

## CASE REPORT

ADVANCED

## CLINICAL CASE

# Rescue Snorkel Technique in a Giant Ruptured Aortic Aneurysm With Thoracic Endovascular Aortic Repair Failure



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## ABSTRACT

A 67-year-old man was sent to our center because of progressively worsening chest pain. A giant ruptured thoracic aortic aneurysm was documented. We performed a successfully rescue snorkel technique for thoracic endovascular aortic repair failure because of type IA endoleak after the first endoprosthesis implantation. The patient was discharged after 6 weeks. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2019;1:815–8) © 2019 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

**W**e report a case of a 67-year-old man with progressively worsening chest pain, dysphonia, dysphagia, weight loss, and intermittent gastrointestinal bleeding over the previous 5 months. A week before he arrived at our center,

he had a strong stabbing chest pain radiating toward the left scapula, associated with diaphoresis and hemoptysis. He was assessed in another hospital, where they performed an endoscopy with no bleeding data and a computed tomography angiography (CTA) scan that showed a giant ruptured descending thoracic aortic aneurysm. He was referred to our center for endovascular repair. At his arrival, the patient was hemodynamically unstable, according to which, urgent thoracic endovascular aortic repair (TEVAR) was performed.

## LEARNING OBJECTIVES

- To be able to make diagnosis according to signs and symptoms, in addition to diagnostic imaging modalities.
- To know that TEVAR is the treatment of choice in this group of patients because there are lower rates of perioperative mortality and morbidity compared with open surgery.
- To know that endoleaks are common complications of TEVAR procedure, and that there are multiple percutaneous treatment options.
- To know that the snorkel technique is a safe and feasible procedure for endoleak persistence during TEVAR procedure.

## PAST MEDICAL HISTORY

The patient had a history of being smoker for the last 20 years, without chronic disease or cardiovascular history.

## INVESTIGATIONS

CTA revealed a giant aortic aneurysm (12 × 13 cm) after the emerge of the left subclavian artery

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Informed consent was obtained for this case.

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## ABBREVIATIONS AND ACRONYMS

**CTA** = computed tomography angiography

**LCCA** = left common carotid artery

**TEVAR** = thoracic endovascular aortic repair

([Figure 1](#)), with displacement of the trachea and esophagus ([Figure 2](#)), and contrast leakage to left lung ([Figure 3](#)). An echocardiogram documented a left ventricular ejection fraction of 37%, anteroapical akinesia without dilatation of the left or right ventricles, and no valvular or pericardial disease.

## MANAGEMENT

We performed an urgent endovascular repair of the descending aorta with a fully percutaneous approach ([Video 1](#)). First a Valiant Captivia endoprosthesis (34 × 34 × 212 mm) (Medtronic, Minneapolis, Minnesota) was implanted at the aortic arch covering left subclavian artery (zone 2) ([Video 2](#)). Control angiography showed a type IA endoleak. Proximal optimization of the landing zone with a Reliant balloon (Medtronic) ([Video 3](#)) and left subclavian artery occlusion with a 16-mm Amplatzer Vascular Plug II (St. Jude Medical, St. Paul, Minnesota) were performed with minimal improvement ([Videos 4, 5, and 6](#)). A second Valiant Captivia endoprosthesis (36 × 36 × 167 mm) was placed at the emerge of the right brachiocephalic trunk, covering the left common carotid artery (LCCA) ([Video 7](#)). A Snorkel technique was performed with a BeGraft peripheral stent (8 × 57 mm) (Bentley InnoMed, Hechingen, Germany), placing the stent into the ascending aorta directed toward the LCCA through an introducer sheath previously placed into the vessel. A final kissing balloon was used to optimize the result ([Video 8](#)). The final angiography showed exclusion of the aneurysm, without residual endoleak and normal flow through the LCCA ([Videos 9 and 10](#)).

## DISCUSSION

Thoracic aortic aneurysm is a rare disease affecting approximately 10 of every 100,000 elderly adults, most between 60 and 70 years of age ([1](#)). Giant aneurysm, considered when the diameter exceeds 10 cm, is associated with very high mortality rates, especially when complicated with rupture (as high as 76% at 24 h), so many patients die before receiving medical attention ([2,3](#)). Most patients remain asymptomatic until they become evident with dissection or rupture ([1](#)) or when it produces compression of surrounding structures including the trachea or bronchi or the esophagus ([4,5](#)). Ruptured aneurysm usually presents with severe, abrupt chest, neck, back, or abdomen pain, and it should be treated urgently because imminent risk of death ([1](#)). Traditionally, open repair has been the treatment of choice, especially for those with aortic rupture; however, this carries significant

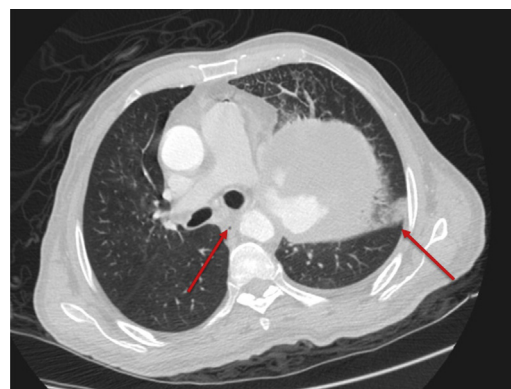
**FIGURE 1** 3-Dimensional Thoracic Aortic Aneurysm Reconstruction



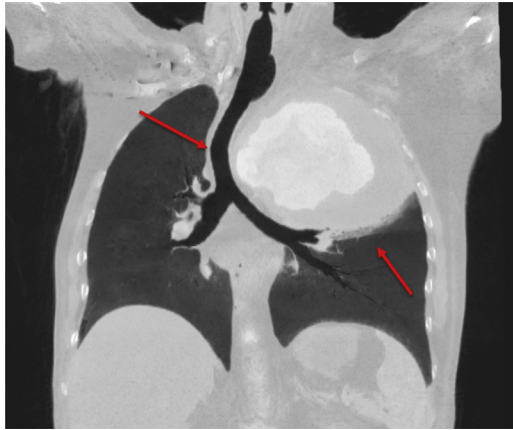
Image of giant aortic aneurysm (12 × 13 cm).

morbidity and mortality (30-day mortality of 33% and major complications between 5.5% and 11.1%). Recently, some case reports suggest that TEVAR is an effective and possibly advantageous treatment for this group of patients because of its lower rates of perioperative morbidity and mortality (30-day mortality of 19%) compared with surgical repair ([5,6](#)). TEVAR complications includes stroke, spinal cord ischemia, retrograde type A dissection, and prosthesis endoleaks ([6](#)). In our center, treatment of aortic aneurysms

**FIGURE 2** Computed Tomography Scan Showing Trachea and Esophagus Displacement

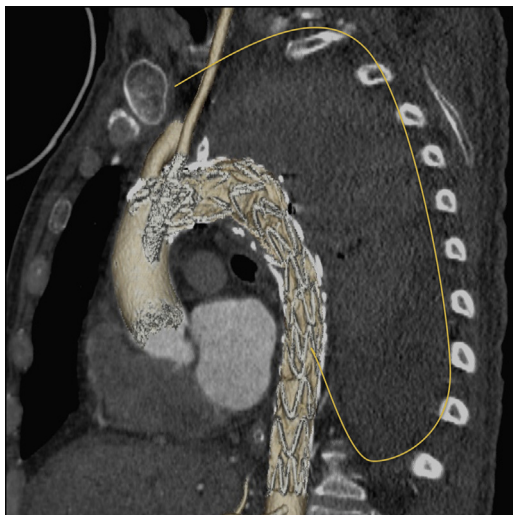


**FIGURE 3** Computed Tomography Scan Showing Contrast Leakage to Left Lung



and their complications, including aortic rupture, is individualized and based on the Heart Team decision. In patients with hemodynamic instability, urgent TEVAR is preferred, especially those with advanced age and favorable anatomy. So, in this case, we decided to perform an endovascular repair. However, after first endoprosthesis was implanted, a type IA endoleak was documented. Endoleak incidence is estimated around 5.2% in TEVAR procedures and type IA is the most commonly observed (5). We considered that location and size of the aneurysm, as well as scanty landing zone (zone 2) were determining factors in the inadequate sealing at the proximal end of the

**FIGURE 4** Computed Tomography Scan Reconstruction Showing Aortic Endoprosthesis, Without Endoleak and With Residual Sac



**FIGURE 5** 3-Dimensional Thoracic Aorta Reconstruction After TEVAR and Snorkel Procedure



Complete aortic aneurysm exclusion is shown.  
TEVAR = thoracic endovascular aortic repair.

endoprosthesis, leading to type IA endoleak. Detection of type IA endoleak requires urgent interventions, most of which can be performed endovascularly with repeated balloon dilatation, insertion of an aortic cuff, or implantation of vascular plugs or coils (7). In these scenarios, maintenance of adequate flow through the LCCA and an adequate sealing of the aortic endoprosthesis may be challenging (8). TEVAR and the snorkel technique would stabilize the patient in a very short time, with a high technical success (about 89.5% according to some European registries) and very similar and low reintervention rate (patency of 98% at 30 days and freedom from reintervention rate of 88.6% at 5 years), compared with surgery (patency of  $90.4 \pm 4\%$  at 5 years) (9,10). We used a BeGraft peripheral stent because balloon expandable stents have greater radial force, and better radiographic visibility, that allow for more precise placement. Some recent small series consider that self-expandable stents have an increased tendency for type I endoleak. It is important to mention that these devices have less flexibility compared with self-expandable stents, but in this case, we introduced the stent through an introducer sheath placed at LCCA.

The literature provides scant information about the snorkel technique for thoracic repair because there

are only a few published reports, with no more than 10 to 15 treated patients for each (10). Boisiers *et al.* (10) reported type IA endoleak in about 10.5%, despite post-balloon by the use of the kissing technique; a 30-day mortality rate of 9.5%; stroke incidence and patency of snorkel grafts of 4.2% and 98% at 30 days, respectively; and 60% of survival at 5-years follow-up (10). Despite interventions, if the endoleak persists, conventional open surgery should be considered (7). Fortunately, in this case we had a positive outcome maintaining adequate flow through the LCCA, with total exclusion of the giant aneurysm, and full repair of the type IA endoleak. However, routine use of this technique seems inconvenient because the snorkel technique can give rise to endoleak, so we prefer individualized treatment.

#### FOLLOW-UP

The patient had a complicated recovery by massive hemothorax, so urgent surgical drainage of the residual sac was successfully performed (Figure 4).

Ventilator-associated pneumonia and pseudomembranous colitis was also documented during hospitalization. Finally, after 6 weeks, the patient was successfully discharged. Before discharge an CTA showed complete exclusion of the aortic aneurysm (Figure 5).

#### CONCLUSIONS

Ruptured thoracic aortic aneurysm is a fatal complication. TEVAR has become first-line treatment because decreased operative time, blood loss, and perioperative mortality. Endoleak is one of the most common complications; in this case, we showed that the rescue snorkel technique is a safe and feasible procedure for endoleak persistence, with adequate results and minimizing surgical risk.

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#### REFERENCES

- González-Urquijo M, Dominguez-Porras VA, Tellez-Martinez LG, Lozano-Balderas G, Flores-Villalba E, Fabiani MA. A case report of successful endovascular repair of a giant 15 cm diameter asymptomatic thoracic aortic aneurysm. *Int J Surg Case Rep* 2018;51:344-8.
- Milan A, Naso D, Veglio F, Avenatti E. Giant proximal aorta aneurysm: a successfully managed time bomb. *J Cardiovasc Echogr* 2013; 23:102-5.
- Di Marco L, Attinà D, Pacini D. Giant thoracoabdominal aortic aneurysm. *J Cardiovasc Med* 2018;19:34-5.
- Srivastava V, AlHadid K, Saravanan P, Zacharias J, Bittar MN. Giant aneurysm of the ascending aorta. *Case Rep* 2011;2011:740247.
- Riambau V, Böckler D, Brunkwall J, *et al.* Editor's choice - management of descending thoracic aorta diseases. *Eur J Vasc Endovasc Surg* 2017;53:4-52.
- Georgiadis GS, Argyriou C, Koutsoumpelis A, *et al.* Revised endografting for a giant descending thoracic aorta aneurysm due to synchronous type III/IV endoleak, causing dysphagia. *Ann Vasc Surg* 2018;53:272. e11-7.
- Kocaaslan C. Open repair of type Ia endoleak with a giant abdominal aortic aneurysm sac. *North Clin Istanbul* 2017;5:261-3.
- Ma T, Dong ZH, Fu WG, Chen B, Jiang JH, Shi Y. Endovascular management of a ruptured aortic arch pseudoaneurysm using the snorkel technique and coil embolization. *Ann Vasc Surg* 2017;41:281. e7-10.
- Kulik A, Castner CF, Kouchoukos NT. Outcomes after total aortic arch replacement with right axillary artery cannulation and a prewoven multi-branched graft. *Ann Thorac Surg* 2011;92:889-97.
- Bosiers MJ, Donas KP, Mangialardi N, *et al.* European multicenter registry for the performance of the chimney/snorkel technique in the treatment of aortic arch pathologic conditions. *Ann Thorac Surg* 2016;101:2224-30.

**KEY WORDS** aortic aneurysm, endoleak, endoprosthesis, snorkel, TEVAR

**APPENDIX** For supplemental videos, please see the online version of this paper.