Case in Point

Percutaneous Endovascular Treatment of Subclavian Steal Syndrome

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Many patients with this condition—particularly elders—may have contraindications to surgical revascularization. Fortunately, there's a less invasive option that's also effective.

Subclavian steal syndrome (SSS) occurs when occlusive disease of the subclavian artery at the origin of the vertebral artery—usually atherosclerotic in nature—reduces blood flow to the arm and creates a negative pressure situation that "steals" blood from the contralateral vertebral artery, thus compromising circulation to the brain and causing such neurologic symptoms as dizziness, vertigo, and syncope. Although it's relatively rare, SSS is more likely to occur in patients who are male or older than 50 years.[1]

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When symptoms of SSS become debilitating, intervention is required. Ideally, patients with such severe disease would receive surgical revascularization. But for elders and others with contraindications to surgery, this may not be advisable. That's why, in recent years, less invasive options have come to the forefront of SSS management.

In this article, we report on the case of an elderly woman whose SSS resolved following a percutaneous endovascular procedure.

INITIAL EXAM

An 87-year-old woman presented to a cardiovascular clinic with recurrent dizziness, vertigo, and weakness in her left arm. The weakness occurred when she used that arm more than her right, which had a painful prosthetic elbow. Her medical history included type 1 diabetes mellitus, hypertension, and a previous myocardial infarction. In addition, she had undergone reverse saphenous vein bypass grafting from the aorta to the superior mesenteric artery five years before to correct mesenteric ischemia secondary to severe narrowing of the superior mesenteric artery at its origin.

Physical examination revealed the absence of both the left brachial and left radial pulses with no evidence of rest ischemia. Blood pressure was 170/80 mm Hg in the right arm and 110/70 mm Hg in the left arm. A loud bruit with systolic and diastolic components was audible in the left supraclavicular fossa.

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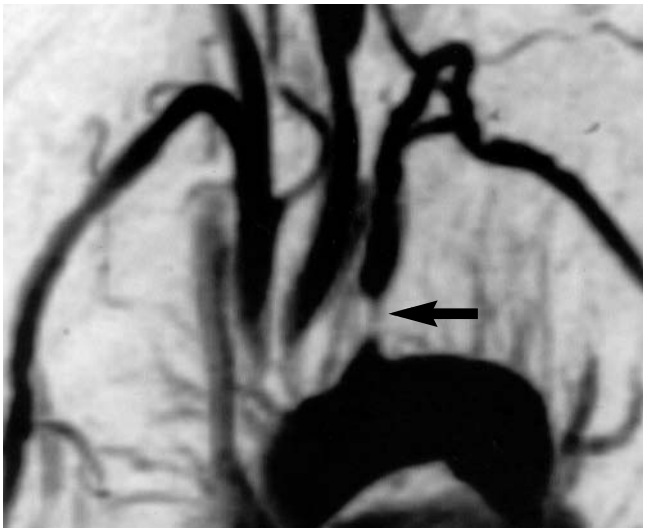

Figure 1. Magnetic resonance angiography of the aortic arch, showing 80% stenosis at the origin of the left subclavian artery (arrow). (Narrowing of the origins of the right innominate and left carotid arteries are related to slice selection rather than to true stenosis.)

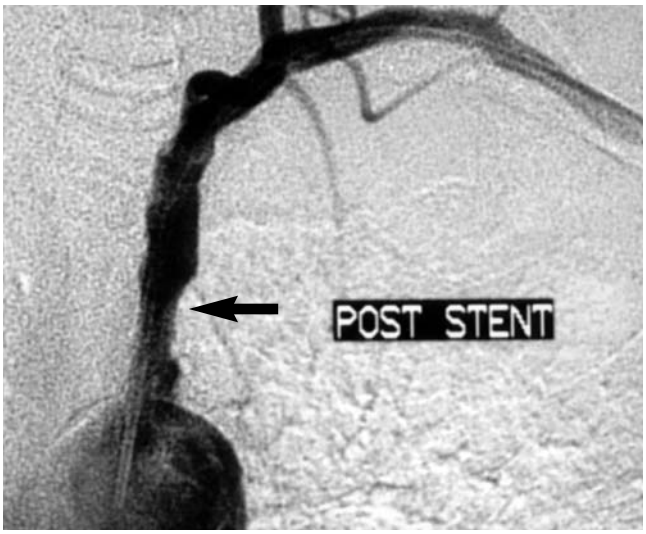

Figure 2. Digital subtraction angiography of the left subclavian artery following stent placement. The widely patent stent (arrow) has relieved stenosis effectively.

Magnetic resonance angiography (MRA) of the aortic arch showed 80% stenosis at the origin of the left subclavian artery (Figure 1). This finding, along with the patients' symptom profile and physical exam results, suggested a diagnosis of SSS.

TREATMENT COURSE

The patient declined surgical intervention but agreed to undergo percutaneous angioplasty and stent deployment on an outpatient basis. An 8-mm balloon dilation of the 40-mm Corinthian stent (Cordis Corporation, Miami Lakes, FL) was placed in the left subclavian artery at the site of stenosis.

Digital subtraction angiography of the left subclavian artery performed immediately following stent placement showed a widely patent stent (Figure 2). No new neurologic symptoms developed either during or immediately after the procedure. The patient was prescribed a four-week course of aspirin 325 mg/day and clopidogrel bisulfate 75 mg/day.

On clinical follow-up three months later, the patient's dizziness, vertigo, and left arm weakness had resolved. The left brachial and left radial pulses were present and equivalent to those on the right side, and there was only a 10-mm difference in systolic blood pressure between the left and right arms. The supraclavicular bruit had diminished markedly.

ABOUT THE CONDITION

In 1961, Reivich and colleagues first described a reversal of blood flow through the vertebral artery and its effect on cerebral circulation in two patients with stenosis of the left subclavian artery proximal to the origin of the vertebral artery.[2] Arteriography demonstrated flow reversal as a result of blood pressure distal to the area of stenosis dropping to a level below that found at the vertebrobasilar junction, thus reversing the pressure gradient. The patients had symptoms of vertebrobasilar insufficiency that appeared with use of the affected extremity, decreases in blood pressure in the same extremity, and a bruit over the involved subclavian artery. The authors studied pathophysiologic changes in blood flow in the carotid and vertebral arteries after producing experimental proximal stenosis of the subclavian artery in dogs.

Four years later, in 1965, Patel and Toole delineated various causes responsible for SSS, based on their review of 125 patients with the condition (Table).[3] Overall, the origin of SSS most frequently is atherosclerotic.

Diagnosis

The typical symptom complex is dizziness, vertigo, syncope, tinnitus, drop attacks, ataxia, and blurred vision. Exercise or frequent use of the

Table. Causes of subclavian steal syndrome[3]

Congenital
- Subclavian artery aplasia
- Coarctation of the aorta
- Complete interruption of the aortic arch

Acquired
- Takayasu's arteritis
- Atherosclerosis
- Iatrogenic (Blalock-Tussig shunt)

affected extremity usually precipitates these symptoms. Occasionally, symptoms may be triggered by turning the head or sitting up suddenly.

The key signs in recognizing SSS are (1) unequal peripheral pulses and systolic pressure between the two arms and (2) thrill or bruit over the path of the affected section of the subclavian artery.[2] Clinicians can elicit these signs and symptoms by exercising the affected arm, but this practice should be used judiciously and only when a strong suspicion is combined with an unclear clinical picture.[3]

The most useful diagnostic test for SSS is noninvasive MRA, which can be performed on an outpatient basis—as was the case with our patient. Catheter-based angiography may be necessary if delineation of posterior circulation is inadequate. When the patient has subclavian artery stenosis distal to the orifice of the vertebral artery, angiography does not show reversal of blood flow.[4]

Treatment

Reconstructive surgery is the definitive therapy for patients with SSS whose symptoms recur. Possible procedures include thromboendarterectomy, aortosubclavian bypass, direct transposition of the subclavian artery to the common carotid artery, subclavian-carotid bypass, and ipsilateral vertebral artery ligation.

Of these revascularization procedures, end-to-side transposition of the subclavian artery to the carotid artery is preferred most often. In a retrospective review of 190 patients who underwent surgical revascularization for proximal subclavian stenosis at a single specialty surgical clinic over the course of 25 years, Edwards and colleagues reported a four-year patency rate of 99.4% and an operative mortality rate of 1.1% among those who had subclavian carotid transposition.[5] In contrast, the patency rate of autologous saphenous vein graft for subclavian-carotid bypass is only 65%.[5]

The morbidity and mortality associated with thoracotomy is particularly grave in elders. And though this type of incision can be avoided by using a supraclavicular approach for subclavian carotid transposition (which can be done with relative ease on either the right or the left side), the potential risks of any surgical revascularization may outweigh the benefits for many older patients. For this reason, percutaneous endovascular techniques may be preferred.

Percutaneous transluminal angioplasty (PTA) of the subclavian artery has been performed since 1980. Most reported case series of subclavian PTA have been limited to about 50 to 55 patients.[6] In one such study, the procedure had an initial technical success rate of about 90% and a complication rate of about 10%.[6] The rate of restenosis at a follow-up of two to 90 months was 14%.[6] Stent placement following PTA often improves these results further, as it did for our patient.

To date, no randomized trials have compared surgery and PTA for SSS. Nevertheless, PTA has become many clinicians' first choice of therapy because of reduced morbidity, mortality, length of hospital stay, and cost. ●

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