surg.* 1959;140 (2):170-9.
 16. Lo CM, Liu CL, Fan ST, et al. Prospective randomized study of early versus delayed laparoscopic cholecystectomy for acute cholecystitis. *Ann Surg.* 1998;227 (4):461-7.
 17. Lai PB, Kwong KH, Leung KL, et al. Randomized trial of early versus delayed laparoscopic cholecystectomy for acute cholecystitis. *Br J Surg.* 1998;85 (6):764-7.
 18. Johansson M, Thune A, Blomqvist A, et al. Management of acute cholecystitis in the laparoscopic era: results of a prospective, randomized clinical trial. *J Gastrointest Surg.* 2003;7 (5):642-5.
 19. Kolla SB, Aggarwal S, Kumar A, et al. Early versus delayed laparoscopic cholecystectomy for acute cholecystitis: a prospective randomized trial. *Surg Endosc.* 2004;18 (9)1323-7.
 20. Falor AE, de Virgilio C, Stabile BE, Kaji AH, Caton A, Kokubun BA et al. Early laparoscopic cholecystectomy for mild gallstone pancreatitis: time for a paradigm shift. *Arch Surg.* 2012; 147(11):1031–1035.
 21. Jackson PG, Evans SR. Biliary system. In: Townsend CM, Evers BM, Beauchamp RD, Mattox KL, editors. *Sabiston Textbook of Surgery.* 20th ed. Philadelphia: Elsevier; 2017; 1494.
 22. Lai PB, Kwong KH, Leung KL, Kwok SP, Chan AC, Chung SC, et al. Randomized trial of early versus delayed laparoscopic cholecystectomy for acute cholecystitis. *Br J Surg.* 1998; 85:764-7.
 23. Kolla SB, Aggarwal S, Kumar A, Kumar R, Chumber S, Parshad R, et al. Early versus delayed laparoscopic cholecystectomy for acute cholecystitis: A prospective randomized trial. *Surg Endosc.* 2004; 18:1323-7.
 24. Wu XD, Tian X, Liu MM, Wu L, Zhao S, Zhao L. Meta-analysis comparing early versus delayed laparoscopic cholecystectomy for acute cholecystitis. *Br J Surg.* 2015; 102:1302-13.
 25. Chang TC, Lin MT, Wu MH, Wang MY, Lee PH. Evaluation of early versus delayed laparoscopic cholecystectomy in the treatment of acute cholecystitis. *Hepatogastroenterology.* 2009; 56:26-8.
 26. Somasekar K, Shankar PJ, Foster ME, Lewis MH. Costs of waiting for gall bladder surgery. *Postgrad Med J.* 2002; 78:668-70.
 27. Casillas RA, Yegiyants S, Collins JC. Early laparoscopic cholecystectomy is the preferred management of acute cholecystitis. *Arch Surg.* 2008; 143:533-7.
 28. Yamashita Y, Takada T, Kawarada Y, Nimura Y, Hirota M, Miura F, et al. Surgical treatment of patients with acute cholecystitis: Tokyo Guidelines. *J*

- Hepatobiliary Pancreat Surg. 2007; 14:91-7.
29. Bhattacharya D, Ammori BJ. Contemporary minimally invasive approaches to the management of acute cholecystitis: A review and appraisal. Surg Laparosc Endosc Percutan Tech. 2005; 15:1-8.
 30. Bhattacharya D, Senapati PS, Hurle R, Ammori BJ. Urgent versus interval laparoscopic cholecystectomy for acute cholecystitis: A comparative study. J Hepatobiliary Pancreat Surg. 2002; 9:538-42.
 31. Madan AK, Aliabadi-Wahle S, Tesi D, Flint L, Steinberg SM. How early is early laparoscopic treatment of acute cholecystitis? Am J Surg. 2002; 183:232-6.
 32. Vishweshwara R M, Manangi M, Dharini D, C SS, Kumar S, Ramesh M K, Rao K S. Laparoscopic cholecystectomy in acute cholecystitis: A feasible option regardless of timing. Formosan Journal of Surgery. 2020; 53(6):198.55.
 33. Verma S, Agarwal P.N, Bali R S, Singh R, Talwar N. Early versus Delayed Laparoscopic Cholecystectomy for Acute Cholecystitis: A Prospective Randomized Trial. ISRN Minimally Invasive Surgery. 2013; 486107:3.
 34. Chhajed R, Dumbre R, Fernandes A, Phalgune D. Early versus delayed laparoscopic cholecystectomy for acute cholecystitis: a comparative study. Int Surg J. 2018;5(10):3381-3385.
 35. Jarrar MS, Chouchène I, Fadhl H, Ghrissi R, Elghali A, Ferhi F, et al. Early versus delayed laparoscopic cholecystectomy for lithiasic acute cholecystitis during emergency admissions. results of a monocentric experience and review of the literature. Tunis Med. 2016; 94:519-24.
 36. Uysal E, Turel KS, Sipahi M, Isik O, Yilmaz N, Yilmaz FA. Comparison of early and interval laparoscopic cholecystectomy for treatment of acute cholecystitis. Which is better? A multicentered study. Surgical Laparoscopy Endoscopy Percutaneous Techniques. 2016;26: e117-21.
 37. Chang TC, Lin MT, Wu MH, Wang MY, Lee PH. Evaluation of early versus delayed laparoscopic cholecystectomy in the treatment of acute cholecystitis. Hepato-Gastroenterol. 2009; 56:26-8.
 38. Asoglu O, Ozmen V, Karanlik H, Igci A, Kecer M, Parlak M, et al. Does the complication rate increase in laparoscopic cholecystectomy for acute cholecystitis? J Laparoendosc Adv Surg Tech A. 2004; 14:81-6
 39. Ozkardes A B, Tokac M, Dumlu E G, Bozkurt B, Ciftci A B, Yetisir F, Kilic M. Early Versus Delayed Laparoscopic Cholecystectomy for Acute Cholecystitis: A Prospective, Randomized Study. Int Surg. 2014; 99: 56–61.