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Internal Carotid Artery Dissection

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Agenda

- Presentation of a clinical case
- Discussion of the clinical features of ICA dissection
- Discussion of the imaging modalities used to diagnose ICA dissection



Our Patient

- 29M with sudden onset of severe right-sided headache associated with exertion
- Pt called his primary care doctor who sent him to the emergency department for evaluation
- Normal neurological exam with no focal findings
- Non-contrast head CT and CT angiogram were performed to rule out subarachnoid hemorrhage



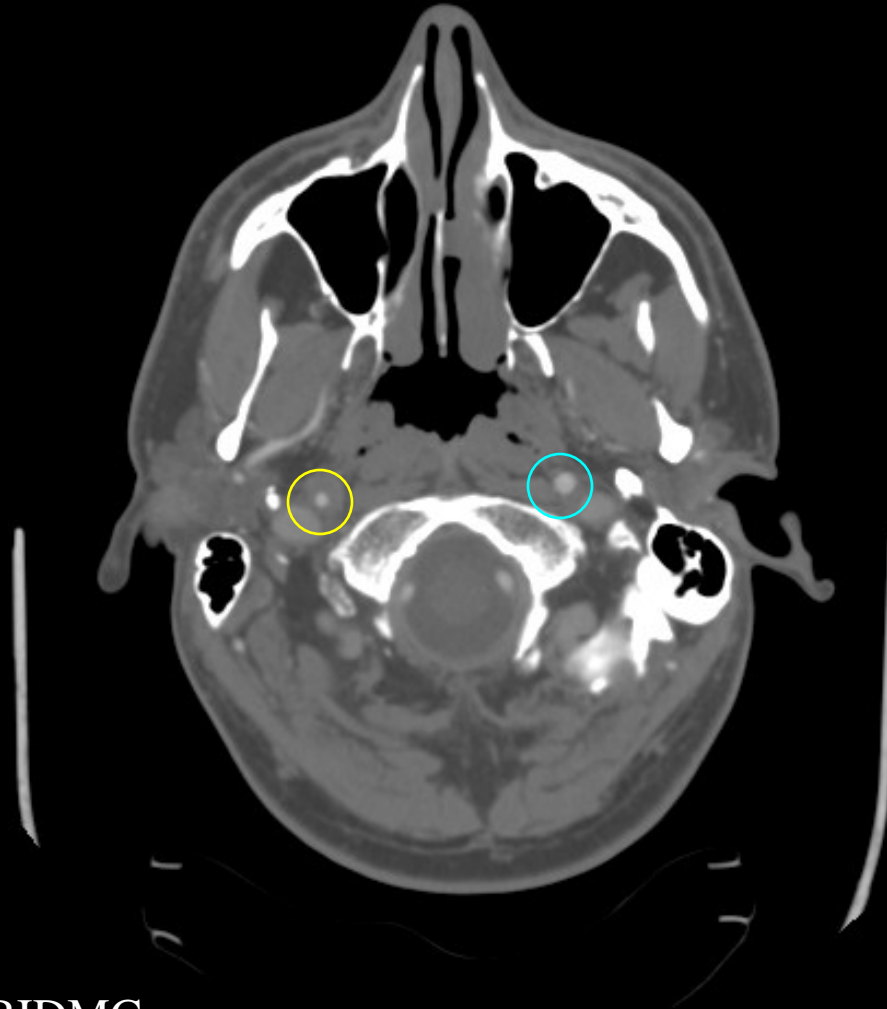
Our Patient: Non-Contrast Head CT



Final read:
negative for
acute
intracranial
process

Our Patient: CTA

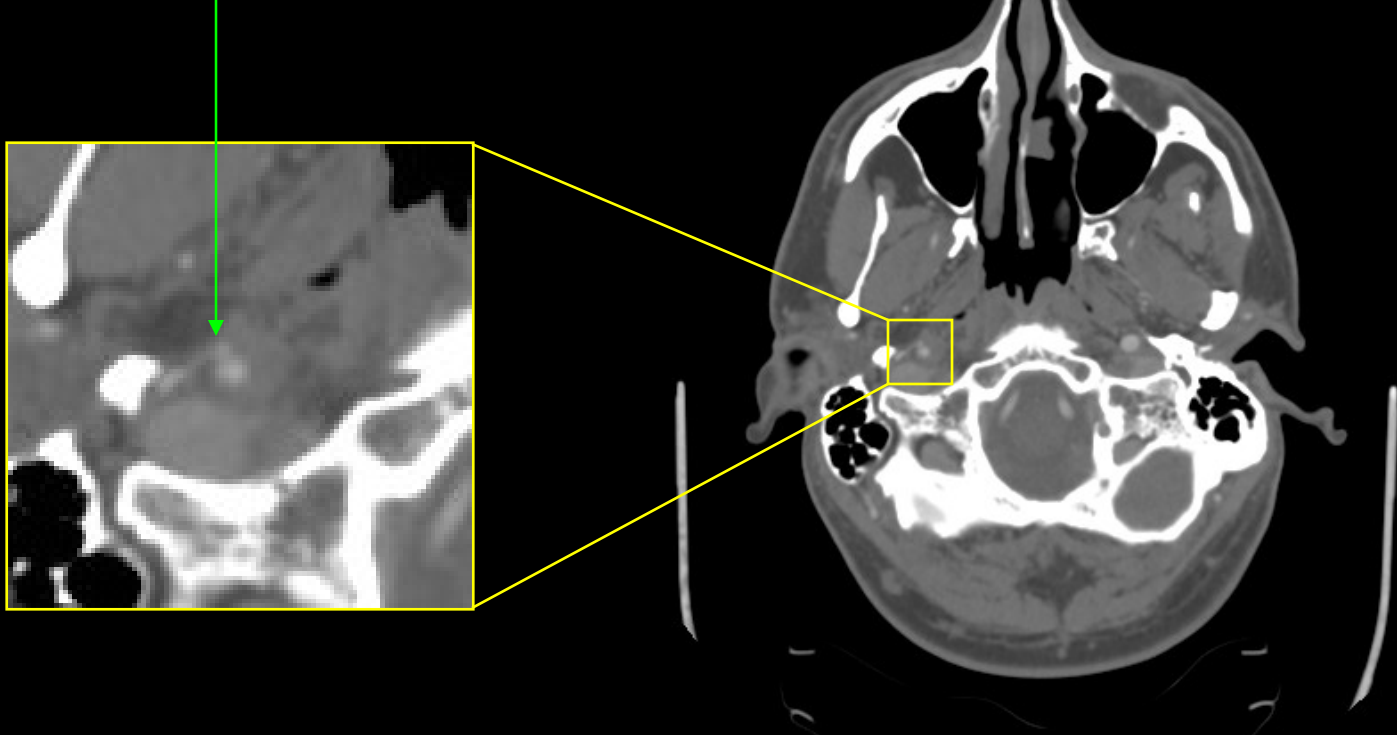
Right ICA
with
slightly
narrowed
lumen



Left ICA
with normal
lumen

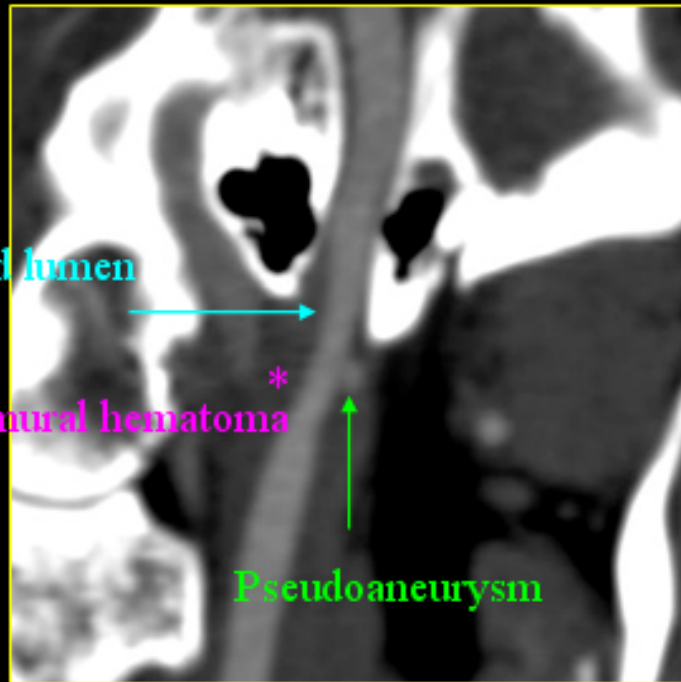
Our Patient: Pseudoaneurysm on CTA

Pseudoaneurysm



Right ICA

Our Patient: Narrowed Carotid on CTA

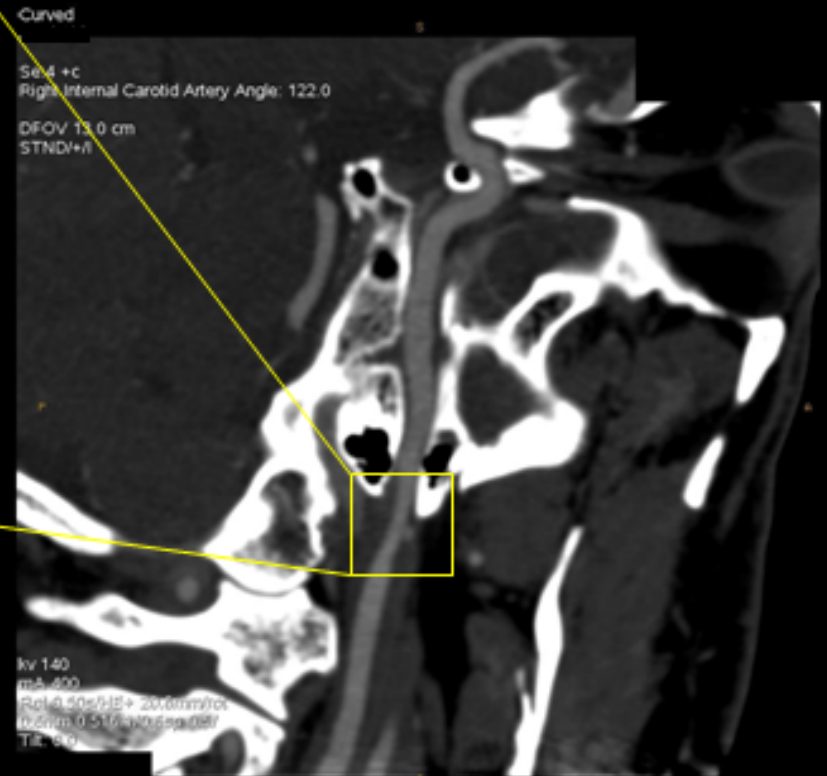


Narrowed lumen

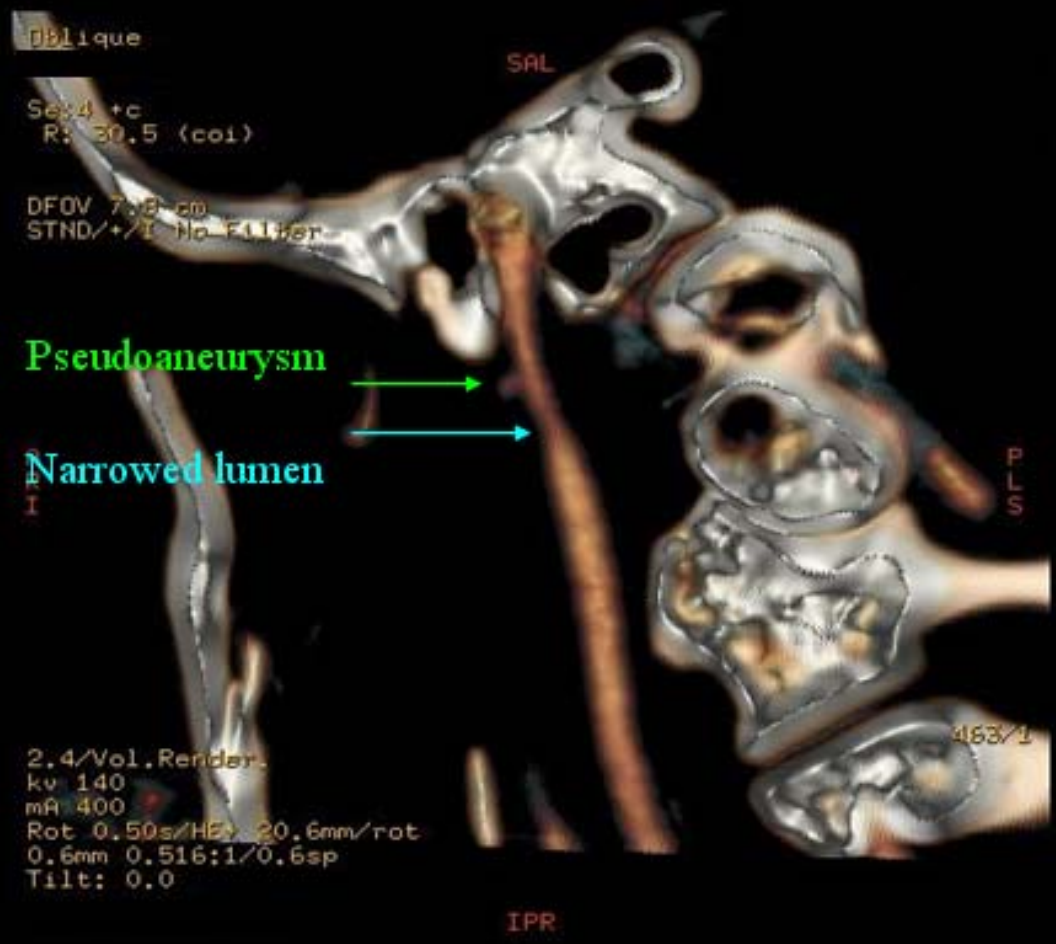
Intramural hematoma *

Pseudoaneurysm

Right ICA



Our Patient: CTA Reconstruction



CTA reconstruction
Image from PACS, BIDMC



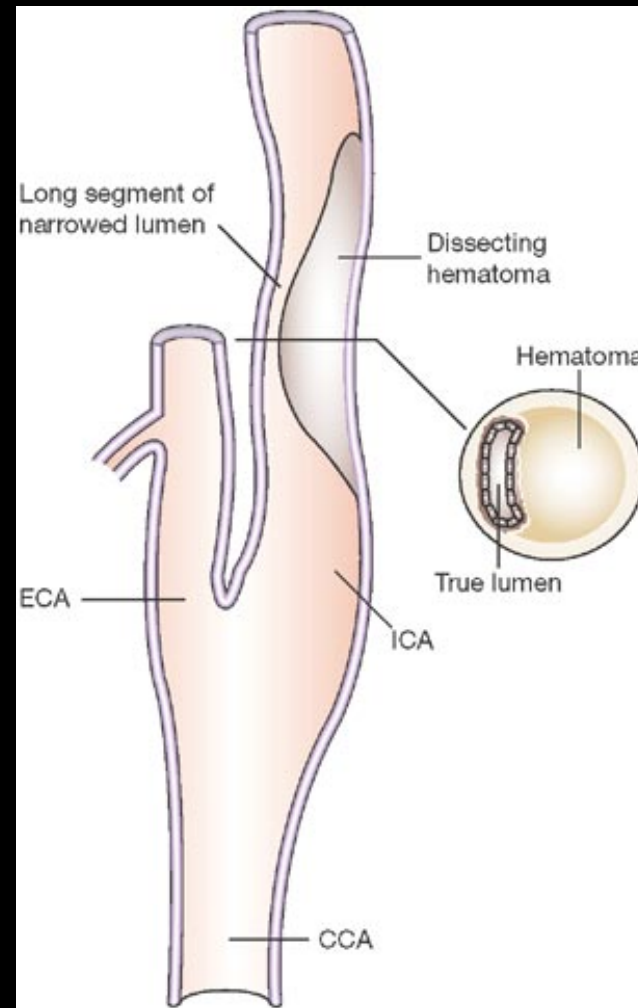
Clinical Features of ICA Dissection

- Tends to occur in young and middle-aged adults
- Unilateral pain in head, face, or neck
- Unilateral Horner's syndrome (oculosympathetic palsy: miosis and ptosis)
- Cerebral or retinal ischemia
- Cranial nerve palsies (in ~12% of pts)
- Pulsatile tinnitus
- Objective bruit
- Due to its diversity of clinical features, imaging plays a key role in diagnosis!



Pathophysiology

- Usually arises from an intimal tear
- Intramural hematoma forms, compressing lumen
- Subintimal dissection leads to lumen stenosis
- Subadventitial dissection leads to pseudoaneurysm formation





Pathogenesis - Genetic Factors

- Underlying structural defect of the arterial wall
 - * Identified in only 1-5% of pts with spontaneous ICA or vertebral dissection
 - Ehlers-Danlos Syndrome (particularly Type IV)
 - Marfan's Syndrome
 - Autosomal Dominant Polycystic Kidney Disease
 - Osteogenesis Imperfecta Type I
- 15% of pts with spontaneous dissection have evidence of fibromuscular dysplasia



Pathogenesis - Environmental Factors

- History of a minor precipitating trauma
 - Yoga
 - Painting a ceiling
 - Coughing, vomiting, sneezing
 - Undergoing anesthesia
- Chiropractic manipulation
 - ~ 1 in 20,000 causes a stroke
- Seasonal variation (most present in the fall)
 - Possibly an infectious trigger?
- Atherosclerosis is *uncommon* in pts with dissection



Differential Diagnosis

- Fibromuscular dysplasia
- Dysgenesis of the ICA
- Other causes of arterial thickening:
 - Atherosclerosis
 - History of radiation treatment
 - Takayasu arteritis
 - Bechet's disease
 - Giant cell arteritis



Treatment

- To prevent thromboembolic complications:
 - Anticoagulate with IV heparin
 - Bridge to oral warfarin, INR 2.0-3.0 for 3-6 months
- Contraindications:
 - Intracranial hemorrhage
 - Intracranial extension of the dissection
- No randomized controlled trials have proven the effectiveness of anticoagulation
 - However, imaging suggests ~ 90% of infarcts secondary to dissection are thromboembolic rather than hemodynamic in origin



Imaging in ICA Dissection

- ACR Appropriateness criteria for:
 - Sudden onset severe headache
 - Suspected ICA dissection
- Findings on various imaging modalities:
 - Ultrasound (US)
 - Computed tomography angiography (CTA)
 - Magnetic resonance (MR)
 - Conventional angiography



Imaging for Sudden-Onset Severe Headache

Variant 3:

Sudden onset of severe headache (“Worst headache of one’s life”, “thunderclap headache”).

Radiologic Procedure	Rating	Comments	<u>RRL*</u>
CT head without contrast	9		☼ ☼ ☼
CTA head with contrast	8	Usage of CT vs MRI depends on local preference and availability.	☼ ☼ ☼
MRA head with or without contrast	8	Usage of CT vs MRI depends on local preference and availability. See statement regarding contrast in text under “Anticipated Exceptions.”	○
Arteriography cervicocerebral	7		☼ ☼ ☼
MRI head without contrast	7	May be helpful after CT depending on CT findings.	○
MRI head without and with contrast	6	May be helpful after CT depending on CT findings. See statement regarding contrast in text under “Anticipated Exceptions.”	○
CT head without and with contrast	6		☼ ☼ ☼
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Imaging for Suspected ICA Dissection

Variant 4: **Sudden onset of unilateral headache, or suspected carotid or vertebral dissection or ipsilateral Horner's syndrome.**

Radiologic Procedure	Rating	Comments	<u>RRL*</u>
CTA head and neck with contrast	8	Usage of CT versus MRI depends on local preference and availability.	☼ ☼ ☼
MRA head and neck with or without contrast	8	Usage of CT versus MRI depends on local preference and availability. See statement regarding contrast in text under "Anticipated Exceptions."	○
MRI head without and with contrast	8	With diffusion-weighted sequences. See statement regarding contrast in text under "Anticipated Exceptions."	○
MRI head without contrast	8	With diffusion-weighted sequences.	○
CT head without contrast	7		☼ ☼ ☼
Arteriography cervicocerebral	7		☼ ☼ ☼
CT head without and with contrast	6		☼ ☼ ☼
US carotid duplex	3		○
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level



ICA Dissection on US

- Possible findings include:
 - Mural hematoma and/or thrombus (thickened hypoechoic vessel wall)
 - Stenosis or occlusion
- Drawbacks:
 - Sensitivity decreases as the extent of stenosis decreases
 - Does not detect most pseudoaneurysms



Thickened
hypoechoic
vessel wall

Normal lumen

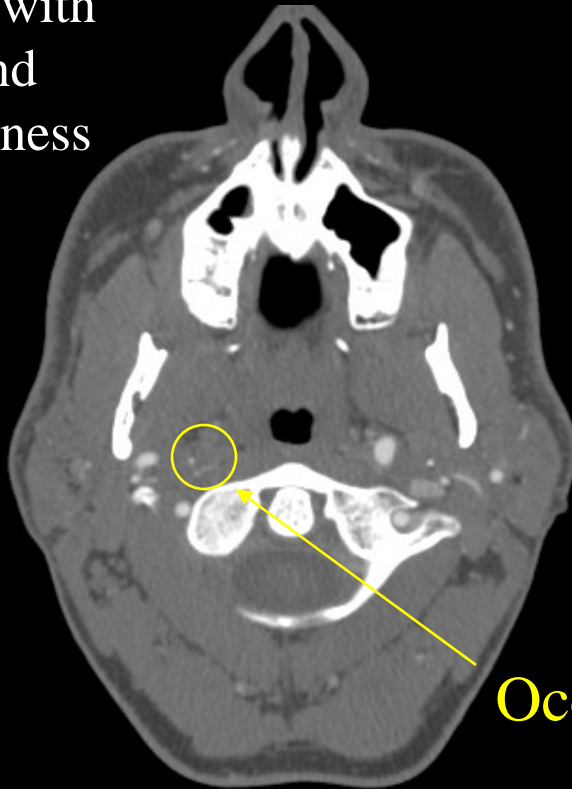


ICA Dissection on CTA

- Possible findings:
 - Narrow eccentric lumen with increased external diameter of the artery
 - Crescent-shaped region isoattenuating to surrounding muscles
 - Intimal flap
 - Pseudoaneurysm
- Drawbacks:
 - Bone artifacts at skull base
 - Dental artifacts

Companion Patient #1: Bilateral ICA Dissection on CTA

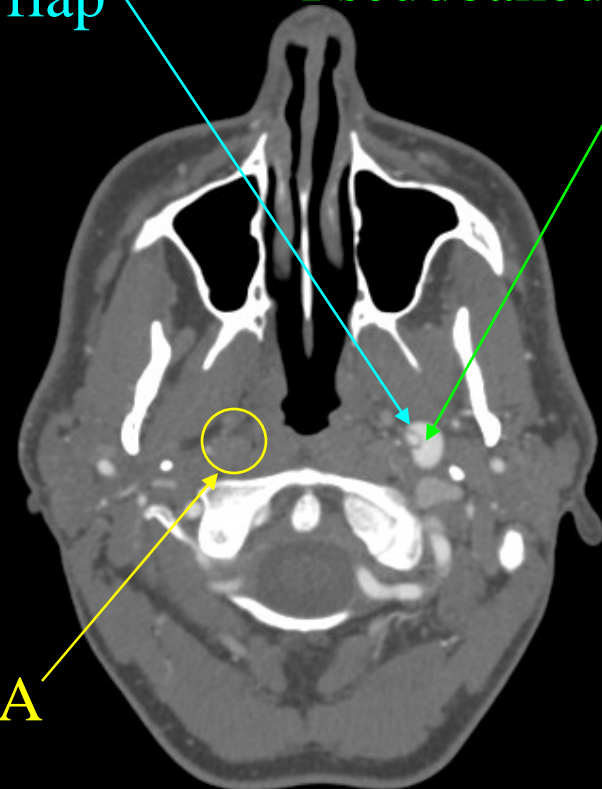
47M with
L hand
weakness



Occluded R ICA

Intimal flap

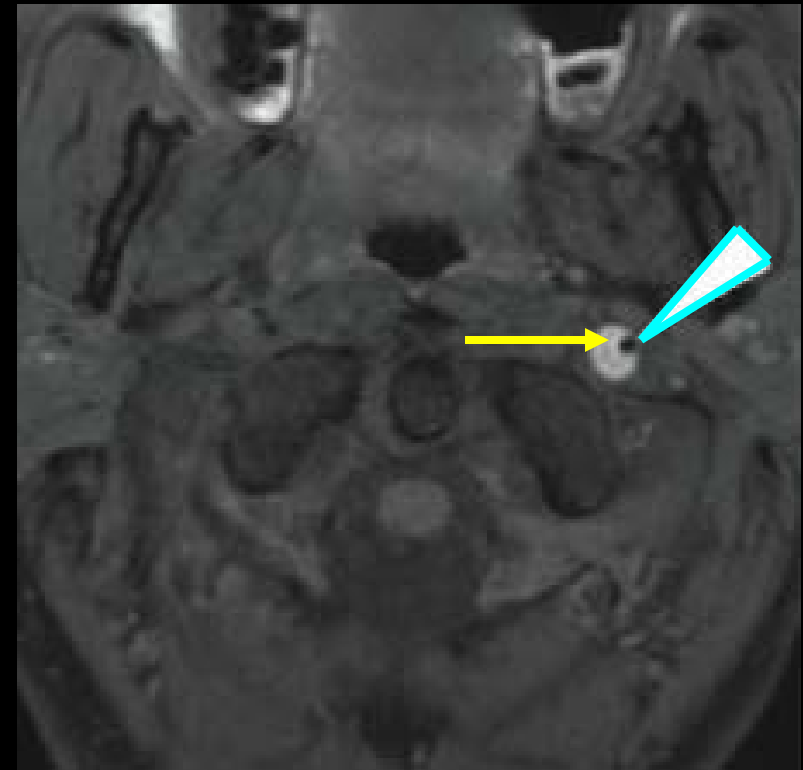
Pseudoaneurysm



Companion Patient #2: ICA Dissection on MR

55M with TIA:

- Possible findings:
 - Narrowed eccentric flow void
 - Crescent-shaped subacute intramural hematoma
- Compared to conventional angiography:
 - 84% sensitive
 - 99% specific



Axial T1 MR with fat saturation



ICA Dissection on Conventional Angiography

- The gold standard imaging modality
- String sign: long, tapered, eccentric and irregular stenosis that begins distal to the carotid bulb
- String and pearl sign: focal narrowing with a distal site of dilatation





Summary

- Suspect ICA dissection in young patients who present with sudden onset headache
- Imaging modalities used to diagnose ICA dissection include:
 - US: thickened hypoechoic vessel wall
 - CTA: narrow eccentric lumen with increased external diameter of the artery
 - MR: narrowed eccentric flow void with crescent-shaped subacute intramural hematoma
 - Conventional angiography: string sign
- Treatment: anticoagulation

Outcome For Our Patient

- Diagnosed with right ICA dissection
- Admitted to neurology
 - Started on heparin
 - Discharged on enoxaparin and warfarin
 - Plan for repeat CTA and neurology follow-up in 3 months



Outcome For Our Patient, cont.

- Several days after discharge, presented to ED with left arm weakness
- CTA at that time showed decrease in size of right ICA lumen and increase in size of pseudoaneurysm
- INR found to be sub-therapeutic
- MR showed no acute cerebral infarct
- Admitted to neurology given concern for TIAs secondary to ICA dissection
 - Started on heparin
 - Discharged on increased dose of warfarin

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References

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