Percutaneous Cholecystostomy for Gallbladder Perforation: Early Response and Final Outcome in 10 Patients

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Purpose: To evaluate the efficacy of percutaneous cholecystostomy (PC) as a therapeutic maneuver for patients with spontaneous gallbladder (GB) perforation.

Material and Methods: Ten patients with acute cholecystitis and suspected GB perforation underwent emergency PC; perforation was documented by means of ultrasound, computed tomography, and/or fluoroscopy. All patients but two had a variety of high risk factors for open cholecystectomy: diabetes mellitus (n=2), cardiac disease (n=2), acute renal failure (n=1), liver cirrhosis (n=1), overwhelming sepsis (n=1), and age over 80 (n=1). All percutaneous cholecystostomies were performed with ultrasound guidance and preferably via the transhepatic route. A favorable response to PC was defined as an improvement in clinical symptoms and signs or reduction in fever, and return of the WBC to normal within 72 hr of the procedure.

Results: All procedures were technically successful, and no major procedure-related complications occurred. Eight patients (80%) responded favorably to PC. One, who did not respond, underwent emergency cholecystectomy next day due to worsening peritonitis, and the other who failed to respond within 72 hr showed delayed response after drainage of a coexistent liver abscess at seven days after the procedure. A patient who responded to PC experienced catheter dislodgement four days after the procedure but reinsertion was not required. Five of eight patients who responded positively underwent elective cholecystectomy after the improvement of clinical symptoms, and the three remaining patients improved without further surgery.

Conclusion: For the treatment of patients in whom GB perforation is suspected, PC is a safe and effective alternative to surgical cholecystectomy.

Index words: Cholecystitis
Gallbladder, interventional procedure
Gallbladder, perforation

Perforation of the gallbladder (GB) occurs in about 3% to 10% of all patients with acute cholecystitis (1, 2). Since its original description by Duncan in 1844 (3) and classification by Neimeier in 1934 (4), GB perforation has, because of its high morbidity and mortality rates, been regarded as a serious disease entity (5, 6). Although prompt cholecystectomy is the treatment of choice, elderly patients are frequently at high surgical risk due to limited cardiorespiratory or renal reserve and concomitant sepsis. Moreover, delay in diagnosis or intervention decreases the likelihood of a favorable outcome.

For the treatment of acute cholecystitis, PC has been advocated as a temporary measure until a patient is sufficiently stable for surgery (7 - 10). Other than one
small series that described the expanded use of PC for the treatment of frank perforation of the GB or leakage of infected bile (11-13), there have, however, been few individual case reports. This article describes the outcome of surgery in ten patients who underwent emergency PC for acute cholecystitis accompanied by perforation.

**Materials and Methods**

Between January 1994 and July 1997, ten patients (eight men and two women) with a GB perforation and a pericholecystic abscess underwent PC. Their ages ranged from 45 to 84 (mean, 65) years, and all had suffered an acute episode of cholecystitis with septicemia. Five had calculous cholecystitis, and in one

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**Fig. 1.** A 45-year-old male with alcoholic liver cirrhosis and longstanding diabetes mellitus.

**A.** CT scan shows gallbladder with partially disrupted wall (arrow). Air bubbles are noted in the lumen and around the GB.

**B.** In the cranial portion of (A), a large subphrenic fluid collection is seen.

**C.** Antegrade cholecystogram obtained 10 days after PC shows leak of contrast media through the GB wall defect into subphrenic space and mucosal irregularity of the GB.

**D.** CT scan obtained 6 weeks after PC shows small shrunken GB. GB wall defect is not detected anymore. Disconnected fistular tract from the GB is seen (arrow) and subhepatic abscess is nearly evacuated (not shown).
A 59-year-old male with sepsis and renal failure.

A. Ultrasonogram shows that a hole disrupting the wall of the GB is in continuity with a pericholecystic abscess (arrow).

B. CT scan shows a distended GB and connection between GB and pericholecystic abscess through the wall defect (arrow).

C. A pericholecystic abscess is photographically confirmed to have communication with the GB on cholecystogram.

of these, there was accompanying cholelithiasis; the others had acalculous cholecystitis. Because of an underlying medical condition, all patients but two were considered to be poor candidates for immediate cholecystectomy. Risk factors included diabetes mellitus (n=2), cardiac disease (n=2), acute renal failure (n=1), liver cirrhosis (n=1), overwhelming sepsis (n=1), and age above 80 (n=1). All patients had right upper quadrant pain and tenderness, and a temperature higher than 38°C; four were in the intensive care unit. One patient was receiving vasopressors for septic shock (systolic pressure less than 90 mmHg), eight had elevated WBC counts, and five had an elevated serum bilirubin level.

In all patients, radiological examinations performed prior to surgery included abdominal sonography and abdominal CT. For sonography, an Acuson XP (Mountain View, Calif., U.S.A.) or an ATL HDI 3000 unit (Bothell, Wash., U.S.A.), was used with a 3.5 or 5-MHz transducer. Multiple axial and longitudinal gray-scale images of the GB were obtained. CT imaging involved the use of a Somatom plus 4 scanner (Siemens, Erlangen, Germany) at a slice thickness of 8-10 mm and after oral administration of diluted gastrografin and IV administration of contrast material (120 ml iopamidol 300 mg I/ml, or 100 ml ultravist 300 mg I/ml). All cross-sectional studies were performed within 84 hr of PC.

Cross-sectional imaging findings thought to suggest cholecystitis were gallstones, wall thickening greater than 3 mm, pericholecystic fluid collection, and distension (i.e., gallbladder length > 10 cm or transverse dimension > half the gallbladder length). GB perforation was diagnosed when the GB wall was defective (Fig. 1, Fig. 2), bulging was seen on US or CT (Fig. 3), or contrast extravasation from the GB was revealed by an antegrade cholecystogram obtained during the procedure (Fig. 4).

All percutaneous cholecystostomies were performed in the vascular suite of the radiology department using real-time ultrasonography; all patients received periprocedural broad-spectrum antibiotics. The access route was ultrasonically determined, and was preferably via the transhepatic route. Atrophine was not routinely
used in these patients. The skin was anesthetized, and a scalpel blade was used to open this skin and subcutaneous tissue. Under ultrasonographic guidance, an 18-gauge Seldinger needle was advanced percutaneously through the liver into the gallbladder, access to which was confirmed by the aspiration of bile. A 0.038-inch guide wire (Sooho, Seoul, Korea) was placed through the needle into the gallbladder; the needle was removed and access dilated to 7- or 8-F using an Accustick set (Meditech, Watertown, Mass) for placement of a 7-F locking gallbladder catheter (Meditech/Boston Scientific, Watertown, Mass) or an 8.5-F drainage catheter (Cook, Bloomington, Ind.), which was sutured to the skin. For culture and sensitivity, a bile sample was obtained; bile was drained as completely as possible from the GB, but so that the
gallbladder was not overmanipulated, catheter irrigation was not performed on the initial puncture. To assess catheter position, contrast leakage, cystic duct patency, and stone size and position, an antegrade cholecystogram was usually obtained 7 days after catheter insertion; a small amount of ionic contrast medium diluted to a concentration of 150 mgI/ml was added. The catheter was placed on gravity drainage, flushed daily with 10ml of saline to avoid occlusion and maintained in place for at least 2 weeks to permit a fibrous tract to form. In one patient with a large right subphrenic abscess, another pigtail catheter was placed in the abscess (Fig. 1). In patients with acalculous cholecystitis, cholecystostomy catheters were clamped, and the patients were observed for at least a day prior to removal of the tube.

A positive response to PC was defined as resolution of the right upper quadrant pain and tenderness, reduction in temperature to less than 37.5°C, and reduction in WBC to less than 11,000/mm³ within 72 hr of the procedure. For the evaluation of technical problems and complications of emergency cholecystostomy, we retrospectively reviewed the patients’ charts. Data analysed included the procedure, catheter type and size, method of catheter insertion, and associated complications. The number of days of drainage prior to catheter removal or cholecystectomy, and patient outcome, were reviewed. Patients whose catheters were removed were contacted by telephone and asked about the recurrence of symptoms.

Results

PC performed on an emergency basis for patients with suspected subacute GB perforation was technically successful in all patients; all were treated with a combination of catheter drainage, antibiotics, and supportive measures. No patients showed major complications related to the procedure. Eight of ten (80%) in whom the procedure was successful responded within 72 hrs; the other two (20%) failed to respond. One of these had calculous cholecystitis and next day underwent emergency cholecystectomy due to worsening peritonitis and failure to affect the septic course. In this patient, a necrotic perforation was found during cholecystectomy in the fundus of the GB, and a GB wall defect revealed on CT corresponded to the site of perforation (Fig. 1). The other patient showed delayed response due to overwhelming sepsis after drainage of a coexistent liver abscess seven days after the procedure. A patient experienced catheter dislodgment four days after the procedure but because clinical symptoms and signs had shown remarkable improvement, did not require reintersion.

Bile cultures were positive in seven patients; Escherichia coli in five, Acinebacter Baumannii in one, and Klebsiella in one. In order to assess catheter position and leakage, follow-up catheter cholangiograms and ultrasonograms were usually obtained one to four weeks after procedure. When each patient had recovered from GB infection and leakage, and follow-up cholangiogram showed no further contrast leakage, cholecystostomy catheters were clamped and the patients were observed for at least one day prior to removal of the tube. Following the improvement of clinical symptoms and signs, a variety of treatment measures— including cholecystectomy, discontinuation of drainage, or long term drainage— were discussed with all nine patients. Because of the possible risk of recurrence of acute cholecystitis, however, cholecystectomy was recommended in all cases. Five of the nine underwent the procedure after improvement of their clinical symptoms, but four declined. Because he had gallstones and was not considered to be a suitable candidate for cholecystectomy, due to advanced age and a cardiac problem, one patient was discharged with cholecystostomy catheters in place. After three months’ follow-up, during which time these were not removed, he was well. In one patient with acalculous cholecystitis, the injection of contrast material into the tube and track four weeks after the procedure confirmed the patency of cystic duct as well as track maturity, and the catheter was removed. During six months’ follow-up, no further episodes of cholecystitis occurred in this patient. In a patient with calculous cholecystitis, the gallstone was dealt with after successful GB drainage by choledochoscopy, and the catheter was then removed. At follow-up 20 months later, she was well. In the patient who showed delayed response seven days after the procedure, the catheter was removed 30 days after the bile leak; during the ensuing 40 months, he remained asymptomatic.

Discussion

GB perforation is a grave complication of acute cholecystitis, and in elderly patients, the incidence of morbidity and mortality is high (1–5, 14–15). It occurs more frequently in patients with a pre-existing systemic disease such as diabetes mellitus or in those with acalculous cholecystitis, in whom the incidence approaches 40% (2), and the mortality rate may be as high as 60%. According to the classification proposed by Niemeier (4), gallbladder perforation can be either (a) an acute event, during which free bile enters the peritoneal cavity and generalized peritonitis results;
(b) a subacute process with formation of a pericholecystic abscess; or (c) a chronic problem with internal or external fistulization. Localized perforation with pericholecystic abscess formation, similar to the findings in our cases, is the most common type of perforation (4). CT scanning showed that most of our cases fell into the second category, subacute perforation.

Where there is GB perforation, a favorable outcome depends on prompt surgical intervention. It is, however, difficult to distinguish clinically between patients with GB perforation and those with uncomplicated acute cholecystitis, since the symptoms are similar (16, 17). Although nonspecific, the reported US findings of GB perforation are complex echogenic pericholecystic fluid collection, thickened hypochoic edematous GB wall, and cholelithiasis (16). These signs are, however, nonspecific. Chau et al. (18) described the ultrasonic "hole sign" as bearing a striking resemblance to a defect in a perforated balloon, and this may be the only sign which allows preoperative diagnosis of perforation by US. Kim et al. (16) showed that for the depiction of GB wall defect, CT was better than US, and that in pericholecystic fluid, it might be difficult, using the latter, to discriminate echogenic GB wall from adhered omental or mesenteric fat and from pseudoseptation. They reported that GB wall defect and/or bulging of the GB wall, which suggested a site of perforation, was revealed by US in 38.5% of cases, and by CT in 69.2%.

Although elective cholecystectomy is safe, morbidity and mortality rates rise markedly in the elderly patient with severe respiratory compromise, myocardial disease, sepsis, and frank GB perforation (19–21). Even cholecystostomy is considered to be high risk in these patients; controversies involved include the indications for its use, frequency of use, and advisability in relation to cholecystectomy (11, 12, 22). In addition, cholecystostomy mortality rates vary from 3.5% to over 20%, depending on the patient's physiologic state at the time of surgery (12).

PC has become a well-established technique for urgent decompression of acutely inflamed gallbladders, and provides the same temporizing benefits as surgical decompression, while offering lower morbidity and mortality than the surgical approach (7–10). In 1991, vanSonnenberg et al. (12) stated that in four patients with a perforated GB, PC allowed this to heal, obviating the need for surgery and general anesthesia in the acute setting. The data presented here demonstrate that PC is safe and effective in the diagnosis and treatment of GB perforation accompanied by pericholecystic abscess formation. Three observations support the above statement. First, in this series of ten patients, there were no procedure-related deaths or no major complications, and this indicates the safety of this procedure. Second, we achieved 100% technical success in GB catheterization, which in all cases was achieved on the first pass with the use of real-time US guidance. Third, our data establish the clinical effectiveness of PC for the treatment of GB perforation accompanied by pericholecystic abscess formation. PC was therapeutically beneficial in nine of ten cases including one in which response was delayed. One patient required cholecystectomy after PC failed to affect the septic course; a gangrenous perforation of the fundus of the GB was found during surgery in this patient. Response to PC clearly depends not only on the patient's overall medical condition but also on the timing of intervention, because percutaneous cholecystostomy in a septic patient may be performed too late. This patient had suffered from severe right upper quadrant pain since ten days before the procedure and on the day of surgery showed several signs of peritonitis and sepsis. We considered, therefore, that was too late.

After clinical symptoms improved, five of the eight patients with positive response underwent elective cholecystectomy. Radiograms of specimens could not be obtained because in all cases, complete total excision was impossible due to adhesion to adjacent structures. A patient was discharged with cholecystostomy catheters in situ and was well at 1-month follow-up. In one patient with acalculous cholecystitis, the catheter was removed four weeks after initial drainage and no further episodes of cholecystitis occurred during four months' follow-up. The patient who showed a delayed response seven days after the procedure had the PC catheter removed without problem 30 days after the bile leak, and remained asymptomatic during 38 months' follow up. This interesting subset underscores that healing of GB wall necrosis is possible with catheter decompression and antibiotics, despite proven perforation and bile leakage. It should, however, be pointed out that a gallbladder wall that has undergone full-thickness necrosis or diffuse desquamation might not be capable of contraction and appropriate emptying, despite cystic duct patency, and may be a potential source of recurrent cholecystitis.

In acalculous cholecystitis, PC may be the only treatment necessary, since cholecystectomy is not usually indicated if postdrainage cholangiogram findings are normal, as described in the literature by Skillings et al. (22) and Welch and Malt (23). VanSonnenberg et al. (12) showed that in cases of perforation, PC allowed the decompression of bile and prevented continued leakage, while allowing the perforation to heal. In this series, it would seem that for patients with acalculous
cholecystitis and pericholecystic abscess formation who received immediate benefit from PC, cholecystostomy might be the only therapy required. To determine whether PC may be used as a definitive front-line therapy in cases of acute acalculous cholecystitis with perforation, further studies are needed.

In summary, PC was safe and very effective for the decompression of bile and preventing continued leakage, and was a potentially lifesaving option in patients with gallbladder perforation and pericholecystic abscess.

References

경피적 담낭루 설치술에 의한 담낭천공의 치료:
10명의 환자에서 초기 반응과 최종 결과

목적: 자연적으로 발생된 담낭천공을 동반한 급성담낭염 환자에서 경피적 담낭루 설치술의 효용성을 평가하고자 하였다.

대상 및 방법: 급성담낭염으로 인한 담낭천공이 의심되는 10명의 환자를 대상으로 응급 경피적 담낭루 설치술을 시행하였다. 담낭천공은 초음파, 전산화 단층촬영술, X선 투시기 등을 이용하여 진단하였다. 두 명을 제외한 8명의 환자는 당뇨(2명), 심장질환(2명), 급성 신부전(1명), 간경화(1명), 심한 폐혈증(1명), 또는 80세 이상의 고령(1명) 등의 다양한 수술하기 어려운 요인들을 가지고 있었다. 모든 시술은 초음파 유도하에 주로 경간 경로를 통하여 시행되었다. 시술 후 72시간 이내에 임상적 증상 및 정후의 호전, 해열, 백혈구치의 감소 등이 있는 경우를 시술에 반응이 있는 것으로 정의하였다.

결과: 전례에서 성공적으로 경피적 담낭루 설치술을 시행할 수 있었으며, 시술과 관련된 중요 합병증은 발생하지 않았다. 8명의 환자가 시술에 반응하였다. 시술에 반응이 없었던 2명의 환자는 복막염의 악화로 인하여 다음날 응급 담낭절제술을 받았고, 다른 1명의 환자는 시술 후 초기 3일 이내에는 호전이 되지 않았으나 동반된 간질환의 배액 후 7일째 호전되었다. 시술 후 호전이 있었던 8명의 환자 중 1명에서 시술 후 4일에 튜브가 빠졌으나 임상상의 악화는 경험하지 않았다. 5명에서는 임상증상의 호전 후 담낭절제술을 성공적으로 받았으며, 3명에서는 다른 수술적 치료 없이 경피적 담낭루 설치술을 통한 배액만으로 치유되었다.

결론: 경피적 담낭루 설치술은 담낭천공이 의심되는 환자의 치료에 있어서 담낭절제술을 대신할 수 있는 안전하고 효과적인 치료법이다.