# 2024 MMC ED Stroke Packet

## ISCHEMIC STROKE

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**STROKE PACKET eSUPPLEMENT (available in on-line versions only)**

*See EM CLINICAL GUIDELINES – under Neurology/Neurosurgery*

- e1. APPENDIX A: CODE STROKE PAGING MATRIX  
- e2-4. APPENDIX B: CODE STROKE ROLES AND RESPONSIBILITIES  
- e5-7. Imaging Pathways (D2CT, non-D2CT and D2MR)

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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.
Guidelines for Activation of MMC ED CODE STROKES

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

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

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

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

If FAST-ED Score ≥ 4 & LKW < 24h

ACTIVATE “MMC ED Endo Code Stroke”

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

ACTIVATE “MMC ED Code Stroke”

Call REMIS 662-2950

Obtain BP, blood glucose and answers to the 3 lytic questions from patient/patient representative/chart review as quickly as possible

Use the ED Acute Stroke Order Set

3 Lytic Questions & if Yes, when and what?
- Any recent surgeries, procedures or trauma?
- Any history of any bleeding problems, including ICH?
- Is the patient on any blood thinners?
Refer to TNK Eligibility Criteria for any Yes answers

Patients with obvious absolute contraindications to thrombolysis upon presentation, should NOT have an ED Code Stroke activated; However, they may still meet criteria for an ENDO Code Stroke

IMPORTANT NOTES:
- NIHSS must be performed before TNK and EVT and within 12 hours of arrival on all other stroke patients (a Joint Commission requirement for Comprehensive Stroke Centers)
- § Stroke with non-disabling symptoms: See “MMC ED Code Stroke Pathway”
- 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 fundoscopy.
- LVO with minor deficits: All patients suspected of having a stroke or TIA within the last 24 hours should have an STAT 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.

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**FAST-ED Score: Field Assessment Stroke Triage for Emergency Destination**

A score of **greater than or equal to 4** has a sensitivity of 0.61 and a specificity of 0.89 (PPV 0.72) for **large vessel occlusion**.

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>F</strong> Facial palsy</td>
<td>Normal or mild facial asymmetry</td>
<td>Obvious droop on one side of the mouth</td>
<td>N/A</td>
<td>Score</td>
</tr>
<tr>
<td><strong>A</strong> Arm weakness</td>
<td>Extend the weak arm with palm facing down to 90° (if sitting) or 45° (if supine) and ask them to hold it there for 10 seconds</td>
<td>No drift down x 10 seconds</td>
<td>Drifts, but not all the way down</td>
<td>Drifts all the way down or no movement at all</td>
</tr>
<tr>
<td><strong>S</strong> Speech changes</td>
<td>Note spontaneous speech; ask the patient to name 3 common items; ask the patient to show you 2 fingers without demonstrating this visually to the patient</td>
<td>Normal speech</td>
<td>Impaired but comprehensible speech, and/or unable to name any of the items, and/or unable to follow the command</td>
<td>Incomprehensible speech and/or complete lack of understanding or mute</td>
</tr>
<tr>
<td><strong>T</strong> Time LKW*</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td><strong>E</strong> Eye deviation</td>
<td>Ask the patient to track your hand all the way to the left and then all the way to the right</td>
<td>Normal horizontal eye movements</td>
<td>Eyes tend to only move to one side</td>
<td>Eyes both forced over to one side</td>
</tr>
<tr>
<td><strong>D</strong> Denial/Neglect</td>
<td>With eyes closed, touch the patient on both arms at the same time and ask if they feel both sides; Show the patient the hand on the side of their weakness and ask them “Whose hand is this?”</td>
<td>Able to sense touch on both sides at the same time and recognizes the weak hand as their own</td>
<td>Unable to feel one side of the touch but can recognize their hand as their own</td>
<td>Unable to feel one side of touch and does not recognize their hand as their own</td>
</tr>
</tbody>
</table>

**TOTAL SCORE**

*Time is documented for decision making purposes and is not scored.

**FAST-ED Score: TIPS and TRICKS**

<table>
<thead>
<tr>
<th>Coma = patient is not alert or interactive despite verbal or noxious stimuli (includes sedation)</th>
<th>Difficult patient to examine, aphasic or confused</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>F</strong> Default score: 1</td>
<td>Use noxious stimulation to elicit grimace.</td>
</tr>
<tr>
<td><strong>A</strong> Default score: 2</td>
<td>Observe spontaneous arm movements, hold up arms and note any effort against gravity or asymmetry of drop, note asymmetry of withdrawal to noxious stimuli.</td>
</tr>
<tr>
<td><strong>S</strong> Default score: 2</td>
<td>Choose score based on ability for the examiner to understand any attempts at communication and whether patient is following any commands or not.</td>
</tr>
<tr>
<td><strong>E</strong> Hold eyes open and note if eyes are deviated to one side. Then swiftly turn head side-to-side (Doll’s eyes maneuver) and note if eyes can cross midline to both sides or not.</td>
<td>Note if eyes are deviated to one side. Make eye contact and move your face from side to side and note if the patient tracks you across the midline to both sides or perform Doll’s eyes maneuver.</td>
</tr>
<tr>
<td><strong>D</strong> Default score: 0</td>
<td>Score only if present:</td>
</tr>
</tbody>
</table>

Posterior Stroke Recognition

For patients who present to the Emergency Department with one of the “5D’s” of posterior circulation symptoms:

The 5D’s

- Dizziness (Vertigo)
- Diplopia (or loss of vision)
- Dysarthria
- Dysphagia
- Dystaxia (limbs > gait)

If pt present with ANY 1 of the 5 D’s, ASK about the other 4.
If you confirm that the pt has ≥ 1 of the 5 D symptoms, then confirm that these were:

- SUDDEN in onset
- UNPROVOKED and
- UNEXPLAINED by another process

Yes

Establish LKW
Perform a FAST-ED

Initiate appropriate ED Code Stroke Process

Yes

Potential acute stroke therapy candidate?

No

Perform complete neurological exam, focusing on the following posterior circulation findings to identify possible central causes of symptoms

Dizziness/vertigo: If dizziness is still present, document whether nystagmus is present (record a short video for pt chart if possible) & perform a HINTS-plus exam (plus = check hearing to finger-rub bilaterally)

Diplopia: Check extraocular movement and look for ocular palsies while asking about subjective diplopia

- Vision: Formally test Visual Fields with EACH EYE tested separately

Dysarthria: Listen to the quality of the pts speech, note palate elevation, check for tongue deviation

Dysphagia: Ask about difficulty swallowing or drooling – if present, ask RN to do a bedside swallow screen

Dystaxia: Check finger-to-nose, heal-to-shin and gait

If there is concern for central cause of vertigo

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

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

- **Arrives with pre-notification**
  - **Direct-to-CT Pathway**

- **Arrives without pre-notification**
  - **NonDirect to CT Pathway**

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

**Appropriate Code Stroke Process is Activated**

**Head CT followed immediately by CTA head and neck**

- **TNK candidate?**
  - **Yes**
    - **TNK 0.25 mg/kg, Max 25 mg IV push**
    - **Use STROKE - Acute Treatment with Thrombolytic Order Set**
    - **Goal CTA to TNK order (CTO) ≤ 10 min**
    - **Goal order to TNK administration ≤ 5 min**
  - **No**

- **LVO detected on CTA?**
  - **Yes**
    - **Proceed with CT Perfusion (CTP)**
    - **EVT candidate?**
      - **Yes**
        - **Patient transported STAT to IR suite**
        - **Time to groin puncture minimized**
        - **Time to reperfusion minimized**
        - **Once reperfusion attained, HOB no longer needs to be kept at 0°**
      - **No**
        - **No**

- **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**

**References:**
ENDOVASCULAR STROKE TRANSFER PATHWAY

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

**LKW/Onset of symptoms**

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

Large Vessel Occlusion is clinically suspected or imaging confirmed?

- **Yes**
  - **Patient felt to be a good endovascular (EVT) candidate?**
    - **Yes**
      - The **NI** accepts patient for endovascular therapy (EVT) evaluation
      - **REMIS “Endo Stroke Alert, [name of OSH]” with Patient information & ETA**
    - **No**
      - The **Neurologist** considers whether there are other acute stroke treatment options and if there is need for transfer and triages as appropriate

- **No**

**Tell OSH to put HOB at zero degrees** *(can be lateral decubitus position) AND start maintenance rate IVF with crystalloid to maintain cerebral perfusion pressure (keep BP < 180 if post-lytic pt)*

**Tell OSH to put HOB at zero degrees** *(can be lateral decubitus position) AND start maintenance rate IVF with crystalloid to maintain cerebral perfusion pressure (keep BP < 180 if post-lytic pt)*

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

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

**ED-to-ED transfer to MMC STAT via EMS**

**Patient arrives at MMC ED via inter-facility transfer**

**Pt taken D2CT**

**CT/CTA/CTP performed as directed by the NI**

**Patient admitted to the appropriate level of care**

- **No**
  - Use the **Ischemic Stroke ICU** Order Sets for ICU admissions
  - Use the **Gen Med Ischemic Stroke Admission** Order Set for floor admissions
- **Yes**
  - **EVT candidate?**
    - **Yes**
      - Patient is taken to NIR Suite STAT keeping HOB at 0° as above until thrombectomy is complete
      - Use the **Cerebral Thrombectomy Post-Procedure** Order Set
    - **No**
      - **NCC to use the appropriate Ischemic Stroke ICU Order Sets**

See **Code Stroke Paging Matrix; Code Stroke Roles and Responsibilities and D2CT and D2MR Pathways**

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

Clinical staff calls 662-2345 and states “Possible Inpatient Stroke” AND notifies the pt’s primary team of possible stroke.

Neurology/NCC & Code White team evaluates 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
  - NIHSS is ≥ 6 in a pattern c/w an LVO?
    - No
    - 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.
    - Yes
    - ACTIVATE “Inpatient Code Stroke”
      - Use the Inpatient Stroke Alert Order Set
      - Call REMIS 662-2950

CT/CTA +/- CTP performed STAT

- 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
    - Yes
      - ED Nurse Coordinator will direct patient location in CC
      - Use STROKE – Acute Treatment with Thrombolytic Order Sets
      - TNK CANDIDATE: 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 pt is taken to the IR Suite
        - Unless patient is vomiting or unable to tolerate the zero degree position due difficulty breathing or other medical condition in which case put HOB at 30 degrees
        - Use the Cerebral Thrombectomy Post-Procedure Order Set
        - Use the Ischemic Stroke ICU Order Sets for ICU admissions
        - EVT CANDIDATE: Patient is taken to IR Suite directly from CT following administration of TNK (if indicated) with HOB zero degrees* until thrombectomy is complete
        - Post-lytic or EVT the patient will need to be bedded in an ICU, Neurocritical Care Unit preferred
          - 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.
          - Note: ED BOARDERS 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.

- No
  - ATCT ≤ 15 min
  - ATN ≤ 30 min
  - ATP ≤ 60 min
  - ATR ≤ 90 min

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See Appendix A. Code Stroke Paging Matrix and Appendix B. Code Stroke Roles and Responsibilities
For patient who presents to the ED with **transient** focal neurological or retinal symptoms or **minor non-disabling** symptoms thought to be due to ischemic stroke

Immediate triage & physician assessment

CT head with CTA head and neck performed STAT, (STAT b/c LVOs can present as TIsAs or minor strokes)

- **LVO identified?**
  - Yes
  - Use the ED Acute or Subacute Order Set and select ED Acute Stroke Order Set
  - For transient or persistent monocular blindness add ocular U/S and fundoscopy, and if pt > 50 yo, add ESR and CRP to labs
  - No
  - CT head with CTA head and neck STAT

Further clinical evaluation & monitoring (Imaging, ECG, labs, UA) – consider the DDx of sx

TIA/Stroke still suspected as etiology of presenting sx?

- Yes
  - Neurology consult may be telehealth or in the morning on nights when no inhouse coverage is available
  - Neurology consult will assess patients appropriateness for TIA/Stroke clinic

- No
  - Neurology consult will arrange clinic, MRI, and TTE appointments
  - Administer anti-platelets PRIOR TO DISCHARGE

**Administer anti-platelets PRIOR TO DISCHARGE**

**ABCD2 Score 0-3:**
- Aspirin 81 mg po daily (load with 324 mg po x1 if aspirin naive)

**ABCD2 Score ≥ 4 or non-disabling stroke:**
- Clopidogrel 300 mg po x1 (unless already on clopidogrel), continue 75 mg po daily x21 days
- Aspirin 81 mg po daily (load with 324 mg po x1 if aspirin naive)

Alternatives to clopidogrel include:
- Ticagrelor 180 mg load, then 90 mg bid
- Or Cilostazole 100 mg bid (no load)

**Criteria for CDU observation:**
- ABCD, Score 0-3 with pt preference for inhouse work up
- ABCD, Score 4-6 with no high risk features after neurology assessment
- Minor non-disabling stroke per ARAMIS criteria
- Pt must be able to safely ambulate unassisted to the bathroom and back
- Must have passed the dysphagia screen
- Must not have baseline severe dementia, neurological or medical co-morbidities

**Neurology consult** will assess patients appropriateness for TIA/Stroke clinic

- **TIA/Stroke Clinic follow up is appropriate?**
  - Yes
  - Neurology consult will arrange clinic, MRI, and TTE appointments
  - Administer anti-platelets PRIOR TO DISCHARGE
  - **ABCD2 Score 0-3:**
    - Aspirin 81 mg po daily (load with 324 mg po x1 if aspirin naive)
  - **ABCD2 Score ≥ 4 or non-disabling stroke:**
    - Clopidogrel 300 mg po x1 (unless already on clopidogrel), continue 75 mg po daily x21 days
    - Aspirin 81 mg po daily (load with 324 mg po x1 if aspirin naive)
  - Alternatives to clopidogrel include:
    - Ticagrelor 180 mg load, then 90 mg bid
    - Or Cilostazole 100 mg bid (no load)

- **ED to assess for appropriateness for CDU admission**
  - **Criteria for CDU observation:**
    - ABCD, Score 0-3 with pt preference for inhouse work up
    - ABCD, Score 4-6 with no high risk features after neurology assessment
    - Minor non-disabling stroke per ARAMIS criteria
    - Pt must be able to safely ambulate unassisted to the bathroom and back
    - Must have passed the dysphagia screen
    - Must not have baseline severe dementia, neurological or medical co-morbidities

- **Appropriate for CDU?**
  - Yes
  - Use the ED CDU TIA Protocol Observation Order Set
  - Admin to CDU

- **No**
  - Use the ED Acute or Subacute Order Set and select ED Acute Stroke Order Set
  - For transient or persistent monocular blindness add ocular U/S and fundoscopy, and if pt > 50 yo, add ESR and CRP to labs
  - CT head with CTA head and neck performed STAT

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

3 Lytic Questions

- **Clinical presentation/medical history**
  - LKW > 4.5h
  - SX of SAH
- **Have you had any recent trauma, surgeries or procedures?**
  - Severe head trauma w/in 3 mo
- **Have you had any bleeding problems?**
  - Intracranial or intraspinal surgery w/in 3 mo
  - H/o intracranial hemorrhage§
  - Major non-cranial surgery† or trauma w/in 14 days with uncontrollable bleeding site (e.g. internal organs)
  - Gl or GU bleeding > 21 days ago
  - Hemorrhagic ophthalmologic condition
  - Menorrhagia‡
- **Are you taking any blood thinners?**
  - Warfarin w/ INR > 1.7
  - UFH w/ ↑ aPTT
  - Therapeutic dose LMWH w/in 24 hrs
  - DOAC w/in 48 hrs
  - INR > 1.7
  - PT > 15 sec
  - aPTT > 40 sec
  - Plt < 100K
- **Imaging**
  - Acute intracranial hemorrhage
  - Completed infarct
  - LKW > 4.5h
  - Cerebral aneurysm
  - Intracranial or intraaxial neoplasm (not extra-axial, i.e. not meningioma)
  - Intra-cranial arterial dissection
  - Unruptured or untreated intracranial vascular malformation
  - SIH
  - ↑ BP
  - ≤ 185/110
- **Labs**
  - BG < 50
  - or > 400
  - BG > 140
  - GIB
  - Menorrhagia
  - ↑ INR
  - ≥ 1.7
  - ≥ 3 hr from time LKW
  - Hypertension (BP > 160/100)
  - Severe white matter disease on head CT (Fazekas grade ≥ 3)

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 > 160/100)
- 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.

**TNK Eligibility Criteria**

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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

BP less than 185/110?

Yes

Proceed with TNK administration/EVT.

Maintain BP less than 180/105 during and for 24 hours after TNK administration and/or thrombectomy.

Intensive BP lowering post-EVT with successful recanalization has not been shown to improve outcomes and is generally not recommend.

No

BP less than 185/110 within 5 min of IV labetalol x2?

Yes

BP less than 185/110 after titration of nicardipine/clevidipine?

Yes

TNK is contraindicated

EVT is not contraindicated

No

Give labetalol* 10-20 mg IV x1 STAT;
May repeat after 5 min x1 if BP not at goal
May start with 5 mg in elderly or low weight
*If pt has bradycardia or bronchospasm, do not use labetalol, go straight to calcium channel blocker gtt

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. Arterial Line placement is recommended if IV drips are used to control BP to ensure accurate dosing and adjustment.

BP less than 185/110?

Yes

Give labetalol* 10-20 mg IV x1 STAT;
May repeat after 5 min x1 if BP not at goal
May start with 5 mg in elderly or low weight

*If pt has bradycardia or bronchospasm, do not use labetalol, go straight to calcium channel blocker gtt

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Increase by doubling the dose every 2-5 min as needed.
Max 21 mg/hr. Arterial Line placement is recommended if IV drips are used to control BP to ensure accurate dosing and adjustment.

BP less than 185/110 within 5 min of IV labetalol x2?

Yes

BP less than 185/110 after titration of nicardipine/clevidipine?

No

TNK is contraindicated

EVT is not contraindicated

Post-TNK/EVT management:
- 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 x 24 hours after TNK unless there is another compelling reason to do so (such as intravascular stenting required for mechanical thrombectomy)

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 patients (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 euvo1ema 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.


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**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.

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**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**

- 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)*

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**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


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**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

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

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

- Non-contrast Head CT +/- CTA

**ICH identified**

- Initiate reversal of anticoagulation as indicated
  - See ICH Reversal of Anticoagulation Protocol

**Based on current SBP, time LKW and size of hematoma**

- Initiate BP management as per the ICH BP Management Protocol

**Monitor BP q10 – 15min**

- For GCS ≤ 8 or signs of increased ICP, give mannitol 1 gm/kg IV x1 or bolus hypertonic saline (250-500 ml 3% NS)
  - Consult Neurosurgery and Neurocritical care STAT

**Indications for URGENT Neurosurgical Consultation:**

- Patient with pre-stroke mRS ≤ 3, reasonable prognosis and ≥1 of:
  - GCS ≤ 13
  - Supratentorial ICH volume ≥ 20 mL
  - Posterior fossa ICH
  - Obstruction of the 3rd and/or 4th ventricle(s)
  - Evidence of tumor or AVM on imaging

**Continued ED Care after imaging and stabilization:**

- 12-lead ECG
- CXR if indicated
- Dysphagia screen and aspiration precautions if not intubated
- Nursing to continue q 10-15 min BP monitoring and neuro assessments

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

- Admit to Neurocritical Care Unit
- Ensure ICH Score is documented
- Repeat head CT at 6-24 hours to assess for hematoma stability and STAT for any clinical deterioration

**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

**Obtain clinical information:**

- Time LKW
- Current BP
- Anticoagulation use and time last taken
- Document GCS Score on arrival

**All patients:**

- ICH Score must be documented in Epic within 6 hours of presentation and before any NS intervention (Joint Commission CSC Metric)
- Ascertain Code Status and Goals of Care (GOC)

**Prophylactic anti-seizure medication is NOT indicated for primary ICH; initiate ONLY if clinical concern for seizure**

- Levetiracetam 20-60 mg/kg up to max 4500 mg IV x1 followed by 1000-1500 mg q12 hours

**Arrival**

- DTCT ≤ 15 min

- Reversal of AC initiated ≤ 30 min

- BP tx initiated ≤ 30 min

- BP at Target ≤ 60 min

ICH Blood Pressure Management Protocol

For patients with spontaneous (non-traumatic) Intracerebral Hemorrhage

**SBP < 130**
- Bolus with crystalloid fluid
- Continue IVF at maintenance rate once euvoletic
- Work up for potential causes of hypotension as clinically indicated

**SBP 130-150**
- Do not initiate BP lowering
- Initiate maintenance rate IVF while NPO to maintain euvoletic
- Continue to closely monitor BP and treat as needed

**SBP 150-220 mm Hg**

**Time LKW < 6 hours and mild to moderate hematoma size (≤ 30 mL)**
- 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;
  Arterial line placement recommended for accurate dosing if IV drips used for BP control

**Target SBP 130-150 mm Hg**
- Continue close monitoring and careful titration to ensure continuous, smooth and sustained control of BP
  Avoid peaks and large BP swings

**SBP > 220**
- Aggressive BP lowering may be associated with worse outcomes
- Target SBP less 40-60 mm Hg during the first 12-24 hours
- Avoid acute drops of > 60 mm Hg

**Time LKW > 6 hours OR large hematoma size (>30 mL) OR Pt requiring surgical decompression**

**Target SBP 140-160 mm Hg**

**Initiation of BP lowering within 30 min of arrival with goal of reaching target within 1 hour**

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

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

Use the **ED ICH Order Set**

Use the **ICH Admission Order Set**

ICH Reversal of Anticoagulation Protocol

For patient with spontaneous intracerebral hemorrhage (ICH) on antithrombotics

All Patients:
- Review history of anticoagulation 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)

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

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

IV Unfractionated Heparin (UFH)
- 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
- Enoxaparin (Lovenox)
- If last administration ≤ 8 hours ago: 1 mg IV protamine per 1 mg LMWH; Max 50 mg
- If last administration > 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

## eAPPENDIX A. CODE STROKE PAGER MATRIX

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**eAPPENDIX B: CODE STROKE ROLES AND RESPONSIBILITIES**

<table>
<thead>
<tr>
<th>EMS PROVIDERS: FROM THE FIELD:</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Perform a Cincinnati pre-hospital stroke score (CPSS) and if positive perform a FAST-ED Score</td>
<td></td>
</tr>
<tr>
<td>Minimizes On-Scene time as able</td>
<td></td>
</tr>
<tr>
<td>Documents time last known well (LKW) and witness, obtain name(s) &amp; phone number(s) for witness(es)/caregiver(s) who can confirm time LKW and can provide further medical history and consent for treatment</td>
<td></td>
</tr>
<tr>
<td>Check vital signs and FSBS and treats abnormalities as indicated per Maine EMS guidelines</td>
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<tr>
<td>Asks the patient/caregiver the 3 lytic questions, document answers and relay responses to EM physician</td>
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<tr>
<td>Transport patient in accordance with the Stroke Triage Algorithm for Maine EMS</td>
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<tr>
<td>Provides pre-notification of suspected stroke per Maine EMS protocols with the results of the stroke scores, time LKW an ETA</td>
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</tr>
<tr>
<td>Place 1-2 large bore IVs in the antecubital fossae, with luer lock if possible</td>
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</tr>
<tr>
<td>Remove heavy clothing and jewelry from the patient if possible</td>
<td></td>
</tr>
<tr>
<td>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 EM providers</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INTERFACILITY TRANSFERS:</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Use of the EMS Stroke Interfacility Orders is encouraged</td>
<td></td>
</tr>
<tr>
<td>Use of the EMS Interfacility Transfer of Acute Stroke Documentation sheet is encouraged</td>
<td></td>
</tr>
<tr>
<td>Target BP: &lt; 220/110 for non-lytic patients, &lt; 180/100 for post-lytic patients, &lt; 160/100 for ICH, &lt; 14090 for aneurysmal SAH</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>REMIS: FROM THE FIELD:</th>
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</thead>
<tbody>
<tr>
<td>Sends “EMS Code Stroke” when notified by EMS that patient meets criteria for field activation of the CT scanner</td>
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</tr>
<tr>
<td>Sends “MMC ED Code Stroke” or “MMC ED Endo Code Stroke” when notified by the EM physician to activate and which page to send</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>INTERFACILITY TRANSFERS:</th>
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</thead>
<tbody>
<tr>
<td>Sends ETA page once a patient accepted in transfer by the NI, “Endo stroke alert, [OSH]” with the patient’s name, DOB, current location and ETA</td>
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</tr>
<tr>
<td>Once notified by EMS that ETA is 10-30 minutes out from MMC, sends an “Endo stroke patient, ETA xx min” page</td>
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</tr>
<tr>
<td>When patient arrives at MMC, overhead announces “Endo Stroke Patient Direct-to-CT”</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>ENDO CODE STROKE, D2MR:</th>
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<tbody>
<tr>
<td>Same as above for Endo stroke alert, however adds “Direct-to-MR Protocol” to the page</td>
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</table>

<table>
<thead>
<tr>
<th>INPATIENT CODE STROKE:</th>
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<tbody>
<tr>
<td>Sends “Possible Inpatient Stroke” when notified by in-house staff of patient with symptoms concerning for stroke and includes the patient’s name, DOB and location on the page</td>
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</tr>
<tr>
<td>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</td>
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</tbody>
</table>

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

<table>
<thead>
<tr>
<th>REGISTRATION:</th>
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<tbody>
<tr>
<td>Register the patient in the system immediately upon arrival</td>
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<thead>
<tr>
<th>Triage RN:</th>
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<tbody>
<tr>
<td>For walk-ins, BEFAST screen performed for patients with any neurological symptoms</td>
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<tr>
<td>If BEFAST positive, overhead page “Trigger patient to critical care” and have patient brought to a CC room</td>
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<table>
<thead>
<tr>
<th>ED CC Nurse:</th>
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<tbody>
<tr>
<td>D2CT:</td>
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<tr>
<td>o Meets patients in the ambulance bay upon arrival and accompanies patient to CT</td>
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<tr>
<td>Non-D2CT:</td>
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</tr>
<tr>
<td>o 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</td>
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<tr>
<td>o Notifies CT techs of non-D2CT patient &amp; calls CT techs to see if scanner is open</td>
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<tr>
<td>o As soon as CT scanner is open, transports patient to CT</td>
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<tr>
<td>Prior to CT:</td>
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<tr>
<td>o Checks one set of vital signs</td>
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<tr>
<td>o Check FSBS (if not done by EMS)</td>
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<tr>
<td>o Draws and sends STAT labs</td>
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<tr>
<td>o Places/ensures 2 large bore IVs in place</td>
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<tr>
<td>Post CT:</td>
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</table>

- 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
- If pt has an LVO, place HOB at 0 degrees unless pt vomiting or unable to tolerate position; otherwise place HOB at 30 degrees
- Keep pt strictly NPO until dysphagia screen is performed AND DOCUMENTED in Epic
- 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 the patient in the CT as soon as possible
  - 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
  - Communicates appropriate BP targets and monitoring frequency with the bedside RN
  - Contacts the appropriate service for admission

**LAW 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 EM 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 (Imaging must be read by ≤ 45 min per Joint Commission standards)

**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 pt arrives after hours, which would be done in CC 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 pt 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 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 (specifies if the D2MR pathway should be invoked)
- 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, the NI should request 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 EM attending so that the order will be placed
- 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 EM attending so that the correct orders will be placed
- 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; if an emergency thrombectomy is required and pt consent cannot be obtained, the provider should document the emergency circumstances and need for the immediate treatment in the medical record; if telephone consent of a family member is required, a witness signature of the conversation must also be obtained
- Performs procedure and appropriately documents all time stamps, TICI score and any complications of the procedure
- Following the procedure, 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

**ANESTHESIOLOGIST:**

- Receives Endo Stroke pages as a “heads up” and awaits confirmation from the NI whether the case is a “go” or “no go”
- Evaluates and consents patients undergoing endovascular treatment for anesthesia
- Manages ventilation, sedation and hemodynamics for patients going to the IR suite
- Avoids hypotension and mitigates large swings in blood pressure in acute stroke patients

**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 when there is no Neurology Resident in-house

**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 pt care OR provides Neuro team a pager if they need to leave the bedside to care for other pts
- Transfers care of the patient to the Neurocritical care team if the patient requires acute stroke therapies

**SCU COORDINATOR/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**

- Phlebotomist should draw labs PRIOR to taking pt to CT if labs are needed; results will be called to the SCU coordinator 662-0595

**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

**NEUROLOGY**

- Responds to REMIS page within 5 minutes to confirm receipt of the page and responds to bedside ASAP
- Assesses patient per the MMC Inpatient Code Stroke Pathway
Patient in the community experiences symptoms concerning for stroke

Inter-facility transfer via EMS for suspected LVO (see Endo Stroke Transfer Pathway)

Patient transported directly to MMC from the field via EMS with pre-notification for suspected stroke

Patient met by registration, ED CC RN and EM Physician immediately upon arrival and sign out from EMS received

T = 0

Patient medically stable?

No

Pt taken to CC bay for stabilization and once stable proceed with further work up

Yes

Presentation consistent with stroke?

No

Further work up and management as indicated

Yes

FAST-ED Score performed

For patient transported directly to MMC from the field See Guidelines for Activation of MMC ED CODE STROKES

Endo Stroke Transfers DO NOT require any additional activation

Patient taken directly to CT

CT head with CTA head and neck

If LVO detected

CTP added

References:
Direct-to-MRI (D2MR) Pathway

For patients being transferred from an outside hospital (OSH) with BASILAR ARTERY THROMBOSIS (BAT) in whom the Neurointerventionalist (NI) and Neurologist agree MRI is necessary prior to decision to proceed with thrombectomy

Patient transported to the MR scanner

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

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

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 transported via EMS to MMC

T = 0

DTR ≤ 90 min

DTMR ≤ 30 min

DTP ≤ 60 min

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

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

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

At the request of the NI, REMIS sends an “Endo Stroke Alert, [OSH] Direct-to-MR Protocol” page and enters Next-of-Kin into the ED-to-ED accept note in Epic

T = 0

Patient medically stable?

Vent management: Respiratory therapist

Yes

Patient cleared for MR?

No

Patient transported to the MR scanner

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

EVT candidate?

No

Vent management: Respiratory therapist

Yes

Vent management: Anesthesia

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

Patient taken back to CC bay for further management & to determine disposition

Vent management: Respiratory therapist

No

Patient taken to CC bay for stabilization & MR technician notified of delay 662-4028

Once patient is stabilized

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

No metal identified

Yes

No metal identified

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

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