Lumbar Puncture (LP) Training Program

Department of Neurology

Indications for a LP
- Suspect CNS Infection
- Suspect Demyelinating/Inflammatory CNS Process
- Suspect SAH with Negative CT of the Head
- Diagnose NPH/Pseudo tumor Cerebri
- Obtain CSF for Cytological Analysis
- Infuse Anesthetic or Contrast Agents
- Intrathecal Treatment
  - Chemotherapy
  - Antibiotics
  - Remove CSF to Treat NPH

Contraindications for LP
- Skin Infection over the lower lumbar area
- Uncorrected Coagulopathy
  - INR > 1.5
  - Platelets < 50,000
  - After correction, LP is safe
  - Hold Heparin Drip for 6 hours prior to LP
- Suspect Increased Intracranial Pressure (ICP)
  - Alteration in Consciousness
  - Focal Neurological Deficits
  - Papilledema
  - CT Findings
- Acute Spinal Cord Trauma
- Cardio respiratory Compromise
**What to Look for on Non-Contrast CT Head**

- Symmetry
- Open Cisternal Spaces/
  Ventricles without Distortion
  - Especially 4th Ventricle
- Sulcal Preservation

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**CSF Dynamics**

Produced in the **choroid plexus** of the lateral ventricles (LV)

Flows Through:
- Interventricular Foramina of Monro (yellow)
- Third Ventricle (TV)
- Aqueduct of Sylvius (Green)
- Fourth Ventricle (FV)
- Lateral Foramina of Luschka
- Foramen of Magendie (Blue)
- Cisterna Magna (CM)
- Spinal Cord

CSF flows over the Convexities of the Brain, Cerebellum, and Brainstem

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**CSF Dynamics**

- Adults have **140 mL** of CSF
- CSF is Produced at 0.3 mL/min
- **9-10 mL** – "Standard" amount removed 
  Replaced in 30 Minutes
Anatomy of the Spinal Cord

- 33 Vertebrae
  - 7 Cervical
  - 12 Thoracic
  - 5 Lumbar
  - 5 Sacral
  - 4 Fused coccygeal

At Birth - Spinal cord ends at L3

The Vertebral Column Grows More than the Spinal Cord

The Spinal Cord Ends at L1 in 50% of Adults
- Spinal Cord Ends Slightly Lower than L1 in 50% of Adults

LP Complications

1. Positional Headache – 40%
   - Usually appears within 3 days - due to pressure on pain sensitive bridging vessels due to continued CSF leakage
   - Symptoms same as meningitis
     - Bilateral fronto-occipital, non-throbbing, pain worse in the upright position and with coughing/straining, better when supine
     - Photophobia, Nausea, Stiff Neck
   - Prevention
     - Small caliber spinal needle
     - Proper bevel placement
     - Stylet in place whenever needle is moved
     - Bedrest has not been shown to prevent headache
     - The patient should avoid any straining, rest, give cough stool softener medication
   - Treatment
     - Fluids, especially caffeinated beverages
     - An epidural blood patch is rarely needed
LP Complications

2. Localized Back Pain – 30%
   - Due to Muscle Trauma From Needle
   - Treat with NSAIDs

3. Rare Complications (< 0.5%)
   - CSF Infection
   - Spinal hematoma
   - Herniation
   - Spinal Cord Damage if done above L3 spine level
   - Disc Herniation

Brain Herniation

CSF Studies Interpretation

- Increased OP - can be due to any intracranial abnormality
  - Patients with CHF or dialysis may have variable OP due to oncotic fluctuations, so interpret with caution

- Appearance
  - Cloudy fluid is most often seen in bacterial meningitis so, start treatment immediately
  - Bright red – probable traumatic tap
  - Xanthochromic – yellow fluid - Always pathologic
    - Blood > 12 hours old
    - SAH, HSV Encephalitis
### CSF Studies Interpretation

- RBCs and WBCs should be < 0-5 cells/hpf
  - In traumatic tap, Tube #1 should have more bright red blood than Tube #4
  - WBC:RBC ratio the same as peripheral blood
- Blood clots that form in the CSF collection tubes are from a traumatic tap
- Glucose
  - Always a comparison – normally 60% of serum blood glucose levels

### CSF “Profiles”

<table>
<thead>
<tr>
<th>Test</th>
<th>Bacterial Meningitis</th>
<th>Viral Meningitis</th>
<th>SAH</th>
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</thead>
<tbody>
<tr>
<td>Opening Pressure</td>
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<td>Elevated</td>
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<tr>
<td>Appearance</td>
<td>Clear/turbid</td>
<td>Clear</td>
<td>Clear/bloody</td>
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<tr>
<td>Xanthochromia</td>
<td>Negative</td>
<td>Negative</td>
<td>Present</td>
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<tr>
<td>RBC’s</td>
<td>&lt; 5/hpf</td>
<td>&lt; 5/hpf</td>
<td>&gt; 50/mm3</td>
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<tr>
<td>WBC’s</td>
<td>Elevated, PMNs</td>
<td>Elevated, lymphs</td>
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<tr>
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</tr>
<tr>
<td>Gram Stain</td>
<td>Organisms</td>
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