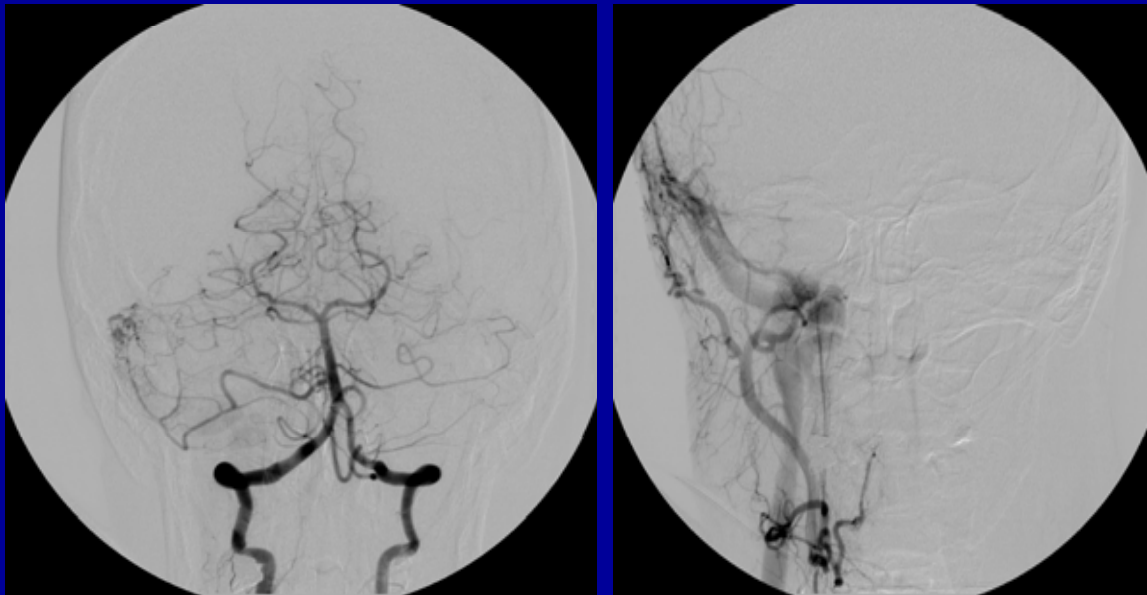


Multi-modality Management of Dural Arterio-Venous Fistulas (DAVFs)

Michael Horowitz

Clinical presentation of DAVFs



- CCF
- Sagittal sinus
 - Often have aggressive course with seizures, hemorrhage, neuro deficit
- Transverse/Sigmoid sinus
 - Headache, bruit
 - Often indolent

Classification of DAVFs

•Djindjian 1978/Cognard 1995

I Anterograde into sinus

IIa Retrograde into sinus

IIb Retrograde into cortical veins

IIa and II b Both of above

III Direct cortical venous drainage without ectasia

IV Direct cortical venous drainage with ectasia

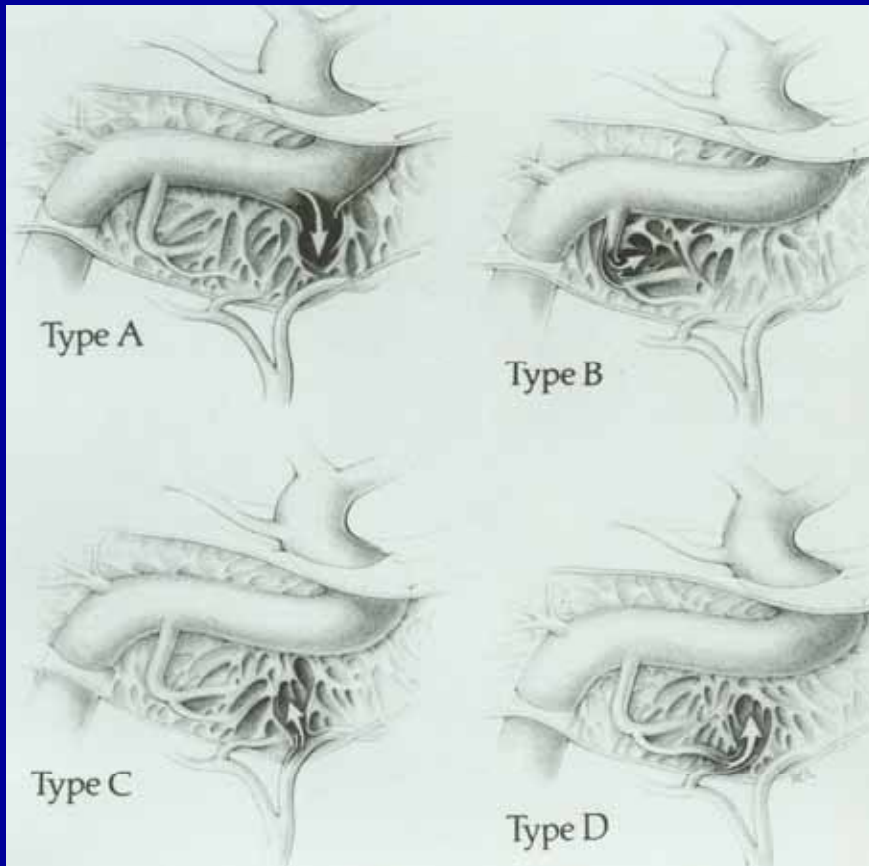
•Borden 1995

I Direct into dural sinus or menigeal veins

II Retrograde into subarachnoid veins

III Subarachnoid venous drainage without dural sinus drainage

Barrow's classification and etiology of CCF (1985)



A– Traumatic, Aneurysm rupture

B,C,D-- Spontaneous (indirect/dural)

-Middle-aged women

-Thrombosis

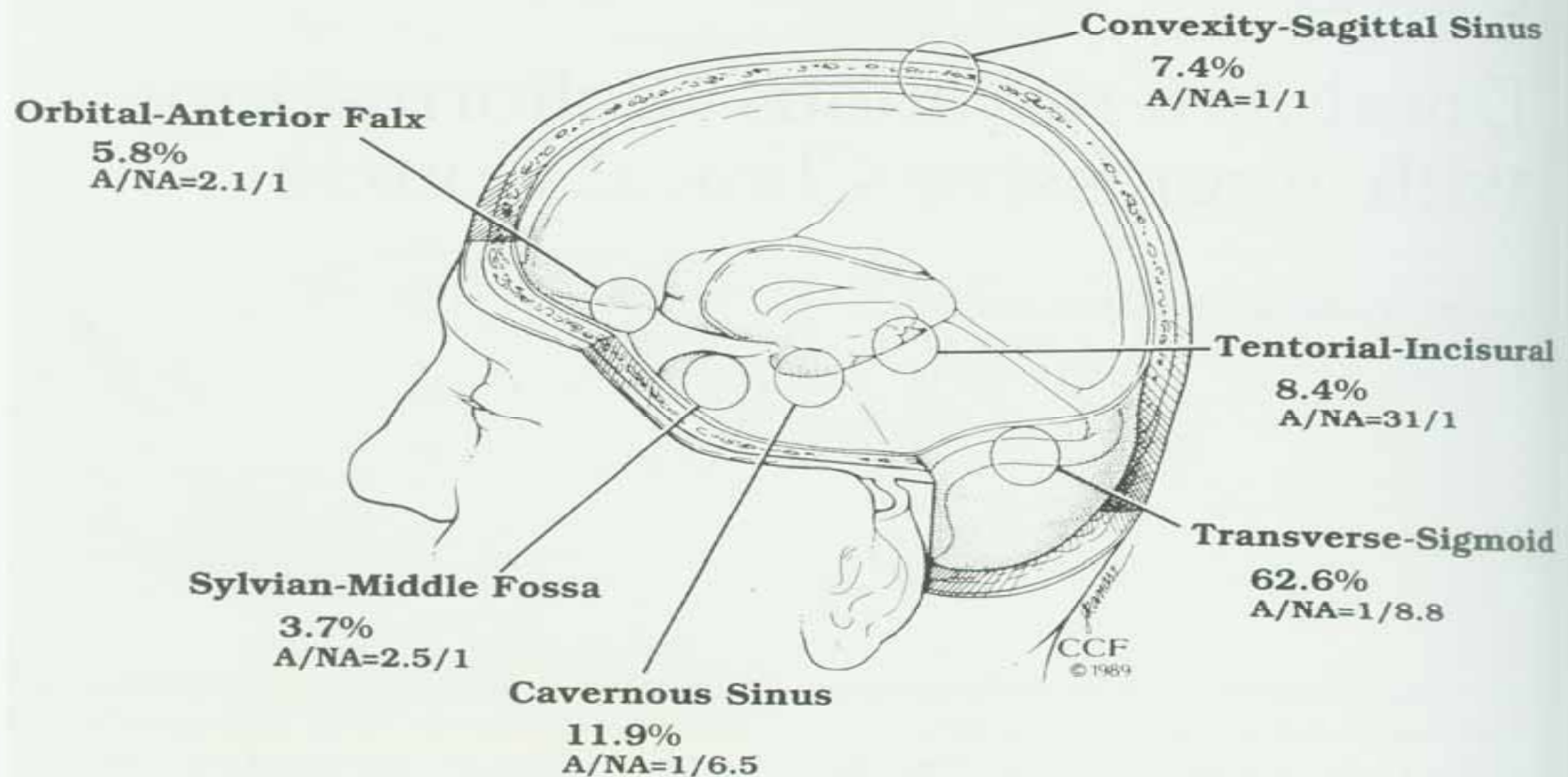
-Congenital

-Vessel rupture

-Angiopathy (Ehlers-Danlos, FMD)

Location of DAVFs

Distribution and Clinical Course of 377 Dural AVM's

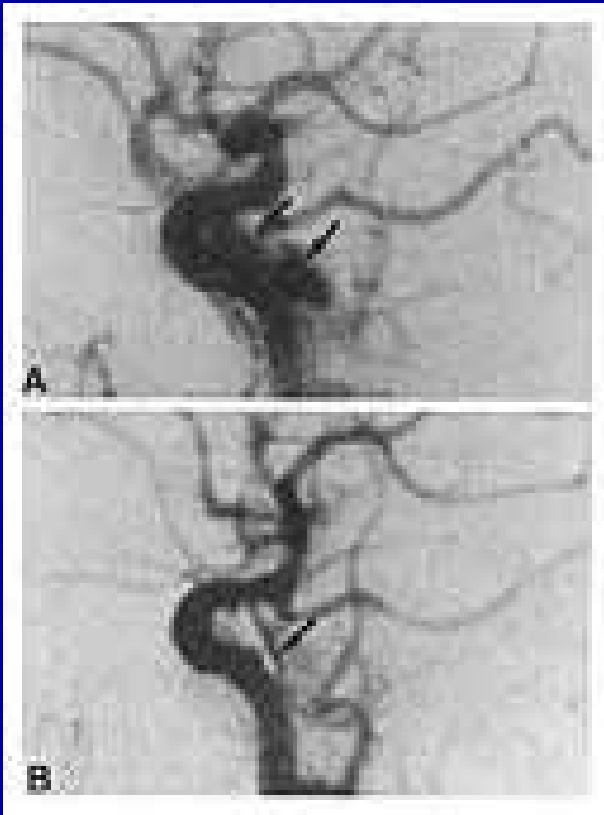


A=Aggressive
NA=Non-Aggressive

Role of Location on treatment outcome

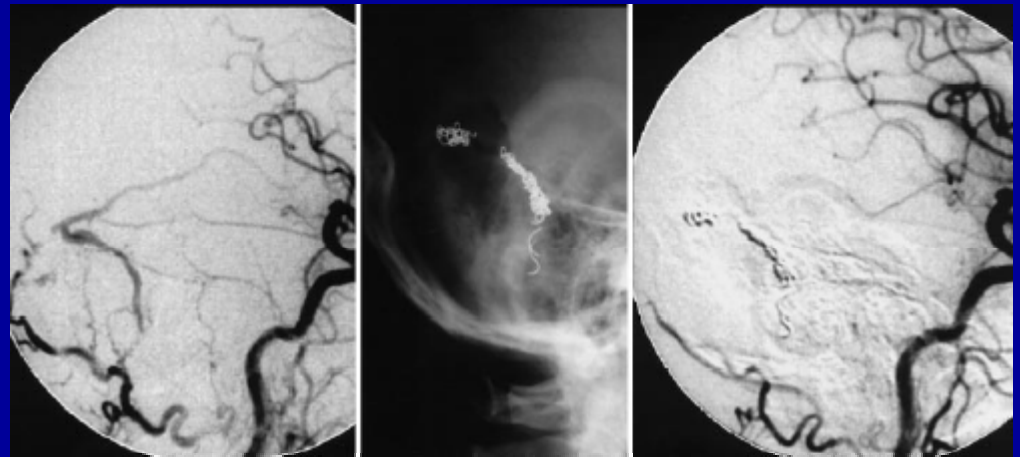
- CCF
 - Transvenous embo more successful than transarterial
- Tentorial
 - Combined embo and surgery better than embo alone
- Anterior fossa
 - Surgery alone is highly effective (95%)
- TS/SS
 - Combined endo and surgery better than either modality alone
 - Simple ligation of feeding vessels not recommended

Surgical treatment



Day and Fukushima,
Neurosurgery 1997

- Often reserved for residual DAVF after other modalities exhausted
- Highly effective but risk of poor outcomes high without preoperative embolization

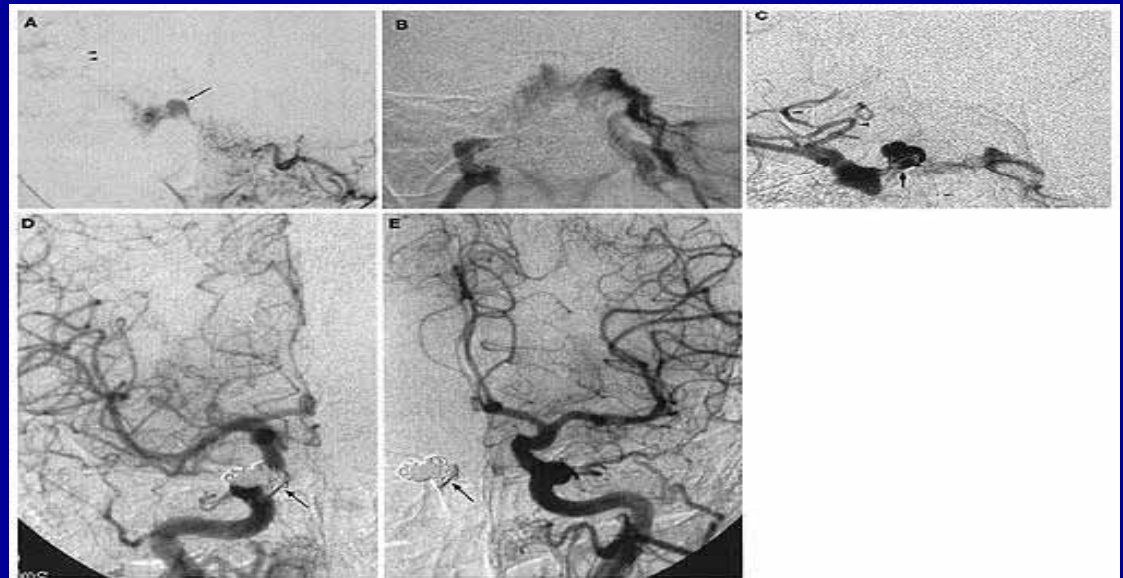
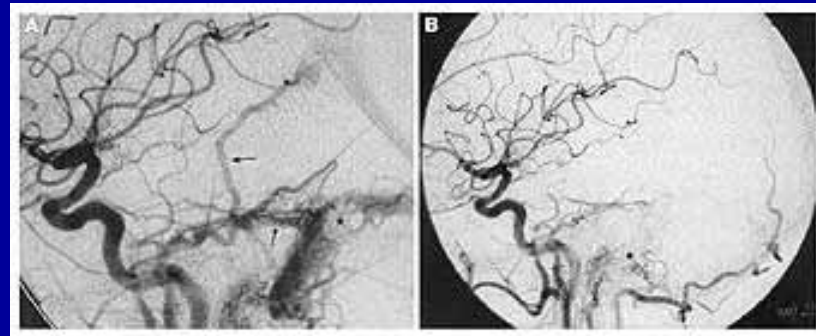


Endo et al., JNS 1998

Embolization-transvenous vs. transarterial

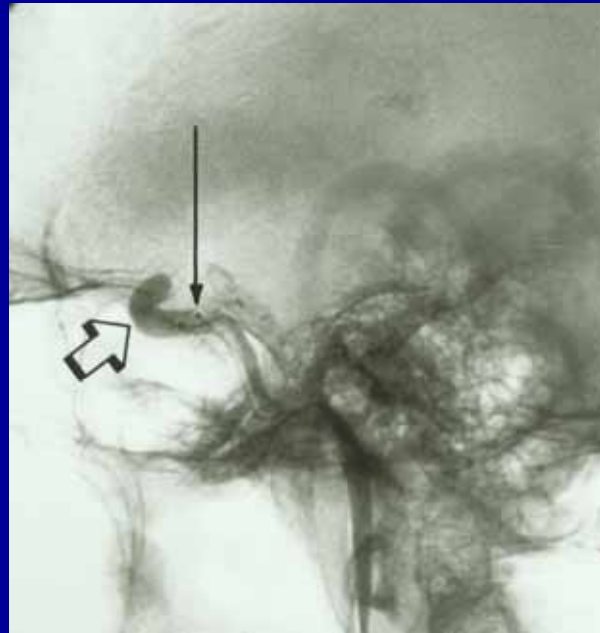
Transvenous

- Definitive occlusion of fistula outflow
- Minimal risk of venous infarct



(Roy and Raymond, Neurosurgery 1997)

Transarterial embolization



High-risk

-Thromboembolic events

-Venous thrombosis

-Lower rate of definitive cure when multiple feeders involved

-UCSF study on CCF

Radiosurgery for DAVFs

Mayo Clinic experience

- Gamma Knife performed followed by embolization in patients with high-risk features or intolerable symptoms
- 95% symptom resolution/improvement
- Angiographic obliteration in 93% of CCF and 65% of TS/SS fistulas
- No ICH/Radiation-related complications
- 10% of CCF patients had symptomatic venous thrombosis after embolization
- 10% recurrence rate

University of Pittsburgh experience

- 18 patients (9 men:9 women, mean age=65 yo)
- Location: 10 CCF, 4 TS/SS, 3 SSS, 1 Tentorial
- 16 embolization procedures on 10 patients
 - Only 2 done post-GKR (referral bias)
- Mean margin dose: 20 Gy
- Mean max dose: 42.6 Gy
- Mean nidus volume: 2.16 cm
- Mean dose to optic nerve in CCF: 5 Gy

Clinical presentation

	Chemosis / Proptosis	H A	Bruit	EOM defect	Pulsatile Tinnitus	Increased IOP	IC H	Eye Pain	Intermittent Visual Loss	Transient Hemiparesis
Carotid- Cavernous Sinus (n=10)	9	3	3	5	0	4	0	2	0	0
Tentorial- Sigmoid Sinus (n=5)	0	2	2	0	4	0	1	0	1	0
Convexity- Sagittal Sinus (n=3)	0	0	0	0	0	0	2	0	0	1
Total # of patients affected by symptom	9	5	5	5	4	4	3	2	1	1

Note: 3 of 4 patients with CVD presented with ICH

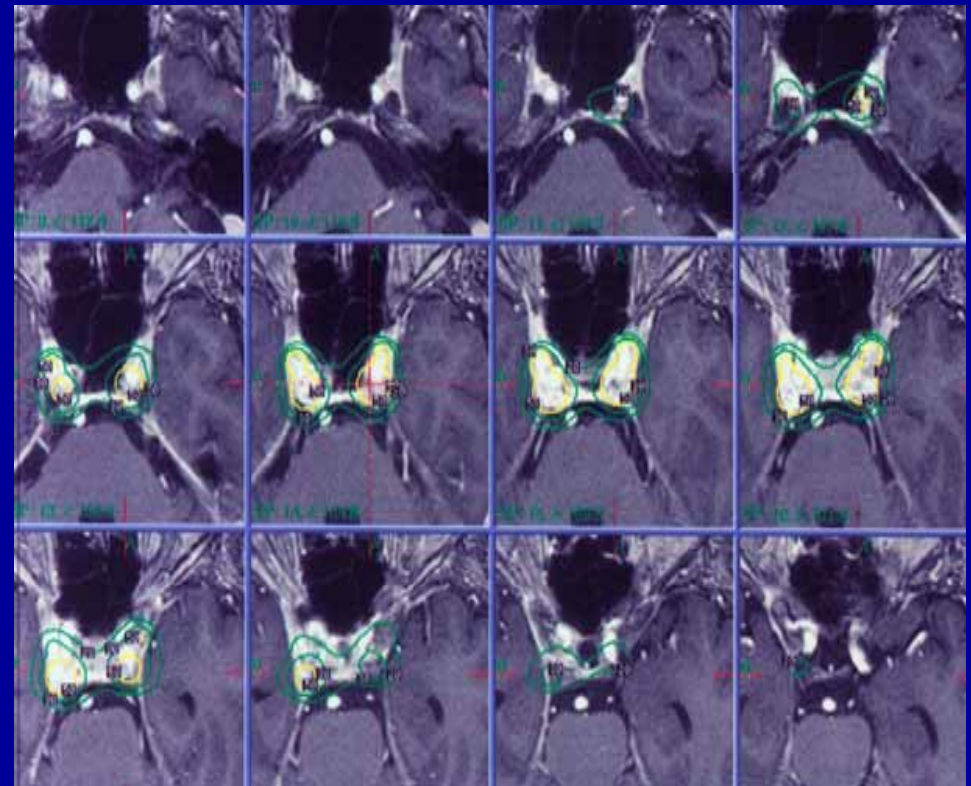
Case example

74 yo woman with
bilateral CCF

-Transarterial ECA and IC
embolization

-Post-embo GKR

-MRI showed resolution of
CVD

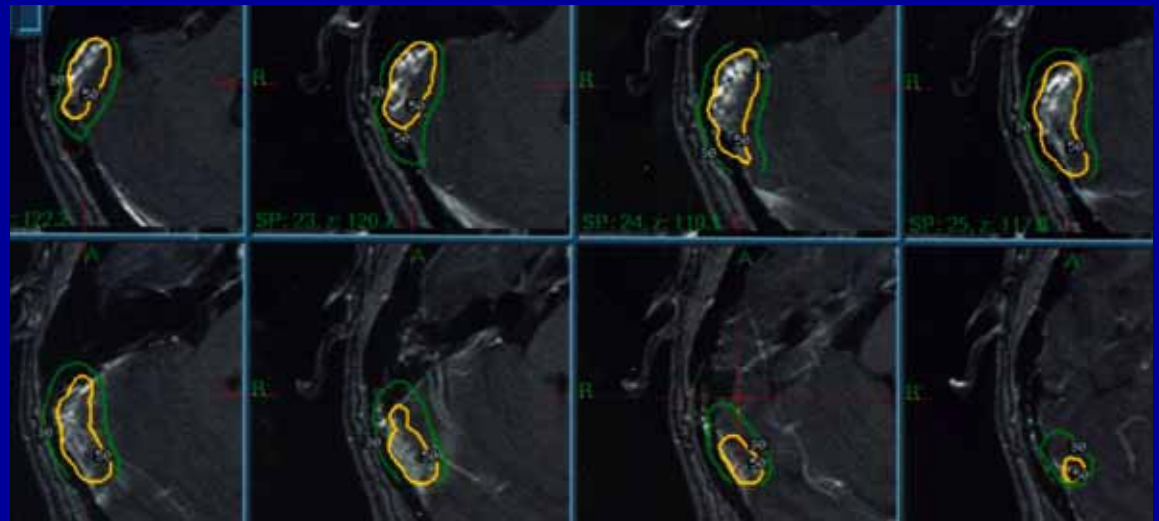


Case example

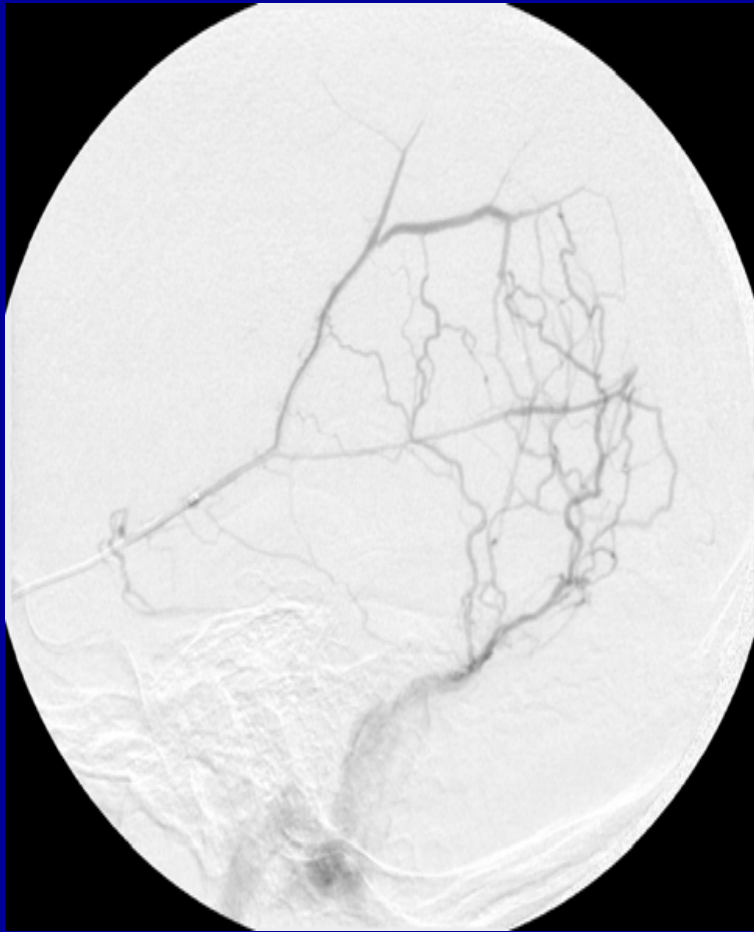
49 yo woman with severe headaches and pulsatile tinnitus

-GKR as initial treatment

Immediate post-GKR transarterial embo of multiple ECA feeders



Case examples (cont.)



Clinical Outcomes

<u>Location</u>	Excellent	Good
Carotid-Cavernous Sinus (n=10)	5	5
Tentorial-Sigmoid Sinus (n=5)	2	3
Convexity-Sagittal Sinus (n=3)	2	1
	Total: 9	Total: 9

excellent response: complete resolution of all clinical symptoms
good response: resolution of all but one presenting symptom

Angiographic outcomes

	<u>Angiography</u>		<u>Computed Tomography Angiography (CTA)</u>		<u>Magnetic Resonance Angiography (MRA)</u>	
	Complete Obliteration	Partial Obliteration	Complete Obliteration	Partial Obliteration	Complete Obliteration	Partial Obliteration
Carotid- Cavernous Sinus (n=10)	2	-	1	-	2	2
Tentorial- Sigmoid Sinus (n=5)	4	-	-	-	1	-
Convexity- Sagittal Sinus (n=3)	2	-	-	-	-	1

Impact of timing of embolization on outcome

	<u>Clinical Response</u>	
	Excellent Response	Good Response
Radiosurgery Alone (n=8)	6	2
Embolization followed by Radiosurgery (n=9)	3	6
Radiosurgery followed by Embolization (n=1)	1	0
	Total: 10	Total: 8

Conclusions

- When treating a disease with a “benign” course, the least invasive procedure must be performed without complication
- Radiosurgery and embolization provide clinical and angiographic cure of DAVFs
- DAVFs should be evaluated by a team of experts in each aspect of multi-modality treatment options