# 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

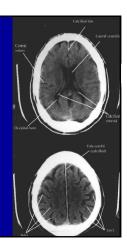
#### **Contraindications for LP**

- 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

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#### What to Look for on **Non-Contrast CT Head**

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

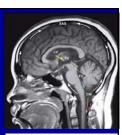


#### **CSF Dynamics**

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)

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



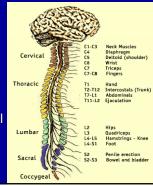


# **CSF Dynamics**

- 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



#### **Anatomy of the Spinal Cord**

- 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

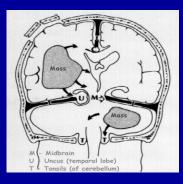
    - Bedrest has not been shown to prevent headache

       But 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, <u>start treatment immediately</u>
  - Bright red probable traumatic tap
  - Xanthochromic yellow fluid Always pathologic
    - Blood > 12 hours old
    - SAH, HSV Encephalitis

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# **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"						
Test	Bacterial Meningitis	Viral Meningitis	SAH			
Opening Pressure	Elevated	Elevated	Elevated			
Appearance	Clear/turbid	Clear	Clear/bloody			
Xanthochromia	Negative	Negative	Present			
RBC's	< 5 /hpf	< 5/hpf	> 50/mm3			
WBC's	Elevated, PMNs	Elevated, lymphs	Increased			
Glucose	Low	Normal	Normal			
Protein	Elevated	Elevated	Elevated			
Gram Stain	Organisms	Normal	Normal			

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