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Original Research Article

Conversion rate and complications in laparoscopic cholecystectomy in acute versus chronic cholecystitis: a prospective cohort study

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ABSTRACT

Background: Laparoscopic cholecystectomy (LC) is the gold standard treatment for symptomatic gallstone disease. However, acute cholecystitis (AC) is traditionally considered more challenging than chronic cholecystitis (CC) due to edema, adhesions, and distorted anatomy in Calot's triangle. These factors may increase operative time, conversion rates, and complication risks. With modern safety strategies such as the critical view of safety (CVS), outcomes may be comparable between the two conditions.
Methods: A prospective cohort study was conducted including 70 patients undergoing LC, divided into two groups: 35 patients with AC and 35 with CC. Operative time, intraoperative difficulty, conversion to open surgery, postoperative complications, and hospital stay were compared.
Results: The conversion rate was 5.7% in both groups. Operative time was marginally longer in AC but without statistical significance. Intraoperative bleeding, bile leak, wound infection, and subhepatic collection were slightly more frequent in the acute group; however, no statistically significant difference was observed. No major bile duct injury occurred in either group.
Conclusions: LC in AC is safe and feasible when performed with adherence to standard safety principles. Conversion and complication rates are comparable to CC in experienced hands.

Keywords: Acute cholecystitis, Chronic cholecystitis, Laparoscopic cholecystectomy, Conversion rate, Postoperative complications, Critical view of safety

INTRODUCTION

Laparoscopic cholecystectomy (LC) is the gold standard treatment for symptomatic gallstone disease.[1] However, AC is traditionally considered more challenging than CC due to edema, adhesions, and distorted anatomy in Calot's triangle.[2] These factors may increase operative time, conversion rates, and complication risks. With modern safety strategies such as the CVS, outcomes may be comparable between the two conditions.[3]

Gallstone disease is one of the most common surgical conditions worldwide, with a higher prevalence in females and in North Indian populations.[4] LC has replaced open cholecystectomy as the standard treatment due to reduced postoperative pain, shorter hospital stay, and faster recovery.

AC results from cystic duct obstruction leading to gallbladder wall edema, inflammation, and possible suppuration.[5] In contrast, CC is characterized by fibrosis and repeated episodes of inflammation. Both conditions may cause anatomical distortion in Calot's triangle, increasing surgical difficulty.

Acute inflammation may increase the risk of bleeding and bile duct injury due to friable tissues and unclear

anatomy. CC may also present challenges due to dense fibrosis and adhesions.[6]

Modern surgical principles emphasize achieving the CVS before clipping the cystic duct and artery. When safe dissection is not possible, early conversion or subtotal cholecystectomy is recommended to prevent bile duct injury.[7]

This study compares conversion rates and complications of LC in acute versus CC in a tertiary care centre.

METHODS

Study design

This prospective cohort study was conducted in the department of general surgery, Pt BD Sharma, PGIMS, Rohtak over a period of one year.

Seventy patients undergoing laparoscopic cholecystectomy were enrolled: AC group (n=35) and CC group (n=35).

AC was diagnosed based on clinical features, laboratory findings, and ultrasonographic evidence of gallbladder wall thickening and pericholecystic fluid. CC patients had long-standing symptoms without acute inflammatory signs.

Exclusion criteria included: age <15 years, BMI >40 kg/m², pregnancy, immunocompromised state and unfitness for general anaesthesia. All patients underwent routine preoperative evaluation and informed consent.

Study period

Study carried out for 1 Year (May 2024-May 2025).

Study population

Patients with gallstone disease undergoing cholecystectomy.

Methods of selection

Inclusion criteria for AC

Symptoms of AC less than 72 hrs. of onset-Pain in abdomen, fever, vomiting, blood investigations showing leucocytosis and radiological investigations (Ultrasonography), gallbladder wall thickness >4 mm and peri cholecystic fluid collection were included.

Inclusion criteria for CC

Symptoms of CC of variable duration, radiological investigations (Ultrasonography)-Multiple gallbladder calculi and normal gallbladder wall thickness with no peri cholecystic fluid collection.

Exclusion criteria

Patients with previous multiple abdominal surgery, very obese patients (BMI >40 kg/m^2), patients less than 15 years of age, patients not giving consent for laparoscopic surgery, patients not fit for general anaesthesia, pregnant patients and immunocompromised patients (HIV, HbSAg and HCV positive) were excluded from study.

Sample size

Sample size was calculated on basis of previous study conducted by Hussain et al.[8] In the study, Type I error (Alpha, Significance), Z_α was 1.96, $Z_{1-\beta}$ was 0.84, power was 80%, percentages of effect (Δ) was 6% (base on Conversion rate in group A) and standard deviation (σ) was 0.84.

$N=2(Z_\alpha+Z_{1-\beta})^2\ (\sigma)^2/(\Delta)^2$

$=2\ (1.96+0.84)^2(0.08)^2/(0.6)^2$

$=0.1003/0.003$

$=33.45=35$

Hence the sample size was taken as 35 in each group.

Methodology

A total of 70 patients (35 patients in each group i.e. AC and CC were studied prospectively. The patients included in the study were informed regarding their participation. During the preoperative examination and counselling, a detailed history was taken in view of the proposed laparoscopic surgery. It included history pertaining to the present condition, history of chronic illnesses, and history of any drug allergy specifically opioids and NSAIDs. Patients were subjected to detailed examination and routine preoperative investigations. Findings were noted in the proforma. Patients were given full information about the proposed surgery and postoperative measure under the study. The patients were be taken up for laparoscopic surgery after clearance from anaesthesia following which intraoperative difficulties, postoperative complication and subsequent outcomes were recorded.

Outcome measures

Primary outcome measures included conversion to open cholecystectomy and intraoperative complications. Secondary outcome measures included operative time, postoperative complications, pain assessment using the visual analogue scale (VAS), and length of hospital stay. These outcomes were selected to capture both technical and patient-centred aspects of surgical performance.

Therapeutic intervention

All surgeries were performed under general anaesthesia using the standard four-port laparoscopic technique. The CVS was attempted in all cases.

If anatomy was unclear or bleeding was uncontrolled, conversion to open cholecystectomy was performed as a safety measure.[9,10]

Intraoperative findings

Parameters recorded included-Adhesions in Calot's triangle, omental adhesions, gallbladder wall thickness, mucocele or pyocele, difficulty in identifying cystic duct and artery and intraoperative bleeding.

Operative time was recorded from skin incision to closure.

Postoperative course

Postoperative complications monitored included-Wound infection, bile leak, subhepatic collection and haemorrhage.

Pain was assessed using the VAS. Duration of hospital stay was recorded.

Follow-up course

Patients were followed at regular intervals to assess-Resolution of symptoms, late bile leak and surgical site infection

Statistical analysis

Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean±SD and median. Normality of data was tested by Kolmogorov-Smirnov test. If the normality was rejected then a non parametric test was used. A $p<0.05$ was considered statistically significant.

The data was entered in MS excel spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 22.0 (SPSS Inc., Chicago, IL, USA).

Ethical approval

All the procedures mentioned in material and method section of present study plan are standard procedures worldwide. No unethical tests or procedures were employed during this study. Hence this study was ethically justified. However, the proposed study entitled "To study the conversion rate and complications in laparoscopic cholecystectomy in acute vs CC was undertaken after getting informed consent from the enrolled patients.

Appropriate ethical approval was taken from the designated ethics committee.

RESULTS

Study population

This prospective cohort study included 70 patients with gallstone disease who underwent laparoscopic cholecystectomy. Patients were divided into two equal groups based on clinical and intraoperative diagnosis: AC n=35 and CC, n=35. All enrolled patients fulfilled the predefined inclusion and exclusion criteria. Primary outcome measures were conversion to open cholecystectomy and intraoperative complications. Secondary outcome measures included operative time, postoperative complications, postoperative pain by VAS, and length of hospital stay.

Demographic profile

Age distribution

The age distribution was comparable in both groups. In the AC group, 15 patients (43%) were aged <40 years, 8 (23%) were 40 to 50 years, 6 (17%) were 50 to 60 years, 4 (12%) were 60 to 70 years, and 2 (5%) were >70 years. In the CC group, 16 patients (45%) were aged <40 years, 7 (20%) were 40 to 50 years, 8 (24%) were 50 to 60 years, 2 (5%) were 60 to 70 years, and 2 (5%) were >70 years. Mean age in the AC group was 44.46±14.09 years with a median of 42 years, while mean age in the CC group was 45.06±15.00 years with a median of 45 years. The difference was not statistically significant (p=0.863).

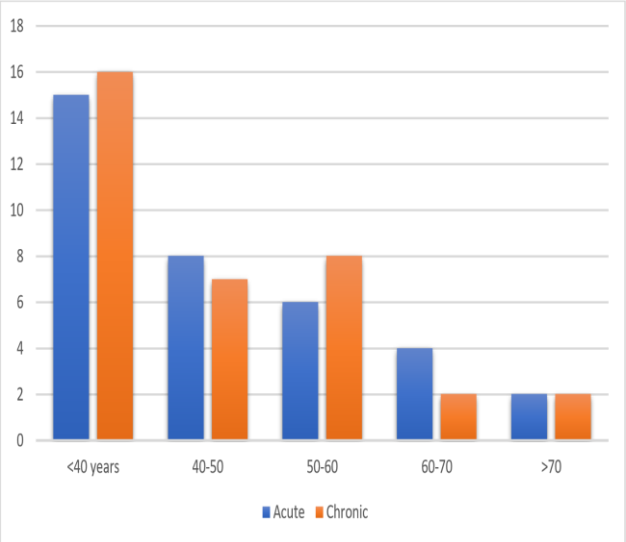

Figure 1: Age distribution.

Sex distribution

There was female predominance in both groups. In the AC group, 8 patients (23%) were male and 27 (77%)

were female. In the CC group, 6 patients (17%) were male and 29 (83%) were female. The difference in sex distribution between the two groups was not statistically significant (p=0.721).

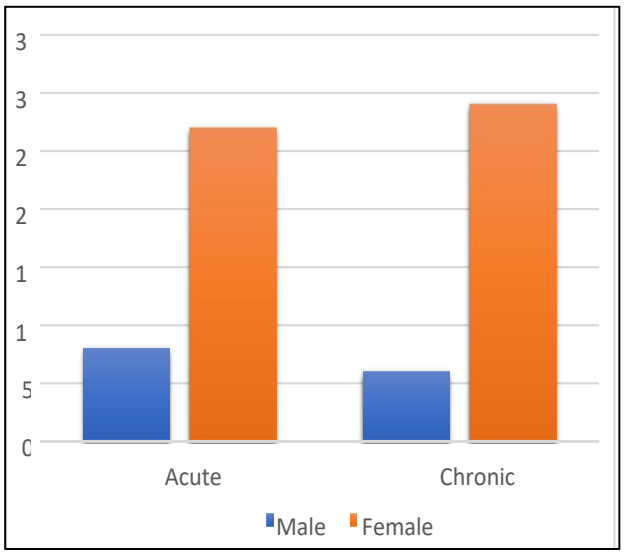

Figure 2: Gender distribution.

Intraoperative findings and clinical characteristics

Adhesions in Calot's triangle

Adhesions in Calot's triangle were present in 20 patients (57%) in the AC group and 17 patients (49%) in the CC group. This difference was not statistically significant (p=0.715).

Adhesions with inferior surface of liver

Adhesions between the gallbladder and inferior surface of the liver were noted in 21 patients (60%) in the AC group and 22 patients (63%) in the CC group. The difference was not statistically significant (p=1.000).

Omental adhesions

Omental adhesions were observed in 21 patients (60%) in the AC group and 18 patients (51.4%) in the CC group.

Non-visualization of Calot's triangle

Non-visualization of Calot's triangle was encountered in 9 patients (26%) in the AC group and 6 patients (17%) in the CC group. The difference was not statistically significant (p=0.728).

Mucocele/pyocele of gallbladder

Mucocele or pyocele of the gallbladder was present in 8 patients (23%) in the AC group and 2 patients (6%) in the CC group. This difference was statistically significant (p=0.0457).

Other gallbladder characteristics

Analysis of intraoperative findings also showed that AC more often had inflammatory adhesions, tense and distended gallbladder, mucocele/pyocele, and difficult visualization of Calot's triangle, while CC more often had dense fibrotic adhesions, contracted gallbladder, and partially intraparenchymal gallbladder. In the comparative table, partially intraparenchymal gallbladder was seen more frequently in AC (6 cases) than in CC (2 cases).

Operative time

Duration from port placement to clipping

The mean duration from port placement to clipping of the cystic duct and artery was 19.00±6.95 minutes in the AC group and 19.58±7.01 minutes in the CC group. The median duration was 15 minutes in both groups. This difference was not statistically significant (p=0.722).

Duration from clipping to gallbladder removal

The mean duration from clipping to gallbladder removal was 28.43±8.73 minutes in the AC group and 26.94±10.02 minutes in the CC group. The difference was not statistically significant (p=0.345).

Total operative time

The mean total operative time was 79.57±37.11 minutes in the AC group and 75.83±42.94 minutes in the CC group. Median operative time was 75 minutes in the AC group and 70 minutes in the CC group. The difference was not statistically significant (p=0.488).

Conversion to open cholecystectomy

Conversion to open cholecystectomy was required in 2 patients (5.7%) in the AC group and 2 patients (5.7%) in the CC group. The conversion rate was identical in both groups, and the difference was not statistically significant (p>0.05).

Indications for conversion included dense adhesions, non-visualization of Calot's triangle, bleeding, inability to safely identify the cystic duct and artery, and failure to achieve the CVS. No conversion was performed because of bile duct injury.

Intraoperative complications

Bleeding

Intraoperative bleeding was observed in 8 patients (22.9%) in the AC group and 3 patients (8.6%) in the CC group. Difference was not statistically significant (p>0.05). Most bleeding episodes were controlled laparoscopically.

Bile duct injury

Bile duct injury occurred in 2 patients (6%) in the AC group and 1 patient (3%) in the CC group. The difference was not statistically significant (p>0.05).

Postoperative complications

Wound infection

Postoperative wound infection was noted in 2 patients (5.7%) in the AC group and in no patient in the CC group. The difference was not statistically significant (p=0.239).

Subhepatic collection

Subhepatic collection was present in 9 patients (26%) in the AC group and 6 patients (17%) in the CC group. The difference was not statistically significant (p=0.951).

Bile leak

Bile leak was observed in 2 patients (6%) in the AC group and 1 patient (3%) in the CC group. The difference was not statistically significant (p>0.05). All cases were managed conservatively.

Bleeding

Postoperative/intraoperative bleeding as listed in the complication summary occurred more frequently in the AC group than the CC group. In the complication comparison table, bleeding was recorded as 8 cases (23%) in AC and 3 cases (9%) in CC (p=0.342).

Overall complication rate

Overall postoperative complications occurred in 12 patients (34.3%) in the AC group and 9 patients (25.7%) in the CC group. The difference was not statistically significant (p=0.737).

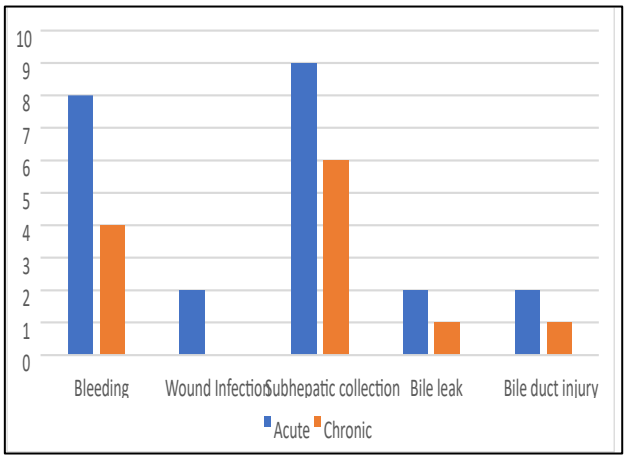

Figure 3: Postoperative complications.

Postoperative recovery

Pain assessment

Postoperative pain was assessed using VAS at 1 week and 2 weeks.

At 1 week, in the AC group, 13 patients had VAS score 1 and 22 patients had VAS score 2. In the CC group, 15 patients had VAS score 1 and 20 patients had VAS score 2. Median VAS score at 1 week was 2 in both groups (p=0.704). At 2 weeks, in the AC group, 32 patients had VAS score 1 and 3 patients had VAS score 2. In the CC group, 30 patients had VAS score 1 and 5 patients had VAS score 2. Median VAS score at 2 weeks was 1 in both groups (p=0.314).

Hospital stays

Mean hospital stay was 5.40±3.02 days in the AC group and 5.11±3.46 days in the CC group. Median hospital stay was 5 days in AC and 4 days in CC. The difference was not statistically significant (p=0.346).

Summary of key findings

Among all measured variables, the only statistically significant difference between the two groups was the higher frequency of mucocele/pyocele in the AC group (23% vs 6%, p=0.0457). Age, sex distribution, adhesions, non-visualization of Calot's triangle, operative time, conversion rate, postoperative pain, hospital stay, and individual complication rates did not differ significantly between groups.

DISCUSSION

This prospective study evaluated the feasibility and safety of LC in acute AC versus CC, addressing concerns around operative difficulty, conversion rates, and complications.[11-13] A total of 70 patients were included, with equal distribution between groups (35 AC, 35 CC), allowing balanced comparison.

Demographically, both groups were comparable. Mean age was similar, 44.46±14.09 years in AC and 45.06±15.00 years in CC (p=0.863), consistent with existing literature.[14] Female predominance was observed in both groups, reflecting known epidemiology of gallstone disease, with no significant difference in sex distribution (p=0.721). These findings suggest that demographic factors did not influence operative outcomes.

Intraoperative difficulty parameters showed largely comparable findings. Adhesions in Calot's triangle, liver bed, and omentum were common in both groups, with no statistically significant differences. This reflects overlapping pathology, acute inflammation causing

oedema and friability, while chronic disease leads to dense fibrosis, both contributing to technical difficulty.[15]

Mucocele or pyocele was significantly more frequent in AC (22.9% vs 5.6%, p=0.0457), indicating more severe inflammatory pathology.[16] Despite this, most cases were successfully managed laparoscopically, supporting feasibility even in advanced presentations.

Non-visualization of Calot's triangle was more common in AC (25.7% vs 17.1%), though not statistically significant. Clinically, this remains important due to its association with bile duct injury risk. Adherence to CVS and timely conversion likely contributed to safe outcomes. [17]

Operative time was slightly higher in AC but not significant (79.57 vs 75.83 minutes, p=0.488). Phase-wise analysis also showed comparable durations. This suggests that acute inflammation and chronic fibrosis may impose similar technical challenges when managed with standardized techniques. Increasing surgical experience likely contributes to narrowing differences reported in earlier literature.

Conversion rates were identical in both groups (5.7%), indicating comparable operative difficulty. Conversions were primarily due to unclear anatomy, adhesions, or bleeding, and importantly, none were due to bile duct injury. This reinforces conversion as a proactive safety measure rather than a complication.

Postoperative outcomes were also similar. Overall complication rates were 34.3% in AC and 25.7% in CC (p=0.737). Bile duct injury occurred in both groups (5.7% AC vs 2.9% CC), emphasizing that risk is related more to anatomical misinterpretation than disease acuity.[17] Other complications, including wound infection, bile leak, subhepatic collection, and bleeding, showed no significant differences.

Recovery parameters were comparable. Postoperative pain scores at 1 and 2 weeks were identical across groups. Hospital stay was slightly longer in AC (5.40 vs 5.11 days, p=346), likely reflecting cautious monitoring rather than increased morbidity.

Overall, this study aligns with contemporary evidence supporting early LC in AC. It demonstrates that with appropriate surgical technique and decision-making, outcomes in AC are comparable to CC in terms of operative time, conversion, complications, and recovery. The findings highlight that perceived increased difficulty in acute cases does not necessarily translate into worse clinical outcomes in routine practice.

Limitations

Despite its strengths, this study has certain limitations: The sample size was relatively small (70 patients), which may have limited ability to detect statistically significant differences in outcomes with low event rates, such as bile duct injury and conversion. The study was conducted at a single centre, which may limit generalizability. Surgeon experience and case complexity were not stratified, which could influence operative outcomes, especially in technically demanding acute cases. Long-term follow-up beyond the early postoperative period was not included.

These limitations should be considered when interpreting the results.

CONCLUSION

Laparoscopic cholecystectomy for AC is safe and feasible when performed with proper technique and adherence to safety principles. Conversion and complication rates are comparable to CC.

Surgeon judgment, early conversion when required, and strict compliance with the CVS are essential to minimize morbidity.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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