

RADY 401 Case Presentation

Kimberly Mournighan, MS4
UNC School of Medicine
July 2018

Ed. John Lilly, MD



SCHOOL OF MEDICINE
Radiology

65-year-old woman presents with
the worst headache of her life

Focused patient history and workup

HPI:

65yoF w/ PMH of HTN and atrial fibrillation (on apixiban).

Pt was resting at home when she experienced sudden onset excruciating headache with associated blurry vision and nausea.

She reports no vomiting, confusion, lethargy.

Physical Exam:

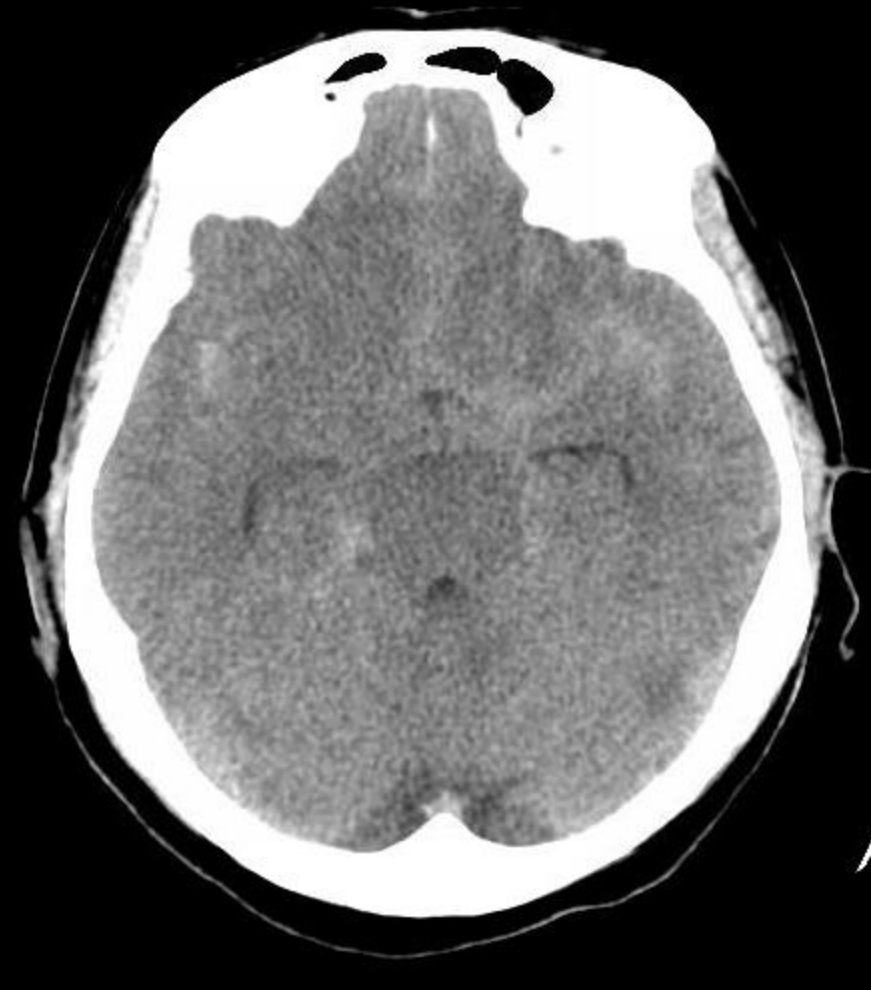
All exam components, including neurologic exam, within normal limits:

Eyes open spontaneously, Oriented to name, location, time, Pupils equal and reactive bilaterally, Extraocular movements intact bilaterally, Facial sensation intact V₁-V₃ bilaterally, Face symmetric, Tongue protrudes in the midline, Full shrug bilaterally, Motor strength 5/5 x 4, No pronator drift, Absent Hoffman sign bilaterally, Absent ankle clonus bilaterally, Sensation to light touch intact throughout

List of imaging studies

- CT head w/o contrast
- CTA
- IR angiogram

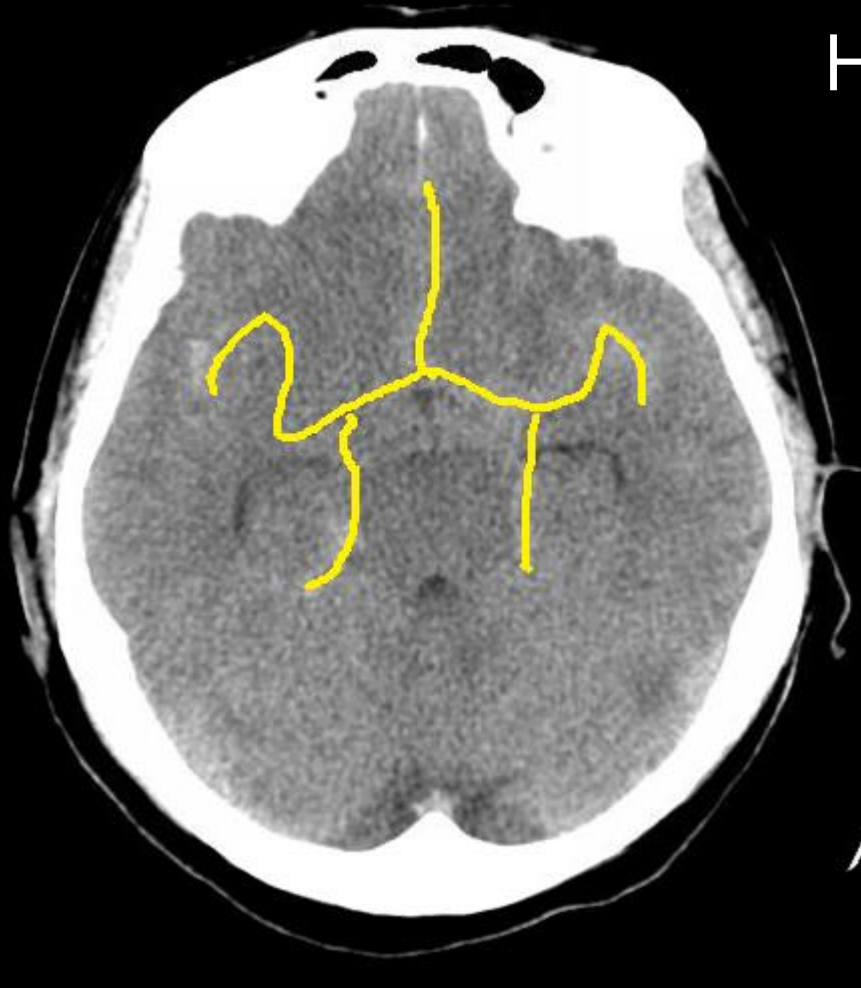
CT head without contrast (axial and sagittal)



Findings?

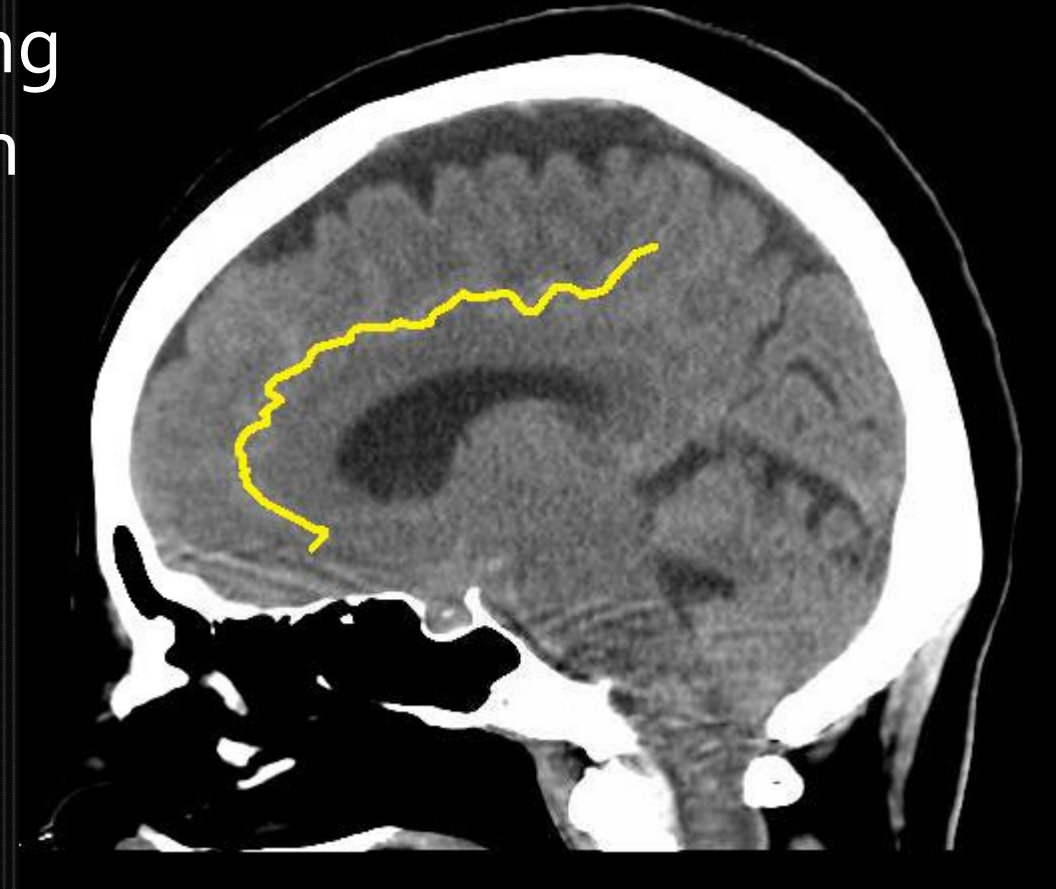


CT head without contrast



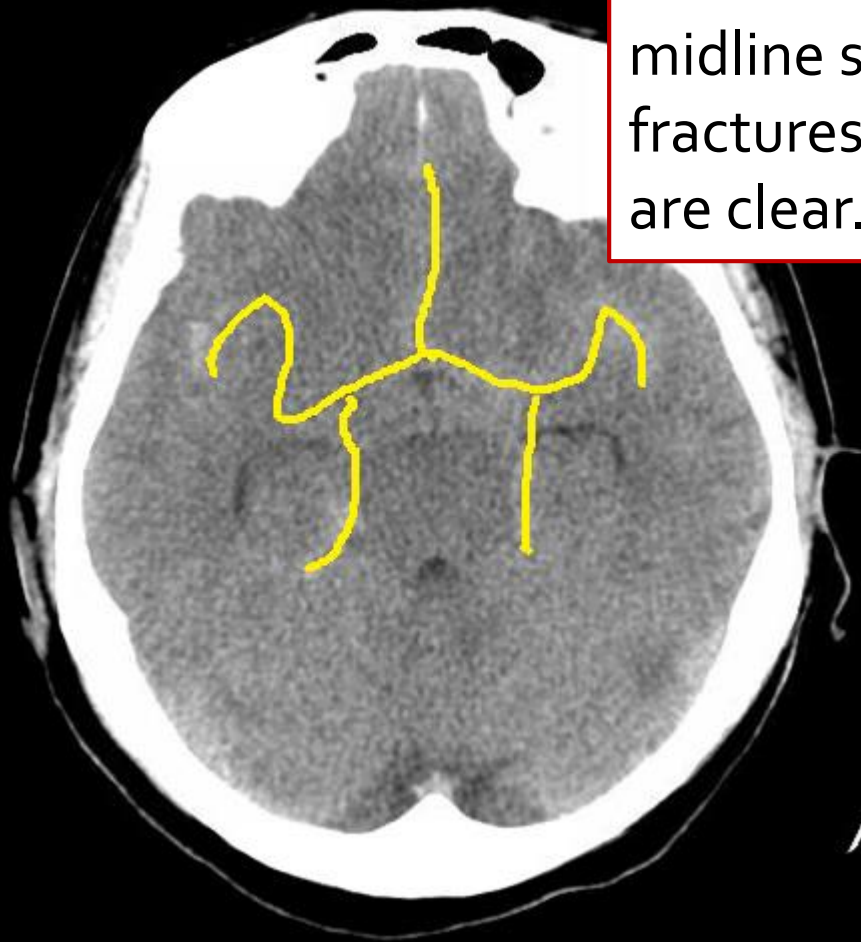
Hyperattenuating material is seen filling the subarachnoid space

Most likely etiology?



CT head with

Diffuse subarachnoid hemorrhage through the interhemispheric fissures, bilateral sylvian fissures, ambient cisterns, left frontotemporal sulcus, and small volume layering intraventricular blood at the occipital horns of the lateral ventricles. Mildly prominent third ventricle and temporal horns of lateral ventricle. There is no midline shift or mass lesion. There is no evidence of acute infarct. No fractures are evident. The sinuses are pneumatized. Mastoid air cells are clear.

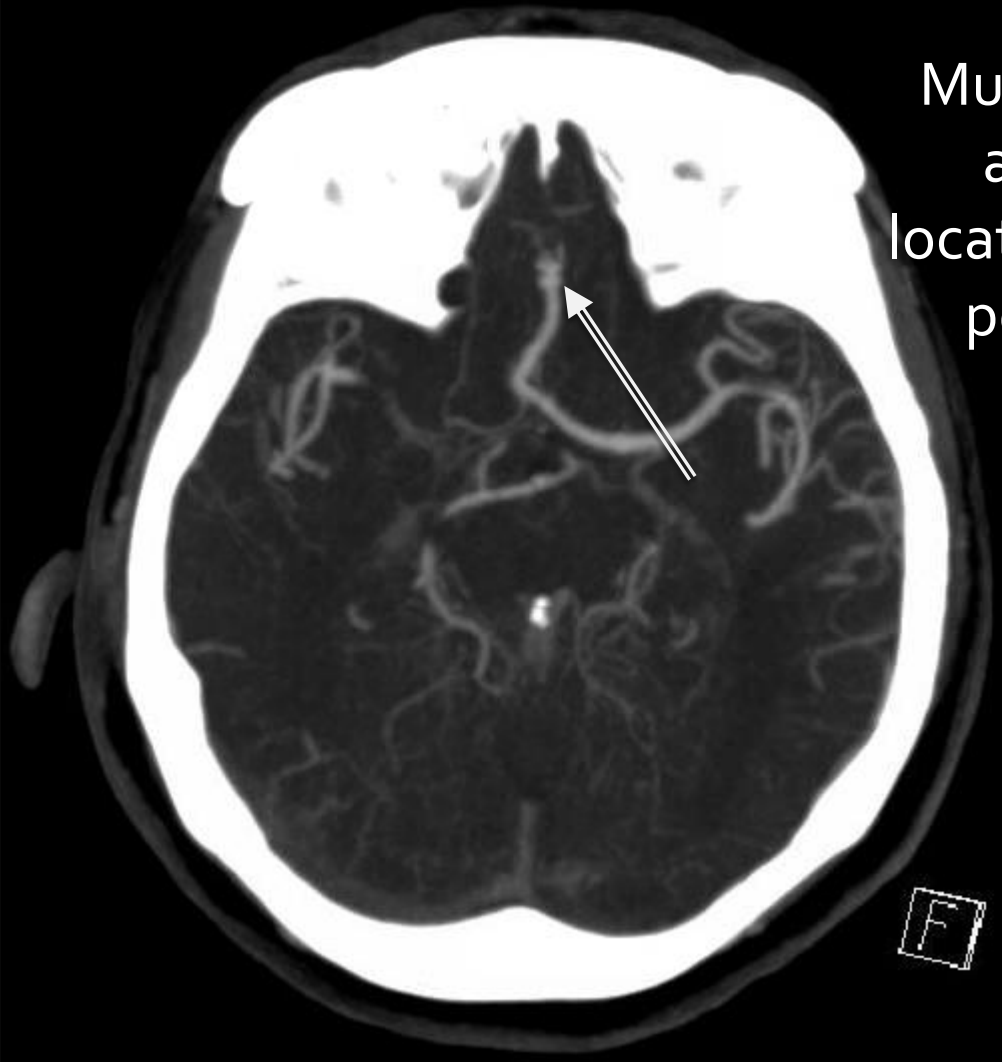


lining the
subarachnoid
space

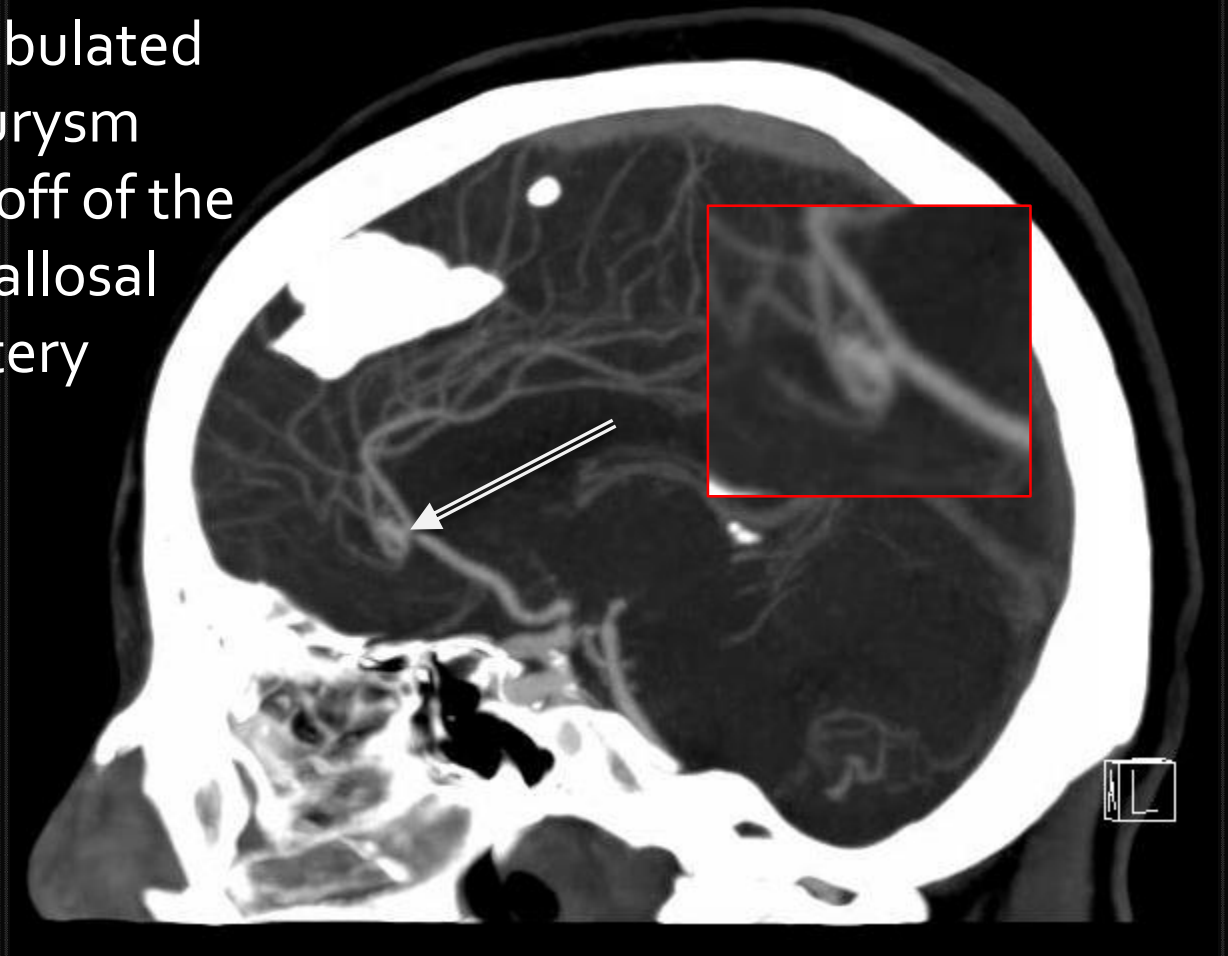
Most likely
etiology?



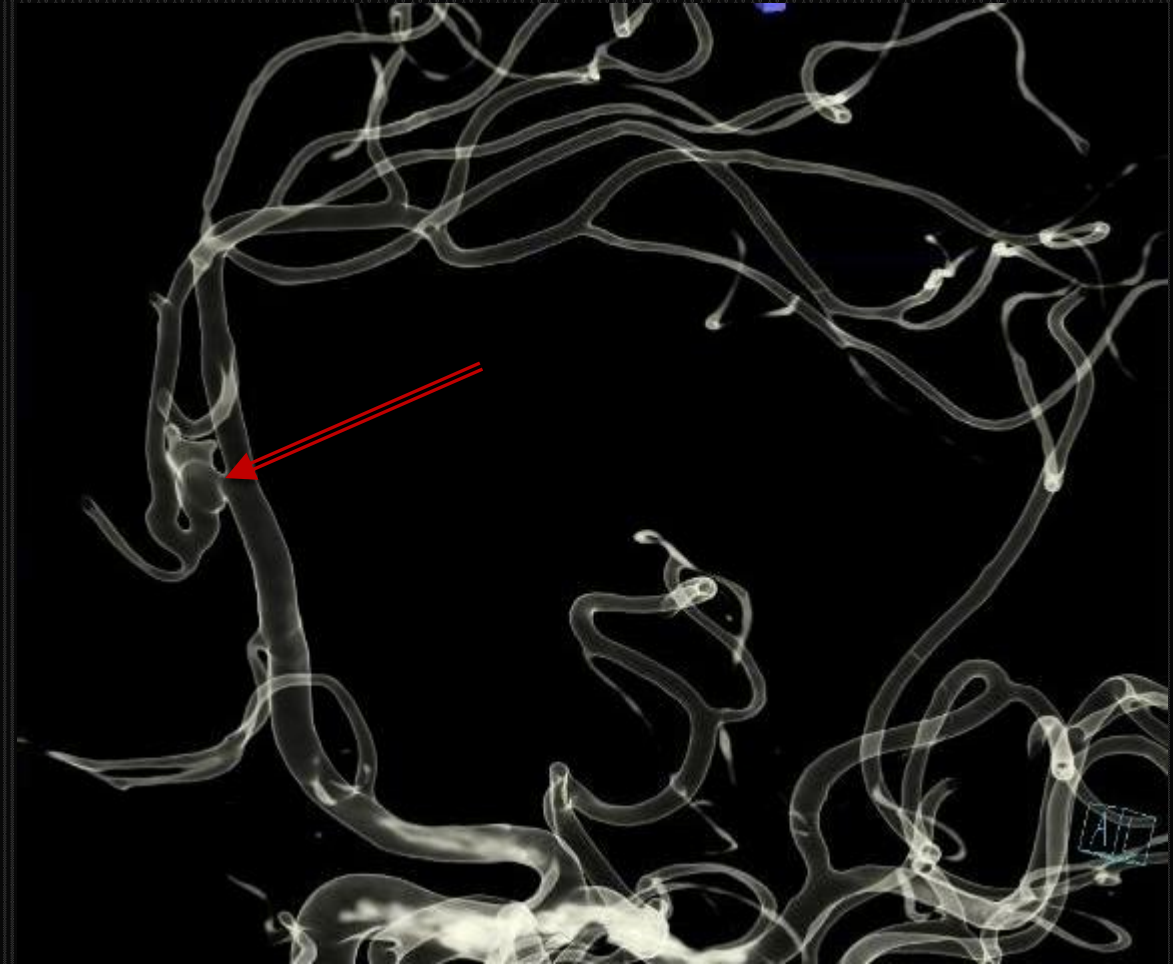
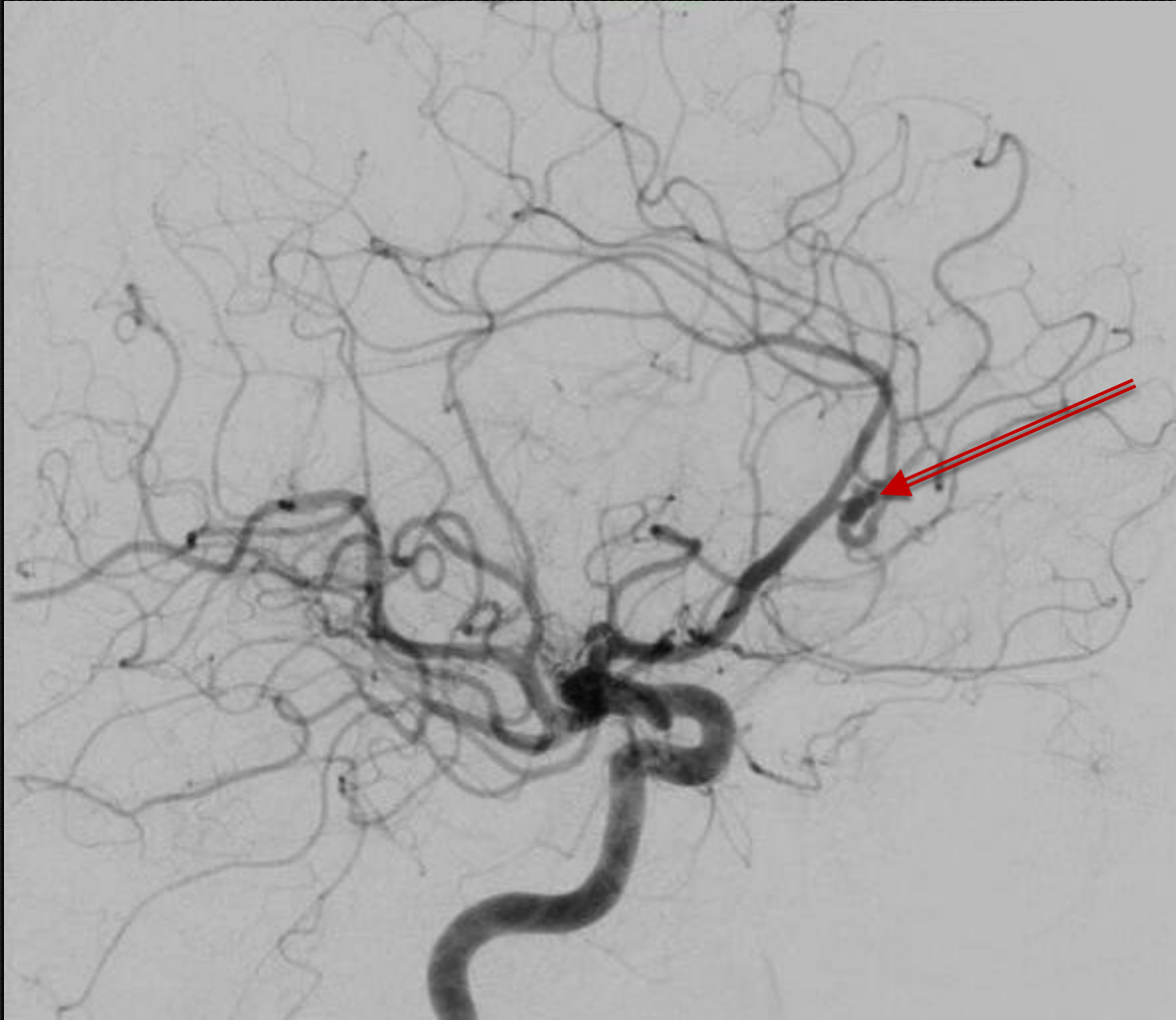
CT Angiogram



Multilobulated
aneurysm
located off of the
pericallosal
artery

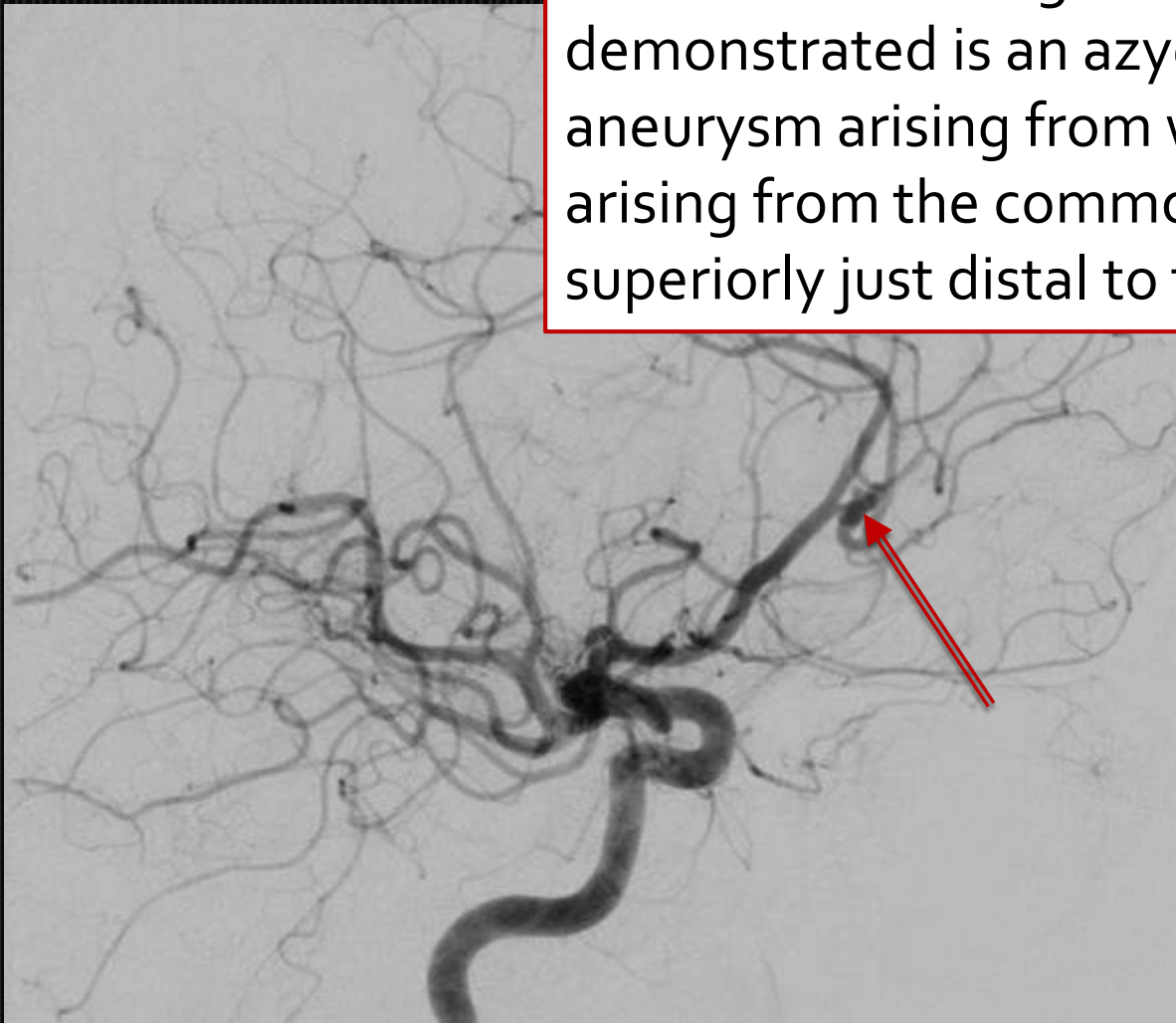


IR cerebral angiogram (with 3-D rotational angiogram)

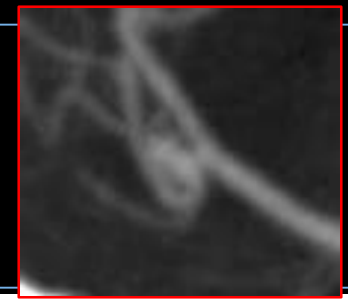


IR cerebral an

Left internal carotid artery injection demonstrates opacification of the left middle and anterior cerebral arteries. There is opacification of the left posterior cerebral artery and flash filling of the basilar artery with its branches through the posterior communicating artery. Again demonstrated is an azygos A2 segment. There is a small irregular aneurysm arising from what appears to be a left pericallosal artery arising from the common A2 segment. The aneurysm is directed superiorly just distal to the origin of the A3 segment.



Patient treatment: Aneurysm clipping

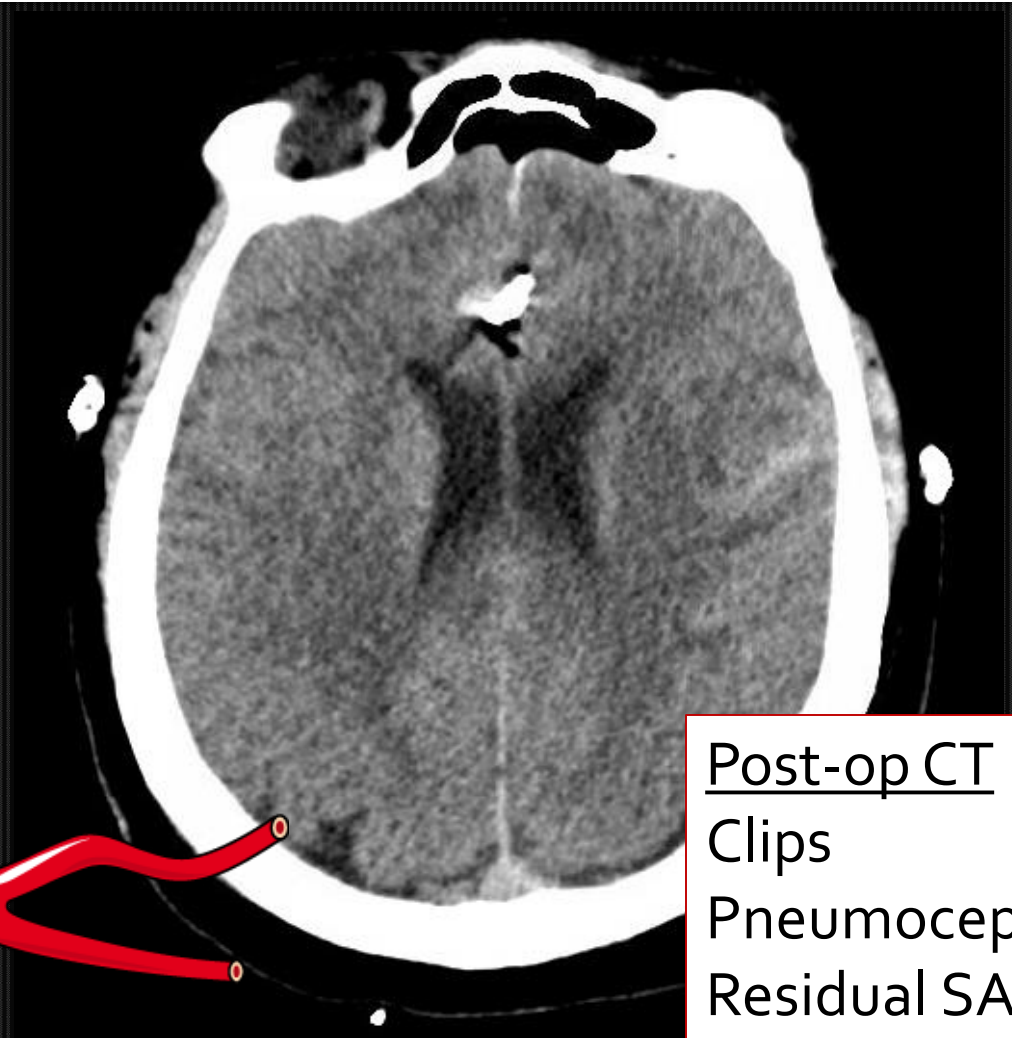
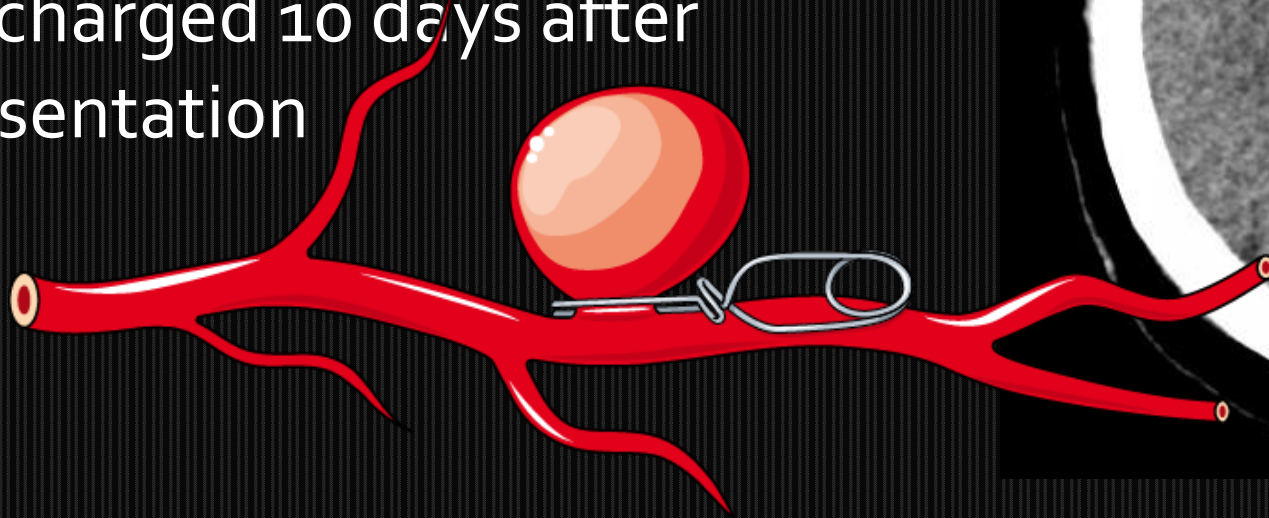


From Op Note for right frontal craniectomy for clipping of pericallosal aneurysm

- It was decided that surgical clipping may be the best therapeutic option considering the small size of the aneurysm and the relatively wide neck.
- Upon approaching the aneurysm we then dissected posteriorly to find the distal A₃ vessels thought to be arising from the aneurysm and utilized this to orient ourselves anatomically towards the aneurysm. We then focused our dissection inferior and anterior to reach the proximal A₃ vessel. During this portion we first noted a small amount of arterial bleeding followed by a brisk rush of blood revealing an intraoperative rupture. The patient was placed in burst suppression and the bleeding was quickly stopped over approximately several minutes with modest blood loss and the use of temporary clips. No change was observed in neurophysiologic monitoring during this time period. We then focused on further revealing the aneurysm which appeared multiobular/fusiform in appearance. We placed three small mini clips along the origin of the aneurysm taking care to preserve a small callosal marginal branch arising at the base of the aneurysm. The temporary clips were then removed. Intraoperative ICG was then performed which demonstrated good flow into the parent vessels without flow into the aneurysm.

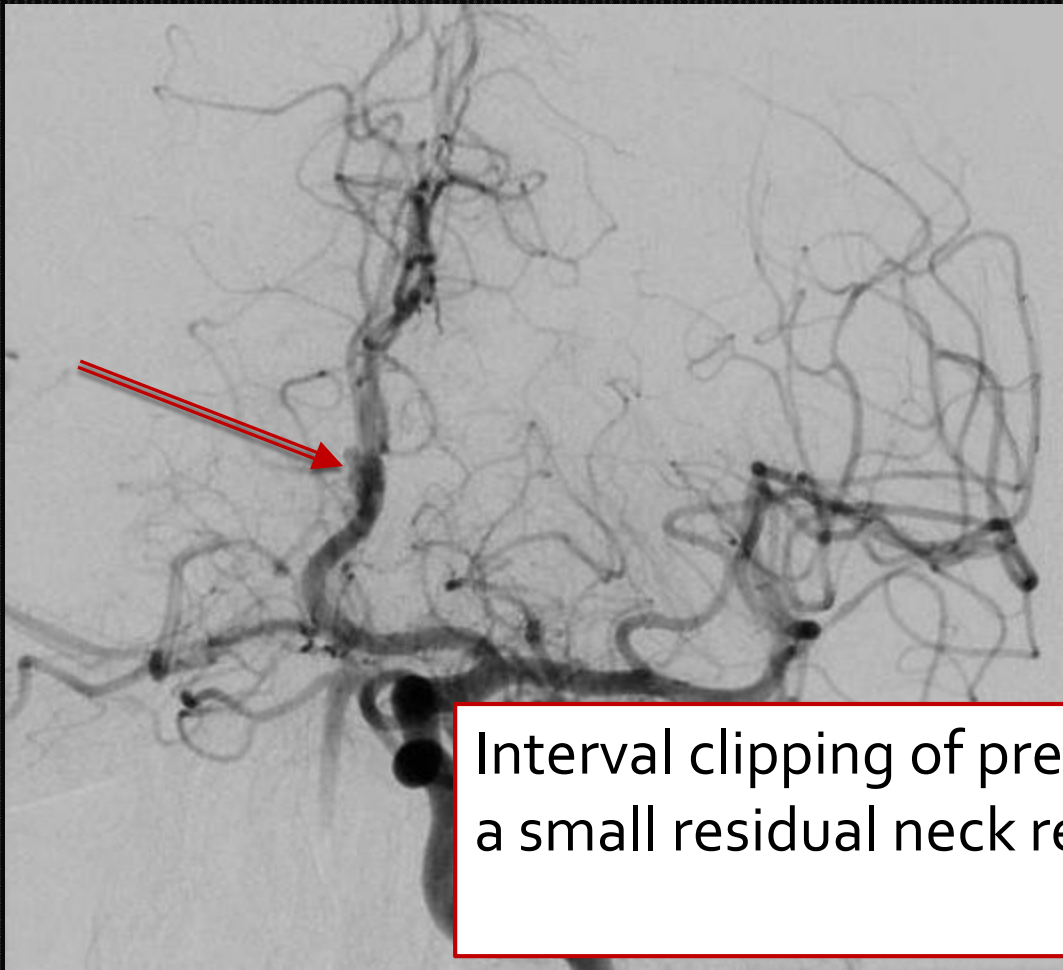
Patient treatment or outcome

- Pt underwent right frontal craniectomy for clipping of pericallosal aneurysm
- Intraoperative rupture controlled
- Monitored in NSICU
- Discharged 10 days after presentation



Post-op CT
Clips
Pneumocephalus
Residual SAH

Intraoperative fluoroscopy

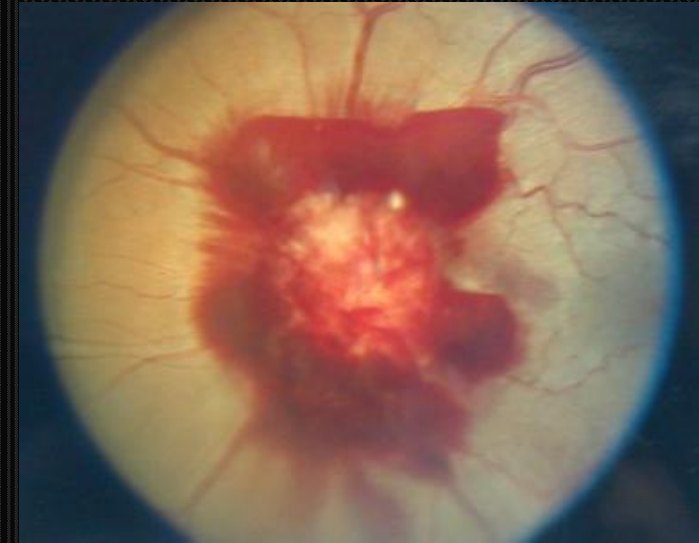


Interval clipping of previously seen pericallosal artery aneurysm, with a small residual neck remnant.

Discussion: Subarachnoid Hemorrhage⁵

- 10% of hemorrhagic strokes
- ~50% fatality rate
- Typically occurs in the setting of trauma or ruptured aneurysm
- Clinical Presentation
 - 97% experience sudden, severe headache
 - AMS, vomiting
 - Preretinal subhyaloid hemorrhages
=> Terson Syndrome
 - Lack of lateralizing neurologic signs

A thunderclap headache (TCH) is a very severe headache of abrupt onset that reaches its maximum intensity within **one minute or less** of onset



<https://emedicine.medscape.com/article/1227921-overview>

Discussion^{1,2}

- ACR Appropriateness Criteria for initial diagnosis:¹
 - CT head non contrast
 - Brain MRI
- Lumbar Puncture²

Clinical Condition: Headache

Variant 3: Sudden onset of severe headache (“Worst headache of my life”, “thunderclap headache”).

| Radiologic Procedure | Rating | Comments | RRL* |
|---------------------------------------|--------|--|------|
| CT head without IV contrast ← | 9 | | ⊗⊗⊗ |
| CTA head with IV contrast ← | 8 | | ⊗⊗⊗ |
| MRA head without and with IV contrast | 7 | | ○ |
| MRA head without IV contrast | | | |
| Arteriography cervicocerebral | | | |
| MRI head without IV contrast | 7 | depending on CT findings. Include FLAIR and GRE or SWI in this procedure. | ○ |
| MRI head without and with IV contrast | 6 | Include FLAIR and GRE or SWI in this procedure. This procedure may be helpful after CT depending on CT findings. | ○ |
| CT head without and with IV contrast | 5 | | ⊗⊗⊗ |
| CT head with IV contrast | 3 | | ⊗⊗⊗ |

Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate

*Relative Radiation Level

CT sensitivity in the first 6 hours after onset of headache is nearly 100%!⁷

Discussion^{1,2}

- ACR Appropriateness Criteria for initial diagnosis:¹
 - CT head non contrast
 - Brain MRI
- Lumbar puncture²

The sensitivity of head CT for detecting SAH is highest in the first 6 to 12 hours after SAH (nearly 100 percent) and then progressively declines over time to about 58 percent at day five. FLAIR and T2 sequences on MRI may have comparable sensitivity to CT. Additionally, they have a high sensitivity in patients with a subacute presentation of SAH (eg, >4 days from the bleed)

Failure to obtain a head CT scan at initial contact was the most common error, occurring in 73 percent of misdiagnosed patients.

You MUST do lumbar puncture if there is suspicion for SAH despite normal head CT. Classic findings of SAH are elevated opening pressure and elevated red blood cell count that does not decrease from CSF tube one to tube four (one study proposed 63% reduction-- Czuczman).

| | | |
|---|---|---------------------------|
| CT head with IV contrast | 3 | ☼☼☼ |
| <u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate | | *Relative Radiation Level |

Discussion

- Determining cause⁵
 - Digital subtraction angiography is the gold standard
 - CTA
 - MRA
- Grading severity⁵
 - Hunt and Hess grade – based on neurologic status
 - Fisher grade – based on CT findings

| Grade | Neurologic status |
|-------|---|
| 1 | Asymptomatic or mild headache and slight nuchal rigidity |
| 2 | Severe headache, stiff neck, no neurologic deficit except cranial nerve palsy |
| 3 | Drowsy or confused, mild focal neurologic deficit |
| 4 | Stuporous, moderate or severe hemiparesis |
| 5 | Coma, decerebrate posturing |

| Group | Appearance of blood on head CT scan |
|-------|--|
| 1 | No blood detected |
| 2 | Diffuse deposition or thin layer with all vertical layers (in interhemispheric fissure, insular cistern, ambient cistern) less than 1 mm thick |
| 3 | Localized clot and/or vertical layers 1 mm or more in thickness |
| 4 | Intracerebral or intraventricular clot with diffuse or no subarachnoid blood |

Discussion

A system proposed by Ogilvy and Carter stratifies patients based upon age, Hunt and Hess grade, Fisher grade, and aneurysm size. In addition to predicting outcome (~80% had good to excellent outcomes in grades 0 to 2), this scale more accurately substratifies patients for therapy.

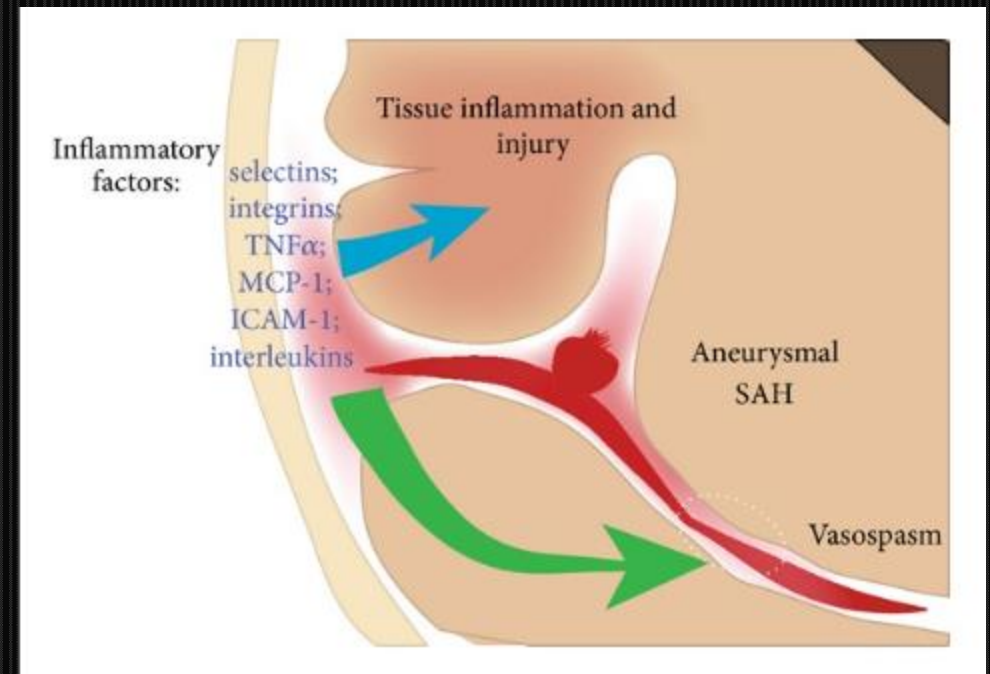
- Determining cause⁵
 - Digital subtraction angiography is the gold standard
 - CTA
 - MRA
- Grading severity⁵
 - Hunt and Hess grade – based on neurologic status
 - Fisher grade – based on CT findings

| Grade | Neurologic status |
|-------|---|
| 1 | Asymptomatic or mild headache and slight nuchal rigidity |
| 2 | Severe headache, stiff neck, no neurologic deficit except cranial nerve palsy |
| 3 | Drowsy or confused, mild focal neurologic deficit |
| 4 | Stuporous, moderate or severe hemiparesis |
| 5 | Coma, decerebrate posturing |

| Group | Appearance of blood on head CT scan |
|-------|--|
| 1 | No blood detected |
| 2 | Diffuse deposition or thin layer with all vertical layers (in interhemispheric fissure, insular cistern, ambient cistern) less than 1 mm thick |
| 3 | Localized clot and/or vertical layers 1 mm or more in thickness |
| 4 | Intracerebral or intraventricular clot with diffuse or no subarachnoid blood |

Discussion

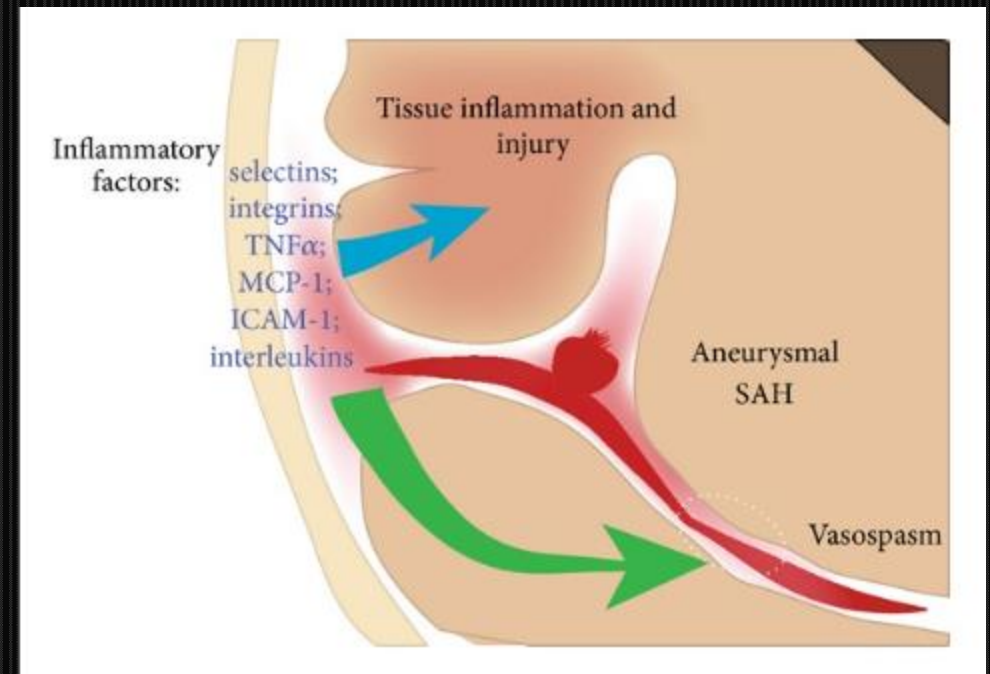
- Treatment^{3,4,6}
 - Microsurgical clipping or endovascular coil is equally effective
 - Complication Prophylaxis
 - Rebleeding
 - Vasospasm
 - Serial transcranial dopplers
 - Nimodipine x 3 weeks
 - Hydrocephalus
 - Hyponatremia 2/2 to SIADH or cerebral salt wasting
 - Seizures



Discussion

Sodium levels should be checked daily (goal >135)
Goal SBP <160 until aneurysm secured, <180 after securing – permissive hypertension to prevent ischemia (While lowering blood pressure may decrease the risk of rebleeding in a patient with an unsecured aneurysm, this benefit may be offset by an increased risk of infarction)
Keppra 500 BID until aneurysm secured and x7 days post op

- Treatment^{3,4}
 - Microsurgical
 - Complication Prophylaxis
 - Rebleeding
 - Vasospasm
 - Serial transcranial dopplers
 - Nimodipine x 3 weeks
 - Hydrocephalus
 - Hyponatremia 2/2 to SIADH or cerebral salt wasting
 - Seizures



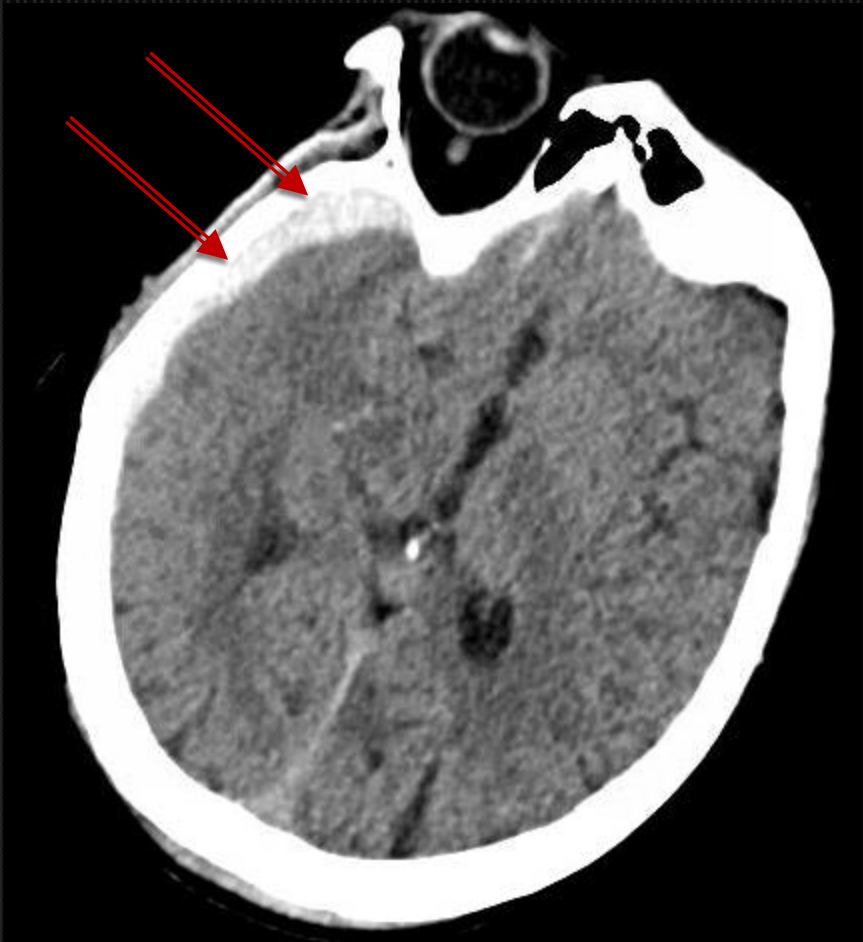
Discussion

1mSv = 4 months background radiation

~12-15mSv and about that much in thousands of dollars, but all pales in comparison to the total 40,000-185,000 for brain aneurysm repair

- Imaging Costs:^{1,10}
 - 3 CTs – 1-10 mSv x 3 / \$600 each
 - 1 CTA – 1-10 mSv / \$1500
 - 1IR angiogram – 1-10mSv / \$7,600
 - Intraop fluoro – 1-10mSv / ??
 - 1 CXR – 0.1mSv / \$70
 - 1 Abd XR – 0.1mSv / \$60
 - 1 Echo – 0mSV / \$600
 - 5 transcranial dopplers – 0mSV / \$180 each

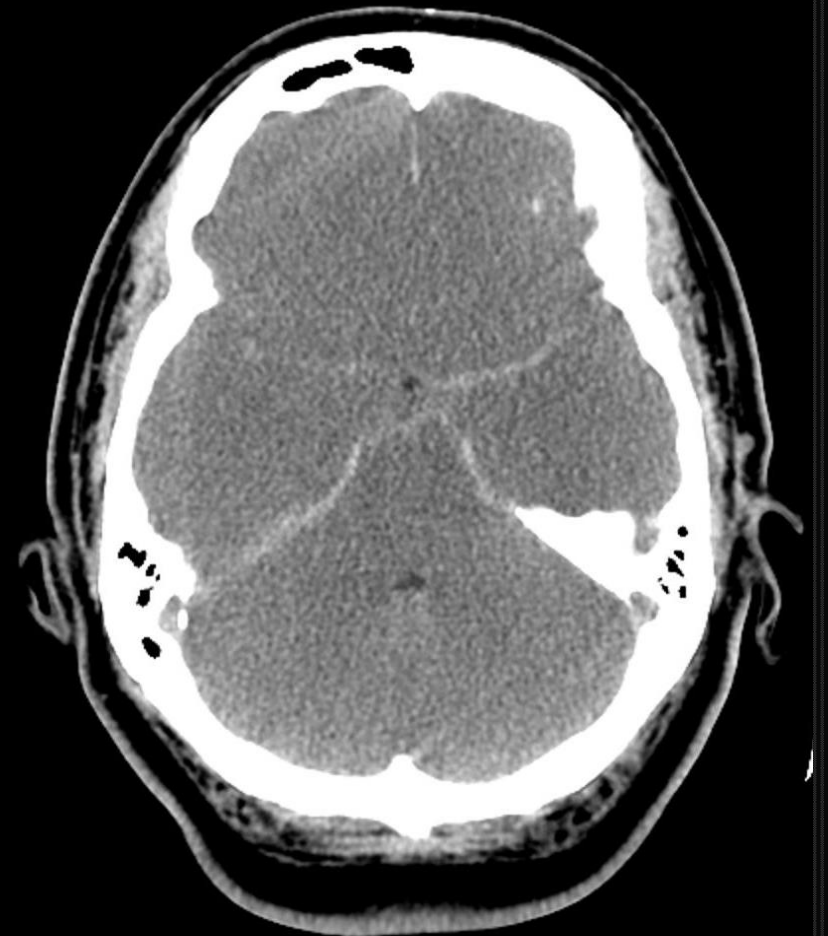
Companion Cases: SDH due to trauma



- Traumatic subdural hematoma (SDH) with small right frontal subarachnoid hemorrhage – note difference in distribution compared to aneurysm-related SAH

Companion Cases: Pseudo-SAH^{8,9}

- Pseudo-SAH is usually due to cerebral edema due to hypoxic ischemic brain injury



References

1. Acsearch.acr.org. (2018). Appropriateness Criteria. [online] Available at: <https://acsearch.acr.org/list> [Accessed 24 Jun. 2018]
2. Czuczman, A., et al. (2013). Interpreting red blood cells in lumbar puncture: distinguishing true subarachnoid hemorrhage from traumatic tap. *Academic Emergency Medicine*. 20(3):247-56.
3. Miller, B., et al. (2014). Inflammation, vasospasm, and brain injury after subarachnoid hemorrhage. *Biomed Research International*. doi: 10.1155/2014/384342.
4. Sandstrom, N., et al. (2013). Comparison of microsurgery and endovascular treatment on clinical outcome following poor-grade subarachnoid hemorrhage. *Journal of Clinical Neuroscience*. 20(9):123-8.
5. Singer, R., et al. (2013). Clinical manifestations and diagnosis of aneurysmal subarachnoid hemorrhage. *UpToDate*. Last updated Sep 26, 2013.
6. Singer, R., et al. (2014). Treatment of aneurysmal subarachnoid hemorrhage. *UpToDate*. Last updated Oct 7, 2014.
7. Perry, J., et al. (2011). Sensitivity of computed tomography performed within six hours of onset of headache for diagnosis of subarachnoid haemorrhage: prospective cohort study. *BMJ*. 2011;343:d4277
8. Case courtesy of Dr David Holcldorf, Radiopaedia.org, rID: 44918
9. Case courtesy of Dr Andrew Dixon, Radiopaedia.org, rID: 9345
10. Healthcare Bluebook. (2018). [online] Available at: <https://www.healthcarebluebook.com>