Spontaneous SAH without aneurysm in initial cerebral angiography

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Case presentation I (#08530423)

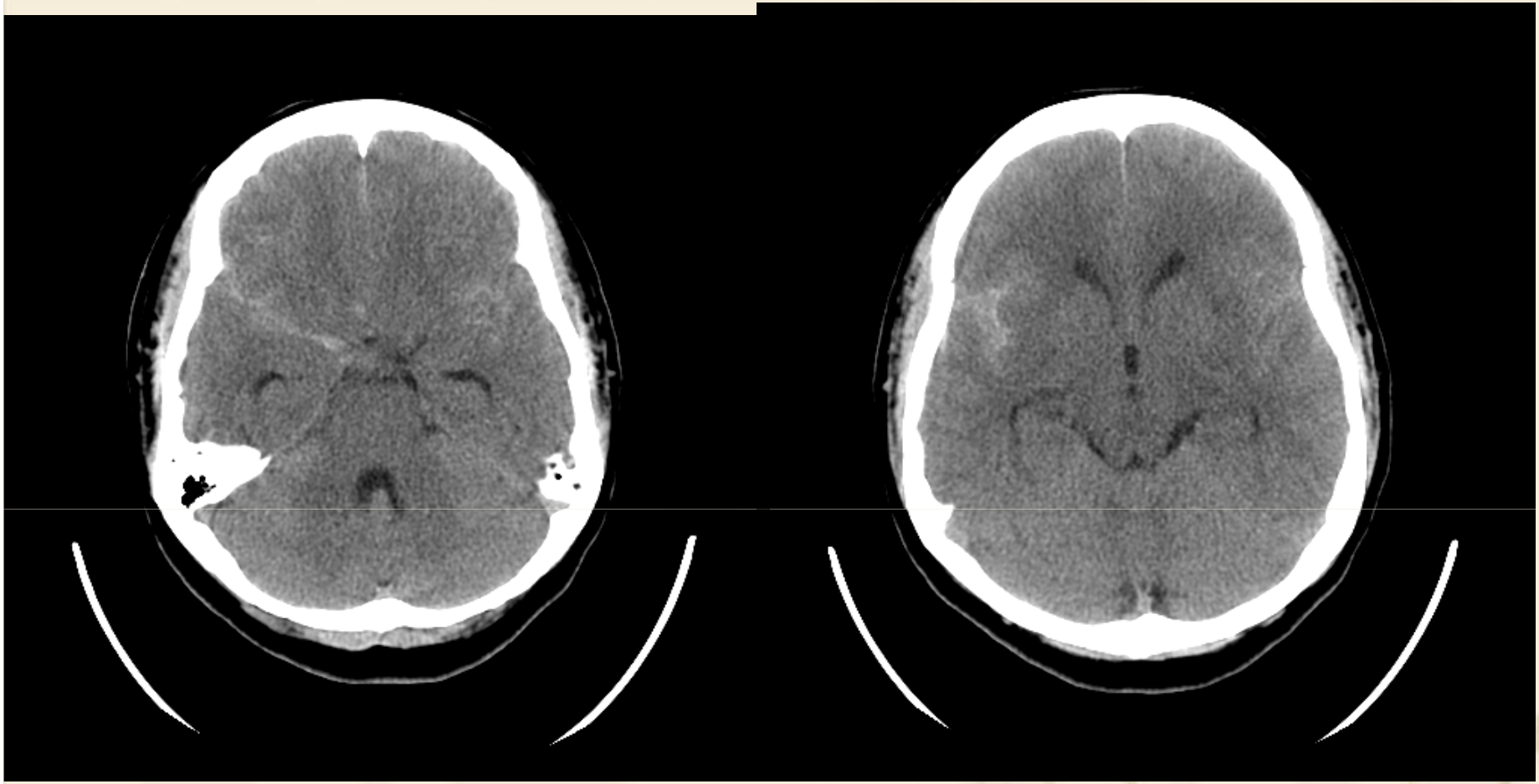
- 54 y/o woman, sudden, severe pulsating headache for 6 days before her admission.
- Vomiting without diplopia. Symptom partially relieved after medication from ER. (no brain image in ER)
- Persistent headache although less severe.
- Visited OPD because of recurrence of the same severity headache and vomiting one day ago.
- Headache spread to neck and refractory to medication

Case presentation (#08530423)

- BP: 166/91 mmHg
- Suffering appearance with normal orientation.
- Isocoric and reactive pupils.
- Mild rigidity of neck
- No limitation of extraocular muscle movement
- No long tract signs

Reasonable thinking of a neurologist

- Localization: systemic, less favored localized lesion in brain
- Etiology: SAH, meningitis, ICH with ventricular extension……
- Arrange brain CT



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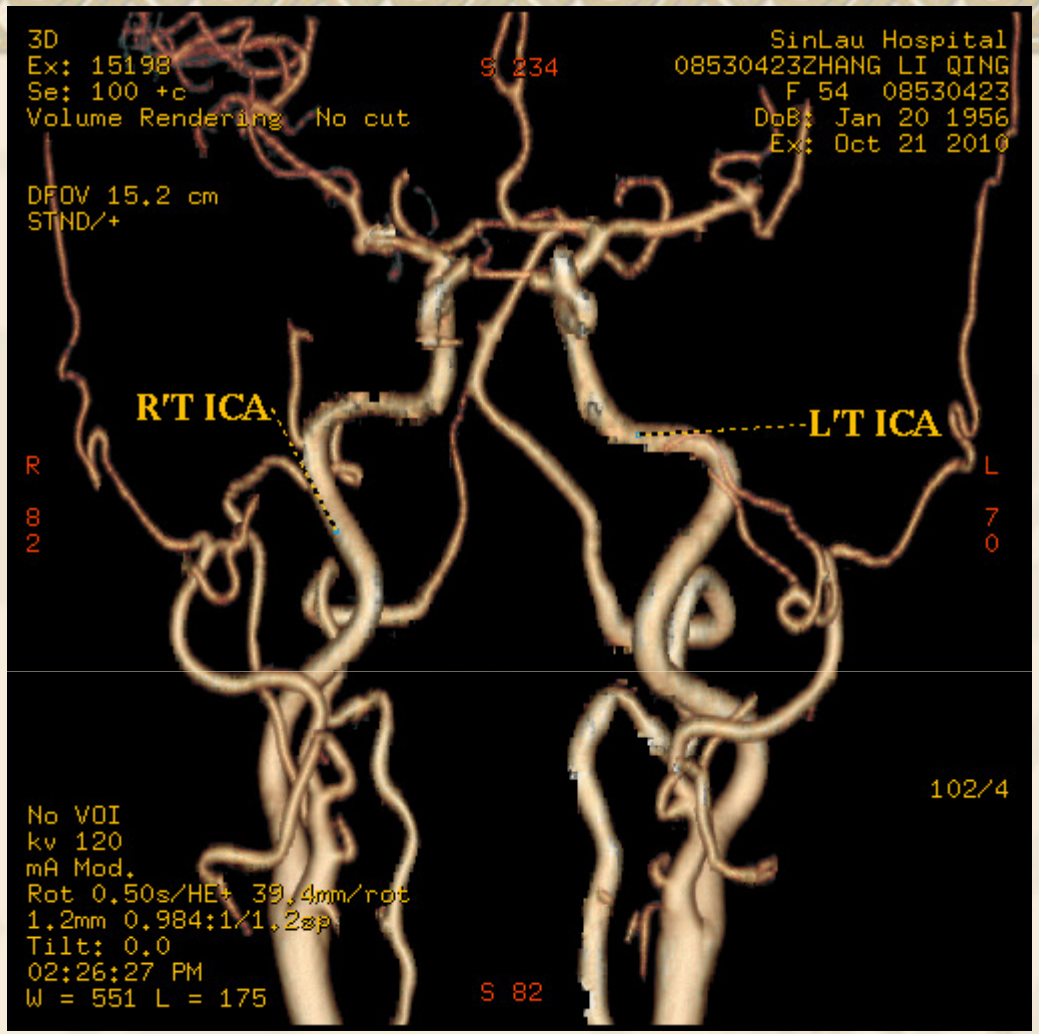
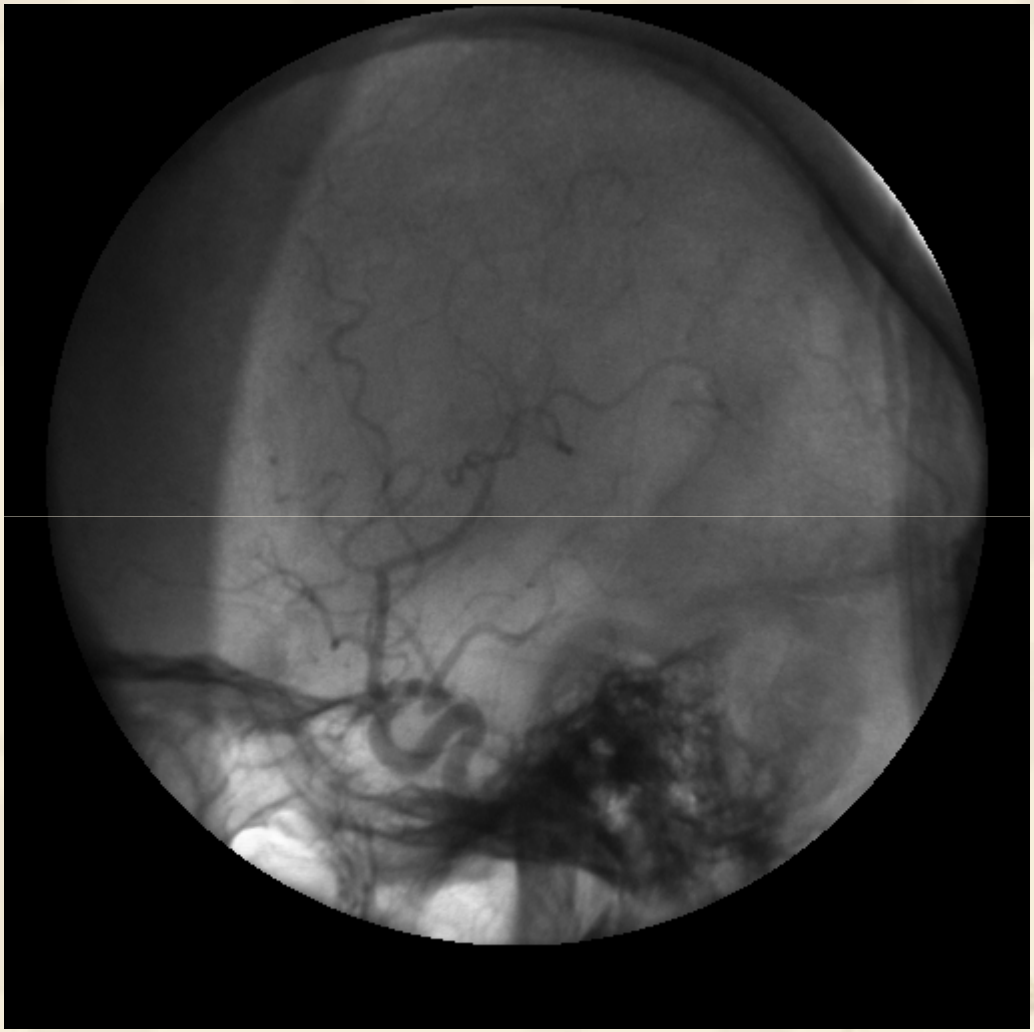


Negative finding of CT-angiography, 99-10-21 (1 week after initial onset of HA)

How and what to do next?

- Headache partially relieved by symptomatic treatment
- Nimodipine IV drip
- Repeat cerebral angiography 2 wks later

99-11-10



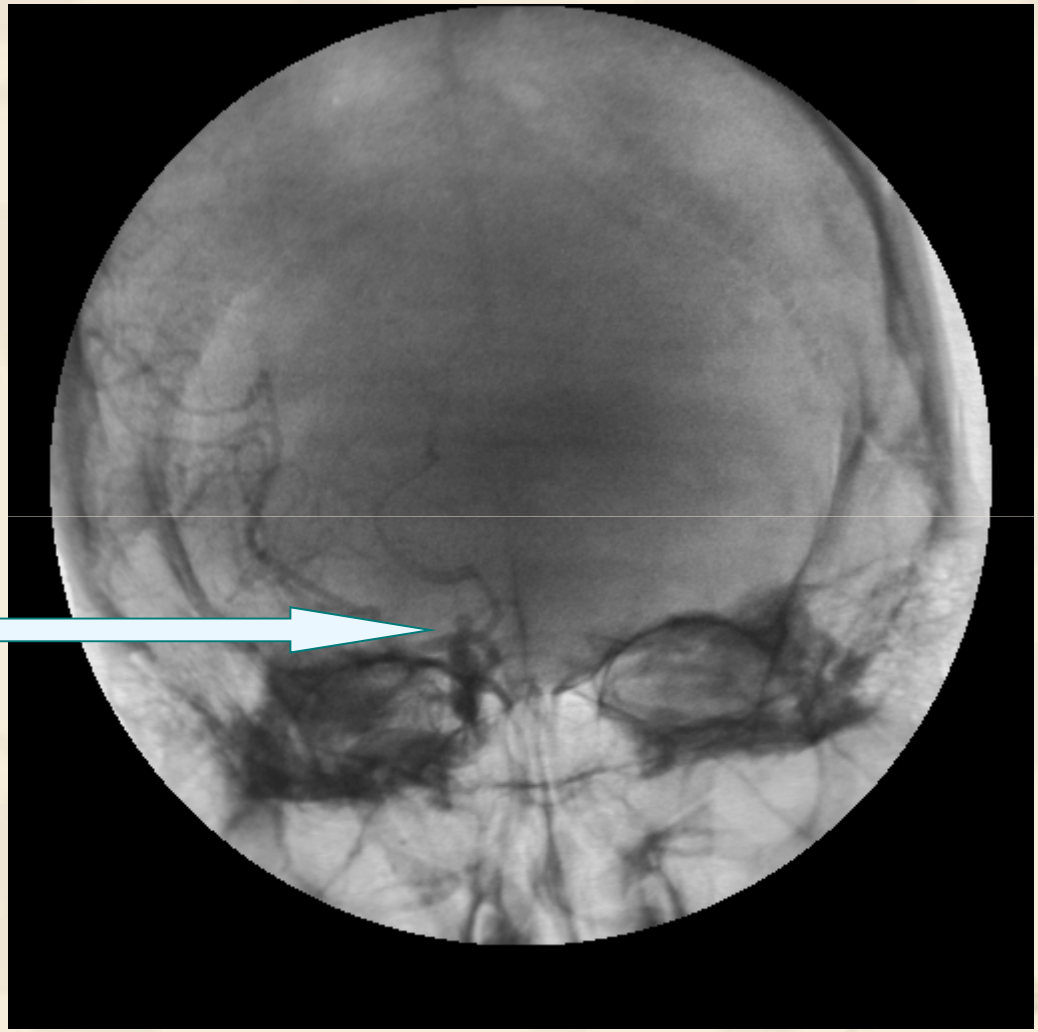
99-11-10

But disaster came…….

- Sudden severe explosive HA **with vomiting in the morning of** 12/7. Consciousness remained clear.



Small aneurysm



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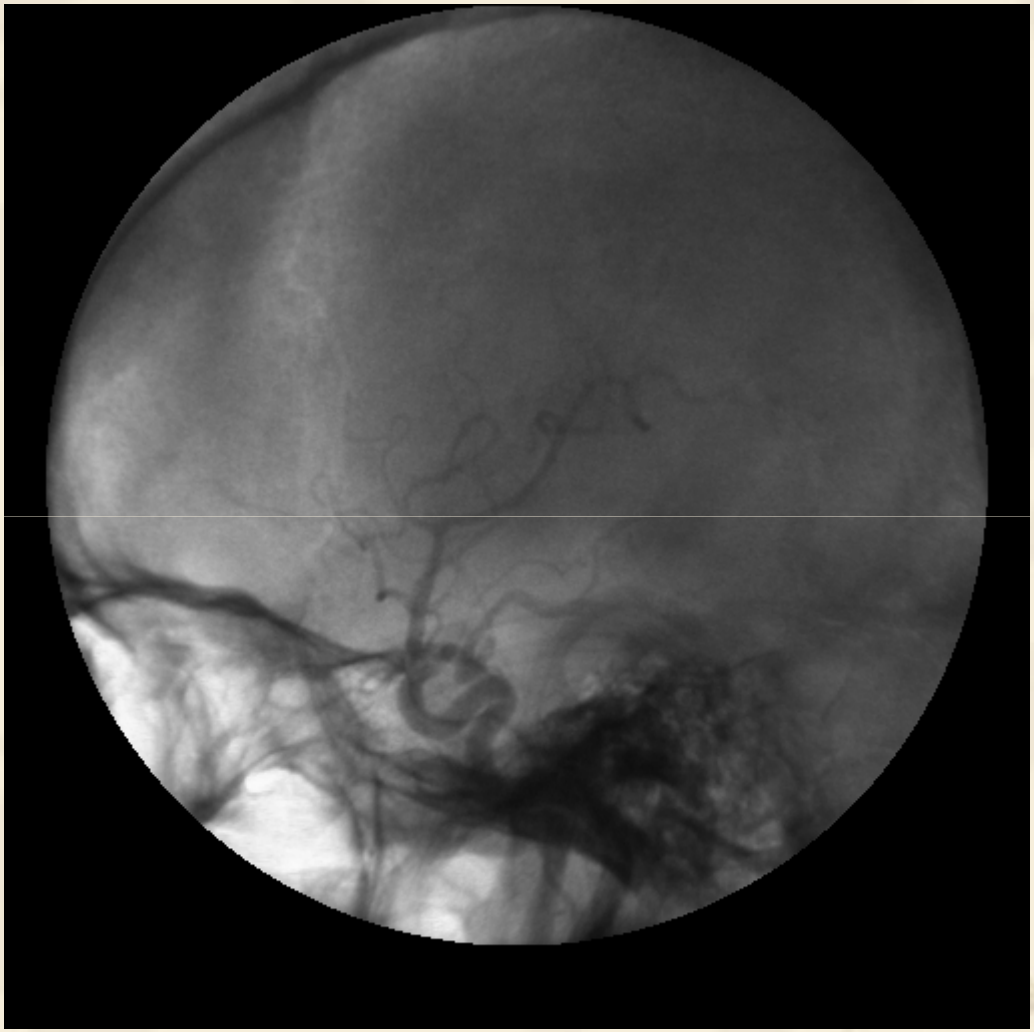
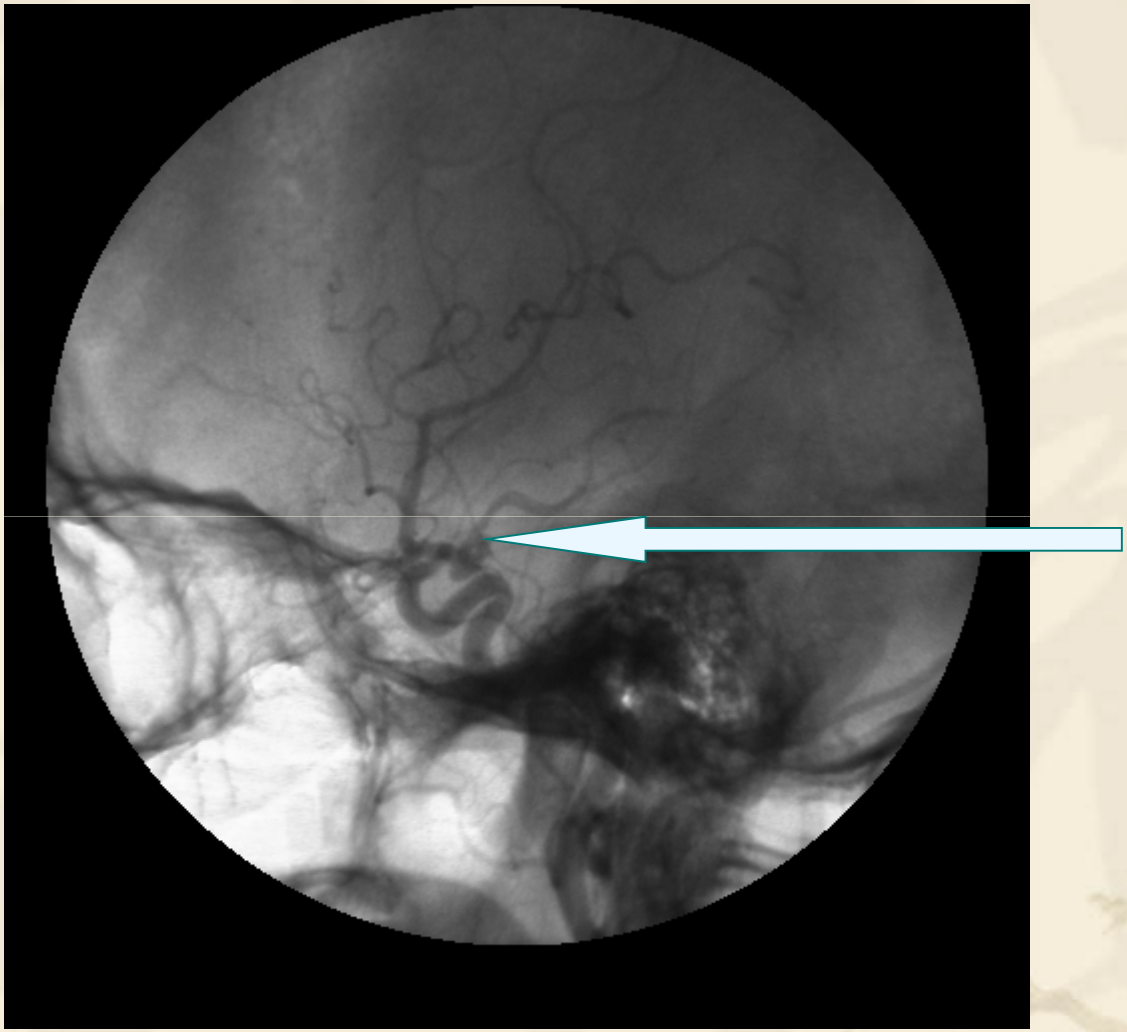
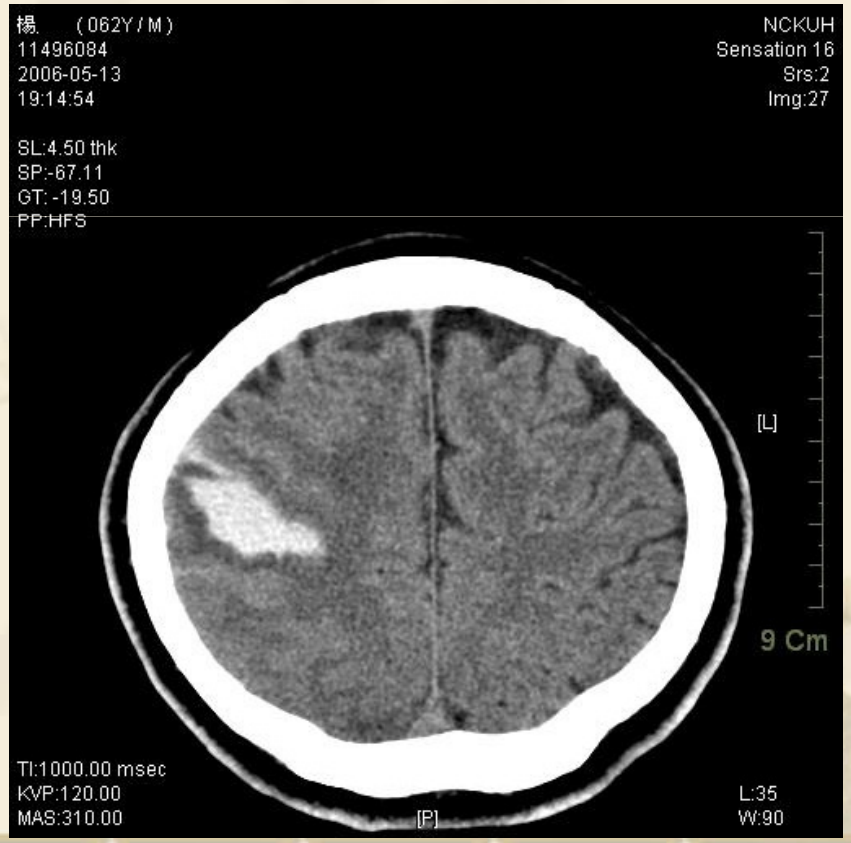


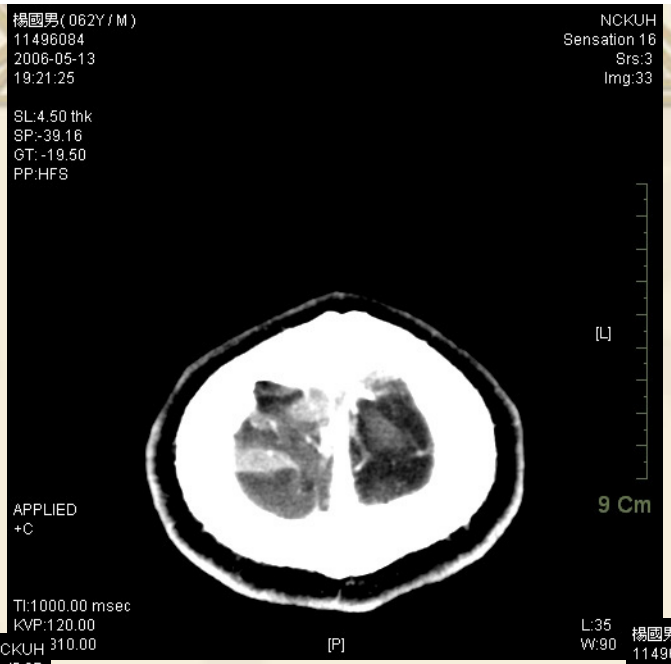


99-12-7

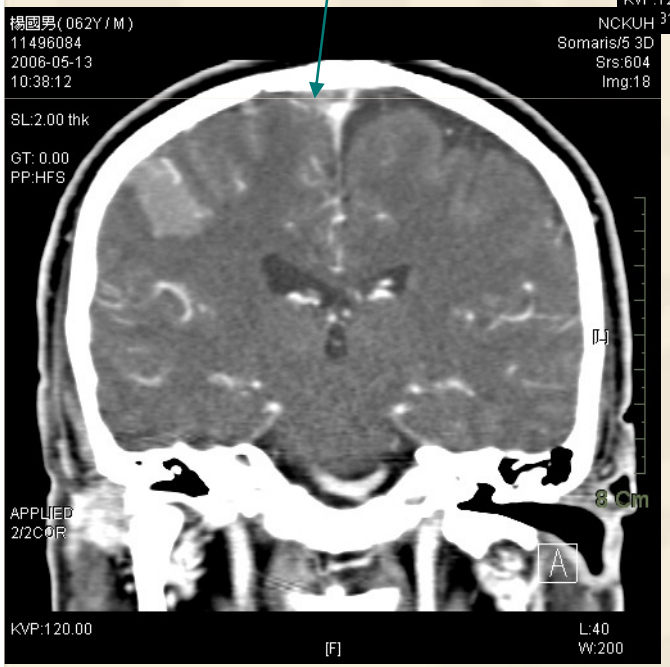
Case Presentation II (#6563184)

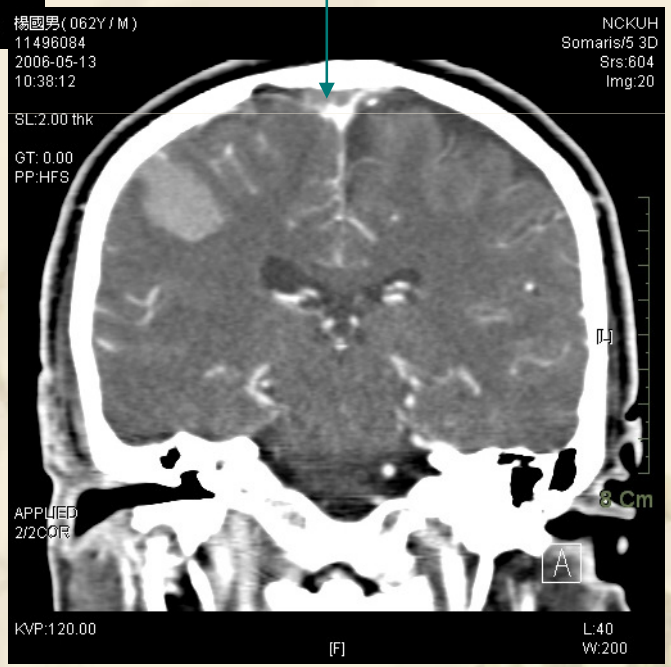
62 y/o man, sudden severe HA. Transferred to NCKUH as seizure and left side weakness, so repeated brain CT (image right side)





Filling defect





成大 CTA: no aneurysm, favor right cortical vein to SSS thrombosis

Spontaneous SAH

- 15-20% pts have no vascular lesion in initial cerebral angiography
- About 24% find aneurysm in repeated angiography

Etiologies of nonaneurysmal, spontaneous SAH

- Perimensencephalic SAH
- Occult aneurysm
- Intracranial or spinal vascular malformation
- Intracranial arterial dissection
- Other rare causes:

cerebral venous thrombosis, sickle cell disease, coagulopathy, cocaine abuser, pituitary apoplexy, cerebral amyloid angiopathy , spinal aneurysm

Reasons for false-negative angiography in SAH

- Technical or interpretation error
- Small size of aneurysm
- Obstruction of aneurysm by vasospasm, hematoma or thrombosis of aneurysm.

Outcome in patients with subarachnoid hemorrhage and negative angiography according to pattern of hemorrhage on computed tomography. (Lancet 1991;338:964-8)

- 113 pts with angiogram-negative SAH.
- Mean follow-up 45 months (6-96 mo).
- Among 113 pts, 77 with perimesencephalic SAH (PM-SAH) had no mortality or disability.
- In 36 pts of nonPM-SAH, 9 died or disabled and 4 had rebleeding

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Clinical study

Spontaneous subarachnoid haemorrhage with negative initial angiography: A review of 143 cases

Jin Young Jung [a], Yong Bae Kim [b], Jae Whan Lee [a], Seung Kon Huh [a,*], Kyu Chang Lee [a]

[a] *Department of Neurosurgery, Brain Research Institute, Yonsei University, College of Medicine, Seoul*
[b] *Department of Neurosurgery, National HIC Medical Center, Goyang, Korea*

Subarachnoid haemorrhage (SAH) patterns seen on CT scans of patients with initially negative angiograms ($n = 143$)

CT findings	No. patients (%)
Group I	12 (8.4)
Group II	94 (65.7)
Group III	37 (25.9)
Sylvian	15 (10.5)
Interhemispheric	5 (3.5)
Tentorial	6 (4.2)
Diffuse	11 (7.7)

Gr I: no SAH in CT, but confirmed by CSF

Gr II: perimesencephalic SAH (PM-SAH)

Gr II: non PM-SAH

Rebleeding and false negative rate of initial angiogram

Group	Rebleeding (%)	False negative[a] (%)
Group I ($n = 12$)	–	0/1 (–)
Group II ($n = 94$)	1 (1.1)	1/65 (1.5)
Group III ($n = 37$)	2 (5.4)	17/37 (45.9)
Total ($n = 143$)	3 (2.1)	18/103 (17.5)

[a] False negative rate = number of positive findings/number of repeat angiograms.

Clinical outcome ($n = 143$)

Grade[a]	Group I (%) ($n = 12$)	Group II (%) ($n = 94$)	Group III (%) ($n = 37$)
0	–	–	–
1	12 (100.0)	87 (92.6)	32 (86.5)
2	–	5 (5.3)	3 (8.1)
3	–	2 (2.1)	2 (5.4)
4	–	–	–
5	–	–	–

[a] Modified Rankin scale.

Incidence of complications ($n = 143$)

Complication	Group I (%) ($n = 12$)	Group II (%) ($n = 94$)	Group III (%) ($n = 37$)
Vasospasm	–	13 (13.8)	8 (21.6)
Hydrocephalus	–	11 (11.7)	3 (8.1)
Re-bleeding	–	1 (1.1)	2 (5.4)

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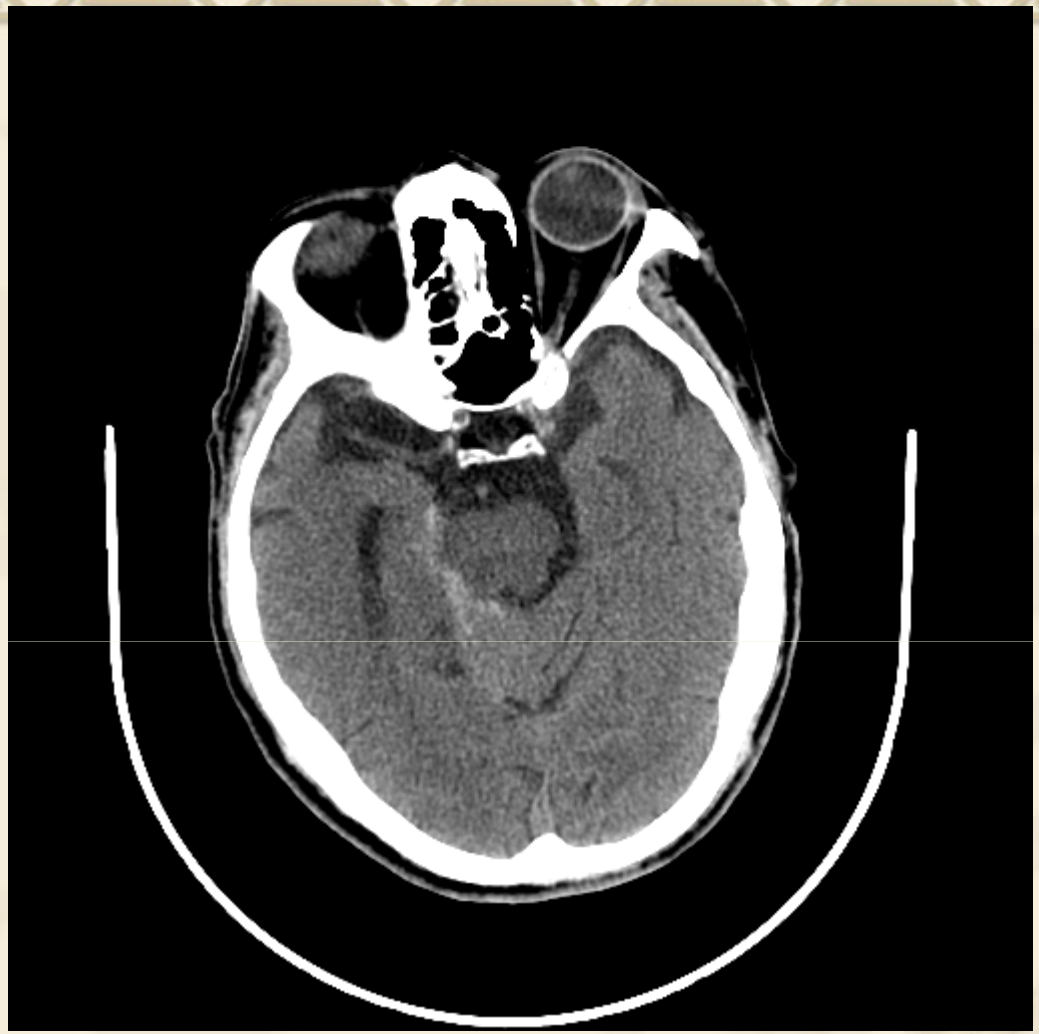
- Conclusion:

1. in CT negative SAH (confirmed by CSF) or PM-SAH when initial angiography negative, the false negative rate is low after repeating angiography. The prognosis is also good.
2. It is strongly indicated to repeat cerebral angiography in non PM-SAH if first angiography is negative. Even need 3rd time!

Perimesencephalic SAH

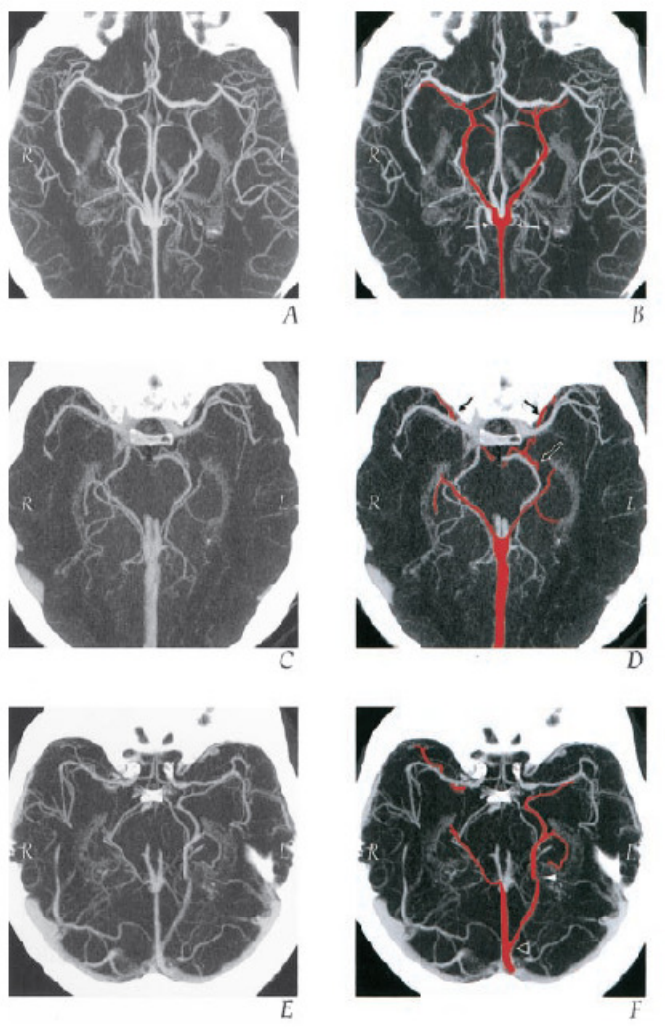
- Hematoma confined in subarachnoid space surrounding midbrain.
- About 10% of spontaneous SAH.
- 2/3 of cases of nonaneurysmal SAH.
- Probably venous bleeding.
- Good outcome



70 y/o man with PM-SAH, 1st and 2nd angiography 17 days later all negative for aneurysm. mRS: 2 three months later

Types of venous drainage in midbrain

(Watanabe A, *neuroradiology 2002)*



Type A: normal continuous drainage

Basal v. of Rosenthal is continuous with middle cerebral v. and drains into v. of Galen (Fig. A,B)

Type B: normal discontinuous drainage

Anterior to uncal v., posterior to v. of Galen (R hemisphere of Fig. C, D, E, F)

Type C: discontinuous segmented drainage

Anterior to uncal v., posterior to v. of Galen and perimesencephalic to sup petrosal sinus (L hemisphere of Fig C, D) or posterior directly to straight sinus. (L hemisphere of Fig. E, F)

Venous Drainage in Perimesencephalic Hemorrhage

Irene C. van der Schaaf, MD; Birgitta K. Velthuis, MD; Alida Gouw, MSc; Gabriel J.E. Rinkel, MD

Background and Purpose—In perimesencephalic nonaneurysmal hemorrhage (PMH), subarachnoid blood accumulates around the midbrain. Clinical and radiological characteristics suggest a venous origin of PMH. We compared the venous drainage of the midbrain between patients with PMH and aneurysmal subarachnoid hemorrhage (aSAH) by means of computed tomography angiography (CTA).

Methods—CTAs of 55 PMH patients and 42 aSAH patients with a posterior circulation aneurysm were reviewed. Venous drainage was classified into: (1) normal continuous: the basal vein of Rosenthal is continuous with the deep middle cerebral vein and drains mainly to the vein of Galen (VG); (2) normal discontinuous: drainage anterior to uncal veins and posterior to VG; and (3) primitive variant: drainage to other veins than VG. Additionally, we compared in PMH patients the side of the primitive variant and side of the bleeding.

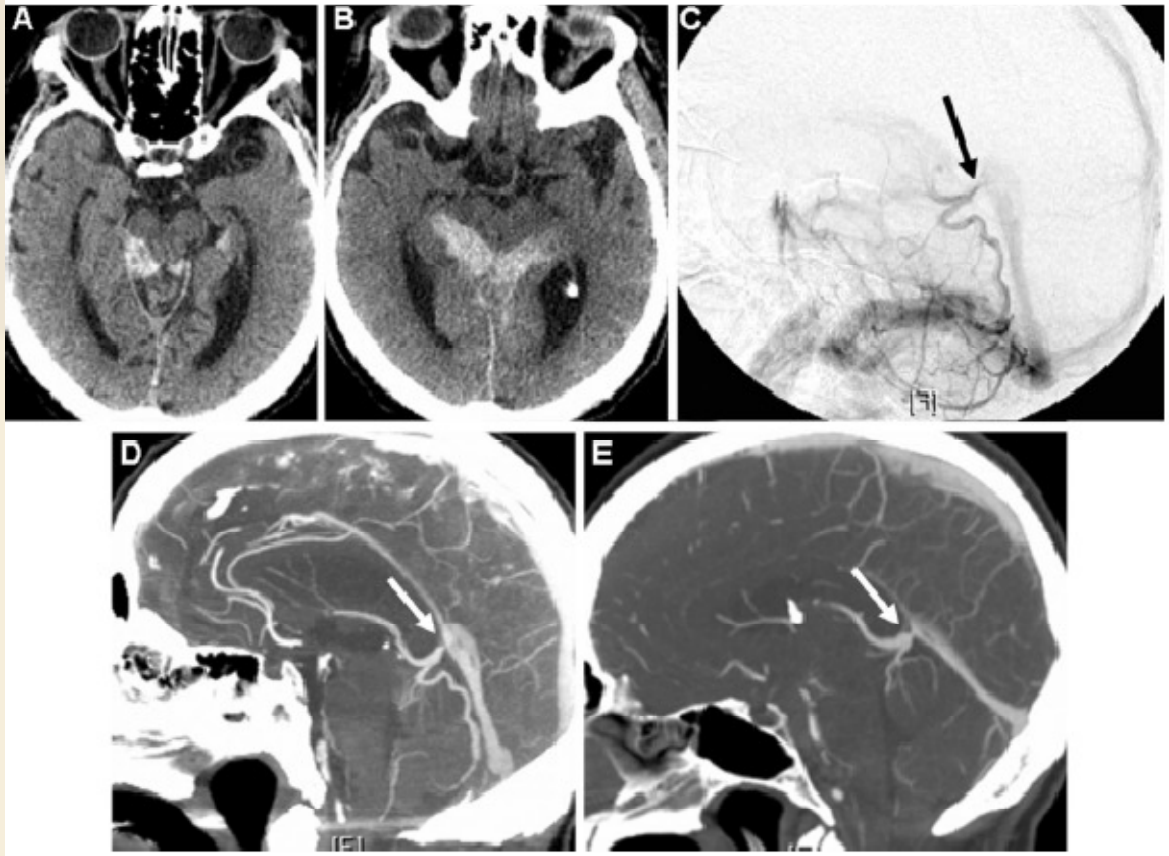
Results—A primitive variant was present on one or both hemispheres in 53% of PMH patients with PMH (95% CI, 40% to 65%) and in 19% of aSAH patients (95% CI, 10% to 33%). In all 16 PMH patients with a unilateral primitive drainage, blood was seen on the side of the primitive drainage (100%; 95% CI, 81% to 100%); blood was never found mainly on the side with normal drainage.

Conclusions—Patients with PMH have a primitive venous drainage directly into dural sinuses instead of via the vein of Galen more often than do controls. Moreover, the side of the perimesencephalic hemorrhage relates to the side of the primitive drainage. These results further support a venous origin of PMH. **(*Stroke*. 2004;35:1614-1618.)**

Key Words: perimesencephalic hemorrhage ■ subarachnoid hemorrhage ■ computed tomography ■ angiography

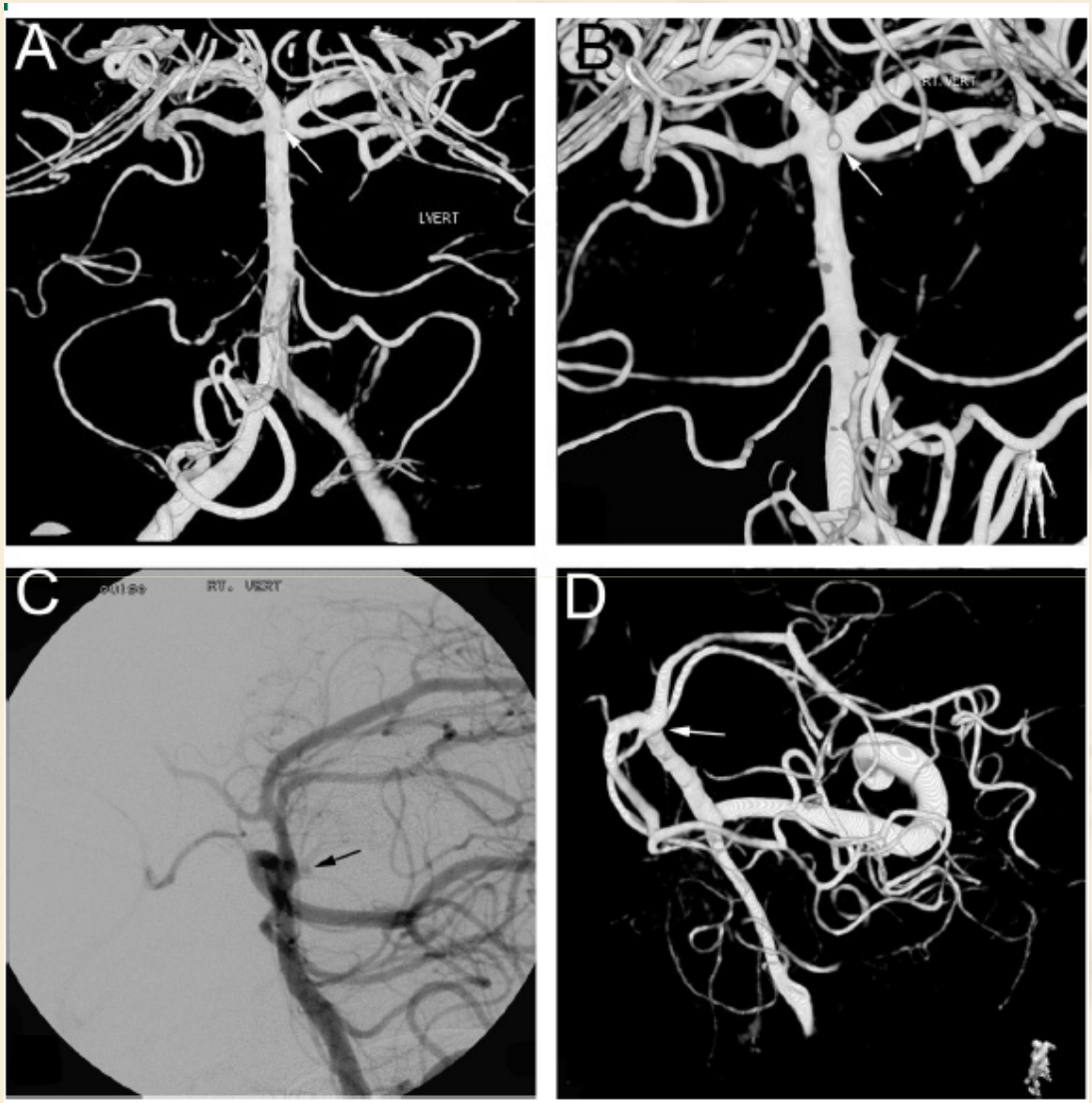
Perimesencephalic nonaneurysmal hemorrhage associated with vein of Galen stenosis

Figure Noncontrast head CT of case 1 at presentation (A) and at 3 days (B)



Catheter angiographic study (lateral projection) in case 1 verifies the stenosis at the junction of the vein of Galen with straight sinus (arrow), prominent inferior vermian vein which filled in retrograde fashion on serial angiographic frames, and slight hypervascularity of venous drainage in the vermis (C). In retrospect, vein of Galen stenosis (arrow) was present in both cases on CT angiography (D = case 1; E = case 2).

Marlon S. Mathews et al,
Neurology 2008



47 y/o woman with PM-SAH.

1st 3DRA negative for aneurysm.

2nd 3DRA and conventional DSA showed a 1.2mm saccular aneurysm in dorsal aspect of B.A 2 wks later.

(Fig. B, C)

3rd 3DRA 18 days after 2nd one, aneurysm vanished again (Fig.D)

J. Bradley White et al. *Neurology, 2008*

Why fluctuating appearance of aneurysm?

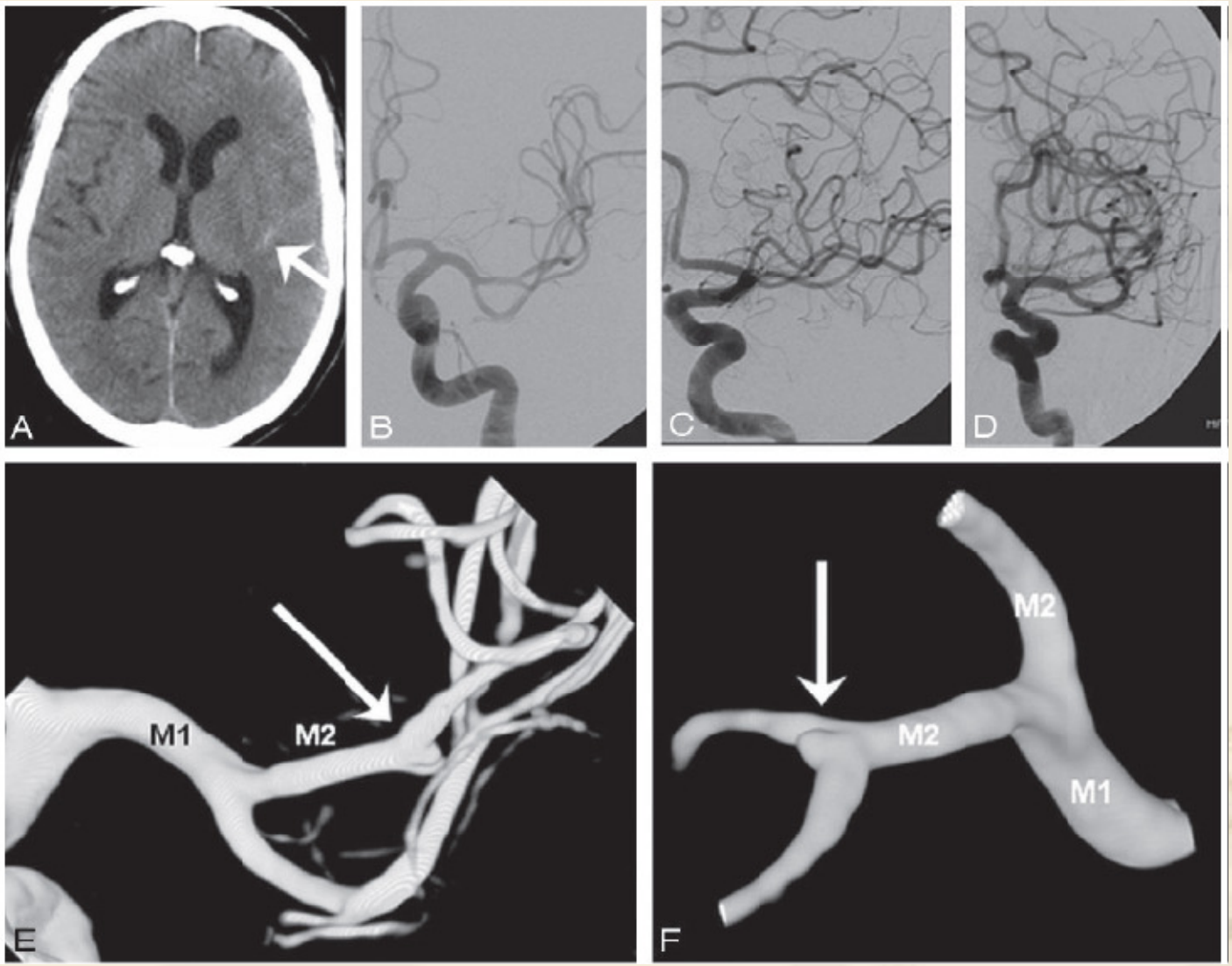
- Tiny aneurysm difficult to resolve on angiography.
- Possibly thrombosis of aneurysm after rupture, and then recanalization.

Additional Value of 3D Rotational Angiography in Angiographically Negative Aneurysmal Subarachnoid Hemorrhage: How Negative Is Negative?

AJNR 2008; 29: 962-66

- 298 pts with suggested ruptured aneurysm received DSA exam , 98 pts DSA negative.
- 23 pts further 3DRA.
- 75 pts did not, as 4 very old age and 1 died soon. 70 low clinical suggestion of ruptured aneurysm (30 CSF confirmed SAH, 24 PM-SAH, 8 IPH, 4 IVH, 3 traumatic, 1 SDH)
- 18 of 23 pts with (78%) 3DRA found aneuyrsm.
- Location: A-com (11), MCA (3), P-com (2), others(2)
- Size: 1-3 mm.

AJNR 2008; 29: 962-66



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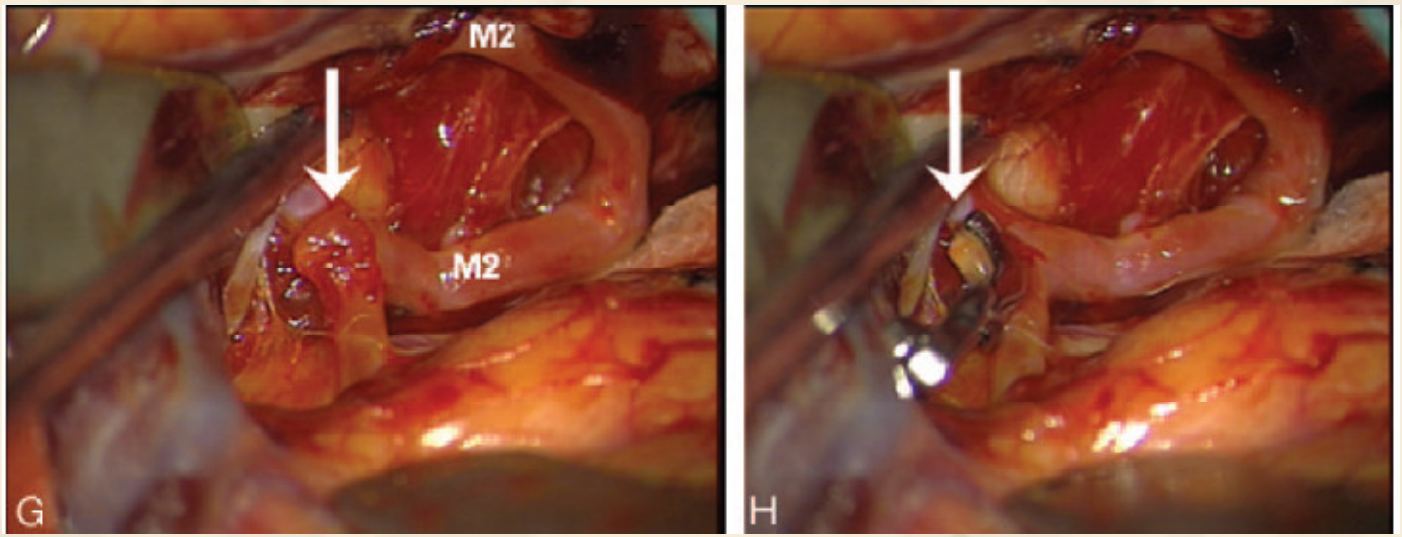
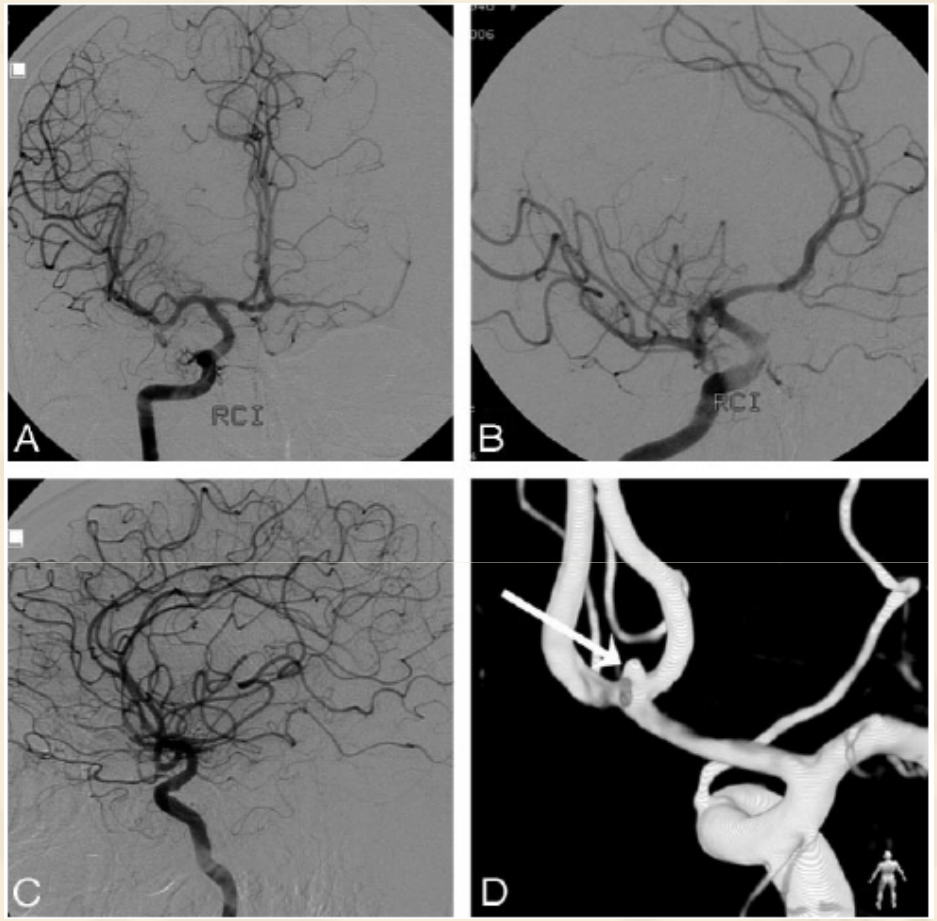


Compatible with a small aneurysm (1mm) in M2-M3 junction

AJNR 2008; 29: 962-66



Negative DSA and posterior view of 3DRA revealed a 1.6 mm aneurysm in A-com

Experience from Sin-Lau Hospital

- 82 pts with spontaneous SAH (46 F, 36 M, mean age: 61.1 ± 14.1) in the past 3 years.
- 68 pts has hypertension
- 69 pts received conventional angiography or CTA at least once.
- 17 pts (24.6%) had no intracranial aneurysm in first angiography
- 8 of 17 pts found aneurysm in repeated angiography (false negative: 47%)

Analysis of the 17 pts with first angiography negative

- mean age :56.5 ± 13.3.
- 4 out of these 17 cases were assumed diffuse SAH and cerebral edema resulting in obscured aneurysm.
- 1 considered sepsis with coagulopathy, another 1 was assumed venous thrombosis.
- 3 pts with perimencephalic SAH without aneurysm in repeated angiography.
- Aside from the 4 critical pts, the remaining 13 pts had better outcome at discharge by mRS (Mantel-Haenszel $\chi 2 = 17.066$, df=1, P value<0.001)

Take home message

- In spontaneous SAH with initial angiographic negative for aneurysm, about 24% find aneurysm in repeated angiography.
- PMSAH usually has low false negative rate of aneurysm and better outcome.
- PMSAH possibly resulted from venous hemorrhage or microaneurysm from perforating arteries.
- Repeated angiography is indicated in nonPM-SAH when initial angiography is negative.

- 謝謝聆聽