

Esophageal stent fracture: Case report and review of the literature

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Abstract

Endoscopic esophageal stent placement is widely used in the treatment of a variety of benign and malignant esophageal conditions. Self expanding metal stents (SEMS) are associated with significantly reduced stent related mortality and morbidity compared to plastic stents for treatment of esophageal conditions; however they have known complications of stent migration, stent occlusion, tumor ingrowth, stricture formation, reflux, bleeding and perforation amongst others. A rare and infrequently reported complication of SEMS is stent fracture and subsequent migration of the broken pieces. There have only been a handful of published case reports describing this problem. In this report we describe a case of a spontaneously fractured nitinol esophageal SEMS, and review the available literature on the unusual occurrence of SEMS fracture placed for benign or malignant obstruction in the esophagus. SEMS fracture could be a potentially dangerous event and should be considered in a patient having recurrent dysphagia despite successful placement of an esophageal SEMS. It usually requires endoscopic therapy and may unfortunately require surgery for retrieval of a distally migrated fragment. Early recognition and prompt management may be able to prevent further problems.

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Key words: Esophagus; Self-expanding metal stent; Stent complication; Stent fracture; Stent migration

Core tip: Esophageal self expanding metal stents are widely used for the treatment of a variety of benign and malignant esophageal conditions. A rare and infrequently reported complication of this procedure is stent fracture and subsequent migration of the broken pieces. There have only been a handful of case reports describing this problem. We report a case of spontaneous fracture of a nitinol esophageal self expanding metal stent, the first reported case from the United States, and review the available literature on this unusual occurrence.

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INTRODUCTION

Esophageal stent placement is widely used for the palliative treatment of esophageal and gastric cardia cancer. More recently, fully covered esophageal stents have been used for benign esophageal conditions such as refractory stricture, tracheoesophageal fistula, iatrogenic perforation, and post-surgical leaks^[1,2]. Esophageal stents have

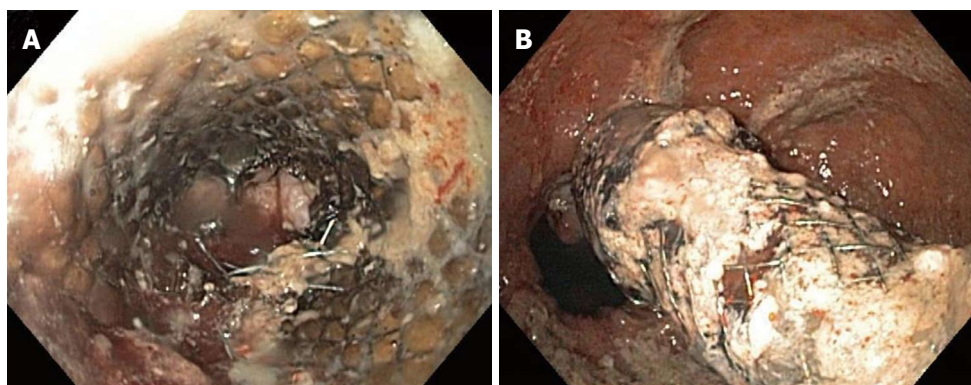


Figure 1 Endoscopic view of the fractured pieces of the esophageal self expanding metal stent with the proximal fragment embedded in the upper esophagus and the distal migrated fragment wedged in the hiatal hernia. A: Proximal fragment; B: Distal migrated fragment.

evolved from rigid polyvinyl plastic prostheses (“Celestin tubes”) to self-expanding metal stents (SEMS) which may be uncovered, partially covered, or fully covered. SEMS are associated with significantly reduced rates of stent related mortality and morbidity in the form of esophageal perforation and stent migration as compared to plastic stents^[3]. SEMS offer a safe and effective means of treatment, which can be placed as an outpatient procedure at low costs^[4].

However, SEMS are associated with their own complications. Early complications include chest pain, aspiration from gastroesophageal reflux, bleeding, perforation and stent migration. Delayed complications include stent migration, stent occlusion, tumor ingrowth or overgrowth, stricture formation, reflux, tracheoesophageal fistula formation, bleeding and perforation. Stent migration is the most common complication amongst all, with a frequency of 7%-75%^[5,6]. A rare complication of esophageal SEMS is stent fracture described in a handful of case reports, dating as early as 1999 with periodic reports since then. We report a case of a spontaneously fractured nitinol SEMS, which is the first recorded instance in the United States and present a review of all previously published reports of esophageal SEMS fracture.

CASE REPORT

A 71-year old female with history of squamous cell carcinoma (SCC) of the tongue was treated with radiation and surgical excision 10 years ago. She presented with worsening dyspnea, progressive dysphagia and weight loss. CT scan showed a subcarinal mediastinal mass with extension to the mid-esophagus and metastatic disease to the right upper lung. Endoscopic ultrasound with fine needle aspiration of a lymph node confirmed recurrence of SCC. Chemotherapy was begun and the esophageal lesion was treated with four rounds of liquid nitrogen cryotherapy resulting in shrinkage of the esophageal tumor with symptomatic improvement of her dysphagia.

One year later, she again developed dysphagia; repeat endoscopy showed a malignant stricture from 26 to 31

cm from the incisors. The stricture could only be traversed with an ultra-thin endoscope (outer diameter 5.5 mm) with some resistance. An 18 mm diameter by 12 cm long fully covered Nitinol SEMS (Bonastent, Standard Sci-Tech, Inc, Seoul, South Korea) was successfully deployed across the stricture with its proximal end at 24 cm. Radiographic images of the deployed stent revealed that it was correctly positioned and post-placement fluoroscopy showed complete passage of contrast. The patient also received targeted stereotactic radiotherapy to the right upper lobe of her lung after the stent was placed due to enlarging pulmonary lesions. The radiation field for the lung did not overlap the position of the esophageal stent.

An episode of food impaction within the stent occurred 7 mo after deployment which was cleared endoscopically and she was found to have candida esophagitis with food stasis. During that endoscopy, it was noted that the esophageal stent had Nitinol wire disruption at the 9 o'clock position in the middle of her stent however, the stent lumen was intact. Four months later (11 mo after stent placement), she presented again with dysphagia. Endoscopy showed recurrence of stenosis from the tumor and a complete fracture of the stent at its mid-point with the proximal half embedded into the esophageal lumen and the distal fragment migrated and wedged in a hiatal hernia (Figure 1). Endoscopic dilation was performed using a 10 to 13.5 mm through-the-scope balloon catheter. After dilation, the distal fragment of the broken stent was gently directed down into the stomach. The retrieval lasso at the flared end of the distal fragment was grasped with retrieval forceps and the stent fragment was removed with careful maneuvering. The retrieval lasso at the flared end of the proximal piece was pulled, but the stent could not be moved due to embedding into the esophageal mucosa. The distal end of the proximal fragment was then grasped with an alligator forceps and turned inside out finally allowing successful removal (Figure 2). A new 18 mm diameter by 10 cm long partially covered Nitinol SEMS (WallFlex, Boston Scientific, Marlborough, MA, United States) was deployed successfully under fluoroscopic and endoscop-



Figure 2 Endoscopically removed pieces of the fractured esophageal self expanding metal stent.

ic guidance. The patient had significant improvement of her dysphagia and tolerated an oral diet. The patient died 3 mo later after an episode of massive hemoptysis.

DISCUSSION

Esophageal SEMS may be made of stainless steel or Nitinol. Nitinol is an alloy made of 55% nickel and 45% titanium, whose name is derived from its composition and its place of discovery: Nickel Titanium Naval Ordnance Laboratory^[7]. Nitinol's biocompatibility and the unusual and useful property of shape memory are the reasons for its widespread use in medicine. These stents may be exposed to significant stress-induced fatigue which over a period of time may cause weakening of the metal structure of the stent leading to subsequent fracture and fragmentation.

There have only been 8 published cases of complete esophageal SEMS fracture^[8-14] (Table 1). These were all Nitinol stents from different manufacturers and the timing of stent fracture was anywhere from 8 to 40 wk after initial stent placement. The mean patient age was 66 years (range 50-79 years) with 5 male patients, 1 female patient and 2 with gender not reported. The presenting complaint in all cases was dysphagia. They were managed in a variety of different ways. In some cases, the fractured stent pieces were removed endoscopically and a new stent was placed. In other cases, a new stent was placed without removal of the fractured stent. Surgical removal of the distally migrated stent fragment was required in 2 instances. Three of the SEMS were fully covered stents and 5 uncovered. Half of these cases involved the Esophacoil SEMS, which is no longer available. There has been a report of an esophageal fractured stent fragment migrating into the stomach and resulting in the formation of a gastrocolic fistula^[13] and thus whenever possible, migrated stents should be retrieved.

Partial Nitinol esophageal stent fracture has been reported more commonly, with 6 publications accounting for 33 patients^[9,15-19]. However most of these cases did not need any intervention as it did not affect stent func-

tion and only 6 of these cases required placement of new stents through the lumen of the damaged stent due to symptomatic dysphagia, tumor ingrowth and stenosis. Since these stents did not fracture completely, migration of the stent was not an issue.

Fracture of Nitinol SEMS used for the management of malignant obstruction in other parts of the gastrointestinal tract have also been reported. One study reported 2 cases of partial break in the stent wall both in an uncovered and covered enteral Nitinol SEMS placed for symptomatic management of malignant gastric outlet obstruction, with the latter one requiring cutting of the broken part and placement of a second stent to manage food impaction^[20]. Two case reports described complete circumferential stent fractures of enteral Nitinol SEMS, one with 2 consecutive fully covered enteral Nitinol SEMS placed for benign duodenal stricture in the same patient^[21] and another with an uncovered Nitinol SEMS for duodenal obstruction from periampullary adenocarcinoma^[22]. There have been 5 reports describing a total of 14 cases of partial as well as complete fractures of uncovered biliary Nitinol SEMS placed for palliation of malignant biliary obstruction^[23-27]. There have also been 3 reports of fracture of colonic Nitinol SEMS placed for malignant large bowel obstruction^[28-30].

The possibility of disease or treatment related factors leading to stent fracture have been considered. The use of balloon catheters to dilate Nitinol stents immediately post deployment to guarantee rapid and complete stent expansion to their maximum diameter has been associated with stent fracture in 1 reported case^[17]. There have been some instances where esophageal stent breakage has occurred related to laser application to control bleeding from tumor ingrowth. In these cases the authors have postulated that thermal straining of the nitinol alloy could have resulted in stent fracture^[18]. In another case series, high dose radiation therapy was associated with fracture of stainless steel tracheobronchial stents^[31]. Our patient had also undergone stereotactic radiotherapy to the right upper lobe of her lung after the stent was placed. However the area that was irradiated did not involve the esophagus and hence most likely this did not contribute to the stent fracture.

Nitinol esophageal SEMS are a great improvement over Celestin tubes for the management of malignant dysphagia, mainly due to considerably easier and safer deployment. In addition, they are seeing wider use for management of refractory benign esophageal strictures. However, there are potential complications that may occur following successful deployment. Stent fracture is a rare but potentially dangerous occurrence that should be considered in a patient having recurrent dysphagia after successful placement of an esophageal SEMS. This complication may occur as early as 2 mo after placement. It usually requires endoscopic therapy and may unfortunately require surgery for retrieval of a distally migrated fragment. Early recognition and prompt management may be able to prevent further problems.

Table 1 Review of all cases of complete esophageal self-expanding metal stent fracture

Ref.	Country of Origin	Age (yr)/ Gender	Reason for stent placement	Location	Pre-stent procedures	Initial stent	Stent fracture time after placement	Stent fracture management	Repeat stent placement
Current Case	United States	71/female	Dysphagia from metastatic esophageal squamous cell carcinoma	Mid esophagus	None	18 mm × 120 mm, Fully covered Nitinol SEMS - Bonastent, Standard Sci-Tech, Inc, Seoul, South Korea	45 wk	Proximal piece in the upper esophagus and distal fragment wedged in a hiatal hernia, both removed endoscopically	18 mm × 100 mm, Partially covered Nitinol SEMS - Wallflex, Boston Scientific, Marlborough, MA, United States
Wadsworth <i>et al</i> ^[8] , 2010	United Kingdom	75/female	Dysphagia from refractory benign esophageal stricture	Distal esophagus	None	22 mm × 120 mm, Fully covered Nitinol SEMS - EBN stent, Diagmed Healthcare Ltd, Thirsk, United Kingdom	8 wk	Proximal piece in esophagus removed endoscopically, and distal fragment migrated to the colon, passed rectally	Was under consideration at the time of publication
Wiedmann <i>et al</i> ^[9] , 2009	Germany	69/not reported	Dysphagia from metastatic EAC	Distal esophagus	None	22 mm × 160 mm, Fully covered Nitinol SEMS - Hanarostent, M.I.Tech Co., Inc, Seoul, South Korea	20 wk	Proximal piece in esophagus and distal fragment in the gastric antrum, both removed endoscopically	22 mm × 120 mm, Fully covered Nitinol SEMS - Hanarostent, M.I.Tech Co., Inc, Seoul, South Korea
Chhetri <i>et al</i> ^[10] , 2008	United Kingdom	50/male	Dysphagia from EAC	Distal esophagus	Palliative chemotherapy	18 mm × 110 mm, Fully covered Nitinol SEMS - Choostent, M.I.Tech Co., Inc, Seoul, South Korea	28 wk	Proximal piece in the esophagus removed endoscopically as it was causing trauma and bleeding, and the distal fragment wedged in the distal two-thirds of the tumor	18 mm × 120 mm, Partially covered Nitinol SEMS - Ultraflex Boston Scientific, Natick, MA, United States, was placed across the exposed upper end of the tumor and through the prior fractured stent
Doğan <i>et al</i> ^[11] , 2005	Turkey	50/not reported	Dysphagia from metastatic EAC	Distal esophagus	None	18 mm × 100 mm, Uncovered Nitinol SEMS - Esophacoil, Medtronic InStent Inc., Minneapolis, MN, United States	10 wk	Proximal piece with tumor overgrowth and partial obstruction in the esophagus and distal fragment migrated and left in the stomach	18 mm, Uncovered Nitinol SEMS - Esophacoil, Medtronic InStent Inc., Minneapolis, MN, United States inserted through the proximal fractured fragment
Reddy <i>et al</i> ^[12] , 2003	United Kingdom	76/male	Dysphagia from EAC at the GE junction	GE junction	Dilation and argon plasma ablation	18 mm × 100 mm, Uncovered Nitinol SEMS - Esophacoil, Kimal PLC, Uxbridge, United Kingdom	22 wk	Proximal piece in the esophagus with tumor occlusion and the distal fragment in the stomach which subsequently migrated into the right inguinal hernia, removed surgically by enterotomy, followed by herniorrhaphy	Uncovered Nitinol SEMS - Esophacoil, Medtronic InStent Inc., Minneapolis, MN, United States inserted through the proximal fractured fragment

Reddy <i>et al</i> ^[12] , 2003	United Kingdom	76/male (same patient)	Dysphagia from EAC at the GE junction	GE junction	None	Size NR, Uncovered Nitinol SEMS - Esophacoil, Kimal PLC, Uxbridge, United Kingdom	23 wk	Stent fracture in 2 places with proximal piece in the esophagus, middle piece in the stomach and the distal piece in the small intestine, not removed as patient died due to aspiration pneumonia	None
Altıparmak <i>et al</i> ^[13] , 2000	Turkey	52/male	Dysphagia from EAC	NR	None	Size NR, Uncovered Nitinol SEMS - Wallstent, Schneider Inc., Plymouth, MN, United States	40 wk	Proximal piece in the esophagus and the distal fragment in the stomach causing a gastrocolic fistula with unsuccessful endoscopic removal requiring surgical gastrotomy and fistula repair	None
Grimley <i>et al</i> ^[14] , 1999	United Kingdom	79/male	Dysphagia from refractory anastomotic stricture after resection of EAC	Proximal esophagus	Dilation of anastomotic stricture	18 mm × 100 mm, Uncovered Nitinol SEMS - Esophacoil, Medtronic InStent Inc., Minneapolis, MN, United States	8 wk	Proximal piece in the esophagus and the distal 2 cm fragment migrated into the stomach, subsequently passed rectally	Partially covered Nitinol SEMS - Ultraflex Boston Scientific, Galway, Ireland, was placed across the exposed upper end of the tumor and through the prior fractured stent

SEMS: Self-expanding metal stent; EAC: Esophageal adenocarcinoma; GE: Gastroesophageal.

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