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Combined antegrade and retrograde dilation (CARD) for management of complete esophageal obstruction: Multicenter case series

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ABSTRACT

Background and study aims Complete esophageal obstruction (CEO) is a rare complication of radiation therapy for esophageal or head and neck cancers and can be challenging to manage endoscopically. A rendezvous approach by combined anterograde and retrograde endoscopic dilation (CARD) can be used to re-establish luminal integrity in such cases. Our study aimed to review our experience with patients with CEOs managed by CARD.

Patients and methods Six patients who had CARD for CEO were reviewed. The primary outcomes were immediate technical and clinical success of CARD. Secondary outcomes were adverse events (AEs) associated with the procedure and continued dependency on the percutaneous endoscopic gastrostomy (PEG)-or jejunostomy tube.

Results The mean age was 59 years (range 38–83). Five patients had CEO secondary to neoadjuvant chemoradiotherapy for esophageal cancer, and one patient had complete obstruction secondary to neck trauma. CARD was technically successful in five patients (86%). Two patients had AEs. One had pneumomediastinum requiring no intervention, while the other had bilateral pneumothorax requiring chest tube placement. The median follow-up duration of repeated dilations to maintain liminal patency was 20 months. Four patients had improvement in dysphagia, tolerating oral intake, and mouth secretions after the procedure, with a mean functional oral intake scale (FOIS) score > 3 and an overall success rate of 83%.

Conclusions The CARD approach to re-establish esophageal luminal patency in CEO is a safer alternative to high-risk blind antegrade dilation or an invasive surgical approach. It is usually technically feasible with improved swallowing ability in most patients.

Introduction

Complete esophageal obstruction (CEO) is a relatively uncommon phenomenon [1] that can result from benign or malignant causes [2]. External beam radiation therapy for head and neck or lung cancers is a common cause of CEO [3,4]. Radiation can cause esophageal strictures through progressive chronic inflammatory changes in the esophageal lining, leading to collagen deposition and fibrosis [3,4]. Less common causes of CEO include gastroesophageal reflux disease (GERD), caustic

▶ **Table 1** Patient demographics and procedure characteristics: Diagnosis, stricture, access, and scopes.

Patient number	Diagnosis/pathology	Stricture location (cm)	Stricture diameter (contrast used) How was initial dilatation achieved?	Access (percutaneous tube)	Scopes used (anterograde/retrogade), dilation of ostomy require?
1	Adenocarcinoma GE junction	20	Balloon dilation	J-tube	EUS needle was passed through the antegrade scope
2	Adenocarcinoma GE junction	21	Ballon dilation with subsequent stent placement	J-tube	EUS needle was passed through the antegrade scope
3	Motor vehicle injury caused oesophageal stenosis	20–23	Savary dilators	G-tube	EUS needle was passed through the retrograde scope
4	Squamous cell cancer hypopharynx	17	Ballon dilation and subsequent NG tube placement	PEG-tube	Wire passed from the retrograde scope
5	Squamous cell cancer hypopharynx	15	Ballon dilation and subsequent NG tube placement	PEG-tube	Wire passed from the antegrade scope
6	Squamous cell cancer hypopharynx	16	NA	PEG-tube	NA

EUS, endoscopic ultrasound; PEG, percutaneous endoscopic gastrostomy.

injury, and Plummer-Vinson syndrome [5, 6, 7]. Routine endoscopic dilation using balloon or wire-guided dilators is impossible with CEO, and attempts may cause esophageal perforation or formation of a false lumen [8, 9]. Combined anterograde-retrograde endoscopic dilation (CARD) is a rendezvous technique to treat CEO. It provides better visualization and safer dilation with decreased risk of perforation [10].

Here, we present a series of patients with CEO of various etiologies successfully managed with CARD using the rendezvous technique.

Patients and methods

The electronic database of endoscopy procedures was queried at two centers from January 2005 to November 2022 for patients who underwent CARD for CEO. CEO was defined as total occlusion of the esophageal lumen, preventing antegrade advancement of a small-caliber endoscope and a guidewire.

Data were extracted on patient demographics, procedure complications, and long-term adverse events, procedure outcomes, and need for repeat dilation procedures after CARD. Technical success was defined as successful restoration of luminal continuity. Procedure clinical success was assessed by independence from the percutaneous endoscopic gastrostomy (PEG) tube feeding or functional oral intake score (FOIS) ≥ 3.

Patient characteristics

Six patients were identified who had undergone the CARD procedure. CEO was confirmed by direct endoscopic visualization of the obstruction and radiological findings. Five patients were male and one was female. The mean age was 59 years (range 38–83). All patients were unable to swallow before the CARD procedure. Four patients were PEG-tube-dependent, while two were managed with jejunostomy (J)-tube feeding. All patients had mature enteral access.

Five patients had undergone radiotherapy and chemotherapy for oropharyngeal cancer (3 patients) or distal esophageal cancer (2 patients) (▶ **Table 1**). Two patients with distal cancer had esophagectomy followed by esophageal anastomosis leak and subsequent development of CEO. Three patients had CEO from chemoradiotherapy treatment for squamous cell carcinoma of the hypopharynx. One patient had esophageal obstruction after trauma to the neck.

Endoscopic (CARD) technique

Endoscopy was done with general anesthesia and fluoroscopic guidance with two endoscopists using flexible video endoscopes. The procedure was started with an antegrade approach using a standard Olympus gastroscope (9.8-mm diameter). Floppy tip biliary guidewires (0.035”, 0.025”, or 0.019”) and spring tip wires were used to assess luminal patency under fluoroscopy. The second endoscopist then inserted the scope retrograde through a mature gastrostomy or jejunostomy using a small-caliber or standard endoscope, sometimes requiring balloon dilation of the ostomy for access. The procedures were done under multiplanar fluoroscopy guidance.

In case of failure to pass the guidewire, a 19G endoscopic ultrasound (EUS) fine-needle aspiration needle (Boston Scientific) with a blunt end (needle within the sheath) was used to probe the lumen to identify a bulge at the opposite end seen with the retrograde scope before needle puncture.

Transillumination and fluoroscopy guidance were used to choose an optimal puncture site. During the transillumination process, the light from one endoscope (usually antegrade

scope) can be seen across the occluded lumen by the retrograde scope.

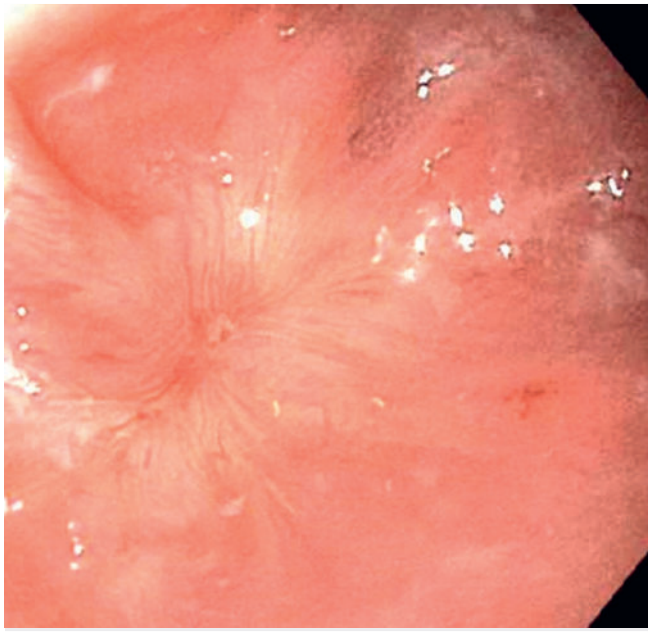
Fluoroscopy guidance was used to choose an optimal puncture site where the distance between the two scopes was the shortest and in a straight line. After needle access, a guidewire was passed through the needle lumen and was grasped with a snare using the second endoscope. When needed, tunneling was performed using forceps with a bite-on-bite technique and a needle knife under fluoroscopic guidance to gain wire access across the obstruction. Once wire access was achieved, dilatation was performed with wire-guided Savary dilators or balloon dilators. Luminal patency was maintained with a nasogastric NG-tube or placement of a fully-covered esophageal stent. Subsequent follow-up procedures were scheduled to increase the lumen caliber in a graded manner with sequential dilations in all patients (▶ **Fig. 1, Fig. 2, Fig. 3, Fig. 4**). An algorithm of the procedural steps is described in ▶ **Fig. 5**.

Procedure characteristics

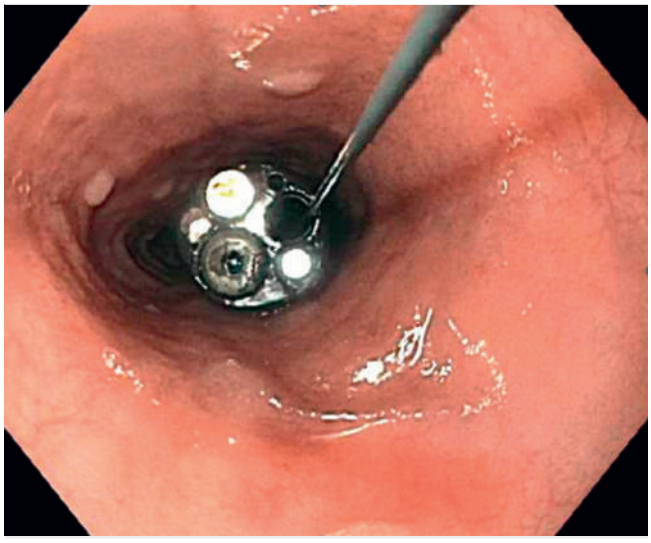
In four patients, a biliary guidewire was passed through an EUS needle or after access through tunneling to cross the CEO, while a spring-tipped guidewire was used in one patient. Balloon dilation was done in four patients, and one had Savary dilation. In one patient (Patient 5), forceps and a needle knife were used for the initial puncture, followed by a bronchoscope to access the tunnel and grasp the wire. In another patient, tunneling with biopsy forceps was done to grasp the wire with forceps (▶ **Table 2**). The mean initial dilation was 10.3 mm (range 6–16), and the mean stricture length was 2.3 cm. All patients needed repeated dilations to maintain esophageal luminal patency; the mean number of repeat dilations was six (range 1–23). Two patients had esophageal stents placed. ▶ **Table 3** describes the contents of the FOIS score.

Case 1

The level of obstruction was at 21 cm from incisors. After confirming the CEO, a retrograde approach was used through the J-tube. The jejunostomy tract was dilated to 8.5 mm over a wire with subsequent placement of a GIF-XP190N gastroscope, advancing to the upper esophageal stricture under fluoroscopy guidance. GIF190 scope was passed antegrade, and the two endoscopes were aligned under fluoroscopy guidance. A 22-gauge EUS needle was passed through the antegrade scope, and intervening obstructing mucosa was probed and punctured. The needle could be visualized crossing the obstruction via the retrograde scope. A 0.018-inch Novagold wire was passed through the needle and grabbed with the retrograde scope for stability. The tract was dilated with a 4 mm x 4 cm (Boston Scientific hurricane balloon) and then an 8.5 to 10.5 mm balloon (Olympus EZDilate) to a diameter size of 10.5 mm. This was subsequently stented with an 18 mm x 100 mm fully-covered esophageal metal stent (Olympus HANARO). The patient underwent subsequent stent exchanges every 6 months. The patient can tolerate a near-regular diet with an 18-month follow-up.



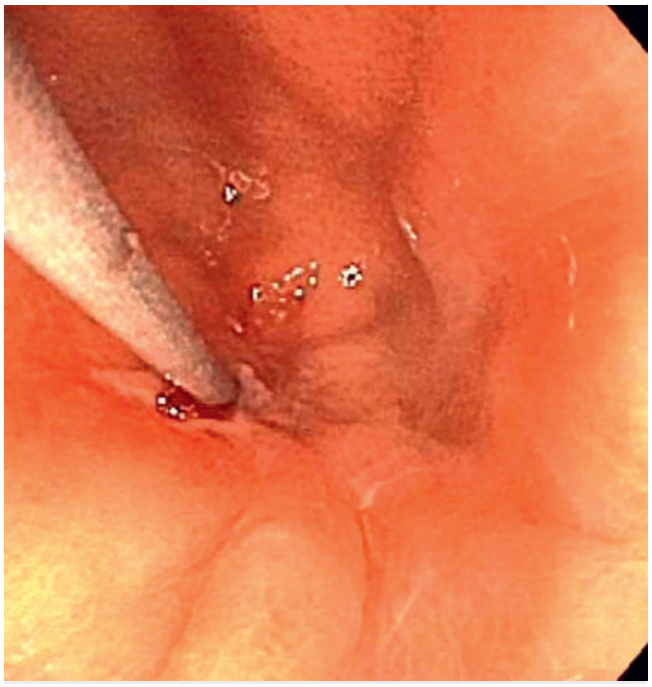
▶ **Fig. 1** Gastroesophageal anastomosis with complete obstruction.



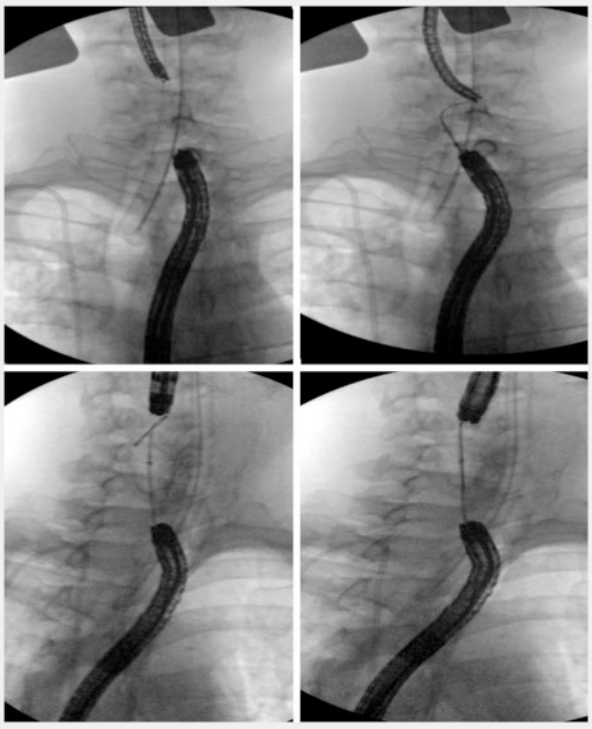
▶ **Fig. 2** Transillumination of complete esophageal obstruction.

Case 2

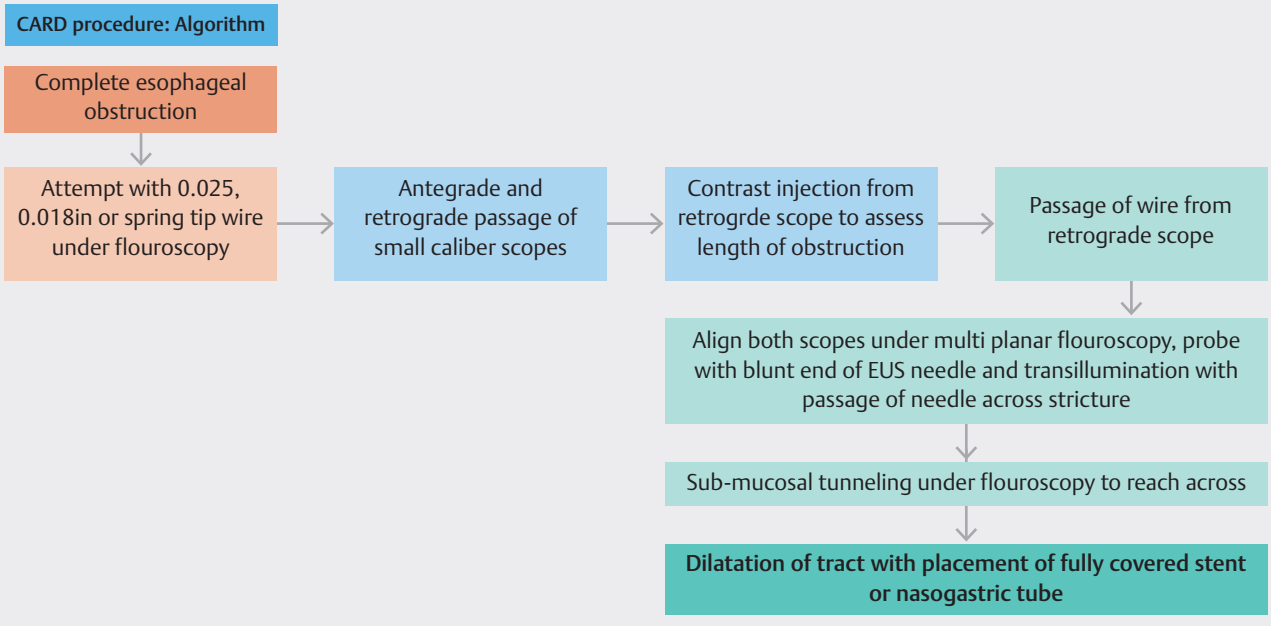
The obstruction level was 21 cm from the incisors. After the failed antegrade approach, the J-tube was removed after passing a 0.035-inch x 450 cm guidewire. Retrograde access was initially made by a GIF-XP190N gastroscope, which could not reach the esophagus due to its shortness. The jejunostomy tract was dilated with a 10- to 12-mm CRE balloon (Boston Scientific), and a pediatric colonoscope (PCF-H180AL) was subsequently passed, which reached the proximal esophagus. The antegrade scope (GIF-H180) was passed and two scopes were aligned using fluoroscopic guidance, and transillumination was possible.



▶ **Fig. 3** Antegrade view showing the retrograde endoscope after reconnecting the esophageal lumen.



▶ **Fig. 4** Fluoroscopic view of step-by-step CARD approach.



▶ **Fig. 5** CARD procedure. Algorithm of procedure steps.

▶ **Table 2** Patient demographics and procedure characteristics: Technique, dilations, post-procedure diet, complications.

Patient number	Technique used	Follow-up dilations	Diet tolerated after CARD	Complications
1	Rendezvous	1	Diet soup, mashed potato Remained J tube-dependent	None
2	Rendezvous	3 sessions 18-mm dilation achieved	Liquid diet Remained J tube-dependent	None
3	Rendezvous	9 sessions	Liquid diet Remained PEG tube-dependent	None
4	Rendezvous (submucosal tunneling with biopsy forceps)	23 sessions	Liquid and sometimes clear liquids Remained PEG tube-dependent	Minor pneumomediastinum, Neck crepitus
5	Rendezvous	5 sessions	Tolerating feeding liquid food PEG tube-dependent after the procedure; tube removed after repeated dilations	None
6	Rendezvous	N/A	N/A	Bilateral pneumothorax requiring chest tube placement

CARD, combined anterograde and retrograde endoscopic dilation; PEG, percutaneous endoscopic gastrostomy.

▶ **Table 3** FOIS score.

Levels	Functional Oral Intake Scale (FOIS)
1	Nothing by mouth
2	Tube feeding with minimal attempts with liquid foods
3	Tube-dependent with consistent oral liquid food intake
4	Total single-consistency oral diet
5	A total oral diet with multiple consistencies but with specific preparations
6	A total oral diet with multiple consistencies without specific preparations but with some food limitations
7	No restrictions, normal diet

The obstruction was traversed by passing a 19-gauge EUS needle (EZShot 3 Plus) anterograde through the upper scope with a 0.025-inch guidewire passing through the needle. The tract was dilated with a 6-mm dilating balloon under fluoroscopic guidance with subsequent placement of a 15 mm (diameter) x 10 mm (saddle length) fully-covered AXIOS stent. The stent was removed after 5 months, with the stricture requiring dilations up to 20 mm every 4 months for 1 year. The patient tolerated a regular diet during his follow-up period of 22 months.

Case 3

The existing gastrostomy tract was dilated to 11 mm over a 0.035-mm wire using Savary dilators with the passage of a GIF-XP190N gastroscope to the upper esophagus site of obstruction. A guidewire could not be advanced across the obstruction, and contrast injection confirmed the obstruction was complete. The wire was maneuvered and manipulated and was seen under fluoroscopy to reach close to the antegrade scope. Cold biopsy forceps disrupted the mucosal lining/membranous obstruction and exposed the wire passed from the retrograde scope. The wire was grasped with the biopsy forceps via the antegrade scope and withdrawn through the mouth. After establishing wire access, dilation was performed sequentially to 15 mm with subsequent passage of 18F NG-tubes at the end of the procedure. The NG-tube was removed, and the tract was dilated to 18 mm on follow-up endoscopy in 1 week. The tract was dilated to 20 mm on subsequent endoscopies (four) without additional dilation. At present, the patient tolerates a regular diet without the need for supplemental nutrition. The gastrostomy tube has been removed.

Case 4

Intrinsic stenosis with CEO was found 21 cm from the incisors. The GIF-XP190N gastroscope was advanced to the obstruction through the gastrostomy site.

A spring tip guidewire was passed under fluoroscopic guidance and punctured the obstruction site. Subsequently, serial dilations were performed with a 6-mm to 20-mm savory dilator using an antegrade approach. The patient has required multiple endoscopic interventions, including savory and balloon dilations, IT2 Knife incisional therapy, Kenalog steroid injections, esophageal stent, and most recently, placement of a fully-covered AXIOS stent. The patient has been followed for 7 years. He can tolerate a modified full-liquid diet with a need for regular dilations. He is meeting all calorie intake requirements by mouth.

Case 5

GIF-XP190N gastroscopes were passed antegrade and retrograde through the mouth and gastrostomy site. Contrast injection showed a 1-cm stricture and complete obstruction beyond. A bronchoscope was used as an antegrade scope, and a GIF-XP190N gastroscope passed through the gastrostomy. Cold biopsy forceps and needle knife tunneling (about 2 cm) were performed until a thin membrane remained between the two scopes. A 22-gauge EUS needle loaded with a 0.018-inch guidewire was advanced through the thin membranous obstruction and into the lumen of the upper esophagus; the wire was grabbed with the upper scope, achieving wire access across the obstruction. The tract was dilated with a 6- to 80-mm dilating balloon with subsequent passage of a 10F NG- tube. The NG-tube was removed during subsequent endoscopies, and the stricture was dilated to 12 mm and then 15 mm on follow-up. The patient remained dependent on gastrostomy feeds for nutritional support. However, during 9-year follow-up, the patient was able to tolerate a liquid diet.

Case 6

After failing to pass the wire using the antegrade approach, the gastrostomy tract was dilated with a 10–12 balloon over a 0.035-inch x 450-cm wire. The GIF-140N scope was passed retrograde, and a second scope was passed antegrade. Contrast injection through the retrograde scope was used to estimate stricture length. A 22G EUS needle was used to probe the obstruction. A needle could not be passed across it. Air tracked from the false needle tract through the mediastinum to the pleural space resulted in bilateral pneumothorax, requiring chest tube placement.

Results

Technical success

The combined antegrade/retrograde dilation procedure was technically successful in five patients (83%) and unsuccessful in one patient. Stricture length was 3 to 4 cm and needle access to the retrograde scope in the esophageal lumen across the obstruction was unsuccessful.

Clinical success

All five patients tolerated a soft and liquid diet after the procedure while initially remaining dependent on tube feeding. All patients required subsequent endoscopy with serial dilations. All patients were evaluated by speech therapy, and four of five of them showed subsequent improvement in dysphagia with a mean FOIS score ≥ 3 and an overall success rate of 83%. One patient had 23 dilations and remained gastric tube-dependent for feeding. One patient had recurrent esophageal cancer. Despite tolerating oral intake, some patients required supplement tube feeding to fulfill caloric needs.

Procedure adverse events

Procedure complications were reported in two patients. One patient had pneumomediastinum and mild neck crepitus, requiring no intervention. The patient who had failed the CARD procedure developed bilateral pneumothorax due to repeated attempts to puncture the CEO, which required bilateral chest tube placement. The latter case was done before the use of CO_2 insufflation.

Discussion

CEO is a rare manifestation of esophageal strictures. They can be technically challenging to treat because the standard dilation technique is impossible. The esophageal and hypopharyngeal anatomy is typically altered in these patients, and treatment carries the potential for higher complication rates [1, 11]. The CARD procedure using a rendezvous technique is helpful in re-establishing esophageal luminal patency in these patients. A rendezvous procedure is possible by passing a scope through the oral cavity anterogradely and through the PEG- or J-tube retrogradely. In addition, the present case series emphasizes the significance of graded esophageal reconstitution by serial dilations to maintain luminal patency. The CARD procedure necessitates the presence of a short gap between the proximal and distal esophagus so that it can be transilluminated, or a one-to-one bulge is noted on probing with the needle before puncturing and restoring esophageal continuity. Multiplanar dynamic fluoroscopy imaging also helps direct the needle toward the retrograde scope. The length of obstruction usually determines the ease of the rendezvous procedure and the success of restoring luminal patency of the esophagus. Fluoroscopy with contrast injection, usually from the retrograde scope, is used to determine the obstruction planning, which is very important in planning intervention.

Here, we present a retrospective case series of six patients with CEO treated with endoscopic antegrade-retrograde rendezvous dilation. Half of the patients had undergone radiation therapy for pharyngeal cancer, the most common cause of esophageal strictures. Two patients had CEO due to primary esophageal carcinoma and underwent esophagectomy post chemoradiotherapy, while one had CEO from neck trauma. Overall, technical success was achieved in five patents. CARD was unsuccessful in one patient. All five patients tolerated oral intake after the procedure; however, all required additional dilatation procedures. Despite dilatations, some remained tube feeding-dependent with an overall FOIS ≥ 3. Our study findings demonstrated successful maintenance of esophageal patency after the CARD procedure in terms of oral food intake using (the FOIS scoring system) and holding the secretions, making it a viable and successful technique for CEO.

Our study findings are similar to a recently published case series of CARD. Dellon et al. reported technical and clinical success with the CARD procedure for dilating CEO resulting from radiation-induced strictures in 12 patients [12]. They also used both balloon and Savary dilations with the CARD approach. Similarly, Grooteman et al., in the largest reported case series, used Dakkak and Bennet scores to report clinical success with the CARD procedure to assess improvement in dysphagia in patients with CEO. Only 44% of patients could eat liquid or soft food after the procedure. After 2 years of follow-up, 56% re-

mained PEG-tube-dependent even after repeated dilations [13]. Other studies have reported clinical success rates of 45% to 80% in improving oral intake [14, 15]. Bertolini et al. reported technical and clinical success with the CARD procedure for CEO due to radiation-induced strictures in six patients [6]. A recent meta-analysis of 19 studies found technical success in 88.9% and dysphagia improvement in 58.4% of cases after the CARD procedure [16]. The need for repeated dilations occurred in 78.9%. Although five of our patients remained partially tube feeding-dependent, they all were able to initiate some oral intake after the procedure.

In our case series, two patients had complications. One patient had mild neck emphysema and crepitus, which resolved with conservative follow-up. The second patient had bilateral pneumothorax, requiring bilateral chest tube placement. This resulted from air tracking in the mediastinum and then the pleural cavity. Chest tubes were removed after the lungs re-expanded. This procedure was done before CO_2 insufflation was available. As in all third-space endoscopy procedures, CO_2 insufflation is vital to minimize complications, because tracking of CO_2 is not uncommon. Other studies have reported pneumomediastinum and esophageal perforation after CARD for CEO in 18% and 5% of patients, respectively [14]. The meta-analysis found the rates of perforation and pneumomediastinum to be 8% and 9.9%, respectively, and a 6.8% mortality rate related to the procedure [16].

Our study has limitations. First, it was a retrospective multicenter study with few patients. Second, the relatively low incidence of CEO limits CARD use in tertiary care hospital settings; therefore, these findings may not be generalizable to other settings.

Conclusions

In conclusion, CARD using the rendezvous technique to re-establish esophageal luminal patency in complete obstruction is a safe and effective alternative to high-risk blind antegrade dilation or an invasive surgical approach. It is usually technically feasible with improved swallowing ability in most patients. Although most of our patients remained tube feeding-dependent after the procedure and required further dilations, they could tolerate some food intake and tolerated oral secretions well, greatly increasing their quality of life.

Conflict of Interest

The authors declare that they have no conflict of interest.

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