76169_Auto_Edited.docx

WORD COUNT	2978	TIME SUBMITTED	01-JUN-2022 04:56PM
		PAPER ID	86751624

Name of Journal: *World Journal of Clinical Cases*
Manuscript NO: 76169
Manuscript Type: CASE REPORT

Short benign ileo-colonic anastomotic strictures. Management with bi-flanged metal stents: Six case reports and review of literature

Panagiotis Kasapidis, Georgios Mavrogenis, Dimitrios Mandrekas, Fateh Bazerbachi

Abstract

BACKGROUND

The endoscopic management of benign short post-anastomotic ileocolonic stricture (PAICS) that is refractory to primary and secondary treatment modalities remains challenging. The lumen-apposing metal stent (LAMS) is a novel device recently developed for therapeutic gastrointestinal endoscopy. LAMSs have demonstrated significantly better results with regard to stent migration than fully covered self-expandable metal stents (FCSEMSs).

CASE SUMMARY

This article presents six cases of symptomatic PAICS treated successfully with LAMS and reviews the literature. We report a life-saving technique not previously documented and the use of technology to improve patient outcomes. The six patients (median age, 75 years) suffered from vomiting, constipation and recurrent abdominal pain, with symptoms starting 23-25 wk post-surgery. The median stricture length was 1.83 cm. All six patients underwent successful and uneventful bi-flanged metal stent (BFMS)-LAMS placement for benign PAICS. All patients remained asymptomatic during the three months of stent indwelling and up to a median of 7 mo after stent removal. According to the literature, the application of LAMS for PAICS is associated with a < 10% risk of migration and a < 5% risk of bleeding. Conversely, FCSEMS has a high migration rate (15%-50%).

CONCLUSION

The evolving role of interventional endoscopy and the availability of LAMS provide patients with minimally invasive treatment options, allowing them to avoid more invasive surgical interventions. The BFMS (NAGI stent) is longer and larger than the prototype AXIOS-LAMS, which should be considered in the management of short ileocolonic post-anastomotic strictures longer than 10 mm and shorter than 30 mm.

Key Words: Bi-flanged metal stent; Lumen-apposing metal stent; Anastomotic ileocolonic stricture; Self-expanding metal stent; Endoscopic innovation; Case report

Kasapidis P, Mavrogenis G, Mandrekas D, Bazerbachi F. Short benign ileo-colonic anastomotic strictures. Management with bi-flanged metal stents: Six case reports and review of literature. *World J Clin Cases* 2022; In press

Core Tip: The lumen-apposing metal stent have demonstrated significantly better results with regard to stent migration than fully covered self-expandable metal stents. We present six cases of post-anastomotic ileocolonic strictures treated successfully with a bi-flanged metal stent (NAGI stent) and then review the literature. The length and broad flanges of the bi-flanged metal stent may reduce the migration rate and improve patient tolerance and thus may represent a suitable alternative to traditional endoscopic options, with better long-term results in the management of luminal gastrointestinal strictures longer than 10 mm and shorter than 30 mm.

INTRODUCTION

Colonic anastomotic stricture occurs in 3%-28% of patients following colorectal surgery[1-3]. The management of benign gastrointestinal (GI) stricture includes incisional therapy, intralesional steroid injection, endoscopic balloon dilatation, and the deployment of self-expandable metal stents (SEMSs) and biodegradable stents (BDS)[4,5]. However, these endoscopic management techniques are not always successful despite repeated interventions[5]. In particular, refractory post-anastomotic ileocolonic stricture (PAICS) may require multiple dilatations[6]. For stubborn cases, SEMS may be used. However, SEMSs can migrate, with migration rates exceeding 15%-50%[3,7]. The underlying risk of perforation (12%-20%) increases with the deployment of pre- or post-balloon dilatations[8,9]. Fully covered SEMSs (FCSEMSs) also demonstrate a high rate of migration (40%-60%), with an overall incidence of 20%[6,8-10].

The lumen-apposing metal stent (LAMS) is a novel device recently developed for therapeutic GI endoscopy. LAMS was originally designed for pancreatic fluid collection drainage but is currently being used for many off-label indications[2,5,7,8].

The bi-flanged metal stent (BFMS), another type of LAMS, is a saddle-shaped metal (nitinol) stent that achieves lumen apposition because of its bilateral anchoring flanges, thus decreasing the risk of stent migration[5-7,11]. Moreover, because of its larger intraluminal diameter, it can accomplish more efficient drainage, and its silicone coating prevents tissue ingrowth and thus facilitates easy removal[7,12]. The BFMS (Nagi-LAMS stent) has flared ends and a bi-flanged design, with a longer saddle (up to 3 cm) compared to the 1-cm saddle of the AXIOS-LAMS stent (Figure 1). Successful management of multiple types of GI stenoses (esophageal, gastric, and colonic) with LAMS has been reported in several studies[2,3,5,13]. However, data on the role of BFMS (Nagi-LAMS stent) in these scenarios are limited.

This study aims to evaluate the efficacy, feasibility, indications and safety of BFMS placement as a new endoscopic management approach for symptomatic short benign PAICS. This report describes a life-saving technique not previously documented and provides a review of the related literature.

Literature search

These case reports adhere to the SCARE criteria[14]. The review follows the PRISMA guidelines[15]. All original studies and case reports concerning symptomatic benign GI strictures treated endoscopically with LAMS, BFMS or FCSEMS were included. We performed an electronic literature search in PubMed, Cochrane Library, and Embase databases for articles published between March 2010 and November 2021.

CASE PRESENTATION

Chief complaints

Cases 1-5: Patients suffered from constipation and abdominal pain.

Case 6: Patient suffered from recurrent symptomatic small-bowel obstruction with nausea, vomiting, abdominal pain, and flatulence.

History of present illness

Cases 1-5: Patients developed symptoms starting at 23-25 wk post-surgery.

Case 6: Patient required hospitalization at the 28th week postoperatively.

Case 1-6: All included patients underwent ileocecal resection and one-stage, end-to-end anastomosis without diverging ileostomy for adenocarcinoma in the right colon. The average age of the patients was 75 years (range: 68-82). None of the six patients received adjuvant chemotherapy because the tumor staging was < T3N0M0. The median time between surgery and the diagnosis of stenosis was 206.33 d (range: 167-257). The demographic characteristics, disease etiology, complaints, treatments administered and other characteristics of the luminal anastomotic benign strictures in patients who underwent BFMS placement are summarized in Table 1.

History of past illness

Cases 1, 3: Patients had a disease-free medical history.

Cases 2, 4, 5: Patients had hypertension.

Case 6: Patient had obesity, osteoporosis, cataract, hypertension, and type 2 diabetes mellitus.

Personal and family history

Cases 1-6: None of the patients had a family history of GI tumors.

Physical examination

Cases 1-5: Patients had tenderness in the right upper quadrant of the abdomen. Their temperature, blood pressure and pulse rate were normal.

Case 6: Patient had persistent periumbilical pain and was pale but alert at admission, with blood pressure of 90/60 mmHg and a heart rate of 98 beats/min

Laboratory examinations

Cases 1-6: Patients had normal serum carcinoembryonic antigen (reference range: 0-5.0 ng/mL) and hemoglobin levels, with an average of 12.0 g/dL among men and 10.2 g/dL among women. Normal hemoglobin levels are 13.0-17.5 g/dL for men and 11.6-16 g/dL for women.

Case 6: The hospitalized patient had a white blood cell count of 12000 cells per microliter, with the normal range being 4500-11000 cells per microliter (4.5×10^9/L).

Imaging examinations

Cases 1-5: Computed tomography (CT) of the abdomen revealed anastomotic stricture.

Case 6: CT revealed partial small-bowel obstruction at the level of the ileocolonic anastomosis.

Cases 1-6: Colonoscopies demonstrated tight benign anastomotic stenoses that could not be transversed with a pediatric colonoscope. Preoperative evaluation by CT scan and intraprocedural assessment were performed to assess the length and degree of all strictures. Regarding the necessity of magnetic resonance imaging for the evaluation of stricture length, colonoscopy with injection contrast material and CT scan could accurately depict the anastomotic stricture[9,10].

FINAL DIAGNOSIS

All patients were found to have high-grade strictures (residual lumen, d < 7 mm) with a median length of 1.83 cm (range 1.5-2.0). Malignancy was ruled out in all patients *via* biopsies and histological examination.

TREATMENT

Midazolam was used for conscious sedation, or propofol was used if more profound sedation was needed. Fluoroscopic and direct endoscopic guidance, the latter with a flexible colonoscope, EC-590WM (Fujifilm, Tokyo, Japan), with a length 1330 mm

and broad working channel with a diameter of 3.8 mm was employed to reach the stricture site in the transverse colon in all the procedures. We delivered the BFMS *via* colonoscopy because the usable length of the NAGI-LAMS stent was longer than the working length of the colonoscope (1800 mm *vs* 1330 mm). The risk of intraprocedural perforation and stent migration was reduced by avoiding balloon dilatation either before or after BFMS deployment[8,9]. Access across the stricture was achieved using a 0.035 inch, 450-cm long guidewire (Jagwire, Boston Scientific, Natick, MA, United States). The deployed BFMSs were NAGI-LAMS stents (Taewoong Medical, Gyeonggido, South Korea) with a length of 30 mm, lumen diameter of 16 mm, 10 Fr delivery catheter, and flange diameter of 20 mm (Figure 2). Subsequently, over the guidewire and through-the-scope, a stent was inserted, and contrast injection revealed a stricture in the anastomotic area (Figure 3), which was stented with a BFMS under fluoroscopic guidance (Figure 4). The distal (downstream) flange of the BFMS was deployed under fluoroscopic guidance, and the proximal (upstream) end of the stent was deployed under direct endoscopic visualization. Clinical success was defined as the alleviation of GI obstructive symptoms, such as nausea, vomiting, constipation, abdominal distention and/or pain and occlusive ileus. Major adverse events were regarded as tissue perforation and stent migration. Minor adverse events were regarded as transient fever, vomiting, nausea, abdominal pain and self-limited hemorrhage. Any different endoscopic technique or urgent surgery was regarded as procedural failure.

Informed consent forms and authorization of the use of personal information forms were signed by all the patients before the procedure for the off-label use of BFMS. Furthermore, the six patients provided written informed consent for publication. Ethics approval is not required for case reports at our institution.

OUTCOME AND FOLLOW-UP

Cases 1-6: The endoscopic BFMS placement procedure, including scope insertion to reach the stricture site (Figure 5, right), had a median duration of 18.16 min (range: 12-26). There was constant stool and gas flow after BFMS deployment. All patients underwent colonoscopy 4-5 wk after stent deployment. Three months later, after a

median of 90 d (range: 85-94), the stents (Figure 5, left) were removed without any adverse events. No patients required additional interventions at a median follow-up of 214.6 d (range: 188-241). The patients completed at least two follow-up visits during the subsequent seven months. The first and the second visits took place at the 3rd and 6th months, respectively.

Cases 1, 3-5: No immediate adverse events occurred.

Case 2: The patient complained of mild post-procedural abdominal pain that lasted two days and he responded to analgesics (paracetamol, 1000 mg/24 h, for two days).

Case 6: Patient complained of mild postprocedural discomfort that lasted three days and she responded to analgesics (paracetamol, 1000 mg/24 h, for two days).

DISCUSSION

GI luminal stents are an appealing endoscopic option for managing selected colonic disorders, particularly post-anastomotic stricture. Strictures longer than 2 cm require multiple balloon dilatations, with limited long-term potency, perhaps due to a lack of stricture remodeling and scaffolding[8,15,16]. A solid proposition for managing benign anastomotic colon strictures are metal stents (SEMS, FCSEMS, LAMS-BFMS). This recommendation is based on the fact that constant radial force can be applied to the stricture for an extended time compared with balloon dilatation, thus inducing remodeling in these recalcitrant fibrotic strictures[10,13,17-19]. The major adverse event of SEMS and FCSEMS placement is stent migration, which has been reported to occur in 15%-50% of patients after a mean period of one month[4,8,14,20]. In addition, a high rate (40%-60%) of FCSEMS migration has been noted postoperatively in patients with colorectal diseases[6,8]. In a review of 8 studies involving 192 patients that evaluated LAMS for benign GI strictures, LAMS demonstrated significantly better results with regard to stent migration and post-procedural pain than FCSEMS and BDS stents[5,17].

The endoscopic placement of LAMS and BFMS with fluoroscopic guidance is generally successful, with only a minority of cases requiring endoscopic ultrasound guidance because the lumen is fully obscured[7,12,17]. Early LAMS placement has been proposed as a viable option for long-term symptomatic relief in patients with short ileocolonic or colocolonic anastomotic strictures[3,6,18]. Patients with benign refractory stenosis who suffer from post-surgical ileocolonic anastomotic strictures may benefit from LAMS if symptoms remain after two dilatations[2-4,18,21]. LAMS has the potential to delay or ultimately prevent the need for consecutive dilations or surgical intervention[3,18]. Furthermore, the underlying risk of perforation (12%-20%) and migration (> 20%) increases with the deployment of pre- or post-balloon dilatations[8,9,18]. Due to the reasons mentioned above, a NAGI-LAMS stent was chosen, and non-pre-balloon dilatations were performed in these six patients.

In the literature, the rate of successful LAMS deployment for ileocolonic anastomosis is reported to be 89%-98%[3,7]. Overall stent migration has been reported in only 7%-9% of patients[3,18]. Proximal stent migration occurred during the first 3 wk in 6% of patients[1,3,4,7,13]. One patient (4.5%) had self-limiting bleeding, and this complication was associated with LAMS migration one week after placement[5,7]. No perforation or mortality has been attributed to LAMS placement[1,3,4,13]. Our results describing successful NAGI-LAMS placement for the management of PAICS are in line with the two most extensive studies of LAMS in the literature, showing its utility in the treatment of benign short PAICS[3,16]. Our clinical success rate in treatment-naïve patients was 100% (6/6). All patients in our cases tolerated NAGI-LAMS deployment and indwelling for the entire therapy duration without severe post-procedural pain or stent migration. In the literature, LAMS (Nagi, Axios) intolerance is reported to be < 5% post-deployment[22-26]. In addition, LAMS has demonstrated less stent migration (9% *vs* 40%) and post-procedure pain than FCSEMS and BDS[24,27-29]. The overall rates of successful LAMS (Nagi, Axios) deployment (98%), migration (7%-9%), and bleeding (4.5%) without perforation in the treatment of luminal colonic strictures are all encouraging and indicate that LAMS should be considered in the treatment algorithm of benign, short ileocolonic post-surgical stenosis in a multidisciplinary setting[3,6,13,22,23]. Evidence of the clinical

utility of NAGI-LAMS for ileocolonic or colocolonic anastomotic strictures has been presented in a few case reports[25,28]. Only 20 cases have been reported in the literature exploring the use of LAMS (Axios, Nagi) for the endoscopic management of colonic strictures[4].

The maximum efficacy and minimum adverse events regarding the optimal duration of LAMS placement remain undetermined. Many authors suggest limiting the indwelling period of LAMS (Nagi, Axios) to three months[5,6,12,18,22]. The novel design of these stents permits a longer indwelling time, which induces better clinical results and yields low recurrence rates[3,4,18,19]. In the reviewed literature, the mean stent indwelling time was 3.56 mo for the NAGI-AXIOS-LAMS stent[4,5,11,13]. For these reasons, we decided to remove the NAGI-LAMS stents after a period of 3 mo, and our patients were followed clinically for median of 7 mo without the need for additional interventions due to major or minor adverse events. The optimal period of stent indwelling remains to be evaluated in future studies.

One of the innovative aspects of our study is that we evaluated the efficacy, feasibility and safety of the NAGI-LAMS stent placement for the endoscopic management of symptomatic, short benign PAICSs. We report a life-saving technique that has not been previously documented, the off-label use of NAGI-LAMS stents and the application of technology to improve patient outcomes. The saddle length of this NAGI stent is longer than that of the AXIOS stent (30 mm *vs* 10 mm), and it may therefore be better for longer (> 1 cm) luminal GI strictures[5,10,12]. Another difference between the NAGI-LAMS and the AXIOS-LAMS is the stent diameter (Diameter = 10, 12, 14, 16 mm *vs* 10, 15 mm)[10,12]. Stent diameter and length selection are crucial for the clinical success of the procedure (Figure 1). Given these parameters (length and diameter) of LAMS, the NAGI-LAMS stent would be effective for strictures < 30 mm in size, and the AXIOS-LAMS stent would be effective for strictures < 10 mm in size[5,11,13]. The anchoring effect of the NAGI stent stems from its bi-flanged design rather than lumen apposition[12]. Importantly, the NAGI stent delivery catheter can be introduced *via* colonoscopy, while the AXIOS stent delivery catheter, which is shorter, can only be delivered either *via* a therapeutic forward-viewing gastroscope or echoendoscope[4,5,12,17].

Our study focuses only on the endoscopic management of short (median length 1.8 cm) benign ileo-colonic anastomotic strictures using a bi-flanged metal stent, not on the choice between stent placement and another treatment (*e.g.*, re-surgery). In the literature, there is no concrete evidence of treatment preference based on long-term results. According to the literature, the average time of surgery was delayed by endoscopic management for 6.45 years. Therefore, endoscopic management (metal stent, balloon dilatation, *etc.*) prolongs the need for surgery for a significant period of time. Most of these benign anastomotic strictures are simple narrowing's that are shorter than 2 cm, which can be successfully treated by endoscopic alternatives. Only 28% of these patients will require surgical correction, which could be technically difficult and carry the possibility of requiring colostomy. For these reasons, a part of the re-surgery strategy could include a bi-flanged metal stent, which could represent an alternative therapeutic option for this specific type of luminal stricture [30,31].

The small sample size in our study and the absence of comparative groups are significant limitations that should be acknowledged. Although our results are concordant with the current literature, there are some limitations related to the three-month indwelling time and the short duration (7 mo) of follow-up time. More prospective multicenter trials are required to develop guidelines for the utility of NAGI-LAMS in the endoscopic management of benign ileocolonic stricture. Further data are needed to validate the long-term safety and efficacy of BFMS (NAGI-LAMS) in treating luminal GI stenosis.

CONCLUSION

In conclusion, the length and broad flanges of BFMS (NAGI-LAMS) may reduce the stent migration rate and improve patient tolerance. BFMS placement is a minimally invasive endoscopic procedure that may be beneficial as a bridge to surgery or definitive therapy when managing patients with refractory short benign post-anastomotic ileocolonic strictures. BFMS could represent an important alternative to traditional endoscopic options and achieve better long-term results for the management of luminal GI strictures longer than 10 mm and shorter than 30 mm.

76169_Auto_Edited.docx

ORIGINALITY REPORT

5%
SIMILARITY INDEX

PRIMARY SOURCES

1	www.ncbi.nlm.nih.gov Internet	58 words — 2%
2	Rathan Reddy, Umangi Patel, Paul Tarnasky, Prashant Kedia. "Lumen-apposing stent placement for management of a short benign colonic anastomotic stricture", VideoGIE, 2018 Crossref	16 words — < 1%
3	Shuntaro Mukai, Takayoshi Tsuchiya, Takao Itoi, Shujiro Tsuji et al. "Prospective evaluation of a new biflanged metal stent for the treatment of pancreatic fluid collections (with videos)", Gastrointestinal Endoscopy, 2017 Crossref	13 words — < 1%
4	www.wjgnet.com Internet	13 words — < 1%
5	"ENDO 2020 Blue Ribbon Poster presentation", Digestive Endoscopy, 2020 Crossref	11 words — < 1%
6	"Abtracts from the 30th Annual Meeting of the Society of General Internal Medicine", Journal of General Internal Medicine, 2007 Crossref	10 words — < 1%
7	Ryan B. Perumpail, V. Raman Muthusamy. "Gastrointestinal stents: Thinking outside the	10 words — < 1%

box", Techniques and Innovations in Gastrointestinal Endoscopy, 2020
Crossref

8	Www.dovepress.com Internet	10 words — < 1%
9	bmccancer.biomedcentral.com Internet	10 words — < 1%
10	journal.frontiersin.org Internet	10 words — < 1%

EXCLUDE QUOTES	ON	EXCLUDE SOURCES	< 10 WORDS
EXCLUDE BIBLIOGRAPHY	ON	EXCLUDE MATCHES	< 10 WORDS