

CASE REPORT

Multimodality imaging in subclavian steal syndrome

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Abstract

Subclavian steal syndrome is a rare vascular cause of recurrent effort-related syncope events, affecting ~2% of the general population. Here, we report a case of a 64-year-old male who was hospitalized because of recurrent effort-related syncope events. Physical examination revealed several characteristic clinical clues for subclavian steal syndrome. Indeed, through the use of multimodality imaging, the diagnosis was established. We demonstrate that the combination of history taking, thorough physical exam and subsequent imaging studies can establish a relatively rare diagnosis of recurrent syncope.

INTRODUCTION

When the proximal section of the subclavian artery becomes stenotic, blood supply to the ipsilateral arm may become impaired. Rarely, in the face of growing flow demand, blood flow through the posterior circulation may reverse as a compensatory mechanism, resulting in diminished cerebral blood flow, which may be manifested as episodes vertigo and/or syncope [1].

Commonly, atherosclerosis is the primary condition that begins this cascade of events [2].

CASE REPORT

A 64-year-old male suffered from recurrent episodes of dizziness and three syncope events. All three episodes were preceded by physical effort which involved the upper extremities. No chest pain, palpitations or cough spells prior to the occurrence of syncope were reported. His past medical history included diabetes mellitus, hyperlipidemia and active cigarette smoking, without a previous history ischemic heart disease, arrhythmias, previous peripheral vascular interventions nor a

diagnosis of chronic lung disease. Due to his complaints, he was initially seen by his family medical doctor, where low blood pressures were recorded (90/60 mm Hg). Following a third episode of syncope he was referred to the hospital and subsequently admitted to the department of cardiovascular medicine for further workup. Upon examination, a significant difference in blood pressures was noted between the upper limbs (130/70 mm Hg on the right brachial artery, 90/70 on the left brachial artery). Other vital signs were normal: heart rate of 72 bpm and O₂ saturation of 98% in room air. A bruit was noted on auscultation over the left subclavian artery. No differences in pulse amplitude, strength, skin color or arm circumference were noted upon examination of the upper limbs, and carotid sinus massage and test for orthostatic hypotension were both negative. Provocative arm maneuvers resulted in dizziness, but not syncope. Electrocardiographic recording demonstrated a normal sinus rhythm, normal axis, normal PR interval, without ischemic changes in the ST-T segments; lab exams at admission demonstrated Troponin-T measurements of 15.5 and 13.4 ng/L, hemoglobin and glucose measurements were within normal range.

Received: December 26, 2020. Revised: February 14, 2021. Accepted: April 16, 2021

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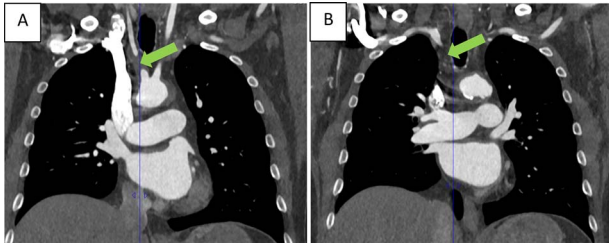


Figure 1: Computed tomography angiography scan, sagittal plane. (A) Obstruction and retrograde filling of the right common carotid artery (marked by green arrow); (B) Obstruction of the right brachiocephalic trunk (marked by green arrow).

Taking these unique physical examination features into account, subclavian steal syndrome was suspected as the cause for the patient's complaints, and a computerized tomography angiography (CTA) was carried to further explore this option. Indeed, CTA scan demonstrated an obstruction and retrograde filling of the right common carotid artery and obstruction of the right brachiocephalic trunk (Fig. 1A and B). To prove whether stealing of blood flow is the trigger for the recurrent syncope events, a Doppler ultrasound was done, revealing blood flow reversal in the right external carotid artery (Fig. 2), a blunted 'Parvus et tardus' blood flow in the right common carotid artery (Fig. 3), and a 'pre-steal' component in the right vertebral artery (Fig. 4).

Percutaneous interventions to treat the underlying vascular pathology by vascular surgeons failed, and the patient ultimately decided to refrain from further vascular attempts while avoiding strenuous activities involving the upper limbs. As of yet, no further hospitalizations were reported.

DISCUSSION

Subclavian steal syndrome is a condition in which significant stenosis and/or occlusion of the subclavian artery results in a compromise of distal perfusion to the vertebral artery. As the stenosis progresses, a pressure gradient between the two vertebral arteries gradually emerges, favoring a reversed blood flow in the vertebral artery distal and ipsilateral to the diseased subclavian artery [3]. This condition is relatively rare, affecting ~2–4% of the general population, although prevalence is higher among those with concomitant established cardiovascular disease [4]. Treatment options for subclavian steal syndrome are diverse and mainly include angioplasty and stenting [5] as well as bypass implantations [6]. Indeed, Bates et al. reported a 76% 5-year survival in a large case series of patients who underwent subclavian artery stenting [7].

In summary, our report demonstrates that subclavian artery stenosis is a rare cause for syncope that should be suspected if relevant clues emerge during meticulous history taking and physical examination of pulses and blood pressures. The use of

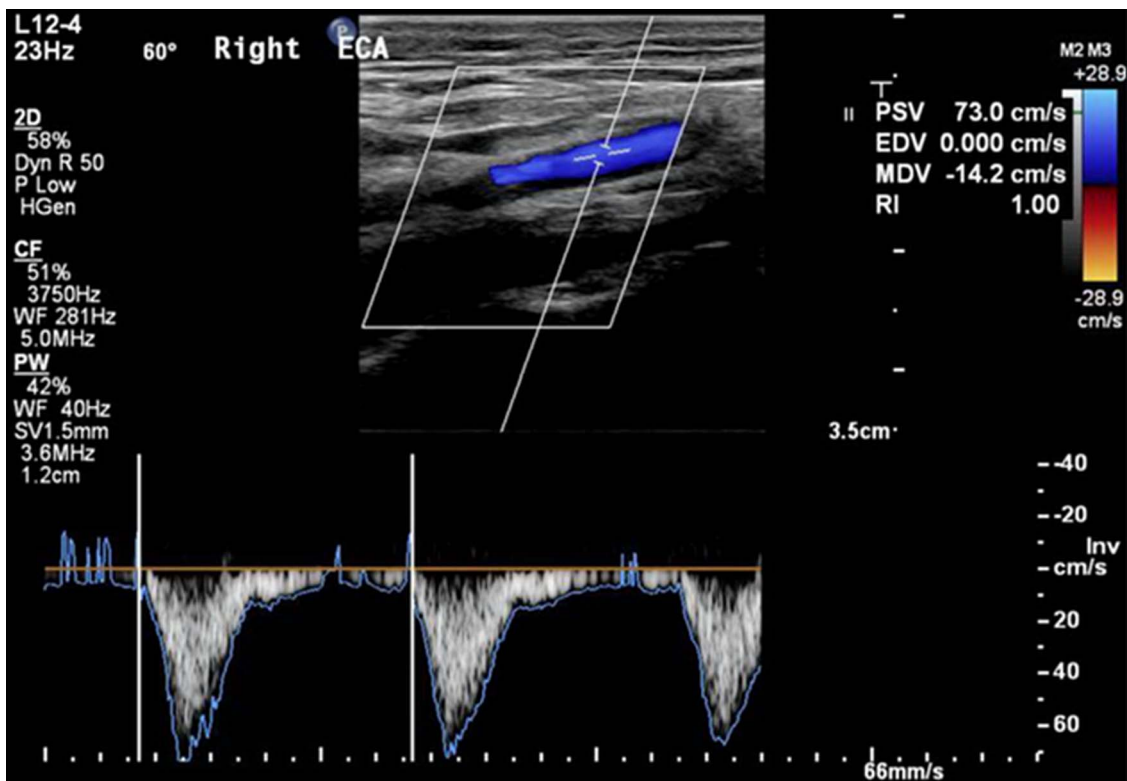


Figure 2: Doppler ultrasound of the right external carotid artery, revealing blood flow reversal.

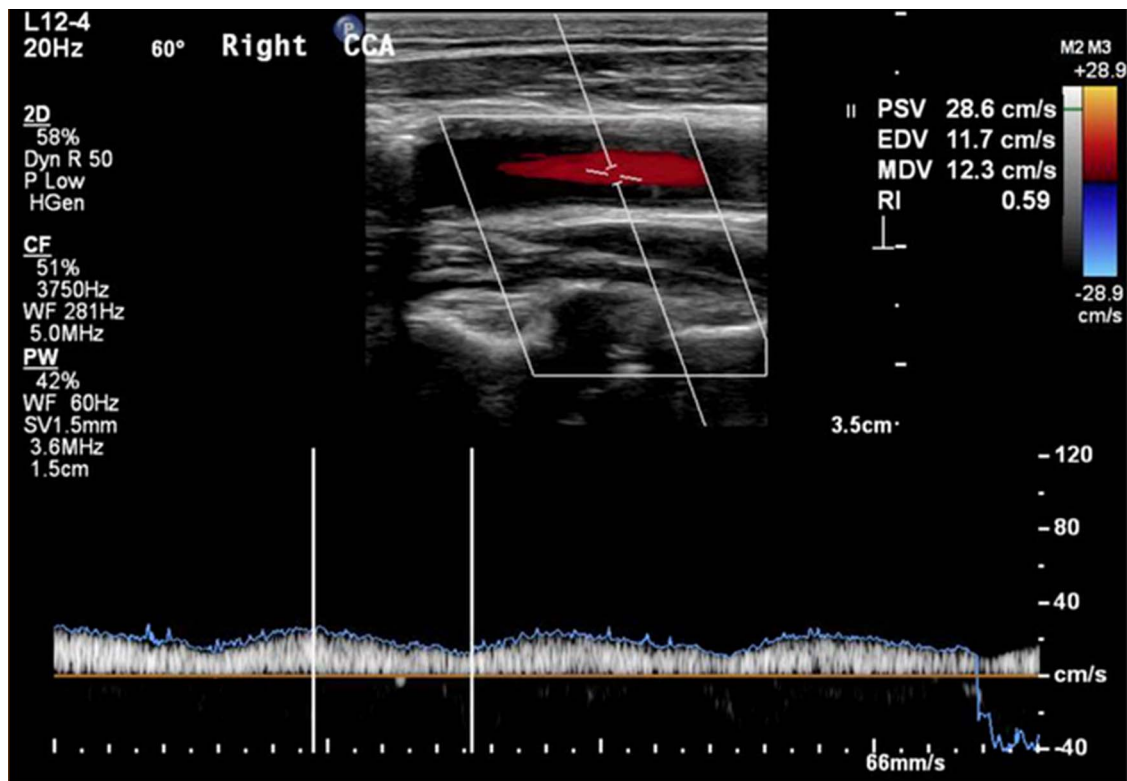


Figure 3: Doppler ultrasound of the right common carotid artery. A blunted 'Parvus et tardus' blood flow is noted, indicating a critical chronic obstruction of the brachiocephalic artery on the ipsilateral side.

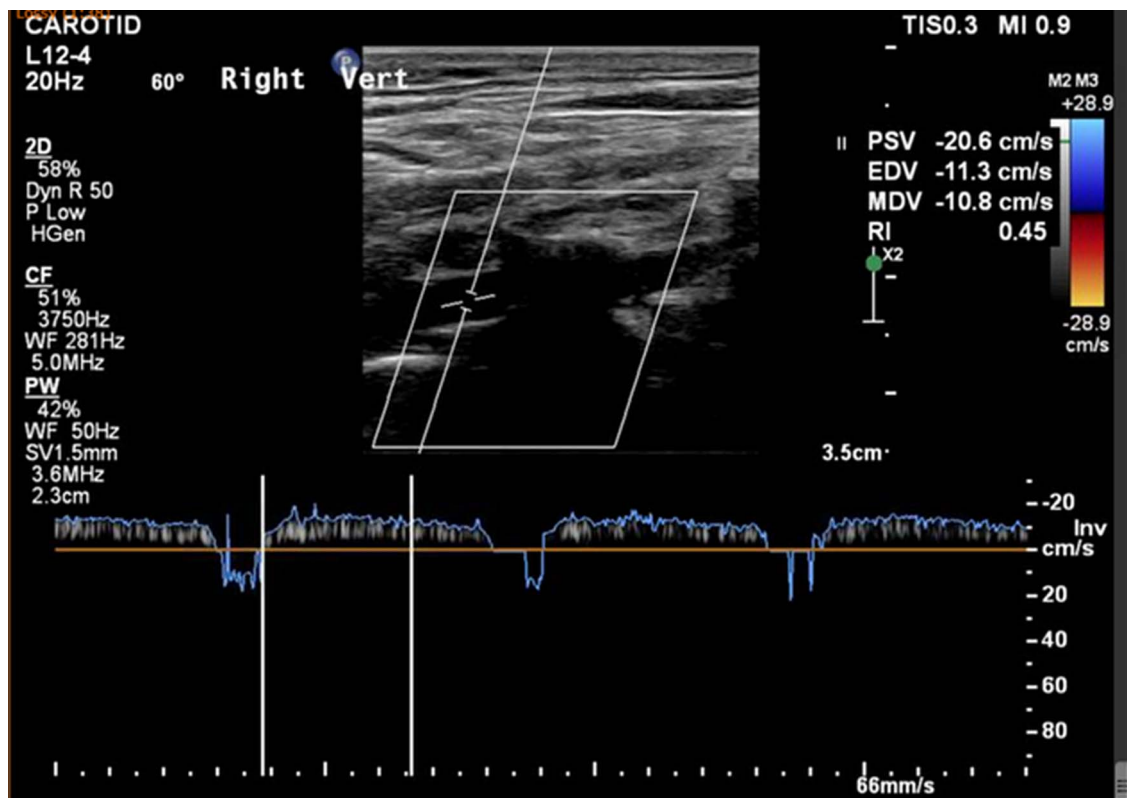


Figure 4: Doppler ultrasound of the right vertebral artery, demonstrating 'pre-steal' component.

duplex ultrasonography and CTA can confirm the presence of subclavian steal syndrome.

ACKNOWLEDGMENT

This case report had no source of funding.

CONFLICT OF INTEREST STATEMENT

None declared.

ETHICAL APPROVAL

Not applicable.

CONSENT

Written consent obtained.

GUARANTOR

ES is nominated as the manuscript's guarantor.

REFERENCES

1. Kargiotis O, Siahos S, Safouris A, Feleskouras A, Magoufis G, Tsvigoulis G. Subclavian Steal syndrome with or without Arterial Stenosis: a review. *J Neuroimaging*. 2016;**26**:473–80.
2. Takach TJ, Reul GJ, Cooley DA, Duncan JM, Livesay JJ, Ott DA, et al. Myocardial thievery: the coronary-subclavian steal syndrome. *Ann Thorac Surg* 2006;**81**:386–92.
3. Potter BJ, Pinto DS. Subclavian steal syndrome. *Circulation*. 2014;**129**:2320–3.
4. Waduud MA, Giannoudi M, Drozd M, Malkin CJ, Patel JV, Scott DJA. Coronary subclavian steal syndrome-is there a need for routine assessment for subclavian artery stenosis following coronary bypass surgery. *Oxf Med Case Rep* 2018;**2018**:omy102.
5. Westerband A, Rodriguez JA, Ramaiah VG, Diethrich EB. Endovascular therapy in prevention and management of coronary-subclavian steal. *J Vasc Surg* 2003;**38**:699–703.
6. Takach TJ, Reul GJ Jr, Cooley DA et al. Concomitant occlusive disease of the coronary arteries and great vessels. *Ann Thorac Surg* 1998;**65**:79–84.
7. Bates MC, Broce M, Lavigne PS, Stone P. Subclavian artery stenting: factors influencing long-term outcome. *Catheter Cardiovasc Interv* 2004;**61**:5–11.