Management of Acute Ischemic Stroke in Hospitalized Adult Patients

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INITIAL ASSESSMENT

- Call on-call provider STAT
- Notify attending provider and MERIT as appropriate

- STAT orders:
  - Monitoring: 12-lead EKG
  - Laboratory tests:
    - POC finger stick glucose
    - CBC with differential, electrolytes, BUN, serum creatinine (SCr), cardiac panel, PT/INR, and aPTT without delaying brain imaging
  - Imaging: CT head without contrast
    - For suspected brain metastasis, STAT CT head with contrast or STAT MRI brain with contrast (if readily available)
    - Inform Radiology that patient has a possible acute ischemic stroke
    - Contact Transportation to arrange rapid transportation to imaging
  - Medications: Alteplase (rt-PA) if the patient is a potential candidate. Contact pharmacy to begin mixing the alteplase. If the alteplase is subsequently cancelled, return all medications and tubing to pharmacy.

- Consults
  - Neurology
  - Case Manager or OSA if appropriate for possible transfer to stroke center
  - Complete neurological exam using NIHSS (see Appendix C)
  - Insert and maintain IV access
  - Correct hypotension and hypovolemia to maintain perfusion
  - Avoid inserting foley catheter, nasogastric tube, or intra-arterial pressure catheter if possible
  - Supplemental oxygen to maintain oxygen saturation > 94%
  - Obtain urine pregnancy test if appropriate

Evidence of bleeding on CT head or MRI brain?

- Yes
  - Intraparenchymal hemorrhage or subarachnoid hemorrhage
  - Consult Neurosurgery
  - For management, refer to Acute Intracranial Hemorrhage in Adult Cancer Patients algorithm

- No
  - Ischemic stroke per clinical assessment
    - See Page 2 for continued assessment and management

1 Signs and symptoms of acute ischemic stroke:
  - Numbness and/or paralysis to face, arm or leg (especially on one side)
  - 5 Ds of posterior circulation stroke: dizziness, diplopia, dysarthria, dysphagia, dystaxia
  - Sudden confusion
  - Trouble speaking or understanding
  - Sudden painless vision loss in one or both eyes (retinal stroke)
  - Sudden severe headache

2 Physician may make the determination to transfer patient to a stroke center prior to Neurology consult to prevent any transfer delays. Time permitting, Neurology may assist with determining if a patient is a candidate for endovascular intervention for large vessel occlusion at a stroke center. See Appendix B for Criteria for Transfer to Stroke Center.
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**CONTINUED ASSESSMENT & MANAGEMENT**

- **Symptom onset < 4.5 hours?**
  - Yes
  - **If no contraindications to aspirin, give aspirin 325 mg**
  - **Transfer² to stroke center if appropriate**
  - **Contraindication to thrombolytic therapy¹?**
    - Yes
    - **If no contraindications to aspirin, give aspirin 325 mg**
    - **Transfer² to stroke center if appropriate**
    - **BP < 185/110 mmHg prior to rt-PA?**
      - Yes
      - **If SBP > 185 mmHg or DBP > 110 mmHg, consider the following antihypertensives³:**
        - Labetalol 10 mg IV push (IVP) over 2 minutes every 10 minutes for 3 doses (do not use if heart rate < 60 beats per minute) or
        - Hydralazine 10 mg IVP over 2 minutes every 10 minutes for 3 doses
        - If labetalol/hydralazine IVP have been given up to 3 doses, start nicardipine IV continuous infusion⁴ at 5 mg/hour. Titrate nicardipine infusion by 2.5 mg/hour every 5 minutes to the desired effect. Maximum dose is 15 mg/hour.
      - **No**
      - **Administer alteplase per IP Neurology Acute Ischemic Stroke During/Post rt-PA Infusion order set, see Page 3**
    - **No**
  - **No**
  - **BP < 185/110 mmHg and symptom onset < 4.5 hours?**
    - Yes
    - **If no contraindications, give aspirin 325 mg**
    - **Management of BP is not recommended for the first 24 hours unless BP > 220/120 mmHg or in the presence of significant comorbidities⁵**
    - **Transfer² to stroke center if appropriate**
    - **No**

**BP** = blood pressure
**DBP** = diastolic blood pressure
**SBP** = systolic blood pressure

¹ See Appendix D for Contraindications to Thrombolytic Therapy
² See Appendix A for Emergency Transfer Administrative Process
³ Blood pressure should not be reduced by > 15%
⁴ For specific cardiac monitoring for continuous infusion administration, refer to the institutional policy attachment Adult Cardiac Medication Monitoring Guidelines (ATT1842)
⁵ Examples of significant comorbidities: severe cardiac failure, aortic dissection, or hypertensive encephalopathy
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INPATIENT/ACCC MANAGEMENT

Administer alteplase\(^1\) per Acute Ischemic Stroke During/Post rt-PA Infusion Order Set

Patient develops severe headache, acute hypertension, severe nausea and vomiting?

- Yes
  - Stop alteplase and obtain STAT CT head without contrast
  - Consult Benign Hematology and Neurosurgery
  - STAT labs: CBC, PT/INR, aPTT, fibrinogen, and type & cross-match
  - Consider treatment with:
    - Cryoprecipitate 10 units infused over 10-30 minutes with additional doses for fibrinogen level < 150 mg/dL
    - Tranexamic acid 1,000 mg IV infusion over 10 minutes or aminocaproic acid 4-5 grams IVPB bolus over 1 hour followed by 1 gram IV infusion until bleeding is controlled (see Acute Intracranial Hemorrhage in Adult Cancer Patients algorithm)

- No
  - Patient develops angioedema?
    - Yes
      - Stop alteplase and treat allergic reaction (see Adult Hypersensitivity (HSR)/Allergic Reaction Management algorithm)
      - Endotracheal intubation:
        - May not be necessary if edema is limited to tongue and lips
        - May be required for edema with rapid progression (within 30 minutes) involving larynx, palate, floor of mouth, or oropharynx
      - Hold all ACE inhibitors and ARBs
    - No
      - Patient’s BP increases to > 180/105 mmHg?
        - Yes
          - Admit to ICU or transfer\(^3\) to stroke center\(^4\) as appropriate
          - Treat hyperglycemia to maintain glucose in a range of 140-180 mg/dL
          - Avoid hypoglycemia (glucose < 60 mg/dL)
          - Stress ulcer prophylaxis
          - Deep vein thrombosis (DVT) prophylaxis\(^5\)
        - No
          - If SBP > 180-230 mmHg or DBP > 105-120 mmHg, consider the following antihypertensives:
            - Labetalol 10 mg IVP bolus then IV continuous infusion\(^7\) at 2-8 mg/minute (do not use if heart rate < 60 beats per minute) or
            - Nicardipine IV continuous infusion\(^7\) at 5 mg/hour. Titrate by 2.5 mg/hour every 5 minutes to desired effect. Maximum dose is 15 mg/hour.

\(^1\) Maintain strict BP control in the first 24 hours after alteplase administration
\(^2\) For specific cardiac monitoring for continuous infusion administration, refer to the institutional policy attachment Adult Cardiac Medication Monitoring Guidelines (ATT1842)
\(^3\) See Appendix A for Emergency Transfer Administrative Process
\(^4\) See Appendix B for Criteria for Transfer to Stroke Center
\(^5\) Initiate mechanical prophylaxis immediately if no contraindications, consider pharmacological prophylaxis 24 hours after alteplase administration, and begin aspirin therapy at least 24-48 hours after alteplase administration

\(ACE\) = angiotensin-converting enzyme
\(ARB\) = angiotensin II receptor blocker

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Approved by The Executive Committee of Medical Staff on 06/15/2021
APPENDIX A: EMERGENCY TRANSFER ADMINISTRATIVE PROCESS

**Transfer accepted?**

- **Yes**
  - Case Management or OSA will:
    - Coordinate EMS transportation
    - Complete the Memorandum of Transfer
    - Ensure proper documentation accompanies patient
    - Notify appropriate nursing unit when the approval to transfer has been obtained along with information such as address and phone numbers for calling clinical report
  - Inform patient/family that care will continue at outside hospital
  - Manage patient as clinically indicated

- **No**
  - Inform patient/family that care will continue at MD Anderson Cancer Center
  - Manage patient as clinically indicated

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1. Contact Case Management or OSA (Off Shift Administrator) via operator. OSA is listed as ‘Administrators On-Call’ in the On-Call directory.
2. Refer to Transfer of Patients to, from and Within MD Anderson Cancer Center Policy (MD Anderson Institutional Policy # CLN0614)
3. UT Memorial Hermann is the preferred stroke center for transfer. Discuss with Attending Physician regarding preference for receiving hospital based on clinical scenario
4. See Appendix E for Texas Medical Center (TMC) Hospital Contact Information. If transfer approval is not promptly obtained, Case Management/OSA to contact alternate hospitals to avoid delay.

- Documentation:
  - “Face sheet”
  - Medical records to include a current reconciled medication list and transfer orders per primary care team
  - Others as appropriate

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EMS = emergency medical services
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APPENDIX B: Criteria for Transfer to Stroke Center

| Thrombectomy in acute ischemic stroke from emergent large vessel occlusion (ELVO) |
|---------------------------------|---------------------------------|
| Time from symptom onset | ● Up to 24 hours  
● If > 24 hours, discuss with stroke center |
| Location of large vessel occlusion | Intracranial and extracranial occlusion of the internal carotid artery (ICA) including tandem or isolated occlusion of the middle cerebral artery (MCA), basilar artery occlusion, and carotid and vertebral dissections |
| Stroke severity by NIHSS score | ● NIHSS score of > 6 per several published trials  
● NIHSS score of < 6 but with disabling symptoms such as isolated aphasia should be considered for thrombectomy  
● No improvement in NIHSS score post alteplase administration |
| Age and baseline level of functioning | Assessment of thrombectomy risk benefits with primary oncologist in patients with significant disability, refractory cancer, wild metastatic disease, poor performance status, and contraindications to alteplase administration |

**Note:** Patients who received alteplase could be considered candidates for thrombectomy. Such cases should be further discussed with the stroke center/specialist.
APPENDIX C: National Institutes of Health Stroke Scale (NIHSS)

<table>
<thead>
<tr>
<th>Title</th>
<th>Responses</th>
<th>Score</th>
</tr>
</thead>
</table>
| 1A Level of consciousness | 0 – Alert  
1 – Drowsy  
2 – Obtunded  
3 – Coma/unresponsive |       |
| 1B Orientation questions (2) | 0 – Answers both correctly  
1 – Answers 1 correctly  
2 – Answers neither correctly |       |
| 1C Response to commands (2) | 0 – Performs both task correctly  
1 – Performs 1 task correctly  
2 – Performs neither |       |
| 2 Gaze | 0 – Normal horizontal movements  
1 – Partial gaze palsy  
2 – Complete gaze palsy |       |
| 3 Visual field | 0 – No visual defect  
1 – Partial hemianopia  
2 – Complete hemianopia  
3 – Bilateral hemianopia |       |
| 4 Facial movement | 0 – Normal  
1 – Minor facial weakness  
2 – Partial facial weakness  
3 – Complete unilateral palsy |       |
| 5 Motor function (arm):  
○ Left  
○ Right | 0 – No drift  
1 – Drift before 10 seconds  
2 – Falls before 10 seconds  
3 – No effort against gravity  
4 – No movement |       |
| 6 Motor function (leg):  
○ Left  
○ Right | 0 – No drift  
1 – Drift before 5 seconds  
2 – Falls before 5 seconds  
3 – No effort against gravity  
4 – No movement |       |
| 7 Limb ataxia | 0 – No ataxia  
1 – Ataxia in 1 limb  
2 – Ataxia in 2 limbs |       |
| 8 Sensory | 0 – No sensory loss  
1 – Mild sensory loss  
2 – Severe loss |       |
| 9 Language | 0 – Normal  
1 – Mild aphasia  
2 – Severe aphasia  
3 – Mute or global aphasia |       |
| 10 Articulation | 0 – Normal  
1 – Mild dysarthria  
2 – Severe dysarthria |       |
| 11 Extinction or inattention | 0 – Absent  
1 – Mild loss (1 sensory modality lost)  
2 – Severe loss (2 modalities lost) |       |

Score ≤ 25: Very severe neurological impairment

Score 5-24: Mild to severe neurological impairment

Score < 5: Mild impairment
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APPENDIX D: Contraindications to Thrombolytic Therapy

**ABSOlute CONTRAINDICATIONS**

- Patient history:
  - Ischemic stroke or severe head trauma in the previous 3 months
  - Previous intracranial hemorrhage
  - Intra-axial intracranial neoplasm
  - Gastrointestinal malignancy
  - Gastrointestinal hemorrhage in the previous 21 days
  - Intracranial or intraspinal surgery within the prior 3 months

- Clinical:
  - Symptoms suggestive of subarachnoid hemorrhage
  - Persistent blood pressure elevation (SBP ≥ 185 mmHg or DBP ≥ 110 mmHg)
  - Active internal bleeding
  - Presentation consistent with infective endocarditis
  - Stroke known or suspected to be associated with aortic arch dissection
  - Acute bleeding diathesis, including but not limited to conditions defined under hematologic Hamatologic:
    - Platelet count < 100 K/microliter
    - Current anticoagulant use with an INR > 1.7 or PT > 15 seconds or aPTT > 40 seconds
    - Current use of treatment dose LMWH in the past 24 hours (e.g., to treat VTE and ACS); this exclusion does not apply to prophylactic doses (e.g., to prevent VTE)
    - Current use of direct thrombin inhibitors (dabigatran) or direct factor Xa inhibitors (rivaroxaban, apixaban, and edoxaban) within 48 hours assuming normal renal function

- CT head/MRI brain findings:
  - Evidence of hemorrhage
  - Extensive regions of obvious hypodensity consistent with irreversible injury

**Relative CONTRAIndICATIONS**

- Only minor and isolated neurologic signs or rapidly improving symptoms
- Serum glucose < 50 mg/dL (≤ 2.8 mmol/L) or > 400 mg/dL (≥ 22.2 mmol/L)
- Serious trauma in the previous 14 days
- Major surgery in the previous 14 days
- History of gastrointestinal bleeding (remote) or genitourinary bleeding
- Seizure at the onset of stroke with postictal neurologic impairments
- Pregnancy
- Arterial puncture at a noncompressible site in the previous seven days
- Large (≥ 10 mm), untreated, unruptured intracranial aneurysm
- Untreated intracranial vascular malformation

**ADDITIONAL CONTRAINDICATION IF SYMPTOM ONSET 3-4.5 HOURS**

- Age > 80 years
- Oral anticoagulant use regardless of INR
- Severe stroke (NIHSS score > 25, see Appendix C)
- Combination of both previous ischemic stroke and diabetes mellitus

ACS = acute coronary syndrome  
LMWH = low molecular weight heparin  
VTE = venous thromboembolism

1 Although it is desirable to know the results of these tests, thrombolytic therapy should not be delayed while results are pending unless there is clinical suspicion of a bleeding abnormality or thrombocytopenia, the patient is currently on or has recently received anticoagulants (e.g., heparin, warfarin, a direct thrombin inhibitor, or a direct factor Xa inhibitor), or use of anticoagulants is not known. Otherwise, treatment with intravenous alteplase can be started before availability of coagulation test results but should be discontinued if the INR, PT, or aPTT exceed the limits stated in the table, or if platelet count is < 100 K/microliter.

2 Consult Benign Hematology

3 Patients may be treated with intravenous alteplase if glucose level is subsequently normalized

4 Alteplase is reasonable in patients with a seizure at stroke onset if evidence suggests that residual impairments are secondary to acute ischemic stroke and not to a postictal phenomenon

5 The safety and efficacy of administering alteplase is uncertain for these relative exclusions

6 Although these were exclusions in the trial showing benefit in the 3-4.5 hour window, intravenous alteplase appears to be safe and may be beneficial for patients with these criteria, including patients taking warfarin with an INR < 1.7

Department of Clinical Effectiveness V9  
Approved by The Executive Committee of Medical Staff on 06/15/2021
APPENDIX E: Texas Medical Center (TMC) Hospital Contact Information

<table>
<thead>
<tr>
<th>For Transfers:</th>
<th>Memorial Hermann TMC</th>
<th>CHI St. Luke’s TMC</th>
<th>Methodist TMC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Transfer Center (713) 704-2500</td>
<td>Transfer Center (832) 355-2233</td>
<td>Transfer Center (713) 441-6804</td>
</tr>
</tbody>
</table>
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SUGGESTED READINGS


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DEVELOPMENT CREDITS

This practice consensus statement is based on majority opinion of the Ischemic Stroke work group experts at the University of Texas MD Anderson Cancer Center for the patient population. These experts included:

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