

Complex Strokes and Strokes of Unknown Etiology

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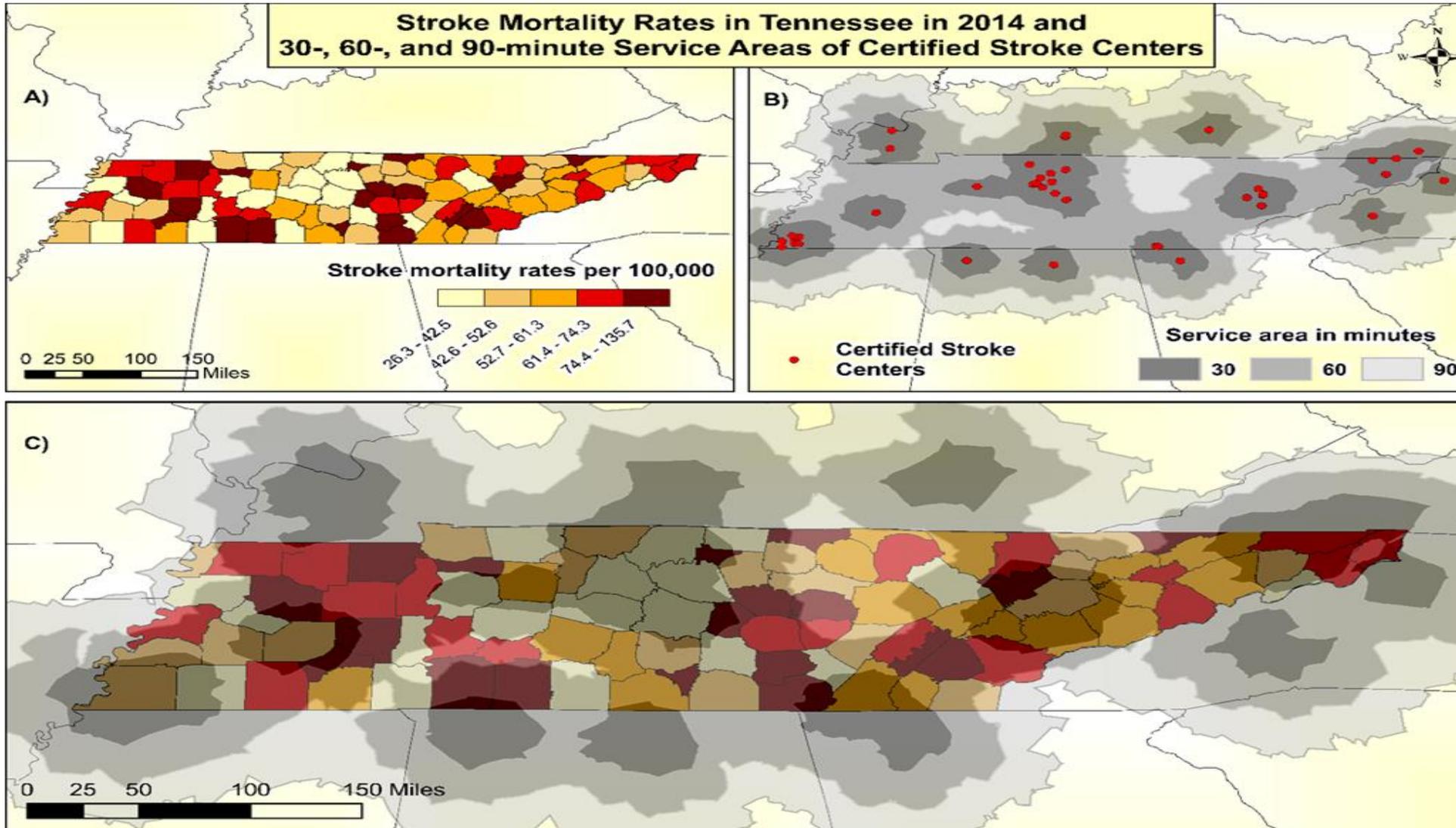
Disclosures

- No financial disclosures
- Sub-Investigator
 - Stroke AF trial
 - RESPECT-ESUS trial

OBJECTIVES

- Identifying the signs and symptoms of a posterior circulation stroke
- Discuss the best work-up for hard-to-diagnose strokes
- Discuss treatments for posterior circulation strokes
- Discuss the interventions for cryptogenic stroke

“Where I come from...it’s cornbread and chicken...”



Posterior Circulation Strokes

- Confounding symptoms
 - Mimic other medical problems
 - Posterior circulation vessels supply very diverse regions
 - Posterior parts of the **cerebrum** to the **brainstem** and **cerebellum**
- Greater than 20% of these strokes are missed in the ED and the patients are sent home
- Are nearly 3x more likely that “anterior” circulation strokes to be missed

Early recognition=Early intervention=Best recovery chance

- Occlusion of the large vessels in this area has a mortality risk of 85%
 - Think: Basilar=Brainstem



Common Symptoms

Deadliest of D's

- Dizziness
- Diplopia
- Dysarthria
- Dysphagia
- Dysphonia
- Dysmetria
- Dysthesia
- Drop Attacks (DFO)
- Dystaxia

Other Symptoms

- Altered mental status
- Tinnitus
- Nausea
- Vomiting
- Vertigo
- Facial numbness
- Perioral numbness
- Nystagmus
- Cross symptoms
- Unilateral or bilateral sensory loss
- Unilateral or bilateral hemiparesis
- Quadraparesis



The posterior cerebral arteries stem in most individuals from the basilar artery but sometimes originate from the ipsilateral internal carotid artery.

Functional Areas of the Brain¹

Motor Area

- control of voluntary muscles

Sensory Area

- skin sensations (temperature, pressure, pain)

Frontal Lobe

- movement
- problem solving
- concentrating, thinking
- behaviour, personality, mood

Broca's Area

- speech control

Temporal Lobe

- hearing
- language
- memory

Brain Stem

- consciousness
- breathing
- heart rate

Parietal Lobe

- sensations
- language
- perception
- body awareness
- attention

Occipital Lobe

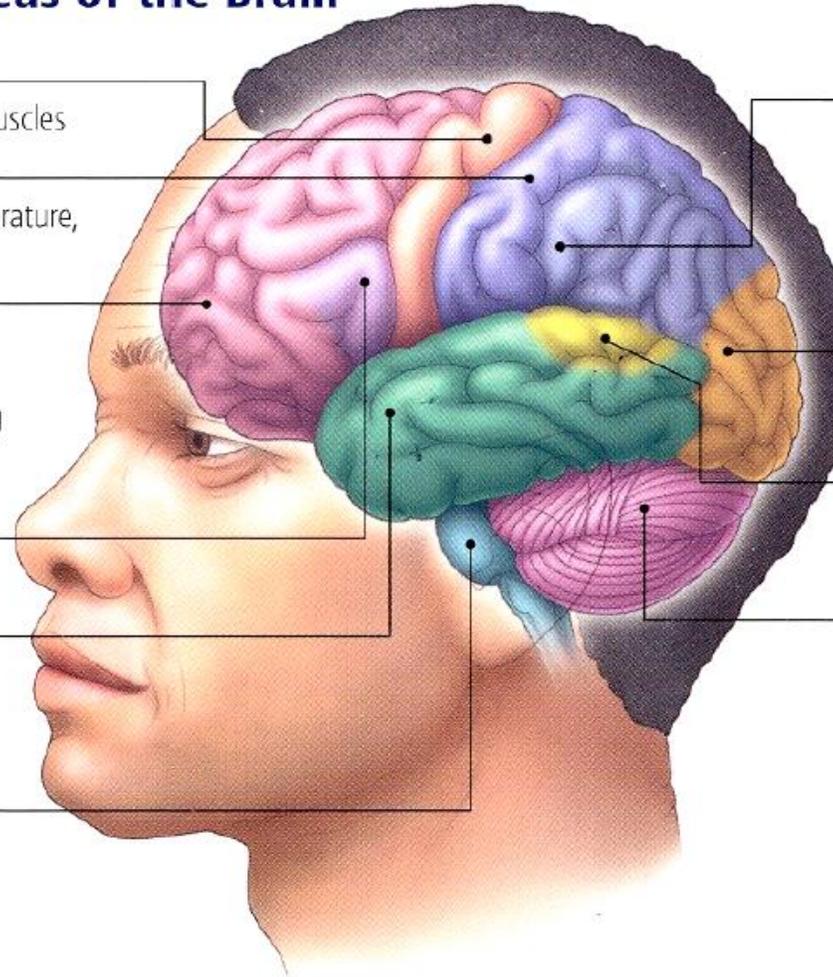
- vision
- perception

Wernicke's Area

- language comprehension

Cerebellum

- posture
- balance
- coordination of movement



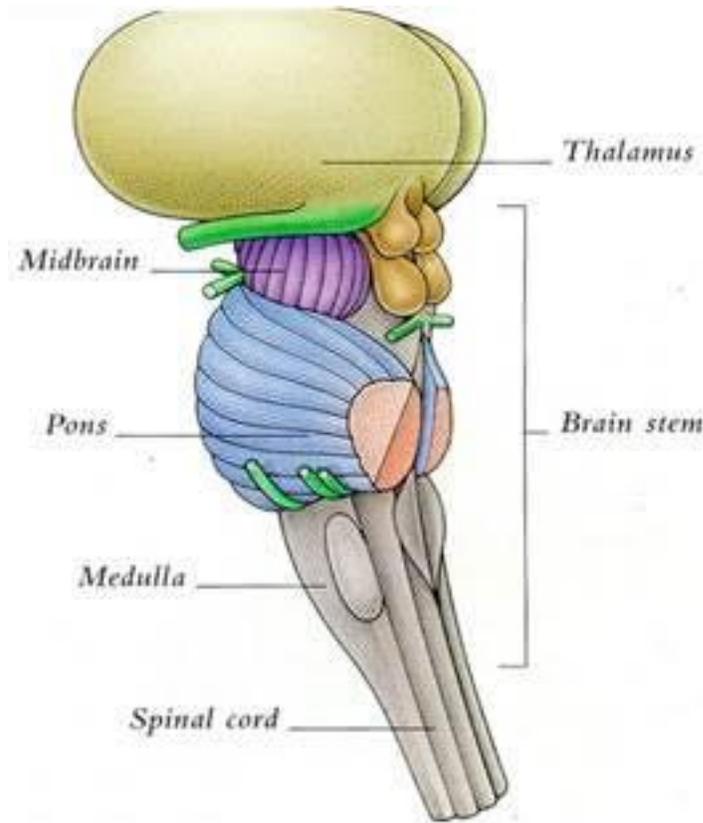
The posterior arteries supply the **temporal and occipital lobes** of the left cerebral hemisphere and the right hemisphere.



Cranial Nerve Exam

Pupil light reflexes
Visual fields
Facial symmetry
Voice
Tongue deviation
Sensation
Palate elevation
Gag reflex
Head turning and shoulder shrug

Big Deal?



BRAINSTEM

Most of the cranial nerves are here

Impairment:

- ❖ Motor or sensory loss in all 4 limbs
- ❖ Crossed signs (face vs. body)
- ❖ Nystagmus
- ❖ Ataxia
- ❖ Dysarthria
- ❖ Dysphagia
- ❖ Respiration
- ❖ Living



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Clinical Assessments: “It ain’t right”

- LAMS (Arm, Grip, Facial Droop)
- Cincinnati (Facial Droop, Arm, Speech)
- FAST-ED (Face, Arm Speech, Eye Deviation, Denial/Neglect)
- RACE (Face, Arm, Leg, Head/Eye Deviation, Aphasia, Agnosia/Neglect)
- BE FAST
 - Balance + Eyes
- NIHSS
 - Mostly for anterior strokes
 - Weakness
 - Ataxia
 - Visual deficits
 - Gaze
- Have the patient
 - Swallow and Speak
- Eye Exam
 - Nystagmus? Deviations?
- CN Exam
- Define Dizziness
 - Ear roaring? Med Changes? Dimming vision?
- Test the Gait!!
- How often do you walk your patients in the ED?
 - Should you discharge him/her before seeing that?
- What about some clinical decision support tools?

Cranial Nerve Exam

Pupil light reflexes

Visual fields

Facial symmetry

Voice

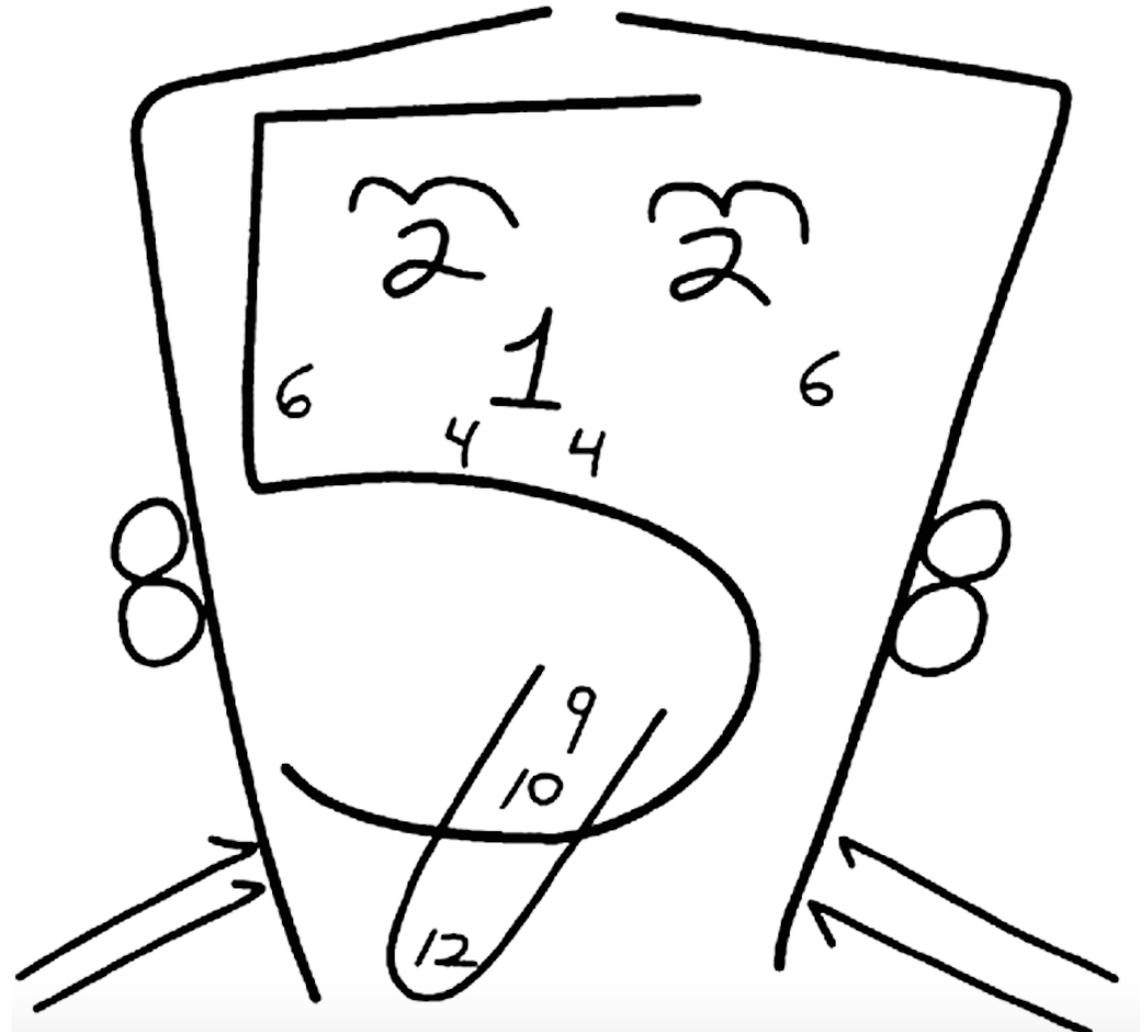
Tongue deviation

Sensation

Palate elevation

Gag reflex

Head turning and shoulder shrug



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Ischemic

- Vert dissection
- Large vessel plaques:
 - Vertebral origins
- Dissections where the artery enters the skull
- Small vessel disease
- Embolic infarcts
 - PFO, ASD
 - Endocarditis
 - Afib

Etiology

Hemorrhagic

- Basilar Tip aneurysms
- HTN
- Drug use
- Alcohol
- Trauma



The Stroke Work-up



- CT...
 - Do we do it for the ones listed later? Dizzy—get a CT?
 - Bad News: CT has poor resolution in the posterior fossa
 - 12% false negatives
- NIHSS testing
- MRI
 - Can miss a small posterior fossa stroke but it's better than CT
- CTA/Perfusion
 - Many CTA/P will not give you an accurate penumbra in the posterior fossa
 - Thrombus?
 - Dissection?



Missed Diagnosis=Disaster

Cerebellar Hemorrhage

Cerebellar Infarction

Epidural/subdural hematoma

Demyelinating disorders

Seizure w/postictal paralysis

Vertebrobasilar Insufficiency

Brain Tumors/mets/Cerebellar neoplasm

Meniere's Disease

Infection; Toxins/Metabolic Issues; Medications

Benign Paroxysmal Positional Vertigo, Migrainous Vertigo, Vestibular Neuritis=labyrinthitis (also tinnitus)

Conversion Disorder

If you miss it

- No tpa
- No MER
- 50% of the patients show up inside of the treatment windows
- Increased LOS
- Stroke Coordinator nightmares (and those nasty letters to providers)
 - Missed metrics
- Discharge differences
 - SNF instead of IPR
 - Double readmission rates
- Increased morbidity and mortality



Case Study

- 60 year old male
 - Tobacco, alcohol, DM, HTN, chronic Afib on Xarelto and a beta blocker for rate control
- Symptoms began: 1530
 - Headache, Nausea, Vomiting, Dizziness
- OSH at 1630
 - AF on arrival with RVR—Immediate treatment of his AF, rate control with Cardizem drip
- 2145-Stopped speaking, Right hemiparesis
 - Telemedicine consult-wife declines tPA
- 2215-Begins posturing “like a seizure”
 - No longer protecting airway-intubated
 - They call the helicopter
- 2330-Arrival to the CSC
 - Believe symptoms began about 1530

CTA on arrival:
Right vertebral artery=Occluded
Basilar artery=proximal 2/3 occluded
Early ischemia in the right cerebellar hemisphere



This is the initial MRI

Management

Day 1

No neuro responses NIHSS 31

- Neurology
 - OOW for tpa due to likely onset of symptoms (possibly started at 1530)
 - Wife declined tPA anyway
- STAT Neurosurgical Consult
 - Mechanical Thrombectomy-not done
 - Cited risk of hemorrhage and death in cerebellum with established stroke
 - Cerebellar hemorrhage risk
- Management:
 - Heparin drip
 - Avoid hypotension

Day 3

Blinks to responses, No motor

- Continued treatments
- Craniectomy watch
- Palliative Care Consults

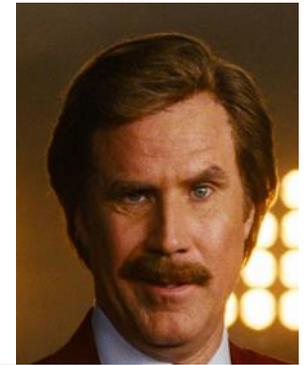


Assessment:
All reflexes gone



This is the repeat MRI

So, it went too far...



Osmotic Diuretics

Mannitol 0.5-1.0 gm/kg

10-20 mL of 23.4% NaCl

Volume expansion for cerebral blood volume circulation

3% NaCl

Albumin

Steroids—more in tumors

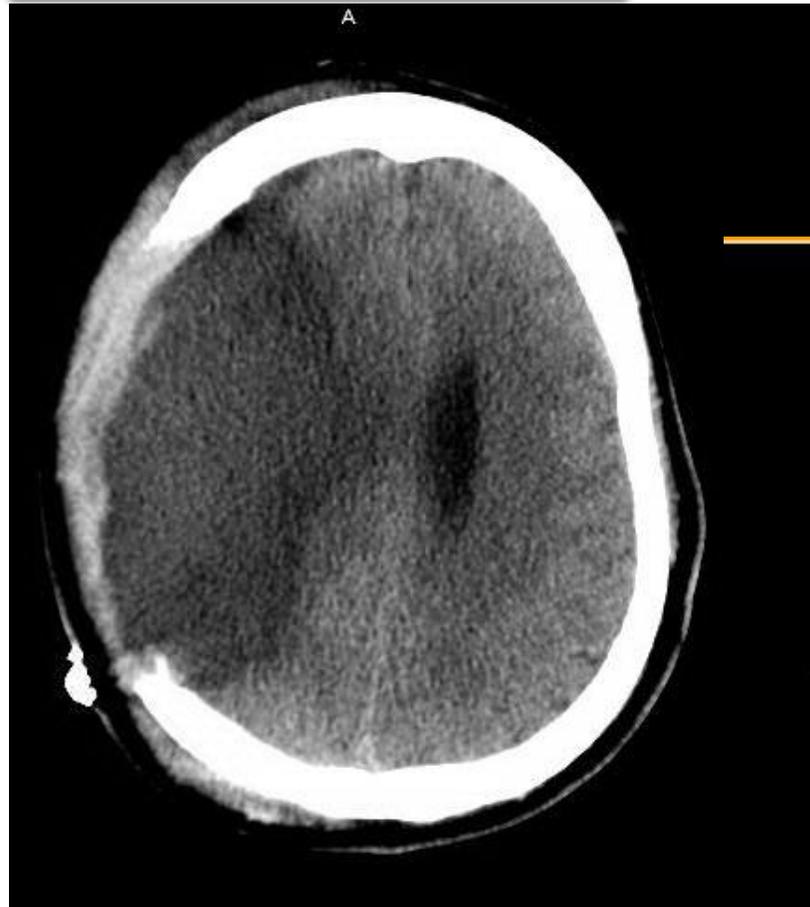
Lowers CSF production

Decrease BBB permeability

Sedatives to decrease metabolic activity

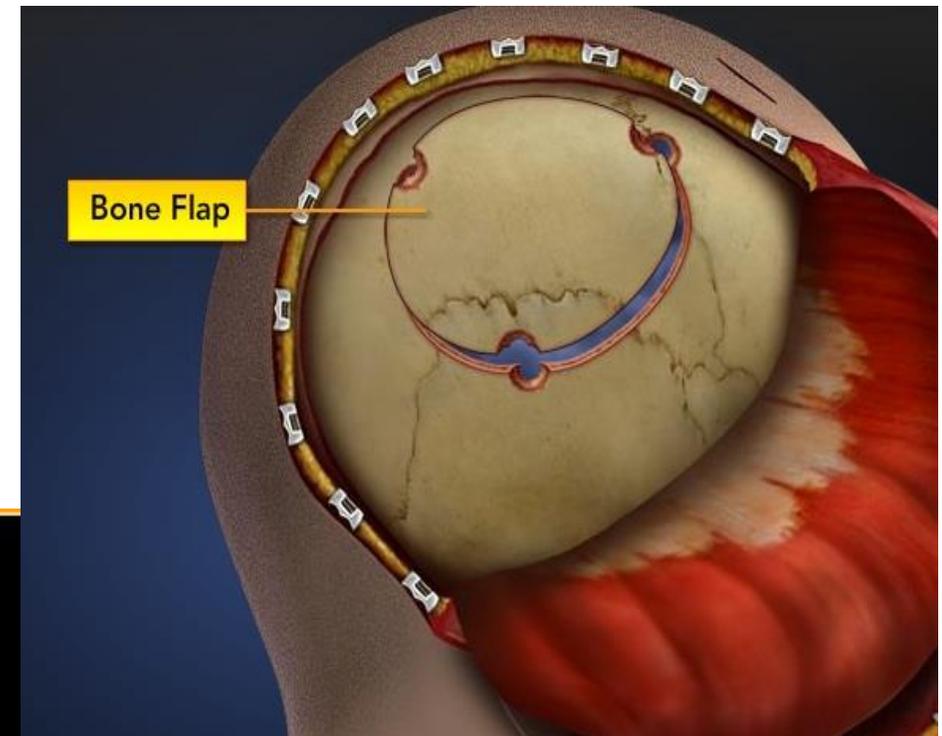
Barbiturates

Diprivan, opiates, etc



Large ischemic area

Craniectomy



Named by the bone plate/area removed

Hematoma evacuation

- Hemorrhage 3-4cm
- Brainstem compression
- Posterior fossa

Craniotomy

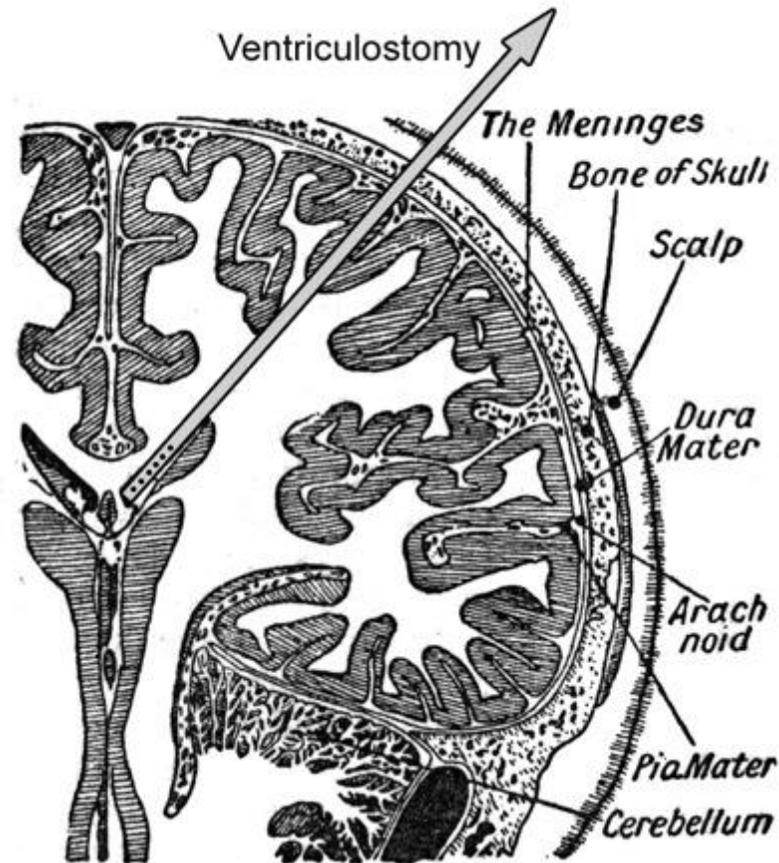
Clot is evacuated
Bone flap replaced



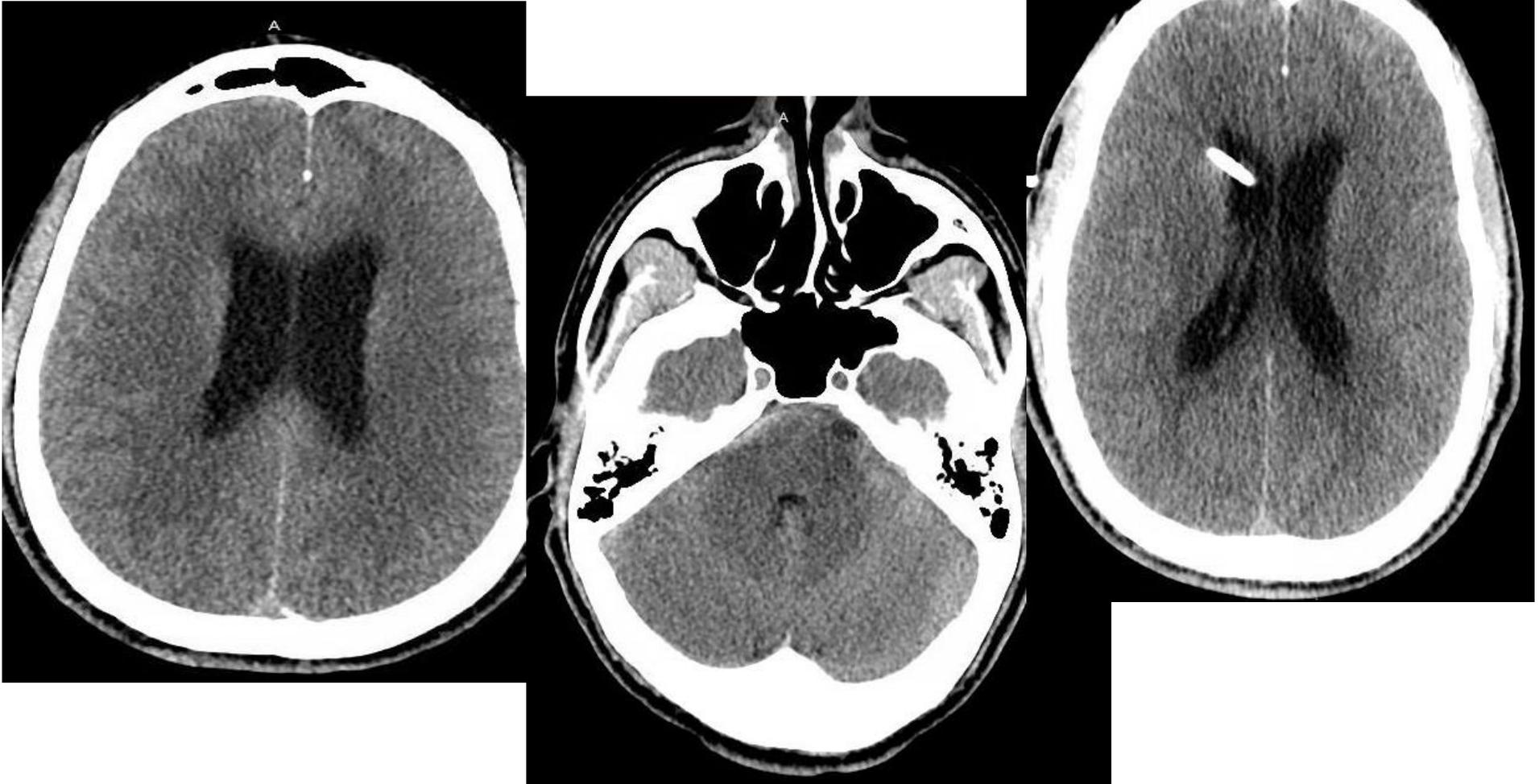
Endoscopic aspiration



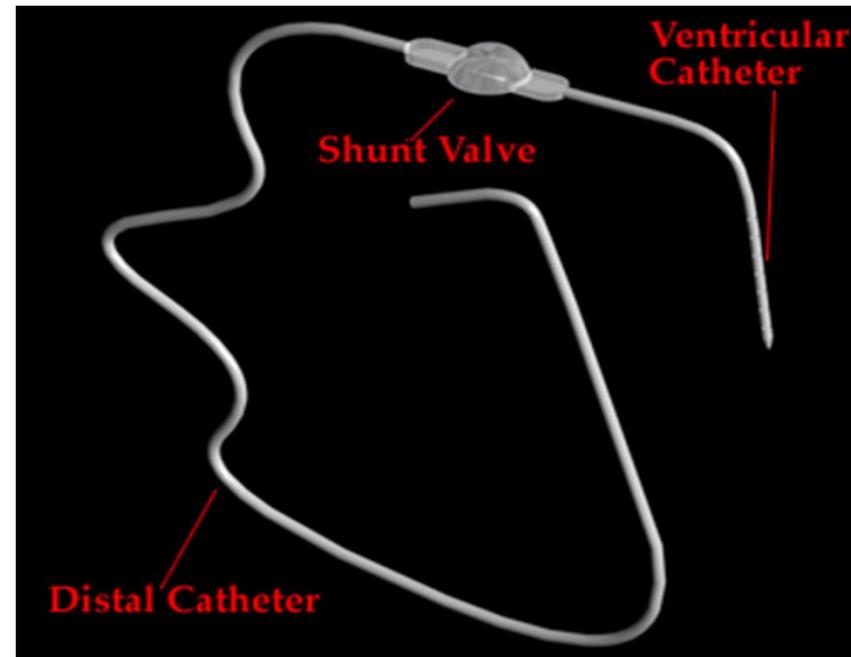
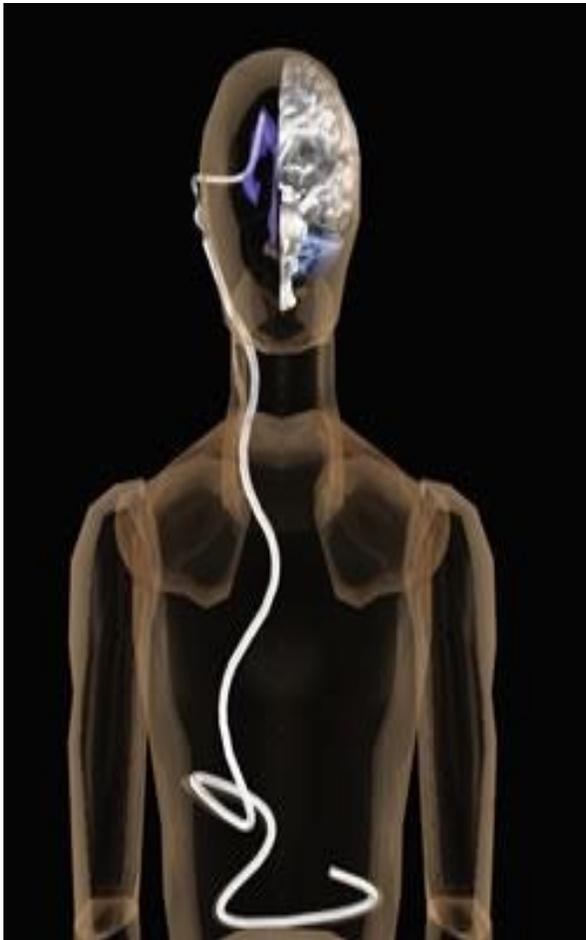
External (intra)ventricular drain (EVD)



Hydrocephalus



Ventriculoperitoneal Shunt



What if it isn't a stroke.....

- What if it turns out to be just dizziness? Or another mimic
- Neurology 2010 study (Chernyshev, et al., 2010):
- 512 patients received tPA
 - On f/u imaging, 21% did not show an infarct
 - Median NIHSS 7 on admit, 0 at discharge
 - No sICH
 - Independent at discharge (median LOS 3 days)
- Most frequent mimics:
 - Seizure, conversion, migraine



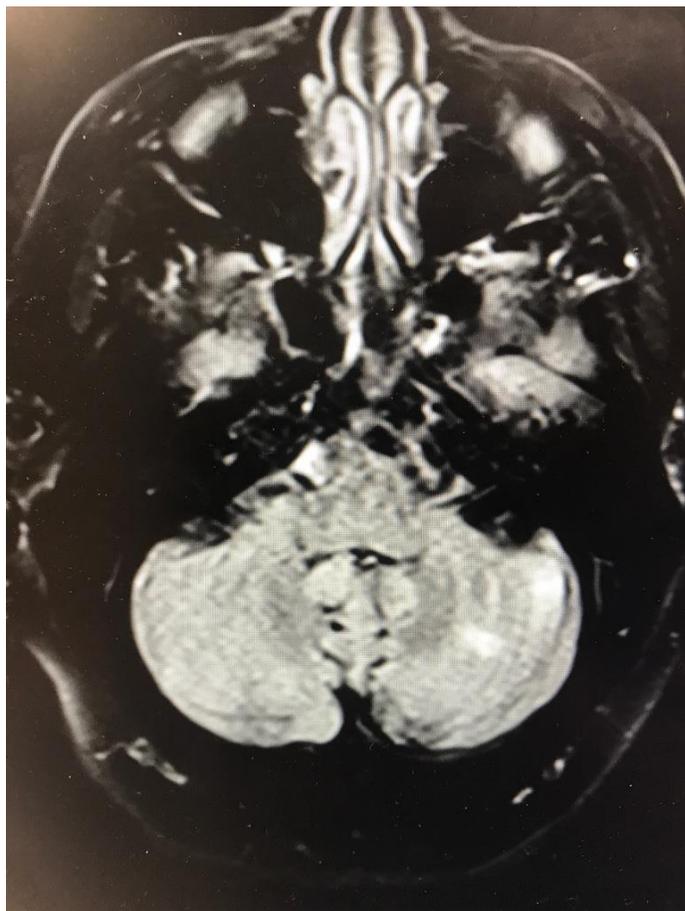
Cryptogenic Stroke

Case Study

57 year old man (CAD, stents, H/O TURP 2006, recent hematuria

- On ASA and Plavix
- Confused while driving for 2 hours AND 2 weeks of “wavy or glittery vision”
- HTN meds recently increased—
- Arrives at 1430
 - CT negative
 - Symptoms improved, NIHSS 0
 - BP 190/110
- DDX:
 - TGA
 - HTN Encephalopathy
 - TIA





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The Work-up (Hint: it's the same as for any stroke)

- Imaging
 - CT
 - MRI
 - CUS
 - CTA/MRA (Always done on a TIA??)
- Cardiac Evaluation
 - TTE or TEE
 - Age dependent
 - Suspicion for embolic events high/low
 - Telemetry
- NIHSS
- Neuro Checks
- CTA
 - Distal left vertebral artery 80+% stenosis
 - 50% stenosis of right vertebral artery
 - 50% or less of carotids
- MRI
 - Multiple & Diffuse tiny acute ischemic strokes in the posterior circulation
 - One cortical stroke supplied by the RMCA
- TEE
 - LV normal with EF 64%
 - All chambers normal
 - No ASD or PFO or Thrombus
 - Mild athero of descending aorta

Cryptogenic: Embolic with no real source identified

- Maximal Medical Management
- Dual antiplatelets
 - Failed this already
 - Placed him on Aggrenox and ASA
- High dose atorvastatin
- Endovascular angioplasty of vertebral artery?
 - Only if fails medical management
 - Vertebral artery angioplasty/stenting would be an option
- Prolonged ECG monitoring
 - AHA Guidelines: “up to six months after stroke”
 - ESC 2016 AF Guidelines

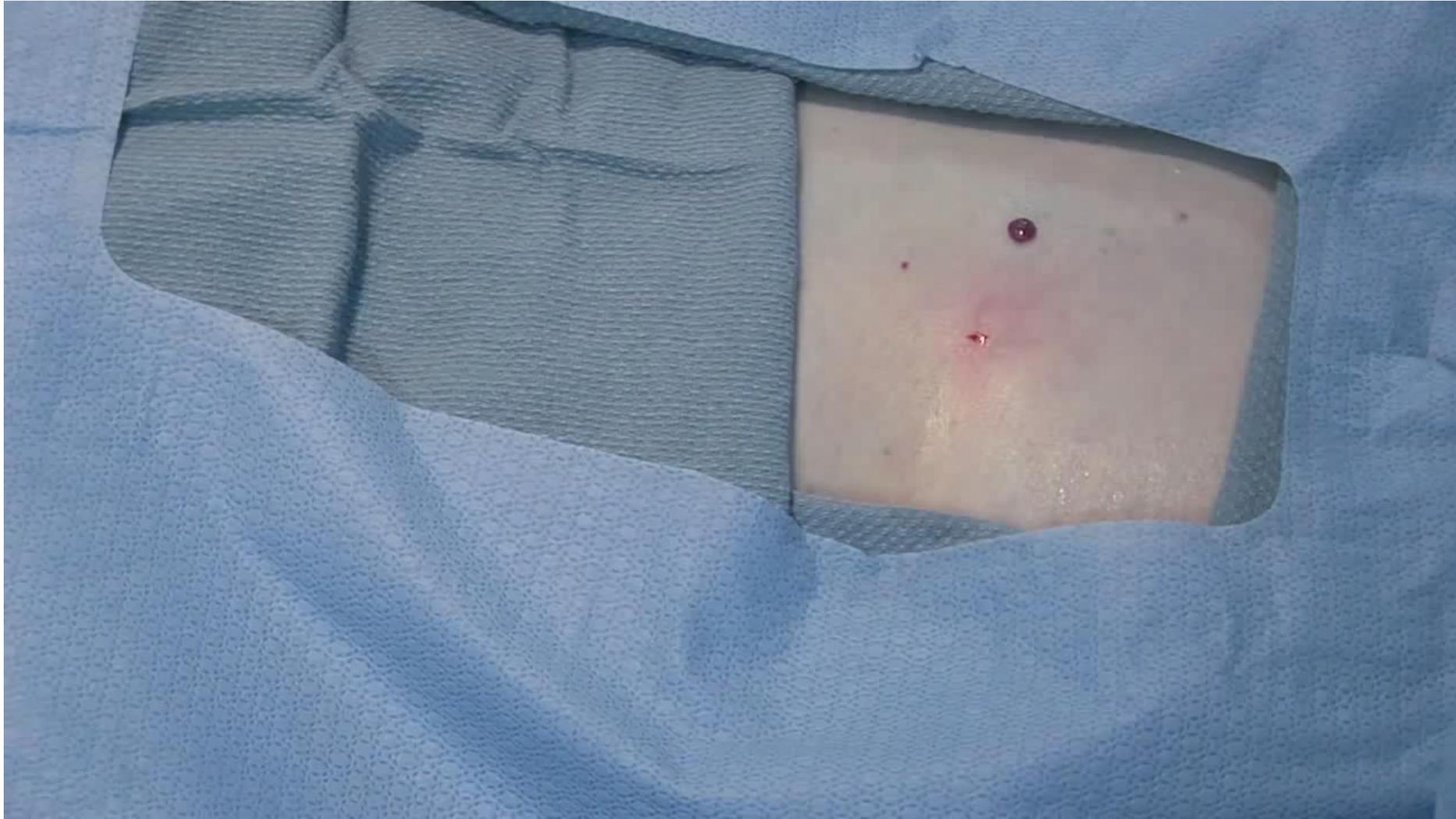
Missing cryptogenic stroke or AF

What's the big deal?

- Atrial Fibrillation
 - Largest strokes
 - Most debilitating
 - Likelihood of next stroke is high
 - Different treatments
 - Antiplatelets
 - Anticoagulation
- No OAC
 - AF on OAC: approaches 65-80% protected
 - AF on antiplatelet: approaches 20% protected
- Readmission



Implantable Loop Recorder



Management Post Discharge

- Continuous ECG monitoring post discharge
 - Inpatient telemetry isn't enough
 - How long?
 - 7-day? 14-day? Longer with implantable monitor?
- Cryptogenic Stroke Pathways
 - Inpatient?
 - Outpatient?
 - Who is responsible?
 - Referrals?
 - Neurology and Cardiology have to talk
 - Administrative approval
 - Where will you do it inpatient
 - Financially, figure out if it's better INPT or OUTPT
 - Volumes are growing, new guidelines
 - Can your implant team handle it?



Unanswered questions

- No AF in 3 months?
 - Then, see ya?
 - CRYSTAL AF says averages 84 days
- Who follows the patient?
 - Stroke Clinic?
 - Neurologists?
 - EP Team?
 - NPs?
- Now what??
- OAC given?
 - By whom?

Questions? --Reach out!

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