

CASE REPORT

PEER REVIEWED | OPEN ACCESS

Stroke like symptoms, radiation therapy induced atypical subclavian steal syndrome: Diagnosis and treatment

Ruiqing Sun, Prashant Rai, Varun Shah, Karthikram Raghuram, Anish Bhardwaj, Adham Kamel

ABSTRACT

Introduction: Radiation therapy induced subclavian stenosis can cause subclavian steal syndrome, which can present with posterior fossa stroke like symptoms. We present atypical subclavian steal syndrome, a stroke mimic induced by radiation therapy. **Case Report:** A 63-year-old female with prior lung radiation therapy who presented with posterior circulation stroke like symptoms dizziness and unsteady gait. Patient had negative orthostatic vital signs, Hallpike maneuver, and head thrust test. Brain magnetic resonance imaging (MRI) and magnetic resonance angiogram (MRA) head were unremarkable. However, MRA neck demonstrated focal severe stenosis of the proximal left subclavian artery proximal to the origin of the left vertebral artery. The subclavian artery stenosis was further confirmed by a difference in blood pressure readings between bilateral extremities and absence of the left radial pulse. Patient was treated with left subclavian stent implantation resulting in restoration of antegrade flow in the left vertebral artery. **Conclusion:** Subclavian stenosis

should be considered in patient with history of chest/neck radiation therapy presenting with posterior circulation stroke like symptoms. Early diagnosis of subclavian steal syndrome is the prerequisite for timely treatment with antiplatelets and angioplasty/stent implantation to restore adequate perfusion.

Keywords: Radiation therapy, Stroke, Subclavian steal syndrome, Subclavian stent

How to cite this article

Sun R, Rai P, Shah V, Raghuram K, Bhardwaj A, Kamel A. Stroke like symptoms, radiation therapy induced atypical subclavian steal syndrome: Diagnosis and treatment. Int J Case Rep Images 2019;10:101040Z01RS2019.

Article ID: 101040Z01RS2019

doi: 10.5348/101040Z01RS2019CR

Ruiqing Sun¹, Prashant Rai², Varun Shah¹, Karthikram Raghuram³, Anish Bhardwaj⁴, Adham Kamel⁵

Affiliations: ¹Resident PGY 3, Department of Neurology, UTMB, Galveston, USA; ²Fellow PGY 5, Department of Neurology, UTMB, Galveston, USA; ³Director of Diagnostic and Interventional Neuroradiology, Department of Radiology, UTMB, Galveston, USA; ⁴Chairman, Department of Neurology, UTMB, Galveston, USA; ⁵Director of Stroke Program, Department of Neurology, UTMB, Galveston, USA.

Corresponding Author: Ruiqing Sun, 15410 Rocky Oak Ct, Houston, Texas 77059, USA; Email: rusun@utmb.edu

Received: 08 April 2019

Accepted: 11 June 2019

Published: 29 July 2019

INTRODUCTION

Subclavian steal syndrome (SSS) is a constellation of signs and symptoms due to proximal ipsilateral subclavian artery stenosis or occlusion proximal to the origin of the vertebral artery. When the ipsilateral arm is exerted (which increases blood flow to the arm and decreases arterial resistance), the distal subclavian artery may steal blood from contralateral vertebral artery in a retrograde direction down to the ipsilateral vertebral artery at the expense of the vertebrobasilar circulation [1]. Subclavian steal syndrome typically manifests as exercise-induced arm pain, fatigue, coolness, paresthesia or numbness, and vertebrobasilar ischemia with neurological symptoms, such as dizziness, vertigo, ataxia, disequilibrium, etc. [2].

CASE REPORT

A 63-year-old right-handed Caucasian female with past medical history of chronic obstructive pulmonary disease, right small cell lung cancer in 2006, left lung adenocarcinoma in 2013 (both treated with radiation and chemotherapy, currently in remission) presented with dizziness and unsteady gait. Patient had two sequential episodes of dizziness and unsteadiness while she was using her bilateral arms prior to the admission. Patient denied any visual field deficit, diplopia, rhinitis, hearing change, or focal weakness. The symptoms resolved after one minute. She had experienced a similar episode about one month prior. Upon further inquiry, patient recalled she that started having left breast numbness, intermittent left arm weakness, and cramps about five months ago. This patient received radiation therapy for her right lung small cell lung cancer and prophylactic cranial irradiation 12 years ago (total dose of 86.7 Gy in 26 fractions), for her left lung adenocarcinoma five years ago (total dose of 50 Gy in four fractions). Chest computed tomography (CT) four years ago revealed radiation fibrosis in the medial left upper lung. Patient had multiple chest CT in the past four years, but never underwent a CT neck angiogram. Reviewing her previous records, her blood pressure (BP) was 120s/70s in 2013–2015, but started having some low reading 90–100s/60s two years ago.

On physical examination, T 36.5, simultaneous bilateral BP 110/67 (right arm), 92/62 (left arm), P 105, SaO₂ 96%, orthostatic vital signs were negative. Patient was alert and oriented, had no nystagmus, Dix–Hallpike maneuver and head thrust tests were negative. Right radial pulse was present, but left radial pulse was absent, length dependent reduced sensation to light touch, temperature, pin prick, and vibration at bilateral lower extremities (BLE), Romberg test was positive, otherwise the rest of the examination was unremarkable.

Brain MRI and MRA head did not show any acute intracranial abnormality. Magnetic resonance angiogram (MRA) neck showed focal severe stenosis of the proximal left subclavian artery proximal to the origin of the right vertebral artery with distal reconstitution (Figure 1A). Transthoracic echocardiogram was essentially a normal study.

Neurointerventional radiology was consulted. Patient underwent conventional angiogram with access via right femoral artery. Angiogram of right vertebral artery was performed which showed subclavian steal (Figure 1B). The patient was treated with angioplasty and stenting of the left subclavian artery (Figures 2 and 3). After stent implantation, antegrade flow was restored in the left vertebral artery (Figure 3B); the significant BP difference between the left arm and right arm resolved and left radial pulse became palpable. Patient has not had any dizziness, unsteady gait, left breast numbness, left arm weakness, or cramping episode after the procedure.

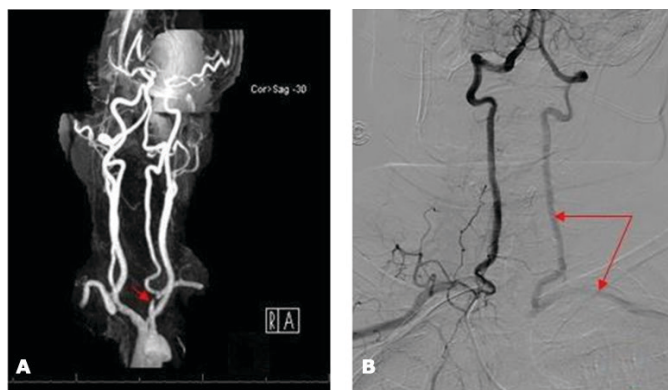


Figure 1: (A) MRA neck: Focal severe stenosis (red arrow) of the proximal left subclavian artery prior to the origin of the left vertebral artery with distal reconstitution. (B) Retrograde filling of left vertebral and subclavian arteries (red arrows) upon contrast injection in right vertebral artery.

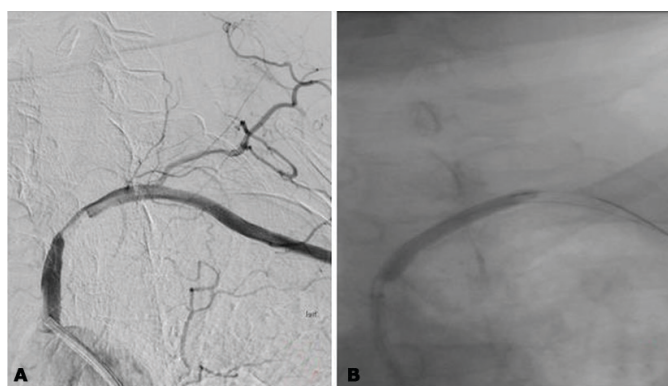


Figure 2: (A) Left subclavian artery with critical stenosis proximal to the origin of left vertebral artery. (B) Inflated balloon across the stenotic subclavian segment.



Figure 3: (A) Left proximal subclavian artery post-balloon dilatation. (B) Left proximal subclavian artery post-stenting with reconstitution of the antegrade flow in the left vertebral artery. (Express SD renal/biliary monorail premounted stent system (Boston Scientific): 6 mm×18 mm×150 cm).

DISCUSSION

Subclavian steal manifests as vertebrobasilar insufficiency (a stroke mimic), may also manifest

angina in patient with internal mammary artery (IMA) graft (coronary-subclavian steal) [2]. Subclavian artery stenosis proximal to vertebral artery and IMA is usually caused by atherosclerosis, radiation therapy, arterial congenital malformations, dialysis arteriovenous fistulas, etc. Although arterial insufficiency is a rarely reported sequel to radiotherapy, there are increasing evidences that radiation therapy could cause subclavian artery stenosis or occlusion [3–8]. Hull et al. reported that 7.4% survivors of Hodgkin lymphoma treated with radiation therapy developed carotid and/or subclavian artery disease at a median of 17 years after treatment [3]. Hirano et al. reported that the mean period between radiation and appearance of artery stenosis symptoms was years, with a range from 3 to 24 years [9]. Thus, it seems that radiation-induced subclavian stenosis is not uncommon, arterial insufficiency may occur years or decades later after the radiation therapy and the lesion can be caused by relatively low doses of radiation, such as 40–80 Gy [3].

Angiogram revealed that there was no other intracranial or extracranial stenosis to suggest atherosclerosis as the underlying cause. The patient did not have any risk factors for atherosclerosis. Based on these facts, we believe that the left subclavian stenosis was caused by radiation therapy.

The diagnosis of subclavian steal should be considered in a patient with history of neck/chest radiation therapy and presenting stroke like symptoms (dizziness, unsteady gait), even without complaint of arm ischemic symptoms. The discrepancy of >15 mm Hg in blood pressure readings in both upper extremities, decreased pulse in the affected side, and supraclavicular fossa bruit is essential for the diagnosis [2, 10]. Noninvasive imaging including duplex ultrasound, transcranial Doppler, and magnetic resonance (MR) or computed tomographic (CT) angiography can be used to confirm the diagnosis definitively. Catheter-based cerebral angiography is generally not needed to establish a diagnosis. The treatment of subclavian stenosis includes percutaneous or surgical revascularization. Endovascular intervention (angioplasty with or without stenting) is appropriate for patients with short proximal stenosis or occlusion [11, 12].

CONCLUSION

We reported the atypical subclavian steal syndrome induced by radiation therapy. The diagnosis was confirmed with MRA neck and conventional angiogram, patient was treated with angioplasty and stent implantation. The lesson learned is that particular attention should be paid to subclavian stenosis in patient with history of chest/neck radiation therapy. Routine bilateral arm BP and pulse checks, and review of subclavian steal syndrome symptoms are essential for early diagnosis, which is the prerequisite for timely treatment with antiplatelet and angioplasty/stent implantation to restore adequate perfusion.

REFERENCES

1. Fisher CM. A new vascular syndrome — The subclavian steal. *New Eng J Med* 1961;265:912–3.
2. Potter BJ, Pinto DS. Subclavian steal syndrome. *Circulation* 2014;129(22):2320–3.
3. Yamanaka T, Fukatsu T, Satou H, Ichinohe Y, Komatsu H, Hirata Y. A case of radiation-induced subclavian artery stenosis treated with percutaneous transluminal angioplasty. *J Cardiol Cases* 2015;12(2):61–4.
4. Hull MC, Morris CG, Pepine CJ, Mendenhall NP. Valvular dysfunction and carotid, subclavian, and coronary artery disease in survivors of Hodgkin lymphoma treated with radiation therapy. *JAMA* 2003;290(21):2831–7.
5. Smith E, Magee B. Arm pain due to subclavian artery stenosis after radiotherapy for recurrent breast cancer. *Clin Oncol (R Coll Radiol)* 2003;15(1):37.
6. Stein JS, Jacobson JH 2nd. Axillary-contralateral brachial artery bypass for radiation-induced occlusion of the subclavian artery. *Cardiovasc Surg* 1993;1(2):146–8.
7. Hashmonai M, Elami A, Kuten A, Lichtig C, Torem S. Subclavian artery occlusion after radiotherapy for carcinoma of the breast. *Cancer* 1988;61(10):2015–8.
8. Budin JA, Casarella WJ, Harisiadis L. Subclavian artery occlusion following radiotherapy for carcinoma of the breast. *Radiology* 1976;118(1):169–73.
9. Hirano S, Katoh H, Sasaki S, Shiiya N, Sakuma M, Yasuda K. Brachiocephalic and right axillary artery occlusion 16 years after mastectomy and radiotherapy. *Jpn J Vasc Surg* 1995;4:801–5.
10. Clark CE, Taylor RS, Shore AC, Ukoumunne OC, Campbell JL. Association of a difference in systolic blood pressure between arms with vascular disease and mortality: A systematic review and meta-analysis. *Lancet* 2012;379(9819):905–14.
11. De Vries JP, Jager LC, Van den Berg JC, et al. Durability of percutaneous transluminal angioplasty for obstructive lesions of proximal subclavian artery: Long-term results. *J Vasc Surg* 2005;41(1):19–23.
12. Wang KQ, Wang ZG, Yang BZ, et al. Long-term results of endovascular therapy for proximal subclavian arterial obstructive lesions. *Chin Med J (Engl)* 2010;123(1):45–50.

Author Contributions

Ruiqing Sun – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Prashant Rai – Acquisition of data, Drafting the work, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that

questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Varun Shah – Analysis of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Karthikram Raghuram – Conception of the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Anish Bhardwaj – Conception of the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Adham Kamel – Design of the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Guarantor of Submission

The corresponding author is the guarantor of submission.

Source of Support

None.

Consent Statement

Written informed consent was obtained from the patient for publication of this article.

Conflict of Interest

Authors declare no conflict of interest.

Data Availability

All relevant data are within the paper and its Supporting Information files.

Copyright

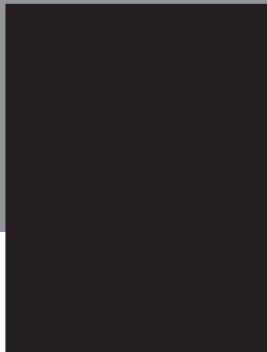
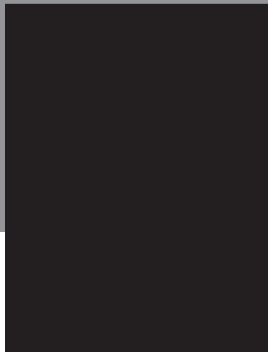
© 2019 Ruiqing Sun et al. This article is distributed under the terms of Creative Commons Attribution License which permits unrestricted use, distribution and reproduction in any medium provided the original author(s) and original publisher are properly credited. Please see the copyright policy on the journal website for more information.

Access full text article on
other devices



Access PDF of article on
other devices





Submit your manuscripts at
www.edoriumjournals.com

