Pediatric Acute Ischemic Stroke (AIS) Flowsheet, pg 2
February 2013

- Supportive care to minimize secondary injury
- Consult Cardiology, OT/PT/speech therapy
- If moderate to large infarct or cerebellar infarct consult neurosurgery regarding ICP monitoring and/or decompression
- Priority diagnostic studies:
  - Cardiac ECHO <24 hrs after AIS identified to look for cardioembolic source/atrial level communication
  - Cerebral vascular study within hours of AIS identified

Cardioembolic source or arterial dissection identified?

- No
- Yes

Start Aspirin 5 mg/kg/d (max 81 mg/d)

Evaluate for appropriateness of anticoagulation
- No ICH
- No recent surgery or neurosurgical procedure
- No massive extracranial hemorrhage
- No thrombolytics received in the last 24 hours
- Infarct is < 1/3 of a vascular territory

Consult Hematology

Is surgery or invasive diagnostic study anticipated (e.g. conventional angiogram)?

- No
- Yes

LMWH preferred (see anticoagulation guidelines)

UFH preferred (i.e. heparin gtt) (see anticoagulation guidelines)

If clinical status deteriorates and/or new deficits identified, obtain neuroimaging to assess for ICH.

Once anticipated invasive studies/procedure completed switch to LMWH

Schedule Stroke clinic follow up for 1 month from presentation

Laboratory studies
- Blood culture
- See prothrombotic lab sheet (pg 3)
- For sickle cell patients, stat
  - Type and cross
- BS check Q1hr x 4 hr, then Q2 x 4 then Q4hr
- Daily CBC, CMP, PT/PTT/INR

Diagnostic guidelines
- HCT w/o contrast, r/o ICH (stat)

Vascular Studies
- MRI/MRA within 1st 24 hrs (consider DWI only 1-2 min if anesthesia is a limitation)
- If no MRA available acutely, CTA (include neck if posterior circulation AIS suspected)

Cardiac studies
- Transesophageal Echo cardiology (TEE) with bubble study within 24 hrs (r/o cardioembolic source)
- If known h/o cardiac disease, will need a TEE

- Blood culture
- See prothrombotic lab sheet (pg 3)
- For sickle cell patients, stat
  - Type and cross
- BS check Q1hr x 4 hr, then Q2 x 4 then Q4hr
- Daily CBC, CMP, PT/PTT/INR
Acute AIS
Confirmed with either CT/CTA or MRI/MRA
GCS < 12

Management goals:
1. Goal BS > 80 and < 200
2. Adequate sedation and analgesia
3. Core temperature 36-37°C
4. ICP < 20 mmHg
5. NIRS > 55%, no change > 20%
6. Avoid hyponatremia
7. Minimum target CPP goals: 0-1 yr > 50 mmHg, 1-12 yrs > 55 mmHg, > 12 yrs > 60 mmHg

ICP > 20 mmHg for > 5 min
Consider 2nd tier therapies (e.g., thrombectomy via IR, craniectomy)
Persisting CPP deficit or ICP > 20 mmHg

BP Parameters

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>MAP* (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2 yrs</td>
<td>&gt; 55</td>
</tr>
<tr>
<td>3-4 yrs</td>
<td>&gt; 63</td>
</tr>
<tr>
<td>5-6 yrs</td>
<td>&gt; 68</td>
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<tr>
<td>7-8 yrs</td>
<td>&gt; 70</td>
</tr>
<tr>
<td>9-10 yrs</td>
<td>&gt; 74</td>
</tr>
<tr>
<td>11-12 yrs</td>
<td>&gt; 76</td>
</tr>
<tr>
<td>13-14 yrs</td>
<td>&gt; 78</td>
</tr>
<tr>
<td>15-17 yrs</td>
<td>&gt; 82</td>
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</tbody>
</table>

*MAP value is 50%ile for 50% of height

Sedation and Analgesia
- Per PICU sedation protocol

Supportive Medications/Therapies
- Ranitidine (1 mg/kg/dose Q 8 h, max)
- Acetaminophen (15 mg/kg/dose PRN T > 37 or pain, max 4 g/24 h)
- Miralax or Lactulose
- Cooling blanket for T > 37 not responsive to meds

Hyperosmolar Therapies for Documented inc ICP or CPP
- Hypertonic Saline (3%) - via central line
  - bolus 5 ml/kg (max 250 ml)
  - continuous infusion at 1 ml/kg/hr, titrate for serum Na 150-160 or serum osmolality < 360
- Mannitol 1 g/kg
- See hyperosmolar algorithm for more details

Laboratory/Diagnostic monitoring
- Blood glucose check Q1 h x 4 then Q2 h x 4, then Q4
- Daily CBC, CMP, PT/INR/PTT, serum osmolality
- Daily CXR
- Blood cx on admission if not already done
- Pro-thrombotic evaluation (see page 4)

Fluid Therapy, Vasopressors
- Maintain CVP 5 to 10 mmHg - critical if vasculopathy present

Inotrope/vasopressor 1st line
- If < 6 mos, use D5NS for maintenance (+K after 24 hr)
- If > 6 mos use NS for maintenance (+K after 24 hr)

Inotrope/vasopressor 2nd line
- 1st line - Dopamine
  - Once Dopamine > 10 mcg/kg/min, start Norepinephrine (warm ext) or Epinephrine (cool extremities)
  - Goal fluid balance: +0-10 mg/kg/d
  - Maintain Hgb > 8 g/dl

Safety/Activity
- Patient Position (head neutral, HOB flat)
- Seizure precautions, prevent, identify, and treat seizures
- Fall precautions
  - If post puberty, compression stockings, consider prophylaxis with lovenox
  - NPO (x 24-48 hrs then may start feeds)
- Aspiration precautions
- Neuro checks Q1 hour

Acute AIS Addendum for GCS ≤ 12, pg 3
Feb 2013
### Laboratory Evaluation

<table>
<thead>
<tr>
<th>Tier 1 (To be done in ER or upon arrival to PICU)</th>
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<tbody>
<tr>
<td>CBC, Blood cx</td>
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<tr>
<td>ESR, Beta-HCG</td>
</tr>
<tr>
<td>ANA, Sickle cell prep</td>
</tr>
<tr>
<td>CRP, PT/INR/PTT</td>
</tr>
<tr>
<td>TSH, Thrombin time</td>
</tr>
<tr>
<td>Tchol/LDL/HDL, Fibrinogen</td>
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<tr>
<td>Triglycerides</td>
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<table>
<thead>
<tr>
<th>Tier 2 (Initial Prothrombotic work-up prior to starting anticoagulation)</th>
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<tbody>
<tr>
<td>D-Dimer, Protein C, Functional</td>
</tr>
<tr>
<td>Antithrombin III Assay, Protein S, Functional</td>
</tr>
<tr>
<td>Lupus anticoagulant panel, Factor VIII activity</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Tier 3 (At some point)</th>
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<tbody>
<tr>
<td><strong>Subsequent Prothrombotic work-up</strong></td>
</tr>
<tr>
<td>Factor V leiden mutation testing, Lipoprotein A (misc test)</td>
</tr>
<tr>
<td>Prothrombin gene mutation, APC resistance</td>
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<tr>
<td>Homocysteine, Anti-cardiolipin panel</td>
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<tr>
<td>Beta 2 Glycoprotein I antibody panel</td>
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<thead>
<tr>
<th><strong>Vasculopathy work-up</strong></th>
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<tbody>
<tr>
<td>VZV titers (VZV CSF PCR if available), Lyme titers</td>
</tr>
<tr>
<td>HIV, Enterovirus titers (panel)</td>
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<tr>
<td>Parvo titers, C3/C4 complement</td>
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<tr>
<td>CMV PCR/titers, Albumin</td>
</tr>
<tr>
<td>Mycoplasma titers, RF</td>
</tr>
<tr>
<td>Anti-dsDNA Ab, Anti-SM Ab</td>
</tr>
<tr>
<td>ANCA, p-ANCA</td>
</tr>
<tr>
<td>VDRL, c-ANCA</td>
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<tr>
<td>Hemoglobin electrophoresis (if sickle cell status unknown)</td>
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<thead>
<tr>
<th><strong>Metabolic disorders work-up</strong></th>
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<tbody>
<tr>
<td>Serum amino acids, Urine organic acids</td>
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<tr>
<td>Mitochondrial DNA (point mutation, Baylor)</td>
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</table>
Inclusion Criteria (Absolute)
Acute ischemic infarct confirmed by MRI DWI sequence and/or arterial thrombus seen by CTA
Symptom onset < 4 hours before t-PA given (symptom onset must be witnessed)
NIHSS > 4

Exclusion Criteria
Presence of hemorrhage by imaging (e.g. SAH, subdural hematoma, hemorrhagic conversion, etc)
Evidence of significant mass effect with midline shift on imaging
Infarct is > 33% of MCA territory
Positive beta-HCG
Elevated PTT or PT
Platelets < 100,000 or HCT < 25
Baseline labs: glucose < 50 or >400
SBP > 185 or DBP > 110 (doesn’t come down with aggressive BP management)
Coma
Symptoms are rapidly improving
Seizure within last 6 hours
Previous ICH (ever)
Stroke is presumed result of septic embolus
Pericarditis, ventricular thrombus
Recent arterial puncture or spinal tap (last 7 days)
MI or GI/GU hemorrhage within the last 21 days
Recent surgery, trauma, biopsy, ulcerative wound or injury to parenchymal organs in last 30 days
Known hereditary or acquired hemorrhagic diathesis
Stroke, head trauma, spinal or intracranial surgery in last 90 days
Heparin use within last 48 hours
Serious advanced terminal illness
Hemocult stool guiac positive
Sickle cell disease
Severe asphyxia within 7 days
Vascular malformations
Fibrinogen < 100mg/dl
Sepsis
Active bleeding

Orders
Notify pharmacy of need for tPA STAT
Counsel family regarding risk and benefit of tPA. Obtain consent for tPA administration
Pediatric Acute Ischemic Stroke (AIS) Flowsheet, pg 6
Feb 2013

**tPA Information Sheet**

**Nursing:**
- Patient needs 2 IVs
- VS and neuro checks Q15 min x 2 h then Q30min x 6h then Qh x 16 h then Q 4h
- Check for angioedema (tongue enlargement) Q 20min x 4 after tPA starts
- Notify MD for bleeding
- Post sign indicating use of tPA and time tPA given
- No NGtube x 24 h
- No intramuscular injections x 24 h
- No urinary catheterizations x 24 h
- No rectal temperatures x 24 h
- No arterial punctures x 24 h
- Stool guiac Qd x 2 d

**Diet:**
NPO x 24 hr

**Labs:**
- STAT labs: CBC with diff/platelets, CMP, PT/PTT, INR, Fibrinogen.
- Type and cross match 1 unit PRBC

**Imaging:**
Head ct at 24 hrs

**Medications:**
- tPA total dose 0.6 mg/kg = ________ mg (max dose 60 mg)
- administer 0.06 mg/kg (10% of 0.6 mg/kg dose) = ________ mg IV push
- if no angioedema, give the rest (0.54 mg/kg = ________ mg) over 1 hour
- No ASA, ibuprofen, NSAIDS, other antiplatelet agents for 24 h after tPA administered
- No heparin, LMWH, warfarin for 24 h after tPA administered
- Topical thrombin and gauze compresses to bedside PRN bleeding
- If suspect angioedema:
  - Stop tPA if still infusing
  - Benadryl (max dose 50 mg)
  - If angioedema persists despite tx above- solumedrol (max dose 80-100 mg) IV
  - If angioedema persists, epinephrine and STAT ENT for possible emergent fiberoptic nasotracheal intubation or cricotomy/tracheostomy if oral intubation unsuccessful

**Bleeding complications:**
- Non CNS oozing: topical thrombin powder and direct pressure
- Major bleeding
  - stop tPA if still infusing
  - STAT CBC with diff/platelets, PT/PTT, INR, Fibrinogen
  - Type and cross match 6-8 units of cryoprecipitate (fibrinogen, Factor VIII)
  - Type and cross match 6-8 units of platelets
  - Head CT if suspect intracranial bleeding