Endoscopic Management of Peripancreatic Fluid Collection

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Abstract

Patients with acute necrotic pancreatitis occasionally develop walled-off necrosis (WON). Traditionally, surgical necrosectomy has been the standard treatment for symptomatic WON. However, open surgical necrosectomy has been associated with high morbidity and mortality rates. In recent years, the endoscopic step-up approach has been developed as an alternative to open surgical necrosectomy, and studies have demonstrated that this method is associated with a high clinical success rate. In the endoscopic step-up approach, endoscopic ultrasonography-guided transmural drainage (EUS-TD) is presently the standard first step. In the absence of improvement by EUS-TD alone, endoscopic necrosectomy is performed. More recently, the electrocautery-enhanced lumen-apposing metal stent was invented for use in EUS-TD. Although there have been advancements in the devices, techniques, and methodology of EUS-TD, the mortality rate of WON still appears to be high owing to the serious complications, including bleeding and perforation. Therefore, multidisciplinary management by endoscopists, surgeons, and interventional radiologists is required.

25.1 Introduction

Peripancreatic fluid collection (PFC) is a well-known clinical consequence of acute necrotizing pancreatitis. In the revised Atlanta classification, PFC is classified into the following four categories [1]. Acute peripancreatic fluid collection, which is the collection of peripancreatic fluid associated with interstitial edematous pancreatitis that is seen within the first four weeks after the onset of pancreatitis, pancreatic pseudocyst (PP), which is a late complication of interstitial edematous pancreatitis that is seen usually more than four weeks after onset, acute necrotic collection, which is the formation of variable amounts of both fluid and necrosis that is associated with necrotizing pancreatitis, and walled-off necrosis (WON), which is a mature encapsulated necrotic collection usually occurring more than four weeks after the onset of pancreatitis. PFC, including WON, has been traditionally managed by open necrosectomy [2]. However, the procedure is associated with high morbidity and mortality [3]. Management of PFC has changed significantly in the previous decade, and endoscopic techniques are increasingly utilized in the management of PFC. Recently, the endoscopic step-up approach has been developed as an alternative to surgical necrosectomy [4]. This method aims to control the PFC by a less invasive approach in the first step of treatment, and then moving to more invasive approaches step by step. This endoscopic step-up approach has been reported to achieve high technical and clinical success rates [5, 6]. Endoscopic ultrasonography-guided transmural drainage (EUS-TD) and endoscopic necrosectomy (EN) play an important role in the endoscopic step-up approach. The lumen-apposing metal stent (LAMS) has been increasingly used for EUS-TD [7, 8]. This stent anchor is designed to distribute pressure evenly over the luminal wall and to securely anchor the stent to prevent migration. The large bore enables the evacuation of debris, and direct scope insertion when performing EN. More recently, the novel electrocautery-enhanced lumen-apposing metal stent (EC-LAMS) was invented and has contributed to enabling simpler and quicker endoscopic procedure [9]. However, determining the indications and timing of drainage, as well the timing of step-up is occasionally difficult. Herein, we describe the present status of the management of PFC, including the indications of drainage and the endoscopic techniques that are used.

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25.2 Indications of Drainage

In general, drainage of PFC is not recommended in the early phase, owing to the lack of formation of a matured capsule. Well-encapsulated PFCs, i.e., PP and WON, are safely drained and are good indications of intervention. Drainage is recommended for patients with confirmed or clinically suspected infected WON, in whom control by conservative therapy, such as by antibiotics, was unsuccessful. Furthermore, symptomatic WON, such as organ compression, including gastric outlet obstruction, intestinal and biliary obstruction, and pain owing to a large mass is also an indication for drainage. However, the appropriate timing to perform the drainage is controversial. If the patient is tolerating the WON, the intervention is recommended to be delayed for four weeks; however, if the patient's condition is severe and associated with organ failure, it should be drained, as long as it is encapsulated. Contrast-enhanced computed tomography (CT) is often the initial imaging modality used to evaluate the size of the cavity and the presence of a pseudoaneurysm. Magnetic resonance imaging (MRI) is also considered before the intervention, as the contents of PFC, whether liquid or solid, are more accurately characterized by MRI. Pseudoaneurysms are occasionally associated with infected PFC and surrounding artery disruption. If an aneurysm is present, preceding interventional radiology (IVR) and embolization is required to avoid bleeding, which is a common adverse event of drainage. Understanding the differences between PP and WON is also important, as the endoscopic drainage of WON has been demonstrated to have a significantly lower success rate and higher adverse events rate, as well as requires more frequent reinterventions and a longer hospital stay than that of PP. Some contraindications to endoscopic drainage include splenic or portal vein occlusion, gastric varices, and the presence of pseudoaneurysm [10].

25.3 EUS-TD Technique

A linear array echoendoscope is first inserted into the stomach or duodenum, and the diameter of the PFC and the distance between the GI tract and cavity are measured. The distance between the GI tract and cavity wall longer than 1 cm should be avoided. The conventional method is to use a 19-gauge needle to puncture the PFC cavity under EUS guidance. After the needle puncture, a 0.035-inch or 0.025-inch guidewire is advanced within the cavity under fluoroscopic guidance. The tract is dilated using an electrocautery dilator and/or balloon dilator. After tract dilation, plastic stents or fully covered self-expandable metal stents (SEMS) are placed. Plastic stents are usually double-pigtail stents in order to avoid migration. The metal stents used are either fully covered biliary stents, esophageal SEMS, or LAMS [11, 12]. The recently developed EC-LAMS, which has an electrocautery wire at the distal tip of the delivery system, enables one-step stent deployment without needle puncture, guidewire advancement, or tract dilation [9]. EC-LAMS, such as the Hot-AXIOS system (Boston Scientific, Natick, MA, USA), has enabled simplification of the endoscopic drainage procedure (Fig. 25.1).

25.4 EN Technique

In patients in whom there is a poor clinical response to the drainage, EN is performed through the previously placed stent (Fig. 25.2). EN involves direct insertion of the endoscope into the cavity with a combination of suction and removal of the debris using a polypectomy snare, basket catheter, and retrieval forceps. The use of CO_2 instead of air for insufflation during necrosectomy is mandatory to reduce the risk of gas embolism. EN is usually performed once or twice a week, until clinical improvement is achieved. A balance between efficacy and safety is required to avoid injury to the intracavity vessels and retroperitoneal tissue, which leads to bleeding and perforation. In the case of bleeding during the procedure, clip hemostasis, epinephrine injection, and argon plasma coagulation are useful [13]. However, if endoscopic hemostasis is unsuccessful, emergent IVR or surgical hemostasis is required (Fig. 25.3). Contrast-enhanced CT is performed during the interval period of necrosectomy to evaluate the appearance of pseudoaneurysms.

25.5 Treatment Algorithm and Outcomes

The treatment algorithm for symptomatic PFC has evolved from invasive open surgical necrosectomy to a less invasive endoscopic step-up approach. The step-up approach was first introduced by a Dutch group in 2010, in which they reported a randomized controlled trial (RCT) comparing open necrosectomy with minimally invasive endoscopic or percutaneous drainage, and patients in the step-up approach group were found to experience significantly fewer major complications [14]. A recent retrospective study demonstrated that the endoscopic step-up approach is associated with a technical success rate of 99% and a clinical success rate of 96.5% [5]. The European Society of Gastrointestinal Endoscopy guidelines, which are recently released multidisciplinary guidelines for the endoscopic management of acute necrotizing pancreatitis, also recommend the use of the step-up approach [15]. In the step-up approach, the first step is the drainage of the infected fluid endoscopically or percutaneously. Endoscopic transmural drainage appears to be advantageous in patients in whom the PFC is located adjacent to the stomach or duodenum. At present, EUS-TD

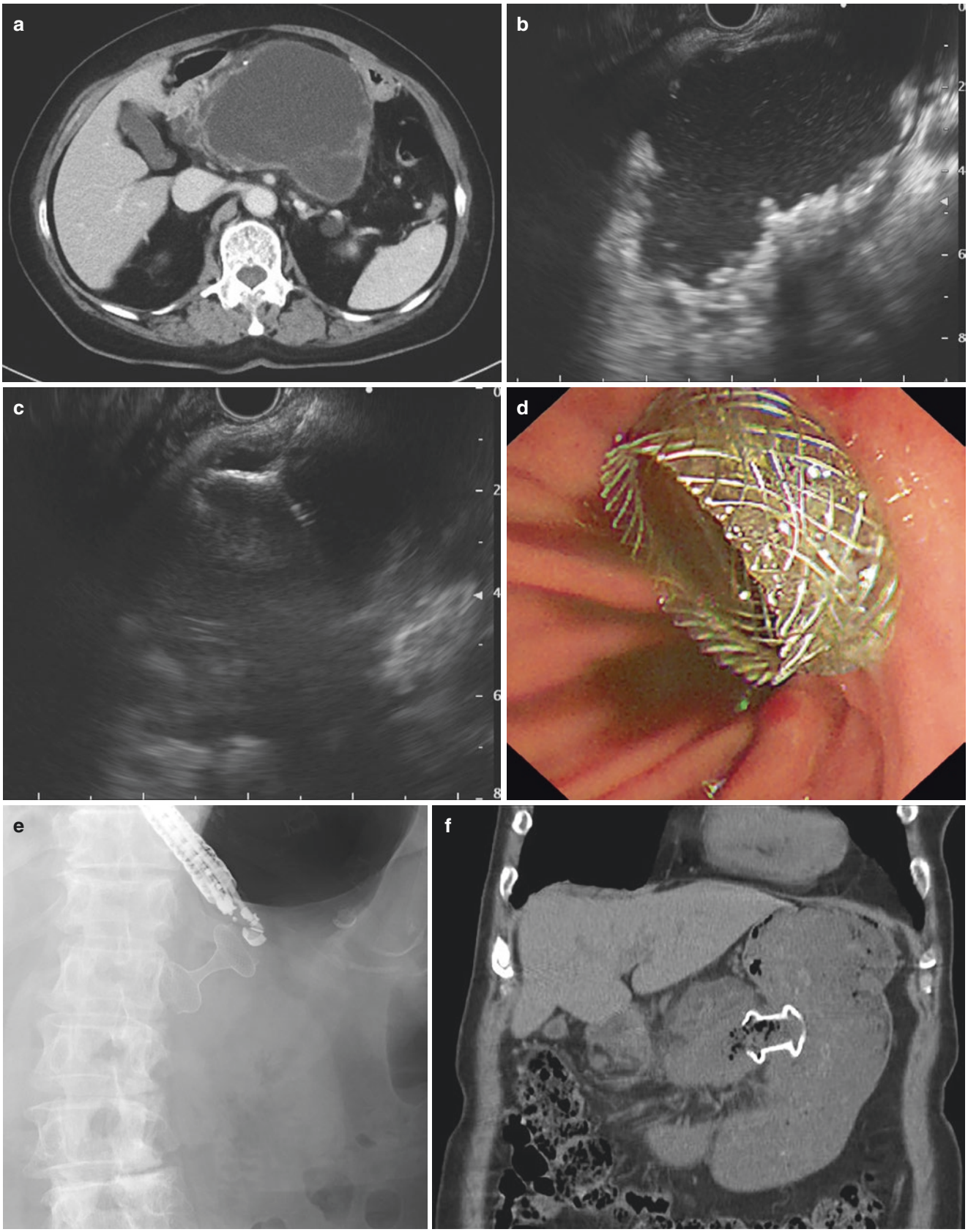

Fig. 25.1 Images of the EUS-TD. (**a**) CT scan axial view of WON. (**b**) EUS image of the encapsulated WON. (**c**) The opened distal stent anchor is visible on EUS. (**d**) Endoscopic image of Hot-AXIOS. (**e**) Fluoroscopic image of Hot-AXIOS. (**f**) CT scan coronal view of Hot-AXIOS

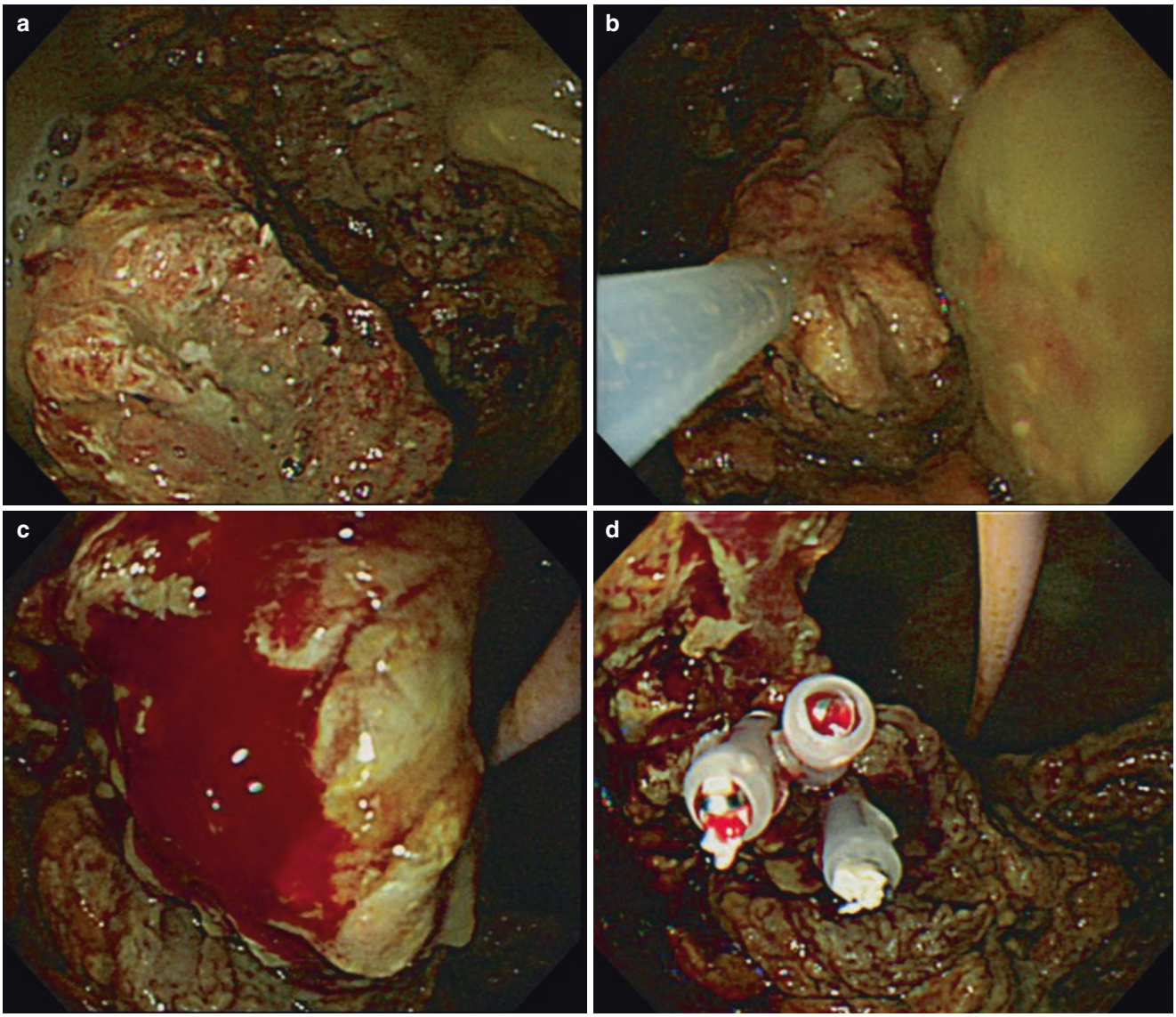

Fig. 25.2 Images of the EN. (**a**) Necrotic debris within the WON cavity. (**b**) Necrosectomy through the stent. Polypectomy snare was used for the debris removal. (**c**) Bleeding from intracavity vessel was seen during the necrosectomy. (**d**) Clip hemostasis was performed

is the optimal transmural drainage approach, replacing the conventional transmural drainage method using a gastroscope, owing to the higher success rate of drainage. Regarding the type of stent, some retrospective studies demonstrated no differences in the treatment success rate of drainage between plastic stents and metal stents, although procedure time was shorter in the metal stents group [16, 17]. However, a recently published systematic review demonstrated that resolution of WON was more likely with the use of metal stents than with plastic stents, with a trend of lower perforation and stent occlusion with metal stents, although there is more migration [18]. Another systematic review demonstrated that the clinical success rate of drainage using metal stents was 93.8% and the adverse events rate was 10.2%, which included bleeding, perforation, stent migration, and infection [19]. At present, most clinical institutions use metal stents, particularly LAMS for the initial drainage. The technical success rate of EUS-TD using EC-LAMS has been demonstrated to be 100% with no procedure-associated complications, and a 96% clinical success rate regarding resolution of the PFC [20]. If the PFC is located far from the stomach or duodenum, percutaneous drainage can be considered as an appropriate first step. The percutaneous procedure is performed under CT or ultrasound guidance. In the case of extended WON to the pelvic area, a combination of EUS-TD with additional percutaneous drainage is considered. In patients with multiple cavities or a large WON showing insufficient response to drainage alone, the multiple transluminal gateway technique (MTGT) and/or single transluminal gateway transcystic multiple

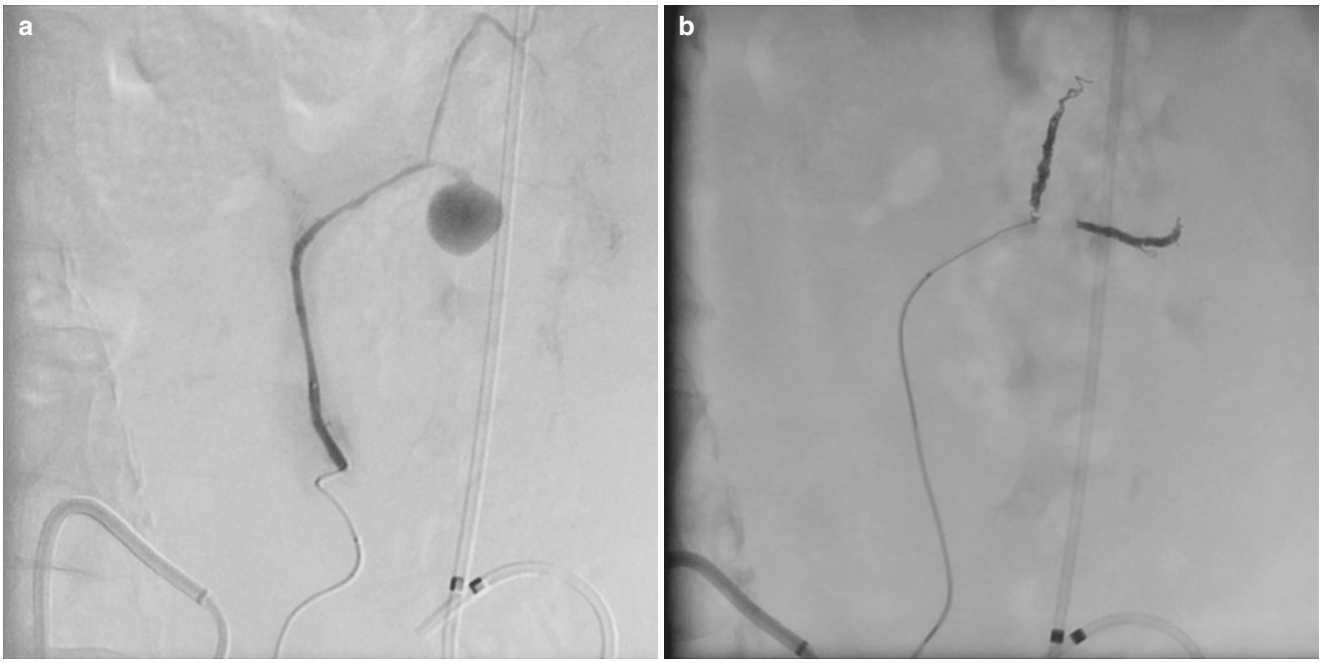

Fig. 25.3 Images of the IVR. (**a**) Rupture of pseudoaneurysm was seen from the marginal artery. (**b**) IVR with hemostatic coiling was conducted

drainage (SGTMD) should be considered [21, 22]. MTGT involves creation of some transmural gateways, and SGTMD involves drainage via one gateway by placing multiple plastic stents for the multiple cavities. Both methods were established from the idea that multiple sites of access to the cavities would achieve more efficient drainage. In the absence of improvement by drainage, EN is the next step of therapy. Patients who require EN tend to have a larger collection with more solid and necrotic debris [6]. Although EN is less invasive than surgical necrosectomy, the rate of adverse events is not low. One study demonstrated that the clinical success rate of endoscopic necrosectomy was 75%, with an adverse events rate of 33% and mortality rate of 11% [23]. The potential serious adverse events, such as bleeding, perforation, and air embolism can be life-threatening. Therefore, the procedures should be performed in a multidisciplinary setting, in which emergency rescue surgery or IVR can be performed. The LAMS should be retrieved within four weeks of placement, to avoid stent-associated complications [24]. If treatment is incomplete after four weeks, the plastic stent should be replaced. If clinical improvement is not achieved by these procedures, the next step is minimally invasive surgery, such as video-assisted retroperitoneal debridement (VARD), which minimizes the surgical incision, usually along the previously placed percutaneous catheter, or open surgical necrosectomy [14]. Indications of surgery have become limited, although surgery plays an important salvage role, such as decompressive laparotomy in cases of abdominal compartment syndrome, which is a less common but lethal complication of acute necrotizing pancreatitis [25]. These studies indicate that the endoscopic step-up approach is a reasonable treatment algorithm. However, a recently reported RCT comparing the endoscopic step-up approach and the surgical step-up approach, which consists of percutaneous catheter drainage followed by VARD if necessary, demonstrated that the endoscopic step-up approach is not superior to the surgical step-up approach in reducing major complications or death, although the rate of pancreatic fistulas and length of hospital stay were lower in the endoscopy group [4]. Regarding the role of endoscopic retrograde cholangiopancreatography (ERCP) for the management of WON, if the patient has disconnected pancreatic duct syndrome (DPDS), which is disruption of the main pancreatic duct (MPD) owing to WON, combining EUS-TD with transpapillary stenting by ERCP for bridging the disruption is considered. ERCP enables management of the underlying source of persistent leakage. A recent retrospective study demonstrated that DPDS occurs more frequently in patients with WON than those with other PFCs [26]. However, routine ERCP with transpapillary drainage is not necessary in patients that do not have DPDS. If transpapillary stenting for the MPD disruption is unsuccessful or if there is complete disruption, EUS-guided pancreatic duct drainage can be considered [27]. Although most of the previous data were from small retrospective studies, and the procedure is technically challenging, the placement of a stent as pancreatico-gastrotomy is feasible for patients with a dilated MPD.

25.6 Conclusion

The step-up approach is useful for the treatment of patients with WON. However, despite advancements in the devices, techniques, and methodology, the mortality of patients with WON is still high owing to its serious complications. Therefore, multidisciplinary management by endoscopists, surgeons, and interventional radiologists is required for successful treatment of WON.

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