Hyper-acute Stroke MRI

Who to perform it on and how to get it done quickly and safely!
Hyper-acute Stroke MRI Outline

• Background – Why a streamlined protocol?
• MRI for which patients?
• Learning the MRI protocol – what is your role?
• Patient Cases
• MRI Safety Training – required
• Hands on protocol training in ED – Small Groups in coming month
Background

• For years, getting an MRI on a hyper-acute stroke patient has taken too long, > 1 hour
• In April 2013, members from multiple departments (Neuro, ED, MRI) got together in one room for 2 days to develop a new streamlined hyper-acute MRI stroke protocol
• Process led by a Lean Performance Engineer, Brian Hoff, BSE, expert in making hospital processes more efficient, safe, effective
Future State

• All protocol delays have been worked out step-by-step to ensure a streamlined process from ED to MRI to IV tPA delivery in MRI
  - Ex. All EKG leads on stroke page patients will be MR-compatible; Pyxis added to MRI (has tPA, BP meds)
• Goal MRI decision to Needle time <30 min
• Goal Door to Needle Time 55 minutes
• Plan to Begin New MRI Protocol in Mid-August
• Will need your feedback on each case
When do I order a Hyper-Acute stroke MRI?

Andria Ford, MD
In which patients do I consider ordering a Hyper-Acute MRI?

1. Stroke Mimic
2. Interventional Neuro-Radiology (INR) Candidate
3. Wake-up stroke or unwitnessed onset stroke
Stroke Mimic

• Use MRI to aid diagnosis in potential stroke mimics when:
  - Suspicion for stroke is very low, but still on the differential
  - Pt has strong history for a competing diagnosis
  - Suspicion is low and there is greater than normal risk of bleeding complications with IV tPA

• Examples:
  - Pt has history of migraine with focal neurological features/similar presentation and low risk factor profile
  - Pt has functional components on exam and has a low stroke risk factor profile
  - Pt has history of seizures causing similar symptoms in the past and has a low stroke risk factor profile
  - When exam does not localize well for stroke (bilateral weakness, aphasia vs. encephalopathy/drowsiness)
Stroke Mimic

• Do NOT use MRI when you think stroke is the probable cause for pt’s symptoms
  - MRI is not 100% sensitive for strokes
    • MRI will miss up to 10% of acute strokes especially within the first few hours of stroke symptoms, for small strokes, for posterior circulation strokes; on repeat imaging the stroke will be there
  - Giving IV tPA to stroke mimics is typically safe (very low sICH rate in pts with stroke mimics) so if you feel stroke is the likely diagnosis, and potential benefit outweighs potential risk, then treat quickly with IV tPA; do not wait for MRI
Interventional (INR) Candidates

• Typically use MRI/MRA for “IV tPA failures” also called “bridge” candidates

• When a pt is given IV tPA either at BJH or at OSH and has a high NIHSS (> 8), Discuss with chief/fellow/attending if INR will be consulted and consider hyper-acute MRI; If so, send pt for hyper-acute MRI; if pt does not improve by end of IV tPA infusion, then will proceed to INR

• Do not wait for full 60 min to see if pt improves; Obtain MRI during 60 min and then go to INR if pt does not improve by end of IV tPA infusion
Wake-up / Unwitnessed Stroke Onset (MR-WITNESS study)

• Call 40-STUDY first
• If meets time criteria (arrived in hospital within 4.5 hrs of symptom discovery despite last known normal time > 4.5 hrs), then order hyper-acute MRI, and study team will help consent / enroll pt
• If MRI shows recent stroke onset, then pt will get IV tPA (per study protocol)
Hyper-acute Stroke MRI Protocol

Joshua Buck, MD
Current Assumptions:

• Finished HCT, pt HPI/exam
• Person fits criteria for hyper-acute MRI:
  - Can get tPA or INR
  - Stroke mimic
  - Bridge therapy
  - Wake-up stroke
• Chief is go for hyper-acute MRI
Update

Team

Prep

Inform

ED

ED to MRI

Discuss with ED attending. ED Resident will place order.

Tell ED RN to get ready for MRI!!

Do MRI screening sheet

- Make sure patient is in MRI-compatible gown (if not, ask PCT)
- WRITE CR and Weight of patient on form

Inform MRI

- Fax Screening sheet (keep a copy for yourself)
- Call MRI charge tech (get ETA if possible)
- Ensure pt is safe for MRI, ask MR tech about potential contraindications if unsure

Inform MRI
ED to MRI

Safety Check

Ensure patient is in MRI-compatible gown (lace ties, no snaps)

Transport

Push pt with RN to 5th Floor Mallinckrodt

De-Metal Yourself

KEEP your pagers, phone in hand
Put all metal in bag (while waiting/in elevator)

MRI (Zone 1)
Enter MRI (Zone 2)

- Ensure yellow MRI badge is visible to staff
- Put metal bag in locker, hang up white coat
- Put pagers, phone in MRI basket
- Move to scanner
- Transfer pt to MRI stretcher with RN and tech
- Pt will be placed on MRI-compatible pulse-ox
- Review live images with Neuro-radiologist
- Move pt back to "Scanner A" (3T magnetic field)
- Review images with Neuro-radiologist

MRI Patient

MRI (Zone 1)

MRI (Zone 4)
Call ED Attending over speaker phone to discuss tPA decision and get tPA order

Notify chief of MRI results / tPA decision

Mimic → ED → Home?

Okay for INR → to Angio

MRI (Zone 2)

Have RN mix tPA

Move patient moved to Zone 2. Get vitals!

Have RN mix tPA

tPA?

Move for tPA

Post-MRI Discussion

MRI (Zone 4)
Pre-tPA

- Recheck NIHSS to ensure not improved
- Get BP below 185/110 with prn IV meds
- Ensure no contra-indications (should’ve already been done)
- You or RN push bolus

Post-tPA

- Inform family
- Call to see if room ready. If not, return to ED.

MRI (Zone 2)

ED/Floor/SDU
What if you are NF?

If another tPA page goes off...

• Chief should contact stroke (1st choice) floor resident to cover hyper-acute MRI pt
  - Chief should give sign-out to PGY-2
  - Floor resident goes to MRI

• NF should leave MRI screening sheet with weight with RN
  - Consults can wait for a few minutes
Summary PGY-2/3

**ED**
- Discuss with ED (they should order)
- Fill/fax screening sheet. Include Cr, Wt. Keep a copy!

**ED to MRI**
- Tell RN to get ready for MRI
- Fill/fax screening sheet. Include Cr, Wt. Keep a copy!
- Call MRI Charge Tech. Get an ETA on 3T scanner!
- Ensure patient has no metal. Check gown!
- De-Metal your person. Keep phone/pagers!
- Put phone/pager in basket
- Make sure patient on MRI pulse-ox

**MRI Zone 2**
- Review images with Neurorads
- Call ED attending and notify chief for tPA decision.

**MRI Zone 4**
- Make sure RN getting vitals, control BP (<185/110)
- Push bolus if RN busy

**tPA**
Summary PGY-4

Get story from PGY-2/3

ED
- Look up patient to ensure go for tPA

MRI Zone 2
- Determine disposition: tPA, bridge, ED
- Access
- Go to MRI if possible, otherwise MD's

MRI Zone 4
- Help with getting bed ready

tPA
MRI Process Feedback

• Chief to email Andria Ford and Josh Buck with pt info, names of residents involved, any protocol issues
Hyper-acute MRI Cases

Naim Khoury, MD
• A 46 yo. white female patient presented with R sided weakness and numbness

• She was at work and was noted to have slurred speech; she complained of blurred vision and numbness on the right side of her body, as well as the right and left sides of her face

• She also had severe headache and told her colleagues she was unable to walk

• Sx onset at noon; her colleagues called EMS at 12:30pm.
ED evaluation 13:10 (1h10min from onset)

• BP 156/91, HR 88, RR 17, Sat 95%, Temp 37.1
• HCT: normal
• NIHSS=6
  - 1=R face, very mild
  - 1=RUE
  - 1=RLE
  - 1=Slurred speech
  - 1=Aphasia (?stuttering)
  - 1=R sensory

• PMHX: Depression/Anxiety, was told she has HTN but not taking medication, previous ED visit with headache and R sided numbness that resolved with Toradol
• Social Hx: Smoker, was arguing with her boss before Sx onset, colleagues by phone confirmed acute onset of Sx at noon
13:40 (1h40min from Sx Onset)

• You’ve examined the patient twice: sx stable, confirmed with colleagues history and reviewed medical chart, ready to call your chief to discuss the case

• Challenging points:
  - You think the aphasia is more stuttering than word finding difficulty
  - The speech is slurred without a doubt, and the arm and leg are weak on the R but deficits might be effort-related, you are not sure
  - You are certain she an asymmetric smile
  - Her BP is not normal, but not extremely elevated like other stroke patients you’ve seen so far
  - She has a severe headache and keeps her eyes closed while talking to you
  - She has stroke risk factors: HTN and smoking
  - She has social/medical red flags: hx anxiety, arguing with boss at time of onset, previous admission with headache related focal neurologic deficit
• Patient eligible for IV tPA but might be a stroke mimic: Hyperacute MRI could help
Stroke Mimics: Non-Vascular Process with Stroke-like Clinical Picture

- **Organic cause:** a physiological impairment of the structure which generates the function
  - **Mass lesion**
    - Subdural hematoma, cerebral abscess, primary CNS tumors, and metastatic tumors
      - Focal neurologic deficit based on location
        - Commonly duration longer than one day with careful Hx
  - **Migraine**
    - Hemiplegic Migraine (complicated migraine)
      - Most difficult to distinguish
        - Consider vascular until proven otherwise
  - **Post-ictal Todd’s paralysis (Seizures)**
    - Brief but may last up to 48hrs
  - **Hypoglycemia**
    - Aphasia and Paralysis
      - Common in Diabetics and Alcoholics
  - **Hyperglycemia**
    - And other toxic/metabolic hyperosmolar states
      - Focal neurologic deficit

- **Functional cause:** intact structural components with impaired functional output
  - **Conversion Disorder**
    - Somatization, Somatic Symptoms
  - **Factitious Disorder** (and Factitious disorder by proxy)
    - deliberately producing, feigning, or exaggerating symptoms
    - primary aim is to obtain the sympathy and attention accompanying the sick role
      - Different from Malingering: patient wishes to obtain external gains such as disability payments or to avoid an unpleasant situation, such as military duty.
        - Malingering and Factitious disorder are mutually exclusive
Case 2

• 65 yo male patient presented to the ED at 4 hours from Sx onset with NIHSS=16 & RMCA syndrome
• He was eligible for IV tPA and the bolus was given at 4h 20min
• The neurology resident discussed with his attending the possibility of interventional treatment in case of no improvement and the attending physician was agreeable with the idea
• 20min after bolus time, NIHSS was unchanged
• The patient met all criteria to proceed to bridge therapy (IV to IA therapy) -- aka “tPA failure”
  - Per protocol vascular imaging is required to document occluded vessel
  - Interventional treatment cannot begin until the tPA infusion is complete (i.e. at one hour from bolus)
• The patient was taken for a hyperacute MRI
  - Could characterize the size and location of infarct
  - Obtain MRA with MRI
Case 3

• 56 yo woman was last known normal 12 hours prior to presentation when she and her husband went to bed last night.
• She was discovered by her husband in bed with aphasia and R facial weakness 2.5hrs prior to presentation.
• This scenario represents an un-witnessed stroke.
• Un-witnessed stroke are usually of two types:
  - “found down” stroke
  - “wake-up” stroke
• Patient met inclusion criteria for MR-WITNESS clinical trial
• Hyperacute MRI was obtained to determine IV tPA treatment eligibility