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Retrospective Evaluation of Patients with Acute Cholecystitis Who Undergoing Percutaneous Cholestostomy with All Treatment Aspects: Single Center Results

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Abstract

Objectives: Percutaneous cholecystostomy (PC) is an important procedure for the treatment of acute calculous cholecystitis (ACC). The main purpose of this research study was to retrospectively analyze all data of patients who underwent PC placement via the transperitoneal (TP) or transhepatic (TH) approach in patients with ACC.

Methods: The datasets of the 59 patients included in the research study included cases who underwent PC in the interventional radiology clinic after ACC diagnosis between January 1, 2022 and September 1, 2024. The data included all six-month follow-up results recorded following the placement of permanent tube catheters with TP or TH percutaneous cholecystostomy procedural techniques after the clinical and radiological imaging diagnoses of ACC.

Results: A total of 59 patients diagnosed with ACC underwent PC placement in 41 cases with TP and 18 cases with TH approach; In patients using the TH procedural technique, there was a slight increase in the bleeding rate (1.8% vs. 0.6%, p=0.01), but there was no significant difference between the two groups in terms of other post-procedural complications (tube dislocation, bile leakage and bile leakage hemorrhage, tube occlusion, peritonitis, organ perforation, etc.).

Conclusion: PC has become an important procedure for the treatment of acute cholecystitis. PC is mostly performed in patients who cannot undergo emergency laparoscopic cholecystectomy, and PC-related complications are much rarer compared with other invasive biliary procedures. The following resolution of the clinical presentation of ACC, cholecystectomy should be performed in patients who can tolerate anesthesia and surgical risks to prevent biliary event recurrence. PC is an effective and reliable intervention to decompress the gallbladder and prevent widespread sepsis.

Keywords: Percutaneous cholecystostomy, percutaneous transhepatic gallbladder drainage, percutaneous transperitoneal gallbladder drainage, calculous cholecystitis, cholecystectomy, percutaneous cholangiography

Introduction

Percutaneous cholecystostomy (PC) is increasingly preferred for acute sepsis control and gallbladder decompression in patients with acute calculous cholecystitis (ACC) and is considered an effective treatment procedure performed by interventional radiologists. Although laparoscopic cholecystectomy (LC) is the current standard treatment for ACC for patients who can tolerate surgery; it has been clearly proven in the last decade that PC is an alternative safe procedure for the emergency treatment of ACC, especially in cases with multiple comorbidities and in patients considered to be at high risk for surgery or anesthesia.[1,2] The developmental stages of PC date back to the 1970s, when PC was first applied to patients with obstructive jaundice. In the 1980s, PC was gradually performed in acute cholecystitis (AC) patients. Currently, according to the World Society for Emergency Surgery guidelines, PC is widely indicated as an alternative treatment for ACC patients who are not suitable for emergency LC, such as those with severe sepsis, shock, or multiple comorbidities.[3-5]

Although there are different techniques for PC, PC is typically performed under local anesthesia using the Seldinger technique and usually under ultrasound systems or scopy guidance for direct visualization of the needle. However, trocar techniques have also been described for applications guided by computed tomography. There is an ongoing debate about the best access route to the gallbladder; the two main techniques involve crossing a segment of the liver to access the gallbladder [transhepatic (TH) approach] or directly entering the lumen of the gallbladder with a puncture [transperitoneal (TP) approach].[1,6-8]

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The TH approach is recommended to provide stable access to a potentially mobile gallbladder, provide a good ultrasonographic acoustic window, and reduce the risk of iatrogenic perforation of the intestines. In addition, the possibility of bile leakage and subsequent peritonitis decreases when the gallbladder perforation is contained by the liver parenchyma.[4,7,8] In contrast, TP approaches can be considered a simpler procedure with a reduced risk of liver parenchymal injury and hemorrhage. Anatomical considerations, including the patient's body structure and mobility, can determine the approach technique and treatment procedures.[9,10]

Methods

The datasets of the 59 patients included in this research study include patients who underwent PC in the interventional radiology clinic of Erzincan Binali Yıldırım University Faculty of Medicine Training and Research Hospital after the diagnosis of ACC between January 1, 2022 and September 1, 2024. For this retrospective research study, scientific approval and permission was obtained from the Ethics Committee of Erzincan Binali Yıldırım University Faculty of Medicine (approval number: 2023.12/003-128.6, decision date: 12.12.2023). The data included detailed evaluations of all six-month follow-up results recorded following the placement of permanent tube catheters with TP or TH PC procedural techniques after the diagnosis of ACC as clinical and radiological imaging. Case data were collected by obtaining follow-up data on catheter placement techniques together with short-term and medium-term results (including post-procedural complications and re-application).

Data Collection

The obtained data included preprocedural demographic information, biochemical analyses, radiological imaging results, complicated or uncomplicated cholecystitis, and factors associated with the technical PC procedure. The patient group defined as complicated cholecystitis included cases associated with emphysematous cholecystitis, gangrenous cholecystitis, abscess formation and collection, gallbladder perforation, or biloma.

Statistical Analysis

Statistical analysis was performed using IBM Statistical Package for the Social Sciences version 27 (IBM Corp. Armonk, NY). Categorical data points were analyzed using Fisher's exact test or χ^2 test. Mann-Whitney U test was used for ordinal or nonparametric continuous variables, and the independent sample t-test was used for other variables. Data were evaluated using multivariate logistic regression modeling to account for potential confounders, such as age, gender, and ACC severity. Throughout the data analysis, p values <0.05 were consistently considered significant.

Results

A total of 59 patients (33 female, 26 male) diagnosed with ACC underwent PC placement in 41 cases via TP and 18 via TH approach; there was a slight increase in the bleeding rate in patients using TH procedural technique (1.8% vs. 0.6%, p=0.01), but there was no significant difference between the two groups in terms of other post-procedural complications (cholecystostomy tube dislocation, bile leakage and bile leakage hemorrhage, tube obstruction, tunnel infection, peritonitis, organ perforation, etc.). The frequency of primary complications associated with PC was recorded as only 11 cases (18.6%) in the entire series. No significant difference was observed in mortality rates within the first 3 months after PC application (TH vs. TP, 5.3%, p=0.64 and 7.9%, p=0.52, respectively). Rehospitalization rates in patients with recurrent calculous cholecystitis were significantly higher in the TH group than in the TP procedural approach (13.2% vs. 8.9%, respectively, p=0.01).[3,11,12]

There was no significant difference in the size of the cholecystostomy tube between the 8- and 10-Fr catheter tube groups. More patients in the TP group had complicated cholecystitis than in the TH group (54.9% vs. 38.7%, p=0.02). No statistically significant difference was found in median C-reactive protein (CRP) (274 TH vs. 281 TP, mg/L) in the biochemical analysis, which is considered an indicator of sepsis burden. No significant difference in morbidity associated with other PC procedures, including biloma formation or abscess formation, was observed. There was no relationship between tube size and periprocedural bleeding rates (Table 1).[3,13-15]

Discussion

PC is a technically feasible and safe alternative to emergency cholecystectomy in patients with AC who have multiple comorbidities or severe inflammation and infection. PC is also considered an effective procedure that can drain infectious bile and relax the gallbladder; moreover, PC reduces the severity of systemic infection in a short time. Regarding the time from PC placement to disease resolution, Horn et al.[16] reported that most patients showed clinical improvement on an average of 3-4 days after PC placement. They demonstrated significant decreases in white blood cell and CRP levels after PC; in particular, the latter study focused mainly on patients with acute acalculous cholecystitis.[3,14,17,18]

The TP approach was not associated with increased bile leakage, which is an important rationale for preferring a TH approach in the literature and popular discourse. This may be due to limited bile leakage from the site at the time of placement or in the context of acute sepsis and severe inflammation, where a small bile leak may not cause significant additional irritation to the peritoneum (Table 2).[1,9,13]

For patients with complete PC tube displacement, complete evaluation is necessary. Once the patient is confirmed to be asymptomatic, he or she can be discharged without repeat PC. For patients with suspected partial PC tube displacement, cholangiography can be performed to confirm the position of the drainage tube. The decision to keep or remove the drainage tube is made by the physician or radiologists based on the general condition of the patient. Among patients complicated by bile leakage, which is usually symptomatic, antibiotics and image-guided

Table 1. High-risk and critical patient groups for cholecystectomy operation

1. Advanced age
2. Leukocytosis
3. Hypoalbuminemia
4. Pericholecystic fluid
5. Diabetes mellitus
6. Elevated total bilirubin content
7. Male sex
8. History of abdominal surgery
9. History of pulmonary disease
10. Serum hemoglobin <9 mg/dL
11. Gallbladder wall diameter (gallbladder wall thickness is over >6.5 mm)

Table 2. Classification of acute cholecystitis severity according to the 2018 Tokyo guidlines[1]

Grade 1 (mild)	Grade 2 (moderate)	Grade 3 (severe)
- No criteria for grade 2 or 3 - Acute cholecystitis in a previously healed patient with no organ dysfunction and mild inflammation of the gallbladder	Any of the following conditions: - Leukocytosis >18,000/mm^3 - Palpable tumor in the right upper quadrant - Symptom duration >72 h - Marked local inflammation (gangrenous cholecystitis, pericholecystic abscess, bile peritonitis, emphysematous cholecystitis)	Any of the following organ dysfunctions: - Cardiovascular: low blood pressure with need for 5 µg/kg/min of dopamine or norepinephrine - Neurological: decline in alertness - Respiratory: PaO_2/FiO_2>300 - Kidney function: oliguria or creatinine >2.0 mg/dL - Liver: INR >1.5 - Hematologic: plateletes >100,000/mm^3

INR: International normalized ratio

drainage should be considered.[8,17] Most patients complicated by minor bleeding can be managed conservatively. If the examination shows tube obstruction, subsequent treatment, including PC tube reinsertion or emergency cholecystectomy, should be based on the patient's clinical condition. Cholecystectomy is recommended for patients who are physically fit for surgery. However, if the patient refuses surgery or has multiple comorbidities, PC tube replacement is recommended. In studies that have compared PC versus open cholecystectomy in critically ill patients with acalculous cholecystitis, less morbidity, fewer days of hospital stay, and lower associated costs have been observed in patients who have undergone PC placement.[15,16,18]

The primary function of PC is to reduce inflammation or infection in patients with AC who cannot tolerate the risk of surgery or anesthesia and not to limit the possibility of definitive surgery. It is important to identify patients who are not suitable for surgery or who are suitable for PC after surgery. In addition, the latest Tokyo Guidelines 2018 revised the algorithm for severe cholecystitis and suggested that patients with Charlson Comorbidity Index 4 and American Society of Anesthesiologists Physical Status 3 should receive expectant management; however, the effectiveness of this classification has not been studied.[10] Future research is needed on the effectiveness of the latest classification and new objective factors that can distinguish patients who are suitable for surgery from those who are not (Figure 1).[3,10,17,19,20]

Despite the lack of clear evidence, the initial puncture of the PC biliary system drainage under ultrasound guidance has been accepted as the standard in many international guidelines. LC is the gold standard treatment procedure for AC and is superior to PC. PC is a valuable option for high-risk and critically ill patients in intensive care who are not suitable for LC and may even be the definitive treatment option. Ultrasonographically guided PC can be performed at the bedside in critically ill patients without fluoroscopy. Recent studies have reported that contrast-enhanced USG can be used in PC for the selection of the correct placement technique and appropriate catheter needle and for confirming the sealing of the gallbladder (Figure 2).[10,13,19,21]

The biggest and most important limitation of this study is that we could not make a comparison with high-risk and critically ill patients who underwent cholecystectomy in the same period. Whether cholecystectomy would be advantageous for this patient group remains unclear.[21,26] In addition, urgent PL may be superior to PC as a definitive treatment method because of the high rate of recurrent ACC symptoms after PC.[22] The results of our study have proven that PC is a safe and effective way to manage AC, especially in high-risk critically ill patients who are followed in the intensive care unit, compared with conservative treatments; we recommend PC as the first treatment option for this particular patient group. We also suggest that PC is an effective and definitive treatment option for stone-free AC in this patient group. In addition, we primarily recommend the TP approach for PC procedures because it is easily applicable, safe, and effective.[7,8,15,22]

Although many meta-analyses have clearly demonstrated that PC is an effective and reliable treatment alternative in high-risk and critically ill patients in whom LC surgery is contraindicated; it is clear that a standard definition is needed for the criteria considered contraindicated for the operation procedure in the future. The primary function of PC is to reduce the inflammation or infection status of patients with AC who

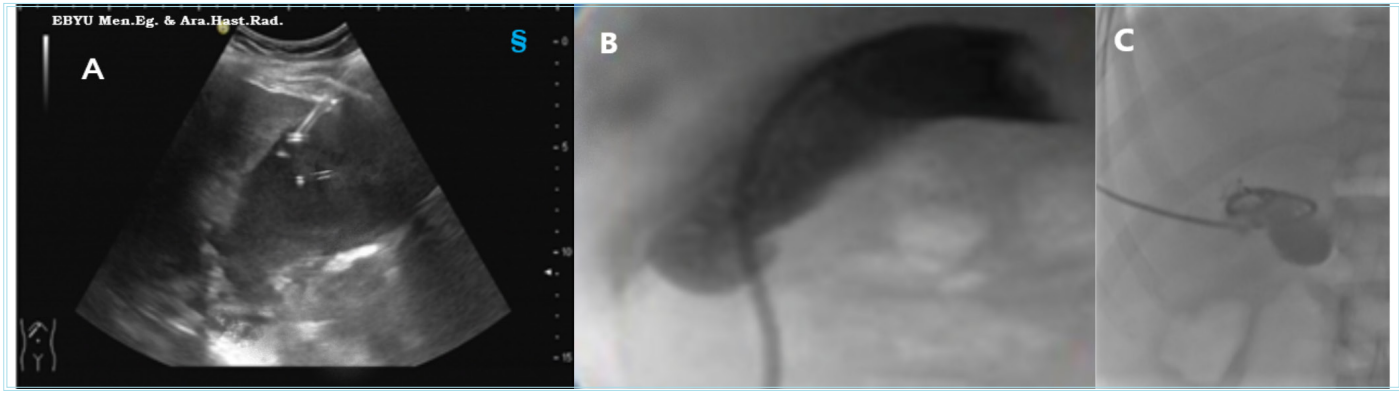

Figure 1. Techniques used for TP or TH percutaneous cholecystostomy. Application of TP or TH percutaneous cholecystostomy under ultrasonography (A) and fluoroscopic guidance (B, C). Placement of 8- and 10-Fr multihole pigtail indwelling drainage catheters after successful confirmation of gallbladder lumen by percutaneous puncture and contrast injection

TP: Transperitoneal, TH: Transhepatic

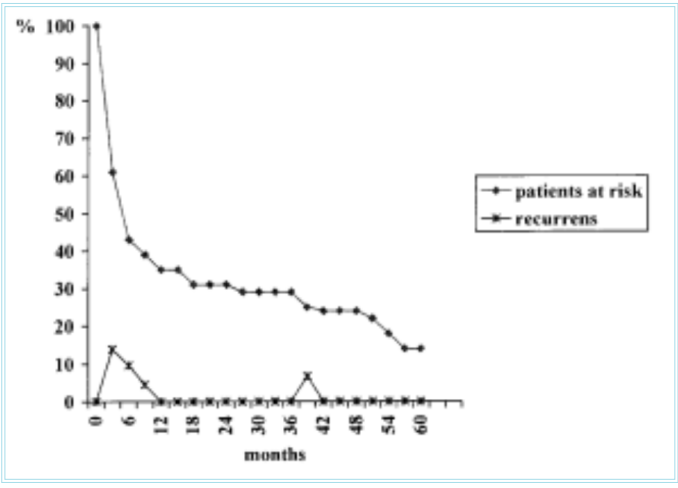

Figure 2. Risk and recurrence of acute cholecystitis in the period following imaging-guided percutaneous cholecystostomy procedures[10]

cannot tolerate the risk of surgery or anesthesia and not limit or prevent the possibility of definitive surgical treatment. Expertise, experience, and clinical experience in interventional interventions directed at the biliary system under ultrasound guidance are increasing, and we believe that they will become more widely applied in the future.[11,22,23] However, it seems certain that all types of interventional radiological procedures will play an increasing role in treatment planning and applications in developed countries with better-equipped health systems and high-technology radiological modalities in the future.[5,11,19,18,24,25]

Conclusion

In recent years, PC has become an important procedure for the treatment of AC. PC is mostly performed in patients who cannot undergo emergency LC, and PC-related complications are much rarer compared with other invasive biliary procedures. The following resolution of the clinical presentation of ACC, cholecystectomy should be performed in patients who can tolerate anesthesia and surgical risks to prevent biliary event recurrence. PC is an effective and reliable intervention to decompress the gallbladder and prevent widespread sepsis until definitive surgical operations.[1,19,26] The placement of the PC catheter tube, procedural techniques, and management should be evaluated individually for each patient, and a personalized decision should be made. Although drainage can be provided with PC as a palliative procedure until the patient is ready for surgery; the presence of gallbladder stones in these patients is a definitive indication for cholecystectomy. Although a time period of 6-8 weeks is generally recommended between PC and cholecystectomy by general surgery authorities; there is no consensus yet on the optimum timing. In selected patients, the strategy of performing cholangiography before removing the PC catheter tube is generally applied. The TP PC approach may be safer than TH, with a lower bleeding complication rate and fewer readmissions.[7,8,15,19]

Ethics

Ethics Committee Approval: All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study was approved by the Ethics Committee of Erzincan Binali Yıldırım University Faculty of Medicine (approval number: 2023.12/003-128.6, decision date: 12.12.2023).

Informed Consent: Since the study was a retrospective study, informed consent was not required by the ethics committee. No animal or human studies were conducted by the author for this article.

Footnotes

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