Subclavian steal and rest pain in a case of brachiocephalic artery occlusion

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A patient with multiple vessel disease presented with symptoms of significant bilateral upper extremity pain and weakness that was more significant on the right side. On carotid duplex scanning, brachiocephalic artery occlusion with retrograde flow was noted through the right common carotid and right vertebral arteries at rest. Furthermore, 50% to 90% occlusion of the left internal carotid was noted. Filling of the right subclavian artery was noted to be through

the right vertebral and right common carotid arteries. Unlike isolated subclavian steal syndrome, brachiocephalic artery occlusion induces significant hemodynamic alterations in extracranial arterial flow, which normally produces no symptoms at rest, but may produce symptoms with exercise. The occurrence of subclavian steal phenomenon in the presence of brachiocephalic occlusion is extremely rare. The present case is the first to report a patient presenting with bilateral upper extremity rest pain in the presence of brachiocephalic artery occlusive disease.

Key Words: Arm pain; Carotid ultrasound; Subclavian steal

The most typical presentation of atherosclerotic vascular disease is carotid stenosis (1). Atherosclerotic occlusive disease of the brachiocephalic artery is far less common, comprising less than 2% of all extracranial causes of cerebrovascular insufficiency (2,3). While uncommon, brachiocephalic occlusion threatens both cerebrovascular and upper extremity ischemia (4,5). Common symptoms associated with brachiocephalic stenosis include visual disturbances, upper extremity pain with movement and transient ischemic attacks. Subclavian steal syndrome may also occur with occlusive lesions of the brachiocephalic artery (6). Most often, upper extremity claudication occurs on the side of the lesion after exercise of the extremity. We encountered an unusual case of bilateral upper extremity pain that occurred at rest and was more marked on the right side. In this patient, the only cerebral supply was offered by a moderately stenosed left carotid artery and the left vertebral artery.

CASE PRESENTATION

A 72-year-old woman with a medical history significant for hypertension, coronary artery disease, myocardial infarction and right subclavian stenosis presented with bilateral upper extremity pain and weakness for a number of years that was significantly greater in the right arm than in the left. The patient described 'cramping', dull, achy pain that was present constantly, and was exacerbated by exercise and unrelieved by over-the-counter pain medications. The patient had no focal neurological deficits, dizziness or amaurosis fugax. Her physical examination was remarkable for a bruit in the left carotid artery and a higher systolic blood pressure (difference of 20 mmHg) in the left arm than in the right arm (blood pressure was 90/50 mmHg in the left arm and 70/40 mmHg in the right arm). Pulses were noted to be mildly reduced in the right

arm compared with the left arm. The patient's physical examination was otherwise unremarkable.

The patient had a carotid duplex scan, which demonstrated 80% stenosis of the left internal carotid artery and a hemodynamically insignificant stenosis of the right internal carotid artery. Furthermore, retrograde flow suggestive of brachiocephalic artery stenosis was demonstrated in the right common carotid, right internal carotid and right vertebral arteries. Follow-up computed tomography with three-dimensional reconstruction revealed opacification of the right brachiocephalic artery. The reconstruction also demonstrated retrograde filling of the right carotid and vertebral arteries and filling of the right subclavian from the vertebral artery. Furthermore, computed tomography of the thorax with intravenous contrast demonstrated occlusion of the brachiocephalic artery with no clear opacification of the right common carotid. There was also opacification of the right vertebral artery, presumably due to retrograde filling of the artery. After discussion of endovascular and surgical treatment options, the patient opted for conservative treatment.

DISCUSSION

Occlusive disease of the brachiocephalic artery is relatively rare (2,3). Symptoms related to brachiocephalic disease are usually related to ischemic changes in downstream organs, especially the retinae and upper extremities. There is also a higher incidence of transient ischemic attacks in these patients (7,8). Patients with atherosclerotic disease often present with multiple arterial diseases, as was the case in our patient.

Only 1.5% to 2% of occlusive cerebrovascular deficits are due to occlusive extracranial lesions caused by stenosis of the brachiocephalic artery (1,2). Upper extremity claudication is usually associated with greater degrees of stenosis and is usually

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unilateral, involving the right arm secondary to decreased blood flow through the right subclavian artery (6). In one case series (3), it was noted that some patients had filling of the right subclavian artery through steal from either the right internal carotid or right vertebral artery.

Occlusion of the brachiocephalic artery secondary to atherosclerotic disease may result in a number of hemodynamic changes to maintain blood flow (9,10). In the present patient, there was occlusion of the brachiocephalic and left common carotid arteries. On carotid duplex scanning, incidental retrograde flow was noted through the right vertebral, internal carotid and common carotid arteries. These noted defects had associated symptoms of bilateral upper extremity rest pain, which were more marked in the right arm, but no additional neurological or functional deficits except for a past cerebellar infarct noted on magnetic resonance imaging. A recent study (11) suggested there is a distinctive pattern of hemodynamic alterations in brachiocephalic artery stenosis in which reversed or bidirectional flow may be seen in the right vertebral artery, and the presence of midsystolic deceleration in branches of the right carotid system. Uncommonly in these patients, complete reversal in both the right carotid and right vertebral arteries may be seen.

In one case series (12) involving 20 patients with brachiocephalic artery lesions, it was noted that only one of 12 patients with a 40% to 80% narrowed diameter of the brachiocephalic artery presented with right upper extremity pain. Most of these patients developed pain with exercise of the arm. Of eight patients with 80% to 100% stenosis in this case series, six were shown to have right upper extremity pain with exercise (11). There are no reported cases in the English literature of rest pain in a patient with brachiocephalic artery stenosis.

Subclavian steal in the presence of occlusion of the brachiocephalic artery has been noted in previous case reports; however, it is relatively rare (6). The presence of filling of the right subclavian artery through both the right common carotid and right vertebral arteries has not been reported in the English literature. The insufficient blood flow to the right arm was noted clinically in the context of the present patient's rest pain. Pain in the left arm was likely due to a relative steal from the left subclavian artery to maintain cerebral perfusion and contribute to filling of the right subclavian artery, especially in the context of the patient's moderate left carotid stenosis.

In summary, a unique case of brachiocephalic artery stenosis with subclavian steal presenting with bilateral upper extremity rest pain was presented.

REFERENCES

1. Law MM, Colburn MD, Moore WS, Quinones-Baldrich WJ, Machleder HI, Gelabert HA. Carotid-subclavian bypass for brachiocephalic occlusive disease; Choice of conduit and long-term follow-up. *Stroke* 1995;26:1565-71.
2. Wylie EJ, Effenev DJ. Surgery of the aortic branches and vertebral arteries. *Surg Clin North Am* 1979;59:669-80.
3. Damme HV, Caudran D, Defraigne JO, Limet R. Brachiocephalic arterial reconstruction. *Acta Chir Belg* 1992;92:37-45.
4. Ruebben A, Tettoni S, Muratore P, et al. Feasibility of intraoperative balloon angioplasty and additional stent placement of isolated stenosis of the brachiocephalic trunk. *J Thorac Cardiovasc Surg* 1998;115:1316-20.
5. Sasaki T, Ogasawara K, Konno H, Suzuki M, Ogawa A. Improvement of visual function after balloon angioplasty for innominate artery stenosis: A case report. *No Shinkei Geka* 2000;28:1101-4.
6. Hirose H, Takagi M, Kugimiya T. Subclavian steal syndrome secondary to isolated innominate artery stenosis possibly due to fibromuscular dysplasia: A case report. *Vascular Surgery* 1999;33:711-6.
7. Kieffer E, Sabatier J, Koskas F, Bahnini A. Atherosclerotic innominate artery occlusive disease: Early and long-term results of surgical reconstruction. *J Vasc Surg* 1995;21:326-37.
8. DeBakey ME, Crawford ES, Morris GC, Cooley DA. Surgical considerations of occlusive disease of the innominate, carotid, subclavian, and vertebral arteries. *Ann Surg* 1961;154:698-725.
9. Azakie A, McElhinney DB, Higashima R, Messina LM, Stoney RJ. Innominate artery reconstruction: Over 3 decades of experience. *Ann Surg* 1998;228:402-10.
10. Kempczinski R, Hermann G. The brachiocephalic steal syndrome. *J Cardiovasc Surg* 1979;20:481-6.
11. Grant EG, El-Saden SM, Madrazo BL, Baker JD, Kliever MA. Innominate artery occlusive disease: Sonographic findings. *Am J Roentgenol* 2006;186:394-400.
12. Grosveld WJ, Lawson JA, Eikelboom BC, Windt JM, Ackerstaff RG. Clinical and hemodynamic significance of innominate artery lesions evaluated by ultrasonography and digital angiography. *Stroke* 1988;19:958-62.