

Neuroimaging Highlight

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Traumatic Carotid-Cavernous Fistula

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A 48-year-old man was struck down by a motorcycle and suffered multiple left orbitofacial fractures and cerebral contusions. Three weeks later, he experienced rapidly progressive orbital swelling. He had marked proptosis and chemosis, no light perception of the left eye and an objective orbital bruit. Computerized tomography (CT) and magnetic resonance (MR) revealed a massively enlarged left superior ophthalmic vein (SOV) which indicated the presence of a fistula (Figure 1 and 2) confirmed with catheter angiography (Figure 3a). Endovascular obliteration of the carotid-cavernous fistula (CCF) with a detachable latex balloon preserved the internal carotid artery (ICA) (Figure 3b,c). The patient had rapid improvement of orbital findings with the



Figure 1: Enhanced axial CT demonstrates marked left orbital swelling and proptosis, transfixing fractures and massive left superior ophthalmic vein (SOV) (arrow).

exception of his vision which was already irreversibly damaged (Figure 4a,b).

Traumatic CCF results from laceration of the ICA by shearing forces and/or bony spicules from adjacent fractures resulting in a high-flow shunt into the cavernous sinus. High pressure reversed flow into the orbital veins results in chemosis, proptosis, elevated intraocular pressure, decreased ocular movement, but co-existing soft tissue swelling from the inciting trauma frequently limits examination and results in delayed diagnosis. The diagnosis is suspected clinically and imaging (CT/MR) including catheter angiography confirms the diagnosis. Immediate treatment is indicated to prevent complications related to the eye (visual loss, corneal exposure, pain) and to the brain (cortical venous reflux with risks of intracranial hemorrhage, neurologic deficit and seizure).¹

Transarterial embolization with detachable balloons is accepted as the best initial treatment as it is curative and has low complication rates in experienced hands.¹⁻³

REFERENCES:

1. Lewis AI, Tomsick TA, Tew Jr JM. Management of 100 consecutive direct carotid-cavernous fistulas: results of treatment using detachable balloons. *Neurosurgery* 1995;36:239-245.
2. Lewis AI, Tomsick TA, Tew JM Jr. Long-term results in direct carotid-cavernous fistulas after treatment with detachable balloons. *J Neurosurg* 1996;84:400-404.
3. Debrun G. Management of traumatic carotid-cavernous fistulas. In: Vinuela F (ed). *Interventional Neuroradiology: Endovascular Therapy of the Central Nervous System*. New York: Raven Press, 1992; 107-112.

(See Figures 2-4 on page 72)

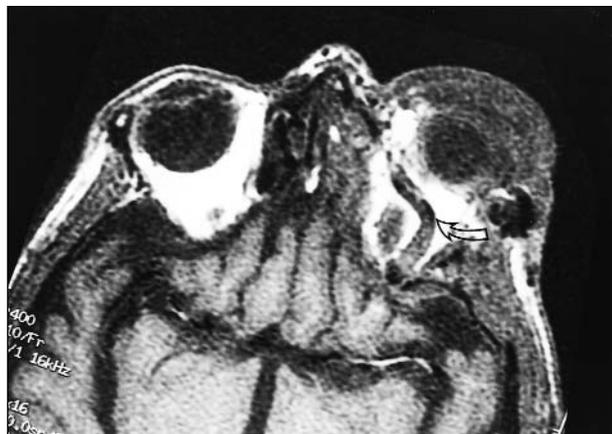


Figure 2a: MR (Axial post-gadolinium T1 with fat saturation).

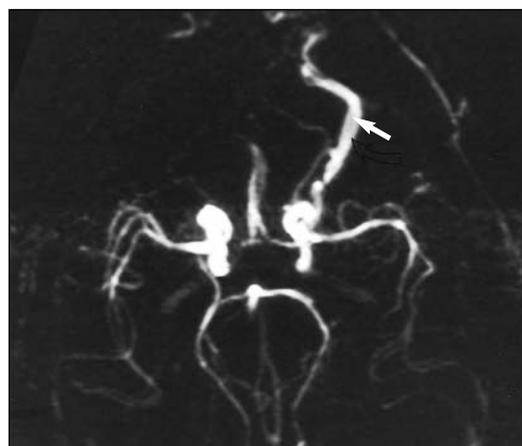
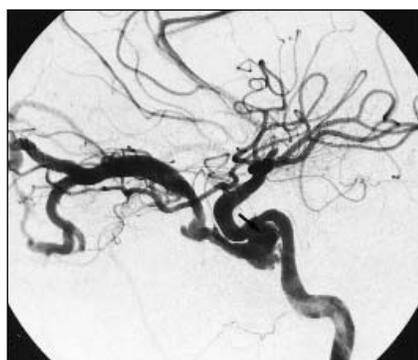


Figure 2b: MR venography (axial 2D phase contrast) demonstrate rapid flow in the left SOV (arrow) consistent with a CCF.



A

Figure 3a: Catheter angiogram (left ICA injection, lateral view pre-embolization) demonstrates a high-flow CCF with a tear in the proximal aspect of the cavernous ICA (arrow). Rapid shunting into the cavernous sinus is seen with marked orbital venous reflux.

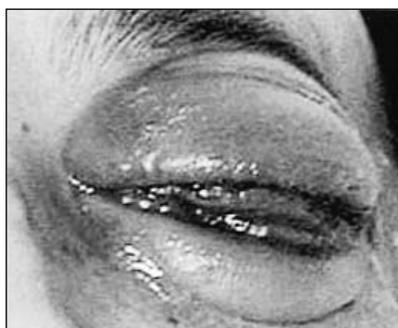


B



C

Figures 3b,c: (post-embolization) Complete occlusion of the CCF is seen with preservation of the ICA. The unsubtracted image (**Figure 3c**) shows the single detachable balloon (arrow) placed through and occluding the tear in the ICA.



Figures 4a,b: Pre- and post-treatment photos show improvement in orbital swelling.