Complex Strokes and Strokes of Unknown Etiology

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

The posterior arteries supply the temporal and occipital lobes of the left cerebral hemisphere and the right hemisphere.
Big Deal?

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

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
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
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Etiology

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

**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
Neurosurgical Treatments

Craniectomy

Named by the bone plate/area removed

Large ischemic area
Hematoma evacuation

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

Endoscopic aspiration

Craniotomy
Clot is evacuated
Bone flap replaced

David Fiorella et al. J NeuroIntervent Surg
doi:10.1136/neurintsurg-2014-011293
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
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
    - Susicion 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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