Pancreatic Disorders & Therapy
ISSN: 2165-7092

Enver, Pancreatic Dis Ther 2012, 2:1
DOI: 10.4172/2165-7092.1000e106

Editorial Open Access

Minimally Invasive Management of Acute Necrotizing Pancreatitis

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Keywords: Acute pancreatitis; Pancreatic necrosis; Infection; Non-surgical treatment; Percutaneous drainage

Introduction

About 10% to 20% of patients with acute pancreatitis develop severe disease, which is characterized by intrapancreatic or peripancreatic necrosis [1-6]. Necrotizing pancreatitis is the most severe form of acute pancreatitis associated with high morbidity and mortality due to the development of infected pancreatic necrosis, and multisystem organ failure. In severe necrotizing pancreatitis, the mortality rate ranges from 10% to 40%, and it is especially high (up to 50%) when the necrosis is infected and progressing to sepsis and multiorgan failure [1-3,7]. The appropriate treatment of infected pancreatic necrosis remains the subject of much debate. It is generally accepted that in infected necrotizing pancreatitis the infected non-vital solid tissue has to be removed in order to control the sepsis. For decades, open surgery and immediate surgical necrosectomy was the gold standard treatment for patients with infected pancreatic necrosis [1,3,7,8]. However, several reports have shown that early surgical intervention for pancreatic necrosis could result in a worse prognosis compared to cases where surgery is delayed or avoided [9-13]. It has been suggested that the invasiveness of open surgery in an already critically ill patient may be the cause of high morbidity rates. Therefore, several groups worldwide have developed new minimal invasive approaches using conservative treatment, endoscopic necrosectomy or drainage therapy in the management of infected necrotizing pancreatitis [14-19].

Conservative treatment

All patients with necrotizing pancreatitis should be receiving standard intensive care treatment according to their general condition. This encompasses supportive care, maintenance of circulation volume in order to prevent electrolyte imbalance, nutritional supplements, analgesics, oxygen supplementation, mechanical ventilation, as well as monitoring for respiratory, cardiovascular and renal insufficiency and correcting them early. Indications for fine-needle aspiration are [4,18,20] patients with persistent symptoms and greater than 30% pancreatic necrosis, and those with smaller areas of necrosis and clinical suspicion of sepsis. Once the microbiological study revealed the causative organism and the results of the susceptibility tests were known, the appropriate antibiotic regimen was started [18,21].

Percutaneous drainage

Endoscopic surgery is less aggressive compared to open surgery but it is much more aggressive a method compared to percutaneous or endoscopic catheter drainage using 8 or 10 F catheters under ultrasound or computed tomography control (general anaesthesia, progressive dilatation of drain tract to 30F allowing insertion of trocar, using grasping forceps for removal of necrotic tissue) [22,23]. Percutaneous catheter drainage seems technically feasible in the vast majority of patients with necrotizing pancreatitis [18,24]. Besides, with this method a few catheters can be simultaneously introduced into liquid areas of necroses (into different pancreatic and peripancreatic regions) without general anaesthesia and with fewer traumas, performing vigorous irrigation with similar or better effects than by endoscopic surgery. The value of drainage therapy for removal of solid debris is equivocal. Generally, at the begining of disease catheter drainage of infected necrotic tissue is poor and several authors consider that surgical resection of necrotic tissue is mandatory [3,4,7-9,25-27]. But, some authors deem [12-19] that solid tissue and necrotic debris could be removed with draining fluid and that the use of vigorous irrigation through large-bore catheters could effectively remove the tissue. The rationale for this strategy is that large bore catheters may be more effective for mobilizing solid tissue and evacuating the necrotic tissue from the cavities. Other authors report no significant correlation between drainage catheter size and outcome of disease [5,12,18]. Some percutaneous drainage procedures are performed to stabilize the seriously ill patient prior to surgical debridement, while others are done with the intent to cure [28,29].

Technique of image guidance

The choice of imaging modality for percutaneous needle aspiration or percutaneous catheter placement depends on the size and location of the collection and patient habitus. Most pancreatic fluid collections are located in the lesser sac, the anterior pararenal space, or other parts of the retroperitoneum [29,30]. Access routes that avoid crossing small or large bowel, or major mesenteric, peripancreatic, or retroperitoneal blood vessels are selected to minimize the risk of bacterial contamination and hemorrhage. In 1998, Freeny et al. [31] described their results with computed tomography-guided percutaneous catheter drainage of infected necrosis. They demonstrated that the majority of patients could be treated by drainage without the need for necrosectomy. Ultrasound has the advantages of being a portable modality, which can be useful in cases involving patients in an intensive care setting, as well as being widely available. However, ultrasound is less successful in large patients, deeper collections and the cases of severe acute pancreatitis which are associated with adynamic ileus. The endoscopic approach is suitable because pancreas lies adjacent to the stomach, but both endoscopic and radiological skills are required. Besides, in the case of superinfection or drainage problems, the monitoring, catheter manipulation and the analysis of cystic content are very difficult by endoscopic approach. Moreover, in the case of catheter problems or presence of residual cavity, using percutaneous drainage one could perform repositioning or aspiration of the catheter much easier than by endoscopic approach [32,33].

The fluid contained in collections caused by pancreatic necrosis is often viscous. Therefore, adequate drainage of pancreatic and

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Received December 12, 2011; **Accepted** January 03, 2012; **Published** January 09, 2012

Citation: Zerem E (2012) Minimally Invasive Management of Acute Necrotizing Pancreatitis. Pancreatic Dis Ther 1:e106. doi:10.4172/2165-7092.1000e106

peripancreatic collections typically requires large diameter catheters with multiple side holes. Depending on the operator experience, tandem trochar technique or Seldinger technique can be used. If the Seldinger technique is used, the catheter tract should be sequentially dilated over a guidewire [29,30].

Percutaneous intervention in acute pancreatitis ranges from needle aspiration to the placement of multiple drainage catheters. Understanding the indications and roles of needle aspiration and catheter drainage is essential. Image-guided catheter drainage of fluid collections in and around the pancreas in patients with acute necrotizing pancreatitis is an important therapeutic option either alone or as an adjunct to surgery. Successful percutaneous treatment of necrotic collections of the pancreas depends on several important factors. Catheters often need to remain in place for several weeks and sometimes months, hence the need for close follow-up.

Minimally invasive surgical techniques

Minimally invasive necrosectomy techniques were developed to deal with the solid necrosis with the opportunity for less invasive treatment alternatives to the traditional primary surgical approach which results in significant deterioration and organ dysfunction [34]. The aim which these techniques have in common is the attempt to minimize the surgical stress and physiological insult in patients who are already critically ill [3,35,36]. They can be classified according to the type of scope used (endoscope, laparoscope, nephroscope) and the route of access (transperitoneal, transgastric, retroperitoneal) [37-40]. Natural orifice transluminal endoscopic surgery and laparoscopic retroperitoneal/trans-peritoneal debridement represent the mini-invasive surgical approaches most widely used. In 2000, Seifert et al. [41] first published the result of endoscopic transluminal necrosectomy from the stomach or duodenum and Carter et al. [42] described their technique and good results of percutaneous retroperitoneal necrosectomy. Each of the routes of access has its own advantages and disadvantages, such as ease of access, ability to deal with multiple collections and risk of collateral injury. In 2001, Horvath et al. [43] described the videoassisted retroperitoneal debridement (VARD) approach, using a 4–5cm retroperitoneal incision and regular laparoscopic equipment to remove the infected necrosis. Critics of these techniques point out that they require numerous repeated procedures to perform complete necrosectomy with possible serious complications and a high frequency of fluid collections relapses [44]. The actual position of endoscopic drainage seems to differ only slightly from that of the percutaneous techniques.

Step-up approach

This approach is based on the statement that surgical necrosectomy may represent overtreatment at the beginning of the disease in patients with usually poor general condition, with difficulties to discriminate between necrotic tissue and normal tissue during the procedure and a very high risk of bleeding from vessels in necrotized tissue during or immediately after the surgery [12,18]. Step-up approach can be summarized as: delayed intervention, catheter drainage and minimally invasive drain-guided retroperitoneal debridement [19]. In this approach, conservative treatment with proper intravenous hydration and administration of proper antibiotics (in case of early diagnosis or suspicion of infected necrosis) should be performed at the begining of disease. Percutaneous drainage with vigorous irrigation should be considered when truly conservative treatment fails to resolve infected pancreatic necrosis. Besides, gastroenterologists may use endoscopic transluminal drainage as minimally invasive treatment which also adheres to the step-up concept. If the patient's condition improves, after percutaneous or endoscopic approach, no surgical debridement is performed. This is so in about 35% of cases [19]. Surgical intervention is postponed for as long as possible so that the infected collection may become encapsulated [18,19] and is performed when the patient's condition does not improve or if it deteriorates. Several recently published studies [14-19,24] compared outcome of the step-up approach with primary open necrosectomy and showed that the step-up approach was clearly superior as it reduced morbidity, mortality and costs per patient.

Conclusion

Management of patients with acute pancreatitis requires a multidisciplinary approach involving gastroenterologists, surgeons, and application of diagnostic and interventional imaging methods. The management of acute pancreatitis, whether conservative, surgical or done by interventional imaging techniques varies with the severity and depends on the type of complications that require treatment [45-46]. Classification of the complications of acute pancreatitis into groups according to the Atlanta classification system is vitally important before deciding the treatment strategy because different types of local complications of acute pancreatitis are treated in different ways, either conservatively using medical therapy, or by interventional radiology or surgery [32]. Although no universally accepted treatment algorithm exists, the step-up approach may be considered as the reference standard intervention for this disorder. Recent studies support [14-19,24] the current body of evidence on the merits of the step-up approach to infected necrotizing pancreatitis. The probable greater safety of the "step-up" approach to severe necrotizing acute pancreatitis lies in synthesis and integration of evolving techniques [47]. In the presence of infection of pancreatic/peripancreatic necrosis, evacuation of the fluid infected component can treat the infection together with concomitant antibiotics; otherwise, it may play a bridging role between the critical early time after onset of acute pancreatitis and the optimal later time point for definite intervention. The individual components of the step-up approach may be subject to improvement. Future studies should focus on the optimal technique of catheter drainage (e.g. route of drainage, drain size, duration of drainage, timing of drainage) and minimally invasive retroperitoneal debridement (e.g. endoscopic transluminal, percutaneous retroperitoneal or video-assisted retroperitoneal [VARD]. However the concept of the step-up approach, i.e. delay, drain, debride, seems to be here to stay [19]). Methodologies are still in progress and standardization is currently evolving; nevertheless, these alternative treatment options should notably ameliorate the management of severe acute pancreatitis in the near future.

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