

Case Report

Endovascular treatment of subclavian artery stenosis complicated with subclavian artery aneurysms: a case report

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Abstract: Subclavian steal syndrome is a constellation of signs and symptoms caused by retrograde flow of blood in the vertebral artery due to ipsilateral arm exercise or exertion. In this study, we reported a case with symptoms of subclavian artery stenosis and subclavian artery aneurysms. Angioplasty and stenting were applied to treat the subclavian artery stenosis and subclavian artery aneurysms. After treatment, the symptoms were ameliorated with excellent recovery. A long-term therapeutic effect was also confirmed. Through this study, we believe that the right subclavian artery aneurysms would result in greater flow after treatment of the ipsilateral subclavian artery stenosis.

Keywords: Subclavian steal syndrome, stenosis, aneurysms, endovascular treatment

Introduction

Subclavian steal syndrome is a constellation of signs and symptoms that arise from retrograde flow of blood in the vertebral artery due to ipsilateral arm exercise or exertion. The symptoms, including diplopia, dizziness, vertigo, syncope and dysarthria, are indications of vertebrobasilar ischemia caused by diminished blood pressure due to a proximal stenosis or occlusion of the subclavian artery [1]. The risk factors for subclavian steal syndrome are thus similar to those of atherosclerotic diseases including smoking, hyperlipidemia, hypertension, diabetes mellitus, family history and aging process. Patients older than 50 years are more likely to have subclavian steal syndrome, possibly due to the increased atherosclerosis in this age phase. Here, we reported a case of right subclavian artery stenosis associated with subclavian artery aneurysms with symptoms of subclavian steal syndrome. The successful angioplasty and stenting of a right subclavian artery stenosis were reported.

Illustrative case

The patient was a 73-year-old man whose chief complaint was paroxysmal vertigo attack for a

month when he exercised his right upper extremity. The symptoms lasted for a few seconds to 2-3 minutes. The patient appeared with diplopia and instability of gait, and the symptoms were relieved when the patient had a rest. There was no history of hypertension, diabetes, hyperlipidemia, traumatic lesions and smoking with this case. During the examination, his consciousness and speech were normal, without any dysarthria. Muscle tone and power in his extremities were normal and the plantar responses were flexor. His right radial pulse was feeble and significantly different from the left one, with an obvious difference in blood pressure (right arm 106/62 mmHg and left arm 144/70 mmHg). The peripheral pulses in the lower extremities were normal. Blood work was within the normal range. The chest X-ray was normal. The computed tomography (CT) angiography demonstrated a right proximal subclavian artery stenosis associated with subclavian artery aneurysms and the ostia of right vertebral artery exactly located in the aneurysms. Left vertebral artery was the prominent vessel compared with the right vertebral artery (**Figure 1**). The angiography of ascending aortic artery revealed that the right proximal subclavian artery stenosis was associated with aneurysm. The contrast medium only reached the V2 seg-

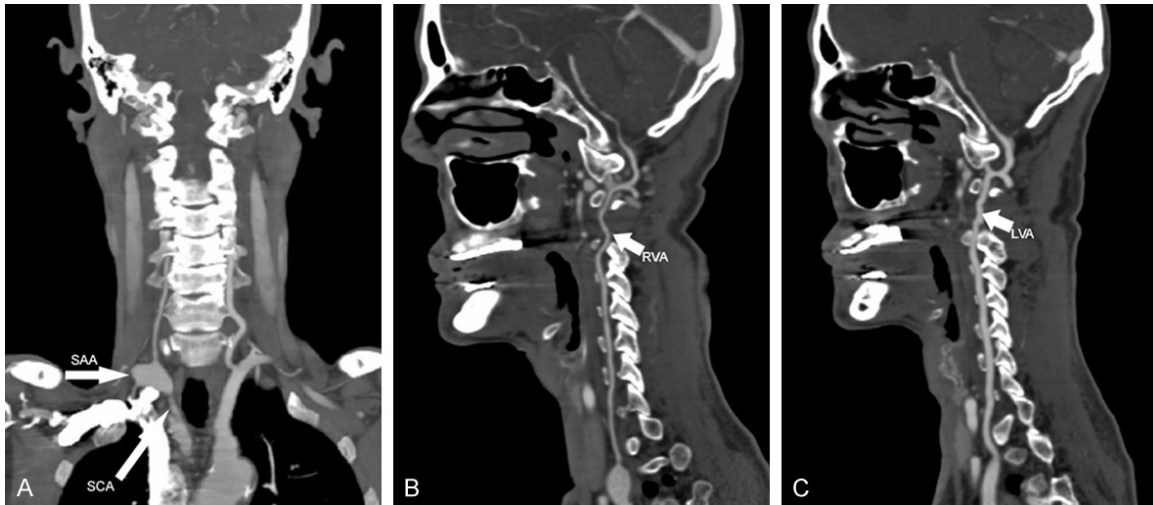


Figure 1. CTA demonstrated a right proximal subclavian artery (SCA) stenosis associated with subclavian artery aneurysms (SAA), the ostia of right vertebral artery (RVA) exactly located in the aneurysms. The left vertebral artery (LVA) is the prominent vessel compared with the RVA (A-C).

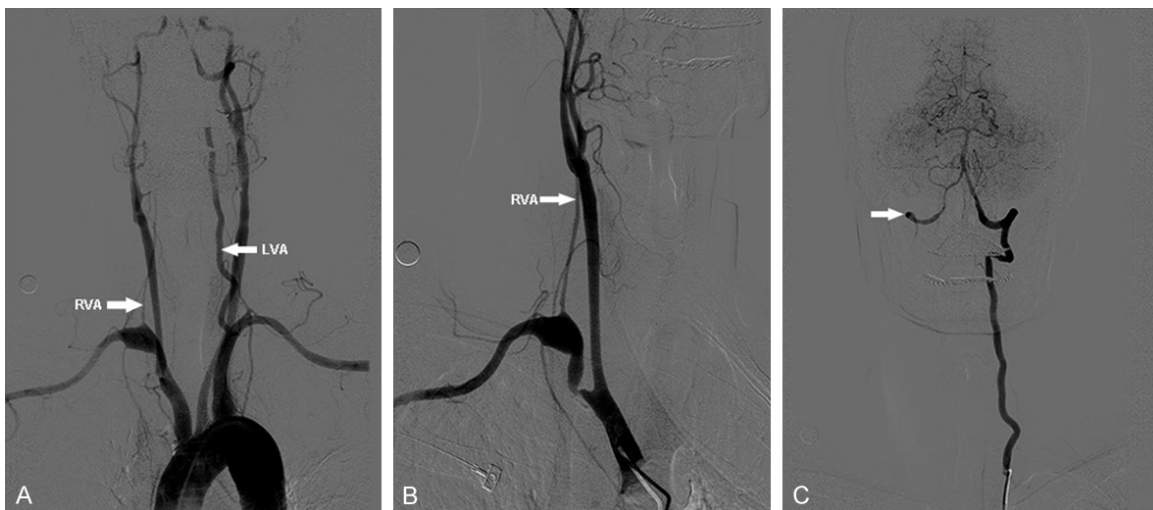


Figure 2. The angiography of ascending aortic artery demonstrated the (left vertebral artery) LVA is the prominent vessel compared with the right vertebral artery (RVA) (A). The Digital subtraction angiography showed the contrast medium only reach the V2 segment of RVA (B). The entire LVA was well visualized. Retrograde flow enables the visualization of the contralateral vertebral artery (C, arrow).

ment of right vertebral artery and retrograded flow through V4 segment of left vertebral artery which suggest a subclavian steal syndrome (**Figure 2**). The primary view is to treat the subclavian artery stenosis in order to alleviate the vertigo. However, we thought that after treatment of the subclavian artery stenosis would improve the blood flow and increase the rupture risk of adjacent subclavian artery aneurysms. Considering subclavian steal syndrome and rupture of subclavian artery aneurysm, a decision was made to treat the subclavian

artery stenosis and subclavian artery aneurysms with angioplasty and stenting.

Procedure

Arteriotomy of the right femoral artery was performed using a modified Seldinger technique. With fluoroscopic guidance, an 8F guiding catheter was positioned to the brachiocephalic trunk over MPA catheter (Cordis) and 0.035 guidewire (Terumo Interventional Systems, Tokyo), adjoining the proximal of the subclavi-

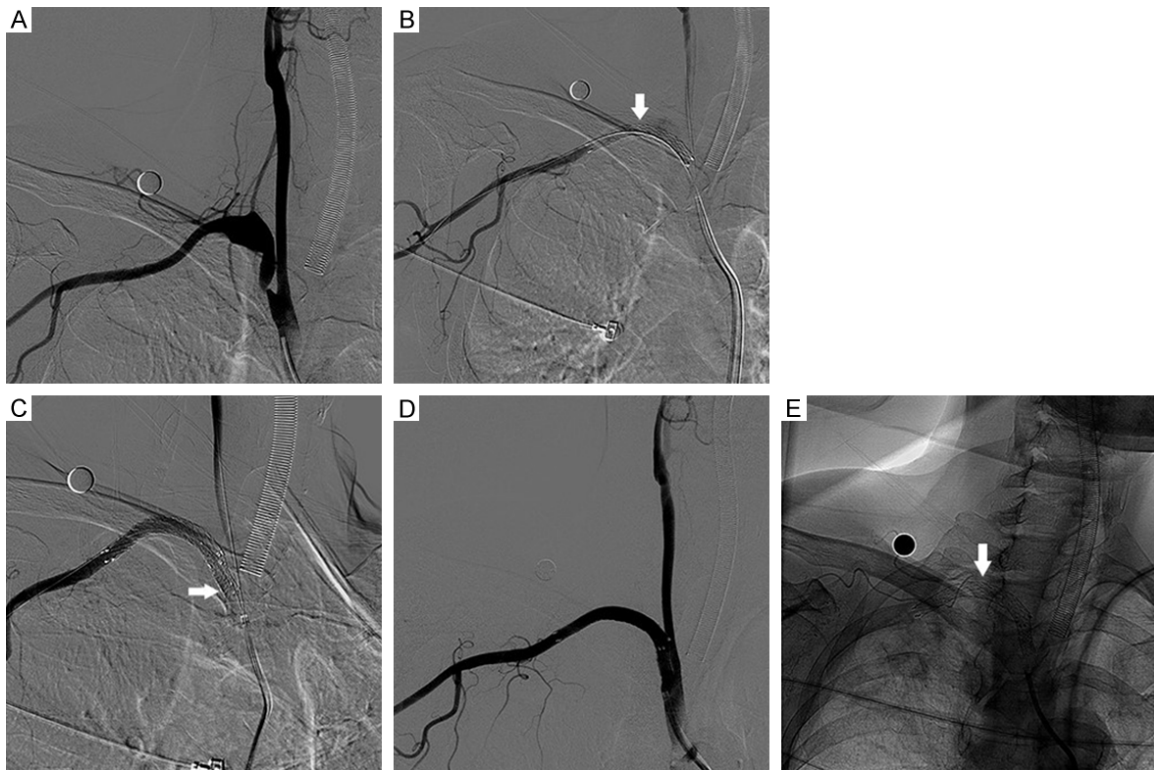


Figure 3. The digital subtraction angiography demonstrated a right proximal subclavian artery stenosis associated with subclavian artery aneurysms and the ostia of right vertebral artery exactly located in the aneurysm (A). An 8 mm × 60 mm Fluency plus vascular stent graft was selected for treatment of subclavian artery aneurysms (B, arrow). A 7 mm × 19 mm balloon stent was selected for treatment of subclavian artery stenosis (C, arrow). Angiography following angioplasty and stenting demonstrates the correction of stenosis and disappearance of the aneurysm (D). The chest X-ray showed the location of the expanded stent (E, arrow).

an artery stenosis. After that, a 0.014 guidewire was positioned to the right external carotid artery. Another 0.014 guidewire was superiorly selected through the stenosis and aneurysm for stenting. Taking into consideration the extent of aneurysm (3.5 mm × 30 mm) and caliber of the artery proximal (6.28 mm) and distal (7.06 mm) to the aneurysm, an 8 mm × 60 mm Fluency plus vascular stent graft (Boston Scientific, Natick, MA) was selected. At the same time, considered that the extent of stenosis and caliber of the artery distal was less than 8 mm, a 7 mm × 19 mm (Biotronik AG) balloon stent was selected for treatment of stenosis. Using fluoroscopy and roadmap guidance, the graft stent was positioned across the aneurysm and then the balloon stent was positioned across the stenosis. After stenting, the angiography of brachiocephalic trunk was performed again to confirm the correction of stenosis and disappearance of the aneurysm (**Figure 3**). The arteriotomy site was then closed with an 8 Fr angioseal. After overnight staying in neuroin-

tensive care unit where he received 900 international units heparin per hour for 12 h, the patient was discharged home on clopidogrel and ticlopidine (for 4 weeks).

Discussion

For patients with only isolated symptoms, conservative treatments alone are firstly recommended, involving reducing the risk for subclavian arterial atherosclerosis and giving antiplatelet drug and statins [2]. Unfortunately, the patient's symptoms were not alleviated at all after one month conservative treatments. The recurrent episodes seriously influence the patient's life quality and induce considerable anxiety. It is necessary to provide a further treatment to alleviate the vertigo. The techniques which were effective to treat atherosclerotic occlusive and lesions include the open surgical options such as bypass grafting, or endovascular treatments using angioplasty and stenting. However, each method has par-

ticular advantages and specific potential complications. In recent years, the development of endovascular therapy has fundamentally changed the management of subclavian steal syndrome patients. Similar clinical outcomes to open surgical methods can now be achieved with minimal risks under local anesthesia [3, 4]. Considering the patient's age and the degree of stenosis, we thought that the endovascular repair appeared to be the preferred treatment.

However, subsequent question is how to deal with the subclavian artery aneurysms presented without symptoms. Aneurysms involving the peripheral arteries, subclavian artery aneurysms are relatively rare and have various causes [5]. Atherosclerotic vascular disease is the most common cause of both the artery stenosis and the fusiform aneurysms. Subclavian artery aneurysms occur more frequently on the right side but may also develop bilaterally. Frequent symptoms include upper chest and shoulder pain, numbness, and coldness of the upper extremity due to ischemia injury [6]. In our case, no sign or symptoms are displayed.

A aneurysm presented in this report has a proximal stenosis to the aneurysm, although it is unclear whether the close proximity of the stenosis to the aneurysm is only coincidental [7]. It is well known that the wall shear stress plays a very important role in atherosclerosis. Computer simulation models have displayed the growth of fusiform aneurysm coincided with location of high hemodynamic impact, however, it remains unclear whether hemodynamic forces is responsible for aneurysm growth and ultimate rupture [8]. Fusiform aneurysms may be initiated by some local weakness in the arterial wall, with the results of low wall shear stress causing an interruption of the normal protective function of the endothelium. The vessel wall was exposed to persistent hemodynamic stress resulting in fusiform aneurysm [9, 10]. On the other hand, one possible treatment of fusiform aneurysms is to attempt to reduce the hemodynamic forces acting on the aneurysm by sacrificing a proximal supplying artery [11]. That, in turn, is good evidence of hemodynamic forces playing an important role in aneurysm growth.

Based on above studies, we believe that the right subclavian artery aneurysms would prog-

ress resulting in greater flow after treatment of the ipsilateral subclavian artery stenosis. The indication for exclusion of subclavian artery aneurysms is usually based on prevention of upper limb thrombosis, embolisation and rupture. The occurrence of complications depends on various aneurysm-related characteristics, including its etiology and localization. Proximal and mid-clavicular aneurysms had a higher incidence of rupture, when compared to distal aneurysms. As a result of the complication risk, prompt diagnosis and treatment are required [12]. Compare to surgery treatment, endovascular treatment appears to be the preferred choice, due to a lower rate of cardiopulmonary complications. More important, the patient can be treated with subclavian artery stenosis and aneurysms at the same time.

However, the stent placement of aneurysms presents the danger of occluding the right vertebral artery inevitably that will give rise to two different results. If the flow in the contralateral vertebral artery is enough to supply the vertebrobasilar system, the patient's symptom of vertigo will be alleviated because the steal phenomenon has been solved. On the contrary, if the flow in the contralateral vertebral artery is not abundant, the patient's symptom will get worse. Fortunately, we found the contrast medium only reach the V2 segment of right vertebral artery and no stenosis in the left vertebral artery in angiography. Therefore, treating the subclavian artery aneurysms and sacrificing the ipsilateral vertebral artery are the better therapeutic schedule. We also anticipate that the patient's symptom of vertigo may be alleviated because the abnormal flow has been addressed. The same was supported by the fact that the patient's symptoms resolved once the subclavian stenosis and aneurysms were treated. Taking into account of the patient's recurrent symptoms and the presence of stent, we place the patient receiving stents on 4 weeks of aspirin (100 mg/d) and clopidogrel (75 mg/d), followed by clopidogrel alone.

Conclusion

This case demonstrates the successful angioplasty and stenting of a right subclavian artery stenosis associated with subclavian artery aneurysm. The long-term therapeutic effect was also confirmed because the patient has remained asymptomatic in the following two years.

Disclosure of conflict of interest

None.

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