

## Subclavian Steal in a Patient With Hemodialysis Access in the Left Arm

Yasushi Shibata, MD, PhD

1 Department of Neurosurgery, Mito Medical Center, Mito Kyodo General Hospital, University of Tsukuba, Miyamachi 3-2-7, Mito, Ibaraki, 3100015, Japan.

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**Correspondence to:** Yasushi Shibata, MD, PhD, Department of Neurosurgery, Mito Medical Center, Mito Kyodo General Hospital, University of Tsukuba, Miyamachi 3-2-7, Mito, Ibaraki, 3100015, Japan.

Telephone: +81-29231-2371

Fax: +81-292315137

Email: [yshibata@md.tsukuba.ac.jp](mailto:yshibata@md.tsukuba.ac.jp)

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### ABSTRACT

Subclavian steal is caused by pressure gradient reversal in the vertebral artery, in situations such as blood flow increase in a distal subclavian artery or subclavian arterial stenosis proximal of vertebral artery branching. Reports on subclavian steal caused by an internal shunt in the forearm are scarce. A 68-year-old man, diagnosed with hypertension and renal failure at ages of 42 and 46 years, respectively, was started on hemodialysis at the age of 49 years after an internal shunt construction in the left forearm. He underwent a neurological examination for the first time in our hospital, which revealed no abnormality. Brain magnetic resonance imaging demonstrated few lacunar infarctions and white matter lesions. No micro bleeds

were observed. Magnetic resonance angiography revealed mild arteriosclerosis without major stenosis or occlusion. Continuous backflow in the left vertebral artery in both systolic and diastolic phases was detected on carotid ultrasound. Subclavian steal caused by an internal shunt is relatively rare, and symptomatic subclavian steal syndrome caused by an internal shunt is rarer. Nevertheless, as this pathology is iatrogenic, it needs appropriate care.

**Key words:** Subclavian steal; Hemodialysis access; Carotid ultrasound; Internal shunt

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### INTRODUCTION

Subclavian steal is caused by pressure gradient reversal in the vertebral artery, in situations such as blood flow increase in a distal subclavian artery or subclavian arterial stenosis proximal of vertebral artery branching<sup>[1]</sup>. Reports on subclavian steal caused by an internal shunt in the forearm are scarce<sup>[2,3,4,5-6]</sup>.

### CASE REPORT

A 68-year-old man, diagnosed with hypertension and renal failure at ages of 42 and 46 years, respectively, was started on hemodialysis at the age of 49 years after an internal shunt construction in the left forearm. He had a smoking habit until the age of 60 years. He underwent a neurological examination for the first time in our hospital, which revealed no abnormality. He had no subjective symptoms. His blood pressure values were 157/90 and 187/80 mmHg in the right and left forearms, respectively. Blood examination revealed mild anemia and renal failure. Brain magnetic resonance imaging (MRI) demonstrated few lacunar infarctions and white matter lesions. No micro bleeds were observed. Magnetic resonance angiography (MRA) revealed mild arteriosclerosis without major stenosis or occlusion. Arterial spin labeling imaging showed mild

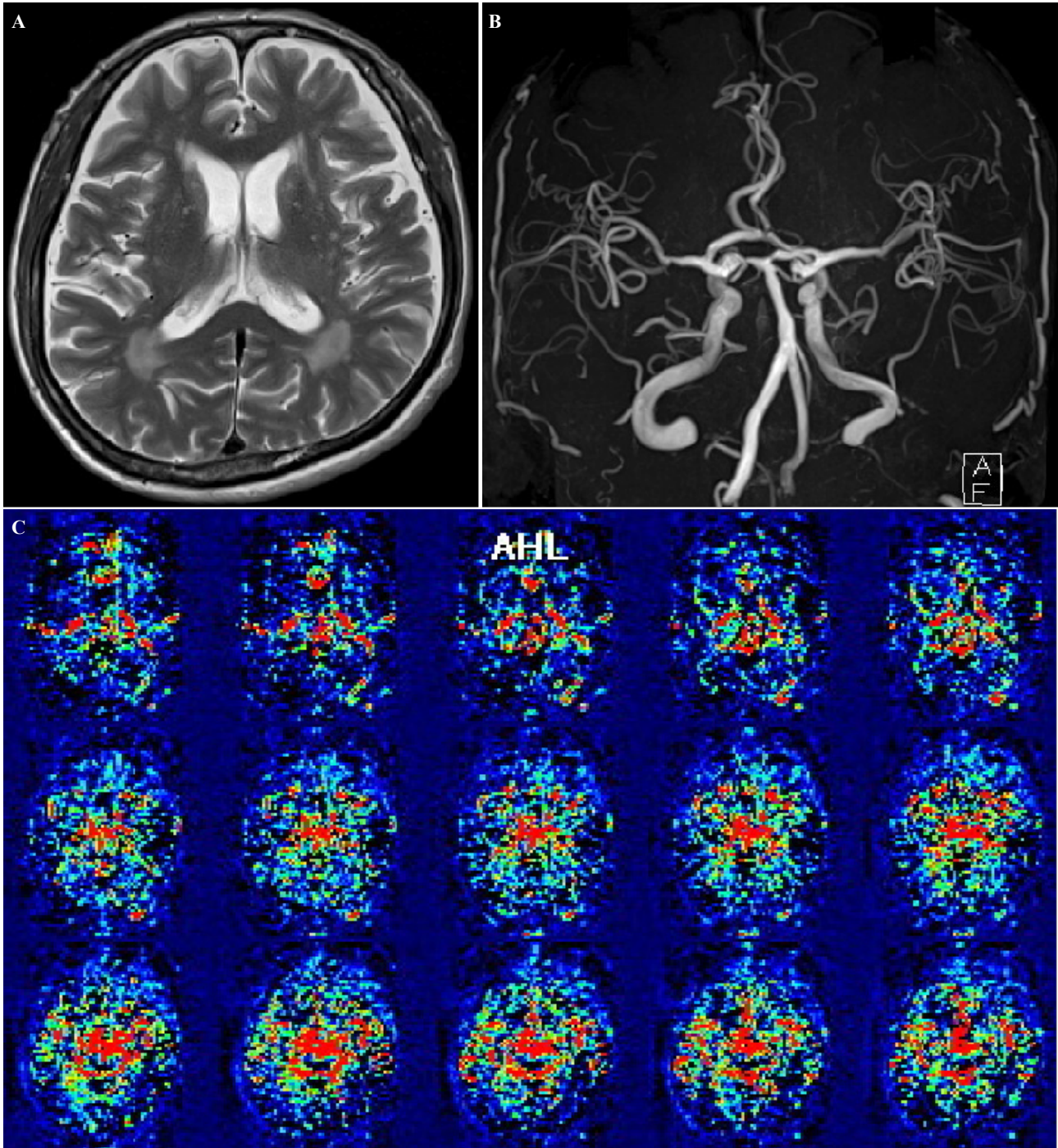


Figure 1 Brain MRI T2 weighted image(A), MRA(B), Tc-ECD SPECT(C).

hypo perfusion in the vertebrobasilar territory. Continuous backflow in the left vertebral artery in both systolic and diastolic phases was detected on carotid ultrasound. During this period, he had no ischemic symptoms; hence, we planned a follow-up examination without any medication. In a later period, he showed arrhythmia. Coronary angiography revealed significant coronary arterial stenosis. After a percutaneous coronary intervention, he was started on dual antiplatelet therapy. MRI, MRA, and carotid ultrasound follow-up examinations revealed no significant changes.

## DISCUSSION

In a study of 154 hemodialysis patients, the carotid ultrasound

revealed asymptomatic subclavian steal in 4 patients (2.6%)<sup>[7]</sup>. Although definite diagnosis may require catheter angiography, carotid ultrasound can provide sufficient diagnostic findings. Patients with the asymptomatic subclavian steal phenomenon generally demonstrate backflow only in the systolic phase, whereas those with the symptomatic phenomenon demonstrate backflow in both systolic and diastolic phases. Static MRA cannot provide a subclavian steal diagnosis. Magnetic resonance (MR) digital subtraction angiography or 4D-MRA may be useful for diagnosis; however, using MR contrast media is prohibited in patients with renal failure<sup>[8]</sup>.

Subclavian steal caused by an internal shunt is relatively rare, and symptomatic subclavian steal syndrome caused by an internal shunt is rarer<sup>[2-6]</sup>. Nevertheless, as this pathology is iatrogenic, it needs

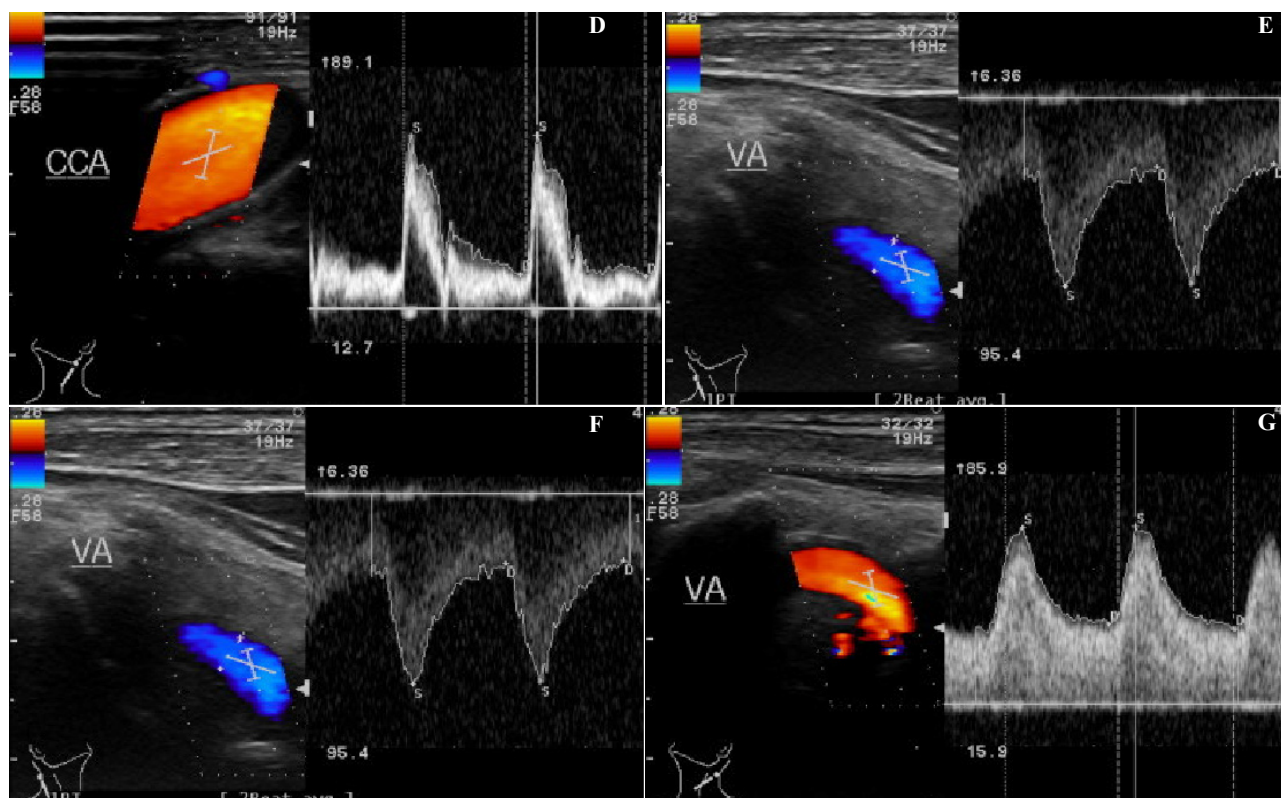


Figure 1 Cervical Ultrasound of Right carotid artery(D), Left carotid artery(E), Right vertebral artery(F), Left vertebral artery(G).

appropriate care. Restriction of shunt flow is effective in symptomatic cases<sup>[2]</sup>. The indication of antiplatelet medication must be clarified in future studies.

## REFERENCES

1. Kotval PS, Shah PM, Berman H. Doppler diagnosis of subclavian steal due to arteriovenous hemodialysis fistula in the ipsilateral arm. *Journal of Ultrasound in Medicine*. 1989; 8(12): 697-700.
2. Schenk WG. Subclavian steal syndrome from high-output brachiocephalic arteriovenous fistula: A previously undescribed complication of dialysis access. *Journal of Vascular Surgery*. 2001/04/01/2001; 33(4): 883-885.
3. Fujimoto K, Iida J, Kawaguchi S, Sakaki T, Shiiki H, Saito Y. [Subclavian steal phenomenon complicating an upper extremity arteriovenous fistula for hemodialysis]. *No To Shinkei*. 2004; 56(7): 599-602.
4. Omae T, Hirai Y, Fujii K, Ikeda K, Ibayashi S, Iida M. [Subclavian steal phenomenon induced by arteriovenous fistula for hemodialysis]. *Nihon Naika Gakkai Zasshi*. 2005; 94(1): 129-131.
5. Maiodna E, Ambekar S, Johnson JN, Elhammady MS. Dialysis arteriovenous fistula causing subclavian steal syndrome in the absence of subclavian artery stenosis. *Case Rep Vasc Med*. 2015; 2015: 720684-720684.
6. Kaneko Y, Yanagawa T, Taru Y, et al. Subclavian steal syndrome in a hemodialysis patient after percutaneous transluminal angioplasty of arteriovenous access. *J Vasc Access*. 2018; 19(4): 404-408.
7. Kimura K, Yamaguchi T, Yasaka M, Tsuchiya T. [Hemodynamics of the vertebral artery in subclavian steal syndrome and subclavian steal phenomenon]. *Rinsho Shinkeigaku*. 1991; 31(9): 970-973.
8. Virmani R, Carroll TJ, Hung J, Hopkins J, Diniz L, Carr J. Diagnosis of subclavian steal syndrome using dynamic time-resolved magnetic resonance angiography: a technical note. *Magnetic Resonance Imaging*. 2008/02/01/2008; 26(2): 287-292.