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(dural fistula)

10 - 15% (6 - 8, 10 - 13) (6, 7), (8, 9), (14 - 16)

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(2).

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(bruit) . 1 7 가 1 가 . 1 , , 1 4 2.5 DSA angiostar(Siemens, Ehrlangen, Germany) 6 가 가 (meningohypophyseal trunk), , 가 . 6 5 (Table 1). 가 5 (Tungsten coil: Balt, Montmorency, France) 1 (Platinum coil : Target therapeutics, Fremond, CA, U.S.A.) (paravertebral venous plexus) 가 2 (Guglielmi detachable coil, GDC : Target therapeutics, Fremond, CA, U.S.A.) 4 3 가 2 . 6 3-8 mm . 6 5 polyvinyl alcohol (Contour emboli, ITC, Fremond, CA, U.S.A.) 가 4

**Table 1.** Angiographic Findings and Treatment Outcomes of DAVFs at Marginal Sinus

Outcome of Treatment																	
Arterial Feeder				Draining Vein					Outcome of Treatment								
Case	MHT	Ascending Pharyngeal	Occipital	Posterior Auricular	Middle Meningeal	Accessory Meningeal	DIM	Vertebral	IJV	PVP	CS-SOV	Cortical Vein	Multiplicity	TAA	TVA	Angiographic Result	Clinical Outcome
1	B	B	B	-	R	R	B	B	+	++	-	-	single	done	done (via PVP)	complete occlusion	cure
2	-	B	B	R	R	-	R	B	++	-	-	-	multiple	done	done	partial occlusion	improved
3	R	R	R	R	-	-	-	-	++	+	-	-	multiple	done	done	partial occlusion	improved
4	B	B	R	-	R	-	-	-	++	-	+	-	single	done	done	complete occlusion	cure
5	-	B	B	B	R	R	R	-	+	+	+	+	single	done	done	complete occlusion	cure
6	B	B	L	-	L	-	-	-	+	-	++	+	single	-	done	complete occlusion	cure

MHT : meningohypophyseal trunk

DIM : distal internal maxillary

B : both

R : right

L : left

IJV : internal jugular vein

PVP : paravertebral venous plexus

CS-SOV : cavernous sinus-superior ophthalmic vein

++ : main root of venous drainage

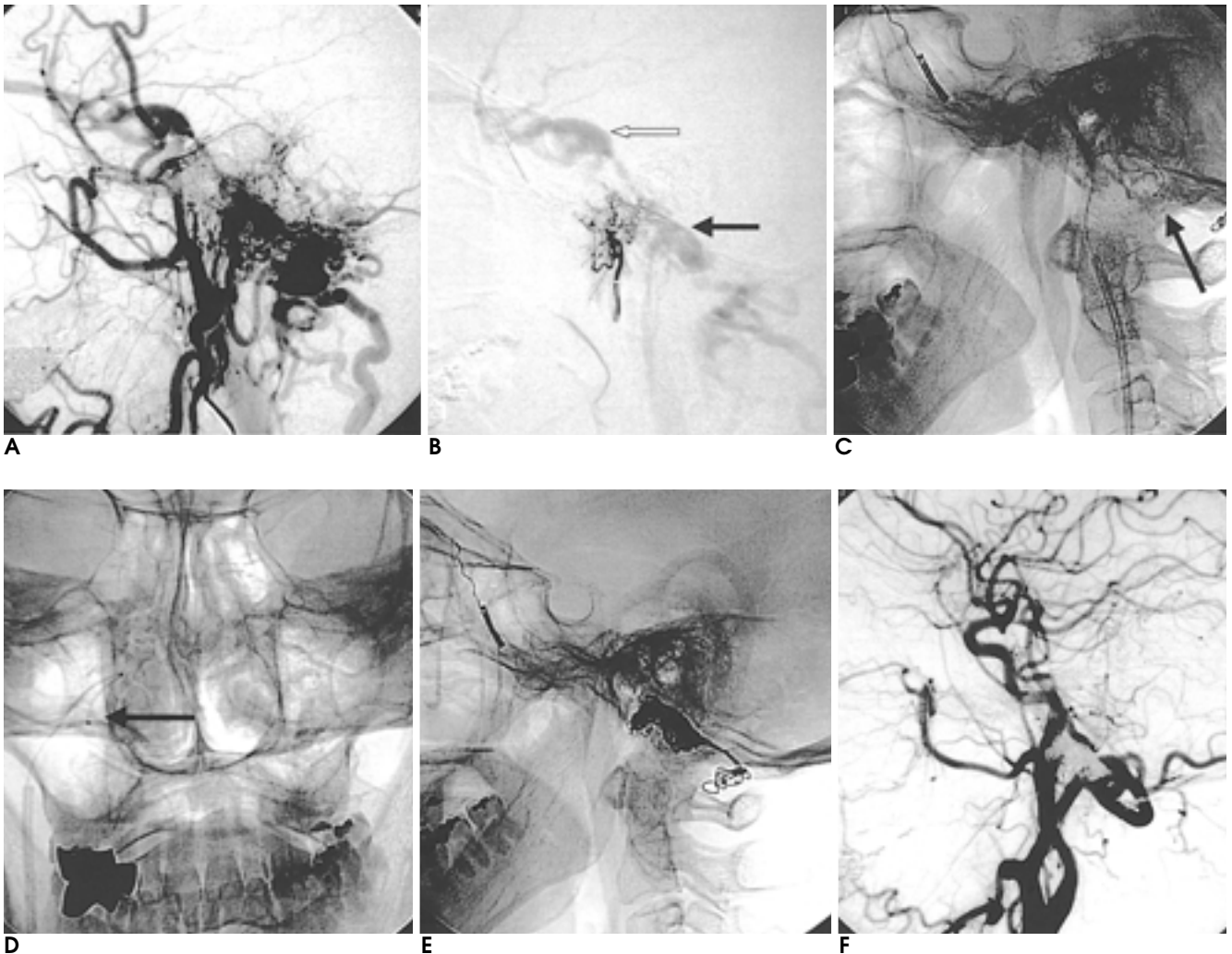
+ : detectable venous flow

- : no detectable venous flow

TAA : transarterial approach

TVA : transvenous approach

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(Fig. 1)  
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**Fig. 1.** DAVFs at marginal sinus with transvenous coil embolization through jugular vein.

**A.** Right ECA angiogram shows large amount of blood flow at fistula site around foramen magnum.

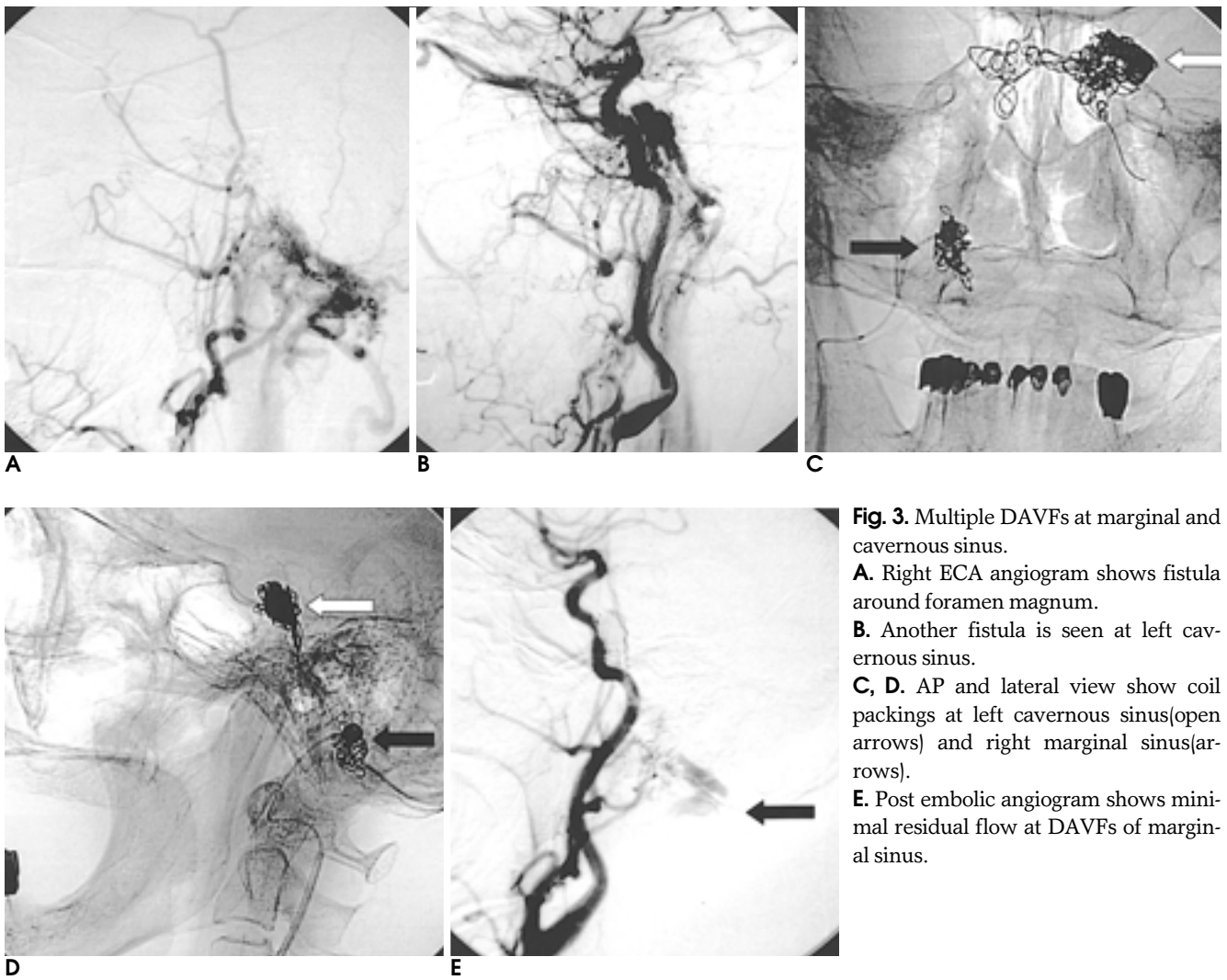
**B.** On selective angiogram of right ascending pharyngeal artery, venous flow from marginal sinus(arrow) is seen at internal jugular vein and paravertebral venous plexus with retrograde flow to cavernous sinus(open arrow), ophthalmic artery and cortical vein.

**C, D.** Superselected micrcatheter is located at around foramen magnum(arrows), more medially and anteriorly than sigmoid or transverse sinus.

**E.** Tight coil packing is seen at marginal sinus.

**F.** Post embolic right CCA angiogram shows complete occlusion of marginal sinus DAVFs





**Fig. 3.** Multiple DAVFs at marginal and cavernous sinus.

**A.** Right ECA angiogram shows fistula around foramen magnum.

**B.** Another fistula is seen at left cavernous sinus.

**C, D.** AP and lateral view show coil packings at left cavernous sinus(open arrows) and right marginal sinus(arrows).

**E.** Post embolic angiogram shows minimal residual flow at DAVFs of marginal sinus.

(basilar venous plexus) ,

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Pierot (27)

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McDougall (28)

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McDogall (28) 14

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road map

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## Dural Arteriovenous Fistula at Marginal Sinus: Angiographic Findings and Treatment with Transvenous Coil Embolization<sup>1</sup>

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**Purpose:** The purpose of this study was to evaluate the angiographic findings of dural arteriovenous fistulas (dAVFs) at the site of a marginal sinus and to assess the efficacy of transvenous embolizations.

**Materials and Methods:** Six patients in whom an angiographically confirmed dural arteriovenous fistula was present at the site of a marginal sinus were involved in this study. Arterial feeders and the venous drainage of dAVFs were evaluated, and we describe the location of other combined dAVFs. Transvenous, with or without arterial, embolization was performed in all patients, and the angiographic findings and clinical outcomes were evaluated.

**Results:** Ascending pharyngeal and occipital arteries were the main arterial feeders, and dAVFs were also supplied from the meningohypophyseal trunk, posterior auricular artery, middle meningeal arteries, and the accessory meningeal, internal maxillary, and meningeal branch of the vertebral artery. In five of six cases, the supply originated not only from the ipsilateral arterial system, but also from the contralateral system. Posterior venous drainage occurred via the internal jugular vein and the paravertebral venous plexus, and superiorly, via the and cavernous sinus. All six patients underwent transvenous coil embolization. Except in one case, in which drainage involved the paravertebral venous plexus, the venous route of embolization was the internal jugular vein. In four of six patients, angiography revealed complete occlusion of the fistula, and the clinical symptoms showed complete resolution. In the other two cases there was minimal residual flow, but the clinical symptoms showed improvement. In both, a further fistula was seen at a site other than the marginal sinus.

**Conclusion:** In all patients, the angiographic findings were evaluated and subsequent endovascular treatment was successful. Transvenous embolization involving dAVFs at the site of a marginal sinus were effective; clinical outcomes depended on successful endovascular treatment and the extent of dAVFs.

**Index words :** Arteriovenous malformations, dural  
Angiography  
Veins, therapeutic embolization

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