Pediatric (Childhood) Stroke

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Disclosures

No financial conflicts

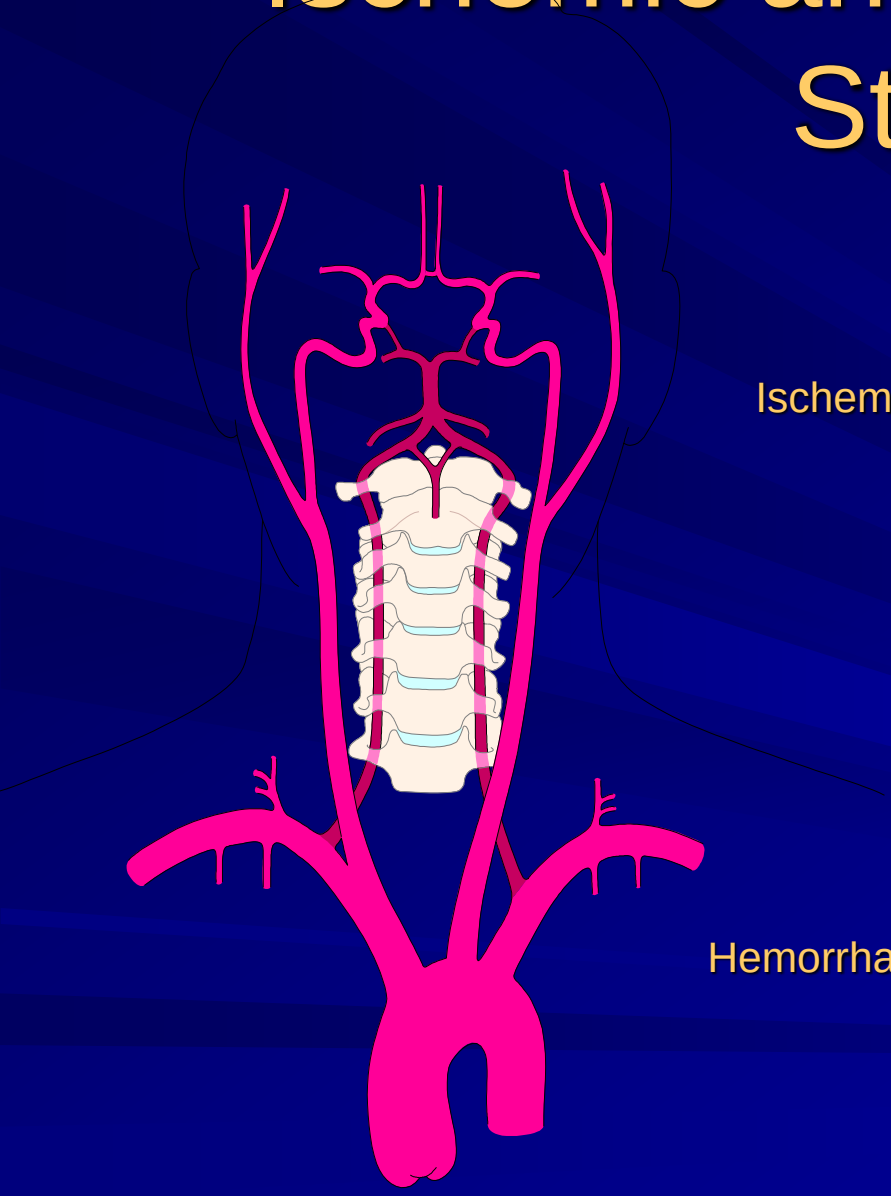
Pediatric (Childhood) Stroke

- Childhood stroke annual incidence 3-25 per 100,000
- May be missed because of lack of awareness
- Delays in seeking medical care and diagnosis
- Strokes may be misdiagnosed as migraines, seizures, or Bell's Palsy
- tPA is not approved but is sometimes used off-label
- Interventional stroke treatment is off-label and available
- Early diagnosis and treatment is important for better outcomes

Childhood Stroke Risk factors

- **No risk factors in half of childhood strokes**
- Congenital heart disease
- Cardiac disorders
- Cerebral vascular disorders
- Carotid and vertebral dissection
- Infections
- Head and neck trauma
- Sickle cell disease
- Autoimmune disorders

Ischemic and Hemorrhagic Stroke

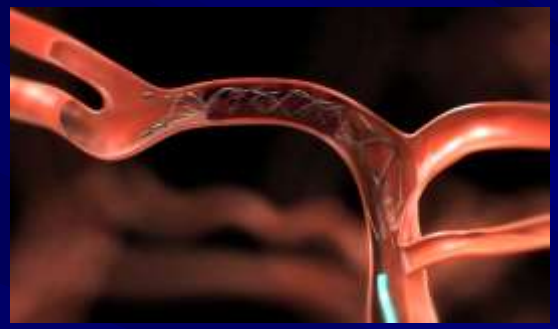


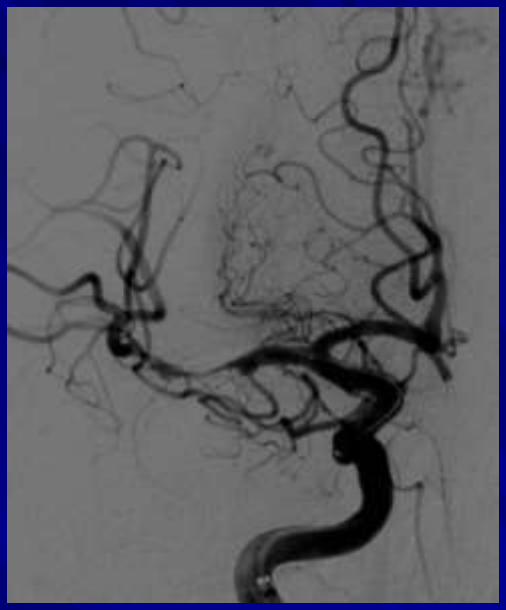
Ischemic Stroke

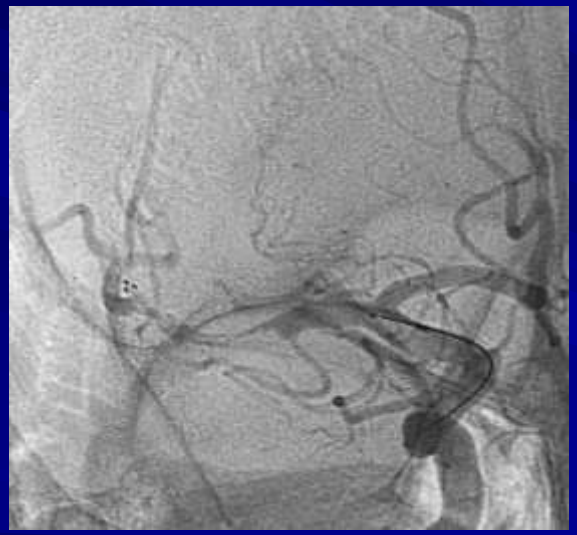
Hemorrhagic Stroke

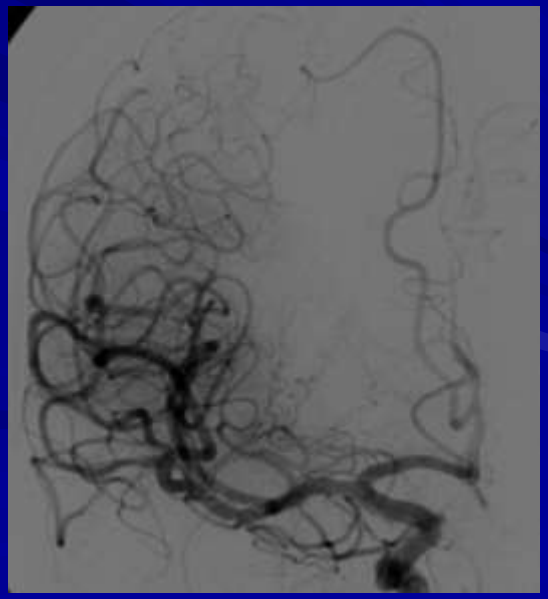
9 yo M with RT MCA Syndrome

Mechanical Thrombectomy
Stent Triever

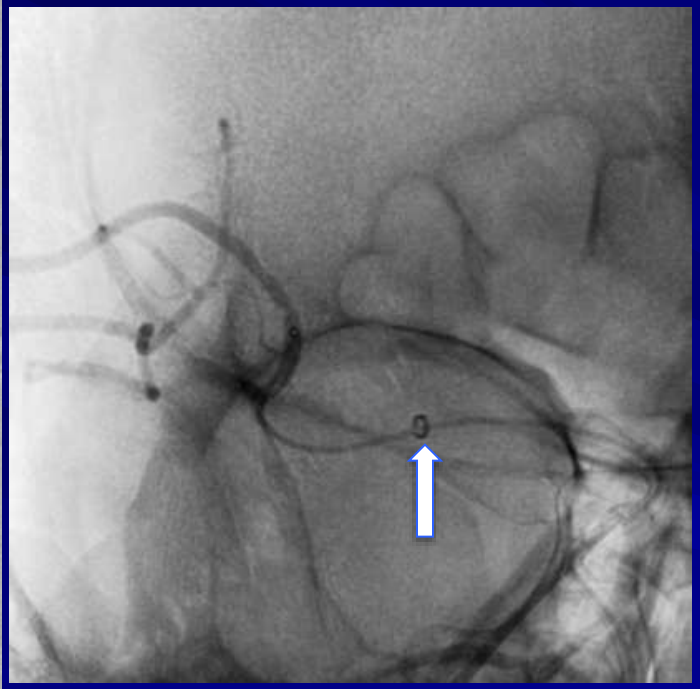




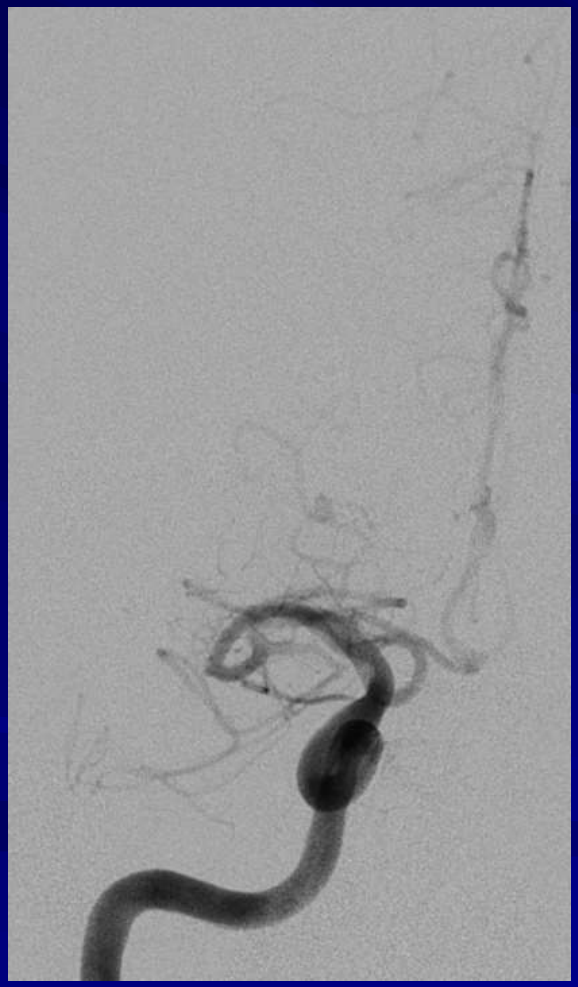


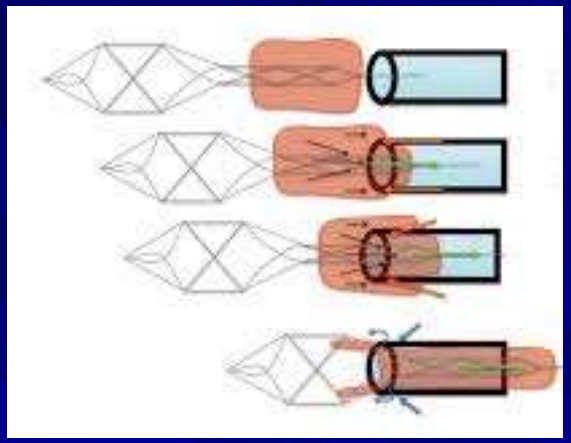


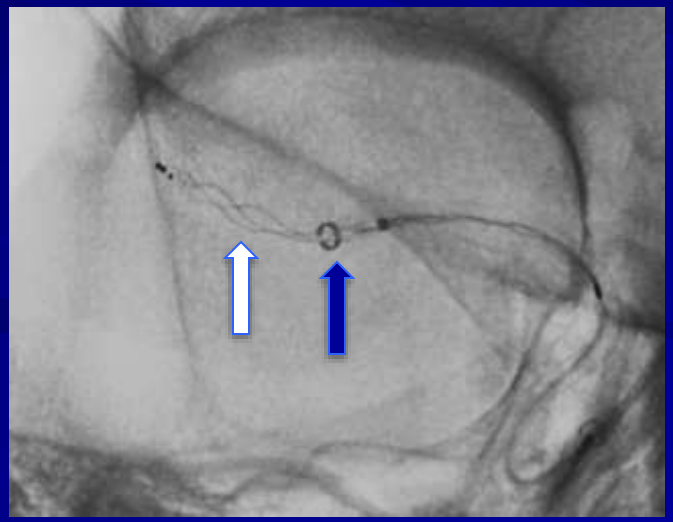
ADAPT Mechanical Thrombectomy : A Direct Aspiration First Pass Technique



Combined Technique
Aspiration with Stent Triever





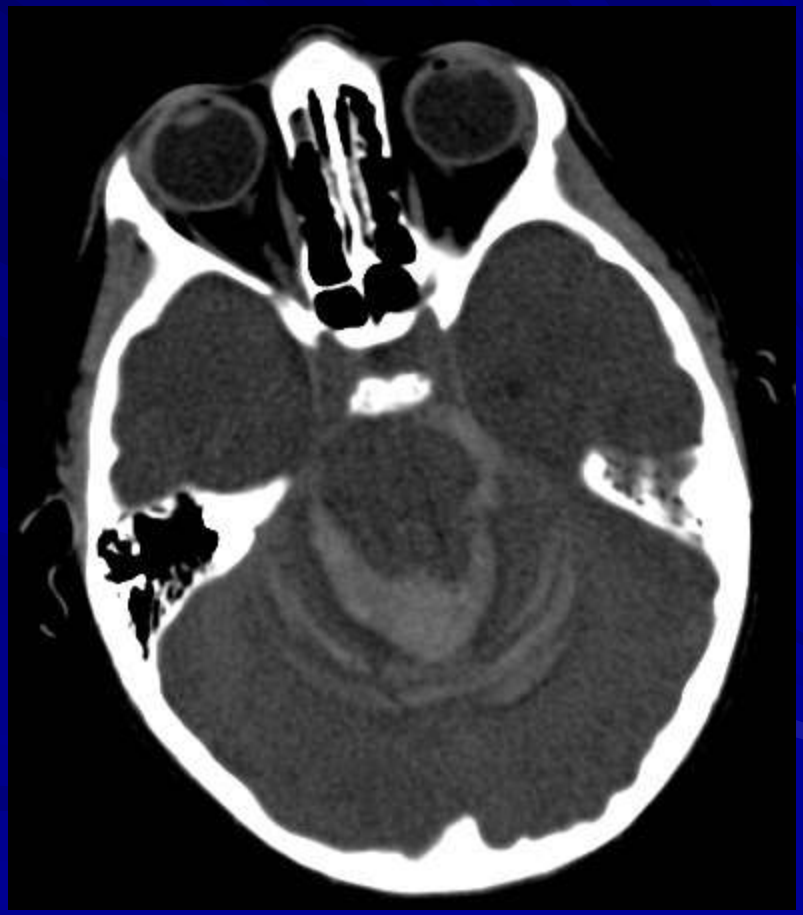


Expanding the Intervention Window: Age Pediatric Stroke (less than 18)

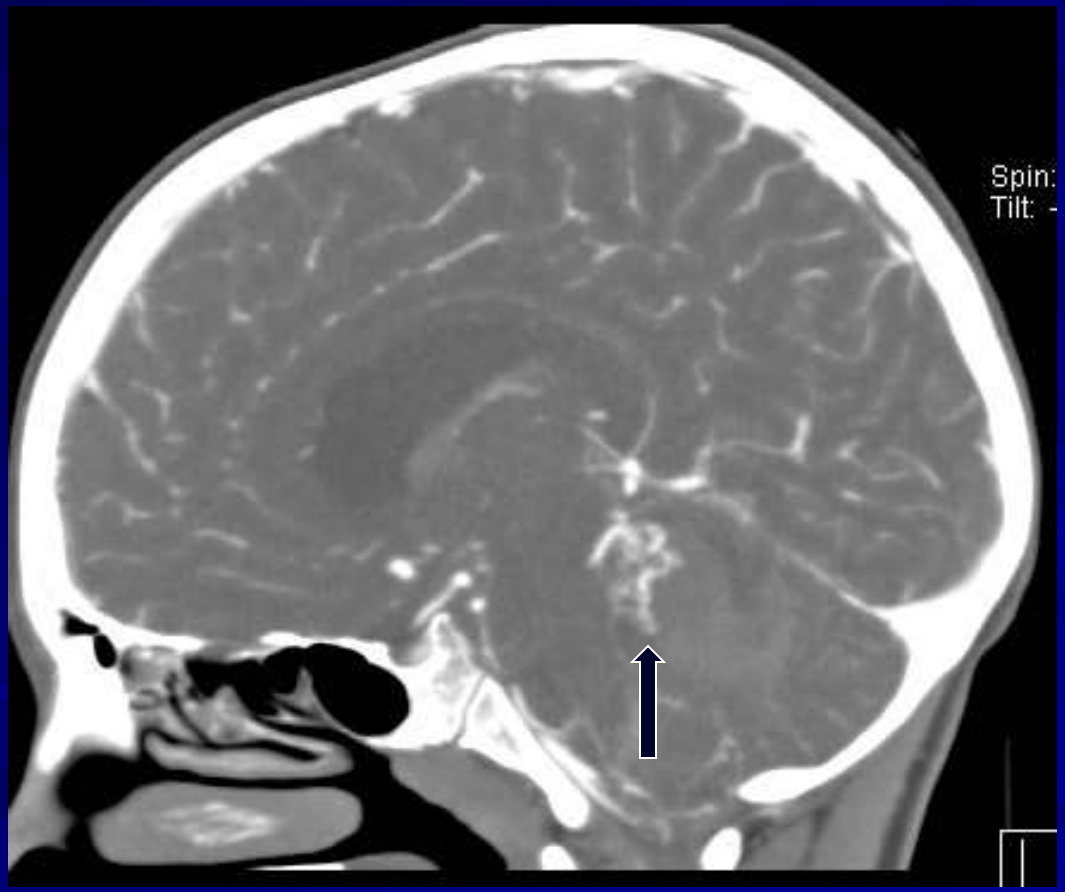
- JNIS 2016: Mechanical thrombectomy for pediatric acute ischemic stroke: review of the literature
  - MT in High NIHSS in peds pts have excellent recanalization and outcome
- JNS 2019: Mechanical thrombectomy in pediatric stroke: systematic review, individual patient data meta-analysis, and case series
  - MT may be considered for LVO for pts age 1-18
- Stroke 2022: Endovascular Thrombectomy for Pediatric Acute Ischemic Stroke
  - Meta-analysis supports that EVT in peds is safe with high rates of favorable outcomes
- Development of Pediatric Code Stroke Program at RWJUH

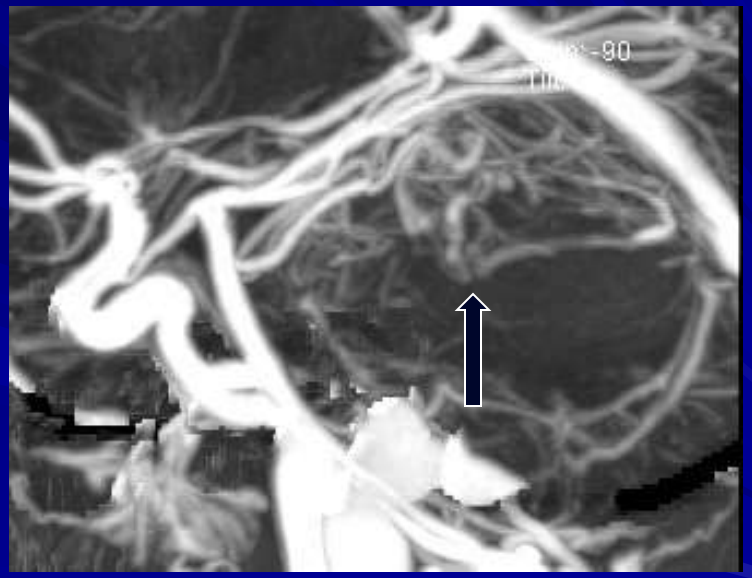
Head Injury or Vascular Malformation?

7 year old Boy found down next to playground slide. Helicopter lifted from football field.

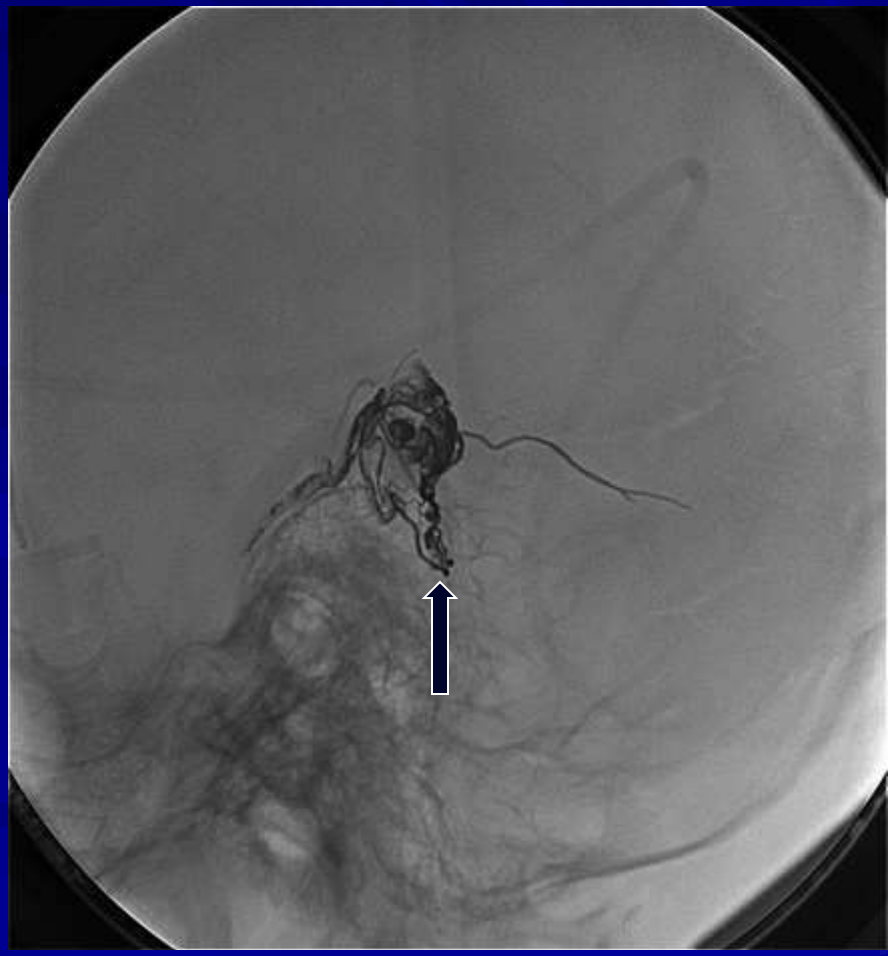


Brain AVM (Arteriovenous Malformation)





Onyx Treatment of AVM and Aneurysm

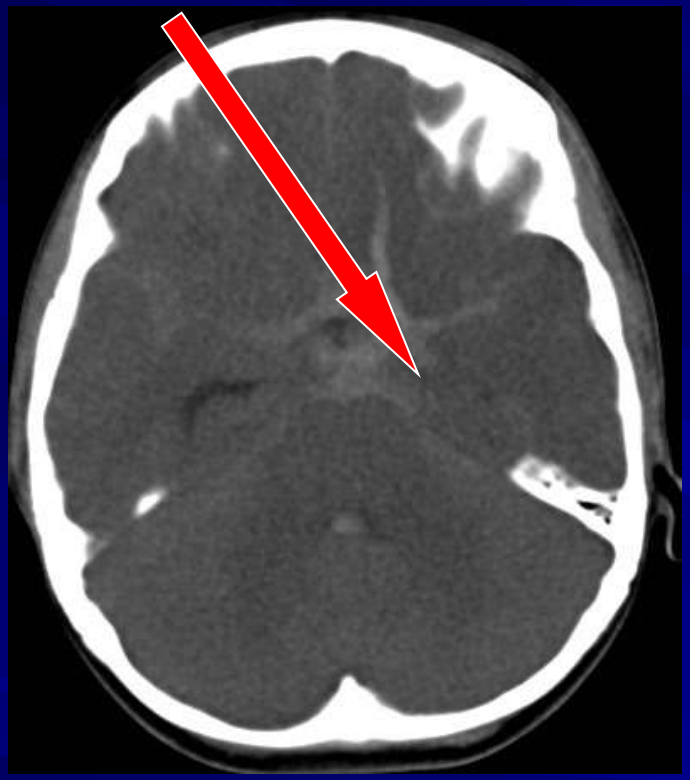


Head Trauma Case

- 7 y/o girl accidentally shot in the head with an arrow

Path of arrow

Traumatic MCA Pseudoaneurysm and MCA Stroke



Left MCA transected by arrow causing simultaneous pseudoaneurysm with SAH and MCA stroke

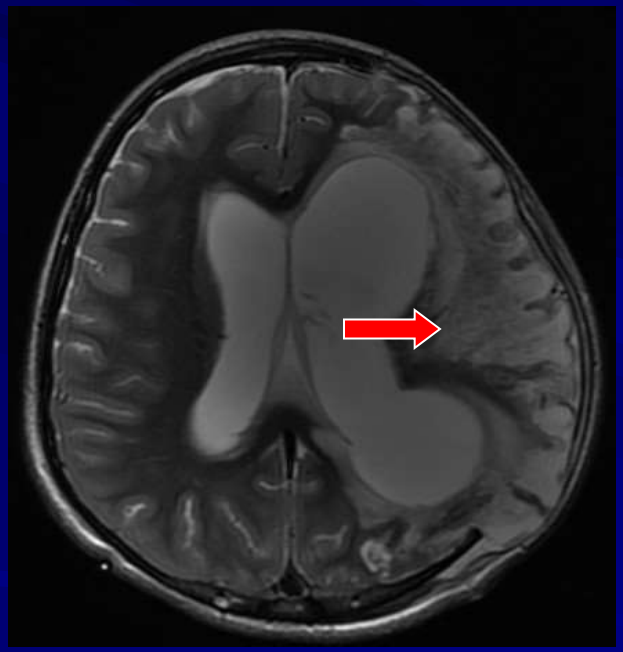
Traumatic MCA Pseudoaneurysm

Pseudoaneurysm treated with balloon assisted coiling

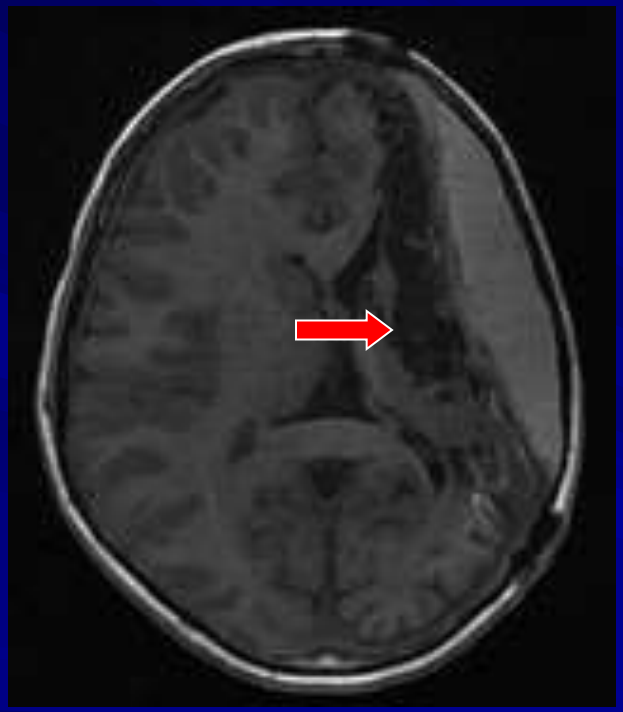
Left MCA Stroke

- Global aphasia and right UE hemiplegia
- Causes mass effect and midline shift
- Worsens the effect of vasospasm from SAH by decreasing perfusion
- Mass effect treated with hemicraniectomy to allow brain to swell
- Pt had slow recovery of language and some right arm movement

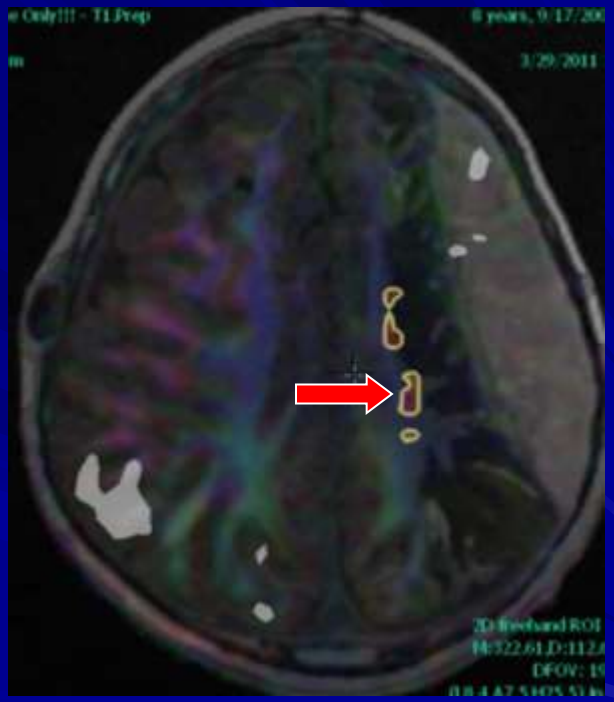
Partial functional recovery at 6 months after arrow injury



MCA stroke
(3 weeks)

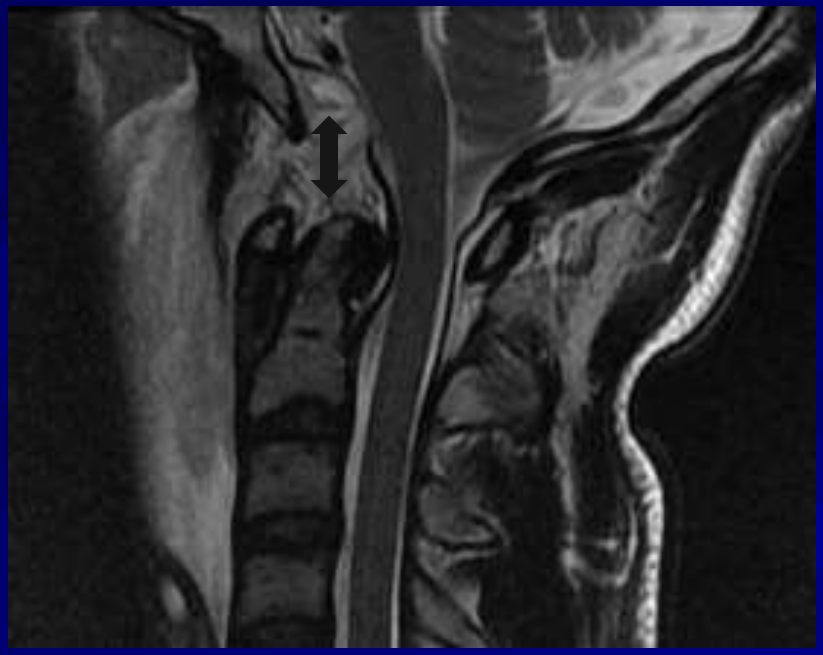


MCA stroke
(6 months)



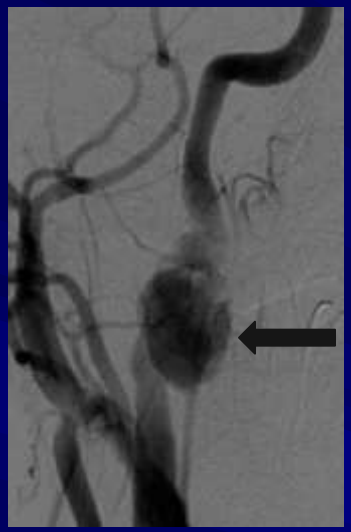
fMRI partial recovery
of Rt sided movement

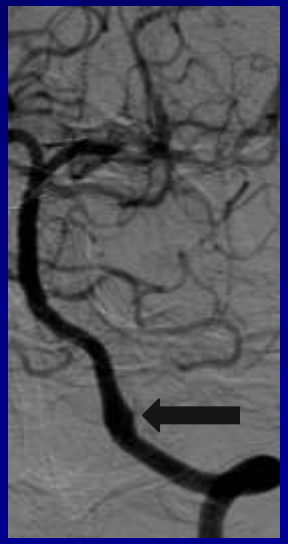
Head Trauma Case

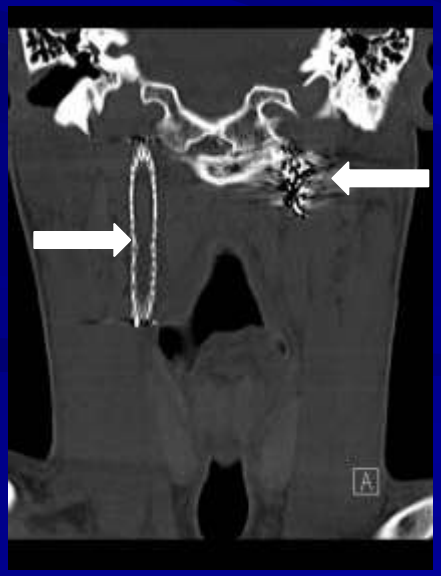
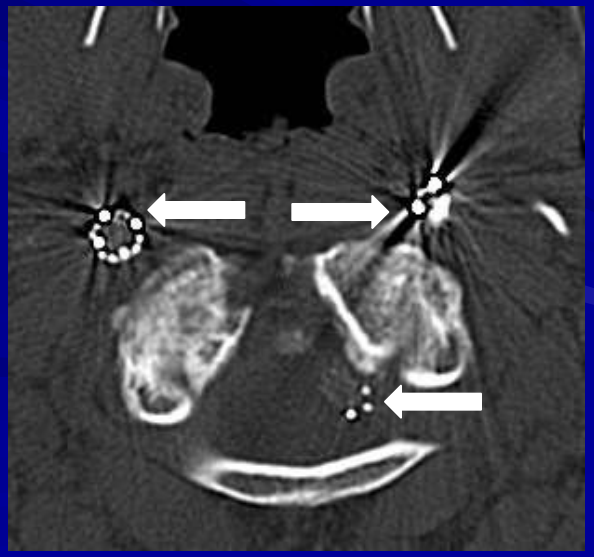


20 yo M pedestrian hit by automobile.
Atlanto-Occipital Dislocation

Traumatic 4 Vessel Injury



Head Trauma

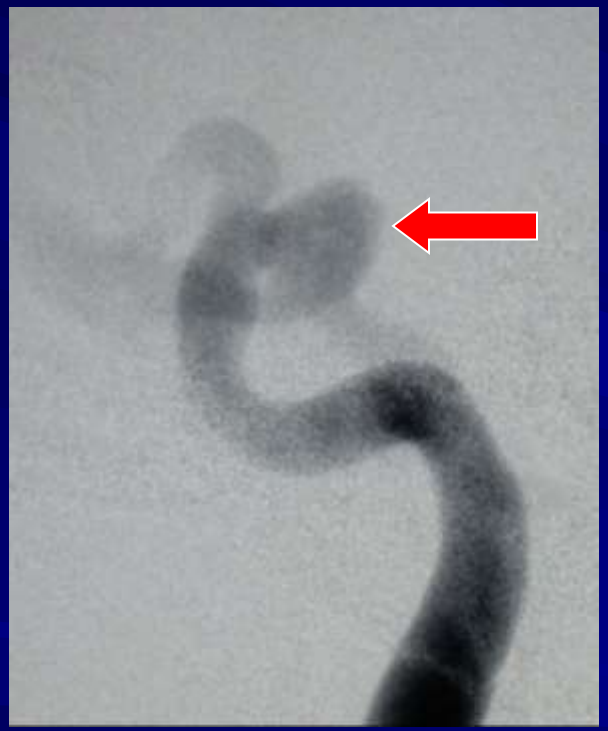
- 18 y/o M with h/o MVA with head injury in early teens presents with several months of progressive right eye pulsatile proptosis and pulsatile tinnitus

Traumatic Carotid-Cavernous Sinus Fistula (CCF)

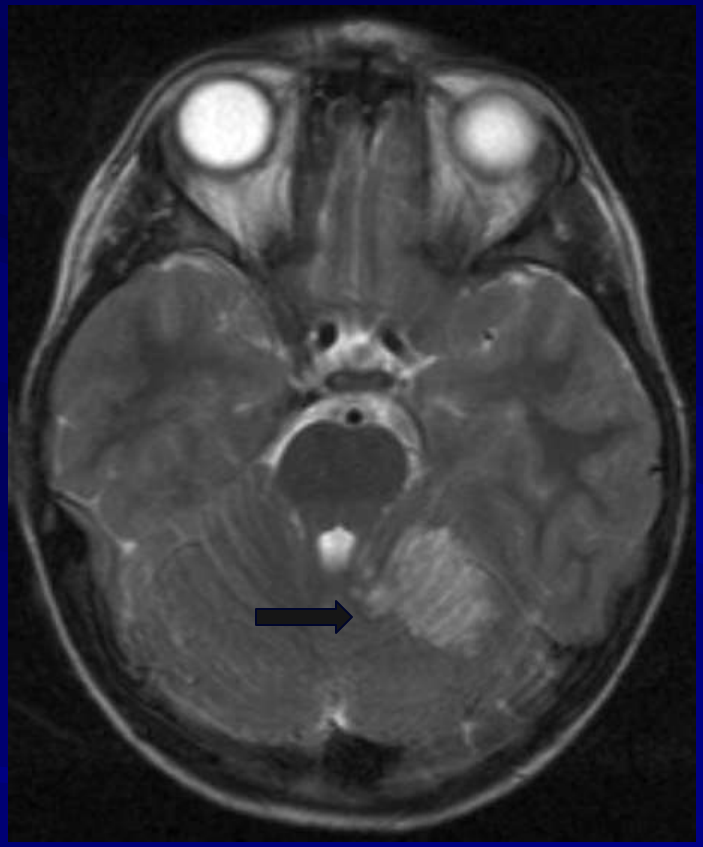
Lateral

A-P

Traumatic CCF Balloon Occlusion

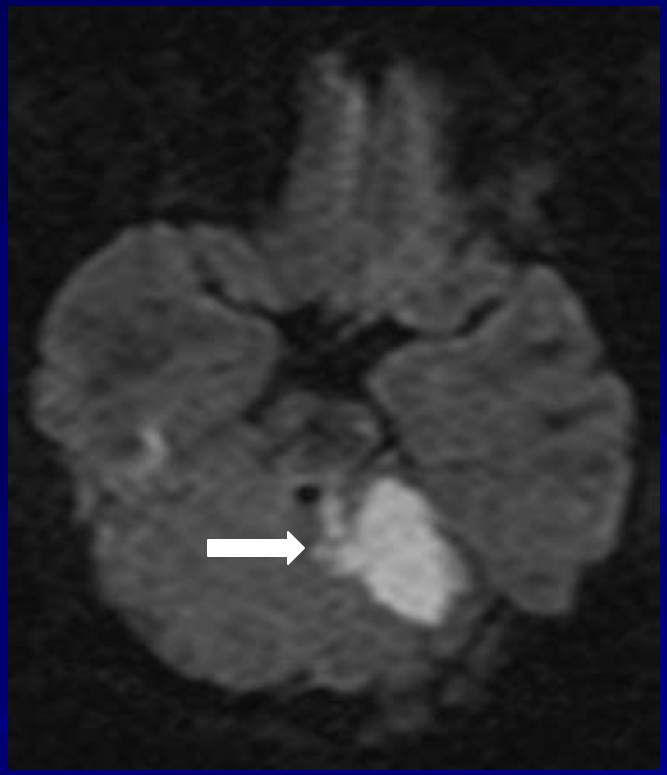


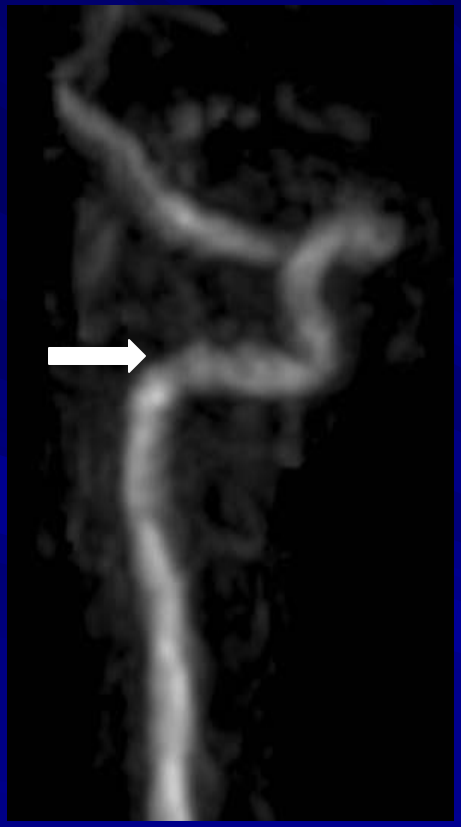
Ischemic Stroke Case



7 yo with dizziness and ataxia after neck injury

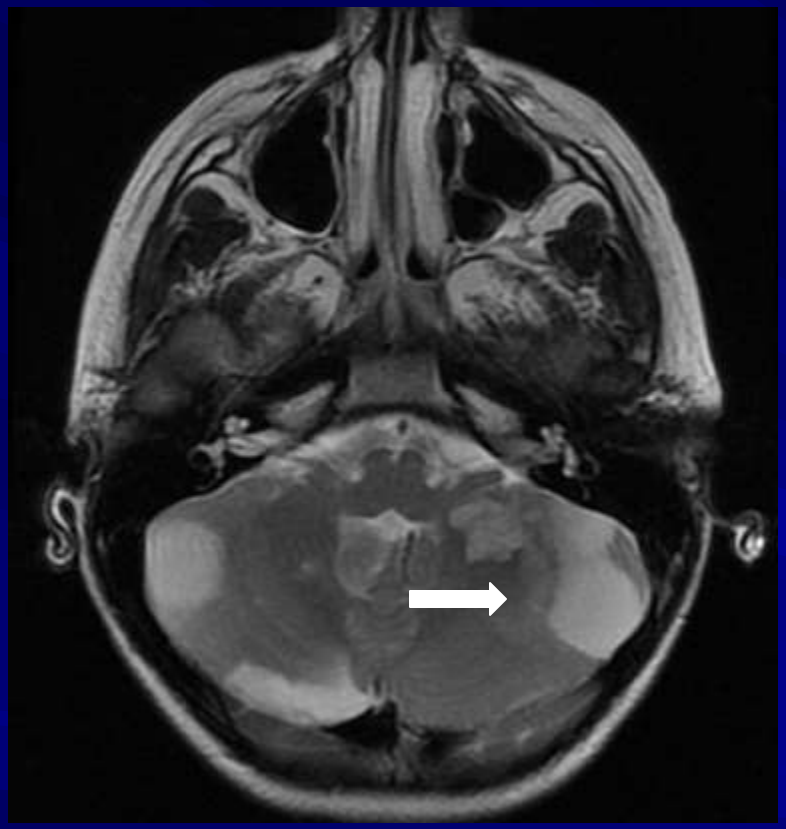
Vertebral Artery Dissection





7 yo with dizziness and ataxia after neck injury

Basilar Artery Occlusion



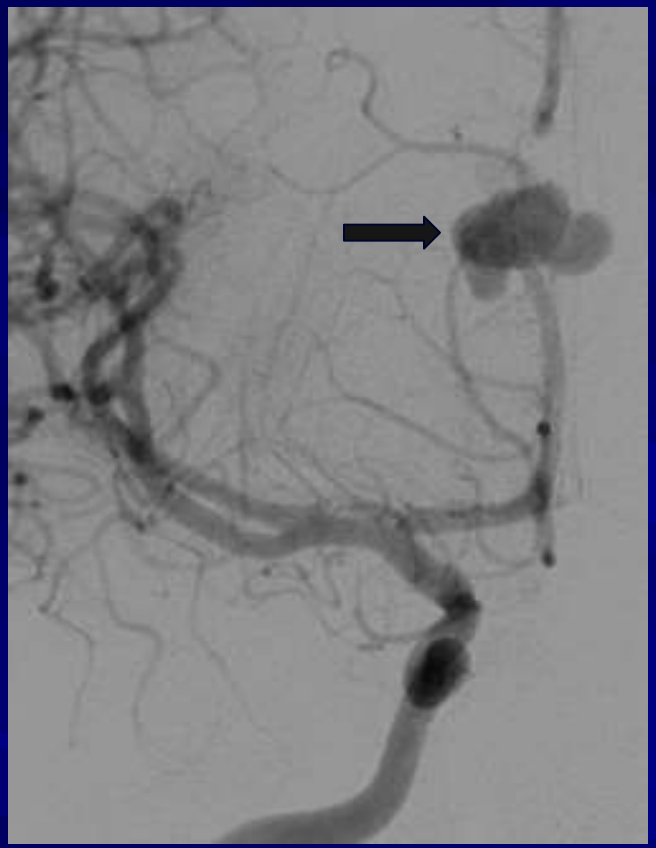
6 yo Boy with LOC extending into coma

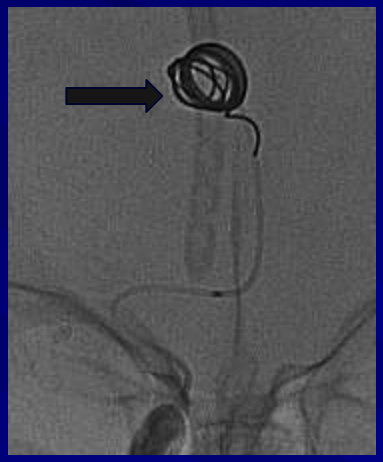
Basilar Artery Thrombolysis

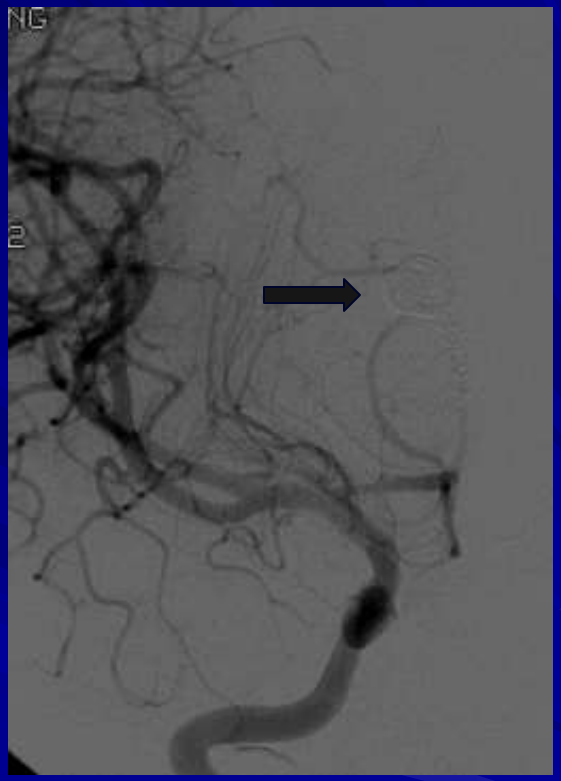
Brain Aneurysm

- 7 y/o girl with HA, decreased mental status, and bilateral LE weakness

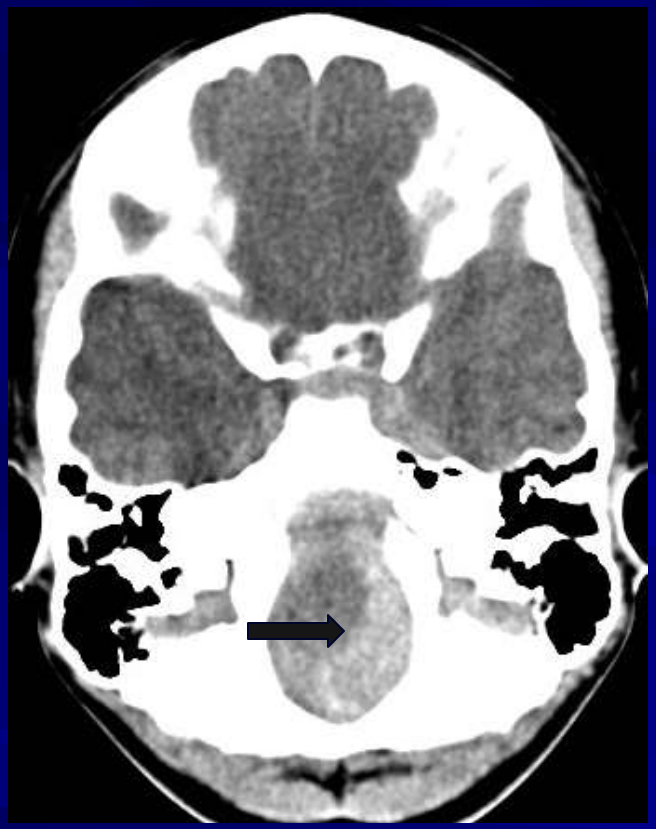
Giant ACA Aneurysm Coiled

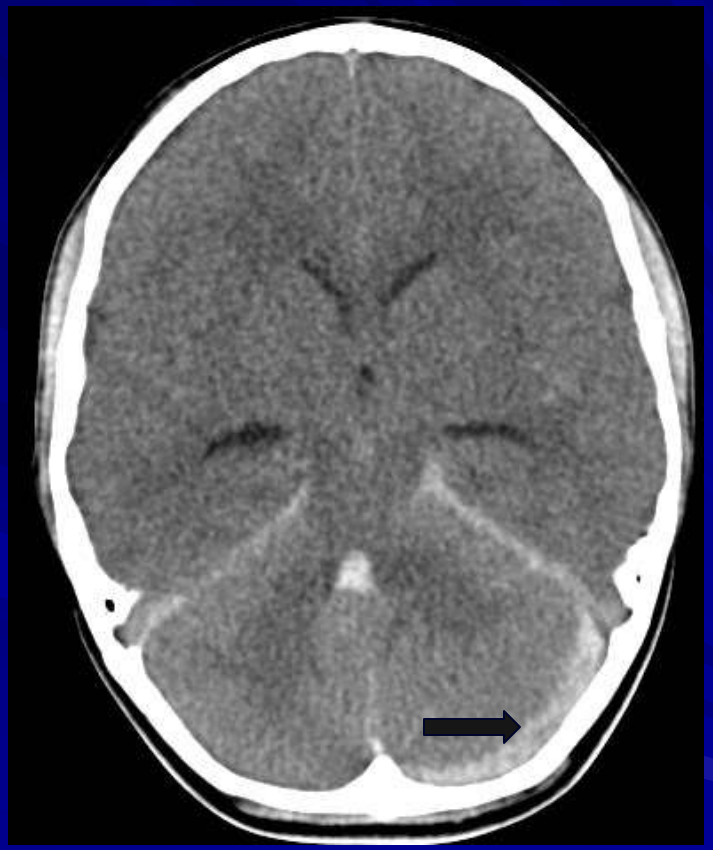






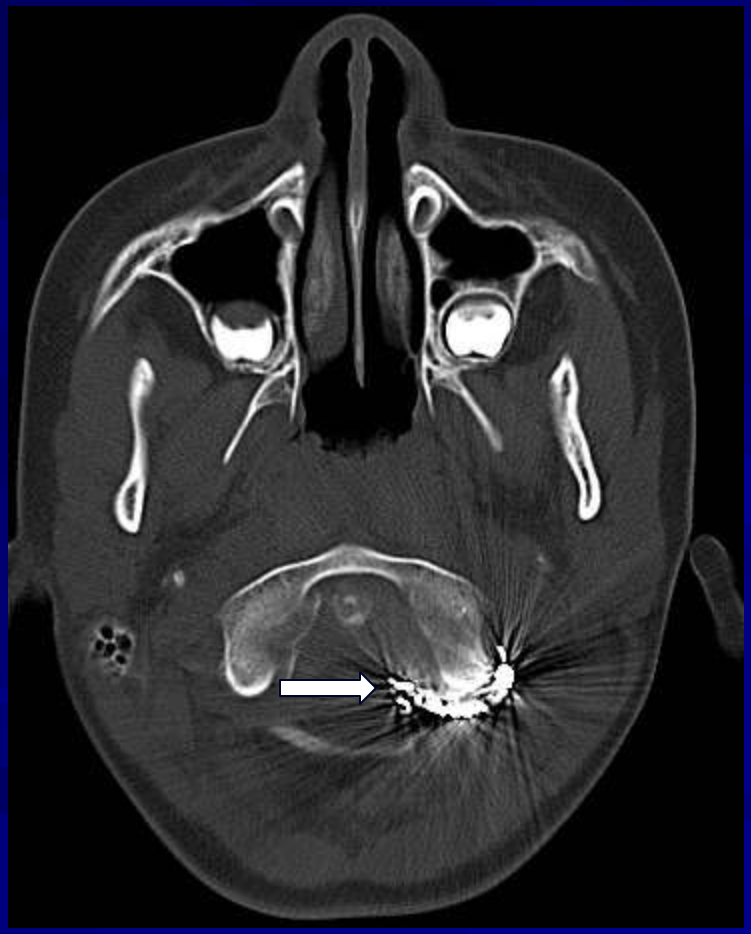
PICA Aneurysm

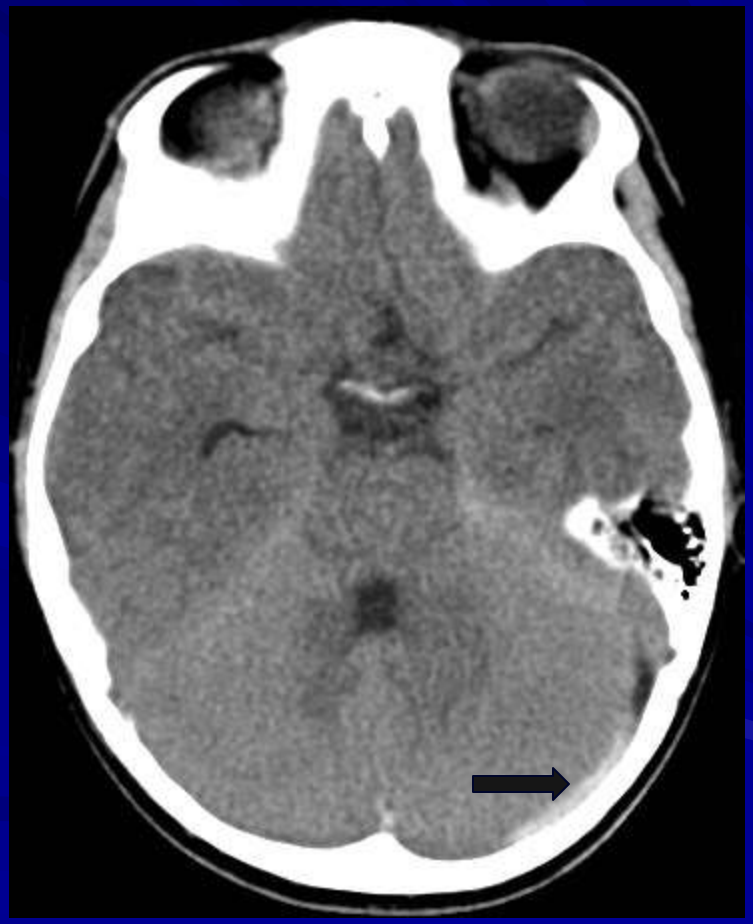




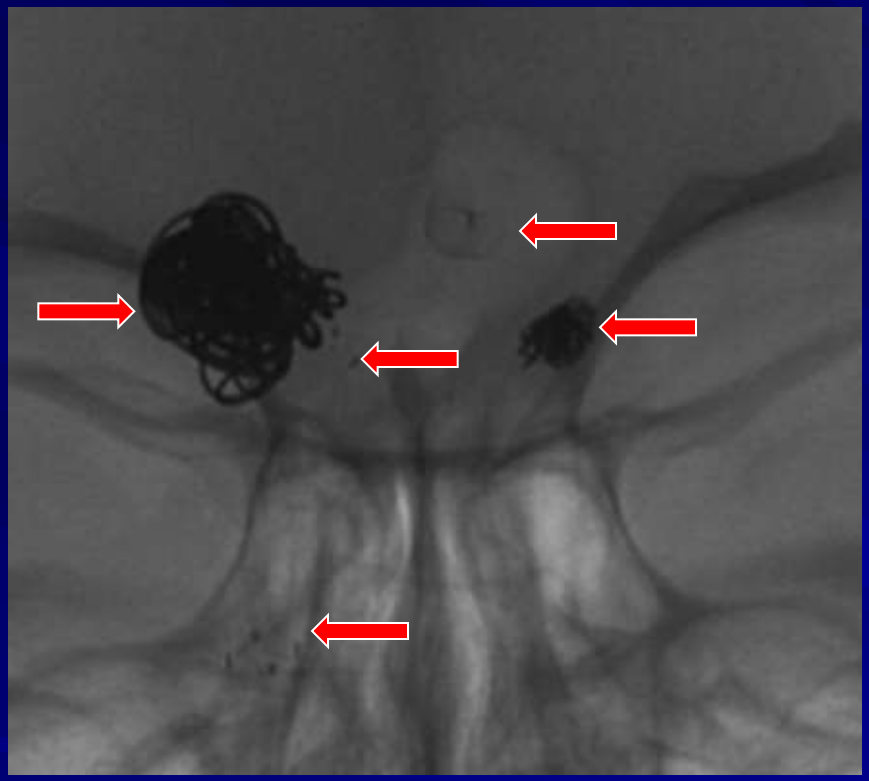
7 yo Boy with severe HA and ataxia

PICA Aneurysm Coiled





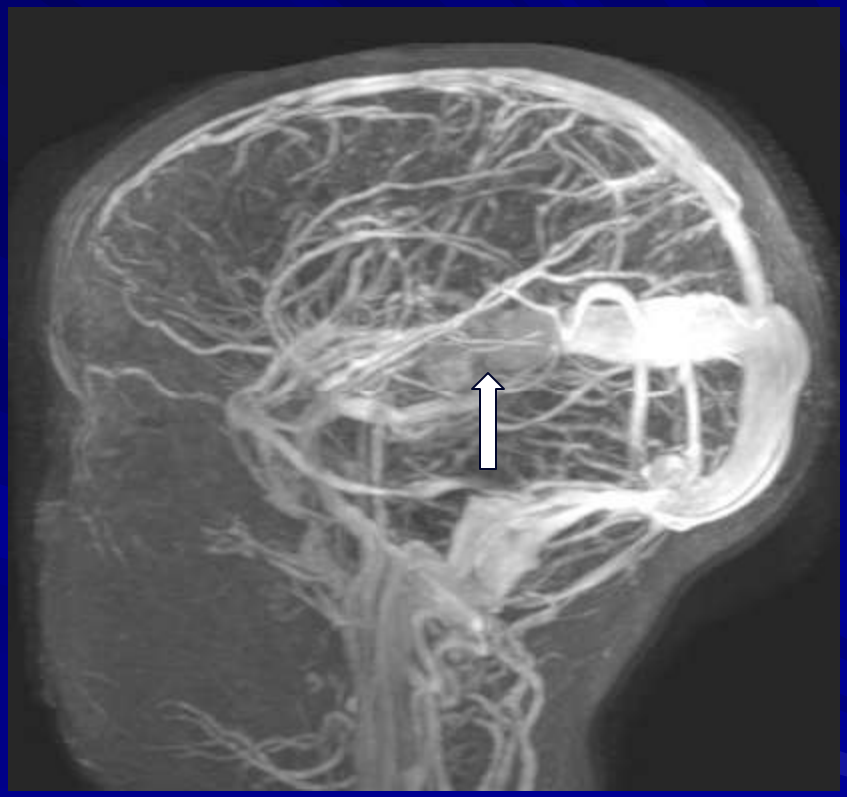
Family History of Brain Aneurysm



Mother - 3 Aneurysms

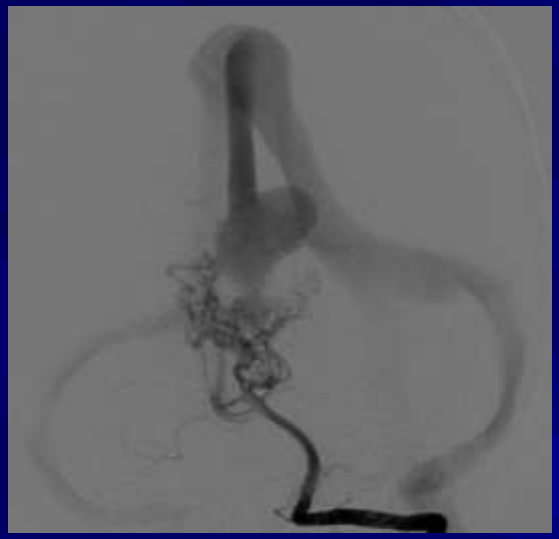
12 yo Daughter

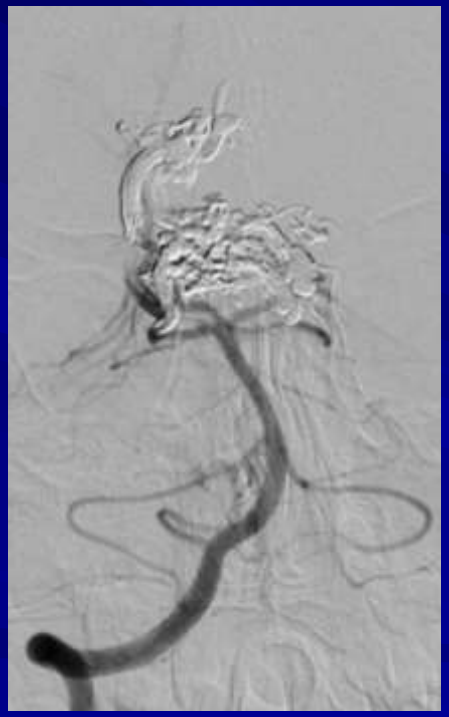
Vein of Galen Malformation (VOGM)



4 yo M with neonatal VOGM tx medically for CHF now presents with suspected DD and autism.

VOGM Onyx Embolization

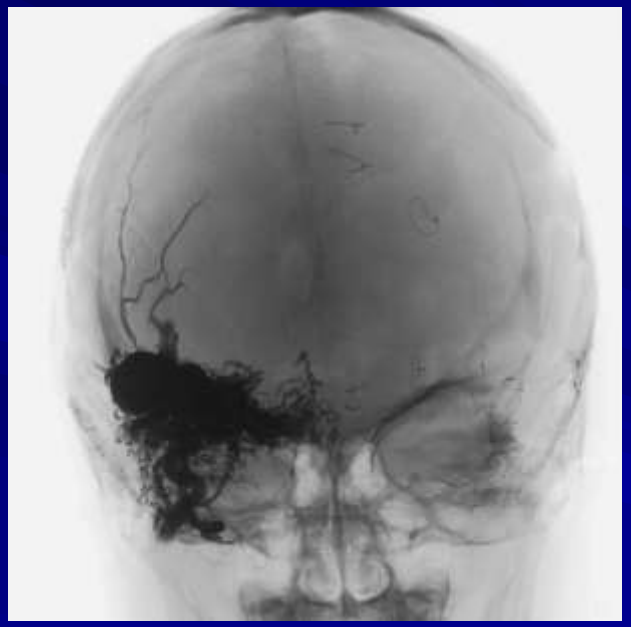




Dural AV Fistula

6 yo M with severe HA

Dural AV Fistula
Onyx Embolization

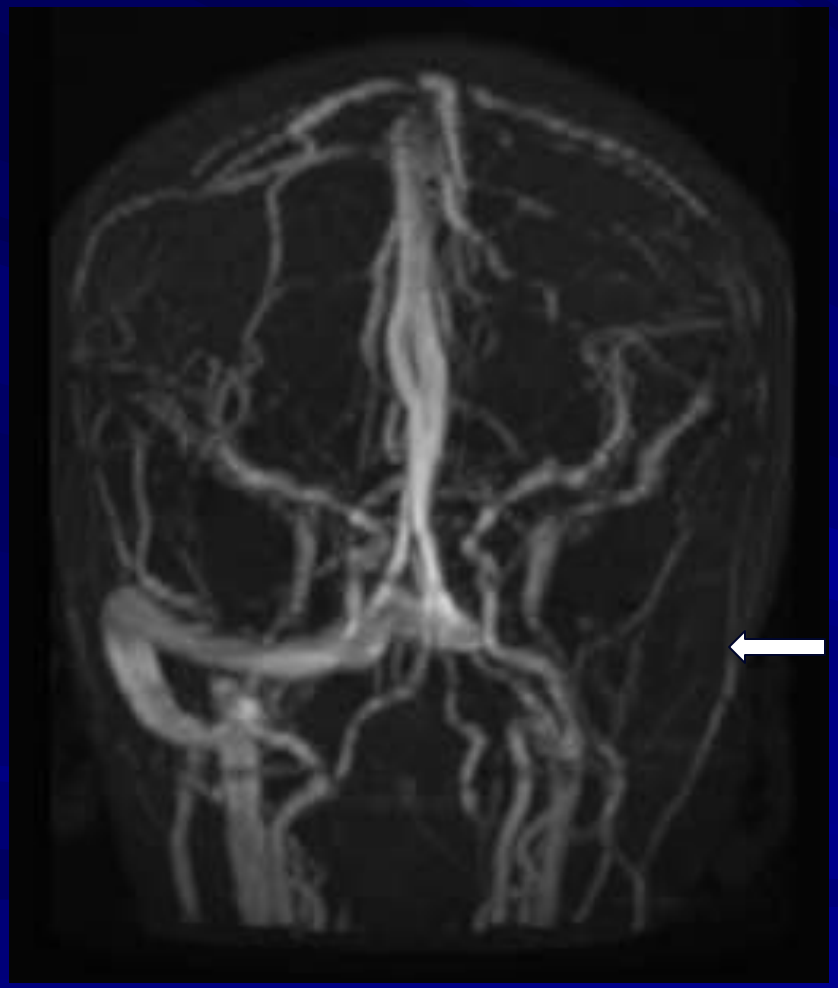


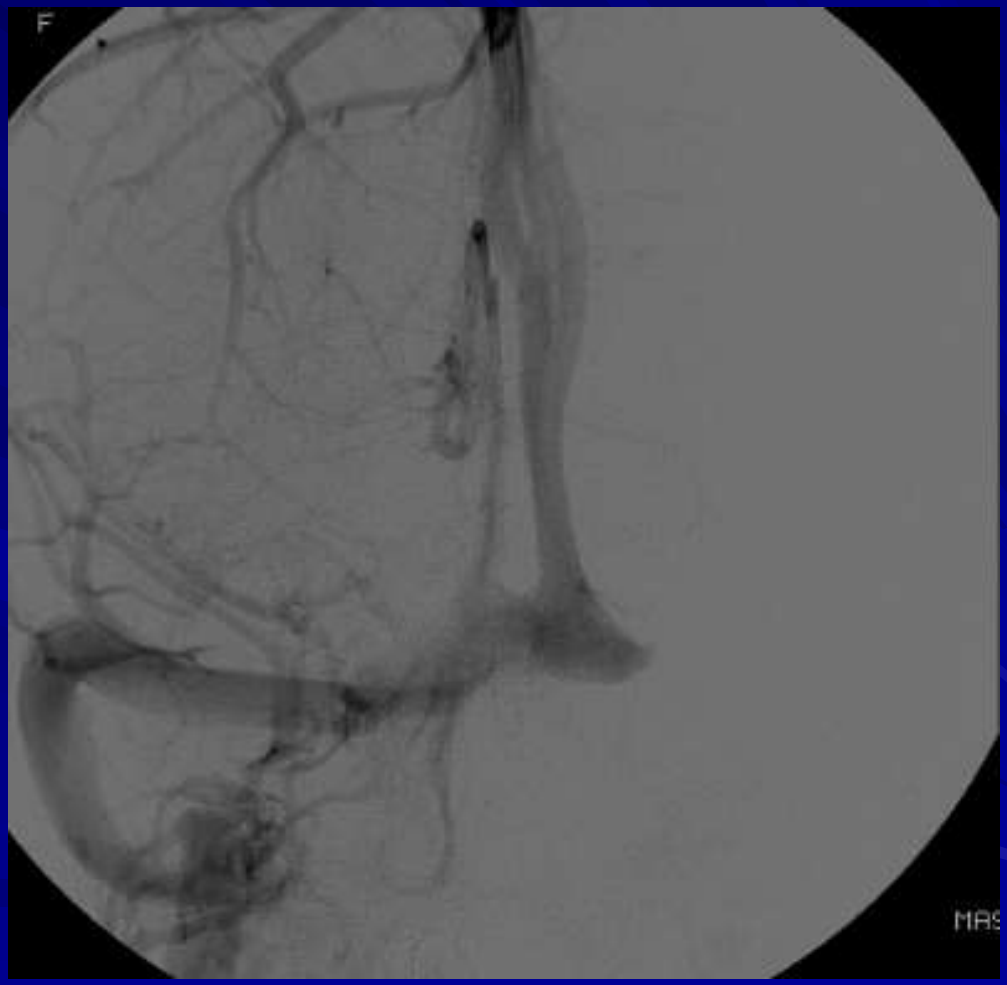
Case

- 5 y/o F with h/o Crohn's disease diagnosed at age 3 presents with sudden onset of headache, seizure, and expressive aphasia. On exam, she also has a right homonymous hemianopsia.

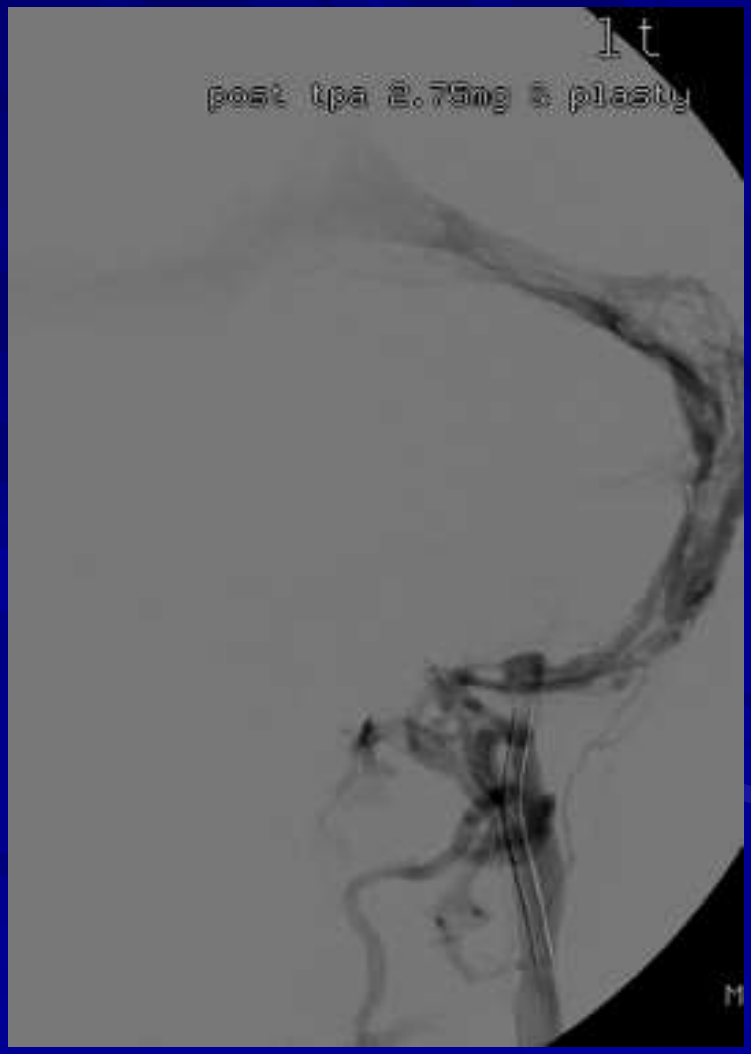
5 y/o F with Aphasia

Venous Sinus Thrombosis

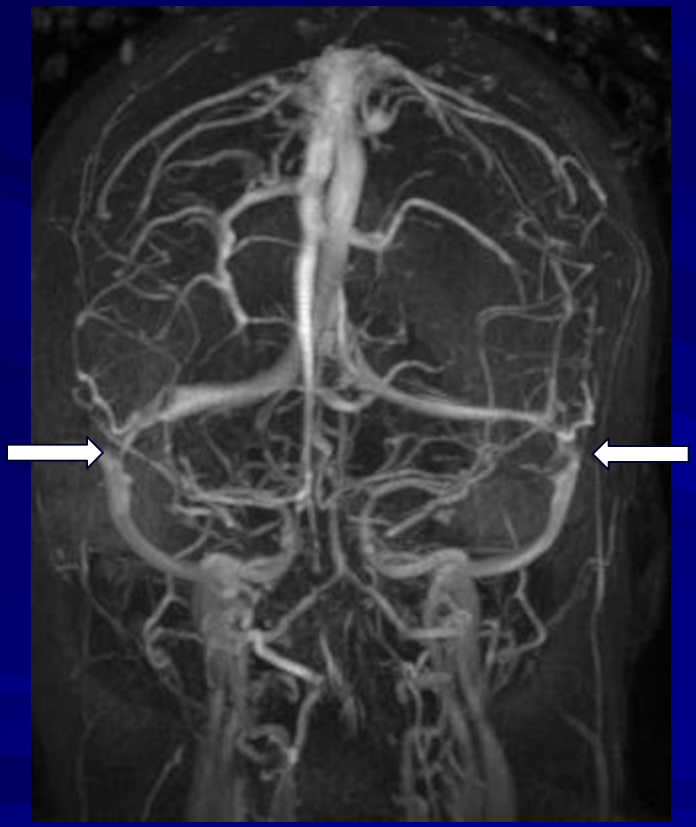




Transverse Sinus Angioplasty and Thrombolytic Therapy

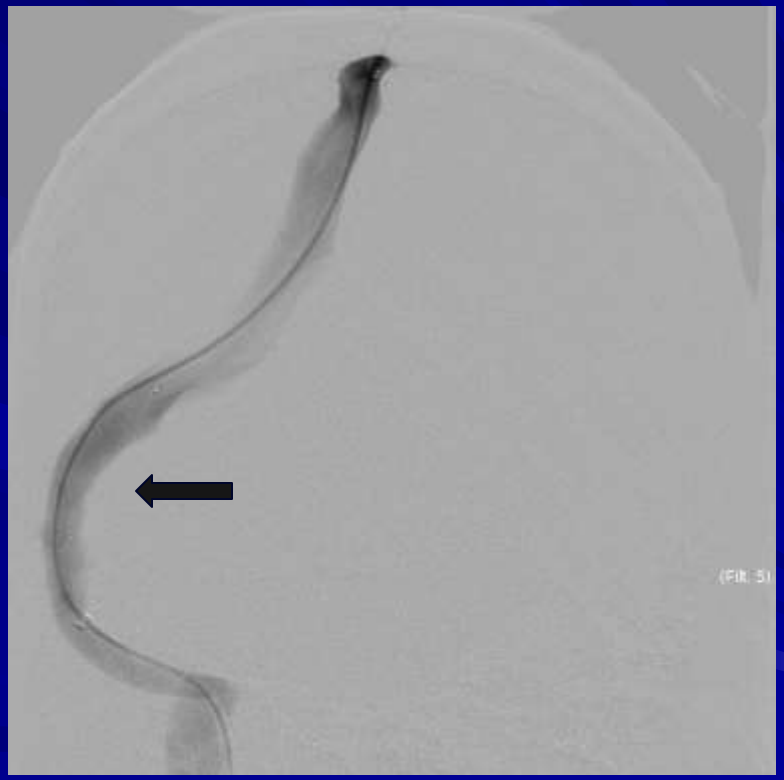


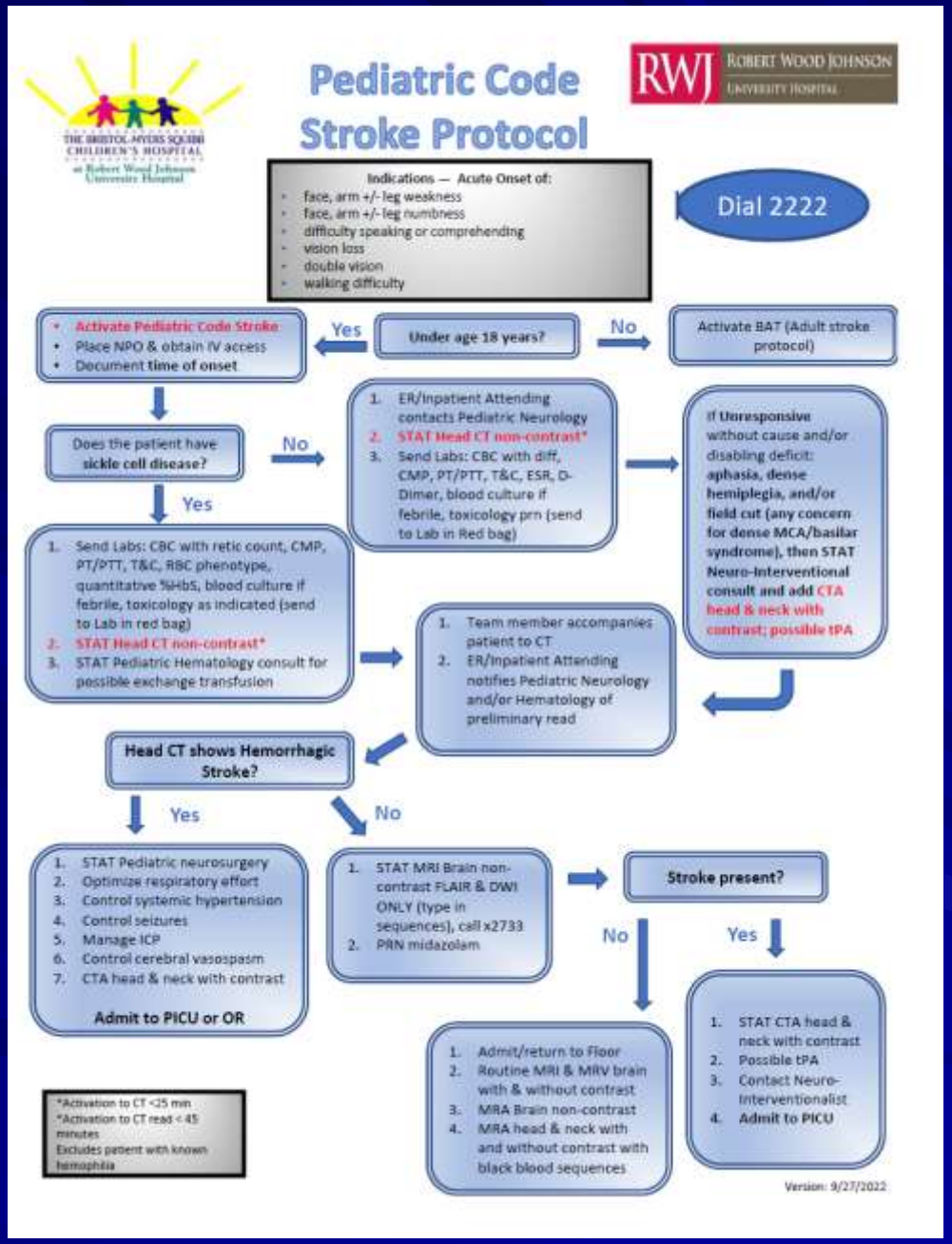
Bilateral Transverse Sinus Stenoses



20 yo F with severe HA, papilledema and increased intracranial pressure diagnosed with Pseudotumor cerebri aka Idiopathic Intracranial Hypertension IIH

Pseudotumor Cerebri
Idiopathic Intracranial Hypertension
Transverse Sinus Stenting




Pediatric Code Stroke Protocol
THE BRISTOL-MYERS SQUIBB CHILDREN'S HOSPITAL at Robert Wood Johnson University Hospital
RWJ Robert Wood Johnson University Hospital
Indications — Acute Onset of:
face, arm +/- leg weakness
face, arm +/- leg numbness
difficulty speaking or comprehending
vision loss
double vision
walking difficulty
Dial 2222
Under age 18 years?
Yes
No
Activate BAT (Adult stroke protocol)
Activate Pediatric Code Stroke
Place NPO & obtain IV access
Document time of onset
Does the patient have sickle cell disease?
No
Yes
1. ER/Inpatient Attending contacts Pediatric Neurology
2. STAT Head CT non-contrast*
3. Send Labs: CBC with diff, CMP, PT/PTT, T&C, ESR, D-Dimer, blood culture if febrile, toxicology prn (send to Lab in Red bag)
If Unresponsive without cause and/or disabling deficit: aphasia, dense hemiplegia, and/or field cut (any concern for dense MCA/basilar syndrome), then STAT Neuro-Interventional consult and add CTA head & neck with contrast; possible tPA
1. Send Labs: CBC with retic count, CMP, PT/PTT, T&C, RBC phenotype, quantitative %HbS, blood culture if febrile, toxicology as indicated (send to Lab in red bag)
2. STAT Head CT non-contrast*
3. STAT Pediatric Hematology consult for possible exchange transfusion
1. Team member accompanies patient to CT
2. ER/Inpatient Attending notifies Pediatric Neurology and/or Hematology of preliminary read
Head CT shows Hemorrhagic Stroke?
Yes
No
1. STAT Pediatric neurosurgery
2. Optimize respiratory effort
3. Control systemic hypertension
4. Control seizures
5. Manage ICP
6. Control cerebral vasospasm
7. CTA head & neck with contrast
Admit to PICU or OR
1. STAT MRI Brain non-contrast FLAIR & DWI ONLY (type in sequences), call x2733
2. PRN midazolam
Stroke present?
No
Yes
1. Admit/return to Floor
2. Routine MRI & MRV brain with & without contrast
3. MRA Brain non-contrast
4. MRA head & neck with and without contrast with black blood sequences
1. STAT CTA head & neck with contrast
2. Possible tPA
3. Contact Neuro-Interventionalist
4. Admit to PICU
*Activation to CT <25 min
*Activation to CT read < 45 minutes
Excludes patient with known hemophilia
Version: 9/27/2022

Pediatric Stroke
Interventional Neuroradiology