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Maturation of the Tract After Percutaneous Cholecystostomy with Regard to the Access Route

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Abstract

Purpose: To assess the shortest time for catheter removal with regard to the transhepatic or transperitoneal approach in patients undergoing percutaneous cholecystostomy (PC).

Methods: In this prospective study, 40 consecutive high-risk patients with acute cholecystitis (calculous, $n = 22$; acalculous, $n = 18$) underwent PC by means of a transhepatic ($n = 20$) or transperitoneal ($n = 20$) access route. In 28 patients (70%) computed tomography was used for puncture guidance, while in the remaining 12 (30%) the procedures were performed under ultrasound control. A fistulography was performed on the 14th postprocedural day in all patients and was repeated weekly if the tract was found to be immature. The catheter was removed only if a mature tract without evidence of leakage was delineated.

Results: In 36 of 40 patients the procedure was technically successful (90%). Three of the unsuccessful punctures were attempted transperitoneally and one transhepatically. Thirty-five of 36 patients showed rapid improvement within the first 48 hr following the procedure (96%). Three of them died of their severe underlying disease (7.5%) and in another three the catheter was accidentally removed prior to the first fistulography (7.5%). A total of 30 patients could be fully evaluated after the procedure: 15 with a transhepatic, and 15 with a transperitoneal PC. Whereas 14 of 15 patients (93%) with transhepatic gallbladder access developed a mature tract after 14 days and the remaining patient after 3 weeks, only 2 of 15 patients (13%) with a transperitoneal route presented a mature tract after 2 weeks ($p < 0.0001$; χ^2 test with Yates' correction). Eleven patients (73%) with transperitoneal access required 3 weeks and two patients (13%) 4 weeks for complete tract formation.

Conclusion: A period of 2 weeks suffices for the majority of patients to develop a mature tract when the transhepatic access route is used; when using the transperitoneal route at least 3 weeks are required. We suggest that the transhepatic route is preferable since it allows earlier removal of the catheter and reduces the incidence of complications and discomfort for the patients.

Key words: Gallbladder, interventional procedure—Cholecystitis—Percutaneous cholecystostomy

Percutaneous cholecystostomy (PC) is an efficient interventional technique for decompression of the acutely inflamed or obstructed gallbladder in high-risk patients [1–3]. Wide acceptance and application of the procedure has resulted in questions regarding the safest puncture route and the postprocedural management [4–6]. An important consideration, after PC has served its initial purpose, is the optimal timing in order to remove the catheter safely and to minimize possible major complications such as bile leakage [1] that may cause bile peritonitis—a dangerous situation for high-risk patients.

This study was conducted to assess the shortest time for catheter removal in relation to the transhepatic or transperitoneal approach in patients undergoing PC.

Materials and Methods

This prospective study comprised 40 consecutive high-risk patients with a score greater than 12 according to the APACHE II system [7]. These patients presented with acute cholecystitis, and were promptly treated with PC, between December 1994 and May 1996. They were

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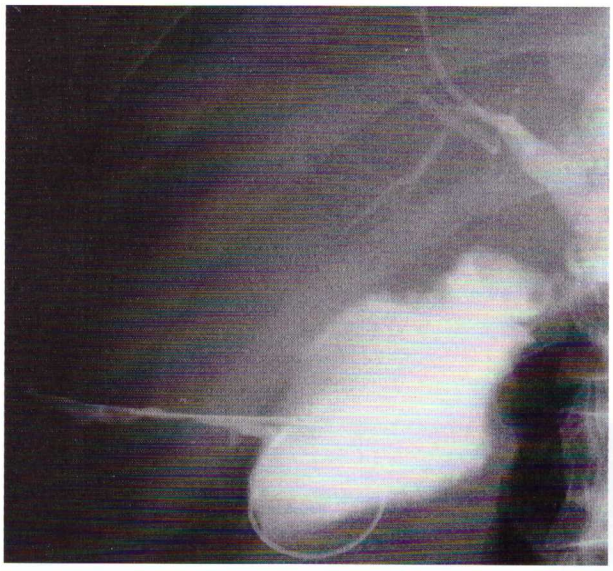

Fig. 1. Fistulography 14 days after a transhepatic percutaneous cholecystostomy (TH PC). After bile aspiration and injection of diluted contrast medium, a guidewire is placed in the gallbladder lumen and the catheter is withdrawn. The tip of an 8 Fr dilator (not visible) is placed in contact with the skin hole and undiluted contrast medium carefully injected. The full length of the tract was evaluated without evidence of leakage.

16 men and 24 women, aged 64–96 years (mean 73 years). Twenty-two of the patients suffered calculous and 18 acalculous cholecystitis. None of them was cirrhotic or had evidence of ascites. The clinical diagnosis was confirmed by the presence of right upper quadrant pain and fever (> 37.5°C), by blood tests (> 10×10^9 WBC/L) and by abdominal ultrasonography (US) findings of an enlarged gallbladder (transverse diameter > 40 mm, length > 90 mm) and thickened wall (> 4 mm). A pericholecystic fluid collection was noted in only one case. The initial diagnosis of acute cholecystitis was confirmed in all patients during the follow-up. After the drainage, 25 of the patients were no longer characterized as high-risk patients (APACHE II score < 12) and were potentially operable.

PC was performed 4–24 hr after the initial US examination. In 22 patients the Seldinger technique and an 8–9 Fr nephrostomy pigtail catheter (Nephrostomy Set, Angiomed, Karlsruhe, Germany) was used. In 18 patients a trocar drainage catheter system of 7–8 Fr (van Sonnenberg Gallbladder Catheter, Medi-tech, Watertown, MA, USA) was utilized. All patients were premedicated with an intramuscular injection of 50 mg hydrochloric pethidine.

A transhepatic route (TH) was chosen in 20 cases (11 with acalculous, 9 with calculous cholecystitis): 15 under computed tomography (CT) and 5 under US guidance. The transperitoneal route (TP) was used in another 20 cases (7 with acalculous, 13 with calculous cholecystitis): 13 under CT and 7 under US guidance. The correct position of the catheter was confirmed by bile aspiration and was controlled by CT or US imaging.

Postprocedural radiologic evaluation included transcatheteral cholecystography and PC-tract fistulography. On the third or fourth day after PC a transcatheter cholangiography was performed to assess the correct catheter position, the patency of the cystic duct and the presence or absence of gallstones. Fistulography of the cholecystostomy tract followed on the 14th postprocedural day. Fistulography was performed, after aspiration of the gallbladder content, using 10–15 ml of diluted contrast medium, injected to evaluate the patency of the cystic and common choledochal duct. Subsequently, a guidewire was placed through the catheter and the catheter was removed. The maturation of the tract was checked by injecting undiluted contrast material through the skin hole using a dilator (Fig. 1). The tract was considered well formed (mature) in the absence of leakage to the peritoneal cavity, and the subphrenic, subhepatic, and subcapsular spaces. The guidewire was then withdrawn. In the case of leakage, a new catheter of the same caliber was immediately positioned for a further week, and the procedure repeated until the maturity of the tract was finally confirmed.

Results

In 36 of 40 patients (90%; 19 TH and 17 TP) the procedure was technically successful (Table 1). Thirty-five of 36 patients (96%) rapidly improved their clinical condition during the first 48 hr following the procedure. One intensive care patient with myasthenia gravis did not improve and died 7 days later (TH approach). In total three patients died 7–10 days after the procedure because of severe underlying disease including cardiopulmonary disease and myasthenia gravis (7.5%; 2 TH and 1 TP). The 30-day mortality rate was 7.5%; none of the deaths was procedure-related.

In three patients the draining catheter was accidentally removed 3–5 days after placement (7.5%; 2 TH and 1 TP). Two of these patients (1 TH and 1 TP) immediately developed signs of bile peritonitis with pain, transient fever and abdominal rigidity. Their condition improved after 2–3 days of conservative treatment, which was preferred by the surgical department to the alternative of immediate reintroduction of a new drainage catheter.

Four patients with a technically unsuccessful puncture were also treated conservatively and improved their clinical status in 8–10 days. In three of them the attempted access was TP (2 under CT, 1 under US guidance) and in one TH (under CT guidance). The reasons for failure were suboptimal patient cooperation in two cases and lack of experience in another two. No other minor or major complications were noted in the series.

In total, 30 patients (15 TH and 15 TP) with complete follow-up were included in the tract maturation study (Table 1). In all patients the catheter was removed after the tract maturation. In 14 of 15 patients with a TH access route, a well-formed tract was noted 14 days after the procedure and in one case on the 21st day. In this last case subcapsular contrast medium leakage was noted on the 14th day (Fig. 2, Table 2). Repositioning of a PC catheter for a further week was utilized. Two of the 15 patients with a TP puncture route showed a fully mature tract on the 14th postprocedural day, 11 on the 21st and two on the 28th day (Fig. 3, Table 2). There is a statistically significant difference between the time needed for tract maturation with the TH route compared with the TP route (2 weeks vs 3 weeks or longer, respectively), in favor of the TH route ($p < 0.0001$; χ^2 test with Yates' correction).

Table 1. Summary of results

Puncture route	PCs tried	PC guidance	Successful PCs	Unsuccessful PCs	Clinical improvement	Patients died	Catheters removed	Tracts studied
TH	20	15 CT, 5 US	19	1 (CT)	18	2	2	15
TP	20	13 CT, 7 US	17	2 (CT), 1 (US)	17	1	1	15
Totals	40	28 CT, 12 US	36 (90%)	4 (10%)	35 (96%)	3 (7.5%)	3 (7.5%)	30

PC = percutaneous cholecystostomy; TH = transhepatic; TP = transperitoneal; CT = computed tomography; US = ultrasound

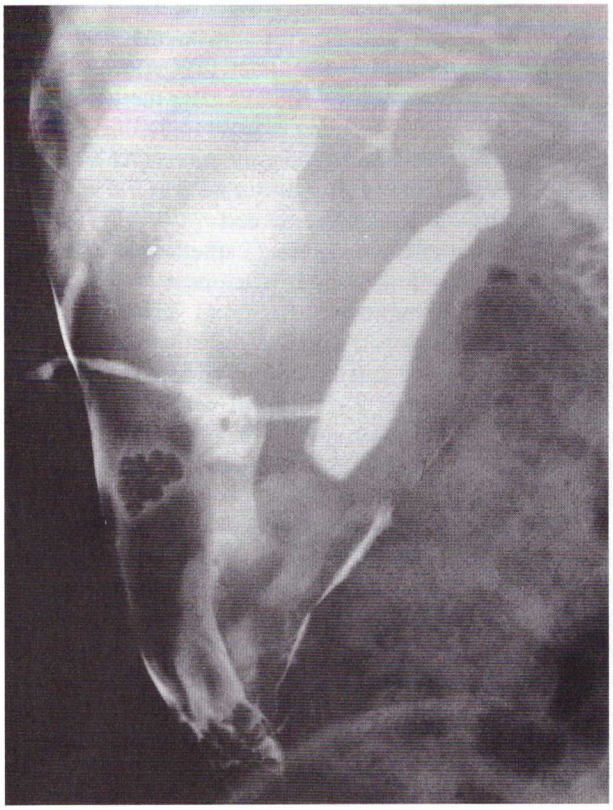

Fig. 2. Fistulography 14 days after a TH PC. Subcapsular contrast medium leakage is present. A new catheter was positioned for a further week.

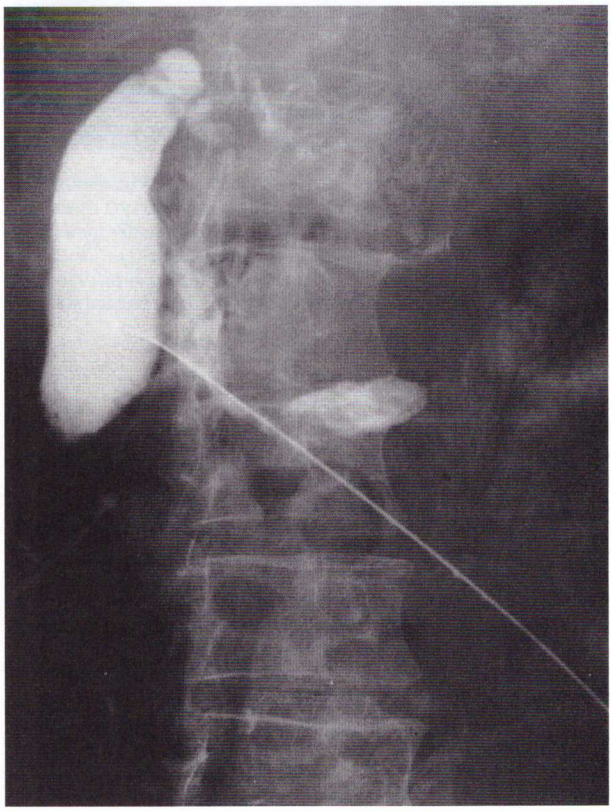

Fig. 3. Fistulography 14 days after a transperitoneal PC. Contrast medium leakage from the immature tract into the peritoneal cavity is noted. A new catheter was positioned for a further week.

Table 2. Time needed for formation of a well-matured catheter tract

Puncture route	No. of patients	No. of mature tracts on		
		14th day	21st day	28th day
TH	15	14 ($p < 0.0001$)	1	0
TP	15	2	11	2
Total	30	16	12	2

None of the 15 patients with acalculous cholecystitis underwent cholecystectomy or had a relapse after a follow-up period of 2–17 months (mean 11.5 months; median 10 months). Ten of the 15 patients with calculous cholecystitis were operated on 1–3 months later, since their APACHE II score fell below 12 after PC. The remaining five patients refused any further treatment such as surgical cholecystectomy or percutaneous cholecystolithotomy. Three of them remained high-risk patients, due to severe cardiopulmonary disease and a unchanged APACHE II score > 12. These

patients, as well as another two who refused any further treatment, remained symptom-free for a period of 3–9 months (mean 5.6 months; median 5 months).

Discussion

Percutaneous cholecystostomy is a safe and effective minimally invasive procedure for the diagnosis and treatment of acute cholecystitis in high-risk patients [1, 3, 6, 8]. The technical success rate is very high, ranging from 98% to 100% [1, 6, 8, 9]. Relief of clinical symptoms varies from 59% to 93%, depending on the patient's condition [3, 6, 8, 9]. Our technical success rate of 90% was lower than that reported in the literature. The two main reasons for our lower success rate were suboptimal patient cooperation and lack of experience. Early in our series we used CT guidance, since this technique allows better delineation of the needle and the catheter position. Lack of optimal patient cooperation, which is essential for procedures under CT control, was the reason for two of the four unsuccessful PCs. Once we started to perform PCs under US guidance and our experience became adequate, our success rate rapidly increased (100% in the last 25 cases). Our clinical improvement rate of 96% correlates well with that of other series.

Three of four technically unsuccessful punctures in the series were attempted transperitoneally. Two of them were performed under CT guidance and one under US guidance, all using the Seldinger technique. The TP approach under US guidance with a trocar catheter system proved to be easier and faster. The Seldinger technique was preferable when a TH route was chosen, since a fine needle was used for the initial puncture, and corrections can be done with a lower incidence of complications.

A 12% overall complication rate is reported for PC, with biliary peritonitis occurring in 2.5% of patients [1]. This is a much lower morbidity rate than that reported for similar patient groups undergoing emergency open cholecystectomy (20%–40%) [10] or laparoscopic cholecystectomy (18%) [11]. This comparison is of course limited, since it does not consider the additional complications of cholecystectomy which follow a period of percutaneous gallbladder catheter drainage and the risk of recurrent acute cholecystitis if the gallbladder is left in position. Biliary peritonitis occurs after bile leakage from the puncture site on the gallbladder wall. This is the reason why most interventional radiologists prefer the TH access route, aiming at the "bare area" of the gallbladder [5, 8, 9, 12]. Recent reports, however, have shown the safety of the TP route [6], whereas no difference in the complication rate has been found between patients drained transhepatically and those drained transperitoneally [9]. Our results are in agreement with these reports.

In all cases of calculous and acalculous cholecystitis, a TH puncture route is preferable in the absence of severe liver disease or coagulopathy [1, 6]. In patients with acalculous cholecystitis, PC can be the definitive treatment [12]. In cases of calculous cholecystitis and poor life expectancy, the approach route for an early fistula formation is not an important issue, since the catheter can be left in place until the death of the patient. Also, in patients with calculous cholecystitis who are potential candidates for cholecystectomy because their APACHE II score is predicted to fall below 12 after PC, either the TH or TP route can be chosen on the basis of the anatomically easier approach, and the catheter can be left in place until the operation date. On the other hand, TP access may be difficult to perform in these cases if massive ascites or colon interposition is present [5, 13]. In inoperable patients with calculous cholecystitis and good life expectancy a TH approach for PC can be chosen if percutaneous stone dissolution or lithotripsy are available. These recent techniques can be performed through the TH tract with tubes not greater than 15–18 Fr [14]. The advantage of these tracts is that they mature faster than the TP tract [15], and the procedure can be completed earlier.

Factors known to prolong the time needed for tract formation include steroid therapy, chronic renal failure, infection of the drainage tract, severe malnutrition, or uncontrolled diabetes mellitus [16, 17]. Ascites may be included in this list, especially when the transperitoneal puncture route is used [5]. In this study none of the patients suffered from such conditions, though there were three with well-controlled diabetes mellitus.

To our knowledge, this is the first attempt to investigate differences in the time required for maturation of the PC tract in relation to a TH or TP approach. A statistically significant difference in tract maturation time was found between the TH and TP puncture routes, tract formation being faster after a TH puncture ($p < 0.0001$). This assessment is probably limited to those patients without any factors predisposing to prolongation of fibrous tract formation. In cases when such factors are present a TH route should be preferred, since it leads to a more stable cholecystostomy tract, allowing a faster maturation process [5].

D'Agostino et al. [4] were the first to study tract formation after PC, and reported the development of a mature tract in 28 patients in whom the drainage catheter was in place for at least 20 days. They suggested that routine imaging of the tract at the time of catheter removal may provide information about bile leakage, to eliminate a major complication such as bile peritonitis. Cheslyn-Curtis et al. [18] found a mature tract 10 days after TP puncture for PC. In this

report a Foley catheter (Latex) was used, which is known to induce a faster fibrous reaction of the tissue and thus faster tract formation [4]. Our maturation time of 14 days is favorable compared with these results.

Candidates for PC usually have other severe health problems and so one should try to minimize the period of their discomfort resulting from the percutaneous catheter. Safe catheter removal after PC is crucial for avoiding further complications. This can be achieved by performing fistulography of the PC tract and removal of the drainage catheter only after tract maturation. In any other case, the catheter should be immediately reintroduced to avoid bile leakage and bile peritonitis. According to our results, the TH puncture route is always preferable for PC, except in patients with severe liver disease or coagulopathy, since there is strong evidence that a TH cholecystostomy fistula matures in about 14 days, allowing faster catheter removal. In patients with limited life expectancy or when cholecystectomy can be planned, either the TH or the TP route can be chosen, depending on the anatomically easier access.

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