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Acute Red Eye as the Presenting Feature of a Dural Carotid-Cavernous Fistula: A Case Report

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Abstract | **Case Report**

A 48-year-old man with diabetes and hypertension presented with a one-week history of a painful red right eye and ophthalmoplegia. Orbital computed tomography showed mild right proptosis, an enlarged right cavernous sinus and a dilated, tortuous right superior ophthalmic vein. Arterial time-of-flight magnetic resonance angiography demonstrated flow-related signal in the enlarged vein, linking the orbital congestion to an arteriovenous shunt. Selective cerebral angiography identified a right cavernous sinus dural fistula supplied by meningeal branches of both external carotid arteries and the left internal carotid artery, establishing a Barrow type D fistula. The shunt drained into both inferior petrosal sinuses, with additional reflux into a dilated left parietal cortical vein. This case illustrates how a common ocular symptom, such as a painful red eye, can be the presenting feature of a dural carotid-cavernous fistula.

Keywords: Carotid-Cavernous Fistula, Cortical Venous Reflux, Superior Ophthalmic Vein, Magnetic Resonance Angiography, Cerebral Angiography, Ophthalmoplegia.

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INTRODUCTION

Carotid-cavernous fistulas are abnormal arteriovenous shunts between the carotid arterial system and the cavernous sinus. They may be direct, arising from a defect in the wall of the internal carotid artery, or indirect (dural), supplied by meningeal branches of the internal and/or external carotid arteries. Their ocular manifestations reflect the venous outflow pattern and may initially resemble an inflammatory orbital disorder [1]. The Barrow classification describes arterial supply [2], whereas the route of venous drainage helps explain the presentation and identifies structures exposed to venous hypertension [3]. We report a right-sided dural fistula in which the superior ophthalmic vein provided the first imaging clue and angiography disclosed reflux into a cortical vein of the opposite hemisphere.

CASE REPORT

A 48-year-old man with type 2 diabetes of four years' duration, hypertension and obesity was undergoing neurologic evaluation for possible neurosarcoidosis after right oculomotor and left facial nerve palsies. He presented with a one-week history of a painful red right eye and ophthalmoplegia. Ophthalmologic examination revealed mild right-sided proptosis and marked conjunctival hyperemia with dilated, tortuous episcleral vessels (Figure 1A). Decimal visual acuity was 0.4 in the right eye and 0.3 in the left. Bilateral retinal hemorrhages and macular edema were recorded (Figure 1B).



Figure 1A: External photograph of the right eye showing marked conjunctival hyperemia with prominent, dilated and tortuous episcleral vessels displaying a corkscrew appearance

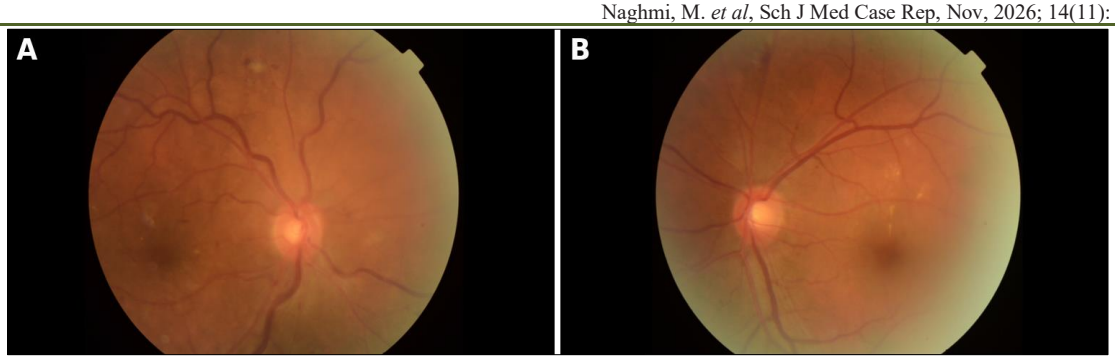


Figure 1B: Fundus photographs from the ophthalmologic evaluation, showing bilateral retinal hemorrhages associated with an abnormal macular reflex, without exudates, neovascularization, or signs of tractional retinal detachment.

Thin-section orbital CT performed before and after intravenous contrast administration demonstrated asymmetric enlargement of the right cavernous sinus with outward bowing of its lateral wall. The right superior ophthalmic vein was dilated and tortuous but remained patent. The right extraocular muscles were enlarged, with associated grade I proptosis. This constellation of findings suggested right orbital venous congestion secondary to a carotid-cavernous fistula (Figure 2).

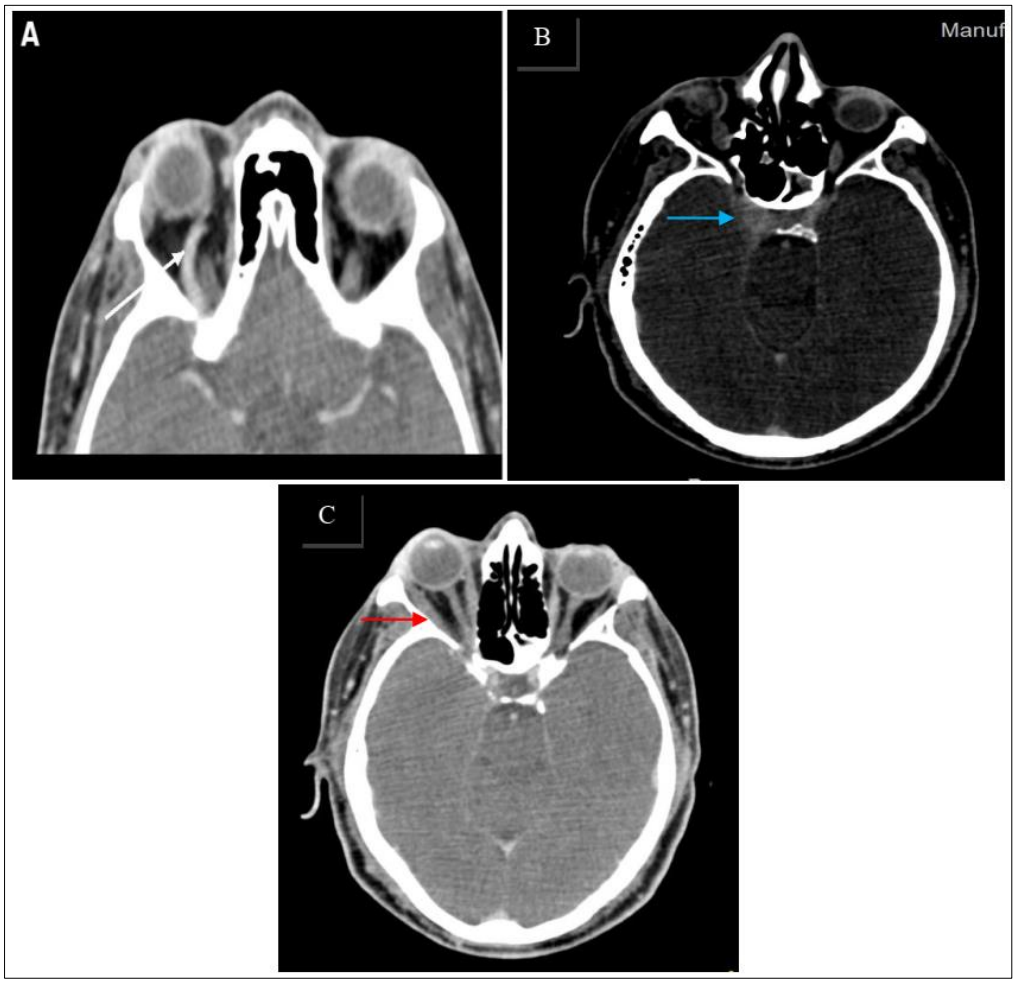


Figure 2: Orbital CT. (A) Axial image shows the enlarged, tortuous right superior ophthalmic vein (white arrow) behind the globe. (B) Axial image shows asymmetry of the cavernous sinuses, with fullness on the right (blue arrow). (C) Axial image shows thickening of the right extraocular muscles (red arrow) and mild (grade I) right proptosis, with preserved intraconal and extraconal fat planes

MRI performed the following day showed flow-related hyperintensity within the right superior ophthalmic vein on arterial time-of-flight (TOF) source images. Orbital short tau inversion recovery (STIR) images showed edema of the enlarged extraocular muscles and infiltration of the intraconal and extraconal fat. The right lacrimal gland was edematous and displaced anteriorly. Postcontrast T1-weighted images

confirmed asymmetric enlargement of the right cavernous sinus with convexity of its lateral wall. The optic pathways appeared normal, and there was no orbital mass. Bilateral frontoparietal white matter hyperintensities on FLAIR showed neither diffusion restriction nor enhancement. There was no acute infarction or recent hemorrhage (Figure 3).

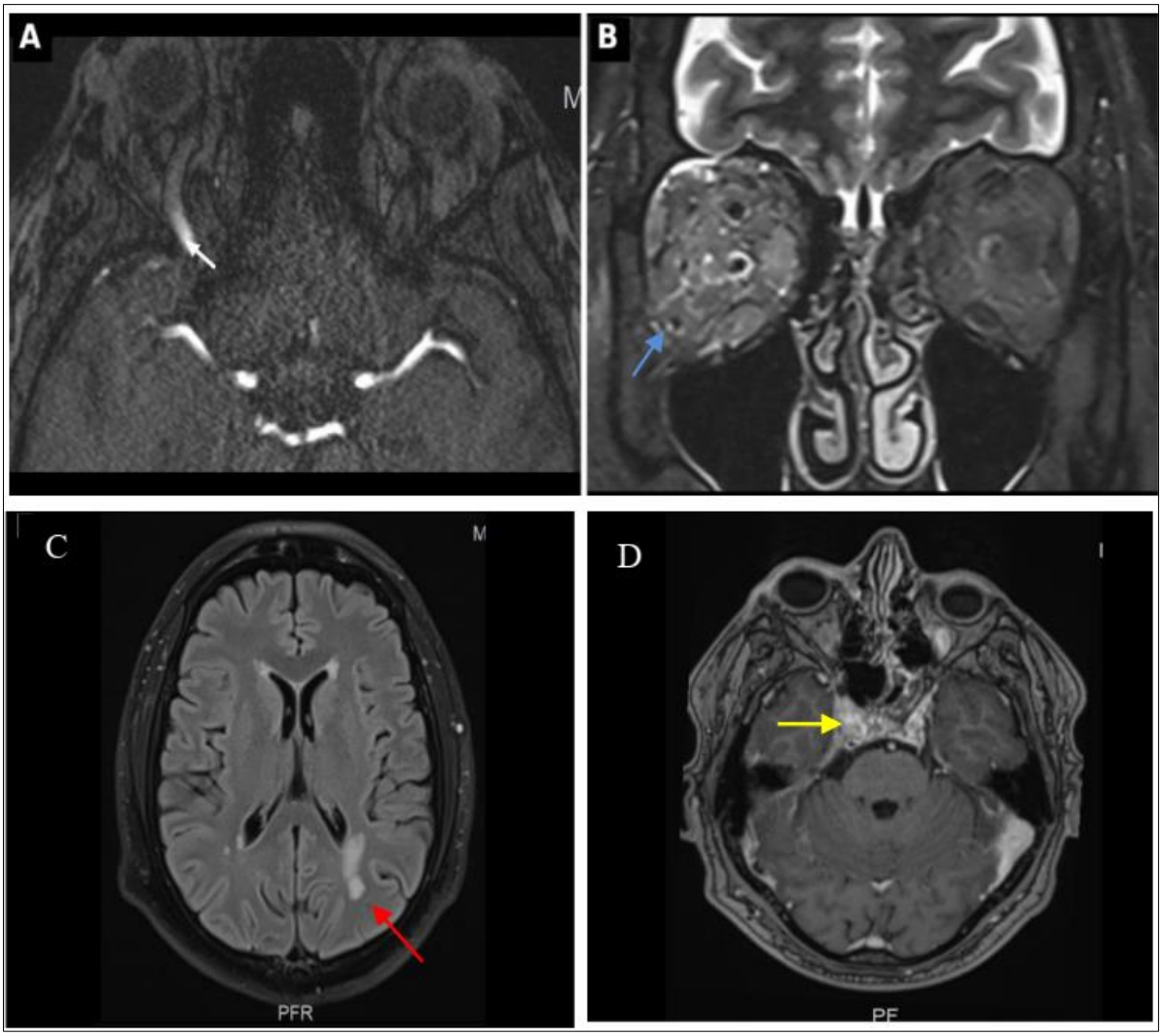


Figure 3: Orbital MRI and MR angiography. (A) Arterial TOF source image shows flow-related signal in the enlarged right superior ophthalmic vein (white arrow). (B) Coronal STIR image shows asymmetric high signal within the right orbital fat and extraocular muscles (blue arrow). (C) Axial FLAIR image shows nonspecific white matter hyperintensities, most conspicuous adjacent to the atrium of the left lateral ventricle on this section (red arrow). (D) Axial postcontrast T1-weighted image shows asymmetric enlargement of the right cavernous sinus with convexity of its lateral wall (yellow arrow)

Ten days after CT, selective cerebral angiography was performed via right common femoral artery access. Both internal carotid arteries, both external carotid arteries, and the left vertebral artery were selectively injected.

Angiography demonstrated a dural arteriovenous fistula of the right cavernous sinus. The arterial supply arose predominantly from branches of both external carotid arteries, including the frontal and parietal branches of the right middle meningeal artery (Figure 4A and D) and the left middle meningeal artery (Figure 4C), as well as sphenopalatine branches of both maxillary arteries.

Additional supply arose from meningeal branches of the inferolateral trunk and the meningohypophyseal trunk (Figure 4B) of the left internal carotid artery. There was no direct communication between either internal carotid artery and the cavernous sinus. These findings were consistent with a Barrow type D indirect carotid–cavernous fistula.

Venous drainage was through both inferior petrosal sinuses, with reflux into a dilated left parietal cortical vein that drained into the straight sinus.

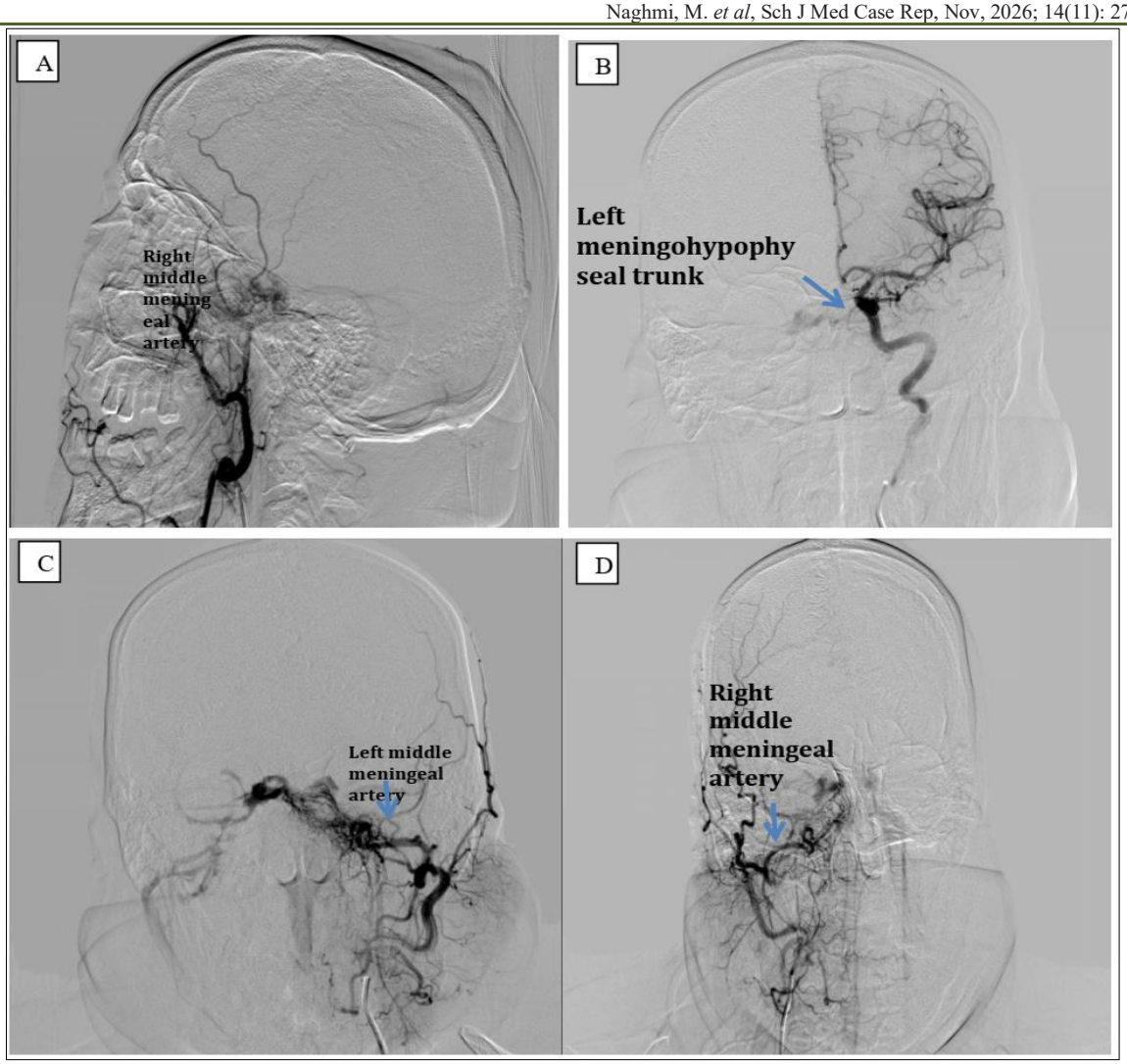


Figure 4: Angiographic demonstration of arterial feeders to a right dural carotid–cavernous fistula (Barrow type D). (A) Right middle meningeal artery. (B) Left meningohypophyseal trunk. (C) Left middle meningeal artery. (D) Additional view of the right middle meningeal artery.

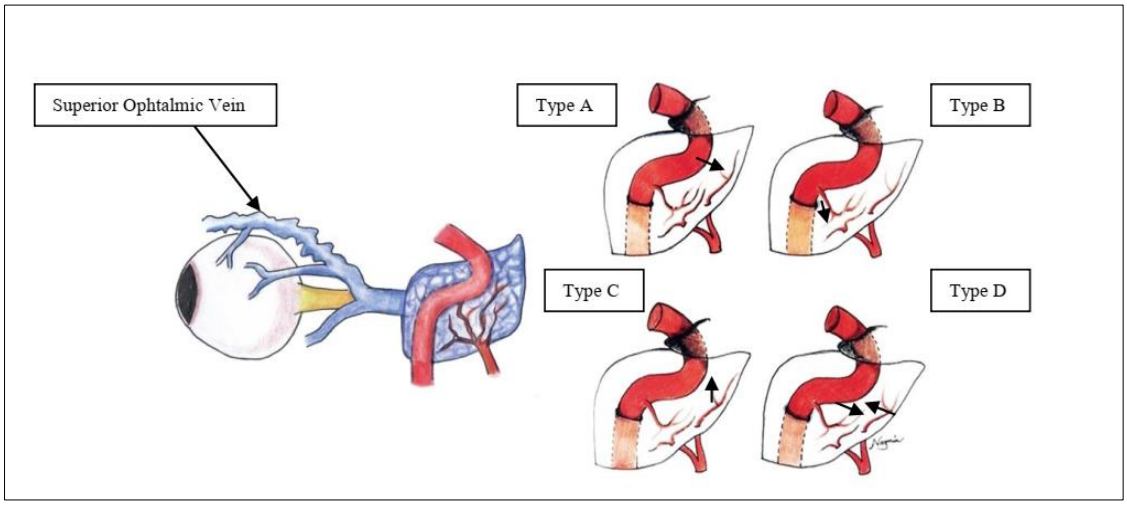


Figure 5: Barrow classification of carotid-cavernous fistulas. Type A is a direct shunt from the internal carotid artery to the cavernous sinus. Types B, C and D are dural shunts supplied by branches of the internal carotid artery, external carotid artery or both, respectively. Reproduced unchanged from Figure 2 in Chowdhury FH, Alam S, Ahmed N and Haque MR, "Caroticocavernous Fistula (CCF)," p. 279. © 2024 the authors.
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DISCUSSION

The enlarged, tortuous right superior ophthalmic vein was the first imaging clue to the cause of this patient's painful ophthalmoplegia (Figure 2). Proptosis and extraocular muscle enlargement can also occur with orbital inflammation; however, the accompanying enlargement of the right cavernous sinus on CT and the flow-related signal in the superior ophthalmic vein on arterial time-of-flight MR angiography (Figure 3) favored a carotid-cavernous shunt [1-4]. Orbital venous congestion accounted for the painful red eye and proptosis. The available findings did not establish a relationship between the fistula and the nonspecific white matter lesions.

In a retrospective series of 98 patients investigated for suspected carotid-cavernous fistula, Kim et al. found prominent venous drainage in 36 of 38 angiographically confirmed cases [4]. An abnormal cavernous sinus contour and orbital soft-tissue swelling were also associated with the diagnosis. In the present case, TOF localized the abnormal orbital flow, but neither its signal intensity nor the degree of proptosis established the source of the shunt or the direction of intracranial venous drainage.

The left internal carotid artery contribution illustrates the value of selective bilateral carotid injections even when ocular signs are unilateral. Demonstrating the meningeal origin of this supply was essential: together with the bilateral external carotid feeders, it defined a type D fistula, while the absence of a direct carotid defect excluded a type a lesion (Figure 5) [2]. The arterial classification alone does not convey the risk associated with cortical reflux. Stiebel-Kalish *et al*., linked orbital manifestations to anterior venous drainage [3]. Here, the enlarged right superior ophthalmic vein accounted for the side of presentation, yet the angiographic study also identified petrosal outflow on both sides and a cortical outlet on the left.

Cortical venous reflux exposes cerebral veins to shunt pressure and is associated with venous infarction and intracranial hemorrhage. Its presence warrants prompt neurointerventional assessment even when brain MRI shows no acute injury [1-5]. For dural cavernous sinus fistulas requiring treatment, transvenous embolization through an inferior petrosal sinus is a commonly used approach. Its feasibility depends on access to the shunted compartment and the configuration of normal venous outlets [6]. In this patient, the bilateral petrosal drainage offered two potential transvenous access routes. Whether either route was used and whether the fistula was ultimately occluded remain unknown.

CONCLUSION

In painful unilateral ophthalmoplegia, a dilated superior ophthalmic vein on CT should prompt scrutiny of the ipsilateral cavernous sinus and assessment for arterialized venous flow on MRA. In this case, bilateral selective angiography identified dural supply from the contralateral internal carotid artery and left parietal cortical reflux, findings that could not have been predicted from the side or severity of the proptosis.

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Competing Interests: The authors declare no competing interests.

REFERENCES

1. Henderson, A. D., & Miller, N. R. (2018). Carotid-cavernous fistula: Current concepts in aetiology, investigation, and management. *Eye, 32*(2), 164–172. https://doi.org/10.1038/eye.2017.240
2. Barrow, D. L., Spector, R. H., Braun, I. F., Landman, J. A., Tindall, S. C., & Tindall, G. T. (1985). Classification and treatment of spontaneous carotid-cavernous sinus fistulas. *Journal of Neurosurgery, 62*(2), 248–256. https://doi.org/10.3171/jns.1985.62.2.0248
3. Stiebel-Kalish, H., Setton, A., Nimii, Y., Kalish, Y., Hartman, J., Huna Bar-On, R., Berenstein, A., & Kupersmith, M. J. (2002). Cavernous sinus dural arteriovenous malformations: Patterns of venous drainage are related to clinical signs and symptoms. *Ophthalmology, 109*(9), 1685–1691. https://doi.org/10.1016/S0161-6420(02)01166-1
4. Kim, D., Choi, Y. J., Song, Y., Chung, S. R., Baek, J. H., & Lee, J. H. (2020). Thin-section MR imaging for carotid cavernous fistula. *American Journal of Neuroradiology, 41*(9), 1599–1605. https://doi.org/10.3174/ajnr.A6757
5. Vranic, J. E., Regenhardt, R. W., Awad, A., Doron, O., & Rabinov, J. (2026). Endovascular and medical management strategies for carotid-cavernous fistulas: A safety and efficacy analysis. *Interventional Neuroradiology, 32*(5), 2088–2095. https://doi.org/10.1177/15910199241261761
6. Harake, E. S., Nieblas-Bedolla, E., Wilseck, Z., Chaudhary, N., Armonda, R. A., Pandey, A. S., & Dowlati, E. (2026). Endovascular approaches for the treatment of dural carotid-cavernous fistulas: A systematic review. *Interventional Neuroradiology, 32*(4), 1714–1728. https://doi.org/10.1177/15910199241272595.