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REVIEW

Update: Role of surgery in acute necrotizing pancreatitis

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Necrosectomy;
Step-up approach;
Emergency surgery;
Laparotomy

Summary Acute necrotizing pancreatitis is a prevalent disease with high morbidity and mortality. The development of radiologic and endoscopic techniques to manage pancreatic necrosis commands a multidisciplinary approach, which has considerably decreased the need for laparotomy. The objective of this update is to define the role of surgery in the multidisciplinary approach to management of necrotizing acute pancreatitis.

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Introduction

The diagnosis of Acute Pancreatitis (AP) is based on the association of epigastric abdominal pain (typically through-and-through) and elevated levels of serum lipase above three times normal. The Atlanta classification, revised in 2012, should be used to guide management [1]. During AP, pancreatic necrosis may develop in the pancreatic parenchyma, in the peripancreatic tissues, or both, [2], constituting what is called Acute Necrotizing Pancreatitis (ANP). Currently, AP is classified in two evolutive phases: the early inflammatory phase associating signs of systemic inflammation and the late phase characterized by the onset of local complications (Fig. 1). Between 20 and 40% of patients develop Walled-Off Necrosis (WON), differentiated from pseudocysts, which are completely liquid, by Magnetic Resonance Imaging (MRI). Only 2 to 4% of WON will require surgical or endoscopic necrosectomy [3]. The Atlanta classification defines three degrees of severity for AP: (i) mild AP, absence of, local or systemic complications or organ

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failure; (ii) moderate AP characterized by either transient organ failure (less than 48 h) or local complications; and, (iii) severe AP, characterized by failure of one or several organ systems persisting more than 48 hours. Only 1/4 of patients with necrosis present signs of severity but in this setting, mortality is 98%, either secondary to infection of the necrosis, or to an acute complication such as gastrointestinal perforation or hemorrhage [4]. The prognosis of patients with ANP depends principally on two factors: the persistence of organ failure and secondary infection of pancreatic necrosis [5].

Traditionally, surgery was the only means to manage the acute complications related to severe pancreatic necrosis (ANP associated with organ failure persisting at least 48 h), representing 10 to 20% of all AP. However, morbidity and mortality were high. The development of less aggressive techniques with radiologic or endoscopic guidance, has limited the morbidity related to necrosis in patients with severe AP. The role of surgery in the management of ANP has thus evolved considerably during the last decades. The goal of this update is to define the role of surgery within a multidisciplinary strategy for severe ANP.

Treatment of pancreatic necrosis

When should pancreatic necrosis be treated?

Evolution of necrosis

Infection of necrotic collections is a major turning point in the evolution of patients with AP, occurring usually between the third and eighth weeks after onset. Mortality from infected necrosis, the main cause of death in AP, ranges from 30 to 35% [6]. The mechanisms of infection are multiple, including, by decreasing order of prevalence, iatrogenic, intestinal bacterial translocation, colonic micro-perforations with micro-vascular involvement [7], hematogenous contamination and, exceptionally, duodenobiliary reflux via pancreatic fistula. The prevalence of infected necrotic collections after surgical drainage increases from 25% during the first week to 60% during the first three weeks [8]. Lastly, the likelihood of a necrotic collection becoming infected increases proportionally with its volume [9]. Secondary infection of pancreatic necrosis should be suspected in the presence of CT scan changes or clinical degradation. For instance, the presence of air bubbles in undrained necrotic collections is strongly suggestive of anaerobic superinfection [10]. In patients who undergo operation for ANP with borderline hemodynamic status, about 40% have infected pancreatic necrosis on bacterial culture [11].

Indications for treatment of necrosis

The value of drainage and debridement has been established only for secondarily infected pancreatic necrosis [12], confirmed by positive pancreatic bacterial cultures, or strongly suspected (onset or persistence of temperature > 38.5°C, organ failure, the need of hemodynamic, respiratory and/or renal support, elevated or worsening white blood cell counts, increased C-reactive protein and/or discovery of bacteraemia). Percutaneous fine needle aspiration of peripancreatic collections to identify the presence of bacteria is not routinely performed [13]. The benefits of identification of the bacteria responsible for the infection and adaptation of antibiotic therapy are counter-balanced

by the risk of false negative results (up to 25%) [11]. Patients with infected collections or necrosis require an interventional approach to provide material for bacteriologic culture and therefore needle puncture is not useful. Strong clinical suspicion of necrosis infection and/or CT scan changes is elements that by themselves call for drainage; initial drainage techniques should not be surgical, if at all possible.

Delay before surgical intervention for necrosis

Surgery for pancreatic necrosis should be delayed for at least four weeks, in order for the collection to become "walled off" as much as possible and therefore prevent bacterial and chemical dissemination into the peritoneal cavity. Such contamination can lead to peritonitis, which strongly influences morbidity and mortality of patients who undergo operation [14]. Rodriguez et al. studied 167 patients treated by surgical necrosectomy. The mortality rate for patients undergoing operation more than 28 days after the onset of symptoms was 5% vs. 20% in the first four weeks [11]. One meta-analysis of eleven series totaling 1136 patients confirmed a statistically significant negative correlation between the duration of the interval before operation and mortality ($R = -0.603$; $P = 0.05$) [15]. The current recommendation is to wait at least four weeks [16,17].

How to treat pancreatic necrosis?

"Classical" surgical techniques

The objectives of treatment of pancreatic necrosis are to debride the devitalized tissues and drain all purulent collections.

Necrosectomy via laparotomy

Laparotomy has long been the rule, allowing exploration of the abdominal cavity to inventory the lesions and to remove as much infected necrosis as possible, accepting substantial associated morbidity (34 to 95%) and mortality (11 to 39%) [18]. The approach could be a midline or bilateral subcostal incision. The greater omentum is opened, exposing the lesser sac and the pancreas. In case of difficulties, the transmesocolic approach has been described as an alternative. Debridement is generally performed by manual fragmentation, taking care to respect the neighboring organs [19]. Numerous bacterial samples are necessary. Certain authors have proposed leaving the abdomen open at the end of the procedure to prevent the onset of Abdominal Compartment Syndrome (ACS) and to facilitate a "second look" procedure.

Upon closure, negative pressure wound therapy with the possibility of lavage allows continued debridement several days after operation. One non-randomized retrospective study evaluating 244 patients found that mortality was decreased owing to drainage/lavage after debridement [20]. In this study, pancreatic endocrine and/or exocrine insufficiency developed in half of cases requiring postoperative surveillance of pancreatic function.

Mikulicz sacs, filled with long prostate wicks and placed in contact, can be useful to buffer bleeding areas after necrosectomy and constitutes, for some teams, the first step before inserting large-bore Lévy-type spiral drains for irrigation-aspiration. These drains can be removed temporarily to allow complementary local water jet debridement to evacuate necrotic debris [21].

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