PEDIATRIC ARTERIAL ISCHEMIC STROKE (AIS)

Algorithm 1. Stroke Alert - Network of Care (NOC) or Outside Hospital (OSH)

Inclusion Criteria:
- Patients older than 1 month of age, with onset of signs/symptoms of focal neurological deficit within last 24 hours

Exclusion Criteria:
- Patients with: Moyamoya or brain tumor; seizures with Todd’s paralysis; current signs of meningitis or endocarditis; onset of signs/symptoms more than 24 hours ago; hemorrhagic stroke

Signs/symptoms of focal neurological deficit:
- Weakness on one side of the body
- Numbness on one side of the body
- Weakness on one side of the face
- Able to understand, but not speak
- Awake and alert, but “word salad” speech
- Uncoordinated on one side of body
- Unable to see on one side

Does patient have focal neurological deficit with onset within the last 24 hours?

Contact CHCO Neurology via Transfer Center (720-777-8838) for appropriate disposition:
8am – 5pm: Neurology Inpatient ICU Resident
5pm – 8am: Neurology Inpatient Resident

Call Transfer Center (720-777-8838) to place a text page to Neurology Inpatient Resident
"Emergency page, stroke concern NOC or OSH"

Transfer Center will coordinate conference call between Neurology Inpatient Resident, referring physician, and any other physicians requested, to determine optimal patient evaluation, treatment and disposition

Transfer:
Most patients who need stroke care will be transferred to Children’s Hospital Colorado Anschutz campus. In conjunction with Network of Care (NOC) or outside hospital (OSH) provider, Neurology may consider direct transfer to facility with intra-arterial (IA) availability, such as University Hospital, if the patient is good candidate for consideration of IA therapy.

For direct transfer of a child to University Hospital, patient must meet the following:
- Age 14 years or older
- Previously healthy
- Weight greater than 40kg
- No history of Sickle Cell Disease (SCD)

Obtain CT Head
If advised by stroke team, obtain MRI/MRA or CTA Head/Neck

Is there a demonstrated large vessel (ie internal carotid artery or M1) occlusion or high likelihood of a large vessel occlusion?

Is this a likely diagnosis of stroke in an otherwise uncomplicated patient?

Transfer to CHCO to evaluate for stroke

Patient meets criteria for consideration of intra-arterial therapy after evaluation at CHCO? (see Appendix E)

May consider transfer to alternative comprehensive stroke center or CHCO weighing risks and benefits of dual transfer

May transfer to University if clinically appropriate for consideration of intra-arterial therapy; if not, transfer to CHCO

Keep patient at CHCO for further work up

May transfer to University if clinically appropriate for consideration of intra-arterial therapy

Yes

No

Yes

No

Yes

No

Yes

No
Algorithm 2. Stroke Alert ED/PICU/CICU

A patient presenting with signs/symptoms of focal neurological deficit such as:
- Weakness on one side of the body
- Numbness on one side of the body
- Weakness on one side of the face
- Able to understand but not speak
- Awake and alert but ‘word salad’ speech
- Uncoordinated on one side of the body
- Unable to see on one side

Does the patient meet the Phase I Stroke Alert Criteria?

No

Call for a neurology consult (+ hematology for sickle cell disease patients) ext. 7-3990

Yes

Inclusion Criteria:
- Patients older than 1 month of age, with onset of signs/symptoms of focal neurological deficit within last 24 hours

Exclusion Criteria:
- Patients with: Moyamoya or brain tumor; seizures with Todd’s paralysis; current signs of meningitis or endocarditis; onset of signs/symptoms more than 24 hours ago; hemorrhagic stroke

Begin algorithm

Call a Phase I Stroke Alert! ext.7-5555
Note: ANY provider may call a Phase I Stroke Alert

Algorithm continued on page 3

Options for a work-up outside of stroke alert:
EPIC order – MRI Stroke or TIA (urgent perform within 24 hours)
Note: attending to attending discussion required if outside of pathway
Algorithm 2. Continuation of Stroke Alert

**ED/PICU/ICU/Floor Procedures:**
- May use EPIC orderset – EDSTROKE
- Vital signs: Pulse oximetry, height, weight, temperature, pulse, respiratory rate, and blood pressure
- Establish IV access
- EKG
- NPO
- Head of bed flat
- Normotension: target systolic blood pressure between 50th percentile and 15% above 95th percentile for age. Treat low blood pressure with normal saline. Consider treatment of malignant hypertension with labetolol or ACE inhibitor to lower by no more than 25% over 24 hours
- Normovolemia: normal saline at maintenance (Warning: Hold IV fluids until mass is ruled out with initial scan)
- Normal O2: Titrate O2 to maintain SPO2 greater than 92%
- Normoglycemia: no glucose in intravenous fluid unless hypoglycemic
- Normothermia: treat temperature greater than 38.3°C with acetaminophen
- Seizure control: AED for suspected seizure activity
- Transfer to PICU if currently on non-ICU floor (except ED)

**Neurology Procedures:**
- Neurology at bedside ASAP, responsibilities include:
  - Document Pediatric NIH Stroke Scale score
  - Indications for phase II Stroke Alert
    a. Non-neonatal stroke
    b. Presentation consistent with AAIS
    c. Time of symptom onset within 24 hours
  - NOTE: If patient is within Intra-arterial (IA) timeframe, greater than 40kg, greater than or equal to 14 years of age and previously healthy, may consider direct transfer to University Hospital for IA availability without pediatric anesthesiology. Younger patients will need to be stabilized at CHCO and accompanied by a pediatric anesthesiologist and pediatric nurse if transferred.
  - Neurology to review tPA form (Appendix A) and IA checklist (Appendix F) for guidance
  - Neurology to obtain signed consent and order tPA via Epic order set in ED/PICU/ICU setting
  - Neurology to determine appropriate disposition

**Options for work up outside of stroke alert:**
- EPIC order - MRI Stroke or TIA (urgent perform within 24 hrs); can be expedited to be as soon as possible but outside of pathway requires attending to attending discussion

**Abbreviation Key:**
- AAIS: acute arterial ischemic stroke
- IA: intra-arterial
- TIA: transient ischemic attack
- tPA: tissue plasminogen activator
Algorithm 3. Stroke Alert - Colorado Springs Hospital

**Inclusion Criteria:**
- Patients older than 1 month of age, with onset of signs/symptoms of focal neurological deficit within last 24 hours

**Exclusion Criteria:**
- Patients with: Moyamoya or brain tumor; seizures with Todd’s paralysis; current signs of meningitis or endocarditis; onset of signs/symptoms more than 24 hours ago; hemorrhagic stroke

**Signs/symptoms of focal neurological deficit:**
- Weakness on one side of the body
- Numbness on one side of the body
- Weakness on one side of the face
- Able to understand, but not speak
- Awake and alert, but “word salad” speech
- Uncoordinated on one side of body
- Unable to see on one side

**Transfer:**
Most patients who need stroke care will be transferred to Children’s Hospital Colorado Anschutz campus. In conjunction with the CHCO Colorado Springs provider, Neurology may consider direct transfer to facility with intra-arterial (IA) availability, such as University Hospital, if the patient is good candidate for consideration of IA therapy.

- Age 14 years or older
- Previously healthy
- Weight greater than 40kg
- No history of Sickle Cell Disease (SCD)

**Obtain CT head. Add CTA Head/Neck if there are no contraindications to IV contrast.**
If advised by the on-call Neurologist, obtain MRI/MRA Head/Neck.

**Is there a demonstrated large vessel (ie internal carotid artery or M1) occlusion or high likelihood of a large vessel occlusion?**

**Is this a likely diagnosis of stroke in an otherwise uncomplicated patient?**

**Consider transfer to CHCO Anschutz for sickle cell and other cases require specialized intervention**

**Patient meets criteria for consideration of intra-arterial therapy?**
(see Appendix F)

**May consider transfer to nearest comprehensive stroke center or CHCO Anschutz weighing the risks and benefits of dual transfer**

**Is patient 14 years or older and greater than 40kg?**

**May transfer to the nearest comprehensive stroke center for consideration of intra-arterial therapy**

**Keep patient at current CHCO facility – Anschutz or Colorado Springs – for further workup**

Call Transfer Center (720-777-8838) to place a text page to the on-call CHCO Colorado Springs Neurologist. The Neurologist will determine whether to include the CHCO stroke team on the call, which the transfer center can arrange.

Transfer Center will coordinate conference call between Neurology, referring physician, and any other physicians requested, to determine optimal patient evaluation, treatment and disposition.

May transfer to the nearest comprehensive stroke center if clinically appropriate for consideration of intra-arterial therapy.
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- **Initial Triage for Children OUTSIDE CHCO**
- **Initial Evaluation and Clinical Management**
- **Treatment**
- **Further Work-up**

**EPIC Order Sets, Phone Numbers, Forms and Documents**

- **Appendix A.** Stroke Alert – tPA Form
- **Appendix B.** Patient Informed Consent – IV-tPA for Stroke
- **Appendix C.** Childhood Acute Ischemic Stroke Educational Material
- **Appendix D.** Pediatric NIH Stroke Scale (NIHSSPed)
- **Appendix E.** Early Decompressive Surgery in Malignant Infraction
- **Appendix F.** IA Therapy Checklist

**References**

**Clinical Improvement Team**

### TARGET POPULATION

**Inclusion Criteria**

- Patients older than 1 month of age, with onset of signs/symptoms of focal neurological deficit within last 24 hours

**Exclusion Criteria**

Patients with:

- Moyamoya or brain tumor
- Seizures with Todd’s paralysis
- Current signs of meningitis or endocarditis
- Onset of signs/symptoms more than 24 hours ago
- Hemorrhagic Stroke

### BACKGROUND | DEFINITIONS

**Focal neurological deficit:** signs/symptoms of focal neurological deficit may include one or more of the following:

- Weakness on one side of body
• Numbness on one side of the body
• Weakness on one side of the face
• Able to understand, but not speak
• Awake and alert, but “word salad” speech
• Uncoordinated on one side of body
• Unable to see on one side

INITIAL TRIAGE (SEE ALGORITHM 1. STROKE ALERT NOC OR OSH)

For children located OUTSIDE (NOC or OSH) of Children’s Hospital Colorado (CHCO) Anschutz campus

If patient displays symptoms 24 hours or less and focal neurological deficit:

• Call the Transfer Center (720-777-8838) to place a text page to Neurology Inpatient Resident: “Emergency page, stroke concern NOC or OSH”.
• Transfer Center will coordinate conference call between Neurology Inpatient Resident, referring physician, and any other physicians requested, to determine optimal patient evaluation, treatment, and disposition.
• The Neurology fellow is expected to call back immediately and provide further guidance.
• If the patient has sickle cell disease (SCD), the neurology resident and transfer center will conference in the hematology fellow/attending immediately.

Most patients who need stroke care will be transferred to Children’s Hospital Colorado Anschutz Campus. In conjunction with Network of Care (NOC) or outside hospital (OSH) provider, Neurology may consider direct transfer to facility with intra-arterial (IA) availability, such as University Hospital, if the patient is a good candidate for consideration of IA therapy.

For direct transfer to University Hospital (UH), children must meet the following:

• Age 14 years or older
• Previously healthy
• Weight greater than 40kg
• No history of Sickle Cell Disease (SCD)

If not meeting criteria for transfer to UH, may consider transfer to alternative comprehensive stroke center or CHCO weighing risks and benefits of dual transfer.

Treatment considerations for NOC or OSH provider to discuss with Neurology:

• Call hematology for SCD patients
• Aspirin after hemorrhage ruled out by imaging
• Transportation
  o Utilize most rapid means of transportation available, based upon timeframe for potential treatment. Take into account distance, weather, and the patient’s clinical status
  o Transfer Center can assist in arranging transportation
  o Transport with 1 parent if possible to facilitate rapid stroke treatment consent
  o Frequent neurological checks en route
Symptoms more than 24 hours:

Contact CHCO Neurology via Transfer Center (720-777-8838) for appropriate disposition:

- 8am – 5pm: Neurology Inpatient ICU Resident
- 5 pm – 8am: Neurology Inpatient Resident

INITIAL TRIAGE (SEE ALGORITHM 3. STROKE ALERT COLORADO SPRINGS HOSPITAL)

For children located at Colorado Springs Hospital Campus

If patient displays symptoms 24 hours or less and focal neurological deficit:

- Call the transfer center (720-777-8838) to place a text page to the on call CHCO Neurology - Colorado Springs provider. The Colorado Springs Neurologist will determine whether to include the CHCO stroke team on the call, which the transfer center can arrange
- Transfer Center will coordinate conference call between the on-call Colorado Springs Neurologist, referring physician, and any other physicians requested, to determine optimal patient evaluation, treatment, and disposition.
- If the patient has sickle cell disease (SCD), the neurology resident and transfer center will conference in the hematology fellow/attending immediately.

The main reasons for transferring a child with stroke from Children’s Hospital Colorado – Colorado Springs campus to the Anschutz Campus (CHCO or University), or to another comprehensive stroke center are 1) for intra-arterial therapy, 2) for consideration of exchange transfusion in the case of sickle cell disease, or 3) for other complicated strokes for which the resources are not available at the Colorado Springs Campus.

For direct transfer to University Hospital (UH), children must meet the following:

- Age 14 years or older
- Previously healthy
- Weight greater than 40kg
- No history of Sickle Cell Disease (SCD)

If not meeting criteria for transfer to UH, may consider transfer to alternative comprehensive stroke center or CHCO weighing risks and benefits of dual transfer.

Treatment considerations for the Colorado Springs Hospital provider to discuss with Neurology:

- Call hematology for SCD patients
- Aspirin after hemorrhage ruled out by imaging
- Transportation
- Utilize most rapid means of transportation available, based upon timeframe for potential treatment. Take into account distance, weather, and the patient’s clinical status
- Transfer Center can assist in arranging transportation
- Transport with 1 parent if possible to facilitate rapid stroke treatment consent
- Frequent neurological checks en route
INITIAL EVALUATION AND CLINICAL MANAGEMENT (SEE ALGORITHM 2)

AT CHILDREN’S HOSPITAL COLORADO ANSCHUTZ CAMPUS

STROKE ALERT - PHASE I Procedures

Stroke Alert Phase I should be called for any patient who meets the following:

Phase I Stroke Alert Criteria:

- **Focal Neurological Deficit**
- Older than 30 days of age
- Onset of symptoms < 24 hours ago
- No history of Moyamoya disease or brain tumor
- No history of seizures with Todd’s paralysis (first time seizure is not a contraindication)
- No signs of meningitis or endocarditis

**Note:** Any provider in the hospital can call a stroke alert

**Roles and Responsibilities**

- **Neurology Inpatient Resident** is expected to evaluate patient ASAP and direct management of all non-sickle cell patients. Neurology responsibilities include:
  - Document Pediatric NIH Stroke Scale score
  - Establish time of onset
  - Call **Phase II Stroke Alert** if appropriate: 1. Operator (75555) 2. CT Tech (78645)
- **Acute Stroke Team Attending** will co-attend with the neurology attending for any thrombolysis candidates from arrival to CHCO through tPA administration, and/or transfer to University for potential thrombectomy.
- **Neurology attending** is the primary neurology attending of record for all stroke patients, and responsible for final neurology recommendations.
- **Hematology fellow** is expected to evaluate sickle cell disease (SCD) patients ASAP and hematology will direct management of all SCD patients. If red cell exchange is indicated, hematology will contact apheresis team. Hematology fellow is also expected to review hematology/coagulation labs, dosing of tissue plasminogen activator (tPA), and contraindications for non-SCD patients.
- **Primary team (ED/PICU/CICU/Floor)** is expected to order initial labs and start basic stroke care (EPIC orderset: EDSTROKE)
- **PICU Fellow** is expected to identify bed in PICU (or CICU as appropriate) & prepare for possible post-tPA/IA therapy. If patient has SCD, preparations will include line placement for red cell exchange.
- **Anesthesiology Fellow** is expected to notify attending and prepare for sedated MRI, likely with Propofol.
- **Radiology MR Tech (7 am - 6 pm) or CT Tech (6 pm - 7 am)** – (ext 78645) is expected to schedule STAT MRI head and neck at Phase II – MRI Brain STROKE ALERT – EMERGENT (performed ASAP).
- **Pharmacy** is expected to prepare for possible need for tPA.
- **Nursing Supervisor** is expected to prepare for possible need for tPA.
- **Cardiology Fellow** is expected to evaluate patient within 30 minutes if there is known/suspected cardiac disease.
Stabilization of Patient: In Emergency Department (ED) or PICU/CICU

May use EPIC orderset: EDSTROKE

- Vital signs: Pulse oximetry, height, weight, temperature, pulse, respiratory rate, and blood pressure
- Establish IV access
- EKG
- NPO
- Head of bed flat
- Normotension: target SBP between 50th%ile and 15% above 95th%ile for age. Treat low blood pressure with normal saline. Consider treatment of malignant HTN with labetolol or ACE inhibitor to lower by no more than 25% over 24 hours.
- Normovolemia: NS at maintenance (Warning: Hold IV fluids until mass is ruled out with initial scan)
- Normal O₂: Titrate O₂ to maintain SPO₂ > 92%
- Normoglycemia: no glucose to IV unless hypoglycemic
- Normothermia: treat all T > 38.3°C with acetaminophen
- Seizure control: AED for suspected seizure activity
- Transfer to PICU if patient is currently on non-ICU floor (except ED)

<table>
<thead>
<tr>
<th>Patients with Sickle Cell disease (SCD)</th>
<th>Patients with Sickle Cell disease (SCD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Labs:</strong> CBC, CMP, DIC panel, LFTs,</td>
<td>CBC, CMP, serum or urine β-HCG when</td>
</tr>
<tr>
<td>ESR, CRP, urine toxicology screen.</td>
<td>appropriate, urine toxicology screen,</td>
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<tr>
<td>When appropriate serum or urine β-</td>
<td>type and cross match, and hemoglobin</td>
</tr>
<tr>
<td>HCG or specialized testing for patient</td>
<td>electrophoresis. Draw blood cultures</td>
</tr>
<tr>
<td>on anticoagulation.</td>
<td>if SCD patient is febrile.</td>
</tr>
<tr>
<td><strong>Imaging:</strong> MRI BRAIN STROKE ALERT</td>
<td>MRI BRAIN STROKE ALERT – EMERGENT</td>
</tr>
<tr>
<td>– EMERGENT (perform ASAP)</td>
<td>– EMERGENT (perform ASAP)</td>
</tr>
<tr>
<td>CT head - if MRI is not immediately</td>
<td>CT head- if MRI is not</td>
</tr>
<tr>
<td>available or patient symptoms are</td>
<td>immediately available or patient</td>
</tr>
<tr>
<td>worsening.</td>
<td>symptoms are worsening.</td>
</tr>
<tr>
<td><strong>Other:</strong> If neurology asks for a</td>
<td>If neurology asks for a different</td>
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<td>different imaging modality, such as</td>
<td>imaging modality, such as</td>
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<tr>
<td>CT/CTA, then proceed with that</td>
<td>CT/CTA, then proceed with that</td>
</tr>
<tr>
<td>modality.</td>
<td>modality.</td>
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<tr>
<td>Febrile patients: consider starting</td>
<td>Febrile patients <em>with</em> SCD: start</td>
</tr>
<tr>
<td>antibiotics and drawing blood cultures.</td>
<td>antibiotics after drawing blood</td>
</tr>
<tr>
<td></td>
<td>cultures.</td>
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</tbody>
</table>
STROKE ALERT - PHASE II Procedures

In Stroke Alert - Phase II (Radiology), Goal – complete within 60 to 120 minutes (1-2 hours) of presentation

- Primary team (ED/PICU/CICU/Floor) See EPIC orderset: EDSTROKE
- Expected to order MRI Brain STROKE ALERT – EMERGENT (performed ASAP). In certain clinical situations, a CT/CTA or other imaging modality may be preferable to MRI. If neurology asks for a different imaging modality, such as CT/CTA, then proceed with that modality.
- Neurology to complete IA/IV tPA criteria form (Appendix A), dose tPA (via order set: tPA for stroke), and educate family. Neurology to also review IA therapy checklist (Appendix F).

Post-MRI Case Review:

- Radiology reviews MRI for confirmation of acute infarction with restricted diffusion in an arterial territory consistent with the clinical syndrome.
- Radiology confirms no intracranial arterial dissection or other contraindications to tPA and/or follows IA therapy checklist including providing stroke volumes (Appendix F).
- Available personnel from Neurology, Attending (ED, CICU or PICU), Cardiology (if appropriate), Hematology (if applicable) and Stroke Team to meet in person and/or via speakerphone (7-3990 can facilitate) and discuss MRI findings and clinical presentation.
- If there is consensus, that patient should be considered for IV tPA, and/or thrombectomy then therapy may be offered.
- If patient has a large stroke (>50% of MCA), they should be followed by the Early Decompressive Surgery in Malignant Infarction guideline (Appendix E).

TREATMENT

If less than 4.5 hours from symptom onset (and does not have SCD):
If less than 4.5 hours from symptom onset and good intravenous (IV) tissue Plasminogen Activator (tPA) candidate, IV tPA will be offered if:

- Consent is signed (see Appendix B)
- Care team consensus is to offer therapy

If more than 4.5 hours from symptom onset (and does not have SCD):
If patient is a good candidate for IA therapy (see Appendix F), consider transfer to UH.

IA therapy will be performed if:

- Family desires transfer
- Care team consensus is to offer therapy

In special circumstances, such as basilar thrombosis, the decision to provide intra-arterial therapies beyond established guidelines may be made, but are outside the scope of this guideline.

Management of tPA administration

- Once tPA is brought to the PICU for administration (or ED/CICU if appropriate), the tPA will be physically held by the Stroke Team until the decision is made by the Stroke Team Attending to administer the drug.
- Recently extubated patients will not be administered tPA until they are through the entire extubation process, and completely stable from a respiratory and cardiovascular standpoint, as deemed by the PICU attending.
• Extubation and recovery should follow standard of care guidelines at all times, including a safe hand-off to the PICU from anesthesia. Consideration of tPA will only be made once patient has completed recovery from extubation, as deemed appropriate by the by the PICU attending. Alternatively, care team may decide to offer tPA to a patient who is sedated and intubated if clinically appropriate.

Usual Dosage Range and Route for Systemic tPA (use tPA for stroke ORDERSET):

0.9 mg/kg to a maximum of 90 mg:

• First 10% of calculated dose GIVEN BY PHYSICIAN as intravenous bolus dose.
• Remaining 90% of calculated dose given in infusion over 1 hour.

If outside time window or excluded for other reasons, options for workup include:

• If stroke concern still exists but patient is not appropriate for acute intervention due to contraindication or timeline, obtain neurology consult to decide upon further workup and disposition.
• Admitted patients outside of the acute pathway (e.g. possible AIS outside of the 24 hour time-window or with a high suspicion TIA) should receive cerebral and neurovascular imaging within 24 hours of presentation as tolerated, or sooner if indicated. Exact timing of MRI (and consideration of interval head CT) for patients in this latter category should involve an attending-to-attending discussion between neurology (and/or stroke attending) and radiology.
  o MRI Stroke or TIA (Urgent, perform within 24 hours). This will include MRI brain and MRA head and neck (time of flight with contrast and T1 fat sat images) performed at less than 24 HOURS.
  o MRI BRAIN STROKE ALERT – EMERGENT (perform ASAP) only if approved by attending-to-attending discussion with Radiology

FURTHER WORK-UP AND MANAGEMENT OF PATIENTS WITH ARTERIAL ISCHEMIC STROKE OR TIA (NON-SICKLE CELL DISEASE)

• Please use EPIC sub-acute stroke order-set for complete work-up and management guidelines.
• Admitted patients should be monitored in PICU or CICU for at least 24 hours.
• Patients receiving tPA should be cared for using the tPA specific sub-acute stroke orderset.

EPIC ORDER SETS, PHONE NUMBERS, FORMS AND DOCUMENTS

<table>
<thead>
<tr>
<th>EPIC:</th>
<th>Important phone numbers:</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED Stroke Orderset: EDSTROKE</td>
<td>Stroke Alert phase I: Operator (75555)</td>
</tr>
<tr>
<td>PICU Stroke Orderset (no tPA given)</td>
<td>Stroke Alert Phase II: Operator (75555) &amp; CT tech (78645)</td>
</tr>
<tr>
<td>Subacute AIS Management – no alteplase given</td>
<td>Inpatient On-call Neurology Resident: One-call (7-3990)</td>
</tr>
<tr>
<td>PICU Stroke Orderset (tPA given)</td>
<td>Stroke Attending: One-call (7-3990)</td>
</tr>
<tr>
<td>Subacute AIS Management – alteplase given</td>
<td>University Hospital Stroke Service: UH ICU (720-848-5490)</td>
</tr>
<tr>
<td>Neuro Stroke assessment and plan: .strokeorders (smart phrase)</td>
<td>Conference Call: One-Call (7-3990)</td>
</tr>
<tr>
<td>tPA orderset: tPA for Stroke</td>
<td>Call One-Call with time of conference call (typically in 5-10 minutes) &amp; desired participants. One-Call will page everyone and set-up call.</td>
</tr>
<tr>
<td>Transfer center: 720-777-8838</td>
<td></td>
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</tbody>
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<thead>
<tr>
<th>Stroke MRIs:</th>
<th>Related forms and documents:</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRI Stroke Alert (Emergent, perform ASAP) – MRI/MRA head and neck for stroke alert</td>
<td>tPA form</td>
</tr>
<tr>
<td>MRI Stroke or TIA (Urgent, perform within 24 hours) – MRI/MRA head and neck for inpatient needing urgent imaging (i.e.- stroke concern &gt;12 hours or TIA)</td>
<td>Pediatric NIH Stroke Scale</td>
</tr>
<tr>
<td>MRI Stroke (Routine) – MRI/MRA head and neck that is not urgent</td>
<td>Consent Form</td>
</tr>
</tbody>
</table>
APPENDIX A. STROKE ALERT – TPA FORM (REVISED 05/25/12)

Indications and contraindications for imaging and consideration of tPA administration

**Part I: INDICATIONS for Stroke Alert PHASE II imaging** (‘Yes’ to **all** criteria required)

- No / Yes 1. Non-neonatal stroke
- No / Yes 2. Clinical presentation consisting of clearly defined acute onset of neurological deficit in a pattern consistent with arterial territory ischemia.
- No / Yes 3. Time of symptom onset within 24 hours. Time of symptom onset is defined as time the patient was last seen awake and at neurological baseline.

**Note:** Patient outside of these criteria may still need emergent imaging, but this must be discussed with radiology

**Part II: INDICATIONS for consideration of IA/IV tPA**

- **Note:** In extraordinary circumstances, where aggressive measures may be lifesaving, these contraindications may be waived.

- No / Yes 1. Age 2-17 years inclusive** Note:** Patients 18 or older may be eligible for IV or IA tPA as standard of care.
- No / Yes 2. Clinical presentation consisting of clearly defined acute onset of neurological deficit in a pattern consistent with arterial territory ischemia.
- No / Yes 3. Clinically significant deficit as defined by a PedNIHSS score of > 6 and < 24 felt to be due to acute stroke that is not improving at the time of initiation of tPA administration. (Note: NIHSS ≥ 24 is an absolute contraindication for the previous NIH TIPS TRIAL, but relative contraindication for tPA in adults (or children in selected circumstances))
- No / Yes 4. Time of symptom onset (defined as time the patient was last seen awake and at neurological baseline) within 4.5 hours of initiation of treatment for IV tPA?

**Note:** In adults (or children in selected circumstances) within 6 hours of onset in an anterior circulation stroke, IA therapy may be considered. In adults (or children in selected circumstances) with posterior circulation events the therapeutic window may be extended beyond 6 hours.

- No / Yes 5. Radiological confirmation of an acute arterial ischemic stroke in one of two ways:
  - a. MRI confirmation, consisting of acute infarction with restricted diffusion in an arterial territory consistent with the clinical syndrome plus MRA showing partial or complete occlusion in an intracranial artery corresponding to the infarct location, OR
  - b. CT and CT angiogram confirmation consisting of normal head CT or early hypodensity in an arterial territory consistent with the clinical syndrome plus CT angiogram showing partial or complete occlusion in an intracranial artery corresponding to the infarct location
- No / Yes 6. Baseline neuroimaging (CT or MRI) with no evidence of intracranial hemorrhage (including HI-1, HI-2, PH-1 or PH-2). If no head CT scan done, pre-tPA MRI must include GRE or susceptibility weighted imaging (SWI) sequences.
- No / Yes 7. Seizures are not the cause of the neurological deficit. Children with seizures at or following onset of stroke may be included, as long as the clinical picture is consistent with the documented arterial occlusion.

**Part III: CONTRAINDICATIONS for consideration of IA/IV tPA**

- **Note:** In extraordinary circumstances, where aggressive measures may be lifesaving, these contraindications may be waived.

- No / Yes 1. Is this a patients in whom time of symptom onset is unknown.
- No / Yes 2. Is the patient pregnant?
- No / Yes 3. Is the clinical presentation suggestive of subarachnoid hemorrhage (SAH), even if head CT scan is negative for blood?
- No / Yes 4. Would the patient decline blood transfusion if indicated?
- No / Yes 5. Does the patient have a known history of prior intracranial hemorrhage?
- No / Yes 6. Does the patient have a known history of cerebral arterial venous malformation, aneurysm, or neoplasm?
- No / Yes 7. Is there persistent Systolic Blood Pressure > 15% above the 95th percentile for age while sitting or supine?
- No / Yes 8. Does the patient have a glucose <50 or > 400 mg/dl?
- No / Yes 9. Does the patient have a bleeding diathesis including platelets less than (<) 100,000, PT greater than (>) 15 sec (INR > 1.4) or elevated PTT greater than (>) upper limits of the normal range.
- No / Yes 10. Is the clinical presentation consistent with acute myocardial infarction (MI) or post-MI pericarditis that requires evaluation by cardiology prior to treatment?
No / Yes 11. Does the patient have a known history of stroke, major head trauma, or intracranial surgery within the past 3 months?

No / Yes 12. Does the patient have a known history of major surgery or parenchymal biopsy within 10 days (relative contraindication for NIH TIPS TRIAL and adults)?

No / Yes 13. Does the patient have a known history of gastrointestinal or urinary bleeding within 21 days (relative contraindication for NIH TIPS TRIAL and adults)?

No / Yes 14. Does the patient have a known history of arterial puncture (or arterial catheter) at noncompressible site or lumbar puncture within 7 days. Patients who have had a cardiac catheterization via a compressible artery are not excluded. (relative contraindication for NIH TIPS TRIAL and adults)?

No / Yes 15. Does the patient have an active malignancy or a history of malignancy within 1 month of completion of treatment for cancer?

No / Yes 16. Does the patient have a known history an underlying bleeding disorder? Patients with a mild platelet dysfunction, mild Von Willebrand’s Disease or other mild bleeding disorder are not excluded.

No / Yes 17. Does the patient have a mild deficit (PedNIHSS ≤ 6) at start of tPA infusion?

No / Yes 18. Does the patient have a severe deficit suggesting very large territory stroke, with pre-tPA PedNIHSS greater than (> 25), regardless of the infarct volume seen on neuroimaging. (Note: absolute contraindication for TIPS, but relative contraindication for tPA in adults (or children in selected circumstances)?

No / Yes 19. Is the stroke suspected to be due to subacute bacterial endocarditis, moyamoya, sickle cell disease, meningitis, bone marrow or fat embolism?

No / Yes 20. Does the patient have a known history of previously diagnosed primary angiitis of the central nervous system (PACNS) or secondary CNS vasculitis. Focal cerebral arteriopathy (FCA) of childhood is not a contraindication?

No / Yes 21. Is there intracranial hemorrhage (HI-1, HI-2, PH-1 or PH-2) on pretreatment head MRI or head CT?

No / Yes 22. Is there an intracranial dissection (defined as at or distal to the ophthalmic artery)?

No / Yes 23. Is there a large infarct volume, defined by the finding of acute infarct on MRI involving an estimated 1/3 or more of the complete MCA territory involvement, regardless of the pre-tPA PedNIHSS score due to increased risk of ICH? (Note: absolute contraindication for TIPS, but relative contraindication for tPA in adults (or children in selected circumstances)

No / Yes 24. Is there a large infarct volume, defined by the finding of acute infarct on CT involving an estimated 1/3 or more of the complete MCA territory involvement, regardless of the pre-tPA PedNIHSS score due to increased risk of ICH?

No / Yes 25. Does the patient have a known allergy to recombinant tissue plasminogen activator?

No / Yes 26. For a patient on anticoagulation therapy, is their INR > 1.4?

No / Yes 27. For a patient who received heparin within 48 hours is the aPTT outside the normal range?

No / Yes 28. Has the patient received LMWH within past 24 hours (aPTT and INR will not reflect LMWH effect)?

No / Yes 29. For a patient who received a direct oral anticoagulant (eg dabigatran, rivaroxaban, apixaban, edoxaban), was it administered in the last 48 hours? If on these agents, discuss risks/benefits with hematology.
APPENDIX B. PATIENT INFORMED CONSENT - IV-TPA FOR STROKE (REVISED 9/30/12)

1. I ________________________________, parent/guardian of ________________________________ authorize ________________________ to administer intravenous Tissue Plasminogen Activator (IV-tPA) to my child.
   • I understand the reason for giving IV-tPA is that my child has had a stroke
   • Alternatives to the administration of IV-tPA have been fully discussed with me by the physician named above

2. I understand that the Children's Hospital Colorado is a teaching institution and that physicians in training may actively participate in the care of my child. I also understand that other clinical staff such as physician assistants may be involved. All the above individuals work under the direction of my attending physician.

3. **Risks:** I give this authorization with the understanding that the administration of IV-tPA may involve certain risks or hazards. **I understand that such risks include, but are not limited to, life-threatening bleeding and allergic reactions.** These risks may imply serious, possibly fatal, consequences. **The major significant risks of this particular procedure include:** bleeding in the brain, death, bleeding at other sites, or allergic reaction.

4. **Risk/Benefits:** I understand that the risks and benefits of IV-tPA are unclear in children and have reviewed the attached educational handout. In addition, I understand that benefit of giving tPA to children with stroke is uncertain and have read the following excerpt from the American Heart Association Guidelines:
   Until there are additional published safety and efficacy data, tPA generally is not recommended for children with arterial ischemic stroke outside a clinical trial. However, there was no consensus about the use of tPA in older adolescents who otherwise meet standard adult tPA eligibility criteria.

5. I understand that no guarantee or assurance had been made as to the ultimate result of the administration of IV-tPA. It may not cure the condition for which it is given.

6. **Patient's Consent:** I have read and fully understand this consent form. I understand that I should not sign this form if all items, including my questions, have not been explained or answered to my satisfaction or if I do not understand any of the words contained in this form.

**IF YOU HAVE ANY QUESTIONS AS TO THE PROPOSED/PROCEDURE, OR ITS RISKS, ASK YOUR PROVIDER NOW BEFORE SIGNING THIS CONSENT FORM.**

___________________         __________________                _____________________________________________________________________________________________
Date              Time                                     Signature of Patient, or Person with authority to consent for patient

____________________________________________________________
Relationship to Patient

____________________________________________________________
Telephone Consent obtained by (if applicable) Date Witness to telephone consent Date

7. **Physician:** I have explained the administration of IV-tPA to the patient and have answered all the patient's questions; and to the best of my knowledge, I believe the patient has been adequately informed and has made an informed decision to consent to the administration of IV-tPA.

____________________________________________________________
Physician Print Name Signature Date Time

____________________________________________________________
Attending Physician/Dentist Print Name Signature Date Time
Based on findings from large medical research studies, clot dissolving treatments have become part of the standard care for many adults at the time of a stroke that is caused by a blockage in blood flow to the brain. When clot-dissolving treatments are used within a few hours after the start of a stroke, blood flow may be restored before major brain damage has occurred. This could make it more likely for a patient to have a good recovery from his/her stroke. Outcomes in childhood stroke are largely unknown, but thought to be similar to adults. Clot-dissolving medicines can also cause serious bleeding in the brain or elsewhere, which could be life threatening. In adults, studies have shown an overall benefit in brain function, despite the bleeding risk, when clot dissolving treatments are used within a few hours after the start of a stroke that is caused by a blockage in blood flow to the brain. It is not known if this is also true for children.
APPENDIX D. PEDIATRIC NIH STROKE SCALE (NIHSSPED)

Pediatric NIH Stroke Scale (NIHSSPed) – R. Ichord, 2004

Administer stroke scale items in the order listed. Follow directions provided for each exam item. Scores should reflect what the patient does, not what the clinician thinks the patient can do. **MODIFICATIONS FOR CHILDREN:** Modifications to testing instructions from the adult version for use in children are shown in bold italic with each item where appropriate. Items with no modifications should be administered and scored with children in the same manner as for adults.

Case ID# _______________ EXAMINER ______________________ Onset symptoms: Date_____________ Time________________

<table>
<thead>
<tr>
<th>Instructions</th>
<th>Scale Definition</th>
<th>DATE:</th>
<th>TIME:</th>
</tr>
</thead>
</table>

1a. **Level of Consciousness:** For children age 2 yrs and up, the investigator must choose a response, even if a full evaluation is prevented by such obstacles as an endotracheal tube, language barrier, orotracheal trauma/bandages. A 3 is scored only if the patient makes no movement (other than reflexive posturing) in response to noxious stimulation. **For infants age 4 months up to age 2 years, multiply the score for this item by three, and omit scoring items 1b and 1c.**

- 0 = Alert; keenly responsive.
- 1 = Not alert, but arousable by minor stimulation to obey, answer, or respond.
- 2 = Not alert, requires repeated stimulation to attend, or is obtunded and requires strong or painful stimulation to make movements (not stereotyped).
- 3 = Responds only with reflex motor or autonomic effects or totally unresponsive, flaccid, areflexic.

1b. **LOC Questions:** The patient is asked the month and his/her age. The answer must be correct - there is no partial credit for being close. Aphasic and stuporous patients who do not comprehend the questions will score 2. Patients unable to speak because of endotracheal intubation, orotracheal trauma, severe dysarthria from any cause, language barrier or any other problem not secondary to aphasia are given a 1. It is important that only the initial answer be graded and that the examiner not “help” the patient with verbal or non-verbal cues.

**Modified for children, age 2 years and up. A familiar Family Member must be present for this item:** Ask the child “how old are you?” Or “How many years old are you?” for question number one. Give credit if the child states the correct age, or shows the correct number of fingers for his/her age. For the second question, ask the child “where is XX?”, XX referring to the name of the parent or other familiar family member present. Use the name for that person which the child typically uses, e.g. “mommy”: Give credit if the child correctly points to or gazes purposefully in the direction of the family member. **Omit this item for infants age 4 months up to age 2 years. See comment under item 1a.**

- 0 = Answers both questions correctly.
- 1 = Answers one question correctly.
- 2 = Answers neither question correctly.

1c. **LOC Commands:** The patient is asked to open and close the eyes (For children > age 2 years, this command to open and close the eyes is suitable and can be scored as for adults.) and then to grip and release the non-paretic hand. **For children > age 2 years, substitute the command to grip the hand with the command “show me your nose” or “touch your nose”**. Substitute another one step command if the hands cannot be used. Credit is given if an unequivocal attempt is made but not completed due to weakness. If the patient does not respond to command, the task should be demonstrated to them (pantomime) and score the result (i.e., follows none, one or two commands). Patients with trauma, amputation, or other physical impediments should be given suitable one-step commands. Only the first attempt is scored. **Omit this item for infants age 4 months up to age 2 years. See comment under item 1a.**

- 0 = Performs both tasks correctly
- 1 = Performs one task correctly
- 2 = Performs neither task correctly
### 2. Best Gaze:

Only horizontal eye movements will be tested. Voluntary or reflexive (oculocephalic) eye movements will be scored but caloric testing is not done. If the patient has a conjugate deviation of the eyes that can be overcome by voluntary or reflexive activity, the score will be 1. If a patient has an isolated peripheral nerve paresis (CN III, IV or VI) score a 1. Gaze is testable in all aphasic patients. Patients with ocular trauma, bandages, pre-existing blindness or other disorder of visual acuity or fields should be tested with reflexive movements and a choice made by the investigator. Establishing eye contact and then moving about the patient from side to side will occasionally clarify the presence of a partial gaze palsy.

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal</td>
</tr>
<tr>
<td>1</td>
<td>Partial gaze palsy. This score is given when gaze is abnormal in one or both eyes, but where forced deviation or total gaze paresis are not present.</td>
</tr>
<tr>
<td>2</td>
<td>Forced deviation, or total gaze paresis not overcome by the oculocephalic maneuver.</td>
</tr>
</tbody>
</table>

### 3. Visual:

Visual fields (upper and lower quadrants) are tested by confrontation, using finger counting (for children > 6 years) or visual threat (for children age 4 months to 6 years) as appropriate. Patient must be encouraged, but if they look at the side of the moving fingers appropriately, this can be scored as normal. If there is unilateral blindness or enucleation, visual fields in the remaining eye are scored. Score 1 only if a clear-cut asymmetry, including quadrantanopia is found. If patient is blind from any cause score 3. Double simultaneous stimulation is performed at this point. If there is extinction patient receives a 1 and the results are used to answer question 11.

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No visual loss</td>
</tr>
<tr>
<td>1</td>
<td>Partial hemianopia</td>
</tr>
<tr>
<td>2</td>
<td>Complete hemianopia</td>
</tr>
<tr>
<td>3</td>
<td>Bilateral hemianopia (blind including cortical blindness)</td>
</tr>
</tbody>
</table>

### 4. Facial Palsy:

Ask, or use pantomime to encourage the patient to show teeth or raise eyebrows and close eyes. Score symmetry of grimace in response to noxious stimuli in the poorly responsive or non-comprehending patient. If facial trauma/bandages, orotracheal tube, tape or other physical barrier obscures the face, these should be removed to the extent possible.

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal symmetrical movement</td>
</tr>
<tr>
<td>1</td>
<td>Minor paralysis (flattened nasolabial fold, asymmetry on smiling)</td>
</tr>
<tr>
<td>2</td>
<td>Partial paralysis (total or near total paralysis of lower face)</td>
</tr>
<tr>
<td>3</td>
<td>Complete paralysis of one or both sides (absence of facial movement in the upper and lower face)</td>
</tr>
</tbody>
</table>

### 5 & 6. Motor Arm and Leg:

The limb is placed in the appropriate position: extend the arms (palms down) 90 degrees (if sitting) or 45 degrees (if supine) and the leg 30 degrees (always tested supine). Drift is scored if the arm falls before 10 seconds or the leg before 5 seconds. For children too immature to follow precise directions or uncooperative for any reason, power in each limb should be graded by observation of spontaneous or elicited movement according to the same grading scheme, excluding the time limits. The aphasic patient is encouraged using urgency in the voice and pantomime but not noxious stimulation. Each limb is tested in turn, beginning with the non-paretic arm. Only in the case of amputation or joint fusion at the shoulder or hip, or immobilization by an IV board, may the score be "9" and the examiner must clearly write the explanation for scoring as a "9".

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No drift, limb holds 90 (or 45) degrees for full 10 seconds.</td>
</tr>
<tr>
<td>1</td>
<td>Drift, Limb holds 90 (or 45) degrees, but drifts down before full 10 seconds; does not hit bed or other support.</td>
</tr>
<tr>
<td>2</td>
<td>Some effort against gravity, limb cannot get to or maintain (if cued) 90 (or 45) degrees, drifts down to bed, but has some effort against gravity.</td>
</tr>
<tr>
<td>3</td>
<td>No effort against gravity, limb falls.</td>
</tr>
<tr>
<td>4</td>
<td>No movement</td>
</tr>
<tr>
<td>9</td>
<td>Amputation, joint fusion explain:</td>
</tr>
</tbody>
</table>

#### 5a. Left Arm

#### 5b. Right Arm
7. Limb Ataxia: This item is aimed at finding evidence of a unilateral cerebellar lesion. Test with eyes open. In case of visual defect, ensure testing is done in intact visual field. The finger-nose-finger and heel-shin tests are performed on both sides, and ataxia is scored only if present out of proportion to weakness. In children, substitute this task with reaching for a toy for the upper extremity, and kicking a toy or the examiner’s hand, in children too young (< 5 years) or otherwise uncooperative for the standard exam item. Ataxia is absent in the patient who cannot understand or is paralyzed. Only in the case of amputation or joint fusion may the item be scored “9,” and the examiner must clearly write the explanation for not scoring. In case of blindness test by touching nose from extended arm position.

<table>
<thead>
<tr>
<th>6a. Left Leg</th>
<th>6b. Right Leg</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = Absent</td>
<td>0 = Absent</td>
</tr>
<tr>
<td>1 = Present in one limb</td>
<td>1 = Present in one limb</td>
</tr>
<tr>
<td>2 = Present in two limbs</td>
<td>2 = Present in two limbs</td>
</tr>
</tbody>
</table>

If present, is ataxia in
Right arm: 1 = Yes 2 = No
9 = amputation or joint fusion, explain
Left arm: 1 = Yes 2 = No
9 = amputation or joint fusion, explain
Right leg: 1 = Yes 2 = No
9 = amputation or joint fusion, explain
Left leg: 1 = Yes 2 = No
9 = amputation or joint fusion, explain

8. Sensory: Sensation or grimace to pinprick when tested, or withdrawal from noxious stimulus in the obtunded or aphasic patient. For children too young or otherwise uncooperative for reporting gradations of sensory loss, observe for any behavioral response to pinprick, and score it according to the same scoring scheme as a “normal” response, “mildly diminished” or “severely diminished” response. Only sensory loss attributed to stroke is scored as abnormal and the examiner should test as many body areas [arms (not hands), legs, trunk, face] as needed to accurately check for hemisensory loss. A score of 2, “severe or total,” should only be given when a severe or total loss of sensation can be clearly demonstrated. Stuporous and aphasic patients will therefore probably score 1 or 0. The patient with brain stem stroke who has bilateral loss of sensation is scored 2. If the patient does not respond and is quadriplegic score 2. Patients in coma (item 1a=3) are arbitrarily given a 2 on this item.

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<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Normal; no sensory loss.</td>
<td>Mild to moderate sensory loss; patient feels pinprick is less sharp or is dull on the affected side; or there is a loss of superficial pain with pinprick but patient is aware he/she is being touched.</td>
<td>Severe to total sensory loss; patient is not aware of being touched in the face, arm, and leg.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. Best Language: A great deal of information about comprehension will be obtained during the preceding sections of the examination. For children age 6 years and up with normal language development before onset of stroke: The patient is asked to describe what is happening in the attached, name the items on the attached naming sheet (see pictures used in the STOP study, attached), and to read from the attached list of sentences (see the list of words/phrases from the STOP study; or who premorbid were known to be unable to read). Comprehension is judged from responses here as well as to all of the commands in the preceding general neurological exam. If visual loss interferes with the tests, ask the patient to identify objects placed in the hand, repeat, and produce speech. The intubated patient should be asked to write. The patient in coma (question 1a=3) will arbitrarily score 3 on this item. The examiner must choose a score in the patient with stupor or limited cooperation but a score of 3 should be used only if the patient is mute and follows no one step commands. For children age 2 yrs to 6 yrs (or older children with premorbid language disability), score this item based on observations of language comprehension and speech during

For Children age 2 years and up:

<p>| | | | | |</p>
<table>
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</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>No aphasia, normal</td>
<td>Mild to moderate aphasia; some obvious loss of fluency or facility of comprehension, without significant limitation on ideas expressed or form of expression. Reduction of speech and/or comprehension, however, makes conversation about provided material difficult or impossible. For example in conversation about provided materials examiner can identify</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
the preceding examination. For infants age 4 months to 2 years, score for auditory alerting and orienting responses.

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal</td>
</tr>
<tr>
<td>1</td>
<td>Mild to moderate; patient slurs at least some words and, at worst, can be understood with some difficulty.</td>
</tr>
<tr>
<td>2</td>
<td>Severe; patient's speech is so slurred as to be unintelligible in the absence of or out of proportion to any dysphasia, or is mute/anarthric.</td>
</tr>
<tr>
<td>9</td>
<td>Intubated or other physical barrier, explain______________</td>
</tr>
</tbody>
</table>

10. Dysarthria: If patient is thought to be normal an adequate sample of speech must be obtained by asking patient to read or repeat words from the attached list. If the patient has severe aphasia, the clarity of articulation of spontaneous speech can be rated. Only if the patient is intubated or has other physical barrier to producing speech, may the item be scored "9", and the examiner must clearly write an explanation for not scoring. Do not tell the patient why he/she is being tested.

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal</td>
</tr>
<tr>
<td>1</td>
<td>Mild to moderate; patient slurs at least some words and, at worst, can be understood with some difficulty.</td>
</tr>
<tr>
<td>2</td>
<td>Severe; patient's speech is so slurred as to be unintelligible in the absence of or out of proportion to any dysphasia, or is mute/anarthric.</td>
</tr>
<tr>
<td>9</td>
<td>Intubated or other physical barrier, explain______________</td>
</tr>
</tbody>
</table>

11. Extinction and Inattention (formerly Neglect): For children age 2 years and up: Sufficient information to identify neglect may be obtained during the prior testing. If the patient has a severe visual loss preventing visual double simultaneous stimulation, and the cutaneous stimuli are normal, the score is normal. If the patient has aphasia but does appear to attend to both sides, the score is normal. The presence of visual spatial neglect or anosagnosia may also be taken as evidence of abnormality. Since the abnormality is scored only if present, the item is never untestable. For children age 4 months to 2 years, score as "1" if there is either a sensory or motor deficit, score as a "2" if there are both sensory and motor deficits on the general neurological examination.

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No abnormality.</td>
</tr>
<tr>
<td>1</td>
<td>Visual, tactile, auditory, spatial, or personal inattention or extinction to bilateral simultaneous stimulation in one of the sensory modalities.</td>
</tr>
<tr>
<td>2</td>
<td>Profound hemi-inattention or hemi-inattention to more than one modality. Does not recognize own hand or orients to only one side of space.</td>
</tr>
</tbody>
</table>

TOTAL SCORE

 Comments (e.g. confounders, clarification on scores):
Pediatric NIH Stroke Scale: Picture for Item 9 “Best Language”

*Items from the STOP neurologic exam:

1. Naming – pictures are of a clock, pencil, skateboard, shirt, baseball, bicycle (see end of document for pictures).
2. Repetition – each of 4 word-repetition tasks is presented:
   a. Stop
   b. Stop and go
   c. If it rains we play inside
   d. The President lives in Washington
3. Reading – each of 3 items is presented for the child to read (adjust expectations according to child’s age/school level): See below for printed stimulus.
   a. Stop
   b. See the dog run
   c. Little children like to play outdoors

1. Stop.

2. See the dog run.

3. Little children like to play outdoors.
D2. Naming to Confrontation
Ask patient to identify:
APPENDIX E. EARLY DECOMPRESSIVE SURGERY IN MALIGNANT INFARCTION
(REVISED 02/02/18)

(V.02.02.18)

Pediatric patients with all of the following criteria should be followed closely for consideration of decompressive hemicraniectomy:

- Large Infarct Volume (e.g. greater than 50% of MCA) territory [as determined by neuroradiology, neurosurgery and neurology] on presenting CT or MRI.
- Age greater than 1 year.
- Timepoint less than 48 hours from last known normal.

If patient meets these criteria, the patient should be admitted to the PICU (or CICU). The neurosurgical team should decide upon either: 1) early decompressive surgery in first 24 hours, or 2) close monitoring. Close monitoring should include:

- Scheduled fast-sequence MRI (or CT scans if MRI unfeasible or unavailable) x 48 hours as permitted by clinical condition (Suggested: Q8-12 hours for 24 hours from stroke onset, then 36 hours and 48 hours from stroke), unless clinical condition is too tenuous for travel.
- Q1 hour neuro checks.

If close monitoring reveals a significant clinical or radiographic change (see below), a multidisciplinary conversation involving the stroke team, neurosurgery, and critical care is encouraged; and decompression should be considered.

- ≥8 mm of midline shift on imaging (overall).
- Progression of midline shift of ≥2 mm as compared to prior scan.
- Development of hemorrhagic transformation and/or increase in hemorrhagic transformation compared with any previous CT/MRI scan.
- Significant change in mental status.
- Anisocoria.

Desired Outcome: Decreased prevalence of patients progressing to clinical herniation as defined as blown pupil, and improved 3-month outcome on PSOM (Pediatric Stroke Outcome Measure) as compared to historical controls.
APPENDIX F. INTRA-ARTERIAL THERAPY CHECKLIST

(In special circumstances, such as basilar thrombosis, the decision to provide intra-arterial therapies beyond established guidelines may be made, but are outside the scope of this guideline.)

Considerations for Pediatric Patients <6 hours from symptom onset

Patient meets criteria for possible thrombectomy if yes to all the following:

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient &gt; 3 years of age?*</td>
<td></td>
</tr>
<tr>
<td>Able to perform groin puncture prior to last known normal of 6 hours?*</td>
<td></td>
</tr>
<tr>
<td>Little to no pre-stroke disability?*</td>
<td></td>
</tr>
<tr>
<td>NIHSS &gt; 6?*</td>
<td></td>
</tr>
<tr>
<td>Occlusion of ICA or M1 on MRA?*</td>
<td></td>
</tr>
<tr>
<td>MRI ASPECTS Score &gt; 6* or &lt; 1/3rd MCA?*</td>
<td></td>
</tr>
<tr>
<td>Does patient meet criteria for IV tPA?</td>
<td></td>
</tr>
<tr>
<td>– If yes, may consider IV tPA first. Treatment does not influence thrombectomy decision*</td>
<td></td>
</tr>
</tbody>
</table>

If all of the above criteria are met, the child meets all of the current AHA Acute Ischemic Stroke Guidelines 2018 for thrombectomy in adults (*) and CHCO stroke council guidelines (+), and may be considered for thrombectomy.

Cases where criteria for consideration of thrombectomy has less evidence for safety and/or efficacy, but could be considered in certain situations

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate pre-stroke disability?*</td>
<td></td>
</tr>
<tr>
<td>Occlusion of M2?*</td>
<td></td>
</tr>
<tr>
<td>Occlusion in Posterior Circulation?*</td>
<td></td>
</tr>
<tr>
<td>NIHSS &lt; 6?*</td>
<td></td>
</tr>
<tr>
<td>Patient &lt;3 years of age*</td>
<td></td>
</tr>
</tbody>
</table>

If any of the above criteria are met, the child meets a lower level of evidence of thrombectomy in adults within 6 hours (AHA Acute Ischemic Stroke Guidelines 2018 level 2B evidence) (*) and/or a relative contraindication for thrombectomy as determined by the CHCO Stroke Council (+).

Considerations for Pediatric Patients 6-24 hours from symptom onset

Patient meets criteria for possible thrombectomy if yes to all the following:

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient &gt; 3 years of age?*</td>
<td></td>
</tr>
<tr>
<td>Last known normal between 6-24 hours ago?*</td>
<td></td>
</tr>
<tr>
<td>Little to no pre-stroke disability (mRS 0-1)?*</td>
<td></td>
</tr>
<tr>
<td>Occlusion of ICA or M1 on imaging?*</td>
<td></td>
</tr>
<tr>
<td>Patient must have a mismatch between severity of clinical deficit and infarct volume as defined as either 1 OR 2:</td>
<td></td>
</tr>
<tr>
<td>1. NIHSS 10-19?</td>
<td></td>
</tr>
<tr>
<td>-AND-</td>
<td></td>
</tr>
<tr>
<td>Infarct volume &lt; 31ml using DWI?*</td>
<td></td>
</tr>
<tr>
<td>2. NIHSS ≥ 20?</td>
<td></td>
</tr>
<tr>
<td>-AND-</td>
<td></td>
</tr>
<tr>
<td>Infarct volume of &lt; 51 ml using DWI?*</td>
<td></td>
</tr>
<tr>
<td>Able to safely transfer patient to University Hospital so that groin puncture can be done 6-24 hours after last known normal?*</td>
<td></td>
</tr>
</tbody>
</table>

If all of the above criteria are met, the child meets all of the current AHA Acute Ischemic Stroke Guidelines 2018 for thrombectomy in adults (*) and CHCO stroke council guidelines (+), and may be considered for thrombectomy.
REFERENCES

Child Neurology Society Ad Hoc Committee on Stroke in Children.
CLINICAL IMPROVEMENT TEAM MEMBERS

Tim Bernard, MD | Pediatric Neurology
Megan Barry, MD | Pediatric Neurology
Sharon Poisson, MD | Adult Neurology
Tim Schardt, PharmD | Clinical Pharmacy
Corbett Wilkinson, MD | Pediatric Neurosurgery

Children’s Hospital Colorado Stroke Council:

- Cardiology: Scott Auerbach
- ED: Kevin Carney
- Neuro-IR: Josh Seinfeld, David Case, and Chris Roark
- ICU: Amy Clevenger
- Anesthesia: Morris Dressler
- Neuroradiology: Nick Stence, David Mirsky
- Hematology: Beth Warren
- Neurosurgery: Corbett Wilkinson
- Neurology: Craig Press, Andra Dingman, Ricka Messer, Jan Martin, William Jones, Jennifer Simpson, Jennifer Armstrong, Brad Miller
- Other: Christine Silva, Joe Darmofal

APPROVED BY

Children’s Hospital Colorado Stroke Council – August 3, 2018
Clinical Pathways & Measures Committee – August 20, 2018
Pharmacy & Therapeutics Committee – September 6, 2018

<table>
<thead>
<tr>
<th>MANUAL/DEPARTMENT</th>
<th>Clinical Pathways/Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINATION DATE</td>
<td>November 14, 2014</td>
</tr>
<tr>
<td>LAST DATE OF REVIEW OR REVISION</td>
<td>April 29, 2019 (Colorado Springs alignment)</td>
</tr>
</tbody>
</table>
| COLORADO SPRINGS REVIEW BY | Michael DiStefano, MD  
Chief Medical Officer, Children’s Hospital Colorado – Colorado Springs |
| APPROVED BY | Lalit Bajaj, MD, MPH  
Medical Director, Clinical Effectiveness |

REVIEW/REVISION SCHEDULE

Scheduled for full review on September 6, 2022

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