# ENDOVASCULAR TREATMENT OF CRANIAL DURAL ARTERIOVENOUS FISTULAS(DAVFS) IN THAILAND: THE SIRIRAJ HOSPITAL EXPERIENCE

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## PURPOSE

To summarize the clinical results of our management of DAVFs related to clinical presentation and angioarchitectural classification of DAVFs.

## METHODS

This retrospective analysis concerns 56 patients, including 22 Male and 34 female (range from 19-80 years, mean age is 52.4 years), who were clinically and radiologically assessed and were received diagnosis and treatment of DAVF by embolization in our Siriraj Hospital Faculty of Medicine, Mahidol University during July 2002-June 2005. Analyzed data includes patient clinical presentation, topographic and angioarchitectural classification of DAVFs as a benign and aggressive type correlated to the Borden and the Cognard classification (Table 1), Strategies of endovascular treatment emphasis in aggressive DAVF and results are reviewed. Embolization procedures were classified into complete and partial treatment related to shunt disconnection. Follow-up information was obtained for 53 patients ( 95%) after diagnosis or treatment with a mean follow-up period of 10 months. During the follow-up period, the clinical status of patients and angiography was schedule evaluated in our weekly neurovascular clinic.

**TABLE 1** Classification of Cranial Dural Arteriovenous Fistulas (DAVFs)

| Type (Borden/Cognard) | Number (%) |
|---|---|
| 1/IA | 28 (50%) |
| 1/IB | 1 (1.75%) |
| 1/IIA | 5 (8.9%) |
| 2/IIB | 4 (7.1%) |
| 2/IIA+B | 16 (28.6%) |
| 3/III | 1 (1.75%) |
| 3/IV | 1 (1.75%) |

## RESULTS

We detected 22 aggressive DAVFs and 34 benign DAVFs in ours patients. Location of the fistulas were at the cavernous sinus (CS) in 31 (55.4%), transverse-sigmoid sinus (TS-SS) in 16 (28.5%), superior sagittal sinus (SSS) in 2 (3.6%) and the others (included at torcular, inferior petrosal sinus (IPS), and posterior fossa vein) in 7 (12.5%) of the patients.

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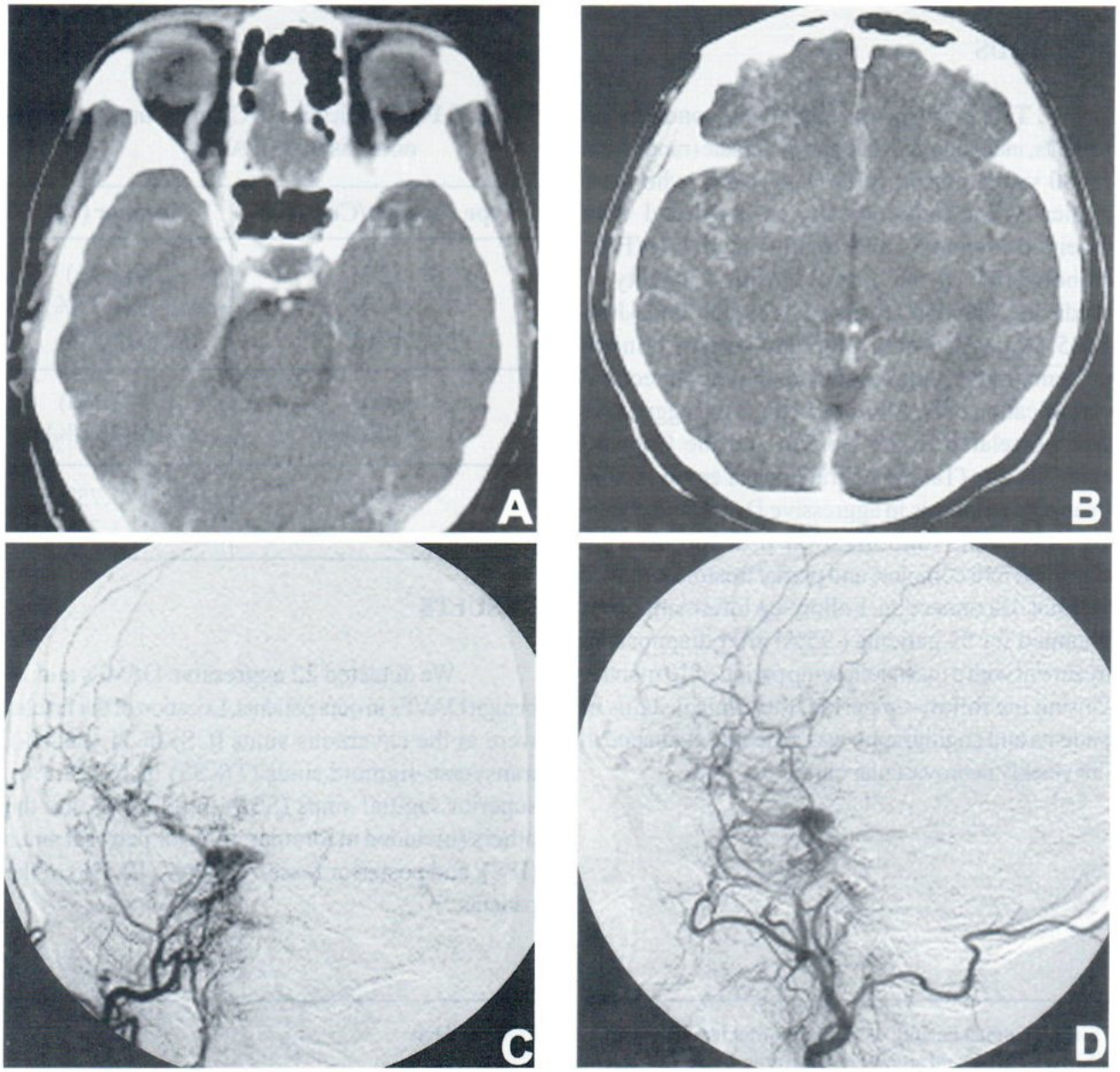
Among patients with aggressive DAVF lesions (Table 2&3), there were varieties of presenting symptoms (neurological symptoms 50%, eye symptoms 61%, hemorrhage 5.5%, tinnitus 17%). Most of these patients were treated by transarterial embolization with NBCA and/or Polyvinyl alcohol (47%), treated by transvenous embolization with coils (32%) and treated by combined transarterial-transvenous embolization (21%) that resulted in 41% complete shunt closure and 59% partial successful resulted with reduction of cortical venous reflux. For group of patients treated by transvenous embolization, there is 1 patient whom transvenous access to the cavernous sinus were not successful due to failure to cannulate of small inferior petrosal sinus (IPS). However, this patient was successfully treated by transfacial catheterization through the superior ophthalmic vein (Fig 1). One patient was decided to wait and see due to old age and improper medical condition for embolization procedure. Almost all of ours patients were clinical improvement on clinical follow up.



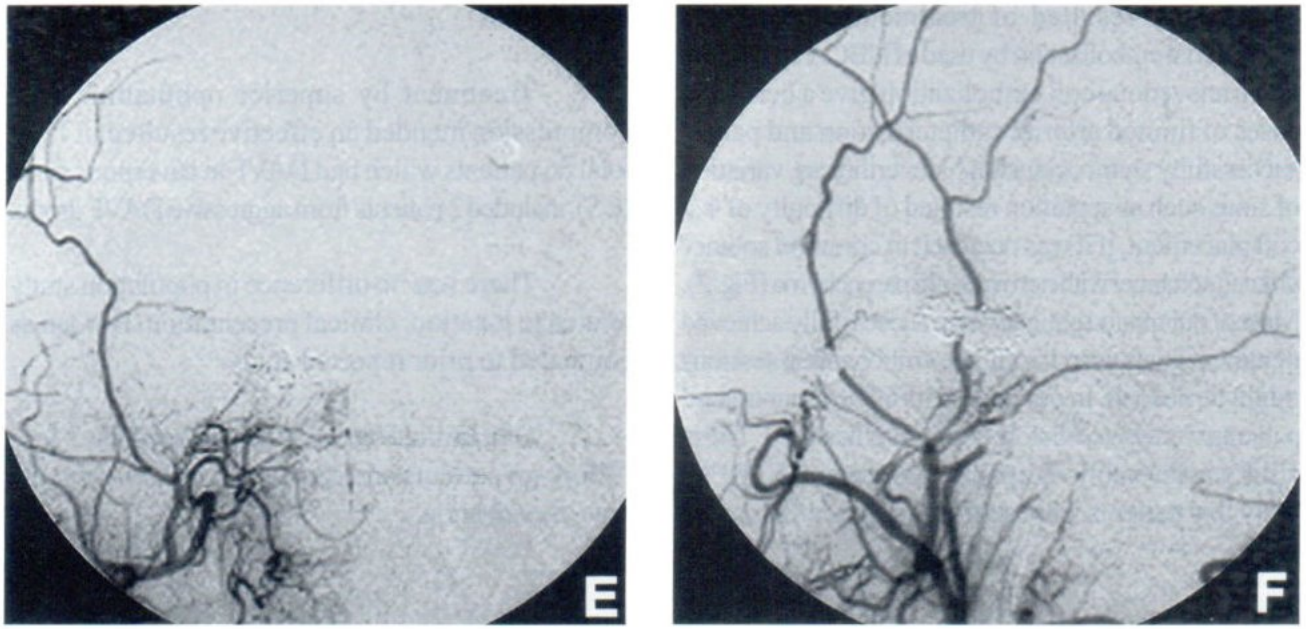



**Fig.1** Successful transvenous coil embolization via Rt. Facial vein.
A 56-year-old female patient presented with headache and blurred vision of Rt.eye. CT brain(A,B) revealed dilated Rt.superior ophthalmic vein and enlarged Rt.cavenous sinus with some venous congestion at Rt.frontotemperal region. Preembolization angiogram(C,D) revealed dural arteriovenous shunts at Rt. Cavenous sinus fed by branches of Rt.external carotid artery and major drained via superior ophthalmic vein and sphenoparietal vein. Control angiogram(E,F) showed immediately complete obliterated shunts.

Among patients with benign DAVF lesions (Table 4&5), 3 patients were lost to follow-up before having treatment or post manual compression (8.8%). Patients were treated if they presented with intractable symptoms. Most of ours patient presented with eye symptoms and tinnitus. Some of ours patients have spontaneous thrombosis of shunts especially by manual compression of superior ophthalmic vein (26.4%). 22 patients (64.7%) were submitted to endovascular therapy. Most of our treated patients were clinically improved during interval follow up and some patients were angiographic cured.

## DISCUSSION

Cranial DAVFs with cortical venous reflux (CVR) should be considered aggressive lesions and mandated prompt diagnosis and subsequent endovascular or surgical treatment because they proved to carry a high risk for neurological sequelae or death at presentation and in their disease course. Disconnection of the CVR along may enough because lesions without CVR have been shown to follow a benign course.[1-3]

Our endovascular treatment strategies were disconnected the arteriovenous shunt and CVR for reducing of cerebral venous congestive encephalopathy as much as possible by alleviating some conditions concerning patient's risk, for examples, unintended occlusion of dangerous anastomotic pathways to ophthalmic artery or arterial feeder for cranial nerves such as inferolateral trunk. Disconnection of the CVR along might enough because lesions without CVR have been shown to follow a benign course. We also didn't attempt to occlude the affected dural venous sinus if it wasn't necessary. We selected the safest way for each patient by precise angiographic analysis. We found

satisfactory resulted of treatment by selective transarterial embolization by used of NBCA and agreed that transvenous coil embolization give a benefit in cases of limited arterial catheterization and partial successfully shunt occlusion.[5] Nevertheless, variation of sinus such as septation resulted of difficulty of last coil placement, if it was occurred in common solitary drainage channel with normal brain parenchyma (Fig. 2). Most of our treated patients were successfully achieved treatment goals even if multiple embolization sessions might be needed. In our series, 50-60% of our treated patients were immediately angiographic cured. These result was favorably with published reports of 50-70%.[4] Only few patients were sent for surgery after partial embolization.

Treatment by superior ophthalmic vein compression mended an effective resulted in 11 of total 56 patients which had DAVF at cavernous sinus (CS), included 2 patients from aggressive DAVF group.

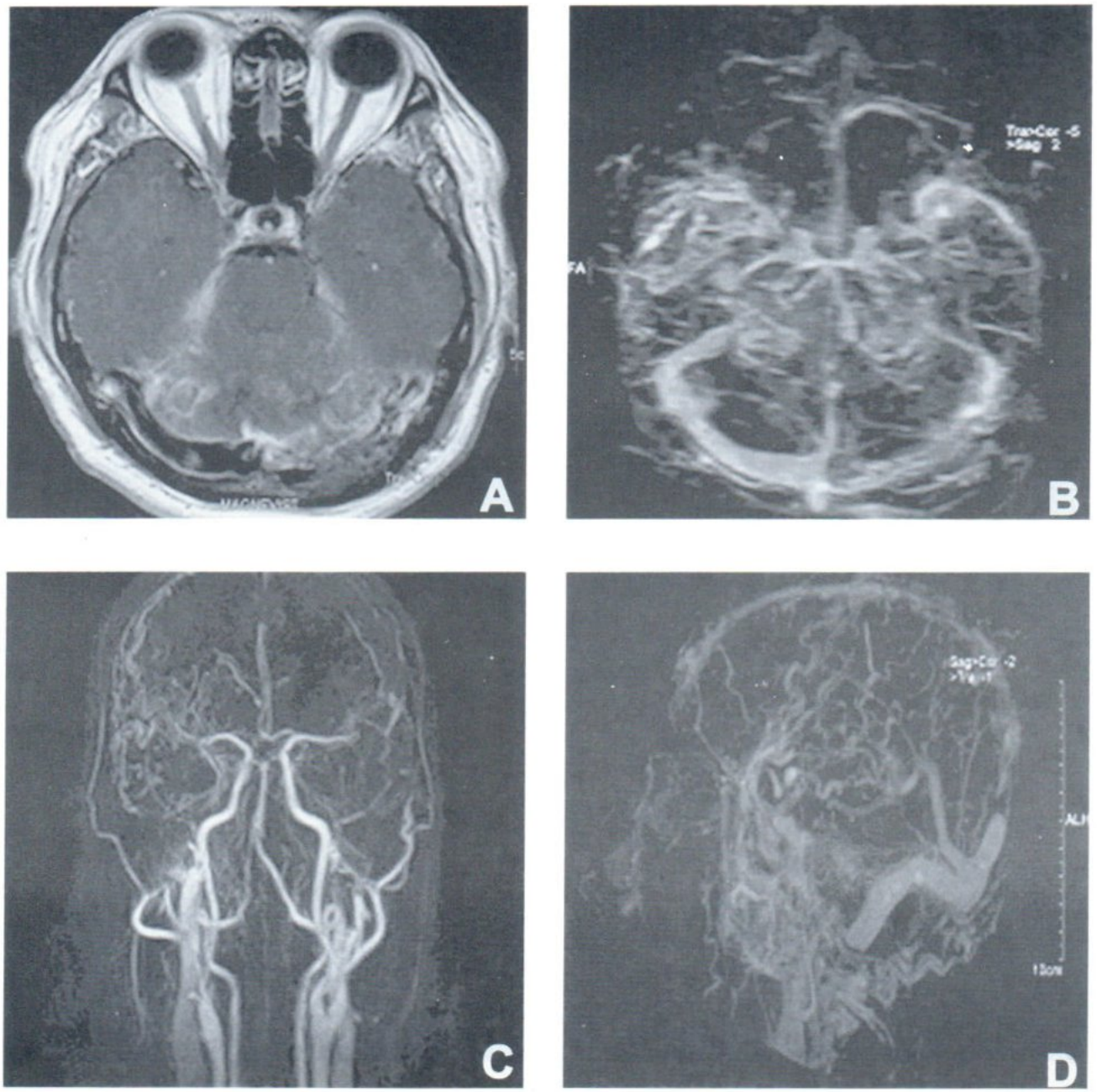
There was no difference in population study related to location, clinical presentation, Borden as compared to prior reported study.[1-3]

Our limitations of study caused by 3 loss follow-up patients and a too short follow-up at the time of evaluation.

**TABLE 3** Summary of Type and Treatment Results in Patients with Aggressive DAVF

| **Procedure** | **Number (%) (total of 22 patients)** | **Results** |
|---|---|---|
| Embolization<br>TAE<br>TVE<br>TAE+TVE | 20(90.1%)<br>11(50%)<br>5(22.7%)<br>4(18.2%) | Improved symptoms (35%)<br>Cured by angiography (60%)<br>Stable (5%) |
| Manual compression of superior ophthalmic vein(SOV) | 2(9.1%) | Improved symptoms (100%)<br>Cured by angiography (50%) |

**TAE** = Transarterial embolization, **TVE** = transvenous embolization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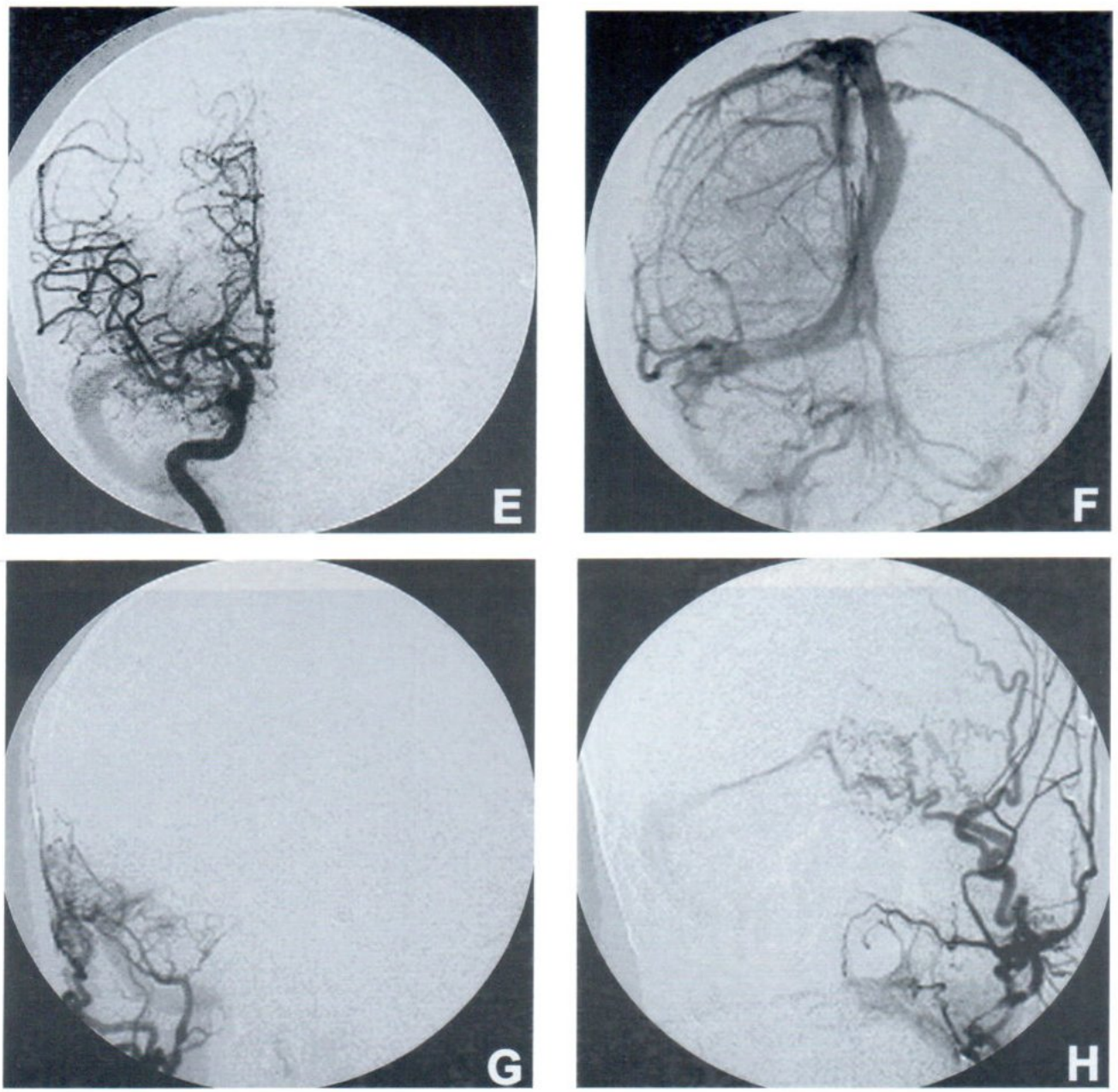
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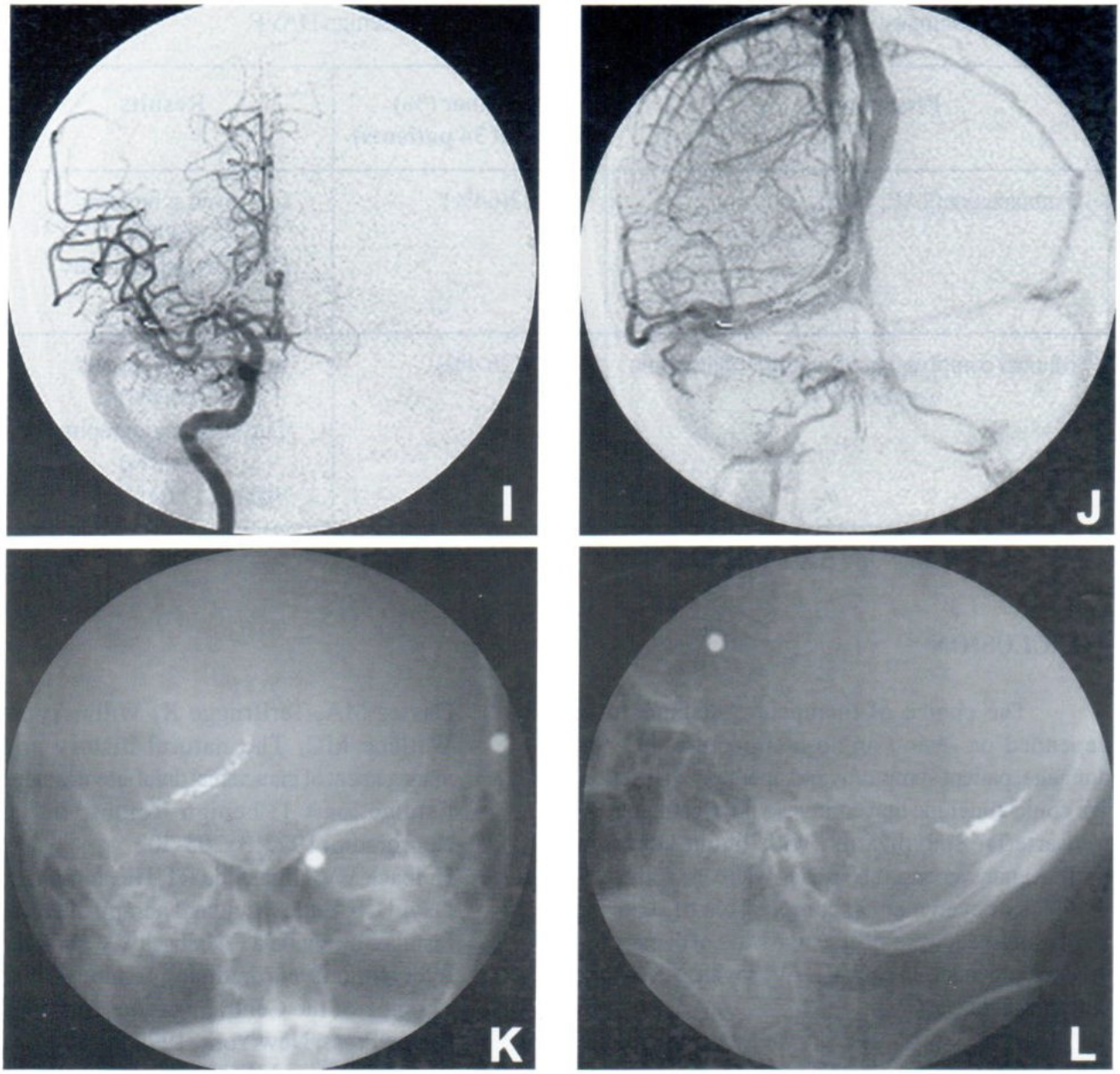


**Fig. 2** Successful transvenous coil embolization into septated portion of Rt.transverse sinus. A 49-year-old man with history of Rt.hemiplegia and cognitive impairment and blurred vision. Prior MRI& MRA (A-D) is suspicious of vascular shunts at Rt.transverse sinus with Lt. transverse sinus thrombosis and diffuse cortical venous reflux, Dural AV fistula is likely, with white matter infarction at left periventricular white matter and centrum semiovale(not shown). Pretreatment Cerebral angiography(E-H) shows Dural AVF at Rt. transverse-sigmoid sinus, at septated portion(arrow), supplied from dural branches of Rt ECA, Lt.ECA and Rt.ICA and thrombosis of Lt. transverse sinus. Control cerebral angiography of Rt.ICA after coil embolization(I,J) and Skull radiograph(K,L) showed position of coils placed only in pathologic septated sinus. Immediate decreased cortical reflux in both supra-and infratentorial systems are apparent. However, complete closure of other shunts at this transverse-sigmoid sinus of this patient is obtained after combined glue(NBCA) embolization into few branches of Rt.ECA afterward.

**TABLE 5** Summary of Type and Treatment Results in Patients with Benign DAVF.

| Procedure | Number (%) (total of 34 patients) | Results |
|---|---|---|
| Embolization(TAE, TVE) | 22(64%) | Improved symptoms (100%) Cured by angiography (50%) |
| Manual compression of superior ophthalmic vein(SOV) | 9(26.4%) | Improved symptoms (88.9%) Cured by angiography (33.3%) Stable (11.1%) |

**Note:** Loss follow-up 3 patients(8.8%)

## CONCLUSION

The choice of therapeutic methods was depended on lesion angio-architecture, venous drainage, patient symptoms and operator experience. We could conclude that endovascular treatments by transarterial embolization with liquid adhesive (NBCA), transvenous embolization with coils, combined methods or even manual compression of superior ophthalmic vein were all effective ways of therapy for selected patients with cranial DAVFs with satisfactory clinical outcomes.

## REFERENCES

1. J. Marc C. van Dijk, TerBrugge K, Wilinsky R, Wallce MC. Clinical course of cranial dural arteriovenous fistulas with long term persistent cortical venous reflux. Stroke, 2002; 33: 1233.
2. Davies MA, TerBrugge K, Willinsky R, Wallace MC. The natural history and management of intracranial dural arteriovenous fistulae, part 2: aggressive lesions. Interv Neuroradiol. 1997;3:303-311
3. Davies MA, TerBrugge K, Willinsky R, Wallace MC. The natural history and management of intracranial dural arteriovenous fistulae, part 1: benign lesions. Interv Neuroradiol 1997; 3: 295-302
4. Halback VV, Higashida RT, Hieshima GB, David CF. Endovascular Therapy of Dural Fistulas. In; Vinuela F, Halback VV, Dion JE. Intervention Neuroradiology endovascular Therapy of the Central Nervous Systems. Raven Press, New York, 1992:29-50.
5. Roy D, Raymond J. The role of transvenous embolization in the treatment of intracranial dural arteriovenous fistulas. Neurosurgery. 1997; 40: 1133-1141.