

# Complete Fracture of a Chimney Stent in the Left Common Carotid Artery after Thoracic Endovascular Aortic Repair for Thoracic Aneurysm

Bao-Lei Guo, Wei-Guo Fu, Da-Qiao Guo, Zhen-Yu Shi

Department of Vascular Surgery, Zhongshan Hospital, Fudan University, Institute of Vascular Surgery, Shanghai 200032, China

To the Editor: We reported a rare complication after thoracic endovascular aortic repair (TEVAR) with a chimney stent.

A 68-year-old patient with no history of chest or back pain history presented to our hospital for evaluation of the endograft for TEVAR of a thoracic aneurysm approximately 4 years previously. Computed tomography angiography showed significant type Ia endoleak and the endograft had severe compression and migration [Figure 1a]. The chimney stent was an 8 mm × 39 mm Palmaz Genesis balloon-expandable stent (CordisCo, Bridgewater, NJ, USA). Interestingly, it was unobstructed but completely fractured [Figure 1b]. One part of the chimney stent was lost in the thoracic aneurysmal sac and one part was embedded in the wall of the aorta; however, the remaining part was located in the orifice of the left common carotid artery (LCCA) and kept the LCCA unobstructed [Figure 1c]. During the TEVAR in 2010, the endograft size was selected according to the aortic diameter as assessed by CT scan [Figure 1d] of the proximal landing zone with 20% oversizing. The chimney stent in the LCCA was implanted to extend the proximal landing zone and a 42 mm × 216 mm Zenith TX2 endograft (COOK Inc., Bloomington, IN, USA) was fixed distal to the innominate artery and completely covered the aneurysm. The chimney stent was parallel with the endograft in the aorta for a length of approximately 20 mm. The final angiography showed the thoracic aneurysm was successfully repaired without endoleak and endograft migration [Figure 1e]. Postoperatively, medical management included β-blockers and calcium antagonists administered in combination to maintain systolic blood pressure at <140 mmHg. Dual antiplatelet therapy (aspirin [100 mg once per day] and clopidogrel [75 mg once per day]) was recommended for the first 3 months, and lifelong aspirin therapy was recommended thereafter. However, the patient did not have a good blood pressure control and needed follow-up in the vascular outpatient clinic. Careful surveillance was recommended based on an asymptomatic condition; because of the high risk for mortality, re-intervention was also recommended. A hybrid strategy would be necessary if aorta-related symptoms occurred. Written informed consent was obtained from the patient.

The chimney technique with selective or bail-out conditions was used to extend the proximal landing zone in TEVAR. Mangialardi

*et al.* reported the rate of chimney stent fracture was 3.8%, with a patency rate of 89.3% and a type Ia endoleak rate of 20%.<sup>[1]</sup> Although both self-expanding and balloon-expandable devices could be used for the chimney stent technique, there is still controversy. Balloon-expandable stents have far more resistance to compression, whereas self-expanding stents are less compression-resistant but have more rebound force.<sup>[2]</sup> Despite increasing experience, these procedures remain challenging with mid-term and long-term follow-up. Bail-out procedures are minimally invasive and have promising results.

Of note, the influence of wall shear stress on the chimney stent and main endograft is an important related risk factor. Shahcheraghi *et al.*<sup>[3]</sup> demonstrated that peak values of wall shear stress were observed in the vicinity of the three arch branches and along the distal walls of the branches themselves. Wall pressure was low along the inner aortic wall and high around the branches and along the outer wall in the ascending thoracic aorta. Moreover, wall shear stress was found to be lowest along the inner wall of the descending thoracic aorta and the proximal walls of the arch branches. With the complicated changes of hemodynamics, the chimney technique should not become the “holy grail” of endovascular treatment for extending the proximal landing zone in elective or nonelective patients.<sup>[4]</sup>

To our knowledge, complete chimney stent fracture with one part in the aneurysmal sac, one part embedded in the wall of the aorta, and the other unobstructed in the LCCA after TEVAR, has rarely reported previously. The case reported herein aimed to direct more attention to the serious complications induced by the chimney technique. Fractured chimney stent flow to the peripheral arteries can lead to lethal consequences.

**Address for correspondence:** Dr. Wei-Guo Fu,

Department of Vascular Surgery, Zhongshan Hospital, Fudan University,  
Institute of Vascular Surgery, Shanghai 200032, China  
E-Mail: fu.weiguo@zs-hospital.sh.cn

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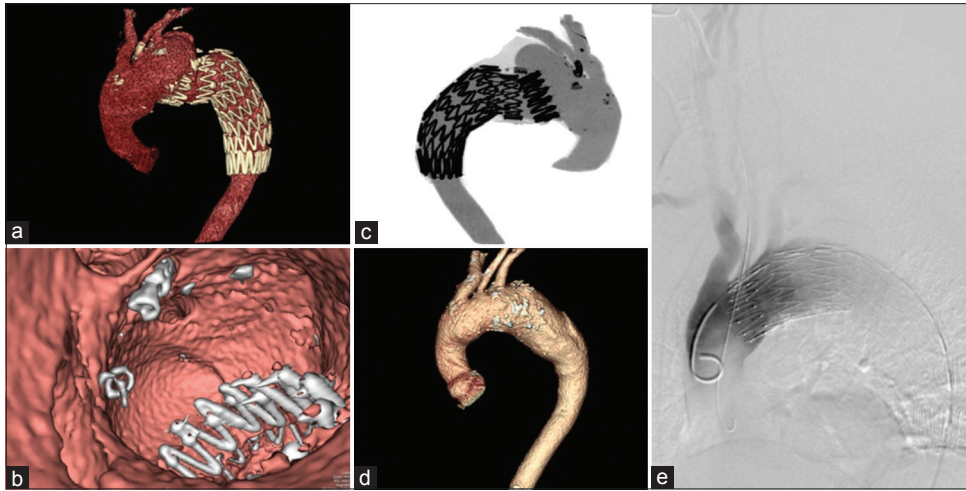
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**Figure 1:** (a) Computed tomography angiography showed a significant type Ia endoleak and the stent graft with a severe compression and migration. (b) The chimney stent was patent but completely fractured. (c) The stent debris embedded in the wall of the aorta. (d) Preoperative computed tomography scan showed an aortic arch aneurysm. (e) The thoracic aneurysm was successfully repaired without endoleak and endograft migration.

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### Conflicts of interest

There are no conflicts of interest.

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