

REVIEW ARTICLE

Pancreatic Pseudocysts

Observation, Endoscopic Drainage, or Resection?

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SUMMARY

Background: Pancreatic pseudocysts are a common complication of acute and chronic pancreatitis. They are diagnosed with imaging studies and can be treated successfully with a variety of methods: endoscopic transpapillary or transmural drainage, percutaneous catheter drainage, laparoscopic surgery, or open pseudocysto-entrostomy.

Methods: Relevant publications that appeared from 1975 to 2008 were retrieved from the MEDLINE, PubMed and EMBASE databases for this review.

Results: Endoscopic pseudocyst drainage has a high success rate (79.2%) and a low complication rate (12.9%). Percutaneous drainage is mainly used for the emergency treatment of infected pancreatic pseudocysts. Open internal drainage and pseudocyst resection are surgical techniques with high success rates (>92%), but also higher morbidity (16%) and mortality (2.5%) than endoscopic treatment (mortality 0.7%). Laparoscopic pseudocysto-entrostomy, a recently introduced procedure, is probably similar to the endoscopic techniques with regard to morbidity and mortality.

Conclusions: An interdisciplinary approach is best suited for the safe and effective stage-specific treatment of pancreatic pseudocysts. The different interventional techniques that are currently available have yet to be compared directly in randomized trials.

Key words: pancreatitis, drainage, endoscopy, minimally invasive therapy, spontaneous remission

The decision whether to treat a patient with a pancreatic pseudocyst, as well as when and with what technique, is a difficult one. This review article is intended to help physicians base their therapeutic decisions on the current state of therapeutic technology and published data.

Definition

The management of cystic changes of the pancreas is an old problem. At the beginning of the twentieth century, Eugene Opie was the first to distinguish true pancreatic cysts, which are, by definition, lined by epithelium, from pseudocysts, which are surrounded by a wall composed of collagen and granulation tissue. The Atlanta classification of 1993 further distinguishes acute from chronic pseudocysts; the definition of chronicity is based, not on the age of the cyst, but rather on the underlying illness (*Figure 1*) (1). The Atlanta classification consists of four distinct disease entities:

- acute fluid collections that develop early in the course of acute pancreatitis and do not yet have a cyst wall;
- acute pancreatic pseudocysts, which arise as sequelae of acute pancreatitis or trauma, and whose wall consists of granulation tissue and extracellular matrix;
- chronic pancreatic pseudocysts, which arise as sequelae of chronic pancreatitis and are likewise surrounded by a wall; and
- pancreatic abscesses, which are intra-abdominal collections of pus immediately adjacent to the pancreas, without any large areas of necrosis.

Acute fluid collections, pancreatic pseudocysts, and pancreatic abscesses can be distinguished from one another by the history, imaging studies of the wall of the abnormality and its contents, and, if necessary, a needle aspiration of the content.

Incidence and etiology

Pancreatic pseudocysts often arise as a complication of acute or chronic pancreatitis. The prevalence of pancreatic pseudocysts in acute pancreatitis has been reported to range from 6% to 18.5% (2, 3). The prevalence of pancreatic pseudocysts in chronic pancreatitis is 20% to 40% (4). Pancreatic pseudocysts most commonly arise in patients with alcoholic chronic pancreatitis (70% to 78%) (5). The second most common cause is idiopathic chronic pancreatitis (6% to 16%), followed by biliary pancreatitis (6% to 8%).

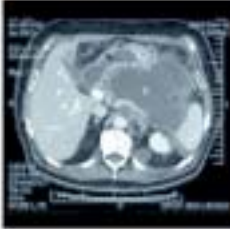

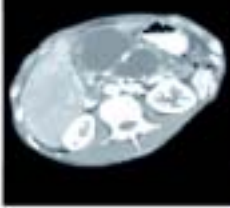
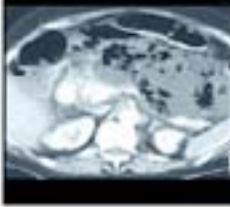
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The Atlanta classification and its therapeutic implications

FIGURE 1

Designation	Definition	Intervention
 <p>Acute fluid collection</p>	<p>Arises in the early course of acute pancreatitis; usually immediately adjacent to the pancreas; has no cyst wall; possible infection; high likelihood of spontaneous regression. Treatment rarely needed (generally only when infected).</p> <p>Etiology: acute (less commonly, chronic) pancreatitis.</p>	<p>Transcutaneous drainage: Success rate 42–96%, complication rate 0–15%, mortality 0%, recurrence rate 4–24%. Fistula formation is common.</p> <p>Endoscopic drainage: Success rate 47–100%, complication rate 3–21%, mortality 0–1%, recurrence rate 0–22%.</p>
 <p>Acute pancreatic pseudocyst</p>	<p>Present for more than 6 weeks; contains pancreatic secretions; over time, becomes surrounded by a cyst wall composed of collagen-containing granulation tissue, without evidence of acute infection.</p> <p>Etiology: acute pancreatitis or pancreatic trauma.</p>	<p>Endoscopic drainage: Success rate 79.2%, complication rate 12.8%, mortality 0.7%, recurrence rate 7.0%.</p> <p>Operative drainage: Success rate 90–100%, complication rate 16%, mortality 2.5%, recurrence rate 0–12%.</p>
 <p>Chronic pancreatic pseudocyst</p>	<p>Contains pancreatic secretions; surrounded by a cyst wall composed of collagen-containing granulation tissue, without evidence of acute infection.</p> <p>Etiology: chronic pancreatitis without a prior episode of acute pancreatitis.</p>	<p>Endoscopic drainage: Success rate 85%, complication rate 13.3%, mortality 0.2%, recurrence rate 10.7%.</p> <p>Operative drainage: Success rate 90–100%, complication rate 16%, mortality 2.5%, recurrence rate 0–12%.</p>
 <p>Pancreatic abscess</p>	<p>Circumscribed intra-abdominal collection of pus.</p> <p>Etiology: acute pancreatitis, pancreatic trauma, or chronic pancreatitis; to be distinguished from an infected (acute or chronic) pancreatic pseudocyst.</p>	<p>Transcutaneous drainage: Success rate 87%, complication rate 4–17%, mortality 8%. Fistula formation is possible.</p> <p>Operative removal: Success rate 90–100%, complication rate 20%, mortality 5–20%.</p>

Diagnostic evaluation

The diagnosis of a pancreatic pseudocyst is usually established by imaging studies, among which trans-abdominal ultrasonography is important as an initial investigation (7, e50, e51). Computerized tomography (CT) is often the imaging method of choice, with 82% to 100% sensitivity and 98% specificity (8). For the distinction of acute fluid collections from pancreatic abscesses and acute pancreatic pseudocysts, endosonography (EUS) has the highest sensitivity (93% to 100%) and specificity (92% to 98%) (e52). The diagnostic puncture of a pseudocyst under EUS guidance helps distinguish cystic malignancies from pseudocysts. A malignant lesion is more likely when the carcino-embryonic antigen (CEA) value exceeds 192 ng/mL and when the cyst contents are highly viscous (e53) (9).

Course

The most important question in everyday clinical practice is often whether and when an acute or chronic pancreatic pseudocyst ought to be treated. In earlier studies on the clinical course of pancreatic pseudocysts,

the rate of spontaneous regression ranged from 8% to 70%. Two major factors affecting the rate of regression are the size of the pseudocyst and the time that has elapsed since it was diagnosed. Bradley followed the course of 93 patients (10) and found that 42% of the acute pseudocysts that were less than six weeks old regressed without any intervention, as compared to only 8% of those that had been present for more than seven weeks.

In 1997, Gouyon was able to show convincingly in a multivariate analysis that the single independent parameter affecting the spontaneous regression of chronic pancreatic pseudocysts is the size of the cyst. Cysts under 4 cm in size regressed spontaneously significantly more frequently and had a lower rate of complications (11).

Maringhini and colleagues found that even acute pancreatic pseudocysts larger than 4 cm in size can still regress spontaneously in 65% of cases (3).

At least five studies document the fact that the great majority of acute pancreatic pseudocysts measuring less than 4 cm in diameter regress spontaneously and thus require no treatment, as long as they are asymptomatic.

The situation is different for chronic pancreatic pseudocysts. The rate of spontaneous regression in most studies is under 10%.

Other factors that make spontaneous regression unlikely include the presence of multiple cysts (e3), location in the tail of the pancreas (3), a wall thickness greater than 1 cm (12), lack of communication with Wirsung's duct (13), proximal ductal stenosis, biliary or traumatic etiology, or an increase in size on follow-up (e3) (Table 1).

Indications for treatment

When is there an indication for surgical, interventional, or endoscopic treatment? Treatment is indicated if one of the following complications is present:

- compression of major vessels (with manifestations such as ischemic pain, a positive Hemocult test due to ischemia, disturbed intestinal motility, a rise in the serum lactate concentration, or radiological demonstration of vascular compression),
- compression of the stomach or duodenum leading to clinical symptoms,
- stenosis of the common bile duct or impairment of biliary flow, with cholestasis,
- infection of, or hemorrhage into, the cyst, or
- a pancreaticopleural fistula.

Furthermore, treatment is definitely indicated for symptomatic cysts causing, for example, a feeling of abdominal distension, nausea and vomiting, pain, or gastrointestinal bleeding. A relative indication for treatment is present for pseudocysts greater than 4 cm in size with either unchanged size and morphology or progression over a period of more than 6 weeks (1). Pseudocysts of this size that have been present for this long rarely regress spontaneously and are increasingly likely to

cause complications. The most suitable pseudocysts for endoscopic treatment are those with a wall thickness of less than 1 cm and more than 5 mm (14). In this range the pseudocyst wall can be readily penetrated with the endoscopic needle, yet are still stable enough for the insertion of pigtail stents.

A further relative indication for treatment is the presence of chronic pancreatitis with duct abnormalities or stones in the pancreatic duct. In these entities, constant irritation promotes inflammation and lowers the rate of spontaneous regression, which is no higher than 10% to 26% even for small cysts (11). Surgical treatment is urgently indicated whenever a malignant tumor is suspected (Boxes 1 and 2) (21).

Treatment

The first successful operation for the drainage of a pancreatic pseudocyst was described by Bozeman in 1882. When these lesions are treated surgically, it usually suffices to incise and debride the cyst and to perform a partial resection so that tissue can be obtained for histopathology. The most important aspect of open surgical treatment is that the deepest point of the cyst should be drained or anastomosed whenever possible. This type of internal surgical cyst drainage, which may consist of a pseudocystoduodenostomy, a pseudocystogastrostomy, or a pseudocystojejunostomy, carries an average mortality of 2.5% and a morbidity of 16%. The rate of technical success is 90% to 100%, while the recurrence rate ranges from 0% to 12% over 96 months of postoperative follow-up and depends on the site of the pseudocyst as well as on the underlying illness (15).

A further development of the conventional surgical treatment of pancreatic pseudocysts makes use of a laparoscopic approach. 253 cases of laparoscopic

TABLE 1

Spontaneous regression of pancreatic pseudocysts

Reference	Study period	Etiology alcohol	Diagnostic criteria (CT, US)	Chronic pancreatitis (ERCP)	Definition of pseudocysts by the Atlanta criteria	Spontaneous regression
Czaja et al. 1975 (e10)	1970–1972	80%	No	No	No	70%
Pollak et al. 1978 (e2)	1966–1976	NA	Some	No	No	30%
McConnell et al. 1982 (e14)	1960–1981	NA	Some	No	No	20%
Aranha et al. 1983 (e3)	1974–1981	97%	All	No	Yes	29%
Agha 1984 (e8)	1977–1982	80%	All	No	No	20%
Warshaw und Rattner (4)	1985	NA	All	Yes	No	21%
London et al. 1989 (e20)	1984–1986	NA	All	No	No	64%
Bourliere und Sarles 1989 (e23)	1972–1985	4%	All	Yes	Yes	20%
Maringhini et al. 1999 (48)	1986–1995	0%	All	No	Yes	65%
Mehta et al. 2004 (e36)	2001–2003	60%	Some	Yes	Yes	60%
Cheruvu et al. 2003 (e33)	1991–2002	14%	Some	Yes	Yes	39%

CT, computerized tomography; US, ultrasonography; ERCP, Endoscopic retrograde cholangiopancreatography; NA, data not available

pseudocyst drainage have been reported to date around the world. The reported rate of technical success is 92%, with 0% mortality, a 9% complication rate, and a 3% recurrence rate. In 6.7% of cases, the procedure had to be converted to an open laparotomy (16, e54) (Table 2). A direct comparison of surgical and interventional techniques has so far been performed only for transcutaneous drainage, but not for endoscopic drainage (17). In general, surgical (including minimally invasive) techniques are hard to compare with transcutaneous interventional techniques, because of an evident selection bias. Patients that have been rejected as surgical candidates because of multimorbidity are often treated interventionally.

It has been repeatedly shown, however, that the complication rate in the treatment of chronic pancreatic pseudocysts is lower than that of acute pancreatic pseudocysts, and that this is true independently of the choice of therapeutic procedure.

Currently, transcutaneous drainage is indicated only as an emergency procedure for acute fluid retention or infected cysts, as the recurrence rate after this form of treatment ranges as high as 70% and percutaneous fistulae are a very common complication (more than 20% of cases).

The first alternative to surgery to be developed was percutaneous, endoscopically guided cyst drainage into the stomach (18). The endoscopic transpapillary approach to the pseudocyst is probably the least traumatic procedure. Thus, when a pancreatic pseudocyst is found to have a connection to Wirsung's duct, the preferred treatment is often the transpapillary insertion of a stent for internal drainage.

There have not yet been any prospective, randomized trials on the question of the optimal timing of elective stent changes or the necessary duration of stent treatment for pancreatic pseudocysts (trials of this type have already been published for stents in the common bile duct). Depending on the individual report, 22% to 57% of pancreatic pseudocysts have been found to be connected to the pancreatic ductal system (13, e15). The current state of technology supports the performance of endoscopic retrograde pancreatography (ERP) to demonstrate a connection to the ductal system, or to rule out rupture of the pancreatic duct (as seen in 8% of cases after acute necrotizing pancreatitis), before endoscopic transmural drainage (19). Transmural drainage in the presence of an unrecognized rupture of the pancreatic duct, or when the pancreatic pseudocyst is connected to a stenotic pancreatic duct, is less likely to meet with long-term success.

The study of Arvanitakis made a major contribution to the treatment of pancreatic pseudocysts that have arisen through rupture of the pancreatic duct (19). He compared the effect of immediate stent removal with that of moderately prolonged stent drainage (the stents were left in place for a median duration of two months) after initially successful transgastric drainage. The result indicated that the stent should remain in place even after complete emptying of the pseudocyst, because

BOX 1

Indications for the Treatment of Pancreatic Pseudocysts

Complicated pancreatic pseudocyst (one criterion suffices)

- Compression of the abdominal great vessels (clinical manifestations or radiological evidence)
- Clinically relevant gastric outlet stenosis or duodenal stenosis
- Stenosis of the common bile duct with jaundice due to compression
- Infected pancreatic pseudocyst (septic focus)
- Hemorrhage into a pancreatic pseudocyst (danger of recurrent hemorrhage)
- Pancreaticopleural fistula (risk of pneumonia, ARDS)

Symptomatic pancreatic pseudocyst

- Abdominal distension
- Nausea and vomiting
- Pain
- Upper gastrointestinal bleeding (10–20%)

Asymptomatic pancreatic pseudocyst

- Pseudocyst >5cm, without any regression after more than 6 weeks of observation (1)
- Cyst wall >5 mm (mature cyst) = high success rate of endoscopic or laparoscopic drainage (14)
- Chronic pancreatitis with advanced pancreatic duct changes, pancreaticolithiasis = persistent irritation leading to inflammation, no more than 26% of cysts regress spontaneously in this situation; when they do not regress, the complication rate rises over the further course of illness (11)
- Suspected cystic pancreatic tumor: median 5-year survival after early resection is good (63%) (21)

ARDS, acute respiratory distress syndrome

BOX 2

Prerequisites and recommendations for the endoscopic drainage of pancreatic pseudocysts

- The distance between the pseudocyst and the gastric or duodenal wall should be less than 1 cm (15, 22).
- The chosen approach should be through the site of greatest impression by the pseudocyst on the adjacent gastric or duodenal wall (22, e24).
- Ideally, the cyst should be more than 5 cm in size and should cause impression of the gastric or duodenal wall; single cysts, mature cysts, and cysts without interruption of the pancreatic duct can be drained with high rates of success (24).
- For the drainage of mature cysts, the pancreatic ductal system should first be investigated endoscopically, and transpapillary drainage is to be preferred whenever possible (24).
- Symptomatic pancreatic pseudocysts: cysts that have been present for more than 6 weeks and have not regressed under conservative treatment should be treated (25).
- Malignant lesions and pseudoaneurysms should always be ruled out before endoscopic treatment (15).

TABLE 2

The laparoscopic treatment of pancreatic pseudocysts

Reference	Number of patients	Success rate	Complete cyst drainage	Recurrence rate	Complications
Cuschieri et al. 1998 (e18)	8	8 (100%)	8 (100%)	0	1 (13%)
Chowbey et al. 2001 (e38)	5	5 (100%)	5 (100%)	0	0
Ramachandran et al. 2002 (e28)	5	5 (100%)	5 (100%)	0	0
Park & Heniford et al. 2002 (e12)	28	27 (96%)	28 (100%)	0	2 (7%)
Mori et al. 2002 (e17)	17	14 (82%)	17 (100%)	1 (6%)	3 (18%)
Fernandez-Cruz et al. 2002 (e30)	6	6 (100%)	6 (100%)	0	0
Zhou et al. 2003 (e7)	13	12 (92%)	13 (100%)	1 (8%)	0
Teixeira et al. 2003 (e27)	8	8 (100%)	8 (100%)	0	0
Obermeyer et al. 2003 (e40)	6	4 (67%)	6 (100%)	0	1 (17%)
Palanivelu et al. 2007 (37)	108	98 (91%)	107 (99%)	1 (1%)	9 (8%)
Hauters et al. 2004 (e11)	17	16 (94%)	15 (88%)	0	2 (12%)
Davila-Cervantes et al. 2004 (e21)	10	10 (100%)	9 (90%)	0	2 (20%)
Hindmarsh et al. 2005 (e16)	15	12 (80%)	14 (93%)	2 (13%)	2 (13%)
Owera & Ammori et al. 2008 (e1)	7	7 (100%)	7 (100%)	0	0
Total	253	232 (92%)	248 (98%)	5 (3%)	22 (9%)

the recurrence rate is significantly higher when it is removed early. This finding conflicts with the received opinion that stents should be removed as soon as possible after the emptying of a fluid collection because occlusion of the stent might lead to recurrence. In current practice, drainage stents in the pancreatic duct are changed every six weeks at the latest, and the treatment is continued for at least two months after regression of the pseudocyst.

The pre-interventional administration of antibiotics before endoscopic retrograde cholangiopancreatography (ERCP) is necessary whenever a pancreatic pseudocyst is suspected or is itself the indication for ERCP or ERP. If antibiotics are not given and the pseudocyst communicates with the pancreatic duct system, danger may arise from the retention of infected contrast medium. The study-specific incidence of infected pseudocysts and pancreatic abscesses rises if antibiotic prophylaxis is withheld (e15).

The endoscopic transgastric or transduodenal approach is a current alternative to a surgical procedure if transpapillary drainage of the pseudocyst is not possible. Since the first descriptions of this technique by Sahel 1987 and Cremer 1989, it has been tested in 1126 published cases and is now considered a safe and effective technique for the treatment of pancreatic pseudocysts, with a low complication rate in experienced hands. An important further development, which has also led to a broadening of the indications for this technique, is the use of endoscopic ultrasonography, including Doppler ultrasonography. When this is done, the rate of iatrogenic hemorrhage and perforation is lower, and the success

rate is markedly higher. The reported success rate among 1126 patients was 79.2%, while the success rates in recent studies are well over 85%, which corresponds to the results of surgery. The mortality in larger series with more than 30 patients is 0.2%, while the recurrence rate is 7.6% and the complication rate is 12.8% (Table 3).

The further technical development of endoscopic techniques is still in progress. In a recently published prospective study involving 116 patients, Deviere and colleagues (e41) drew the following conclusions:

- The treatment of pancreatic pseudocysts should always involve an interdisciplinary therapeutic approach.
- Endoscopic interventions are more often successful when multiple wide stents are placed, and this does not elevate either morbidity or mortality. This is particularly true with regard to the placement of pigtail catheters
- Pigtail catheters are preferable to straight stents, because their complication rate is markedly lower (e55).

Which procedure, when?

When fluid retention occurs, as may happen in the early phase of acute pancreatitis, transcutaneous or endoscopic drainage is indicated only in rare, exceptional cases. The success rates of transcutaneous drainage range from 42% to 96%. The morbidity and mortality are low, but the recurrence rate is high (24%), and the likelihood of a persistent pancreaticocutaneous fistula should not be underestimated. Only relatively few data on endoscopic drainage for this indication have been published to date.

TABLE 3

The endoscopic treatment of pancreatic pseudocysts

Reference	Number of patients	Success rate	Complete cyst drainage	Recurrence rate	Complications
Kozarek et al. 1985 (e9)	4	2 (50%)	2 (50%)	0	1 (25%) died
Cremer et al. 1989 (e31)	33	28 (85%)	30 (91%)	4 (12%)	3 (9%)
Sahel et al. 1991 (e5)	37	31 (86%)	36 (97%)	2 (5%)	5 (14%)
Kozarek et al. 1991 (e45)	14	11 (79%)	NA	2 (14%)	3 (21%)
Bejanin et al. 1993 (e46)	26	19 (73%)	NA	4 (15%)	4 (15%)
Funnel et al. 1994 (e19)	5	5 (100%)	5 (100%)	0	0
Deviere et al. 1995 (e43)	12	10 (87%)	10 (87%)	0	2 (13%)
Vitale et al. 1999 (e22)	36	31 (86%)	31 (86%)	5 (14%)	1 (3%)
White et al. 2000 (e47)	20	20 (100%)	20 (100%)	0	2 (10%)
Giovannini et al. 2001 (e24)	15	15 (100%)	15 (100%)	0	1 (6,6%)
Libera et al. 2000 (e6)	25	21 (84%)	20 (80%)	1 (4%)	6 (28%)
Norton et al. 2001 (e42)	17	14 (82,4%)	13 (76,5%)	1 (7,1%)	3 (17,6%)
Sharma et al. 2002 (e13)	38	37 (97%)	37 (97%)	7 (16%)	5 (13%)
Binmüller et al. 1995 (32)	53	43 (81%)	47 (89%)	11 (23%)	6 (11%)
Smits et al. 1995 (35)	37	24 (65%)	24 (65%)	3 (12,5%)	6 (16%)
Barthet et al. 1995 (e15)	30	23 (77%)	26 (87%)	3 (11,5%)	4 (13%)
Baron et al. 2002 (e44)	64	52 (81%)	59 (92%)	7 (12%)	11 (17%)
Catalano et al. 1995 (e25)	21	16 (76%)	17 (81%)	1 (5%)	1 (5%)
Antillon et al. 2006 (e29)	33	31 (94%)	24 (82%)	1 (3%)	2 (6%)
Hookey et al. 2006 (e41)	116	102 (87,9%)	108 (93,1%)	19 (16,4%)	13 (11%), 6 (5,2%) died
Krüger et al. 2006 (e34)	35	33 (94%)	30 (88%)	4 (12%)	0
Weckmann et al. 2006 (e26)	165	142 (86,1%)	146 (86,1%)	8 (5,3%)	16 (10%)
Kahaleh et al. 2006 (e39)	99	93 (94%)	NA	NA	19 (19%)
Cahen et al. 2005 (e49)	92	89 (97%)	79 (86%)	4 (5%)	31 (35%) 1 (1%) died
Total	1126	892 (79,2%)	779 (87,3%)	86 (7,6%)	144 (12,8%)

NA, data not available

The procedure seems promising, however, and would be an appropriate way of lowering the rate of secondary infectious complications. The transgastric endoscopic approach to infected pancreatic necroses and fluid collections in acute pancreatitis is now increasingly the procedure of choice, including in the authors' institution.

In cases of symptomatic or complicated acute pancreatic pseudocyst, or of an acute pseudocyst measuring greater than 5 cm that has been present for more than 6 weeks, an endoscopic procedure should be chosen preferably via a transpapillary or transmural approach, although drainage through the gastric wall has the highest rate of technical success. Operative pseudocyst drainage, because of its higher mortality, should be used as the primary treatment only in rare cases or when the pseudocyst extends far down into the pelvis.

The treatment criteria listed in Table 3 are also valid for the treatment of symptomatic or complicated chron-

ic pancreatic pseudocysts or of chronic pseudocysts greater than 5 cm in size (Figure 2). It must be borne in mind, however, that chronic pseudocysts regress spontaneously much less commonly than acute ones. Moreover, the surgical treatment of pseudocysts due to chronic pancreatitis carries a markedly lower mortality and morbidity. In this situation, laparoscopic pseudocystojejunostomy is gradually becoming established as an alternative to open surgery. In highly experienced laparoscopic centers, endoscopic drainage yields comparable results with respect to effectiveness and safety. There have not yet been any published reports from Germany concerning the results of laparoscopic pseudocyst drainage.

Pancreatic abscesses (collections of pus in the retroperitoneal space) can be drained either transcutaneously or transmurally. Large case series are available only for transcutaneous drainage (success rate up to 87%,

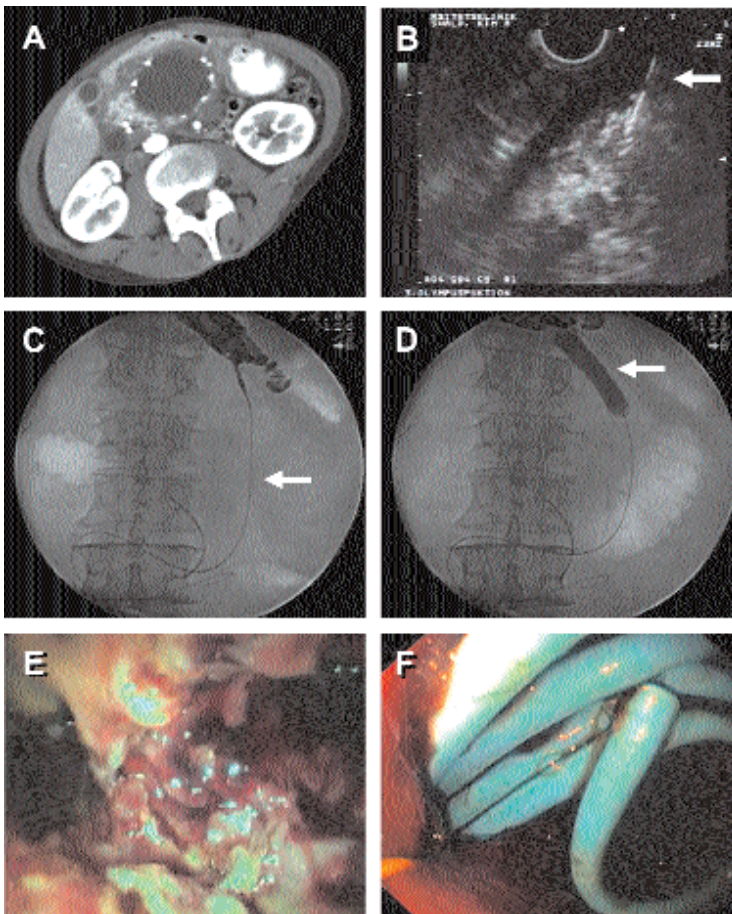


FIGURE 2: The individual steps in the endoscopic treatment of a large pancreatic pseudocyst are shown.

- (a) A CT scan shows the head of the pancreas with a symptomatic pancreatic pseudocyst due to chronic pancreatitis. There are calcifications in the pseudocyst wall.
- (b) An avascular area of the gastric wall is located endosonographically and the pseudocyst is punctured with a needle (arrow).
- (c) A wire (arrow) is introduced through the needle into the pseudocyst; a dilating balloon (arrow in [d]) is then introduced over the wire so that the path of approach can be widened to the diameter of the endoscope.
- (d) Introduction of the dilatation balloon (arrow)
- (e) View through the endoscope into the pancreatic pseudocyst, with the opportunity to take biopsies to rule out malignancy
- (f) The endoscopic path of approach is held open by the introduction of pigtail catheters (usually two to four) between the stomach and the pancreatic pseudocyst; this prevents rapid spontaneous closure and enables regression of the pseudocyst.

complication rate 4% to 17%, mortality 8%). Operative treatment carries a higher mortality. Here, too, the authors currently prefer to use the transgastric endoscopic approach in their own institution.

Pancreatic pseudocyst versus cystic malignant tumor

The differential diagnosis of a pancreatic pseudocyst from a cystic malignancy is difficult. In addition to obtaining cyst fluid by puncture, there are a number of further criteria that can aid in the differential diagnosis: prior episodes of acute pancreatitis, or known chronic pancreatitis, makes a pancreatic pseudocyst more likely; cystic malignant tumors are more common in women

than in men. Weight loss, a palpable mass, and the lack of pre-existing pancreatic disease all make a malignant tumor more likely. Pancreatic pseudocysts more often have a calcified cyst wall, usually lie in the head of the pancreas, and usually have a wall that is less than 1 cm thick. Cystic malignant tumors, on the other hand, are often multilocular and tend to arise in the body and tail of the pancreas; their walls are less commonly calcified and more often over 1 cm thick, with nodular components. An important criterion for malignancy is a markedly elevated CEA value in the cyst fluid (e56). In general, the rule applies: When in doubt about the possibility of malignancy, operate.

Guidelines

There are no current guidelines for the treatment of pancreatic pseudocysts in either the German-speaking or the English-speaking countries. An update of the older guidelines of the German Society for Digestive and Metabolic Diseases (Deutsche Gesellschaft für Verdauungs- und Stoffwechselkrankheiten, DGVS) is planned to appear in 2009. Even today, most of the data are derived from uncontrolled, mostly retrospective case series (evidence level III). Randomized, prospective trials (19, 20) are urgently needed.

Overview

The endoscopic and minimally invasive therapeutic procedures for the drainage of pancreatic pseudocysts are superior to open surgical techniques with respect to their success rates, morbidity, and mortality, but they can not always be performed (Box 2). In making treatment decisions, it is important to recall that 50% of pancreatic pseudocysts do not require any intervention and can be successfully managed by a wait-and-watch approach (Table 1). Laparoscopic and endoscopic drainage have comparable success rates, while that of transcutaneous drainage is somewhat worse. Thus, the choice of technique depends very heavily on the experience of the treatment center. In all cases where a malignant tumor is suspected, open surgery should be performed. Pancreatic pseudocysts require treatment when they cause symptoms, produce complications, or have reached a size exceeding 5 cm and do not regress after 6 weeks of observation (Box 1). In the last-named situation, treatment is indicated because complications can otherwise be expected.

Conflict of Interest Statement

The authors declare that they have no conflict of interest as defined by the guidelines of the International Committee of Medical Journal Editors.

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Key messages

- About 50% of pancreatic pseudocysts regress spontaneously and need no treatment.
- If treatment is indicated (*Box 1*), endoscopic and laparoscopic therapeutic procedures have comparable results, while open surgery carries a somewhat higher morbidity and mortality.
- Endoscopic pseudocyst drainage with the aid of pigtail catheters by way of the pancreatic duct or the gastric wall (less commonly, the duodenal wall) is currently the safest and most frequently used technique.
- There are no randomized studies directly comparing the therapeutic techniques.
- Whenever a cystic malignant tumor is suspected, open surgery should be chosen.

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REVIEW ARTICLE

Pancreatic Pseudocysts

Observation, Endoscopic Drainage, or Resection?

Markus M. Lerch, Albrecht Stier, Ulrich Wahnschaffe, Julia Mayerle

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