



Original Article

# Transvenous embolization of cavernous sinus dural arteriovenous fistula via angiographic occlusive inferior petrous sinus

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## Abstract

**Background:** Trans-inferior petrous sinus (IPS) coil embolization is an efficient and safe method to manage cavernous sinus dural arteriovenous fistulas (CSDAVFs). However, some CSDAVFs may be associated with angiographic occlusive IPS making access difficult. The purpose of this study was to report our experience of transvenous embolization of the CSDAVF via angiographic occlusive IPS.

**Methods:** We reviewed the cases of 20 patients who underwent transvenous embolization via angiographic occlusive IPS over a 6 year period. The study consisted of seven men and 13 women, ranging from 46 years to 78 years of age (mean, 60 years). We retrospectively analyzed the angioarchitecture of the CSDAVFs, the procedural time and the angiographic as well as the clinical outcomes after embolization.

**Results:** True occlusive IPS was found in 13 of the patients, while patent IPS with compartment of the IPS-CS was demonstrated in the remaining seven patients. The microcatheter was successfully navigated to the fistula site of the CS in 16 patients (80%), while such navigation failed in four patients following numerous attempts. The mean procedural times for truly occlusive IPS and for compartment of the IPS-CS were 111 minutes and 129 minutes, respectively. No recurrent fistula was observed on follow-up neuroimages. Three patients had transient third or sixth cranial nerve palsy, and one patient had perforation of the IPS leading to temporary headache. The mean clinical follow-up period was 18 months.

**Conclusion:** Angiographic occlusive IPS of CSDAVF may be related to true occlusion of IPS or patent IPS with compartment of the IPS-CS. There is no statistically significant difference in procedural times for these two different fistula anatomies. Transvenous embolization via angiographic occlusive IPS is a safe and effective method to manage CSDAVFs.

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**Keywords:** cavernous sinus; dural arteriovenous fistula; embolization; inferior petrous sinus

## 1. Introduction

Cavernous sinus dural arteriovenous fistulas (CSDAVFs) are arteriovenous fistulas of the cavernous sinus (CS), fed by dural

branches of internal and/or external carotid arteries. Most CSDAVFs are low-flow shunts presenting with benign neuro-ophthalmic symptoms such as ocular-orbital venous congestion, cephalic bruit and/or impairment of visual acuity.<sup>1–6</sup> However, certain CSDAVFs with insufficient venous drains may have pial venous reflux associated with the potential risk of hemorrhagic or nonhemorrhagic neurologic deficit.<sup>2,3</sup> Trans-inferior petrous sinus (IPS) coil embolization is a safe and effective method to manage CSDAVFs that require treatment.<sup>4–6</sup> Nevertheless, this access route may become difficult in CSDAVFs due to angiographic occlusive IPSs.

Conflicts of interest: The authors declare that they have no conflicting interests related to the subject matter or materials discussed in this article.

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The purpose of this study was to evaluate the angioarchitecture of CSDAVFs with angiographic occlusive IPS, and to report our experience and outcomes using transvenous coil embolization.

## 2. Methods

From May 2008 to April 2014, a total of 67 patients with 71 CSDAVFs were referred to our institute for endovascular embolization because of progressive neuro-ophthalmic symptoms. From available records, we enrolled 57 patients with CSDAVFs undergoing trans-IPS coil embolization via the IPS. Of these 57 CSDAVF patients, 20 underwent transvenous embolization via angiographic occlusive IPS. Before this article was initiated, informed consent was obtained from all 20 patients. The clinical data of the 20 patients are summarized in Table 1. These patients comprised seven men and 13

women with ages ranging from 46 years to 78 years (mean, 60 years). Transvenous embolization via occlusive IPS was performed under general anesthesia using bilateral femoral approaches with 5 French (F) and 6F femoral sheath (Prelude, Merit Medical system, Inc., South Jordan, Utah, USA) placements to the left femoral artery and right femoral vein, respectively. Activated clotting time was monitored and maintained at a value of twice the baseline value by intravenous administration of heparin. A 4 F diagnostic catheter was positioned in the feeding carotid artery as a guide for subsequent transvenous embolization. A 6 F guiding catheter (Envoy; Codman & Shurtleff, Raynham, MA, USA) was placed into the internal jugular vein (IJV) for the retrograde catheterization of angiographic occlusive IPS. CSDAVFs were demonstrated by carotid roadmaps, and a 2 tip 0.017 inch microcatheter (Headway; MicroVention Inc., Tustin, CA, USA or Echelon; Covidien, Minneapolis, MN, USA) and a 0.014

Table 1  
Demographics and clinical outcomes of 20 patients with cavernous sinus dural arteriovenous fistulas (CSDAVFs), managed by trans-angiographic occlusive inferior petrous sinus (IPS) embolization.

Patient/sex/age (y), mean = 60 y	Clinical manifestations	Occlusive or patent IPS	Fistulae flow drainage	Procedural time (min), mean = 123 min	Angiographic outcome	Complication	Clinical follow-up (mo), mean = 18 mo
1/M/62	Chemosis, ophthalmalgia	Occlusive	SOV, SMCV	101	Cure	Nil	11
2/F/67	Chemosis, impairment of visual acuity	Occlusive	SOV, C-CS	107	Cure	Nil	25
3/M/55	Chemosis, bruit, impairment of visual acuity	Patent	SOV, C-CS	157	Cure	Nil	21
4/F/48	Chemosis, bruit	Occlusive	SOV, SMCV	103	Cure	Nil	18
5/M/51	Chemosis, proptosis	Patent	SOV	137	Cure	Nil	17
6/F/58	Chemosis, bruit, ophthalmalgia	Occlusive	SOV, C-CS, C-SOV	162	Cure	Transient CN3 palsy	8
7/F/52	Chemosis, impairment of visual acuity	Occlusive	SOV, SMCV	138	Cure	Nil	19
8/F/66	Chemosis, proptosis, ophthalmalgia	Occlusive	SOV, SMCV, SPS	98	Cure	Nil	14
9/F/64	Chemosis, proptosis, ophthalmalgia	Patent	SOV, C-CS, C-SOV	115	Cure	Nil	10
10/F/47	Chemosis, impairment of visual acuity	Patent	SOV, SPS	97	Cure	Nil	15
11/M/52	Chemosis, proptosis	Occlusive	SOV	153	Cure	Nil	24
12/F/72	Chemosis, proptosis, ophthalmalgia	Patent	SOV, SMCV	147	Cure	Transient CN3 palsy	24
13/F/59	Proptosis, impairment of visual acuity	Occlusive	C-CS, C-SOV	107	Cure	IPS perforation	17
14/M/54	Chemosis, diplopia	Occlusive	SOV	failure	Cured by transfacial vein	Nil	7
15/M/46	Chemosis, proptosis	Occlusive	SOV, SMCV	116	Cure	Nil	31
16/F/67	Chemosis, impairment visual acuity	Occlusive	SOV, SPS	123	Cure	Transient CN6 palsy	21
17/F/72	Chemosis, ophthalmalgia	Occlusive	SOV, SPS	failure	Refer to GKS	Nil	NA
18/F/78	Limb weakness, respiratory failure	Occlusive	Pontomedullary vein	failure	Cured by direct puncture	Nil	34
19/M/53	Hemiparesis, aphasia	Patent	SOV, SMCV	106	Cure	Nil	13
20/F/67	Chemosis	Patent	Cerebellar vein, SPS, SOV	failure	Refer to GKS	Nil	NA

C-CS = contralateral cavernous sinus; CN = cranial nerve; C-SOV = contralateral superior ophthalmic vein; GKS = Gamma Knife surgery; IPS = inferior petrous sinus; NA = not available; SMCV = superficial middle cerebral vein; SOV = superior ophthalmic vein; SPS = superior petrous sinus.

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