

Oh No, Say It Isn't So... Pediatric Stroke

Haley Gilstad, RN BSN ASC-BC SCR N CEN

Holly Nissen, MSN RN ASC-BC CNRN SCR N



Financial Disclosure

- No relevant financial relationship exists

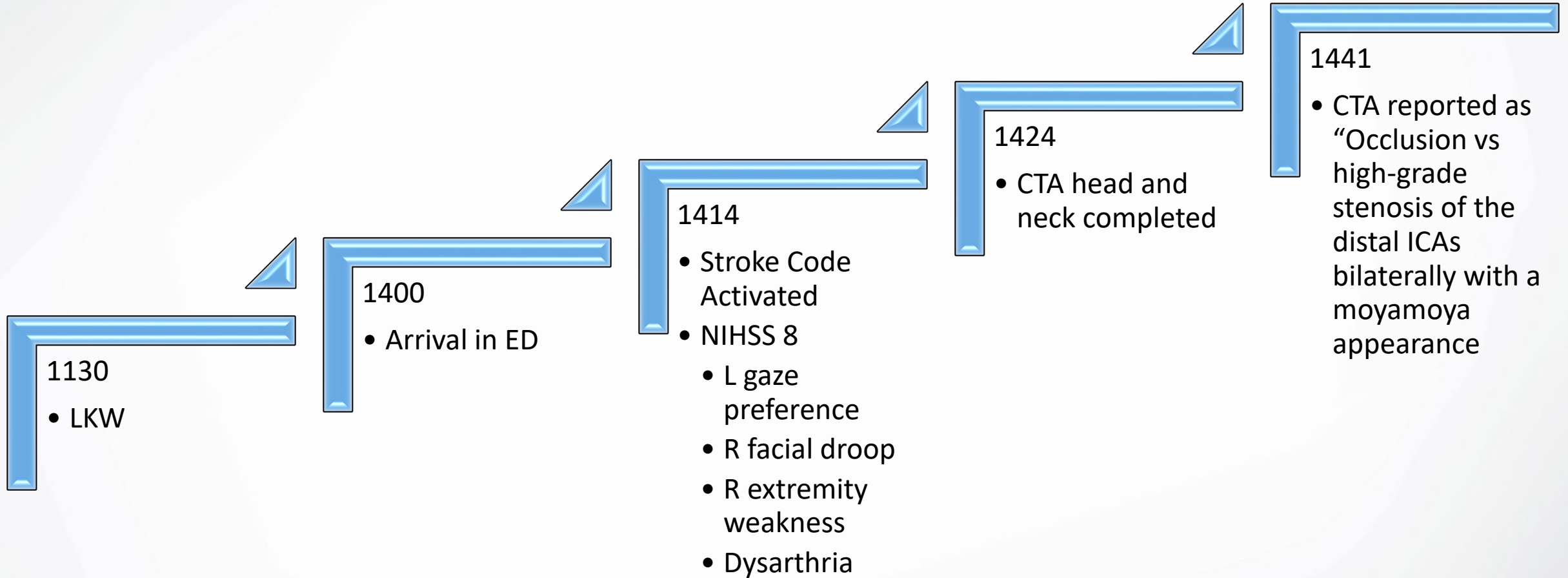
Pediatric Stroke

- Perinatal Stroke
 - 28 weeks gestation to 28 days postnatal life
- Childhood stroke
 - 28 days of life to 18 years

Incidence of Childhood Stroke

- Ischemic Stroke
 - 1-2 in 100,000 children
 - Higher incidence:
 - Age – Infants and children less than 5 years of age
 - Males
 - Race – Black and Asian
- Hemorrhagic Stroke
 - 1-1.7 in 100,000

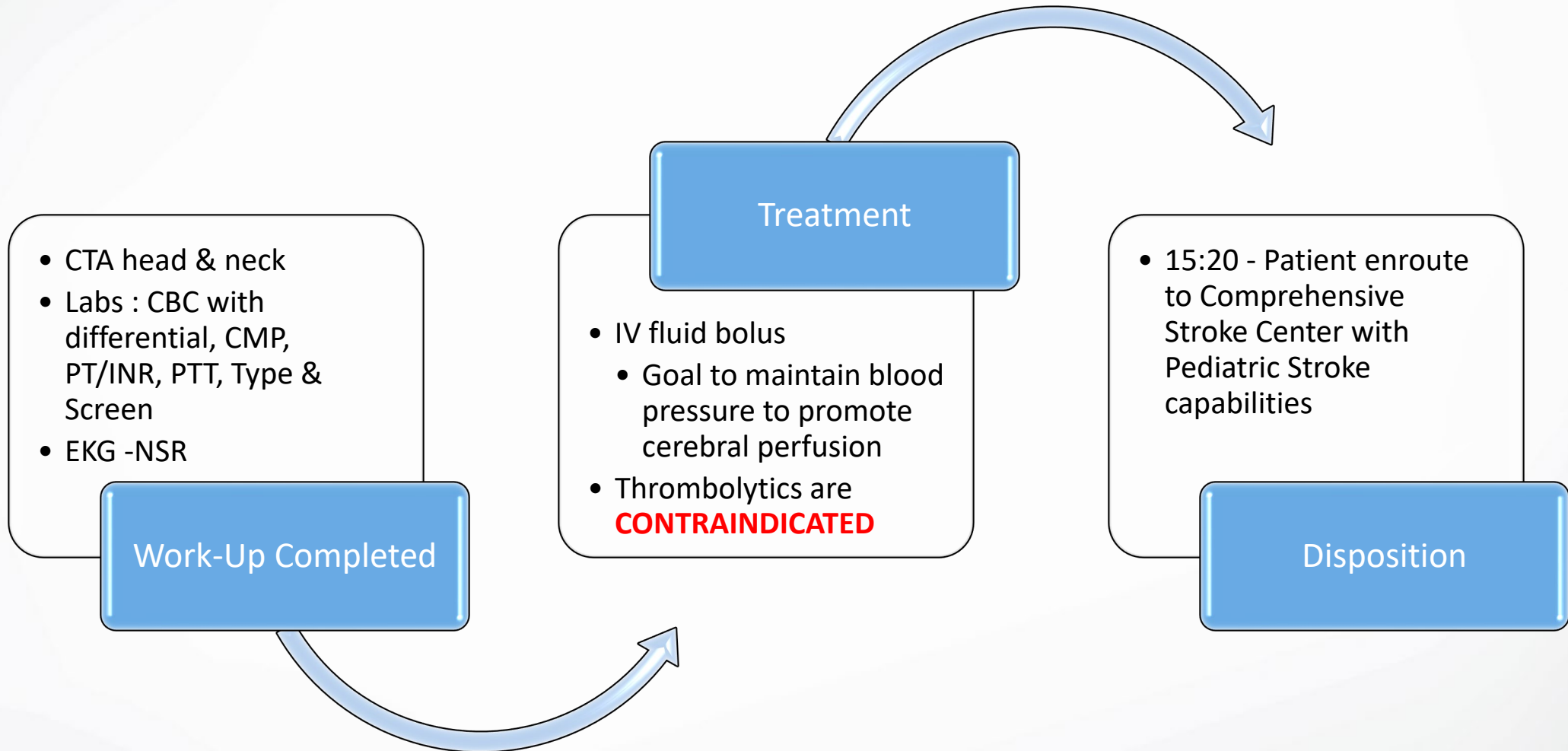
Case Study



Imaging



Case Study



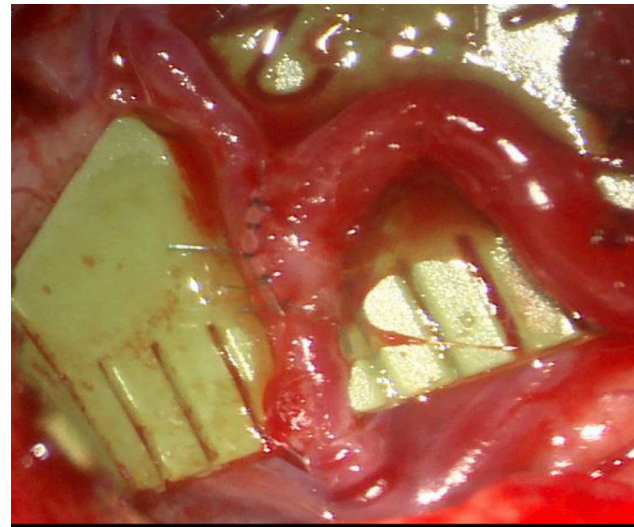
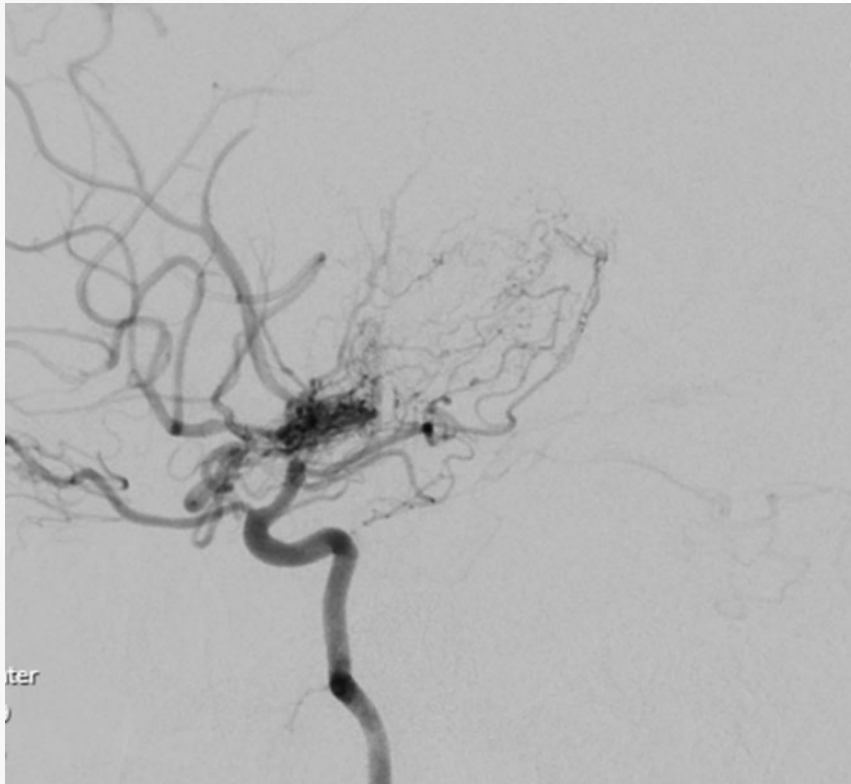
Treatment of Moya Moya in children



- Treatment plan:
- Diagnostic Angiogram
- encephalo-duro-arterio-myosynangiosis (EDAMS)
- STA-MCA bypass

Case study images

- Angio – “puff of smoke”



- Intraop STA-MCA connection
- DSA months after the EDAMS and STA-MCA bypass surgery (STA feeds LMCA territory)



References

- Ferriero, D. M., Fullerton, H. J., Bernard, T. J., Billinghamurst, L., Daniels, S. R., DeBaun, M. R., deVeber, G., Ichord, R., Jordan, L. C., Massicotte, P., Meldau, J., Roach, E. S., & Smith, E. R. (2019). Management of stroke in neonates and Children: A scientific statement from the American Heart Association/American Stroke Association. *Stroke*, *50*(3). <https://doi.org/10.1161/str.000000000000183>



TRINITY
HEALTH

Stroke Case Study-2023 Gave Thrombolytics-Now What?

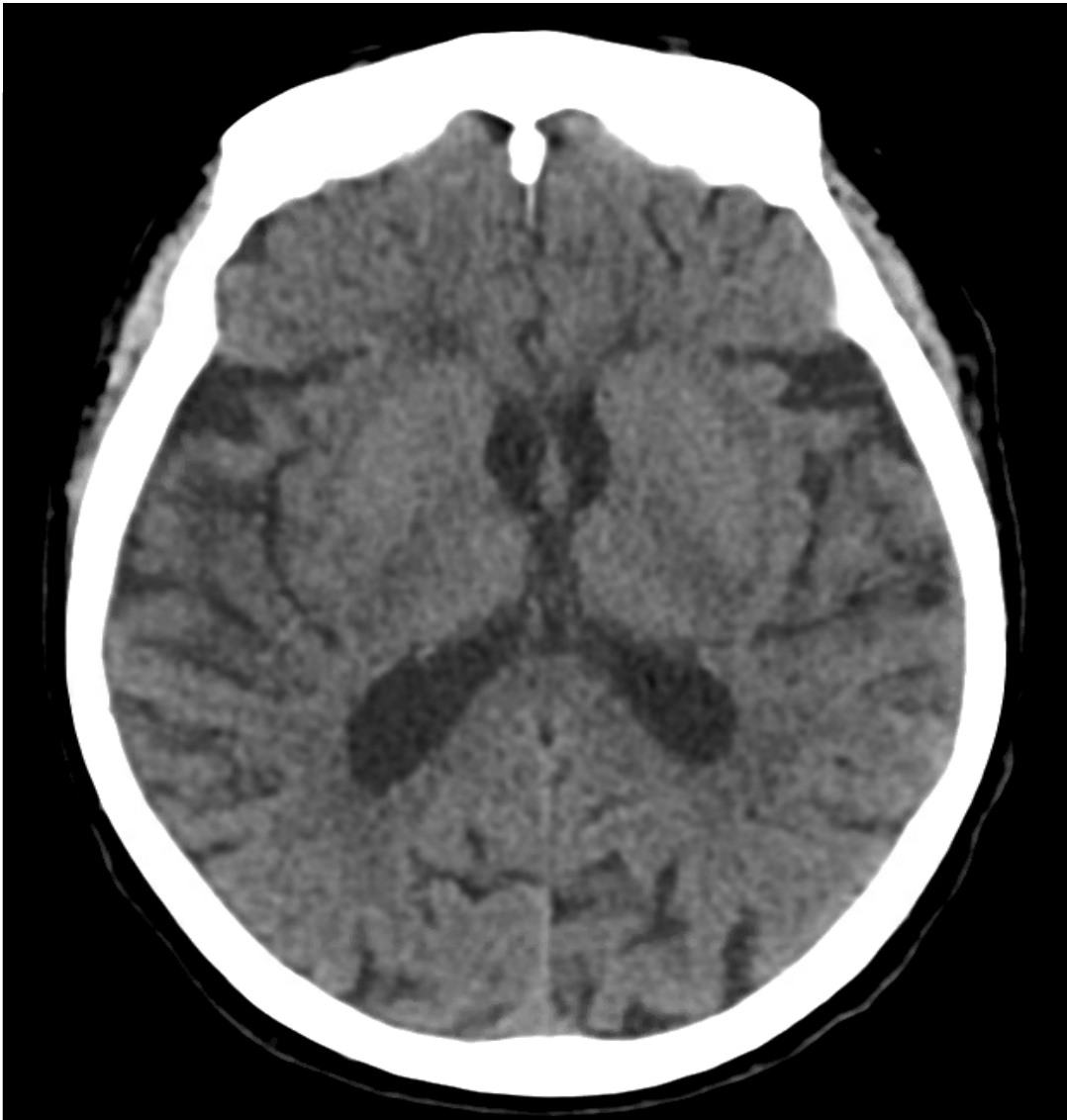
Jerilyn Alexander, BSN, RN Stroke Coordinator Trinity Health

Disclosure

Jerilyn Alexander has no relevant financial relationships with any companies to disclose

Patient Background-Arrival at CAH

- **89 yo female** presents to Critical Access Hospital by EMS with complaints of a fall.
- LKW 1045
- Past medical history: HTN, HLD, Seizure Disorder, CKD Stage 4
- Current meds: Metoprolol, Norvasc, Zocor, Losartan, Aspirin, Sertraline
- Normal baseline: A/O, ambulates with walker, lives with daughter
- Arrival at 1211
- Assessment: Incomprehensible speech, left facial droop
- Stroke Alert activated at 1224
- Patient to CT



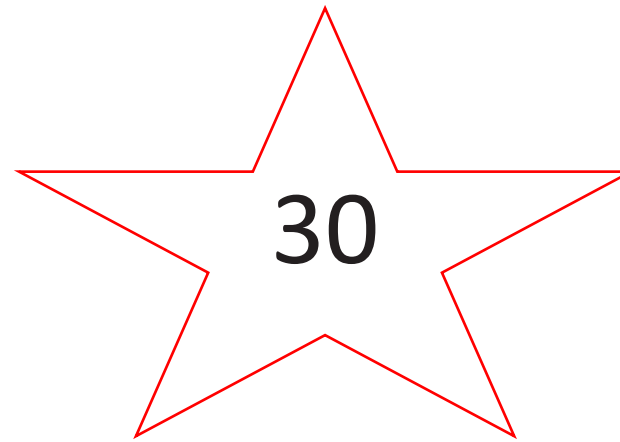
CT Head-
CAH
Scout
image at
1224
Reported
at 1245

IMPRESSION:

1. There is no intracranial hemorrhage.
2. No evidence of an acute intracranial abnormality. Correlate clinically for an acute stroke as an early or small stroke may not be visible on the CT imaging.
3. Moderate atrophy and moderate chronic small vessel ischemic changes in the brain.

NIHSS-Baseline

- 1a. Level of Consciousness -2
- 1b. LOC Questions -2
- 1c. LOC Commands -2
- 2. Best Gaze -0
- 3. Visual -0
- 4. Facial Palsy -2
- 5a. Left Motor Arm -4
- 5b. Right Motor Arm -2
- 6a. Left Motor Leg -4
- 6b. Right Motor Leg -3
- 7. Limb Ataxia -2
- 8. Sensory -1
- 9. Best Language -3
- 10. Dysarthria -2
- 11. Extinction and Inattention -1



CAH Information

- VS: 165/60 HR 64 100% Room Air
- Lab drawn 1235
- Pertinent Lab results-Hgb 9.5, Glucose 107, Cr. 2.3
- Trinity Health Neurologist consulted. With the elevated NIHSS, Last known well time, he felt the patient should receive Alteplase and be transferred
- CAH provider discussed the risks and benefits of Alteplase with the patient and family. They agreed and the patient was eligible.
- Alteplase was given at 1420, within the 4.5 hour window
- Door to needle **129** minutes
- Patient departs CAH at 1445 (Door in Door out **154** minutes)
- Patient is a DNR/DNI per patient and family wishes

EMS Transfer

- Patient transferred with Paramedic and Driver as a crew
- Alteplase infusing while enroute
- EMS assessment: Garbled speech, left facial droop, drooling noted, left side weakness
- BP monitored Q 15 minutes ranging 137-166 systolic over 75-96
- HR 60-100, RR 16-18, Oxygen sats 94-98% on room air
- Patient becomes more alert while enroute to Trinity. Attempts to speak but speech remains garbled.
- Patient arrives at Trinity at 1557

Arrival at Trinity Health ETC

- Stroke alert activated prior to arrival, team waiting for patient
- Upon arrival, patients breathing was audible from the doorway.
- Her tongue was swollen, protruding from her mouth, firm to palpation, bruised with blood oozing from her mouth
- EMS was questioned about this finding and stated “she was like that when we picked her up”
- VS: 153/60 HR 69, RR 20, Oxygen sats 94% on Room air
- NIHSS improved on arrival to 10
- CT Angio/Perfusion scan ordered
- Nursing staff concerned about lying the patient flat for scans with the tongue swelling. ETC Provider alerted
- Patient medicated with Benadryl, Solumedrol, and Pepcid

Trinity Health ETC

- Patient went for CTA/Perfusion scan
- This was negative for LVO and the perfusion scan had significant motion artifact but no large areas of ischemia
- It also showed:

8. Masslike soft tissue with inflammatory changes surrounding the left submandibular gland and left parotid gland. Findings are nonspecific but may be seen with infection, salivary gland inflammatory process, or neoplasm. Recommend clinical correlation and consider direct visualization for further evaluation. Also recommend follow-up CT of the neck and 8-12 weeks to document resolution.

Addendum

Masslike soft tissue swelling with inflammatory changes within the left oropharynx and hypopharynx surrounding the left submandibular gland, left parotid gland and tongue predominantly the left side. Findings are nonspecific but may be seen with infection, inflammatory process, or neoplasm. **Additionally, since patient got tPA this may represent angioedema post TPA.** Recommend clinical correlation and consider direct visualization for further evaluation. Also recommend follow-up CT of the neck and 8-12 weeks to document resolution.

- Patient returned to the ETC and provider felt her tongue was swelling was worse. Patient received another dose of Benadryl, and Epinephrine SubQ.
- Patient transitioned to the ICU at 2005

Trinity Health ICU

- Patient was admitted to the ICU per routine post-thrombolytics protocol
- H & P states tongue is largely swollen with ecchymosis
- There was some suspicion that the patient bit her tongue when she fell but the CT report supported Angioedema
- Her sats remained above 94% on room air so no airway interventions were performed, and she was a DNR/DNI
- She was given Reglan, Benadryl and Solumedrol every 6 hours to try to decrease symptoms of angioedema
- Day 2 the patient continued to have a swollen tongue so unable to speak. Would follow commands and her stroke symptoms seemed to be improving.
- CT head completed 24 hours after alteplase administration and was negative for any hemorrhagic transformation

Trinity Health-Progressive Care Unit

- Patient transitioned out of the ICU on Day 3 of hospitalization
- Her tongue was better as far as swelling but was very bruised; she was able to speak.
- Her Hgb dropped to 6.9 so 2 units of PRBC's were transfused.
- She had a repeat head CT which was negative for hemorrhage and an abdominal ultrasound and CT which did not show any source of bleeding.
- ENT was consulted regarding continued swelling to the posterior pharyngeal wall and posterior aspect of the tongue. He recommended just monitoring and no intervention
- Patient was becoming more lethargic. Patient unable to swallow due to swelling. Concerns for nutrition post stroke due to inability to swallow.

Trinity Health PCU

- Day 5 of hospitalization the patients creatinine began to climb. She was a poor candidate for dialysis.
- Day 6 the family decided on CMO and the patient expired

Angioedema Post Thrombolytics

Oral angioedema is a rare but life-threatening complication for patients receiving IV thrombolysis.

Incidence ranges from 0.9% to 5.1% in stroke patients receiving thrombolytics (1)

Swelling associated with fibrinolytic agents is likely bradykinin mediated as plasmin has been reported to activate coagulation factor XII of the contact system (2)

Treatment of Angioedema

2018 Guidelines for management of Acute Ischemic Stroke (3)

Table 9. Management of Orolingual Angioedema Associated With IV Alteplase Administration for AIS

Class IIb, LOE C-EO
Maintain airway
Endotracheal intubation may not be necessary if edema is limited to anterior tongue and lips.
Edema involving larynx, palate, floor of mouth, or oropharynx with rapid progression (within 30 min) poses higher risk of requiring intubation.
Awake fiberoptic intubation is optimal. Nasal-tracheal intubation may be required but poses risk of epistaxis post-IV alteplase. Cricothyroidotomy is rarely needed and also problematic after IV alteplase.
Discontinue IV alteplase infusion and hold ACEIs
Administer IV methylprednisolone 125 mg
Administer IV diphenhydramine 50 mg
Administer ranitidine 50 mg IV or famotidine 20 mg IV
If there is further increase in angioedema, administer epinephrine (0.1%) 0.3 mL subcutaneously or by nebulizer 0.5 mL
Icatibant, a selective bradykinin B ₂ receptor antagonist, 3 mL (30 mg) subcutaneously in abdominal area; additional injection of 30 mg may be administered at intervals of 6 h not to exceed total of 3 injections in 24 h; and plasma-derived C1 esterase inhibitor (20 IU/kg) has been successfully used in hereditary angioedema and ACEI-related angioedema
Supportive care

ACEI indicates angiotensin-converting enzyme inhibitor; AIS, acute ischemic stroke; IV, intravenous; and LOE, Level of Evidence.

Sources: Foster-Goldman and McCarthy,¹⁵⁸ Gorski and Schmidt,¹⁵⁹ Lewis,¹⁶⁰ Lin et al.,¹⁶¹ Correia et al.,¹⁶² O'Carroll and Aguilar,¹⁶³ Myslimi et al.,¹⁶⁴ and Pats et al.¹⁶⁵

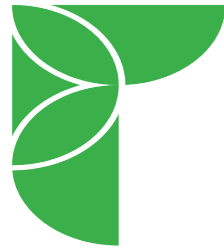
Stroke Protocols

- Every facility should have stroke protocols that include the treatment of any complication related to thrombolysis, including angioedema
- The incidence is low, but it can occur.
- Our facility has had a total of 5 cases (4 in 1 year)
- Teach your patients and families what to be aware of and what to watch for. We had 1 family notice the angioedema and alert nursing staff.
- Its good to do an oral exam prior to administering thrombolytics to have that baseline assessment.
- Include your assessment of angioedema in your documentation. If it's not documented, it is not done.


Questions??

Citations

1. Fröhlich K. MD, Macha S, MD, Gerner S., MD, et al. Angioedema in Stroke patients with Thrombolysis. Stroke;2019;50:1682-1687
2. Agostoni A., Gardinali M, Frangi D. et al. Activation of Complement and kinin systems after thrombolytic therapy in patients with acute myocardial infarction. A comparison between streptokinase and recombinant tissue-type plasminogen activator. Circulation. 1994 Dec;90(6):2666-70
3. Powers, W., et al. 2018 Guidelines for the Early Management of Patients with Acute Ischemic Stroke-A Guideline for Healthcare Professionals from the American Heart Association/American Stroke Association. Stroke. 2018;49:e46-e99



TRINITY
HEALTH



Central Retinal Artery Occlusion CRAO

Holly Nissen MSN RN SCRNCNRN ASC-BC

Chelsey Kuznia BSN RN SCRNCNRN

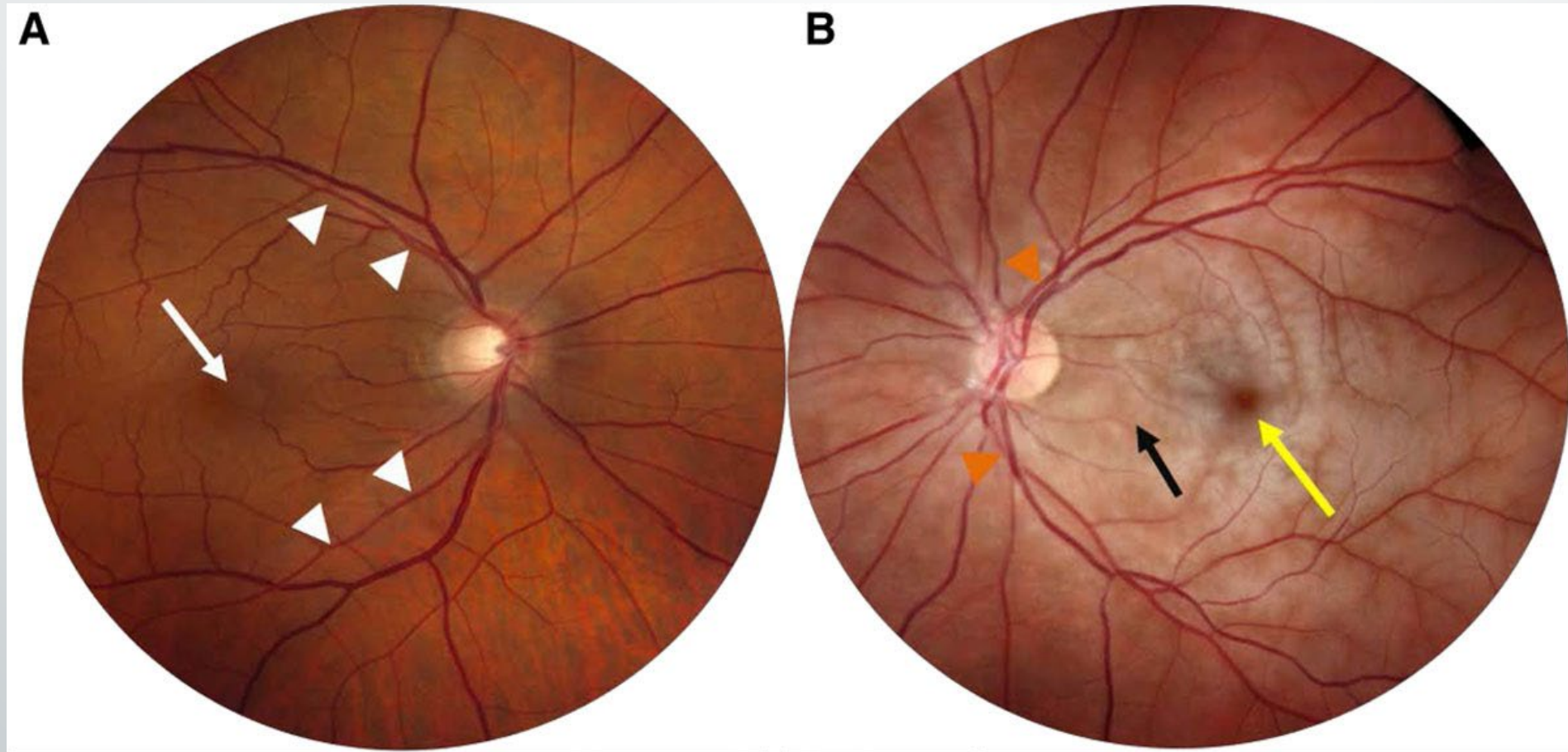
Patient Scenario – Primary Hospital

- 73 yo F admitted for GI Bleed and chest pressure.
 - Hx of DVT, PE, and stroke - was on anticoagulation until 2 days prior
- Suddenly develops loss of vision in left eye after returning from a colonoscopy
 - Stroke code called inpatient
 - MRI done with scattered infarcts in her left hemisphere.
 - No focal neuro deficits – NIHSS 1

Is the patient eligible for Hyperbaric Oxygen Therapy?

- CRAO diagnosis must be made by Ophthalmology
 - Funduscopic Exam – cherry red spot, retinal whitening
- Is the patient an IV thrombolytic candidate with LKW within 4.5 hours?
 - If so give the lytic, then consider HBOT treatment but must wait at least 2 hours post-thrombolytic administration
 - This patient was not a lytic candidate due to current GIB
- Was symptom onset of sudden, painless, unilateral vision loss within the last 6 hours? 18 hours?
 - LKW 4.5 – 6 hours: consider IA tPA (if available)
 - LKW 0-18 hours or after being consider for IV or IA thrombolytics: consider HBOT

Example of Fundus Photograph



Patient Scenario - After Transfer

- Baseline vision upon admission: loss of upper quadrants of visual field in the left eye
- Scheduled for 10 – HBO treatments BID, each dive 110 minutes with two 5-minute air breaks
- 1st Dive occurred the night of transfer – Patient Tolerated Well
- 2nd Dive the next morning – Patient unable to tolerate due to pressure and pain in the ears and sinuses
 - Flonase and Afrin nasal sprays were ordered prior to HBOT to help with the symptoms but were ineffective
- Bilateral Myringotomy and Tube Placement by ENT provider that afternoon
 - 2nd Dive completed after procedure, resumed BID schedule the next morning

Protocol

- Fundoscopic exam to confirm CRAO diagnosis and exclude other causes
- Screening for arteritis (ESR/CRP Lab Draw)
- Treatment with IV thrombolytic, if eligible
- Treatment with HBO twice daily for 5 days, total of 10 dives
- Emergent Myringotomy – may be necessary to relieve pressure
- Ophthalmology reassesses vision Day 3 (if available)
 - May also consider ocular ultrasound to assess blood flow if Ophthalmology unavailable

Challenges

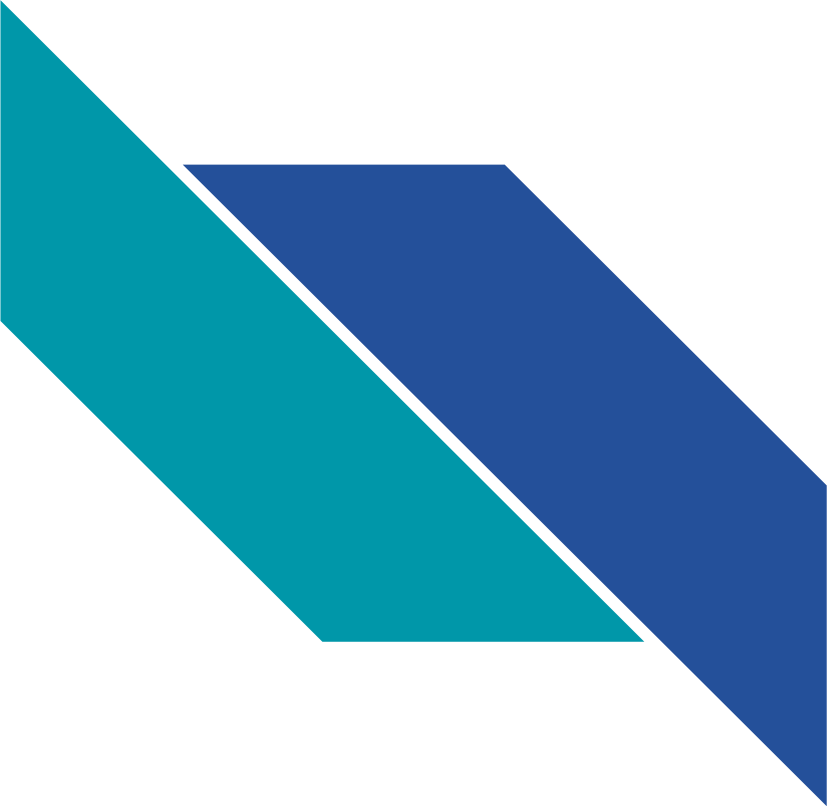
- Patient's arrival and diagnosis within the ideal treatment window for HBOT
- Ophthalmology coverage in the Acute Hospital Setting
- Emergent Myringotomy
- Timely Transfer
- Neuro assessments post Lytic administration for up to 2 hours
 - Minimal Neuro assessments can be done in the chamber

Patient Outcome

- Completed 10 of 10 Ordered Dives
- Discharged Home with an NIHSS of zero
- Patient reported full restoration of vision

Summary

- Central Retinal Artery Occlusion is a Stroke
- Hyperbaric Oxygen Therapy is an FDA approved treatment for CRAO
- Diagnosis of CRAO is essential to drive treatment options
- Providers should prioritize IV or IA thrombolytics in the treatment of CRAO



2023 Cardiac & Stroke Conference Case Study

Brannigan Hamrick, RN BSN

**Holly Nissen, MSN RN CNRN SCRNC ASC-
BC**

Background

Patient History

- 45 y.o. patient.
- PMH includes -
- Migraines
- Essential HTN
- GERD
- No anticoagulants

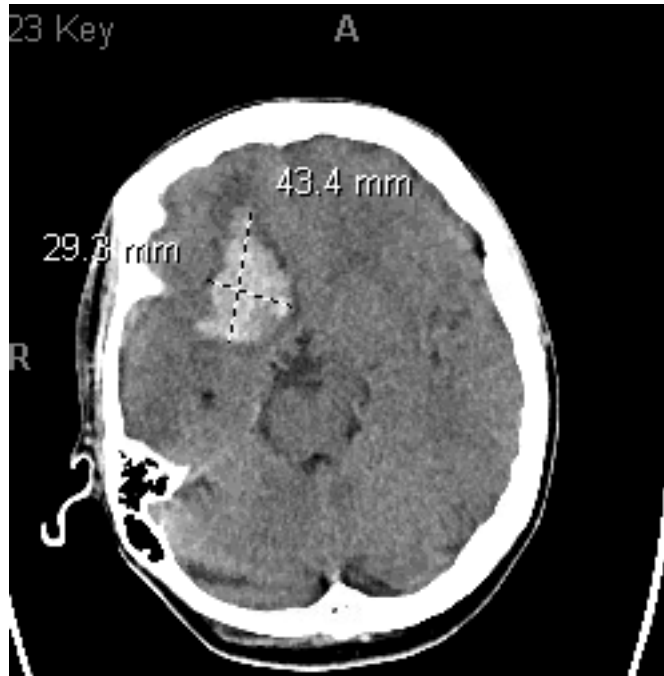
Presenting Symptoms

- Notable left side facial droop
- Headache
- Unsteady gait
- Nausea w/ emesis x1
- Ataxia of the left upper extremity
- Question left hemisphere visual neglect

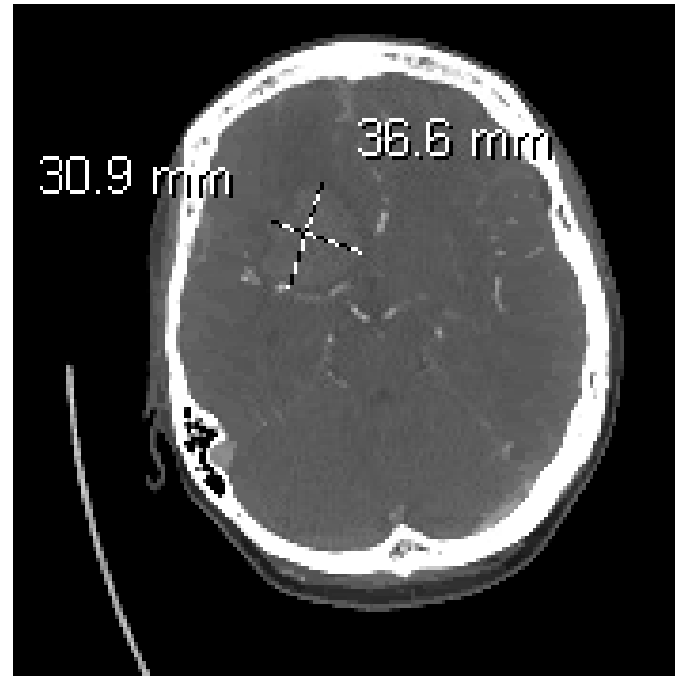
Code stroke called, patient taken to CT for initial scan and assessment from tele neurology.

Images of ICH

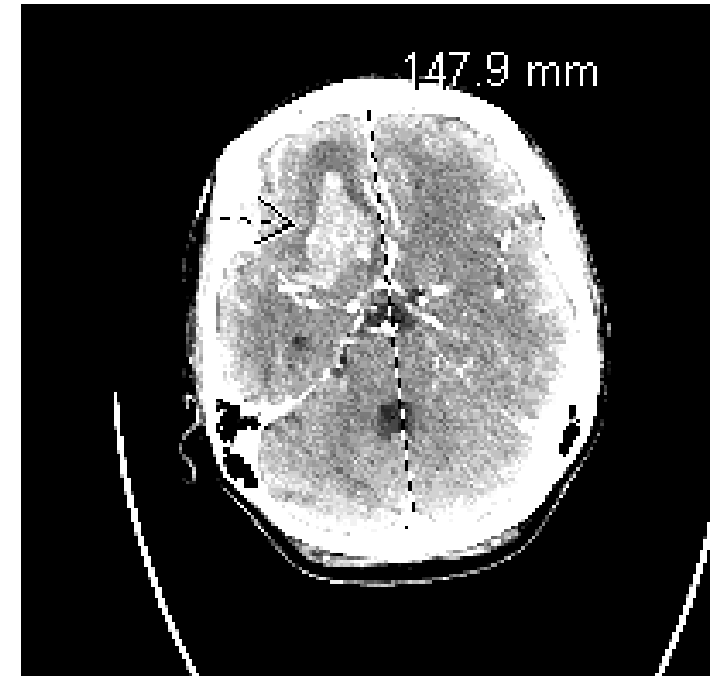
CTH without contrast



CT Angiogram Head



CT Angiogram Head



Key Takeaways

Last Known Well?

- Last Known Well @ 18:30
- Arrival To facility with family @ 20:23

ED Assessment

- Last Known Well 18:30
- NIHSS = 5
- CT head = acute right frontal intraparenchymal hemorrhage with mild mass effect
- ICH score = 0
- CTA = ruptured right MCA aneurysm with large right inferior frontal intraparenchymal hematoma, 4 mm midline shift
- TS recommends stat neurosurgical consult after reading head CT.
- Stat Neurosurgeon consult-recommends tx to Fargo for further intervention (coiling vs. Clipping)

Disposition

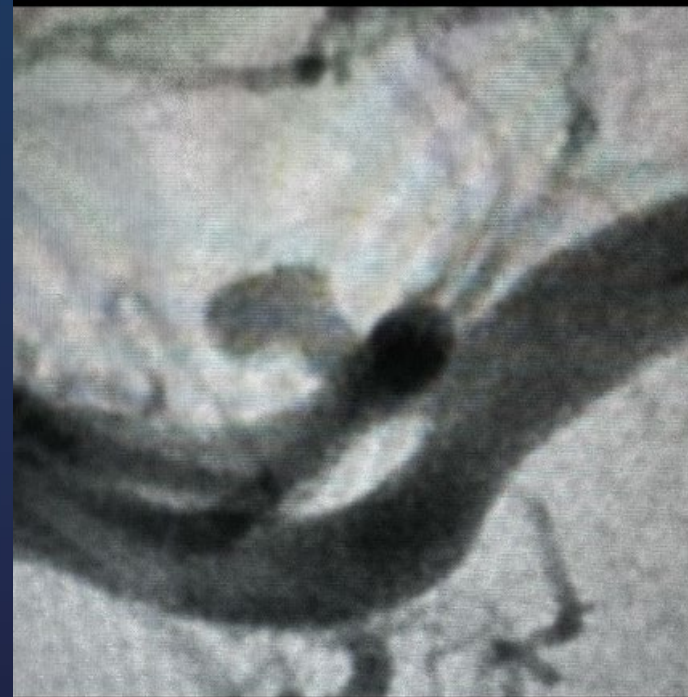
- Transferred to Sanford Fargo
- Patient transferred via fixed wing for further intervention from ED @ 22:00.

Patient transferred to SMCF

- Pt arrived at SH: 23:55
 - Subtle left facial droop, mild confusion, and GCS of 14
- CT head complete by: 00:06
 - Slight increase in the size of hemorrhage
 - Ruptured R)MCA aneurysm, SAH, ICH, and SDH
- To cath lab for balloon assisted coiling of M1 aneurysm by Dr. Drofa
 - Procedure start time: 00:30
 - DSA done to visualize the 3.0 mm aneurysm
 - 1 coil placed
 - Procedure complete: 01:04

Hunt Hess Score: 3
Fischer Score: 4

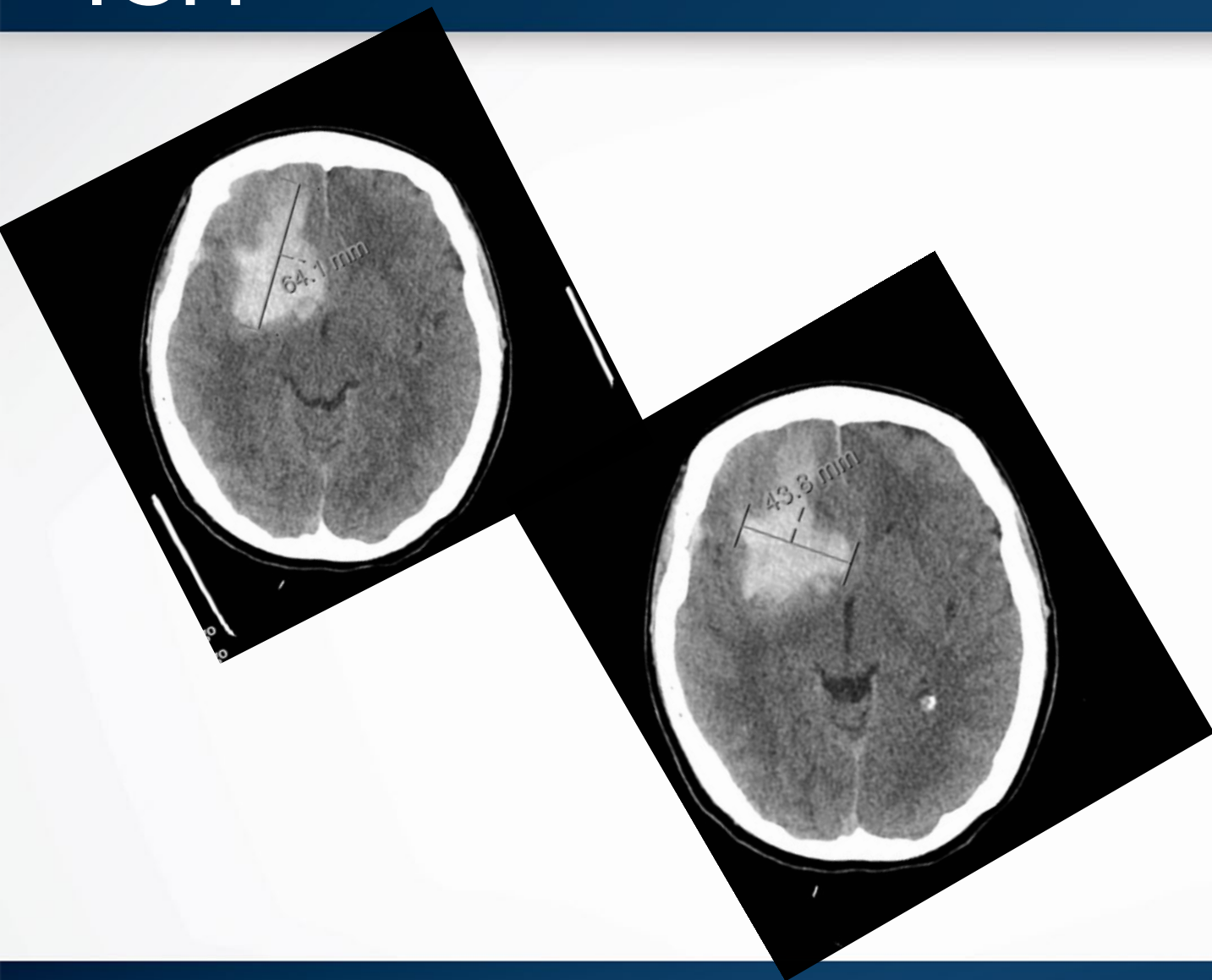
Aneurysm & Coil



Return to the OR

- In neurocritical care, pt was becoming increasingly more drowsy and responding less to nurses
 - Head MRA: No LVO, good occlusion of the aneurysm: 03:06
 - Head CT: Large frontal ICH with 4mm shift: 06:05
- Due to ICH and edema, the pt was brought back to the OR for craniotomy 09:05
 - Frontal ICH microsurgical evacuation

ICH



Monitor, watch and wait – Neuro Critical Care

- ICU care for 14-21 days (vasospasm risk)
- Frequent neuro checks
 - NIHSS – 1 (for facial droop)
 - Sitting up in bed A&O X3
 - Head CT to monitor for swelling
 - TCDs to evaluate for vasospasm
 - Nimodipine
 - BP control – Permissive HTN once secured.
- Pain management for HA
- PT, OT, SLP

HYDROCEPHALUS – can develop within a few hours after aneurysm rupture
Recognize – signs of increasing ICP, decreased LOC

Tx – External ventricular catheter (EVD) , ventriculoperitoneal shunt, lumbar drain

VASOSPASM – can cause AIS, peaks at 4-7 days after aneurysm rupture

Recognize – signs of ischemic stroke, need fq neuro assessments

Tx – euvolemia, IA Verapamil, BP mgmt, balloon-angioplasty

Discharged home 14 days later

- Outpatient rehab
 - PT, OT
- 6 week follow up with Dr. Drofa
- Follow up angiogram in 3 months