2021

Emergency Provider Stroke Education

Intended for Physicians, APPs, and Nurses working at:

Rhode Island Hospital Comprehensive Stroke Center
TJC Certified since 2014

The Miriam Hospital Primary Stroke Center
TJC certified since 2006

The Newport Hospital Primary Stroke Center
TJC certified since 2010

Prepared by Tracy Madsen, MD, PhD, FACEP, FAHA
June 30, 2021

What's New in 2021?

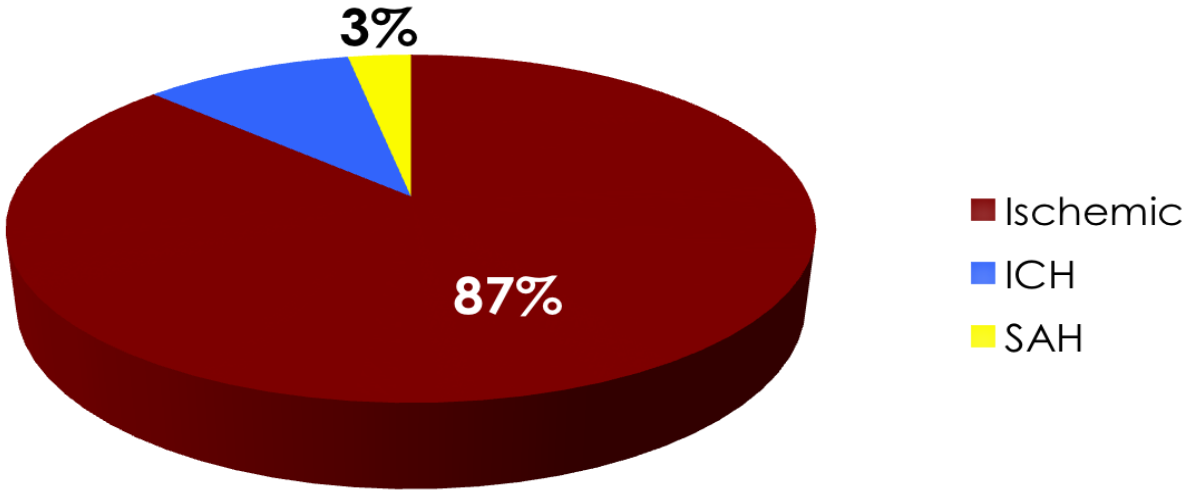
- Increased attention to time to tPA metric
- tPA time out at RIH
- Successful Joint Commission Surveys
- For primary stroke centers (TMH, NPT)– continued emphasis on New Joint Commission metric of door in / door out time for transfers
- Revised ED order sets for stroke patients coming soon
- Revised code stroke algorithms at TMH and RIH coming soon

JOINT COMMISSION VISITS

- All three of our sites have been surveyed this past year
- Successful surveys overall, but identified some opportunities for improvement
- Increased focus on order set usage, neurologic assessments
- Next round of surveys to come between July and December 2022

STROKE STATS

- 4TH most common cause of death in the U.S. for women and 5th for men, 3rd for black women and Hispanic women
- The leading cause of long-term disability
- Approximately 800,000 new strokes annually in the U.S.
- Over 2,500 strokes treated annually at Lifespan hospitals



SHARED MISSION

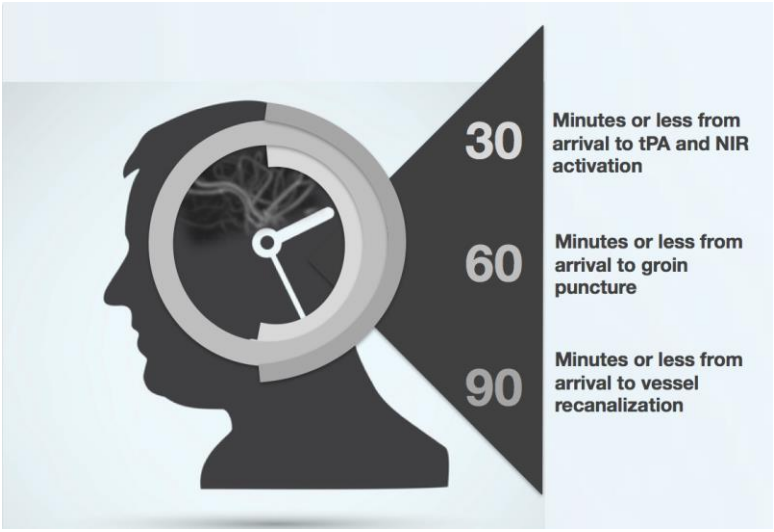
“To provide the highest quality stroke care to the people of Rhode Island & surrounding communities”

Code Stroke Initial Tasks

- Receive pre-notification from EMS and prepare for patient arrival
- Assess ABCs and clear patient to proceed direct-to-CT
  - Place order for **'CTA ELVO head and neck'** (this is a multiphase CTA that pushes images to LifeImage for NIR to review remotely)
- Complete registration and obtain IV access
- Collect history, time LKW, contraindications to tPA from surrogate while patient in CT scanner
- Weigh patient (prior to CT at TMH, following CT at RIH/NPT)
- Finish assessing and examining patient following CT, discuss risks/benefits of treatment (if indicated) and make treatment decision. Place order for tPA as soon as decision is made

Internal Code Stroke Goals

- Door-to-Provider < 5 min
- Door-to-CT < 10 min
- Door-to-tPA < 30 min
- Door-to-Angio for ELVO < 60 min
- Door-to-Reperfusion for ELVO < 90 min

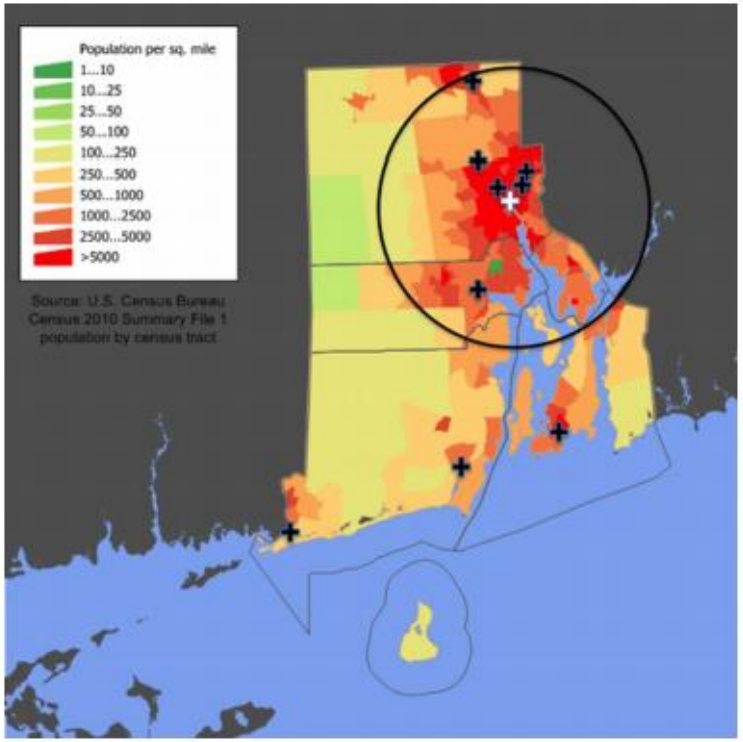


Interfacility Stroke Transfer Goals

- First hospital arrival-to-RI Express Care call < 15 min
- Door-in / Door-out time < 45 min
- RI Express Care call-to-Angiogram start for ELVO < 90 min
- Angiogram start to recanalization time < 30 min

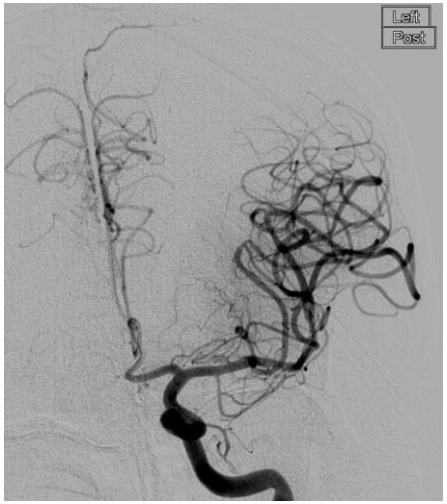
EMS Field Triage for Suspected Stroke

- Since March 2017, RI EMS has been using field severity stroke scoring to divert around the nearest hospital to RIH if LAMS 4-5 and within a 30 minute drive time to RIH for suspected stroke patients within 24hr of LKW
- Since LAMS is being performed in the field, there is no need to perform LAMS upon arrival to the ED



EMERGENT LARGE VESSEL OCCLUSION (ELVO)

- Includes internal carotid artery (ICA), middle cerebral artery (MCA) (M1 and proximal portion of M2) and basilar arteries
- The more proximal the vessel occlusion, the less likely tPA will be effective alone
- Mechanical thrombectomy + best medical therapy is now considered the standard of care (AHA Class I, Level A)for select patients with ELVO within 16 hours of symptom onset, Class IIa/Level B recommendation for patients with ELVO between 16 and 24 hours from last known well
- RIH is the only regional facility performing this procedure. Beyond 6 hours of LWK, a RAPID hyperacute MRI using perfusion imaging aids decision-making in some cases
- For patients in the RIH ED, the Neurovascular Center APP will notify NIR attendings of confirmed ELVO on CTA
- **At TMH/NPT, call RI Express Care as soon as the diagnosis is suspected** (even before CTA if significant deficits are present). They will mobilize the NIR team who will review the CTA on LifeImage.
- Thrombectomy patients should still get IV tPA if eligible, and workflow for NIR activation and IV tPA should proceed in parallel
- Have a low threshold to give empiric antiemetics (eg Zofran) for patients with severe deficits (such as LAMS 4-5)



Current Stroke Workflow

Call CODE STROKE for:

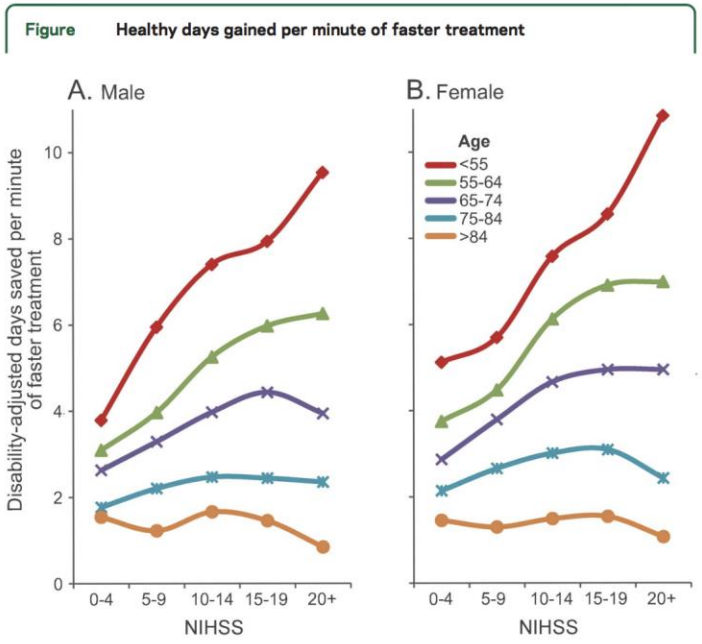
- **Any new, ongoing focal neurologic symptoms of <24 hours duration***

  *** For cases in which EMS PRE-NOTIFIES triage of a code stroke, code stroke should be called in advance of patient arrival and confirmed upon patient arrival by the ED attending.**

**** This revised criteria is aimed at capturing all likely reperfusion candidates, while increasing code stroke activation specificity***

- Remember **Time is Brain**:

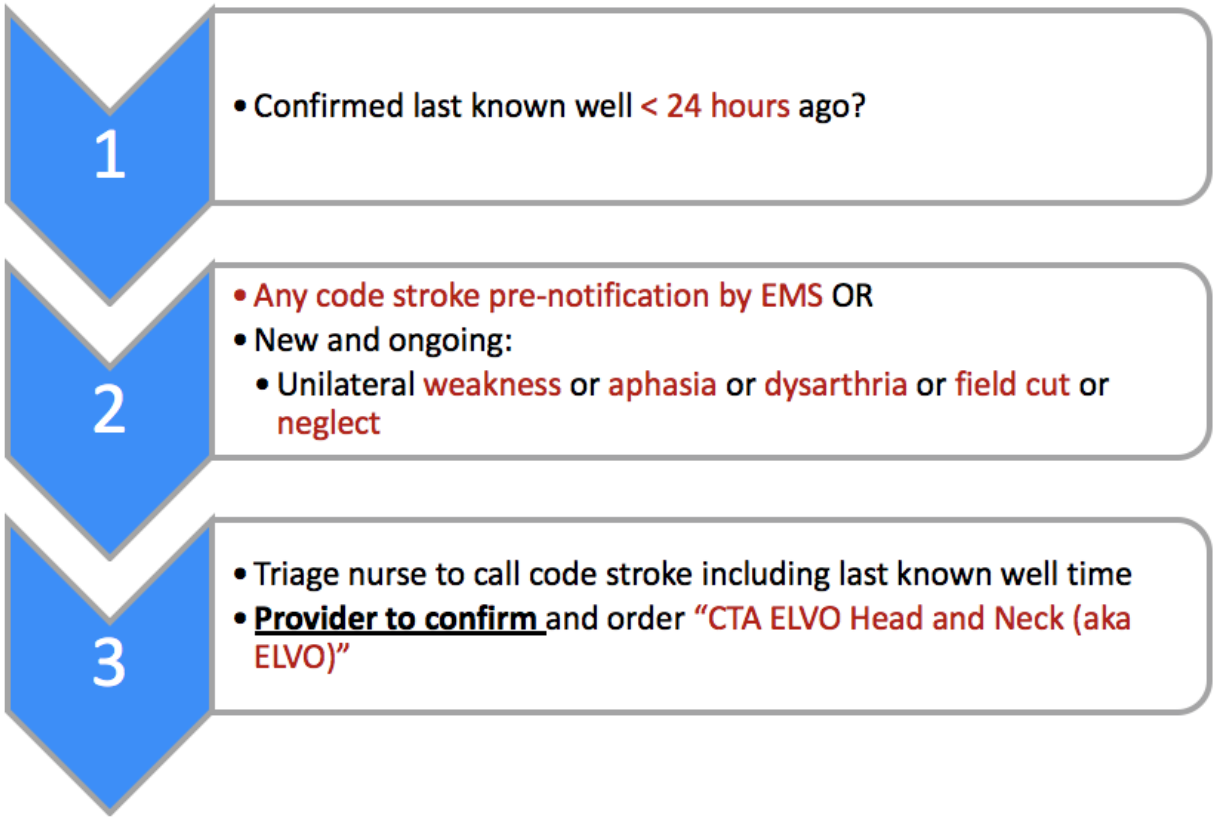
  1. ***For tPA treatment, on average 1 month of disability-free life is saved for every 15 minute reduction in treatment time!***
  2. ***For mechanical thrombectomy, on average 1 week of disability-free life is saved for every minute reduction in treatment time!***



Relationship between disability-adjusted days gained per minute of faster treatment by sex ([A] male, [B] female), age, and stroke severity (NIH Stroke Scale [NIHSS]).

Meretoja et al Stroke 2014
Meretoja et al Neurology 2017

RIH CODE STROKE ACTIVATION PROTOCOL



For other suspected stroke syndromes (i.e. sustained dizziness + additional neurologic deficit/ suspected posterior stroke, pure sensory stroke), call code stroke at discretion of ED attending.

•For all code strokes, use "ED Neuro Code Stroke" order set which contains "CTA ELVO Head and Neck" order.
•Patients beyond 4.5 hours of LKW with no imaging evidence of LVO, ICH, SAH or felt to be stroke mimic may be re-triaged to Urgent area at MD discretion.
• For inter-facility stroke transfers from outside hospitals, activate medical team (not CODE STROKE), triage to CC room, and coordinate management plan with Neurology.

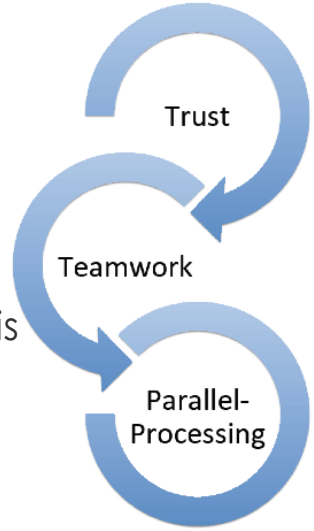
Approved 8/28/19 by RIH Stroke Committee

Med Comm Code Stroke Activation:

- In order for Med Comm to activate a Code Stroke blast page, the following information is needed:
  1. Time Last known well (must be <24 hours)
  2. Synopsis of stroke deficit (i.e weakness, facial droop, etc)
  3. Symptoms are ongoing
- Please be sure to relay this information to Med Comm when requesting that a code stroke be called, just as we do for trauma activations
- Pre-hospital notification of this information already occurs in the vast majority of suspected stroke patients arriving by EMS and EMS providers are now responsible to relay the LA motor score
  - Code Strokes may be activated from the field prior to arrival
  - When hearing "code stroke ETA 10 min" attempt to collect information in advance of arrival to aid in timely decision-making. The neurovascular APPs will assist with this

RIH Hallway Pre-CT assessment:

- In the Anderson ED, the following tasks should happen during the hallway pre-CT assessment:
  - Brief (<90 seconds) assessment of stability (ABCs) and stroke deficits
  - Ensure that a functioning IV is in place
- Patient should then be moved into CT scan bay to have CTA ELVO performed
- After CT, patient moves to destination bed assigned
  - **CC bay if:** tPA eligible, ELVO, ICH or SAH present or patient in extremis
  - **Obtain patient weight** using the red scale stretchers following CT
  - **Urgent Area bed if:** no reperfusion option (tPA ineligible or not a thrombectomy candidate) and no ICH or SAH
  - After CT, direct to NIR in selected cases



How to Call Off a Code Stroke:

- True stroke symptoms are generally 'negative' or ablative phenomena with a loss of normal neurologic function, as opposed to 'positive' symptoms or irritative phenomena, which are rarely from ischemia
- One exception is dizziness, which is discussed separately
- Headache can be associated with stroke. However, headache and purely irritative phenomena are suggestive of a non-stroke mimic
- ED attendings may call off/cancel a code stroke if it doesn't meet criteria in previous slides, though if CTA-ELVO imaging has already been obtained, there is no need to cancel the code stroke

Negative symptoms: (concerning for stroke)

- Weakness or loss of normal motor function
- Sensory Loss (not tingling)
- Vision loss, visual field deficit, or diplopia
- Loss of normal coordination
- Loss of normal speech fluency & articulation
- Abrupt and sustained loss in consciousness

Positive symptoms: (less likely a stroke)

- Bilateral subjective weakness
- Tingling (as opposed to numbness)

Direct to NIR for Select Stable (ABCs intact) LVOs

1) **Who:** Stable stroke patients (ABCs intact) found to have LVO on CT-ELVO study during "off-hours" (all day Saturdays/Sundays and 5 PM - 6:30 AM on weekdays).

2) **What?** For stable patients going to NIR for thrombectomy during these hours, patients will be moved back to the CC hallway (right outside of CT scanner) to the NIR suite down the hall (right next to MRI). These patients will not return to a critical care room.

3) **What is our role as ED physicians?**
Our role is to approve the transfer to the NIR service. This includes evaluating the patient for stroke vs. competing diagnoses and ensuring the patient is stable to be moved away from the CC bays.

-- After CT is done, patient will stay in the hallway while CT is being read. If LVO is present, the neuro/NIR APP will call the NIR attending to determine plan (will take generally 5-10 min).

Direct to VIR (2)

-- For those patients determined to need thrombectomy, the neuro APP will let you know that the patient is going "direct to NIR." ***This is also the time to finish any evaluation you haven't completed, get the admitting attending's name, place admit order, and discuss whether pt is tPA eligible or not.***

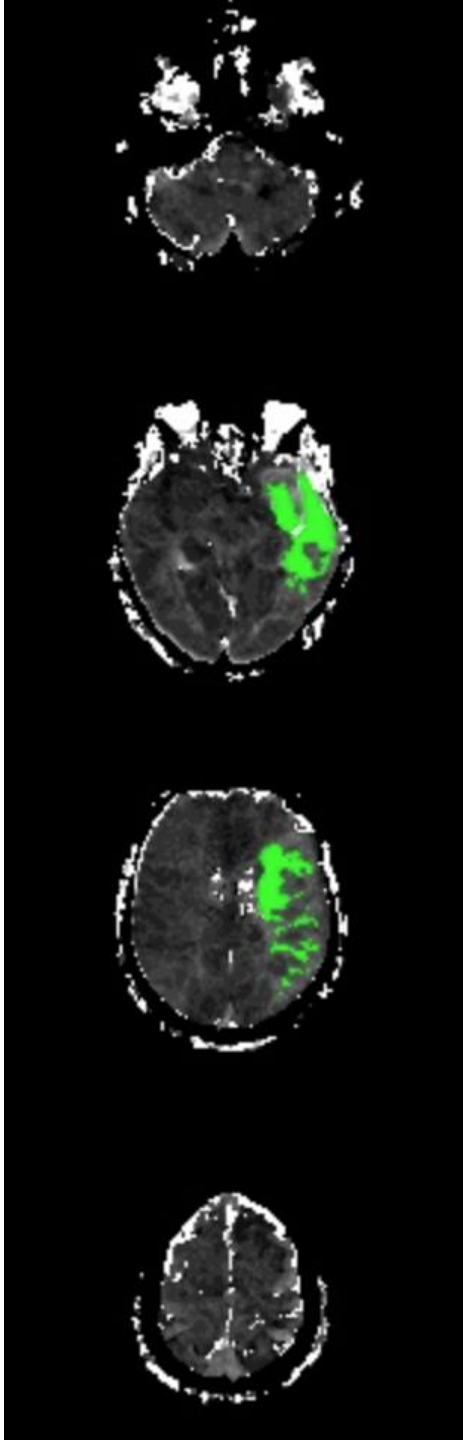
-- Patients requiring airway interventions or deemed to be unstable need to go to a critical care room and should not be taken direct to NIR.

-- If you have stepped away from the code stroke patient to take care of other patients, it is expected that the ***neuro APP will call the critical care attending phone and communicate the following: Yes, patient is going direct to NIR, admitting attending name, plan for IV tpa (yes/no).*** If tPA eligible this will be given in the NIR suite.

-- The admitted patient will then be taken down the hall by the APP along with an ED nurse.
-- NIR team will meet patient in room for procedure.
-- Patients will be admitted to stroke unit from NIR suite (will not board in ED).

Why a Hyperacute MRI?

- In patients with a time last known well between 6-24 hours, a diffusion-perfusion mismatch on MRI can inform as to which patients have a large penumbra of 'tissue at risk' making them ideal candidates for mechanical clot retrieval (thrombectomy)
- Our neurointerventional program is among the busiest in the country, due to a high volume of interfacility transfers and our long eligibility window
- When asked to order a **'MRI brain hyperacute RAPID'** by NIR, please also do the following:
  - Order mild sedative (2mg midazolam IV once, may repeat once if needed)
  - Order antiemetic (ondansetron 4 mg IV once, may repeat once if needed)
- The neurovascular APPs should facilitate the MRI and relay of information between ED, neurology and NIR
- The ED CC resource nurse typically accompanies the patient to MRI (scan time ~10min)



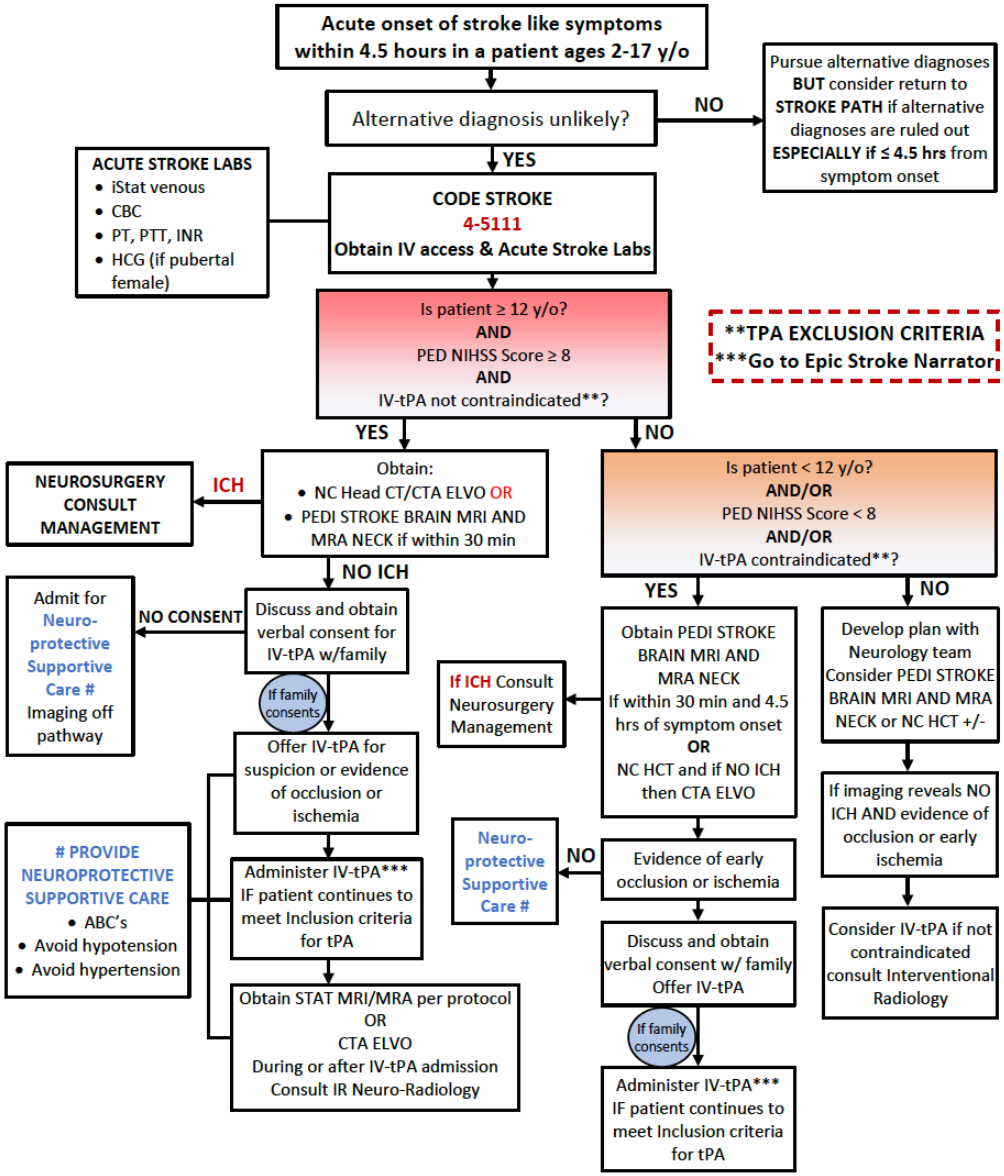
Pediatric Code Stroke:

- Strokes are less common in children, but do occur and portend significant morbidity
- Treatment of acute ischemic stroke in pediatric patients with tPA is controversial and its safety and efficacy is not well established
- At Hasbro Children's Hospital, tPA can be considered in pediatric patients if:
  - Age ≥12 with significant deficits (ped NIHSS ≥ 8) and a NCCT showing no hemorrhage <4.5 hours from LKW

  OR
  - Any aged pediatric patient <4.5 hours from LKW has evidence of early occlusion or ischemia on MRI/A (see flow chart)
- Mechanical thrombectomy can be performed in pediatric patients with confirmed ELVO
- Any reperfusion decision should be made with Neurology and with family consent
- The following flow chart and inclusion/exclusion criteria should be used as a reference

PEDIATRIC NEUROLOGY IV-tPA

(Revised 6/10/2020)



Pediatric Code Stroke
Simplified Algorithm for Neuro Residents

If Patient is **> 12 yo AND NIHSS >8 AND no contraindication to TPA**

- Obtain CT ELVO OR MRI brain and MRA neck (discuss with Pediatric Neuro attending)
  - if **ICH** -> Neurosurgery consult
  - if **NO ICH-** > discuss consent for TPA with family
    - if **CONSENT-** > offer TPA if suspect stroke and administer TPA -> admit for Neuroprotective Supportive care
    - if **NO CONSENT-** > admit for Neuroprotective Supportive Care

If Patient is **<12 yo AND/OR NIHSS <8 AND/OR with contraindication to TPA**

- Obtain MRI brain and MRA neck or CT non-contrast (discuss with Ped Neuro attending)
  - if **ICH** -> Neurosurgery consult
  - if **NO ICH-** > obtain CTA ELVO and discuss consent for TPA with family
    - if **CONSENT-** > offer TPA if suspect stroke and administer TPA -> admit for Neuroprotective Supportive care
    - if **NO CONSENT-** > admit for Neuroprotective Supportive Care

PEDIATRIC ALTEPLASE (TPA) EXCLUSION CRITERIA 04/14/2016

tPA contraindications:

HISTORY

- 4.5 hrs from last seen well
- Patients in whom time of symptom onset is unknown
- Stroke, major head trauma or intracranial surgery in the last 3 months
- History of prior intracranial hemorrhage, known AVM or aneurysm
- Major surgery or parenchymal biopsy within 10 days
- GI or GU bleeding within 21 days
- Patient with neoplasm/malignancy or within one month of completion of treatment for cancer.
- Patients with underlying significant bleeding disorders. Patients with mild platelet dysfunction , mild von Willebrand disease or other mild bleeding disorders are not excluded.
- Previously diagnosed with primary angiitis of the central nervous system or secondary arteritis.

PATIENT FACTORS

- Patient who would decline a blood transfusion if indicated.
- Clinical presentation c/w acute myocardial infarction or post MI pericarditis that requires evaluation by cardiology before treatment
- Arterial puncture at noncompressible site or lumbar puncture w/in last 7 days. Patients who have had cardiac catheterization via a compressible artery are NOT excluded.

ETIOLOGY

- Stroke due to SBE, sickle cell disease, meningitis, embolism (bone marrow, air or fat), or moyamoya disease.

EXAM

- Persistent systolic blood pressure > 15% above the 95th percentile for age while sitting or supine
- Mild deficit (PedNIHSS <8) at start of tPA infusion
- Severe deficit suggesting very large territory stroke pre-tPA

IMAGING

- Symptoms suggestive of SAH even if CT or MRI of head are normal
- CT with hypodensity/sulcal effacement >33% of MCA territory or ASPECTS ≤7
- Intracranial cervicocephalic arterial dissection.

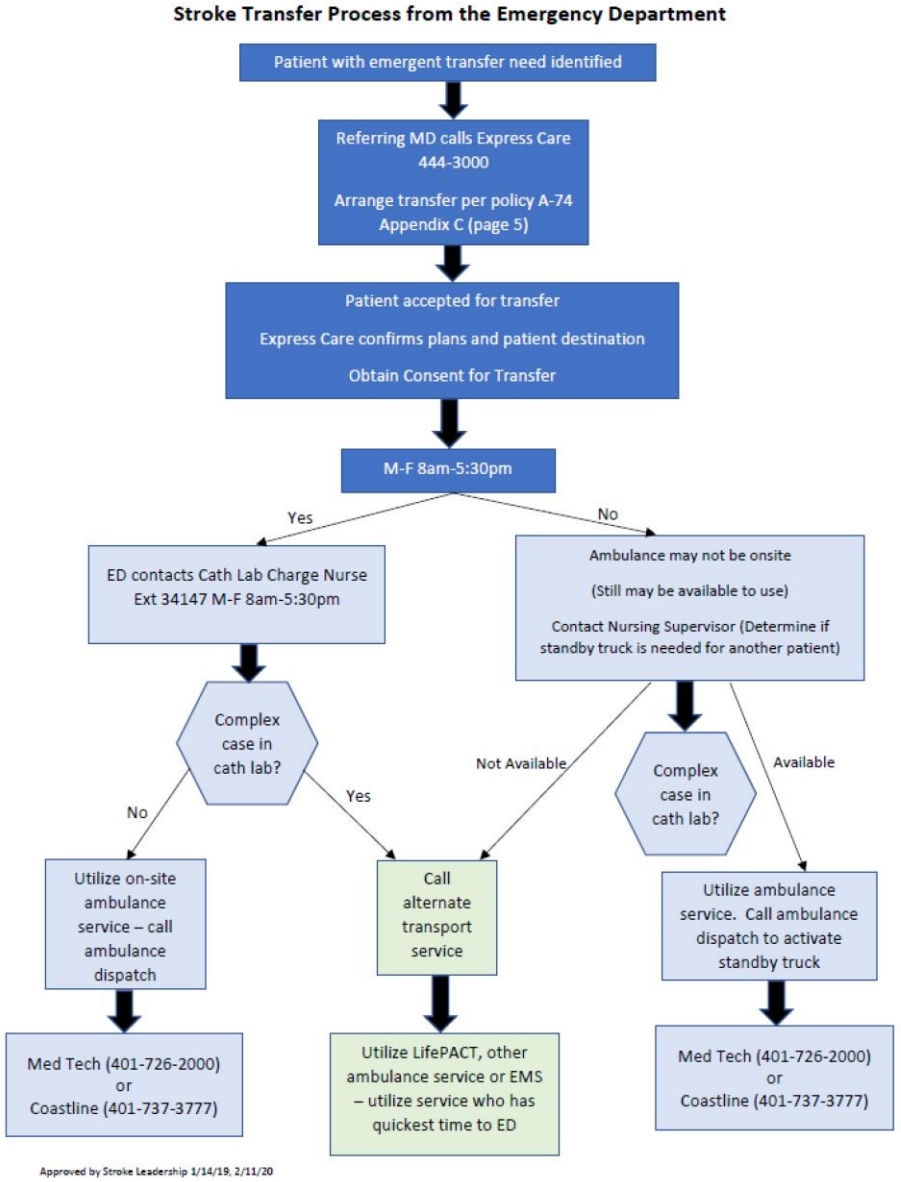
LAB DATA

- Glucose <50 mg/dL (2.78 mmol/L) or >400 mg/dL (22 mmol/L) uncorrected
- Bleeding diathesis including Platelets <100,000, PT >1

Primary Stroke Center Code Strokes: TMH

- **TMH** acute stroke workflows mirror RIH with the following exceptions:
  - An MD performs the initial tasks (quick assessment, code stroke orderset, CTA ELVO)
  - NIHSS MUST be documented by treating MD
  - tPA is prepared and mixed by pharmacy at TMH
  - The neurologist typically consults by phone for early decision-making
  - **At TMH: RI Express Care should be called (444-3000) as soon as ELVO is suspected and when confirmed. They facilitate notification of the NIR interventionist on call**.
  - All ELVO, ICH and SAH should be transferred to RIH unless the patient is CMO. See next slide for transfer protocol
  - If Monday through Friday 8 AM – 5:30 PM, follow protocol on next slide (preferentially uses on-site ambulance)
  - If outside of these hours, use Lifepact, ambulance companies or EMS as appropriate. Do not use "Round Trip" unless no other options available

Transfer Process at TMH (Monday-Friday, 8 AM – 5:30 PM)*



*Outside of these hours onsite ambulance may still be available. Utilize appropriate ACLS resources (LifePact, Coastline, Med Tech, EMS or other).

TMH ED Stroke Workflow

CODE STROKE ACTIVATION PROTOCOL

1. • **LAST KNOWN WELL <24 hours ago?**
2. • **Code Stroke by EMS OR**
   • **New and Ongoing focal neurologic deficit:**
   • **Unilateral weakness OR aphasia OR dysarthria OR visual field cut OR neglect**
3. • **Call code stroke including Last Known Well time**
   • **Order "CTA ELVO Head and Neck (aka ELVO)"**

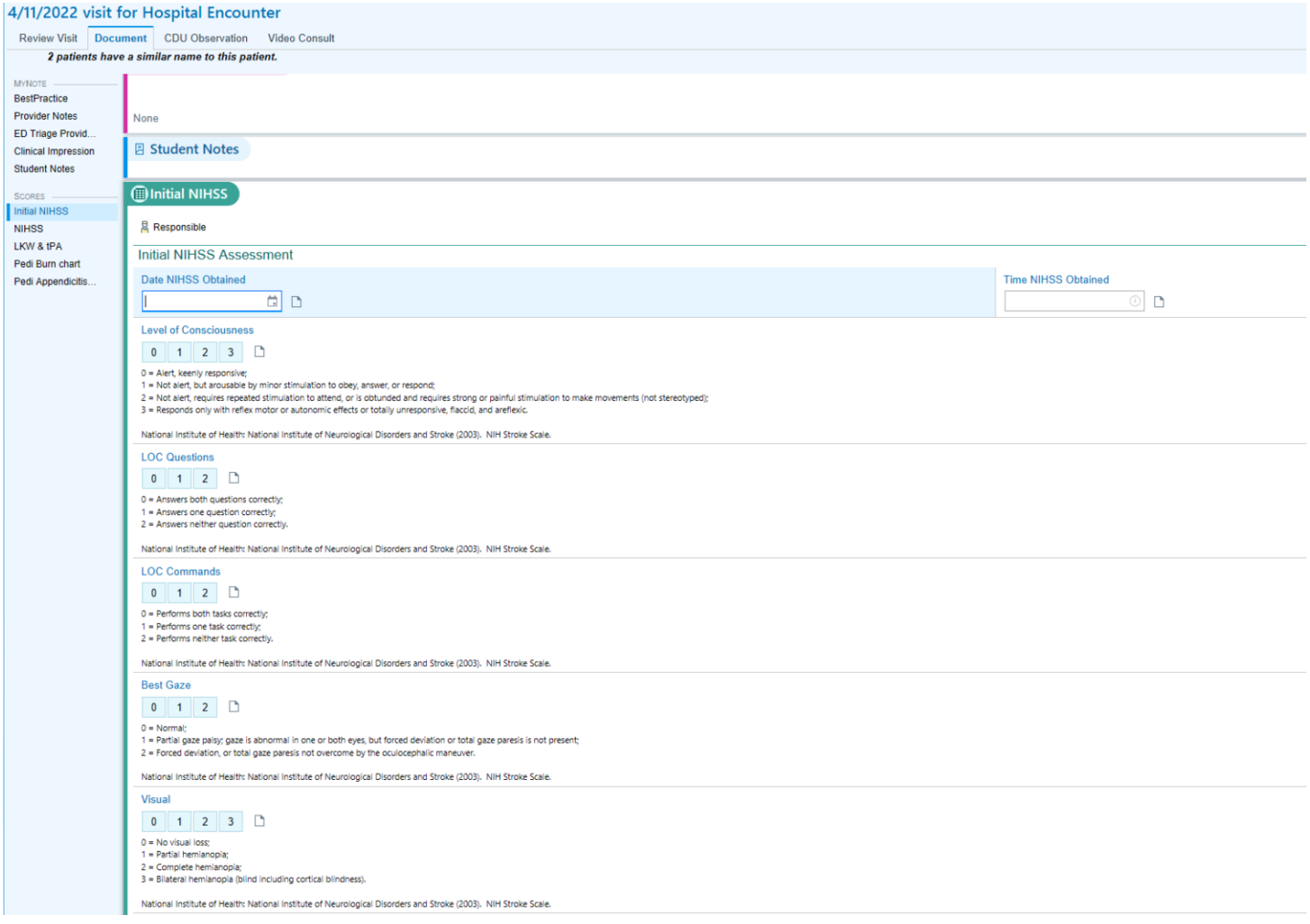
For other suspected stroke syndromes (i.e. sustained dizziness + additional neurologic deficit/ suspected posterior stroke, pure sensory stroke), call code stroke at discretion of ED attending.

Approved 02/19 TMH Stroke Committee

ADDITIONAL NOTES -- For tPA-eligible patients, code strokes are called overhead in ED
-- Triage MD and treating MD meet at the CT scanner to discuss case
-- Use this meeting to begin considering tPA exclusion criteria, discussing risks and benefits with patients' family as needed

TMH ED Stroke Workflow

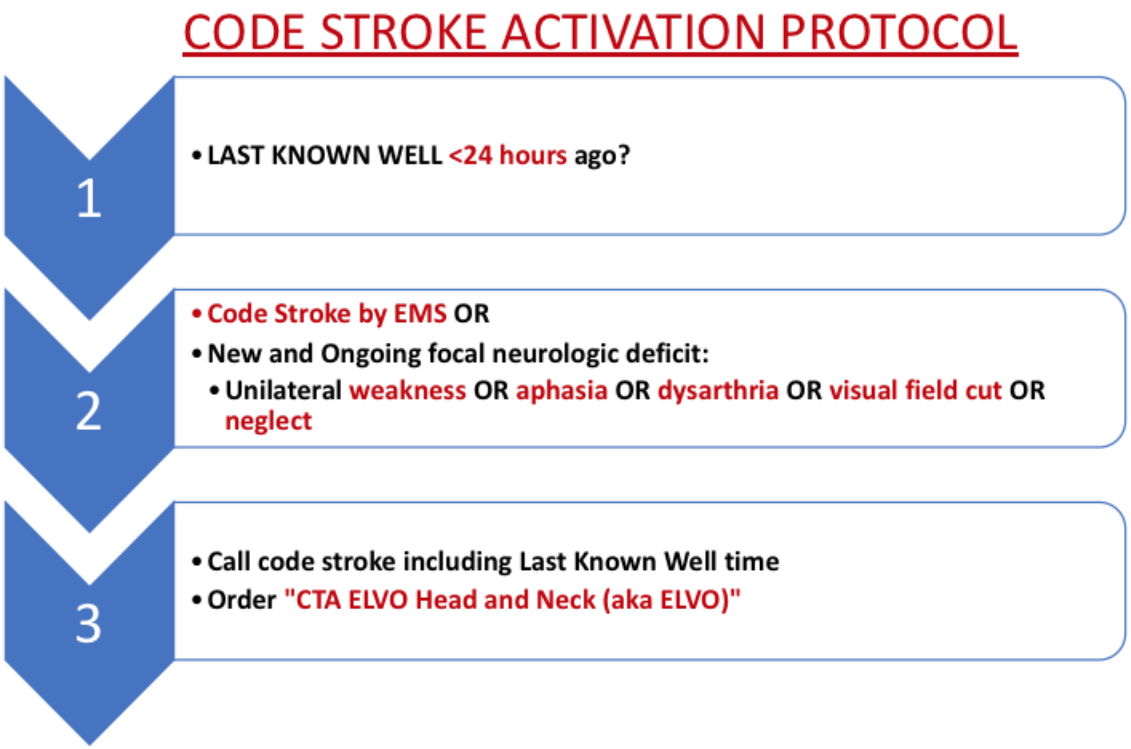
- NIHSS (with date/time), last known well time, and reason for no IV tPA in non-tPA cases must be documented (Use tabs in stroke navigator under "Document" tab as seen below)



Primary Stroke Center Code Strokes: Newport

- **Newport ED** acute stroke workflows mirror RIH with the following exceptions:
  - An MD performs the initial tasks (quick assessment, code stroke orderset, CTA ELVO)
  - NIHSS must be documented by treating MD
  - At Newport: RI Express Care should be called (444-3000) as soon as ELVO is suspected and when confirmed. They facilitate notification of the NIR interventionist on call. You need to request LifePACT if you would like them to transfer the patient.* In general, the most efficient means of safe ACLS transfer should be utilized (LifePACT vs. local ambulance). Use your discretion
  - All ELVO, ICH and SAH should be transferred to RIH unless the patient is CMO
  - The neurologist typically consults by phone for early decision-making

Newport ED Stroke Workflow



For other suspected stroke syndromes (i.e. sustained dizziness + additional neurologic deficit/ suspected posterior stroke, pure sensory stroke), call code stroke at discretion of ED attending.

Approved by Newport ED Director / Stroke Leadership, July 2020

How To Reduce Door-to-Needle Time?

- Prepare in advance and proceed direct-to-CT
- Determine time Last Known Well (LKW) & review inclusion/exclusion criteria with family during CT scan
- At TMH, communicate patient weight to pharmacy from CT
- tPA can be pulled from Omnicell and mixed as soon as we know that the CT shows no ICH and the LKW is <4.5 hours
- If no contraindication to tPA, place order in Lifechart
- Streamline risks/benefits discussion and perform it while it is being prepared (see suggested language)
- Administer bolus as soon as it is ready
- At TMH, the orange stroke folder in Teams 1,2 & 5 have NIHSS resources
- Reference the stroke workflows and resources on Lifespan intranet

IV tPA Criteria for Adults

t-PA Inclusion Criteria:

- Patients with acute onset of stroke-like symptoms with a clearly defined time of onset (or last seen well) < 4.5 hours before treatment
- Patients ≥ 18 years of age (Refer to pediatric inclusion/exclusion criteria for patients < 18 years)

t-PA Absolute Exclusion Criteria:

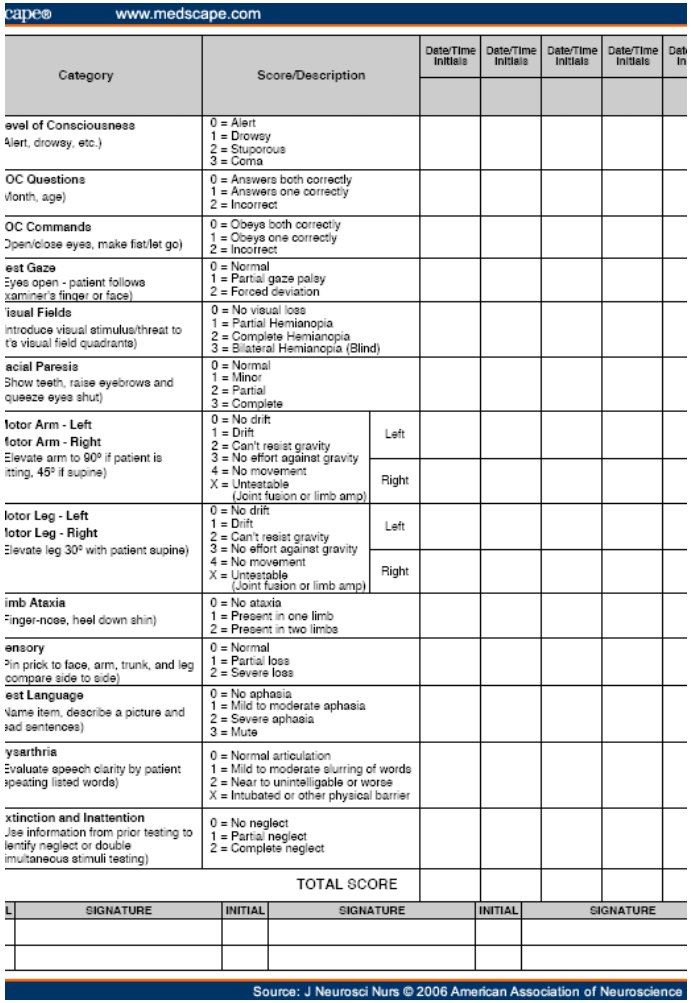
- Current intracranial or subarachnoid hemorrhage
- Active uncontrollable internal bleeding
- Use of intravenous IIb/IIIa or P2Y12 inhibitors within 24hours (i.e abciximab or cangrelor infusions)
- Persistent systolic blood pressure > 185 mm Hg or diastolic blood pressure > 110 mm Hg despite aggressive intervention

t-PA Relative Exclusion Criteria

- **Weigh risks/benefits and get approval from fellow/attending prior to administration**
- Recent (within 14 days) major surgery or procedure (e.g. coronary artery bypass graft, obstetrical delivery, organ biopsy, previous puncture of non-compressible vessels)
- Recent (within 3 months) MI, intracranial or intraspinal surgery, or serious head trauma
- Presence of intracranial conditions that may increase the risk of bleeding (e.g. some neoplasms)
- Bleeding diathesis
- Recent intracranial hemorrhage
- Recent (within 21 days) gastrointestinal or genitourinary bleeding
- Recent trauma
- High likelihood of left heart thrombus
- Acute pericarditis
- Subacute bacterial endocarditis
- Hemostatic defects including those secondary to severe hepatic or renal disease
- Significant hepatic dysfunction
- Pregnancy
- Diabetic hemorrhagic retinopathy, or other hemorrhagic ophthalmic conditions
- Septic thrombophlebitis or occluded AV cannula at seriously infected site
- If direct oral anticoagulant (DOAC) taken ≤ 48 hrs AND ≥ 4hrs of last known normal, discuss tPA decision with vascular neurology attending.
- If on direct thrombin inhibitor such as dabigatran (Pradaxa), etc., aPTT above normal range **OR** medication ingested within 4 hours prior to lab drawn
- If on factor Xa inhibitors (i.e. rivaroxaban, apixaban, edoxaban, etc.), anti-XA at a level ≥ 0.04 **OR** medication ingested within 4 hours prior to lab drawn
- Received IV heparin in the last 48 hours and aPTT not in normal range
- If on warfarin, INR >1.7
- Any other condition in which bleeding constitutes a significant hazard or would be particularly difficult to manage because of its location
- Established acute infarct in greater than one third of MCA territory

NIHSS

- Needs to be completed and documented during the initial assessment in the ED and prior to tPA administration
- There is no lower limit NIHSS cutoff to be eligible for tPA or endovascular therapy. As long as the symptoms are functionally disabling and thought to be due to an acute stroke, then treatment should be considered
- You can become NIHSS certified here



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Category	Score/Description		Date/Time Initials	Date/Time Initials	Date/Time Initials	Date/Time Initials	Dat In
evel of Consciousness Alert, drowsy, etc.)	0 = Alert 1 = Drowsy 2 = Stuporous 3 = Coma						
OC Questions Month, age)	0 = Answers both correctly 1 = Answers one correctly 2 = Incorrect						
OC Commands Open/close eyes, make fist/let go)	0 = Obeys both correctly 1 = Obeys one correctly 2 = Incorrect						
est Gaze Eyes open - patient follows xaminer's finger or face)	0 = Normal 1 = Partial gaze palsy 2 = Forced deviation						
isual Fields Introduce visual stimulus/threat to t's visual field quadrants)	0 = No visual loss 1 = Partial Hemianopia 2 = Complete Hemianopia 3 = Bilateral Hemianopia (Blind)						
acial Paresis Show teeth, raise eyebrows and queeze eyes shut)	0 = Normal 1 = Minor 2 = Partial 3 = Complete						
lotor Arm - Left lotor Arm - Right Elevate arm to 90° if patient is itting, 45° if supine)	0 = No drift 1 = Drift 2 = Can't resist gravity 3 = No effort against gravity 4 = No movement X = Untestable (Joint fusion or limb amp)	Left Right					
lotor Leg - Left lotor Leg - Right Elevate leg 30° with patient supine)	0 = No drift 1 = Drift 2 = Can't resist gravity 3 = No effort against gravity 4 = No movement X = Untestable (Joint fusion or limb amp)	Left Right					
imb Ataxia Finger-nose, heel down shin)	0 = No ataxia 1 = Present in one limb 2 = Present in two limbs						
ensory Pin prick to face, arm, trunk, and leg compare side to side)	0 = Normal 1 = Partial loss 2 = Severe loss						
est Language Name item, describe a picture and ead sentences)	0 = No aphasia 1 = Mild to moderate aphasia 2 = Severe aphasia 3 = Mute						
ysarthria Evaluate speech clarity by patient epeating listed words)	0 = Normal articulation 1 = Mild to moderate slurring of words 2 = Near to unintelligable or worse X = Intubated or other physical barrier						
xtinction and Inattention Use information from prior testing to lentify neglect or double imultaneous stimuli testing)	0 = No neglect 1 = Partial neglect 2 = Complete neglect						
	TOTAL SCORE						

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Source: J Neurosci Nurs © 2006 American Association of Neuroscience

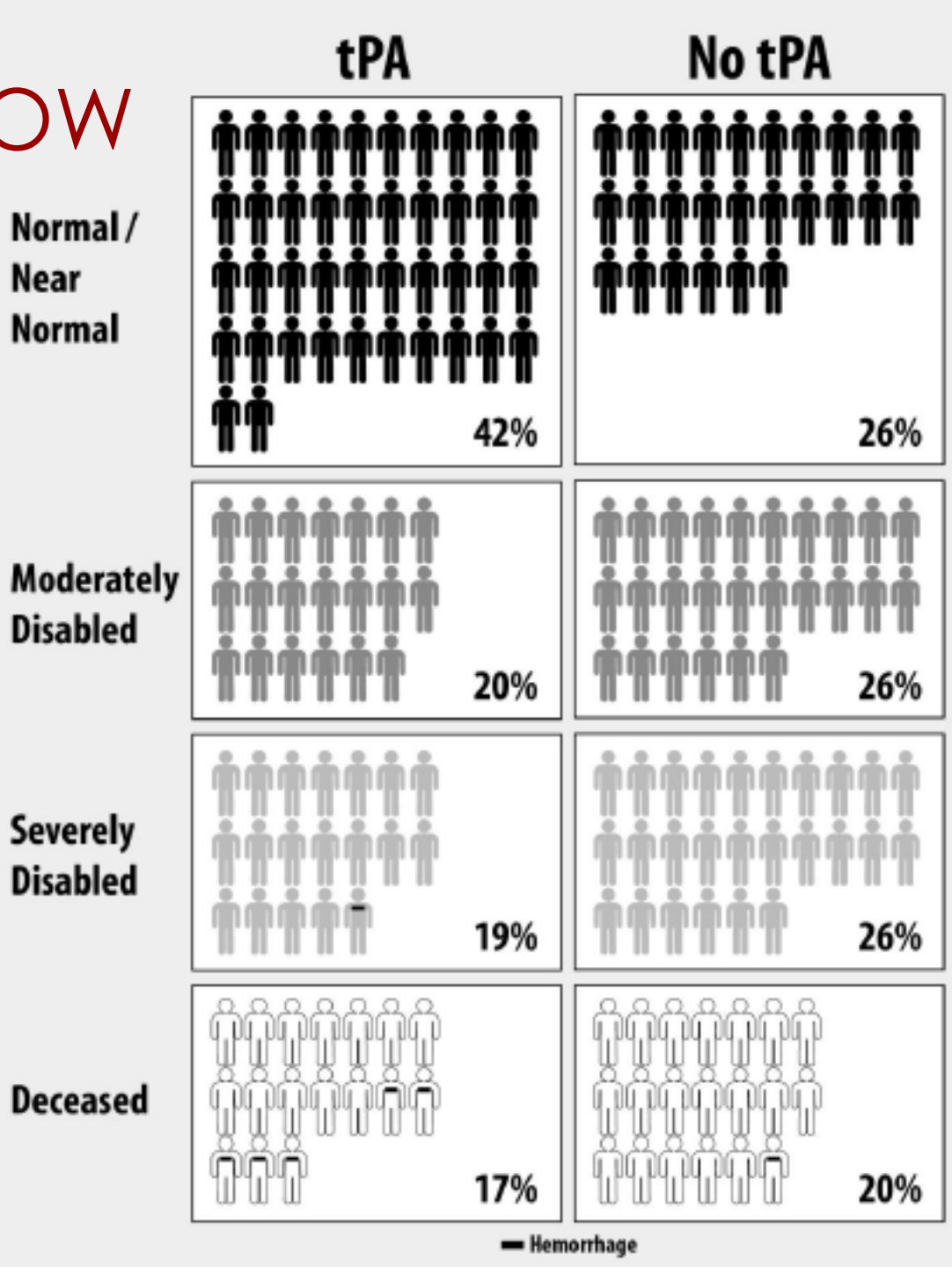
RISKS & BENEFITS of TPA (suggested language)

- tPA is considered standard-of-care for patients with functionally disabling stroke symptoms or ≤ 4.5 hours duration without listed contraindications
- Written informed consent is **NOT** required. Rather, it is suggested that there be a brief discussion of risks and benefits emphasizing the institutional recommendation to administer the drug (aka informed refusal)
- Document your tPA discussion
- Visual aids and shared decision-making can help streamline the discussion
- Use this to discuss with patient/family:

"tPA is the only FDA approved medication for the treatment of stroke. The FDA has approved it for use up to 3 hours of stroke onset, however most medical societies and institutions around the world support its use up to 4.5 hours of onset. On the whole, more patients are helped than harmed from this medication and it is our recommendation that your loved one receive this medication as fast as possible. The major risk of getting tPA is bleeding, which can occur anywhere is the body and can be significant enough to cause symptoms in 5-8% of patients. This may be severe enough to require transfusion of blood products. tPA can also cause an allergic reaction in 1-5% of patients, which rarely can be severe. If you would like more information, I would be happy to show you a visual aid which summarizes the data on the use of tPA in stroke."

0-3 HOUR WINDOW

- **Use this to discuss with patient/family:**
- **This shows the 3 month outcomes of 100 patients treated within 3 hours of stroke onset:**
  - Patients treated with tPA are between 1.5 and 2x as likely to return to normal or near normal function at 3 months
  - **1 in 7** patients who receive tPA have an improvement in outcome due to the drug
  - The effects of the drug are time-dependent. If the drug can be given within 1.5 hours of onset, the chance of improvement increases to **1 in 3**
  - **1 in 18** patients who received tPA had significant bleeding due to the drug
  - The risk of dying from the stroke is similar regardless of the treatment
  - tPA increases the chances of functional independence, but with a 10-fold increase in risk of bleeding



IV tPA for Acute Ischemic Stroke within 3 Hours

You (or your family member) are suffering from an ischemic stroke. This is the type of stroke most often caused by a blood clot blocking the flow of blood to a portion of the brain. If this blockage doesn't correct itself or get corrected by medication, the affected brain tissue is likely to die. Tissue Plasminogen Activator (tPA) is a medication used to treat certain people with ischemic strokes by helping to dissolve the blood clot.

- tPA was approved by the FDA in 1996 to treat certain people with ischemic strokes in the first three hours after the onset of symptoms.

- Approximately 1 in 3 patients who are treated appropriately within 3 hours return to normal or nearly normal function within three months. This is between 1½ and 2 times more frequently than patients not treated with tPA.

- Unfortunately, there are risks. 6 out of 100 patients treated with tPA in this timeframe develop significant bleeding in the brain. This is ten times more common than for patients who are not treated with tPA. For some, this bleeding causes disability or death.

- Despite these concerns, patients treated with tPA are overall more likely to do well and are no more likely to die than people not treated with tPA.

The chances that any of these benefits or complications will be experienced by you cannot be exactly determined. If significant complications happen during the tPA treatment, the tPA will be stopped and any complications will be medically treated as indicated. After treatment, you must be monitored very carefully for at least 24 hours. For this reason, you will be admitted to an intensive care unit. Vital signs and neurological status will be checked frequently. If changes occur, extra blood work or imaging tests may be done.

Weighing the available information, your attending neurologist and attending emergency medicine physician feel that treatment with tPA is indicated. Please feel free to ask any questions or raise any concerns related to this recommendation. tPA therapy will not be initiated until you are satisfied that you understand the risks and benefits and agree with therapy.

3-4.5 HOUR WINDOW

- **Use this to discuss with patient/family:**
- **In the 3-4.5 hour window:**
  - tPA has been shown to be beneficial up to 4.5 hours from symptom onset
  - Though only FDA-approved up to 3 hours from onset, many international medical societies, including the American Stroke Association, have endorsed its use in select patients
  - In one study, 52% of those given tPA returned to normal or near normal at 3 months, compared 45% given placebo. This was statistically significant
  - **1 in 14** patients who received tPA had an improvement in outcome because of the drug
  - **1 in 22** patients who received tPA had significant bleeding due to the drug
  - The risk of dying from the stroke is similar regardless of the treatment
  - tPA increases the chances of functional independence, but with a 10-fold increase in risk of bleeding

IV tPA for Acute Ischemic Stroke Between 3 and 4½ Hours

You (or your family member) are suffering from an ischemic stroke. This is the type of stroke most often caused by a blood clot blocking the flow of blood to a portion of the brain. If this blockage doesn't correct itself or get corrected by medication, the affected brain tissue is likely to die. Tissue Plasminogen Activator (tPA) is a medication used to treat certain people with ischemic strokes by helping to dissolve the blood clot.

- tPA was approved by the FDA in 1996 to treat certain people with ischemic strokes in the first three hours after the onset of symptoms. A recent large study, though, showed that tPA remains beneficial up to 4½ hours after the onset of symptoms. The FDA has not approved using tPA between 3 and 4½ hours after the onset of symptoms, but many international medical societies, including the American Stroke Association, have endorsed its use in select patients.

- Just over half of patients who are treated appropriately between 3 and 4½ hours return to normal or nearly normal function within three months. This is just over 1¼ times more frequently than patients not treated with tPA.

- Unfortunately, there are risks. About 3 out of 100 patients treated with tPA in this time frame develop significant bleeding in the brain. This is ten times more common than for patients who are not treated with tPA. For some, this bleeding causes disability or death.

- Despite these concerns, patients treated with tPA are overall more likely to do well and are no more likely to die than people not treated with tPA.

The chances that any of these benefits or complications will be experienced by you cannot be exactly determined. If significant complications happen during the tPA treatment, the tPA will be stopped and any complications will be medically treated as indicated. After treatment, you must be monitored very carefully for at least 24 hours. For this reason, you will be admitted to an intensive care unit. Vital signs and neurological status will be checked frequently. If changes occur, extra blood work or imaging tests may be done.

Weighing the available information, your attending neurologist and attending emergency medicine physician feel that treatment with tPA is indicated. Please feel free to ask any questions or raise any concerns related to this recommendation. tPA therapy will not be initiated until you are satisfied that you understand the risks and benefits and agree with therapy.

Should tPA be given for minor deficits (NIHSS 0-5) that are not clearly disabling?

- tPA has not proven to be efficacious in patients with minor symptoms
- This was the aim of the PRISMS trial which was recently published and can be accessed here. Important take-home points include:
  - This was a phase 3b, double-blind, double-placebo, multicenter randomized clinical trial of alteplase versus aspirin for AIS patients with NIHSS 0-5 whose deficits were judged not clearly disabling and treatment could be initiated within 3 hours of LKW
  - No significant difference in functional outcome at 90 days (mRS 0-1) was observed. However, there was a significant increase in symptomatic ICH at 36 hours for patients treated with alteplase (risk difference 3.3, 95% CI 0.8-7.4)
- Keep in mind that some patients with initially low NIHSS will experience early deterioration, particularly if there is a proximal vessel occlusion or large territory of brain tissue at risk
- While some NIHSS 0-5 may not be clearly disabling, other deficits are (such as leg or dominant hand weakness or aphasia)
- **As a general rule, tPA should be considered only in patients with persistent and disabling focal neurologic deficits**
- **The decision to administer tPA in these patients should be made on a case-by-case basis using your discretion and with input from your neurology colleagues**

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Post tPA Considerations

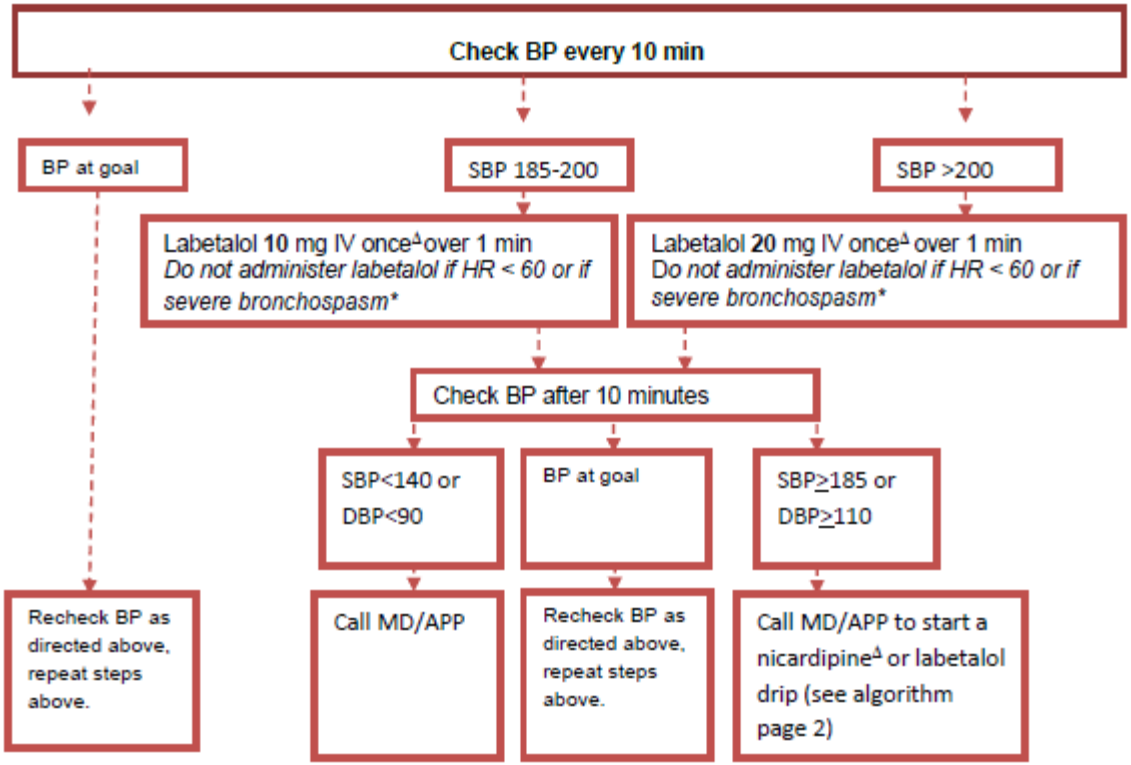
- Do **NOT** give aspirin in the ED to patients receiving tPA
- Ensure a nursing stroke swallow screen has been performed
- Vital signs and neuro checks need to be performed and documented every **15 min** for 2 hours following tPA administration while in the ED (then every **30 min**)
- Make sure to use the tPA orderset which includes vitals and stroke assessments at the correct frequencies
- The time surrounding transport from the ED to the designated stroke unit is the most common time for missed documentation of vital signs and neuro checks. 100% compliance is key!

BP MANAGEMENT IN STROKE

- **STROKE-SPECIFIC BP GOALS:**
  - Prior to giving tPA, goal is **<185/110 mmHg**
  - Post- IV tPA Ischemic Stroke : **<180/105 mmHg**
  - Ischemic Stroke / TIA - IV t-PA ineligible: **<220/120 mmHg**
  - ICH: **<160/90 mmHg (MAP < 110)**
  - Aneurysmal SAH **(Systolic < 140)**

- **CHOICE OF AGENT:**
  - Start with Labetalol 10-20mg x 1 unless there are contraindications
  - If second dose required, start nicardipine infusion

BP Guideline *before* tPA
GOAL BP <185/110



Foot notes:
$^{\Delta}$ *If BP is not at goal after one dose of labetalol, call MD/APP to initiate a nicardipine drip.*
**Initiate nicardipine drip and do not administer labetalol bolus if HR < 60 or if severe bronchospasm.*

Nicardipine contraindications/ warning/precautions:

- Use caution in patients with mild to moderate aortic stenosis. Use is contraindicated in advanced aortic stenosis
- Use caution and titrate dosage slowly for patients with heart failure, hepatic impairment, renal impairment and elderly patients.

Labetalol contraindications/ warning/precautions:

- Use is contraindicated in severe bradycardia, heart block greater than first degree (except in patients with a functioning artificial pacemaker); cardiogenic shock.
- Use caution in patients with bronchospastic disease, conduction abnormality, heart failure, myasthenia gravis, peripheral vascular disease, hepatic impairment, and elderly patients.
- Labetalol may mask signs of hypoglycemia and hyperthyroidism.

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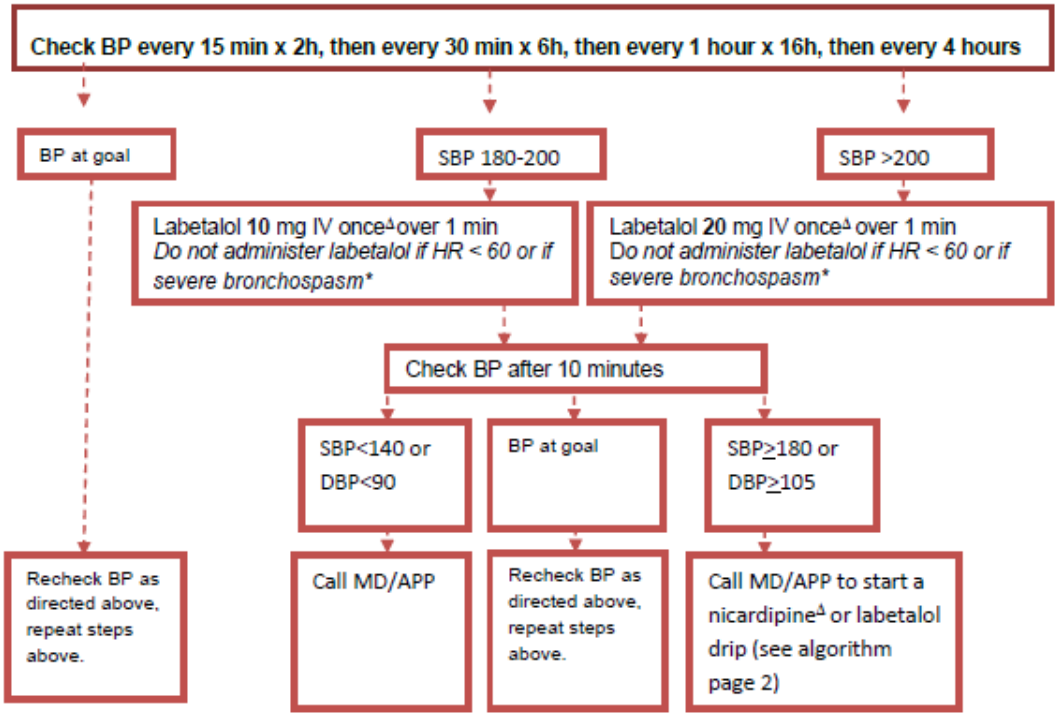
BP Guideline *after* tPA alone or thrombectomy with TICI 0/1/2a

GOAL: BP < 180/105 mmHg



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- Labetalol may mask signs of hypoglycemia and hyperthyroidism.

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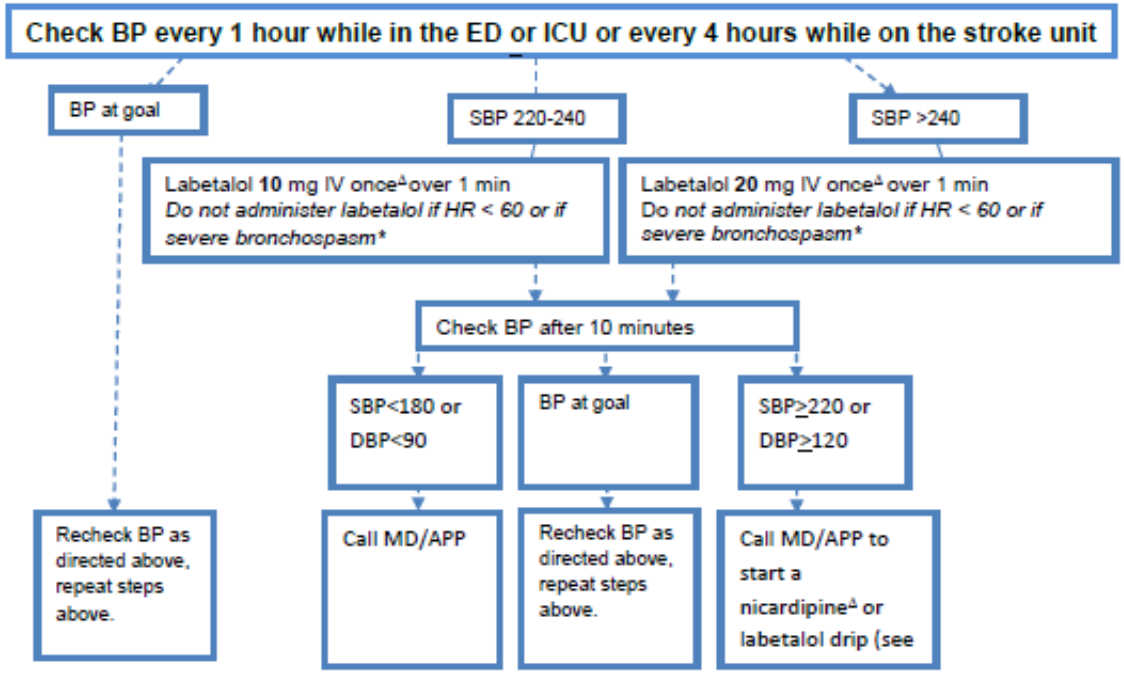
BP Guidelines TIA or Stroke NO TPA, with or without thrombectomy TICI 0/1/2a

Goal BP <220/120mmHg



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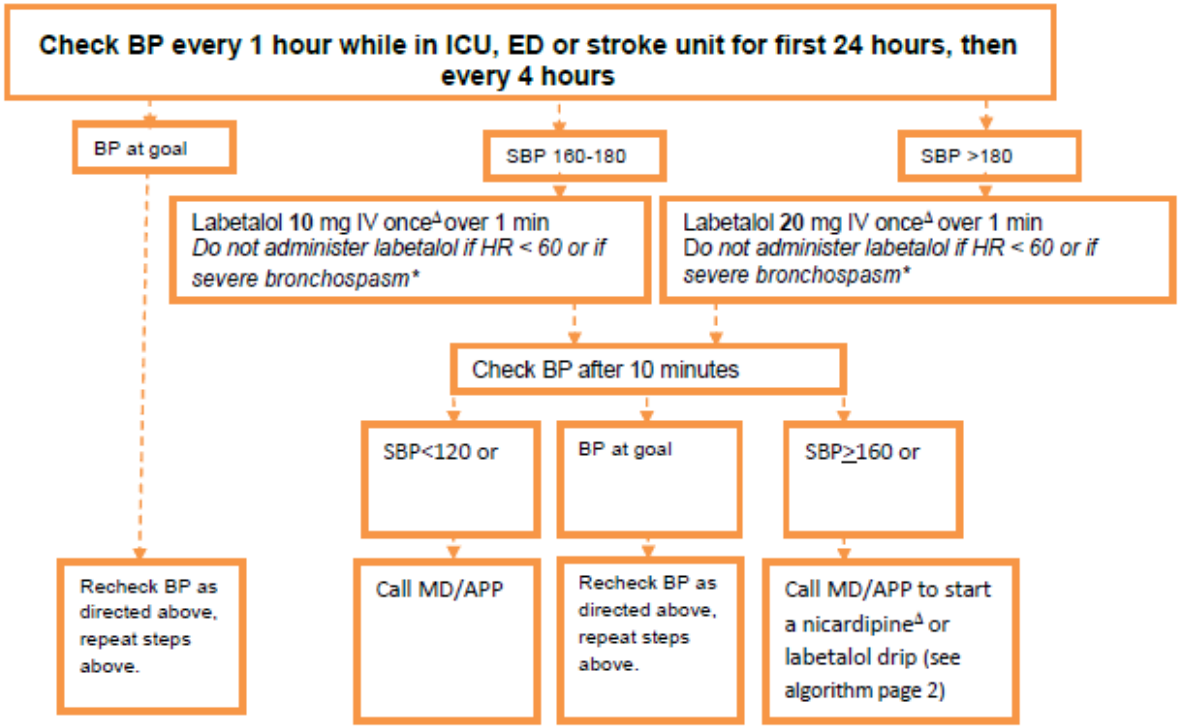
BP guidelines ICH

GOAL BP < 160/90 mmHg



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- Use caution and titrate dosage slowly for patients with heart failure, hepatic impairment, renal impairment and elderly patients.

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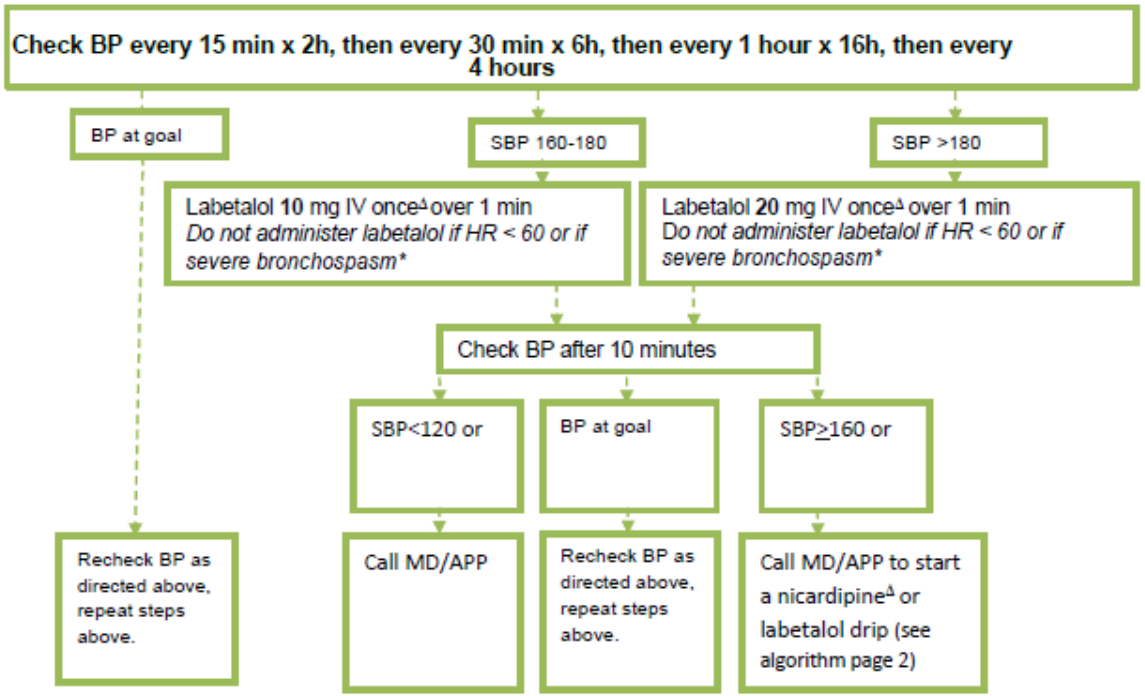
BP Guideline LVO Post Thrombectomy (TICI 2b/2c/3)

GOAL BP < 160/90



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Approach to ICH/SAH

- Ensure stability of hemodynamics (BP per here)
- Reverse anticoagulation (per intranet guidelines)
- Assess for signs of elevated ICP (Hypertonic saline 3% and 23.4% and mannitol per intranet guidelines)
- HOB elevation at 30 degrees
- Nursing stroke swallow screen prior to any PO
- Maintain normoglycemia and normothermia
- Please send a tox screen with labs (NCCU requests this)
- Seizure prophylaxis only for SAH. Patients with ICH should only have clinical seizures treated, no empiric prophylaxis for ICH unless specifically requested by Neurosurgery.

- All ICH/SAH patients at TMH/NPT EDs should be expeditiously transferred to RIH (at TMH use on-site ambulance if available, otherwise use LifePACT if available) unless patient/family refuses transfer or clearly expresses wishes to be CMO

- At RIH, consult neurosurgery for SAH, or for ICH if obstructive hydrocephalus, intraventricular hemorrhage, posterior fossa location, or patient in **extremis**

Reversal of Anticoagulation

- Administer appropriate reversal agent as fast as possible to prevent progression of bleeding **(goal <60min)**
- 4-factor PCC (Kcentra) is the preferred agent for vitamin K antagonists and direct factor Xa inhibitors:
  - **Warfarin:** Administer Kcentra (fixed dosing, see slide 47) & 10mg IV Vit K
  - **Rivaroxaban & Apixaban:** Fixed dose Kcentra (2000 units for all)
- Idarucizumab is the preferred agent for direct thrombin inhibitors
  - **Dabigatran:** If aPTT >32s or patient has taken within past 3 hours, then administer Idarucizumab 5 grams (2.5gm in 50 ml x 2 doses)
- Protamine is the preferred agent for reversal of therapeutic (not prophylactic) doses of heparin and LMWH
  - **Enoxaparin:** If administered < 8 hours ago, give 1mg protamine for every 1mg of enoxaparin. If > 8 hours ago, give half (0.5mg/mg). Max single dose is 50 mg protamine.
  - **Unfractionated heparin:** If administered in last 2 hours, give 1mg protamine per 100 units. If dose unknown, give 25 mg protamine
- Post-reversal monitoring:
  - **Warfarin**: check INR 30 min after PCC infusion (treat to INR$\leq$ 1.5)
  - **Dabigatran:** check aPTT 12 hours after Idarucizumab infusion

Definition of Clinical Bleeding:

Grade 1: Does not require any specific treatment or red cell transfusion

- Mucocutaneous Hemorrhage (oral blood blisters)
- Petechiae (lesions < 2 mm in size)
- Purpura less than 2.54 cm (1") diameter
- Ecchymosis (lesions ≤ 10 cm in size)
- Conjunctival bleeding
- Epistaxis < 1 hour in duration and not requiring intervention
- Abnormal vaginal bleeding (non-menstrual) with spotting < two pads per day

Grade 2: May require local measures, but not red cell transfusion

- Ecchymosis (lesions > 10 cm in size)
- Hematoma
- Epistaxis > 1 hour in duration or packing required
- Retinal hemorrhage without visual impairment
- Abnormal vaginal bleeding (not normal menses) using > 2 pads per day
- Melena, hematemesis, hemoptysis, hematuria, hematochezia
- Bleeding from invasive sites, musculoskeletal bleeding

Grade 3: Requires red cell transfusion: Grade 3A – 1-2 units only --- Grade 3B > 2 units

- Melena, hematemesis, hemoptysis, hematuria – including intermittent gross bleeding without clots, abnormal vaginal bleeding, hematochezia, epistaxis, and oropharyngeal; bleeding ***requiring red cell transfusion specifically for support of bleeding within 24 hours of onset***
- Bleeding from invasive sites, musculoskeletal bleeding, or soft tissue bleeding ***requiring red cell transfusion specifically for support of bleeding within 24 hours on onset.***

Grade 4: Life-threatening bleeding or rapid reversal for emergent surgery

- Debilitating bleeding including retinal bleeding with visual impairment defined as a field deficit
- Documented CNS bleeding with/without neurological signs and symptoms
- Potential life threatening or limb bleeding from any anatomic location

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Anticoagulant	Prolonged Parameters w/o Bleeding	Mild Bleeding	Moderate Bleeding	Severe Bleeding	Life Threatening or Requiring Rapid Reversal for Emergent Surgery	Monitoring	Comments/ Rationale
Warfarin (Coumadin)							
Half-life: **40 hours** **Mechanism of action:** Vitamin K antagonist (VKA) inhibits vitamin K required in the synthesis of clotting factors II, VII, IX and X. Warfarin Guidelines	INR < 4.5 • discontinue and/or decrease dose INR 4.5 – 10 • Hold 1 to 2 doses, • restart at decreased dose INR 10-20 • Hold 1 to 2 doses, • Restart at decreased dose • Vitamin K 5-10 mg PO INR > 20 • Hold Warfarin • Vitamin K 10 mg IV, may repeat in 12 hours	At any INR • discontinue Warfarin • give Vitamin K 5 mg IV	At any INR • discontinue Warfarin • give Vitamin K 5 mg IV	At any INR • Discontinue Warfarin • give Vitamin K 10 mg IV	At any INR Discontinue Warfarin give Vitamin K 10 mg IV Give 4-factor Prothrombin Complex Concentrate (4F-PCC) (KCentra®): • INR < 5 or unknown: - Patient weight <45 kg: give 4F-PCC 1000 units (round up to vial size) - Patient weight 45-100 kg: give 4F-PCC 1500 units (round up to vial size) - Patient weight >100 kg: give 4F-PCC 2000 units (round up to vial size) • INR ≥ 5: - Give patient 4F-PCC 2000 units (round up to vial size)	Check INR: 30 minutes post administration of 4F-PCC (KCentra®) and at 6 hours, 12 hours, and 24hours If INR > 1.4 after 4F-PCC (KCentra®) administration *OR* suspect ongoing life threatening bleeding give additional dose of 4F-PCC 500 units (rounded up to vial size). Recheck INR 30 minutes after infusion of second dose of PCC. If INR > 1.4 OR suspect ongoing life-threatening bleeding consider a hematology consult. If INR > 1.4 24 hours after initial Vitamin K dose AND patient at risk of re-bleeding give additional vitamin K 10 mg IV x 1	4F-PCC is the fastest option for reversing the INR and should be given when the immediate cessation of bleeding is necessary Vitamin K IV onset is 1-2 hours and peak effect 6-12 hours. For reversal in pediatrics and Nonemergent surgery refer to warfarin guidelines Reversal of patients with cerebral venous thrombosis with concomitant Intraparenchymal hemorrhage is not recommended.

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Anticoagulant	Prolonged Parameters w/o Bleeding	Mild Bleeding	Moderate Bleeding	Severe Bleeding	Life Threatening or Requiring Rapid Reversal for Emergent Surgery	Monitoring	Comments/ Rationale
Direct factor Xa inhibitors (rivaroxaban, apixaban, edoxaban)							
Mechanism of Action: Oral direct factor Xa inhibitor (rivaroxaban apixaban, edoxaban) Rivaroxaban guidelines Apixaban guidelines **Half-life (see comments)**	No routine laboratory monitoring recommended	Discontinue factor Xa inhibitor	Discontinue factor Xa inhibitor Consider Oral Charcoal 25 g PO x 1 (if ingestion < 2 hours before and mental status intact)	Discontinue factor Xa inhibitor Consider Oral Charcoal 25 g PO x 1 (if ingestion < 2 hours before and mental status intact)	Discontinue factor Xa inhibitor Give 4F-PCC (KCentra®): 2000 units IV Consider Oral Charcoal 25 g PO x 1 (if ingestion < 2 hours before and mental status intact)	Monitor for ongoing clinical signs and symptoms of bleeding	4F-PCC (KCentra®) has been studied at a fixed dose of 2000 units in adult patients to reverse active bleeding from direct factor Xa inhibitors. Half-life: rivaroxaban Half-life 5 to 9 hours, apixaban half-life approx. 12 hours, edoxaban half-life 10 to 14 hours)

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Anticoagulant	Prolonged Parameters w/o Bleeding	Mild Bleeding	Moderate Bleeding	Severe Bleeding	Life Threatening or Requiring Rapid Reversal for Emergent Surgery	Monitoring	Comments/ Rationale
Dabigatran (Pradaxa)							
Half-life: **12-17 hours** **Mechanism of Action:** Oral direct thrombin inhibitor. Dabigatran guidelines	No routine laboratory monitoring recommended If aPTT > 70 seconds delay next dose or discontinue treatment as appropriate	Discontinue treatment	Discontinue treatment Consider Oral Charcoal 50 g (if ingestion < 2 hours before and mental status intact)	Discontinue treatment Consider Oral Charcoal 50 g PO x 1 (if ingestion < 2 hours before and mental status intact) Consider Dialysis	Discontinue treatment If aPTT > 32 seconds OR patient has taken dabigatran within the last 3 hours: Administer idarucizumab IV 5 grams, provided as two separate vials each containing 2.5 grams/50 mL. Consider Oral Charcoal 50 g PO x 1(if ingestion < 2 hours before and mental status intact) Consider Dialysis	Monitor for hypersensitivity reactions such as pyrexia, bronchospasm, hyperventilation, rash, and pruritus. Re-evaluate coagulation parameters 12 hours after administration as possible elevation can be seen If aPTT > 32 seconds *OR* suspect ongoing bleeding consult hematology	Idarucizumab (Praxbind) is a humanized monoclonal antibody fragment that binds to dabigatran and its metabolites, neutralizing their anticoagulant effect Recommended dose is provided as two vials that should be administered consecutively May repeat dose in life threatening bleeds if no clinical improvement in 12 hours and if benefits outweigh the risks. Use with caution in patients with known hereditary fructose intolerance due to sorbitol excipient as serious side effects have been seen. A pre-existing IV line may be used for administration, but the line must be flushed prior to infusion. No other infusions should be administered in parallel via the same IV access.

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Anticoagulant	Prolonged Parameters w/o Bleeding	Mild Bleeding	Moderate Bleeding	Severe Bleeding	Life Threatening or Requiring Rapid Reversal for Emergent Surgery	Monitoring	Comments/ Rationale
Low Molecular Weight Heparins (LMWH's)							
Mechanism of Action: Inhibits both Factor Xa and Antithrombin. LMWH's have a greater effect on factor Xa than on antithrombin as compared to UFH **Enoxaparin half-life:** **2-8 hours** **Dalteparin half-life:** **2-5 hours** **Tinzaparin half-life:** **3-4 hours** LMWH guidelines	No laboratory monitoring routinely indicated In indicated patients follow LMWH guidelines	Delay next dose or discontinue treatment as appropriate	Delay next dose or discontinue treatment as appropriate Consider IV Protamine Dosing: **Enoxaparin:** administered < 8 hours ago: Give 1 mg Protamine IV for every 1 mg of enoxaparin If administered 8 hours ago or longer: Give 0.5 mg protamine for every 1 mg of enoxaparin **Dalteparin or Tinzaparin:** administered < 8 hours ago: Give 1 mg Protamine IV for every 100 anti-Xa units administered If administered 8 hours ago or longer: Give 0.5 mg protamine for every 100 anti-Xa units administered	Discontinue LMWH Give IV Protamine Dosing: **Enoxaparin:** administered < 8 hours ago: Give 1 mg Protamine IV for every 1 mg of enoxaparin If administered 8 hours ago or longer: Give 0.5 mg protamine for every 1 mg of enoxaparin **Dalteparin or Tinzaparin:** administered < 8 hours ago: Give 1 mg Protamine IV for every 100 anti-Xa units administered If administered 8 hours ago or longer: Give 0.5 mg protamine for every 100 anti-Xa units administered	Discontinue LMWH Give IV Protamine Dosing: **Enoxaparin:** administered < 8 hours ago: Give 1 mg Protamine IV for every 1 mg of enoxaparin If administered 8 hours ago or longer: Give 0.5 mg protamine for every 1 mg of enoxaparin **Dalteparin or Tinzaparin:** administered < 8 hours ago: Give 1 mg Protamine IV for every 100 anti-Xa units administered If administered 8 hours ago or longer: Give 0.5 mg protamine for every 100 anti-Xa units administered	No laboratory monitoring indicated May repeat protamine in 2-4 hours if needed for continued clinical bleeding at a dose of 0.5 mg protamine for every 1 mg of enoxaparin	Only partial reversal is possible with protamine with a maximum of 60% anti-factor Xa activity neutralized. Rapid administration of Protamine can cause anaphylaxis, hypotension, bradycardia, and bronchoconstriction Reversal of LMWH in patients receiving prophylactic dosing of LMWH is not recommended. Protamine maximum administration rate = 5mg/min Protamine maximum single dose is 50 mg.

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Anticoagulant	Prolonged Parameters w/o Bleeding	Mild Bleeding	Moderate Bleeding	Severe Bleeding	Life Threatening or Requiring Rapid Reversal for Emergent Surgery	Monitoring	Comments/ Rationale
Unfractionated Heparin (UFH)							
Half-life: **1-2 hours** **Mechanism of Action:** Potentiates the action of Antithrombin III and thereby inactivates thrombin and prevents the conversion of fibrinogen to fibrin	Follow heparin Protocol Heparin High Intensity Guideline Heparin Low Intensity Guideline	Discontinue heparin treatment as appropriate If continuing treatment follow Heparin Protocol Heparin High Intensity Guideline Heparin Low Intensity Guideline	Discontinue heparin Consider IV Protamine **Dosing:** UFH Continuous Infusion: Consider Protamine 1 mg/100 units UFH administered over the last 2 hours If unable to determine amount of heparin administered in the last 2 hours consider one-time dose of protamine 12.5 mg IV x 1 UFH Intermittent Dosing: Consider reversal of prophylactic subcutaneous heparin if AntiXa is significantly elevated (>0.15 units/ml)	Discontinue heparin Give IV protamine **Dosing:** UFH Continuous Infusion: Give Protamine 1 mg/100 units UFH administered over the last 2 hours If unable to determine amount of heparin administered in the last 2 hours give one-time dose of protamine 25 mg IV x 1 UFH Intermittent Dosing: Consider reversal of prophylactic subcutaneous heparin if AntiXa is significantly elevated (>0.15 units/ml)	Discontinue heparin Give IV Protamine **Dosing:** UFH Continuous Infusion: Give Protamine 1 mg/100 units UFH administered over the last 2 hours If unable to determine amount of heparin administered in the last 2 hours give one-time dose of protamine 25 mg IV x 1 UFH Intermittent Dosing: Consider reversal of prophylactic subcutaneous heparin if AntiXa is significantly elevated (>0.15 units/ml)	AntiXa at least 30 minutes post Protamine administration then recheck in 3 hours If antiXa continues to be prolonged and suspect severe/life threatening bleed continuing may repeat administration of protamine at a dose of 0.5 mg protamine per 100 units of UFH	Rapid administration of Protamine can cause anaphylaxis, hypotension, bradycardia, and bronchoconstriction Protamine maximum administration rate = 5mg/min Protamine binds to UFH, inactivating and reversing UFH's anticoagulant effect Excessive protamine administration may exacerbate bleeding, since protamine itself is a weak anticoagulant Protamine maximum single dose is 50 mg.

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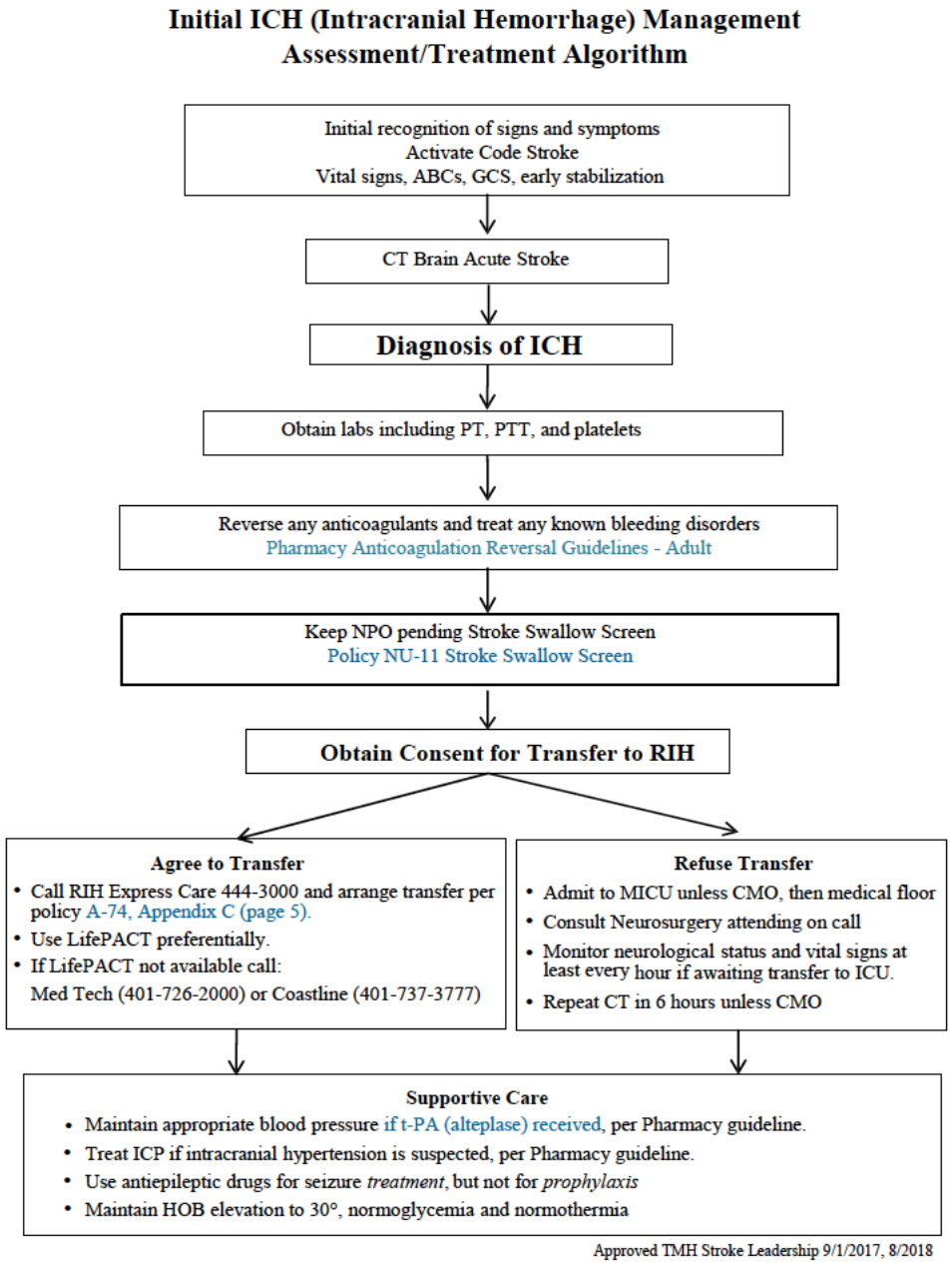
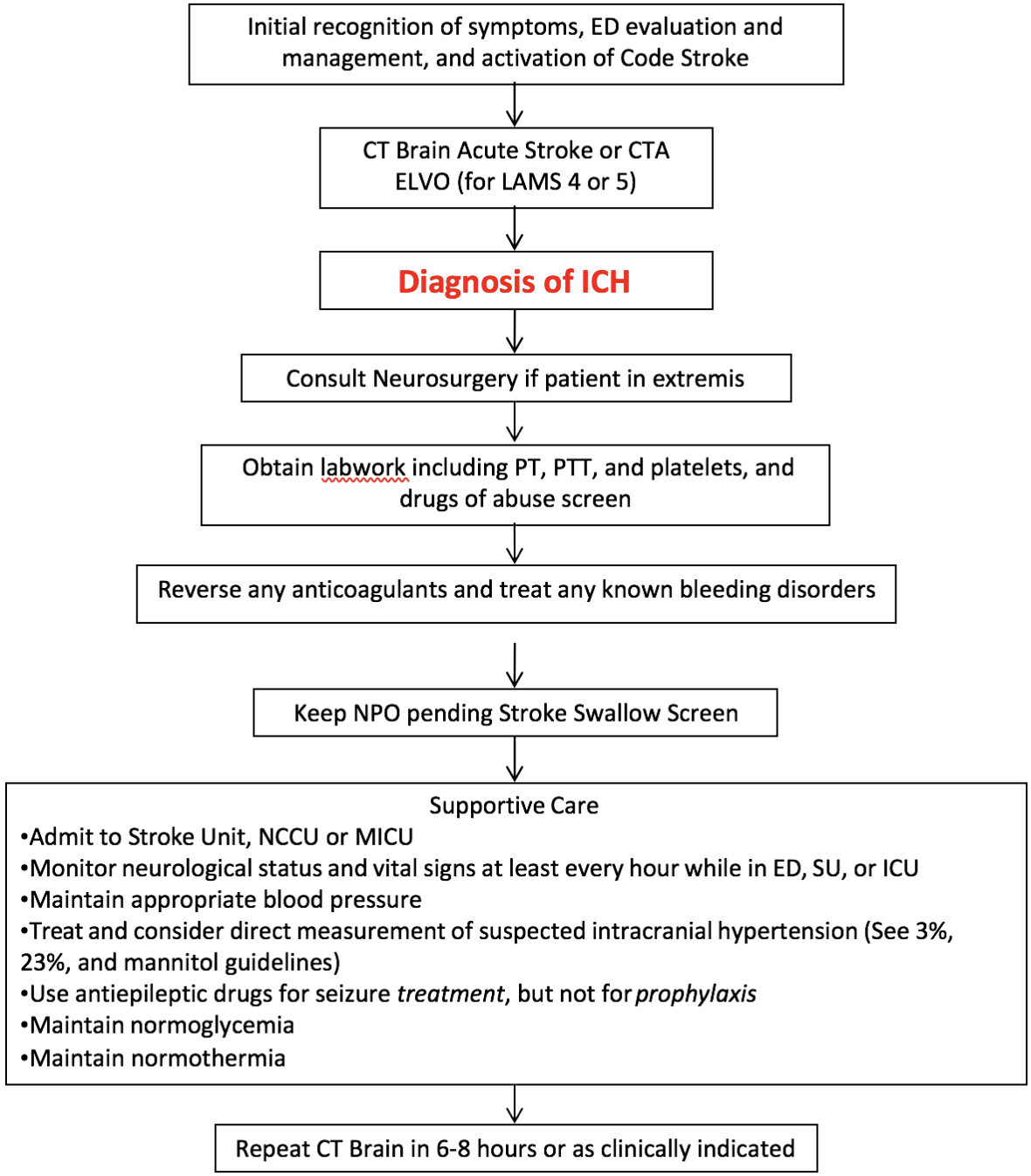
TMH PATHWAY

Remember:
Onsite ambulance may be available. Utilize appropriate ACLS resources (LifePact, Coastline, Med Tech, EMS or other).



RIH PATHWAY



April 2016

Approach to post tPA ICH

- **For suspected ICH:**
  - Stop tPA immediately (as soon as suspected)
  - Obtain emergent NCCT Brain
  - Monitor vital signs and neuro checks every 15 min
  - Assess for signs of elevated ICP
- **For confirmed ICH:**
  - Consult neurology and neurosurgery
  - Obtain stat labs (type and cross for 2 units PRBCs, Hb, INR, aPTT, platelets, fibrinogen, d-dimer)
  - Treatment per guideline (next slide) including:
    - cryoprecipitate, Tranexamic Acid, platelets if indicated
    - ICP management

Approach to post tPA bleeding

Anticoagulant	Prolonged Parameters w/o Bleeding	Mild Bleeding	Moderate Bleeding	Severe Bleeding	Life Threatening or Requiring Rapid Reversal for Emergent Surgery	Monitoring	Comments/ Rationale
tPA Alteplase							
Half Life: Approx. 5 minutes **Mechanism of action: Thrombolytic** tPA guidelines	No laboratory monitoring routinely indicated	Discontinue tPA	Discontinue tPA	Discontinue tPA	Discontinue tPA STAT CT Brain: -If excludes hemorrhage resume tPA infusion -If confirms hemorrhage or if reversal for emergency surgery required - Give Cyroprecipitate 10 units if fibrinogen < 150 units (do not wait for lab results to begin infusion) - Give tranexamic acid (TXA) 1 g IV in 250 ml over 20 minutes. - If platelets are <100,000/ml then give one pack of platelets. - If patient was on warfarin and INR ≥1.5, then reverse with 4F-PCC (Kcentra) 1000 units (rounded up to nearest vial size) and Vitamin K 10 mg IV.	STAT fibrinogen, CBC, PT/INR, PTT, platelet **Fibrinogen level** - if initial fibrinogen level returns <100mg/dl, give additional 10 units Cyroprecipitate - Repeat fibrinogen level in one hour after initial treatment and every 6 hours thereafter until fibrinogen level ≥150mg/dl. - fibrinogen level: ≥ 150mg/dL: discontinue Cryoprecipitate < 150mg/dL: recheck fibrinogen in six hours. If fibrinogen is still < 150 mg/dL give additional cryoprecipitate 10 units. Repeat fibrinogen every 6 hours until ≥150mg/dl	tPA has a very short half-life. However, it works by converting plasminogen to plasmin, which breaks down fibrin clots and creates a hypofibrinogenemic state. That state is more prolonged (>24 hours). Cryoprecipitate is the mainstay of tPA "reversal" because it replaces fibrinogen. TXA is an antifibrinolytic agents, surgical and trauma literature did not show a significant increase in thrombosis when given. FFP historically was given to replace fibrinogen and other factors including Factor V, which is known to be proteolyzed by plasmin. However, it is not recommended due to risk with infusion and it contains plasminogen. Prothrombin complex concentrate is only indicated if the patient was also on warfarin.

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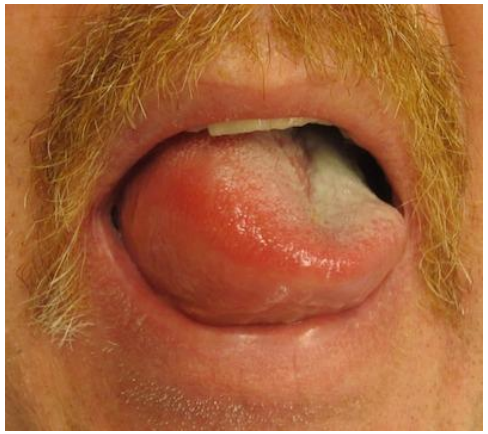
Management of tPA-induced Perioral and Lingual Edema

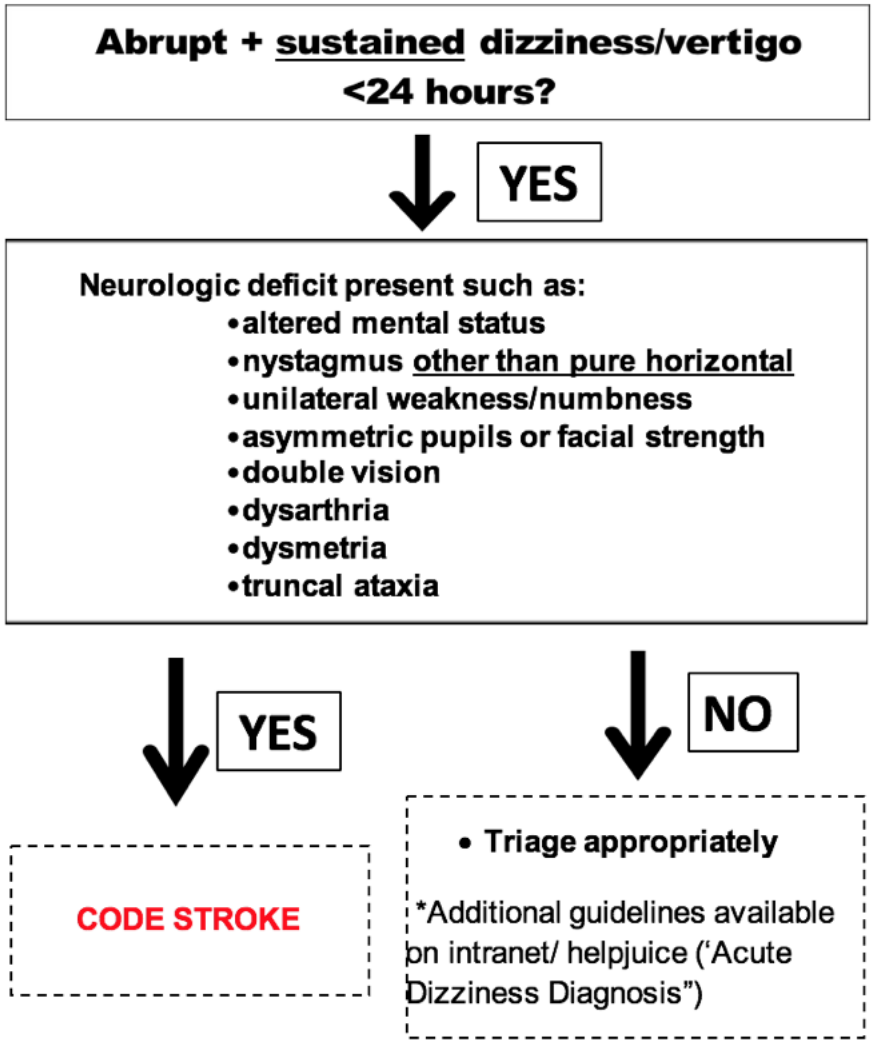
- **Stop tPA immediately**
- Consider intramuscular epinephrine (discuss with ED attending), consider intubation as clinically indicated
- Administer:
  - Famotidine 40mg IV x 1
  - Diphenhydramine 50mg IV x 1
  - Methylprednisolone 125mg IV x 1, which may be repeated every 6 hours for 4 doses as needed for continued swelling
- Close respiratory monitoring
- Do **not** resume tPA
- Add tPA to patient's allergies



Atypical Stroke Detection

- Posterior circulation and brainstem strokes can present with subtle, atypical and non-lateralizing symptoms that can be difficult to diagnose. Atypical symptoms are more common in women.
- Think acute stroke with new onset:
  - Diplopia
  - Cranial nerve deficit
  - Ataxia (Truncal or Gait)
  - Dysphagia
  - Nystagmus (other than horizontal & unidirectional nystagmus or torsional nystagmus of BPPV)
  - Acute mental status changes
- Dizziness has now been incorporated directly into our code stroke algorithms at RIH and TMH.
- If a patient has acute, sustained, non-episodic and ongoing dizziness/vertigo, consider performing a **HINTS exam** in addition to a focused neurologic exam to determine central vs peripheral cause

Acute Dizziness Triage Guideline



Approved by RIH, TMH Stroke Committee 2/2019

Approved by Newport ED Director / Stroke Leadership, July 2020

Acute Dizziness Diagnosis

If does not meet criteria for acute, sustained dizziness/vertigo < 24 hours associated with additional neurologic deficit

THEN

- Consider non-stroke diagnoses as indicated
- Consider peripheral vertigo if horizontal, unidirectional nystagmus; tinnitus/ ear fullness is also suggestive.
- Consider HINTS exam (Head Impulse, Nystagmus, Test of Skew). Horizontal/unidirectional nystagmus AND positive head impulse test AND absence of vertical skew deviation confirm a peripheral etiology.
- If concern for central cause, consider neurology consult.

Approved by RIH and TMH Stroke Committees 2019

Approved by Newport ED Director / Stroke Leadership, July 2020

Dizziness

- Most dizzy patients do not need to be activated as code strokes
- Consider activating a code stroke if symptoms were abrupt in onset, are persistent, and are associated with additional neurologic deficits
- The following framework can help cater your differential diagnosis:

- Acute Vestibular Syndrome:
  - Abrupt, persistent, does not completely resolve
  - DDx: Vestibular Neuritis, Labyrinthitis, Stroke
- Chronic Vestibular Syndrome:
  - Post-exposure, prolonged, insidious-onset
  - DDx: med effect, tumor
- Episodic Vestibular Syndrome:
  -Intermittent episodes that completely resolve
  -DDx: TIA, vestibular migraine, Meniere's, arrhythmia
- Triggered Vestibular Syndrome:
  - Short-lived (<1min) episodes that resolve, triggered by movement
  - DDx: BPPV, Orthostasis

TRANSIENT ISCHEMIC ATTACK

- Warns of impending stroke in up to 30% of patients
- Risk of stroke is highest within the first few days following a TIA
- Nearly 20% of patients we think had a TIA rule-in for infarction on DW-MRI
- Clinical risk stratification tools (ABCD2 score) are imperfect
- Acute stroke risk can be reduced by 80% by determining the underlying vascular cause (large of small vessel disease or cardioembolism) and optimizing individualized secondary prevention strategies
- Consider ordering dual antiplatelet therapy for suspected TIAs (Clopidigrel + Aspirin, soon to be integrated into CDU TIA order set)
- Stroke mimics are common and include seizure, brain tumor, migraine, etc.
- TIA patients in the RIH and TMH EDs should be considered for CDU observation.

Remember These Critical Actions!

- A nursing stroke swallow screen needs to be performed on every stroke prior to any PO intake
  - If patient fails swallow screen, no PO meds should be ordered.
- Document the NIHSS on every suspected / confirmed stroke or TIA patient
- Medical decision-making with supportive documentation should include:
  - tPA indicated yes/no and why?
  - Your discussion of tPA risks and benefits
  - If there was a delay to tPA administration (>45 min), why?
- **Use the Code Stroke order sets**

Intranet Resources by Site

- RIH
- Newport
- TMH

THANK YOU

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Contact me anytime with questions or concerns.