

## Comprehensive Stroke Center Performance Measures

\*\*\*Include in Documentation for ALL Stroke Admissions \*\*\*

### ALL STROKE (Ischemic, IPH, SAH)

- Venous Thromboembolism (VTE) Prophylaxis:** SCDs/SQH/LMW/H
- Stroke Education:** Education handout; Smoking Cessation
- Rehab Assessment:** PT, OT, SLP evals for swallow & cog

### +ISCHEMIC STROKE

- Thrombolytic Therapy?** Last known normal? Lytic given within 3 hours? If not, why?
- Antithrombotic Therapy By End of Hospital Day 2?**
- Discharged on Statin? If not, why?**
- Discharged on Antithrombotic Therapy? If not, why?**
- NIHSS** score documented w/ time stamp

### +ISCHEMIC STROKE WITH A-FIB

- Anticoagulation Therapy for Atrial Fibrillation/Flutter Started? If not, why? Plan in place?**

### +SAH/ICH

- Severity measurement performed on admission:** Hunt and Hess for SAH and ICH score for ICH on admission
- Procoagulant Reversal Agent:** For ICH if INR >1.4
- Nimodipine Treatment Administered:** For SAH, within 24 hours of admission

### Stroke

Ischemic ICH SAH

Blue + Green = ISCHEMIC stroke patients • Blue + Green + Red = ISCHEMIC stroke with A-FIB  
Green+ Purple: SAH/ICH

### HMC Contacts

**Stroke phone:** 744-6789

#### HMC Team Contacts

##### NCCS Numbers:

Team 1 (Sumi): 540-4233 (p)  
Team 2 (Copass): 540-1945 (p)  
Admission cell: 491-3068

##### Neurology Resident Pagers:

-ED consult: 663-0651  
-Inpatient consult: 663-0650

##### Team Pulsara Phones:

-Sumi/Copass: 744-7455  
-Consult: 708-3618

##### HC Specialists:

-Anna Krumpke: 986-1911 (p)  
-Lynne Smith: 540-1319 (p)  
-Allison Walczyk: 314-4760 (p)  
-Holly Stone: 314-0429 (p)

##### Neurology Pharmacist:

-Pager: 540-9648  
-Cell: 948-8626

Pharmacy: 4-3220

**STAT Pharmacy (lytics): 4-2241**

Team room #: 4-2979/2144/4556

Paging operator: 4-0147

HMC operator: 4-3000

Angio: 4-3381, 4-6506

NeuroRads Reading Rm: 4-6143

**NeuroRads HOT Line: 4-8484**  
(Code Stroke & Stroke STAT Reads)

3W Charge RN: 4-7879

3W desk: 4-3347

3W fax #: 4-8576

3W nurses stations

A: 4-5561, B: 4-5562, C: 4-5563

NCCS nurses stations

A: 4-5361, B: 4-5362, C: 4-5363

Stroke Office: 4-3975

(Stroke@uw.edu)

Anna Kwak-Callen (Manager) 4-2410

Tammie (Stroke Resource RN):

4-6093

Shanteal (Stroke Clinic): 4-6155

Stroke Clinic Back Line: 4-1712

Stroke Clinic Front Desk: 4-0401

**Stroke Conference:** send referrals  
to stroke@uw.edu by Thurs, 2 pm

Neuro CCN: 405-9267 (p)

Neuro floor SW: 626-2679 (p)

NCCS SW: 4-2423, 540-125 (p)

#### Room Codes

3W Team room: 979 979\*

Neurology call room: 3113 3113\*

Supply / nutrition rooms: 731 731\*

EEG reading room: 10 10 84\*

Skybridge bathroom: 325 325\*

R1 call room (4MB 402): 6891

6891\*

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## Commonly Used Risk Calculators

### CHADS2-VASC (Afib ischemic stroke risk)

CHF (+1)	Stroke risk per yr 1 point = 0.6%	0 = "low" risk  1 = "low-moderate" risk: consider antiplatelet or anticoagulation  ≥2 = "moderate-high" risk: anticoagulation candidate
HTN (+1)	2 points = 2.2%	
Age: <65 (0), 65-74 (+1), ≥75 (+2)	3 points = 3.2%	
Diabetes mellitus (+1)	4 points = 4.8%	
Stroke, TIA, thromboembolism (+2)	5 points = 7.2%	
Vascular disease history (+1)	6 points = 9.7%	
Female sex (+1)	7 points = 11.2%	
	8 points = 10.8%	
	9 points = 12.2%	

### ABCD2 (stroke risk after TIA)

Age ≥ 60 yo (+1)																				
Initial BP: SBP≥140 or DBP≥90 (+1)																				
Clinical TIA	<table><tr><th>Score</th><th>2 day stroke risk</th><th>7 day stroke risk</th><th>90 day stroke risk</th></tr><tr><td>0-3</td><td>1%</td><td>1.2%</td><td>3.1%</td></tr><tr><td>4-5</td><td>4.1%</td><td>5.9%</td><td>9.8%</td></tr><tr><td>6-7</td><td>8.1%</td><td>11.7%</td><td>17.8%</td></tr></table>	Score	2 day stroke risk	7 day stroke risk	90 day stroke risk	0-3	1%	1.2%	3.1%	4-5	4.1%	5.9%	9.8%	6-7	8.1%	11.7%	17.8%			
Score		2 day stroke risk	7 day stroke risk	90 day stroke risk																
0-3		1%	1.2%	3.1%																
4-5		4.1%	5.9%	9.8%																
6-7		8.1%	11.7%	17.8%																
- Unilateral weakness (+2)																				
- Speech disturbance w/o weakness (+1)																				
- Other symptoms (0)																				
Duration of symptoms																				
- <10 min (0)																				
- 10-59 mins (+1)																				
- >60 min (+2)																				
Diabetes mellitus (+1)																				

### Risk of Paradoxical Embolism (RoPE) Score Calculator

Patient Factor	RoPE Score Points	Total RoPE Score	Probability Stroke PFO related (95% CI)	RoPE Score and High Risk Features (HRF*)	PFO Related Stroke Likelihood	Rel Risk of Stroke post closure	Rel Risk of Persistent AF post closure
No hypertension	1	0-3	0 (0-4)				
No diabetes	1	4	38 (25-48)				
No hx stroke/TIA	1	5	34 (21-45)				
Nonsmoker	1	6	62 (54-68)				
Cortical infarct	1	7	72 (66-76)				
Age 18-29	5	8	84 (79-87)				
30-39	4	9-10	88 (83-91)				
40-49	3						
50-59	2						
60-69	1						
70+	0						

RoPE <7, no HRF unlikely 1.1 (0.53, 2.5) **3.7 (1.3, 10.8)**

RoPE <7, yes HRF Possible **0.38 (0.2, 0.7)** **3.1 (1.3, 7.7)**

RoPE ≥7, no HRF Probable **0.10 (0.03, 0.4)** 2.06 (0.63, 6.78)

RoPE ≥7, yes HRF Probable **0.10 (0.03, 0.4)** 2.06 (0.63, 6.78)

\* HRF = large PFO or atrial septal aneurysm  
Note: simultaneous DVT, PE or PFO straddling clot further increases likelihood of PFO relatedness

### ICH score

GCS: 3-4 (+2), 5-12 (+1), 13-15 (0)	HMC mortality (2005-2008) by ICH score* 0 = 0.9% 1 = 0.7% 2 = 5.3% 3 = 15.3% 4 = 36.8% 5 = 60.0% *Comfort care excluded	ICH volume calculation: ABC/2 - A: largest diameter of ICH (cm) - B: largest diameter 90 deg to measurement A on same slice (cm) - C: (# CT slices on which ICH seen) x (slice thickness)
Age ≥ 80 yo (+1)		
ICH volume ≥ 30 cc (+1)		
Intraventricular hemorrhage (+1)		
Infratentorial origin (+1)		

GCS	1	2	3	4	5	6
Eye opening	None	To pain	To sound	Spontaneous	—	—
Verbal	None	Incomprehensible	Inappropriate	Confused	Oriented	—
Motor	None	Extending	Abnormal Flexion	Flexing	Localizing	Obedient
Total score: 3 (unresponsive) to 15 (best response)						

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## Spontaneous Intraparenchymal Hemorrhage Reversal Guide for Warfarin

UW Medicine December 2021

For guideline updates and info on managing bleeds in patients on antiplatelet agents, heparin, LMWH, etc. visit: [stroke.washington.edu](http://stroke.washington.edu)

- For all patients:
- 1) Order STAT EMERGENCY STROKE PANEL (includes PT/INR, PTT, HB/HCT, PLT and DOAC screen)
  - 2) Obtain history about use of antithrombotic agents, including date/time of last dose
  - 3) TYPE AND SCREEN – EMERGENCY
  - 4) If crash craniotomy is considered, request 2 units emergent un-crossmatched Group O (universal donor) PRBCs

### IF ON WARFARIN

Immediately give vitamin K 10mg IV

Standard practice: If INR  $\geq 1.6$ , determine eligibility for PCC (preferred) vs FFP  
Low evidence: INR 1.3 – 1.5, consider on case-by-case basis

History of thrombotic or thromboembolic event in past 6 weeks (DVT/PE, ischemic stroke, ACS, acute venous/arterial ischemia, etc.)  
Known prothrombotic condition (malignancy, DIC, hypercoagulable condition, hepatic disease, polytrauma, HIT, etc.)  
Major surgery within 6 weeks  
IPH considered not survivable

NO

YES

### PCC (Kcentra) Pathway

• PCC (Kcentra) 2000 units IVPB x1

Check PT/INR 15-30min, 6 hrs and 24 hrs after completion of PCC:

If INR  $> 1.5$  at 15-30 min, consider giving another 500 units PCC  
If INR  $> 1.5$  at 6 hrs, repeat vitamin K 10mg IV over 30 min  
If INR  $> 1.5$  at 24 hrs, repeat vitamin K 10mg V over 30 min

PCC = Prothrombin Complex Concentrate; preferred agent is Kcentra

### FFP Pathway

- Immediately give 4 units emergency-release FFP and request 4 more units of type-specific thawed FFP (send sample for STAT type and screen)
- Consider furosemide if patient has CHF
- Upon completion of infusion, repeat STAT Emergency Stroke Panel
- If INR still  $> 1.5$ , give the 4 U type-specific thawed FFP
- Upon completion, repeat STAT Emergency Stroke Panel
- If INR still  $> 1.5$ , repeat vitamin K 10mg IV over 30 minutes and consult hematology
- Once INR  $\leq 1.5$ , repeat INR every 6 hrs for 24 hrs
- If INR increases to  $> 1.5$ , repeat vitamin K 10mg IV over 30 min and consult hematology

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## Spontaneous Intraparenchymal Hemorrhage Reversal Guide for Direct Oral Anticoagulants

UW Medicine December 2021

For guideline updates and info on managing bleeds in patients on antiplatelet agents, heparin, LMWH etc. visit: [stroke.washington.edu](http://stroke.washington.edu)

- For all patients:
- 1) Order STAT EMERGENCY STROKE PANEL (includes PT/INR, PTT, HB/HCT, PLT and DOAC screen)
  - 2) Obtain history about use of antithrombotic agents, including date/time of last dose
  - 3) TYPE AND SCREEN – EMERGENCY
  - 4) If crash craniotomy is considered, request 2 units emergent un-crossmatched Group O (universal donor) PRBCs

IF ON DABIGATRAN (direct thrombin inhibitor)  
AND TT is prolonged or not readily available

IF ON RIVAROXABAN OR APIXABAN (factor Xa inhibitors) AND Direct Xa Inhibitor screen or anti-Xa for the specific anticoagulant (RIVAR1 or APIXN1) is elevated  
IF ON EDOXABAN OR BETRIXABAN (factor Xa inhibitor) Direct Xa Inhibitor screen will exclude the presence of clinically relevant drug. No calibrated specific assays.

If ingestion within 2 hours, give one dose activated charcoal orally

Give idarucizumab (Praxbind) 5gm IV, administered as two 2.5gm doses no more than 15 minutes apart, each infused over 5-10 minutes

If idarucizumab is not available, proceed to consider PCC (Kcentra)

CONSIDER PCC (Kcentra) 2000 units ONLY if the patient does not have:

History of thrombotic or thromboembolic event in past 6 weeks (DVT/PE, ischemic stroke, ACS, acute venous/arterial ischemia, etc.)  
Known prothrombotic condition (malignancy, DIC, hypercoagulable condition, hepatic disease, polytrauma, HIT, etc.)  
Major surgery within 6 weeks  
IPH considered not survivable

Emergent dialysis may be considered in certain circumstances (renal failure; known dabigatran overdose);  
~ 65% removed by hemodialysis  
Dabigatran  $t_{1/2}$  = 14 hrs (up to 34 hrs in severe renal impairment)

PCC = Prothrombin Complex Concentrate; preferred agent is Kcentra

Rivaroxaban, Apixaban, Edoxaban & Betrixaban are NOT dialyzable

Rivaroxaban  $t_{1/2}$  = 9 hrs (longer in renal impairment)  
Apixaban  $t_{1/2}$  = 12 hrs (longer in renal impairment)  
Edoxaban  $t_{1/2}$  = 10-14 hrs (longer in renal impairment)  
Betrixaban  $t_{1/2}$  = 19-27 hrs (longer in renal impairment)

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NIH Stroke Scale Item	Function	Scores
1a. Level of Consciousness (Alert, Drowsy, etc.)	Alert	0
	Drowsy	1
	Stuporous (requires repeated stimuli)	2
	Comatose (reflex responses only)	3
1b. LOC Questions (Ask month, age)	Both correct	0
	One Correct	1
	Both Incorrect, unable to answer*	2*
1c. LOC Commands (Open, close eyes, make fist, let go)	Obeys both correctly	0
	Obeys one correctly	1
	Both Incorrect, unable to perform*	2*
2. Best Gaze (Eyes open-patient follows examiner's finger or face)	Normal	0
	Partial gaze palsy (for coma see Note 2 below)	1
	Forced deviation	2
3. Visual (Introduce visual stimulus/threat to patient's visual field quadrants)	No loss	0
	Partial hemianopia (for coma see Note 3 below)	1
	Complete hemianopia	2
	Bilateral hemianopia	3
4. Facial Palsy (Show teeth, raise eyebrows and squeeze eyes shut)	Normal	0
	Minor asymmetry	1
	Partial (lower face paralysis)	2
	Complete*	3*
5a. Motor Arm-Left (Elevate extremity 90 degrees when sitting and score drift/movement)	No drift	0
	Drift	1
	Some effort against gravity	2
	No effort against gravity	3
	No movement*	4*
5b. Motor Arm-Right (Elevate extremity 90 degrees when sitting and score drift/movement)	No drift	0
	Drift	1
	Some effort against gravity	2
	No effort against gravity	3
	No movement*	4*
6a. Motor Leg-Left (Elevate extremity 30 degrees when lying down and score drift/movement)	No drift	0
	Drift	1
	Some effort against gravity	2
	No effort against gravity	3
	No movement*	4*
6b. Motor Leg-Right (Elevate extremity 30 degrees when lying down and score drift/movement)	No drift	0
	Drift	1
	Some effort against gravity	2
	No effort against gravity	3
	No movement*	4*
7. Limb Ataxia (Finger-Nose, heel down shin)	Absent*	0*
	Present in upper or lower	1
	Present in both	2
8. Sensory (Pin prick to face, arm, trunk, and leg compare side to side)	Normal	0
	Partial Loss	1
	Dense Loss*	2*
9. Best Language (Name items, describe picture and read sentences)	No aphasia	0
	Mild-moderate aphasia	1
	Severe aphasia (see Intubated and Alert notes if appropriate)	2
	Mute*	3*
10. Dysarthria (Evaluate speech clarity by patient repeating listed words)	Normal articulation	0
	Mild-moderate slurring	1
	Severe, nearly unintelligible or worse*	2*
11. Extinction and Inattention (Use information from prior testing to identify neglect or double simultaneous stimuli testing)	No neglect	0
	Partial neglect	1
	Profound Neglect*	2*

NIH Stroke Scale\*

\*assign this score if patient comatose or unresponsive

Note 2: perform oculoccephalic testing to determine score if comatose, absent oculoccephalic reflex leads to score of 2

Note 3: determine via visual threat if comatose, no response leads to score of 3

Intubated and Alert: for item 9, make best guess and score; for item 10, untestable so score 0





**MAMA  
TIP-TOP  
FIFTY-FIFTY  
THANKS  
HUCKLEBERRY  
BASEBALL PLAYER  
CATERPILLAR**

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- . You know how.
- . Down to Earth.
- . I got home from work.
- . Near the table in the dining room.
- . They heard him speak on the radio last night.



## Lytic Inclusion, Cautionary & Exclusion Criteria

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### Inclusion

- Diagnosis of ischemic stroke causing measurable neurological deficit
- Aged  $\geq 18$  yo
- Onset of symptoms  $< 3$  hours
- 3h-4.5h time window criteria same, except for following cautionary criteria:
  - $> 80$  yo
  - Hx of both DM and prior stroke
  - Baseline NIHSS  $> 25$
  - Ischemic injury  $> 1/3$  of MCA territory
  - Oral anticoagulant use
- Unknown LKN/ wake up stroke (without LVO) consider tPA administration if:
  - Per WAKE UP trial: MRI with diffusion/ FLAIR mismatch

### Exclusion Criteria

- CT with evidence of hemorrhage
- CT with extensive regions of clear hypoattenuation
- Ischemic stroke within prior 90 days
- History of severe head trauma within prior 90 days
- Clinical presentation suggestive of SAH, even if CT normal
- Intracranial or intraspinal surgery within prior 90 days
- Elevated BP (SBP  $> 185$  or DBP  $> 110$ ) unresponsive to meds
- Active internal bleeding
- Hx of GI malignancy or recent GI or urinary tract hemorrhage within last 21 days
- Acute hemorrhagic diathesis, including but not limited to:
  - Platelet count  $< 100,000$  (if no known hx of thrombocytopenia, can start tPA before labs return then stop if plt count  $< 100,000$ )
  - Use of warfarin with prolonged PT  $> 15$ sec, INR 1.7, or aPTT  $> 40$ sec
  - Confirmed or suspected use of direct thrombin inhibitor or direct FXa inhibitor within 48h (assuming wnl renal function)
  - Abnormal values in emergency stroke panel: TT, PT, aPTT, anti-Xa
  - Use of treatment-dose heparin/LMWH in previous 24h
- Blood glucose  $< 50$ mg/dl
- Arterial puncture at non-compressible site in last 7 days
- Unruptured and unsecured intracranial aneurysm ( $> 10$ mm)
- Intracranial, intra-axial tumor (extra-axial tumors likely OK)
- Symptoms consistent with infective endocarditis
- Aortic arch dissection

### Cautionary Criteria

- Prior known non-traumatic intracranial hemorrhage
- Vascular malformation unless severe neurological smx (ischemic risk outweighs ICH)
- Pregnancy; risk to fetus and woman unknown—consult OB/GYN ASAP
- Major extra-cranial surgery or trauma within 14 days
- Acute or recent MI (within 3 months), depending on what type of MI
- Acute pericarditis
- Abnormal aPTT, TT, or anti-Xa activity with unknown use of direct thrombin inhibitor or factor Xa inhibitor (may be false positive due to lupus anticoagulant, consider tPA if able to reliably confirm pt is not taking one of these agents)
- Cerebral microbleeds:  $> 10$  on prior MRI may increase risk for ICH

**TNK dose: 0.25mg/kg, max dose of 25 mg**

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## IV thrombolysis CONSENT GUIDELINES

- Neuro consents for lytic but not for thrombectomy (we help to get family contact)
- Do NOT delay lytic, if pt can't consent & family not available, OK to treat as standard of care
- For lytic administration, document consent for ALL cases
  - \*Key Risks/Benefits/Alternatives:
    - ♦ lytic dissolves blood clots but bleeding is side effect
    - ♦ If given w/in 4.5h of LNW, can increase chance of good outcome, smaller chance of brain bleed
    - ♦ 1 of 3-4 will have improved outcome / 1 of 8 will have excellent outcome
    - ♦ 1/16 can have brain hemorrhage as complication
    - ♦ Despite lytic, significant disability is still possible, a good outcome is not guaranteed
    - ♦ Alternative to lytic are standard treatments to try to optimize outcome from stroke, and though these may be safer, these treatments may not be as effective

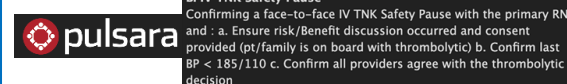
## Thrombolytic Consent: "GIST" version

"Getting this clot buster after a stroke reduces your risk of disability. People who get this to treat their stroke have a better chance of recovering without disability and getting back to the activities they love compared to people who do not receive the treatment. All medicines have some risk. With this medicine, there is a risk of serious bleeding. However, time is important as well. We have found the faster the med is administered, the greater the chance that patients will have the best possible outcome. Do you have any questions?"

## Documenting Thrombolytic Consent

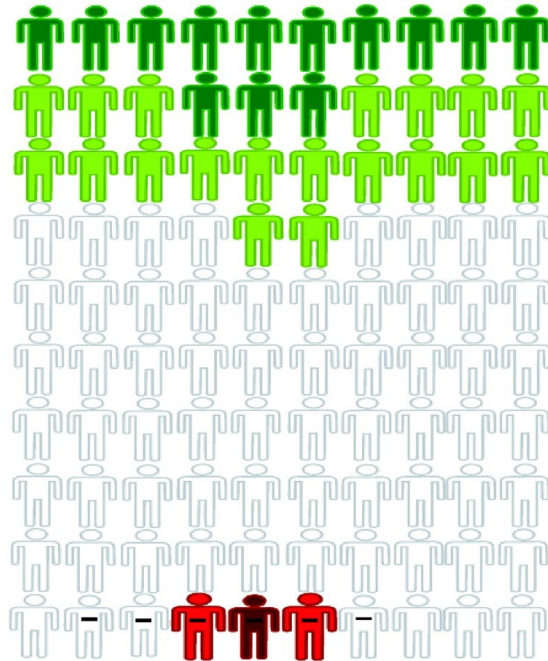
\*If patient **ABLE** to consent, document discussion (example listed):  
 "After establishing eligibility for IV thrombolysis thru a careful review of inclusion and exclusion criteria, I discussed the risks, benefits and alternatives to TNK treatment with the patient and/or their family. A good outcome was not guaranteed. They understood the relevant issues, had a chance to ask questions and agreed to proceed."

\*If patient **UNABLE** to consent, document discussion (example listed):  
 "After establishing eligibility for IV thrombolysis thru a careful review of inclusion and exclusion criteria, it was noted that the patient was not able to participate in a risks/benefits/alternatives discussion due to stroke deficits, no family was available, and so we proceeded with TNK treatment as an evidence based and guideline endorsed standard of care."



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## TPA for Cerebral Ischemia within 3 Hours of Onset-Changes in Outcome Due to Treatment



Changes in final outcome as a result of treatment:

- Normal or nearly normal
- Better
- No major change
- Worse
- Severely disabled or dead

Early course:

- No early worsening with brain bleeding
- Early worsening with brain bleeding

## Endovascular Therapy

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- Thrombolytic candidates should still receive thrombolytic ASAP
- **Exclusion Criteria:** intracranial hemorrhage, not consistent with goals of care

### Mechanical Thrombectomy Inclusion Criteria—ALL CASES\*

- Last known well to first puncture possible w/in 24h
- Intracranial ICA, M1, prox M2, or basilar artery occlusion
  - \* Possible select distal M2/M3, ACA, PCA occlusions
- Disabling symptoms (generally NIHSS  $\geq 6$ ), no pre-existing disability
- Call Stroke Phone to discuss
- \* other factors to consider, but may not exclude, on a case by case basis: NIHSS < 6, age > 90, pre-existing disability, dementia, goals of care

### Anterior Circulation Thrombectomy

- ASPECTS  $\geq 6$ : consider CTP (esp. > 6 hrs), usually qualify
- ASPECTS 3-5: consider CTP, case by case carefully considered, may qualify
- ASPECTS 0-2: CTP, might occasionally qualify if core 50-100 cc

### Basilar Artery Thrombectomy

- No established time-window, any suspected basilar artery occlusion is a potential candidate
- PC-ASPECTS  $\geq 6$ : many may qualify
- Discuss with Stroke Phone if additional imaging needed, "Code Stroke MRI" (includes DWI and FLAIR, w/ option of MRA TOF)

### Resident and Fellow Responsibilities

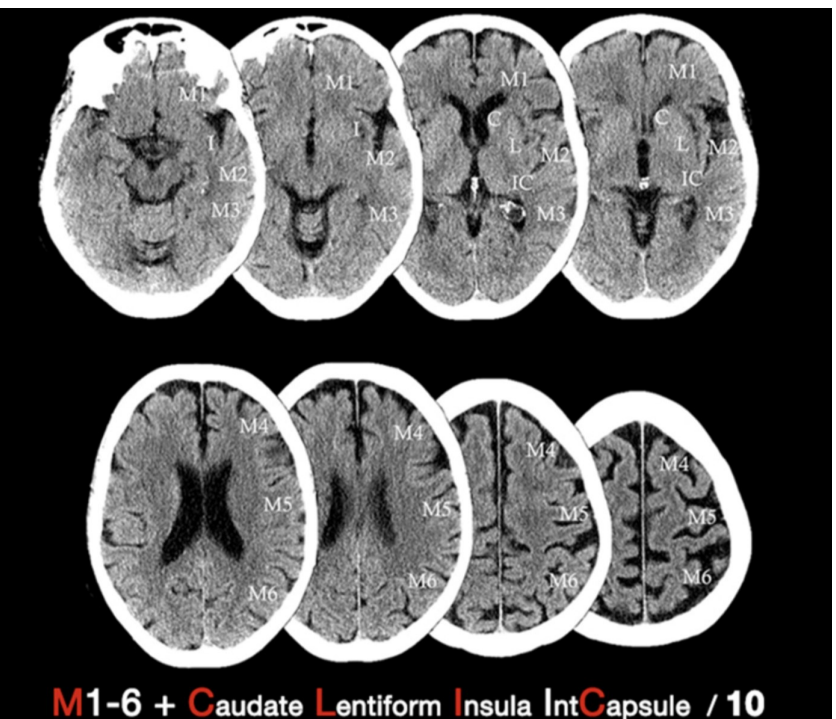
- ABC's, blood glucose, STAT emergency stroke panel, CBC, BMP
- Confirm Last Known Normal/Well (LNW)
- Perform NIHSS and enter into Pulsara
- If presenting w/in 24h LNW (Code Stroke): NCHCT  $\rightarrow$  lytic if indicated
- CTA Neck (includes head and neck)
- Call stroke phone  $\rightarrow$  provide 1 sentence summary of presentation, last known well, NIHSS (& disabling focal sx), lab results  $\rightarrow$  discuss HCT, CTA findings + whether CTP/MRI needed
- Expedite admin of lytic (enter lytic given time in Pulsara) \* Obtain consent prior to lytics
- Transfer to neuro-angio suite & conduct hand-off to neuro-IR + anesthesia (stay until procedure time-out)
- Notify NCCS of admission and admit to Neuro ICU w/ Neuro as Primary
- Ensure Dual Energy HCT done (after EVT & before NICU admission)
- MUST attend post-thrombectomy huddle on admit to Neuro ICU for hand-off w/ NICU team and anesthesiology
- BP goals: During procedure >140mmHg (Neuroanesthesia responsible)
  - After procedure, SBP 140-180 (same as post-lytics)
- Repeat Head CT or MRI 24hr study should be done at 24h post procedure (+/- 6h)



# ASPECTS

(Alberta Stroke Program Early CT Score)

start at 10 and subtract 1 point for each abnormal region

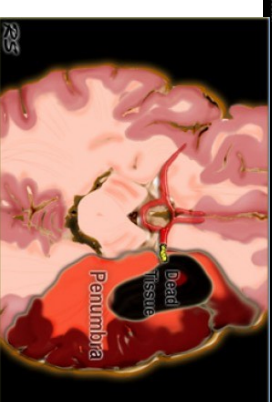
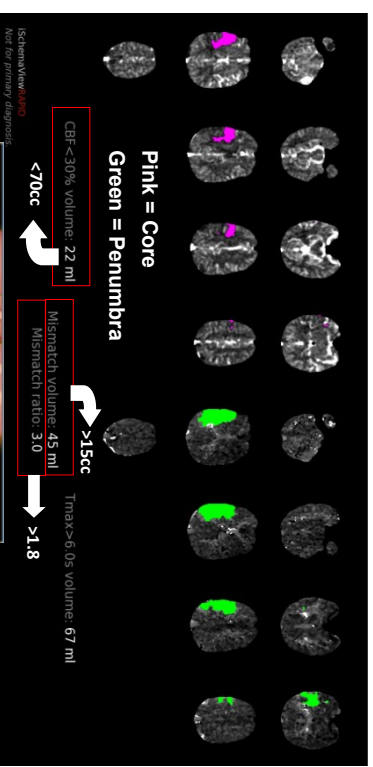


## Terms:

- Mean Transit Time (MTT) or Time to Peak (TTP): Avg time (sec) that RBC spend in a determined volume of capillary circulation  
MTT = CBV/CBF
- Cerebral Blood Flow (CBF): volume of blood passing through given amount of tissue per unit time (ml of blood/min/100g of brain tissue)  
↓ ↓ ↓ CBF
- Cerebral Blood Volume (CBV): volume of blood in given amount of brain tissue (ml of blood/100g of brain tissue)  
↓ ↓ ↓ CBV
- Infarct Core: Part of brain that is already infarcted or destined to infarct.  
↑ MTT/Tmax    ↓ ↓ ↓ CBF    ↓ ↓ ↓ CBV
- Ischemic Penumbra: area of brain tissue that is at risk of progressing to infarction. Surrounds infarct core. Will have prolonged Tmax, >6sec. CBV may be increase due to autoregulation.  
↑ MTT/Tmax    ↓ ↓ CBF    wnl to ↑ CBV

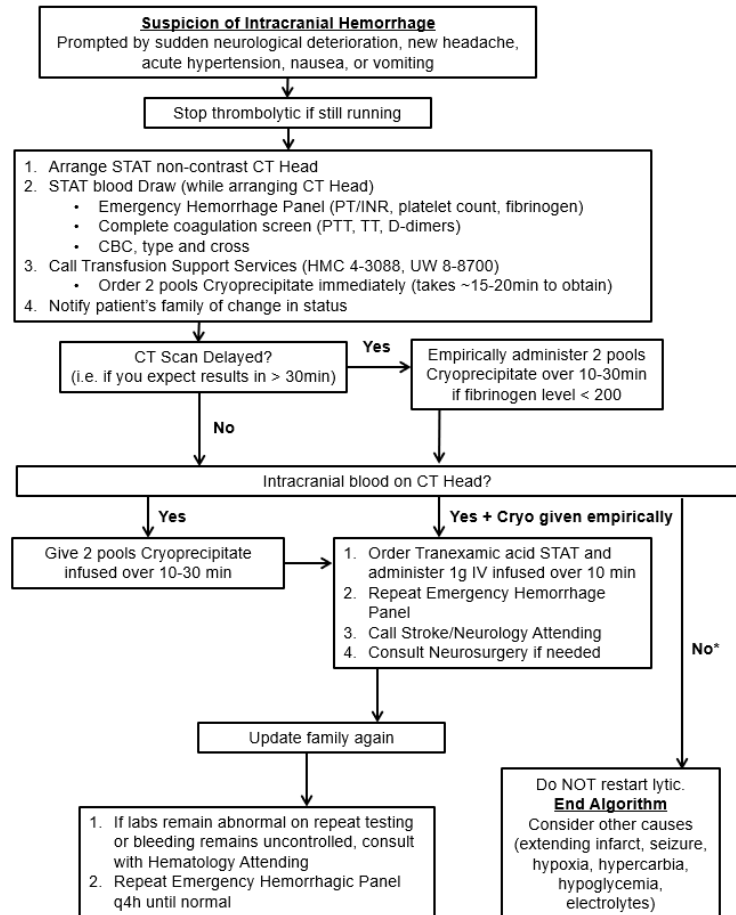
## Tips:

- Decreased blood flow 2/2 poor cardiac function, a/fib, and/or severe proximal arterial stenosis can lead to inaccurate perfusion maps and overestimate MTT and underestimate CBF
- Small infarcts are poorly visualized on CTP



RAPID summary slide showing good mechanical thrombectomy candidate per DEFUSE 3 criteria

## Suspicion of ICH post IV thrombolytic for Ischemic Stroke



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

Class IIb, LOE C-E0
Maintain airway
Endotracheal intubation may not be necessary if edema is limited to anterior tongue and lips.
Edema involving larynx, palate, floor of mouth, or oropharynx with rapid progression (within 30 min) poses higher risk of requiring intubation.
Awake fiberoptic intubation is optimal. Nasal-tracheal intubation may be required but poses risk of epistaxis post-IV alteplase. Cricothyroidotomy is rarely needed and also problematic after IV alteplase.
Discontinue IV alteplase infusion and hold ACEIs
Administer IV methylprednisolone 125 mg
Administer IV diphenhydramine 50 mg
Administer ranitidine 50 mg IV or famotidine 20 mg IV
If there is further increase in angioedema, administer epinephrine (0.1%) 0.3 mL subcutaneously or by nebulizer 0.5 mL
Icatibant, a selective bradykinin B <sub>2</sub> receptor antagonist, 3 mL (30 mg) subcutaneously in abdominal area; additional injection of 30 mg may be administered at intervals of 6 h not to exceed total of 3 injections in 24 h; and plasma-derived C1 esterase inhibitor (20 IU/kg) has been successfully used in hereditary angioedema and ACEI-related angioedema
Supportive care

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

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## **BP MANAGEMENT**

### **Goals:**

Ischemic stroke : SBP <220, DBP <120  
After lytics: SBP<180, DBP <105  
After Thrombectomy: SBP <180, DBP <105  
Hemorrhagic: SBP<160, DBP <105

### **Acute care: Ischemic:**

- Labetalol 10 mg IV, repeat q15 min until effective, increasing to 20mg, then 40 mg, then 60mg (max bolus dose), max total dose: 300 mg in 2 hrs.
- If BP refractory contact attending, consider move to ICU, notify attending

### **ICU: Ischemic (no lytic)**

- Labetalol 10 mg IV, repeat q15 min until effective, increase to 20mg, then 40 mg, then 60mg (max bolus dose), to total dose of 300 mg in 2 hrs. (if IPH & BP > 230/120 skip to 20 mg dose)
- Unsatisfactory response: nicardipine IV 5 mg/hr, titrate by 2.5 mg/hr q 15 min to max 15 mg/hr OR nitroprusside IV 0.5 mcg/kg/min, max 10 mcg/kg/min.

## **TIPS**

### **SQH**

Start SQ heparin 48 hours after IPH, 24 hours after lytic  
SCDs in the interim

### **Other**

- Avoid dextrose/glucose (hypotonic solutions) containing IV solutions in stroke pts
- NEVER give standing orders for hypotonic fluids for stroke patients, including D5 (even if on an insulin gtt)

## **TOM'S PHARM PEARLS**

- **Ibuprofen and ASA:** Ibuprofen binds receptors for ASA and decreases effectiveness. Ibuprofen should be taken > 8 hours before or 4h after immediate-release ASA.
- **ACEI w/ renal dysfunction:** Trial captopril before Lisinopril in patient's w/ renal dysfunction to monitor for creatinine change given shorter half life.
  - Captopril in ICU also reaches steady state quicker so impact on BP is better. If patient has renal stenosis or you see a Cr jump you can remove quickly then once to floor can switch to Lisinopril.
- **Amlodipine:** Best minimizes blood pressure variability.
- **Thiazide diuretics:** chlorthalidone twice as potent as HCTZ and longer acting.
  - Starting dose 12.5mg and increase to 25mg (max dose). Do not start in ICU because of potential for sodium changes.
- **Clonidine:** does not increase ICPs.
- **Hydralazine:** can increase ICPs and may cause drops in pressure that may lead to ischemia.

## **PRE THROMBECTOMY IN ANGIO SUITE: NEUROLOGY TO ANESTHESIA HANDOFF**

<b>ALL PARTIES (NEUROLOGY, NEURO INTERVENTIONALIST, ANESTHESIA, ANGIO TECH, STROKE NURSE)</b>
<input type="checkbox"/> Conversations and distractions to a minimum <input type="checkbox"/> Confirm patient with two identifiers
<b>HANDOFF REPORT FROM NEUROLOGY TEAM TO ANESTHESIA</b>
<input type="checkbox"/> <b>PAST MEDICAL HISTORY</b> <ul style="list-style-type: none"><li>▫ Age</li><li>▫ Weight</li><li>▫ Allergies</li><li>▫ Pertinent Premorbid Conditions</li><li>▫ Outpatient Medications</li></ul>
<input type="checkbox"/> <b>SYNOPSIS OF TODAY'S EVENTS</b> <ul style="list-style-type: none"><li>▫ Covid status</li><li>▫ How patient presented</li><li>▫ Last known well</li><li>▫ NIHSS Score</li><li>▫ Neuro exam</li><li>▫ When did patient last eat?</li><li>▫ Hemodynamics<ul style="list-style-type: none"><li>▪ Last BP / BP Goal (usual goal SBP 140-180)</li><li>▪ Airway / Respiratory status</li></ul></li><li>▫ Critical labs</li><li>▫ Was TPA given? <b>Or TNK?</b></li></ul>
<input type="checkbox"/> <b>CT RESULT:</b> Thrombus in _____
<input type="checkbox"/> <b>Family contact info/location</b>
<input type="checkbox"/> <b>Any additional questions/concerns</b>
<b>When completed, ensure ANESTHESIA READY and TECH/NURSE READY Then perform 2<sup>nd</sup> time out, begin case</b>

### POST-THROMBECTOMY TO ICU HANDOFF CHECKLIST

1	<b>ALL PARTIES</b> (NEURO-INTERVENTIONAL PROVIDER, ANESTHESIA PROVIDER, NEUROLOGY PROVIDER, STROKE NURSE, NICU NURSE)
	<input type="checkbox"/> STOP CONVERSATIONS & DISTRACTIONS, INTRODUCTIONS BY NAME & ROLE <input type="checkbox"/> CONFIRM PATIENT WITH TWO IDENTIFIERS
2	<b>NEUROLOGY PROVIDER</b> <b>PAST MEDICAL HISTORY</b> <input type="checkbox"/> Age <input type="checkbox"/> Weight <input type="checkbox"/> Allergies <input type="checkbox"/> Pertinent Premorbid Conditions <input type="checkbox"/> Outpatient Medications <b>SYNOPSIS OF TODAY'S EVENTS</b> <input type="checkbox"/> Covid status <input type="checkbox"/> How patient presented <input type="checkbox"/> Last known well <input type="checkbox"/> CT Results <input type="checkbox"/> TPA given? <b>Or TNK?</b> <input type="checkbox"/> Neuro Status (pre-thrombectomy) <input type="checkbox"/> NIHSS Score (pre-thrombectomy) <b>POST-OPERATIVE MANAGEMENT PLAN</b> <input type="checkbox"/> Orders: call triggers and who to call (name of next neurologist on call) <input type="checkbox"/> Post-op family update – has it been done? Who will do it?
3	<b>NEURO INTERVENTIONAL PROVIDER</b> <b>ANGIOGRAPHY COURSE: INTRAOPERATIVE EVENTS</b> <input type="checkbox"/> Pre procedure Aspect Score <input type="checkbox"/> Thrombus residing in _____ (vessel) <input type="checkbox"/> Post procedure TICI Score <input type="checkbox"/> Hemostasis device and time <input type="checkbox"/> Postop CT
4	<b>ANESTHESIA PROVIDER</b> <b>ANESTHETIC COURSE: INTRAOPERATIVE EVENTS</b> <input type="checkbox"/> Sedation: conscious vs general <input type="checkbox"/> Airway concerns <input type="checkbox"/> Medications given <input type="checkbox"/> Last paralytic/reversal <input type="checkbox"/> IV Fluids <input type="checkbox"/> Urine output <input type="checkbox"/> EBL <b>CURRENT STATE</b> <input type="checkbox"/> Hemodynamic stability <input type="checkbox"/> Ventilation/Respiratory <input type="checkbox"/> Most recent labs/glucose <input type="checkbox"/> Infusions (wt used for calculations and current rate)
5	<b>NICU NURSE</b> <input type="checkbox"/> Clarifications / Questions <input type="checkbox"/> Confirm ICU Post Thrombectomy Orders <input type="checkbox"/> Assess access site / distal pulse <input type="checkbox"/> <b>PERFORM (m)NIHSS with Neurology so all parties know baseline</b>

### HMC STROKE CODE for

### MANDARIN, SOMALI, SPANISH, VIETNAMESE

**TOLL FREE NUMBER: 800-295-8618**

- Mention 'Stroke code' and the language needed; you will be connected to a trained interpreter
- NO patient or provider details will be asked upfront; the interpreters understand the urgency and you can start performing the NIH Stroke scale immediately.
- You **MUST** provide patient details once the NIHSS has been obtained and you are awaiting CT/CTA to be done. This will help us track these cases
- **Do not** use this line for other languages or sites outside of HMC or for non-stroke code issues

### DYSARTHRIA WORDS (internationally used English words)

- TAXI
- MAMA
- COFFEE
- DOLLAR
- DOCTOR
- PASSPORT

If you have any queries/feedback/concerns, please email Dr. Malveeka Sharma at malveeka@uw.edu