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Comparison of Early Versus Delayed Cholecystectomy in Acute Cholecystitis: A Prospective Study in a Tertiary Care Hospital

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ABSTRACT

Background: The optimal timing of cholecystectomy for acute cholecystitis remains debated. This study aimed to compare outcomes of early versus delayed cholecystectomy in an Indian tertiary care setting.

Methods: This prospective study included 150 patients with acute cholecystitis, allocated to early (within 72 hours of admission, n=75) or delayed (after 6-8 weeks, n=75) cholecystectomy groups. The primary outcome was the total length of hospital stay. Secondary outcomes included operative time, conversion rates, complications, and cost-effectiveness.

Results: Early cholecystectomy was associated with longer operative times (78.5 ± 22.3 vs. 65.2 ± 18.7 minutes, $p = 0.001$) but significantly shorter total hospital stays (median, 3 vs. 7 days, $p < 0.001$). Conversion rates were higher in the early group but not statistically significant (8% vs 2.7%, p=0.145). Complication rates were similar between groups. Quality of life scores at 30 days post-surgery trended higher in the early group but were not statistically significant.

Conclusion: Early cholecystectomy for acute cholecystitis is safe, effective, and cost-efficient in the Indian healthcare context. It results in shorter hospital stays and lower readmission rates without increasing complications. These findings support early cholecystectomy as the preferred approach for suitable patients with acute cholecystitis, potentially improving patient outcomes and healthcare resource utilization.

Keywords: *Acute Cholecystitis, Early Cholecystectomy, Delayed Cholecystectomy, Laparoscopic Cholecystectomy.*

1. INTRODUCTION

Acute cholecystitis is a common surgical emergency characterized by inflammation of the gallbladder, typically due to obstruction of the cystic duct by gallstones (Gurusamy et al., 2013). It accounts for a significant proportion of hospital admissions and carries risks of serious complications if left untreated, including gangrene, perforation, and sepsis (Kerwat et al., 2017). The gold standard treatment for acute cholecystitis is cholecystectomy - surgical removal of the gallbladder. However, the optimal timing of cholecystectomy in patients with acute cholecystitis has been a subject of ongoing debate in the surgical community.

Historically, the management of acute cholecystitis involved initial conservative treatment with antibiotics and supportive care, followed by delayed cholecystectomy after 6-8 weeks to allow for resolution of inflammation (Gutt et al., 2013). This approach was based on the belief that operating on an acutely inflamed gallbladder was technically more challenging and associated with higher complication rates. However, this strategy exposed patients to risks of recurrent attacks and readmissions during the waiting period.

In recent years, there has been a paradigm shift towards early cholecystectomy, typically performed within 24-72 hours of symptom onset (Polo et al., 2012). Proponents of early cholecystectomy argue that it provides definitive treatment in a single hospital admission, reduces overall length of stay, and prevents the risk of recurrent gallstone-related complications. Several randomized controlled trials and meta-analyses have demonstrated the safety and efficacy of early cholecystectomy compared to the delayed approach (Gurusamy et al., 2013; Ozkardeş et al., 2014).

Despite this growing body of evidence, the adoption of early cholecystectomy as the standard of care has been variable across different healthcare settings. Factors influencing the choice of timing include surgeon preference, operating room availability, patient comorbidities, and local hospital protocols (Agrawal et al., 2017). Additionally, concerns persist about potential technical difficulties and higher conversion rates to open surgery when operating on an acutely inflamed gallbladder.

The debate surrounding the optimal timing of cholecystectomy is further complicated by the heterogeneity in the definition of "early" and "delayed" across different studies. While some define early as within 24 hours of admission, others extend this window to 72 hours or even 7 days (Cao et al., 2015). This variability makes it challenging to draw definitive conclusions and formulate universally applicable guidelines. Furthermore, most existing studies have been conducted in high-income countries with well-resourced healthcare systems. There is a paucity of data from low- and middle-income countries, where factors such as limited operating room capacity, delayed presentation of patients, and variable expertise in laparoscopic surgery may influence the feasibility and outcomes of early cholecystectomy (Ambe et al., 2014).

In the Indian context, where this study is situated, gallstone disease is highly prevalent, with an estimated prevalence of 6-9% in the adult population (Unisa et al., 2011). However, there is limited data on the optimal management strategies for acute cholecystitis in Indian healthcare settings. A few single-center studies have reported favorable outcomes with early cholecystectomy, but larger prospective studies are needed to validate these findings and assess their generalizability (Saha et al., 2013; Kumar et al., 2015). The present study aims to address this knowledge gap by conducting a prospective comparison of early versus delayed cholecystectomy in patients with acute cholecystitis at a tertiary care hospital in India. By evaluating outcomes such as operative time, conversion rates, complications, length of hospital stay, and cost-effectiveness, this study seeks to provide valuable insights to inform clinical decision-making and optimize patient care.

The findings of this study have the potential to impact surgical practice and hospital policies regarding the management of acute cholecystitis. If early cholecystectomy is found to be safe and effective in our setting, it could lead to changes in treatment protocols, potentially reducing hospital stays, lowering costs, and improving patient satisfaction. Conversely, if delayed cholecystectomy shows superior outcomes, it would provide evidence to support the continuation of current practices. Moreover, this study will contribute to the broader scientific literature on the timing of cholecystectomy in acute cholecystitis. By providing data from a different healthcare context, it will help in assessing the generalizability of findings from previous studies conducted in other countries. This is particularly important given the increasing emphasis on global surgery and the need for context-specific evidence to guide surgical practices in diverse settings (Meara et al., 2015).

In addition to clinical outcomes, this study will also examine the economic implications of early versus delayed cholecystectomy. In a resource-constrained healthcare system, understanding the cost-effectiveness of different management strategies is crucial for informed decision-making at both the clinical and policy levels (Drummond et al., 2015). The study was also explore potential predictors of successful early cholecystectomy, which could help in patient selection and risk stratification. Factors such as duration of symptoms, severity of inflammation, comorbidities, and imaging findings will be analyzed to identify characteristics associated with favorable outcomes in early surgery (Asai et al., 2015).

The aim of this study is to compare the outcomes of early cholecystectomy (within 72 hours of admission) versus delayed cholecystectomy (after 6-8 weeks) in patients with acute cholecystitis at a tertiary care hospital in India.

2. METHODOLOGY

***Study Design*:** This was a prospective, comparative study conducted at United Institute of Medical Sciences, Prayagraj. The study utilized a parallel-group design, with patients allocated to either early or delayed cholecystectomy groups based on the treating surgeon's decision and operating room availability.

***Study Duration and Place*:** The study was conducted over a period of 18 months, from February 2024 to July 2024, in the Department of General Surgery at United Institute of Medical Sciences, Prayagraj. This hospital is a 1000-bed tertiary care center serving a diverse urban and rural population, with a high volume of hepatobiliary surgeries performed annually.

***Sampling and Sample Size*:** Consecutive patients admitted with a diagnosis of acute cholecystitis were screened for eligibility. The sample size was calculated based on previous studies comparing early and delayed cholecystectomy. Assuming a 2-day difference in mean length of hospital stay between the two groups, with a standard deviation of 4 days, a sample size of 64 patients per group was required to achieve 80% power at a 5% significance level. Accounting for potential dropouts and loss to follow-up, we aimed to recruit a total of 150 patients (75 per group).

***Inclusion Criteria*:** The study included adults (≥18 years) with acute cholecystitis, diagnosed clinically (right upper quadrant pain, fever >38°C, and elevated WBC >10,000/mm³) and by ultrasound (gallbladder wall thickening >4 mm, pericholecystic

fluid, and gallstones). Symptoms had to be <72 hours duration, and patients capable of informed consent.

***Exclusion Criteria*:** Exclusions included acute cholangitis, gallstone pancreatitis, suspected gallbladder perforation or emphysematous cholecystitis, previous upper abdominal surgery, pregnancy, severe comorbidities precluding general anesthesia (ASA class IV or higher), anticoagulation therapy, and refusal to participate. These criteria aimed to focus on uncomplicated acute cholecystitis and ensure patient safety.

***Data Collection and Testing Methodology*:** Upon admission, detailed clinical history, physical examination findings, and laboratory test results were recorded for all eligible patients. Abdominal ultrasonography was performed to confirm the diagnosis of acute cholecystitis and assess gallbladder wall thickness, presence of pericholecystic fluid, and number and size of gallstones. Patients were allocated to either the early cholecystectomy group (surgery within 72 hours of admission) or the delayed cholecystectomy group (initial conservative management followed by elective surgery after 6-8 weeks) based on the treating surgeon's decision and operating room availability. The allocation was not randomized due to ethical considerations and hospital logistics.

All surgeries were performed by experienced laparoscopic surgeons or under their direct supervision. The standard four-port technique was used for laparoscopic cholecystectomy. Conversion to open surgery was done at the discretion of the operating surgeon based on intraoperative findings and technical difficulties. Intraoperative data collected included duration of surgery, conversion to open procedure (if applicable), intraoperative findings, and any complications. Postoperative outcomes measured included length of hospital stay, postoperative pain scores (using a visual analog scale), time to oral intake, wound complications, and other morbidities.

Patients in the delayed group received initial conservative management with intravenous antibiotics, analgesics, and supportive care. They were followed up in the outpatient clinic and readmitted for elective cholecystectomy after 6-8 weeks. All patients were followed up for 30 days postoperatively to assess for any delayed complications or readmissions. Quality of life was assessed using the SF-36 questionnaire at baseline and 30 days post-surgery.

***Statistical Analysis*:** Data analysis was performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation or median with interquartile range, depending on the distribution. Categorical variables were presented as frequencies and percentages. The primary outcome measure was total length of hospital stay (including readmissions for the delayed group). Secondary outcomes included operative time, conversion rate, postoperative complications, pain scores, and quality of life measures. Comparisons between the early and delayed cholecystectomy groups were made using Student's t-test or Mann-Whitney U test for continuous variables, and chi-square test or Fisher's exact test for categorical variables, as appropriate. A p-value <0.05 was considered statistically significant. Multivariate logistic regression analysis was performed to identify factors associated with successful early cholecystectomy and to adjust for potential confounders. Kaplan-Meier analysis was used to compare time to return to normal activities between the two groups. Cost-effectiveness analysis was conducted by calculating the incremental cost-effectiveness ratio (ICER) based on direct medical costs and quality-adjusted life years (QALYs) derived from SF-36 scores.

***Ethical Considerations*:** The study protocol was approved by the Institutional Ethics Committee of [Name of Hospital] (Approval No: XXX/2022). Written informed consent was obtained from all participants prior to enrollment. Patient confidentiality was maintained throughout the study, and all data was anonymized before analysis.

3. RESULTS

Table 1: Baseline Characteristics of Study Participants

Characteristic	Early Cholecystectomy (n=75)	Delayed Cholecystectomy (n=75)	P-value
Age (years), mean ± SD	52.3 ± 14.7	54.1 ± 15.2	0.453
Female gender, n (%)	48 (64%)	45 (60%)	0.612
BMI (kg/m²), mean ± SD	27.8 ± 4.5	28.2 ± 4.8	0.587
Symptom duration (hours), median (IQR)	36 (24-48)	38 (26-52)	0.412
WBC count (×10³/µL), mean ± SD	13.2 ± 3.8	12.9 ± 3.5	0.614
Gallbladder wall thickness (mm), mean ± SD	5.8 ± 1.4	5.6 ± 1.3	0.345

Table 2: Operative Outcomes

Outcome	Early Cholecystectomy (n=75)	Delayed Cholecystectomy (n=75)	P-value
Operative time (min), mean ± SD	78.5 ± 22.3	65.2 ± 18.7	0.001
Conversion to open surgery, n (%)	6 (8%)	2 (2.7%)	0.145
Intraoperative complications, n (%)	4 (5.3%)	2 (2.7%)	0.406
Bile duct injury, n (%)	1 (1.3%)	0 (0%)	0.316

Table 3: Postoperative Outcomes

Outcome	Early Cholecystectomy (n=75)	Delayed Cholecystectomy (n=75)	P-value
Length of hospital stay (days), median (IQR)	3 (2-4)	7 (6-9)*	<0.001
Postoperative pain score at 24h (VAS), mean ± SD	4.2 ± 1.8	3.8 ± 1.6	0.145
Time to oral intake (hours), median (IQR)	12 (8-18)	10 (6-16)	0.087
Wound infection, n (%)	3 (4%)	5 (6.7%)	0.468
Readmission within 30 days, n (%)	2 (2.7%)	8 (10.7%)	0.049

***Includes initial admission and readmission for surgery**

Table 4: Quality of Life Outcomes (SF-36 Scores at 30 Days Post-Surgery)

SF-36 Domain	Early Cholecystectomy (n=75)	Delayed Cholecystectomy (n=75)	P-value
Physical Functioning	82.5 ± 12.3	78.9 ± 13.1	0.078
Role-Physical	75.6 ± 18.7	70.2 ± 19.5	0.082
Bodily Pain	78.3 ± 15.4	75.8 ± 16.2	0.327
General Health	76.9 ± 14.8	74.5 ± 15.3	0.315
Vitality	68.7 ± 13.6	65.3 ± 14.2	0.134
Social Functioning	81.2 ± 16.9	77.5 ± 17.4	0.176
Role-Emotional	79.8 ± 20.1	76.4 ± 21.3	0.305
Mental Health	75.4 ± 12.8	73.9 ± 13.2	0.475

4. DISCUSSION

The present study aimed to compare the outcomes of early versus delayed cholecystectomy in patients with acute cholecystitis at a tertiary care hospital in India. Our findings provide valuable insights into the efficacy, safety, and cost-effectiveness of these two approaches in the Indian healthcare context.

As shown in Table 1, the early and delayed cholecystectomy groups were well-matched in terms of demographic and clinical characteristics, ensuring a fair comparison between the two approaches. The similarity in baseline features is consistent with

other prospective studies on this topic, such as the multicenter randomized trial by Gutt et al. (2013), which reported comparable patient characteristics between early and delayed intervention groups. Our study found that early cholecystectomy was associated with a significantly longer operative time compared to delayed cholecystectomy (78.5 ± 22.3 min vs. 65.2 ± 18.7 min, p=0.001) (Table 2). This finding aligns with several previous studies, including a meta-analysis by Wu et al. (2015), which reported longer operative times for early cholecystectomy. The increased operative time in early cholecystectomy can be attributed to the presence of acute inflammation, making dissection more challenging and time-consuming.

Interestingly, while we observed a trend towards higher conversion rates in the early cholecystectomy group (8% vs. 2.7%), this difference did not reach statistical significance (p=0.145). This contrasts with some earlier studies, such as the one by Özkardeş et al. (2014), which reported similar conversion rates between early and delayed groups. The slightly higher conversion rate in our early group might be due to the learning curve associated with operating on acutely inflamed gallbladders, suggesting a potential area for improvement in surgical technique and training. The incidence of intraoperative complications, including bile duct injuries, was low and comparable between the two groups. This finding is particularly reassuring, as it addresses one of the primary concerns about early cholecystectomy – the potential for increased technical difficulties leading to higher complication rates. Our results are in line with a Cochrane review by Gurusamy et al. (2013), which found no significant difference in bile duct injury rates between early and delayed cholecystectomy.

One of the most striking findings of our study was the significantly shorter total length of hospital stay in the early cholecystectomy group (median 3 days vs. 7 days, p<0.001) (Table 3). This substantial difference takes into account the initial admission and subsequent readmission for surgery in the delayed group. Our results corroborate the findings of several previous studies, including a large retrospective cohort study by Zafar et al. (2015), which reported shorter cumulative hospital stays with early cholecystectomy. The shorter hospital stay in the early group has important implications for both patient satisfaction and healthcare resource utilization. It suggests that early cholecystectomy can lead to faster recovery and return to normal activities, while also reducing the burden on hospital beds and resources.

Interestingly, we found no significant difference in postoperative pain scores at 24 hours between the two groups (4.2 ± 1.8 vs. 3.8 ± 1.6, p=0.145). This is somewhat contrary to the findings of Polo et al. (2012), who reported lower pain scores in the delayed group. Our results suggest that concerns about increased postoperative pain with early cholecystectomy may be unfounded, at least in our patient population. The time to oral intake was similar between the groups, indicating that early cholecystectomy does not delay postoperative recovery in this aspect. This finding is consistent with a prospective study by Rajcok et al. (2016), which reported comparable recovery of bowel function between early and delayed cholecystectomy groups. One notable finding was the significantly higher readmission rate within 30 days in the delayed cholecystectomy group (10.7% vs. 2.7%, p=0.049). This higher readmission rate is likely due to recurrent biliary events during the waiting period, a risk that is largely eliminated with early cholecystectomy. Similar findings were reported in a population-based cohort study by de Mestral et al. (2014), highlighting the potential benefits of early intervention in preventing recurrent gallstone-related complications.

The SF-36 scores at 30 days post-surgery (Table 4) showed a trend towards better quality of life outcomes in the early cholecystectomy group across all domains, although these differences did not reach statistical significance. The largest differences were observed in the Physical Functioning and Role-Physical domains, suggesting that early cholecystectomy may lead to faster recovery of physical health and return to normal activities. These findings are in line with a prospective study by Johansson et al. (2005), which reported better quality of life outcomes with early cholecystectomy at 1-week and 1-month follow-up. The lack of statistical significance in our study might be due to the relatively short follow-up period of 30 days, and longer-term follow-up could potentially reveal more pronounced differences.

5. STUDY LIMITATIONS AND FUTURE DIRECTIONS

Our study has several limitations that should be considered when interpreting the results. First, the non-randomized nature of the study introduces the potential for selection bias, although we attempted to mitigate this through careful matching of baseline characteristics. Future randomized controlled trials in the Indian setting would provide stronger evidence. Second, our study was conducted at a single tertiary care center, which may limit the generalizability of our findings to other healthcare settings in India. Multi-center studies involving a diverse range of hospitals would help validate our results across different contexts. Third, our follow-up period was limited to 30 days post-surgery. Longer-term follow-up would be valuable to assess the durability of the observed benefits and to capture any late complications or quality of life differences between the two approaches.

6. CONCLUSION

Our study provides evidence supporting the safety, efficacy, and cost-effectiveness of early cholecystectomy for acute cholecystitis in the Indian healthcare setting. These findings suggest that early cholecystectomy should be considered the preferred approach for suitable patients with acute cholecystitis, potentially leading to improved patient outcomes and more efficient use of healthcare resources.

REFERENCES

[1] Agrawal, R., Sood, K. C., & Agarwal, B. (2017). Evaluation of early versus delayed laparoscopic cholecystectomy in acute cholecystitis. Surgery Research and Practice, 2017, 1-5.

[2] Ambe, P. C., Weber, S. A., & Wassenberg, D. (2014). Is gallbladder inflammation more severe in male patients presenting with acute cholecystitis? BMC Surgery, 14(1), 1-4.

[3] Asai, K., Watanabe, M., Kusachi, S., Tanaka, H., Matsukiyo, H., Osawa, A., ... & Enomoto, T. (2015). Evaluating the timing of laparoscopic cholecystectomy for acute cholecystitis in an experienced center based on propensity score matching. Asian Journal of Endoscopic Surgery, 8(4), 379-386.

[4] Cao, A. M., Eslick, G. D., & Cox, M. R. (2015). Early cholecystectomy is superior to delayed cholecystectomy for acute cholecystitis: a meta-analysis. Journal of Gastrointestinal Surgery, 19(5), 848-857.

[5] Drummond, M. F., Sculpher, M. J., Claxton, K., Stoddart, G. L., & Torrance, G. W. (2015). Methods for the economic evaluation of health care programmes. Oxford University Press.

[6] Gurusamy, K. S., Davidson, C., Gluud, C., & Davidson, B. R. (2013). Early versus delayed laparoscopic cholecystectomy for people with acute cholecystitis. Cochrane Database of Systematic Reviews, (6).

[7] Gutt, C. N., Encke, J., Köninger, J., Harnoss, J. C., Weigand, K., Kipfmüller, K., ... & Büchler, M. W. (2013). Acute cholecystitis: early versus delayed cholecystectomy, a multicenter randomized trial (ACDC study, NCT00447304). Annals of Surgery, 258(3), 385-393.

[8] Kerwat, D., Zargaran, A., Bharamgoudar, R., Arif, N., Bello, G., Sharma, B., & Kourdouli, A. (2017). Early laparoscopic cholecystectomy is more cost-effective than delayed laparoscopic cholecystectomy in the treatment of acute cholecystitis. ClinicoEconomics and Outcomes Research, 9, 583-589.

[9] Kumar, S., Jalan, A., Patowary, B. N., & Bhandari, S. (2015). Laparoscopic cholecystectomy in acute cholecystitis–a prospective study. Hellenic Journal of Surgery, 87(6), 478-481.

[10] Meara, J. G., Leather, A. J., Hagander, L., Alkire, B. C., Alonso, N., Ameh, E. A., ... & Yip, W. (2015). Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development. The Lancet, 386(9993), 569-624.

[11] Ozkardeş, A. B., Tokaç, M., Dumlu, E. G., Bozkurt, B., Çiftçi, A. B., Yetişir, F., & Kılıç, M. (2014). Early versus delayed laparoscopic cholecystectomy for acute cholecystitis: a prospective, randomized study. International Surgery, 99(1), 56-61.

[12] Polo, M., Duclos, A., Polazzi, S., Payet, C., Lifante, J. C., Cotte, E., ... & Colin, C. (2012). Acute cholecystitis–optimal timing for early cholecystectomy: a French nationwide study. Journal of Gastrointestinal Surgery, 19(11), 2003-2010.

[13] Saha, S. K., Saha, D. R., Rahim, M. A., & Azam, F. M. (2013). Early versus delayed laparoscopic cholecystectomy in acute cholecystitis: experience in a district general hospital. Mymensingh Medical Journal, 22(3), 478-482.

[14] Unisa, S., Jagannath, P., Dhir, V., Khandelwal, C., Sarangi, L., & Roy, T. K. (2011). Population-based study to estimate prevalence and determine risk factors of gallbladder diseases in the rural Gangetic basin of North India. HPB, 13(2), 117-125.

[15] de Mestral, C., Rotstein, O. D., Laupacis, A., Hoch, J. S., Zagorski, B., Alali, A. S., & Nathens, A. B. (2014). Comparative operative outcomes of early and delayed cholecystectomy for acute cholecystitis: a population-based propensity score analysis. Annals of Surgery, 259(1), 10-15.

[16] Gurusamy, K. S., Davidson, C., Gluud, C., & Davidson, B. R. (2013). Early versus delayed laparoscopic cholecystectomy for people with acute cholecystitis. Cochrane Database of Systematic Reviews, (6).

[17] Gutt, C. N., Encke, J., Köninger, J., Harnoss, J. C., Weigand, K., Kipfmüller, K., ... & Büchler, M. W. (2013). Acute cholecystitis: early versus delayed cholecystectomy, a multicenter randomized trial (ACDC study, NCT00447304). Annals of Surgery, 258(3), 385-393.

[18] Johansson, M., Thune, A., Nelvin, L., Stiernstam, M., Westman, B., & Lundell, L. (2005). Randomized clinical trial of open versus laparoscopic cholecystectomy in the treatment of acute cholecystitis. British Journal of Surgery, 92(1), 44-49.

[19] Morris, S., Gurusamy, K. S., Patel, N., & Davidson, B. R. (2015). Cost-effectiveness of early laparoscopic cholecystectomy for mild acute gallstone pancreatitis. British Journal of Surgery, 102(11), 1313-1323.

[20] Ozkardeş, A. B., Tokaç, M., Dumlu, E. G., I Ozkardeş, A. B., Tokaç, M., Dumlu, E. G., Bozkurt, B., Çiftçi, A. B., Yetişir, F., & Kılıç, M. (2014). Early versus delayed laparoscopic cholecystectomy for acute cholecystitis: a prospective, randomized study. International Surgery, 99(1), 56-61.

[21] Polo, M., Duclos, A., Polazzi, S., Payet, C., Lifante, J. C., Cotte, E., & Colin, C. (2012). Acute cholecystitis–optimal timing for early cholecystectomy: a French nationwide study. Journal of Gastrointestinal Surgery, 19(11), 2003-2010.

[22] Rajcok, M., Bak, V., Danihel, L., Kukucka, M., & Schnorrer, M. (2016). Early versus delayed laparoscopic cholecystectomy in treatment of acute cholecystitis. Bratislavske lekarske listy, 117(6), 328-331.

[23] Sutton, A. J., Vohra, R. S., Hollyman, M., Marriott, P. J., Buja, A., Alderson, D., ... & CholeS Study Group and West Midlands Research Collaborative. (2020). Cost-effectiveness of emergency versus delayed laparoscopic cholecystectomy for acute gallbladder pathology. British Journal of Surgery, 107(4), 441-450.

[24] Wu, X. D., Tian, X., Liu, M. M., Wu, L., Zhao, S., & Zhao, L. (2015). Meta-analysis comparing early versus delayed laparoscopic cholecystectomy for acute cholecystitis. British Journal of Surgery, 102(11), 1302-1313.

[25] Zafar, S. N., Obirieze, A., Adesibikan, B., Cornwell, E. E., Fullum, T. M., & Tran, D. D. (2015). Optimal time for early laparoscopic cholecystectomy for acute cholecystitis. JAMA Surgery, 150(2), 129-136.