Selective Use of Tube Cholecystostomy With Interval Laparoscopic Cholecystectomy in Acute Cholecystitis

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Hypothesis: Tube cholecystostomy followed by interval laparoscopic cholecystectomy is a safe and efficacious treatment option in critically ill patients with acute cholecystitis.

Design: Retrospective cohort study within a 4½-year period.

Setting: University hospital.

Patients: Of 324 patients who underwent laparoscopic cholecystectomy, 65 (20%) had acute cholecystitis; 15 of these 65 patients (mean age, 75 years) underwent tube cholecystostomy.

Intervention: Thirteen patients at high risk for general anesthesia because of underlying medical conditions underwent percutaneous tube cholecystostomy with local anesthesia. Laparoscopic tube cholecystostomy was performed on 2 patients during attempted laparoscopic cholecystectomy because of severe inflammation. Interval laparoscopic cholecystectomy was attempted after an average of 12 weeks.

Main Outcome Measures: Technical details and clinical outcome.

Results: Prompt clinical response was observed in 13 (87%) of the patients after tube cholecystostomy. Twelve patients (80%) underwent interval cholecystectomy. Laparoscopic cholecystectomy was attempted in 11 patients and was successful in 10 (91%), with 1 conversion to open cholecystectomy. One patient had interval open cholecystectomy during definitive operation for esophageal cancer and another had emergency open cholecystectomy due to tube dislodgment. Two patients (13%) had complications related to tube cholecystostomy and 2 patients died from sepsis before interval operation. One patient died from sepsis after combined esophagectomy and cholecystectomy. Postoperative minor complications developed in 2 patients. At a mean follow-up of 16.7 months (range, 0.5-53 months), all patients were free of biliary symptoms.

Conclusions: Tube cholecystostomy allowed for resolution of sepsis and delay of definitive surgery in selected patients. Interval laparoscopic cholecystectomy was safely performed once sepsis and acute infection had resolved in this patient group at high risk for general anesthesia and conversion to open cholecystectomy. Just as catheter drainage of acute infection with interval appendectomy is accepted in patients with periappendiceal abscess, tube cholecystostomy with interval laparoscopic cholecystectomy should have a role in the management of selected patients with acute cholecystitis.


Eleven percent to 20% of patients requiring cholecystectomy present with acute cholecystitis. Although the laparoscopic approach was initially considered to be contraindicated for acute cholecystitis, with experience, the application of laparoscopic surgery has extended to the treatment of patients with acute cholecystitis with similar operation time, shorter hospital stay, and complication rates compared with open cholecystectomy. Nevertheless, two issues of concern are the higher rate of conversion to an open procedure compared with elective cases and the management of elderly patients with underlying medical conditions. The conversion rate of laparoscopic cholecystectomy for acute cholecystitis has been reported to range from 11% to 28%, which is significantly higher than the less than 5% rate reported for chronic cholecystitis. With conversion, not only the advantage of this minimally invasive procedure is lost, but also the cost and complication rate are increased.

The appropriate management of acute cholecystitis in critically ill or elderly patients with underlying medical conditions is another controversial issue due to high postoperative morbidity and mortality rates after emergency cholecystectomy. Decompression of the acutely
PATIENTS, MATERIALS, AND METHODS

Between January 1, 1994, and May 13, 1998, 324 patients underwent laparoscopic cholecystectomy for symptomatic gallstone disease at Mount Zion Medical Center of the University of California, San Francisco, and 65 (20%) of these patients had acute cholecystitis. Ten patients (3%), 5 with acute and 5 with chronic cholecystitis, had conversions to open cholecystectomy. The conversion rates were 7.7% for acute and 1.9% for chronic cases.

In the same period, cholecystostomy was used for 15 patients with acute calculous cholecystitis. These patients are the subject of this study. There were 10 men and 5 women. Mean patient age was 75 years (range, 43-92 years). Thirteen (87%) of the patients presented to the hospital within 1 to 4 days after the onset of symptoms. The other 2 patients were undergoing evaluation for other conditions, specifically dysphagia and upper gastrointestinal tract bleeding. Three patients (20%) had a history of gallstones and 1 had undergone endoscopic retrograde cholangiopancreatography with sphincterotomy. The diagnosis of acute cholecystitis was made on the basis of clinical and radiologic findings. The most common symptom was right upper quadrant pain, which was experienced by 14 patients (93%). Other signs and symptoms included right upper quadrant tenderness in 13 patients (87%), fever (temperature >38°C) in 12 (80%), nausea or vomiting in 10 (67%), and diffuse abdominal pain in 1 (7%). Thirteen patients (87%) had leukocytosis, and results of liver function tests were abnormal in 7 patients (47%) (Table 1). One patient developed gallstone pancreatitis. Radiologic studies consisted of abdominal ultrasonography (n = 12), abdominal computed tomography (n = 10), and cholescintigraphy (n = 2).

All of the patients received broad-spectrum antibiotics after the clinical diagnosis of acute cholecystitis was made. Patients were subjected to percutaneous cholecystostomy on the basis of their high risk for general anesthesia (13 patients) due to underlying medical conditions or critical illness. Laparoscopic cholecystectomy was attempted for 2 patients (13%) for whom general anesthesia was not contraindicated. Laparoscopic cholecystostomy was performed on these patients because of severe inflammation that precluded safe dissection.

Fourteen patients (93%) had other significant medical problems. Thirteen patients (87%) were either American Society of Anesthesiologists (ASA) status III or IV. Two patients were evaluated as being ASA status II.

PERCUTANEOUS CHOLECYSTOSTOMY TECHNIQUE

Percutaneous cholecystostomy was performed under sterile conditions using intravenous sedation and local anesthesia with 1% subcutaneous lidocaine hydrochloride. The procedure was performed by using ultrasound and fluoroscopy guidance in 12 patients. Adequate visualization of the gallbladder using ultrasonography was not possible in 1 patient and this patient underwent percutaneous cholecystostomy with computed tomographic guidance. A 10F (12 patients) or 8.5F (1 patient) nephrostomy, Cope loop, or multipurpose catheter was placed into the gallbladder using the Seldinger exchange technique and secured in place. A transperitoneal route was used in 8 patients and a transhepatic route was used in 5 patients. A sample of bile was aspirated and sent for culture.

LAPAROSCOPIC CHOLECYSTOSTOMY TECHNIQUE

Under general anesthesia, patients were prepared and draped as for laparoscopic cholecystectomy. The abdomen was entered with a trocar (Optiview; Ethicon-Endo Surgery, Cincinnati, Ohio) at the umbilicus. The decision to proceed with cholecystostomy upon the finding of a gangrenous gallbladder and severe inflammation was made after the second trocar was inserted in 1 patient and after the third was inserted in the other patient. Using laparoscopic ultrasound guidance, an 18-gauge needle was inserted in the subcostal position at the midclavicular line into the gallbladder. After bile was aspirated, a guidewire was placed within the lumen of the gallbladder. This guidewire could be seen on laparoscopic ultrasonography. Over this guidewire, a 14F Cope loop catheter was placed into the lumen of the gallbladder and was secured to the skin. A sample of bile was sent for culture (Figure 1 and Figure 2).

LAPAROSCOPIC CHOLECYSTECTOMY TECHNIQUE

In the absence of symptoms related to a complication, a control fistulogram was obtained within 30 to 45 days of tube placement to show the presence of gallstones and to check the tube. An average of 11.7 weeks (range, 7-22 weeks) was allowed to pass before interval cholecystectomy for the inflammation to subside and the general condition of the patient to improve. After induction of endotracheal general anesthesia, the abdomen was steriley prepared and draped with the cholecystostomy tube passed under the drapes so as to be excluded from the field. The abdominal cavity was entered by direct visualization using an Optiview trocar with a 0° laparoscope. Thereafter, the laparoscope was changed to a 45° scope (Figure 3). A 10-mm port was placed in the subxiphoid position, followed by two 5-mm ports, one in the right lower abdomen used to grasp the fundus of the gallbladder and retract it into the right upper abdomen and one in the right subcostal position used as the assistant port. Laparoscopic ultrasonography was performed using a 7.5-MHz end-viewing laparoscopic ultrasound transducer (Echome- dix, Irvine, Calif). Fluorocholangiography was then performed by passing a Reddick cholangiocatheter into the cystic duct. The cholecystostomy tube was withdrawn at this time. After dissection of the Calot triangle, the gallbladder was separated from the liver bed using a curved spatula. The gallbladder was then withdrawn through the subxiphoid port after being placed into an endoscopic retrieval bag.
scopic cholecystostomy performed to decrease the rate of conversion in cases with severe inflammation precluding safe dissection during attempted laparoscopic cholecystectomy.13,14

The aim of this study was to review our experience to determine the safety and efficacy of the use of tube cholecystostomy with interval laparoscopic cholecystectomy in selected patients with acute cholecystitis.

**RESULTS**

Resolution of clinical symptoms and signs of acute cholecystitis was observed in 13 (87%) of the patients after cholecystostomy (Figure 4). White blood cell counts of 4 patients failed to return to normal within 72 hours. Two of these patients continued to have an elevated white blood cell count and fever, despite the relief of abdominal pain. One of these patients was admitted to the intensive care unit with sepsis. The other patient was admitted to the hospital with a 4-day history of symptoms, established urinary tract infection, and renal failure. Both of these patients died 15 days and 8 days after percutaneous cholecystostomy, respectively, due to septic shock with multisystem organ failure.

Nine patients (60%) had positive biliary cultures, 4 (44%) of whom had mixed organisms isolated. *Enterococcus* species were the most frequently cultured pathogens. Five patients (33%) also had positive cultures from other sites. Excluding the 2 patients who died, the average hospital stay for the cholecystostomy procedure was 9.8 days (range, 1-21 days). Three patients (20%) were admitted to the intensive care unit. The mean ± SD drainage from the cholecystostomy tube during the hospital stay of the patients was 131 ± 122 mL/d (Table 2).

Twelve patients (80%) underwent interval cholecystectomy. Laparoscopic cholecystectomy was attempted in 11 patients, being successful in 10 (91%) with 1 of the patients having conversion to open cholecystectomy due to severe inflammation and gangrene of the gallbladder. One patient underwent interval open cholecystectomy during definitive operation for esophageal cancer and another had emergency open cholecystectomy as described below.

There were 2 complications (13%) related to the cholecystostomy tube that required intervention. One patient developed cholangitis due to clamping of the tube after discharge and responded to broad-spectrum antimicrobial therapy after the tube was returned to gravitational drainage. Another patient with dementia removed her cholecystostomy tube 2 days after the procedure and required an emergency open cholecystectomy. A large biliary collection in the subhepatic space and gangrene of the gallbladder were discovered at operation. Two patients had dislodgment of the cholecystostomy tube. One of these patients underwent tube

<table>
<thead>
<tr>
<th>Component</th>
<th>Mean ± SD Value</th>
<th>Abnormal Result/No. of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>White blood cell count, ×10⁹/L</td>
<td>15.2 ± 4.0</td>
<td>13/15</td>
</tr>
<tr>
<td>Aspartate aminotransferase, U/L</td>
<td>48 ± 66</td>
<td>2/15</td>
</tr>
<tr>
<td>Alanine aminotransferase, U/L</td>
<td>82 ± 129</td>
<td>2/8</td>
</tr>
<tr>
<td>Alkaline phosphatase, U/L</td>
<td>141 ± 127</td>
<td>6/15</td>
</tr>
<tr>
<td>Amylase, U/L</td>
<td>170 ± 432</td>
<td>1/14</td>
</tr>
<tr>
<td>Total bilirubin, µmol/L (mg/dL)</td>
<td>19 ± 15 (1.1 ± 0.9)</td>
<td>2/15</td>
</tr>
</tbody>
</table>

**Table 1. Laboratory Values at Presentation**

![Figure 1](https://via.placeholder.com/150)

*Figure 1. The multipurpose cholecystostomy set (Cook, Bloomington, Ind) used for laparoscopic cholecystostomy in this study.*

![Figure 2](https://via.placeholder.com/150)

*Figure 2. The placement of a pigtail catheter over guidewire catheter in a gangrenous gallbladder during attempted laparoscopic cholecystectomy.*

![Figure 3](https://via.placeholder.com/150)

*Figure 3. The appearance of the gallbladder during interval laparoscopic cholecystectomy.*

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exchange over wire, but the other one remained asymptomatic despite mild elevation of the white blood cell count, and underwent successful laparoscopic cholecystectomy at 8 weeks. Fistulograms obtained in 2 patients with abdominal pain demonstrated mild leakage around the tube in one patient and obstruction in the other (30 days and 4 days, respectively, after tube placement). Both of these tubes were changed over wire under local anesthesia. The operation time for interval laparoscopic cholecystectomy averaged 118 minutes (range, 59-180 minutes). One of the patients underwent endoscopic retrograde cholangiopancreatography with sphincterotomy 1 day after laparoscopic cholecystectomy for distal common bile duct stenosis.

The patient who underwent combined esophagogastrostomy and cholecystectomy developed sepsis and died on postoperative day 32. Excluding this patient, the average length of hospital stay was 1.6 days (range, 1-4 days) for the interval operation. One patient required intensive care for 3 days.

Two patients experienced postoperative complications. One patient developed angina pectoris after laparoscopic cholecystectomy and the patient who underwent conversion to an open procedure had a wound infection. Both of these patients recovered uneventfully.

Pathologic evaluation revealed chronic cholecystitis in 12 patients (92%) and acute cholecystitis in 1 patient (who underwent emergency open cholecystectomy). Necrosis of the gallbladder was detected in 2 patients.

The patients were followed up for an average of 16.7 months (range, 0.5-53 months). Except for 1 patient with a mildly elevated serum bilirubin level due to starvation, which resolved with nutritional support 8 months after interval laparoscopic cholecystectomy, none of the patients had any problems referable to the biliary tract. One patient died at 35 months due to cerebrovascular disease and urinary sepsis and 1 patient developed colon cancer at 12 months.

### Table 2. Characteristics of the Biliary Drainage Through the Cholecystostomy Tube

<table>
<thead>
<tr>
<th>Patient No./Sex/Age, y</th>
<th>Macroscopic Appearance</th>
<th>Biliary Culture Results</th>
<th>Other Culture Results*</th>
<th>Drainage, mL†</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/F/92</td>
<td>Serosanguineous</td>
<td><em>Clostridium perfringens</em></td>
<td></td>
<td>88</td>
</tr>
<tr>
<td>2/M/83</td>
<td>Serosanguineous</td>
<td><em>Enterococcus, Escherichia coli</em></td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>3/F/84</td>
<td>Serosanguineous</td>
<td><em>Enterococcus, Citrobacter, Klebsiella</em></td>
<td></td>
<td>35</td>
</tr>
<tr>
<td>4/M/65</td>
<td>Turbid, dark green</td>
<td><em>E coli</em></td>
<td></td>
<td>158</td>
</tr>
<tr>
<td>5/M/65</td>
<td>Dark brown</td>
<td><em>Aspergillus</em></td>
<td><em>Corynebacterium (blood), coagulase-negative Staphylococcus (catheter)</em></td>
<td>244</td>
</tr>
<tr>
<td>6/M/79</td>
<td>Clear</td>
<td><em>Proteus, Klebsiella</em></td>
<td></td>
<td>172</td>
</tr>
<tr>
<td>7/F/79</td>
<td>Dark black</td>
<td>Negative</td>
<td></td>
<td>251</td>
</tr>
<tr>
<td>8/M/75</td>
<td>Dark green</td>
<td>Negative</td>
<td></td>
<td>48</td>
</tr>
<tr>
<td>9/M/67</td>
<td>Serosanguineous</td>
<td>Negative</td>
<td></td>
<td>112</td>
</tr>
<tr>
<td>10/M/66</td>
<td>Serosanguineous</td>
<td>Negative</td>
<td></td>
<td>65</td>
</tr>
<tr>
<td>11/F/86</td>
<td>Dark green</td>
<td>Negative</td>
<td><em>E coli (urine)</em></td>
<td>55</td>
</tr>
<tr>
<td>12/F/74</td>
<td>Dark brown</td>
<td>Negative</td>
<td></td>
<td>335</td>
</tr>
<tr>
<td>13/M/43</td>
<td>Serosanguineous</td>
<td><em>Enterococcus</em></td>
<td></td>
<td>200</td>
</tr>
<tr>
<td>14/M/79</td>
<td>Murky brown</td>
<td><em>Glycobiacterium, Staphylococcus epidermidis</em></td>
<td><em>E coli (urine)</em></td>
<td>23</td>
</tr>
<tr>
<td>15/M/85</td>
<td>Murky brown</td>
<td><em>E coli</em></td>
<td></td>
<td>NR</td>
</tr>
</tbody>
</table>

*This column represents the positive results of clinically indicated additional cultures that were obtained.
†Values refer to the drainage recorded during the hospital stay. NR indicates not recorded.

Laparoscopic surgery is no longer considered a contraindication for acute cholecystitis and has become the procedure of choice due to decreased morbidity compared with conventional open surgery.2,7,15 Nevertheless, two controversial issues are the high rate of conversion and the management of critically ill patients who are not good candidates for general anesthesia. Tube cholecystostomy with delayed laparoscopic cholecystectomy has been proposed for the management of these patients as an alternative treatment.13,14,16,17

Eighty-seven percent of the patients in our study were either ASA status III or IV and 93% were older than 65 years. Within this high-risk group of patients, our approach consisted of cholecystostomy tube placement, percutaneous or occasionally laparoscopic, followed by interval laparoscopic cholecystectomy an average of 3 months later (Figure 5).

![Figure 4](source-url)  
**Figure 4.** Line graph showing the significant decrease in mean ± SEM white blood cell count (WBC) of the patients after performance of tube cholecystostomy. Postproc indicates postprocedure.
Clinical resolution of toxemia was observed within 24 to 48 hours in 87% of our patients after cholecystostomy. This is comparable to other studies reporting an 81% to 93% response rate.\(^{14,16,18}\) The mortality rate within 30 days of the procedure was 13% in our study. Reported mortality rates for percutaneous cholecystostomy performed for acute cholecystitis in the literature range from 18% to 69%.\(^{14,16,18}\) The high mortality associated with this procedure is attributed to the presence of comorbid conditions in these selected patients.

The relatively lower mortality rate in our series can be related to the prompt referral of the majority of the patients by the primary care physicians to the hospital, prompt diagnosis, and early administration of therapeutic measures including broad-spectrum antibiotics and decompressive tube cholecystostomy. Forty percent of the patients were admitted to the hospital less than 24 hours after the onset of symptoms and 58% underwent cholecystostomy in the first 48 hours after admission.

The morbidity related to the cholecystostomy tube was 13% in our study and 20% of the patients required catheter exchange. Bile leakage, hemorrhage, colonic injury, and vasovagal reactions are among the percutaneous procedure–related complications reported in the literature.\(^{20,21}\) Catheter dislodgment has been reported in 5% to 10% of patients.\(^{21-23}\) Although inconvenient, the cholecystostomy tube should be left in place in these patients until the interval operation, as one of our patients developed cholangitis after clamping of the tube. The transperitoneal route was undertaken in 62% of our patients undergoing percutaneous cholecystostomy and the transthepatic route was used in 38%. The transthepatic approach has been reported to minimize the risk of iatrogenic bile leak and inadvertent injury to the hepatic flexure of the colon, but it carries the inherent risks of pneumothorax, intrahepatic bleeding, and hemobiliary fistula.\(^{16}\) The small number of patients in our study prevents us from making comparisons between different techniques of cholecystostomy.

In the present study, interval laparoscopic cholecystectomy was successful in 91% of the patients in whom it was attempted. One patient with necrosis of the gallbladder, foreshortened cystic duct, and severe inflammatory changes had conversion to the open procedure. We believe that an adequate time delay before interval cholecystectomy for the inflammation to subside is critical for successful laparoscopic intervention, which was an average of 12 weeks in our study. A conversion rate of 0% was reported for laparoscopic cholecystectomy after an interval of 3 months,\(^{17}\) whereas a conversion rate of 31% was observed in patients operated on 5 weeks after placement of percutaneous cholecystostomy tube for acute cholecystitis.\(^{14}\)

The postoperative complication rate for interval laparoscopic cholecystectomy was 18% in our study, consisting of cardiac ischemia and wound infection. Patterson and colleagues\(^{19}\) reported a postoperative complication rate of 23% in their 13 patients with attempted interval cholecystectomy for acute cholecystitis. Our complication rate compares favorably with the 10% to 24% rate reported for open cholecystectomy.\(^{22-24}\) and 6.4% to 26.7% rate for laparoscopic cholecystectomy for acute cholecystitis.\(^{15,19}\) Converted cases have been reported to be associated with an increased morbidity.\(^{1,19}\) Similarly, 1 of the 2 complications we observed in our series was in the case converted to open cholecystectomy. The perioperative mortality in our interval laparoscopic cholecystectomy series was zero, which compares favorably with the emergency open cholecystectomy mortality of 0% to 5%, which increases to between 6% to 30% in high-risk patients.\(^{25}\)

In conclusion, tube cholecystostomy allowed for resolution of sepsis and delay of definitive surgery in a selective group of patients. Interval laparoscopic cholecystectomy could be safely performed once sepsis and acute infection had resolved in this patient group at high risk for general anesthesia and conversion to open cholecystectomy. Just as catheter drainage of acute infection with interval appendectomy is accepted in patients with periappendiceal abscess, tube cholecystostomy with interval laparoscopic cholecystectomy should have a role in the management of selected patients with acute cholecystitis.

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### REFERENCES


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