Retroperitoneoscopic Approaches for Infected Necrotizing Pancreatitis

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Background

Acute pancreatitis is usually a self-limiting disease of which patients recover without serious complications. About 20 % of patients develop severe acute pancreatitis with (extra) pancreatic necrosis or collections [1]. When these collections become organized, usually around 3–4 weeks after onset of disease, they are called walled-off necrosis (WON). In general, necrotizing pancreatitis is associated with a mortality of 15 % [2]. In two-thirds of patients the disease can be treated conservatively, when necrosis remains sterile [3, 4]. Invasive intervention for sterile necrosis carries a serious risk of introducing infection, which necessitates additional interventions and increases mortality [5, 6].

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In about one-third of patients with necrotizing pancreatitis, secondary infection of necrosis occurs [7]. Infected necrosis is one of the most severe complications of acute pancreatitis. It drives clinical deterioration and organ failure in the second phase of the disease, as it usually occurs in the second to the third week after disease onset [7]. It is generally accepted that infected necrosis is an indication for invasive intervention.

Management strategies for invasive intervention in infected necrotizing pancreatitis have evolved over the last decade. The preferred treatment used to be primary open necrosectomy with early and complete debridement of infected necrosis. The current standard is a minimally invasive step-up approach involving percutaneous (or endoscopic) catheter drainage as the first step [8, 9]. When catheter drainage does not lead to clinical improvement, necrosectomy should follow. In a Dutch randomized controlled trial, a step-up approach starting with catheter drainage, followed when needed by retroperitoneoscopic debridement, was superior to open necrosectomy in terms of major early and late complications [8]. This step-up approach is gaining widespread popularity.

There are several forms of minimally invasive necrosectomy, e.g., endoscopic transluminal necrosectomy (ETN), laparoscopic transperitoneal necrosectomy, sinus tract endoscopy (STE), and video-assisted retroperitoneal debridement (VARD). This chapter provides an overview of techniques and outcomes of different minimally invasive retroperitoneoscopic (surgical) approaches.

C.E. Forsmark and T.B. Gardner (eds.), *Prediction and Management of Severe Acute Pancreatitis*,
DOI 10.1007/978-1-4939-0971-1_15,

Transition to Minimally Invasive Techniques

In recent years, there has been an increased interest in the development of minimally invasive techniques to treat gastrointestinal disorders in general. The treatment of infected necrotizing pancreatitis is also shifting toward minimally invasive laparoscopic (transperitoneal), radiological (retro- and transperitoneal), endoscopic (transgastric), and retroperitoneoscopic techniques [10]. Traditionally, open necrosectomy was the procedure of choice. Published mortality rates for open necrosectomy range from 6 [11] to 50 % [12].

Minimally invasive techniques have several potential advantages in comparison with open necrosectomy. These include a reduced inflammatory response to intervention with a lower risk of inducing organ failure in these already critically ill patients, reduced extent of bacteremia, reduced rate of wound complications, shorter hospital and ICU stay, and faster convalescence [2]. Several minimally invasive necrosectomy techniques have been developed, all to facilitate the removal of solid debris. In 1996 Gagner et al. [13] described a laparoscopic debridement, which theoretically holds the risk of spreading the infection into the abdominal cavity and an enhanced risk of intestinal tract erosions. This is why a retroperitoneal approach appears to be a better alternative for open necrosectomy. The peritoneum is left intact and contamination of the peritoneal cavity is prevented.

Retroperitoneoscopic Techniques

Historically, an open retroperitoneal approach with lumbotomy was performed. Three observational cohort studies have reported mortality rates of 20–33 % with a complication rate of 20–50 % [14–16]. Enteric fistulas were noted in 40 % of cases, hemorrhage in 45 %, and colonic necrosis in 15 %. These complications of the open retroperitoneal approach could be the result of the narrow surgical entrance with a largely blind necrosectomy. To overcome these disadvantages different groups have developed alternative retroperitoneal interventions under direct endoscopic vision or video-assisted.

In 1998 Gambiez et al. [17] were first to describe this retroperitoneoscopic approach in the management of infected necrotizing pancreatitis. They treated 20 patients with a short left or right lumbotomy (6 cm in length) centered on the 12th rib. Under direct vision of an endoscope (23-cm mediastinoscope) the peripancreatic necrosis was removed by blunt dissection with a suction metal tube. Afterwards a continuous irrigation tube drain was left in the retroperitoneal space. Later Castellanos et al. [18] used a flexible endoscope for visualization and manual necrosectomy of the necrotic cavity, with a left or right translumbar incision of approximately 15 cm in length. In these two studies, success rate was respectively 75 % and 73 % and mortality 10 % and 27 %.

Hereafter, several derivative retroperitoneoscopic techniques have been described in larger cohorts. Two of these techniques have gained widespread acceptance: STE and VARD. These techniques and their reported results are described in more detail below.

Sinus Tract Endoscopy

Carter et al. [19] in 2000 first described 4 patients undergoing STE after placement of a percutaneous drain. Under CT guidance an 8F pigtail nephrostomy catheter is placed in the infected cavity. The selected route on the left side, that will allow subsequent dilatation, is between the lower pole of the spleen and the splenic flexure. For right-sided necrosis, the route through the gastrocolic omentum anterior to the duodenum, is taken. Under general anesthesia on the operating room, this catheter tract is dilated up to 30F with graduated dilatators under radiologic guidance. A nephroscope is inserted through this dilated drain path under intermittent irrigation and suction and the solid debris is removed using

grasping forceps. A continuous postoperative lavage system is placed, and continued until lavage fluid clears or until the next procedure. If an ongoing sepsis is suspected a second procedure may be performed, after additional CT-imaging. Both a flexible or rigid endoscopic system can be used for STE. Since only small fragments of necrosis can be removed piecemeal with a flexible endoscope, an operating nephroscope may be preferred for primary explorations.

Others have reported STE results using different terminology. Conner et al. [20] described their experience with "minimally invasive retroperitoneal pancreatic necrosectomy (or MIRPN)." They reported the results of 88 procedures in 24 patients; in 21 patients 36 complications occurred (88 %), 6 patients died (25 %), and 5 patients (21 %) required open surgery for or subsequent distant collections or bleeding.

The same group later described an updated cohort of patients undergoing "minimal access retroperitoneal pancreatic necrosectomy (or MARPN)" [11]. They compared MARPN with open necrosectomy in a retrospective analysis of prospective data in 189 patients. Mortality was 19 % compared to 38 % in the open group; 31 % and 56 % of patients, respectively, had postoperative organ failure, 43 % versus 77 % required postoperative ICU support and 55 % versus 81 % had complications. Thus, this study showed significant benefits for this retroperitoneoscopic approach compared to open necrosectomy.

Video-Assisted Retroperitoneal Debridement

VARD is another retroperitoneoscopic technique, and has proven to be safe and efficient [8, 21–23]. VARD is, in essence, a minimally invasive hybrid between the classic lumbotomy and STE, both mentioned above. STE obviates the need for an incision. VARD includes an incision of 5 cm in length, but can also be considered as minimally invasive, opposed to the 15 cm incision in a open translumbar approach. Therefore, larger pieces of necrosis can be removed and VARD seems to be easier to perform than STE, particularly in centers where interventions in this relatively rare condition are not performed routinely [23]. In 2001 Horvath et al. [21] first described the VARD procedure.

In the Dutch PANTER trial [8] VARD was part of a minimally invasive step-up approach as was compared to primary open necrosectomy. In the surgical step-up group, first, a percutaneous catheter drainage (PCD) was placed and the clinical effect was assessed for 72 h. In the case of no clinical improvement, and no possibilities for additional drainage on contrast-enhanced computed tomography (CECT), VARD was performed. In more than 65 % of patients with infected necrosis PCD through the left retroperitoneum was feasible [24].

The VARD procedure [25] is performed under general anesthesia and the patient is in supine position and 30° tilted towards the contralateral side. A VARD can be performed via a left-sided or right-sided approach, the latter being more challenging. The ipsilateral arm is positioned over the patient's head and the following landmarks can be marked; xiphoid, costal margin, anterior superior iliac spine, and mid-axillary line (Fig. 15.1). A preoperatively placed retroperitoneal percutaneous drain is needed as a guideline for safe entry into the left-sided window between spleen, kidney, and colon. From the right side, a safe entry ventral to the inferior caval vein and dorsal to the colon is needed. Near the percutaneous drain, about two fingers below the left costal margin over the mid-axillary line, the planned incision site is also marked. Now the entire abdomen and flank are prepared and draped, to enable conversion to laparotomy. A subcostal 4–5 cm incision is performed over the previously marked site and the muscles are divided sequentially. With the palpating finger the drain is located and followed into the infected collection. The collection wall can be fibrotic. A clamp over the drain may facilitate opening the collection. Care has to be taken to stay close on the drain as from the left side the colon and spleen are nearby. Once the collection is opened, pus will drain spontaneously. The first necrosis can be removed blindly

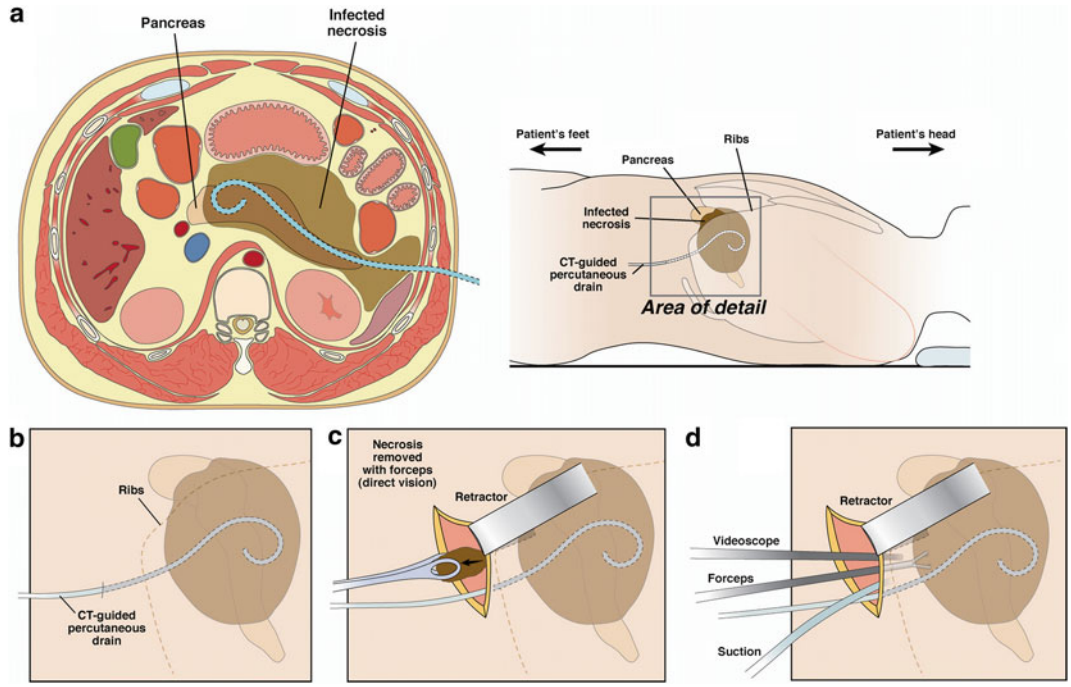

Fig. 15.1 Video-assisted retroperitoneal debridement (VARD). Reprinted from Clin Gastroenterol Hepatol, 10/11, van Brunschot S, Bakker OJ, Besselink MG, Bollen TL, Fockens P, Gooszen HG, et al., Treatment of necrotizing pancreatitis, 1190-1201, Copyright 2012, with permission from Elsevier [35]

using finger fracture, suction, and an extended ring forceps. Subsequently, a 0° laparoscope is introduced and a forceps is used parallel to the video scope in order to remove the necrosis under direct vision. Extended collections, not approachable through one incision, are quite rare but sometimes require another incision in the left groin or right flank. Only loose necrosis should be removed to minimize the risk of bleeding. If there is an arterial bleeding that cannot be easily controlled surgically, the cavity should be packed with gauzes and the intervention radiologist is asked to perform an embolization. In case of venous bleeding, packing should suffice to stop the bleeding, followed by repeat necrosectomy after 24–48 h. In case of severe hemodynamic instability, not improving by packing, the procedure should be converted to laparotomy with opening of the omental sac. In general, the more complete the collection's encapsulation, the easier the necrosectomy can be performed. After completion of the procedure, two large bore surgical drains are placed, one deep in the collection and one more superficial. The fascia is closed over the drains and the skin can be closed or left open for healing by secondary intention. Postoperatively, the drains are continuously lavaged with increasing amounts of saline or peritoneal dialysis fluid, building up from 100 mL per hour to 10 L per 24 h in the first 3 days.

In 2010 a prospective multicenter study [26] reported outcomes on 40 patients with infected necrosis treated in six university medical centers in the USA and Canada. Percutaneous drain placement was the first intervention in all patients. Nine patients (23 %) were treated with drains only. In 60 % of the other 31 patients a successful VARD was performed. The most common reason for crossover from VARD to open surgery was a central collection extending into the mesenteric root and could not be accessed via the flank. Mortality was 5 % and most common complications were pancreatic fistulae and bleeding requiring intervention in respectively 18 % and

8 % of patients. In most patients (81 %) one VARD was sufficient, and no patient required more than two VARD procedures. The overall mortality of VARD reported in literature is 13 %, with a range of 0–33 % [25].

Current Insights into Perspective for the Future

The treatment of necrotizing pancreatitis has changed considerably in the last decades. Management of patients with pancreatic necrosis should be individualized, requiring consideration of all available data (clinical, radiological, laboratory) and available expertise [27]. Intervention is now performed exclusively in case of infected (peri)pancreatic necrosis. Invasive intervention for sterile necrosis is highly controversial. Most experts believe that intervention for sterile necrosis should only be performed if a patient has persistent gastric outlet obstruction with intractable pain and is unable to eat 4–6 weeks after disease onset.

Catheter drainage (e.g., radiologic or endoscopic) is technically feasible in more than 95 % of patients, often via the preferred left-sided retroperitoneal route [8]. The rationale of PCD is to treat infected necrosis as an abscess and drain infected fluid under pressure, without actually removing necrosis. Drainage of the infected fluid may temporize sepsis, improve the patient's clinical condition, and allow for further encapsulation. The preferred route for PCD is through the left retroperitoneum so that the drain can be used as a guide wire for VARD procedure (if necessary) and the peritoneal cavity is not contaminated. Several studies have showed that, in 35–64 % of cases, patients can be successfully treated with PCD alone and do not need to undergo an additional necrosectomy [2, 8, 28, 29].

Every form of intervention, whether open necrosectomy or a minimally invasive retroperitoneoscopic approach, is usually delayed. Based on current literature [9, 30], postponing intervention, preferably until 4 weeks after onset of disease, is widely accepted as the strategy of choice. Since the surgical step-up approach is superior to open necrosectomy and it is known that, catheter drainage can be used to control sepsis and delay or even avoid an additional necrosectomy. But with implementation of the step-up approach, the best timing of catheter drainage is not yet determined. Further prospective (preferably randomized) studies should answer this question and others such as: is it better to postpone catheter drainage until there is walled-off necrosis? Should it be performed immediately after infected necrosis is diagnosed and thereby maximize its clinical effect?

In addition to retroperitoneoscopic approaches ETN is gaining popularity [31, 32]. Theoretically this approach has several advantages in comparison with surgical techniques. Endoscopic treatment of infected necrosis can be performed under deep sedation, thereby avoiding general anesthesia. Also, there is no need for any abdominal wall incision, thereby inducing less surgical stress and potentially reducing complications such as incisional hernia, pancreatic fistula, and wound infections. Until now only one small randomized controlled trial compared ETN with VARD [33]. Twenty patients with infected necrotizing pancreatitis were randomized between ETN and VARD. One-third of patients who underwent an intervention had organ failure and 95 % had proven infected necrosis. ETN significantly reduced the pro-inflammatory response measured by interleukin-6 levels, as well as the composite clinical endpoint consisting of complications and mortality. ETN seems a safe and successful alternative treatment. However, larger randomized controlled trials are needed to confirm these favorable results. In the Netherlands a nationwide multicenter randomized trial is currently being performed comparing an endoscopic with a surgical step-up approach [34]. Results are expected in 2015.

Open necrosectomy seems to be inferior to minimally invasive techniques, although randomized studies directly comparing different surgical techniques for necrosectomy are lacking. These types of studies are difficult to perform. A study powered to detect a difference in mortality is probably not feasible due to the complexity of disease and relatively low incidence of infected necrotizing pancreatitis. Alternative study designs are

needed to evaluate the role of minimally invasive surgical techniques with the other. To this end, an individual patient data meta-analysis (IPDMA) of major international cohorts with patients who underwent a pancreatic necrosectomy is currently underway. In this collaborative project several major international cohorts from seven countries will be pooled to explore risk factors for mortality and compare different methods of necrosectomy and may serve to answer this question.

In conclusion, over the last years the management of patients with necrotizing pancreatitis has changed significantly. Current evidence is clear on the fact that catheter drainage should be the initial treatment step for infected necrosis. There are no randomized studies comparing specifically which surgical technique for necrosectomy is superior in patients who failed to have an effect from catheter drainage. Both STE and VARD are safe and effective in patients with (infected) necrotizing pancreatitis. These and other retroperitoneoscopic techniques are still evolving and need further evaluation in subsequent studies.

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