

Resolution of Refractory Vertigo Following Endovascular Treatment of Right Subclavian Steal Syndrome

Review began 06/24/2026

Review ended 07/07/2026

Published 07/12/2026

© Copyright 2026

Gülesir et al. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY 4.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

DOI: 10.7759/cureus.112552

Muhammed Emre Gülesir^{1,2}, İsa Sincer², Halil Ibrahim Gökce², Umut Ata Ugras³

1. Cardiology, Bolu İzzet Baysal State Hospital, Bolu, TUR 2. Cardiology, Bolu Abant İzzet Baysal Üniversitesi, Bolu, TUR 3. Cardiovascular Surgery, Bolu Abant İzzet Baysal Üniversitesi, Bolu, TUR

Corresponding author: Muhammed Emre Gülesir, meglsir93@gmail.com

Abstract

Subclavian steal syndrome (SSS) is characterized by retrograde blood flow in the vertebral artery caused by proximal stenosis or occlusion of the subclavian artery. Although SSS most often involves the left subclavian artery because it originates directly from the aortic arch, right-sided SSS is anatomically rare. This study reviews the current literature on the diagnostic challenges and therapeutic management of right-sided SSS, emphasizing the safety and efficacy of percutaneous transluminal angioplasty and stenting. Furthermore, we present an illustrative case of a 68-year-old male with medically refractory vertigo and right arm claudication. Clinical examination revealed a 40 mmHg inter-arm systolic blood pressure gradient. Angiography confirmed severe proximal right subclavian artery stenosis with retrograde steal. The patient was successfully treated with a balloon-expandable stent, resulting in complete anatomical resolution and immediate cessation of vertebrobasilar symptoms. Our clinical case underscores the necessity of routine bilateral blood pressure monitoring in patients with refractory vertigo and suggests that endovascular stenting appears to be a safe and effective, low-morbidity treatment strategy in such cases.

Categories: Cardiology

Keywords: atherosclerosis, endovascular procedures, subclavian artery stenosis, subclavian steal syndrome, vertigo

Introduction

Subclavian steal syndrome (SSS) is a condition in which severe stenosis of a segment of the subclavian artery or brachiocephalic trunk, proximal to the origin of the vertebral artery, reverses ipsilateral vertebral artery flow (retrograde flow), thereby supplying the upper extremity [1,2]. Atherosclerosis is the most common etiology [1]. Anatomically, the direct origin of the left subclavian artery from the aortic arch makes this region more prone to plaque formation; however, because the right subclavian artery branches from the brachiocephalic trunk, right-sided SSS is relatively rare in the literature [1,2]. Today, percutaneous endovascular interventions have largely replaced traditional surgery for symptomatic patients, offering low morbidity and high success rates [1-3]. In this study, we review the management of this rare entity and present a case of symptomatic right SSS successfully treated with endovascular stenting. This case is uniquely instructive because it highlights the anatomical rarity of right-sided SSS and demonstrates the dramatic, immediate resolution of chronic, medically refractory vertigo with modern endovascular techniques.

Case Presentation

A 68-year-old male with a history of essential hypertension, hyperlipidemia, hyperthyroidism, and benign prostatic hyperplasia presented to our outpatient clinic with exertional fatigue, exertion-related right arm pain (claudication), and dizziness. His medical history included coronary angiography approximately 10 years prior, with medical follow-up, and there was no history of diabetes mellitus. Notably, his dizziness (vertigo) had persisted for years and was resistant to medical therapy (betahistine). A recent emergency department visit documented a significant difference in blood pressure between his upper extremities (left arm: 140/80 mmHg, right arm: 100/80 mmHg).

During the current visit, his arterial blood pressure was 147/54 mmHg, and his pulse was 70 beats/min. Based on his medical records, his optimized medications included perindopril/indapamide/amlodipine (10/2.5/5 mg), atorvastatin 40 mg, acetylsalicylic acid 100 mg, clopidogrel 75 mg, pantoprazole 40 mg, methimazole 5 mg, tamsulosin 0.4 mg, and betahistine. Baseline laboratory tests were unremarkable (Table 1). Preoperative evaluation revealed a normal sinus rhythm on electrocardiography with a heart rate of 70 beats/min and no acute ischemic changes. Echocardiography demonstrated normal left ventricular systolic function with an ejection fraction of 60%. Detailed objective echocardiographic measurements were as follows: left atrium 3.4 cm, left ventricle 4.2 cm, interventricular septum 1.2 cm, posterior wall 1.2 cm, and ascending aorta 3.4 cm.

How to cite this article

Gülesir M, Sincer I, Gökce H, et al. (July 12, 2026) Resolution of Refractory Vertigo Following Endovascular Treatment of Right Subclavian Steal Syndrome. Cureus 18(7): e112552. DOI 10.7759/cureus.112552

Table with 3 columns: Parameter, Patient value, Reference range. Rows include Hemoglobin (15.7 g/dL) and Creatinine (1.18 mg/dL).

TABLE 1: Baseline laboratory results of the patient upon presentation.

To evaluate his chronic vertebrobasilar symptoms, carotid color Doppler ultrasonography was performed, revealing patent bilateral carotid arteries but a continuous retrograde (reversed) flow pattern in the right vertebral artery. These findings were highly suggestive of a rare right subclavian steal syndrome. The patient was admitted for definitive diagnosis and percutaneous transluminal angioplasty.

Initial coronary angiography showed non-critical plaques in the coronary arteries. Subsequent right brachiocephalic artery angiography revealed severe stenosis of the proximal right subclavian artery just before the origin of the vertebral artery (Figure 1, panel A, Video 1). In some views, the vertebral artery did not fill, appearing stump-like. Retrograde filling from the right vertebral artery into the distal subclavian artery, the pathophysiological hallmark of the steal phenomenon, was strikingly captured and confirmed angiographically (Figure 1, panel B).

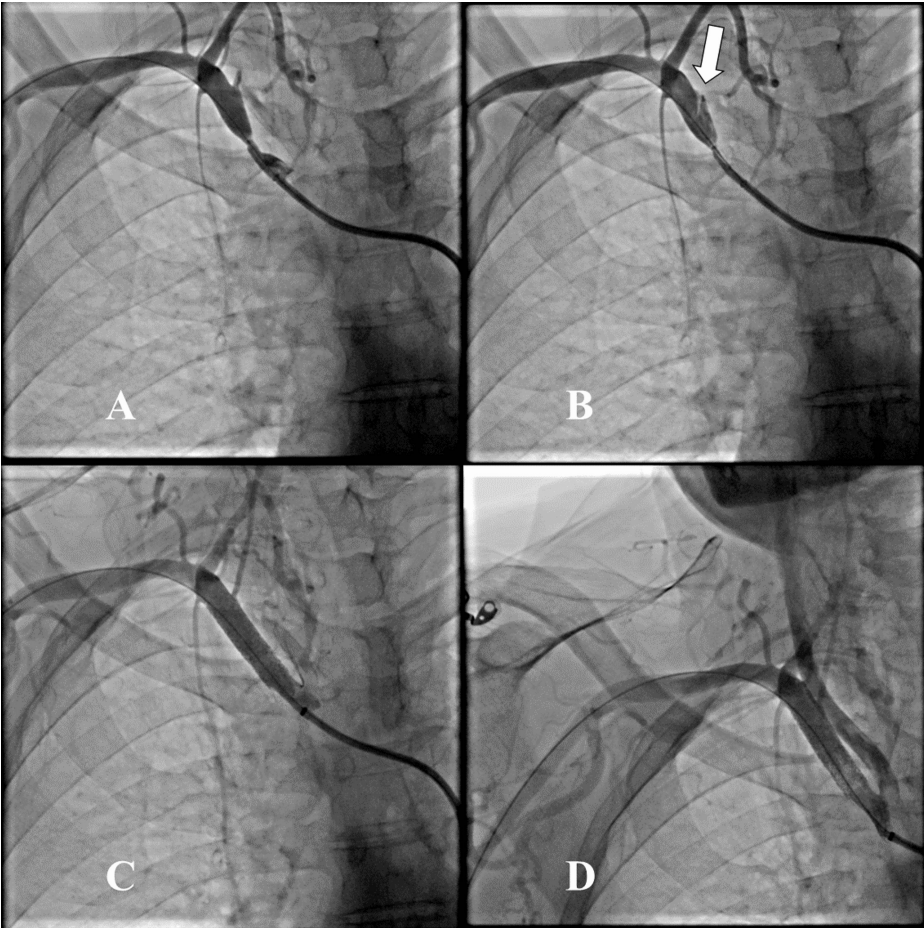


FIGURE 1: Treatment of right subclavian steal syndrome. (A) Proximal right subclavian stenosis. (B) Retrograde filling from the right vertebral artery confirms steal (arrow). (C) Deployment of a 9x31 mm stent. (D) Final angiography showing restored antegrade flow and eliminated steal.

VIDEO 1: Step-by-step angiographic sequence demonstrating the endovascular treatment of right subclavian steal syndrome.

The sequence begins with baseline right brachiocephalic angiography showing severe proximal right subclavian stenosis and retrograde flow from the right vertebral artery (subclavian steal). This is followed by fluoroscopic predilatation using a 7x60 mm balloon. Subsequently, a 9x31 mm balloon-expandable stent is positioned and successfully deployed across the target lesion. The video concludes with final control angiography confirming complete anatomical resolution of the stenosis and the restoration of normal antegrade hemodynamics.

View video here: <https://vimeo.com/1203919849?fl=ip&fe=ec>

A decision was made to perform percutaneous transluminal angioplasty (PTA) and stenting in the same session. Under standard intraprocedural anticoagulation with unfractionated heparin, the right subclavian artery was selectively engaged using a 7F SIM1 catheter. After predilatation of the lesion with a 7x60 mm peripheral balloon, a 9x31 mm balloon-expandable stent was successfully implanted in the target segment without any technical difficulties (Figure 1, panel C). Final control angiography showed complete resolution of the stenosis, full restoration of antegrade flow to the right arm, and correction of retrograde "steal" flow (Figure 1, panel D). No periprocedural complications occurred, and the patient was discharged symptom-free on an optimized dual antiplatelet regimen of acetylsalicylic acid 100 mg and clopidogrel 75 mg daily.

Discussion

While subclavian artery stenoses are often asymptomatic, when symptomatic, the clinical presentation typically includes signs of upper-extremity hypoperfusion and vertebrobasilar insufficiency [1,2]. Our patient exhibited right arm claudication triggered by exertion due to ipsilateral ischemia, along with chronic vertigo resistant to medical treatment. The most common physical examination finding in subclavian artery stenosis is a systolic blood pressure difference of >15–20 mmHg between the arms [1,2]. In our patient, this difference was 40 mmHg, underscoring the crucial role of routine bilateral blood pressure measurement in diagnosis [4].

In the diagnostic approach, carotid color Doppler ultrasonography is a non-invasive, highly reliable first-line test [1,2]. The gold standard for clarifying the degree and localization of stenosis while offering simultaneous treatment is digital subtraction angiography (DSA) [1,2]. In the past, treatment of SSS relied on surgical bypass, but percutaneous transluminal angioplasty and stenting have become the first-line options today [1–3]. Furthermore, recent multicenter data specifically evaluating right subclavian artery occlusive lesions have confirmed that endovascular treatment with balloon-expandable stents is safe and yields excellent long-term patency [5].

Recent literature, including cases published in Cureus, increasingly highlights the efficacy of endovascular approaches, even in anatomically challenging or recurrent presentations of subclavian steal syndrome, emphasizing a significant reduction in periprocedural morbidity compared with open surgery [6,7]. Beyond anatomical and procedural considerations, holistic management of cardiovascular diseases such as SSS requires an understanding of the patient's broader risk profile. Recent comprehensive reviews highlight that socioeconomic and racial determinants, including systemic barriers and lower socioeconomic status, are crucial independent risk factors that can exacerbate traditional elements like hypertension and atherosclerosis, leading to poorer cardiovascular outcomes [8]. Integrating these socioeconomic insights into cardiovascular risk assessments is essential for developing tailored secondary prevention strategies following interventional procedures. In our case, a balloon-expandable stent was successfully implanted, resolving the anatomical stenosis, restoring antegrade flow, and eliminating the pathophysiological steal phenomenon, as definitively demonstrated in our angiographic series. A comprehensive visual overview of the patient's clinical presentation, angiographic diagnosis, and successful endovascular management is summarized in Figure 2.

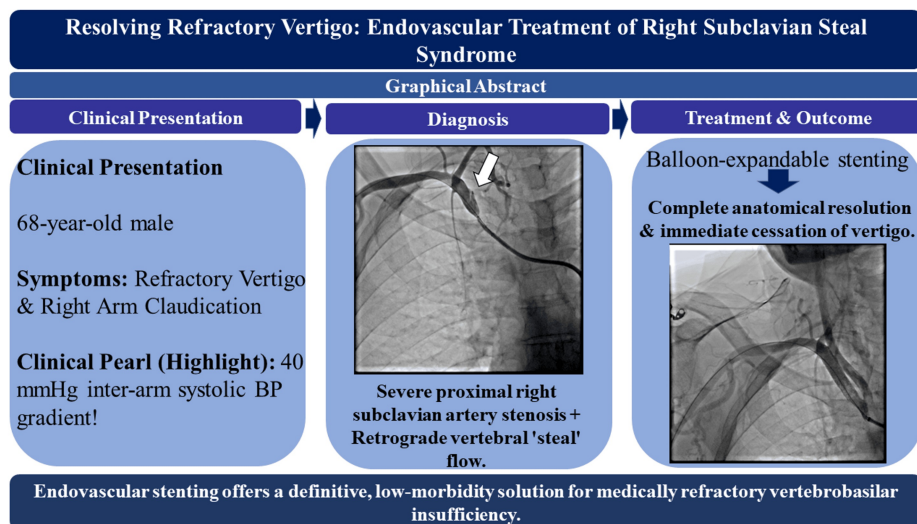


FIGURE 2: Graphical summary of the clinical workflow and endovascular treatment.

This visual summary outlines the patient's clinical journey. The left panel highlights key diagnostic clues, notably a 40 mmHg inter-arm systolic blood pressure gradient and medically refractory vertigo. The middle panel shows angiographic confirmation of severe proximal right subclavian artery stenosis with retrograde vertebral steal flow. The right panel illustrates definitive treatment with a balloon-expandable stent, resulting in complete anatomical resolution and immediate cessation of vertebrobasilar symptoms.

Conclusions

Routine bilateral blood pressure measurements must be obtained in patients with vertebrobasilar symptoms that are resistant to medical treatment and in those with upper-extremity claudication. Right SSS should be considered in the differential diagnosis. In these cases, endovascular stenting of appropriate lesions appears to be a safe and effective therapeutic approach that successfully restores anatomical patency and immediately resolves debilitating symptoms.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Muhammed Emre Gülesir, İsa Sincer, Halil Ibrahim Gökce, Umut Ata Ugras

Acquisition, analysis, or interpretation of data: Muhammed Emre Gülesir, İsa Sincer, Halil Ibrahim Gökce, Umut Ata Ugras

Drafting of the manuscript: Muhammed Emre Gülesir, İsa Sincer, Halil Ibrahim Gökce, Umut Ata Ugras

Critical review of the manuscript for important intellectual content: Muhammed Emre Gülesir, İsa Sincer, Halil Ibrahim Gökce, Umut Ata Ugras

Supervision: Muhammed Emre Gülesir, İsa Sincer, Halil Ibrahim Gökce, Umut Ata Ugras

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

Acknowledgements

The authors acknowledge the use of ChatGPT (OpenAI) strictly for English-language polishing and formatting assistance. The authors take full responsibility for the final content, clinical data, and scientific accuracy of the article.

References

1. Osiro S, Zurada A, Gielecki J, Shoja MM, Tubbs RS, Loukas M: A review of subclavian steal syndrome with clinical correlation. *Med Sci Monit*. 2012, 18:57-63. [10.12659/msm.882721](https://doi.org/10.12659/msm.882721)
2. Aboyans V, Ricco JB, Bartelink ME, et al.: 2017 ESC Guidelines on the diagnosis and treatment of peripheral arterial diseases, in collaboration with the European Society for Vascular Surgery (ESVS): document covering atherosclerotic disease of extracranial carotid and vertebral, mesenteric, renal, upper and lower extremity arteries. Endorsed by: the European Stroke Organization (ESO), the Task Force for the Diagnosis and Treatment of Peripheral Arterial Diseases of the European Society of Cardiology (ESC) and of the European Society for Vascular Surgery (ESVS). *Eur Heart J*. 2018, 39:763-816. [10.1093/eurheartj/ehx095](https://doi.org/10.1093/eurheartj/ehx095)
3. Che W, Dong H, Jiang X, et al.: Subclavian artery stenting for coronary-subclavian steal syndrome. *Catheter Cardiovasc Interv*. 2017, 89:601-8. [10.1002/ccd.26902](https://doi.org/10.1002/ccd.26902)
4. Osborn LA, Vernon SM, Reynolds B, Timm TC, Allen K: Screening for subclavian artery stenosis in patients who are candidates for coronary bypass surgery. *Catheter Cardiovasc Interv*. 2002, 56:162-5. [10.1002/ccd.10198](https://doi.org/10.1002/ccd.10198)
5. Huang Y, Xie X, Huang G, et al.: Long-term outcomes of endovascular therapy for right subclavian artery occlusive lesions: a multi-center experience. *Vascular*. 2025, 33:316-24. [10.1177/170855381241247613](https://doi.org/10.1177/170855381241247613)
6. Tonpe S, Warbhe H, Banode P, Gaddam N: Current advances in diagnostic and treatment approaches for subclavian steal syndrome: a case report and review of the literature. *Cureus*. 2024, 16:[10.7759/cureus.65925](https://doi.org/10.7759/cureus.65925)
7. Vasigh M, Martinez F, Ibeche B, Huda S, Kozman H: A case of recurrent coronary subclavian steal syndrome. *Cureus*. 2020, 12:[10.7759/cureus.9797](https://doi.org/10.7759/cureus.9797)
8. Borkowski P, Borkowska N, Mangeshkar S, Adal BH, Singh N: Racial and socioeconomic determinants of cardiovascular health: a comprehensive review. *Cureus*. 2024, 16:[10.7759/cureus.59497](https://doi.org/10.7759/cureus.59497)