Carotid Artery Stenting for a Nonagenarian Presenting as Stuttering Stroke

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Abstract

Carotid artery stenting (CAS) is performed in patients with minor strokes and transient ischemic attacks (TIAs) to prevent further strokes. However, most operators do not intervene in older adults. We had a 92-year patient with recurrent minor strokes with two possible proximate causes – cardioembolism and significant symptomatic left carotid stenosis. This patient continued to have recurrent ischemic events in the left carotid territory despite optimum management of the cardioembolic source with dual antiplatelets and anticoagulation and was successfully treated with left CAS. The role of carotid revascularization in older patients with high-grade symptomatic carotid stenosis and cardiac comorbidities is discussed.

Keywords: Carotid stenosis, carotid stenting, dual etiology of stroke, stroke in older adults

Case Presentation

A 92-year hypertensive lady who was active and independent, with a history of intermittent sinus bradycardia, presented 3 h after acute onset of right hemiplegia and motor aphasia. There were no strokes or transient ischemic attacks (TIAs) in the past. At presentation, her blood pressure was 174/100 mm Hg, and her pulse was irregular at 74/min. The electrocardiogram (ECG) showed normal sinus rhythm, left bundle branch block, and frequent premature ventricular contractions.

Her National Institutes of Health Stroke Scale (NIHSS) was 12. Computed tomography (CT) of the brain did not show bleed or early ischemic changes, and angiography showed significant left carotid artery stenosis [Figure 1]. She was thrombolysed with 12.5 mg of intravenous tenecteplase, following which there was a significant improvement in NIHSS from 12 to 4 with complete recovery of aphasia. She was started on 75 mg of enteric-coated aspirin 24 h later. While she was being considered for carotid stenting, she developed acute onset aphasia 3 days after the index event. Magnetic resonance imaging (MRI) Brain revealed fresh infarcts [Figure 2]. In addition to 75 mg of aspirin, clopidogrel 75 mg was added. There were no thrombi on transthoracic echocardiography; she had concentric left ventricular hypertrophy with an ejection fraction of 50%. Holter monitoring showed a baseline left bundle branch block, with first-degree atrioventricular block and frequent sinus pauses, the longest pause being 3.2 s. On day 5 after the stroke, the patient had angina pectoris with elevated troponin, suggesting a non-ST elevation myocardial infarction. She was started on enoxaparin 60 mg twice a day. Coronary CT angiography revealed extensively thick coronary calcification.

Diagnostic Issues In Our Case

Since the patient had recurrent strokes corresponding to the left carotid territory with significant left carotid stenosis, the likely stroke subtype was large artery atherosclerosis with artery-to-artery embolism. However, as she had bi-hemispheric infarcts on imaging, a more proximal cause of stroke, such as a cardioembolism, was also considered. The Trial of Org 10172 in Acute Stroke Treatment (TOAST) classification of stroke, in this case, was a stroke of undetermined cause as she had at least two obvious causes of stroke – heart block as well as significant carotid stenosis. One of the most glaring fallacies of the TOAST classification system is the failure to reliably demonstrate causality. Overall inter-rater agreement for the TOAST system is regarded as moderate, with reliability being low for small vessel disease and stroke of undetermined cause.[1] Despite being on dual antiplatelets along with anticoagulation and statins, she had recurrent cerebral ischemic events corresponding to the left carotid territory. So, carotid stenosis could have been the most plausible cause.

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**Therapeutic Challenges in Our Case**

The patient was elderly, had tortuous arterial anatomy, and was technically a challenging case for carotid stenting. Since the patient had a peri-procedural risk of complete heart block, the procedure was planned under monitored anesthesia care with temporary pacemaker backup. Carotid stenting could also be complicated by peri-procedural bradycardia and hypotension due to carotid body compression during the dilatation and stent deployment.\(^2\)

**Hospital Course and Management**

Since the patient had recurrent left-hemispheric TIAs despite optimal management of cardioembolic stroke, it was highly likely that the carotid stenosis was significantly contributing to the pathogenesis of the stroke. Her NIHSS pre-stenting was 6. The pros and cons were discussed with the family, and she successfully underwent left carotid artery stenting (CAS) [Figure 3] 15 days after the index event under close monitoring by the anesthesiology and cardiology team. During the procedure, she had a transient episode of sinus bradycardia (heart rate 40/min), which recovered with 0.6 mg of intravenous atropine and went into hypotension (treated with a noradrenaline infusion), which resolved in 48 h. A catheter-related urinary tract infection complicated hospital stay. She was discharged 21 days after the index event with only mild dysarthria and right-sided facial weakness with no further episodes.

**Discussion**

Atherosclerotic carotid artery disease is responsible for 20% of all strokes and is seen typically at the bifurcation of internal and external carotid arteries. In patients with crescendo TIAs and recurrent strokes with significant carotid stenosis, carotid revascularization in the form of carotid endarterectomy (CEA) or CAS done within 2 weeks is effective in preventing further strokes.\(^3\) The quandary between CEA and CAS becomes more relevant in special populations like the elderly, where complex arterial anatomy and comorbidities make the patient more liable for peri- and post-procedural complications. In our patient, underlying sick sinus syndrome and recent myocardial infarction tipped the scales in favor of CAS.

**Recommendations for treatment**

Society for Vascular Surgery Guidelines 2011, and European Society for Vascular Surgery (ESVS) Guidelines 2017 prefer CAS over CEA for symptomatic carotid stenosis in patients with comorbidities who are surgically at high risk. However, the ESVS Guidelines 2017 recommends that CAS be considered in centers where the documented procedural death/stroke rate is <6%. American Stroke Association 2014 Guidelines recommend that CAS may be used in symptomatic patients at average/low risk of peri-procedural complications with stenosis of >70% on non-invasive imaging or >50% by catheter-based imaging or non-invasive angiogram and perioperative risk is low. The patient’s age and surgical risk are important considerations while making the decision. National Institute of Health and Care Excellence (NICE) 2011 Guidelines are ambiguous and state that CAS can be supported if arrangements are in place.\(^4\)

**Evidence in context**

Abiko *et al*.\(^5\) conducted a retrospective analysis of 97 patients >70 years (divided into octogenarians and non-octogenarians) who underwent CAS, and the success rate was found to be 100% with no major adverse cardiovascular events (MACE) at 30 days. Vulnerable plaques were seen in 50% (15/30 patients) and 26.9% (18/67 patients) of

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*Figure 1: Non-contrast computerized tomography (NCCT) head (a) shows confluent hypodensities in both periventricular white matter (arrows) suggestive of small-vessel ischemic changes. CT angiography (b and c) showed diffuse atherosclerotic disease in the arch of the aorta and calcified plaques; 20% eccentric stenosis of left common carotid artery (arrow in b) and 80% stenosis of the left carotid bulb (arrowhead in b and c)*

*Figure 2: Axial Flair (a) shows confluent hyperintensities in both periventricular white matter suggestive of small-vessel ischemic changes. Axial diffusion-weighted imaging (DWI) MRI Brain images (b–d) show focal areas of diffusion restriction in left corona radiata (arrow in b), left centrum semiovale (arrow in c) and right subcortical white matter (arrow in d), suggesting acute infarcts*
octogenarian and non-octogenarian groups, respectively (P=0.047).⁵ Feng et al.⁶ conducted a retrospective analysis of 1029 elderly patients >70 years who underwent CAS, where post-op major adverse cardiac events (MACE) was 3.01%. Risk factors associated with an increased risk of MACE included a family history of stroke, symptomatic status, and an mRS >3. Another comparative study comparing patients older than 75 years with those younger found no significant differences in outcomes or adverse effects.⁷

There were several high-risk factors for MACE in our patient, such as older age, sick sinus syndrome, and recent myocardial infarction. However, since the patient had multiple acute ischemic events corresponding to the left carotid territory with rapid recovery despite being on optimum medical management of the cardioembolic stroke, it was likely that carotid stenting would lead to significant benefit for her if it were the cause of the strokes. On the other hand, it was also likely that the cause of stroke in this patient was cardioembolism, and in such a case, the stenting was unlikely to prevent the recurrence of stroke.

Diagnostic dilemma and a therapeutic challenge

As is the usual case in medicine, the answer to such complex questions might not be available at the outset. A therapeutic trial of stenting could be offered in such circumstances after explaining the uncertainty, risks and benefits to the patient and the family. However, it is important to be highly vigilant during the procedure and be prepared for adverse events such as cardiac events and stroke peri-procedurally.

Our center is a high-volume center for CAS with a low peri-procedural stroke or death rate. However, she was taken up for left CAS since she continued to have recurrent ischemic events in the territory corresponding to the carotid stenosis despite the best medical management for cardioembolism with dual antiplatelets, anticoagulant, and statins after a comprehensive discussion with the family members.

A careful selection of patients and multi-disciplinary collaboration by experienced operators with anticipation and preparedness for eventualities can lead to successful revascularization.

**Key Points**

- Age alone should not be a deterrent to performing carotid stenting even in a nonagenarian patient
- Carefully selected patients can successfully undergo carotid revascularization by stenting.
- Stroke of undermined etiology with carotid stenosis in the presence of other possible sources such as cardioembolism may need to be treated with CAS after full disclosure.
- Appropriate risk stratification and multi-disciplinary collaboration, including interventional neuro-radiology, cardiology, neuro-anaesthesiology and neurology, is paramount in ensuring a good outcome.

**Ethical approval information**

Ethical approval not needed for individual case reports; patient informed written consent obtained.

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**Conflicts of interest**

There are no conflicts of interest.

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