Concomitant transcarotid artery revascularization and transcatheter aortic valve replacement

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ABSTRACT

Concomitant carotid artery disease and aortic valve disease is common. Whereas carotid stenosis does not appear to have an effect on outcomes of patients undergoing aortic valve replacement, the management of a patient with symptomatic carotid disease and severe aortic stenosis is challenging. The advent of minimally invasive endovascular techniques has provided less invasive and effective treatment options for these respective conditions. In this report, we describe two cases of patients successfully treated with concomitant transcatheter aortic valve replacement and transcarotid artery revascularization. (J Vasc Surg Cases and Innovative Techniques 2020;6:205-8.)

Keywords: Carotid angioplasty and stenting; Transcarotid artery revascularization; Cerebrovascular disease

The prevalence of extracranial internal carotid artery (ICA) stenosis is high in patients with severe aortic stenosis (AS), with up to 33% of patients having carotid stenosis >50%.[1] However, its effect on patients undergoing either surgical aortic valve replacement or transcatheter aortic valve replacement (TAVR) remains debated.[2] The available data have shown that the presence of asymptomatic ICA stenosis is not significantly related to worse outcomes or stroke after TAVR.[3,4] However, the presence of severe symptomatic ICA lesions in patients with severe AS requiring treatment is a challenging clinical situation. There is no consensus as to whether the carotid and valve interventions should be staged or performed in a concomitant manner. Whereas there have been numerous publications regarding the combination of coronary artery bypass grafting and carotid endarterectomy (CEA), data on management of severe symptomatic AS and symptomatic carotid stenosis are sparse. There are many different surgical and endovascular treatment options for both carotid and valvular disease, and the appropriate combination of treatment modalities depends on the patient's anatomy and underlying comorbidities. In this report, we describe two cases of symptomatic ICA stenosis and severe AS successfully treated with concomitant TAVR and transcarotid artery revascularization (TCAR). Both patients provided informed consent for this report and its publication.

CASE REPORTS

Case 1. A 79-year-old man presented with new-onset dysarthria and left arm weakness with symptoms that resolved after 4 hours. Imaging included a negative noncontrast-enhanced head computed tomography (CT) scan and magnetic resonance imaging of the brain, which revealed three acute punctate infarcts in the right parietal lobe. Carotid duplex ultrasound examination revealed 50% to 79% right ICA stenosis, which was confirmed with CT arteriography (Fig 1). Because of the patient's history of severe fatigue and exertional dyspnea, echocardiography was performed, which revealed severe AS with an aortic valve cross-sectional area of 0.7 cm^2. Owing to his high-risk factors, it was recommended that he undergo concomitant TAVR and TCAR using local anesthesia; this was done 3 months after the onset of his original symptoms, which did not recur. With sedation using dexmedetomidine, percutaneous TAVR was performed through a right common femoral artery approach with left transfemoral venous overdrive pacing. The TAVR procedure was uncomplicated. TCAR was then performed with proximal right common carotid artery cutdown after a superficial cervical plexus block; this has been found to provide excellent intraoperative analgesia for TCAR in the authors' experience. Flow reversal was obtained through the previously accessed left femoral vein (Fig 2). The TCAR procedure was uncomplicated, with flow reversal time of 8 minutes and total procedure time of 59 minutes. The patient tolerated the procedures well and was discharged to home on the first postoperative day with no perioperative complications. The patient was free of neurologic symptoms at his 1-year follow-up visit.

Case 2. An 82-year-old woman presented with recurrent episodes of syncope and resultant falls. Her workup included carotid duplex ultrasound examination, which showed the presence of bilateral severe ICA stenosis. This was confirmed with CT arteriography showing >90% stenosis on the left. Because of her history of dyspnea on exertion, echocardiography

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Fig 1. Intraoperative angiography of patient described in case 1, before right carotid angioplasty and stenting.

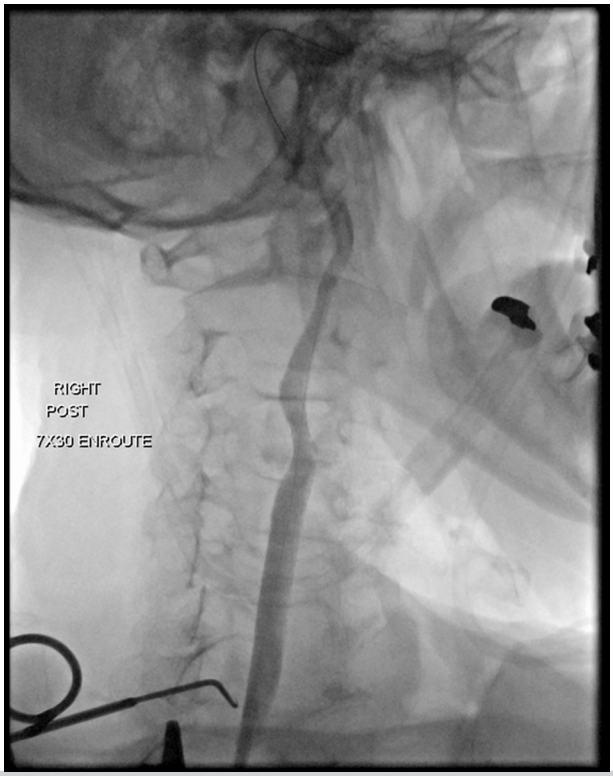

Fig 2. Intraoperative angiography of patient described in case 1, after right carotid angioplasty and stenting.

was performed, which showed severe AS with an aortic valve cross-sectional area of 0.8 cm^2. It was thought that her recurrent syncope was multifactorial in origin, but the severe carotid stenosis was likely to be a causative factor. While she was undergoing workup for open surgical intervention, she suffered additional falls, which resulted in bilateral subdural hematomas. After she recovered from this, with resolution on follow-up CT scan, it was believed that she was at a high surgical risk for open valve replacement. It was thus recommended that she undergo concomitant TCAR and TAVR under local anesthesia. Normal dual antiplatelet therapy with aspirin and clopidogrel was used. Under general anesthesia, the patient underwent a ministernotomy, and TAVR was performed through ascending aortic access as the patient's severely calcified and diseased access vessels were thought to preclude a safe transfemoral approach. The procedure was performed with right transjugular venous overdrive pacing and right common femoral arterial access for diagnostic aortography. Once TAVR was completed, TCAR was then performed with proximal left common carotid artery exposure and left common femoral venous access. The TCAR procedure was uncomplicated, with flow reversal time of 7 minutes and total procedure time of 49 minutes. The patient tolerated the procedures well and was discharged to home on the seventh postoperative day with no perioperative complications. The patient was free of neurologic symptoms at her 3-year follow-up visit.

DISCUSSION

The decision to pursue open vs endovascular treatment as well as timing of an intervention is dependent on many clinical factors. These include clinical presentation and the patient's anatomy as well as associated comorbidities. During the past decades, the introduction of TAVR and TCAR has revolutionized the treatment of patients with severe AS and ICA stenosis, allowing less invasive treatment options with excellent outcomes. TAVR was first demonstrated to be a viable alternative to surgical aortic valve replacement in patients at high surgical risk.[5] Subsequent studies have also demonstrated its utility in patients with intermediate risk and low risk.[6,7] TCAR is a hybrid procedure that allows direct transcarotid stent delivery through surgical exposure of the common carotid artery with neuroprotection using dynamic flow reversal. The principal benefits of this procedure compared with traditional transfemoral carotid artery stenting (TF-CAS) derive from the avoidance of navigating the aortic arch and elimination of the need for unprotected deployment of a distal embolic protection device. The overall stroke rate of 1.4% in high-risk

patients in the Safety and Efficacy Study for Reverse Flow Used During Carotid Artery Stenting Procedure (ROADSTER) was the "lowest reported to date for any prospective multicenter trial of carotid stenting" and compared favorably with historical outcomes of CEA.[8] Subsequent studies evaluating patients' outcomes in the Society for Vascular Surgery Vascular Quality Initiative data set compared TCAR favorably with TF-CAS and CEA.[9,10]

The combination of symptomatic carotid artery stenosis and severe AS is fortunately rare. There is no consensus on the appropriate treatment algorithm for these challenging patients. Staged interventions can be considered, but there is concern that this may lead to suboptimal results. Although patients with AS have not been shown to be at an increased risk of death while undergoing noncardiac surgery, there is a significantly higher risk of adverse cardiovascular events compared with patients without AS.[11] Whereas there is a report of TF-CAS before TAVR, this experience was limited to five patients with asymptomatic disease. One patient suffered acute systolic heart failure requiring emergent balloon aortic valvuloplasty and prolonged vasopressor therapy and intensive care unit stay.[12] There have been reports of concomitant carotid revascularization and TAVR. In a series of 753 TAVRs, 16 underwent concomitant TAVR and CEA for symptomatic severe AS in the setting of severe asymptomatic carotid stenosis.[13] There has been one prior report of a single patient treated successfully with TF-CAS with TAVR.[14] We chose to combine procedures for these patients to minimize the number of trips to the operating room for patients with symptomatic carotid disease, although in lower risk patients, the procedures could be staged.

Whether to use CEA or TCAR to treat severe symptomatic carotid stenosis combined with severe symptomatic AS is controversial, as is the order of procedures when they are combined. The patients in this report were successfully treated with TAVR followed by TCAR during the same procedure. It was decided that TAVR should be performed first as these patients are at a high risk for development of hemodynamic instability. It is common to encounter hypotension and bradycardia during carotid stenting and manipulation of the carotid bulb. In patients who are not properly pretreated (eg, glycopyrrolate), the development of hypotension can lead to severe cardiac decompensation, and severe bradycardia can develop into asystole in patients with severe AS. There is also the question of use of dual antiplatelet therapy related to TCAR and whether this could be avoided with CEA. The current standard of care for TAVR is dual antiplatelet therapy for 3 to 6 months, and although this is a moving target,[15] this is similar to the requirements for TCAR. Our experience also showed that this combination of procedures can be done safely with local/regional or general anesthesia. TCAR and transfemoral TAVR are each performed under local anesthesia with sedation at both senior authors' institutions.

CONCLUSIONS

Concomitant TAVR and TCAR can be safely performed to treat patients with both severe carotid stenosis and severe AS. Because of the high risk of hemodynamic instability during carotid interventions, we recommend that TAVR should be the first procedure performed, followed by TCAR. These procedures should be performed with sedation and local/regional anesthesia when feasible.

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