

# Forward-viewing EUS-guided esophageal repermeabilization



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Complete esophageal obstruction with associated aphagia is a severe complication of locally advanced head and neck cancer. Endoscopic combined anterograde-retrograde rendezvous procedure with repermeabilization and dilatation has been increasingly adopted to manage it. However, in cases of a large gap between the proximal and distal esophagus and absence of transillumination, this classical approach is not possible. In this report, we describe a novel, relatively simple and safe method of endoscopic anterograde-retrograde rendezvous esophageal repermeabilization using forward-viewing endoscopic ultrasound (EUS). EUS allows clearly targeting of the lumen and puncture, avoiding potential interposed vessels. Specifically, this type of echoendoscope, designed with a short rigid portion and wide angulation capability that increases maneuverability and controlled visualization and puncture in the direct axis of the scope, has an additional advantage in cases such as ours, in which narrowing of both esophageal ends could hamper performance of a puncture with a regular side-viewing echoendoscope.

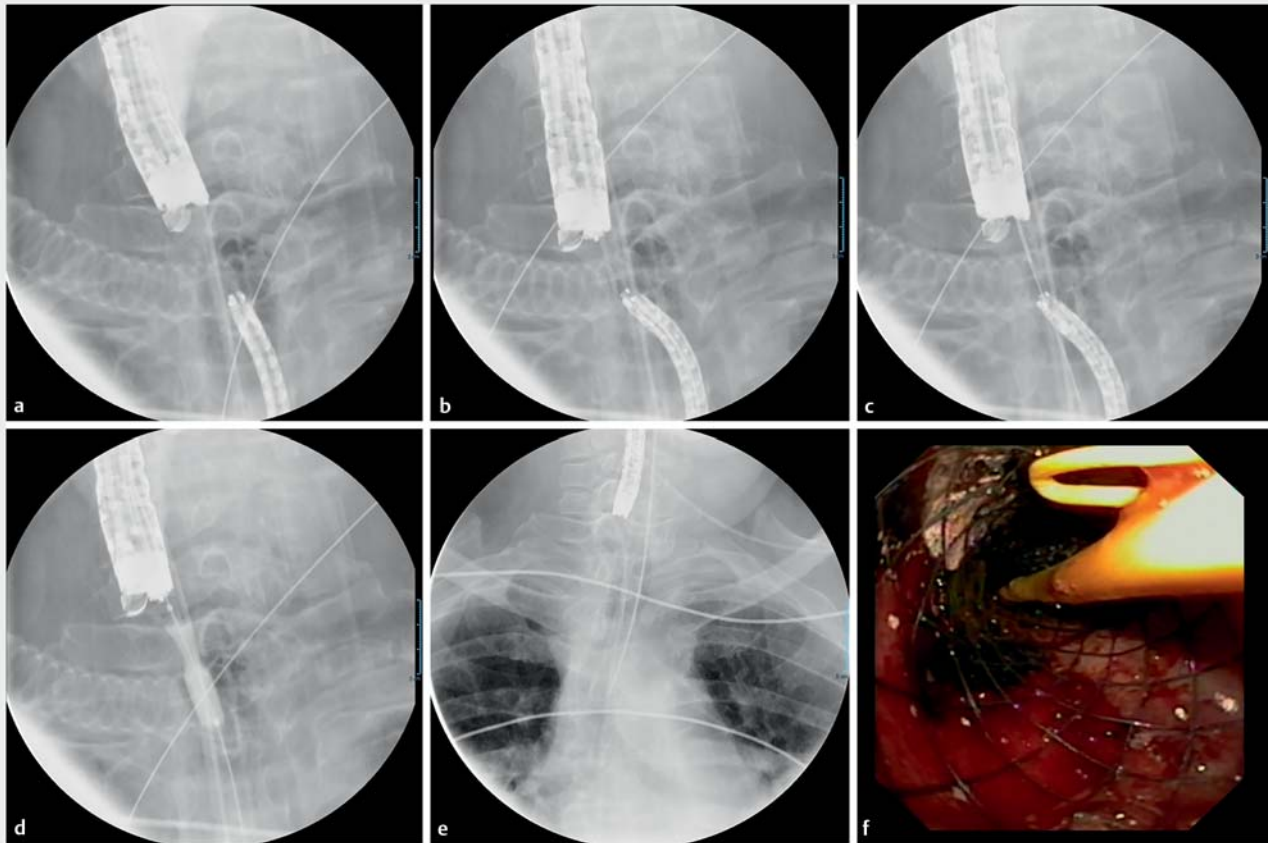
## Introduction

Treatments for locally advanced head and neck cancer (HNC), including surgery and/or (chemo-)radiotherapy, can negatively impact swallowing function and, consequently, quality of life (QoL). Cervical esophageal strictures are relatively common sequelae following HNC treatment, with an incidence

varying between 5% and 15% [1]. Manifestations range from minor issues to complete esophageal obstruction (CEO).

Historically, these strictures were treated with technically demanding surgeries [2]. Endoscopic techniques have since emerged as less invasive alternatives but require the passage of at least a guidewire to achieve dilation and/or stenting. In cases involving CEO, a combined anterograde-retrograde rendezvous procedure with repermeabilization and dilatation, to restore esophageal continuity, was first described in 1998 [3]. Thereafter, several cases of this technique have been published and, recently, a systematic review and meta-analysis has confirmed its role in management of this complication [4]. However, it requires the presence of a very short gap between the proximal and distal esophagus and transillumination.

In this report, we describe a novel, relatively simple and safe approach to endoscopic anterograde-retrograde rendezvous esophageal repermeabilization using endoscopic ultrasound (EUS) with a forward-viewing echoendoscope in two patients with CEO. In these specific situations, a side-viewing echoendoscope could not be used due to angulation at the entry point and transillumination was not possible due to the distance between proximal and distant ends of the stricture.



► **Fig. 1** First session of esophageal repermeabilization using an EUS-forward scope: the EUS scope and an ultra slim endoscope are seen aligned by fluoroscopy (a); the EUS access needle is inserted through the proximal portion of the esophagus to perform the puncture (b); a guidewire is passed into the distal portion and grasped with the slim scope (c); a balloon dilatation is performed (d); and a fully-covered biliary stent is placed (e and f).

## Technical innovation

### Clinical information

Two male patients aged 79 and 69 (Patient 1 and Patient 2, respectively) were referred for aphagia after chemoradiation to treat squamous cell carcinoma of the oropharynx (T3N2cM0) and of the hypopharynx (T4bN2cM0), respectively. They were exclusively fed by percutaneous gastrostomy.

In both, endoscopy revealed complete obstruction at the level of the superior portion of the esophagus, making it impossible to dilate under endoscopic or radiologic control.

The possibility of endoscopic esophageal repermeabilization was discussed with the patients and consent was given to attempt treatment. In addition, Ethics Committee approval was obtained to report these two cases (Ref: P2021/580).

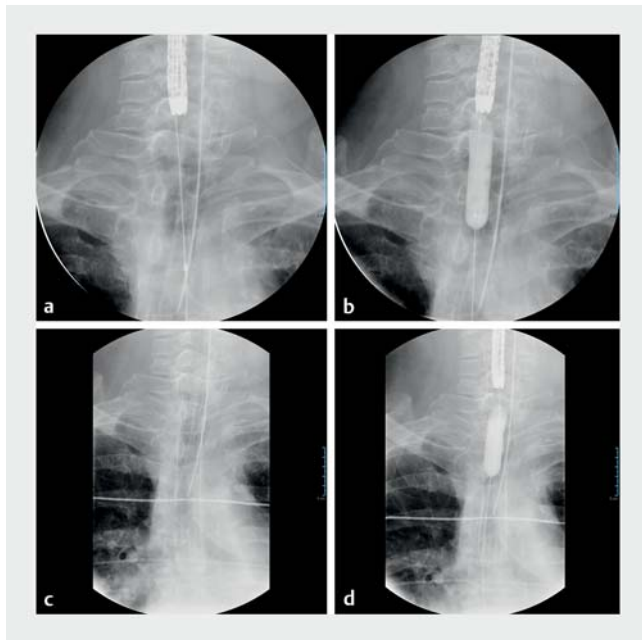
### Technical description

An EUS-guided endoscopic repermeabilization procedure was undertaken under general anesthesia by two endoscopists and achieved according to the following steps:

1. The gastrostomy tube was removed and a 0.035-inch guidewire (Jagwire) was introduced through the stoma and the gastrostomy was dilated using an 8-mm balloon (Hurricane).

An ultraslim endoscope (Olympus GIFP190) was introduced through the gastrostomy up to the distal portion of the esophageal stricture.

2. A forward-viewing echoendoscope (Olympus TGF-UC-180J, with a 3.8-mm working channel) was introduced orally up to the proximal portion of the esophageal stricture and both scopes could be visualized by fluoroscopy (► **Fig. 1a**).
3. Water was injected through the ultraslim endoscope, to localize the distal esophageal lumen with EUS. A puncture was performed with a 19G EUS access needle (Echotip Cook) from the proximal to the distal esophageal lumen (► **Fig. 1b**).
4. A 0.035-inch guidewire (Jagwire) was inserted through the needle and grasped with a snare through the working channel of the ultraslim endoscope (► **Fig. 1c**).
5. The neo-tract was dilated with a 6.5F cystotome (Endoflex) using pure cut current (Patient 1) or with an 8-mm balloon (Hurricane (Patient 2) (► **Fig. 1d**) and a biliary fully-covered 10 × 60 mm self-expandable metal stent (SEMS) (WallFlex) was placed to cover the newly created tract (► **Fig. 1e** and ► **Fig. 1f**). A nasogastric 7F catheter was placed through the stent to maintain the tract in case of stent migration.



► **Fig. 2** Second session of esophageal re-permeabilization: After removing the fully-covered SEMS, a guidewire is fed through distally (a); a balloon dilatation of the tract is performed (b); an esophageal partially-covered SEMS is placed (c); and the stent is dilated to ensure its full expansion (d).

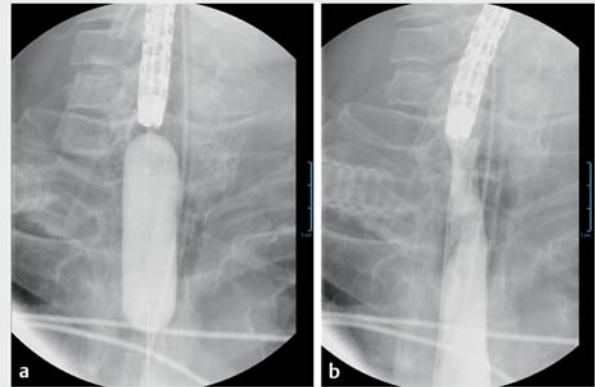
6. Gastrostomy tubes were replaced immediately after the procedure.
7. Five to 7 days later, the stent was removed with a rat-tooth forceps and, after dilation up to 15 mm (CRE balloon), a partially-covered 18 × 23 × 150 mm Ultraflex esophageal SEMS, with proximal release, was placed and adjusted with its proximal end 1 cm below the superior esophageal sphincter (► **Fig. 2**).
8. Two to 4 weeks later, the stent was removed either directly (Patient 1) or using the stent-in-stent technique (Patient 2) in case of significant hyperplasia (using a fully-covered Wallflex SEMS of same diameter and length implanted for 1 week).

No procedure-related complications occurred.

Both patients were allowed to eat soft food from the time of Ultraflex SEMS placement and underwent concurrent active swallowing rehabilitation.

### Follow-up

Patient 1 had relapse of dysphagia 2 weeks after stent removal, ultimately causing difficulty swallowing saliva after 2 months. Recurrence of complete occlusion was confirmed and no wire passage was possible to the distal esophagus. The patient consented to repeat the re-permeabilization procedure. A new reconstruction of the tract under EUS was done following the same steps. After 2 weeks of stenting at a diameter of 18 mm, the stent was removed but a nasogastric catheter was left in place to avoid repeated complete occlusion. Successive dilations at 15 to 18 mm were performed over the next 3 months.



► **Fig. 3** Third session of esophageal re-permeabilization: after removing the stent, a residual stricture is dilated (a) and contrast is administered at the end of the procedure to assess the efficacy of the procedure and exclude complications (b).

Unfortunately, the patient passed away due to SARS-CoV-2-infection during follow-up.

Patient 2 had a first endoscopic reevaluation 2 weeks after stent removal. A residual stricture was dilated up to 18 mm with a CRE balloon (► **Fig. 3**) and 80 mg methylprednisolone was locally injected. Nine months after initial therapy, the patient has been able to resume oral feeding, requiring a single dilation at 18 mm.

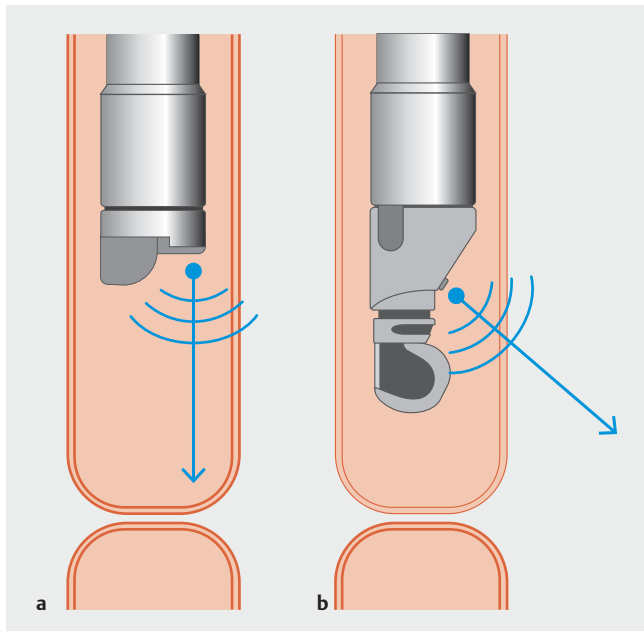
One month later, the patient was reevaluated with endoscopy. At that time, the tract, although stenotic, could be passed with the endoscope. A new dilatation was performed with a CRE balloon up to 19 mm and 80 mg methylprednisolone was administered in a local injection.

Three months later, although the patient was able to eat soft food and maintained swallowing rehabilitation treatment to further improve deglutition, a final dilatation up to 20 mm was performed. The next follow-up endoscopic evaluation was planned for 12 months later.

### Discussion

CEO, as a complication of esophageal/laryngeal radiotherapy, considerably alters QoL and is challenging to treat. Endoscopy is currently the preferred modality for treating esophageal strictures, and as illustrated here, can also be offered for management of CEO. The anterograde endoscopic technique with blind puncture, initially used, was abandoned because it carried higher and unnecessary risks (perforation, bleeding or another inadvertent injury to surrounding critical structures in the neck and chest) [5]. Currently, a combined anterograde-retrograde approach is preferred.

If the stricture is short (<2 cm) and transillumination can be achieved, a combined anterograde-retrograde rendezvous with direct puncture under endoscopic and fluoroscopic control can be performed. If the stricture is longer and/or transillumination is not possible, endoscopic recanalization can be more difficult, as it gets more challenging to approach and align two endo-



► **Fig. 4** The view and puncture angles of a forward-viewing echoendoscope (a) and a side-viewing echoendoscope (b) in a simulation model of an esophageal complete obstruction with aligned proximal and distal ends.

scopes in the same axis. Surgery (or a combined endoscopic-surgical approach) could be offered, but it is technically demanding in the context of prior surgery and/or local irradiation, in often fragile patients.

EUS can be beneficial for repermeabilization of the esophagus because after injection in the distal lumen with the second scope, the endoscopist can clearly target the lumen and puncture, avoiding potential interposed vessels. A forward-viewing US scope was first evaluated for transmural drainage of pancreatic pseudocysts [6]. To our knowledge, EUS-guided repermea-

bilization has been described in two cases so far: one in the esophagus, using a side-viewing echoendoscope [7], and another in the colon, using a prototype forward-viewing echoendoscope [8]. In our cases, we used a forward-viewing echoendoscope. This type of echoendoscope was designed with a short rigid portion and wide angulation capability, increasing maneuverability and controlled visualization and puncture in the direct axis of the scope. Specifically in the above-described cases, use of the forward-viewing echoendoscope was advantageous because both esophageal ends were aligned and were narrowed, which can hamper performance of a puncture with a side-viewing echoendoscope, as shown in ► **Fig. 4**. Antegrade and retrograde approaches remain necessary because the only way to clearly identify the distal lumen with EUS is to fill it with water.

Another, more complex option is per-oral endoscopic tunneling for restoration of the esophagus (POETRE), a recently reported technique using endoscopic submucosal tunneling with combined anterograde-retrograde endoscopic dilatation [9, 10]. A neoesophagus is developed through submucosal tunneling into the obstruction formerly concluded to be too long for a regular rendezvous procedure. Another option could also be the use of magnets to create the path. Magnetic compression anastomosis (magnamosis) has successfully created esophagoesophageal anastomosis in cases of long-gap esophageal atresia [11].

The advantages and disadvantages of each endoscopic techniques for esophageal repermeabilization are summarized in ► **Table 1**.

The major concern regarding endoscopic recanalization is the risk of recurrence. Patients require regular follow-up with repeated endoscopies and dilatations, as needed, to maintain the esophageal lumen. Residual stenosis is frequent and is not easily treated, especially in proximal obstructions. Patient 1 had early recurrence, which surprisingly led to a new CEO in less than 2 months. There are no standardized protocols for deter-

► **Table 1** Advantages and disadvantages of endoscopic techniques for esophageal repermeabilization.

Endoscopic techniques for esophageal repermeabilization	Advantages	Disadvantages
Standard endoscopic combined anterograde-retrograde	Technically easy Low cost	Only for short strictures, when transillumination can be achieved
Side-viewing echoendoscope	Long gaps High availability	Narrow esophageal ends Puncture 2 cm proximal to the stricture
Forward-viewing echoendoscope	Long gaps Narrow esophageal ends Good visualization and puncture from the tip of the scope	Low availability Low experience
Magnets (magnamosis)	Technically easy Probably longer-term clinical response (esophageal atresia)	Low availability Not commercially available in Europe
POETRE		Technically demanding Low experience

POETRE, per-oral endoscopic tunneling for restoration of the esophagus.

mining the best follow-up timing after the rendezvous procedure and the first endoscopy in the follow-up period was only performed once the patient manifested severe complaints, at 2 months. In Patient 2, we considered this risk and organized the surveillance more closely, with a good clinical result.

Another concern is the low availability of forward-viewing echoendoscopes today, which may limit the use of this novel technique in clinical practice. Being able to swallow following HNC treatment is one of the main functional priorities in patients and a driver for health-related QoL [1].

## Conclusions

We have described a novel, relatively simple, feasible and apparently safe method for managing CEO using a forward-viewing endoscope, which should be considered when attempting endoscopic esophageal recanalization. Efficacy has to be confirmed in larger studies.

## Competing interests

The authors declare that they have no conflict of interest.

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