

# Ruptured Blister Aneurysms

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# Disclosures

**Medtronic/Covidien:** Consultant, Speaker, Proctor for Pipeline

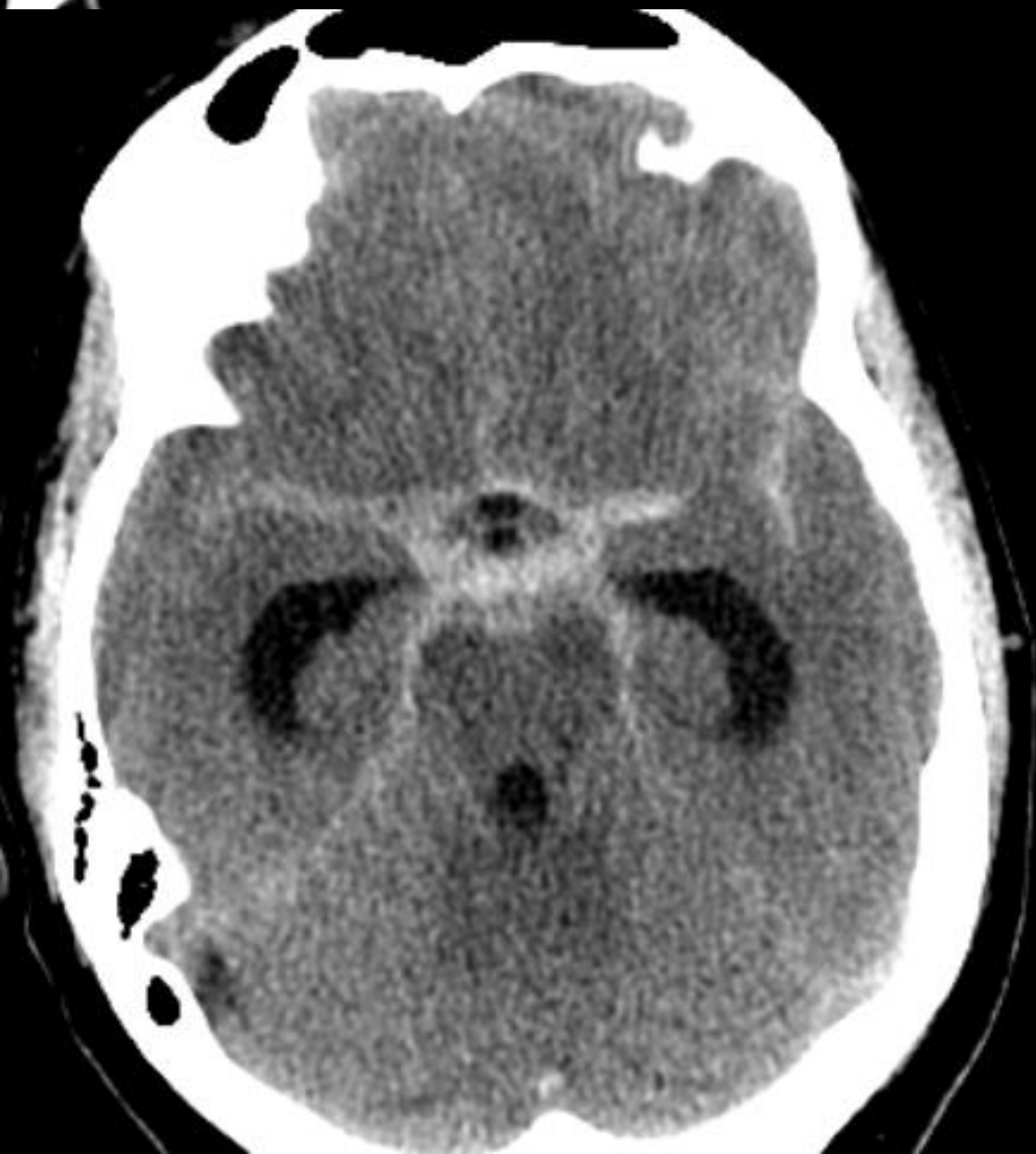
**Stryker:** Consultant, Speaker

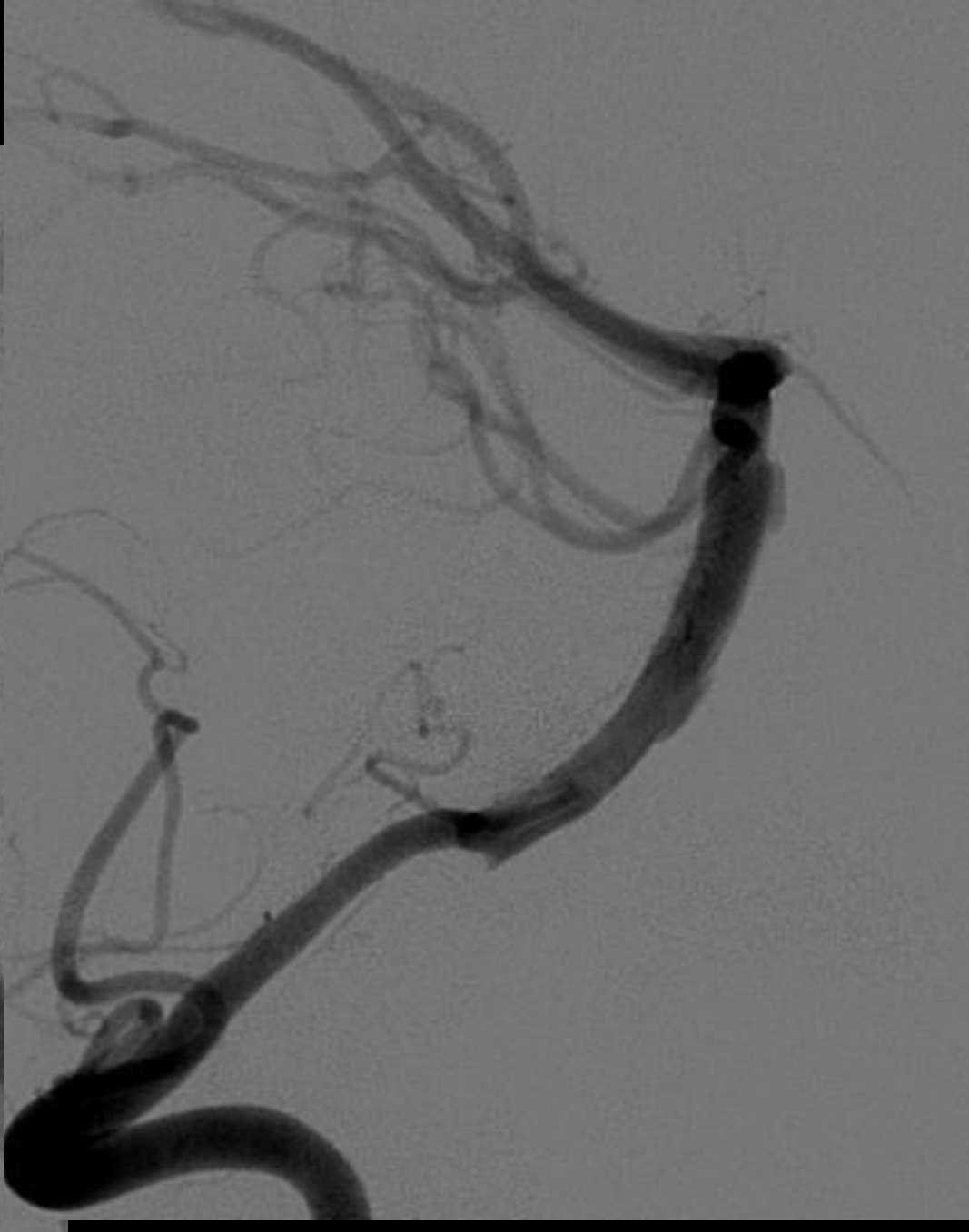
**Codman Neurovascular:** Consultant, Speaker

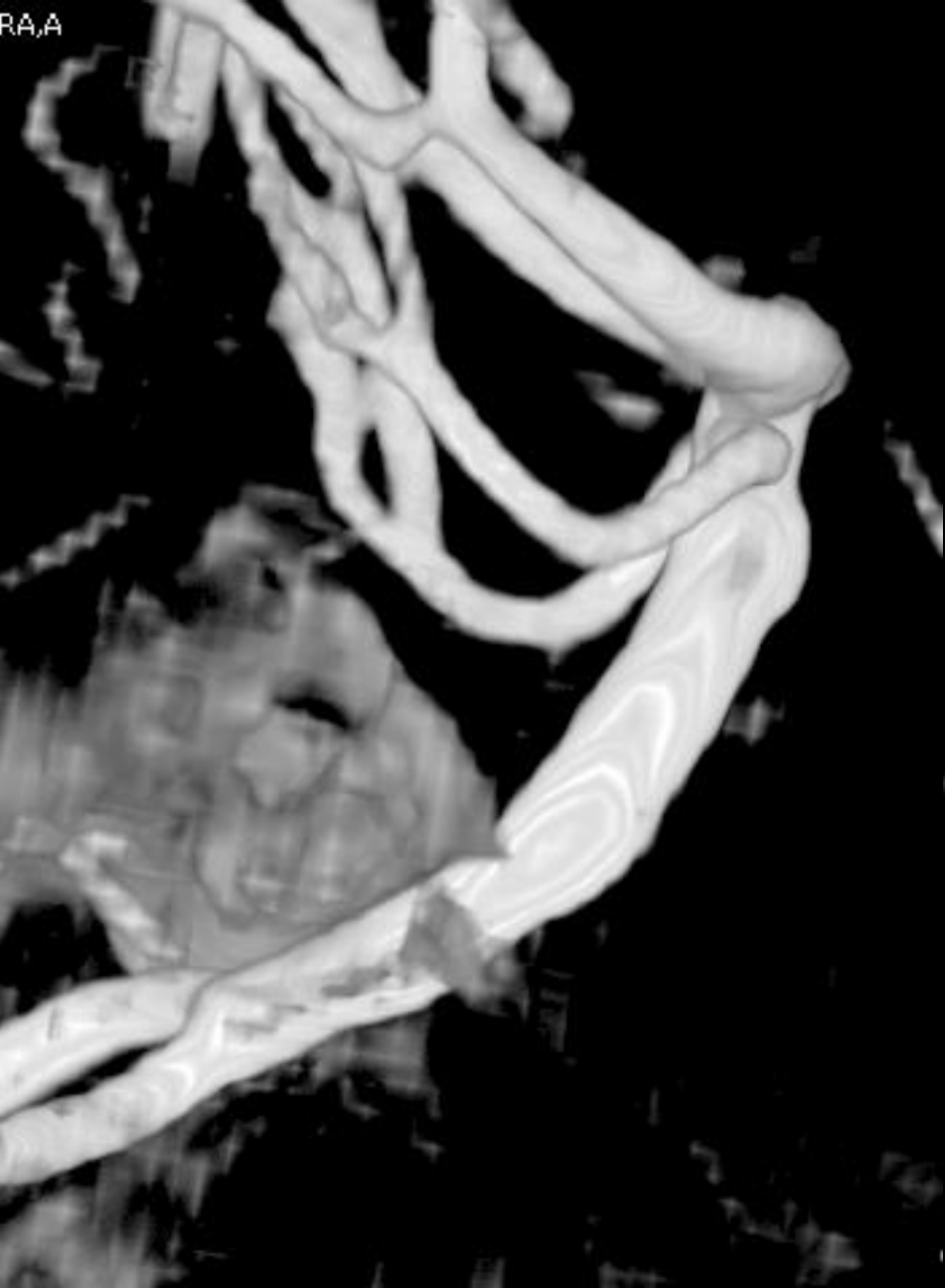
**Surpass, InNeuroCo:** Stock holder

# 2007

- 35 yo woman from Guatemala visiting family in Miami has sudden onset of severe headache, N&V followed by unresponsiveness
- CT: Fisher Grade III SAH
- Neuro Exam improves a after ventriculostomy







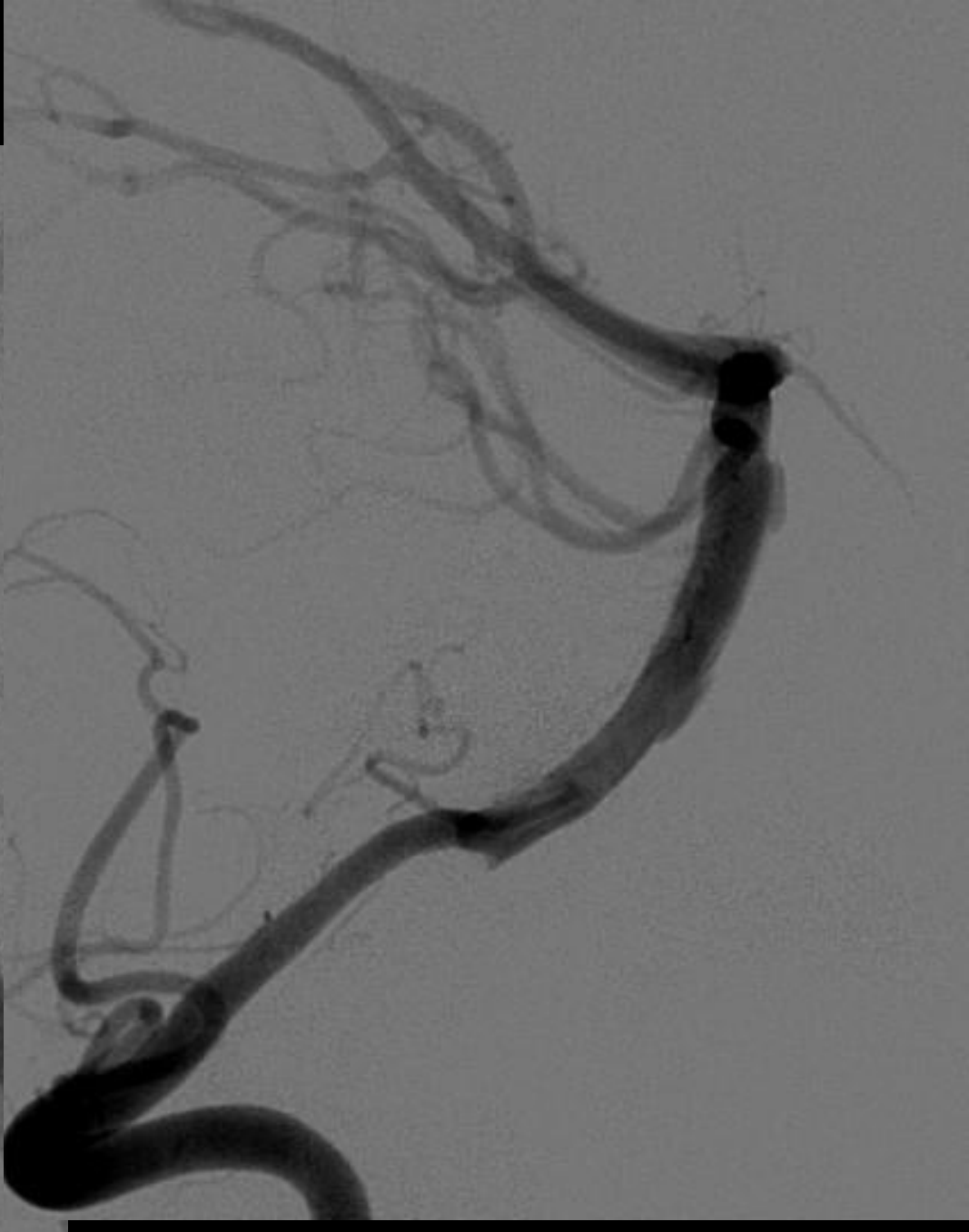
# Blister-Type Aneurysms

- Blister-type aneurysms were initially described in 1986 as arising from the dorsal aspect of ICA
- 0.9-6.5% of ICA aneurysms and < 1% of all intracranial aneurysms
- After the initial description as ICA aneurysms, they have now also been reported in MCA, ACA/Acomm, **Basilar artery** and PICA

# Blister-Type Aneurysms

- The outer wall of the artery is comprised only by adventitia and/or thrombus often adherent to overlying pia
- As a result, a blister-type lesion is a fragile structure without a discernable neck
- If this thin wall is disrupted by surgical manipulation or by minimal changes in arterial blood pressure, it may result in catastrophic intracranial hemorrhage





# Patient

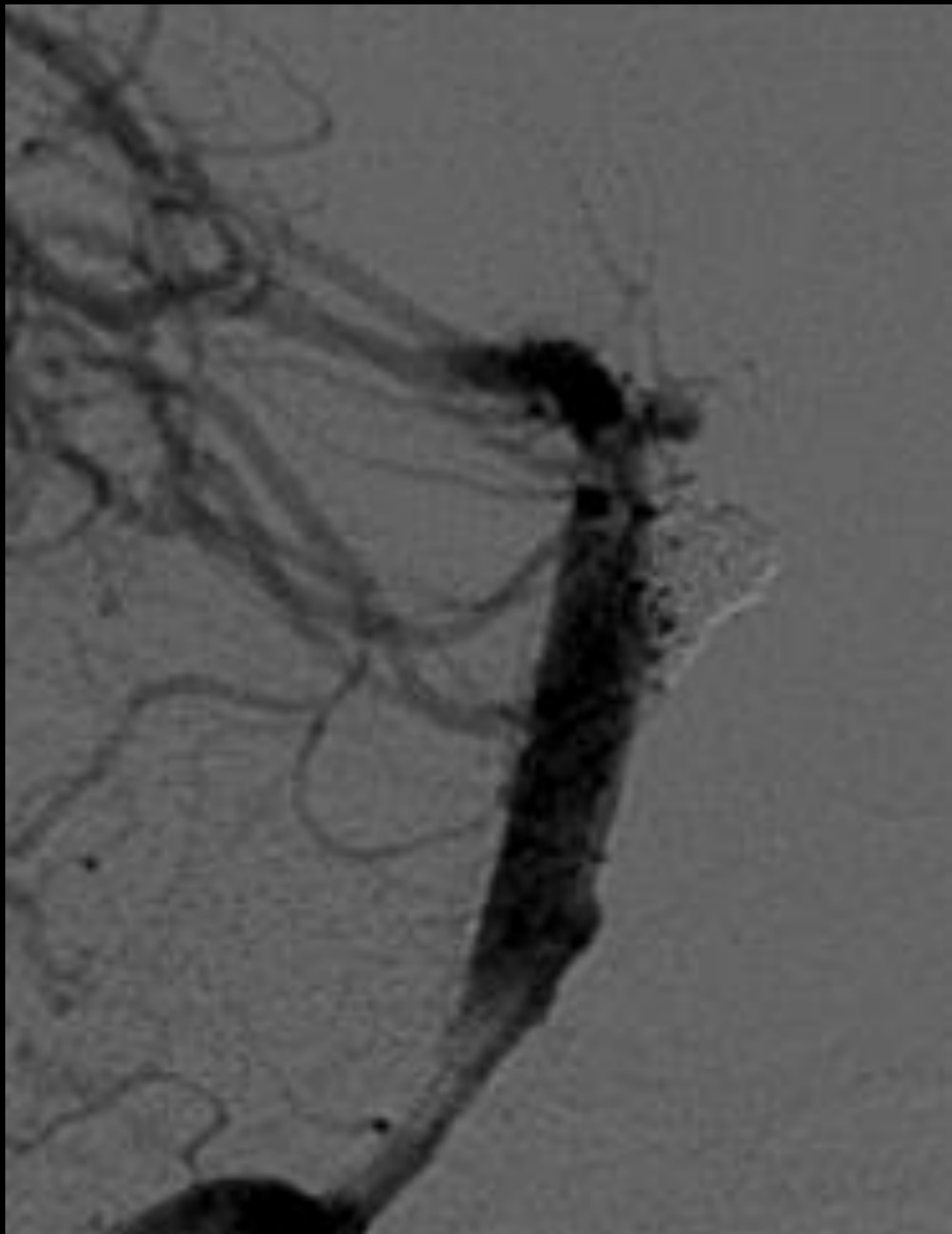
- What to do?
  1. Nothing?
  2. Clipping?
  3. Stent-coil?
  4. Coil?

BRFT 1



# Patient

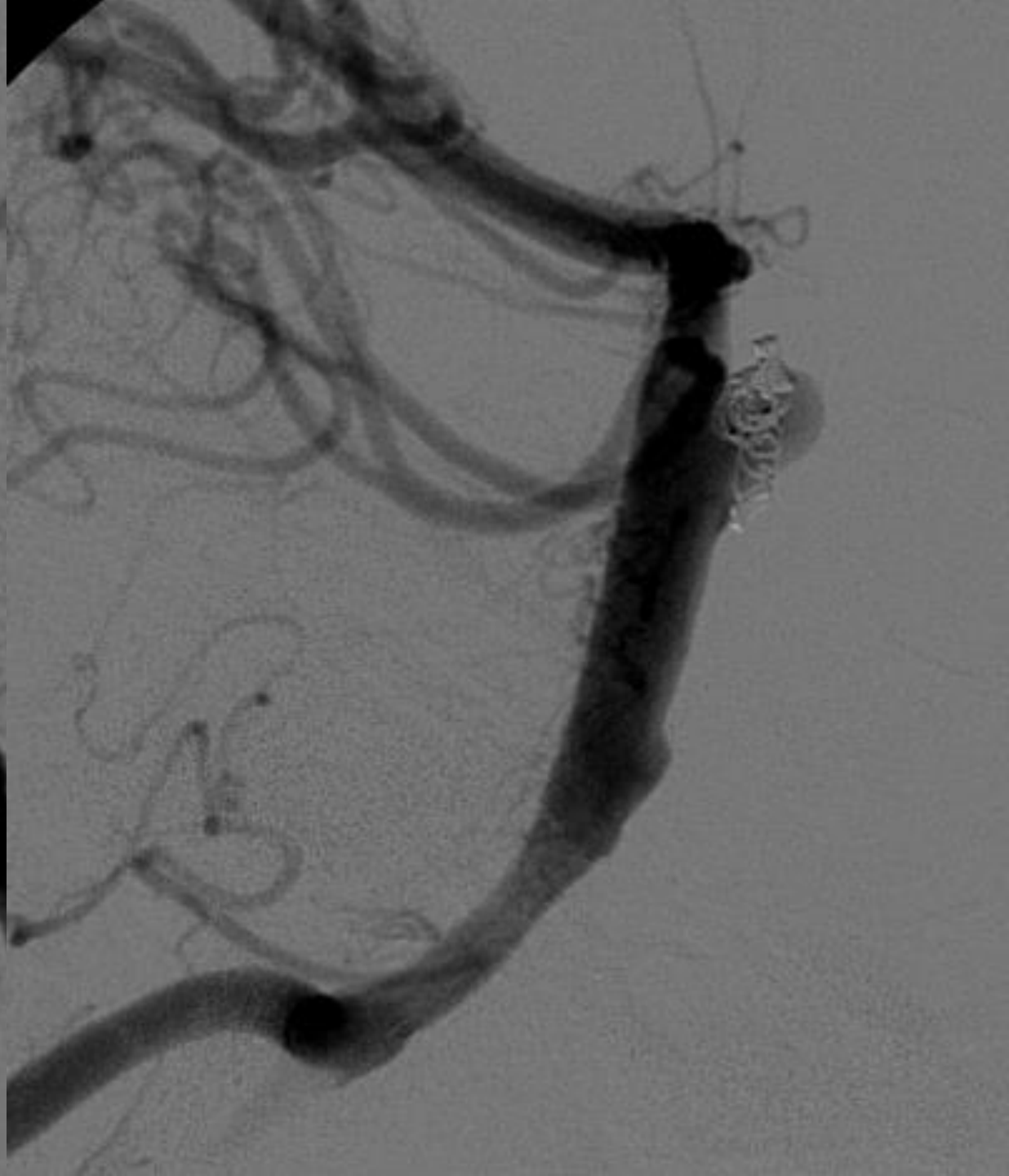
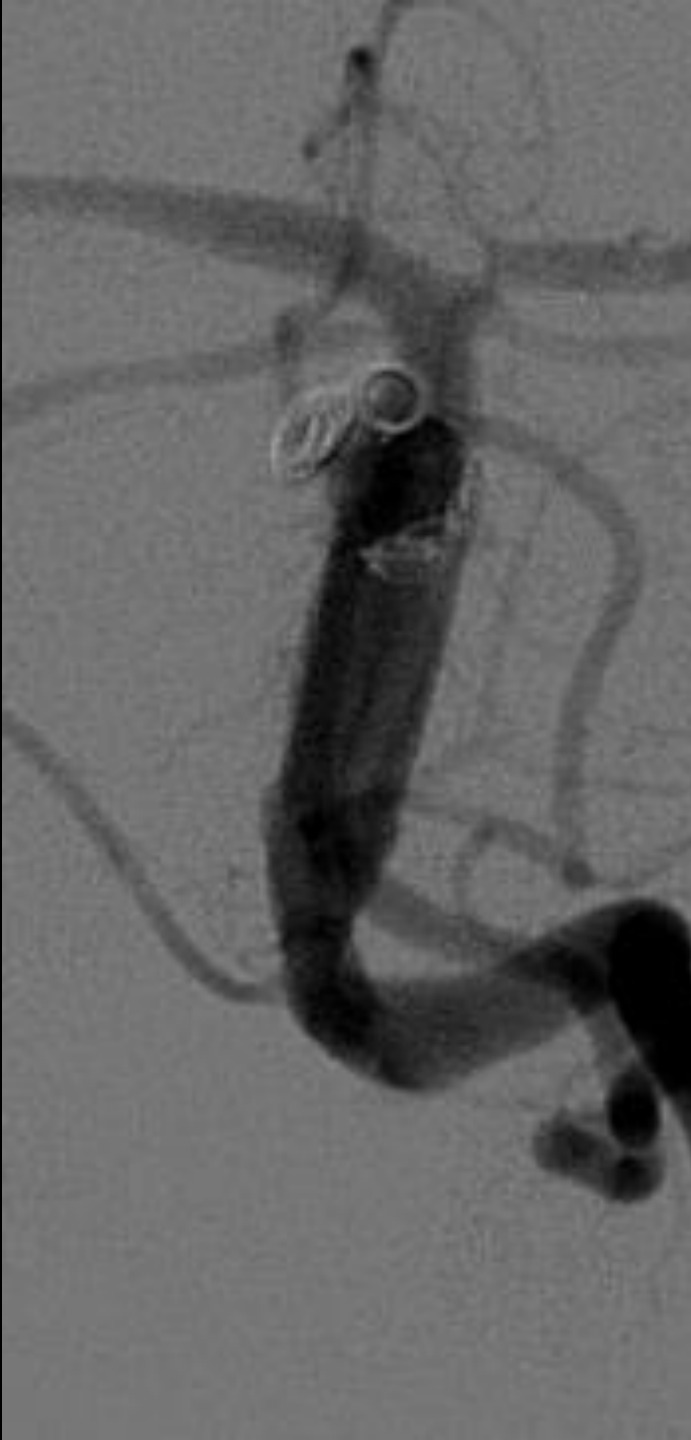
- Vasospasm, treated with angioplasty and IA nicardipine
- Regrowth, on angio. Re-coiled



# Patient

- Vasospasm, treated with angioplasty and IA nicardipine again
- Doing very well neurologically until day 14 post SAH,
- Off-dilantin on ASA plus plavix, she developed a GTC followed by unresponsiveness.
- Intubated

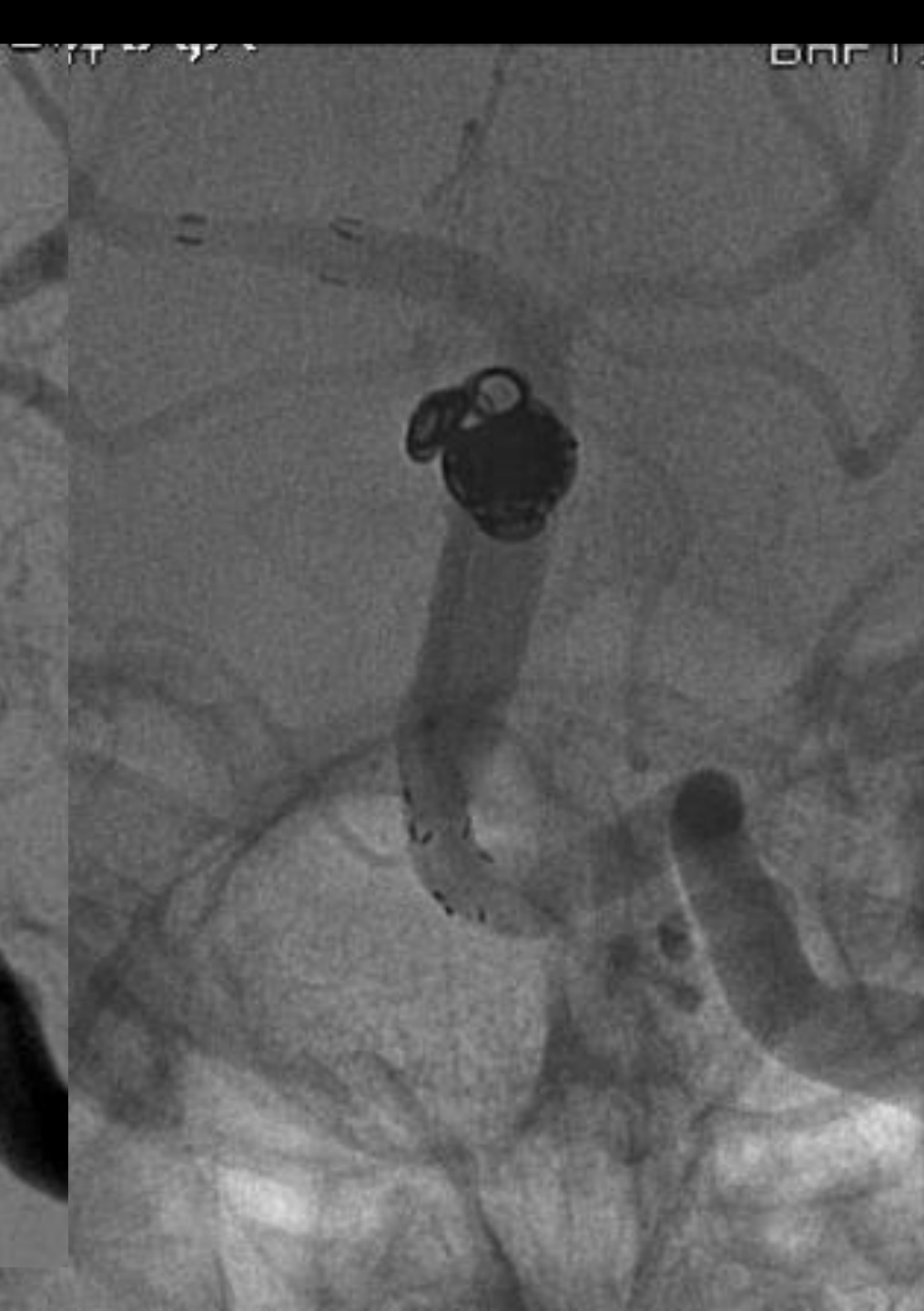






# Patient

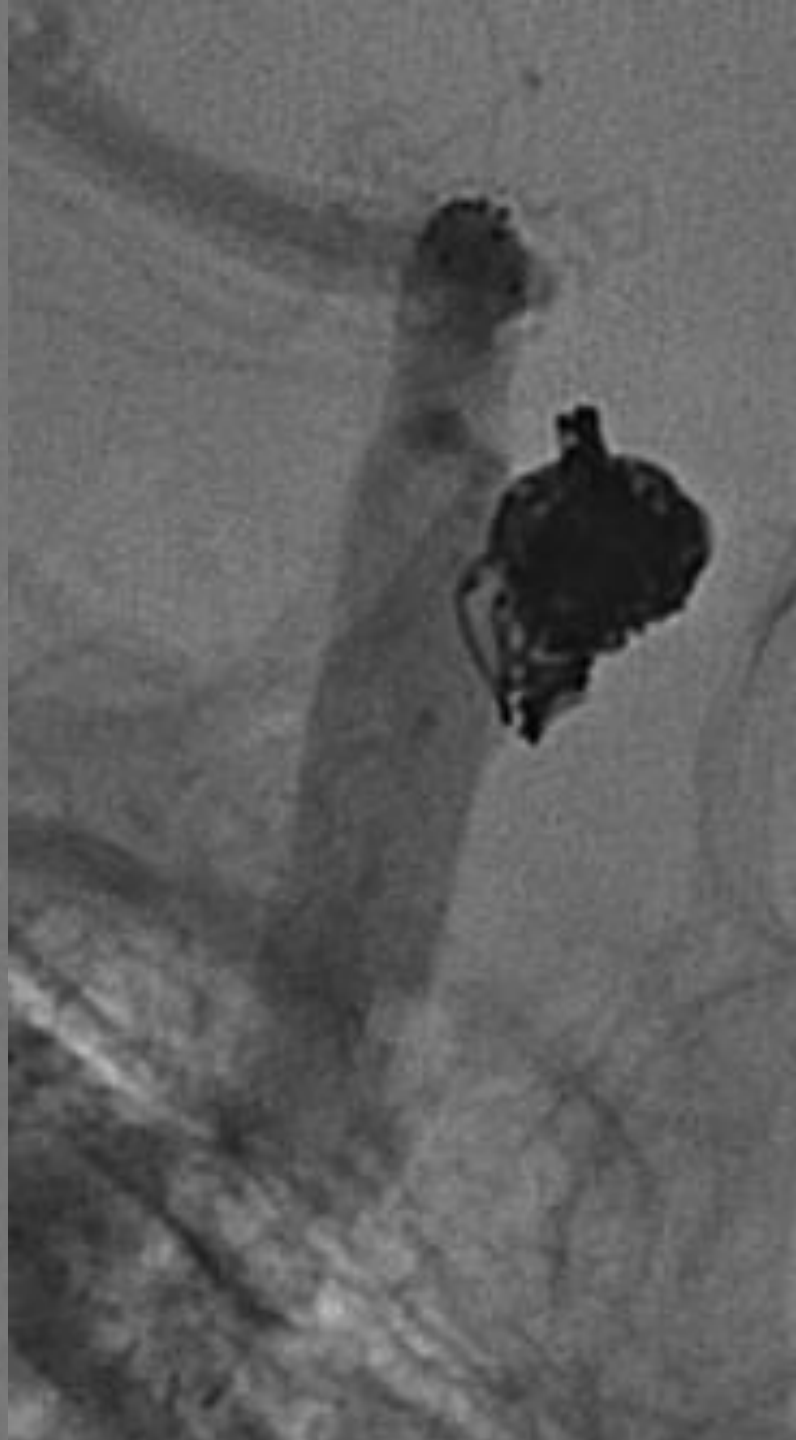
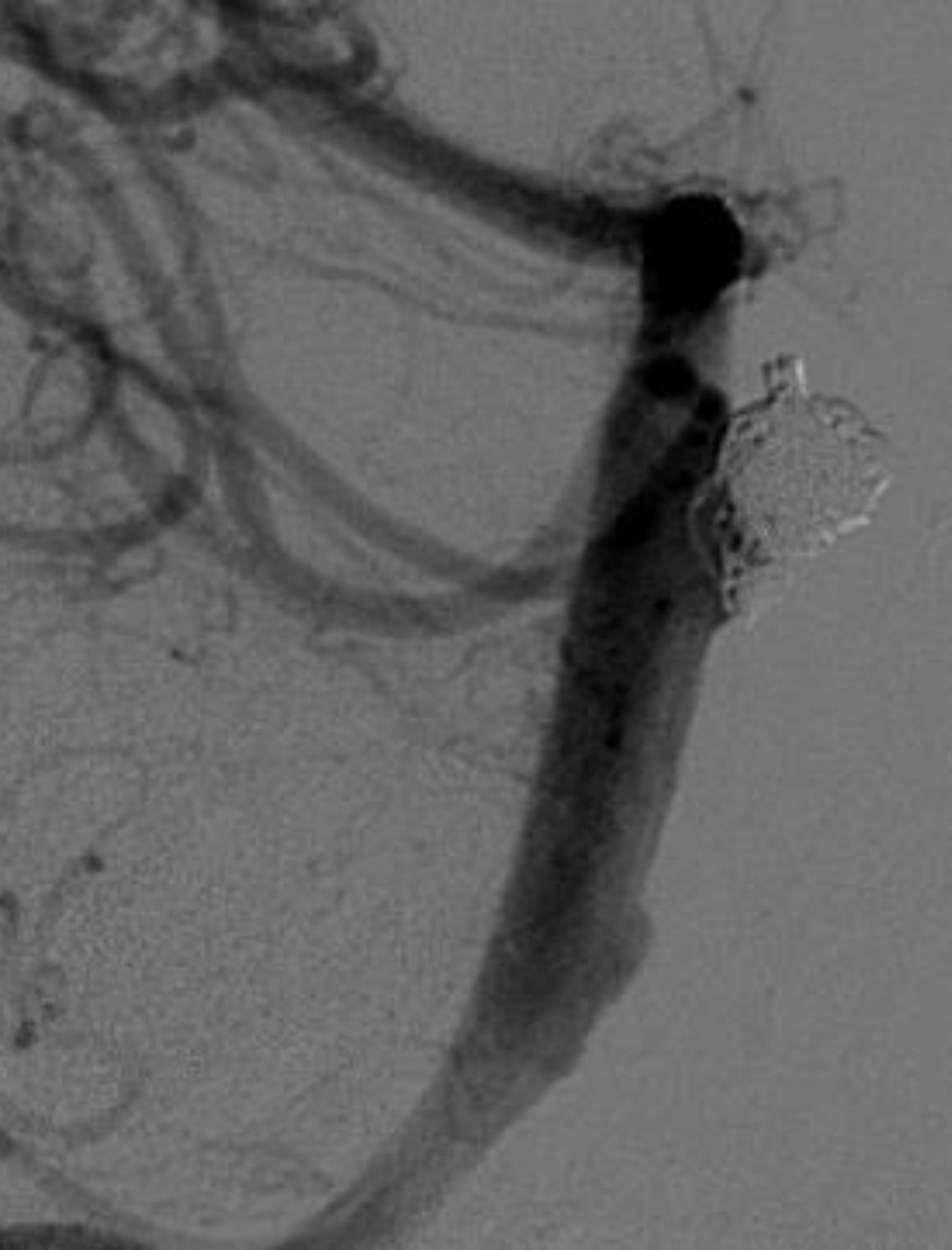
- Regrowth, on angio
- Re-coiled
- Second stent placed (Enterprise)



# Patient

- D/C to rehab at day 24 post SAH
- Dysarthria
- Right arm and leg weakness 4/5, gait ataxia
- Dismetria on finger to nose R > L
- Back to Guatemala by commercial plane day 35 post SAH able to walk with mild assistance

One Year Later...



# Ruptured Blister Aneurysms

- Presentation is typically SAH related to lesion rupture
- Re-bleed is very common in the first week and is associated with high mortality
- Conventional microsurgical approaches including clipping and parent artery trapping are associated with high morbidity and mortality
- Stent, multiple stent and coil is described with acceptable rates of procedural complications, however it has high recurrence rate

Meling TR et al , Blood blister-like aneurysms of the internal carotid artery trunk causing subarachnoid hemorrhage: treatment and outcome. J Neurosurg. 2008 Apr;108(4):662-71.

Ogawa A et al Aneurysms at nonbranching sites in the supraclinoid portion of the internal carotid artery: internal carotid artery trunk aneurysms. Neurosurgery. 2000 Sep;47(3):578-83.

**2 Years Later...**

# Patient

- 56 year old man sudden onset of “worst headache of his life”
- CT: SAH
- Angio: left MCA blister aneurysm
- OR for clipping/wrapping
- Rupture of the MCA during clipping
- Patient expired 5 days later

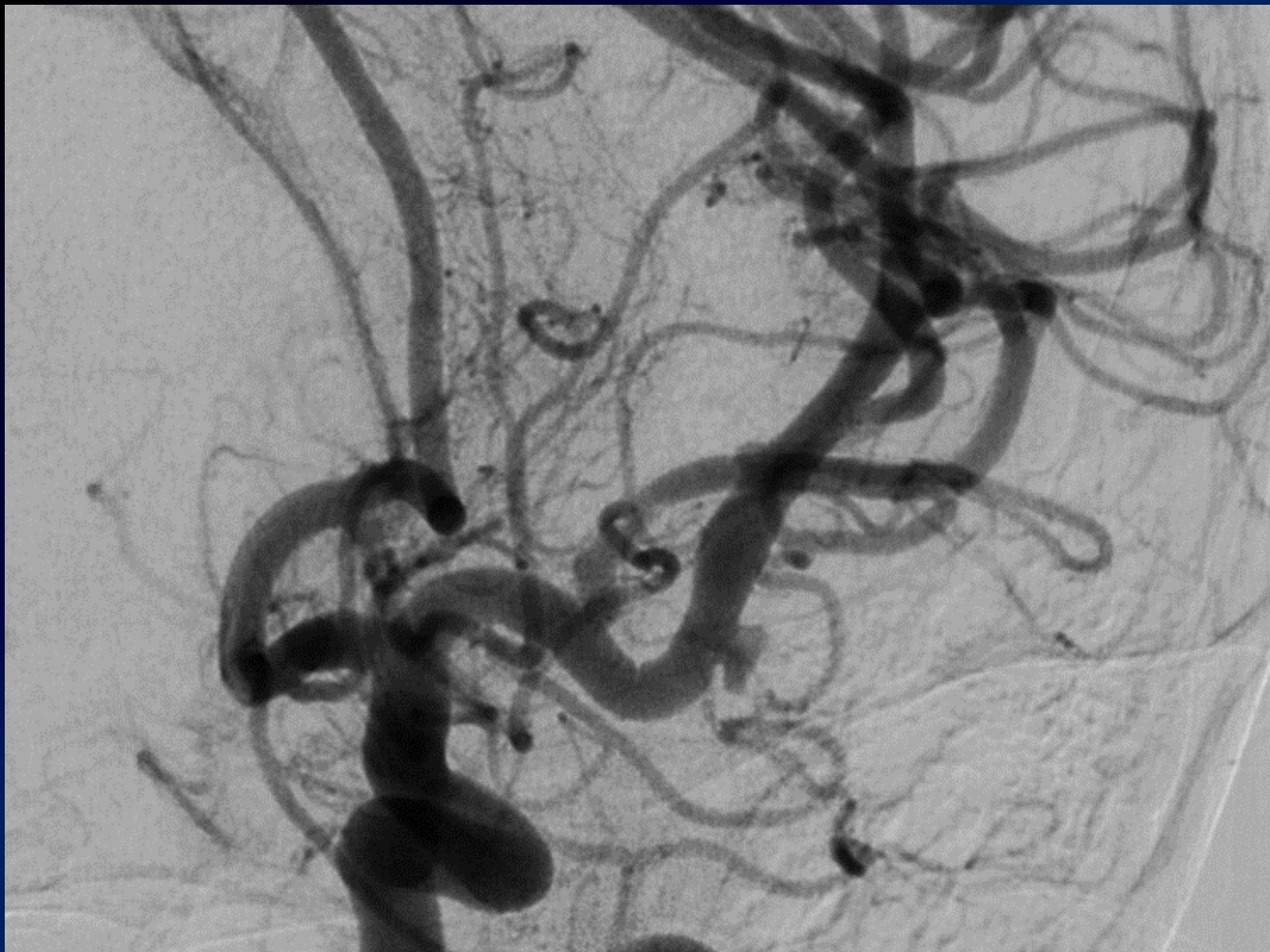


**3 Years Later...**

# Phone Call

- 27 year old woman had sudden onset of “worst headache of her life” at the gym
- Loss of consciousness with mild right face arm and leg weakness
- On admission H&H 3





# Flow Diversion

# FD in Blisters

- April 6, 2011 FDA approved Pipeline Embolic Device (PED)
- Because of the purely endoluminal nature of aneurysmal occlusion, PED may represent an ideal option to repair ruptured BA
- OFF-LABEL use

# Blister: Treatment with Flow Diverter

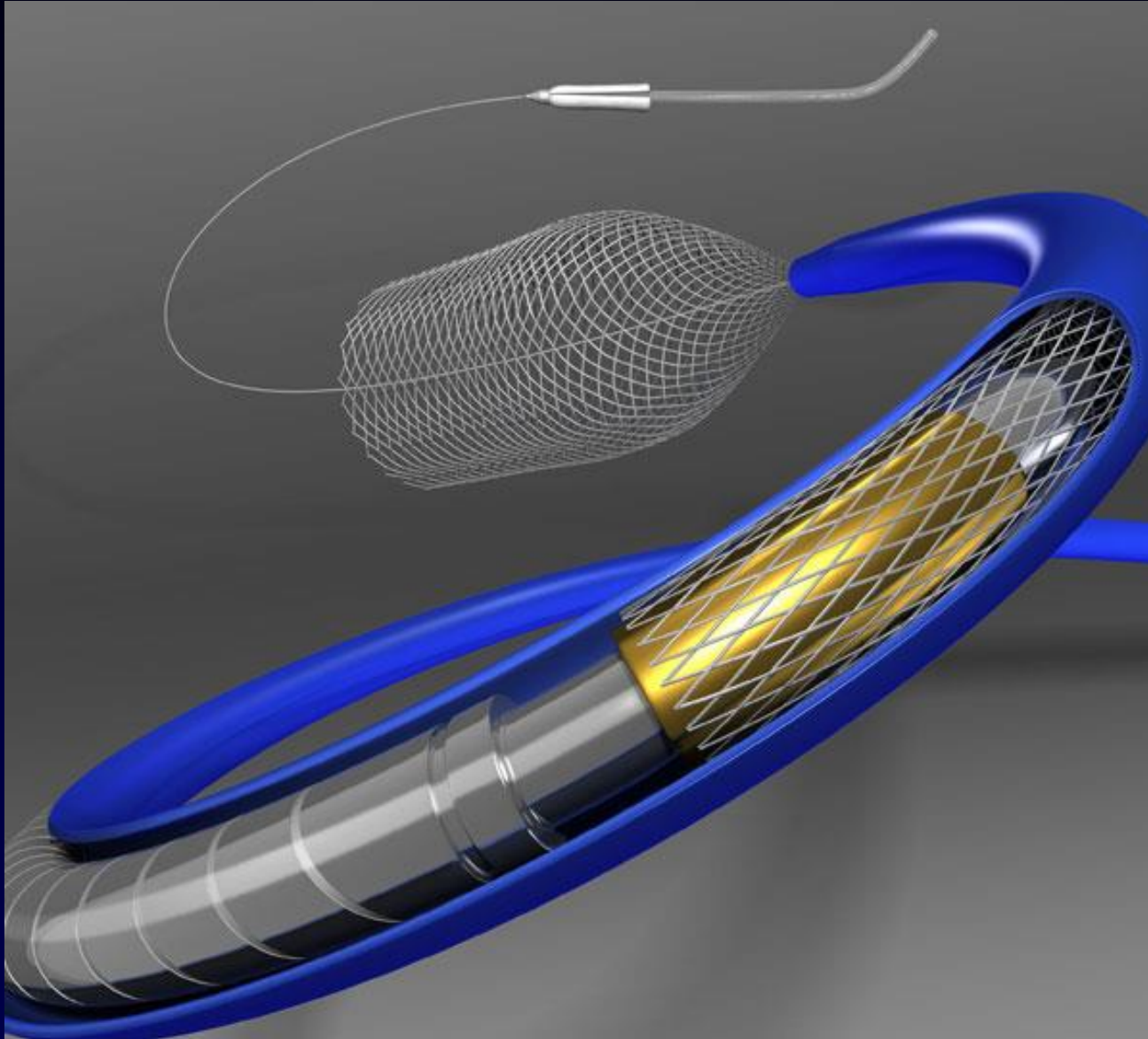
- EVD was placed
- Loaded with 600 mg of plavix, 325 mf ASA after EVD placement
- The day after, Plavix 75 mg and ASA 325
- Taken to angio for treatment

# Set-up

- Neuron Max
- Navien 0.58
- Marksman
- Synchro 0.014
- Pipeline Flex 2.5 x 14 mm

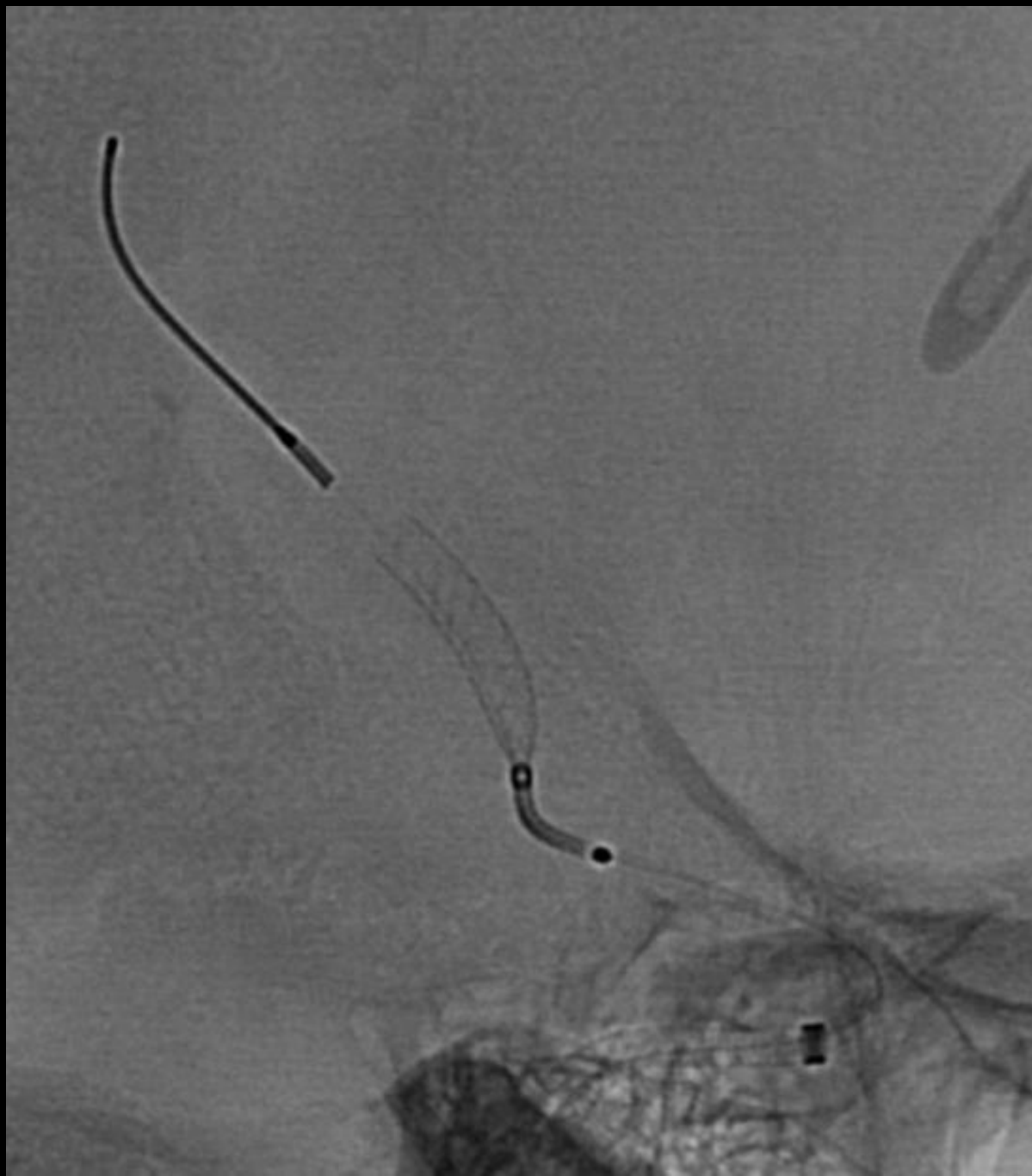


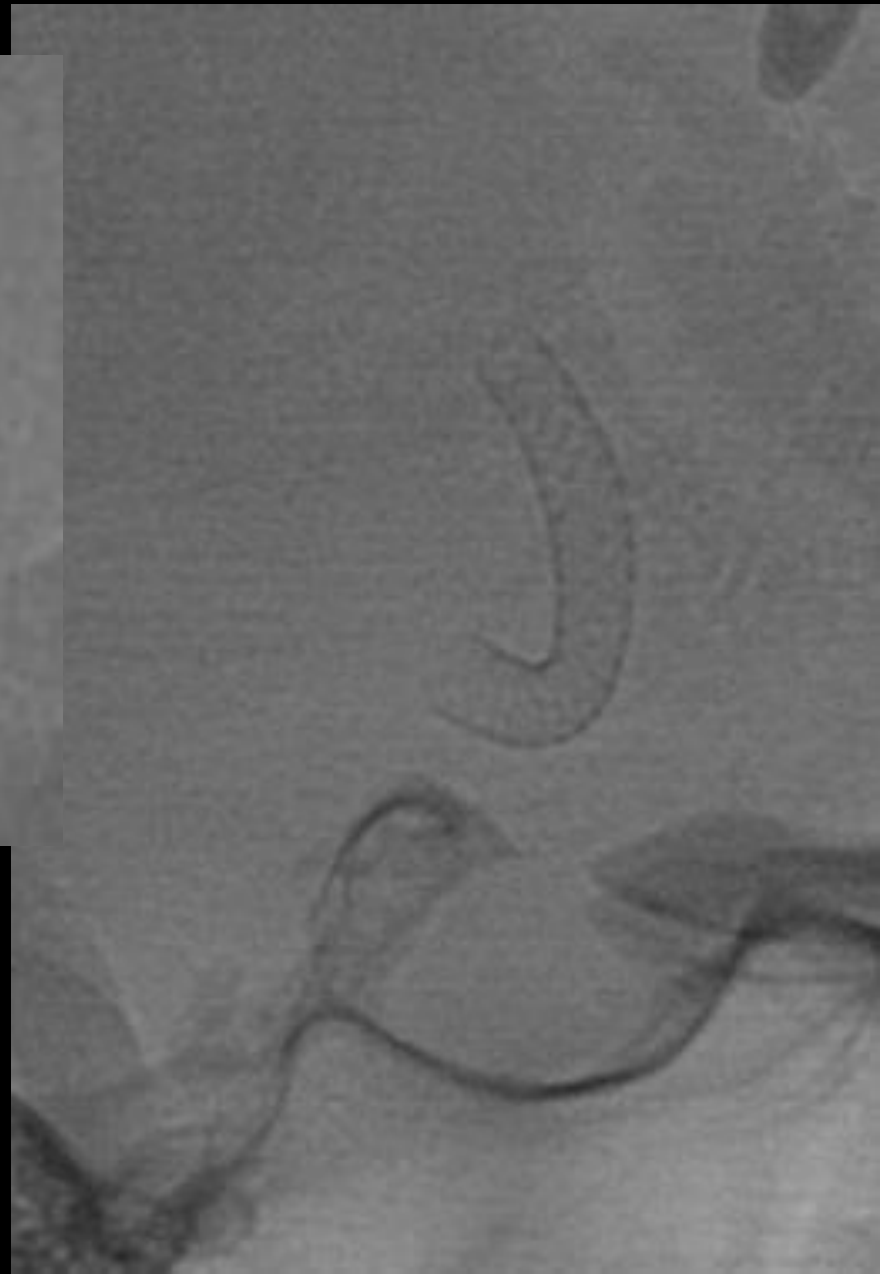
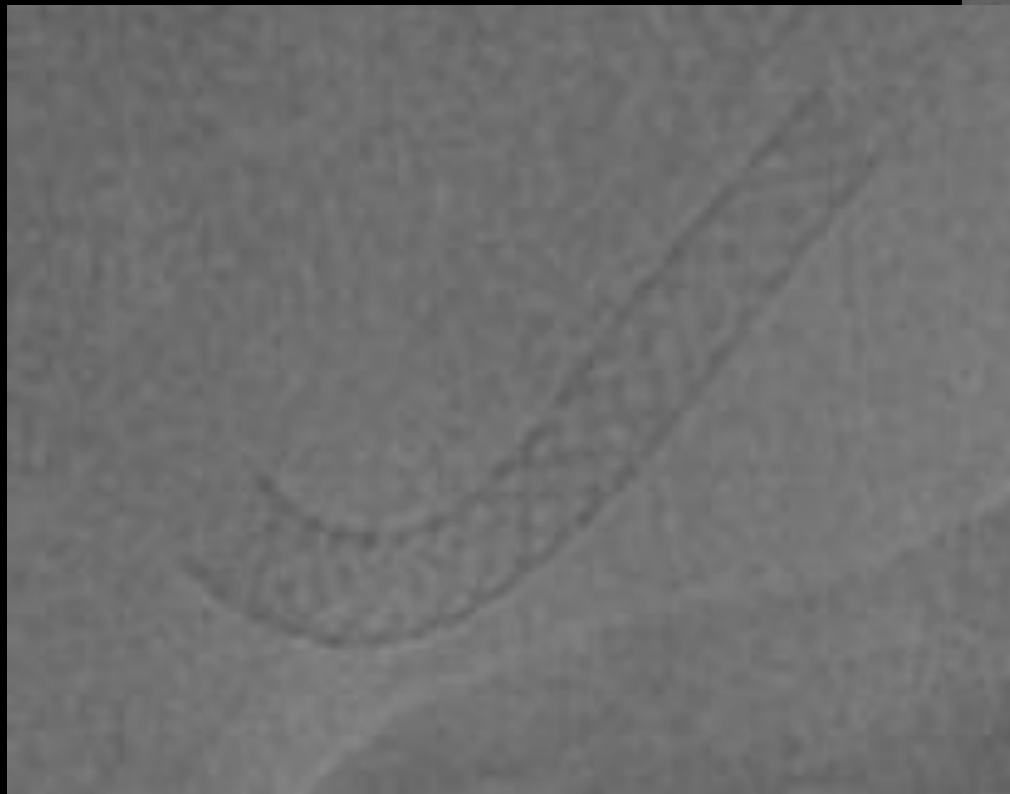
# Pipeline FLEX

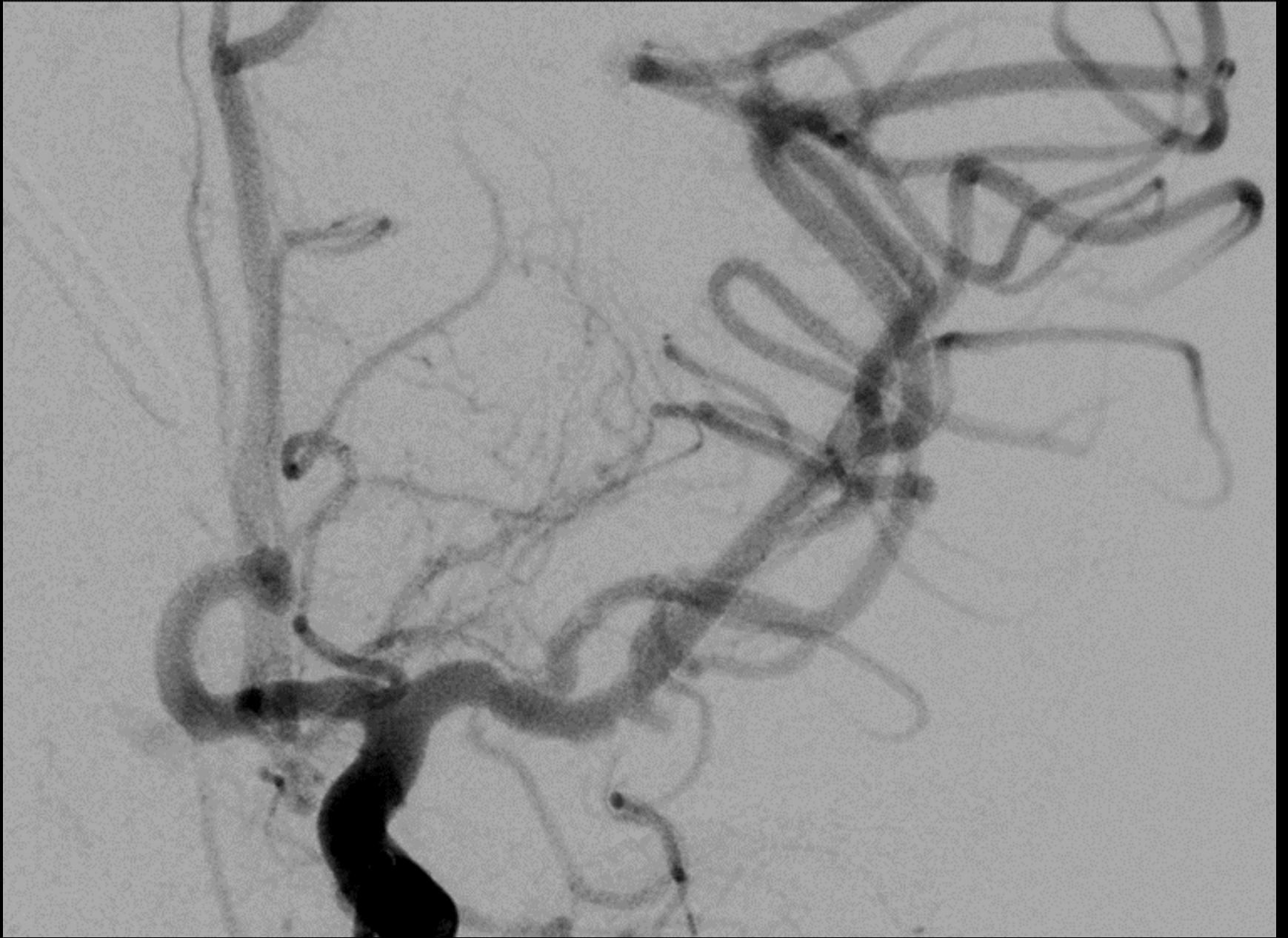


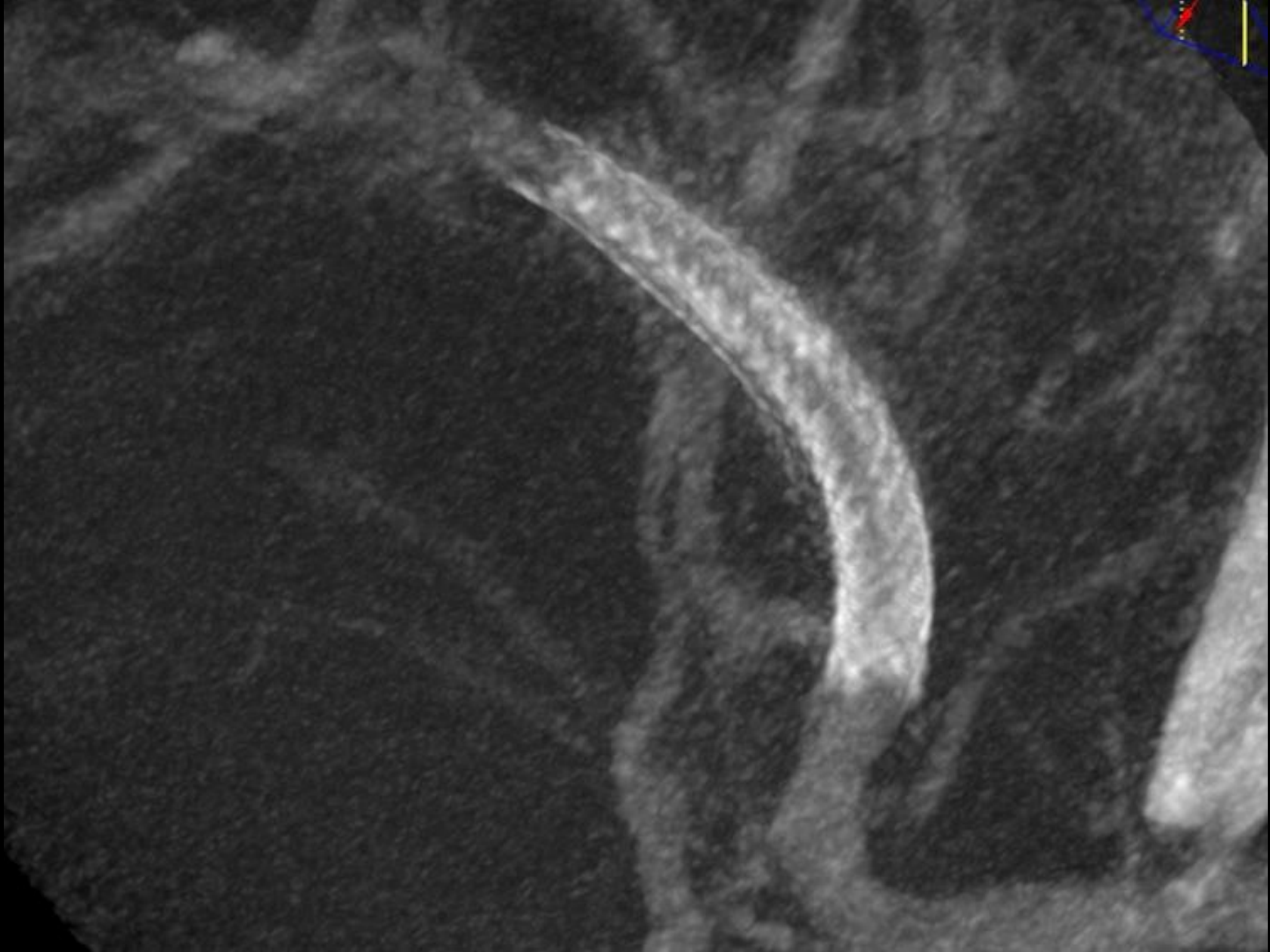










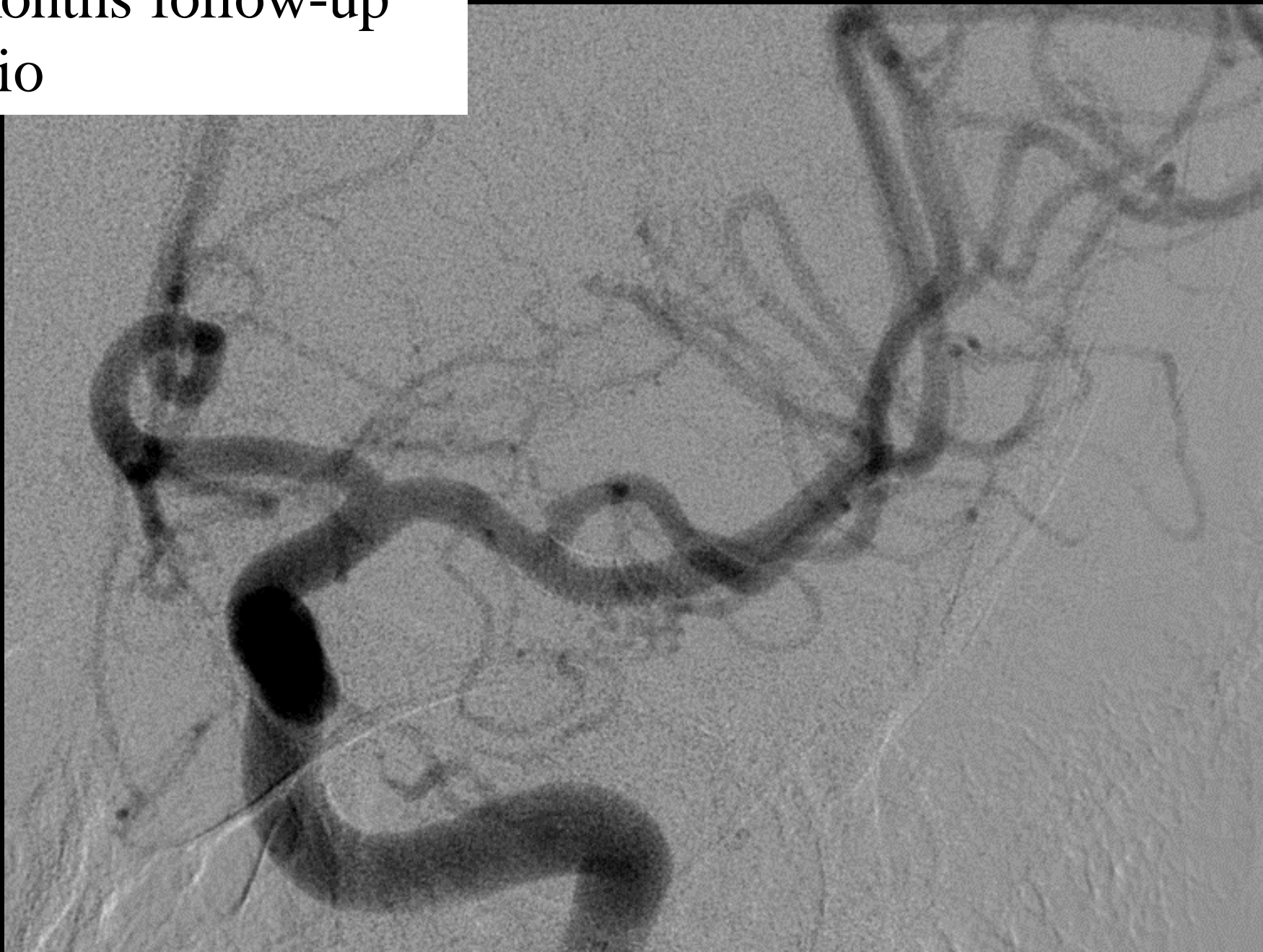


# Patient

- Patient did very well post PED placement
- Not significant vasospasm
- EVD was D/C
- Patient went back to work full time 3 months after the SAH

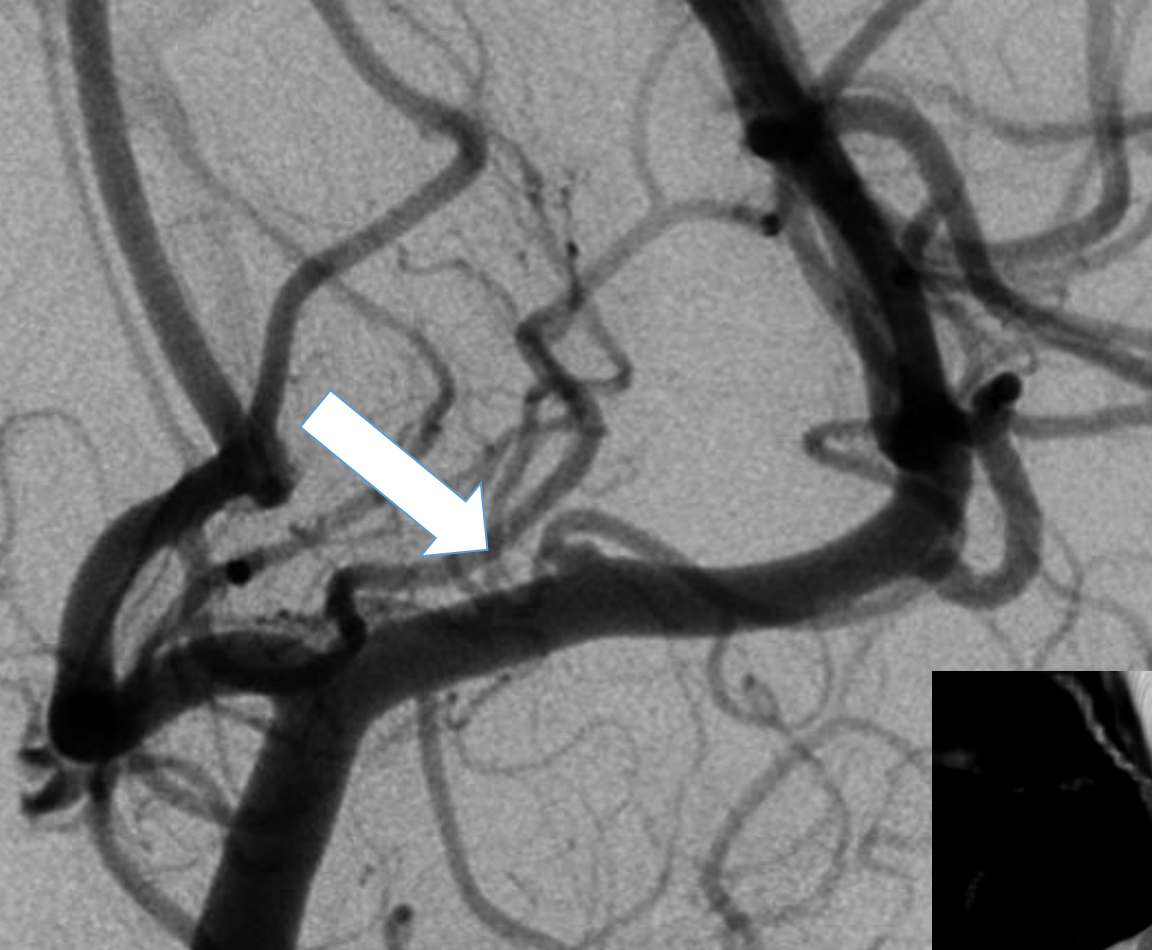


8 months follow-up  
angio

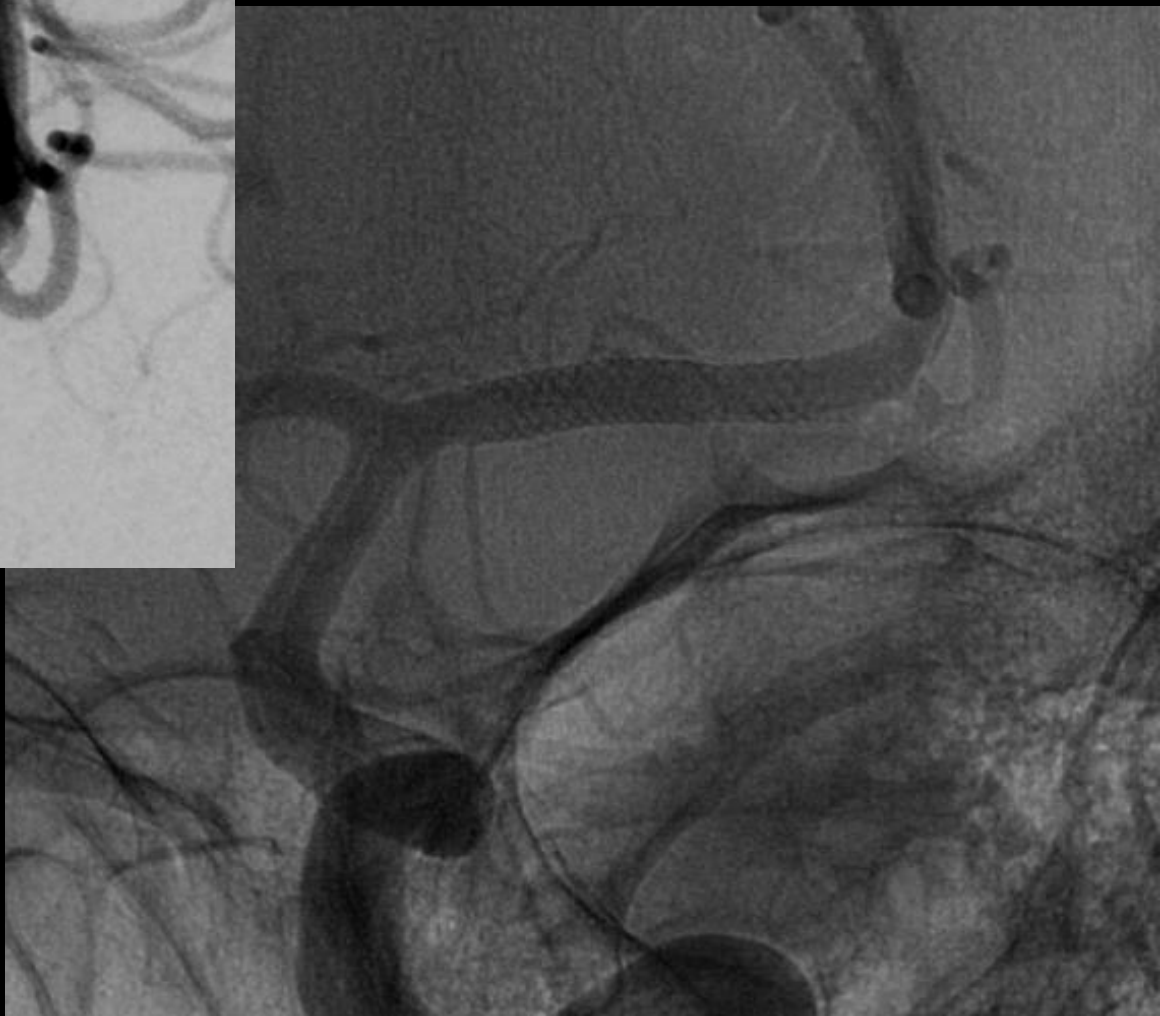
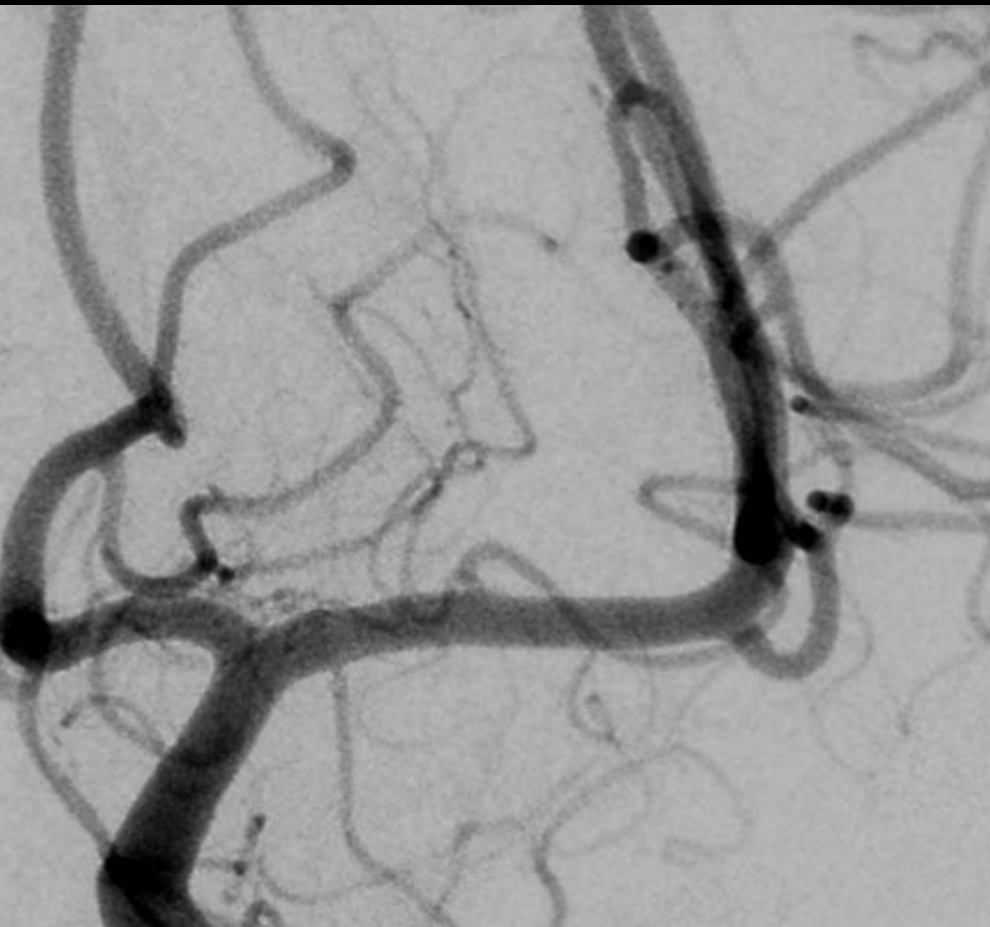


# Patient

- 45 year old man with sudden onset headache
- On admission H&H 1
- CT SAH

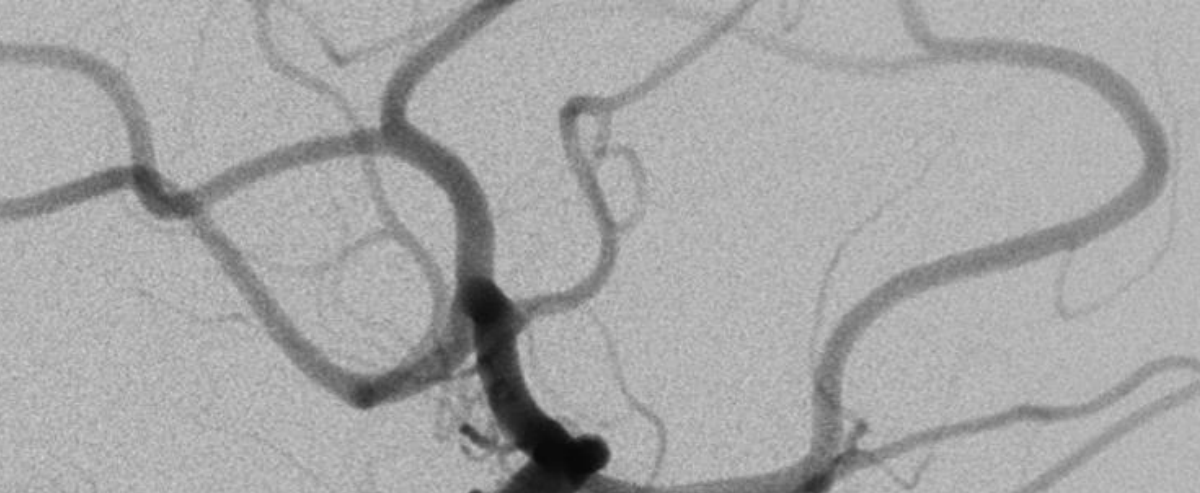


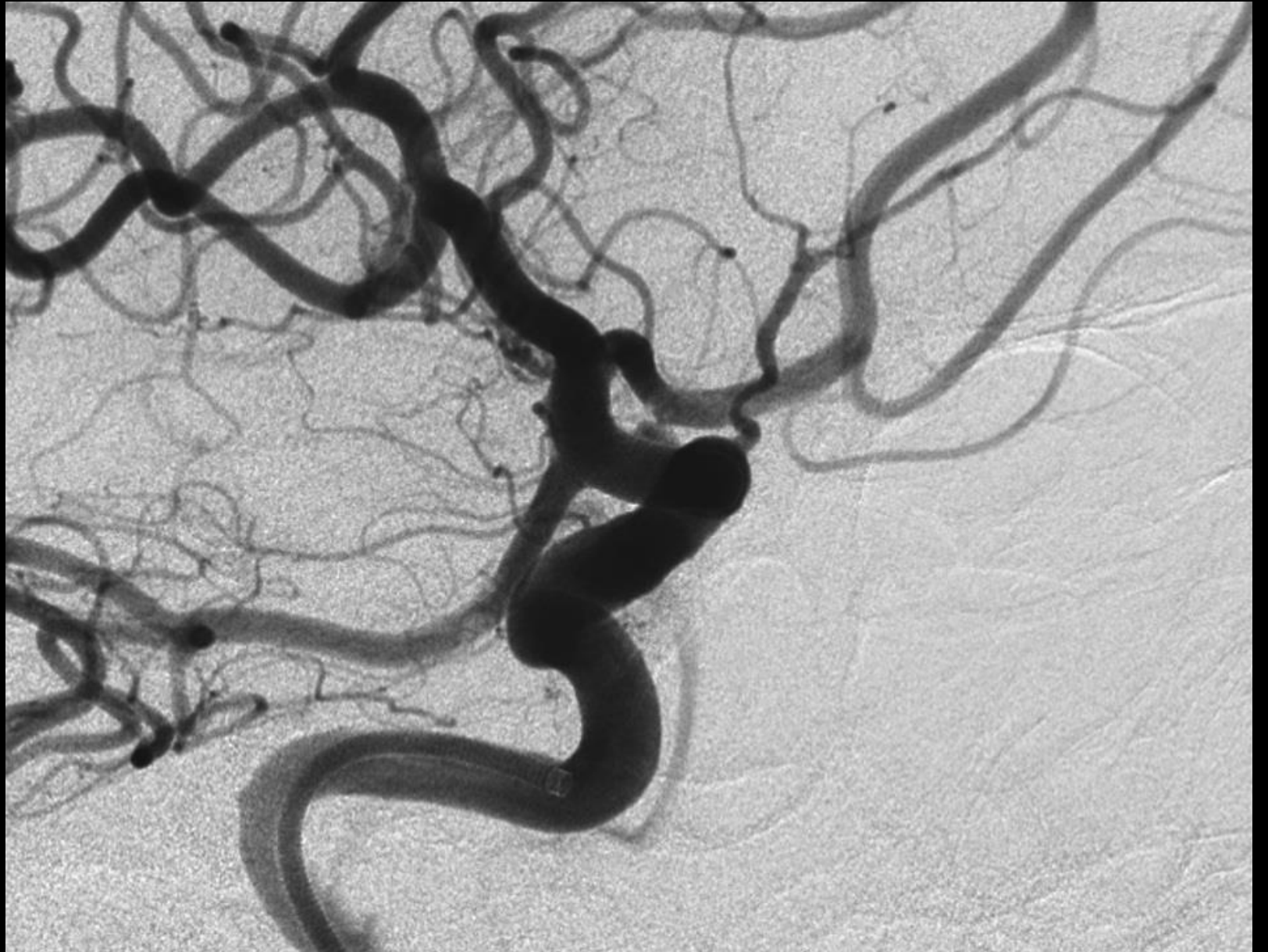
5 months follow-  
up angio



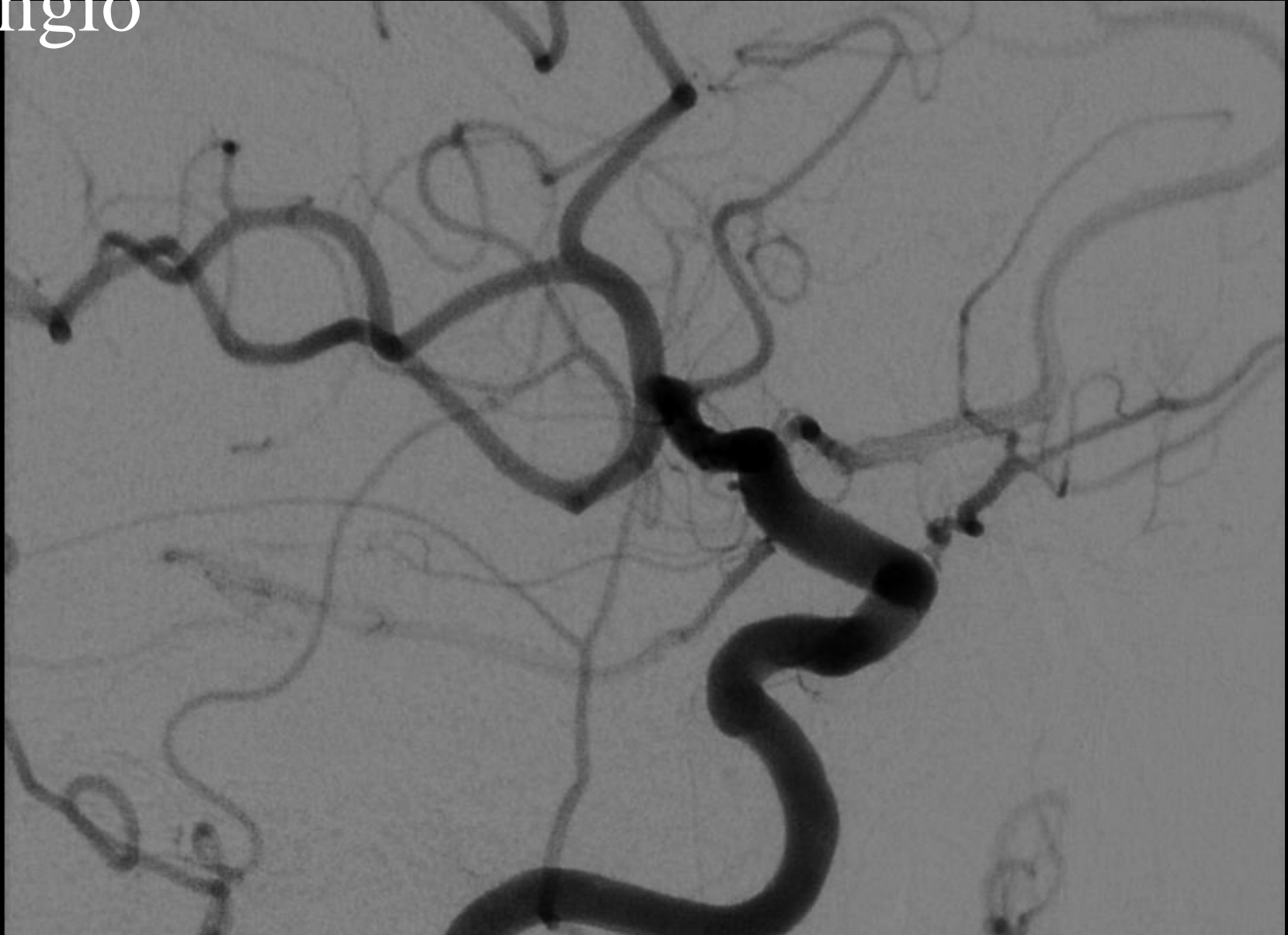
# Patient

- 53 year old man with sudden onset headache
- On admission H&H 3
- CT SAH FG3





6 months follow-  
up angio





CASE SERIES

# Flow diversion with Pipeline Embolic Device as treatment of subarachnoid hemorrhage secondary to blister aneurysms: dual-center experience and review of the literature

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## ABSTRACT

**Background** Aneurysmal subarachnoid hemorrhage (aSAH) secondary to blister-type aneurysms (BAs) is associated with high morbidity and mortality. Microsurgical clipping or wrapping and/or use of traditional endovascular techniques to repair the lesion result in frequent regrowth and rebleeds and ultimately high fatality rates. Because of the purely endoluminal nature of arterial reconstruction, flow diversion may represent an ideal option to repair ruptured BAs.

**Methods** We performed a retrospective analysis of our database including all consecutive patients with aSAH secondary to BAs treated with the Pipeline Embolic Device (PED) between November 2013 and November 2015 in two institutions. We collected basic patient demographics, aneurysm size, location, number and sizes of PEDs used, use of coiling, 30-day modified Rankin Scale (mRS) score, and follow-up imaging data.

**Results** Ten cases of aSAH were found as a result of a ruptured BA. Patients had a mean age of 47.2 years

On digital subtraction angiography (DSA) they appear as very small (1–2 mm) irregularly-shaped aneurysms with a wide or non-discernable neck. Pathologically, BAs are very different from saccular aneurysms.<sup>4</sup> Histological examination shows abrupt loss of both the intima and media.<sup>4 5</sup> As a result, the outer wall of BAs is comprised of only adventitia and/or thrombus, often adherent to the overlying pia, essentially with the body of the aneurysm behaving like a pseudoaneurysm with no true wall structure. Because of such extreme fragility of the entire BA arterial histoarchitecture, we do not currently have safe, effective, and durable options to repair these aneurysms. Manipulation of the lesion either by microsurgical clipping or wrapping and/or traditional endovascular techniques using coils with adjunctive balloons or stents results in rupture of the artery, regrowth, and rebleeding of the aneurysm and ultimately high fatality rates.<sup>6</sup> Additional endovascular approaches have included

**Table 1**

Age	Institution	H&H	FGS	Location	Size	PED size	Complications	Filling post	mRS at SAH	90d mRS	F/U (m)	RS	# PED	
51	BH	4	4	R ICA	1.8	1.5	4.5 x 14	None	Persistent	5	6		3	
45	BH	1	4	L MCA	1	1	2.5 x 14	None	none	2	0	7	1	1
27	BH	2	3	L MCA	1.5	2.8	2.5 x 14	None	small	2	0	12	1	1
56	BH	3	4	L ICA	0.8	1.5	4 x 20	None	small	2	0	15	1	1
68	BH	1	1	L ICA	1.5	1.3	4.5 x 15	None	small	1	0	Pending	1	1
49	UB	1	2	L ICA	1.3	1.2	3.75 x 14	none	none	1	0	13.2	1	1
49	UB	1	1	R ICA	1.5	1.2	5.0 x 20	none	none	3	1	24	1	1
19	UB	1	1	L ICA,	1.5	1.3	4.5 x 30	none	none	0	0	7	1	1
59	UB	1	2	L ICA,	2.1	2	3.25 x 18	none	none	1	0	23	1	1
49	UB	1	1	L ICA	1.6	1.3	3.75 x 16	none	none	0	0	21	1	1

Table 1. Patients characteristics. Abbreviations: BH: Baptist Hospital; UB: University of Buffalo; FGS (Fisher Grading Scale); R: right. L: left; ICA: Internal Carotid Artery; MCA: Middle Cerebral Artery; PED: Pipeline Embolic Device; mRS: modified Rankin Scale; SAH: Subarachnoid Hemorrhage; RS: Raymond Scale

# FD in Blister Aneurysms

- 10 cases ICA or MCA blisters at BH and BU
- Excellent technical result with obliteration with the blister
- 1 patient required multiple PED
- 1 patient expired (H&H 4, severe vasospasm)

# Conclusions

- Ruptured BA are very malignant
- High recurrence/re-bleed
- Clipping/wrapping high mortality
- Coil or Multiple Stent-coil has high recurrence/re-bleed
- FD promising tool for ruptured, blister-type aneurysm
- More data needed