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Journal of Clinical Imaging Science

Original Article

Safety and Efficacy of Percutaneous Cholecystostomy for Emphysematous Cholecystitis

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Received : 13 October 19
Accepted : 10 February 20
Published : 27 March 20

DOI
10.25259/JCIS_145_2019

Quick Response Code:

ABSTRACT

Objective: The objective of the study was to evaluate the safety and efficacy of percutaneous cholecystostomy (PC) in treating critically ill patients with emphysematous cholecystitis who were deemed poor surgical candidates.

Materials and Methods: The Institutional Review Board exemption was obtained for this retrospective study. Patients with emphysematous cholecystitis who were deemed to be poor operative candidates by the treating surgeon and underwent PC placement between May 2008 and April 2017 at a single institution were identified through a medical records search. Demographics, laboratory values, imaging data, procedural technique, complications, hospitalization course, clinical outcome, and survival data were obtained.

Results: Ten consecutive patients were included, with a mean age of 75.0 ± 12.2 years, including six men and four women. The most common comorbidity was diabetes (60%, 6/10) followed by hypertension (40%, 4/10). Intraluminal or intramural gas as well as gallbladder wall thickening were noted in all patients. Procedure technical success rate was 100%. There was a complete resolution of symptoms in 90% (9/10) of patients at a mean of 2.9 ± 1.4 days post-procedure. Thirty-day survival rate was 90% (9/10); one patient died on the 6th post-procedure day from sepsis. Two more deaths occurred within a year after PC from unrelated causes. About 50% (5/10) of patients underwent elective cholecystectomy at a median interval of 69 days post-procedure. In 40% (4/10) of patients, cholecystostomy was the definitive treatment, with tube removal at a median of 140 days post-procedure.

Conclusion: PC appears to be a safe and generally effective alternative management option in patients with emphysematous cholecystitis that is considered very high risk for surgery.

Keywords: Emphysematous cholecystitis, Percutaneous cholecystostomy, Acute cholecystitis

INTRODUCTION

Emphysematous cholecystitis is an uncommon variant of acute cholecystitis that is caused by superimposed infection of the gallbladder by gas-forming organisms such as *Escherichia coli*, *Clostridium perfringens,* and *Bacteroides fragilis*. It predominantly affects men and is more common in diabetic patients. Emphysematous cholecystitis has been reported to have up to 50% morbidity and 25% mortality due to increased risk of pericholecystic abscess, gallbladder necrosis, and perforation; hence, early diagnosis and appropriate treatment is essential.[1,2]

The diagnosis of acute emphysematous cholecystitis is primarily made on imaging in a patient with the appropriate clinical presentation. The presence of gas within the lumen of gallbladder,

gallbladder wall, or pericholecystic tissues in the absence of a known communication with gastrointestinal tract is the imaging feature characteristic of this entity.[3] While ultrasound (US) usually is the first-line imaging modality, CT is the most sensitive and most specific diagnostic imaging study for the detection of intraluminal or intramural gallbladder gas.[4] Emergent cholecystectomy is considered the standard of care treatment. However, surgery may be very risky in a subset of patients, including those that are elderly with multiple comorbidities, at the time of diagnosis.[5-8] There is limited consensus on the management strategy in such circumstances and no definite treatment has been recommended in this scenario.

Several studies have investigated the safety and efficacy of percutaneous cholecystostomy (PC) in the management of uncomplicated acute cholecystitis (non-emphysematous) both as definitive therapy and as a bridge to cholecystectomy.[9-13] However, there is a paucity of information on the safety, efficacy, and therapeutic outcomes of PC in high-risk patients with acute emphysematous cholecystitis. The currently available data for emphysematous cholecystitis are limited to isolated case reports, and a few case series focus on acute cholecystitis that incidentally includes patients with emphysematous cholecystitis in the cohort.[9,14-17]

The aim of this study is to evaluate the safety and efficacy of PC in critically ill patients with acute emphysematous cholecystitis who were deemed poor surgical candidates.

MATERIALS AND METHODS

Institutional Review Board exemption (# 1608018211) from the Yale University Institutional Review Board was obtained on September 26, 2016, for this Health Insurance Portability and Accountability Act compliant retrospective study. The requirement for informed consent was waived for this retrospective chart review.

Patient selection

A search in the electronic medical record of our tertiary care teaching hospital between May 2008 and April 2017 using the terms "percutaneous cholecystostomy" and "cholecystitis" was done. From these results, only those patients with acute emphysematous cholecystitis, confirmed by cross-sectional imaging, in whom surgery was felt to be too risky by the treating surgeon, who, therefore, underwent PC by interventional radiology were included in the study. A request for cholecystostomy tube placement was made by the attending surgeon following an assessment of the patient's clinical and imaging findings, comorbidities, and evaluation of the surgical risks versus benefits.

Defined variables

Standard demographics, medical comorbidities, imaging findings, vital signs, laboratory values, microbiology results (bile and blood culture), route of cholecystostomy access, technical success rate, duration of cholecystostomy tube placement, hospitalization course, clinical outcome, complications, and overall mortality rate were studied. Technical success was defined as the successful placement of PC tube. Duration of tube placement was calculated in days, from the time of PC placement until tube removal. Clinical outcome was defined as resolution of symptoms and complications (if any) related to the PC procedure. Mortality rate was considered as deaths within the first 1 year that is directly attributable to the complications of emphysematous cholecystitis.

PC placement

On admission, all patients received fluid resuscitation, analgesics, and broad-spectrum antibiotics (piperacillin, tazobactam, and metronidazole). Before the procedure, coagulopathy was corrected according to the Society of Interventional Radiology (SIR) guidelines[18,19] with the goal of international normalized ratio (INR) <1.5 and platelet count >50,000 per μL. Under moderate sedation, cholecystostomy was performed through a short transhepatic approach under combined US and fluoroscopy guidance in all patients [Figures 1 and 2]. Aspirated bile was subsequently sent for microbiology assessment.

RESULTS

Ten consecutive patients were included, with a mean age of 75.0 ± 12.2 years, including six men and four women. The most common comorbidity was diabetes (60%, 6/10) followed by hypertension (40%, 4/10) [Figure 3]. Pre-procedure imaging was performed using US, CT, or both US and CT in 2, 7, and 1 patients, respectively. Intraluminal or intramural gas as well as gallbladder wall thickening were noted in all patients. Gall stones were identified in 80% of patients (8/10). Before the procedure, 80% (8/10) of patients had positive systemic inflammatory response syndrome (SIRS).

The procedure was technically successful and uneventful in all patients. An 8-French locking loop drainage catheter was placed in nine patients and a 10-French locking loop drainage catheter was placed in one patient. Aspirated bile was purulent in 40% (4/10) and bloody in 10% (1/10) of the patients. While bile culture was positive in 70% (7/10) of cases [Table 1], 20% (2/10) of patients were noted to have positive blood cultures with the same organisms found in bile culture (*Klebsiella* and *E. coli*). One patient died on the 6th post-procedure day from sepsis. Complete resolution of symptoms

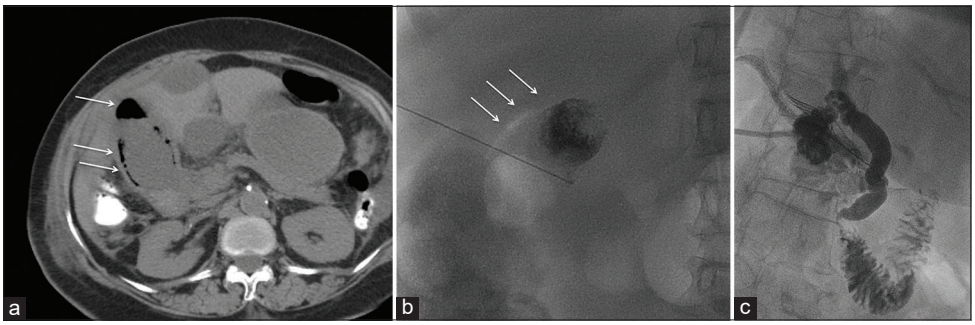

Figure 1: An 82-year-old woman with serous adenocarcinoma of the ovary and peritoneal metastases, who presented with acute abdominal pain. (a) CT scan of the abdomen shows gallbladder wall thickening with intraluminal and intramural gas (arrows). (b) Fluoroscopy image during cholecystostomy also shows the intramural gas (arrows). (c) Cholecystostomy tube check done 4 months after the procedure shows a widely patent cystic duct with free passage of contrast into the duodenum. The tube was subsequently removed, and the patient did not require a cholecystectomy.

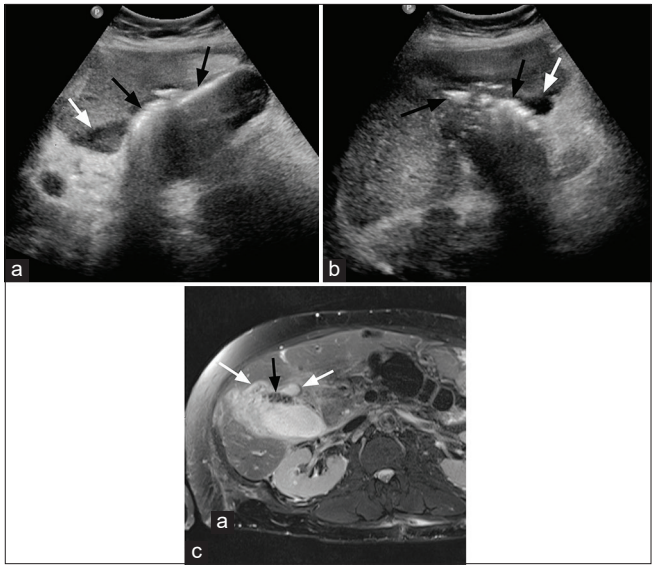

Figure 2: A 62-year-old man with diabetes who presented with abdominal pain and nausea of 5-day duration. Sagittal (a) and transverse (b) gray scale ultrasound showed a distended gallbladder with gas (black arrows) within the anterior wall, which is causing "dirty" acoustic shadowing. Also note the focal fluid collections anterior to the gallbladder (white arrows, a, b), which is concerning for gallbladder perforation. (c) Axial T2-weighted MRI scan confirmed the findings of gas within the gallbladder wall (black arrow) and fluid collections (white arrows).

was achieved in the remaining 9 out of 10 (90%) patients at a mean time interval of 2.9 ± 1.4 days post-procedure. SIRS was also negative in these nine patients within 30 days after cholecystostomy tube placement. These nine patients were discharged in stable condition at a median duration of 8 days post-procedure (mean ± SD, 11.7 ± 10.8 days).

Survival rate at 30 days after the procedure was 90% (9/10). Survival rate remained 90% (9/10) at 60, 90, and 180 days. Two patients died on post-procedure days 276 and 288 due to unrelated causes: Congestive heart failure and peritoneal carcinomatosis, respectively. About 50% (5/10) of patients underwent elective cholecystectomy at a median interval of 69 days (mean ± SD, 61.6 ± 23.2 days) post-procedure. There was no conversion from laparoscopic to open cholecystectomy in this subgroup of patients. In 40% (4/10) of patients, cholecystostomy was the definitive treatment, with tube removal at a median of 140 days (mean ± SD, 151.8 ± 107.0 days) post-procedure.

Table 1: Microbiology of bile culture

Organism	Number of patients	% of total (10)
Klebsiella	1	10
Klebsiella, *Enterococcus,* and *Clostridium*	1	10
Escherichia coli	1	10
Mixed Gram positive	2	20
Mixed Gram negative	2	20
No growth	3	30

DISCUSSION

Emphysematous cholecystitis is an uncommon but potentially fatal variant of acute cholecystitis. Emergent surgical intervention (laparoscopic cholecystectomy) is considered the standard of care for this condition. Nevertheless, the risks of surgery and general anesthesia may be too great in some patients such as the elderly and in those with multiple medical comorbidities. In these circumstances, PC may be used as an alternative management strategy.

In this study, technical success rate for cholecystostomy drain placement was 100%. No procedure-related complications such as bleeding, bile leak, or internal organ injury were encountered. In addition, there were no instances of tube dislodgement or secondary cholangitis.

Numerous studies have demonstrated that PC can serve as the definitive treatment in patients with calculous or

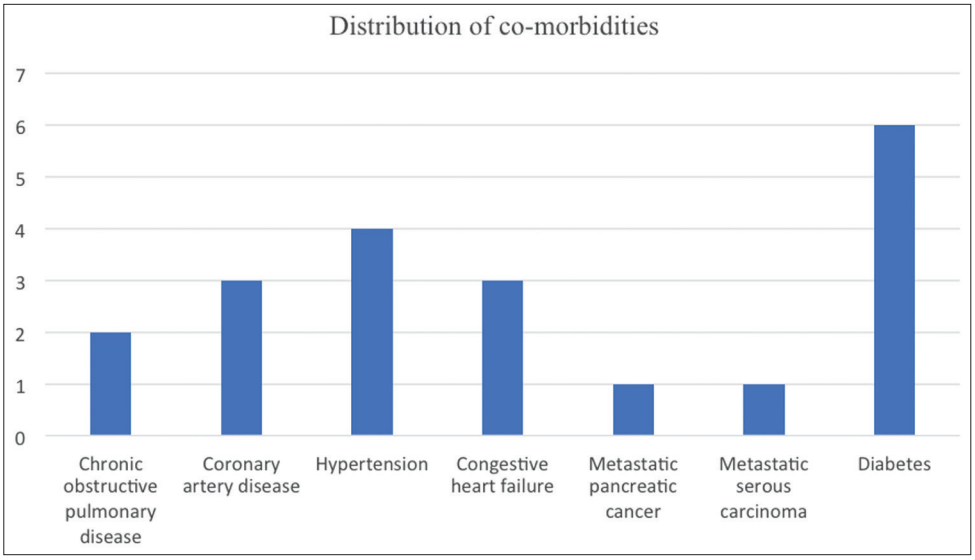

Figure 3: Distribution of comorbidities in the study population.

acalculous acute cholecystitis in 30–80% of cases depending on index presentation and comorbidities.[7,13,20] In our study, PC was the definitive treatment in 40% of patients (4/10) with tube removal at a median interval of 140 days post-procedure. None of these patients redeveloped acute cholecystitis within 1 year following index presentation. Our results also suggest that PC can be used as a safe bridge to elective cholecystectomy in patients who cannot undergo emergent surgery. Five patients (50%) eventually underwent laparoscopic cholecystectomy at a median interval of 69 days post-cholecystostomy drain placement. The reported cholecystectomy rates (laparoscopy and/or open) as definitive treatment after PC placement for acute cholecystitis vary considerably between studies[10,20-24] ranging from 17% to 57%.[20,21] This broad range may be explained by differences in patient population as well as the criteria used for surgical decision-making, among other factors.

In the current study, there was one patient death (10%) that is directly attributable to emphysematous cholecystitis and resultant sepsis. Two more deaths occurred within 1 year post-procedure due to unrelated comorbidities including congestive heart failure and peritoneal carcinomatosis. It is difficult to compare mortality rates across studies due to differences in patient selection, but the 30-day mortality rate of 10% observed in the current study is similar to the reported mortality rates of 6–20% in high-risk patients with acute non-emphysematous cholecystitis who underwent PC.[12,23] The median hospitalization length of 8 days is also similar to the median duration of 7–21 days in studies evaluating PC in critically ill patients with acute non-emphysematous cholecystitis.[9,11]

Bile cultures were positive in 70% of patients in our study, which is within the range of 40–83%[20,24,25] described in other series where patients with acute non-emphysematous as well as emphysematous cholecystitis were included. However, this is less than 100% positive culture rate reported by Garcia-Sancho Tellez *et al.*[2] in 20 patients with acute emphysematous cholecystitis that was treated using emergent surgery. The reason for these differences is unclear, but it is noted that the study by Garcia-Sancho Tellez included patients that were treated between 1977 and 1998, but the other referenced studies included patients that were treated in the past two decades. Furthermore, all patients in our study had received broad-spectrum antibiotics before the procedure.

This study is limited by its retrospective nature, relatively small sample size, and lack of a comparison group. In addition, the clinical determination that the patient is at very high risk for surgical cholecystectomy was made by the patient's attending surgeon at the time of presentation. Different surgeons may use variable criteria to make this determination depending on their past experience and personal preferences. Given the rarity of acute emphysematous cholecystitis, some of these limitations may be addressed in a prospective multicenter case registry.

CONCLUSION

PC may be a safe and effective alternative treatment option in patients with emphysematous cholecystitis that is too high risk to undergo surgery.

Acknowledgments

This study was presented in the Radiological Society of North America meeting in 2017 as an oral paper.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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How to cite this article: Imanzadeh A, Kokabi N, Pourjabbar S, Latich I, Pollak J, Kim H, *et al*. Safety and Efficacy of Percutaneous Cholecystostomy for Emphysematous Cholecystitis. J Clin Imaging Sci 2020;10:9.