2023 MMC ED Stroke Packet Table of Contents

ISCHEMIC STROKE

Thrombolysis resources

Imaging Pathways

ICH Guidelines incorporated into the ED Stroke

INTRACRANIAL HEMORRHAGE

STROKE PACKET SUPPLEMENT

The information in this packet is intended to help facilitate appropriate and consistent care of patients presenting with symptoms of acute stroke. These recommendations do not supersede physician judgment nor do they reflect the individual needs of every patient.

Reviewed and Revised
February 2023

Guidelines for Activation of MMC ED CODE STROKES

For patients thought to be candidates for **thrombolysis** or **acute endovascular intervention** for stroke

NOTE: Neurology is **NOT NOTIFIED** by EMS prehospital notification**!!**

Patient presents to the Emergency Department with **potentially disabling acute onset neurological deficits**

T = 0

Identify time **last known well (LKW)**
Confirm with PRIMARY SOURCE as often as possible

Perform **FAST-ED Score** & Identify time Last Known Well (**LKW**)

Only ONE of these pathways should be activated in any given patient

FAST-ED Score < 4 & **LKW < 4.5 hr**

FAST-ED Score ≥ 4 & **LKW < 24h**

If time LKW is **unknown** at the time of arrival and cannot be quickly determined, **err on the side of activation!**

For patients presenting to the ED outside of these parameters, please **PAGE NEUROLOGY** to discuss or request a consult.

ACTIVATE "MMC ED Code Stroke"

Use the **ED Acute or Subacute Stroke** Order Set

Call REMIS 662-2950

ACTIVATE "MMC ED Endo Code Stroke"

DTA ≤ 10 min

Obtain BP, blood glucose and answers to the **3 lytic questions** from patient/patient representative if possible

Time LKW: _____:_____

FAST-ED Score: _____

BP: _____/_____

Blood glucose: _____

3 Lytic Questions:

- Any recent surgeries, procedures or trauma?
- Any history of any bleeding problems, including ICH?
- Is the patient on any blood thinners?

If Yes, when and what:

_____

_____

_____

NIHSS

The Joint Commission requires that a full NIHSS is performed on all ischemic stroke and TIA patients (includes non-acute stroke and Endo transfers). When Neurology is present for the initial evaluation they will be responsible for obtaining the score, however, if neurology is not in-house at the time of stroke patient arrival, this should completed by the **EM physician.**

NOTES:

- **Determining LKW**: If **witnessed onset**, who witnessed it at what time? If patient **found with deficits**, who found the patient and when were they last seen without their current deficits?
- **CRAO: Sudden onset, painless, monocular blindness** may be a central retinal artery occlusion should prompt an ED Code Stroke Activation and STAT CT/CTA **PLUS STAT ESR/CRP, Ocular U/S and Ophthalmology Consultation.** Exam should include funduscopy.
- **LVO with minor deficits**: All patients suspected of having a stroke or TIA within the last 24 hours should have **an expedient CT/CTA upon arrival.** If there is no completed infarction on the head CT and an LVO is identified on CTA despite a FAST-ED score < 4, activate an **MMC ED ENDO CODE STROKE.**
- **ED Boarders**: If a patient has been admitted to the hospital but is still boarding in the ED, the **ED Code Stroke** process should be followed, **NOT** the Inpatient Code Stroke process, with one addition that the patient's bedside RN will **notify the patient's Primary Team** and they will need to come to bedside to assist with care.

See *Appendix A: Code Stroke Paging Matrix*

See *Appendix B: Code Stroke Roles and Responsibilites*

MMC ED CODE STROKE PATHWAY

For patients who **present to the MMC ED** with suspected acute stroke

LKW/Onset of symptoms

Patient in the community experiences symptoms concerning for acute stroke is brought to MMC

Arrives **with** pre-notification → See **MMC *D2CT Pathway***

Arrives **without** pre-notification → See ***Non-D2CT Pathway***

T = 0

Use the **ED Acute or Subacute Stroke** Order Set

See ***Guidelines for Activation of MMC ED CODE STROKES***

DTA ≤ 10 min

Head CT followed immediately by CTA head and neck

DTCT ≤ 15 min

TNK candidate?

Yes → Neurology recommends TNK
EM physician orders TNK
ED Pharmacists prepares TNK
ED RN administers TNK

Goal CTA to TNK order (CTO) ≤ 10 min
Goal order to TNK administration ≤ 5 min

DTN ≤ 30 min

Yes or No

LVO detected on CTA?

No → Do not proceed with CTP
Patient brought back to CC bay
If not already done in CT, administer TNK to eligible patients

See *TNK Eligibility Criteria*

To administer TNK in the ED: **STROKE - Acute Treatment with Thrombolytic** Order Set

Yes → Proceed with CT Perfusion (CTP)

EVT candidate?

No → Patient admitted to the appropriate level of care based on TNK administration and clinical condition (floor or ICU)

Floor admission:
Gen Med Ischemic Stroke Admission Order Set

ICU admission no TNK:
Ischemic Stroke NON-Thrombolysis ICU Order Set

ICU admission after TNK:
Ischemic Stroke POST- thrombolysis ICU Order Set

Post-EVT:
Cerebral Thrombectomy Post-Procedure Order Set

Yes → Patient transported STAT to IR suite

Time to groin puncture minimized

DTP ≤ 60 min

Time to reperfusion minimized

Goal: single pass TICI 2b or greater reperfusion

DTR ≤ 90 min

See *Appendix A: Code Stroke Paging Matrix*

See *Appendix B: Code Stroke Roles and Responsibilites*

References:
Evidence that Tenecteplase Is Noninferior to Alteplase for Acute Ischemic Stroke. *Stroke.*2019;50:2156-2161.
Renal Safety of CT Angiography and Perfusion Imaging in the Emergency Evaluation of Acute Stroke. *AJNR.* 2008;29:1826-1930.
Time to Treatment With Intravenous Tissue Plasminogen Activator and Outcome From Acute Ischemic Stroke. *JAMA.*2013;309:2480-2488.
Ultra-early Thrombolysis in Acute Ischemic Stroke Is Associated With Better Outcome and Lower Mortality. *Stroke.*2010;41:712-716.

ENDOVASCULAR STROKE TRANSFER PATHWAY

For patients at an **Outside Hospital (OSH)** with a suspected or confirmed acute stroke secondary to **large vessel occlusion (LVO)**

REMIS pages the MMC **Neurologist** (or TeleStroke Neurologist if a TeleStroke Consult is requested) **AND** the **Neurointerventionalist (NI)** for an "**Urgent Stroke" question**

LKW/Onset of symptoms

Large Vessel Occlusion is clinically suspected or imaging confirmed?

No → The **Neurologist** considers whether there are other acute stroke treatment options and if there is need for transfer and triages as appropriate

Yes

Patient felt to be a good endovascular (EVT) candidate?

No → The **Neurologist** considers whether there are other acute stroke treatment options and if there is need for transfer and triages as appropriate

Yes

The **NI** accepts patient for endovascular therapy (EVT) evaluation

If basilar artery thrombosis and LKW > 6hrs, see *D2MR pathway*

REMIS "Endo Stroke Alert, [name of OSH]" with Patient information & ETA

ED-to-ED transfer to MMC STAT via EMS

An ED Acute Stroke Alert is **NOT** activated for OSH Endo Stroke Alerts

Use the **ED Acute or Subacute Stroke** Order Set

Patient arrives at MMC ED via inter-facility transfer

T = 0

See *D2CT Pathway*

CT/CTA/CTP performed as directed by the NI

DTCT ≤ 15 min

EVT candidate?

No → Patient admitted to the appropriate level of care

Use the **Ischemic Stroke ICU** Order Sets for ICU admissions
Use the **Gen Med Ischemic Stroke Admission** Order Set for floor admissions

See *Appendix A: Stroke Pager Matrix*

See *Appendix B: Code Stroke Roles and Responsibilities*

Yes → Patient is taken to NIR Suite STAT

DTP ≤ 60 min

NCC to use the appropriate **Ischemic Stroke ICU** Order Sets
NI to use the **Cerebral Thrombectomy Post-Procedure** Order Set

DTR ≤ 90 min

References:
Time to Treatment With Endovascular Thrombectomy and Outcomes From Ischemic Stroke. *JAMA*.2016;316:1279-88.
Thrombectomy within 8 Hours after Symptom Onset in Ischemic Stroke. *NEJM*.2015;372:2296-2306.
Thrombectomy 6 to 24 hours after Stroke with a Mismatch between Deficit and Infarct. *NEJM*.2017;378:11-21.

MMC INPATIENT CODE STROKE PATHWAY

For patients **admitted to MMC** who develop symptoms concerning for acute stroke

LKW/Onset of symptoms

Clinical staff calls **662-2345** and states **"Possible Inpatient Stroke"**
AND **notifies the pt's primary team** of possible stroke

Neurology & **Code White** team evaluate the patient;
NIHSS performed

Acute stroke suspected?

- No → An Inpatient Stroke Alert is **NOT** activated. Case discussed with an appropriate attending and the encounter is documented in Epic by the Neuro responder.
- Yes

Note: For admitted pts boarding in the ED: The **ED Code Stroke** process should be followed, with the addition that the ED RN will page the **primary team** who must come to the ED to assist with care

NIHSS is ≥ 6 in a pattern c/w an LVO?

- No → **ACTIVATE "Inpatient Code Stroke"**
- Yes → **ACTIVATE "Inpatient Endo Code Stroke"**

Use the **Inpatient Stroke Alert** Order Set

Call REMIS 662-2950

If labs will be necessary for the decision for thrombolysis, they should be drawn **PRIOR** to the patient being taken to CT
A **phlebotomist** is dispatched to the pt's location to do this.

Alert
T = 0

CT/CTA +/- CTP performed STAT

ATCT
≤ 15 min

Acute stroke intervention Indicated?

- No → Patient is either transported back to their original room or change in bed placement is made as clinically indicated with ongoing management by the Primary Team.
- Yes

ED Nurse Coordinator will direct patient location in CC

See *TNK Eligibility Criteria*

Use **STROKE – Acute Treatment with Thrombolytic** Order Sets

See *Pre- and Post TNK and EVT BP Management Guidance*

See *Management of Post-TNK Complications* if needed

Use the **Ischemic Stroke ICU Order Sets** for ICU admissions

Use the **Cerebral Thrombectomy Post-Procedure** Order Set

<u>TNK CANDIDATE</u>:
TNK ordered STAT and initiated in the CT or ED CC area;
Patient is managed and monitored in the ED by an **ED RN** until an ICU bed is available or is taken to NIR Suite

ATN
≤ 30 min

<u>EVT CANDIDATE</u>:
Patient is taken to IR Suite directly from CT following initiation of TNK if indicated

ATP
≤ 60 min

ATR
≤ 90 min

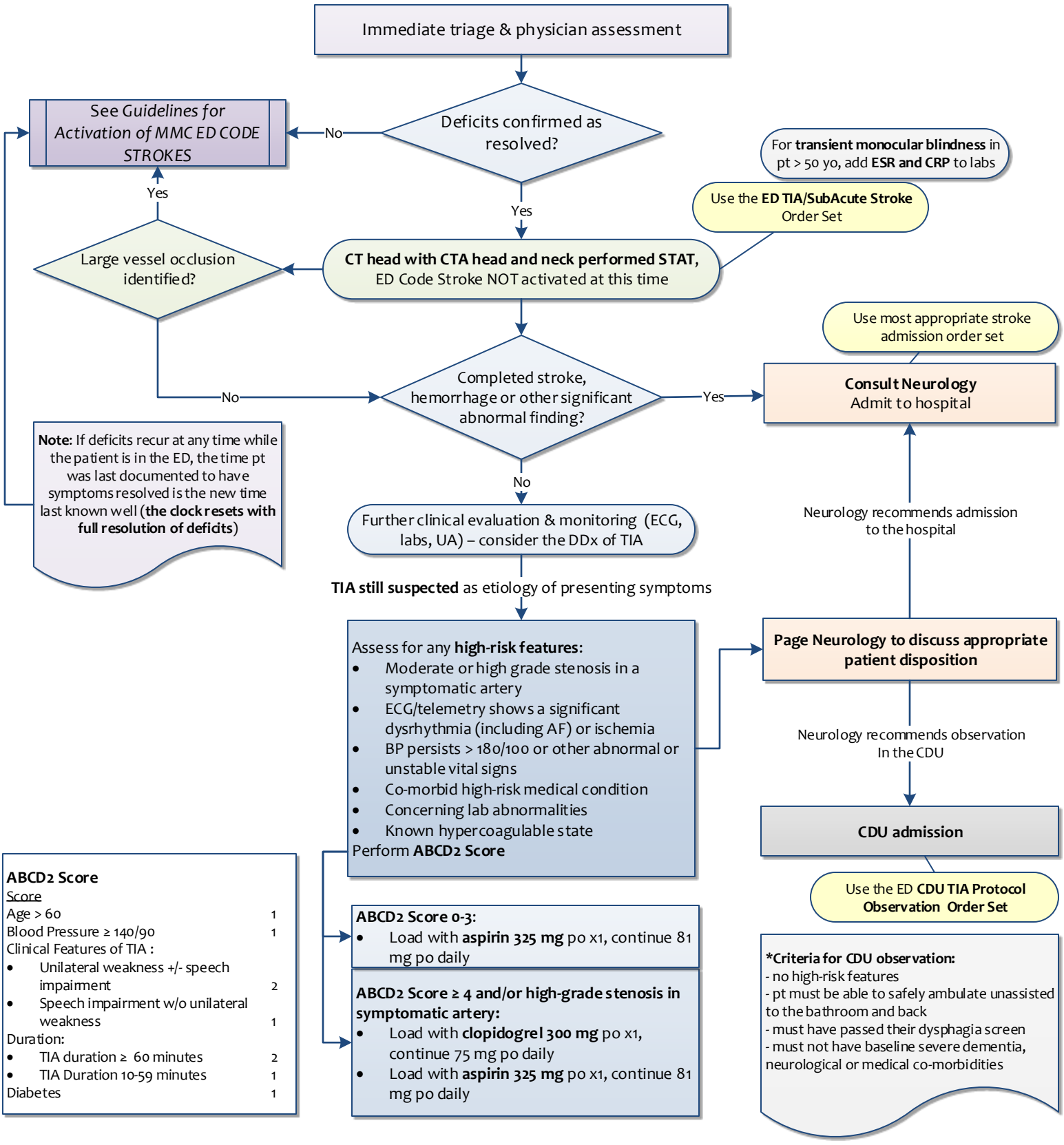
Post-lytic or EVT the patient will need to be bedded in an ICU
If the patient is not already on a service that manages patient in an ICU, transfer of care to an ICU service requires an **attending-to-attending** phone call and the **Primary Team** will maintain management of the patient until the ICU team is able to assume care.

See *Appendix A: Code Stroke Pager Matrix*

See *Appendix B: Code Stroke Roles and Responsibilities*

MMC ED TIA PATHWAY

For patient who presents to the ED with **transient** focal neurological or retinal symptoms that have resolved at the time of initial Emergency Medicine provider assessment



References: Clopidogrel with Aspirin in Acute Minor Stroke or TIA (**CHANCE**). *NEJM*.2013;369:11-19.
Clopidogrel and Aspirin in Acute Ischemic Stroke and High-Risk TIA (**POINT**). *NEJM*.2018;379:215-225.
Ticagrelor and Aspirin or Aspirin Alone in Acute Ischemic Stroke or TIA (**THALES**).*NEJM*.2020;383:207-17.

TNK Eligibility Criteria

For patients with **potentially disabling** symptoms thought *most likely* to be secondary to ischemic stroke

Higher risk

Risk of bleeding

Lower risk

	3 Lytic Questions					
	Clinical presentation/ medical history	**Have you had any recent trauma, surgeries or procedures?**	**Have you had any bleeding problems?**	**Are you taking any blood thinners?**	**Imaging**	**Labs***
TNK is contraindicated	• LKW > 4.5h • Sx of SAH	• Severe head trauma w/in 3 mo			• Acute intracranial hemorrhage • Completed infarct	
Lytic is not recommended/ potentially harmful	• BP cannot be lowered < 185/110 • Sx concerning for endocarditis • Known or suspected aortic dissection	• Intracranial or intra-spinal surgery w/in 3 mo • Major non-cranial surgery† or trauma w/in 14 days with uncontrollable bleeding site (e.g. internal organs)	• H/o intracranial hemorrhage§ (consider the etiology and timing of hemorrhage) • Structural GI malignancy or GIB w/in 21 days	• Warfarin w/ INR > 1.7 • UFH w/ ↑ aPPT • Therapeutic dose LMWH w/in 24 hrs • DOAC w/in 48 hrs	• Intra-axial intracranial neoplasm (not extra-axial, i.e. not meningioma)	• INR > 1.7 • PT > 15 sec • aPTT > 40 sec • Plt < 100K
Safety and efficacy of lytic is not well established	• Age < 18yo • Ischemic stroke w/ in 3 mo • NIHSS > 25 in the 3-4.5 hr window • Cerebral aneurysm > 1 cm in size	• Arterial puncture at a non-compressible site w/in 7 days • Parturition w/in 14 days*	• Known bleeding diathesis	DOACs: Dabigatran (Pradaxa) Rivaroxaban (Xarelto) Apixaban (Eliquis) Edoxaban (Savaysa)	• Intra-cranial arterial dissection • Unruptured or untreated intracranial vascular malformation	*Do not delay lytic administration waiting for lab results **if the pt has no history or reason to suspect anticoagulant use, and has no h/o abnormal bleeding**
Lytic may be considered/may be reasonable, especially if moderate to severe stroke	• Pregnancy‡ • Myocardial infarction w/in 3 mo • Acute pericarditis or LV/LA thrombus	• Lumbar puncture w/ in 7 days • Major non-cranial surgery† or trauma • within 14days with controllable bleeding site (e.g. limb)	• GI or GU bleeding > 21 days ago • Hemorrhagic ophthalmologic condition • Menorrhagia‡	‡ Recent surgeries and procedures: Consider the risk of **bleeding at the site** of the surgery/procedure AND Consider the risk of the surgery/procedure of having caused a **silent stroke (ex: TAVR, CEA, CABG)** that could serve as a potential nidus for thrombolysis-associated hemorrhage		BG < 50 or > 400

‡ Pregnancy and vaginal bleeding:
If patient is pregnant, peripartum or has a history of recent or active vaginal bleeding causing clinically significant anemia, then emergency consultation with a Ob-gyn is recommended before a decision about lytic is made

§ Patients w/ h/o **cerebral microbleeds**:
- 1-10 CMB: administration of lytic is reasonable
- > 10 CMB: administration of lytic may be associated with an increased risk of sICH. Tx may be considered in the setting of moderate to severe stroke

Factors which are not contraindications to lytic, but are known to be associated with an increased risk of post-lytic hemorrhage:
- Older age (> 80 yo)
- Later in the time window (> 3 hr from time LKW)
- Severe stroke (NIHSS > 25)
- Hyperglycemia (BG > 140)
- Hypertension (BP > 180/100)
- Severe white matter disease on head CT (Fazekas grade 3)

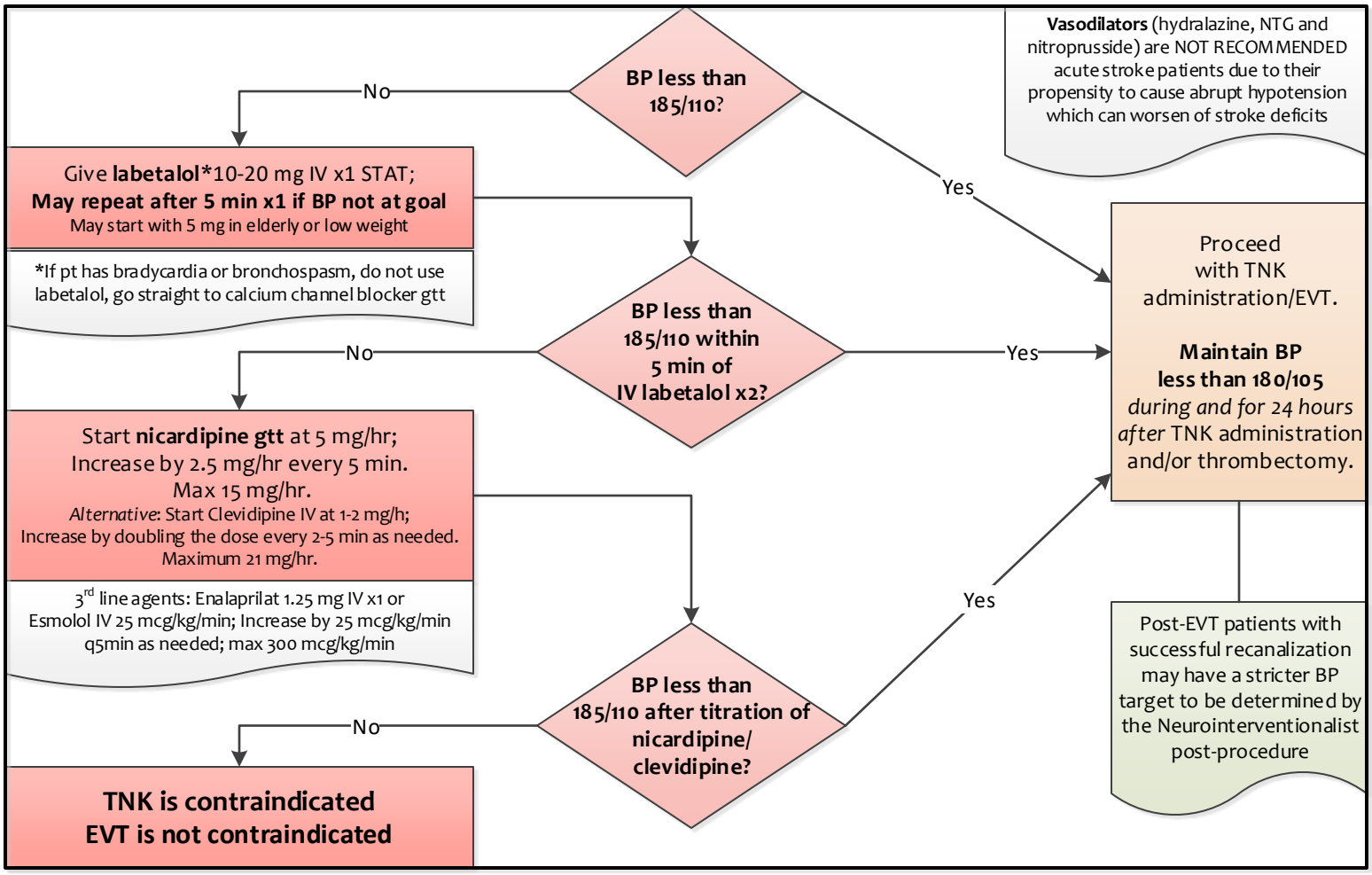
An accumulation of these risk factors should be taken into consideration when making decisions regarding lytic use, especially in patients with less severe stroke symptoms.

In every case, the **risk of bleeding** complications from lytic should be weighed against the **potential benefit** from lytic given the severity of deficits

Reference: Scientific Rationale for the Inclusion and Exclusion Criteria for Intravenous Alteplase in Acute Ischemic Stroke. American Heart Association/American Stroke Association Scientific Statement. *Stroke.*2016;47:581-641.

Pre- and Post-TNK and EVT Blood Pressure Management Guidance

For patient identified as an appropriate TNK candidate
or an EVT candidate with or without TNK



Post-TNK/EVT management:

Use the **Ischemic Stroke POST-thrombolysis ICU** Order Set

- Admit to an ICU for close neurological and blood pressure monitoring for a minimum of 24 hours
- Continue BP and neuro checks every 15 minutes for 2 hours after TNK is administered, then every 30 minutes x 6 hours, then every 1 hour x 16 hours. The frequency of BP checks thereafter should be individualized to meet the patient's needs
- Avoid the following for 24 hours post-TNK: Arterial or central venous punctures/lines, IM injections, nasogastric tubes
- Foley catheter placement should be avoided in stroke patients unless there is a compelling medical reason to do so
- Avoid antiplatelet or anticoagulant medications x24 hours after TNK unless there is another compelling reason to do so (such as intravascular stenting required for mechanical thrombectomy)

If TNK-associated hemorrhage suspected, use **Post-thrombolytic Hemorrhage** Order Set
If patient developed perioral or lingual edema use, **Post-thrombolytic Orolingual Edema** Order Set

See *Management of post-TNK Complications*

Note: Ischemic stroke patients who are **NOT lytic candidates should NOT have BP lowered unless it is greater than 220/120** unless there is another compelling medical reason to do so such as acute coronary event, acute heart failure, aortic dissection, or preeclampsia/eclampsia or if they are more than 48-72 hours post onset of stroke. If BP lowering is required, lowering by 15% is probably safe.

Note: HYPOtension is rare in acute stroke and should prompt rapid assessment for possible etiologies, such as hypovolemia, internal bleeding, myocardial ischemia, aortic dissection, cardiac arrhythmias or sepsis (potentially complicated by infective endocarditis causing stroke). **Hypotension should be treated immediately** with non-dextrose containing crystalloid fluid repletion, correction of any arrhythmias and consideration of pressors in select patents (discuss with Neurology). Consideration for additional acute work up should include cardiac markers, blood cultures, CTA chest prior to lytic administration if aortic dissection is clinically suspected. **Maintain euvolemia** in all stroke patients and ensure patients who are NPO are placed on maintenance rate normal saline unless there is a clear contraindication to doing so until they are able to take adequate hydration PO.

Reference: Guidelines for the Early Management of Patients with Acute Ischemic Stroke: 2019 Update American Heart Association/American Stroke Association. *Stroke*.2019 (12);50:e344-e418.

Management of Post-TNK Complications

All patients given TNK must be monitored closely for **clinical worsening** and **orolingual swelling** for 24 hours after TNK administration

Patient develops severe headache, acute hypertension, nausea, vomiting or worsening neurological status

Use **Post-thrombolytic Hemorrhage** Order Set

- **STAT head CT**
- **Type & Cross** (if not already done)

CT confirms hemorrhage & lytic given within the last 24 hours

CT excludes hemorrhage → Continue post-TNK care

- **Administer 10 units cryoprecipitate IV** over 10-30 min
- **PLUS Tranexamic acid (TXA)** 1000 mg IV over 10 min
- **Maintain BP less than 160/100**
- Consider Neurosurgical consult

- **STAT CBC** and **Coag panel, Bleeding patient**
- Draw *after* administration of cryoprecipitate

Fibrinogen less than 150

→ Administer another **10 units cryoprecipitate** *(ordered from the Post-thrombolysis Hemorrhage Order Set)*

Platelets less than 100,000

→ Administer **1 unit pheresis platelets**

INR greater than or equal to 1.5 in a pt **on warfarin**

→ Use **Warfarin-Associated CNS Hemorrhage** Order Set

Patient develops edema of the tongue, lips, mouth or oropharynx

Use **Post-thrombolytic Orolingual Edema** Order Set

Hold
- ACE inhibitors

Administer:
- Diphenhydramine 50 mg IV x1
- Famotidine 20 mg IV x1
- Methylprednisolone 125 mg IV x1

Provide
- Close monitoring of respiratory status

If there is further increase in angioedema after these measures, or if stridor or imminent respiratory compromise develops, administer
- **0.3 mL (0.3 mg) of 1 mg/mL epinephrine IM** or 0.5 mL of 2.25% racepinephrine nebulized

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
- Manage as Difficult Airway

Risks of Reversal Agents

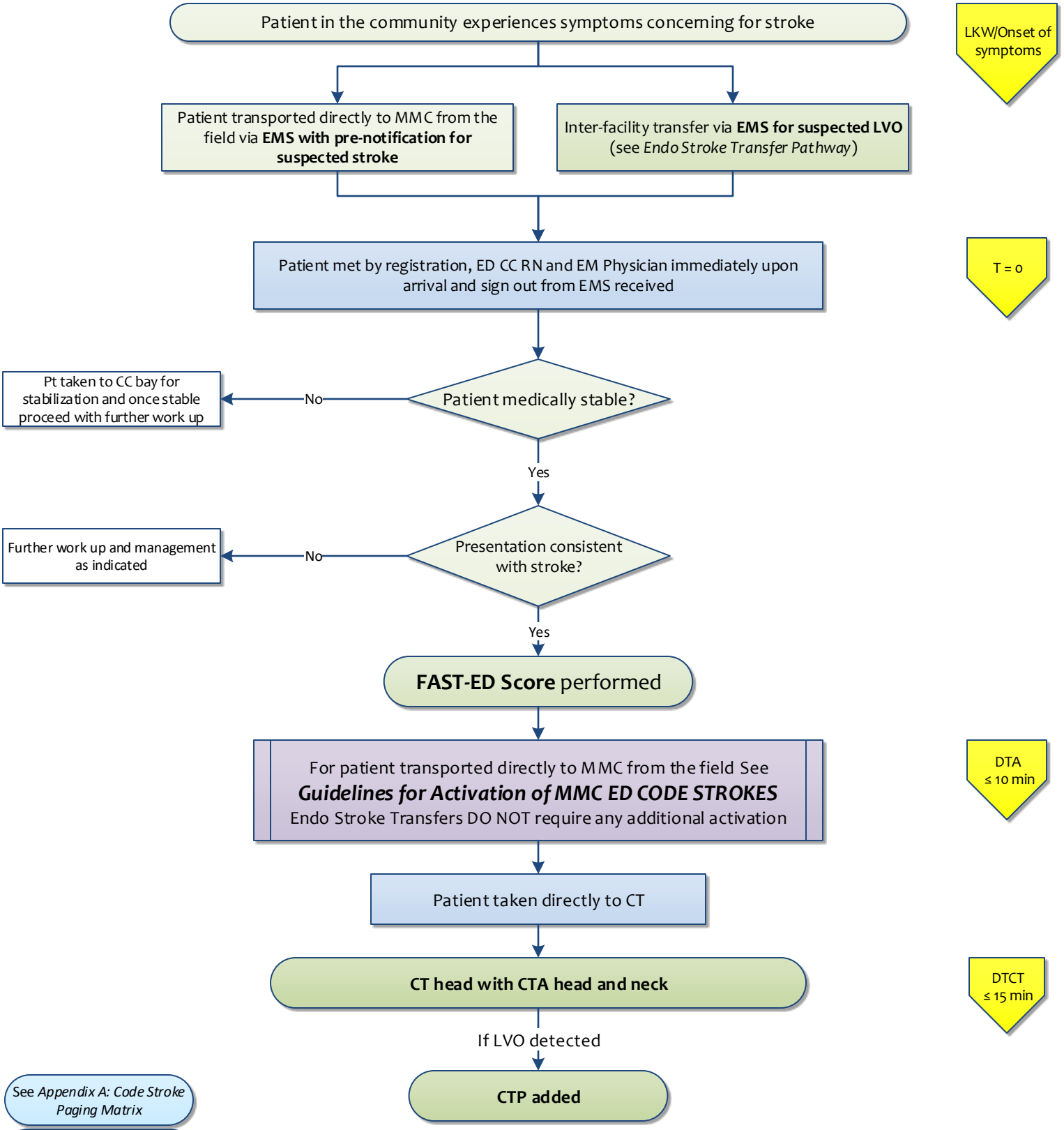
Cryoprecipitate	Transfusion reaction, TRALI
Platelets	Transfusion reaction, TRALI, volume overload
FFP	Transfusion reaction, TRALI, volume overload
PCC	Thrombosis
TXA	Thrombosis
Aminocaproic acid	Thrombosis
Vitamin K	Anaphylaxis

TRALI = transfusion-related lung injury

References:
Guidelines for the Early Management of Patients with Acute Ischemic Stroke: 2019 Update American Heart Association/American Stroke Association. *Stroke*.2019 (12);50:e344-e418.
AHA/ASA Scientific Statement. Treatment and Outcome of Hemorrhagic Transformation after Intravenous Alteplase in Acute Ischemic Stroke.*Stroke*.2017;48e.

D2CT Pathway

For patients with suspected stroke who arrive at the MMC ED **with pre-notification**



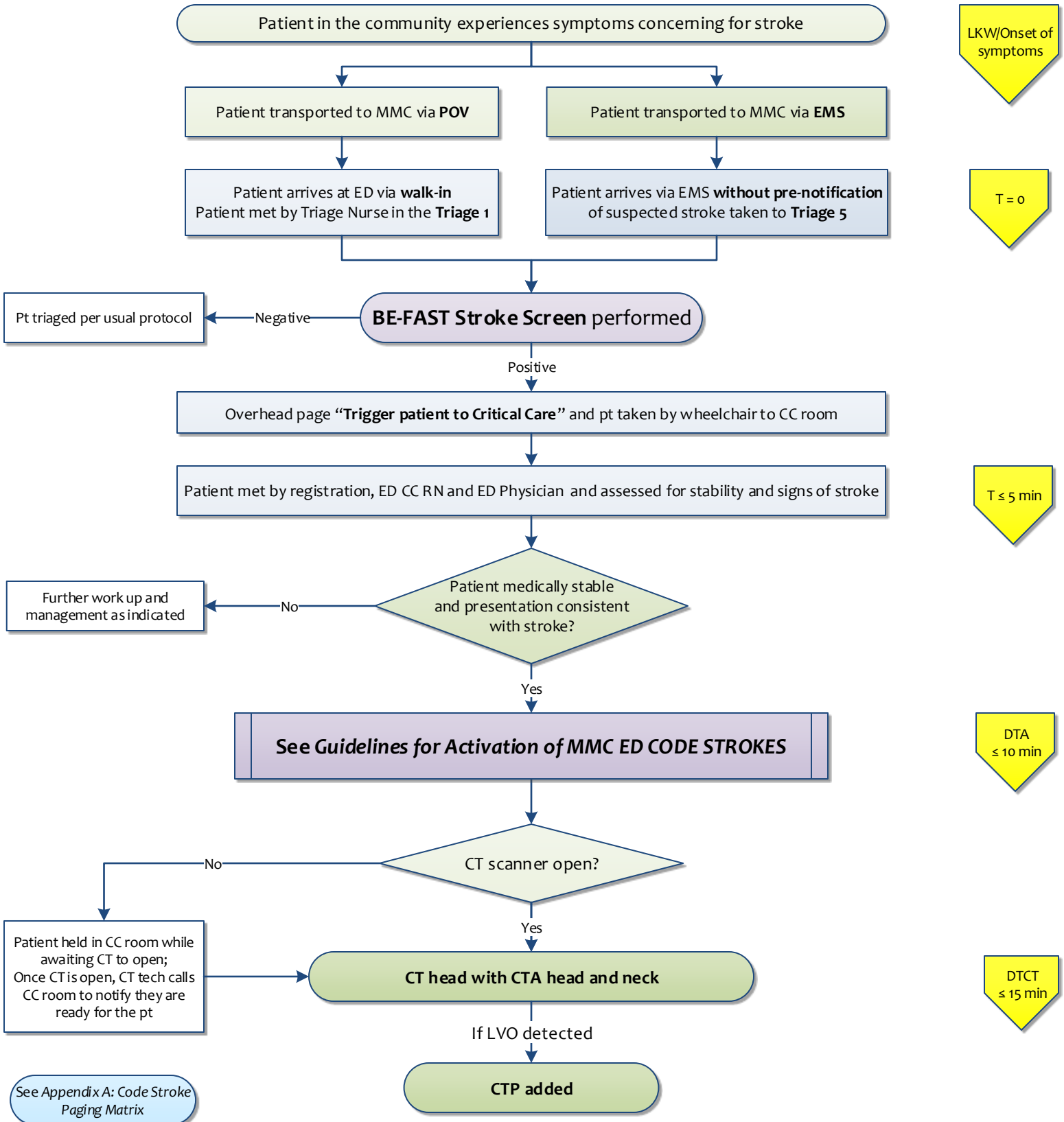
See *Appendix A: Code Stroke Paging Matrix*

See *Appendix B: Code Stroke Roles and Responsibilites*

References:
FAST-ED Field Assessment Stroke Triage for Emergency Destination; A Simple and Accurate Prehospital Scale to Detect Large Vessel Occlusion Strokes. *Stroke.* 2016;47:1997-2002.
Comparing Vessel Imaging: Noncontrast Computed Tomography/Computed Tomographic Angiography Should Be the New Minimum Standard in Acute Disabling Stroke. *Stroke.*2016;47:273-281.

Non-D2CT Pathway

For patients with suspected stroke who arrive at the MMC ED **without pre-notification**



See *Appendix A: Code Stroke Paging Matrix*

See *Appendix B: Code Stroke Roles and Responsibilites*

Reference:
BE-FAST (Balance, Eyes, Face, Arm, Speech, Time) Reducing the Proportion of Strokes Missed Using the FAST Mnemonic. *Stroke*.2017;48:479-81.

Direct-to-MRI (D2MR) Pathway

For patients being transferred from an outside hospital (**OSH**) with **KNOWN** BASILAR ARTERY THROMBOSIS (BAT) AND TIME LKW > 6 hours¥

Patient is accepted by the Neurointerventionalist (NI) for STAT ED-to-ED transfer to MMC

REMIS to send a **"Endo Stroke Alert, [OSH] Direct-to-MR Protocol" page**
And enters **Next-of-Kin** in the ED-to-ED accept note in Epic

If a delay in transfer is anticipated, NI requests the OSH obtain a **CXR** and **KUB** for metal screening and push to Impax

Patient transported via EMS to MMC

MRI technologist prepares for patient arrival during Inter-facility transfer, including calling **Next-of-Kin** for metal screening and **notifies the ED Attending if patient is NOT cleared for MRI**

Patient met by registration, RT, ED CC RN and ED Physician immediately upon arrival
Patient assessed for stability and **NIHSS** performed & documented in Epic

T = 0

Patient medically stable?

No → Patient taken to CC bay for stabilization **& MR technician notified of delay 662-4028**

Once patient is stabilized

Yes

Patient cleared for MR?

No → Go **D2CT** for a **head CT and CT scanogram** (AP & lat scout of neck through pelvis) to screen for metal **under separate orders**

If there is a delay in getting the MRI or pt is unable to get MRI, ED discusses possible alternative imaging (**CTA/CTP**) with the on-call NI

No metal identified

Yes

Vent management: Respiratory therapist

Patient transported to the MR scanner

MRI brain performed
+/- MRA at the discretion of the NI

DTMR
≤ 30 min

EVT candidate?

No → Vent management: Respiratory therapist → Patient taken back to CC bay for further management & to determine disposition

Yes → Vent management: Anesthesia

DTP
≤ 60 min

Patient transported directly from MR scanner to IR Suite
Time to puncture and time to reperfusion is minimized

DTR
≤ 90 min

¥Patients arriving with **BAT < 6h from time LKW** should go directly to the IR suite **without MRI or CTP**

See *Appendix A. Code Stroke Paging Matrix*

See *Appendix B. Code Stroke Roles and Responsibilities*

Reviewed & agreed upon with Drs. Ecker, Sanborn and Williams
Jan 2023

MMC INTRACEREBRAL HEMORRHAGE (ICH) PATHWAY

For patients who **present to the MMC ED** with suspected stroke found to have ICH on initial imaging

LKW/Onset of symptoms

Obtain clinical information:
- Time LKW
- Anticoagulation use and time last taken

Send STAT Labs:
- Stroke Coag Panel
- CBC
- CMP
- Troponin
- Urine pregnancy test for women of childbearing age

Additional information necessary for ICH assessment & management:
- History of HTN
- Other pertinent medications: antihypertensive agents, vasoconstrictors (risk for RCVS), exogenous estrogen (risk for CVT)
- Alcohol, marijuana and illicit drug use
- ICH Score
- Ascertain Code Status and Goals of Care

Additional labs to consider:
- Urine toxicology screen

If clinical concern for infective endocarditis:
- ESR/CPR
- Blood cultures

Use **Intracerebral hemorrhage (ICH) Admission** Order Set

Pre-imaging process is the *MMC ED CODE STROKE PATHWAY*

DTA ≤ 10 min

Non-contrast Head CT

DTCT ≤ 15 min

ICH identified

Review *ICH Imaging Guidance* **PRIOR** to obtaining CTA/CTV & perform further imaging if indicated

Based on time LKW, size of hematoma and current SBP, initiate BP management as per the *ICH BP Management Protocol*

BP at Target ≤ 60 min

Initiate reversal of anticoagulation as indicated
See *Intracranial Hemorrhage Reversal of Antithrombotics Protocol*

Monitor patient for signs of increased ICP, seizures and indications for acute neurosurgical intervention as per the *Additional Acute Management Measures in ICH*

After imaging and stabilization:
- Ensure ICH Score is documented
- 12-lead ECG
- CXR if indicated
- Dysphagia scrreen and aspiration precautions if not intubated
- Frequent BP monitroing and neuro assessments
- Repeat head CT STAT for any clinical deterioration
- Admit to Neurocritical Care Unit

Reference: 2022 American Heart Association/American Stroke Association Guidelines for the Management of Spontaneous Intracerebral Hemorrhage Stroke. *Stroke*.2022;53.

Intracranial Hemorrhage Imaging Guidance

For patients who undergo STAT head CT for symptoms of stroke and are found to have an intracranial hemorrhage

Review patient characteristics and imaging findings

INITIAL IMAGING (FIRST 24 HRS)

CTA recommended for the following
- Age < 70 years with lobar hemorrhage
- Age < 45 years with deep/posterior fossa ICH
- Age 45-70 years with deep/posterior fossa ICH **without** a history of hypertension‡

‡ Hypertension is defined as:
- PMH of HTN
- pt on anti-HTN medications
- evidence of LVH on admission ECG

CTV recommended for the following
- Hyperattenuation within dural venous sinus or cortical vein along the path of drainage of ICH
- Patient with exogenous estrogen use or other risk factors for dural venous thrombosis

Repeat Head CT recommended in all patients: unless not in line with goals of care
- Follow up head CT at approximately 6 and 24 hours to assess for hematoma expansion and document final ICH volume

ADDITIONAL IMAGING

MRI/MRA is reasonable in the following:
- Patients with a negative initial work up to establish a non-macrovascular cause of ICH (such as cerebral amyloid angiopathy, hypertensive arteriopathy, cavernous malformation or malignancy)

Cerebral angiography is recommended for:
- Primary intraventricular hemorrhage (no detectable parenchymal component)
- Abnormal CTA or MRA suggestive of a macrovascular cause

Cerebral angiography is reasonable for:
- Etiology unclear following appropriate work up and non-invasive imaging (CTA/CTV and MRI/MRV)

Repeat cerebral angiography in 3-6 months may be reasonable for:
- Patients with negative initial DSA in whom no clear microvascular diagnosis or other defined structural lesion was identified

Secondary ICH (sICH) Score

sICH Score

Age
- 18-45 +2
- 46-70 +1
- ≥ 70 +0

Sex
- F +1
- M +0

Probability of vascular cause on NCCT¥
- High +2
- Indeterminate +1
- Low +0

Absence of BOTH hypertension‡ AND impaired coagulation§
- Yes +1
- No +0

¥ Probability of vascular cause defined as:

High
- Enlarged vessels or calcifications along the margins of the ICH **OR**
- Hyperattenuation within a dural venous sinus or
- cortical vein along the presumed venous drainage path of the ICH

Low
- No high-probability findings AND
- ICH located within the basal ganglia, thalamus, or brain stem

Indeterminate
- Does not meet criteria for a high- or low-probability NCCT (most commonly, lobar or cerebellar ICH)

§ Impaired coagulation defined as:
- INR > 3 or direct oral anticoagulant use
- aPTT > 80 seconds
- Platelets < 50,000 or daily antiplatelet use

Probability of vascular cause of ICH:

Points	~ % Positive CTA
0	0
1	2
2	4
3	20
4	40
5	80
6	100

References: 2022 American Heart Association/American Stroke Association Guidelines for the Management of Spontaneous Intracerebral Hemorrhage Stroke. *Stroke*.2022;53. Secondary ICH Score. *Am J Neuroradiol*. 2010 Oct; 31(9): 1653–1660.

ICH Blood Pressure Management Guidance

For patients with spontaneous (non-traumatic) Intracerebral Hemorrhage

Several clinical factors must be considered prior to selecting a BP target!

1. Time LKW

Time from **LKW < 6 hours**

Time from LKW > 6 hours¥
BP target of 140-160 is reasonable

2. Size of the hematoma

Mild to moderate hematoma size (**< 30 mL**)

Large hematoma size (>30 mL) or those requiring surgical decompression¥
BP target of 140-160 is reasonable

3. Current Systolic BP

SBP < 130

- **Bolus with crystaloid fluid**
- Continue IVF at maintenance rate once euvolemic
- Work up for potential causes of hypotension as clinically indicated

SPB 130-150

- **Do not initiate BP lowering**
- Initiate maintenance rate IVF while NPO to maintain euvolemia
- Continue to closely monitor BP and treat as needed

SBP 150-220 mm Hg

Start **nicardipine gtt** at 5 mg/hr; Increase by 2.5 mg/hr every 5 min; Max 15 mg/hr

Alternative: Start Clevidipine IV at 1-2 mg/h; Increase by doubling the dose every 2-5 min as needed. Max 21 mg/hr

SBP > 220¥

- Aggressive BP lowering may be associated with **worse outcomes**
- BP target of 140-160 is reasonable; avoid acute drops of > 60 mm Hg

Use the **ICH Admission Order Set**

Initiation of BP lowering upon presentation with **goal of reaching target within 1 hour**

NOTE: High BP variability in the acute phase of ICH is associate with poor outcomes!

NOTE: Acute lowering of BP to < 130 mm Hg is potentially harmful!

Target SBP 130-150 mm Hg

¥ The benefit of aggressive BP lowering is **uncertain in these populations.** In the absence of clinical data providing guidance in these subsets of patients, a more cautious BP lowering recommended.

Continue close monitoring and careful titration to ensure continuous, smooth and sustained control of BP, **avoiding peaks and large BP swings**

After 24-48 hours, BP should be further reduced by the gradual introduction of oral medications to **target BP <130/<80** to prevent recurrent ICH

Reference: 2022 American Heart Association/American Stroke Association Guidelines for the Management of Spontaneous Intracerebral Hemorrhage Stroke. *Stroke*.2022;53.

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Reference: 2022 American Heart Association/American Stroke Association Guidelines for the Management of Spontaneous Intracerebral Hemorrhage Stroke. *Stroke*.2022;53.

ICH Reversal of Antithrombotics Guidance

For patient with spontaneous intracerebral hemorrhage (ICH) on antithrombotics

All Patients:
- Review history of **anti-coagulation** and/or **antiplatelet use** AND **time dose last taken**
- Review results of **STAT coagulation profile, platelets** and **renal function**
- Hold any blood thinning agents and initiate appropriate reversal protocol if indicated based on agent below

Vitamin K antagonist
- Warfarin (Coumadin, Jantoven)

→ Use **Neuro Crit Care – Warfarin Associated CNS Hemorrhage Order Set**

1. **Vitamin K 5 mg** IV x1
2. **4-Factor PCC** (**Kcentra**) IV x1
   - If INR 1.6-1.9, give 15 units/kg
   - If INR greater than or equal to 2.0, give 25 units/kg
3. **Repeat INR** 30 min post-PCC dose. If INR more than 1.5, give additional 10 units/kg

Direct thrombin inhibitor within **24 hrs** (w/ normal renal function)
- Dabigatran (Pradaxa)

→ Use **Pulm/Crit Care – Management of Bleeding on Dabigatran Order Set**

- **Idarucizumab** 2.5 gm IV x2, given 15 min apart (*Consult ED/anticoagulation pharmacist)*
- Activated **charcoal** at standard doses if last dose was within 2 hours
- Maintain adequate **diuresis** with fluid replacement and hemodynamic support
- PCC, FFP and FVIIa do not appear to be effective & should **not** be administered
- **Hemodialysis** can be considered after transfer

Direct FXa inhibitor within **18 hrs**
- Rivaroxaban (Xarelto)
- Apixaban (Eliquis)
- Edoxaban (Savaysa)

→ Use **Pulm/Crit Care – Management of Bleeding on Rivaroxaban or Apixaban Order Set**

- *Andexanet alfa is not available for use at MaineHealth hospitals due to insufficient efficacy and safety data*
- **Kcentra** 25 units/kg to help with clot formation at the site of bleeding
- Activated **charcoal** at standard doses if last dose was within 1-2 hours
- Maintain adequate **diuresis** with fluid replacement and hemodynamic support
- Hemodialysis is **not** indicated

IV Unfractionated Heparin →

1 mg IV **protamine** per 100 units of heparin given over last 2 hours (ex. 1000 units/hr infusion x 2 hours = 2,000 units UFH = 20 mg protamine); Max 50 mg protamine

Low Molecular Weight Heparin →

If last administration less than 8 hours ago: 1 mg IV **protamine** per 1 mg LMWH; Max 50 mg
If last administration greater than 8 hours ago: 0.5 mg IV protamine per 1 mg LMWH; Max 50 mg

Antiplatelets
- Aspirin & aspirin containing products
- Clopidogrel (Plavix)
- Ticagrelor (Brilinta)
- Presurgrel (Effient)

→
- Platelet transfusion is **potentially harmful** and **should not be administered** in the absence of plan for emergent neurosurgical intervention or severe thrombocytopenia (<10,000) in which case it *may be considered* (1 unit of apheresis platelets *prior to surgery*)
- The effectiveness of desmopressin to reduce hematoma expansion is uncertain

Reference: 2022 American Heart Association/American Stroke Association Guidelines for the Management of Spontaneous Intracerebral Hemorrhage. *Stroke*. 2022;53:e282–e361.https://doi.org/10.1161/STR.0000000000000407
Key Points to Consider When Evaluating Andexxa for Formulary Addition. Peled, H., Dau, N.Q. & Lau, H. *Neurocrit Care* (2019). https://doi.org/10.1007/s12028-019-00866-6

Additional Acute Management Measures in ICH

For patient diagnosed with acute non-traumatic intracranial hemorrhage (ICH) or Intraventricular Hemorrhage (IVH)

All patients:
- STAT consult to Neurocritical Care and Neurosurgery
- **Stroke severity score (ICH Score) must be documented in Epic within 6 hours of presentation** (Joint Commission CSC Metric)
- Ascertain Code Status and Goals of Care (GOC)

Monitor for signs/symptoms of increased intracranial pressure (ICP)

Signs/symptoms of increased ICP:
- Headache, nausea, vomiting, diplopia, anisocoria, increased blood pressure, slow heart rate, altered respiratory pattern, seizures, confusion, depressed level of consciousness, coma
- If any develop, order **STAT head CT** and **notify Neurosurgery and Neurocritical Care**

Elevated ICP Management

- Keep head of bed greater than 30 degrees
- Appropriate use of ventilator support and use end-tidal CO_2 monitoring
- Prophylactic continuous hyperosmolar therapy has **no benefit**
- Mannitol 1 gm/kg IV x1 or bolus hypertonic saline can be administered to transiently reduce ICP prior to neurosurgical intervention
- STAT EVD placement per neurosurgery
- Maintain Cerebral Perfusion Pressure > 60
- Corticosteroids are **not** indicated in intracranial hemorrhage

Use **Brain Herniation and ICP Crisis** Order Set

Seizure management

Prophylactic anti-seizure medication NOT indicated for primary ICH – initiate anti-seizure medication ONLY if clinical or electrographic seizure occurs
- Levetiracetam 2000 mg IV x1 followed by 1000-1500 mg q12 hours OR
- Fosphenytoin 15-20 mg PE/kg IV over 100-150 mg PE/min x1 followed by 100 mg q8 hours
  (PE - Phenytoin Equivalent: fosphenytoin 1.5 mg = phenytoin 1 mg)
- Consider EEG/cEEG for unexplained abnormal or fluctuating mental status or suspicion of seizures

Neurosurgical intervention if in line with GOC

Indications for EVD placement:
- Acute hydrocephalus
- Depressed level of consciousness

Intraventricular thrombolysis
- May be considered in patients with primary IVH or ICH < 30 mL with interventricular extension and GCS > 3; Can reduce mortality, but the efficacy to improve functional outcomes is uncertain

Minimally invasive hematoma evacuation
- May be considered in patient with supratentorial ICH > 20-30 mL and GCS 5-12 to reduce mortality, but the effectiveness to improve functional outcomes is uncertain

Craniotomy with hematoma evacuation
- May be considered in patients with supratentorial ICH of moderate or greater severity as a lifesaving measure, but has not been proven to improve functional outcome

Cerebellar hemorrhage: Indications for immediate surgical evacuation with or without an EVD include:
- Volume > 15 mL, Neurological deterioration, Brainstem compression, Hydrocephalus

Initiation of **thromboprophylaxsis**

- In nonambulatory ICH patients, intermittent pneumatic compression devices should be started the **day of admission**
- Low dose UFH or LMWH can be started at **24-48 hours** from ICH onset as long as the hematoma is stable

General Care

Use **Intracerebral hemorrhage (ICH) Admission** Order Set

- All patients should undergo 24-72 of cardiac monitoring
- Monitor blood glucose with a goal of maintaining BG 140-180
- All patients require dysphagia screening prior to giving anything by mouth
- Pharmacologically treating elevated temperatures is reasonable, but the benefits of hypothermia is unclear
- High vigilance and testing for infection on admission and throughout hospitalization is reasonable given the high rate of infectious complications in this patient population
- Early intensive rehab (within the first 24 hours) is associate with a **worse outcome**, though ADL training, stretching and functional task training may be considered in the first 24-48 hours

Reference: 2022 American Heart Association/American Stroke Association Guidelines for the Management of Spontaneous Intracerebral Hemorrhage Stroke. *Stroke.*2022;53.

Patient Selection for CHARM

Blue	Flow
Orange	Inclusion
Green	Basic Exclusion
Purple	Extensive Exclusion

18-70yo patient with clinical diagnosis of acute ischemic stroke in the **MCA** territory (+/- ACA or PCA involvement) with an **NIHSS ≥ 10**
Able to receive study drug within **10 hr LKW¥**

Study drug treatment infusion should be initiated **as soon as possible** but no later than 10 hrs

Draw & send STAT Code Stroke labs upon arrival

Check
FSBS, CBC, CMP & G6PD if h/o hemolytic anemia; Pg test if F ≤ 50yo)
Lab exclusions:
- FSBG < 70
- + Pregnancy test
- G6PD deficiency

ECG exclusion:
- QTc > 520 msec

Perform STAT head **CT/CTA/CTP** within 20 minutes of arrival to ED
Perform **ECG** after imaging is obtained

CT Imaging Inclusions
- NCCT: ASPECTS score 1-5
- **CTP:** Core lesion volume between **80 and 300cm³**

CT Imaging Exclusions
- Hemorrhage (other than small petechial hemorrhages)
- Herniation (anteroseptal/pineal shift ≥2 mm due to cerebral edema)

- Order **IV-TNK 0.25** mg/kg STAT for appropriate candidates based on standard tPA eligibility criteria & initiate ASAP (TNK is **NOT** required **NOR** is it a contraindication for enrollment)
- Proceed with **thrombectomy** if clinically indicated*

Review basic inclusion/exclusion criteria

Medical Exclusions:
- Known sulfonylurea allergy
- Known **sulfonylurea** use w/in 7 d
- Severe cardiac, pulmonary, renal or hepatic disease
- H/o clinically significant hypoglycemia, DKA or diabetic coma
- Pregnancy or nursing

Clinical Exclusion Criteria:
- **Age** < 18 or > 70
- **Pre-stroke mRS ≥ 2**
- **Clinical signs of herniation:** 1 or 2 dilated, fixed pupils; unconsciousness related to edema and/or loss of other brain stem reflexes
- **Rapid improvement** to NIHSS < 10 by the time of enrollment

No basic exclusion criteria met

Page **Critical Care Research Coordinator** at **741-3257**

Research Coordinators: Christine Lord, Meghan Searight, Barb McCrum

Research Coordinator ensures all inclusion/exclusion criteria are met

Exclusion criteria:
- Commitment to decompressive craniectomy prior to enrollment
- Evidence (clinical or imaging) of concurrent infarction in the contralateral hemisphere sufficiently serious so as to affect functional outcome
- Life expectancy <3 months not related to current stroke, or those unlikely to be compliant with follow up
- Serious local infection (e.g., cellulitis, abscess) or systemic infection (e.g., septicemia) that required hospitalization or was clinically significant in the opinion of the Investigator within 3 days prior to screening
- DNR
- Unable to place peripheral IV
- Subjects with mental disability or wards of the state

Consenters: Paul Muscat, Diana Goodman, Jane Morris, Dave Seder, Rich Riker, Patti Lerwick, Patrick Mailloux, Teresa May, Angie Leclerc, Pauline Boyce, Meghan Searight, Sarah Bockian

OBTAIN INFORMED CONSENT

BLINDED RANDOMIZATION

Placebo

Study Drug

- **Infusion must begin within 10 hours of time LKW¥**
- **Patient must be admitted to Neurocritical Care**

¥**For WAKE-UP STROKES**:
- The time LKW is calculated using the **midpoint** between sleep onset and time of wakening
- If sleep onset unknown, use LKW and midpoint does not apply
- This only applies to **night sleep**

- ***Patients who are being considered for **IV-TNK** or **thrombectomy** may not be randomized into the study until these procedures have been completed OR the decision not to perform them has been made. These treatments should not be delayed for study screening procedures. When thrombectomy is performed prior to randomization, a post-procedure MRI must be done
- Use of **intra-arterial tPA** alone or in combination with thrombectomy **is a contraindication**

24/7 CHARM Hotline: 833-793-5298

https://clinicaltrials.gov/ct2/show/NCT02864953

Revised Jan 2022

APPENDIX A. CODE STROKE PAGER MATRIX

	D2CT Stroke Alert (from EMS)	**Endo** Stroke Alert, Outside Hospital (**OSH**)	**Endo** Stroke Alert, OSH, **D2MR**	**MMC ED** Code Stroke	**MMC ED Endo** Code Stroke	*Possible* Inpatient Stroke/Code White	**Inpatient** Code Stroke	**Inpatient Endo** Code Stroke
CT technologists	X	X	X	X	X		X	X
EM Attending	X	X	X					
EM Resident	X	X	X					
ED Critical Care RN	X							
ED Nurse Coordinator	X	X	X	X	X		X	X
ED Triage Nurse	X							
ED Pharmacist	X			X	X		X	X
Registration	X	X						
Lab technician				X	X			
Charge RT			X					
Nursing supervisor			X				X	X
MRI technologist			X					
Neurointerventionalist		X	X		X			X
Neurosurgery APP		X	X		X			X
Neurocritical care APP		X	X		X	X (7pm-7am)		X
NIR lab staff		X	X		X			X
Anesthesiologist		X	X		X			X
CICU & SCU coordinators		X	X		X			X
Neurology attending		X	X	X	X		X	X
Neurology resident		X	X	X	X	X	X	X
Neurology APP		X	X	X	X	X (7am-7pm)	X	X
Stroke program manager		X	X	X	X		X	X
Stroke data coordinator		X	X	X	X		X	X
Code White Team						X		
Phlebotomist							X	X
Float Nurse							X	X

APPENDIX B: CODE STROKE ROLES AND RESPONSIBILITIES

EMS PROVIDERS:

FROM THE FIELD:

- Perform a Cincinnati pre-hospital stroke score (**CPSS) and** if positive perform a **FAST-ED Score**
- Minimizes On-Scene time as able
- Documents time last known well (**LKW**) and **witness,** obtain name(s) & phone number(s) for witness(es)/caregiver(s) who could provide further information and consent for treatment prn
- Check **vital signs** and **FSBS** and treats abnormalities as indicated per Maine EMS guidelines
- Asks the patient/caregiver the **3 lytic questions,** document answers and relay responses to ED physician
- Transport patient in accordance with the **Stroke Triage Algorithm for Maine EMS**
- Provides **pre-notification** of suspected stroke per Maine EMS protocols with the results of the stroke scores, time LKW an ETA
- Place 1-2 large bore **IVs** in the antecubital fossae, with luer lock if possible
- Remove heavy clothing and jewelry from the patient if possible
- Hand-off upon arrival to MMC should include results of the CPSS, FAST-ED, LKW, and "yes" responses to the 3 lytic questions and **witness/caregiver contact name and phone number** to the ED providers

INTERFACILITY TRANSFERS:

- Use of the **EMS Stroke Interfacility Orders** is encouraged
- Use of the **EMS Interfacility Transfer of Acute Stroke Documentation** sheet is encouraged
- Target BP < 220/110 for non-lytic patients, < 180/100 for post-lytic patients, <140/90 for SAH & see *ICH BP Management Guidance* for ICH BP target

REMIS:

FROM THE FIELD:

- Sends "**EMS Code Stroke"** when notified by EMS that patient meets criteria for field activation of the CT scanner
- Sends "**MMC ED Code Stroke**" or "**MMC ED Endo Code Stroke**" when notified by the EM physician to activate and which page to send

INTERFACILITY TRANSFERS:

- Sends code stroke pages according to **REMIS/OneCall Guide for Adult Ischemic Stroke Consult: Outside Hospital**
- If patient accepted in transfer by the NI, sends a **"Endo stroke alert, [OSH]"** page with the patient's name, DOB, current location and ETA
- Obtains **Next of Kin** and enters it into the ED-to-ED accept note in Epic
- Once notified by EMS that ETA is 10-30 minutes out from MMC, sends an **"Endo stroke patient, ETA xx min"** page
- When patient arrives at MMC, announces "**Endo Stroke Patient Direct-to-CT**" overhead

ENDO CODE STROKE, D2MR:

- Same as above for Endo stroke alert, however adds **"Direct-to-MR Protocol"** to the page

INPATIENT CODE STROKE:

- Obtains patient's name, DOB and location to include on the page
- Sends "**Possible Inpatient Stroke**" when notified by in-house staff of patient with symptoms concerning for stroke
- Sends "**Inpatient Code Stroke**" or "**Inpatient Endo Code Stroke**" when notified by neurology or neurocritical care APP to activate an inpatient code stroke and which page to send

CT TECHNOLOGISTS:

- For any pre-notification, clear one of the ED CT scanners in preparation for patient arrival
- Upon arrival in the CT, weigh patient PRIOR to scanning
- Initiate head CT as quickly as possible: **Goal door/alert to CT initiated (DTCT/ATCT) ≤ 15 min**
- Notify radiologist of potential acute stroke patient & expected time to scanning (M-F 8am-5pm: 662 4237; All other times: 662-4517)
- See D2MR below

REGISTRATION:

- Register the patient in the system immediately upon arrival

TRIAGE RN:

- For walk-ins, **BEFAST** screen performed for patients with any neurological symptoms
- If BEFAST positive, overhead page "**Trigger patient to critical care**" and have patient brought to a CC room

ED CC NURSE:

- D2CT:
  - Meets patients in the ambulance bay upon arrival and accompanies patient to CT
- Non-D2CT:
  - Meets patient in CC room
  - Places Hoyer Blue Pad on ED gurney so that it is under the patient before they are taken to CT
  - Notifies CT techs of **non-D2CT** patient & calls CT techs to see if scanner is open
  - As soon as CT scanner is open, transports patient to CT
- Prior to CT:
  - Checks one set of vital signs
  - Check FSBS (if not done by EMS)
  - Draws and sends STAT labs
  - Places/ensures 2 large bore IVs in place
- Post CT:
  - Administers TNK ASAP once eligibility has been determined, even if the patient is still in the CT scanner
  - Documents baseline neuro check and all post-TNK vital signs and neuro checks per orders
  - Patient is kept NPO with HOB at 30 degrees
  - Performs dysphagia screen
  - 12-lead ECG should be obtained **after** imaging

EMERGENCY MEDICINE ATTENDING/RESIDENT:

- D2CT: Meets patients in the ambulance bay upon arrival and accompanies patient to CT
- Non-D2CT: Meets patient in a CC room
- Prior to CT:
  - Confirms patient is medically stable and if not, stabilizes the patient
  - Confirms clinical presentation is consistent with acute stroke
  - Performs **FAST-ED Score** and documents the score in Epic
  - Obtains initial reports of time last known well (**LKW**)
  - **Calls REMIS to activate** the appropriate Code Stroke pathway bases on ED Stroke Packet Guidelines (**Goal arrival to activation ≤ 10 min)**
  - Enters orders into EPIC using the **ED Acute Stroke Order Set**
- Prior to or during CT:
  - Confirms time **LKW** with **Primary Source** if possible
  - Asks **3 lytic questions**, clarifies any "Yes" answers (from patient or patient representative as available)
  - Reviews any additional pertinent contraindications to thrombolysis (see *TNK Eligibility Criteria*)
  - Communicates any identified potential contraindications to lysis with the neurology team
- Post-CT:
  - Orders **TNK** using the **ED Acute Stroke – Treatment with Thrombolytic Order Set** as soon as lytic candidacy is determined
  - Communicates appropriate BP targets and monitoring frequency with the bedside RN
  - Performs the **NIHSS** if neurology is not in house
  - If the patient is not a candidate for thrombolysis, discusses further management recommendation with Neurology
  - Contacts the appropriate service for admission

LAB TECHNICIAN:

- Processes Code Stroke labs STAT and calls the ED with results **(Goal door-to-lab result (DTL) ≤ 30 min)**

RADIOLOGIST:

- Provides prelim results of CT/CTA focusing on excluding signs of hemorrhage or completed stroke and presence or absence of any large vessel occlusions and calls results to the ED attending (**Goal CTA complete to *prelim* read by Radiologist/resident ≤ 5 min)**
- After 20:00 (8 pm) the radiology resident will provide preliminary reads with final read by Synergy

ED PHARMACIST:

- Pulls TNK from Pyxis and brings it to the CT scanner, but does not mix it until it is decided to be given
- Helps with management of hypertension if needed prior to TNK administration
- Prepares TNK once order is received for appropriate candidates – can be given in the CT scanner if it is ready to be given
- **Goal TNK order-to-administration ≤ 5 min**

NEUROLOGY TEAM (attending, resident, APP):

- Responds to all Stroke Alerts by phone (**Goal ≤ 5 minutes**) and is at bedside ASAP (**Goal ≤ 20 min**) for potential TNK candidates (this may be via telestroke video assessment if patient arrives after hours, which would be done in the Critical Care bay after CTs are done)
- Obtains history from EM provider
- Confirms LKW with primary source if possible
- Reviews scans
- Reviews *TNK Eligibility Criteria*, including calling patient caregiver for lytic questions if needed
- Obtains verbal consent from the patient/patient representative
- Recommends TNK if indicated
- Communicates with the EM provider to order TNK from the **ED Acute Stroke – Treatment with Thrombolytics Order Set** (must use this order set for stroke thrombolysis)
- Communicates with the Neurointerventionalist if patient is a potential EVT candidate

NEUROINTERVENTIONALIST (NI)

INTERFACILITY TRANSFERS:

- Discusses patient with outside hospital provider
- Obtains clinical features including age, time LKW, baseline functional status and patient/family wishes and takes this information into consideration prior to recommending transfer
- Ultimately is responsible for decision of whether or not patient should be transferred for evaluation for candidacy for endovascular therapy Accepts patient in transfer and asks REMIS to send a **"Endo Stroke Alert, [OSH]"** page (see below for D2MR)
- Prepares for patient arrival based on ETA

ADDITIONAL PROCESSES FOR THE D2MR PATHWAY:

- Accepts patient in transfer and asks REMIS to send a **"Endo Stroke Alert, [OSH] Direct-to-MR Protocol" page**
- If a delay in transfer is anticipated, requests the OSH to obtain a **CXR** and **KUB** for metal screening and push to Impax
- If the NI wants an MRA head added to the MRI, the NI must communicate this to the ED attending
- If patient is unable to get MRI for whatever reason, the NI will decide whether or not the patient should undergo alternative imaging (**CTA/CTP**) and discuss this with the ED attending
- If the patient is NOT a candidate for IR, the NI alerts the EM Attending that pt will be sent back to the ED for further management and disposition

ALL PATIENTS:

- Determines whether or not a patient is a good EVT candidate and communicates this to the IR staff ASAP
- Obtains and documents consent for the procedure in the medical record, including patient's signature, printed name, the date and the time
- Performs procedure
- If the patient IS a candidate for NIR, the NI is responsible for communicating results of the procedure and any specific post-procedure instructions to the NCC team

NEURO IR NURSE:

- Neuro IR staff prepares IR suite as soon as notified of a potential endovascular case
- Neuro IR nurse transports the patient to the Neuro IR suite directly from CT or MR

ED RESPIRATORY THERAPIST:

- Manages ventilation for intubated patients going D2MR
- Manages ventilator back to the ED from MR if the patient is not an EVT candidate

ANESTHESIOLOGIST:

- Evaluates the patient and consents for anesthesia for patients undergoing thrombectomy
- Manages ventilation for patients going to the IR suite

NEUROCRITICAL CARE TEAM:

- Receives Endo Code Stroke pages so that they are aware of potential EVT cases
- Admits post-thrombolytic and post-thrombectomy ischemic stroke patients and most hemorrhagic stroke patients
- Neurocritical care APP responds to Possible Inpatient Code Strokes from 7pm-7am Monday through Sunday

D2MR Pathway ONLY

MR TECHNOLOGIST:

- Plans for MR scanner to be open around the time of patient arrival
- Contacts patient's **Next of Kin** (obtains information entered by REMIS in the ED-to-ED accept note) to complete MRI screening form and notifies the EM Attending if screening was unable to be competed
    - If MRI screening form cannot be completed and CXR/KUB was not able to be obtained at OSH prior to transfer, the patient will go **D2CT** and get a **head CT with a CT scanogram** to screen for metal; If no metal is identified, patient can then be taken to MRI
- Checks patient for hairpins, hearing aids, dentures, jewelry, patches, etc.
- Scans patient as quickly as possible (FAST-scan)
- Pt held in **MR holding bay** while Radiologist/NI reviews films to determine whether patient is taker to IR vs. back to ED

CT TECHNOLOGISTS:

- If the patient is not cleared for MR by the time of arrival, clears CT for **D2CT** and **head CT and CT scanogram** to screen for metal
- If the head CT/CT scanogram shows metal, the IR specialist may decide to obtain a CTA/CTP in place of the MRI

ED NURSE COORDINATOR:

- Assesses current resources to obtain staff to accompany patient to MR, including the following: Patient's ED RN, Other ED RN, CC Float RN, CC Coordinator, Nursing Supervisor
- If patient is NOT a EVT candidate, the patient will be taken back to **ED Critical Care** by the designated ED resource

FLOAT RN:

- Checks the IVs, Draws and sends acute stroke labs, attaches patient to cardiac monitor
- Patient transported to MR with designated resource

EM PHYSICIAN:

- Enters stat orders for **MR Brain** WO Contrast with "Fast scan for basilar artery thrombosis" selected as the indication **OR** head CT and CT scanogram; if unable to get MRI discuss with NI
- Ensures patient is medically stable for transport to MRI
- Completes **NIHSS if after hours and neurology is not present**
- If patient arrives not intubated, ED physician will intubate the patient prior to going to MRI

RESPIRATORY THERAPIST (RT):

- Meets patient upon arrival for Endo Stroke Alert D2MR
- Places patient on an MRI-compatible portable ventilator
- RT manages ventilator until decision made to go to the IR suite or not
- **RT** hands off to anesthesia if patient goes for EVT; otherwise RT manages patient back to and in the ED

RADIOLOGIST:

- Interprets the **FAST-SCAN MR** ASAP (goal less than or equal to 5 min post processing)
- Calls the Neurointerventionalist with results

INPATIENT CODE STROKES ONLY

PATIENT'S RN

- Establishes time **LKW**
- Check **VS** and **FSBG**
- Ensures 2 large bore **IVs** in place
- Attaches patient to **cardiac monitor**
- Prepares patient for STAT transport to the CT scanner

PRIMARY TEAM

- **Comes to the bedside STAT & assesses patient**
- Helps provide history to the Neurology team
- May be asked to communicate with patient's family/representative regarding updates in patient's change in clinical status
- Remains available to assist in patient care OR **provides Neuro team a pager** if they need to leave the bedside to care for other patients
- **Transfers care** of the patient to the Neurocritical care team if the patient requires acute stroke therapies

SCU COORDINATRO/NURSING SUPERVISOR:

- Identifies resources for stat transport to CT

ICU NURSE who is identified as resource for transport:

- Transports to CT *after labs are drawn if these are necessary for decision regarding thrombolysis*

PHLEBOTOMIST

- **Labs should be drawn *prior* to transport to CT if necessary; results will be called to the SCU coordinator 662-0595** Phlebotomist should draw labs PRIOR to taking patient to CT if labs are needed

ED RN:

- Patient is managed and monitored there by an until an ICU bed is available or patient is taken to NIR Suite for EVT