

Modern Surgical Concepts in the Treatment of Severe Acute Pancreatitis – An Individualized Approach to the Patient

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Abstract

Treatment of patients suffering from severe acute pancreatitis still represents a challenge. Over the last decades there was a clear shift from early repeated open surgical procedures to delayed minimal invasive surgical and/or endoscopic interventions. The initial systemic inflammatory response syndrome is best treated conservatively in the intensive care unit. Surgical or interventional procedures are indicated based on the clinical course. Drains placed under radiological guidance are usually the first step. If further treatment is necessary a minimal invasive approach is preferred. Delaying surgery until the third week after disease onset renders necrosectomy less tedious.

Keywords: Necrosectomy; Laparotomy; Peripancreatic tissue

The Role of Surgery

Severe acute pancreatitis is still a disease with a poor outcome. The severe and critical form of acute pancreatitis is by definition characterized by associated organ dysfunction (eg renal or pulmonary or another organ system) and the occurrence of necrotic tissue of at least 30% of the gland [1,2]. The management of severe acute pancreatitis remains a complex multidisciplinary task [3]. Two decades ago the surgical treatment of these very ill patients consisted of repeated open procedures with laparotomy, evacuation of necrosis and open abdomen. The rationale was to eliminate the source of the Systemic Inflammatory Response Syndrome (SIRS) present in these patients as early as possible. The necrotic pancreatic and peripancreatic tissue, however, could not be evacuated at once for the risk of major bleeding. Later the early and repeated surgical interventions which were associated with considerable morbidity were abandoned and less extensive surgery combined with closed lavage was favoured: After one laparotomy irrigation drains were placed into the necrotic cavity, which was separated from the abdomen by closure of the omental sac. The remaining and often not already completely demarcated necrotic tissue was then removed by continuous lavage over days and weeks. This open technique consisting of an organ preserving necrosectomy followed by a postoperative concept of lavage and/or drainage to evacuate necrotic debris occurring during the further course has then been challenged by various minimally invasive approaches. These included the treatment with broad spectrum antibiotics and early enteral feeding to avoid bacterial translocation in the gut [4]. Two decades ago preemptive antibiotic treatment was thought to be of paramount importance. Several Randomized Controlled Trials (RCT) were published and their data subjected to meta-analysis. It was concluded that patients with severe pancreatitis should be treated with broad-spectrum antibiotics that achieve therapeutic levels in pancreatic tissue [5]. Later on it was realized that the RCTs on that topic were underpowered and the evidence for the routine use of preemptive antibiotics was not convincing. Hence further guidelines abolished this recommendation [6].

Nowadays the approach to necrotizing pancreatitis is primarily non-surgical, due to the fact that systemic morbidity in the early course of the disease is related to a SIRS and this condition does not improve by surgical intervention. Fluid management in the Intensive Care Unit (ICU) is of paramount importance [7,8]. If, however, one of the

conditions listed in Table 1 occurs the patient needs interventional and/or surgical treatment.

If the patient deteriorates, becomes septic and the CT-scan shows gas in the necrosis, or a puncture of the necrosis reveals bacterial growth in the microbiological analysis, the indication for an intervention is given in the sense of a source control.

If organ failures (renal, cardiac, pulmonary and gut) persist and a patient does not improve despite intensive care treatment over 2 to 3 weeks an indication to remove necrotic tissue may be given even if infection of necrotic tissue has not been demonstrated.

In addition to infective problems other complications of severe pancreatitis may appear as varied clinical picture. Bleeding [9] may occur if a vessel is eroded: This results in an instable patient requiring an immediate radiology guided or surgical intervention. Erosion of the colon is another rare but severe complication that may occur, leading to local peritonitis and sepsis [10].

Persisting pseudo cysts are a long-term complication of acute pancreatitis and might cause symptoms due to their size. They may be released when the patient is in a more stable condition but does not improve sufficiently [11].

Depending on the dynamics of the evolution of the disease and

1	Infected pancreatic necrosis [4]
2	Persistent multi-organ failure, despite maximal ICU treatment [24]
3	Other local complications of pancreatitis [4]
4	Persisting and symptomatic pseudo cysts

Table 1: Indications for a surgical intervention in patients with severe acute pancreatitis.

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Received July 08, 2013; **Accepted** October 01, 2013; **Published** October 08, 2013

Citation: Angst E, Storni F, Gloor B (2013) Modern Surgical Concepts in the Treatment of Severe Acute Pancreatitis—An Individualized Approach to the Patient. *Pancreat Disord Ther* 3: 125. doi:[10.4172/2165-7092.1000125](https://doi.org/10.4172/2165-7092.1000125)

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prevailing associated symptoms endoscopy, surgery or a combined approach may be considered. The most important message is to try to delay surgery, then to minimize surgery. This led to the so called step-up approach with drainage first and surgical debridement only second [12]. It is important to discuss the patient for a multidisciplinary approach. The technique used might be dependent on the equipment of the hospital and the personal skills of the surgeon on duty as well as the anatomical location of pancreatic necrosis.

Technical Aspects

CT-guided drainage is well suited for patients with necrosis and fluid collections located in the pancreatic tail or in the flanks. The CT-guided drainage is the first step in our strategy if conservative treatment fails. A CT-guided 8 french drain is placed into the necrosis (Figure 1). This drain aims to control sepsis and releases the pressure in the necrotic cavity [13]. Furthermore the antibiotic treatment can be adapted to the microbial sensitivity test. For about one third of the patients this leads to decompression and healing and obviates the need for surgical necrosectomy [13]. In the event of progressive deterioration or failed recovery, surgery still needs to be performed [14].

Minimal invasive necrosectomy using the drains in place as trail often allows omitting open debridement. It is crucial to keep necrotic debris of the pancreas for microbiological analysis to optimize the antibiotic treatment in the further course. Bleeding is the most dangerous complication of all the interventions. If severe bleeding occurs it requires conversion to laparotomy. All minimally invasivoprocedures may cause acute bacteremia with deterioration of the patient or surgical trauma in neighbouring organs, again necessitating laparotomy.

In order to reduce the systemic insult and morbidity associated with a major laparotomy, several techniques with minimal access were developed. The techniques used for different locations in the pancreas are listed later in this manuscript. The minimal invasive approaches have been proven to be superior to laparotomy [14].

Video-Assisted Retroperitoneal Necrosectomy with Minimal Access

This technique is well suited for patients with necrosis and fluid collection located in the pancreatic tail but we used it as well for necrosis in the pancreatic head with fluid collections on the right side retroperitoneal to the right colon (Figure 2). The access is via the retroperitoneal space and avoids the spread of infected necrosis to the abdominal cavity. When accessing from the left side it is important to spare the neighbouring spleen, the left kidney and the left colon. The patient is positioned $\frac{3}{4}$ on his right side. Then the drain is replaced by a guide wire. By dilatation access to the necrosis is achieved to insert the laparoscope. A targeted evacuation of the necrosis is performed. Two irrigation drains are placed into the cleaned cavity (Figure 3). This



Figure 1: Under CT-guidance an 8 french drain is placed into the necrosis.

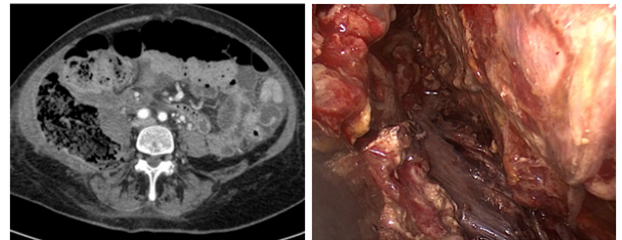


Figure 2: Here the example of a patient with the main necrosis in the pancreatic head and dorsal of the right colon (*). The retroperitoneal access was used to clean the cavity dorsal of the right colon (right panel).



Figure 3: This patient was treated by retroperitoneal necrosectomy 6 weeks ago. The anterior drain was already removed.

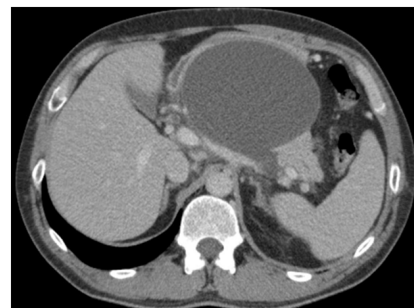


Figure 4: Here an example of a patient with symptomatic pseudocyst. The patient suffered from postprandial epigastric pain.

technique has the advantage of minimal surgical trauma and faster healing because of reduced systemic burden [14]. It avoids the spread of necrotic material and bacteria to the abdominal cavity [15] and it allows repeated necrosectomy in the case of insufficient evacuation easily.

Laparoscopic Transgastricpancreatico-Gastrostomy

This technique is well suited for patients with a well defined cyst wall occurring in both patients with pseudocysts (Figure 4) or a pancreatic necrosis which is walled off after several weeks of conservative treatment (Figure 5). Furthermore the neighbourhood to the stomach is essential. For the surgery the patient is put in a supine position and 20 degree anti-trendelenburg. One optical and 12 mm trocar each and three 5 mm trocars are used to perform this surgery (Figure 6). Before opening the anterior stomach wall with cautery the best localization to open the collection is determined by intraoperative sonography (Figure 7). Anterior of this point the stomach wall is incised. Then another check by sonography is performed before the posterior wall of the stomach is also incised by cautery. This incision is widened with a linear stapler. Now the necrotic debris is removed under vision and put

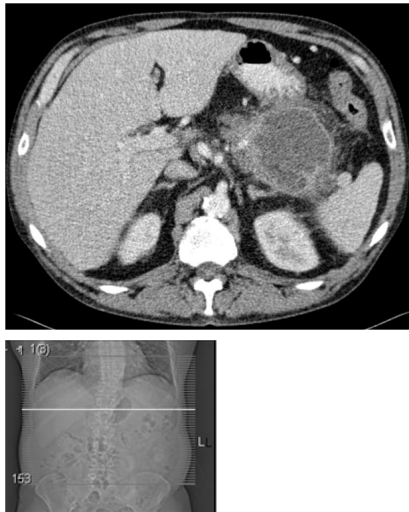


Figure 5: Here the example of a patient with persistent 'Systemic inflammatory response syndrom' and extensive pancreatic necrosis. The cyst wall is well defined and in the neighborhood of the stomach. Around the cyst the inflammatory reaction is still strong.

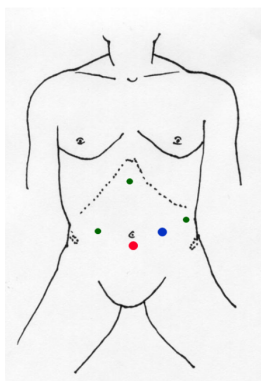


Figure 6: We use 5 trocars for this surgery: an optical trocal (red), one 12 mm trokar (blue) and three 5 mm trocars (green).

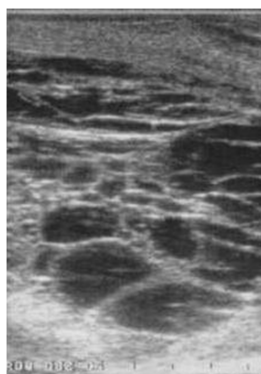


Figure 7: Intraoperative Sonography allows the exact localization of the incision (patient figure XY).

in an endobag before retrieval. After checking hemostasis, the anterior wall of the stomach is closed by a continuous suture. Here a stapler may be used alternatively. This technique reduces the pressure and size of the collection and therefore patients recover from acute pancreatitis.

A CT follow-up is shown in Figure 8. After 6 weeks the incisions are barely visible (Figure 9).

The above mentioned surgical techniques may be combined with endoscopic irrigation and localization. But the necrotic debris is often too big and sticky to be evacuated by endoscopic drainage alone (Figure 10).

Timing of Surgical Intervention

The timing of surgery is of great importance. In the first week of acute pancreatitis, necrotic material is not easily distinguished from healthy tissue [16]. In contrast 3-4 weeks after the onset of pancreatitis, necrosis is better demarcated from healthy tissue and blunt separation is much easier and less prone to cause bleeding. Furthermore vital tissue may then be preserved [16]. The delay of surgery in acute necrotizing pancreatitis is associated with reduced morbidity and mortality [17-20].

Long Term Outcomes

The step-up concept limiting the surgical trauma to only those who do not improve under less invasive procedures [14] is relatively new and no long term data have been published comparing the new concept with traditional open procedures. As mentioned above

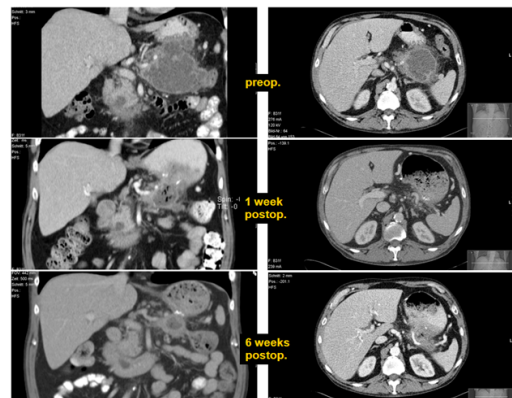


Figure 8: Result in the patient in figure xy. The first row shows the CT-scan prior to surgery, the second row one week postoperatively and the third row six weeks postoperatively.



Figure 9: The scars are barely visible after 6 weeks.

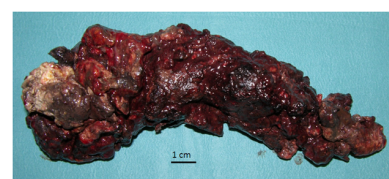


Figure 10: Here the necrosis removed from one patient.

delaying surgery is the key element to avoid unnecessary removal of viable pancreatic tissue because demarcation allows for blunt dissection of only the necrotic material [21]. The less tissue has been removed the more pancreatic function is preserved.

If percutaneous drains are used in the context of a step-up protocol the rate of fistula is low because those who do not recover are selected for further treatment [22].

Data on long term endocrine function after acute pancreatitis have recently been published: Patients often develop prediabetes and/or Diabetes Mellitus (DM) after discharge from hospital, and have a greater than twofold increased risk of DM over 5 years [23].

Summary

A majority of patients with severe necrotizing pancreatitis may be treated effectively non-surgically. For the patient with infected necrosis, multi-organ failure despite ICU therapy or local complications a surgical approach with minimal access is attractive because of its reduced morbidity and mortality compared to primary open debridement.

Acknowledgement

This work was supported by a grant from the Berne Cancer League to EA.

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Citation: Angst E, Storni F, Gloor B (2013) Modern Surgical Concepts in the Treatment of Severe Acute Pancreatitis—An Individualized Approach to the Patient. *Pancreat Disord Ther* 3: 125. doi:[10.4172/2165-7092.1000125](https://doi.org/10.4172/2165-7092.1000125)

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