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Sterile Fluid Collections in Acute Pancreatitis: Catheter Drainage Versus Simple Aspiration

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Abstract

Purpose: To compare the clinical outcome of needle aspiration versus percutaneous catheter drainage of sterile fluid collections in patients with acute pancreatitis.

Methods: We reviewed the clinical and imaging data of patients with acute pancreatic fluid collections from 1998 to 2003. Referral for fluid sampling was based on elevated white blood cell count and fevers. Those patients with culture-negative drainages or needle aspirations were included in the study. Fifteen patients had aspiration of 10–20 ml fluid only (group A) and 22 patients had catheter placement for chronic evacuation of fluid (group C). We excluded patients with grossly purulent collections and chronic pseudocysts. We also recorded the number of sinograms and catheter changes and duration of catheter drainage. The CT severity index, Ranson scores, and maximum diameter of abdominal fluid collections were calculated for all patients at presentation. The total length of hospital stay (LOS), length of hospital stay after the drainage or aspiration procedure (LOS-P), and conversions to percutaneous and/or surgical drainage were recorded as well as survival.

Results: The CT severity index and acute Ransom scores were not different between the two groups ($p = 0.15$ and $p = 0.6$, respectively). When 3 crossover patients from group A to group C were accounted for, the duration of hospitalization did not differ significantly, with a mean LOS and LOS-P of 33.8 days and 27.9 days in group A and 41.5 days and 27.6 days in group C, respectively ($p = 0.57$ and 0.98, respectively). The 60-day mortality was 2 of 15 (13%) in group A and 2 of 22 (9.1%) in group C. Kaplan–Meier survival curves for the two groups were not significantly different ($p = 0.3$). Surgical or percutaneous conversions occurred significantly more often in group A (7/15, 47%) than surgical conversions in group C (4/22, 18%) ($p = 0.03$). Patients undergoing catheter drainage required an average of 2.2 sinograms/tube changes and kept catheters in for an average of 52 days. Aspirates turned culture-positive in 13 of 22 patients (59%) who had chronic catheterization. In group A, 3 of the 7 patients converted to percutaneous or surgical drainage had infected fluid at the time of conversion (total positive culture rate in group A 3/15 or 20%).

Conclusions: There is no apparent clinical benefit for catheter drainage of sterile fluid collections arising in acute pancreatitis as the length of hospital stay and mortality were similar between patients undergoing aspiration versus catheter drainage. However, almost half of patients treated with simple aspiration will require surgical or percutaneous drainage at some point. Disadvantages of chronic catheter drainage include a greater than 50% rate of bacterial colonization and the need for multiple sinograms and tube changes over an average duration of about 2 months.

Key words: Catheter drainage—Fluid collection—Needle aspiration—Pancreatitis, acute

Acute pancreatitis leads to variable amounts of pancreatic and fat necrosis in addition to drainable fluid collections. Published success rates for percutaneous drainage of fluid collections due to acute pancreatitis vary widely from less than 50% up to 90% [1–5] due to the lack of reporting standards for type of material drained percutaneously. Pancreatic abscesses respond best, followed by pseudocysts, and lastly pancreatic necrosis [6]. A consensus of pancreatic specialists in Atlanta in 1992 established improved nomenclature for acute pancreatic processes ranging from simple interstitial pancreatitis without fluid collections up to severe pancreatitis with infected necrosis [7]. Clouding the picture further is the fact that patients with acute pancreatitis

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frequently present with not only abdominal pain but also fevers and elevated white blood cell counts. Many times, this is a systemic response to pancreatitis and is not secondary to infection within the pancreatic fluid collection. The inflammatory process involved in severe acute pancreatitis leads to the release of numerous cytokines and inflammatory mediators responsible for systemic manifestations of this disease, which may be indistinguishable from sepsis [8–10].

Not surprisingly, percutaneous aspiration and drainage of acute pancreatic fluid collections often yields sterile fluid collections by cytologic and bacteriologic culture analysis. In our experience, sterile pancreatic fluid collections that are drained percutaneously often become secondarily infected due to colonization by skin organisms and this fluid collection is converted to an abscess leading to further morbidity for these already ill patients. Accordingly, the objective of this study was to determine the clinical impact of drainage versus simple needle aspiration and expectant management for sterile acute pancreatic fluid collections, with the hypothesis that catheter drainage of such collections provides little clinical benefit and in fact may increase morbidity due to long catheter dwell-times and superinfection of intra-abdominal cavities. We also examined these patients' outcomes to determine whether simple aspiration and close follow-up increased mortality or the hospital length of stay compared with patients who had sterile fluid drained completely.

Materials and Methods

We retrospectively studied patients who were admitted to our institution with pancreatic fluid collections between 1998 and 2003. Patients were excluded if the fluid collections were either postoperative in nature or were chronic and encapsulated (pseudocysts). Seventy-three patients had 118 percutaneous interventions for acute pancreatic fluid collections. Gram stain, cell count, culture results, and chemistries of the aspirated fluid were obtained and only patients with a negative Gram stain and culture results and few or no polymorphonuclear cells (PMNs) were included in this study (sterile fluid collections). Patients with pancreatic abscess or infected necrosis, therefore, were not included. After applying these exclusion criteria, 15 patients had needle aspiration and 22 patients had catheter drainage of acute, sterile pancreatic fluid collections.

Needle aspiration (group A patients) consisted of image-guided placement of an 18–20G needle into a pancreatic fluid collection and withdrawal of 10–20 ml of fluid for chemical and microbiological analysis. No attempt was made to completely aspirate the fluid collection. The purpose of a partial aspiration was to determine whether a peripancreatic fluid collection was infected or sterile. The aspiration, as performed in this study, was not intended to be therapeutic, only diagnostic. Catheter drainage (group C patients) entailed the placement of a 10–22 Fr pigtail catheter into the fluid using a tandem-trocar or Seldinger technique. After catheter insertion, as much fluid as possible was removed and the cavity irrigated copiously with normal saline.

All samples were submitted for both Gram stain and aerobic, anaerobic, and fungal culture analysis at the time of aspiration or drainage. Culture results and Gram stains for all patients in groups A and C were negative with few or no PMNs. Since all patients were on broad-spectrum antibiotics at the time of drainage, aspirates with many PMNs were excluded from this study to avoid the inclusion of sterile, treated abscesses. We potentially excluded patients with sterile fluid collections containing many PMNs. However, in order to compare only patients with sterile fluid collections, we felt that we should be fairly rigorous in removing patients with possible infection. As PMNs are a marker of acute infection, we felt that fluid collections with a large number of PMNs should be excluded, even if the cultures were negative. Although this criterion reduced the size of our study group, we think it removed a potential source of bias.

Drainage catheters in group C ranged from 10 to 22 Fr and were placed to gravity drainage with irrigation two or three times a day with normal saline. Output from the drainage catheters was checked daily and sinograms were performed as needed until the cavity resolved and no fistula was evident. The choice of catheter drainage or aspiration was made by the attending interventional radiologist and was not randomized.

Some physicians in our group place percutaneous drains in all acute pancreatic fluid collections while others prefer aspiration and expectant management. This investigation directly compares these two approaches. To minimize the bias inherent in such a retrospective study, the acute Ransom score, the CT severity index (CTSI), and size of the fluid collection were defined and compared between the two groups (aspiration in group A vs. catheter drainage in group C). These two patient groups were then compared with respect to mortality, length of hospital stay (LOS), and the length of hospital stay after percutaneous aspiration or drainage (LOS-P). For the patients who had catheter drainage of fluid collections (group C), we identified the number of days the catheter was in place, the frequency of sinograms and tube changes, and the incidence of surgical conversion (failure of percutaneous drainage). For the patients who had only needle aspiration of fluid collections (group A), we identified the number of patients who converted to either percutaneous drainage or surgery. The decision to convert to surgical and/or percutaneous drainage was made by the attending surgeon and was based on continued fevers, raised white blood cell counts, or other clinical evidence of sepsis. Statistical analysis was done using Kaplan–Meier survival curves and Kruskal–Wallis one-way analysis of variance to compare the two groups. A p value of less than 0.05 was considered significant.

Results

Patient Characteristics

In the aspiration-only group (n = 15), there were 8 men and 7 women with an average age of 42.2 years (range 17–73 years). Etiology of pancreatitis was gallstones in 7 cases, idiopathic in 3, alcohol-related in 2, pancreatic cancer in 2, and trauma in 1. In the catheter drainage group (n = 22), there were 16 men and 6 women with an average age of 44.3 years (range 18–65 years). Pancreatitis was due to idiopathic causes in 11 cases, gallstones in 4, alcohol in 2, hypertriglyceridemia in 2, trauma in 2, and duodenal ulcer in 1 case. The average CTSI was 6.3 (SD = 3.1) and the average acute

Table 1. Demographics and clinical data of patients undergoing aspiration versus catheter drainage of acute pancreatic fluid collections

Patient characteristics	Group A (n = 15)	Group C (n = 22)	p value
Age (years)	42.2	44.3	0.7
Sex (M/F)	8/7	16/6	
CT severity index (CTSI)	6.3	4.6	0.15
Acute Ranson score	1.7	1.5	0.6
Etiology of pancreatitis	GS, 7; ETOH, 2; other, 6	GS, 4; ETOH, 2; other, 16	

GS, gallstones; ETOH, alcohol-related.

Ranson score was 1.7 (SD = 0.9) in group A compared with 4.6 (SD = 2.1) and 1.5 (SD = 0.8) in group C, respectively. Median values for CTSI and Ranson score were similar to the mean values for groups A and C and were 6.0 and 1.0 and 4.0 and 1.0, respectively. There was no statistical difference between the two groups in Ranson score (p = 0.6), age (p = 0.7), or CTSI (p = 0.15) (Table 1). The average maximum diameter of fluid collections was 8.7 cm in group A (range 3–15 cm) and 14.4 cm in group B (range 5–20 cm)—a statistically significant difference (p = 0.0002). The fluid collections were located in the retroperitoneal, peripancreatic, or lesser sac spaces and were discrete round or lenticular fluid collections. All patients in both groups were on broad-spectrum intravenous antibiotics at the time of drainage or aspiration.

Patient Morbidity

The patients in group C had anywhere between 0 and 11 tube changes/sinograms (average of 2.2 per patient) and the average catheter dwell-time was 52 days (SD = 43 days). Patients in group C had tube problems (clogged, leaking, or displaced catheters) from 0 to 4 times per patient, averaging 1.3 problems per patient, and 4 patients (18%) required hospitalization for sepsis. In the needle aspiration group, 2 of 15 (13%) patients went on to percutaneous drainage, 4 of 15 (27%) had surgical drainage/debridement, and 1 of 15 had both percutaneous drainage and then surgery (total conversions 7 of 15 patients or 47%). This frequency of conversion was significantly greater than the 4 of 22 (18%) of patients in group C who eventually required surgical management (p = 0.03) (Fig. 1). In group A, 2 of the 4 patients converted to surgical debridement, 1 of 2 patients converted to percutaneous drainage, and 3 of 15 or 20% of all group A patients developed infected fluid collections. Thirteen of the 22 group C patients (59%) eventually had colonized or infected fluid, including 2 of the 5 patients converted to surgical drainage. Seven patients (47%) in group A recovered completely after needle aspiration only.

Patient Mortality

The 60-day mortality was 2 of 15 (13%) in the aspiration group and 2 of 22 (9.1%) in the drainage group (p = 0.3) and these deaths were all secondary to multiorgan failure. There was a mean follow-up period of 865 days for group A and 890 days for group B (Fig. 2). The 60-day mortality was calculated to compare the groups since 2 months was the approximate average catheter dwell-time in the group C patients.

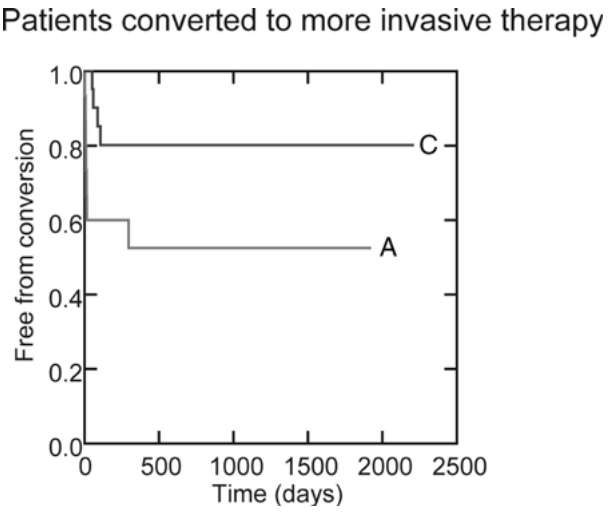

Fig. 1. Kaplan–Meier curves showing conversions to more invasive drainage procedures (surgery for group C, percutaneous drainage and/or surgery for group A).

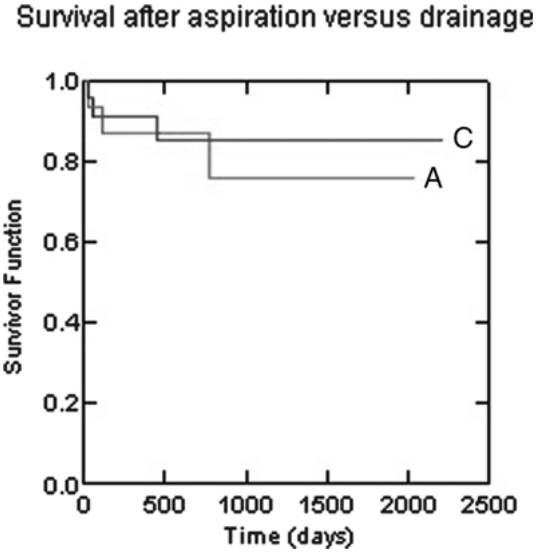

Fig. 2. Kaplan–Meier curves showing survival of group A versus group C patients.

Table 2. Outcome of patients undergoing aspiration versus catheter drainage of acute pancreatic fluid collections

Clinical outcome	Group A (n = 15)	Group C (n = 22)	p
LOS (days)	51	31	0.27
LOS-P (days)	41	19	0.31
LOS excluding crossover[a] (days)	33.8	41.5	0.57
LOS-P excluding crossover[a] (days)	27.9	27.6	0.98
60-day mortality	2 (13%)	2 (9.1%)	0.30
Tube changes/sinograms per patient	0	0–11 (av. 2.2/patient)	NA
Tube problems per patient	0	0–4 (av. 1.3/patient)	NA
Conversions			
Surgery	4 (27%)	4 (18%)	
Percutaneous drainage	2 (13%)		
Both	1 (7%)		
Total conversions to more invasive therapy	7 (47%)	4 (18%)	0.03
No. turning culture-positive	3/15 (20%)	13/22 (59%)	0.03
Catheter dwell-time (days)	0	52	NA

NS, not significant; NA, not applicable.
[a]Accounts for 3 patients in group A who crossed over to group C after catheter drainage.

Length of Hospitalization

The LOS averaged 51 days (SD = 56 days) for group A and 31 days (SD = 30 days) for group C (p = 0.3) and the LOS-P was 41 days (SD = 51 days) and 19 days (SD = 21 days) for groups A and C, respectively (p = 0.3). However, when the 3 patients who crossed over to group C from group A are accounted for, the LOS and LOS-P were very similar, with an LOS of 33.8 and 41.5 days (p = 0.57) and LOS-P of 27.9 and 27.6 days (p = 0.98) for groups A and C, respectively (Table 2).

Discussion

Acute pancreatitis manifests as a clinical spectrum. Mild interstitial pancreatitis presents with abdominal pain and usually responds to conservative therapy. Some patients with more severe pancreatitis develop acute fluid collections and/or necrosis. The infection rate of acute pancreatic fluid collections is 8–2% vs. 30–40% of patients with acute necrotizing pancreatitis [11]. Abscess formation typically develops 2–5 weeks after the onset of symptoms and infectious complications are the cause of death in about 80% of patients with acute pancreatitis [11]. Severe pancreatitis causes systemic release of cytokines and proteases, leading to activation of inflammatory cells (elevated white blood cell count), fever, and multiorgan dysfunction [12]. Since this situation may mimic sepsis, the search for an infectious source very often prompts percutaneous sampling or drainage of peripancreatic fluid collections.

Aspiration of such fluid collections usually reveals indeterminate bloody or turbid fluid and it is difficult to distinguish abscess from sterile fluid by gross inspection of the aspirate. Therefore, these fluid collections are often drained percutaneously with the intent of removing the catheter if microbiological analysis confirms sterile fluid. Once the sterility of the collection has been confirmed, however, many of these catheters are left in place for several weeks or even months due to persistent high output of amylase-rich fluid. Such prolonged percutaneous intubation often leads to colonization of the cavity with microorganisms and results in frequent sinograms and tube changes. In our study tube changes were frequently performed for blocked catheters in patients who became septic while at home (average occurrence of 1.3 times/patient), necessitating a semi-urgent procedure. In fact, almost 20% of our patients required hospitalizations for such catheter problems (Fig. 3). A recent investigation of surgical versus percutaneous drainage of pancreatic fluid found that 74% of patients with catheters experienced some complication, including a 32% risk of sepsis, a 24% risk of catheter occlusion, and a 26% risk of tract cellulitis [13]. To embark on this long course of percutaneous therapy with its attendant complications requires some justification. Therefore, we compared the hospital LOS, the LOS-P, mortality, and the conversion to more invasive procedures (surgery or percutaneous drainage) between groups of patients who had aspiration versus those who had catheter drainage.

As this was a retrospective review without randomization, it was important to verify that the two groups are similar with respect to clinical status and extent of pancreatitis and volume of fluid collections. We found that groups A and C did not differ significantly with respect to Ranson score and CTSI, indicating that the comparison of the clinical outcome between the two groups is a valid one. However, the size of fluid collection was significantly larger in group C compared with group A. This difference likely represents a natural tendency to aspirate smaller fluid collections and drain larger ones. Our data indicate no significant difference in LOS, LOS-P, or mortality between the two groups. Because 3 patients in group A converted to chronic percutaneous drains, we excluded their LOS and LOS-P and included these data in the group C analysis, since these patients essentially ''crossed-over'' to the other group. However, these patients were considered group A for data analysis otherwise. On the other hand, health resource

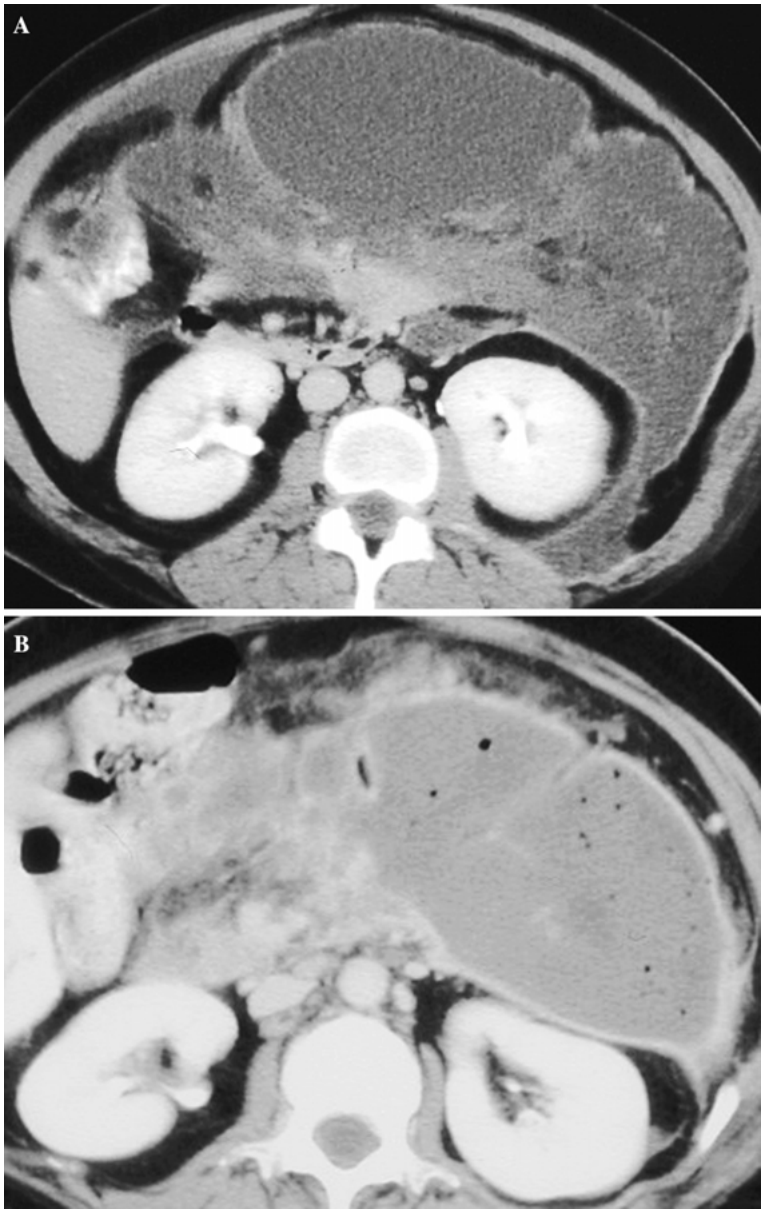

Fig. 3. **A** Patient with acute pancreatic fluid collection. Catheter drainage revealed sterile fluid with no inflammatory cells. **B** One month later, the patient was admitted to the hospital with sepsis due to tube blockage. The catheterized cavity was colonized with *Staphylococcus aureus* and had become a frank abscess.

utilization (sinograms) and morbidity (tube problems) was significant for the catheter drainage group, with 18% of patients requiring subsequent hospitalization for sepsis due to blocked catheters and an average catheter dwell-time of almost 2 months.

This study is not statistically robust given the small sample size and the usual limitations of a retrospective analysis and a larger, prospective study may show some clinical benefit from catheter drainage, perhaps in selected patients, that was not apparent in the present study. Nevertheless, the ability to avoid chronic catheters and multiple sinograms in over half the patients in group A suggests that the conservative approach of aspiration and follow-up is useful in some patients as well. The ''middle ground'' approach of catheter drainage for 1–2 days with removal of catheters draining sterile fluid might optimize clinical outcome while avoiding the complications of chronic catheterization of sterile fluid collections [14]. More invasive therapy for group A was necessary in almost half the cases (47%), which was significantly higher than the conversion to more invasive procedures in group C (18%). Interestingly, only about half of the patients in groups A and C had infected fluid collections at the time of second-line therapy (surgery or catheter drainage). Although we agree that percutaneous drainage of obviously infected pancreatic fluid collections is an effective, yet prolonged process, we suggest that, on the basis of our data, sterile fluid collections can be treated expectantly, with negative aspirations followed closely rather than committing patients to long-term drainage, superinfection, repeated sinography, and troublesome and occasionally life-threatening tube problems. Certainly, some patients treated in this manner will need

repeat aspirations/drainage or surgery (47% in our group) due to a continued poor clinical course, but the savings in tube changes and chronic catheter care may justify this approach in the appropriate clinical setting.

The clinical success of pancreatic fluid evacuation (surgical or percutaneous) is clearly related to the removal of pus in the setting of sepsis. However, the clinical impact of the drainage of sterile fluid is not straightforward, although some believe that the removal of toxic mediators and inflammatory substances from sterile fluid may ameliorate the systemic failure induced by severe acute pancreatitis [12]. On the other hand, the ability to eventually remove a percutaneous catheter from an acute pancreatic fluid collection depends on the extent of pancreatic ductal communication and the patency of the downstream pancreatic duct, with many of these catheters eventually forming a pancreatico-cutaneous fistula and chronically draining a truncated pancreatic duct in the body/tail [13]. In fact, in patients undergoing longitudinal pancreaticojejunostomy for ductal decompression, any existing pseudocysts can be safely aspirated in the operating room and they will not recur [15]. Although supervening infection is an indication for surgical or percutaneous drainage, sterile fluid collections can probably be left alone, in which case they will form mature pseudocysts or resolve spontaneously, depending on their size and, more importantly, on the integrity of the pancreatic duct and the size of the cyst–duct communication.

Our current management of acute pancreatic fluid collections, given the findings from this study, is aspiration or catheter drainage, with removal of drainage catheters at 2 days if the 48-hr culture results remain negative. With this approach, we hope to spare about 50% of patients from needless chronic catheterization and bacterial colonization of their fluid collections.

Conclusions

There is no difference in the mortality and hospital length of stay in patients undergoing catheter drainage versus aspiration of sterile acute pancreatic fluid collections. Chronic catheterization of sterile fluid collections often leads to bacterial colonization and tube problems with increased morbidity and an average catheter dwell-time of almost 2 months. The approach of needle aspiration of acute sterile pancreatic fluid collections may reduce this expense and morbidity, although these patients must be followed closely as almost half will eventually need surgical or percutaneous drainage.

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