

Multimodal necrosectomy with full combined endoscopic necrosectomy in the management of acute necrotizing pancreatitis

S. Ouazzani¹, M. Gasmi, M. Barthet and J.M. Gonzalez

*Ther Adv Gastrointest
Endosc*

2023, Vol. 16: 1–6

DOI: 10.1177/

26317745231182595

© The Author(s), 2023.
Article reuse guidelines:
sagepub.com/journals-
permissions

Abstract: Transgastric and transduodenal endoscopic drainages and necrosectomy are minimally invasive and effective way for the treatment of infected necrosis in the setting of acute pancreatitis (AP), but are limited in case of large and distant collections or in case of altered anatomy. We present an exclusively endoscopic approach consisting of multimodal endoscopic necrosectomy. We included consecutive patients with severe AP and presenting with large and infected necrosis requiring one transgastric and at least one extra-gastric access, among which are percutaneous, transcolonic, and/or transgreluc access. All accesses and necrosectomy sessions were performed endoscopically with CO₂ insufflation. Six consecutive patients were treated. The location of infected collections were perigastric (100%), right and left paracolic (67% and 67%), and paraduodenal (33%). All patients had transgastric or transduodenal access, all had at least one percutaneous access (total: 7 accesses), one had one transcolonic access, and one had one transjejunal access. A median of 4 necrosectomy sessions (2–5) were performed. All patients recovered without additional surgical necrosectomy. Full endoscopic multimodal management of infected necrosis with step-up approach seems feasible, safe, and effective in very large collections.

Keywords: acute pancreatitis, necrosectomy, necrotizing pancreatitis

Received: 24 June 2022; revised manuscript accepted: 30 May 2023.

Introduction

Necrosis of pancreatic and/or extrapancreatic tissue occurs in 10–20% of cases, while one third of these patients will develop necrosis infection, with high mortality despite antibiotics use and advances in critical cares.^{1,2} This life-threatening complication generally requires invasive treatment.³

Over the last decade, treatment has evolved from open surgical procedures, associated with high morbidity and mortality,⁴ toward step-up strategy including endoscopy, radio-guided percutaneous drainage (PD), and minimally invasive surgery. Considering the recent literature, transgastric and transduodenal endoscopic drainage seems to be the safest approach,⁵ but remains technically complicated in the case of

extra pancreatic collections distant from stomach and duodenum, or altered anatomy. Moreover, multiple and large collections are difficult to treat with regular transluminal endoscopy alone; thus, multiple transluminal gateway technique has been proposed to improve drainage.³ It has also been described as an interesting and effective association with PD for collections extending to paracolic gutters.⁶

We report here a case series of six consecutive patients managed for very large infected walled-off pancreatic necrosis, applying a strategy of multimodal full endoscopic necrosectomy, associating usual (transgastric and transduodenal) transmural access, to at least one additional endoscopic non-gastric transmural and/or percutaneous access.

Correspondence to:

S. Ouazzani
Department of
Gastroenterology,
Hôpital Nord, AP-HM,
Aix-Marseille Université,
Marseille, France.
Ouazzanisohid@gmail.com

M. Gasmi
M. Barthet
J.M. Gonzalez
Department of
Gastroenterology,
Hôpital Nord, AP-HM,
Aix-Marseille Université,
Marseille, France



Patients and methods

Patient selection

We reviewed our database of patients hospitalized at Hôpital Nord (AP-HM, Marseille) between 2015 and 2019 for a severe acute pancreatitis (AP) with necrosis. Patients with a large and infected necrosis requiring a multimodal endoscopic management including one transgastric (or transduodenal access) and one extra-gastric access among percutaneous, transcolonic, and/or transgreluc access were kept for analysis. The presence of infection was suspected by the presence of extraintestinal necrotic collection based on clinical evidence of sepsis. It was confirmed at CT that showed the well-collected collection with air inside.

Endoscopic treatment

All endoscopic procedures were performed by three experts in endoscopy (MB, JMG, and MG). Endoscopic procedures were performed under general anesthesia, on intubated patients in supine position, with CO₂ insufflation.

The creation of a transmural access from the digestive lumen toward the cavity was performed under both endoscopic ultrasound (EUS) and fluoroscopic guidance, with the use of a therapeutic linear echoendoscope. Two types of EUS-scopes were used: EG3870UTK (Pentax Medical, Tokyo, Japan) and the EG580UT (Fujifilm Corporation, Tokyo, Japan), both with an operating channel diameter of 3.8 mm. The techniques used were the standard or the direct technique, previously described. Briefly, the standard technique included the collection identification followed by puncture with a 19-gauge needle, the introduction of a guidewire allowing for passing of a 10 French cystotome and then introducing two double pig tail plastic stents after the placement of a second guidewire. The direct technique used a luminal-apposing metal stent (Hot Axios, Boston Scientific, Marlborough, USA), eventually associated by a drain placement for nasocystic irrigation. The techniques were similar for all transmural accesses.

The creation of a percutaneous access for endoscopic necrosectomy was multistep: First, a catheter was placed under radiological CT or percutaneous ultrasound guidance. The second step consisted of catheter withdrawal after guidewire placement into the collection, followed by a percutaneous dilation with a CRE balloon

(Boston Scientific) until 20 mm. This allowed accessing the infected collection in retroperitoneal space with the gastroscope. The path was finally maintained by a 20/100 mm metallic colonic stent for further necrosectomy sessions.

The necrosectomy sessions were performed with a large channel (3.8 mm) therapeutic gastroscope (Pentax Medical), performing water irrigation with a pump and suction on the necrotic debris, eventually helped by the use of a Dormia basket. Patients were all followed in intensive care unit, with a CT scan performed at 1 week after the first drainage to evaluate the evolution, followed by complementary necrosectomy sessions if necessary.

Results

Demographic data

A total of six patients (50% are men) were treated for necrosis infection post-AP using multimodal extra-gastric approach (MEGA). Their median age was 41 years (range, 31–60 years). The etiologies were biliary (2/6), iatrogenic (2/6 including 1 after ERCP and 1 due to pseudocyst infection after its drainage), alcohol related (1/6), and one consecutive to pancreatic trauma (1/6). All of them were hospitalized in intensive care unit and presented septic shock with at least one OF.

The extension of infected collections was as follows: all of the patients had a perigastric collection, 67% (4/6) had right paracolic extension, 67% (4/6) had left paracolic extension, and 33% (2/6) had paraduodenal extension. The necrosis infection occurred after a median time of 6 weeks (range, 4–20 weeks). Patients' characteristics are presented in Table 1.

Initial access

The first access was performed after a median of 6 weeks (range, 4–20 weeks) after pancreatitis onset. Three patients had classical transgastric access, one patient had transduodenal access, and because of post-surgical altered anatomy (previous Roux-en-Y gastric bypass), one patient had trans-jejunal access. The last patient had initially abdominal decompression surgery (AP was due to pancreatic traumatism in a polytraumatic context complicated by abdominal compartment syndrome). The access was performed with a lumen-apposing metallic stent (LAMS, Axios stent, Boston Scientific) in 83% of cases (5/6),

and all of them had at least one necrosectomy session following the drainage.

Additional access

The second access was performed after a median delay of 13 weeks (range, 4–26 weeks) after the pancreatitis onset (i.e. 7 weeks after the first access). The median collections size was 9.5 cm (range, 7–15 cm). All patients had PD, allowing necrosectomy sessions in 5/6 (83%) patients, with a median number of 2.5 sessions (range, 0–4 sessions). In four (67%) patients, a third access was necessary after a median of 5 weeks (range, 4–20 weeks) after the first one following a percutaneous route in three patients (50%), a transcolic route in one patient (17%), and a transduodenal in one patient (17%). These accesses were followed by one session of necrosectomy in two patients: one percutaneous and one transduodenal.

The total median number of necrosectomy sessions (including all access) was 4 (range, 2–5), while the median of extra-gastric necrosectomy sessions was 3 (range, 0–5). For each patient, timing, number and type of access are summarized in Table 2.

Outcomes

All patients recovered, with a complete drain withdraw and a CT scan showing complete collection healing after a median of 13 months (range, 9–36 months). The median hospital duration was 24,5 weeks (range, 8–41 weeks), including a median of 14,5 weeks (range, 4–37) stay in intensive care unit.

None had additional surgical necrosectomy, all patients were endoscopically managed.

Discussion

In this series, we report the results of MEGA for full combined endoscopic necrosectomy based on the step-up approach.

One of the most predictive factors for failure of endoscopic transluminal drainage is large necrotic collections, generally more than 12 cm, with deep extension in paracolic gutters and pelvis.³ In these cases, combination of multiple transgastric gateway technique and of PD according to the location and the size of infected collection are known to provide better outcomes, with better clinical success and less complication,⁶ such as

Table 1. Patients' characteristics.

Characteristics	
Sex, F/M (%)	3/3 (50%/50%)
Median age (range)	41 (31–60)
Etiology	
Biliary	2
ERCP related	1
Alcohol	1
After pseudocyst drainage	1
Post-traumatic	1
Location	
Perigastric	6/6 (100%)
Right paracolic	4/6 (67%)
Paraduodenal	2/6 (33%)
Timing of necrosis infection (range)	6 weeks (4–20)
Timing of first access (range)	6 weeks (4–20)
Timing of second access (range)	13 weeks (4–22)
Collection median size (range)	9.5 cm (7–15)
Type of necrosectomy after second access	
Percutaneous	5/6 (83%)
Transduodenal	1/6 (17%)
Transcolonic	1/6 (17%)
Median number sessions of necrosectomy (range)	3 (2–5)
Median time to complete drain withdraw (range)	13 months (9–36)
F, female; M, male.	

pancreatic fistulae.⁷ PCD is a cornerstone in the arsenal of treatment of necrotizing acute pancreatitis. It allows rapid and effective control of sepsis, avoids the onset or OF persistence, and provides a definitive therapy in more than one third of cases,^{8,9} avoiding additional more morbid intervention in fragile patients. In the case of insufficient clinical response, percutaneous catheters provide an effective path for VARD. Although minimally invasive, this technique requires a surgical flank incision, along percutaneous catheter, and uses rigid laparoscopic instruments with

Table 2. Multimodal access for each patient.

Patients	First endoscopic access (material + timing) EN sessions (n) Duration of first access/replacing material	Second access Timing after 1st access EN sessions (n)	Third access Timing after 1st access EN sessions (n)
Patient 1	Transgastric (LAMS + NCD) at week 20 1 session 4 weeks / NCD	PD (RPCG) 1 week 2 sessions	PD (LPCG) 5 weeks 1 session
Patient 2	Surgical decompression at week 1, followed by PD (RPCG) at week 4 4 sessions, followed by Endovac for 2 weeks	Transduodenal Traumatic perforation, NCD used, at 6 weeks 1 session	NA
Patient 3	Transgastric (LAMS, DPT + NCD) at week 4 2 sessions DPT for 16 weeks	PD (RPCG) 1 week 1 session	NA
Patient 4	Transgastric (LAMS + DPT) at week 8 2 sessions 6 weeks / 2 DPT for 9 months	PD (LPCG) 2 weeks 0 session	Transcolonic (LAMS + DPT) 20 weeks 1 session
Patient 5	Transduodenal (LAMS) at week 6 1 session 5 weeks / 2 DPT for 1 year	PD (RPGD) 3 weeks 3 sessions	NA
Patient 6	Transjejunal (LAMS) at week 6 1 session 2 weeks / 2 DPT for 1 year	PD (RPGD) 4 weeks 3 sessions	PD (LPGD) 4 weeks 1 session
DPT, double pig tail plastic stent; EN, endoscopic necrosectomy; LAMS: lumen-apposing metal stent; LPCG: left parietocolic gutter; NA: not applicable; NCD: nasocystic drain; PD: percutaneous drainage; RPCG: right parietocolic gutter.			

limited maneuverability and penetration into deep retroperitoneal spaces, with risk of vital structures injury.¹⁰ Endoscopic necrosectomy is known to be associated with lesser proinflammatory and tissue injury, with lesser rates of complication compared with surgical minimally invasive debridement.^{4,5} This led to the percutaneous endoscopic necrosectomy (PEN) within the created PD.^{6,11–13} Due to the angulation and versatility offered by flexible endoscope, this technique allows for deeper access in retroperitoneal spaces than rigid laparoscope. In our series, all patients benefited from PCD, followed in almost all cases by PEN.

In this series, two patients had an endoscopic extra-gastric transluminal access, including trans-jejunal and trans-colic path. At our knowledge, they are the first reported cases to treat post-pancreatitis necrosis. The first patient was a

young woman, who had a biliary AP and because post-bariatric surgery altered anatomy, the peripancreatic necrosis was better accessible by trans-jejunal drainage. The transmural access using lumen apposing stent allowed for necrosectomy session. Because of the extension toward the paracolic gutters, bilateral PD were also performed, associated with PEN. The second case involved a woman with alcoholic AP complicated by a retrogastric large collection extending toward left paracolic gutter. A first good evolution was seen after transgastric and PD. However, because of insufficient efficacy of the PD (despite multiple changing), a transcolonic drainage was performed with an Axios stent, placed at 40 cm from anal margin, with rapid resolution of the collection without further intervention. In every case, the extra-gastric transluminal endoscopic drainage was performed because of the proximity of the collection to the digestive wall and because

this was the best available way. No complication occurred during the drainage, during the follow-up, or during the stent withdrawal.

In conclusion, full endoscopic multimodal management of AP complicated by infected necrosis with step-up approach was feasible, safe, and effective. Future studies should compare this approach with endoscopic step-up approach in term of clinical efficacy, complication, and cost-effectiveness.

Declarations

Ethics approval and consent to participate

Our database was completely anonymized and has been validated by the CNIL (Commission nationale pour les Libertés Informatiques) which is the French National Commission incurring patients' protection in research, confirming that all patients' details have been de-identified. Thus, we do not need informed consent from the patients to publish.

Consent for publication

Not applicable.

Author contributions

S. Ouazzani: Formal analysis; Methodology; Writing – original draft; Writing – review & editing.

M. Gasmi: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Supervision; Validation; Writing – review & editing.

M. Barthet: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Supervision; Validation; Writing – review & editing.

J.M. Gonzalez: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Supervision; Validation; Writing – review & editing.

Acknowledgements

None.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

Competing interests

The authors declared the following potential conflicts of interest with respect to the research,

authorship, and/or publication of this article: MB and JMG are consultants for Boston Scientific company.

Availability of data and materials

The datasets during and/or analyzed during the current study available from the corresponding author on reasonable request.

ORCID iD

S. Ouazzani  <https://orcid.org/0000-0001-5274-0738>

References

- Schmid SW, Uhl W, Friess H, *et al.* The role of infection in acute pancreatitis. *Gut* 1999; 45: 311–316.
- Forsmark CE, Vege SS and Wilcox CM. Acute Pancreatitis. *N Engl J Med* 2017; 376: 598–599.
- Arvanitakis M, Dumonceau JM, Albert J, *et al.* Endoscopic management of acute necrotizing pancreatitis: European Society of Gastrointestinal Endoscopy (ESGE) evidence-based multidisciplinary guidelines. *Endoscopy* 2018; 50: 524–546.
- Bakker OJ, van Santvoort HC, van Brunschot S, *et al.* Endoscopic transgastric vs surgical necrosectomy for infected necrotizing pancreatitis: a randomized trial. *JAMA* 2012; 307: 1053–1061.
- van Brunschot S, van Grinsven J, van Santvoort HC, *et al.* Endoscopic or surgical step-up approach for infected necrotising pancreatitis: a multicentre randomised trial. *Lancet Lond Engl* 2018; 391: 51–58.
- Bang JY, Holt BA, Hawes RH, *et al.* Outcomes after implementing a tailored endoscopic step-up approach to walled-off necrosis in acute pancreatitis. *Br J Surg* 2014; 101: 1729–1738.
- Ross AS, Irani S, Gan SI, *et al.* Dual-modality drainage of infected and symptomatic walled-off pancreatic necrosis: long-term clinical outcomes. *Gastrointest Endosc* 2014; 79: 929–935.
- van Santvoort HC, Besselink MG, Bakker OJ, *et al.* A step-up approach or open necrosectomy for necrotizing pancreatitis. *N Engl J Med* 2010; 362: 1491–1502.
- van Santvoort HC, Bakker OJ, Bollen TL, *et al.* A conservative and minimally invasive approach

- to necrotizing pancreatitis improves outcome. *Gastroenterology* 2011; 141: 1254–1263.
10. Trikudanathan G. Percutaneous Endoscopic Necrosectomy (PEN): is the PEN mightier than the VARD. *Dig Dis Sci* 2020; 65: 339–341.
 11. Carter CR, McKay CJ and Imrie CW. Percutaneous necrosectomy and sinus tract endoscopy in the management of infected pancreatic necrosis: an initial experience. *Ann Surg* 2000; 232: 175–180.
 12. Dhingra R, Srivastava S, Behra S, *et al.* Single or multiport percutaneous endoscopic necrosectomy performed with the patient under conscious sedation is a safe and effective treatment for infected pancreatic necrosis (with video). *Gastrointest Endosc* 2015; 81: 351–359.
 13. Jain S, Padhan R, Bopanna S, *et al.* Percutaneous endoscopic step-up therapy is an effective minimally invasive approach for infected necrotizing pancreatitis. *Dig Dis Sci* 2020; 65: 615–622.

Visit Sage journals online
[journals.sagepub.com/
home/cmj](https://journals.sagepub.com/home/cmj)

 Sage journals