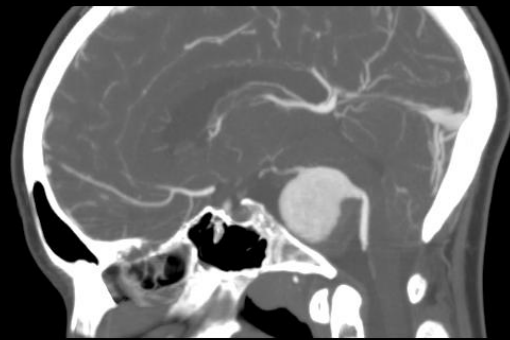
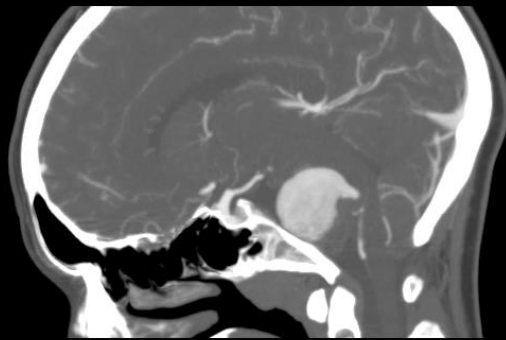
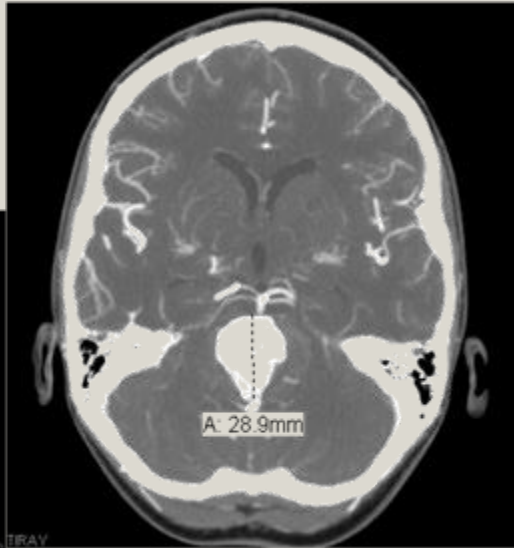
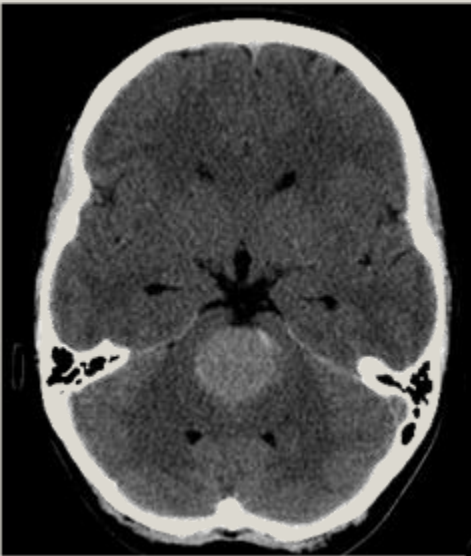


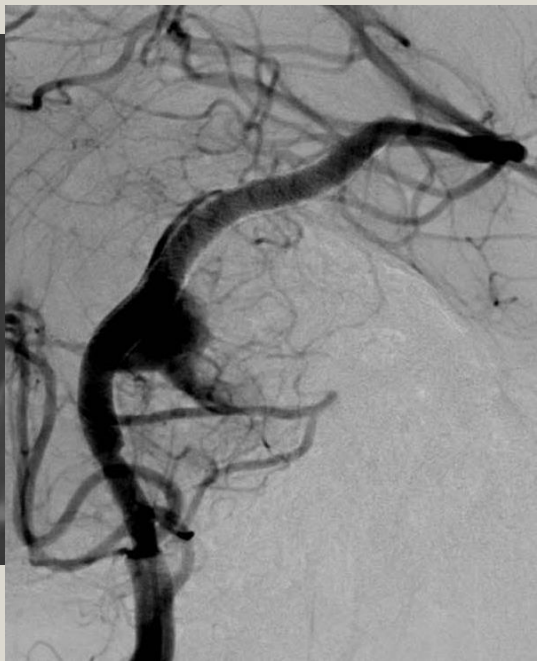
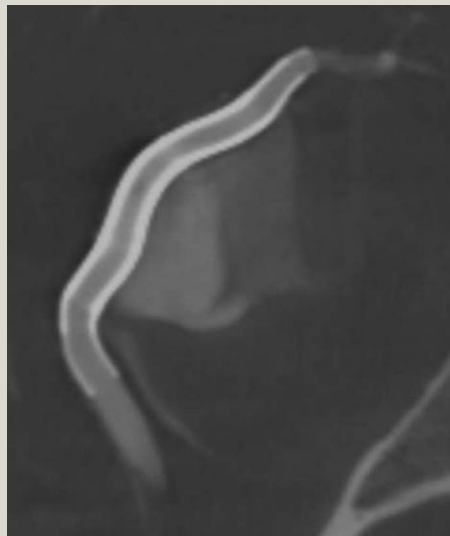
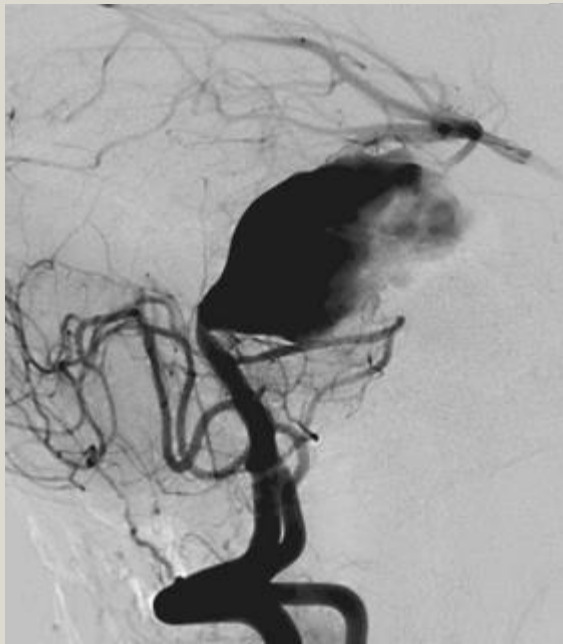
Issues concerning the treatment of complex posterior circulation aneurysms with flow diversion devices

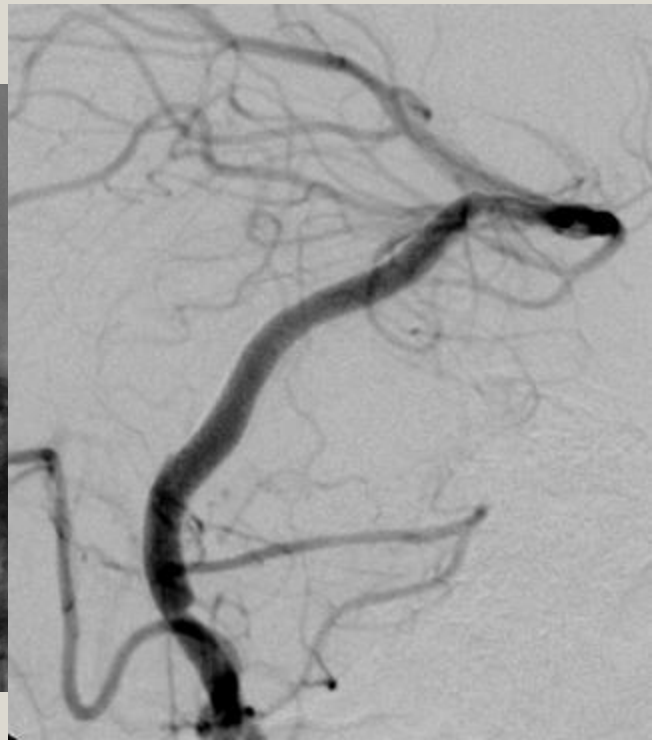
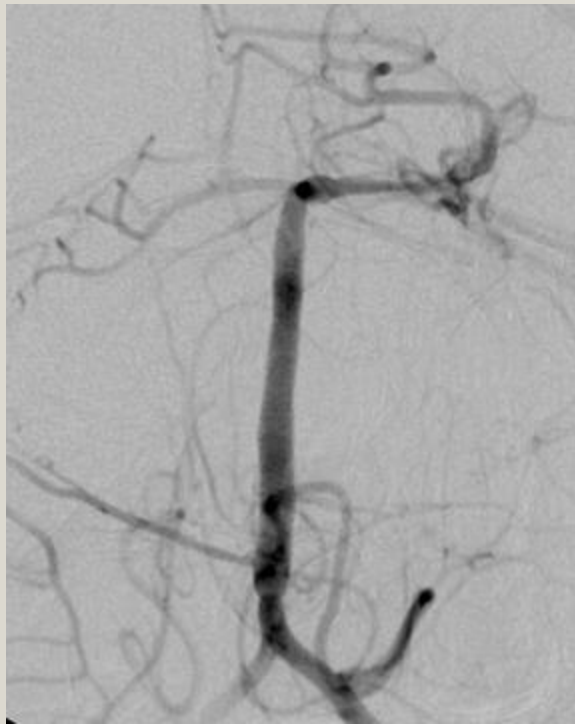
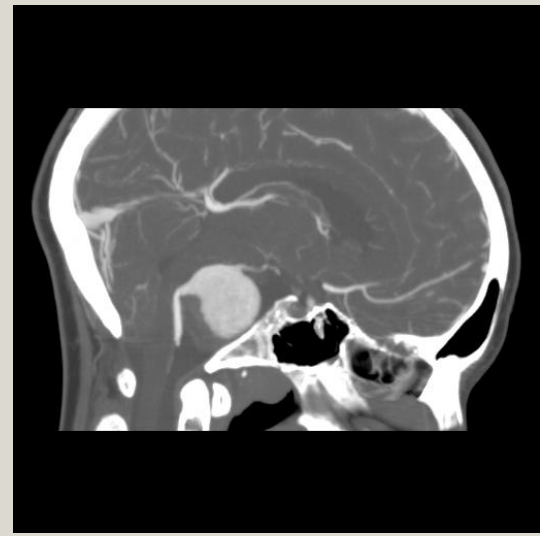
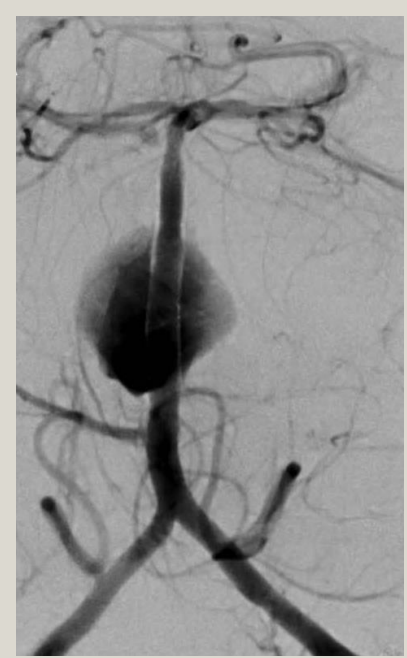
P Kim Nelson

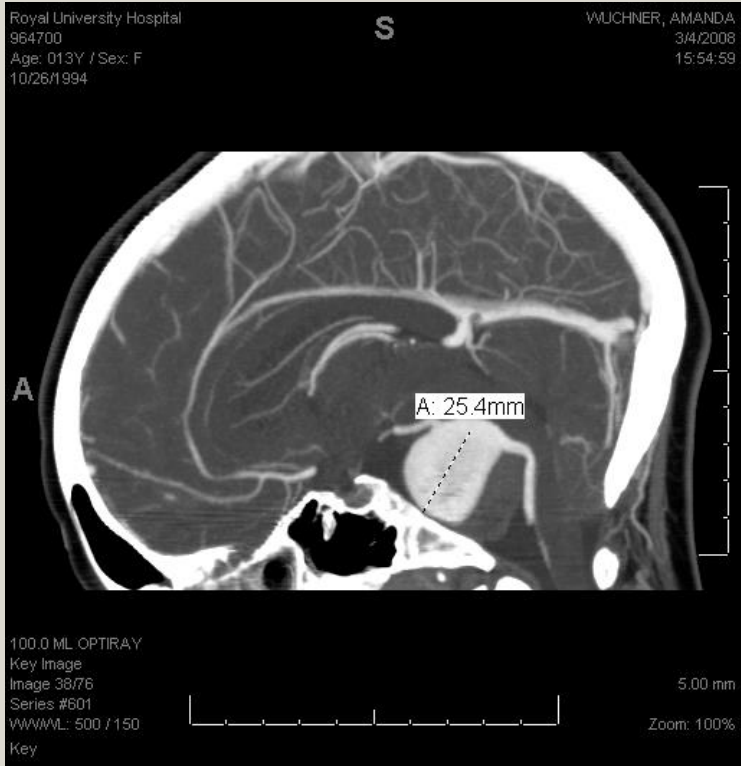
NYU Langone Medical Center

Fiorella D, Kelly ME, Albuquerque FC, Nelson PK: Curative reconstruction of a giant midbasilar trunk aneurysm with the pipeline embolization device. *Neurosurgery* 64:212–217, 2009









3/4/2008



11/13/2008

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3 px Y: 504 px Value: 130.00

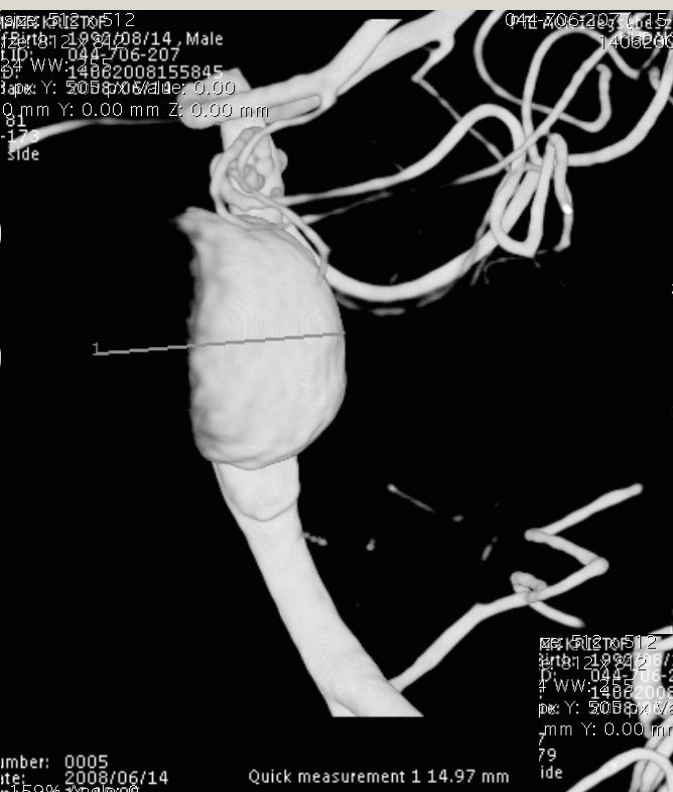


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L: 382 WW: 570
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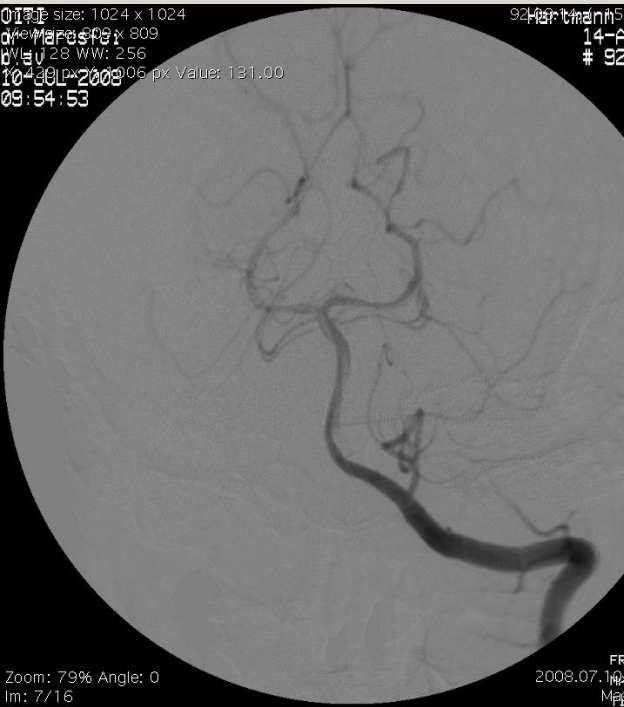


17 year old male

Quick measurement 1 14.97 mm

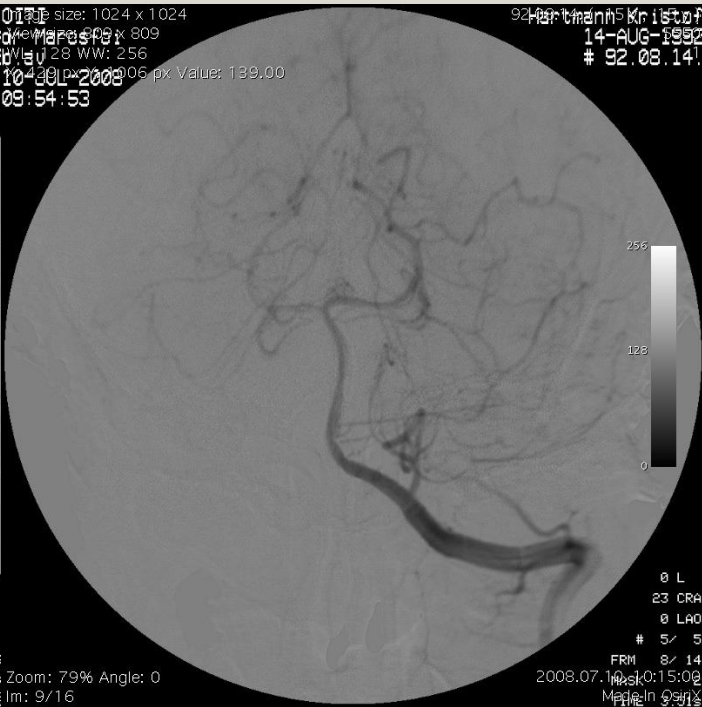
Quick measurement 1 16.22 mm
Quick measurement 2 13.17 mm

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1043012008 06 px Value: 131,00
09:54:53



Zoom: 79% Angle: 0
Im: 7/16

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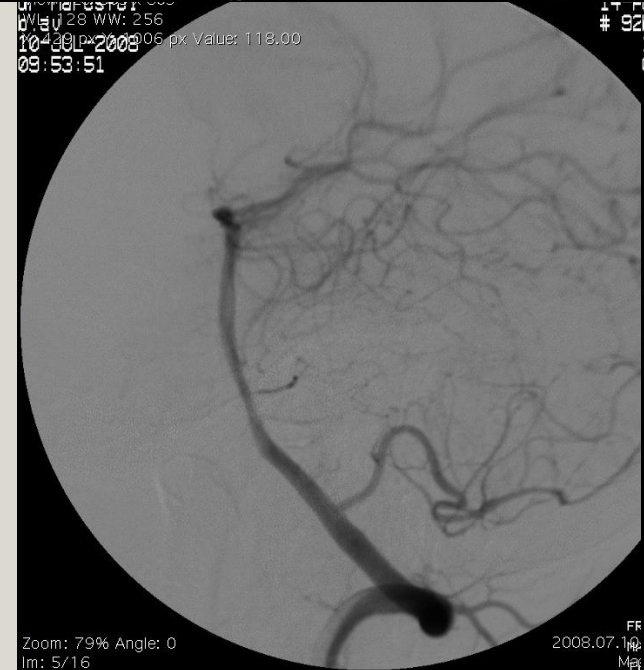
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Zoom: 79% Angle: 0
Mplm: 9/16

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0 L
23 CRA
0 LAO
5 / 5
FRM 8 / 14
2008.07.14 10:15:00
Mplm: 9/16

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09:53:51



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Im: 5/16

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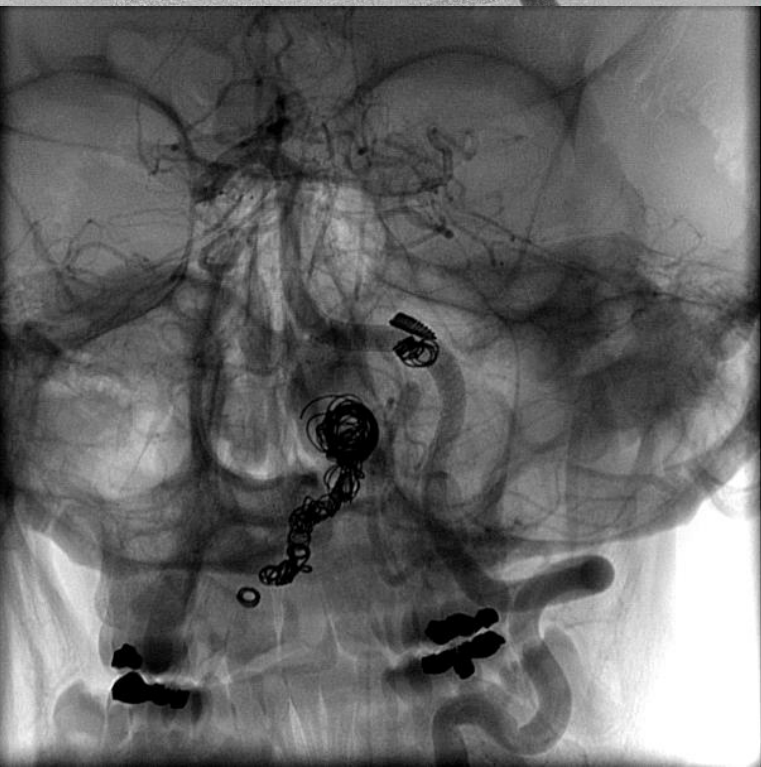
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Mplm: 6/16

0 L
0 CAU
90 LAO
4 / 5
FRM 10 / 15
2008.07.14 10:15:00
Mplm: 6/16



Pre-treatment angiogram
Patient had remotely undergone
occlusion of the right vertebral artery





6 month follow-up angiogram

Panacea or problem: flow diverters in the treatment of symptomatic large or giant fusiform vertebrobasilar aneurysms

Clinical article

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Object. The use of flow-diverting stents has gained momentum as a curative approach in the treatment of complex proximal anterior circulation intracranial aneurysms. There have been some reported attempts of treating formidable lesions in the posterior circulation. Posterior circulation giant fusiform aneurysms have a particularly aggressive natural history. To date, no one approach has been shown to be comprehensively effective or low risk. The authors report the initial results, including the significant morbidity and mortality encountered, with flow diversion in the treatment of large or giant fusiform vertebrobasilar aneurysms at Millard Fillmore Gates Circle Hospital.

Methods. The authors retrospectively reviewed their prospectively collected endovascular database to identify patients with intracranial aneurysms who underwent treatment with flow-diverting devices and determined that 7 patients had presented with symptomatic large or giant fusiform vertebrobasilar aneurysms. The outcomes of these patients, based on the modified Rankin Scale (mRS), were tabulated, as were the complications experienced.

Results. Among the 7 patients, Pipeline devices were placed in 6 patients and Silk devices in 1 patient. At the last follow-up evaluation, 4 patients had died (mRS score of 6), all of whom were treated with the Pipeline device. The other 3 patients had mRS scores of 5 (severe disability), 1, and 0. The deaths included posttreatment aneurysm ruptures in 2 patients and lack of improvement in neurological status related to presenting brainstem infarcts and subsequent withdrawal of care in the other 2 patients.

Conclusions. Whether flow diversion will be an effective strategy for treatment of large or giant fusiform vertebrobasilar aneurysms remains to be seen. The authors' initial experience suggests substantial morbidity and mortality associated with the treatment and with the natural history. As outcomes data slowly become available for patients receiving these devices for fusiform posterior circulation aneurysms, practitioners should use these devices judiciously. (<http://thejns.org/doi/abs/10.3171/2012.2.JNS111942>)

Case No.	Age (yrs)	Preop Stroke	Presentation	Preop mRS Score	Aneurysm Shape	Aneurysm Max Diameter (mm)	Aneurysm Estimated Length (mm)	No. of Flow Diversion Devices†	Device Sizes in mm (no. if >1)	Coils	Postop Stroke	mRS Score at Last FU
1	75	no	difficulty ambulating, dizziness	1	fusiform, midbasilar	14.3	31	2 Silk & 1 Leo stent	4.5 × 50, 4.5 × 30	no	no	1
2	66	yes	slurred speech, recurrent aspirations, gait instability, cognitive impairment, hydrocephalus, quadriplegia	4	fusiform, holobasilar	23.3	85	9	3.75 × 20 (3), 4 × 20 (3), 4.25 × 20 (3)	yes	no	6
3	57	no	headache, incidental	1	fusiform, holobasilar	17.5	76	5	5 × 30, 5 × 20 (4)	yes	ischemic, brainstem	0
4	42	no	hemiparesis, facial weakness	2	fusiform, distal basilar trunk	35.6	29.1	3	4 × 20, 4 × 12, 3.75 × 12	no	ischemic, brainstem; SAH	6
5	42	no	facial numbness, vertigo & ataxia	2	mixed fusiform & saccular, mid-basilar	37.1	10.9	3	4 × 18, 4 × 12, 3.75 × 16	yes	ischemic, brainstem	6
6	51	yes	thalamus & pons stroke; only dysarthria after tPA 2 wks prior to treatment	3	fusiform, holobasilar	9.5	61.5	9	5 × 20 (2), 5 × 16 (2), 5 × 12, 4.75 × 14 (2), 4.75 × 16 (2)	no	ischemic, brainstem	5
7	55	yes	pontine stroke, dysphagia, lt hemiplegia	4 on admission, 5 before angiogram	fusiform, holobasilar	8.5	56	3	5 × 35 (2), 5 × 30	yes	yes, progression of stroke	6

* FU = follow-up; max = maximum; tPA = tissue plasminogen activator.

† Cases 2–7 underwent Pipeline device placement.

Treatment of Posterior Circulation Aneurysms With the Pipeline Embolization Device

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BACKGROUND: Treatment of complex intracranial aneurysms with the pipeline embolization device (PED) has become common practice in neurovascular centers. Very few studies have assessed the safety and efficacy of PED treatment for posterior circulation aneurysms.

OBJECTIVE: To retrospectively present our experience with use of the PED in the posterior circulation.

METHODS: A total of 7 patients harboring 7 posterior circulation aneurysms were treated with the PED at our institution between November 2011 and July 2012.

RESULTS: Aneurysm size was 14.1 mm on average. All patients had unruptured aneurysms. Three aneurysms arose from the vertebral artery, 2 from the basilar artery, and 2 from the vertebrobasilar junction. A single stent was used in 4 patients, 2 stents in 2 patients, and 3 stents in 1 patient. Treatment was successful in all 7 patients. No procedural complications or perforator infarcts were noted in the series. No patient experienced new neurological symptoms related to PED treatment during the follow-up period. Angiographic follow-up was available for 6 patients at a mean time point of 5.5 months. Follow-up angiography showed 100% aneurysm occlusion in 3 patients, marked decrease in aneurysm size in 2 patients, and no change in 1 patient.

CONCLUSION: In our initial experience, it appears that PED treatment in select patients with vertebrobasilar aneurysms may have a reasonable safety-efficacy profile. Larger studies are needed to confirm our findings.

KEY WORDS: Aneurysms, Basilar, Pipeline embolization device, Posterior circulation

**ORIGINAL
RESEARCH**

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J.D. Wenderoth
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H. Rice
T.P. Singh
L. Devilliers
V. Wycoco
S. Meckel
W. McAuliffe



Safety of the Pipeline Embolization Device in Treatment of Posterior Circulation Aneurysms

BACKGROUND AND PURPOSE: The published results of treating internal carotid artery aneurysms with the PED do not necessarily apply to its use in the posterior circulation because disabling brain stem infarcts can be caused by occlusion of a single perforator. In this multicenter study, we assessed the safety of PED placement in the posterior circulation.

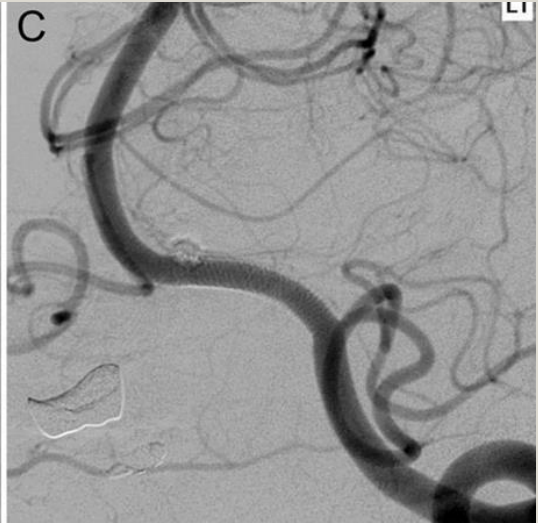
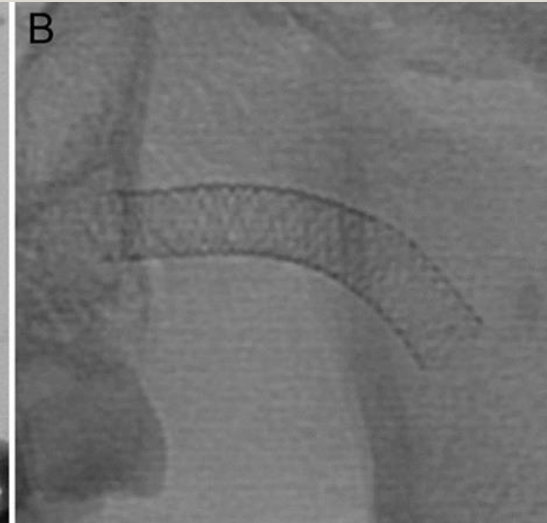
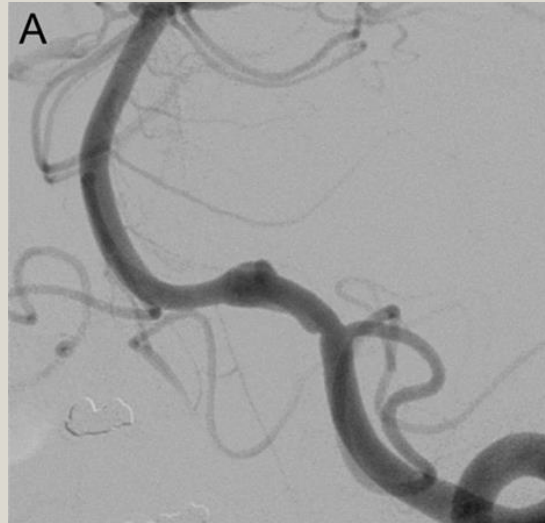
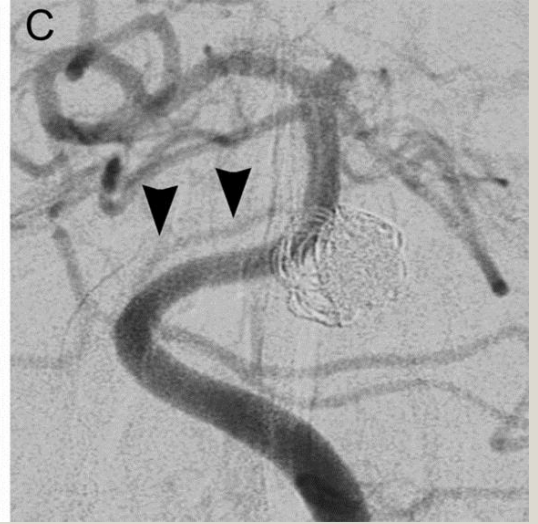
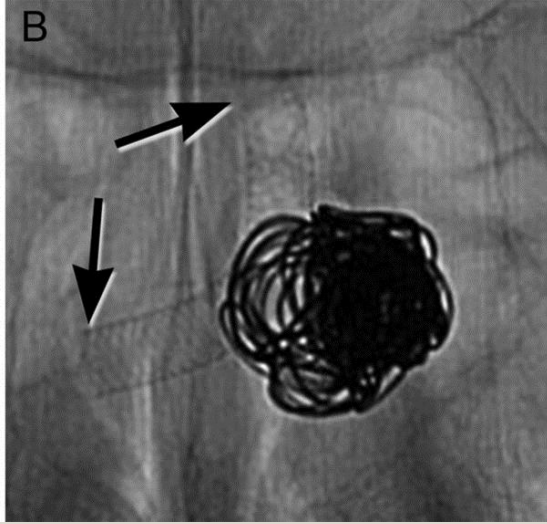
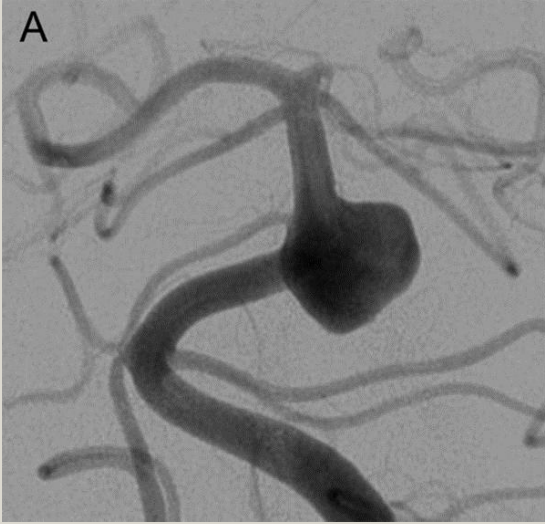
MATERIALS AND METHODS: A prospective case registry was maintained of all posterior circulation aneurysms treated with PEDs at 3 Australian neurointerventional centers during a 27-month period. The objective was to assess the complications and aneurysm occlusion rates associated with posterior circulation PEDs.

RESULTS: Thirty-two posterior circulation aneurysms were treated in 32 patients. No deaths or poor neurologic outcomes occurred. Perforator territory infarctions occurred in 3 (14%) of the 21 patients with basilar artery aneurysms, and in all 3, a single PED was used. Two asymptomatic intracranial hematomas were recorded. No aneurysm rupture or PED thrombosis was encountered. The overall rate of permanent neurologic complications was 9.4% (3/32); all 3 patients had very mild residual symptoms and a good clinical outcome. Aneurysm occlusion was demonstrated in 85% of patients with >6 months of follow-up and 96% of patients with >1 year of follow-up.

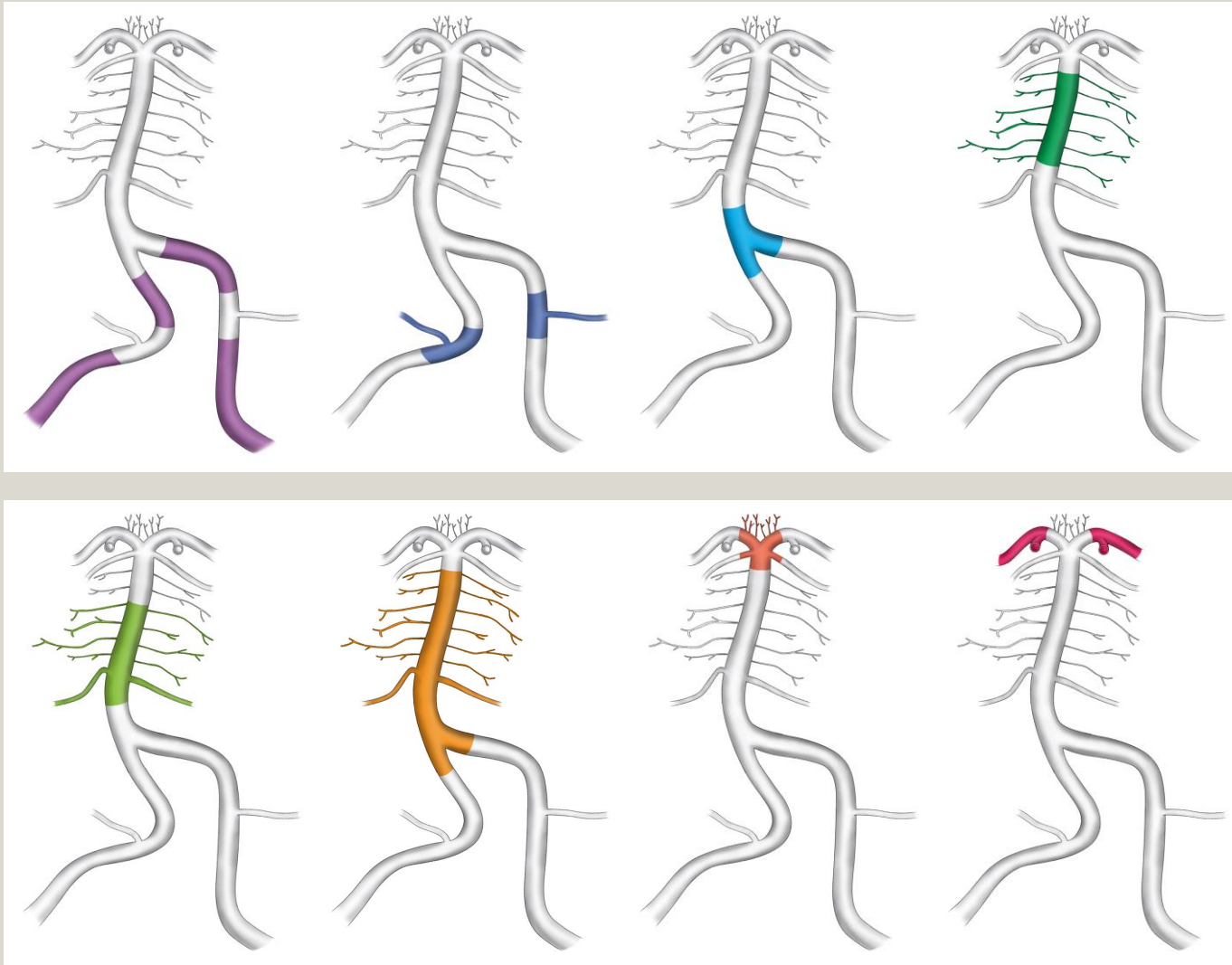
CONCLUSIONS: The PED is effective in the treatment of posterior circulation aneurysms that are otherwise difficult or impossible to treat with standard endovascular or surgical techniques, and its safety is similar to that of stent-assisted coiling techniques. A higher clinical perforator infarction rate may be associated with basilar artery PEDs relative to the internal carotid artery.

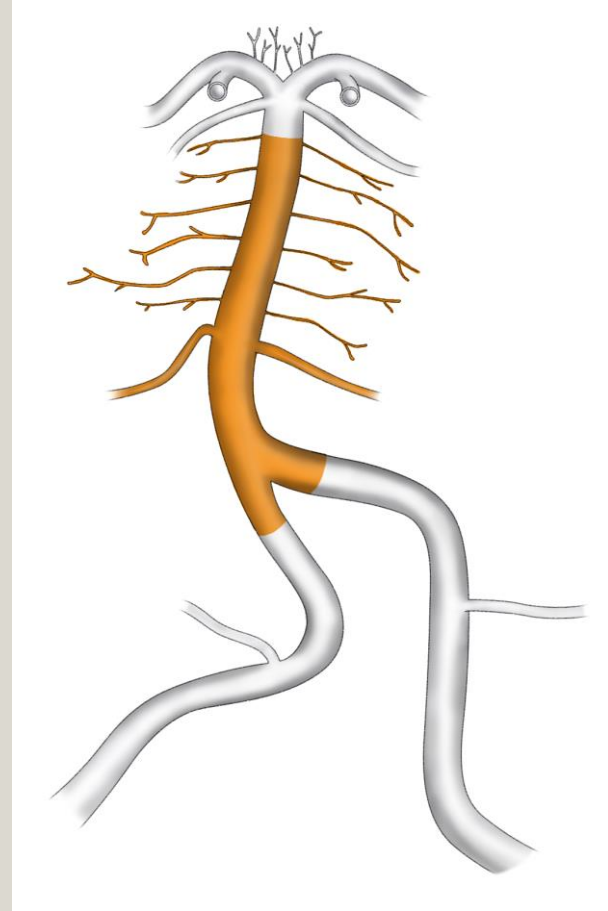
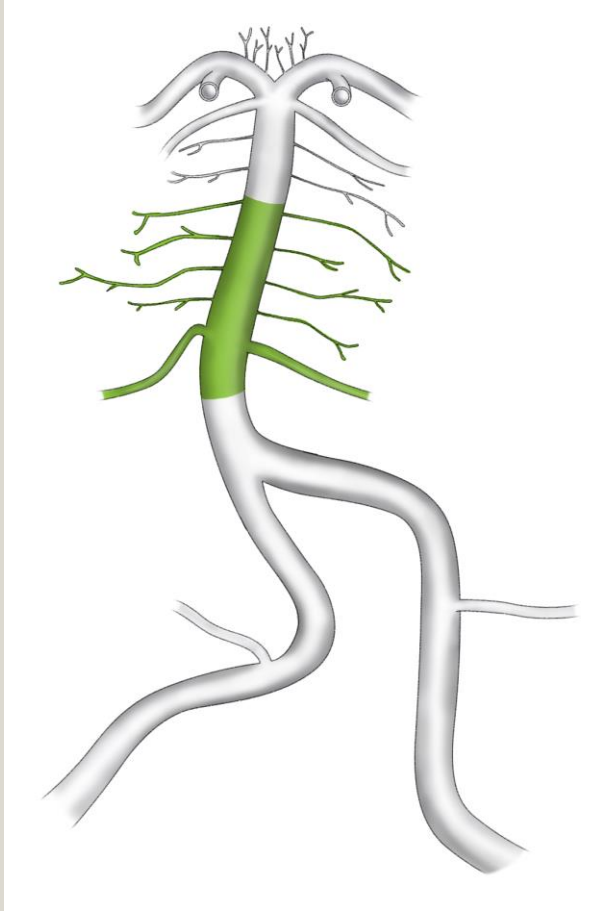
ABBREVIATIONS: mRS = modified Rankin Scale; PED = Pipeline Embolization Device; SFD = Silk flow diverter; TGA = Therapeutic Goods Association; WFNS = World Federation of Neurological Surgeons

Heterogeneity of aneurysms and patients

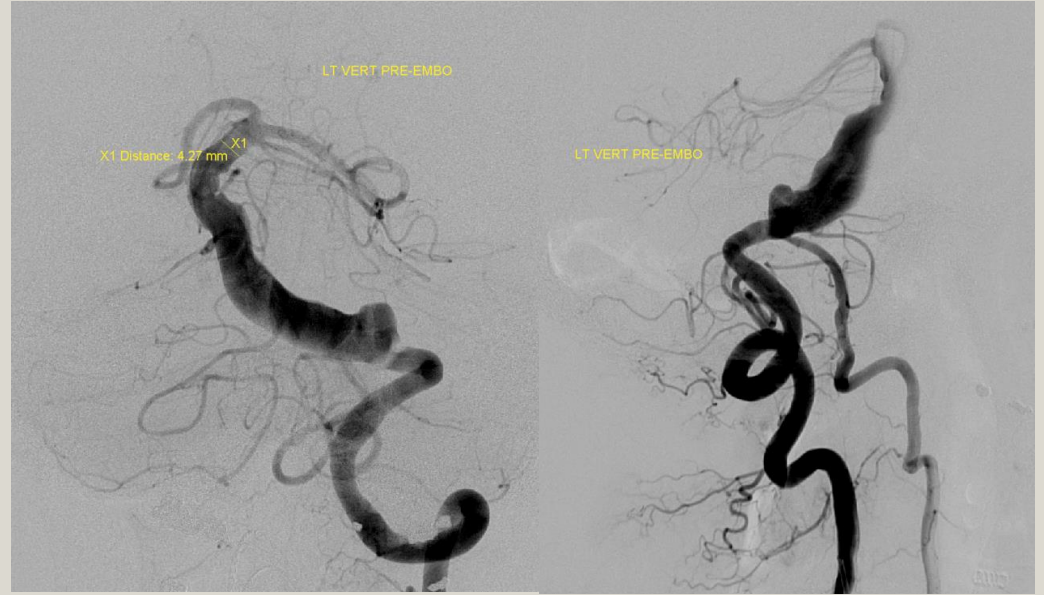


Posterior circulation

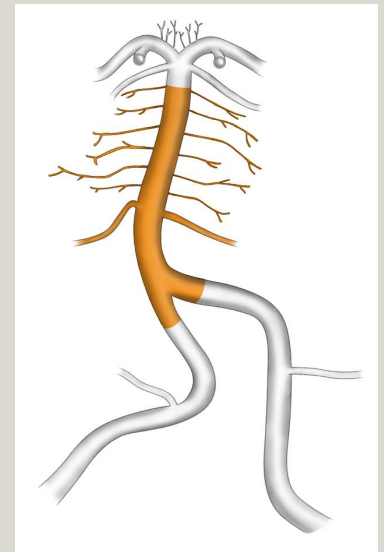


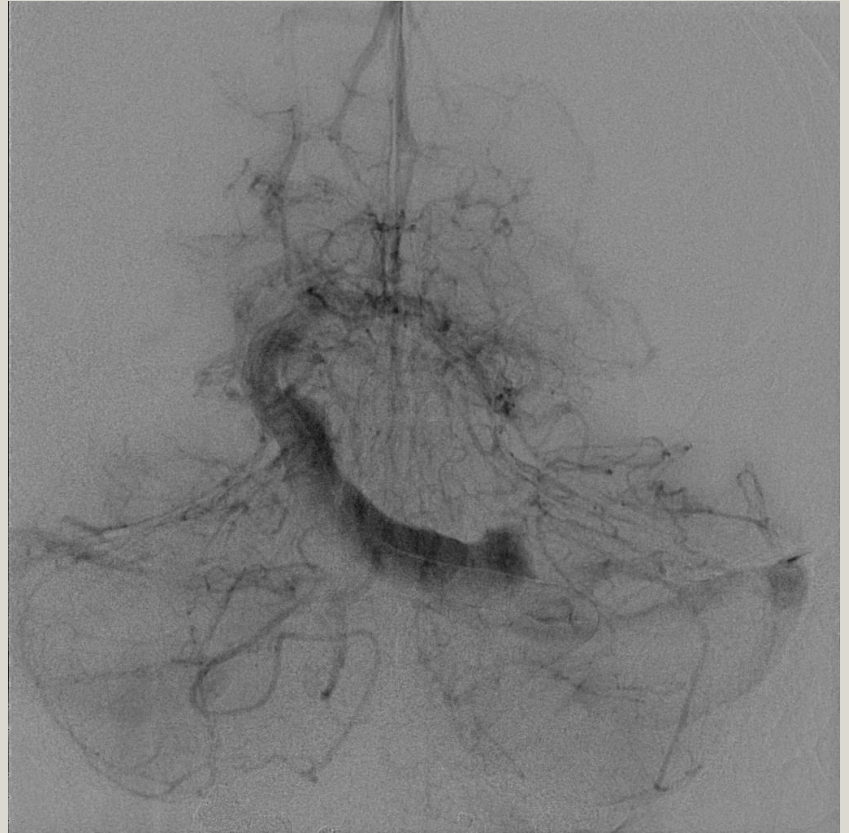


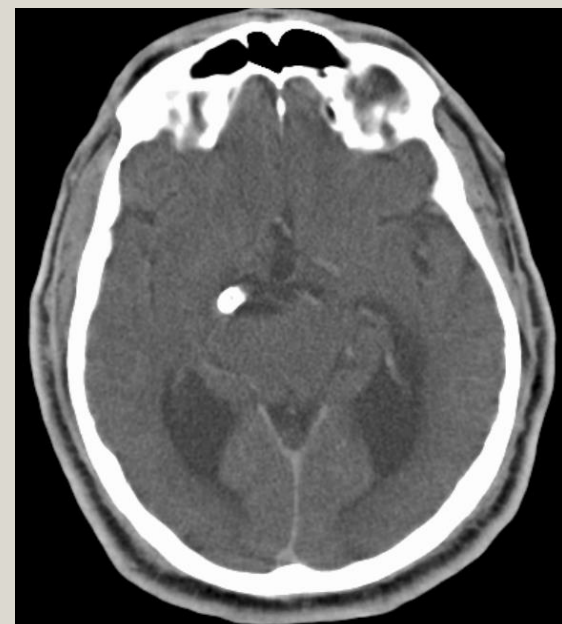
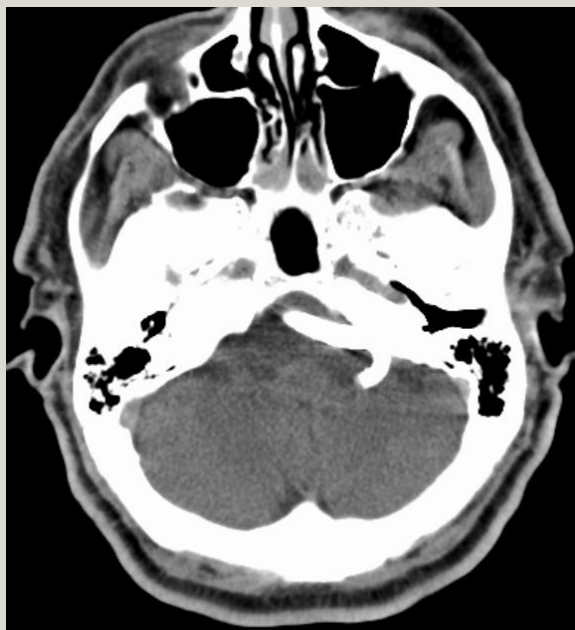


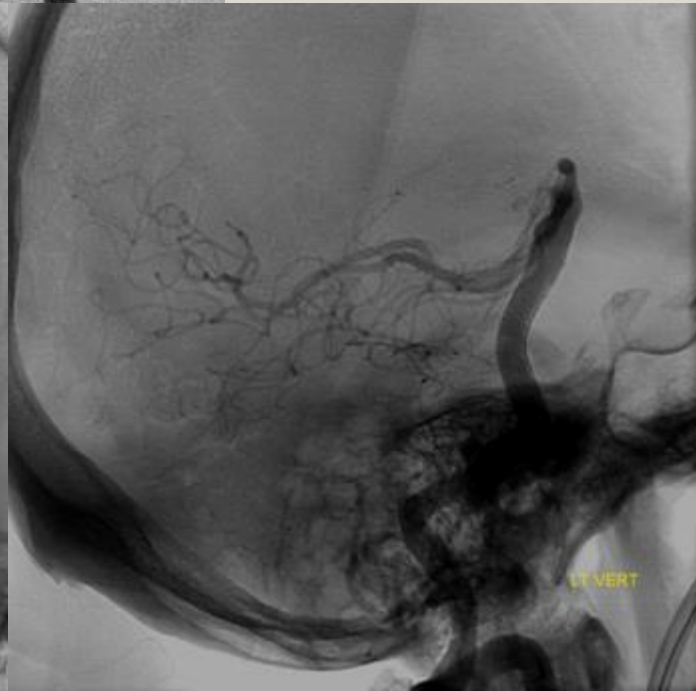
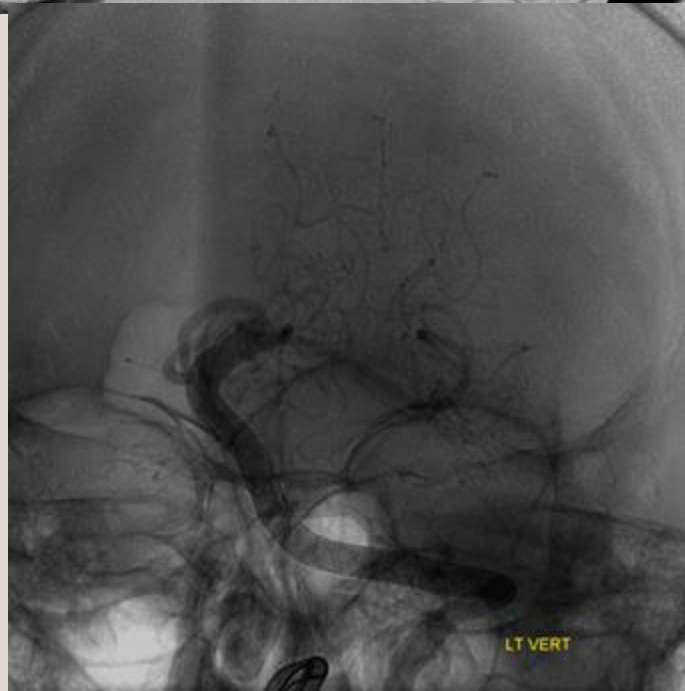
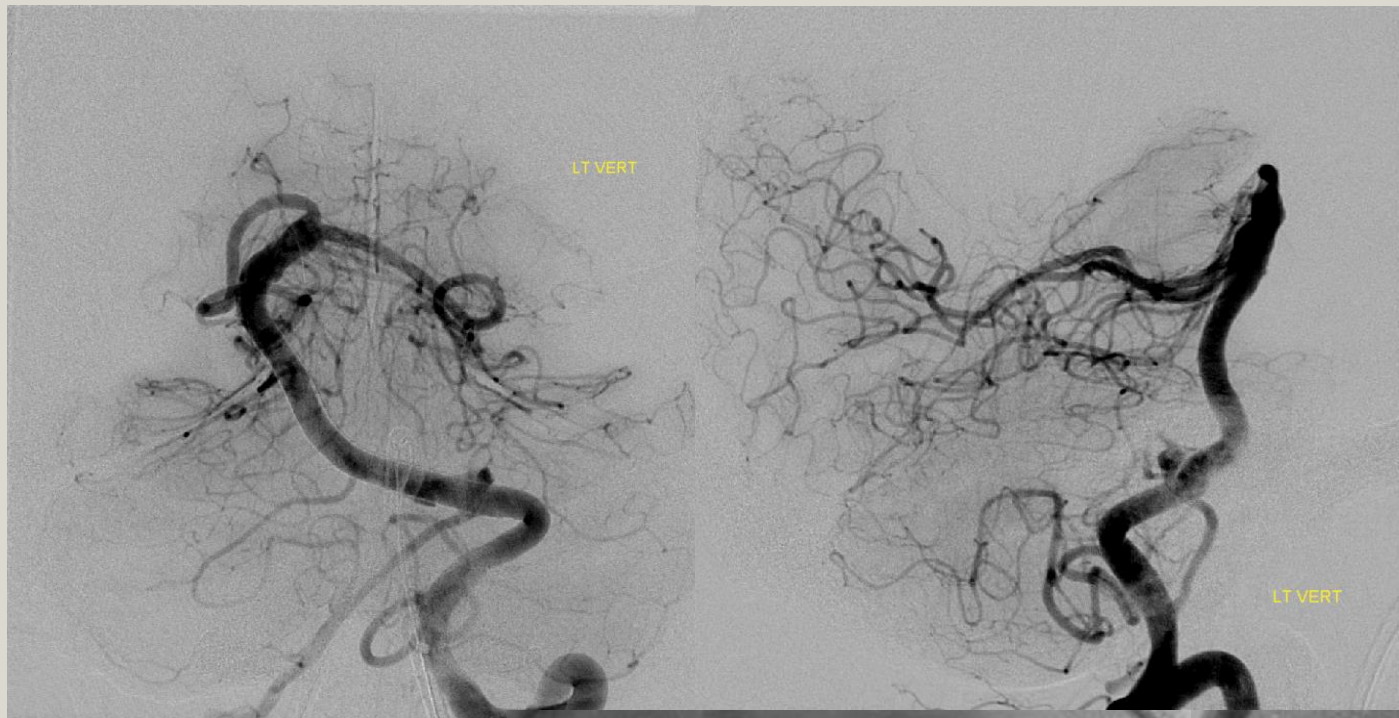


58 year old male with cranial neuropathies and quadraparesis

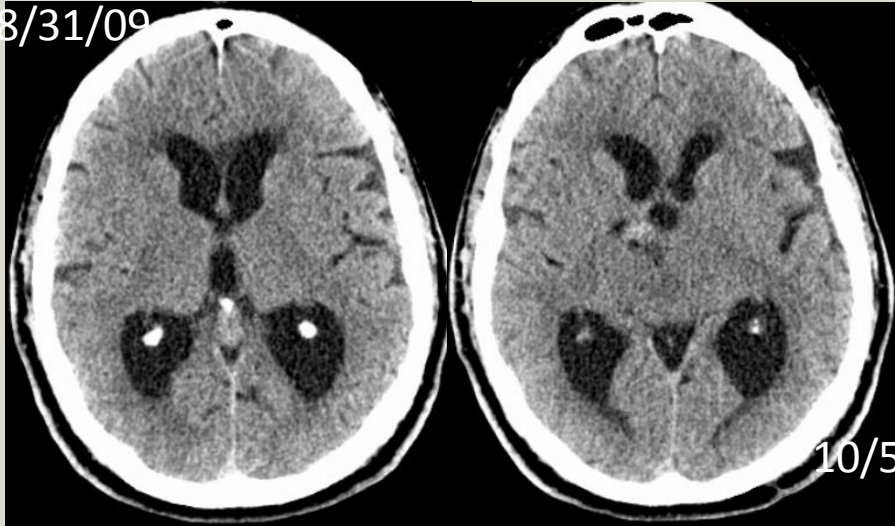




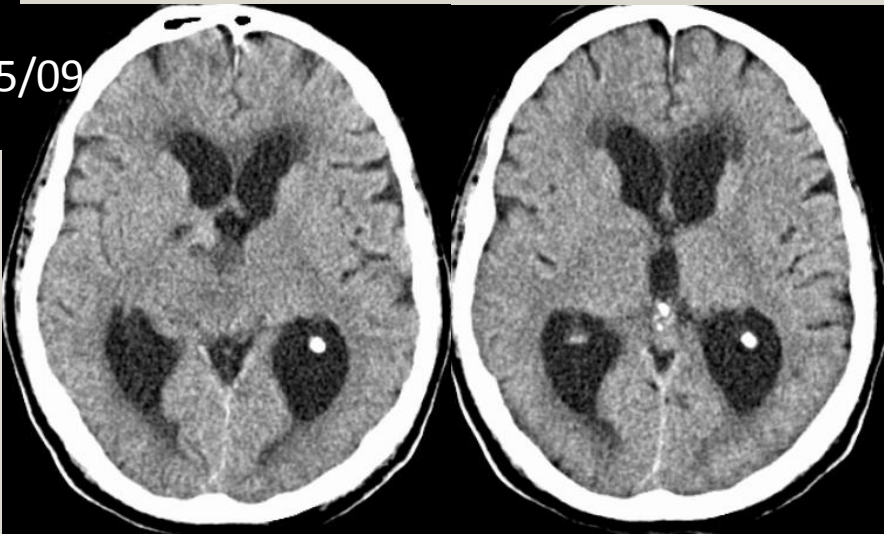


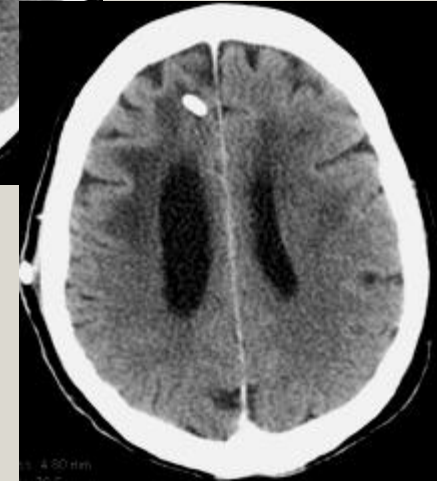


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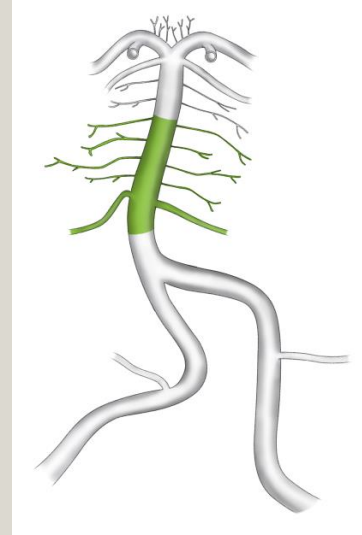
76 year old woman with paraparesis and diplopia

LT VERT PRE EMBO

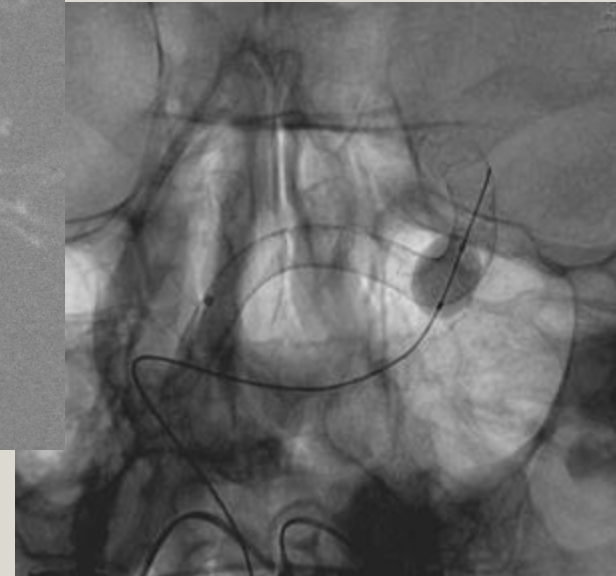
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Pre-treatment angiogram

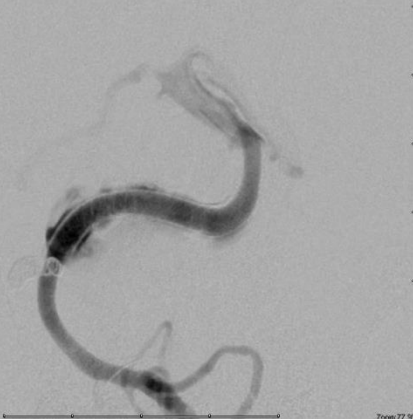
RT VERT



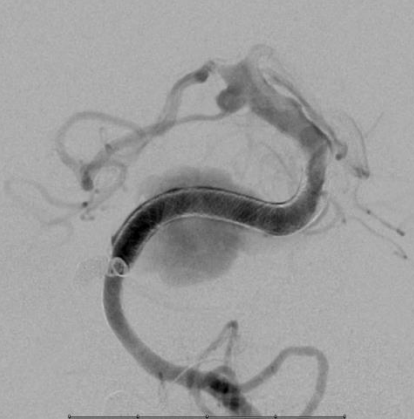
Sequential images of construct fabrication



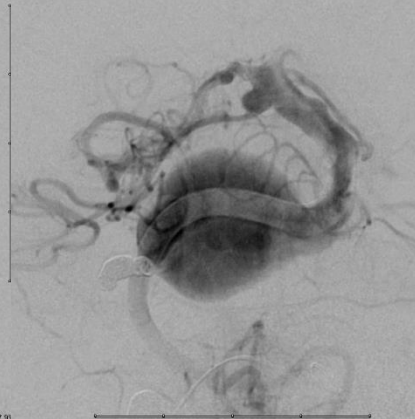
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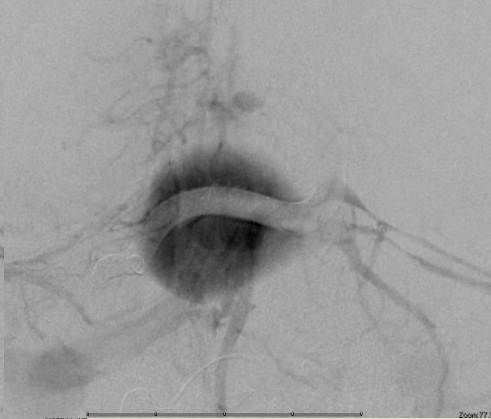
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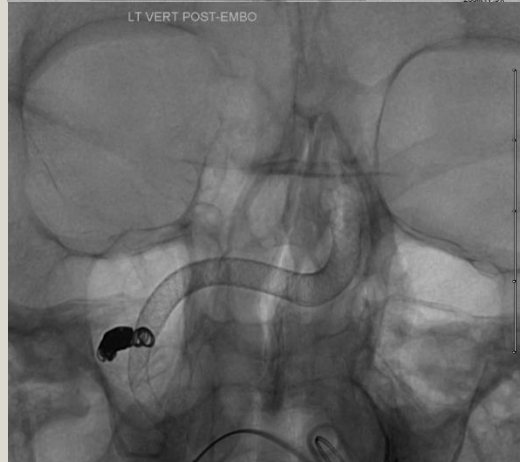
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Series #6
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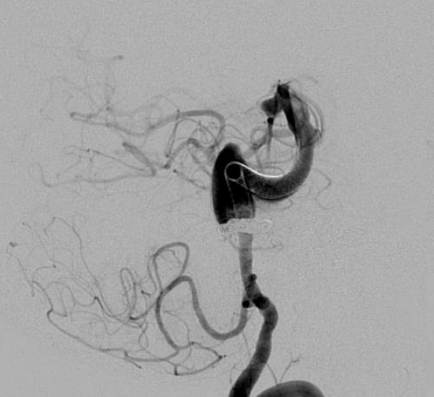


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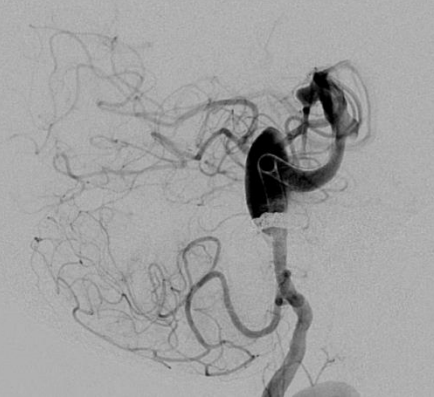


Immediate post-PED angio demonstrating delayed aneurysm washout

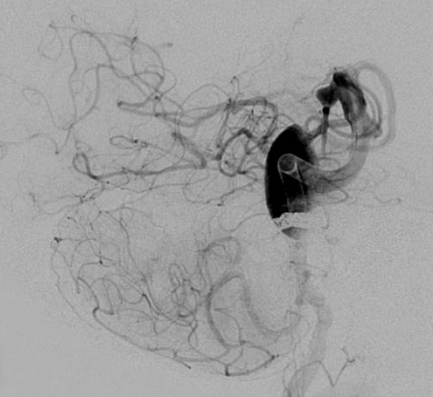
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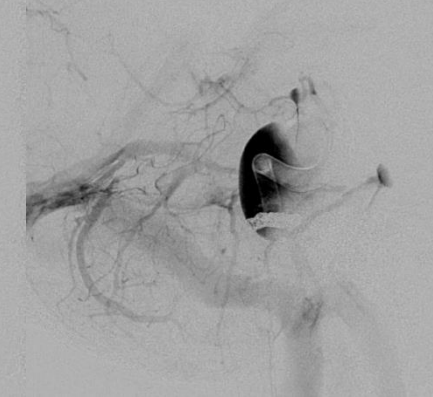
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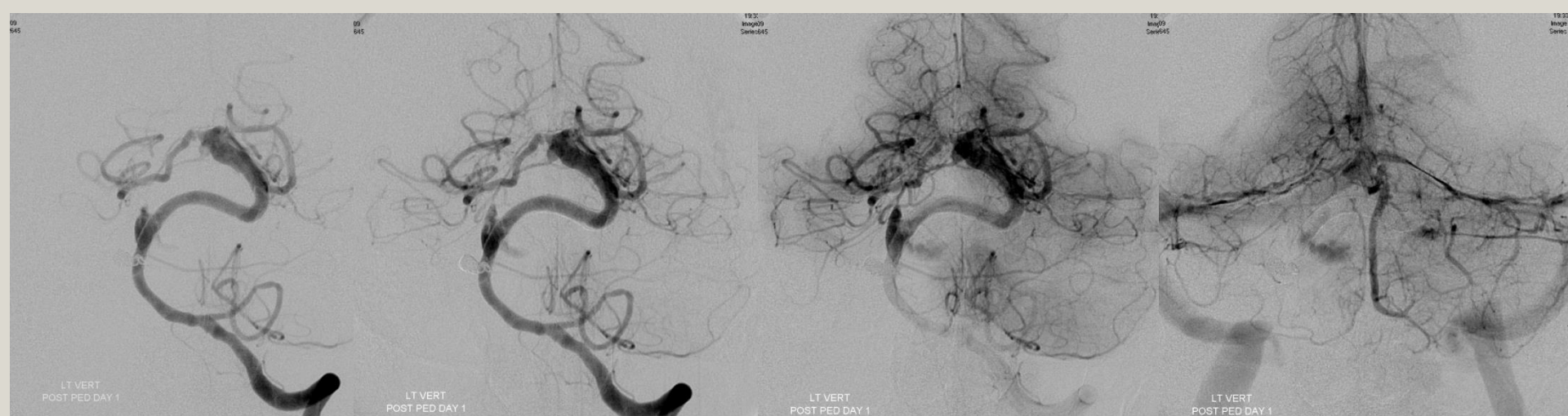


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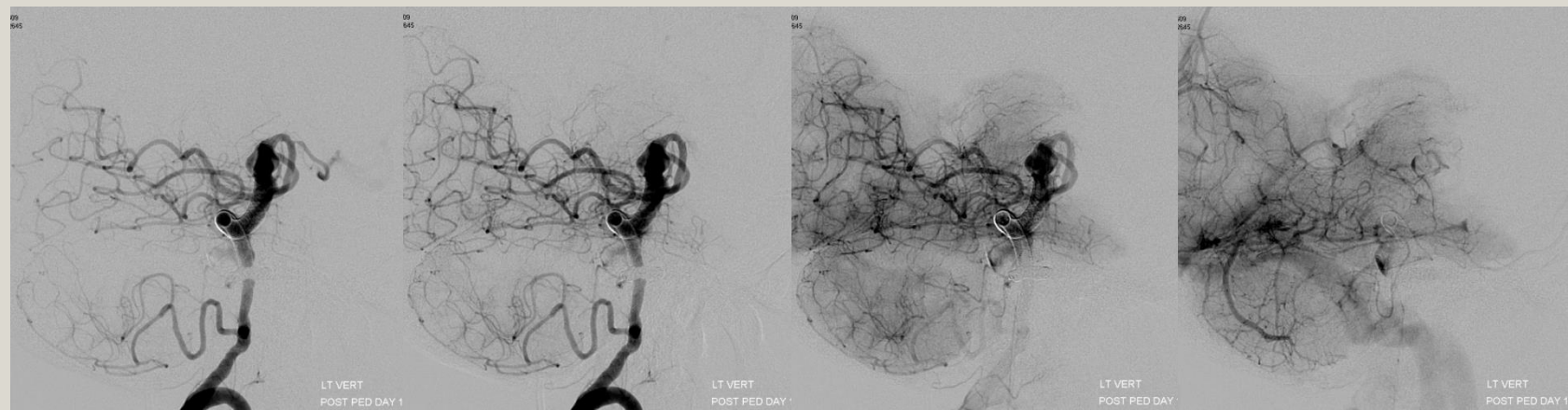
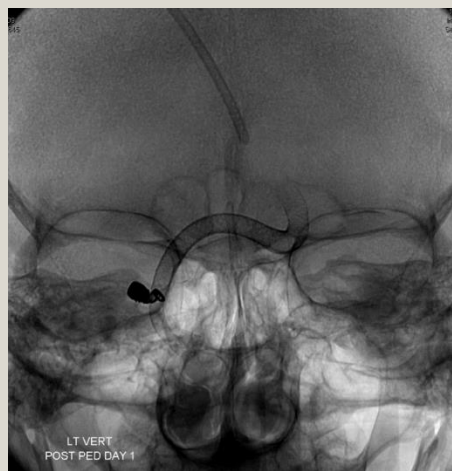


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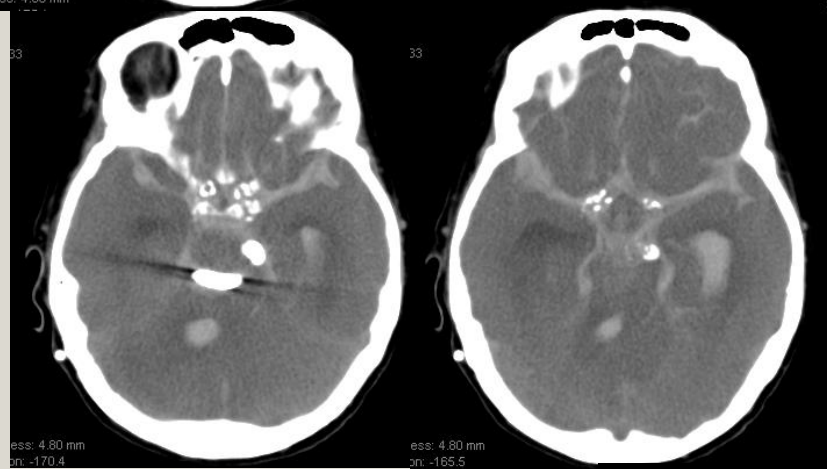
24 hour post-treatment angio demonstrating interval progressive thrombosis of the aneurysm. Minor residual opacification of the proximal aneurysm at the left AICA outflow





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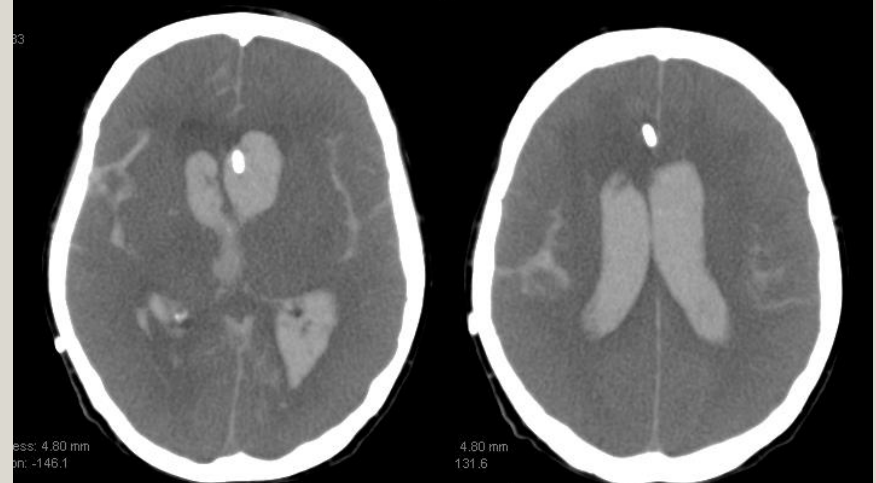
ess: 4.80 mm



ess: 4.80 mm
pr: -170.4

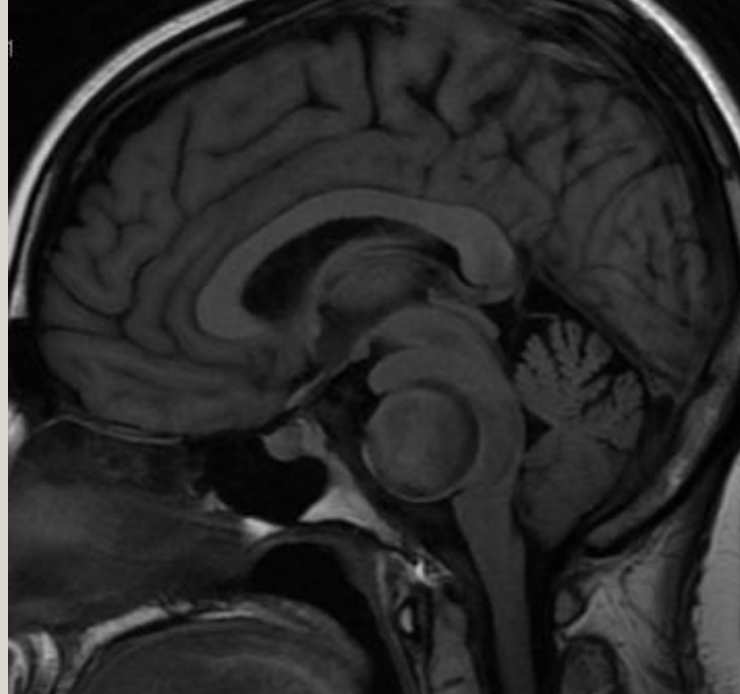
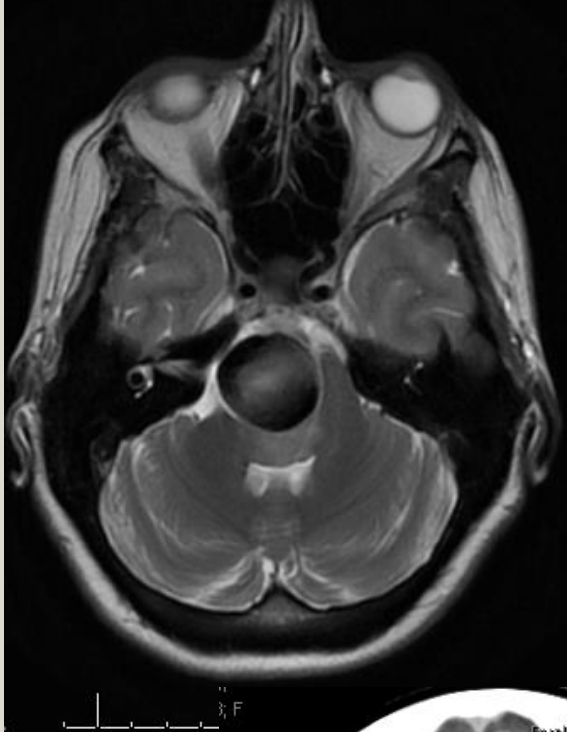
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pr: -165.5

Massive IV/SAH 2 weeks post-treatment

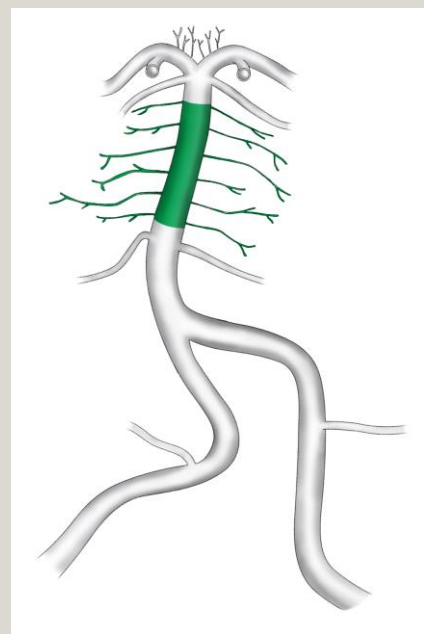
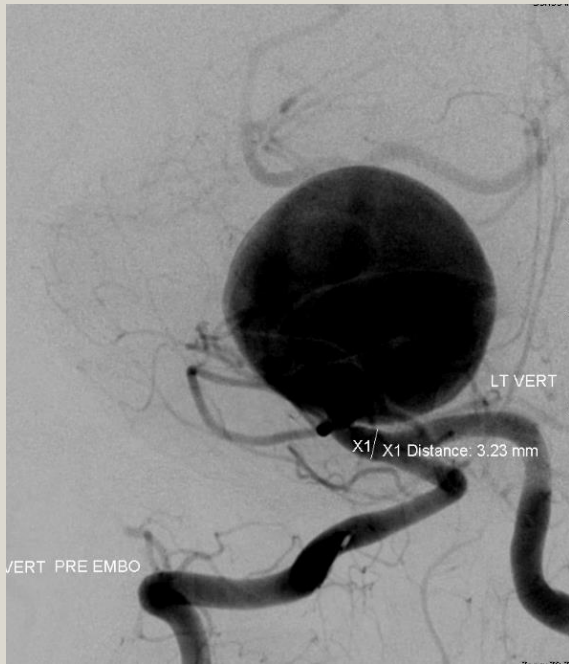


ess: 4.80 mm
pr: -146.1

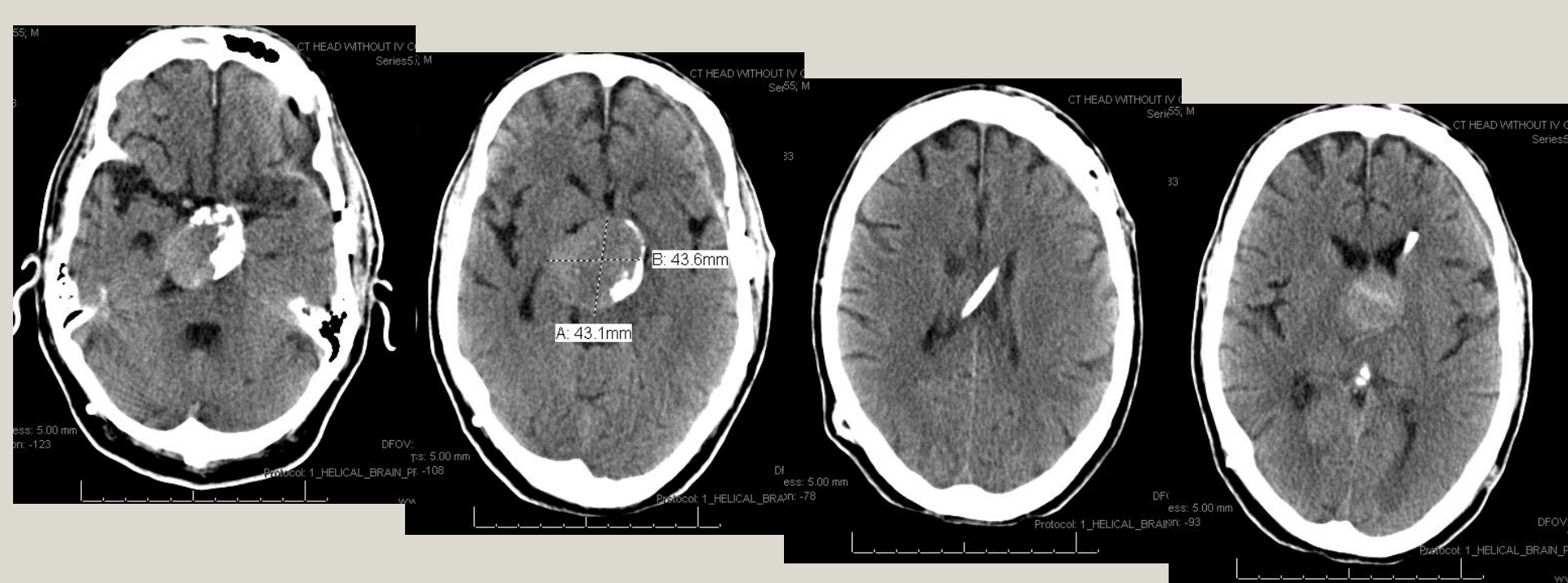
4.80 mm
131.6



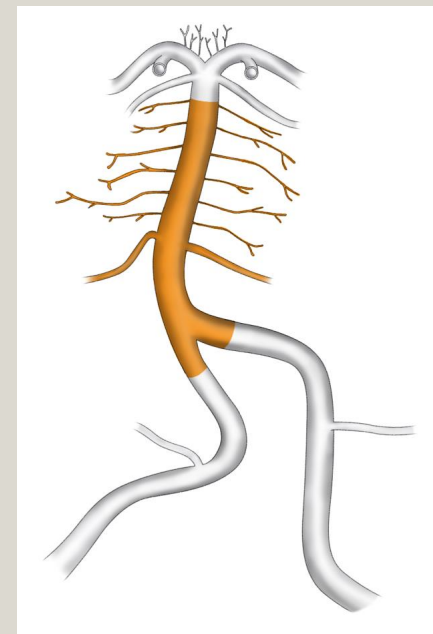
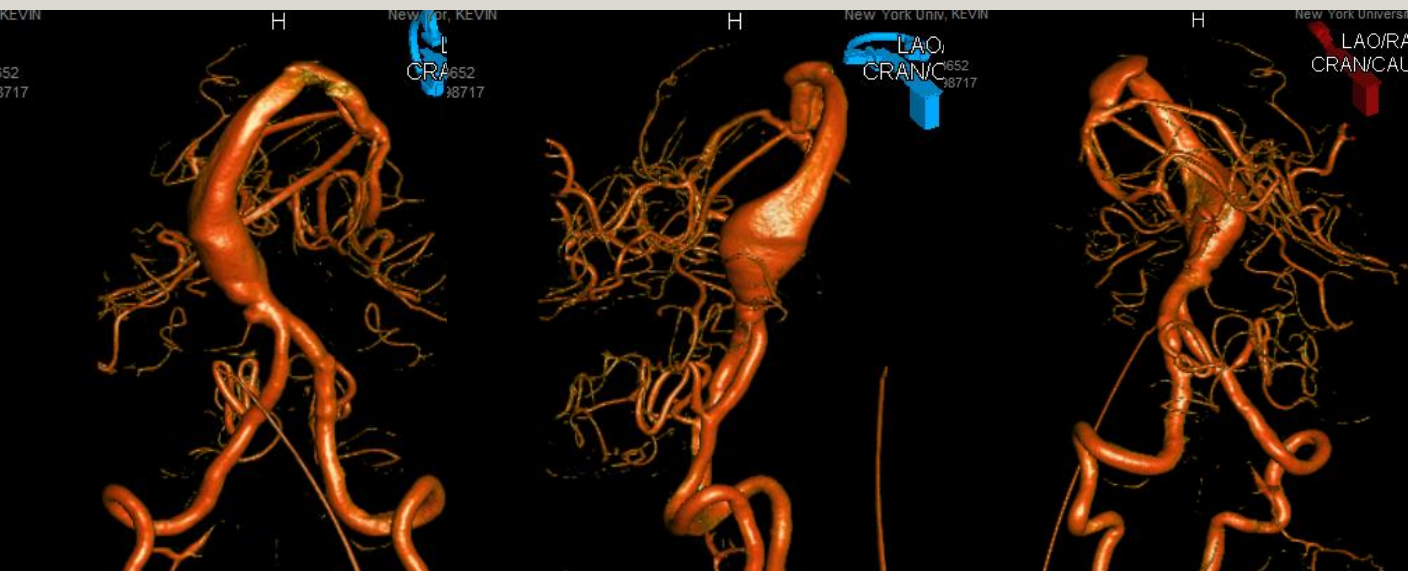
37 year old woman with swallowing disorder, right 6th and 7th N palsies, and trismus

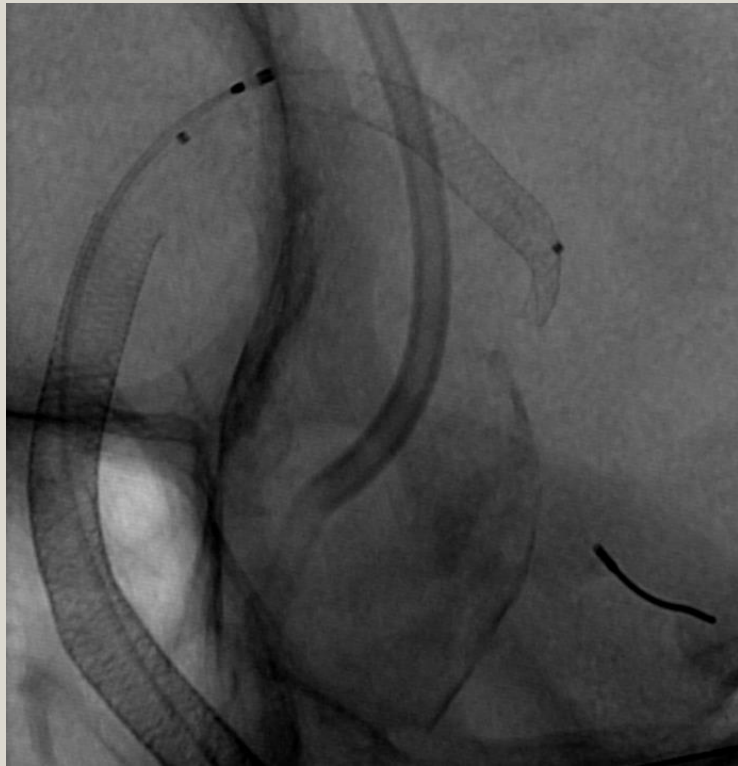
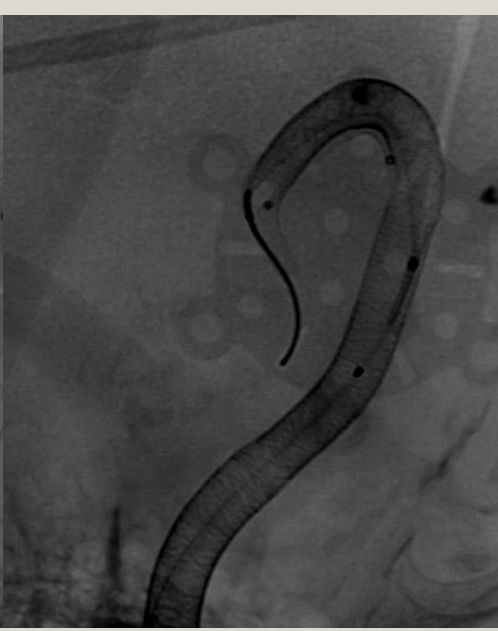
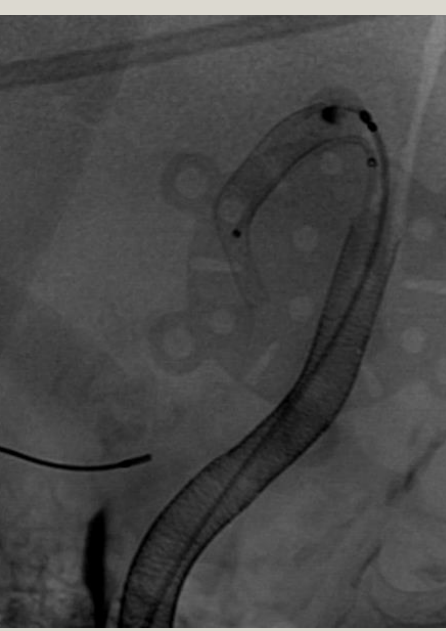


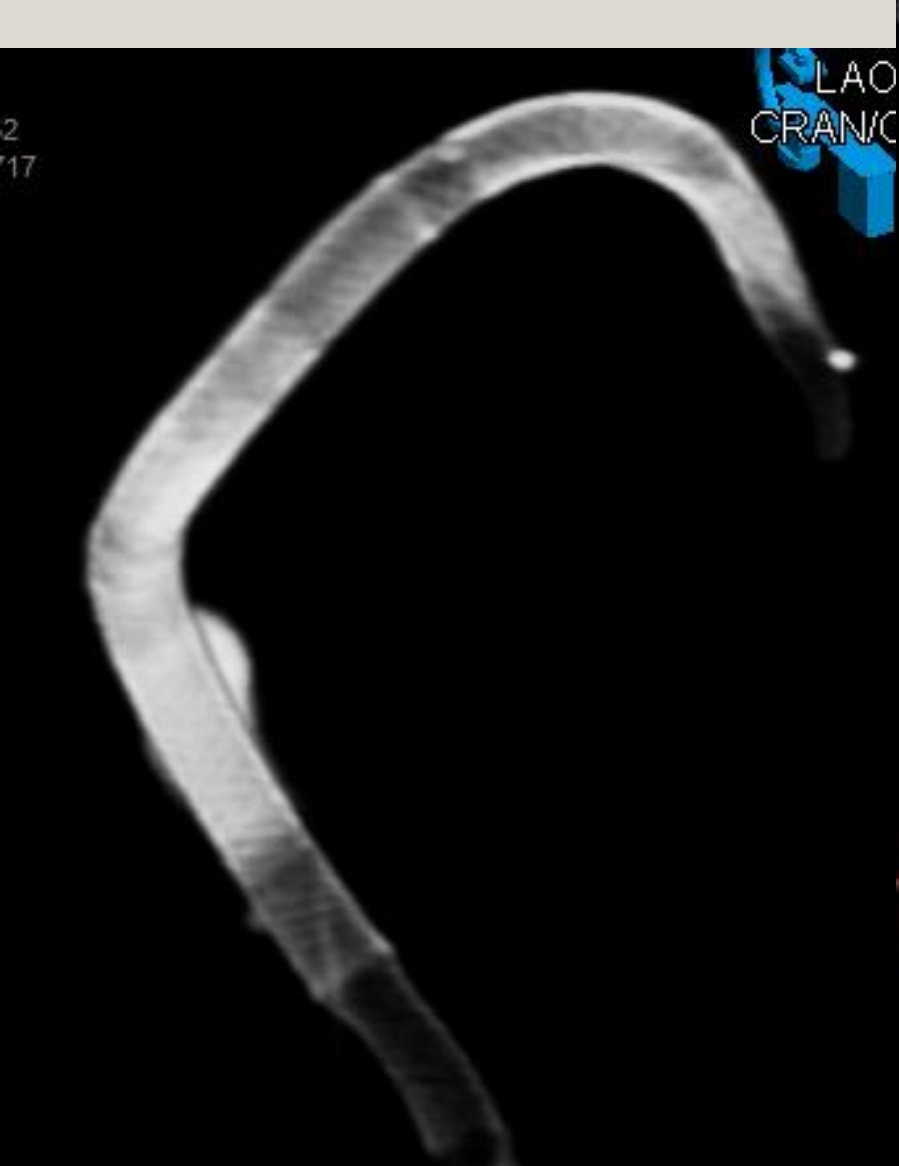




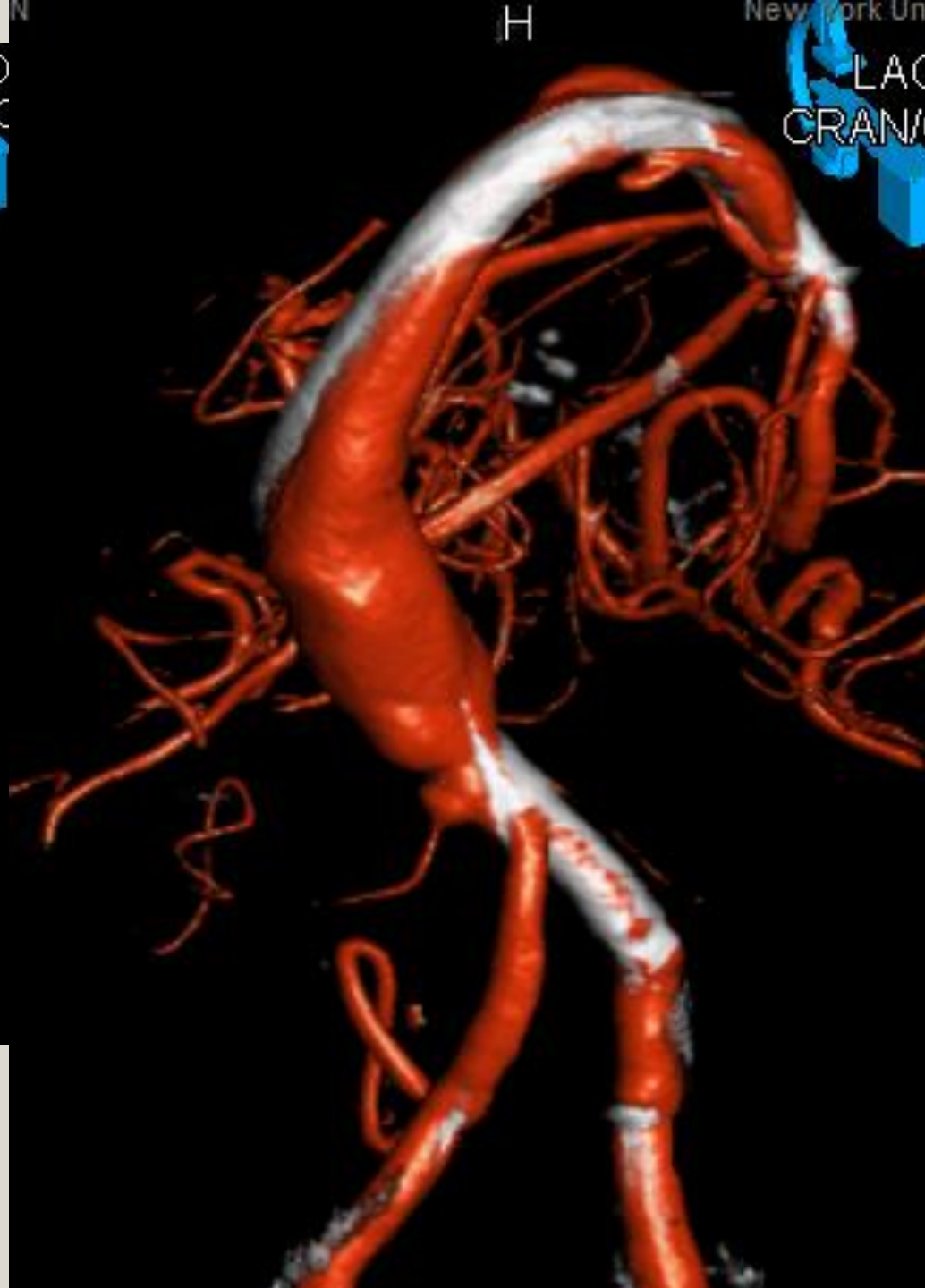
61 year old male (locked in syndrome)

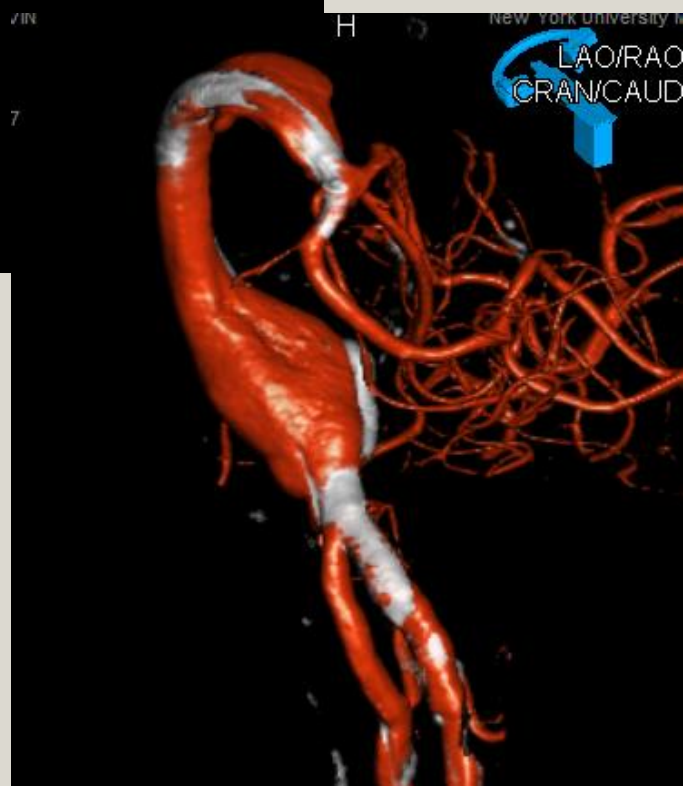
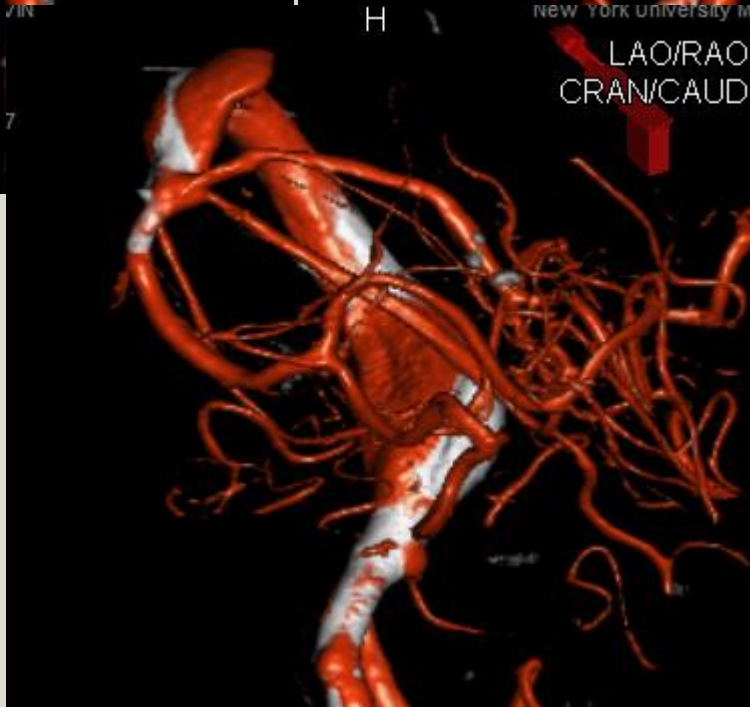
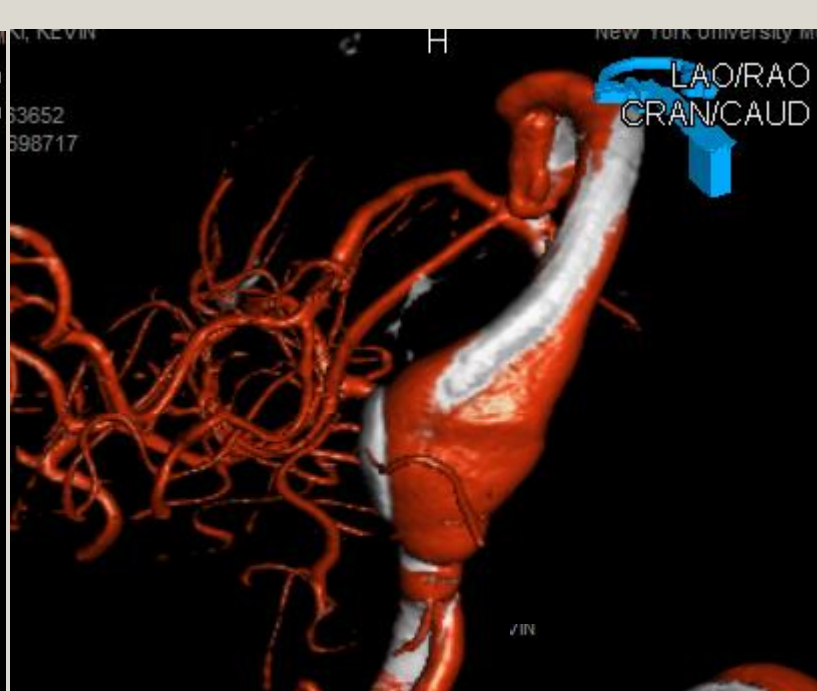
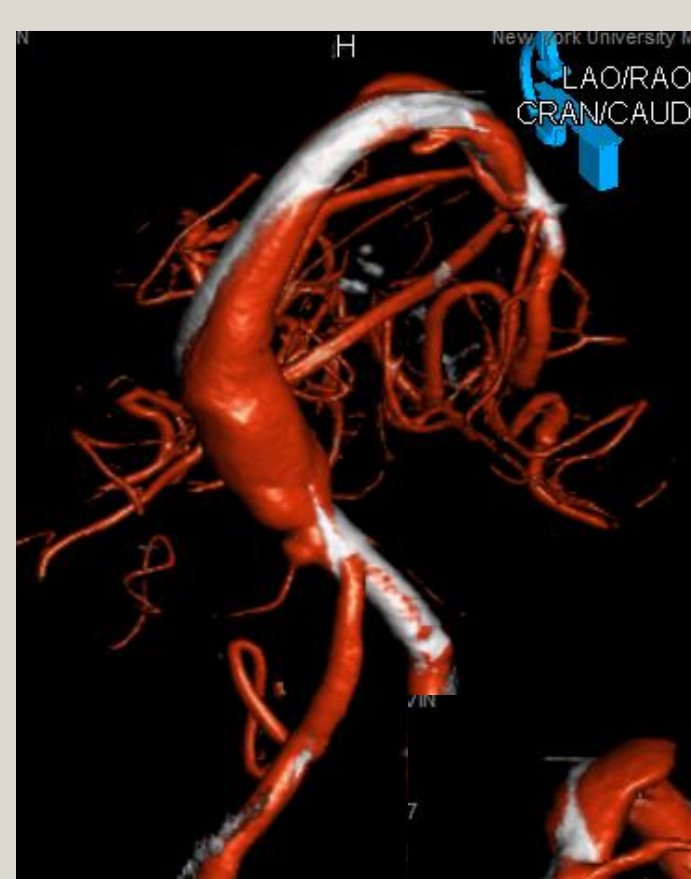


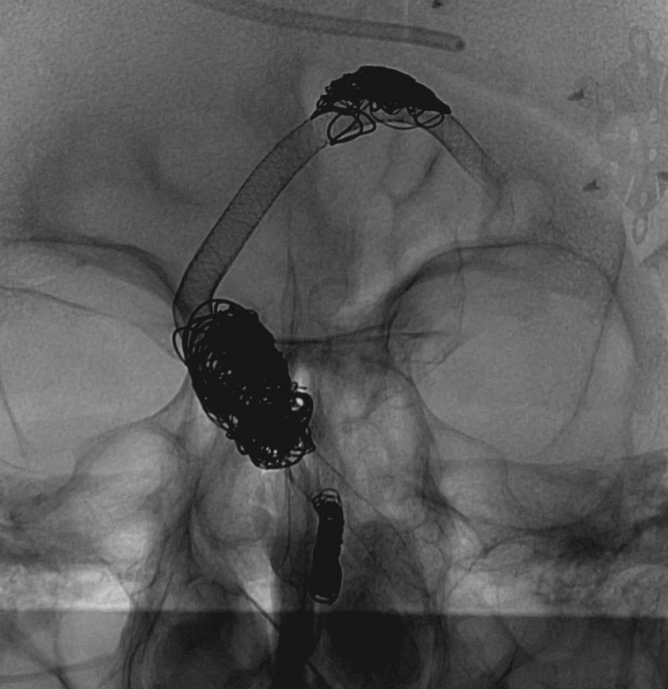


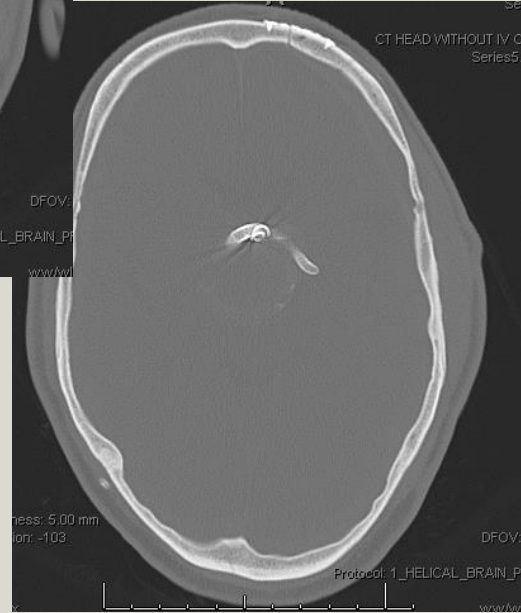


Treatment angiogram

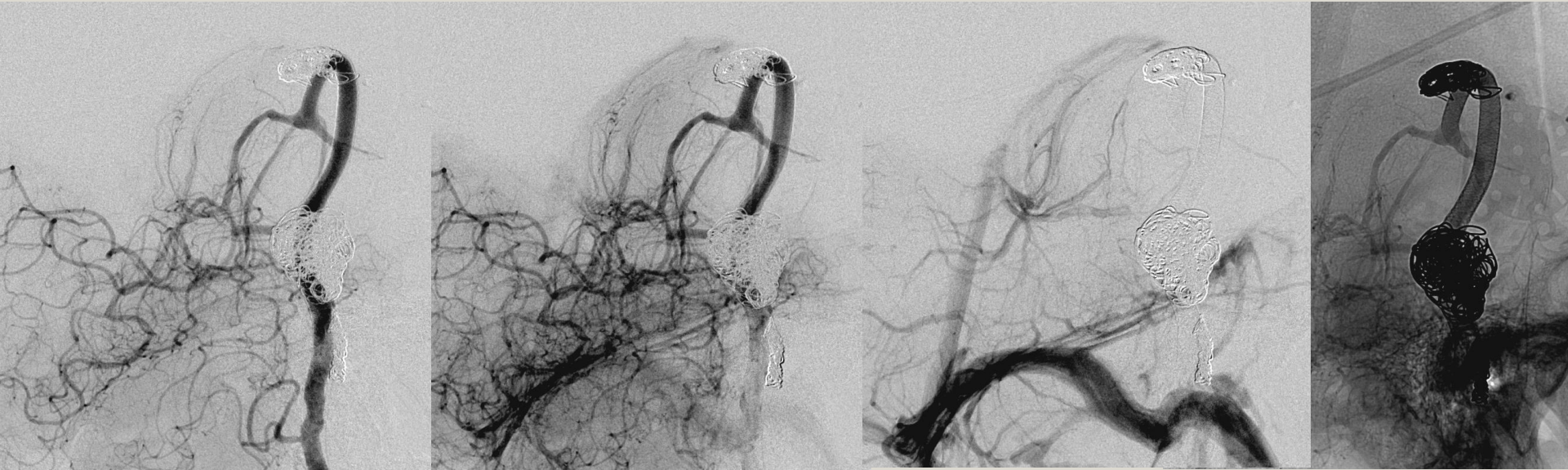


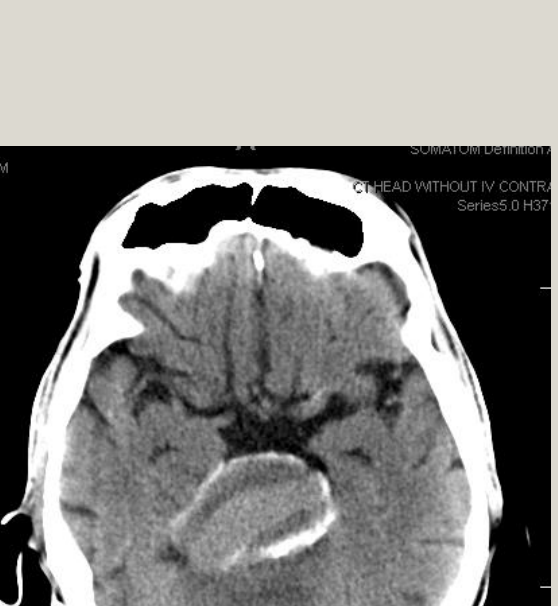
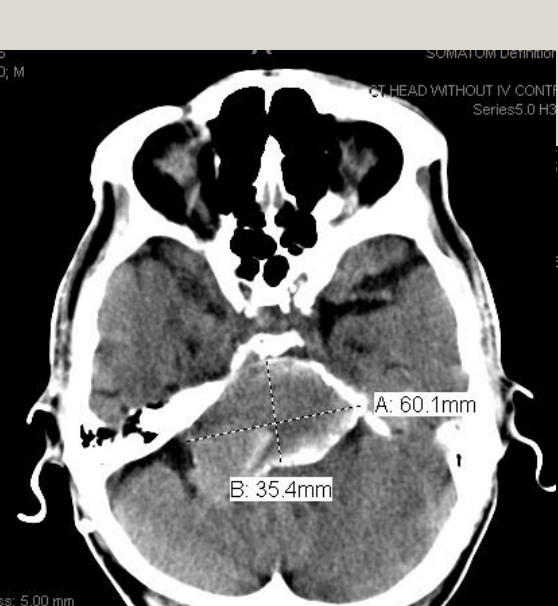
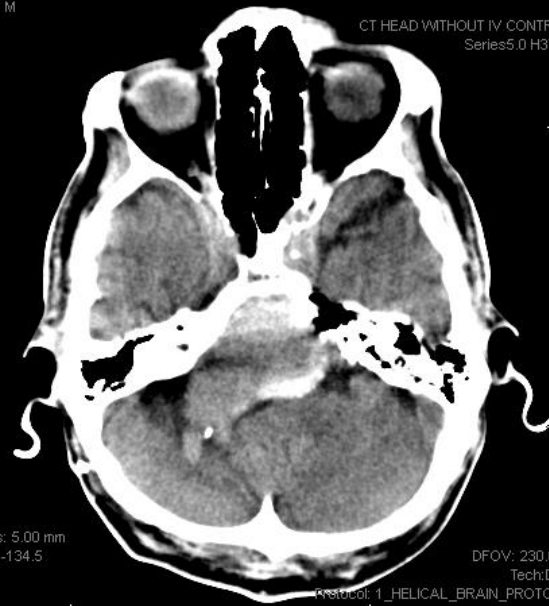




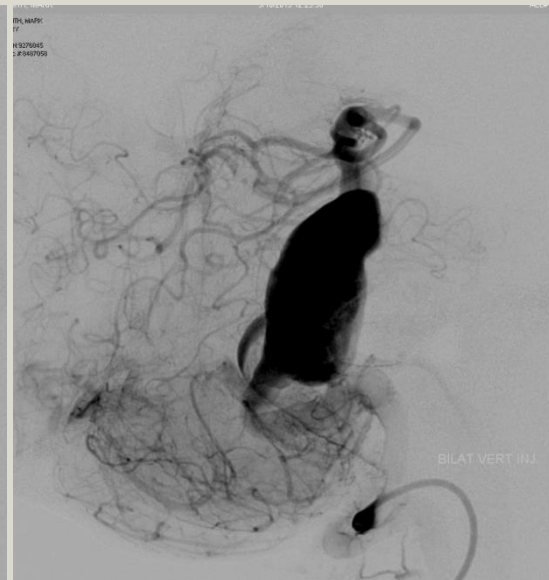
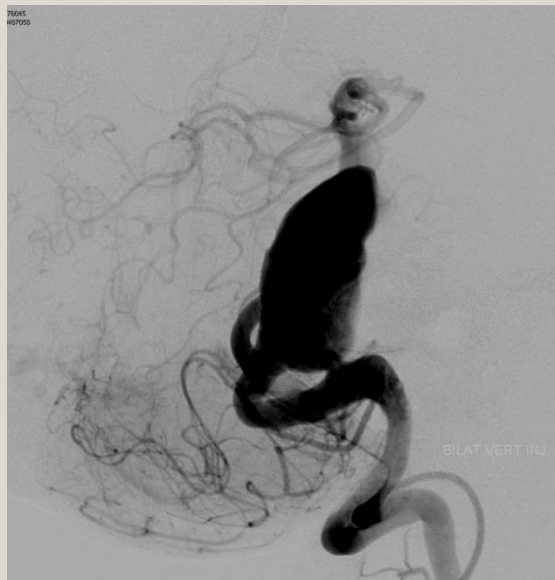


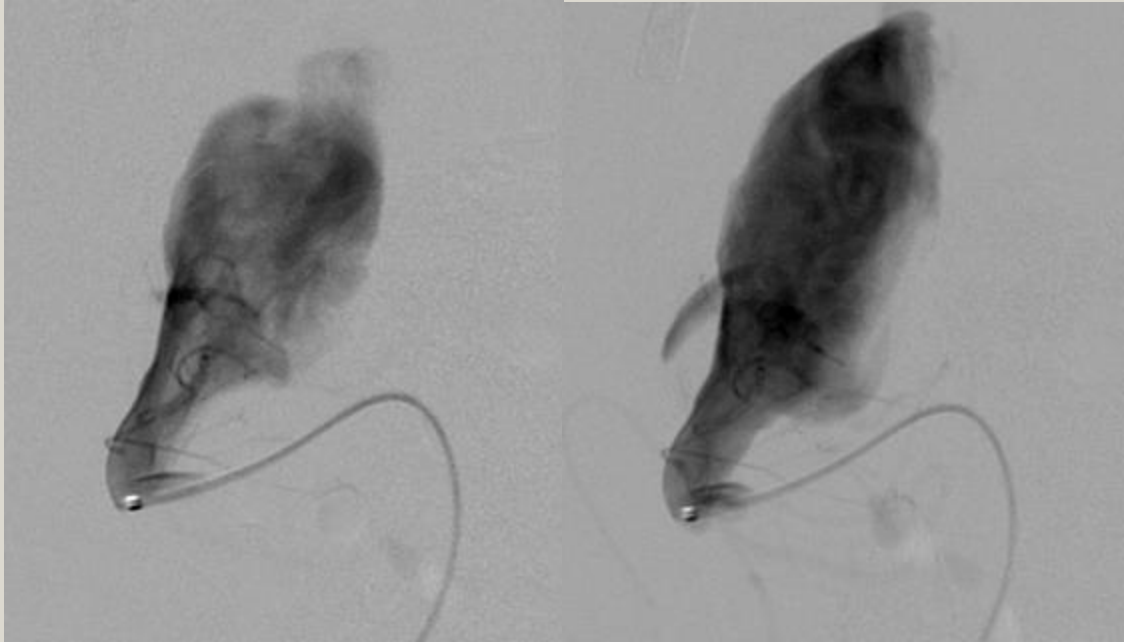
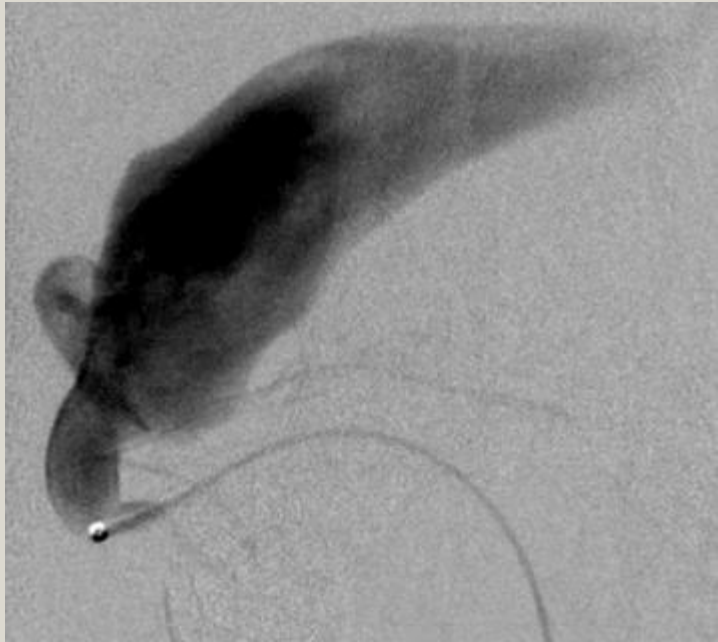
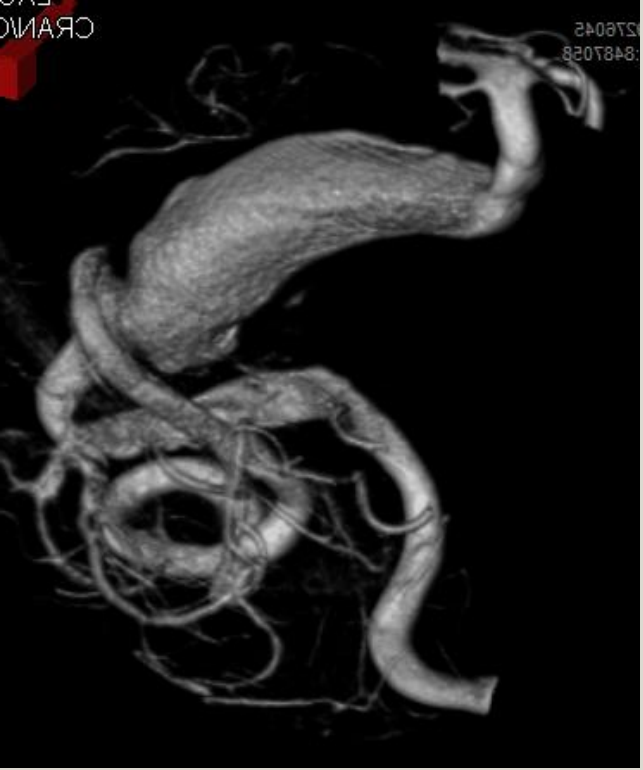
Follow-up angiogram

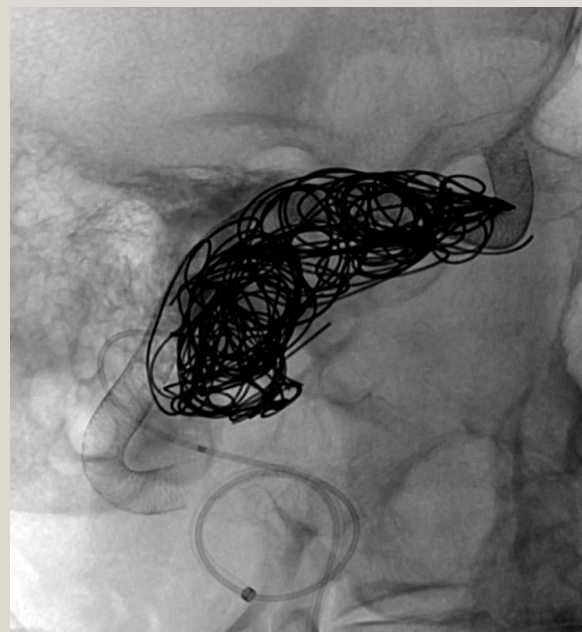
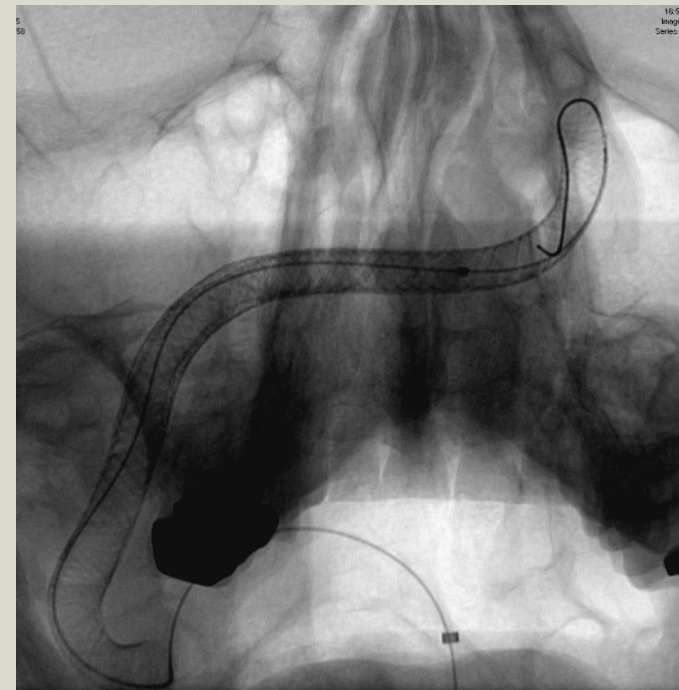


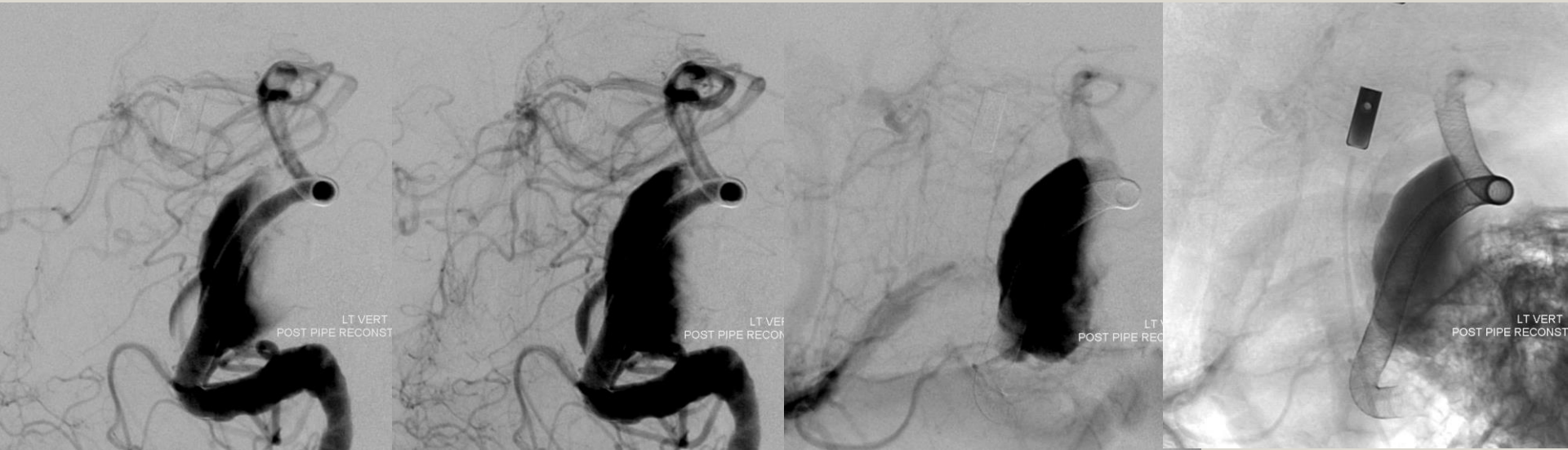


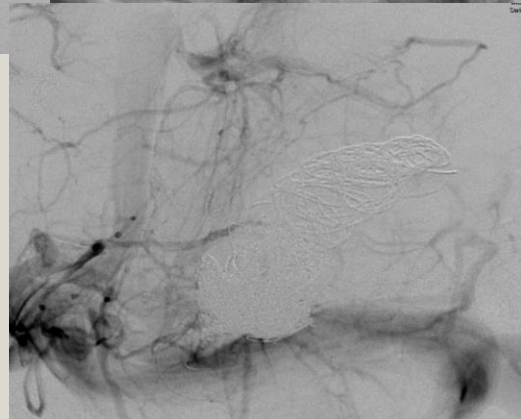
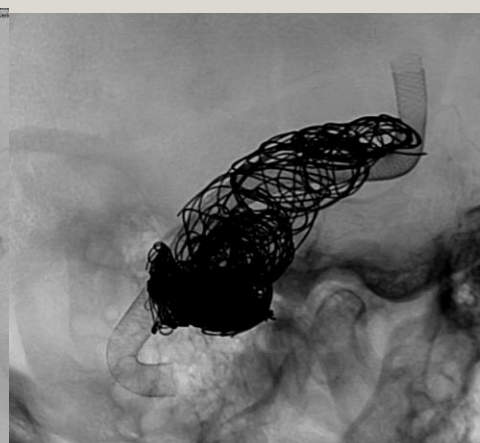
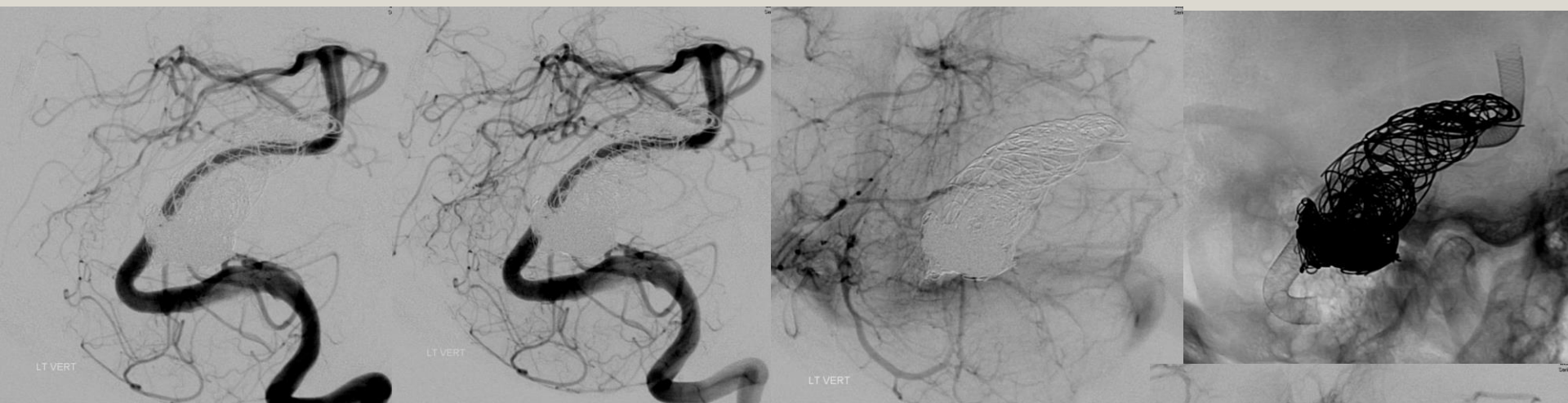
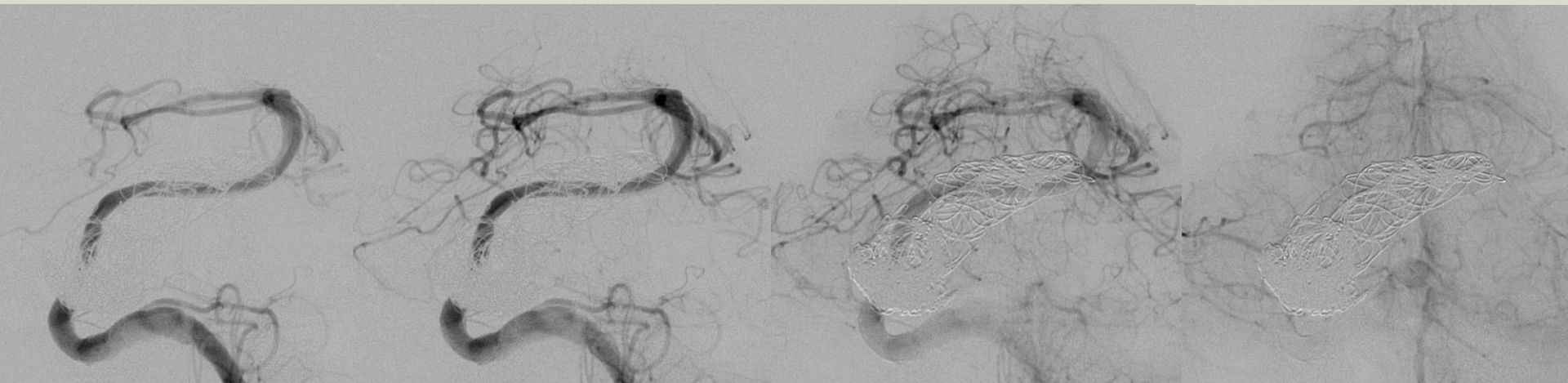
60 year old male with multiple cranial neuropathies and quadraparesis







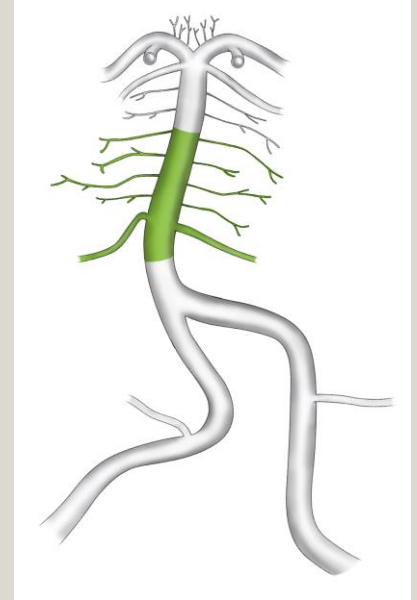
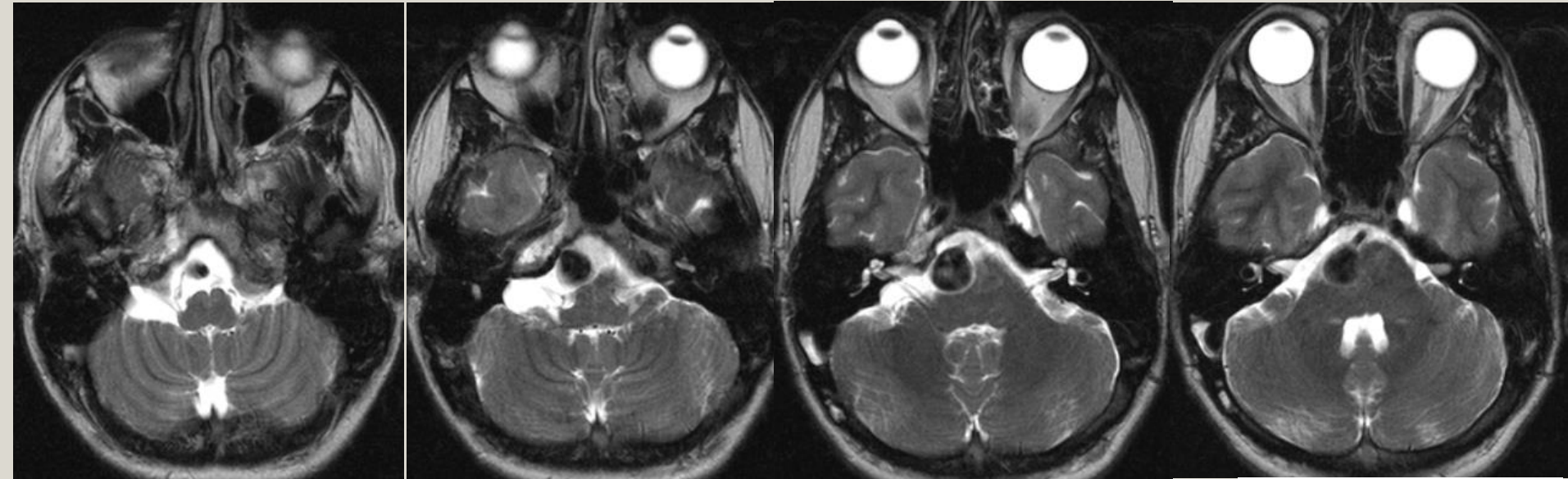


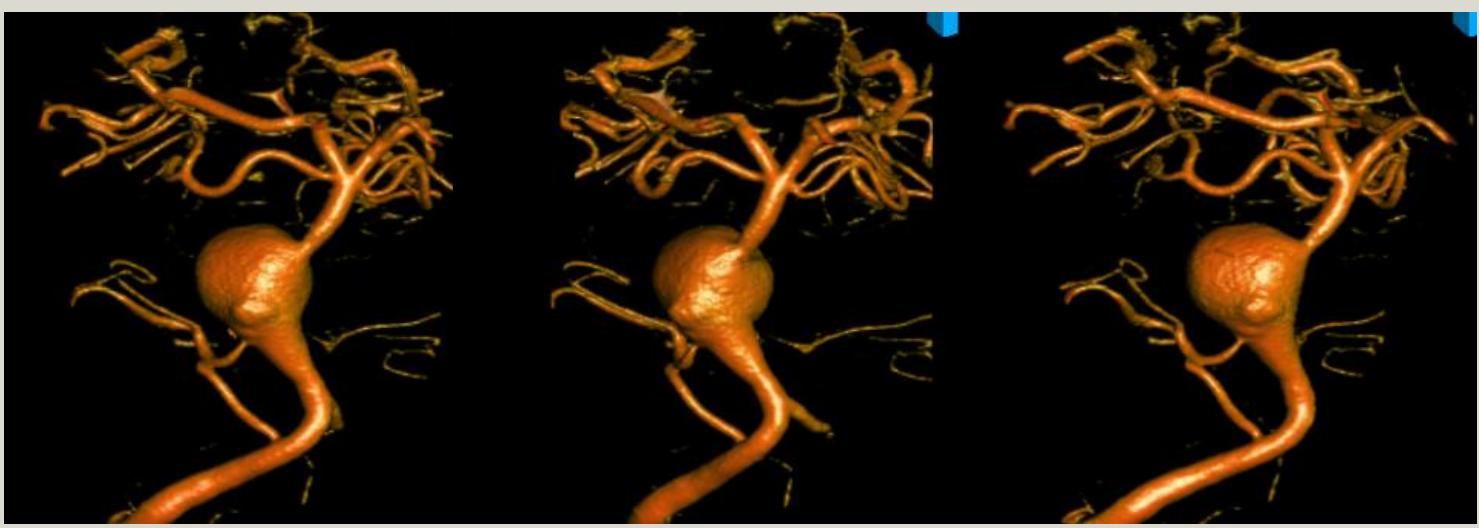
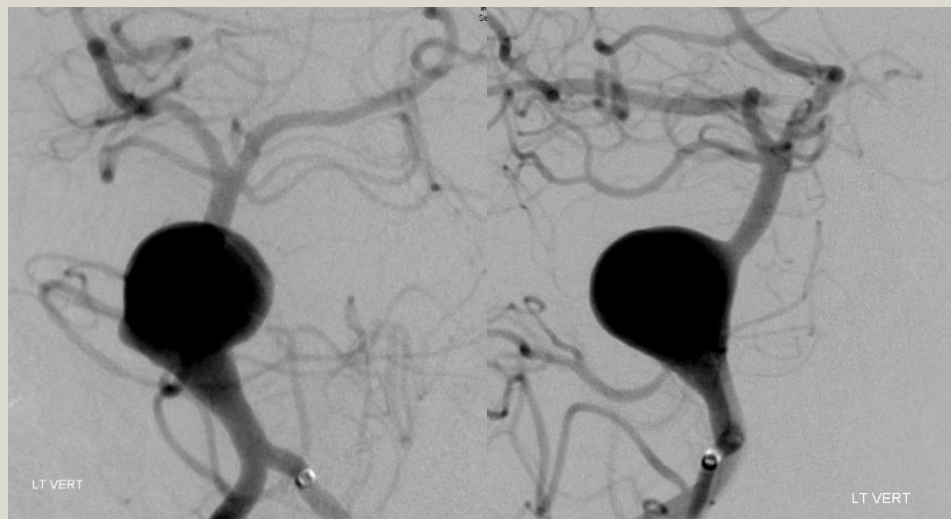
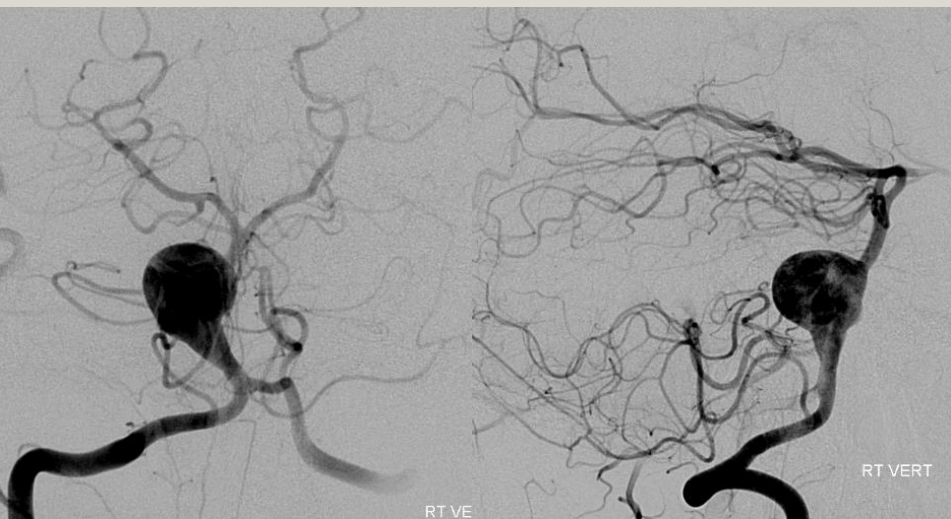


Fusiform Basilar Artery Aneurysm

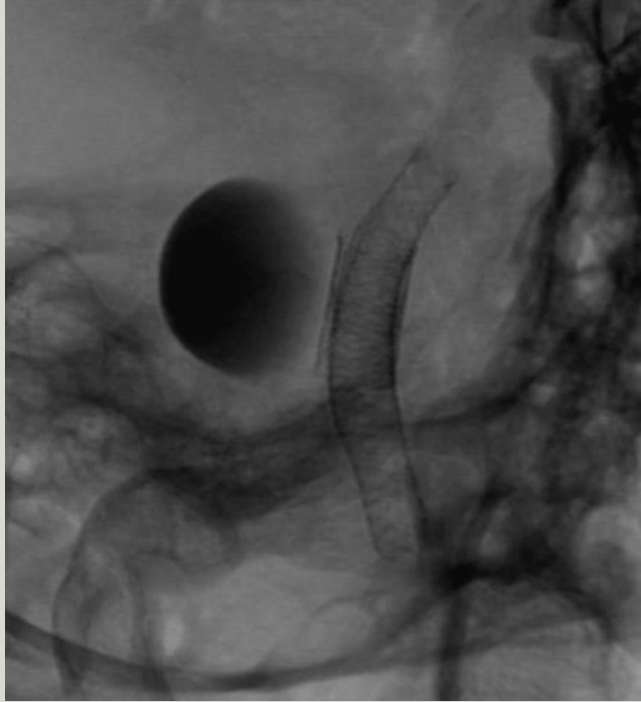
- 25 year old right handed gentleman presenting with acute onset of diplopia
- Neurologic exam: significant for right sixth nerve palsy.

MRI

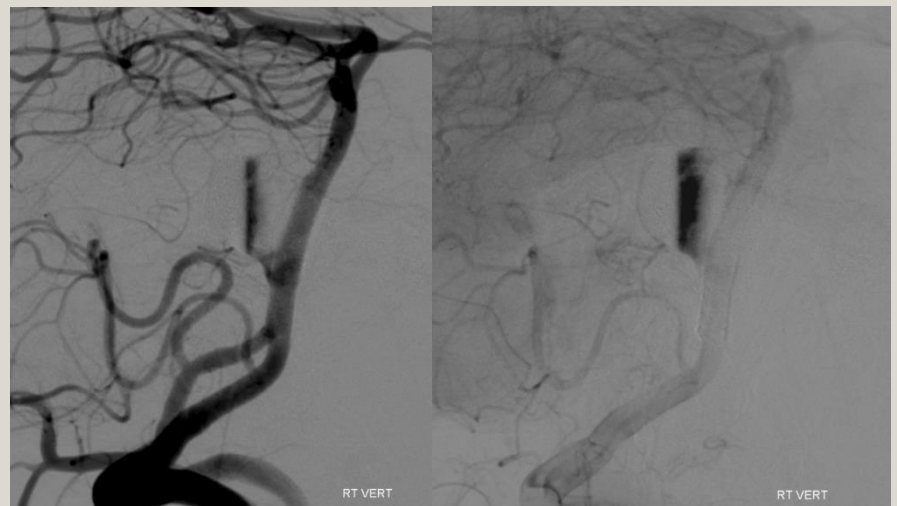
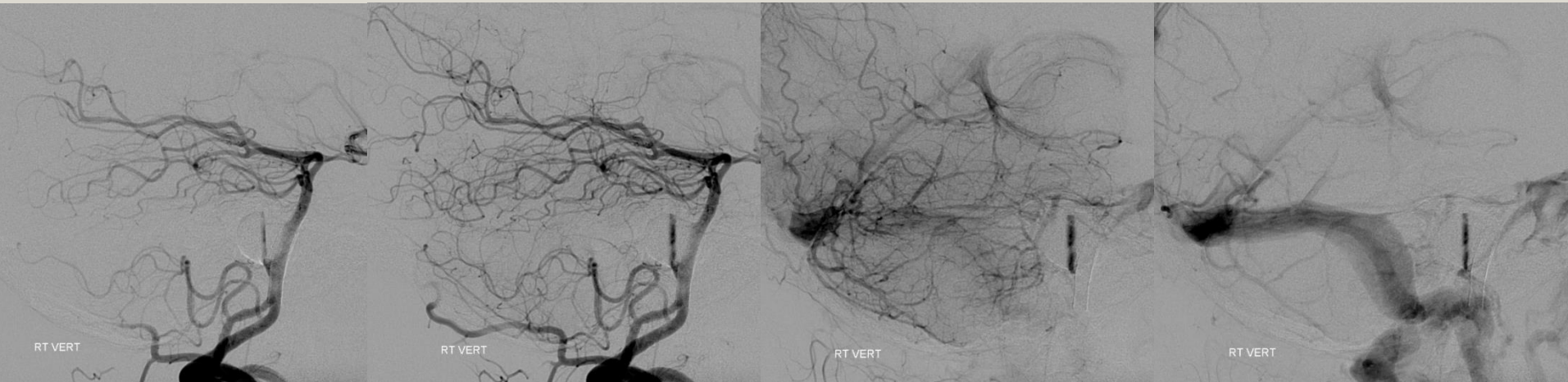




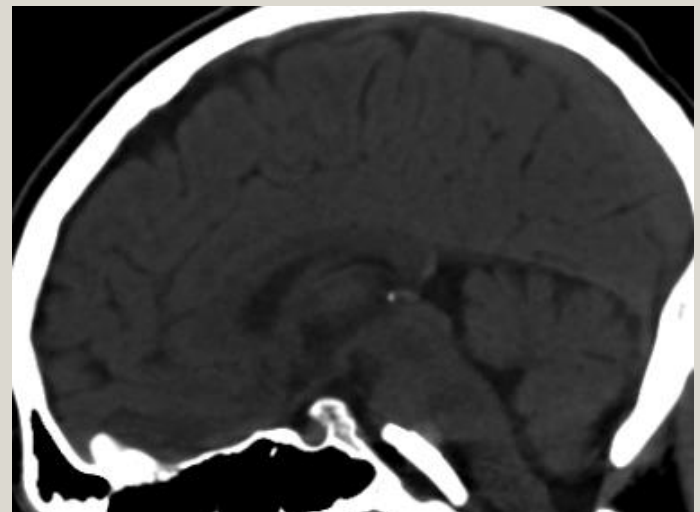
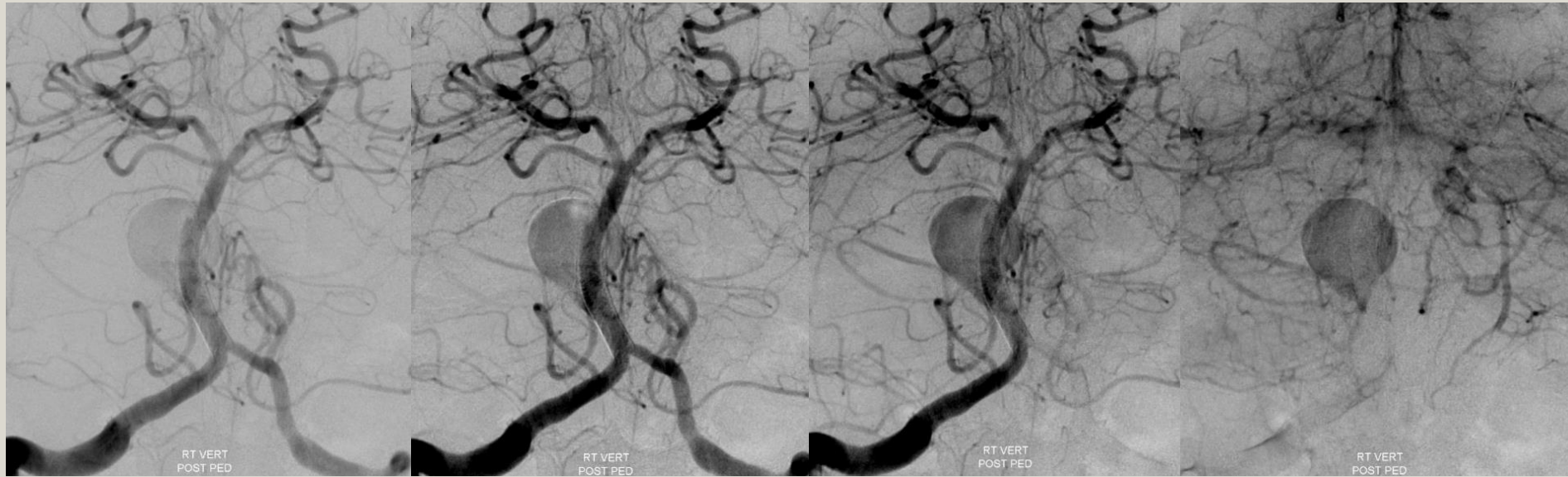
Floating stent as endoluminal baffle



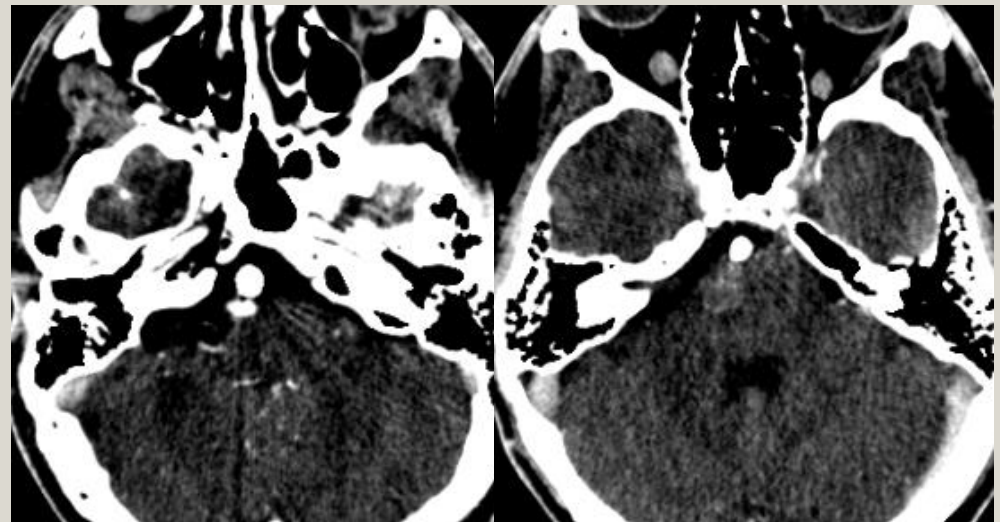
Post-PED embolization LVA angiogram



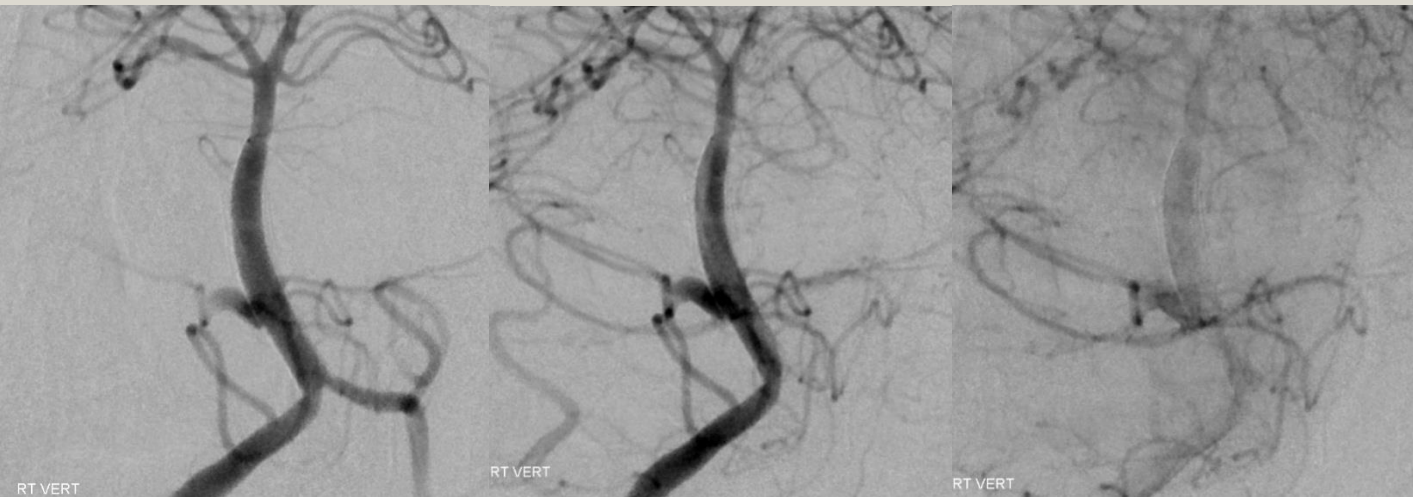
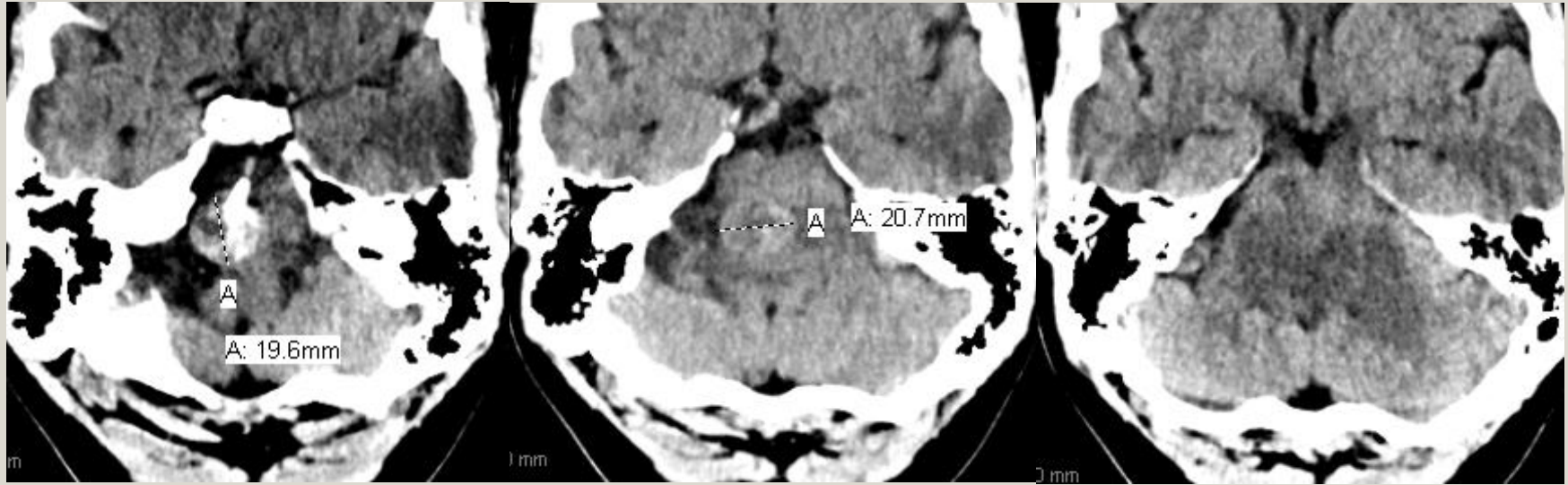
Post-PED embolization LVA angiogram



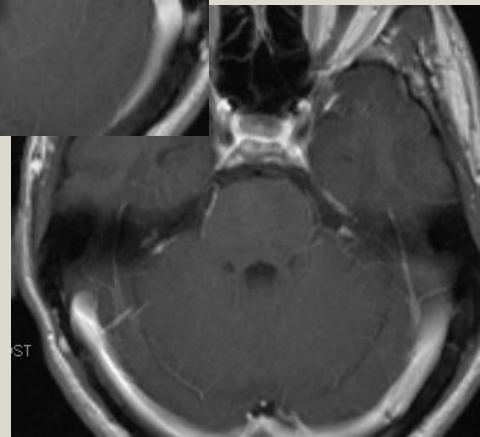
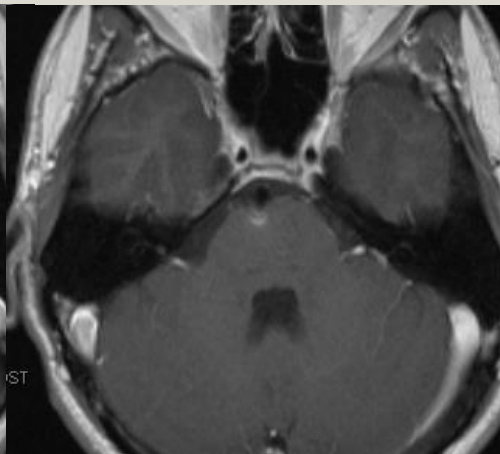
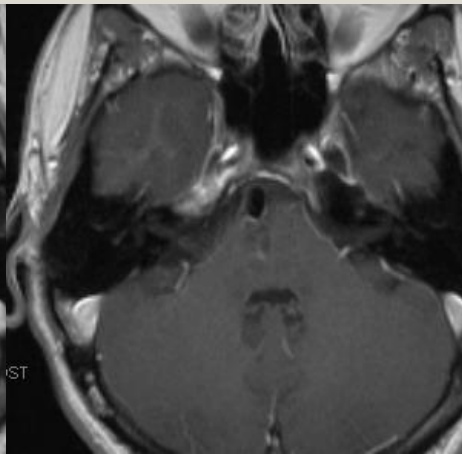
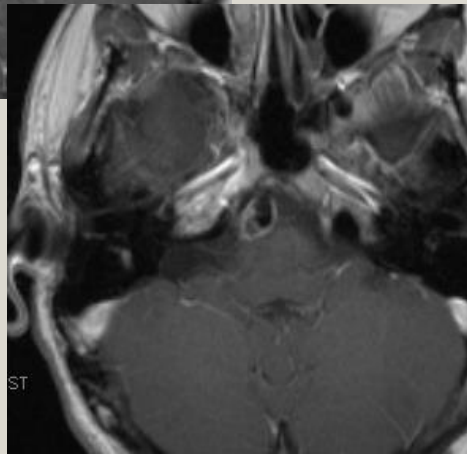
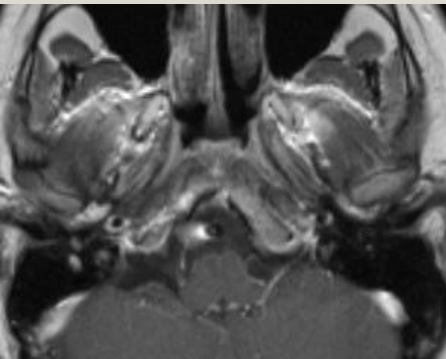
Post-PED RVA 3 day follow-up angiogram



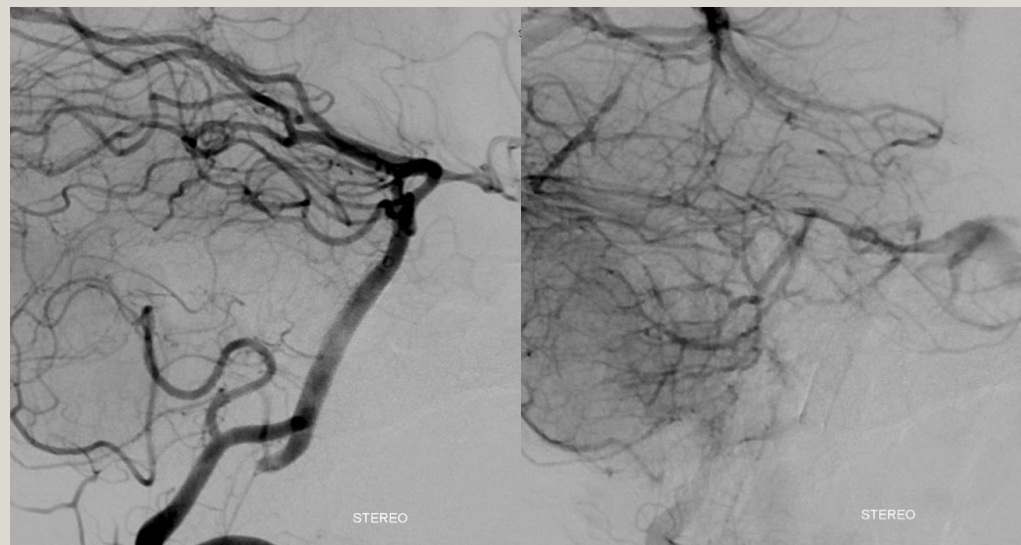
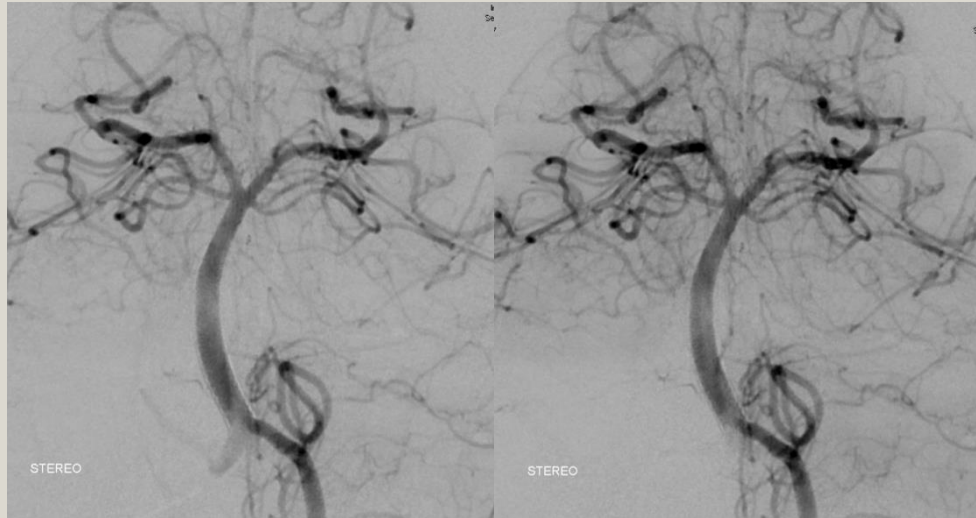
Follow-up imaging 5 weeks post-treatment— Patient with worsening headaches



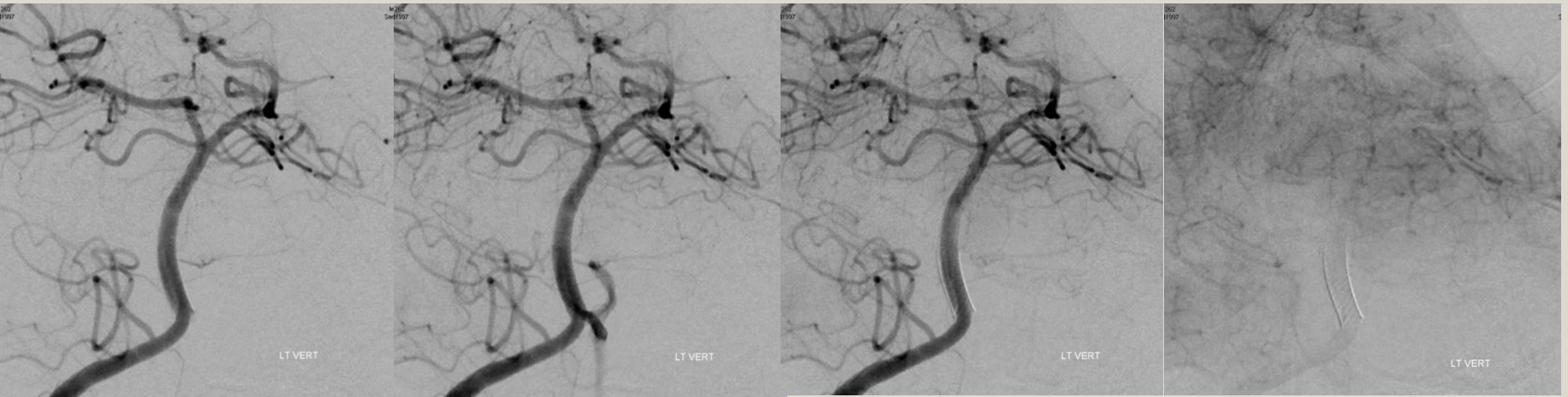
MRI 7 months post-PED: Symptoms resolved



Post-PED 12 month follow-up angiogram



Post-PED 12 month follow-up RVA angiogram



Post-treatment* survival among patients with fusiform basilar aneurysms

