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# Stenting for Benign and Malignant Esophageal Disorders

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## ■ Introduction

Stent placement within the esophagus has been performed for over a century for the palliation of malignant dysphagia as well as for treating refractory benign esophageal strictures. Originally fashioned from sandalwood and ivory, stents are now designed from a variety of metal alloys, stainless steel as well as polyester. This review will highlight the indications, contraindications, complications as well as the outcomes following esophageal stent placement for benign and malignant disorders of the esophagus.

## ■ Indications

The leading indication for esophageal stent placement is palliation of complications related to esophageal malignancies. Up to one half of patients with esophageal cancer will present with stage IV (metastatic) disease; the majority of them will not survive beyond 12 months.<sup>1-4</sup> In this group of patients, treatment goals are essentially aimed at improving quality of life through maintenance of esophageal luminal patency (and reduction in dysphagia), optimization of nutrition, and reduction in the risk of aspiration (and resultant pneumonia).<sup>2</sup> In addition, this group of patients may be prone to the formation of malignant tracheoesophageal fistulae.<sup>5-9</sup> Aside from dysphagia related to obstruction from intrinsic esophageal malignancies, extrinsic compression of the esophageal lumen can be observed in patients with various forms of lung cancer and mediastinal metastases.

Self-expandable metal stent (SEMS) placement has been reported in this population as well.<sup>10</sup>

Self-expandable stent placement has also been utilized for the treatment of benign diseases of the esophagus. Esophageal perforation, anastomotic leaks and refractory, benign esophageal strictures<sup>1</sup> are all amenable to stent placement. Esophageal perforation, which may occur as a result of an iatrogenic injury related to endoscopic therapy or from spontaneous rupture (Boerhaave syndrome), is often associated with significant morbidity when repaired surgically.<sup>1</sup> The placement of a completely covered SEMS or a self-expandable plastic stent has emerged as an alternative therapeutic option in these cases.<sup>11-15</sup> Esophageal leaks following esophagectomy and anastomotic breakdown following bariatric surgery have also been reported to be successfully managed using completely covered SEMS or self-expanding plastic esophageal stents without the need for operative intervention.<sup>16-24</sup>

## ■ Contraindications

There are very few contraindications to esophageal stent placement. Severe cardiorespiratory compromise which may limit the safe performance of upper gastrointestinal endoscopy is an absolute contraindication to the placement of an esophageal stent. Uncontrolled coagulopathy and esophageal varices are additional contraindications.

Tumors located in the mid to upper esophagus raise important clinical issues with regards

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to compression of the tracheobronchial tree. The radial expansion force associated with SEMS placement across tumors in this location has the theoretical risk of causing airway obstruction.<sup>25-28</sup> Although not a contraindication to esophageal stent placement, a chest computed tomography (CT) scan should be obtained and reviewed with a thoracic surgeon or an interventional pulmonologist prior to a SEMS placement. In some cases, bronchoscopy with placement of an airway stent may be indicated prior to or at the same time as SEMS deployment.

### ■ Technique

The technique for endoscopic placement of esophageal stents, both plastic and metal, is relatively straight forward. Selection of appropriate candidates from the standpoint of medical stability and the ability to tolerate an endoscopic procedure is imperative. As for any endoscopic procedure, patients should fast for at least 6 hours prior to the procedure. The choice of anesthetic is based on local practice patterns; however, in our experience most procedures can be performed using conscious sedation with narcotic analgesics and a benzodiazepine. Patients being considered for esophageal stent placement due to a perforation or anastomotic breakdown following bariatric surgery should be approached with caution as these individuals are typically obese with poor oral airways. In these cases as well as in those with multiple medical comorbidities, consultation with an anesthesiologist is recommended.

For patients with malignant disease, an upper endoscopy to define the proximal and distal margins of the tumor is the first step in esophageal stent placement. The total length of the stricture will help to determine the length of the desired stent. In the event that the upper endoscope cannot be passed beyond the esophageal stricture, careful esophageal dilation should be performed to allow passage of the endoscope beyond the tumor in order to obtain proper measurements. Although esophageal dilation techniques exceed the scope of this paper, controlled radial expansion balloon dilators may be preferable to bougies for this purpose as the former allow direct visualization of the stricture and a more “controlled” dilation. Fluoroscopy, while mandatory for esophageal stent placement, may be helpful when dilating malignant esophageal strictures.

The proximal and distal margins of the stricture can be marked using a variety of methods. Endoscopic clips can be applied or a contrast dye can be injected into the submucosa. A less desirable (but cheaper) approach is marking the level of the endoscope externally by using a radio opaque object (such as a paper clip or hemostat). For malignant disorders, the stent should be deployed 2 cm above the proximal tumor margin to decrease the risk of distal stent migration. Once the tumor has been measured and the proximal and distal margins have been marked, a wire guide should be placed across the stenosis into the stomach; the endoscope is then removed leaving the wire guide in place.

For malignant lesions, the type of stent (*i.e.* covered versus uncovered; anti-reflux, length and diameter) will depend on the lesion itself. A smaller stent diameter may be used for lesions within the cervical esophagus in order to decrease the possible “foreign body” sensation associated with stent placement in this location. For most lesions, a partially or fully covered SEMS is preferable to an uncovered stent in order to prevent the tumor ingrowth and tissue hyperplasia. A covered stent should be also be utilized for the treatment of malignant tracheoesophageal fistulas. The major drawback to partially or fully covered stents is the increased risk of stent migration. An uncovered stent may be selected for extrinsic compression and for patients with a prior history of stent migration.

For lesions in the distal esophagus where the stent may cross the gastroesophageal junction, an anti-reflux stent may be selected. Stents placed in this location obliterate the natural reflux barrier and patients almost invariably develop reflux of gastric contents into the proximal esophagus or oropharynx; specifically designed “anti-reflux” stents may help decrease symptoms.

Once the appropriate stent has been selected, deployment is straightforward. The stent is advanced over the wire guide and the outer markings of the stent aligned with the proximal and distal margins of the stricture, recognizing that most SEMS foreshorten by 30-40% with deployment. Release of the stent (which varies by device) can then proceed under fluoroscopic and/or endoscopic control. Post-deployment endoscopy can be performed to ensure proper stent positioning; regarding fully covered metal stents, proximal re-positioning using grasping forceps can be easily accomplished

in most cases. Partially covered stents can be re-positioned in most cases with some difficulty immediately after deployment, especially when the deployed stent is a distal release device.<sup>1</sup>

## ■ Complications

Immediate or early procedure-related complications following esophageal stent placement occur in up to 10% of individuals,<sup>1,29</sup> and include aspiration, airway compromise, malpositioning of the device, entrapment of the stent delivery system, dislodgement of the stent, hemorrhage, severe chest pain, nausea, and esophageal perforation. Late (or delayed) complications include bleeding and fistula formation from stent erosion, severe gastroesophageal reflux, stent migration, and obstruction secondary to tissue in-growth or food bolus impaction.<sup>1,29,30</sup> Some malpositioned or migrated stents can be re-positioned or removed using a grasping forceps, an inflated balloon catheter or a polypectomy snare. On occasion, migrated stents may be left in the stomach and a new stent placed.<sup>1,31</sup> Stents which become occluded secondary to tumor in-growth can be treated with argon plasma coagulation or placement of a second stent through the first (stent-within-stent design). Food bolus impaction can typically be treated endoscopically.

## ■ Outcomes

The ideal modality for the treatment of any patient with metastatic cancer and limited survival should meet the following criteria: wide availability (*i.e.* ease of use), minimal side effects, minimal complications, rapid symptom improvement, and minimal need for re-intervention.<sup>2</sup> With respect to esophageal malignancies, SEMS meet the majority of these criteria.

For malignant disease, SEMS placement is technically possible in nearly all patients in whom it is attempted. SEMS placement may not be possible if the wire guide or the stent introducer cannot be placed across the esophageal stenosis.<sup>1,2</sup> Indeed, this is a rare event. A 2004 review of 415 patients with advanced esophageal cancer in Great Britain found that the technical success rate for SEMS placement ranged from 96 to 100%.<sup>32</sup> In addition to high rates of technical success, SEMS are highly efficacious in their ability to palliate dysphagia

and close malignant fistulae. Multiple case series and meta-analyses performed over the past 20 years suggest immediate improvement in clinical symptoms in 90-100% of patients.<sup>5,9,10,33-50</sup> Despite these high technical and initial clinical success rates, the need for re-intervention remains significant with up to one third of patients experiencing recurrent dysphagia from tumor in-growth or tissue hyperplasia at the proximal or distal stent margins.

A variety of different esophageal stents are currently available worldwide. Covered SEMS have been demonstrated to be superior to fixed-diameter plastic stents and uncovered SEMS for malignant indications.<sup>42</sup> This is due to the fact that covered SEMS prevent the in-growth of tumor, which has been reported in a significant percentage of patients with uncovered SEMS.<sup>51</sup> While there are a variety of currently available prostheses, no single manufacturer's covered SEMS has been proven superior to the others' for palliation of malignant esophageal disease.<sup>1</sup>

A covered self-expandable plastic stent (SEPS) (Polyflex, Boston Scientific, Natick, MA) has been introduced into the marketplace; in Europe, it is less costly than its metallic counterparts. A recent prospective randomized trial from Italy studied the use of covered SEPS versus covered SEMS for palliation of malignant esophageal dysphagia.<sup>52</sup> Although there was no difference in palliation of dysphagia between the two groups, significantly more complications including stent migration were seen in the SEPS group. Other studies have yielded similar findings.<sup>53,54</sup> Despite this, the idea of SEPS or completely covered SEMS placement for malignant disease is appealing in patients who may require neoadjuvant therapy but also have severe dysphagia; these stents could be subsequently removed once therapy is complete and prior to surgery.<sup>32</sup>

Despite the superiority of covered SEMS over their uncovered counterparts for malignant esophageal disorders, they are not without their own limitations. Because of the decrease in tumor intercalation into the prosthesis, completely or partially covered SEMS are prone to migration. In a recent trial, stent migration was observed in 17% of patients who had undergone covered SEMS placement for malignant disease.<sup>55</sup> In an attempt to decrease the risk of migration, some have advocated utilizing stents with a larger diameter. A recent prospective study in patients with dysphagia from obstructing gastroesophageal junction or

esophageal malignancies found that larger caliber covered SEMs were associated with a decreased risk of stent migration, tissue overgrowth or food bolus impaction.<sup>56</sup>

Recurrent dysphagia requiring repeat intervention occurs in up to 30% of patients following SEMs placement. Patients in whom stents are occluded by tumor in-growth can be treated with repeat stent placement or argon plasma coagulation.<sup>1</sup> Moreover, although SEMs provide rapid relief of dysphagia, results of a single randomized trial comparing single-dose brachytherapy to SEMs for incurable esophageal cancer suggest that brachytherapy provides more durable (albeit slower) relief of symptoms.<sup>55</sup> In centers where brachytherapy is available, some authors have suggested that patients be referred for SEMs or brachytherapy depending on a prognostic model; patients with a poor prognosis undergo SEMs placement (rapid onset of symptom relief) while those with an intermediate or good prognosis are referred for brachytherapy (slower onset of relief, longer sustainability).<sup>55</sup> Aside from brachytherapy, other alternative techniques to SEMs placement include local endoscopic techniques such as laser ablation, argon plasma coagulation, and photodynamic therapy.<sup>54</sup>

## ■ Benign Disease

The use of SEPS and, more recently, completely covered SEMs<sup>56</sup> for benign indications is currently evolving. As opposed to their metallic counterparts, SEPS can be easily removed or re-positioned, making them ideal candidates for treating benign esophageal lesions such as strictures, iatrogenic perforations, and postoperative anastomotic leaks. A number of case series have now demonstrated the clinical efficacy of using SEPS for benign indications.<sup>12-24,57</sup> Although most studies suggest promising results (despite limited sample sizes), a recent review from the Mayo Clinic suggests otherwise.<sup>35</sup> Eighty-three SEPS were successfully placed in 30 patients for benign indications. Stent migration occurred in almost 82% of patients in whom SEPS were placed due to benign esophageal strictures, 75% of those with anastomotic strictures, 59% of patients with anastomotic leaks, and 29% of patients with radiation-induced strictures. Long-term symptomatic improvement following stent removal occurred in only 6% of all procedures.

Given these findings, appropriate candidate selection, proper device placement, and close follow-up are indicated in patients considered for SEPS or completely covered SEMs placement for benign disease.

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