



EUS-guided stent removal in buried lumen-apposing metal stent syndrome: a case series

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Background and Aims: Lumen-apposing metal stents (LAMSs) play an increasing role in transgastric and transduodenal drainage of pancreatic fluid collections and allow novel EUS-guided interventions. Alongside the main adverse events of bleeding and occlusion, LAMSs can be overgrown by mucosa, which leads to the inability to visualize the stent in endoscopy.

Methods: We describe a series of 4 cases of buried LAMSs that were removed under EUS guidance for identification of the stent followed by removal with rat-tooth forceps.

Results: The median in situ time of the LAMSs in the reported 4 cases was 53 days. All stents could no longer be visualized endoscopically when drainage of necrosis was complete. All 4 buried LAMSs could be identified by EUS and were removed successfully with forceps. In 1 case, balloon dilation of the stent tract was performed before stent removal. No adverse events were observed after the procedure.

Conclusions: Buried stent syndrome is a rare adverse event of LAMSs. Here we describe a safe and effective approach for stent identification and removal without prior mucosal dissection. (VideoGIE 2019;5:37-40.)

Lumen-apposing metal stents (LAMSs) have become a popular tool in interventional EUS since their development in 2012.¹ Prominent indications include the drainage of pancreatic pseudocysts, pancreatic fluid collections (PFCs), walled-off necrosis (WON),^{2,3} and novel EUS-guided interventions such as biliodigestive anastomosis.⁴ The benefits of using LAMSs are shorter procedure times and fewer required endoscopic sessions. This may, for instance, result in shorter hospital stays as compared with double-pigtail stents.^{5,6} Although the overall safety profile of LAMSs seems favorable,^{7,8} there are also new adverse events associated with LAMSs. Bleeding, infection, stent migration, perforation, and stent occlusion are adverse events reported in the medical literature.⁹ An LAMS-specific adverse event, which does not occur with double-pigtail stents, is “buried stent syndrome.” Buried stents are LAMSs embedded in overgrowing gastric or enteric mucosa. Therefore, the stents can no longer be visualized endoscopically. According to a review published in 2017 on LAMS adverse events, buried stents were reported in 4 out of 14 studies.⁹ In 2 recent multicenter studies, 1 out of 116 patients treated in the United Kingdom (7 weeks median stent in situ time) and 0 out of 118 patients treated in the United States (5-6 weeks median stent in situ time) had buried stent syndrome.^{10,11} Various techniques to remove buried stents have been reported. This includes placing a second LAMS into the buried and

occluded LAMS¹²; unroofing the mucosa with a needle-knife sphincterotome, followed by balloon dilation and stent removal with rat-tooth forceps^{13,14}; and the sequence of forced argon plasma coagulation, needle-knife incision, and dilation of the stent before removal with rat-tooth forceps.¹⁵ One migrated stent into the former PFC was removed under fluoroscopic and EUS guidance.¹⁶ In this case series, we describe 4 cases of buried LAMSs in which an opening was no longer identifiable endoscopically; thus, a purely EUS-guided identification and removal of the stent without prior mucosa dissection had to be performed.

CASE SERIES

Patients and methods

The patients included in this case series were treated with a LAMS between 2015 and 2018. The instructional review board (Ethics Committee of the TU Dresden, no. EK317062019) approved data analysis. LAMSs (Hot Axios, Boston Scientific, Marlborough, MA, USA) were used transgastrically to drain WONs in the pancreatic body resulting from alcohol-induced chronic pancreatitis (n = 2) and for drainage of necrosis close to the biliodigestive anastomosis as an adverse event after Roux-en-Y hepaticojejunostomy (n = 1). The fourth stent was used

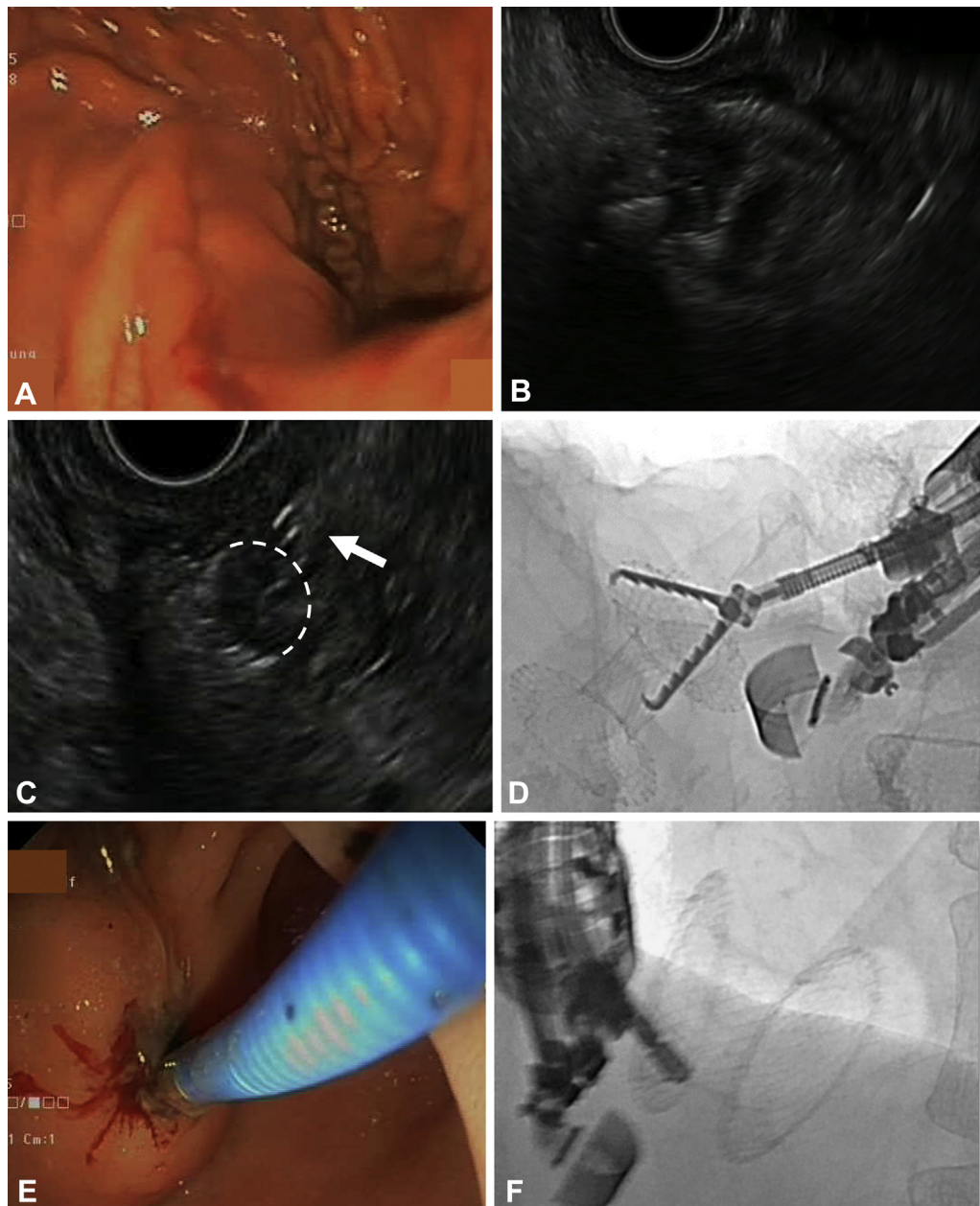


Figure 1. Phases of EUS-guided LAMS removal. **A**, The opening of the transmural stent tract could not be identified by endoscopic imaging. **B**, EUS allowed visualization of the stent tracts as a transmurally echogenic structure. **C**, The tract was cannulated under EUS guidance with closed rat-tooth forceps. **D**, The internal stent mesh was grasped under EUS and fluoroscopic guidance. **E, F**, Stent removal by pulling the endoscope and forceps assembly under fluoroscopic control.

TABLE 1. Characteristics of patients treated with EUS-guided stent removal in buried LAMS syndrome

Patient	Age/sex	LAMS (Hot Axios) indication	Stent location	Stent size (mm)
1	33/M	Chronic alcohol-induced pancreatitis, WON in pancreatic body	Transgastric	8 × 8
2	51/M	Necrotizing alcohol-induced pancreatitis with extrapancreatic tryptic necrosis	Transduodenal	6 × 8
3	75/M	Roux-en-Y hepaticojejunostomy because of CBD stenosis and cholangitis, necrosis medial of biliodigestive anastomosis	Transgastric	10 × 10
4	48/M	Chronic alcohol-induced pancreatitis, WON in pancreatic body	Transgastric	15 × 10

CBD, Common bile duct; LAMS, lumen-apposing metal stent; WON, walled-off necrosis.

transduodenally to drain an extrapancreatic tryptic necrosis caused by alcohol-induced chronic pancreatitis (n = 1). All patients were men between 33 and 75 years old (mean, 51 years). The in situ time of the stents ranged from 40 to 71 days (mean, 53 days). At the time of planned removal, in all patients the LAMS could not be visualized endoscopically because of overgrown mucosa. All procedures were performed with the patient under sedation with midazolam and propofol.

The opening of the former stent lumen was not identifiable endoscopically in all cases. The buried stents were thus visualized by EUS. Although the opening of the transmural stent tract could not be identified by endoscopic imaging (Fig. 1A) because of convoluted, edematous, and inflamed mucosa, EUS, aided by intermittent insufflation of air, allowed visualization of the stent tracts as a transmural echogenic structure (Fig. 1B). This tract was cannulated under EUS guidance with closed rat-tooth forceps (Fig. 1C). The internal stent mesh was grasped under EUS and fluoroscopic guidance (Fig. 1D) and was removed by pulling the endoscope and forceps assembly under fluoroscopic control (Fig. 1E and F). In patient 1, the tract was dilated with a 10-mm balloon, which was not deemed necessary in later cases. Video 1 (available online at www.VideoGIE.org) demonstrates the procedure.

RESULTS

EUS-guided stent removal was performed in a total of 4 patients. Demographic and clinical data for the patients are presented in Table 1. All stents were removed with rat-tooth forceps, with EUS being used for locating the stent and for navigation of the extraction forceps. In 1 out of 4 patients, the cannulated former stent tract was dilated with a balloon before forceps removal. Stent removal was successful in all patients. The procedure times were between 10 and 57 minutes (mean, 34 minutes). In 3 out of 4 patients, a self-limiting bleeding after stent extraction was observed. All patients were monitored for 2 days after the intervention in hospital. No adverse events were recorded during the monitoring time. Three out of 4 patients

were seen in a follow-up examination (26 to 30 days after stent extraction), with no adverse events arising after stent removal.

DISCUSSION

Overgrowing mucosa can “bury” a LAMS and lead to difficulty of visualization and removal when drainage is complete, thus constituting a novel, LAMS-specific adverse event. Several techniques for the removal of buried LAMSs have been described: placing a second LAMS into the buried and occluded LAMS¹²; unroofing the mucosa with a needle-knife sphincterotome, followed by balloon dilation and stent removal with a rat-tooth forceps^{13,14}; and a sequence of forced argon plasma coagulation, needle-knife incision, and dilation of the stent before removal with rat-tooth forceps.¹⁵ In certain instances, however, the former stent opening or fistula tract may not be visible endoscopically at all anymore. This problem may be compounded by inflamed or edematous mucosa, which is frequently found in these patients. Thus, endoscopic identification of the former stent lumen is sometimes impossible. With the use of EUS, however, it is possible to visualize the stent itself and—in our experience—also to identify the former fistula tract. This identification of the fistula tract can be facilitated by insufflation of CO₂ by amplifying the echogenicity of the residual tract. The former lumen of the stent is, in our experience, occluded not by firm fibrous tissue but rather by convoluted mucosa, which is relatively soft. We propose that in these cases, the stent lumen may be cannulated directly with rat-tooth forceps and the LAMS removed without the need for mucosal dissection or balloon dilation. Using EUS to identify the stent and using forceps for removal led to mucosa trauma and self-limiting bleeding in our case series. We suggest grasping the stent in the middle part of the LAMS because that limits the chance of accidental tissue damage. There were no adverse events after the stent removal as described.

In case of stents that have remained in situ for a very long time—in the literature up to 8 months¹⁶—the fistula tract may have closed completely. In these cases, a de-novo EUS-guided puncture to access an extraluminal

TABLE 1. Continued

In situ time (days)	Extraction technique	Technical success	Procedure time (min)	Adverse events		Follow-up, no adverse events (days)
				Interventional	Postinterventional	
47	EUS-guided balloon dilation and forceps extraction	Yes	55	Self-limiting mucosa bleeding	None	27
71	EUS-guided forceps extraction	Yes	10	Self-limiting mucosa bleeding	None	26
40	EUS-guided forceps extraction	Yes	57	Self-limiting mucosa bleeding	None	30
55	EUS-guided forceps extraction	Yes	15	None	None	None

stent may be needed as reported.¹⁶ All overgrown stents in this case study were longer than 5 weeks in situ (mean, 53 days). Thus, as a preventive measure, endoscopic control and stent removal after 3 to 4 weeks if the drainage situation allows, or placement of a plastic double-pigtail stent into the LAMS, should be considered to avoid the buried LAMS syndrome.¹⁷

DISCLOSURE

Dr Hampe is the recipient of speaker honoraria and travel expenses from Boston Scientific, Olympus, B Braun, Falk Foundation, Abbvie, MSD, Takeda, and GWT; of consulting fees from Boston Scientific and B Braun; and of grant support from Bayer Technology. All other authors disclosed no financial relationships relevant to this publication.

Abbreviations: LAMS, lumen-apposing metal stent; PFC, pancreatic fluid collection; WON, walled-off necrosis.

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<https://doi.org/10.1016/j.vgie.2019.09.002>