

## Research Article

# Efficacy and Safety of Percutaneous Cholecystostomy in Complicated Acute Cholecystitis

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**Abstract:** **Introduction:** Acute cholecystitis, commonly caused by gallstone-induced cystic duct obstruction, often requires emergency intervention. Percutaneous cholecystostomy (PC) is increasingly used for managing complicated cases, especially in patients unfit for immediate surgery. This study evaluates the efficacy and safety of PC in managing complicated acute cholecystitis. **Methods:** This hospital-based observational study was conducted at Sher-i-Kashmir Institute of Medical Science, Srinagar, from May 2022 to May 2024. Thirty-two patients with complicated acute cholecystitis unfit for surgery underwent PC using the transhepatic approach. Data on sociodemographic characteristics, comorbidities, and post-procedural outcomes were collected. The procedure's success, complication rates, and hospital stay duration were assessed. **Results:** The study population had a mean age of 55 years, with a female predominance (62.5%). Gallbladder perforation and mucocele were the most common diagnoses (each 37.5%). Major comorbidities included Type 2 diabetes (75%) and hypertension (43.8%). The technical and clinical success rate of PC was 96.8%, with only one case of non-resolution of symptoms (3.1%). Significant improvements in biochemical parameters were observed, with total leukocyte count and C-reactive protein levels markedly decreasing post-procedure ( $p < 0.001$ ). The mean hospital stay was 6.6 days, and the average catheter duration was 5 weeks. During follow-up, 84.4% of patients underwent interval cholecystectomy. Minimal complication rate of 3.1% was observed. **Conclusion:** Percutaneous cholecystostomy is an effective and safe treatment for complicated acute cholecystitis, especially in high-risk patients. The procedure showed a high success rate, rapid clinical improvement, and served as a bridge to elective surgery.

**Keywords:** Cholecystostomy, Percutaneous; Cholecystitis, Acute; Gallbladder Diseases; Ultrasonography; Biliary Tract Infections.

## INTRODUCTION

Acute cholecystitis is a common and serious inflammatory condition of the gallbladder, usually caused by cystic duct obstruction due to gallstones. It accounts for a significant number of emergency surgical admissions in India. The obstruction of the gallbladder due to the gallstones leads to gallbladder distention, increased pressure, and mucosal ischemia, which promotes bacterial overgrowth. The most common pathogens are *Escherichia coli*, *Klebsiella* species, and *Streptococcus faecalis*. Clinically, acute cholecystitis presents with right upper quadrant pain, fever, nausea, vomiting, and Murphy's sign—a sudden halt in inspiration upon palpation due to pain.

Diagnosis involves laboratory tests showing leukocytosis and elevated liver enzymes, but the primary diagnostic tool is ultrasonography, which detects gallbladder wall thickening, pericholecystic fluid, and

gallstones. In equivocal cases, a hepatobiliary iminodiacetic acid (HIDA) scan is used. Untreated acute cholecystitis can result in complications like gangrenous cholecystitis, perforation, peritonitis, and sepsis. Treatment includes supportive care, antibiotics, and cholecystectomy, which is preferred within 72 hours of symptom onset to reduce complications and hospital stay. In high-risk surgical candidates, percutaneous cholecystostomy (PC) is a viable alternative, serving as a bridge to elective cholecystectomy.

PC involves inserting a catheter into the gallbladder under imaging guidance, with the transhepatic approach being common. This method is especially useful for elderly patients or those with comorbidities. It reduces gallbladder pressure, inflammation, and the systemic inflammatory response. PC has shown success rates of 85-95%, making it effective in high-risk patients as a bridge to surgery or as a definitive treatment.

The present study was conducted in order to assess the role of percutaneous cholecystostomy in the management of complicated acute cholecystitis with regards to its technical and clinical success, and to study the complications associated with the procedure.

## MATERIALS AND METHODS

### Study Design and Setting

This hospital-based observational study with a prospective design was conducted at the Department of Radiology, Sher-i-Kashmir Institute of Medical Science (SKIMS), Srinagar, in collaboration with the Department of General Surgery. The study spanned over 24 months, from May 2022 to May 2024.

### Study Population

The study included patients who presented to SKIMS Hospital, Soura, Srinagar, with complicated severe acute cholecystitis and were deemed unfit for surgery.

### Inclusion Criteria

The inclusion criteria were:

1. Patients of any gender.
2. Patients with acute severe cholecystitis with:
  - High ASA (American Society of Anaesthesiologists) grade, or
  - Mucocele /pyocele formation/emphysematous cholecystitis, or
  - Perforation of the gallbladder (type 1 and type 2), or
  - Sepsis.
3. Patients providing written informed consent.

### Exclusion Criteria

The exclusion criteria included:

1. Patients refusing to provide consent for percutaneous cholecystostomy.
2. Patients below 14 years of age.
3. Cases with gallbladder malignancy or porcelain gallbladder.
4. Type 3 gallbladder perforation.

### Sampling Technique

A consecutive sampling technique was used to recruit eligible patients who met the inclusion criteria and did not meet any of the exclusion criteria.

### Intervention

Each patient underwent percutaneous cholecystostomy (PC) under local anaesthesia with systemic analgesia and light sedation using fentanyl. For critically ill or unstable

patients, additional medical or anaesthetic support was employed. Two access routes were available: transhepatic and transperitoneal. However, the safer transhepatic route was used in all cases. The Seldinger technique was employed for catheter insertion, with ultrasound guidance being the primary imaging method. An 8F or 10F pigtail drainage catheter was placed, depending on the viscosity of the bile. Continuous monitoring of vital signs was conducted throughout the procedure.

### Data Collection

Data on sociodemographic factors such as age, marital status, residence, educational and occupational status, and information about cholecystitis were collected for each participant. The ASA status was assessed using the ASA grading system. Laboratory tests, including liver function tests, inflammatory markers, and clotting profiles, were obtained. Any significantly deranged clotting parameters were corrected prior to the procedure in consultation with the hematology department.

### Post-Procedure Care

Following the procedure, patients received bed rest, analgesia, and antibiotics for at least 48 hours. Ultrasound examination was conducted on the second day post-PC to check the catheter site, detect any bile or blood leakage, and assess the gallbladder size. Laboratory data such as leukocyte count and C-reactive protein levels were monitored and re-evaluated three days after the procedure. The catheter was left in place for 4-6 weeks, with the removal guided by clinical response and the intended purpose of the PC.

### Sample Size

All patients presenting to the hospital who met the inclusion criteria and did not fall under the exclusion criteria were included in the study sample.

### Data Management and Statistical Analysis

The collected data were entered into Microsoft Excel and analysed using the Statistical Package for the Social Sciences (IBM SPSS, version 22). Descriptive and inferential statistics were used, with data presented in proportions and continuous data expressed as Mean  $\pm$  Standard Deviation (SD). A p-value of  $<0.05$  was considered statistically significant for the study.

### Ethical Considerations

The study received approval from the Institutional Ethics Committee (IEC) of SKIMS, Srinagar, vide IEC/SKIMS Protocol # 298/2022 dated 08-02-2023. Written informed consent was obtained from all participants before the procedure.

## RESULTS

The results of the study showed that out of 32 patients with complicated acute cholecystitis who underwent percutaneous cholecystostomy (PC), 62.5% were female and 37.5% were male, indicating a higher prevalence of complicated acute cholecystitis in females. The mean age of the patients was 55 years, with the majority (43.8%) falling within the age group of 51-60 years, suggesting that middle-aged individuals were more commonly affected in this cohort.

Regarding the diagnosis, 37.5% of patients had gallbladder perforation, 37.5% had mucocele, 18.8% had pyocele, and 6.3% were diagnosed with emphysematous cholecystitis. The most common comorbidities present in these patients included Type 2 diabetes (75%), hypertension (43.8%), chronic obstructive pulmonary disease (25%), and congestive heart failure (6.3%). The ASA (American Society of Anaesthesiologists) grading revealed that 43.8% of patients were ASA grade 2, 37.5% were grade 3, 12.5% were grade 4, and 6.3% were grade 1, indicating that most patients had a moderate to high surgical risk.

The procedure success rate was high, with a technical and clinical success rate of 96.8%. There was only one instance of non-resolution of symptoms (3.1%), and one patient experienced a bile leak, which was managed conservatively. This high success rate indicates that PC is a viable option for managing complicated acute cholecystitis in high-risk patients.

Significant improvements in biochemical parameters were observed post-procedure. The total leukocyte count (TLC) decreased from a pre-procedural level of  $21.4 \pm 5.3$  (\*1000/cc) to  $10.6 \pm 3$  (\*1000/cc) by day 3 post-procedure ( $p < 0.001$ ), and C-reactive protein (CRP) levels dropped from  $41.1 \pm 24.5$  mg/L to  $10.2 \pm 4.5$  mg/L ( $p < 0.001$ ). These reductions indicate effective management of inflammation and infection through PC.

The mean hospital stay for the patients was 6.6 days ( $\pm 4.5$ ), suggesting that PC was efficient in managing complicated acute cholecystitis. The mean duration of catheter placement was 5 weeks ( $\pm 2.1$ ), demonstrating that the procedure was effective over a relatively short period, facilitating quick recovery.

During follow-up, 84.4% of patients underwent interval cholecystectomy, 6.3% developed hospital-acquired pneumonia, 6.3% had accidental catheter removal but were doing well, and 3.1% experienced a myocardial infarction. These outcomes indicate that PC effectively served as a bridge to elective surgery and was well tolerated by patients, even those with significant comorbidities.

Gallstones were present in 81.8% of the patients, while 12.5% had gallbladder sludge, and 5.7% had neither stones nor sludge, highlighting the strong association between gallstones and complicated acute cholecystitis. These findings underscore the importance of gallstone management in preventing complications.

## Tables and figures

**Table 1. sociodemographic and clinical characteristics of the patients (n=32)**

Parameters	Frequency	Percentage (%)
<i>Sex</i>		
Female	20	62.5
Male	12	37.5
<i>Age (years)</i>		
$\leq 50$	4	12.5
51-60	14	43.8
61-70	8	25
$> 70$	6	18.8
<i>Diagnosis</i>		
Emphysematous cholecystitis	2	6.3
Gallbladder perforation	12	37.5
Mucocele	12	37.5
Pyocele	6	18.8
<i>Comorbidity*</i>		
Type 2 diabetes	24	75
Hypertension	14	43.8
Chronic obstructive pulmonary disease	8	25
Congestive heart failure	2	6.3
<i>ASA grade</i>		
1	2	6.3
2	14	43.8
3	12	37.5
4	4	12.5

\*multiple findings possible in a single patient

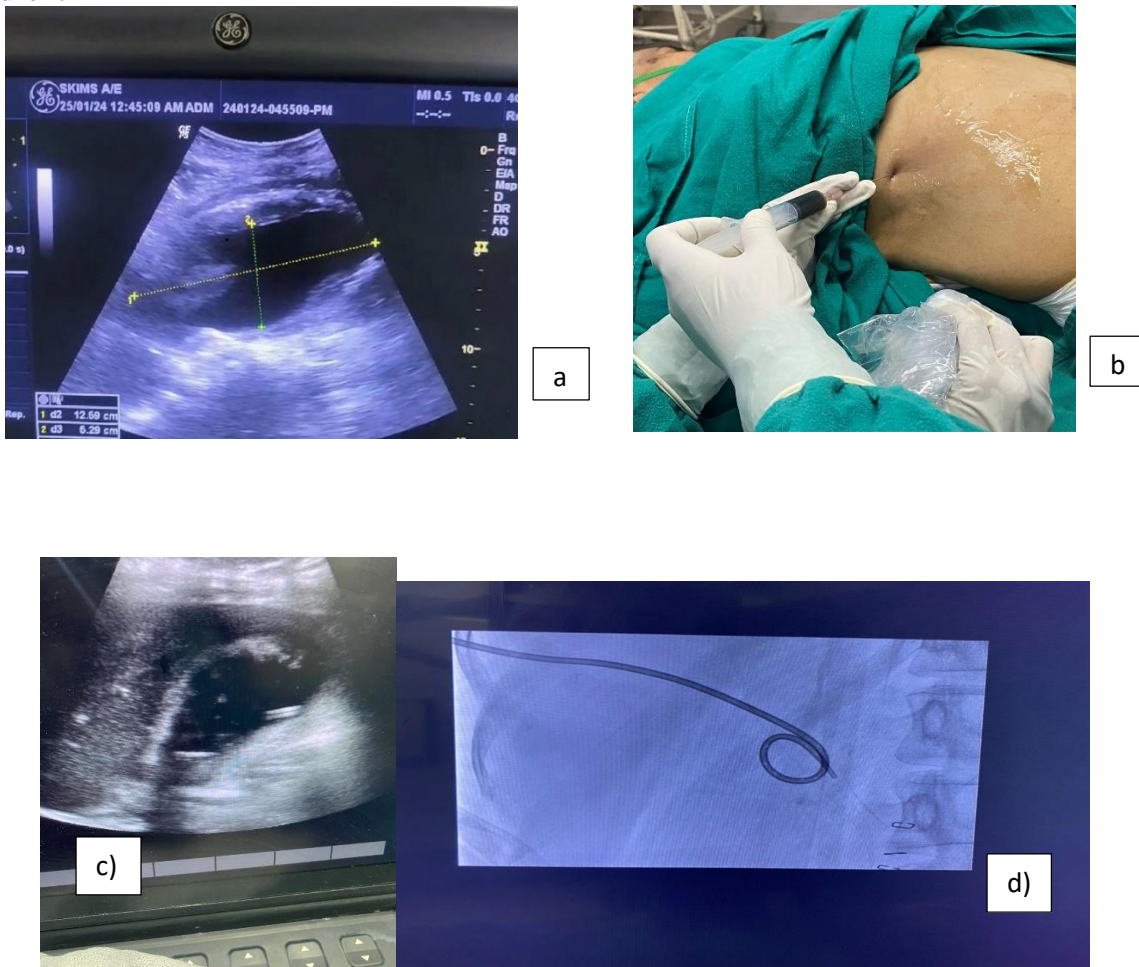
**Table 2. Gallstone distribution in the patients (n=32)**

Parameters	Frequency	Percentage (%)
Present	23	71.8
GB sludge	4	12.5
No stone or sludge	5	15.7

**Table 3. Procedure related characteristics of the patients (n=32)**

Parameters	Frequency/ <i>mean±SD</i>	Percentage (%)
<i>Procedure outcome</i>		
(clinical) Procedure success	31	96.8
Non-resolution of symptoms	1	3.1
(technical) Procedure success	31	96.8
Complication (bile leak)	1	3.1
<i>Hospital stay</i>	<i>6.6±4.5 days</i>	
<i>Duration of catheterisation</i>	<i>5±2.1 weeks</i>	
<i>follow-up characteristics</i>		
Hospital acquired pneumonia	2	6.3
Interval cholecystectomy	27	84.4
Myocardial infarction	1	3.1
Accidental Catheter removal, patient doing well	2	6.3

**Figure 1.**



**a) USG image showing distended gall bladder measuring 12\*5cm consistent with gall bladder mucocele. b) Bile being aspirated through the 18G access needle. c) Catheter advanced into the gall bladder lumen. d) Catheter position confirmed on fluoroscopy.**

## DISCUSSION

The study's demographic data showed a higher prevalence of complicated acute cholecystitis among females, with most patients being middle-aged, particularly between 51 and 60 years. These findings are consistent with Wang et al. (2019) who noted that older adults, especially women, are more vulnerable to severe forms of acute cholecystitis due to underlying comorbidities and the aging process affecting gallbladder function. Morales-Maza et al. (2019) also reported that hormonal factors and lifestyle-related risks in middle-aged women increase their susceptibility to gallbladder diseases, including acute cholecystitis. Hung et al. (2021) supported these observations by emphasizing that women are more likely to develop gallstones, a primary cause of acute cholecystitis. Similarly, Kim et al. (2018) identified a higher incidence of complicated cholecystitis among older females.

The study found that gallbladder perforation and mucocele were the most common diagnoses, each accounting for 37.5% of cases, while pyocele and emphysematous cholecystitis were less frequent. This distribution is similar to the findings of Welschbillig-Meunier et al. (2005), who observed that gallbladder perforation is a significant risk in patients with advanced acute cholecystitis, often due to delayed intervention. The occurrence of mucocele also aligns with Zerem et al. (2013), who identified it as a consequence of chronic gallbladder obstruction, leading to mucus accumulation and often serving as a precursor to more severe conditions like pyocele or emphysematous cholecystitis. Nikfarjam et al. (2013) noted that emphysematous cholecystitis, observed in 6.3% of this study's patients, is associated with comorbid conditions such as diabetes.

The comorbidity distribution indicated a significant burden of chronic diseases, with 75% of patients having Type 2 diabetes, 43.8% with hypertension, 25% with chronic obstructive pulmonary disease (COPD), and 6.3% with congestive heart failure. Byrne et al. (2003) similarly found that patients with acute cholecystitis and multiple comorbidities, especially diabetes and cardiovascular disease, are at an increased risk of complications. Their study, along with Teoh et al. (2005) and Atar et al. (2004), highlighted the effectiveness of PC in managing acute cholecystitis in patients with significant comorbidities, where alternative management strategies are often necessary.

Regarding the American Society of Anaesthesiologists (ASA) grading, 43.8% of patients were classified as ASA grade 2, 37.5% as grade 3, and 12.5% as grade 4, indicating a moderate to high surgical risk among the study population. These findings resonate with Byrne et al. (2003), who reported that higher ASA grades correlate with increased postoperative complications and mortality. Both Teoh et al. (2005) and Atar et al. (2004)

surgery for high-risk patients with elevated ASA scores.16, 17

The study's PC success rate of 96.8%, with only one reported complication (bile leak), aligns with Zarour et al. (2017), who reported a high technical success rate of PC in critically ill patients. Fleming et al. (2020) supported these findings, emphasizing the safety and efficacy of PC, especially in older and comorbid patients. Hung et al. (2021) also confirmed that PC effectively reduces systemic infection and improves clinical outcomes, particularly for patients unsuitable for immediate surgery.10 Suffat et al. (2022) highlighted PC as a valuable option for high-risk patients, serving as an effective bridge to surgery.

The study demonstrated significant postoperative improvements in biochemical parameters, with total leukocyte count (TLC) and C-reactive protein (CRP) levels markedly reduced, indicating the resolution of inflammation. Byrne et al. (2003) and Teoh et al. (2005) similarly reported that PC effectively reduces systemic inflammation and improves biochemical markers.15, 16 The average hospital stay of 6.6 days in this study mirrors the findings of Zerem et al. (2013) and Nikfarjam et al. (2013), who reported that PC shortened hospital stays by promptly controlling infection.13, 14

## CONCLUSION

The study concludes that image-guided percutaneous cholecystostomy (PC) is a highly effective and safe intervention for managing complicated acute cholecystitis, particularly in patients with significant comorbidities who are unfit for immediate surgery. With a high success rate of 96.8% and minimal complications, PC demonstrated its role as a viable alternative treatment, leading to significant reductions in inflammation and facilitating rapid clinical improvement. The procedure effectively served as a bridge to interval cholecystectomy in most patients, ensuring favourable outcomes and shorter hospital stays. Therefore, PC should be considered a first-line treatment in complicated cases of acute cholecystitis, especially when surgical intervention poses substantial risks, ensuring patient stabilization and reducing the overall burden of the condition.

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