

Flow Diverters as Useful Adjunct to Traditional Endovascular Techniques in the Treatment of Direct Carotid-Cavernous Fistulas: A New Paradigm

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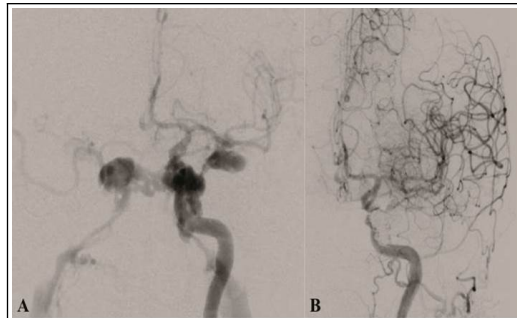
Introduction

- Direct carotid-cavernous sinus fistulas (CCF) are high flow arteriovenous (AV) shunts.
- Their treatment has evolved dramatically over the last few years with improved endovascular techniques.
- Transvenous and transarterial access has been described with the use of detachable balloons, coils, liquid embolic agents, and covered stents.
- More recently, coils have become the mainstay of treatment for high flow CCFs.
- In order to minimize the chance of treatment failure and subsequent complications, endoluminal reconstruction can be added to the treatment construct via placement of a flow-diverting device in the ICA as an adjunct to coil or balloon placement in the cavernous sinus (CS).

Methods

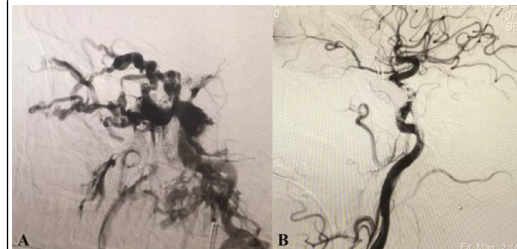
- In all 3 patients, a loading dose of 600 mg clopidogrel + 650 mg aspirin + 50-60 IU/kg body weight bolus of heparin was administered.
- All procedures were performed under general anesthesia.
- Patients were discharged home on clopidogrel 75 mg + aspirin 325 mg daily x 3 months.

Case Illustrations



Case 1: Left direct CCF in a 78 year-old female. Occluded with coils placed within the CS and 2 Pipeline embolization devices (PED; Medtronic, Minneapolis, MN, USA) deployed into the cavernous ICA.

CASE 2



Case 2: Left direct CCF in a 35 year-old male. Occluded with a Magic B1 non-detachable balloon (Balt, France), a Surpass Streamline flow diverter (Stryker, Fremont, CA, USA), coils and Onyx (Medtronic, Minneapolis, MN, USA).

Case Illustrations



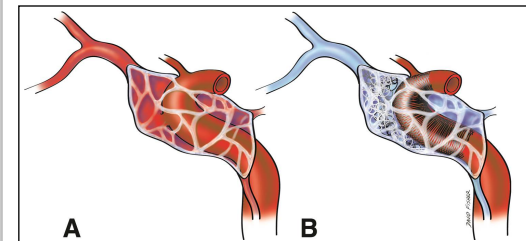
Case 3: Left direct CCF in a 32-year-old male. Occluded with aNext Goldbal B1 detachable balloon (Balt, France), 2 Surpass Streamline flow diverters, coils and Onyx.

Patients' Data

| Clinical Presentation | DSA findings | FU DSA length (months) |
|---|--|------------------------|
| Proptosis, cranial nerve palsy, LOC, seizure | Left CCF, filling of right CS, bilateral sigmoid sinuses, and IJVs, retrograde flow and dilation in both superior ophthalmic veins | 4 |
| Proptosis, cranial nerve palsy, LOC, headache | Left CCF due to ruptured dissecting intracavernous ICA aneurysm | 6.5 |
| Proptosis, cranial nerve palsy, headache | Large left CCF with narrowing of distal ICA and 3 dissecting aneurysms | 2.5 |

Discussion

- The ideal treatment for a direct CCF is permanent occlusion of the fistula, while maintaining physiologic flow in both the arterial and venous circulations.
- We believe that the current treatment strategy can consist of endovascular coil or balloon occlusion of the fistula from either a transvenous or transarterial approach followed by endoluminal reconstruction with a flow diverter.



- The addition of a flow diverter may facilitate endothelialization of the ICA following injury to the vessel wall.

Conclusions

Our experience and literature review presented suggests that endovascular coil or balloon occlusion of the fistula from either a transvenous or transarterial approach followed by flow diversion treatment, may be a suitable treatment for direct CCFs.