Interventional and Surgical Management of Acute Pancreatitis

29

Indications for Interventional and Surgical Treatment of Necrotizing Pancreatitis

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Introduction

Whereas interstitial acute pancreatitis is typically a self-limited disease process that usually responds to supportive care, the more severe necrotizing pancreatitis can be seen in approximately 20% of patients. This is characterized by necrosis of the pancreatic parenchema or peripancreatic tissue, manifestations of the systemic inflammatory response syndrome (SIRS), with risks for infection and multiorgan failure [1]. High rates of morbidity are associated with mortality of up to 15% in the setting of necrotizing pancreatitis and as high as 30% in the subset of patients who develop infected pancreatic necrosis [2,3]. A variety of surgical and interventional approaches have been used in an attempt to limit the substantial morbidity and mortality of necrotizing pancreatitis.

Over the last few decades, there has been a significant change in the indications for intervention in necrotizing pancreatitis, timing of intervention, and methods of surgical, minimally invasive, radiologic, and endoscopic intervention. Recent revision of the 1992 Atlanta classification of acute pancreatitis [4] to more precisely describe the clinical behavior and imaging characteristics of acute pancreatitis [5] has occurred in parallel with a progressively less interventional and less invasive approach to necrotizing pancreatitis. Although no universally accepted management algorithm exists to guide management, evidence-based consensus continues to develop [6].

Interventions for Pancreatic Necrosis: Historical Perspective

Just a few decades ago, the association of pancreatic necrosis with systemic inflammation and secondary infection led to the goal of surgically removing all necrotic pancreas regardless of the presence of infection [7–9]. In 1991, Bradley and Allen published a small series of 11 patients successfully managed nonoperatively with sterile pancreatic necrosis [10]. The general acceptance of nonoperative management for sterile pancreatic necrosis was facilitated by the publication of large series demonstrating favorable overall mortality and complications [11,12]. In this new paradigm, intervention was primarily limited to surgical debridement for cases of infected pancreatic necrosis as demonstrated by computed tomography (CT)-guided fine-needle aspiration (FNA) of the pancreas. Banks et al. showed a sensitivity and specificity of 96.2% and 99.4%, respectively, for detection of infected necrosis, with a positive predictive value of 99.5% and a negative predictive value of 95.3% [13]. The presence of infection or positive Gram stain on CT-guided pancreatic aspiration, however, was considered an absolute indication for debridement, as superinfection of the necrotic parenchyma had been associated with a mortality of virtually 100% without debridement [14].

The absolute necessity of surgical debridement for infected necrosis was subsequently questioned with the

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demonstration of successful nonoperative management in some patients. Runzi et al. [15] showed in a series of over 80 patients with documented infected pancreatic necrosis that initial conservative therapy can be instituted, including antibiotic therapy and maximal supportive care. Mortality in patients managed with surgery was identical to that in those managed nonoperatively. Surgical therapy, when required, was often delayed to a later stage of disease, when the systemic inflammatory response has been stabilized and necrotic pancreas had become demarcated. In other patients, surgical therapy was avoided altogether. Subsequent studies have confirmed this strategy: Garg et al. describe a 10-year series of 80 patients with infected pancreatic necrosis in whom 47 were treated with antibiotics alone [16]. The paradigm of urgent surgical debridement for all patients with infected pancreatic necrosis is therefore no longer considered valid.

Indications and Timing of Intervention

Unlike the prior delineation of pancreatic necrosis to infected and sterile versions, the revised Atlanta classification [5] divides collections associated with necrotizing pancreatitis according to time of disease onset. A collection that develops early and lacks a discrete wall is referred to as an acute necrotic collection (ANC), whereas a collection that persists after 4 weeks is referred to as walled-off necrosis (WON). Both forms may be sterile or infected. Although the presence or absence of infection is crucial for prognosis and affects management decisions, the presence of clinical symptoms rather than suspicion of infection is considered paramount for intervention.

Pancreatic Necrosis with Infection

Despite demonstrated success with nonsurgical management for infected necrosis, many if not most patients with infected pancreatic necrosis require some form of intervention. Some series suggest that clinically stable and relatively asymptomatic patients with infected necrosis can be managed with antibiotics alone [15–17]. Nonetheless, patients with infection are prone to clinical decline and require surgical, endoscopic, or radiographic intervention with the onset of clinical signs not responding to medical management. In the era of surgical management, delayed intervention was far preferable to early surgery. A randomized trial has shown that early surgical intervention is associated with higher morbidity and mortality than when intervention is delayed at least 12 days [18]. Other reviews have confirmed lower mortality with delayed surgical intervension [19,20] and other data suggest that early surgery is in fact an independent predictor of poor outcome in necrotizing pancreatitis [21].

Expedited intervention may be required in patients demonstrating progressive systemic sepsis or hemodynamic instability. In the absence of such systemic signs, clinically stable patients may generally be managed at least temporarily with antibiotics to allow further organization of the inflammatory process. Delayed surgical, endoscopic, or radiologic management may then proceed if clinical symptoms do not improve [6].

Delayed surgical intervention of infected pancreatic necrosis has been facilitated by the use of percutaneous catheter drains. A 1998 series by Freeney et al. [22] demonstrated that some patients with infected pancreatic necrosis might have surgical management delayed or potentially avoided altogether with the use of large-bore percutaneous catheters placed under CT guidance. This strategy was validated in a multicenter trial in which patients were randomized to standard pancreatic debridement versus a "step-up" approach in which debridement was used only if necessary [23]. Using a "step-up" approach, complications were significantly lower, and about one-third of patients were treated with catheter drainage alone.

Infected necrosis is suspected with clinical deterioration of a previously stable patient with acute pancreatitis or pancreatic necrosis. Some patients may demonstrate gas within necrotic debris on abdominal imaging via the presence of gas-forming organisms or via a fistula to the colon, small bowel, or stomach. Alternatively, infection may be proven by culture or Gram stain obtained by image-guided FNA [24]. Although a Gram stain positive for organisms was previously thought to mandate surgical early intervention [11], patients with suspected infection are increasingly managed with antibiotics and supportive care to allow less invasive and delayed management of a walled-off collection [3]. Diagnostic FNA is therefore used less routinely in the management of suspected infection.

Symptomatic Pancreatic Necrosis/ Walled-Off Necrosis

The precise role of radiographic drainage, endoscopic or surgical debridement in sterile pancreatic necrosis is less clear. Although most patients with sterile pancreatic necrosis respond to supportive care without the need for intervention, others will experience clinical decline,

including organ failure despite the presence of demonstrable infection. Historically, some authors had therefore suggested the need for surgical debridement in patients with progression of disease or failure to improve, regardless of the status of infection [25,26]. Unfortunately, no uniform criteria defined which patients with sterile pancreatic necrosis might benefit from debridement. In the era of surgical debridement as the primary intervention for necrotizing pancreatitis, some authors suggested criteria for intervention including the extent of necrosis of more than 50% of the pancreatic parenchyma [25], rapid clinical deterioration with multiple organ failure [27], or the presence or persistence of organ failure [28,29]. However, evidence is lacking to support the use of these criteria as an absolute indication for debridement or drainage. Close analysis of one study of 89 patients with severe sterile necrosis identified only two patients who died that might have theoretically benefitted from earlier surgical debridement, though no clinical parameters were able to easily differentiate these patients from others with severe sterile necrosis [12].

As noted above, in the absence of clinical confirmation of infection by image-guided FNA or suggestive imaging, intervention is typically based on the clinical course and trajectory. Patients are therefore often brought to intervention for not just documented infection, with positive pancreatic FNA, but also for suspected infection based on persistent sepsis or progressive clinical deterioration [30]. Given the additional morbidity and mortality associated with open surgery, radiologic or endoscopic drainage is used prior to surgical intervention [31].

The process of walled-off pancreatic necrosis recognized in the revised Atlanta classification was previously described by Baron as "organized pancreatic necrosis" [32]. In this condition, an intrapancreatic or extrapancreatic heterogeneous semisolid collection develops in the context of acute necrotizing pancreatitis and has an encapsulated wall [5]. A subset of patients with WON may experience a prolonged clinical course marked by persistent pain, malaise, and inability to eat. This symptom complex was described by Warshaw as "persistent unwellness" [33]. The precise indications and timing of intervention are not precisely defined for these patients.

Asymptomatic WON does not require intervention regardless of the size of the collection, and may resolve with conservative management (Fig. 29.1). Symptomatic WON, however, can be marked by pain, intestinal, or biliary obstruction, or later infection. In one series, approximately 10% of patients with sterile pancreatic necrosis underwent surgery for persistent pain and organized necrosis at a mean of 29 days after initial presentation [12].

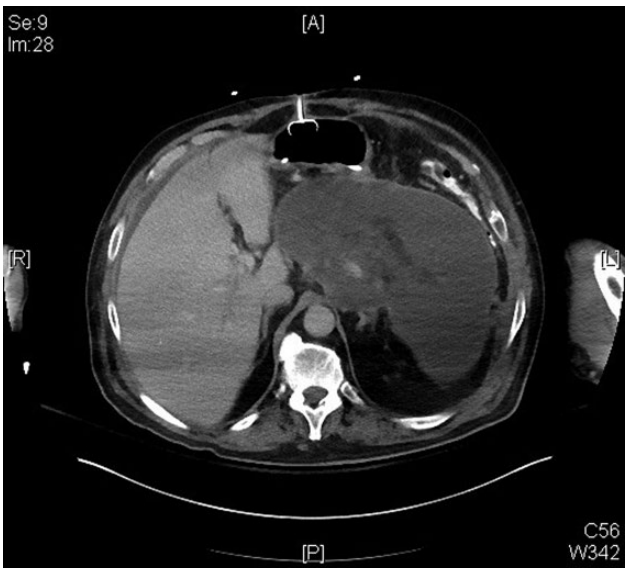

Figure 29.1 Walled-off necrosis. A 55-year-old man presented with severe acute pancreatitis and an acute necrotic collection. He was managed conservatively, and imaging 6 weeks after presentation revealed a large area of walled-off necrosis involving the entire body and tail of the pancreas. The patient remained asymptomatic and no intervention was pursued.

Surgical and Interventional Procedures

The use of various radiologic, surgical, and endoscopic interventions for necrotizing pancreatitis will vary among institutions [6]. Although open surgical necrosectomy was previously considered the definitive management, a number of minimally invasive techniques have been developed. As noted above, delayed intervention is preferable in all patients if possible, particularly when open surgical management is used [34]. However, interventional radiologic techniques may be performed earlier with suspected infection [19]. Even in the setting of suspected or known infection, there is a growing trend to treat with supportive care and antibiotics unless there are signs of sepsis, until the pancreatic collection becomes walled off [3].

Surgical Debridement

Open surgical debridement for years was considered the gold standard of surgical intervention for pancreatic necrosis, by removing necrotic pancreatic and peripancreatic tissue and establishing a means of postoperative drainage while preserving viable pancreatic parenchyma. Methods have included debridement with closure over drains, debridement with open packing of the pancreatic

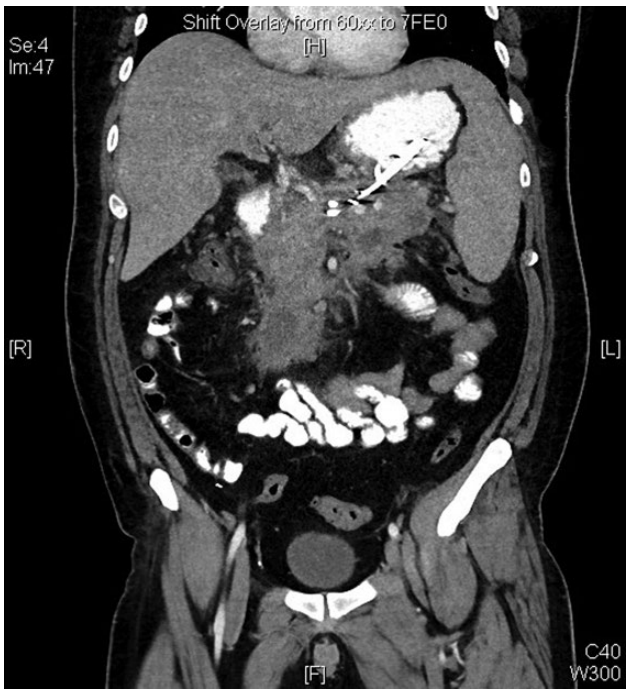

Figure 29.2 Undrained mesenteric abscess after endoscopic debridement. A 50-year-old man underwent uncomplicated endoscopic debridement for symptomatic walled-off pancreatic necrosis. He represented with fevers, pain, leukocytosis, and a phlegmonous abscess tracking down into the small bowel mesentery. Endoscopic debridement and CT-guided drainage were not felt to be possible. Surgical debridement was required.

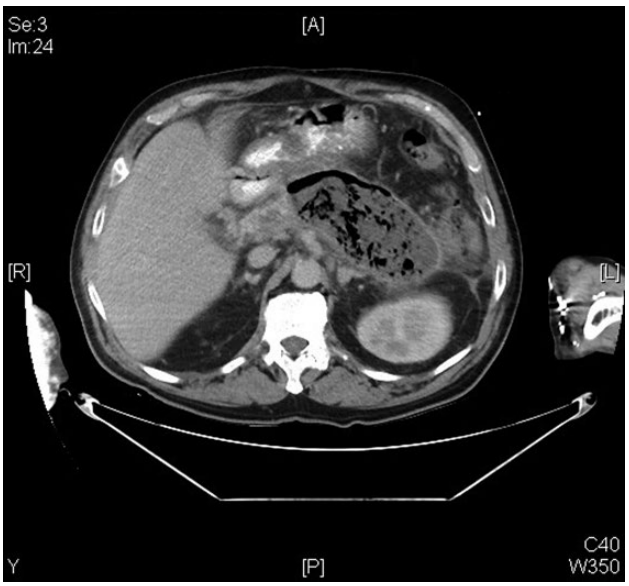

Figure 29.3 Infection of walled-off necrosis with fistula to colon. The patient in Fig. 29.1 presented 12 months after his original episode of pancreatitis with fever and bacteremia. Imaging demonstrated gas in the area of walled-off necrosis, consistent with infection. Endoscopic debridement was attempted, though contrast injection to the cavity demonstrated a fistula to the transverse colon. Open surgical debridement was pursued.

bed, or debridement with closure over irrigation drains [9,35–37]. Mortality and complication rates for published series utilizing these techniques vary widely, although comparisons between studies are confounded by the lack of standardization of disease severity or operative indications.

One advantage of open surgical necrosectomy is that it may offer the best chance to completely remove all necrotic tissue and address other associated complications in a single procedure. Due to its invasiveness and associated perioperative complications, open surgery is typically reserved for patients in whom less invasive methods have failed.

In the setting of minimally invasive options such as image-guided catheter drainage and direct endoscopic necrosectomy as described below, several important potential indications for surgery remain. In some cases, collections may not be accessible via image-guided techniques, may be multifocal, or persistent after minimally invasive necrosectomy (Fig. 29.2). In other instances, a patient may not be deemed clinically stable for minimally invasive measures. Surgical therapy in these instances should be delayed as long as possible given the increased risk of early surgical intervention. Other indications for surgical debridement include the presence of bowel perforation, obstruction, fistula to a hollow viscus such as the colon, and abdominal compartment syndrome [38] (Fig. 29.3).

Of note, minimally invasive forms of surgical debridement have been used in addition to traditional "open" necrosectomy. Laparoscopic approaches are well described, and may be more successful in completely removing all necrotic material compared to other minimally invasive methods [39]. Video-assisted retroperitoneal debridement is a procedure by which the retroperitoneal collection is accessed via the tract of a percutaneous catheter [40]. This avoids the pneumoperitoneum and peritoneal seeding possible with a laparoscopic procedure, but multiple interventions may be required for complete drainage [6]. While open necrosectomy can be avoided in many patients, limited data are available comparing outcomes of these procedures [41].

Percutaneous Catheter Drainage

Percutaneous catheter drainage (PCD) can be performed either as a "step-up" toward endoscopic or surgical necrosectomy once WON has developed, or in some cases as definitive therapy [23]. One significant advantage

of PCD is the opportunity to address symptomatic or infected necrotic collections before WON has developed. PCD may be particularly useful in patients deemed unfit for surgical intervention, or to address residual collections after debridement [6]. Catheters are placed using CT or ultrasound guidance, using either a transperitoneal or retroperitoneal approach. Often multiple catheters are required, and follow-up procedures are often indicated to place additional or larger catheters [40].

As noted, catheter drainage alone is often effective without necrosectomy. In the PANTER trial, use of catheter drainage resulted in significantly decreased morbidity with equal mortality compared to surgical necrosectomy [23]. Other studies have shown an approximately 50% success rate in treating necrotizing pancreatitis, whether sterile or infected [42]. PCD is less likely to be successful as a definitive intervention in patients with duct disruption, who may require eventual surgical or endoscopic therapy [43].

Direct Endoscopic Necrosectomy

Endoscopic necrosectomy is a recognized alternative to surgical debridement, though its availability is limited to specialized centers. A series of 104 patients at six centers showed resolution of WON in 91% with endoscopic necrosectomy, with only 4% requiring surgical debridement [44]. Furthermore, data suggest that endoscopic necrosectomy is associated with fewer complications, less organ failure, and decreased periprocedural inflammation [30].

Similar to PCD, multiple procedures may be required, and not all patients may be candidates for endoscopic therapy. Ideally, collections for endoscopic access are not only walled off but also are adjacent to the gastric or duodenal lumen. Some acute necrotic collections cannot be approached endoscopically due to lack of abutment of the stomach or duodenum. Early collections are not ideally suited for endoscopic therapy due to the risk of intra-abdominal spread of an infected collection, and multifocal collections are less easily approached in this manner.

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