Three episodes of basilar tip occlusion necessitating thrombectomies and a vertebral artery sacrifice in a patient with subclavian artery dissection distal to the vertebral artery origin: a case report

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Background: While acute occlusion of the subclavian artery (SCA) proximal to the vertebral artery (VA) origin is an uncommon but recognized cause of embolic stroke, an occlusion distal to the VA is rare and can be easily overlooked.

Case Description: We describe the clinical presentation and evaluation of a previously healthy 56-year-old woman who experienced four life-threatening posterior circulation strokes within 1 month, three of which led to basilar artery (BA) occlusions requiring thrombectomies. Workup revealed an occlusion of the right SCA located less than 1 cm distal to the VA origin. After the fourth posterior circulation ischemic event and three BA thrombectomies, a decision was made to sacrifice the right VA origin. Following the sacrifice of the origin of the right VA, she recovered with minimal neurological deficits and regained complete functionality with no further ischemic episodes in the following 2 years.

Conclusions: This case highlights an exceedingly rare etiology of posterior circulation stroke: an occlusion of the SCA distal to the VA origin. Though unconventional, the decision to sacrifice the VA origin proved crucial in this context and underscores the need for consideration in similar scenarios. Her recovery emphasizes the safety and effectiveness of recurrent thrombectomy procedures when appropriately indicated.

Keywords: Basilar occlusion; case report; subclavian occlusion; thrombectomy; vertebral sacrifice

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Introduction

Background

Injury to the subclavian artery (SCA) located proximal to the origin of the vertebral artery (VA) has been reported as a potential cause of stroke (1). The anatomical positioning of the SCA, shielded by the clavicles, ribs, and chest wall, renders proximal injuries uncommon (2,3). Typically, blunt force trauma to the SCA results in injury to the middle or distal arterial segment, past the bifurcation of the VA. Although SCA injuries are relatively infrequent, with an incidence reported between 3% and 9%, approximately a quarter of these cases may present with minimal symptoms, complicating the diagnostic process (4).

Rationale and knowledge gap

There is a lack of literature concerning posterior circulation stroke secondary to occlusion of the SCA distal to the VA origin, and when described, is often associated with patients diagnosed with thoracic outlet syndrome (5-8). Yet, a case linking this specific etiology to basilar artery (BA) occlusion requiring endovascular thrombectomy has not been previously described.

Objective

We report an unusual case of a previously healthy woman who experienced four life-threatening posterior circulation strokes within a span of less than 1 month. Three of these incidents led to BA occlusion and necessitated thrombectomies. The only identifiable cause was an occlusion of the SCA distal to the VA origin, culminating in the critical decision to sacrifice the VA's origin. We present this case in accordance with the CARE reporting checklist (available at https://acr.amegroups.com/article/view/10.21037/acr-24-46/rc).

Highlight box

Key findings

- Acute occlusion of the subclavian artery (SCA) distal to the vertebral artery (VA) origin is an exceedingly rare etiology of stroke and may be easily missed.

What is known and what is new?

- Similar cases in the literature describe conservative treatment for such an etiology.
- Sacrifice of the VA origin may be an advantageous treatment for similar cases.

What is the implication, and what should change now?

- It may be important to consider surgical treatment for acute occlusion of the SCA distal to the VA origin.

Case presentation

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for the publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

A 56-year-old female, an amateur volleyball player without significant stroke risk factors who has no history of smoking, presented with sudden onset left-sided numbness, as outlined in *Figure 1*. Physical examination revealed left-sided facial palsy, 4/5 strength on the left side, decreased sensation in the right arm and leg, mild left-sided dysmetria, and left homonymous hemianopia. Initial non-contrast head computerized tomography (NCCT) scan showed no evidence of infarct or hemorrhage. Computerized tomography angiography (CTA) of the head and neck identified a distal occlusion in the right posterior cerebral artery (PCA), with no other vascular abnormalities noted. The patient was treated with an intravenous tissue plasminogen activator (IV tPA) and admitted to the stroke unit. However, 10 hours after IV tPA administration, she experienced a decline in her condition, becoming mute and uncooperative. Repeat imaging revealed an acute right occipital infarct and basilar tip occlusion, which required immediate thrombectomy.

The procedure, employing a combined stent retriever (Solitaire 4X40, Medtronic, Minneapolis, MN, USA) and catheter aspiration (Sofia 5, MicroVention, Aliso Viejo, CA, USA) technique, achieved a thrombolysis in cerebral infarction score of 2B (TICI2B) in a single attempt. Post-thrombectomy, the patient showed significant improvement, though mild left-sided weakness remained. Throughout her hospitalization, extensive diagnostic tests, including transthoracic and transesophageal cardiac echocardiography, 24-hour Holter monitoring, hypercoagulability panel, full-body computerized tomography (CT), hemoglobin A1C (HbA1C), and a lipid profile were within normal limits. In the absence of a clear stroke etiology, warfarin 5 mg was started empirically, and the patient began in-house rehabilitation.

Three weeks into rehabilitation, the patient experienced

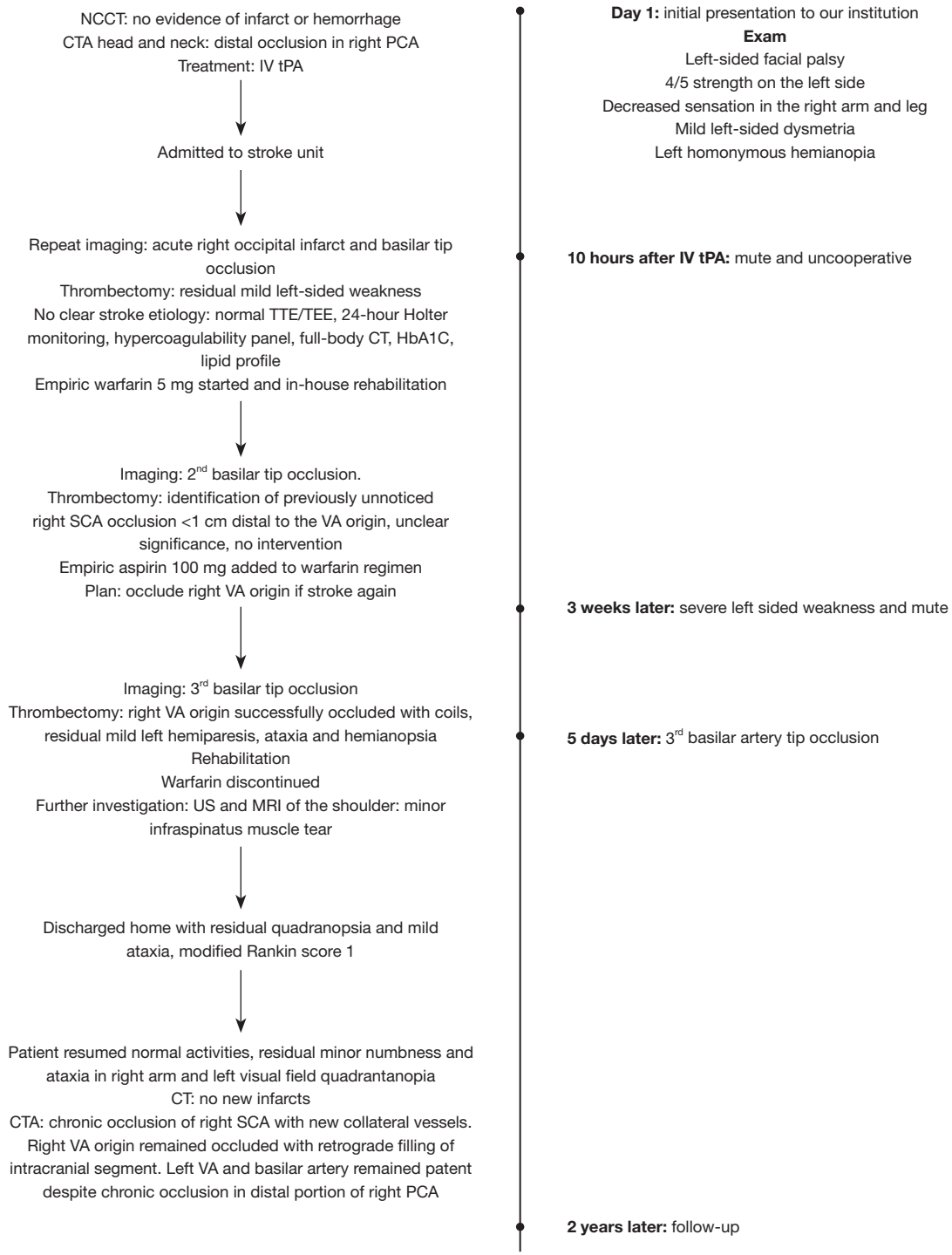

Figure 1 Timeline of patient encounter. NCCT, non-contrast head computerized tomography; CTA, computerized tomography angiography; PCA, posterior cerebral artery; IV tPA, intravenous tissue plasminogen activator; TTE, transthoracic echocardiography; TEE, transesophageal echocardiography; CT, computerized tomography; HbA1C, hemoglobin A1C; SCA, subclavian artery; VA, vertebral artery; US, ultrasonography; MRI, magnetic resonance imaging.

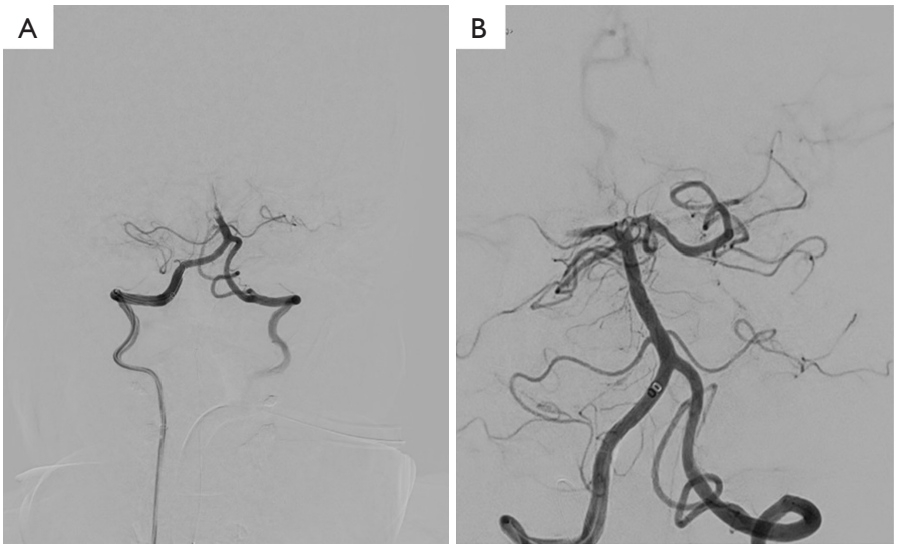

Figure 2 Third endovascular procedure: contrast is injected from right distal VA (v4 segment). (A) Pre-thrombectomy BA occlusion from its middle segment. (B) Post-thrombectomy recanalization of the BA with chronic occlusion of the middle-distal segment of the right PCA, TICI2B. VA, vertebral artery; BA, basilar artery; PCA, posterior cerebral artery; TICI2B, thrombolysis in cerebral infarction score of 2B.

severe left-sided weakness and mutism. Imaging indicated yet another basilar tip occlusion. Her international normalized ratio (INR) was therapeutically set at 2.8. A rapid thrombectomy using the same combined technique resulted in significant recanalization after one pass, returning her to neurological baseline. This episode led to the identification of a previously unnoticed right SCA occlusion less than one centimeter distal to the VA origin, evident in earlier CTAs but overlooked. A multidisciplinary team, comprising a neurologist, neuroradiologist, hematologist, and vascular surgeon opted against endovascular or surgical intervention for the SCA occlusion due to its unclear significance and paucity of relevant data. Aspirin 100 mg was empirically added to the warfarin regimen. Considering the occlusion's proximity to the right VA origin and its potential role in causing flow turbulence and retrograde embolic events, a decision was made to occlude the right VA origin if another stroke occurred.

Five days later, the patient experienced another stroke, with imaging revealing a third BA tip occlusion and the patient underwent another angiography and thrombectomy. The same combined stent retriever/catheter aspiration technique yielded significant recanalization (TICI2B) (*Figure 2*). An investigative angiography was performed and attempts to cross the SCA occlusion were unsuccessful, and aspiration attempts yielded minimal recanalization (*Figure 3*), with multiple large clots found in the catheter, suggesting a subacute SCA occlusion as the likely source of recurrent strokes. Following the team's decision, the right VA origin was successfully occluded with coils, after confirming patency of the left VA to prevent further embolic events (*Figure 4*). This ensured adequate posterior circulation through retrograde filling. Immediately following the procedure, she had mild left hemiparesis, ataxia, and hemianopsia.

The patient made a remarkable recovery following rehabilitation, showing significant clinical improvement. She was discharged home with residual quadranopsia and mild ataxia, achieving a modified Rankin score (mRS) of 1. Following the procedure, warfarin was discontinued, and the patient continued with aspirin. Further investigations, including an ultrasound and magnetic resonance imaging (MRI) of the shoulder, disclosed a minor tear in the infraspinatus muscle, supporting the patient's reported history of trauma. She recalled sustaining an injury to her right shoulder during a volleyball game 1 month before her first stroke, which resulted in mild tenderness but was not severe enough to prompt medical attention.

At the 2-year follow-up, the patient had resumed her normal activities, experiencing only minor numbness and ataxia in her right arm, along with a left visual field quadrantanopia. Subsequent CT scans showed no new infarcts. A follow-up CTA revealed a chronic occlusion of the right SCA with the development of new collateral vessels. The right VA origin remained occluded, with retrograde filling of the intracranial

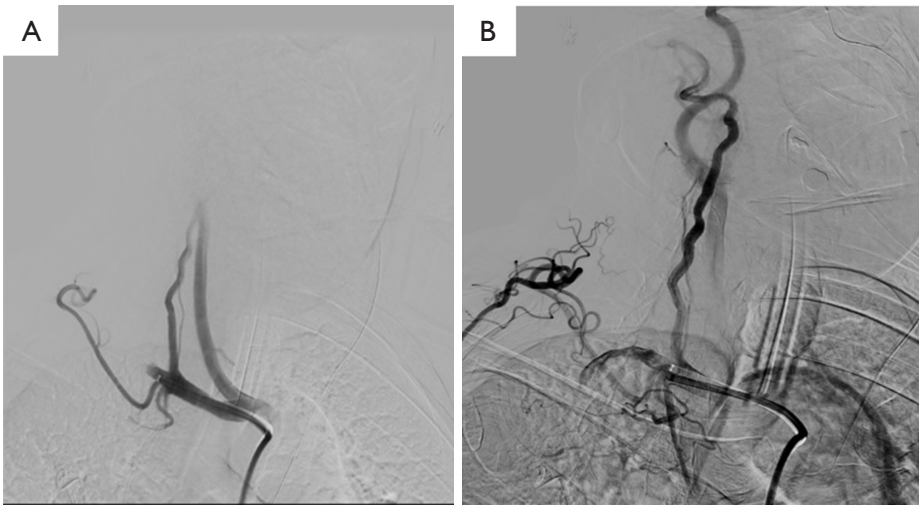

Figure 3 Third endovascular procedure after achieving BA recanalization, a contrast injection to the right SCA demonstrating: (A) complete occlusion of the SCA <1 cm distal to the origin of the right VA; (B) injection post large bore catheter thrombectomy distal to the origin of the VA did not show a significant recanalization. BA, basilar artery; SCA, subclavian artery; VA, vertebral artery.

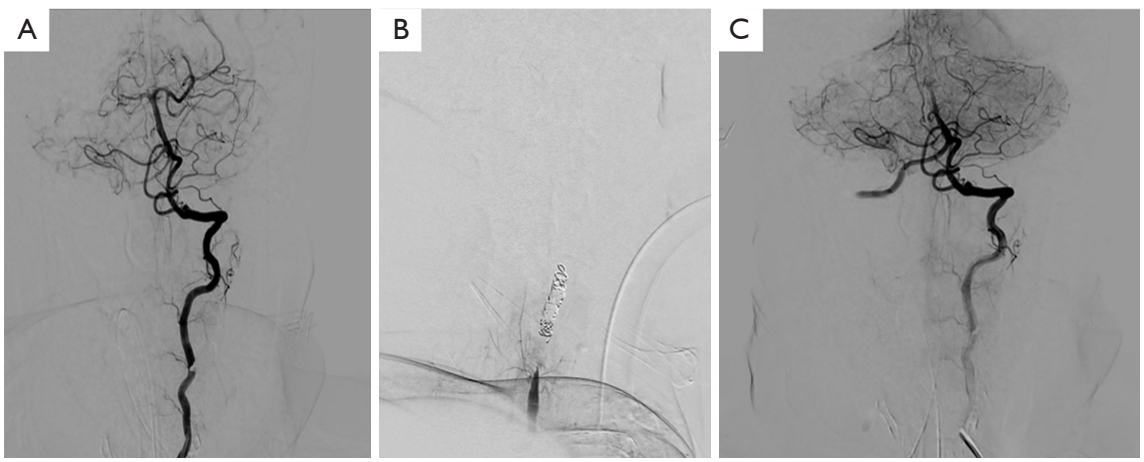

Figure 4 Third endovascular procedure after achieving BA revascularization and assessment of right subclavian artery occlusion. (A) Left VA injection pre-left vert occlusion demonstrating a patent vessel with good filling of the BA, (B) right vertebral origin run post sacrifice, and (C) left VA vert injection post right VA origin sacrifice showing, in addition to good filling of BA, a retrograde filling of the right VA intracranial segment. BA, basilar artery; VA, vertebral artery.

segment. The left VA and the BA remained patent despite a chronic occlusion in the distal portion of the right PCA.

Discussion

Key findings

We report an unusual case of a healthy 56-year-old woman who experienced four life-threatening posterior circulation strokes within 1 month, with three requiring mechanical thrombectomy. The most probable cause of these strokes is considered to be an occlusive dissection of the SCA, just distal to the VA origin, likely resulting from blunt trauma.

Strengths and limitations

Although this patient received comprehensive care, her right SCA occlusion distal to the VA origin was evident in

earlier CTAs, but overlooked.

Comparison with similar researches

Spontaneous or trauma-related SCA dissections are relatively rare, and literature on this subject is limited. Typically, such dissections may resolve spontaneously, often with minor or no symptoms (9-15).

While there are isolated reports of strokes associated with SCA occlusion (5-9,16,17) very few cases (5,8) have specifically identified an occlusion distal to the VA origin. The cases were managed conservatively and our search did not reveal any cases of large vessel occlusion (LVO) requiring thrombectomy in patients with SCA occlusion distal to the VA origin. This rarity may be due to the technical improbability of retrograde embolization forming a clot large enough to cause LVO.

In our case, however, the proximity of the occlusion to the VA origin permitted the recurrent retrograde embolization of large clots. Although the recurrence of strokes post-thrombectomy is documented (18-20), we found no cases in the literature of patients undergoing three cerebral thrombectomies within a single month on the same vessel. The definitive treatment in our case involved occluding the VA origin with coils. Sacrificing a vessel is not typically ideal, but it was deemed necessary due to persistent symptoms despite medical treatment, and after confirming adequate BA filling from the contralateral VA.

Implications and actions needed

Sacrificing a parent vessel is acknowledged in the literature as a treatment method, usually in scenarios involving active bleeding or giant aneurysm, rather than as a preventive measure against embolic events (21). Given the success in our case, we recommend considering such an intervention only when no other treatment options are viable, due to the long-term implications of closing a vessel.

The patient's survival and maintenance of independence, with a mRS of 1, after three life-threatening basilar tip occlusions and thrombectomies within a single month is extraordinary. It underscores the safety and efficacy of endovascular treatment for LVO, marking a significant observation in the field of neurology and stroke management.

Conclusions

We describe a previously healthy 56-year-old woman who experienced four life-threatening posterior circulation strokes within a single month, with three leading to BA occlusions that required thrombectomy for resolution. The underlying cause of these strokes was identified as an occlusion of the SCA distal to the origin of the VA, ultimately necessitating the sacrifice of the VA origin. Remarkably, the patient was able to complete her rehabilitation in a short period, achieving a mRS of 1, and has remained symptom-free for 2 years. Notably, the occlusion of the SCA was initially overlooked in the first two CT angiograms and during the initial thrombectomy. Given the occlusion's location distal to the VA origin, it is unclear if an earlier diagnosis would have altered our initial approach. However, it is conceivable that such knowledge might have led to an earlier decision to sacrifice the VA after the second occurrence of BA occlusion.

This case serves as a critical reminder of the importance of thorough vascular imaging and consideration of rare etiologies in cases of recurrent stroke. Additionally, it introduces VA origin sacrifice as a viable, though unconventional, treatment strategy for similar scenarios. Sharing this case contributes to broader medical knowledge by highlighting an unusual pathology behind recurrent basilar occlusive strokes and endorsing VA origin sacrifice as a possible treatment option in comparable cases.

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Footnote

Reporting Checklist: The authors have completed the CARE reporting checklist. Available at https://acr.amegroups.com/article/view/10.21037/acr-24-46/rc

Peer Review File: Available at https://acr.amegroups.com/article/view/10.21037/acr-24-46/prf

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://acr.amegroups.com/article/view/10.21037/acr-24-46/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are 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. All procedures

performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for the publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

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