Use of Cholecystostomy Tubes in the Management of Patients with Primary Diagnosis of Acute Cholecystitis

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BACKGROUND: Management of patients with severe acute cholecystitis (AC) remains controversial. In settings where laparoscopic cholecystectomy (LC) can be technically challenging or medical risks are exceedingly high, surgeons can choose between different options, including LC conversion to open cholecystectomy or surgical cholecystostomy tube (CCT) placement, or initial percutaneous CCT. We reviewed our experience treating complicated AC with CCT at a tertiary-care academic medical center.

STUDY DESIGN: All adult patients (n = 185) admitted with a primary diagnosis of AC and who received CCT from 2002 to 2010 were identified retrospectively through billing and diagnosis codes.

RESULTS: Mean patient age was 71 years and 80% had ≥1 comorbidity (mean 2.6). Seventy-eight percent of CCTs were percutaneous CCT placement and 22% were surgical CCT placement. Median length of stay from CCT insertion to discharge was 4 days. The majority (57%) of patients eventually underwent cholecystectomy performed by 20 different surgeons in a median of 63 days post-CCT (range 3 to 1,055 days); of these, 86% underwent LC and 13% underwent open conversion or open cholecystectomy. In the radiology and surgical group, 50% and 80% underwent subsequent cholecystectomy, respectively, at a median of 63 and 60 days post-CCT. Whether surgical or percutaneous CCT placement, approximately the same proportion of patients (85% to 86%) underwent LC as definitive treatment.

CONCLUSIONS: This 9-year experience shows that use of CCT in complicated AC can be a desirable alternative to open cholecystectomy that allows most patients to subsequently undergo LC. Additional studies are underway to determine the differences in cost, training paradigms, and quality of life in this increasingly high-risk surgical population. (J Am Coll Surg 2012; 214:196–201. © 2012 by the American College of Surgeons)

Acute cholecystitis (AC) often arises from gallstone disease, a condition that annually affects 20 million individuals in the United States.[1] In addition, acute calculous cholecystitis is associated with increased overall, cardiovascular disease, and cancer mortality.[2] Although acute acalculous cholecystitis is less common, it is frequently observed in critically ill and elderly patients, and is associated with a high incidence of gangrene and death.[3] The standard treatment for AC is laparoscopic cholecystectomy (LC), yet management of critically ill and complex patients with AC remains controversial.[4] Other surgical options include open cholecystectomy (OC), conversion to open (CONV) procedure, or placement of a cholecystostomy tube surgically (sCCT). For elderly patients or younger patients with substantial comorbidities, the risk of general anesthesia might be greater than the proven benefits of operative intervention.[5] A less invasive radiologic procedure, percutaneous cholecystostomy tube placement (pCCT) followed by interval cholecystectomy, is another option for these high-risk patients. CCT allows for adequate and immediate decompression and drainage of an acutely inflamed gallbladder, and can be used as a definitive treatment or a transient measure for decreasing inflammation or recovery from critical illness. There is still debate about how long a tube should remain in a patient and whether subsequent cholecystectomy is necessary.

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Abbreviations and Acronyms

AC	= acute cholecystitis
CCT	= cholecystectomy tube
CONV	= open conversion
LC	= laparoscopic cholecystectomy
OC	= open cholecystectomy
pCCT	= percutaneously placed cholecystostomy tube
sCCT	= surgically placed cholecystostomy tube

Previous studies describing trends of AC patients treated with CCT have either been small scale in patient population or examined percutaneous CCT placement only and not surgically placed CCT.[6-8] In addition, most studies investigating the use of CCTs have been in critically ill patients who were not admitted with AC or presented with AC as their primary diagnosis. The purpose of this report was to determine the role of CCTs in the management of AC. We aimed to review our experience with both sCCTs and pCCTs used to treat patients with AC at a tertiary care center and determine whether there was a benefit to these patients compared with conventional therapy of open conversion or OC.

METHODS

Database and study population

A database was created containing all patients who were admitted at UMass Memorial Center with a primary diagnosis of AC as described by our group previously.[5] From this cohort, all patients who received a CCT, either sCCT or pCCT, during their hospital stay from January 1, 2002 to January 1, 2011, were identified (n = 185). Acute complicated cholecystitis was defined as the presence of AC in patients with medical comorbidities that would deem them high risk for cholecystectomy. The University of Massachusetts Institutional Review Board reviewed and approved the study. Pertinent history, demographics, laboratory findings, and outcomes were recorded. Patients with a primary admission for AC were identified based on ICD-9-CM diagnostic and procedural codes (574.0, 574.3, 574.6, 574.8, 575.0, 575.12). From this cohort, patients with a primary procedure code CCT 51.01, 51.02, or 51.03 were queried. All operative notes were reviewed to confirm intent and operative strategy. Operations beginning laparoscopically and then switched intraoperatively to an open procedure were defined as open conversion (CONV). Partial cholecystectomy procedures (n = 5) were included in the LC group, as these procedures were performed laparoscopically and resulted in similar surgical anatomy. Patients with missing data, incomplete operative notes and documents, and metastatic gastrointestinal cancer were excluded.

Patient characteristics and demographics were compared among patients who received each treatment. Age was maintained as a continuous variable. Self-defined race was divided into white, black, Hispanic, and other. Substantial comorbidities were recorded by reviewing each patient's medical record for the presence of 9 conditions associated with adverse outcomes in hospitalized patients at the time of hospital admission. These comorbidities were atrial fibrillation, coronary artery disease, previous myocardial infarction, chronic renal insufficiency, congestive heart failure, hypertension, diabetes mellitus type 1 or 2, cirrhosis, and COPD. Diagnostic imaging and relevant findings were recorded for each patient. Laboratory values on admission included WBC, total bilirubin, alkaline phosphatase, aspartate aminotransferase, and albumin.

Outcomes

In-hospital mortality was defined as any death during the hospital stay. Major complications (after CCT placement, surgery, or in follow-up) were defined as requiring readmission and identified by reviewing all inpatient and outpatient notes for CCT-related and postoperative-related issues. Complications were categorized as follows: bile leak, bile duct injury, retained stone, bleeding, wound infection, urinary tract infection, pneumonia, subhepatic fluid collection, in-hospital myocardial infarction, and death.

Statistical analysis

For patient-level data, means and SDs were calculated for continuous variables. SAS 9.1.3 software (SAS Institute) was used to analyze data. Patients and outcomes were analyzed after being stratified by admission year and operation performed. All analyses performed were univariate analyses.

RESULTS

Of the 185 patients who received a CCT during their hospital stay, 144 (78%) were placed by radiology (pCCT) and 41 (22%) were placed surgically (sCCT). Surgical consultation was obtained in all cases of CCT placement. Fourteen surgeons placed sCCT, with a median of 1 tube placed by each surgeon (range 1 to 15). The 41 sCCTs were initially planned as LCs but were converted to CCT placement during surgery for a variety of reasons, including adhesions, severe inflammation, and edema. During the study period, the number of CCTs placed annually increased (Fig. 1). Median hospital stay was 5 days, and me-

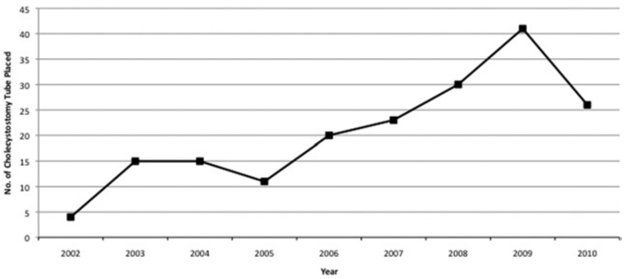

Figure 1. Number of cholecystostomy tubes placed per year at UMass Memorial.

dian length of stay between CCT placement and discharge was 4 days (range 1 to 76 days).

Demographics

Table 1 summarizes the demographics of the cohort. Among the 185 patients who received a CCT during their hospital stay for AC, the median age was 71 years old (range 21 to 99 years old) and 43.8% were female. The majority of patients were of white race (n = 156; 84.3%). Sixty-four (34.6%) of the patients had earlier abdominal operations. The majority of patients (n = 149; 80%) had at least 1 comorbidity, with a mean number of 2.6 comorbidities (median 1). The maximum number of comorbidities was 7 (n = 2). Hypertension was most common, followed by coronary artery disease and diabetes mellitus type 2.

AC was diagnosed based on clinical and radiological findings. Diagnostic imaging results are shown in Table 2. Ultrasonography was the imaging technique of choice and was used in 116 patients and CT was used in 63 patients. One hundred and thirty-two patients (71.4%) had gallstones, 114 (61.6%) showed gallbladder wall thickening, and 101 (54.6%) had evidence of pericholecystic fluid. Available laboratory values were collected, including WBC and bilirubin, alkaline phosphatase, aspartate aminotransferase, and albumin levels (Table 2).

Table 2. Diagnostic Imaging Results and Laboratory Values

Variable	
Radiological study, n (%)	
Ultrasound	116 (64.8)
CT	63 (35.2)
Radiological findings, n (%)	
Gallbladder wall thickening	114 (61.6)
Pericholecystic fluid	101 (54.6)
Sonographic Murphy sign	44 (23.8)
Gallbladder stones	132 (71.4)
Common bile duct stones	9 (4.9)
Laboratory values, mean ± SD	
WBC, cells/μL	14.1 ± 6.2
Bilirubin, mg/dL	2.1 ± 2.7
Alkaline phosphatase, IU/L	133.5 ± 158.0
Aspartate aminotransferase, IU/L	70.6 ± 116.2
Albumin, g/dL	3.9 ± 3.1

Table 1. Demographics of 185 Patients with Acute Cholecystitis Who Underwent Surgery

Variable	n	%
Median age, y	71	
Female sex	81	43.8
Race		
White	15	84.3
Black	5	2.7
Hispanic	19	10.3
Other	5	2.7
Earlier abdominal surgery	64	34.6
Transfer from ICU	18	9.7
Comorbidity		
Atrial fibrillation	36	19.5
Coronary artery disease	58	31.4
Previous MI	23	12.4
Chronic renal insufficiency	24	13.0
Congestive heart failure	38	20.5
Hypertension	111	60.0
Diabetes	53	28.7
Cirrhosis	11	6.0
COPD	28	15.1

CCT Outcomes

Of 185 patients, the majority (n = 105; 56.8%) eventually underwent a subsequent cholecystectomies by 20

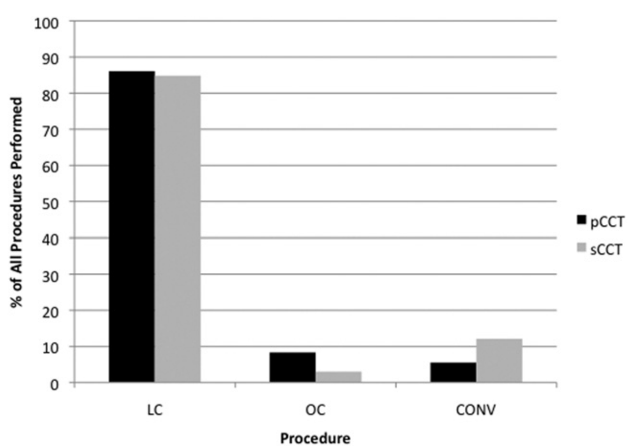

Figure 2. Percentage of procedures performed for removal of gallbladder after placement of percutaneous or surgical cholecystostomy tube. CONV, open conversion; LC, laparoscopic cholecystectomy; OC, open cholecystectomy; pCCT, percutaneously placed cholecystostomy tube; sCCT, surgically placed cholecystostomy tube.

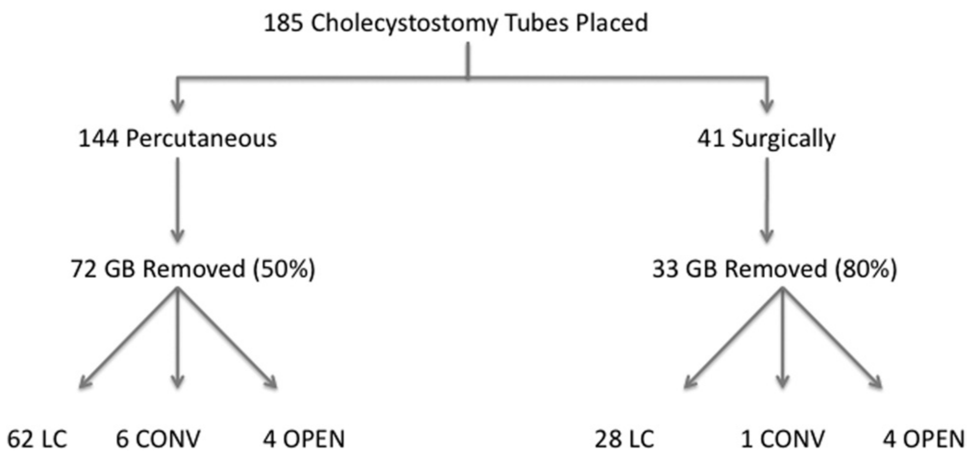

Figure 3. Outcomes of patients who underwent placement of cholecystostomy tube. CONV, open conversion; GB, gallbladder; LC, laparoscopic cholecystectomy; OPEN, open cholecystectomy.

surgeons in a median of 63 days post-CCT placement (range 3 to 1,055 days; Fig. 2). Of these, 86% underwent LC, 8% underwent CONV, and 7% underwent OC. Figure 3 outlines the flow of the patients and subsequent cholecystectomy after placement of pCCT or sCCT. The median number of procedures performed by a surgeon was 2 (range 1 to 27). Of the pCCT patients, 50% underwent interval cholecystectomy in a median of 63 days post-CCT. Of these, 85% underwent LC, 6% CONV, and 8% OC. Of the sCCT patients, 80% underwent subsequent cholecystectomy in a median of 60 days post-CCT as well (Fig. 2). Of these, 85% underwent LC, 12% CONV, and 3% OC. Whether sCCT or pCCT, the same proportion of patients (85%) underwent LC as definitive treatment.

The most common major complications related to CCT placement included leakage or pain around the tube, dislodged tubes, or tube replacement (n = 21; 11.4%). Of the 105 patients who underwent eventual cholecystectomy, operative reports of only 27 (25.7%) patients mentioned removal of CCT during cholecystectomy, and the remaining surgical patients had their CCT removed during surgery and, if it was not clearly stated as so, before surgery, either by a physician, by themselves, or by accident. Of the 80 patients who did not undergo surgery, only 6 (7.5%) patients had CCT documented as removed either by accident or by a physician. The remaining patients, who did not undergo subsequent cholecystectomy, were lost to follow-up (n = 34) or did not have specific documentation about their CCT removal (n = 40). Other common complications postcholecystectomy include bile leak (3.8%), pneumonia (2.9%), and hepatic fluid collection (2.9%). There were 8 deaths (4.3%) during the hospital stay; 7 of the 8 patients (87.5%) had pCCT and 1 patient had sCCT. No patient who went on to undergo cholecystectomy suffered mortality within 12 months.

DISCUSSION

Results of this retrospective case series of 185 patients who underwent CCT at our center confirm the benefits of CCTs in the complicated patient with a primary diagnosis of AC. To our knowledge, this is the largest Western experience reported for using CCTs for patients with AC. We have shown that although most patients underwent pCCT, the majority of patients had their gallbladders removed eventually, whether cholecystostomy was performed surgically or percutaneously. The overarching goal of managing patients with complicated AC is to safely perform cholecystectomy, regardless of the approach, in those who can tolerate it. As such, CCT plays a role in the management of patients with acute and complicated AC. Although the use of CCTs compared with CONV or OC from the onset remains controversial and center- and experience-dependent, additional studies are needed and already underway to determine the differences in cost, training paradigms, and quality of life in this increasingly high-risk surgical population.

The use of CCT was first described as an option of last resort in patients who were critically ill with AC. With the advent of LC, surgeon preference and training has evolved to more comfort with the laparoscopic approach and a resistance and hesitance to perform OC.[4,9-11] This has led to increased use of CCT either placed percutaneously or surgically, although no study has shown this increase in a population-based or multicenter cohort. In our institution, the majority of general surgeons are trained in minimally invasive surgery and, therefore, a large number of sCCTs (41 of 185) were placed. This might be in stark contrast to other centers, where pCCT or OC would be preferred from the outset. Placement of an sCCT laparoscopically offers many advantages for the surgeon who is considering an attempt at LC first, but knows that a sCCT can be performed if the inflammation of the gallbladder is too severe. A carefully constructed intention-to-treat prospective study is necessary to fully understand the behavior and surgical decision making involved in the operating room to compare prolonged LC, CONV, or OC with sCCT.

Use of CCTs as an interval therapy for eventual cholecystectomy has been described previously. Berber and colleagues described an early experience of 15 CCTs placed, out of 65 patients who underwent LC in 2000.[8] Another report by Byrne and colleagues[7] described 45 CCT placements, in which less than half of the patients had their gallbladder subsequently removed. This study had a high mortality rate and did not focus on AC, thereby lumping many critically ill patients into the analysis who might have had numerous comorbid illnesses and a primary diagnosis other than AC. Our report represents a large number of patients who were treated successfully with pCCT and sCCT and underwent completion cholecystectomy with a laparoscopic approach. It is an important contribution to the literature because it represents a modern experience of numerous surgeons with focus on patients with AC. The number of sCCT placed likely reflects more surgical input from the onset compared with a radiologist who places the CCT at the request of a nonsurgeon practitioner. Management of the CCT, outpatient follow-up, and eventual planning of surgery are more likely to occur in the presence of surgical input. It is also possible that surgically placed CCTs are in healthier patients than those placed by radiologists.[5]

Once a CCT is placed, how should the patients be managed? In this report, about 30% of patients did not have stones, and it can be surmised that these patients can just be followed with simple drain removal and not undergo cholecystectomy. CCT alone can also have a role in high-risk patients who do not, or cannot, undergo cholecystectomy. Cholecystectomy was performed by 20 different surgeons at a median of 63 days, but over a wide range of time from placement of CCT. This wide range reflects center experience and judgment in the management of these complicated tubes. Our mortality rate was low and complication rate was acceptable. The cost effectiveness of CCT compared with CONV or OC is currently being investigated. There was a drop in number of CCTs placed in 2010, which cannot be explained due to the lack of follow-up. Additional investigation is necessary to determine if this trend will persist. There are several limitations that must be considered when interpreting the results of this study. Most importantly, this was a retrospective study and, therefore, true surgical intent cannot be accurately assessed. The sample size did not allow us to fully assess the impact of CCTs on mortality and complications in those patients with AC. The current work remains one of the largest in the Western world. Although we tracked records for patients beyond their hospital stay if available, we could not account for complications that might have occurred and were cared for at outside hospitals. For example, if a patient had a postoperative bile leak and sought treatment at an outside hospital after discharge, then this information would be unable to be tracked in this data set. In addition, we cannot reliably confirm if patients underwent a surgical procedure in a large number of cases where patients were lost to follow-up or CCT was not mentioned in subsequent visits. More than 40% of patients who had CCT placed but did not undergo cholecystectomy were lost to follow-up. It is possible that more or less patients received cholecystectomy after placement of CCT.

CONCLUSIONS

This study confirms the benefits of CCT for AC in the current era in the management of difficult gallbladder across a wide range of surgeons in a single department of surgery. We observed an increase in the use of CCT recently in comparison with CONVs or OC, reflecting another change beyond the use of LC in the management of these patients at our center. Their use has resulted in center experience, surgeon comfort, and appropriate follow-up and experience in eventual removal of the gallbladder if possible. Additional studies are required to compare the outcomes, costs, and patient satisfaction of patients who receive sCCT vs OC, and to determine which patients with AC benefit most from each treatment strategy.

Author Contributions

Study conception and design: Cherng, Sneider, Lewis, Cahan, Shah

Acquisition of data: Cherng, Sneider, Wiseman, Lewis, Cahan, Shah

Analysis and interpretation of data: Cherng, Santry, Shah

Drafting of manuscript: Cherng, Witkowski, Santry, Shah

Critical revision: Cherng, Witkowski, Wiseman, Litwin, Santry, Cahan, Shah

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