Facing Complications After Endovascular Thoracic Aneurysm Repair

Use of emergent intra-arterial thrombolysis and middle cerebral artery angioplasty to treat ischemic stroke after TEVAR.

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Endovascular repair of thoracic aortic aneurysm (TEVAR) has gained wide acceptance due to its overall decreased morbidity and mortality rates when compared to open surgical repair.[1] However, even with improvements in endovascular technology and stent graft designs, the incidence of stroke remains significant and ranges between 3% to 8%.[2-4] In most instances, ischemic stroke is secondary to thromboemboli generated from wire, catheter, and stent graft manipulations within the thoracic aortic arch. We present a case report of a patient who developed ischemic stroke after TEVAR and underwent emergent intra-arterial thrombolysis and middle cerebral artery angioplasty in the operating room.

CASE REPORT

The patient was an 80-year-old woman with a medical history significant for coronary artery disease, hypertension, and hypercholesterolemia who was found to have an asymptomatic thoracic aortic aneurysm (TAA) on workup for pneumonia. Subsequently, she underwent a CTA that indicated a 7.4-cm TAA that extended from the left subclavian artery distally to the descending thoracic aorta, a bovine thoracic aortic arch, and a dominant right vertebral artery (Figure 1).

TEVAR was planned using two TAG thoracic devices (34 mm X 20 cm) (Gore & Associates, Flagstaff, AZ) with general anesthesia, cerebral-spinal fluid drainage, and femoral artery cutdown. After left femoral artery cutdown and placement of a 22-F sheath, a stiff Lunderquist wire

Figure 1. A 7.4-cm thoracic aortic aneurysm.

Figure 2. TEVAR with coverage of the left subclavian artery. Proximal TAG thoracic stent graft fixation is at the innominate artery (bovine arch).

(Cook Medical, Bloomington, IL) was advanced into the ascending thoracic aorta and was used to deliver the TAG thoracic stent grafts. A pigtail catheter was placed in the ascending thoracic aorta via percutaneous right femoral approach, and the patient was systemically anticoagulated with heparin with an activated clotting time of 265 seconds. The endovascular TAA repair required coverage of the left subclavian artery and was uneventful; the proximal fixation site was just distal to the innominate artery (bovine arch), and the distal fixation site was in the distal descending thoracic aorta above the celiac artery (Figure 2).

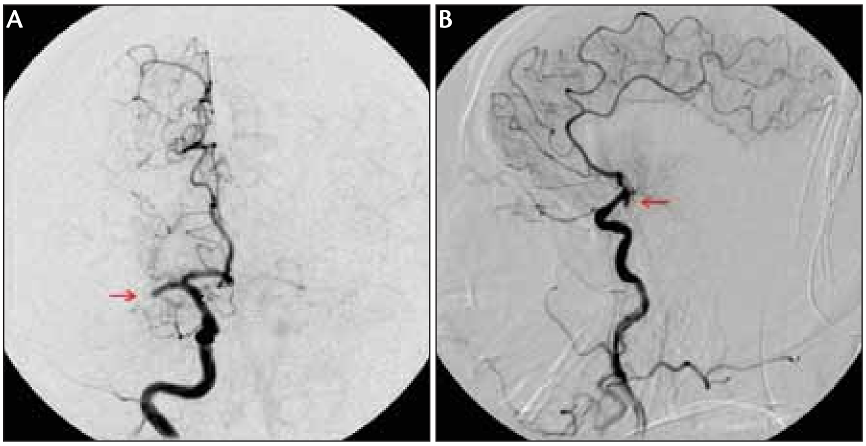

Figure 3. Complete occlusion of the proximal main trunk of the MCA-M1 segment (arrow) (A). Thrombolysis in cerebral ischemia score indicates no antegrade flow beyond the M1 segment occlusion (B). The anterior cerebral artery is patent.

Upon completion of the procedure, the patient was extubated in the operating room and was noted to have left hemiplegia, hemianesthesia, hemineglect, and an NIH stroke scale of 20. The patient was reintubated and underwent an emergent head CTA that indicated right middle cerebral artery (MCA) thromboembolus and no intracranial hemorrhage.

The patient was taken back to the operating room where the left groin incision was reopened and used for access. Rapid angiographic assessment of cerebral circulation was obtained to identity the site of occlusion, as well as the status of the collaterals.

Figure 4. After intra-arterial lysis with tPA, partial thrombus remains in the M1 segment of the MCA (arrow). The superior and inferior M2 segments are patent.

PROCEDURE

Thoracic arch arteriography indicated adequate proximal fixation of the TAG thoracic stent graft just distal to the innominate artery, patent bilateral common carotid arteries, patent right subclavian artery, antegrade flow through the right vertebral artery, and retrograde flow through the left vertebral artery. Right common carotid artery access was achieved with a Vitek catheter (Cook Medical), and carotid cervical and cerebral arteriography indicated 60% ulcerated proximal right internal carotid artery stenosis, complete occlusion of the right MCA-M1 segment, and a patent anterior cerebral artery (Figure 3).

A 6-F, 90-cm guiding sheath (Shuttle, Cook Medical) was advanced into the right common carotid artery over a stiff Glidewire (Terumo Interventional Systems, Somerset, NJ) and was used to deliver the Renegade microcatheter (.021-inch inner-diameter/3-F outer-diameter; Boston Scientific Corporation, Natick, MA) and steerable guidewires to the MCA-M1 segment occlusion. A hydrophilic Microglide wire (Advanced Cardiovascular Systems, Santa Clara, CA) and the Renegade microcatheter were used to carefully traverse the MCA-M1 segment into superior and inferior M2 segments. Furthermore, care was taken to avoid catheter deflection into the lenticulostriate arteries, MCA dissection, or perforation. The microcatheter was subsequently withdrawn through the thrombus interface, and 4 mg of tPA (tissue plasminogen activator) was infused over 15 minutes. Repeat arteriography indicated a marked improvement in MCA-M1/M2 segmental flow with residual M1 segment thrombus (Figure 4). A 3-mm monorail balloon catheter was advanced across the MCA-M1 segment with residual thrombus, and angioplasty to 6 atm was performed (Figure 5).

Completion arteriography indicated a patent MCA-M1 segment without residual thrombus, a patent superior M2 segment, and mild-to-moderate residual thrombus in the inferior M2 segment (Figure 6). An additional 4 mg of tPA was infused into the M2 segments over 15 minutes, and subsequently all catheters and sheaths were removed. Total time from the diag-

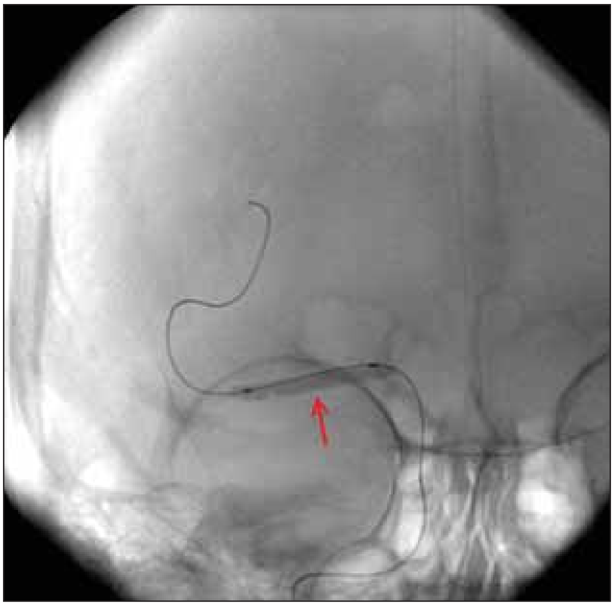

Figure 5. Balloon angioplasty of the MCA-M1 segment.

Figure 6. After angioplasty, the M1 segment of the MCA indicates complete perfusion (TICI-3). The inferior M2 segment has distal occlusion (arrows), treated with intra-arterial tPA.

nosis of stroke to the start of intra-arterial lysis was approximately 1.5 hours and to completion of the procedure was approximately 3 hours. The right femoral artery access was primarily repaired by a 6–0 proline stitch, and the groin incision was closed after achieving hemostasis. The patient received clopidogrel and low-dose IV heparin, and her blood pressures were monitored in the intensive care unit.

The patient was extubated on postoperative day 1, and during the following week, her NIH stroke scale improved to <5 with some residual left upper-extremity weakness.

DISCUSSION

Thromboembolic ischemic stroke during TEVAR continues to be a persistent problem that can affect 3% to 8% of patients[2-4] and leads to significant long-term disability. Important predictors of clinical success are the time of stroke to treatment, location of thromboembolic ischemic stroke (first versus second/third intracranial segmental branches), size of ischemic penumbra, presence of intracranial collaterals, NIH stroke scale, and hemorrhagic conversion.[5] There have been numerous studies evaluating the safety and efficacy of intravenous/intra-arterial thrombolysis, intracranial angioplasty/stenting, and the use of mechanical thrombectomy devices for treatment of acute ischemic stroke.[6-8]

A comprehensive discussion on this subject matter is beyond the scope of this case report. However, because the most important factor in predicting improved outcomes of ischemic stroke is the time to treatment, endovascular specialists involved in treating aneurysmal and/or arterial occlusive disease affecting the thoracic aorta and/or the extracranial carotid arteries should be familiar with current diagnostic and treatment options for salvaging thromboembolic complications of the procedures. ■

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