CASE REPORT

Transmural Drainage with Lumen Apposing Fully Covered Self-expanding Metal Stent and Hydrogen Peroxide Lavage Improves Clinical Outcomes in Patients with Walled-off Pancreatic Necrosis

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ABSTRACT

Context Acute necrotizing pancreatitis, with an incidence of nearly 20% in patients with acute pancreatitis, can lead to significant morbidity and mortality. Management can be difficult and at times requires a multidisciplinary approach. Endoscopic and minimally invasive techniques can reduce end-organ failure, procedure related complications, and the high mortality associated with acute necrotizing pancreatitis. **Case series** We present a series of six consecutive patients who underwent successful Endoscopic Ultrasound guided necrosectomy of symptomatic walled-off pancreatic necrosis using a lumen-apposing fully covered self-expanding metal stent and hydrogen peroxide. Technical success was achieved in 100% of patients. Clinical success was achieved in 83% of patients. Cross-sectional imaging confirmed resolution of walled-off pancreatic necrosis in these patients during follow up. The mean number of endoscopic sessions to perform direct endoscopic necrosectomy was 3.0 and the average follow up duration was 5.5 months. In our series of patients with walled-off pancreatic necrosis, Endoscopic Ultrasound-guided necrosectomy with lumen-apposing fully covered self-expanding metal stents and hydrogen peroxide was both feasible and efficacious. There were no procedure-related adverse events and all patients had resolution of their necroma after treatment except for one that died from other non-procedure related causes.

INTRODUCTION

One of the most serious complications of acute pancreatitis is the development of pancreatic necrosis. In the weeks following the onset of necrotizing pancreatitis, the necrotic tissue is sequestered and can form organized necrotic collections or walled-off pancreatic necrosis [1]. Infection often occurs in these collections and carries a substantial mortality if not adequately treated. Surgical necrosectomy with repeated laparotomies used to be the mainstay of walled-off pancreatic necrosis treatment [2, 3, 4]. More recently, direct endoscopic necrosectomy has emerged as a viable alternative to surgical management of pancreatic necrosis. This technique has been further refined with the addition of Hydrogen peroxide (H_2O_2) [5, 6, 7].

We present a series of six consecutive patients who underwent successful Endoscopic Ultrasound (EUS)-guided necrosectomy of walled-off pancreatic necrosis using a lumen-apposing fully covered self-expanding metal stent and hydrogen peroxide.

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CASE SERIES

A total of 6 patients underwent hydrogen peroxide assisted EUS-guided necrosectomy of walled-off pancreatic necrosis **(Table 1)**. All of the patients were male and had moderate to severe pancreatitis based on their Computed Tomography Severity Index. The location of the walled-off pancreatic necrosis was either in the head or body of the pancreas. The size of necroma ranged from 6 cm to 10 cm in diameter at the time of EUS **(Figure 1)**.

For each patient, EUS was performed using a linear echoendoscope at 7.5 MHz frequency with carbon dioxide gas insufflation. Fine need aspiration (FNA) with a 19-guage needle was performed after color Doppler verified an avascular path through the stomach to the necroma. The stylet was then withdrawn and a 0.035 inch in diameter and 480 cm in length wire was passed into the walled-off pancreatic necrosis. The wire was confirmed to be in correct position with fluoroscopy. A cystotome was passed over the guidewire and the necrotic cavity punctured and dilated to 10 French. Then a 15 mm × 10 mm lumen-apposing fully covered self-expanding metal stent (Axios stent, Boston Scientific, Marlborough MA) was placed in the walled-off pancreatic necrosis under EUS and endoscopic guidance. The stent position was confirmed with fluoroscopy. Subsequently, a dilating balloon was advanced over the guidewire and through the stent. The balloon was slowly inflated to 15 mm. The echoendoscope was then withdrawn and using a forward viewing endoscope, direct endoscopic necrosectomy was performed through the stent **(Figure 2)**. Upon completion

Table 1. Patient Characteristics and Outcomes.

Patient	Etiology of pancreatitis	Size of collection	Percent of pancreas that was necrotic	Computed Tomography Severity Index	Location of the necroma	Prior Interventions on the area of walled-off pancreatic necrosis	Puncture site for necrosectomy	Stent size	Amount of 0.3% Hydrogen peroxide instilled	Number of Endoscopic sessions required	Time till stent removed (days)	Clinical success	Imaging resolution	Length of follow up (days)
72 yo white male	Alcohol	4 cm x 6 cm	< 30%	6	Head	None	Stomach	15 mm x 10 mm	100 cc	3	47	Yes	Yes	164
53 yo white male	Hypertriglyceridemia	4 cm x 7 cm	> 50%	9	Body	Perc drain placement by IR without improvement	Stomach	15 mm x 10 mm	100 cc	3	56	Yes	Yes	201
27 yo white male	Biliary	7 cm x 8 cm	< 30%	6	Body	None	Stomach	15 mm x 10 mm	100cc	5	77	Yes	Yes	187
35 yo white male	Hypertriglyceridemia	6 cm x 6 cm	< 30%	5	Body	None	Stomach	15 mm x 10 mm	100cc	2	77	Yes	Yes	98
61 yo white male	Biliary`	10 cm x 10 cm	< 30%	5	Head-Body	None	Stomach	15 mm x 10 mm	100cc	2	21	Yes	Yes	84
54 yo white male	Biliary	7 cm x 8 cm	30-50%	8	Head-Body	None	Stomach	15 mm x 10 mm	100cc	1	-	No	No	13

of direct endoscopic necrosectomy the cystic cavity was lavaged with 100 cc of 0.3% hydrogen peroxide. The hydrogen peroxide was not suctioned out and proton pump inhibitors were held for 30 days after initial procedure.

The technical success rate was 100% as each patient underwent successful direct endoscopic necrosectomy with fully covered self-expanding metal stent placement. There were no procedure related complications. Clinical success was defined as resolution of symptoms attributed to walled-off pancreatic necrosis. Clinical success was achieved in 83% of patients. Cross-sectional imaging confirmed resolution of the walled-off pancreatic necrosis in these patients during follow up. The mean number of endoscopic sessions to perform direct endoscopic necrosectomy was 3.0 and the average follow up was 5.5 months. The one patient that did not achieve clinical success died 13 days after stent placement secondary to multi-organ failure stemming from the severity of his presenting illness and not related to the procedure itself.

DISCUSSION

This case series adds to the growing body of evidence for hydrogen peroxide-assisted direct endoscopic necrosectomy in treatment of walled-off pancreatic necrosis. Hydrogen-peroxide rapidly dissociates into oxygen and water when it comes into contact with organic tissue. This process facilitates healing and debridement by effervescence which leads to necrotic tissue dislodgement, debris extrication, and oxidation of bacterial cell walls [5].

There are several advantages to using a lumen-apposing fully covered self-expanding metal stent over multiple plastic pigtail stents or traditional tubular fully covered self-expanding metal stents for direct endoscopic necrosectomy via a cystogastrostomy. The lumen-apposing stent has large flanges that decrease migration rates as opposed to tubular metal stents. Furthermore, the stent has a large luminal diameter which not only decreases the likelihood of stent occlusion but can also be used as a port for subsequent direct endoscopic necrosectomy sessions. In contrast, plastic stents have a small luminal diameter of only 10 Fr which makes them prone to occlusion with the thick debris that typically drains from necromas. Plastic stents or tubular metal stents have to be removed prior to any repeat direct endoscopic necrosectomy procedures. Additional dilation of the tract between the stomach and necroma is also usually necessary with plastic stents. The use of lumen-apposing fully covered self-expanding metal stent eliminates the need for repeated stent placements and serial dilations of the cystogastrostomy tract, making subsequent procedures safer and more efficient.

In our series of patients with walled-off pancreatic necrosis, EUS-guided necrosectomy with lumen-apposing fully covered self-expanding metal stent and hydrogen peroxide was both feasible and efficacious. There were no procedure-related adverse events and all patients had resolution of their necroma after treatment except for one that died from other non-procedure related causes.

Figure 1. Pre-Intervention CT scan revealing walled-off pancreatic necrosis (marked with asterisk).

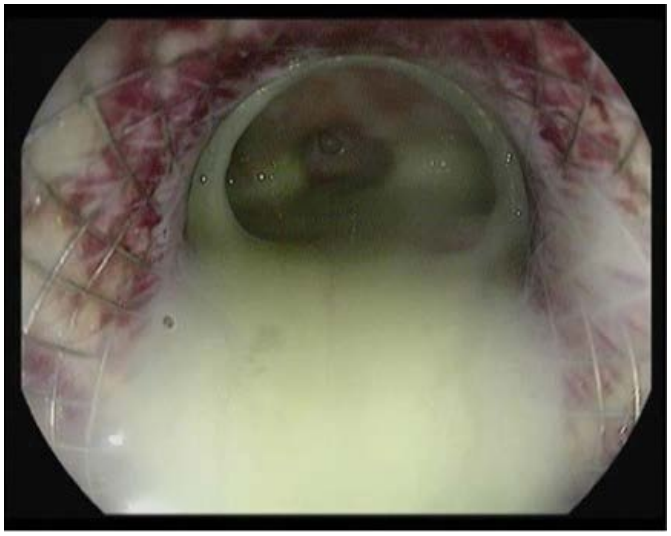

Figure 2. Drainage of pus through the Axios stent.

The lumen-apposing stent used in our case series proved durable with a mean time of 8 weeks before stent removal. There were no cases of stent migration or need for additional stent dilation after the index procedure.

Although, the use of non-EUS-guided transmural drainage has been described by Abdelhafez *et al*. with good results [6], we would still advocate the use of EUS guidance to help avoid interjecting vessels in between the stomach mucosa and area of necrosis. Siddiqui *et al*. [5], showed that hydrogen peroxide was easy to use and reduced the need for additional mechanical debridement. However, in that study of 14 patients, EUS-guidance was used in only half of the patients and one patient had a necrosectomy related perforation. Furthermore, plastic pigtail stents and metal biliary stents were used to keep the cystogastrostomy patent. To date, our study is the largest series of patients using fully covered self-expanding metal stents and hydrogen peroxide in treatment of walled-off pancreatic necrosis. The minimally-invasive approach that we describe eliminates the need for external drainage and surgery. This approach provides an attractive alternative to traditional surgical necrosectomy, which carries a significant morbidity and mortality rate [2, 3, 4, 6, 7]. Additional studies with larger cohorts and long-term follow up are needed to further validate this technique as current literature reveals promising results in a condition that was previously very challenging to treat.

Conflict of Interest

The authors declare that there is no conflict of interests.

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