

# Transorbital Approach for Endovascular Occlusion of Carotid-Cavernous Fistulas: Technical Note and Review of the Literature

**Ching-Jen Chen, MD<sup>1</sup>**; Panagiotis Mastorakos, MD<sup>1</sup>; James P. Caruso, MD<sup>2</sup>; Dale Ding, MD<sup>3</sup>; Paul J. Schmitt, MD<sup>1</sup>; Thomas J. Buell, MD<sup>1</sup>; Daniel M. Raper, MD<sup>1</sup>; Avery Evans, MD<sup>4</sup>; Steven A. Newman, MD<sup>5</sup>; Mary E. Jensen, MD<sup>4</sup>

<sup>1</sup>Department of Neurological Surgery, University of Virginia Health System, Charlottesville, Virginia

<sup>2</sup>Department of Neurosurgery, University of Texas Southwestern Medical Center, Dallas, Texas

<sup>3</sup>Department of Neurosurgery, Barrow Neurological Institute, Phoenix, Arizona

<sup>4</sup>Division of Interventional Neuroradiology, University of Virginia Health System, Charlottesville, Virginia

<sup>5</sup>Department of Ophthalmology, University of Virginia Health System, Charlottesville, Virginia

## Conflict of Interest Declaration

- Herewith I confirm that I do NOT have any relevant financial relationships with commercial interests.

## Introduction

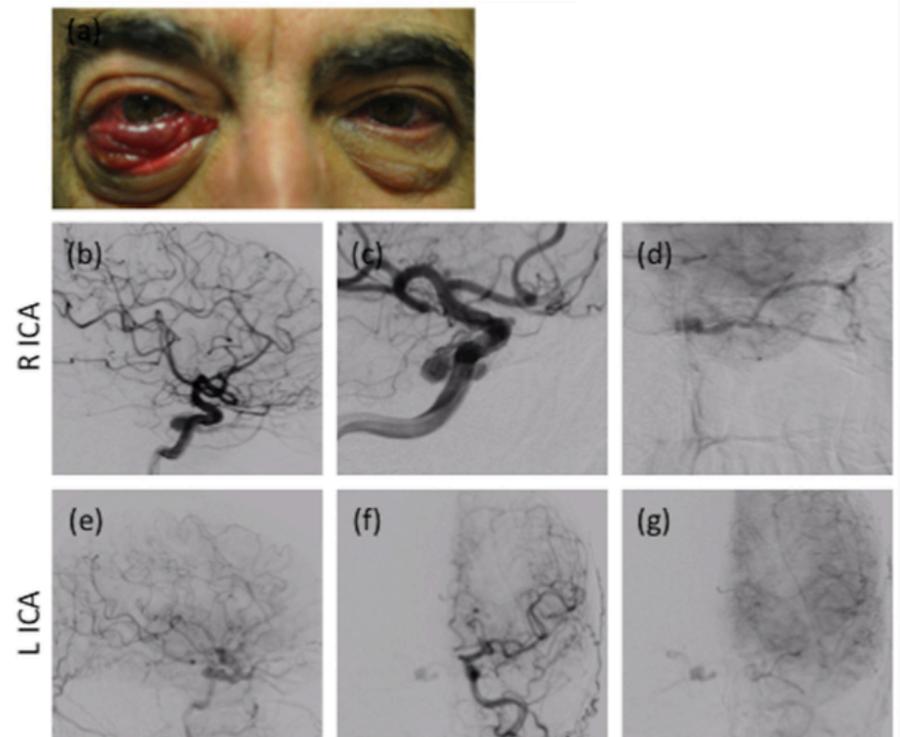
- A carotid-cavernous fistula (CCF) is an abnormal arteriovenous connection between the cavernous sinus (CS) and the cavernous segment of the internal carotid artery (ICA).
- The most common treatment modality for CCFs is endovascular embolization via transvenous catheterization. Numerous routes exist for obtaining transvenous access, including the inferior petrosal sinus and facial vein.
- However, rare cases arise in which anatomic constraints preclude transvenous access to the CS. In these patients, a direct transorbital approach may be employed to access and obliterate the fistula.
- The following technical note describes our procedural experience with transorbital embolization of a CCF.

## Case Report

- We describe a case example with bilateral Barrow Type B CCFs, which were inaccessible using the traditional transvenous approach.
- Hence, a direct transorbital approach, performed under fluoroscopic guidance, was employed to successfully obliterate the CCF.
- At five months follow-up, the patient was recovering without complications.

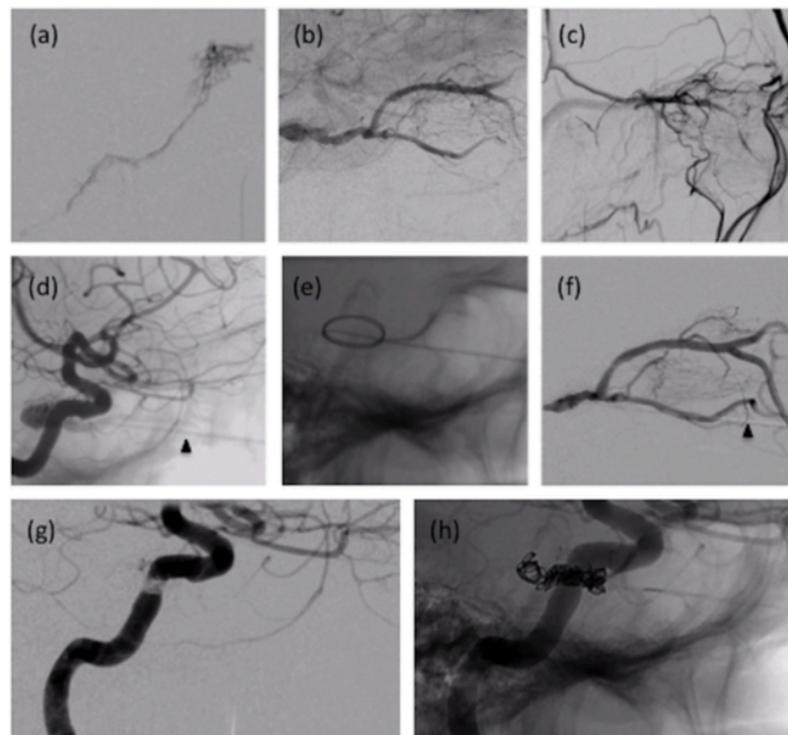
## Case Report cont'd

(a) External examination demonstrating 2-3+ conjunctival injection and 2+ prominence of episcleral vessels of the right eye with 8 mm of exposed conjunctiva. (b-d) DSA following R ICA injection (b) lateral and (c) oblique views of intracranial circulation in arterial phase; (d) lateral view of intracranial circulation in venous phase. (e-g) DSA following L ICA injection (e) lateral view of late arterial phase; (f, g) AP view of (f) arterial and (g) capillary phase. Demonstration of right-sided, indirect, Type B CCF supplied by branches of the meningohypophyseal trunk, inferolateral trunk (b, c), and collaterals from the contralateral meningohypophyseal trunk (f, g), with venous outflow into the SOV and IOV and eventually into the FV (d). Demonstration of left-sided, indirect, Type B CCF supplied by smaller caliber branches of the meningohypophyseal trunk (e-g).



## Case Report cont'd

(a) Lateral view of R inferior petrosal sinus demonstrating relatively normal appearance of the median portion of the CS, isolated from the CCF. (b, c) Lateral view demonstrates venous outflow anatomy of CCF and anatomy of peri-orbital cortical veins via contrast administration in R ICA (venous phase) (b) and facial vein (c). (d) Fluoroscopic demonstration of direct needle placement in IOV through DSA via R ICA injection. Arrowhead demonstrated needle. (e) Micro- guidewire advancement and coiling into the CS. (f) Assessment of venous outflow through direct contrast administration in CS. Arrowhead demonstrates catheter. (g, h) Successful coiling of R CS with no residual shunting of outflow observed from the R ICA to the CCF.



## Case Report cont'd

(a) Three day ophthalmology follow-up reveals improved chemosis and conjunctival injection, along with a steadily improving partial CN III and CN IV palsy. Follow-up at six weeks (b) demonstrated complete resolution of the arterialized vessels in the right eye and improvement in the CN III and IV palsies. Follow-up at five months (c) demonstrated only mild CN III and IV palsies.



## Conclusion

- This case delineates the technical aspects of transorbital CCF embolization and demonstrates that this approach is a viable alternative to conventional transvenous methods for appropriately selected CCF cases.