

Ruptured aneurysm of the artery of Davidoff and Schechter: illustrative case

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BACKGROUND The artery of Davidoff and Schechter (ADS) is an uncommonly encountered meningeal branch originating from the posterior cerebral artery typically identified in the setting of pathology, often dural arteriovenous fistulas (DAVFs). Here, the authors describe the first reported case of an ADS aneurysm, discovered in the setting of subarachnoid hemorrhage (SAH) and complicating a high-grade DAVF.

OBSERVATIONS A 57-year-old female presented after experiencing the worst headache of her life. Noncontrast computed tomography scanning of the head demonstrated SAH. Angiography revealed a high-grade DAVF centered around the anterior straight sinus, consistent with the Galenic subtype of tentorial DAVF. Predominant arterial supply was from the bilateral middle meningeal and occipital arteries. Vertebral artery imaging revealed a 12-mm irregular aneurysm. The prospect that the target artery represented the noneloquent ADS was confirmed by Wada testing. Given the fusiform nature of the aneurysm, treatment required concomitant coil embolization of the aneurysm and parent artery sacrifice. A week later, the DAVF was treated with liquid embolic. The patient tolerated treatment without neurological compromise.

LESSONS The authors describe the first reported case of an ADS aneurysm discovered in the setting of SAH complicating a high-grade DAVF and the lessons learned during our experience managing this unique pathology.

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KEYWORDS artery of Davidoff and Schechter; aneurysm; dural arteriovenous fistula

The artery of Davidoff and Schechter (ADS) is a meningeal branch arising from the P1 or P2 segment of the posterior cerebral artery (PCA) that is not well described in the literature.¹ The ADS supplies the dura of the inferomedial portion of the tentorium cerebelli in hemodynamic balance with the artery of Bernasconi and Cassinari.² The vessel is typically only identified in the setting of pathology involving the tentorium or posterior falx, often with dural arteriovenous fistulas (DAVFs),²⁻⁶ or meningiomas.⁷ Overall, discussion of the ADS in the current literature is minimal. Here, we describe the first reported case of an ADS aneurysm that presented with subarachnoid hemorrhage (SAH) in the setting of a high-grade DAVF.

Illustrative Case

A 57-year-old female with no pertinent past medical history presented to an outside emergency department after experiencing the sudden

onset of the worst headache of her life together with nausea and vomiting. Noncontrast computed tomography (CT) scanning of the head demonstrated SAH in the basal cisterns (Fig. 1, left). Computed tomography angiography (CTA) revealed concern for a complex vascular malformation (Fig. 1, right). The patient was transferred to our facility for further workup and management. Upon arrival she was found to have ongoing headache and nausea but was alert, oriented, and neurologically intact.

Digital subtraction angiography (DSA) was performed with the patient under conscious sedation. A high-grade, high-flow DAVF centered around the anterior portion of the straight sinus, consistent with the Galenic subtype of tentorial DAVF as described by Lawton et al.⁸ Predominant arterial supply was from the bilateral middle meningeal arteries (MMAs) and occipital arteries (OAs; Fig. 2C and D). Multiple fistulous connections along the straight sinus and vein of Galen were evident. The vein of Galen was pathologically

ABBREVIATIONS 3D = three-dimensional; ADS = artery of Davidoff and Schechter; CT = computed tomography; BAER = brainstem auditory evoked response; CTA = computed tomography angiography; DAVF = dural arteriovenous fistula; DSA = digital subtraction angiography; EEG = electroencephalography; MMA = middle meningeal artery; MEP = motor evoked potential; OA = occipital artery; PCA = posterior cerebral artery; SAH = subarachnoid hemorrhage; SCA = superior cerebellar artery; SEEP = somatosensory evoked potential; VA = vertebral artery.

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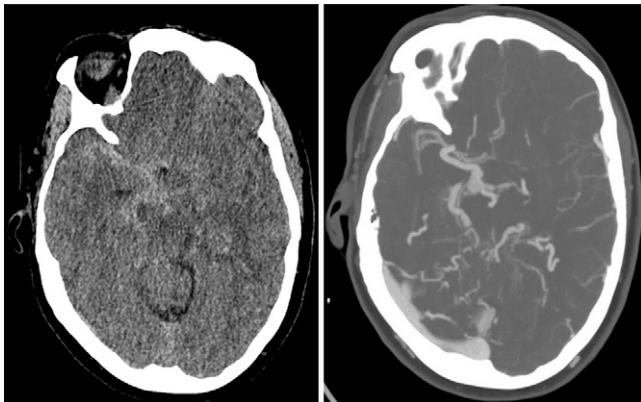


FIG. 1. Noncontrast CT scan (left) demonstrating SAH and CTA (right) demonstrating complex vascular malformation.

dilated, and extensive retrograde cortical venous drainage was demonstrated.

Unexpectedly, vertebral artery (VA) imaging revealed a large, 12-mm, highly irregular aneurysm in a paramedian location intimate with the right PCA and superior cerebellar artery (SCA) in the interpeduncular cistern (Fig. 2A and B). The precise nature of the aneurysm was not clear, but it was considered the source of rupture due to the conspicuous morphology and location central in the hemorrhage. Superselective angiography was performed but was largely noncontributory due to motion and imaging artifact. The case was closed, and the patient was managed overnight in the intensive care unit with regulation of blood pressure, antiepileptic prophylaxis, and aminocaproic acid.

We returned to the angiography suite the following morning and established general anesthesia with neurophysiological monitoring of electroencephalography (EEG), somatosensory evoked potentials

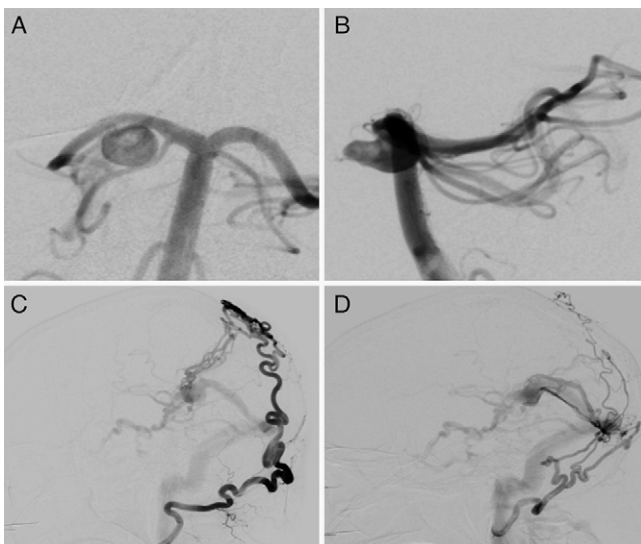


FIG. 2. Coronal (A) and lateral (B) views of left VA injection diagnostic angiography demonstrating aneurysm, and lateral view of left (C) and right (D) OA injection identifying the DAVF.

(SSEPs), motor evoked potentials (MEPs), and brainstem auditory evoked responses (BAERs). Via radial access, three-dimensional (3D) angiography of the posterior circulation was performed. The right SCA and PCA were well delineated on the optimized images. The aneurysm involved a prominent caliber third vessel in the immediate vicinity arising from the right P1. The vessel followed the course of the SCA around the brainstem, coursing through the subarachnoid space, ultimately making a direct fistulous connection to the straight sinus. It was suspected that the vessel represented a pathologically dilated ADS (Fig. 3).

The aneurysm was fusiform in nature, and treatment would require sacrifice of the parent vessel. To confirm the safety of this maneuver, superselective angiography and superselective Wada testing were performed. To achieve this, the aneurysm was crossed with a microcatheter. Superselective angiography of the vessel distal to the aneurysm demonstrated no supply to brain parenchyma (Fig. 4). Superselective Wada testing was then performed with 20 mg of propofol. No significant change to neurophysiological data was identified. The microcatheter was then retracted proximally to the level of the aneurysm and superselective Wada testing was repeated. Again, no important neurophysiological monitoring changes were identified. The data reinforced our hypothesis that the vessel represented the ADS, and that sacrifice would be well tolerated.

Since the ADS supplied the fistula and future access would not be achievable after aneurysm treatment, we navigated a second embolization microcatheter along the length of the ADS to the level of the fistula. Through the first microcatheter, coil embolization of the ruptured aneurysm was performed with concomitant parent vessel sacrifice. Thereafter, Onyx-34 (Medtronic) embolization was performed through the second, distal microcatheter, disconnecting the ADS from the fistulous dura of the straight sinus. Follow-up images demonstrated complete occlusion of the aneurysm and no further supply to the fistula from the target ADS (Fig. 5). The procedure was tolerated with no neurological deficit.

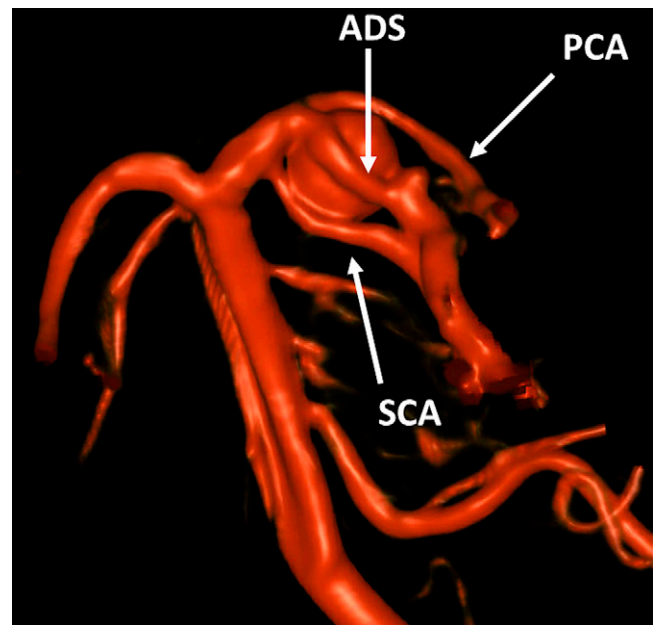


FIG. 3. 3D reconstruction demonstrating the ADS aneurysm.

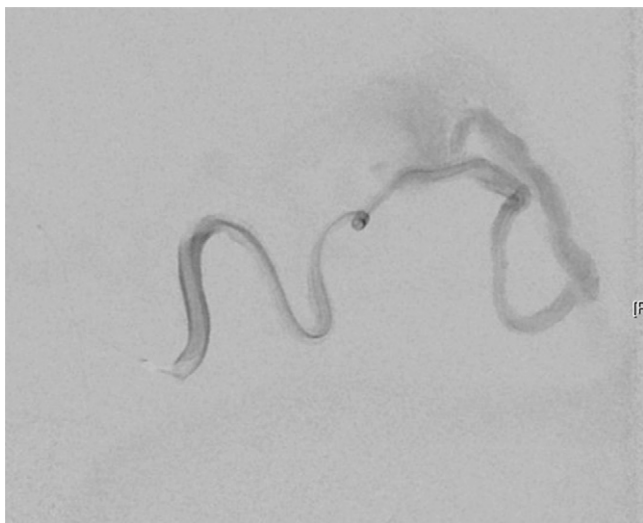


FIG. 4. Supraselective angiography demonstrating no supply to brain parenchyma.

The patient was supported throughout the post-SAH course without complication. Approximately 1 week later, we returned to the angiographic suite for treatment of the high-grade fistula. Balloon-assisted Onyx embolization was performed via the left MMA and the right OA. The fistula was reduced by approximately 95%, with patency of the vein of Galen and straight sinus maintained and no persistent high-grade features.

The procedure was well tolerated, and the patient was discharged home on postoperative day 2. At 2 months follow-up, the patient reports she has returned to all activities of daily living and demonstrates no neurological deficit. DSA follow-up is planned for 6 months postembolization.

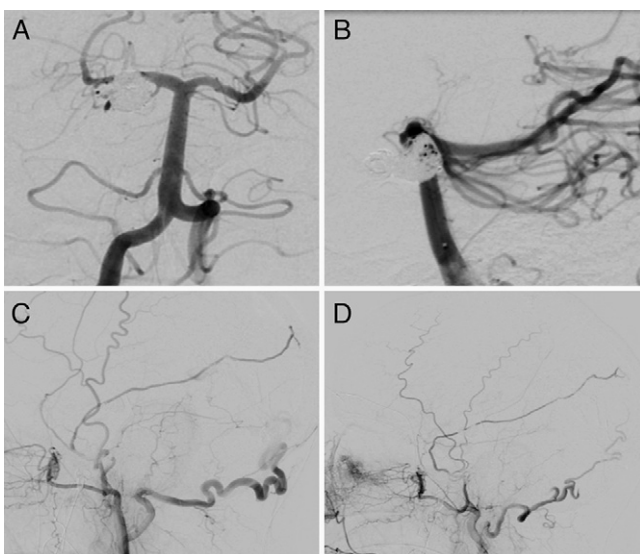


FIG. 5. Coronal (A) and lateral (B) views of right VA injection following coil embolization of the aneurysm and lateral view of left (C) and right (D) OA injection following liquid embolization of the DAVF.

Discussion

The ADS is a meningeal branch classically described as originating from the P1 or P2 segment of the PCA. It was first described by Wollschlaeger and Wollschlaeger,⁹ who identified the artery in 90% of cadaveric dissections by postmortem angiography, followed by *in vivo* discovery by Weinstein et al.¹⁰ One cadaveric study found a much lower presence of the artery but reliably demonstrated the course of the ADS as arising from the proximal PCA, running through the ambient cistern, traversing with the SCA, and supplying the falx cerebri at the falco-tentorial junction and medial tentorium cerebelli.¹¹ The ADS is typically not visualized on DSA unless pathology is present. Although scarcely reported in the literature, studies have described its pathological role in DAVF involving the tentorium or in posterior fossa meningiomas.^{3,7,12}

It is critical to note the similar anatomical course of the ADS in comparison to other major branches of the basilar apex. The PCA, SCA, and medial posterior choroidal artery each arise at or near the basilar terminus, and each subsequently courses around the brainstem in the ambient cistern. These essential branches supply eloquent areas of the posterior fossa, cerebellum, thalamus, and midbrain. The ADS, in contrast, supplies only the meninges, with no involvement in normal parenchymal supply.

Observations

In this case report, a large, irregular aneurysm in the interpeduncular cistern was considered to be the source of SAH. The aneurysm arose from a branch closely associated with the basilar terminus which subsequently coursed through the ambient cistern to ultimately supply the fistula of the straight sinus. Due to the fusiform nature of the aneurysm, treatment would require concomitant occlusion and sacrifice of the parent artery. The eloquent parenchymal branches were carefully confirmed to be separate and distinct from the aneurysmal vessel. The prospect was raised that the target artery represented the noneloquent ADS. Supraselective angiography further refined the characterization and confirmed an absence of parenchymal supply throughout the vessel course. Subsequent supraselective Wada testing further confirmed our hypothesis, resulting in no measurable neurophysiological response on bilateral EEG, SSEP, MEP, or BAER. In the setting of DAVF, a false-negative Wada test can occur due to the anesthetic being shunted into the draining vein without reaching brain parenchyma. However, the anatomical considerations coupled with the neurophysiological data increased our confidence that this was a noneloquent artery and treatment was pursued. Thereafter, the ruptured aneurysm and the ADS were successfully occluded by coil embolization. As hypothesized, the procedure was tolerated with no neurological compromise.

To our knowledge, this is the first reported case of an aneurysm arising from the ADS occurring in the setting of a high-grade DAVF. In this case, the aneurysm was considered the source of SAH. Recalling the significance of this uncommonly encountered artery resulted in a profoundly positive impact on the patient's outcome.

Lessons

The ADS is an uncommonly encountered cerebral artery with concordantly small representation in the current medical literature. To our knowledge, this is the first reported case of an aneurysm arising from the ADS. In DAVF arising from the ADS, pathological dilation of this vessel can lead to a flow-related aneurysm that is prone to rupture causing SAH. Parent vessel sacrifice is a definitive treatment to eliminate arteriovenous shunting and occlude the aneurysm of the

ADS. Accurate identification of the ADS was paramount to our treatment decision-making process, as it is located in close proximity to the SCA, PCA, and medial posterior choroidal artery. Our understanding that the ADS is a pial-derived vessel that supplies the tentorium allows us to safely sacrifice the vessel for treatment of the aneurysm. This is in stark contrast to the vessels previously mentioned that supply eloquent regions of the brain including the posterior fossa, cerebellum, thalamus, and midbrain. This case report serves to describe a unique pathology in the literature and to highlight important lessons learned during the management of this unusual case.

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Disclosures

Dr. Peterson reports honoraria and travel expenses from Stryker and Penumbra. Dr. Ebersole reported personal fees from Stryker Neurovascular and Microvention. No other disclosures were reported.

Author Contributions

Conception and design: De Stefano, Chatley, Ebersole. Acquisition of data: Fry, De Stefano, Ebersole. Analysis and interpretation of data: Fry, De Stefano, Chatley, Peterson, Ebersole. Drafting the article: Fry, De Stefano. Critically revising the article: all authors. Reviewed submitted version of manuscript: Fry, Chatley, Lei, Peterson, Ebersole. Approved the final version of the manuscript on behalf of all authors: Fry. Administrative/technical/material support: Fry, Chatley. Study supervision: Ebersole.

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