Percutaneous Catheter Drainage Compared With Internal Drainage in the Management of Pancreatic Pseudocyst

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The records of 92 patients with symptomatic pancreatic pseudocysts referred for surgical management over a 27-year period were retrospectively reviewed to compare outcome in 42 patients managed with operative internal drainage procedures (group I) with that in 52 patients managed with computed tomography–directed percutaneous catheter drainage (PCD) (group II). The two groups were similar for patient age, sex, pseudocyst location, and cause. The frequency of antecedent pseudocyst-associated complications was less in group I (16.7 *versus* 38.5%, $p < 0.05$). Seven group I patients and four group II patients had major complications (16.7 *versus* 7.7%, not significant). Group II mean duration of catheter drainage was 42.1 days, and the drain track infection rate was 48.1%. The frequency of antecedent operative cyst drainage was similar (14.2 *versus* 13.5%), as was the frequency of subsequent operations for complications related to chronic pancreatitis (9.5 *versus* 19.2%, not significant). Mortality rate was greater in group I (7.1% *versus* 0%, $p < 0.05$). Pseudocysts can be effectively managed either by open operation with internal drainage or by PCD. Drawbacks of PCD include the controlled external pancreatic fistula and the risk of drain track infection. Percutaneous catheter drainage has the following advantages: (1) low mortality rate, (2) does not require a major operation, (3) does not violate the operative field in cases when subsequent retrograde duct drainage procedures are required. Neither PCD nor internal drainage is definitive, and with either technique subsequent correction of underlying pancreatic pathology may be necessary.

PERCUTANEOUS CATHETER DRAINAGE (PCD) of pancreatic pseudocysts with computed tomography (CT), ultrasound, and fluoroscopic guidance has been increasingly employed as an alternative or adjunct to operative drainage of pancreatic pseudocysts over the past decade.[1-3] Over the years, the cornerstone of therapy for symptomatic pancreatic pseudocysts has been internal drainage with cystgastrostomy, cystduodenostomy, or cystjejunostomy.[4-6] To evaluate the role of percutaneous catheter drainage in the management of pancreatic pseudocysts, we compared the clinical presentation and outcome in patients managed with operative internal drainage with that in those managed with CT-directed PCD over a 27-year period.

Subjects and Methods

The records of 42 patients with symptomatic pancreatic pseudocysts who were managed with operative internal drainage from 1965 to 1991 (group I) and 52 patients treated with PCD from 1982 to 1991 (group II) were reviewed retrospectively. Patient age, sex, pseudocyst cause, cyst location, antecedent pseudocyst-related complications, procedures performed in the management of pseudocysts before referral, procedures employed in management, postoperative morbidity and mortality rates, and length of hospital stay were analyzed.

Operative or radiologic intervention was undertaken electively; patients with severe acute pancreatitis, infected pancreatic pseudocysts, and pancreatic abscess were excluded. Selection of cystgastrostomy, cystduodenostomy, or cystjejunostomy was based on cyst location. Initially, we employed PCD to treat patients with major medical comorbidity; subsequent experience with this technique has increased over the study period (Fig. 1). Percutaneous catheter drainage currently is used almost exclusively to treat symptomatic pancreatic pseudocysts larger than 5 cm in diameter without evidence of associated pancreatic duct dilation on CT scan. Percutaneous catheter drainage was performed in the radiology department under local anesthesia with CT guidance. Needle and guide wire localization preceded placement of a 7- to 12-French pigtail catheter into the collection, which was connected to a

Presented at the 103rd Annual Scientific Session of the Southern Surgical Association, Hot Springs, Virginia, December 1–5, 1991.

No reprints available.

Accepted for publication December 24, 1991.

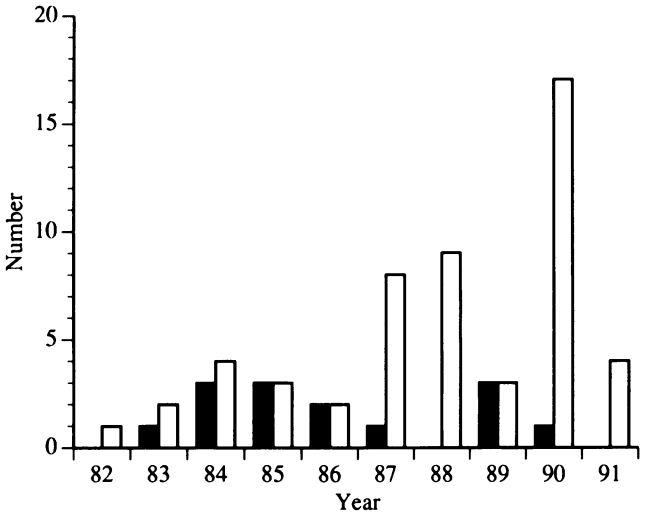

FIG. 1. Percutaneous catheter drainage has been used increasingly since it was first introduced in 1982. ■, internal; □, percutaneous catheter drainage.

closed drainage system (Fig. 2). Bacterial and fungal cultures of the fluid were obtained initially and were repeated when patients developed fever or leukocytosis. Discrete variables in group I and group II were compared with the chi square tests. Continuous variables were analyzed with Wilcoxon's rank sum tests. Significance was accepted when $p < 0.05$.

Results

The two groups were similar for age, sex, pseudocyst location, and underlying cause (Table 1). Most pseudocysts represented complications of pancreatitis due to alcohol abuse. Other causes of pseudocysts included biliary pancreatitis, operative or blunt trauma, and sarcoidosis. Four patients in group I and three in group II had more than one cause or were classified as having idiopathic pancreatitis. Multiple cysts were present in three patients in group I and two patients in group II.

Pseudocyst-related complications present at the time of treatment were seen more frequently in group II (Table 2). Cyst-enteric fistulas were less frequent in group II; however, pancreatic ascites, pancreatopleural fistula, biliary obstruction, duodenal obstruction, and splenic vein occlusion were more common.

Antecedent cyst drainage procedures were noted with similar frequency in both groups (Table 3). One patient in group II had undergone PCD 1 year previously.

Twenty-seven patients in group I were managed with cystgastrostomy, nine with cystduodenostomy, and six with cystjejunostomy. Three patients in group I had multiple cysts; one had a double cystgastrostomy and two were managed with cystgastrostomy and caudal pancreatectomy with cyst excision. In group II, both patients with multiple cysts were managed with two percutaneous catheters.

Treatment morbidity rate is summarized in Table 4. Seven patients in group I and four patients in group II had major complications, including hemorrhage, sepsis, respiratory failure, and myocardial infarction (16.7% *versus* 7.7%, not significant). In group II, mean duration of catheter drainage was 42.1 days (range, 6 to 210 days). Twenty-five of 52 patients (48.1%) developed drain track infections; organisms cultured from drainage fluid are listed in Table 5. In 11 patients cultures yielded single organisms. Staphylococcal species were frequently cultured, present in 22 of 25 (88.0%) of patients. The duration of drainage was less in patients with negative cultures

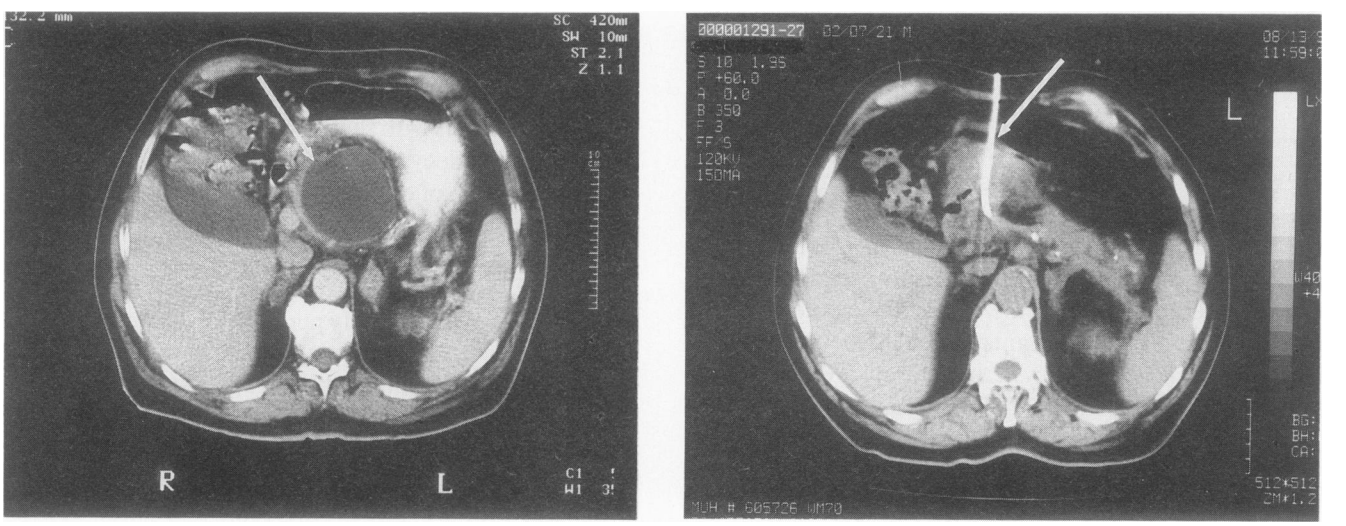

FIG. 2. (A, left) Computed tomography scan showing pseudocyst in region of pancreatic head (white arrow). (B, right) Five days later, needle and guidewire localization preceded placement of 8-French pigtail catheter (white arrow) into cyst.

TABLE 1. *Patient, Sex, Age, Pseudocyst, Cause, and Predominant Cyst Location*

	Group I (Internal) n = 42	Group II (Percutaneous Catheter Drainage) n = 52
Sex		
M	29 (69.0%)	44 (84.6%)
F	13 (31.0%)	8 (15.4%)
Age (yr)		
Mean	45.5	43.2
Range	23–72	21–66
Pseudocyst cause		
Alcohol abuse	31 (73.8%)	42 (80.8%)
Gallstones	5 (11.9%)	3 (5.8%)
Other	6 (14.3%)	7 (13.5%)
Pseudocyst location		
Head	12 (28.6%)	13 (25.0%)
Body	23 (54.8%)	29 (55.8%)
Tail	7 (16.7%)	10 (19.2%)

(mean, 24.2 *versus* 61.4 days; median, 18 *versus* 55 days, $p < 0.05$). Organisms cultured from drainage were not present in concomitant blood cultures obtained from 16 patients. Length of hospital stay was similar (mean, 36.7 *versus* 39.8 days; median, 36 *versus* 30 days, not significant).

There were three postoperative deaths in group I (Table 6) and none in group II (7.1 *versus* 0%; $p < 0.05$).

Subsequent operations required for complications related to chronic pancreatitis are listed in Table 7. In group I, four patients had subsequent operations. One patient who had a cystjejunostomy developed chronic pain in association with a dilated pancreatic duct, which was managed with lateral pancreaticojejunostomy 1 year later. Two patients required gastrojejunostomy for gastric outlet obstruction due to duodenal stenosis, and one required a biliary enteric bypass. In group II, two patients subsequently underwent lateral pancreaticojejunostomy, one in combination with biliary enteric bypass. Three patients had nondilated pancreatic ducts with strictures in the genu or midbody; two had retrograde drainage of the duct after caudal resection using a caudal pancreaticojejunostomy.

TABLE 2. *Antecedent Complications*

	Group I (Internal) n = 42	Group II (Percutaneous Catheter Drainage) n = 52
Cystenteric fistula	4	1
Pancreatic ascites	1	10
Pancreatopleural fistula	0	3
Biliary obstruction	1	4
Duodenal obstruction	0	2
Splenic vein occlusion	1	3
Total patients*	7 (16.7%)†	20 (38.5%)

* Includes patients with multiple complications.
† $p < 0.05$ compared with Group II.

TABLE 3. *Antecedent Cyst Drainage Procedures*

	Group I (Internal) n = 42	Group II (Percutaneous Catheter Drainage) n = 52
Cystgastrostomy	4	4
Cystjejunostomy	1	0
External drainage	1	2
Percutaneous catheter drainage	0	1
Total patients	6 (14.2%)	7 (13.5%)

The third had a resection of a cyst and midbody stricture with pancreatic duct ligation. Another patient developed ductal obstruction in the tail of the pancreas after splenectomy for traumatic splenic rupture with prolonged pseudocyst drainage, which was managed with caudal resection and caudal pancreaticojejunostomy. Two patients had subsequent vagotomy and gastrojejunostomy for gastric outlet obstruction due to duodenal stenosis. Two patients with multiple cysts initially treated with PCD had retrogastric collections, which were inaccessible to PCD and required operative external drainage.

Discussion

The two groups were remarkably similar in terms of patient characteristics such as age, sex, and pseudocyst location and number. The underlying cause was predominantly chronic pancreatitis secondary to alcohol abuse, consistent with previous reports in the literature.[4–11]

Both groups contained examples of pseudocyst complications that were present at the time treatment was initiated. The number of antecedent complications was substantially higher in group II. This was, at least in part, related to improved diagnostic technology available in the later years of the review, and accounts for an increased frequency of identification of pancreatic ascites (CT), biliary stricture (endoscopic retrograde cholangiopancreatography), and splenic venous occlusion (CT, splanchnic angiography).[12]

TABLE 4. *Morbidity*

	Group I (Internal) n = 42	Group II (Percutaneous Catheter Drainage) n = 52
Hemorrhage	2 (4.8%)	1 (1.9%)
Sepsis	2 (4.8%)	1 (1.9%)
Respiratory failure/pneumonia	2 (4.8%)	1 (1.9%)
Myocardial infarction	1 (2.4%)	1 (1.9%)
Gastric ileus	1 (2.4%)	0
Colonic ileus	0	1 (1.9%)
Pneumothorax	0	1 (1.9%)
Pancreatocolonic fistula	0	1 (1.9%)
Dislodged catheter	0	3 (5.7%)
Drain track infection	0	26 (50.0%)
Pancreatocutaneous fistula	0	52 (100%)

TABLE 5. *Organisms Cultured From Drainage Catheters in 25 Patients*

Organism	Patients (n)
Gram-positive organisms	
Coagulase-negative Staphylococcus	13
Staphylococcus aureus	8
Enterococcus sp.	4
Corynebacterium sp.	1
Methicillin-resistant *Staphylococcus aureus*	1
Streptococcus viridans	1
Streptococcus sanguis I	1
Gram-negative organisms	
Pseudomonas aeruginosa	5
Escherichia coli	3
Enterobacter cloacae	2
Proteus mirabilis	2
Pseudomonas maltophilia	2
Pseudomonas fluorescens	1
Klebsiella oxytocca	1
Klebsiella pneumoniae	1
Serratia marcescens	1
Acinetobacter calcoaceticus var. anitratus	1
Bacteroides ovatus	1
Fungal organisms	
Candida albicans	2

The complications resulting from internal drainage procedures differed, both in type and magnitude, from those associated with PCD. Major complications after internal drainage consisted of gastrointestinal hemorrhage, sepsis, respiratory failure and pneumonia, and myocardial infarction, and were similar to previous reports for this procedure[4–6,13]; the morbidity rate of 16.7% was consistent with recent reports of operative management of pancreatic pseudocysts.[8–10,14–16] Similar complications occurred in patients with PCD and, although less frequent, the difference was not significant. Previous experience with external pancreatic fistula after operative external drainage of pancreatic pseudocysts indicated that most fistulas close spontaneously over the course of 2 to 6 weeks.[17] Our results are similar to this experience. Octreotide acetate, a somatostatin analog, inhibits pancreatic exocrine secretion[18–20] and holds considerable promise for accelerating closure of pancreatic fistulas after PCD.

The most prominent problem encountered in the use of PCD was the high rate of drain track infection. All of these patients had clinical findings indicating infection, including fever or leukocytosis, which was treated with appropriate systemic antibiotics and responded promptly; none developed concomitant positive blood cultures or an abscess that required operative drainage. We presume that these infections were caused by skin contaminants, based on the high number of infections caused by resident normal flora of the skin. Also noted were a high number of infections with gram-negative bacilli, organisms known to colonize the skin of hospitalized patients.[21] The insertion of catheters through the skin may lead to local infection, which can progress to deep infection and bacteremia. A direct relationship has been observed between duration of catheterization and the incidence of infection with indwelling intravascular catheters.[22] Our findings were similar with PCD; drain track infection was associated with increased duration of catheter drainage. The obvious importance of drain track infection and its effect on the length of fistula drainage dictates a need to improve the technique of catheter management during PCD. During the period of study, sterile dressings were maintained over the catheter site at skin level. We have established a catheter care protocol similar to that employed with central venous lines in an effort to reduce the rate of drain track infection. Antiseptic and antibiotic catheter irrigations have not been employed.

Three deaths occurred in the group I patients (7%); this is consistent with recent studies of internal drainage, which reported mortality rates ranging from 8% to 13%.[4–7,13] The three deaths occurred in the middle decade of the study; sepsis and associated respiratory failure were major factors. Whether modalities of treatment currently available, including advances in anesthesia, improved antibiotic therapy, and better respiratory therapy would have prevented these unsatisfactory outcomes is problematic.

TABLE 6. *Postoperative Deaths in Group I*

Year	Age	Sex	Operation	Comorbid Conditions	Complications	Postoperative Day of Death
1972	72	F	Cystgastrostomy, cholecystectomy, common bile duct exploration, cholangiogram excision cystjejunal fistula	Cholelithiasis, cystjejunal fistula	Staphylococcal sepsis, upper gastrointestinal bleeding due to gastritis, myocardial infarction	76
1978	40	M	Cystgastrostomy	Head and neck squamous cell cancer	Gram-negative sepsis, adult respiratory distress syndrome	16
1979	24	F	Cystgastrostomy	None	Pneumonia, adult respiratory distress syndrome	42

TABLE 7. *Time Interval From Drainage Procedure to Subsequent Operation for Management of Chronic Pancreatitis*

Operation	Group I (Internal) n = 42 No. (Interval)	Group II (Percutaneous Catheter Drainage) n = 52 No. (Interval)
Lateral pancreaticojejunostomy	1 (1 yr)	2 (1 yr)
Caudal pancreaticojejunostomy	0	3 (<1 yr)
Caudal pancreatectomy with cyst excision	0	1 (<1 yr)
Gastrojejunostomy	2 (2 yr, 1 yr)	2 (<1 yr)
Biliary–enteric bypass	1 (4 yr)	1 (1 yr)*
External cyst drainage	0	2 (<1 yr)
Total patients	4 (9.5%)	10 (19.2%)

* Also had lateral pancreaticojejunostomy.

No deaths have occurred up to the present in patients treated with PCD.

The length of hospital stay was similar in the two groups. In group I, timing of the internal drainage procedure often was determined by a policy to perform the operation approximately 6 weeks after the cyst became clinically apparent. This was based on evidence that some pseudocysts spontaneously resolve during this interval,[23] and that cysts that persist develop a dense fibrous wall that facilitates a safe cystenterostomy. After operation, the recovery period for internal drainage was usually short in uncomplicated cases. In group II patients, less importance was attached to the development of cyst wall maturity, and catheter drainage was instituted soon after diagnosis of the pseudocyst. Much of the hospitalization was required to stabilize and manage the resulting external pancreatic fistula and associated drain track infections. Although several early reports suggested that fistulas that occur after PCD close over the course of several weeks,[1-3] our mean drainage time was 6 weeks.

It is important to emphasize that successful elimination of a pseudocyst by any means cannot be expected to correct the underlying chronic pancreatitis that is responsible for the development of the pseudocyst in most cases. A number of patients in both groups required previous pseudocyst drainage, and therefore represented a recurrence of the problem. Not unexpectedly, a similar number of patients treated either with internal drainage or PCD subsequently have required surgical procedures to manage progression of the underlying pancreatitis. This fact supports the logic of combining a retrograde drainage procedure and cyst decompression or resection whenever possible. For example, smaller cysts often can be decompressed and incorporated into a lateral pancreaticojejunostomy to achieve a more definitive correction both for the pseudocyst and the underlying obstructed and dilated pancreatic ducts. Smaller cysts located in the pancreatic tail can be resected and the pancreatic duct drained either with caudal or lateral pancreaticojejunostomy.

Rarely, pancreatic neoplasms may present as pseudocysts. We are aware of two patients with pancreatic ductal adenocarcinoma who presented with a pseudocyst that developed secondary to ductal obstruction during the study period. These patients were managed initially with internal drainage only to return with evidence of tumor progression; accordingly, they were excluded from the study. Warshaw et al.[24] have emphasized that tumors may masquerade as pseudocysts; this is particularly true with rare cystic neoplasms such as pseudomucinous cystadenocarcinoma. This uncommon occurrence provides justification for biopsy of the cyst wall at the time of internal drainage to avoid overlooking a neoplastic process. It also raises a modest level of concern in cases in which PCD is employed. Failure of cyst resolution, early reaccumulation of a cystic collection, or persistence of the cyst wall should raise suspicion that a tumor, rather than a simple pseudocyst, may be present. To our knowledge, we have not encountered this problem in any patient managed with PCD.

Several recent reports emphasize that asymptomatic or minimally symptomatic pancreatic pseudocysts identified on CT scan can be safely managed nonoperatively.[25,26] This experience indicates that about one half to two thirds of patients managed expectantly will avoid operation over an observation period longer than 1 year. Multiloculated cysts and cysts larger than 6 cm in diameter were more likely to require operative treatment.

Our findings indicate that pancreatic pseudocysts can be successfully managed with either operative internal drainage or percutaneous catheter drainage. Internal drainage requires a period of observation before operation to permit maturation of the cyst wall; however, the postoperative recovery usually is prompt, and postoperative pancreatic fistula is rare. Complications occur in approximately 20%, with sepsis a major factor. Current mortality rates are below 6%.[8,9,16,25,27] Percutaneous catheter drainage can be instituted early in the course, and has the obvious advantage of avoiding a major abdominal operation, which violates the surgical field in those cases requiring a subsequent procedure such as lateral pancreaticojejunostomy to correct underlying pancreatic ductal obstruction associated with chronic pancreatitis. The principal disadvantage of PCD is the resulting pancreatic fistula, which in our experience required 6 weeks to close, and which carried a substantial risk of infection; the latter problem responds to antibiotic therapy, but is associated with an extended drainage period. We have not encountered a death that occurred as a consequence of PCD when employed electively in the management of pseudocysts.

In considering the approach to pancreatic pseudocysts,

the size as well as associated pancreatic pathology enter into the choice of management:

Asymptomatic pseudocysts less than 6 cm in diameter often can be followed with an expectation of complete resolution in most cases and with a low incidence of complications.

Small symptomatic pseudocysts that occur in association with a dilated pancreatic duct can be decompressed and incorporated into a lateral pancreaticojejunostomy used for ductal drainage.[28] Occasionally, smaller cysts in the tail may be associated with little or no ductal dilation. Because of their location, they are difficult to drain internally or externally and carry a risk of hemorrhage because of the close proximity to the spleen and its pedicle. We have resected these, along with the spleen, and drained the transected pancreas with a caudal pancreaticojejunostomy with success.

Because of their location, large pseudocysts preclude any definitive approach to the underlying pancreatic inflammatory disease, and our management preference is PCD. This approach should be undertaken recognizing that subsequent operative correction of underlying pancreatic pathology may be required. We continue to use internal drainage when PCD is not possible because of pseudocyst location.

The principal disadvantages related to PCD include prolonged external pancreatic fistula and secondary infection of the catheter track. Both of these problems may be in part correctable using somatostatin analogs to promote early fistula closure and fastidious attention to the prevention of drain track infections.

Acknowledgments

The authors thank Christopher Hannegan, B.A., for statistical consultation and Anita Kalchthaler, R.N., for chart research.

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DISCUSSION

DR. GEORGE JORDAN (Houston, Texas): Dr. Bland, Dr. Jones; Drs. Anderson and Adams very kindly sent me a copy of their manuscript, and I recommend careful reading of this manuscript to all of you because it contains a lot of information that Dr. Anderson did not have time to present in his report today. The initial treatment of pseudocyst was primarily by external drainage. And as all of you know, a number of techniques were developed. This included marsupialization, which is a highly morbid procedure, really. Most commonly, the external drainage was