Communication from the ASGE Technology Committee

TECHNOLOGY STATUS EVALUATION REPORT

Enteral stents

The American Society for Gastrointestinal Endoscopy (ASGE) Technology Committee provides reviews of existing, new, or emerging endoscopic technologies that have an impact on the practice of GI endoscopy. Evidence-based methodology is used, with a MEDLINE literature search to identify pertinent clinical studies on the topic and a MAUDE (U.S. Food and Drug Administration Center for Devices and Radiological Health) database search to identify the reported complications of a given technology. Both are supplemented by accessing the "related articles" feature of PubMed and by scrutinizing pertinent references cited by the identified studies. Controlled clinical trials are emphasized, but in many cases, data from randomized, controlled trials are lacking. In such cases, large case series, preliminary clinical studies, and expert opinions are used. Technical data are gathered from traditional and Web-based publications, proprietary publications, and informal communications with pertinent vendors.

Technology Status Evaluation Reports are drafted by 1 or 2 members of the ASGE Technology Committee, reviewed and edited by the committee as a whole, and approved by the Governing Board of the ASGE. When financial guidance is indicated, the most recent coding data and list prices at the time of publication are provided. For this review, the MEDLINE database was searched through August 2010 for articles related to enteral, esophageal, duodenal, and colonic stents.

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BACKGROUND

Stents are devices used to maintain or restore the lumen of hollow organs, vessels, and ducts. Current stents available for application in the alimentary tract include self-expandable metal stents (SEMSs) for esophageal, gastroduodenal, and colonic malignant obstruction and self-expandable plastic stents (SEPSs) for benign or malignant esophageal strictures. This report provides an update on the technical specifications, efficacy, safety, and financial considerations regarding stents for use in the esophagus, stomach, small bowel, and colon.

TECHNICAL CONSIDERATIONS

SEMSs consist of woven, knitted, or laser-cut metal mesh cylinders that exert self-expansive forces until they reach their maximum fixed diameter. They are generally packaged in a compressed form and constrained on a delivery device. SEMSs are composed of stainless steel, alloys such as elgiloy and nitinol, or a combination of nitinol and silicone. Elgiloy, an alloy composed primarily of cobalt, nickel, and chromium, is corrosion resistant and capable of generating high radial forces. Nitinol, an alloy of nickel and titanium, yields increased flexibility that is helpful for stenting sharply angulated regions at the cost of lesser radial force relative to stents made with other metals. All SEMSs come in a variety of lengths and diameters. Most have a proximal and/or distal flare to prevent migration. The various stents that are commercially available in the United States and their unique specifications and features are outlined in Table 1.

To prevent tumor ingrowth, the interstices between the metal mesh of esophageal SEMSs may be wholly or partially covered by a plastic membrane or silicone. Currently available enteral and colonic stents are uncovered. Other stent modifications include looped ends to reduce the risk of mucosal injury and a proximal flared end to minimize the risk of stent migration. One specialized covered SEMS that is intended for tumors located near the gastroesophageal junction (Esophageal Z-stent with Dua Anti-reflux valve; Wilson-Cook Medical, Winston-Salem, NC) uses an extended polyurethane membrane 8 cm beyond the metal portion of the stent to prevent gastroesophageal reflux.

An SEPS (Polyflex; Boston Scientific, Natick, Mass) has been developed for esophageal strictures. This stent has a woven polyester skeleton and is completely covered with a silicone membrane. The silicone prevents tissue ingrowth through the mesh, and the polyester braids on the external surface anchor the stent to the mucosa to limit migration. Radiopaque markers positioned at the middle and ends of the stent facilitate visualization of this nonmetallic device during fluoroscopy. The SEPS comes in a variety of lengths and diameters (Table 1).

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TABLE 1. Specifications and features of stents commercially available in the United States

	Composition	Delivery system diameter/ length	Unconstrained outer diameter	Unconstrained lengths (covered length)	List price, $	Features
Esophageal stents						
Boston Scientific						
Ultraflex NG Covered	Nitinol	5 mm/87-95 cm	18 mm, 23 mm (proximal flare, 23 mm and 28 mm, respectively)	10 cm (7 cm) 12 cm (9 cm) 15 cm (12 cm)	2175	Available in distal or proximal release, suture removal release mechanism, 48%-54% foreshortening with deployment; indicated for resectable and nonresectable malignancies
Ultraflex NG Uncovered	Nitinol	5 mm/87-95 cm	18 mm (23-mm proximal flare)	7 cm 10 cm 15 cm	2025	Available in distal or proximal release, 48%-54% foreshortening with deployment; indicated for resectable and nonresectable malignancies
Polyflex	Polyester/silicone	12-14 mm/70 cm	16 mm (20- mm proximal flare) 18 mm (23-mm proximal flare) 21 mm (25-mm proximal flare)	9 cm 12 cm 15 cm	2395	Indicated for refractory benign strictures, resectable and nonresectable malignancies. Studies have demonstrated safe removal weeks after placement, manual loading onto delivery system required, has radiopaque markers at ends and center, 36%-41% foreshortening with deployment
WallFlex partially Covered	Nitinol/silicone	6.2 mm/78 cm	18 mm (23-mm proximal and distal flare) 23 mm (28-mm proximal and distal flare)	10 cm (7 cm) 12 cm (9 cm) 15 cm (12 cm)	2550	Low-profile 18.5F coaxial delivery system, proximal and distal flares, proximal removal suture, endoscopic transition zone for deployment under direct visualization; indicated for resectable and nonresectable malignancies and concurrent esophageal fistulae
WallFlex fully covered	Nitinol/silicone	6.2 mm/78 cm	18 mm (25-mm proximal flare, 23-mm distal flare) 23 mm (28-mm proximal and distal flare)	10 cm 12 cm 15 cm	2650	Low-profile 18.5F coaxial delivery system with reconstrainability up to 75%, proximal and distal flares, proximal removal suture, endoscopic transition zone for deployment under direct visualization; indicated for resectable and nonresectable malignancies and concurrent esophageal fistulae
Cook Medical						
Evolution partially covered	Nitinol	8 mm/78 cm	20-mm body; 2-mm proximal and distal flanges	8 cm (5 cm) 10 cm (7 cm) 12.5 cm (9.5 cm) 15 cm (12 cm)	1924	Silicone coating on the exterior and interior stent surface, proximal and distal uncovered flanges, lasso loop for repositioning immediately after placement, controlled-release trigger deployment and recapturability, 30-40% foreshortening
Evolution fully covered	Nitinol	8 mm/78 cm	18-mm body, 23-mm proximal and distal flanges 20-mm body, 25-mm proximal and distal flanges	8 cm 10 cm 12 cm	1924	Silicone coating on the exterior and interior stent surface, lasso loops on both ends for repositioning immediately after placement, controlled-release trigger deployment and recapturability, 28-33% foreshortening
Z-Stent with dual antireflux valve	Stainless steel	10.3 mm/70 cm	18-mm body, 25-mm flared end	8 cm 10 cm 12 cm 14 cm	1973 2085 2193 2301	Windsock design reduces possibility of gastroesophageal reflux for stents placed at gastroesophageal junction, no foreshortening, required manual loading of stent into delivery system

TABLE 1. (*continued*)

	Composition	Delivery system diameter/ length	Unconstrained outer diameter	Unconstrained lengths (covered length)	List price, $	Features
EndoChoice						
Bonastent	Nitinol	6 mm	18-mm body, 24-mm flare	6 cm 8 cm 10 cm 12 cm 14 cm 16 cm	1985	Hooked crosswire geography offers greater conformability
Merit Endotek						
ALIMAXX-ES	Nitinol (laser cut)	7.4 mm/62-67 cm	12-mm mid-body (17-mm proximal flare, 15-mm distal flare) 14-mm mid-body (19-mm proximal flare, 17-mm distal flare) 16-mm mid-body (21-mm proximal flare, 19-mm distal flare) 18-mm mid-body (23-mm proximal flare, 21-mm distal flare) 22-mm mid-body (27-mm proximal flare, 25-mm distal flare)	7 cm 10 cm 120 cm	1900	Laser cut nitinol design results in virtually no stent foreshortening or elongation. Stent contains antimigration struts that reduce stent migration. Polyurethane cover helps to decrease tissue ingrowth. Silicone lining provides a smooth inner lumen. Accurate 1-handed delivery over target site. Soft distal and proximal flares allow patient comfort because of controlled circumferential stent expansion. Indicated for maintaining esophageal luminal patency in esophageal strictures caused by intrinsic and/or extrinsic malignant tumors and for occlusion of esophageal fistulae.
Colonic/enteral stents						
Boston Scientific						
Ultraflex Precision Colonic Stent System	Nitinol	22F/100 cm	25-mm body, 30-mm flare	57 mm 87 mm 117 mm	2125	Over-the-wire proximal suture release for left-sided colonic obstruction; indicated for palliation and as a bridge to surgery for malignant colonic neoplasms
WALLSTENT colonic and duodenal	Elgiloy	3.3 mm/135 cm and 230 cm	20 mm 22 mm	60 mm 90 mm	2225	Through-the-scope deployment possible; reconstrainable before full deployment; Indicated for palliation and as a bridge to surgery for malignant colonic neoplasms
WallFlex colonic	Nitinol	10F/135 cm and 230 cm	22-mm body, 27-mm flared end and 25-mm body, 30-mm flared end	60 mm 90 mm 120 mm	2625	Low-profile 10F through-the-scope/ over-the-wire delivery catheter; reconstrainable up to 70% deployment; indicated for palliation and as a bridge to surgery for malignant colonic neoplasms
WallFlex duodenal	Nitinol	10F/230 cm	22-mm body, 27-mm flared end	60 mm 90 mm 120 mm	2625	Low-profile 10F through-the-scope/ over-the-wire delivery catheter, reconstrainable up to 70% deployment
Cook Medical						
Colonic Z-Stent	Stainless steel	10.3 mm 40 cm	25-mm body	40 mm 60 mm 80 mm 120 mm	1324 1450 1608 1891	No foreshortening, 35-mm flared end, required manual loading of stent into delivery system

TECHNIQUE

The stricture to be stented is first identified endoscopically. The proximal and distal aspects of the stricture are identified either endoscopically or, in the case of nontraversable strictures, with fluoroscopic guidance. A guidewire is advanced through the stricture, and the stent is positioned across the stricture and then deployed under fluoroscopic and/or endoscopic guidance by release of the constraining mechanism. There are 2 methods of stent delivery: through the scope and over the wire. All enteral SEMS are inserted and deployed over a guidewire. As the stent expands, radial forces anchor it at the site of obstruction. The main differences between delivery systems are the design of the handles, the means of removing the constraining mechanism, and the diameter, which determines the means of deployment. Although the majority of deployment systems release the stent initially at the distal end of the catheter, the Ultraflex Esophageal NG stent (Boston Scientific) is available in both a proximal and distal release system. In contrast to most SEMSs, which are sold in a constrained fashion, the SEPS requires mounting onto the delivery catheter just before use. Also, the colonic Z stent (Cook Medical) requires manual loading of the stent into the delivery system.

One important aspect of deployment is the variable degree of foreshortening that occurs with a majority of SEMSs and SEPSs during the transition from the compressed to fully expanded state. The endoscopist must anticipate and allow for this foreshortening to ensure appropriate placement. Table 1 indicates the foreshortening for each device. The labeled stent length always indicates the length at full expansion.

Dilation to 36F (12 mm) or more is sometimes required to enable passage of the esophageal SEMS, depending on stent type and the character and location of the stricture. In contrast, predeployment dilation is generally not required during gastroduodenal stenting and should be avoided during colonic SEMS placement. Technical details of stent placement and general reviews have been previously published.[1,2]

Although covered SEMSs can often be repositioned or removed, noncovered SEMSs cannot be easily repositioned or removed once fully deployed. The available SEPS has been designed and demonstrated to be removable, although the manufacturer warns that the safety of removal after 9 months has not been demonstrated.

EFFICACY/COMPARATIVE ANALYSIS

Esophageal stents

Esophageal SEMSs are indicated for palliation of malignant strictures and tracheoesophageal fistulae. SEMSs have largely replaced the use of rigid plastic stents in the esophagus as a result of the lower complication rate with their use.[3-6] SEMSs improve dysphagia in more than 90% of patients with esophageal cancer.[4,6] SEMSs also improve dysphagia caused by extrinsic malignant compression; however, outcomes are less optimal in this setting.[7] In a randomized study, SEMSs were associated with more rapid restoration of oral intake and lower hospital mortality compared with palliative bypass surgery.[8] A Dutch cooperative study comparing SEMSs with brachytherapy found that SEMSs more rapidly improved dysphagia, but brachytherapy yielded better long-term control of dysphagia and better overall quality of life with fewer complications.[9] A randomized trial suggested that SEMSs were more effective than laser therapy and required fewer reinterventions.[10] In trials comparing various available SEMSs, no single device was consistently associated with improved outcomes or fewer complications.[11-15]

Covered SEMSs help prevent tumor ingrowth. In 1 randomized, controlled study, during 6 months of observation, covered stents decreased the necessity of reintervention for tumor ingrowth from 27% to 0%.[16] One specialized partially covered SEMS that is intended for tumors located near the gastroesophageal junction (Esophageal Z-stent with Dua Anti-reflux valve; Cook Medical) uses an extended polyurethane membrane 8 cm beyond the metal portion of the stent to prevent gastroesophageal reflux. In vitro studies, animal data, and clinical series suggest that this stent successfully prevents significant reflux,[17,18] when stent placement across the esophagogastric junction is required. Randomized trials of similarly designed windsock antireflux stents have demonstrated mixed results in the prevention of esophageal acid reflux as determined by reflux scores and 24-hour pH monitoring.[19-21] Covered SEMSs are effective for palliation of malignant tracheoesophageal fistulae with successful closure of the fistula in 66% to 100% of patients.[22-26] When fistulae persist despite esophageal stent placement, bronchoscopic placement of a parallel tracheal stent can facilitate closure.[26]

The currently available silicone-covered SEPS is approved for treatment of malignant and benign esophageal strictures. Preliminary reports indicate efficacy for malignant strictures similar to that of SEMSs.[27,28] Although not approved as a removable stent, the complete silicone coating facilitates removal even after it is in place for several months. There are several reports of its use for benign strictures; however, they are uncontrolled and include only small numbers of heterogeneous patients.[29,30] In 1 series, temporary SEPS placement for anastomotic leaks after esophagectomy resulted in more rapid oral intake, shorter average hospital stay, and improved mortality compared with surgery or conservative therapy.[31]

Covered esophageal stents may be temporarily placed to relieve dysphagia, whereas patients undergo neoadjuvant therapy, thereby acting as a bridge to surgery.[32-35] Both plastic[32-34] and metal stents[35] have been used for this indication, which is yet to be approved by the U.S. Food and Drug Administration. After successful stent placement, improvement in dysphagia scores and nutritional status

was reported in almost all patients. Stent migration is a concern, particularly after initiation of neoadjuvant therapy, and has been reported in 24% to 46% of patients.[32-35] Elective removal of the stent has been attempted to reduce the migration risk.[36]

Gastroduodenal stents

Many studies have reported effective palliation of malignant gastric outlet obstruction in the antrum, proximal small bowel, and gastroenteric anastomoses by endoscopic SEMS placement.[37-46] Only the Wallstent Enteral and the recently introduced Wallflex Duodenal (Boston Scientific) are approved for treatment of malignant gastroduodenal obstruction. However, some series include cases in which esophageal stents with introducer systems long enough to reach the duodenum were used. Technical success rates for both stents are generally greater than 90%, and 60% to 85% of patients are able to eat at least soft mechanical diets. A comprehensive review of 32 case series including 606 patients unable to take oral intake reported successful stent deployment in 97% of patients, and oral intake was possible in all successful cases, with 87% of patients capable of eating at least a mechanical soft diet.[44]

There are limited reports comparing stenting of the gastric outlet or small intestine with surgical bypass. A small randomized, prospective study of 18 patients comparing SEMS placement with surgical bypass found no difference in survival, complication rates, or gastric emptying at 3 months, but the SEMS group had more rapid restoration of oral intake and a shorter mean hospitalization.[45] Similarly, a retrospective comparison of a cohort of 27 patients with pancreatic cancer causing duodenal obstruction treated with endoscopic stenting or surgical bypass found no difference in survival but a median hospital stay of 4 days in the stent group compared with 14 days in the surgical group.[39] A prospective, nonrandomized study of 36 patients found no difference in overall survival or ability to tolerate food 1 month after stent placement or surgical bypass.[46] Stent placement is usually associated with better short-term outcomes such as the ability to tolerate oral intake, whereas surgery is associated with better long-term outcomes such as lower rates of recurrent obstruction.[47]

Colonic stents

Currently available colonic stents are uncovered, but many investigators have reported using both uncovered and covered esophageal stents in the colon, and the latter may lower the rate of tissue ingrowth and aid in fistula closure.[48,49] Use of covered stents in the colon may result in higher migration rates.[50,51] Clinical success rates, defined as relief of obstructive symptoms, are reported in 85% to 90% of patients. Stenting lesions in the right colon was difficult with the previously available over-the-wire colonic stents. However, by using newer through-the-scope colonic stents, recent studies report rates of technical and clinical successes that are greater than 85%.[52,53] When SEMS have been used for temporary preoperative decompression (bridge to surgery), success rates for completion of a single-stage elective operation are 60% to 85%.[1,49,54-62]

A meta-analysis of 10 studies that compared outcomes between colonic stenting and surgery reported that stent insertion was technically successful in 92.6% of 244 patients.[63] The length of hospital stay was shorter by 7.7 days in the stent group, which also had lower rates of mortality and medical complications than the surgery group. Although the need for ostomy creation was significantly lower in the stent group, there was no difference in survival between patients who underwent stenting followed by subsequent surgery and those who underwent emergent surgery alone. Similar findings were reported in another single-center retrospective study of 123 patients who underwent surgery or SEMS placement.[64] Although there was no difference in survival between groups, patients who underwent SEMS placement had a shorter length of hospital stay, fewer acute complications, and lower mortality. A decision model of colonic stent placement versus emergency surgery for obstructive left-sided colon cancer estimated that preoperative colonic SEMS placement would decrease surgical procedures by 23% and reduce the need for a stoma from 43% to 7%.[65] In a recently concluded randomized trial of 48 patients with obstructive left-sided colon cancer, 67% of patients who underwent endolaparoscopic surgery (colonic stenting followed by elective laparoscopic resection) had successful 1-stage operations compared with only 38% of patients who underwent emergent open surgery.[66] Taken together, these studies show that colonic stenting for malignant obstruction is associated with less morbidity and cost but no difference in overall survival. Assessment of quality of life (QOL) in patients with terminal colon cancer is challenging. One study reported that SEMS placement in patients with obstructive colon cancer was associated with improved overall QOL and also QOL related specifically to GI symptoms.[67]

There are very limited data on the use of esophageal SEPSs for the management of colonic strictures.[68] In a report of 3 patients with benign postoperative strictures at the rectosigmoid junction or the sigmoid colon, the placement of esophageal SEPS yielded resolution of strictures and/or symptoms in all patients. In another report of 21 patients with benign colonic strictures, SEMS placement yielded clinical success in 76% with a complication rate of 42%, a majority of which occurred in patients with diverticular strictures.[69]

SAFETY

In addition to the standard risks of endoscopy, SEMS placement in the esophagus is associated with several

severe, life-threatening complications including perforation, hemorrhage, and airway compression.[2,3,70] Perforation and hemorrhage may be immediate or delayed. Airway compression is an immediate complication, and some have advocated bronchoscopy and possible tracheal stent placement simultaneously or before esophageal stent placement for bulky lesions in the upper esophagus involving or compressing the airways.[25,71,72] It has been suggested that smaller diameter stents should be chosen for upper esophageal tumors to avoid excessive compressive forces, which can lead to unpleasant symptoms and potentially cause airway compression or pressure necrosis with fistula formation.[35,73] One case series suggests stents can be successfully placed for tumors within 1 cm of the upper esophageal sphincter, but the authors recommended avoiding large-caliber stents in this region.[15] The overall death rate from palliative stenting of the esophagus has been estimated at 0.5% to 3.3% based on retrospective surveys and reports including both SEMSs and rigid plastic stents.[3,74,75] Previous radiation or chemotherapy may be associated with an increased rate of complications. Although some series reported an increased incidence of stent-induced complications[60,76] and mortality,[77] others revealed no increase in mortality or life-threatening complications with esophageal stent placement in this setting.[78,79] Other complications of esophageal stent placement include stent occlusion caused by tissue hyperplasia or tumor ingrowth (11%), stent migration (7%), chest pain (12%), gastroesophageal reflux and aspiration pneumonia (8%), and delayed tracheoesophageal fistula caused by pressure necrosis (2%).[80] The development of ulceration and mucosal reaction at contact points of uncovered and partially covered SEMSs make their endoscopic removal difficult. Although more studies are required, a feasibility trial in humans has demonstrated that fully covered SEMSs can be removed safely at endoscopy after successful resolution of underlying strictures (both benign and malignant), fistulae, or leaks.[81] Another recent study showed that fully covered SEMSs are efficacious in resolving benign strictures in 56% and fistulae, leaks, or perforation in 38% of patients.[82] Although migration occurred in 35% of patients, these stents could be successfully retrieved without complications.

As with SEMS placement in the esophagus, perforation and bleeding are the most serious complications of gastroduodenal stent placement, occurring in 0.7% to 5% of patients, respectively.[42,44] Stent migration (5%) and restenosis (18%) are typically late complications, and the majority of these complications can be managed with insertion of an additional stent.[44] One unique complication for gastroduodenal stent placement is precipitation of cholangitis or biliary obstruction caused by compression of the papilla.[2,38,44] Because the papilla cannot typically be accessed after duodenal SEMS placement, a biliary SEMS should be placed before a duodenal SEMS when biliary obstruction is present or impending.

Perforation is the most severe complication of colonic SEMS occurring in 3.8% to 10% of patients.[49,60] Predeployment dilation has been associated with an increased risk of perforation and hence is discouraged.[83] Other potential factors contributing to perforation include puncture of the colonic wall during guidewire passage, erosion of the colonic wall by free wires at the end of the stent, administration of bevacizumab-based chemotherapy regimens, and intraluminal lesions.[60,84] Stent migration and obstruction are generally delayed complications reported in 10% to 11.8% and 7.3% to 10% of patients, respectively.[49,60] Stent placement low in the rectum can lead to severe tenesmus.[85] One study of 44 patients that provided long-term follow-up reported a complication rate of 51%, which included stent migration in 22%, obstruction 17%, perforation 7%, and tenesmus 5%.[86] Colonic stent placement for luminal obstruction secondary to extrinsic lesions is associated with an increased rate of stent migrations and occurred in 13% of patients in 1 study.[87,88]

FINANCIAL CONSIDERATIONS

The list prices of the available enteral stents are provided in Table 1. Several cost analyses have suggested that stent costs are offset by the relative reduction in the number of surgical procedures and hospital days compared with alternative therapies. In a cost-minimization analysis from the United Kingdom, endoscopic palliation of esophageal cancer with SEMS placement yielded a lower cost per day of survival compared with alternative modalities.[89] Similarly, gastroduodenal stent placement yields 30% lower hospital costs compared with surgical palliation, whereas colonic stenting for palliation or preoperative decompression is associated with a 10% to 20% cost reduction.[46,65,90] In a decision analysis that compared colonic stenting and surgery for acute malignant large-bowel obstruction, the stenting strategy was less costly by $30,000.[91] Likewise, duodenal stenting was found to be $3900 less costly than surgical bypass for the palliation of malignant gastroduodenal obstruction.[92]

As of 2005, there are specific CPT codes that must be used when performing stent placement in the alimentary tract, and facilities must include a separate code for the stent itself (Table 2). Although Centers for Medicare and Medicaid Services do not provide additional payment for the device, facilities are required to report these codes to permit cost tracking for future rate determinations. These requirements change frequently, and each facility should check with its local payers. Dilation of the stricture before stent placement is included in the stent procedure code. Fluoroscopic supervision when done by the physician inserting the stent is separately reported by using CPT 76000.

TABLE 2. CPT codes used when performing stent placement in the alimentary tract

CPT	Procedure
43219	Esophagoscopy with insertion of plastic tube or stent
43256	Upper GI endoscopy with stent placement (includes predilation)
44370	Small-bowel endoscopy with stent placement (includes predilation)
44379	Small intestine endoscopy, enteroscopy beyond second portion of duodenum, not including ileum; with transendoscopic stent placement (includes predilation)
44383	Ileoscopy, through stoma; with transendoscopic stent placement (includes predilation)
44397	Colonoscopy through stoma with stent placement (includes predilation)
45327	Proctosigmoidoscopy, rigid; with transendoscopic stent placement (includes predilation)
45345	Flexible sigmoidoscopy with stent placement (includes predilation)
45387	Colonoscopy proximal to splenic flexure with stent placement (includes predilation)
76000	Fluoroscopy (separate procedure), up to 1 hour physician time
Device codes	
C-1874	Stent covered/coated, with delivery system
C-1876	Stent noncovered/noncoated, with delivery system
APC code	
0384	Used for all GI stenting procedures

AREAS FOR FUTURE RESEARCH

The role of fully covered SEMSs in the treatment of benign esophageal strictures, fistulae, and leaks requires further evaluation in prospective trials. Also, its role as a bridge to surgery in esophageal cancer patients with dysphagia undergoing preoperative neoadjuvant therapy requires further evaluation. Prospective, randomized trials with particular emphasis on quality of life and cost-effectiveness are required that compare gastroduodenal stenting and surgery for palliation of malignant gastric outlet obstruction. There is a need for more data assessing the technical feasibility and clinical outcomes of SEPS and fully covered SEMS placement for the management of benign colonic strictures. Further research by using newer biodegradable and drug-eluting stents is needed to define their role. Development of new devices to prevent migration of stents is desirable.

SUMMARY

Obstruction of the digestive tract is a frequent cause of morbidity in patients with GI malignancies. The role of palliative stenting in the management of these patients has expanded in recent years to include the esophagus, stomach, small bowel, and colon. Stent placement also serves as an adjunct to definitive surgical therapy for obstructing colonic lesions because endoscopic decompression facilitates formal bowel cleansing and subsequent single-stage elective surgery. Stenting has also expanded into the realm of benign esophageal and colonic diseases, with preliminary data demonstrating their use for benign strictures and anastomotic leaks. Endoscopic capabilities are likely to expand with the advent of innovative stenting devices and techniques.

DISCLOSURE

The following authors disclosed financial relationships relevant to this publication: Dr. Varadarajulu: consultant to Olympus and Boston Scientific; Dr. Tokar: consultant to Boston Scientific, consultant to, speaker for, and educational grant from Fujinon, Inc. The other authors disclosed no financial relationships relevant to this publication.

Abbreviations: ASGE, American Society for Gastrointestinal Endoscopy; QOL, quality of life; SEMS, self-expandable metal stent; SEPS, self-expandable plastic stent.

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