

## Metal stenting to resolve post-photodynamic therapy stricture in early esophageal cancer

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### Abstract

Photodynamic therapy (PDT) is an established endoscopic technique for ablating Barrett's esophagus with high-grade dysplasia or early-stage intraepithelial neoplasia. The most common clinically significant adverse effect of PDT is esophageal stricture formation. The strictures are usually superficial and might be dilated effectively with standard endoscopic accessories, such as endoscope balloon or Savary dilators. However, multiple dilations might be required to achieve stricture resolution in some cases. We report the case of stricture that recurred after dilation with a bougie, which was completely relieved by a self-expandable metal stent.

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**Key words:** Photodynamic therapy; Esophageal stricture; Metal stent

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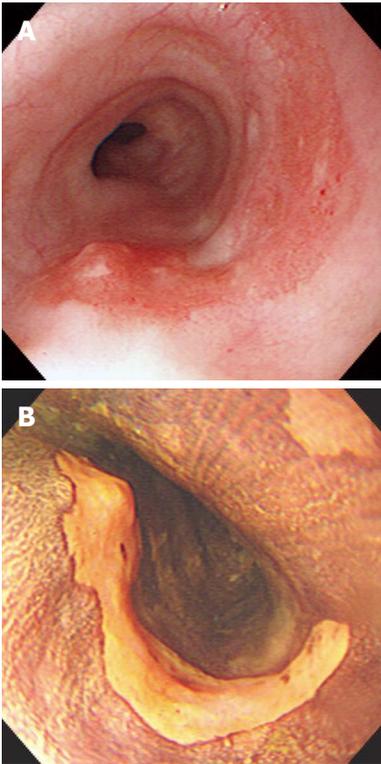
### INTRODUCTION

Photodynamic therapy (PDT) has been approved as an endoscopic treatment for Barrett's esophagus with high-grade dysplasia, and appears to be effective in the treatment of early esophageal cancer<sup>[1-3]</sup>. The most common clinically significant adverse effect of PDT is esophageal stricture formation<sup>[2]</sup>. In some published series, > 30% of the patients treated with PDT developed esophageal strictures<sup>[3,4]</sup>. In the context of benign esophageal disease, stents have been used to seal esophageal perforations as a result of postoperative complications, endoscopic dilation procedures for achalasia<sup>[5]</sup>, and those associated with dilation of post-radiation strictures<sup>[6]</sup>. Self-expandable metal stents (SEMSs) have been used for this indication.

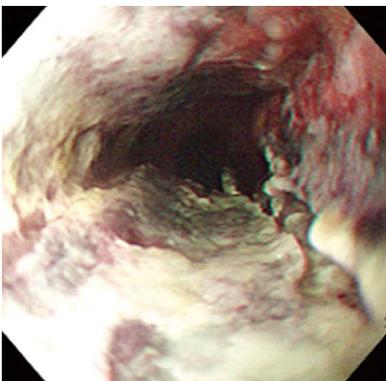
We describe our experience with the successful resolution of an intractable post-PDT stricture using an SEMS in early esophageal cancer.

### CASE REPORT

A 67-year-old man visited our hospital with dysphagia that involved solid and liquid food. Two months earlier, he had undergone PDT for early esophageal cancer. Initial endoscopy showed a flat, reddish lesion in the mid-esophagus. This lesion did not stain with Lugol's solution (Figure 1). Endoscopic biopsy revealed squamous cell carcinoma. Chest computed tomography (CT) showed no definite distant metastasis or lymph node enlargement. The patient refused surgical treatment, therefore, PDT was performed. The patient was given porfimer sodium (Photofrin II; Axcan Pharma, Quebec, Canada) intravenously at a dose of 2 mg/kg, 48 h before endoscopic photoradiation. Light was delivered from a laser (Ceralas PDT 633; CeramOptec, Bonn, Germany) that produced 630-nm light, with an

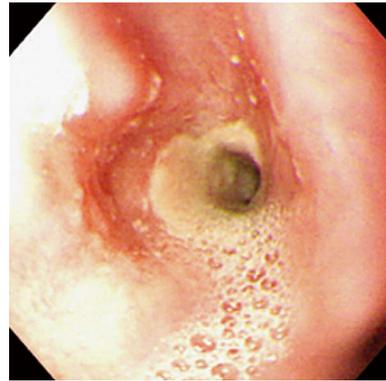


**Figure 1 Gastroscopy before photodynamic therapy.** A: Gastroscopy showed a flat and reddish lesion in the mid-esophagus (a biopsy showed squamous cell carcinoma); B: Gastroscopy showed an unstained lesion after spraying Lugol solution in the mid-esophagus.

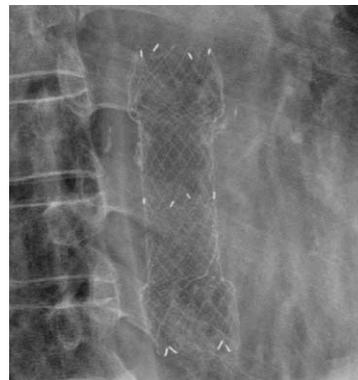


**Figure 2 Two days after Photodynamic therapy.** Endoscopy showed circumferential coagulation necrosis with an ulcer in the photodynamic therapy-treated lesion.

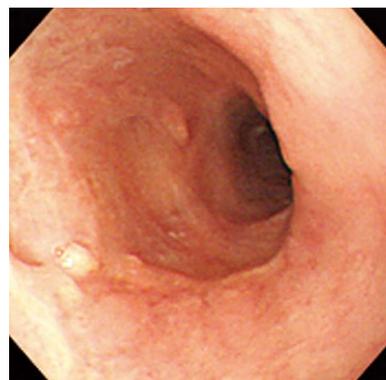
adjusted power output of 400 mW/cm, through a fiber that delivered a total energy of 180 J/cm fiber energy to the lesion. Two days after PDT, endoscopy showed circumferential coagulation necrosis with an ulcer involving the PDT-treated lesion (Figure 2). Two months after PDT, the patient complained of severe dysphagia. At that time, endoscopy showed luminal narrowing with fibrous scarring of the PDT-treated lesion (Figure 3). The patient underwent dilation three times with a Savary dilator (Cook Medical, Bloomington, IN, USA). However, the post-PDT stricture recurred within 1 mo. Consequently, a SEMS (Choo stent, 18 mm × 100 mm; MI Tech, Seoul, Ko-



**Figure 3 Two months after Photodynamic therapy.** Endoscopy showed luminal narrowing with fibrous scarring changes in the photodynamic therapy-treated lesion.



**Figure 4 Fluoroscopic image** showed a metal stent at the stricture site in the esophagus.



**Figure 5 Endoscopy** showed improvement of the previous stricture site 2 mo after stent removal.

rea) was placed through the stricture site (Figure 4). Two months after stenting, we removed the stent with grasping forceps, with no complications. After removing the stent, endoscopy showed a wide opening of the previous stricture and a biopsy revealed chronic inflammation with no tumor (Figure 5).

## DISCUSSION

A stricture is the most common clinically significant ad-

verse effect of PDT<sup>[2]</sup>. Patients who develop strictures after porfimer PDT typically present with symptomatic dysphagia 3 wk after treatment. The mechanism of stricture formation after PDT with porfimer sodium is unknown. It has been hypothesized that the deep, circumferential tissue injury and resultant inflammatory reaction produced by porfimer sodium PDT induces a fibrotic response that produces structuring<sup>[4]</sup>. Other significant predictors of stricture formation are endoscopic mucosal resection before PDT, prior history of esophageal stricture, and multiple treatments of the same esophageal segment<sup>[3,7,8]</sup>.

Can the incidence of post-PDT strictures be reduced or even prevented? One study has shown that the use of oral prednisone beginning at the time of PDT light delivery did not prevent development of porfimer PDT strictures<sup>[9]</sup>. One of the most important ways to prevent esophageal stricture may be to prevent circumferential mucosal injury of the esophagus during PDT.

The strictures are usually superficial and might be dilated effectively with standard endoscopic accessories, such as endoscope balloon or Savary dilators<sup>[10]</sup>. However, multiple dilations might be required to achieve stricture resolution in some cases. The clinical course of post-PDT strictures appears to differ from that of other benign esophageal strictures. In a series of patients with peptic esophageal strictures, the median number of dilations needed for complete relief of dysphagia was only one<sup>[11]</sup>. Compared with this, Prasad et al have reported that the median number of dilations for post-PDT strictures was four (range: 1-42). Another study has reported the need for multiple dilations in 11 of 34 patients<sup>[8]</sup>.

To predict which type of stricture is most likely to recur and benefit from stent placement, it is important to differentiate between esophageal strictures that are simple and those that are more complex<sup>[12]</sup>. Simple esophageal strictures are focal, straight, and most have a diameter that allows passage of a normal-diameter endoscope. These strictures can successfully be treated with bougie or balloon dilation. Complex esophageal strictures are long, tortuous, or have a narrow diameter that does not allow the passage of any size of endoscope. The most common causes include caustic ingestion, anastomotic stricture, and severe peptic injury<sup>[13]</sup>. Some post-PDT strictures are complex. These strictures are more difficult to treat, requiring at least three sessions, and are associated with high recurrence rates. If these strictures cannot be dilated to an adequate diameter, recur within a short time interval, or require ongoing dilation, they are considered to be refractory. Various stent designs, both SEMSs and self-expandable plastic stent (SEPSs), have been used to dilate these types of strictures.

As the long-term clinical success rate of both SEMSs and SEPSs in refractory benign strictures is well below 50%<sup>[13]</sup>, it is important to analyze which factors have played a part in these disappointing results. Factors related to long-term success were type of stricture, with post-radiation strictures being more successfully treated than peptic, anastomotic or achalasia strictures<sup>[14]</sup>, and length

of stricture, with shorter strictures being at lower risk of re-stricturing<sup>[15]</sup>. However, there has been no report of long-term outcome of SEMSs for post-PDT esophageal stricture.

In the present case of stricture that recurred after dilation with a bougie, a SEMS completely relieved the post-PDT stricture. The stricture has not recurred during follow-up for > 1 year. The optimal timing of stent removal has been the subject of debate. Generally, when managing benign disease, the stent should be removed within 2 mo so that late stent-related problems are avoided<sup>[15,16]</sup>. Tissue hyperproliferation at the ends of the stents represents a major limitation to long-term stent placement. Hyperplastic tissue ingrowth or overgrowth is the cause of stent-induced stricture or failure to remove a stent. Strictures that are longer or tighter require longer duration of stent placement<sup>[16,17]</sup>. However, further study is needed with a larger number of patients and long-term follow-up to demonstrate a role for SEMSs in the treatment of post-PDT esophageal stricture.

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