

# Unexpected, complete recovery after emergent thoracic endovascular aortic repair for inoperable type A aortic dissection

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## ABSTRACT

Patients presenting with a Stanford type A acute aortic dissection require immediate surgical treatment; however, up to 30% of patients are deemed inoperable. Here we describe a case of a patient with a complicated type A acute aortic dissection presenting with a severe impact of brain malperfusion. In contrast with open surgery, an emergent thoracic endovascular aortic repair was performed with a Gore cTAG 45 × 150 mm graft and an additional chimney graft Advanta V12 7 × 59 mm graft for the brachiocephalic trunk. After early extubation, unexpected complete neurological recovery was observed. A follow-up computed tomography scan demonstrated complete remodeling of the ascending aorta. This report underlines the potential of thoracic endovascular aortic repair as an alternative for immediate open surgical repair in case of high-risk or inoperable patients. (*J Vasc Surg Cases Innov Tech* 2022;8:167-70.)

**Keywords:** Acute type A aortic dissection; TEVAR; Endovascular

Patients presenting with a Stanford type A acute aortic dissection (ATAAD) require immediate surgical treatment. Thirty percent of patients, however, are deemed inoperable owing to comorbid factors.<sup>1,2</sup> The in-hospital mortality may reach 75% when treated medically.<sup>3</sup> In selected, inoperable patients, endovascular repair may be an alternative treatment option. In the literature, small case reports and series have been reported illustrating its use in isolated ascending aorta dissections, or as bridge to open surgery.<sup>4-7</sup> Here, we present a case with unexpected and complete (neurological) recovery after emergent thoracic endovascular aortic repair (TEVAR) for ATAAD.

## CASE DESCRIPTION

A 72-year-old woman without a cardiac history was found nonresponsive at the geriatric ward in a referring hospital, where she was rehabilitating from a clavicular fracture. At admission, we observed a comatose gasping patient, with right-sided paresis and a deviating head position to the left. Hemodynamically she was tachycardic and hypotensive (100/60 mm Hg). A computed tomography (CT) scan of her head and aorta

excluded cerebral bleeding, but showed a type A aortic dissection with intimal entry in the distal ascending aorta. The false lumen extended retrogradely up to the aortic root, and antegradely into both iliac arteries. Of note, the left common carotid artery (LCCA) was occluded at its origin without distal perfusion with a dissected brachiocephalic trunk (BCT) and left subclavian artery. Additionally, extensive hemopericardium was observed, causing tamponade.

Based on her neurological state caused by the acute dissection, the neurologist concluded a poor prognosis; therefore, open aortic surgery was not pursued. After being watched for 1 hour in the presence of her family, the patient became intermittently conscious, although still hemiparetic. A repeat neurological assessment confirmed her improved condition. Emergent open surgical repair of the ascending aorta, however, was considered to be extremely risky for her malperfused, ischemic brain, as well as technically very challenging with respect to intraoperative brain protection, given the dissected arch vessels with occluded LCCA. As an alternative, endovascular repair was proposed and discussed in detail with the interventional radiologist and anesthesiologist on call.

The total aortic diameter (true and false lumen) measured 43 mm in the mid and distal ascending aorta, the aortic root was not dilated. To ascertain complete closure of the intimal entry tear and exclusion of false lumen flow, we opted for a 45-mm stent graft (oversized by 5%). Despite an extensive stock of stent grafts available at our tertiary aortic center, the shortest stent graft of 45 mm in diameter present at that time was 15 cm in length (Gore cTAG TGM454515, W.L. Gore & Associates, Flagstaff, AZ). Such a length would cover the ostium of both the BCT and the (already occluded) LCCA. A so-called chimney graft would be used in a retrograde fashion to ensure unobstructed flow to the BCT afterward.

After obtaining consent from the family, the patient was transferred to our hybrid operating room. After general anesthesia

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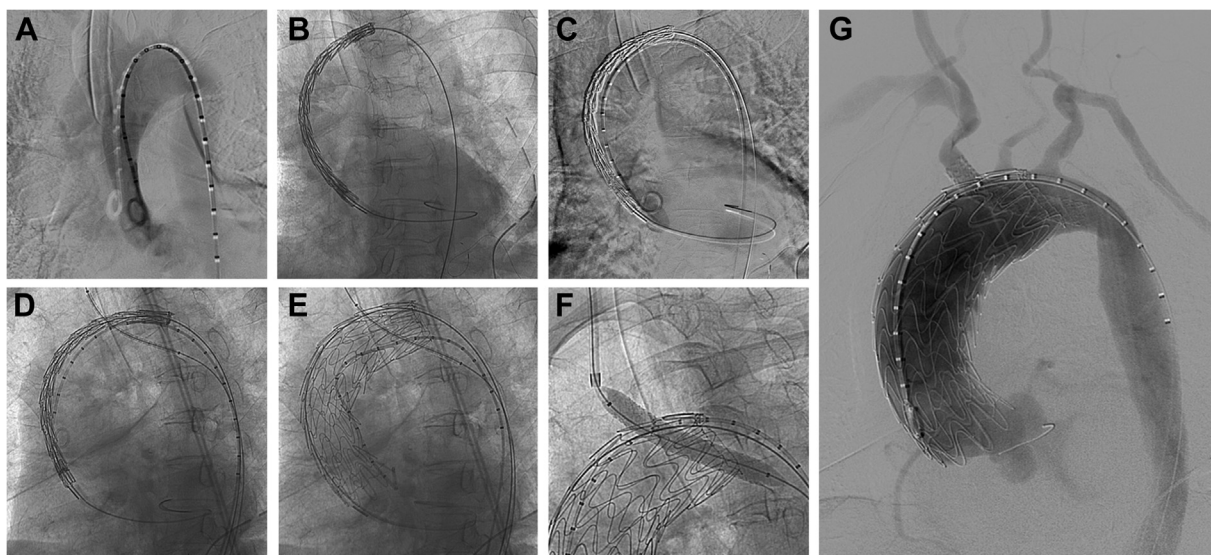
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**Fig 1.** (A) Retrograde access to the true lumen. (B) Crossing the aortic valve with super stiff guidewire and positioning the stent graft. (C) Angiocatheter in true lumen. (D) Retrograde chimney through the right common carotid artery. (E) Staged deployment with proximal angulation. (F) Balloon dilation chimney. (G) Completion angiography.

and the introduction of transesophageal echo, at first a small anterolateral thoracotomy was performed to gradually evacuate the hemothorax. Thereafter, she stabilized hemodynamically. Via percutaneous femoral access, the true lumen was cannulated retrogradely up to the aortic root. The aortic valve was crossed and a super stiff guidewire was introduced at the apex of the left ventricle. Next, the proximal right common carotid artery was surgically exposed in the neck. Through a purse-string suture a short 7F sheath was retrogradely introduced and positioned followed by a balloon expandable stent graft (7 × 59 mm; Advanta V12, Getinge, Merrimack, NH). After angiography via contralateral femoral access, the stent graft (Gore cTAG) was introduced and positioned at the ascending aorta. Using rapid ventricular pacing via external pacemaker wires at the exposed apex of the left ventricle, the stent graft was deployed carefully, taking advantage of the active control system. This consisted of a two-step deployment together with proximal angulation control to align the stent graft with the curved ascending aorta. At last, the Advanta V12 was checked for adequate positioning and expanded by balloon dilation. Intra-arterial pressure monitoring of the right common carotid artery equaled the left radial artery, and was considered adequate. Completion angiography showed an adequate position of both the Gore cTAG and Advanta V12, excluding the false lumen in the ascending aorta without obstruction to the BCT and left subclavian artery (Fig 1). The true lumen in the LCCA remained severely obstructed.

Postoperatively, the patient was kept intubated with blood pressure regulation on the intensive care unit. After a few hours of observation in the intensive care unit, she was awakened and extubated. Surprisingly, there was no neurological deficit at all. The neurologist completed his consultation the following day. Hypertension was prevented during early follow-up.

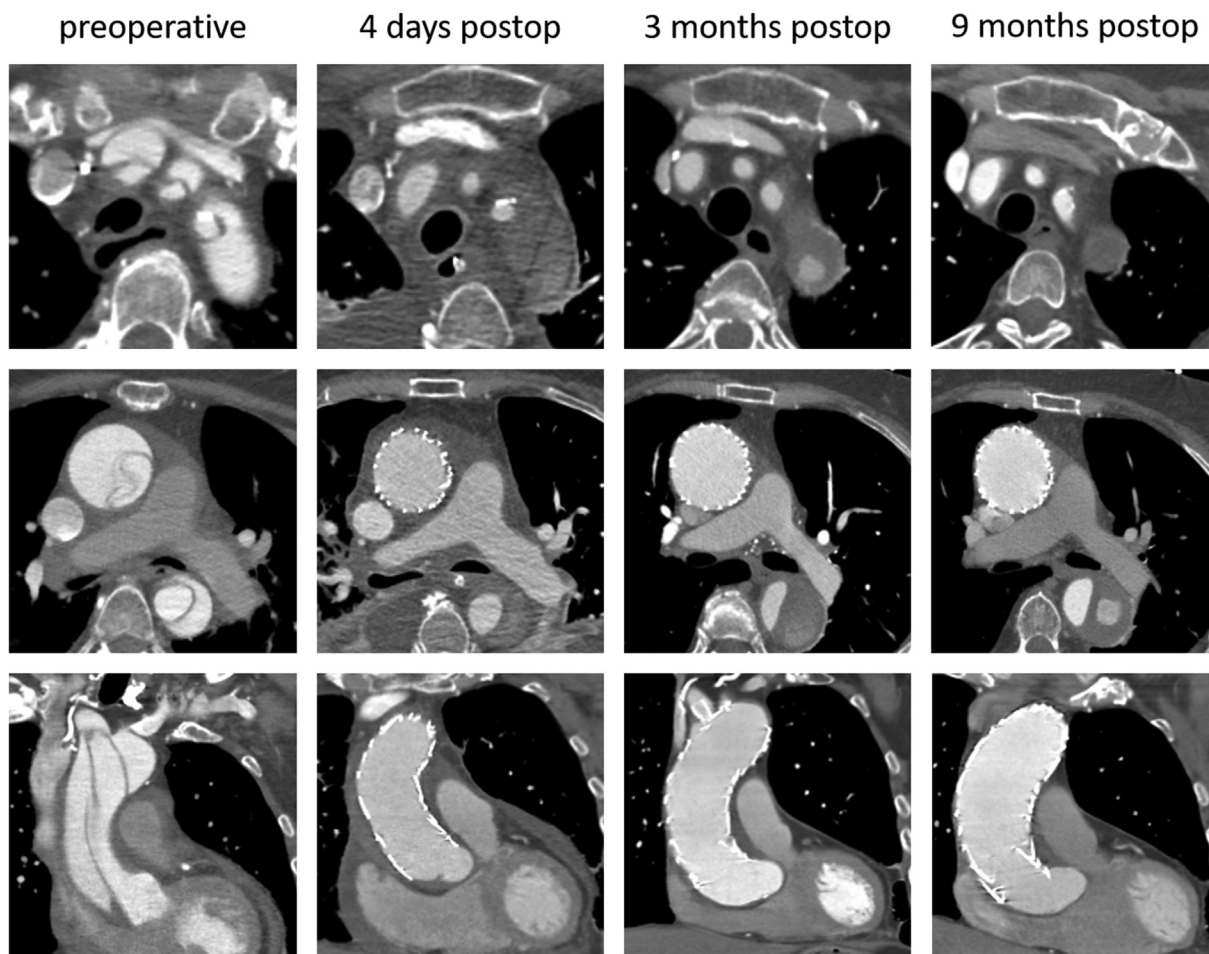
After a protracted postoperative course owing to general weakness, the patient was transferred back to her referring hospital at 4 weeks postoperatively. A control CT scan at 4 days, 3 months, and most recently 9 months postoperatively showed progressive remodeling of the ascending aorta without any stent graft-induced new intimal entries (Fig 2). Surprisingly, all three arch vessels (including the LCCA) were fully patent. Scrutinizing the CT scan revealed that a small gutter owing to the chimney graft perfused the true lumen, resulting in complete remodeling of the LCCA (Fig 3). The residual dissection of the distal BCT and downstream descending aorta remained, without significant progression in diameter at the latest follow-up. The patient is clinically doing fine, and lives home with her family. The patient provided consent for the publication of their case details.

## DISCUSSION

We present a case with unexpected and complete (neurological) recovery after emergent TEVAR for ATAAD in a patient considered at too of a high neurological risk for open repair. The patient presented with an intermittent comatose state, hemiparetic, and with a deviated head position, being hemodynamically compromised owing to tamponade. As a consequence, open surgical repair was deemed to be too high risk.

Emergent endovascular aortic repair not only restored brain function completely, but also resulted in the complete remodeling of the ascending aorta, as well as a preoperatively obstructed LCCA.

Despite maximal angulation at the proximal end of the cTAG device, the enrolled, horizontal course of the aorta resulted (inadvertently) in a slightly more distal position at the outer curvature. Probably just distal to the thrombosed segment of the false lumen, resulting in a



**Fig 2.** Overview of preoperative and postoperative computed tomography (CT) scans. Upper layer axial slice of brachiocephalic arteries. Middle layer axial slice of ascending and descending aorta at level of pulmonary artery bifurcation. Lower layer coronal slice of ascending aorta. **(Left)** The total aorta diameter (true and false lumen) measured 43 mm. The intimal entry was located approximately 6 cm distal to the coronary ostia and 1 cm proximal to the brachiocephalic trunk (BCT).



**Fig 3.** **(A)** Three-dimensional reconstruction of the postoperative computed tomography (CT) scan illustrates the intentional overstented left common carotid artery (LCCA). **(B)** Detailed CT frame showing the gutter endoleak toward the LCCA caused by the chimney graft to the brachiocephalic trunk (BCT).

completely remodeled aorta without new intimal entry proximally. A residual dissection downstream is being followed by regular CT scans, without dilatation to date.

Although reported in individual cases before, TEVAR for ATAAD is almost exclusively performed in carefully selected high-risk patients with often a local dissection

in the ascending aorta. TEVAR is scarcely performed in these patients owing to complex anatomy, with the proximity of the aortic valve, coronaries, and arch branches. To completely exclude the intimal tear, a landing zone of at least 2 cm is preferred at both the proximal and distal landing zones. In case of inadvertent overstenting of the arch vessels, the chimney technique may be useful as a bail-out to maintain perfusion. Furthermore, intraoperative manipulation with wires in the acutely dissected ascending aorta should be done expeditiously to prevent rupture of the false lumen.

Current endovascular devices are not designed yet to fit the ascending aorta. Correct sizing (in length and diameter) to exclude the intimal tear and obtain adequate sealing and fixation is very challenging.<sup>8-10</sup> Similar to our patient, commercially available devices are used off-label. Additionally, the available stock of stent grafts at the hospital site may be insufficient to accommodate the patients' anatomy in case of emergency.

Despite the scarce use of TEVAR for ATAAD, our case, together with previous case reports, demonstrates its potential value in high-risk or inoperable surgical patients. Either as a bridge to, or as definitive repair. Future developments in stent graft design accommodating the specific requirements of the complex ascending aorta may increase the number of patients being treated endovascularly. And consequently will aim to save their lives when deemed inoperable.

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