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ORIGINAL ARTICLE

Self-expanding metal stent in esophageal perforations and anastomotic leaks

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Abstract

Background and Aims Placement of self-expanding metal stents (SEMS) has emerged as a minimally invasive treatment option for esophageal perforation and leaks. The aim of our study was to assess the role of SEMS for the management of benign esophageal diseases such as perforations and anastomotic leaks.

Methods All patients ($n = 26$) who underwent SEMS placement for esophageal perforation and anastomotic leaks between May 2012 and February 2019 were included. Data were analyzed in relation to the indications, type of stent used, complications, and outcomes.

Results Indications for stent placement included anastomotic leaks 65% ($n = 17$) and perforations 35% ($n = 9$). Fully covered SEMS (FCSEMS) was placed in 25 patients, and in 1, partially covered SEMS (PCSEMS) was placed. Stent placement was successful in all the patients ($n = 26$). Four patients did not report for follow-up after stenting. Among the patients on follow-up, 91% (20/22) had healing of the mucosal defect. Stent-related complications were seen in 5 (23%) patients and included stent migration [3], reactive hyperplasia [1] and stricture [1].

Conclusion Covered stent placement for a duration of 8 weeks is technically safe and clinically effective as a first-line procedure for bridging and healing benign esophageal perforation and leaks.

Keywords Achalasia cardia · Benign stricture · Esophageal leaks · Esophageal foreign body · Esophageal perforation · Esophagectomy · Iatrogenic · Mediastinitis · Therapeutic endoscopy

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Bullet points of the study highlights

What is already known?

- Esophageal perforations and leaks are often life threatening and have a high mortality rate; surgical treatment of these is often associated with high incidence of major complications.
- Placement of self-expanding metal stents (SEMS) has emerged as a minimally invasive treatment option for esophageal perforation and leaks.

What is new in this study?

- Esophageal perforations and leaks can be successfully managed using SEMS as a first-line therapy.

What are the future clinical and research implications of the study findings?

- Controlled trials are required to compare the outcomes of endoscopic management vs. surgical therapy in patients with esophageal perforations and leaks.
- Larger number of study patients would enable us to do subgroup analysis among perforations and leaks individually.

Introduction

Esophageal perforations and anastomotic leaks are potentially life-threatening events. Esophageal perforation can be either spontaneous or iatrogenic. Despite treatment, approximately a quarter of patients with esophageal perforations are at risk for in-hospital death [1]. Esophageal anastomotic leak, which occurs as a complication of total gastrectomy or esophagectomy also poses a threat to life. More than a third of patients with anastomotic leaks are at risk for in-hospital mortality [2].

The principles of management of esophageal perforation or leaks include prevention of active spillage from the esophagus, drainage of pleural and/or mediastinal cavities of accumulated spillage, intravenous broad-spectrum antibiotics and adequate nutritional support [3]. Some of the described non-operative measures include closure by placement of metallic clips or by the use of fibrin sealants. However, their utility is limited to a select group of patients with small (≤ 1.5 cm) clean perforations and minimal or no infection [4].

Placement of self-expanding metal stents (SEMS) has emerged as a minimally invasive treatment alternative for esophageal perforations and leaks. Stents are able to effectively seal the mucosal defects in ruptures and leaks and allow esophageal wall healing, leading to control of sepsis and also facilitating early oral intake [3]. Factors associated with successful primary closure include a shorter time from the initial diagnosis to definitive treatment and smaller defect size [5]. The present study was done with an aim to assess the utility of SEMS in the management of esophageal perforations and anastomotic leaks.

Methods

An institutional review board–approved retrospective analysis of data from patients who underwent esophageal stenting for perforations or anastomotic leaks from May 2012 to February 2019. Details of the type of esophageal injury, its duration, location of injury, type of stent placed, duration of stent placement, and need of additional procedures were retrieved from case records and noted in standard data forms. The diagnosis of perforation or leak was made using one or more of the following methods: barium/gastrografin swallows, oral contrast-enhanced computed tomography, and upper gastrointestinal endoscopy.

Definitions

i Technical success: Successful placement of a stent across the mucosal defect with no evidence of contrast leak at the end of procedure

j Clinical success: Complete healing of perforation or leakage by deployment of an esophageal stent, confirmed by no leak of contrast on barium studies

Table 1 Baseline characteristics of the patients

Age (mean, years)	53 (range, 26–73)
Male, *n* (%)	20 (77%)
Esophageal anastomotic leaks, *n* (%)	17 (65%)
Esophageal perforations	9 (35%)
Boerhaave's, *n*	5
Post dilatation, *n*	3
Foreign body: fish bone, *n*	1
Time to stent placement (median, days)	4 (range: 1–50)†
Duration of stent (median, weeks)	8 (range: 6–14)
Type of stent: FCSEMS*, *n*	25
Type of stent: PCSEMS**, *n*	1
Location: upper esophagus < 25 cm	4 (15%)
Mid esophagus 25–30 cm	4 (15%)
Lower esophagus > 30 cm	18 (70%)
Patients requiring drainage procedure, *n*	16‡
Intercostal	13
Mediastinal	3
Abdominal	3

† Data available only for 21 patients

‡ Three patients required simultaneous 2 drains

* FCSEMS: fully covered self-expanding metal stents

** PCSEMS: partially covered self-expanding metal stents

Technique

All stents were placed by trained gastroenterologists either in the endoscopy suite or in the operating room. Endoscopy and fluoroscopy were used in all cases. Using minimal insufflation, a gastroscope was used to locate the site of perforation and a short guidewire was placed within the lumen of the esophagus. Following this, external radiopaque markers were placed over the skin to delineate the proximal and distal portion of the injured esophagus along with the gastroesophageal junction. All the stents were placed over the wire under fluoroscopic guidance. Between 2012 and 2014, in one patient, partially covered self-expanding metal stents (PCSEMS) were placed. After 2014, fully covered self-expanding metal stents (FCSEMS) were used. The FCSEMS were secured in place by means of endoscopic hemostatic clips. After stenting, patients were followed up clinically and with a gastrografin study at 48 h to assess leakage. All the patients were advised to follow-up for stent removal at 8 weeks. Patients continued to receive intravenous broad-spectrum antibiotics after stenting as per institutional protocol. Drainage procedures of mediastinal or pleural collections were performed as decided by the treating physician.

Table 2 Follow-up of the patients and complications

Total, *n*	26
Technical success, *n* (%)	26 (100%)
Follow-up, *n* (%)	22 (85%)
Complications	
Migration, *n*	3
Stricture, *n*	1 (required dilatation)
Reactive hyperplasia, *n*	1
Death, *n*	1 (disseminated fungal infection)
Endoscopic re-intervention	
Successful stent repositioning for migration, *n*	2
Stricture dilatation, *n*	1
Clinical success, *n* (%)	20/22 (91%)

Results

During the 7-year assessment period, 26 patients underwent esophageal stenting for the management of anastomotic leaks and perforations. Baseline characteristics of the patients included in the study are listed in Table 1. Four patients underwent stent placement in the operating room and the others had stent placement in the endoscopy suite. Technical success was achieved in all 26 patients. Seventeen patients had stent placement for esophageal anastomotic leaks following esophagectomy or gastrectomy for primary esophageal or gastric malignancy respectively. Nine patients underwent stenting following esophageal perforation either spontaneous (Boerhaave's or fish bone injury) or iatrogenic. Iatrogenic perforations included two patients following esophageal dilatation for corrosive stricture and one following dilatation for achalasia cardia.

Follow-up

Four patients did not report for follow-up after placement of SEMS. Among the 22 patients on follow-up, 20 (91%) achieved clinical success (Table 2). Two patients failed to achieve clinical success after 8 weeks of stent placement. Of the two who failed to achieve clinical success, one had Boerhaave's syndrome and suffered repeated episodes of stent migration and so underwent laparotomy and transgastric fixation of stent. However, his condition worsened with time and he succumbed to disseminated fungal infection. The other patient had reactive hyperplasia within the PCSEMS, which made endoscopic removal difficult. This patient subsequently underwent surgery.

Stent migration occurred in 2 (13.6%) other patients with anastomotic leaks and both were managed endoscopically with stent repositioning and clipping. Both the patients attained clinical success after stent repositioning. In one patient, although the leak healed, a stricture was noted after removal of the SEMS, which was managed with endoscopic dilatation.

Discussion

To the best of our knowledge, this the first series from India, which describes the utility of SEMS in the management of esophageal perforations and anastomotic leaks. In the present study, the technical success of SEMS placement was 100% and the clinical success was 91%. Several case series have reported similar high technical success rates [3]. The clinical success in our group of patients was higher than that of previously reported series [6–8].

In the present study, stent migration occurred in only 13.6% of patients. This is lower than what has been previously reported, and could be attributed to our protocol of fixation of the proximal end of the stent using hemoclips [9]. Recently, other novel techniques such as clipping with over-the-scope clips (OTSC) have been utilizd in the management of perforations and leaks [10]. Though risk of stent migration is lower with PCSEMS, tissue overgrowth and ingrowth are higher as compared with those with FCSEMS [11]. In the present study, PCSEMS was used in only one patient, who had significant tissue overgrowth, which prevented stent extraction. A novel advancement in stent design is the development of a thick membrane FCSEMS with an anchoring thread to prevent tissue overgrowth and stent migration [12]. The limited sample size did not allow for a good comparison between the different types of stents but a paper by van Boeckel et al. showed similar efficacy among FCSEMS and PCSEMS in sealing benign ruptures or leaks. It also advocated that the choice of stent should depend on expected risks of stent migration and tissue over- or ingrowth [13].

A number of patients in our study required drainage procedures for control of sepsis. Most of the drains were intercostal and mediastinal, and only 3 patients required drainage of abdominal collection. The patient who had Boerhaave's syndrome died due to disseminated fungal sepsis. The risk of in-hospital mortality is high in patients who suffer spontaneous esophageal perforations [14]. Nevertheless, this risk can be mitigated by early diagnosis and initiation of treatment.

A drawback of this study is that we have not analyzed cost effectiveness of esophageal stenting in our patients. Freeman et al. analyzed the outcomes and compared the costs between stent placement and surgical repair for iatrogenic esophageal perforations. They concluded that stent placement resulted in a shorter length of stay, lower rates of morbidity, and lower costs when compared with traditional surgical repair [15]. The present study has some limitations. The retrospective nature of our study with a small sample size restricts the generalization of the findings. Though all the patients were advised to follow-up for stent removal at 8 weeks, there was non uniformity in the duration of the stent placement. This was because most of our patients came from distant places and hence it was not feasible for them to maintain a strict follow-up protocol.

In conclusion, covered stent placement for a period of 8 weeks is technically safe and clinically effective as a first-line procedure for bridging and healing benign esophageal perforation and leaks.

Compliance with ethical standards

Conflict of interest AJ, SDC, RTK, DD, AKD, EGS, VA, AJJ, and IS declare that they have no conflict of interest.

Ethics statement The study was performed conforming to the Helsinki declaration of 1975, as revised in 2000 and 2008 concerning human and animal rights, and the authors followed the policy concerning informed consent as shown on Springer.com.

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