Douglas G. Adler MD, FACG, AGAF, FASGE, Series Editor

Afferent Limb Syndrome Treated via Lumen Apposing Metal Stents: Report of Two Different Approaches in Two Patients

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INTRODUCTION

Afferent limb syndrome is a known postoperative complication that typically occurs in patients who have undergone pancreaticoduodenectomy or gastrectomy with either Roux-en-Y or Billroth II reconstruction. These surgeries create a gastrojejunostomy, an upstream segment of small intestine, which contains biliary and pancreatic anastomoses or the native papilla, and if this limb becomes obstructed it is termed *afferent limb syndrome*. Historically, surgery to relieve the obstruction has been the primary treatment modality for patients with afferent limb obstruction. However, endoscopic interventions have also shown efficacy in treating afferent limb syndrome,[1] and may be preferable in patients not suitable for surgery. Recently, lumen apposing metal stents (LAMS) have provided a novel therapeutic option for the endoscopist seeking to treat afferent limb syndrome. The following cases describe two different approaches for employing LAMS in the treatment of afferent limb syndrome: One transluminal placement and the other endoluminal.

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Case 1

A 59-year-old man with a medical history notable for Stage III pancreatic adenocarcinoma underwent pancreaticoduodenectomy five months prior to presentation. He developed persistent abdominal pain requiring celiac neurolysis three months post operatively. He was referred from an outside hospital following a one-month history of intractable nausea, vomiting, abdominal pain, anorexia and weight loss. A CT scan demonstrated intrahepatic duct dilation and marked dilation of the patient's afferent limb at 4.8 cm with a transition point in the anterior mid abdomen concerning for obstruction and afferent limb syndrome. The patient was deemed to be unable to tolerate surgery due to poor functional and nutritional status and was referred for endoscopic evaluation and treatment.

The patient underwent push enteroscopy to evaluate his anatomy. Stenosis of the afferent jejunal limb was appreciated. The endoscope

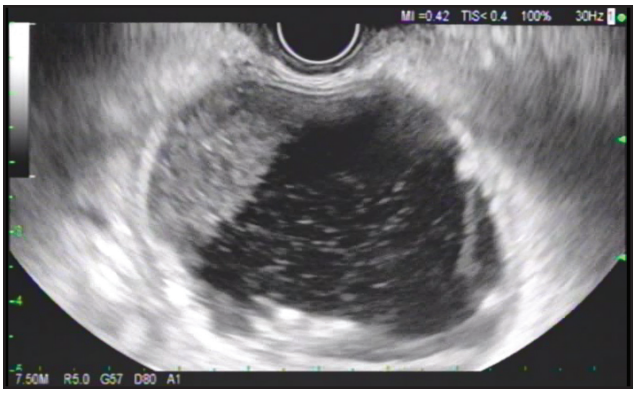

Figure 1. 7.5MHz EUS image of dilated and fluid filled obstructed afferent limb.

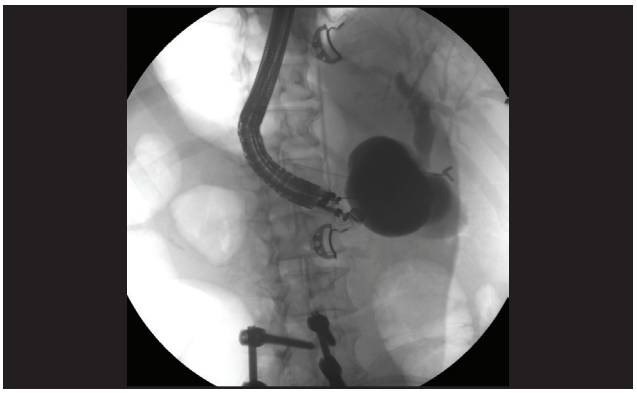

Figure 2. Fluoroscopic image of contrast injected via EUS needle into the afferent limb with resultant cholangiogram, definitively proving the target is in fact the afferent limb

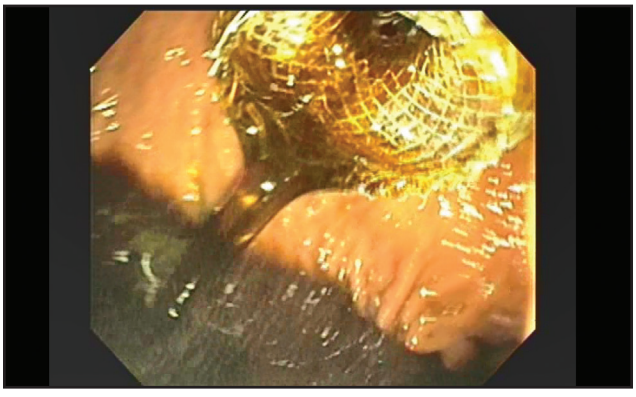

Figure 3. Endoscopic image of LAMS after deployment showing bilious fluid draining to stomach

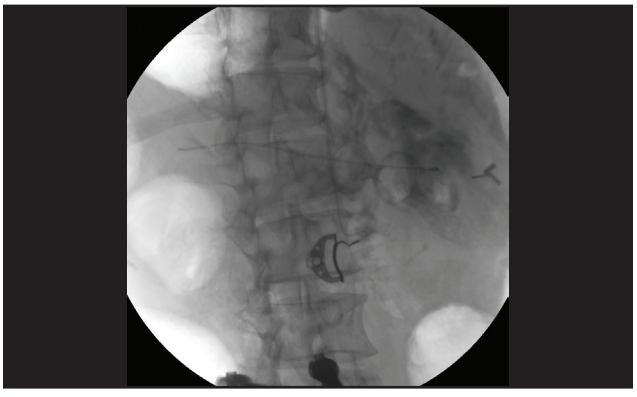

Figure 4. Fluoroscopic image of the LAMS after placement also showing decompression of the afferent limb.

could not pass through the stenosis into the afferent limb. A 10 French x 10cm double pigtail stent was advanced over a 0.035-inch guidewire and placed across the stenosis of the afferent limb in an attempt to allow decompression, but this was clinically unsuccessful and the stent migrated in short order.

Following the push enteroscopy, the patient continued to have ongoing pain, nausea, vomiting and an intolerance for intake by mouth. Subsequent CT four days later showed increased dilation of the afferent limb at 5.9 cm. Given the patient's worsening obstruction, the decision was made to proceed with a transluminal approach to decompression via endoscopic ultrasound (EUS) gastroenterostomy.

The next day the patient was brought back to the endoscopy suite. Using a linear EUS scope, the obstructed afferent limb was identified. The affected small bowel appeared dilated with a diameter of approximately 8-9cm, was fully effaced and was found to contain a large amount of fluid. (Figure 1) After Doppler US confirmed a clear route to access the limb, a 19-gauge EUS FNA needle was used to access the limb. Contrast was injected into the afferent limb with a cholangiogram was obtained during injection, confirming afferent limb access had been obtained. (Figure 2) Aspiration of fluid showed bile, further corroborating afferent limb access. A 0.025" wire was used to maintain access to the afferent limb. An electrocautery enhanced Axios catheter (Boston Scientific, Natick MA) was then used to create a gastroenterostomy over the wire. A 15mm x 10mm Hot Axios LAMS was then deployed across the gastroenterostomy without difficulty. Five liters of bilious fluid, approximately, drained through the stent to the stomach. (Figure 3) The stent was confirmed to be in adequate position as seen on endoscopy, EUS, and fluoroscopy.

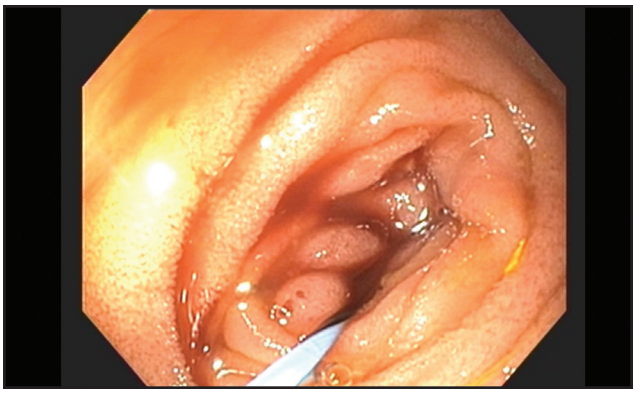

Figure 5. Endoscopic image of guidewire access across the site of obstruction in the afferent limb.

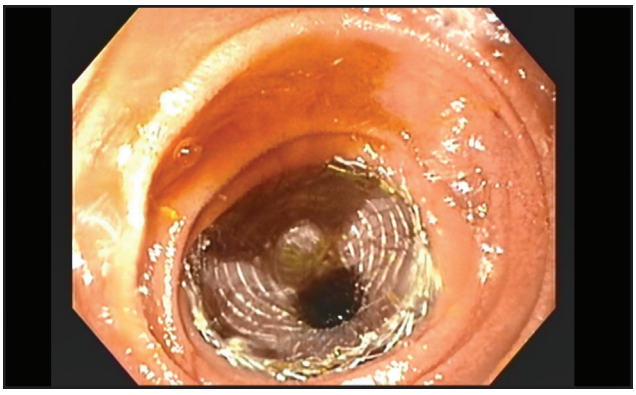

Figure 6. Endoscopic image of LAMS after intraluminal placement showing copious biliary fluid drainage.

Repeat endoscopy six days postprocedure also confirmed suitable stent position and patency and the patient had marked improvement in his symptoms.

Case 2

A 66-year-old woman with Stage II pancreatic adenocarcinoma with a history of a pancreaticoduodenectomy presented to urgent care complaining of paroxysmal abdominal pain without nausea or vomiting. A PET CT scan roughly one month prior demonstrated two hypermetabolic soft tissue densities concerning for recurrence of pancreatic cancer; one 2.3 cm x 1.2 cm near the confluence of the superior mesenteric and portal veins and another 1cm nodule near the pancreaticojejunostomy anastomosis. Laboratory testing obtained on the day of procedure was notable for an elevated total bilirubin at 5.1 and alkaline phosphatase of 1,139 previously 1.4 and 678, respectively, one month prior.

Using a colonoscope, the afferent limb was traversed and was noted to have extrinsic impression on the duodenum causing a high-grade bowel obstruction that was unable to be traversed with the colonoscope. Given the concern for possible afferent limb syndrome, the patient's next of kin was called and consent was obtained for possible LAMS placement.

After consent was obtained, the colonoscope was exchanged for a therapeutic gastroscope and was advanced through the afferent limb to the area of stenosis. Using direct endoscopic and fluoscopic guidance a 9-12mm balloon catheter with a 0.035" guidewire was passed through the stricture. (Figure 5) Fluoroscopy revealed dilated bowel upstream of the stricture, which confirmed previous suspicion of afferent limb syndrome. A 15mm wide x 10mm long Axios stent was advanced over the guidewire and deployed across the stenosis. A large amount of bilious fluid drained through the stent immediately after deployment. (Figure 6) The gastroscope was then withdrawn and an ultrathin gastroscope was inserted and advanced through the LAMS and into the loop of bowel containing the hepaticojejunostomy, further confirming proper stent location. (Figure 7) Contrast was injected and brisk flow of contrast through the ducts was noted as well as diffuse dilation of all intrahepatic biliary ducts.

Linear EUS confirmed that the area of concern previously identified on PET CT appeared to correspond to the identified area of afferent limb narrowing. No overt mass was identified. Additionally, fine needle aspiration was deferred given suboptimal visualization secondary to significant artifact related to air bubbles created by the LAMS. Following LAMS placement, the patient noted clinical improvement as well as improving bilirubin and alkaline phosphatase on follow up laboratory testing.

Discussion

Afferent limb syndrome, sometimes referred to as afferent loop syndrome, is an obstructive complication that occurs following pancreaticoduodenectomy, gastrectomy with Billroth II or Roux-en-Y reconstruction, where

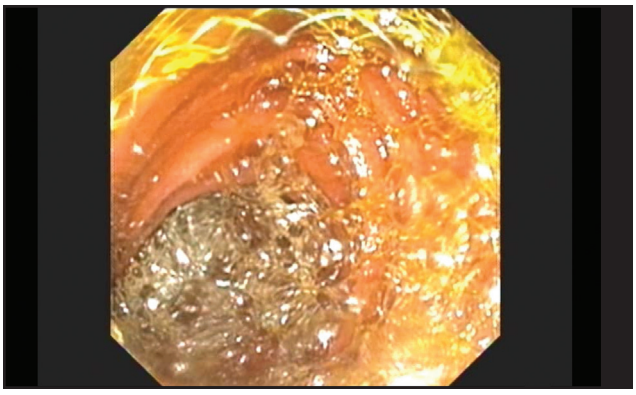

Figure 7. Endoscopic image of afferent limb seen via passing an ultrathin endoscope through the LAMS immediately after deployment.

the afferent limb becomes obstructed and the patient develops abdominal pain. Common etiologies of afferent limb syndrome include postoperative adhesions, enteroenteric hernia, volvulus, stricture, radiation enteritis, recurrence of malignancy, enteroliths or foreign bodies.[2, 3] The overall incidence of afferent limb syndrome is low, affecting between 0.2% - 1% of patients who undergo partial gastrectomy.[2, 4] However, patients who undergo pancreaticoduodenectomy for pancreatic cancer have been noted to have an incidence of 13%.[1] Acute afferent limb syndrome often presents as abrupt, severe abdominal pain accompanied by nausea and vomiting, while chronic presentations may often present as post prandial abdominal discomfort or food avoidance.[1] Jaundice also can be seen despite the absence of biliary obstruction as the afferent limb fills with bilious fluid, which cannot drain. If untreated, afferent limb syndrome may lead to mesenteric ischemia as well as bowel perforation and peritonitis, which can include a component of bile peritonitis. Partial obstruction of the afferent limb syndrome can also cause small intestinal bacterial overgrowth and associated sequelae such as B12 deficiency and steatorrhea.[2,5]

Historically, surgical therapy has been the mainstay treatment of afferent limb syndrome. This may include palliative surgery in the setting of malignancy, possible revision of a Billroth II reconstruction, conversion of a Billroth II to a Roux-en-Y or the addition of a Braun anastomosis, where an anastomosis is created from the afferent limb directly to the efferent limb effectively bypassing the gastrojejunal anastomosis.[6] Non-surgical management options include percutaneous drainage, but this is often a suboptimal treatment from the patient's perspective as it may negatively impact quality of life.[7] Endoscopic interventions provide another approach to afferent limb syndrome and may include balloon dilation, double-pigtail stent placement, biliary plastic or metal stent placement.[1,8]

Most recently the use of LAMS has provided another potential option for managing afferent limb syndrome in patients not suitable for surgery. LAMS have proved useful for a variety of indications including cystgastrostomies,[9] cholecystenterostomies or cholecystgastrostomies,[10] as well as endoscopic ultrasound-directed transgastric ERCP procedures (EDGE).[11] Using a LAMS to access and decompress an obstructed afferent limb endoscopically is another fitting application of this novel technology.

The current literature has several published case reports describing successful deployment of LAMS for treatment of afferent limb syndrome.[12,13,14,15,16] To date the literature only provides one small multicenter study examining the safety and efficacy outcomes of LAMS for management of afferent limb syndrome.[17] The study included eighteen patients and found technical success to be 100%, with only 16.7% experiencing adverse events that were described as abdominal pain.[17] The most common approach in this cohort was the creation of a gastrojejunostomy (72.2%) via LAMS placement. An indirect comparison between patients with LAMS placement for afferent limb syndrome and patients who underwent enteroscopy-assisted luminal stenting revealed that patients with LAMS required fewer repeat interventions.[17]

CONCLUSION

Since their FDA approval in 2013, LAMS have proved to have a variety of uses beyond their original intended purpose: drainage of pancreatic pseudocysts and necrosis. The two cases presented here further demonstrate the versatility of LAMS in successfully treating afferent limb syndrome, using either a transluminal or endoluminal approach. While the use of LAMS for treatment of afferent limb is indeed promising, future longitudinal studies are needed to better describe long-term outcomes and adverse events associated with this procedure. ■

References

1. Pannala R, Brandabur JJ, Gan SI, Gluck M, Irani S, Patterson DJ, Ross AS, Dorer R, Traverso LW, Picozzi VJ, Kozarek RA. Gastrointest Endosc. 2011 Aug;74(2):295-302. doi: 10.1016/j.gie.2011.04.029.
2. Blouhos K, Boulas KA, Tsalis K, Hatzigeorgiadis A. World J Gastrointest Surg. 2015 Sep 27;7(9):190-5. doi: 10.4240/wjgs.v7.i9.190.
3. Lee MC, Bui JT, Knuttinen MG, Gaba RC, Scott Helton W, Owens CA. Cardiovasc Intervent Radiol. 2009 Sep;32(5):1091-6. doi: 10.1007/s00270-009-9561-3. Epub 2009 Apr 14.
4. Ramos-Andrade D, Andrade L, Ruivo C, Portilha MA, Caseiro-Alves F, Curvo-Semedo L. Insights Imaging. 2016 Feb;7(1):7-20. doi: 10.1007/s13244-015-0451-8. Epub 2015 Dec 5.
5. Salem A, Ronald BC (2014) Small Intestinal Bacterial Overgrowth (SIBO). J Gastroint Dig Syst 4: 225. doi:10.4172/2161-069X.1000225
6. Bolton JS, Conway WC 2nd. Surg Clin North Am. 2011 Oct;91(5):1105-22. doi: 10.1016/j.suc.2011.07.001. Review.
7. Sato Y, Inaba Y, Murata S, Yamaura H, Kato M, Kawada H, Shimizu Y, Ishiguchi T. J Vasc Interv Radiol. 2015 Apr;26(4):566-72. doi: 10.1016/j.jvir.2014.11.010. Epub 2015 Jan 19.
8. Brewer Gutierrez OI, Irani SS, Ngamruengphong S, Aridi HD, Kunda R, Siddiqui A, Dollhopf M, Nieto J, Chen YI, Sahar N, Bukhari MA, Sanaei O, Canto MI, Singh VK, Kozarek R, Khashab MA. Endoscopy. 2018 Sep;50(9):891-895. doi: 10.1055/s-0044-102254. Epub 2018 Mar 2.
9. Siddiqui AA, Adler DG, Nieto J, Shah JN, Binmoeller KF, Kane S, Yan L, Laique SN, Kowalski T, Loren DE, Taylor LJ, Munigala S, Bhat YM. Gastrointest Endosc. 2016 Apr;83(4):699-707. doi: 10.1016/j.gie.2015.10.020. Epub 2015 Oct 26.
10. Dollhopf M, Larghi A, Will U, Rimbaş M, Anderloni A, Sanchez-Yague A, Teoh AYB, Kunda R. Gastrointest Endosc. 2017 Oct;86(4):636-643. doi: 10.1016/j.gie.2017.02.027. Epub 2017 Mar 1.
11. Dubroff, J.; Adler, D.G. Practical Gastroenterology, February 2019, Vol.43(2), pp.34-38
12. Ermerak G, Behary J, Edwards P, Abi-Hanna D, Bassan MS. VideoGIE. 2019 Aug 13;4(10):461-463. doi: 10.1016/j.vgie.2019.07.002. eCollection 2019 Oct.
13. Ikeuchi N, Itoi T, Tsuchiya T, Nagakawa Y, Tsuchida A. Gastrointest Endosc. 2015 Jul;82(1):166. doi: 10.1016/j.gie.2015.01.010. Epub 2015 Apr 14.
14. Monino L, Barthet M, Gonzalez JM. Endoscopy. 2019 Jul 1. doi: 10.1055/a-0948-5033. [Epub ahead of print]
15. Lakhtakia S, Chavan R, Basha J, Nabi Z, Gupta R, Reddy DN. Endoscopy. 2019 Sep;51(9):E253-E254. doi: 10.1055/a-0890-3182. Epub 2019 May 9.
16. Rodrigues-Pinto E, Grimm IS, Baron TH. Clin Gastroenterol Hepatol. 2016 Apr;14(4):633-7. doi: 10.1016/j.cgh.2015.11.010. Epub 2015 Dec 7.
17. Brewer Gutierrez OI, Irani SS, Ngamruengphong S, Aridi HD, Kunda R, Siddiqui A, Dollhopf M, Nieto J, Chen YI, Sahar N, Bukhari MA, Sanaei O, Canto MI, Singh VK, Kozarek R, Khashab MA. Endoscopy. 2018 Sep;50(9):891-895. doi: 10.1055/s-0044-102254. Epub 2018 Mar 2.

Answers to this month's crossword puzzle:

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