Neurocritical Care Basics

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GOAL 1: DON’T LET THE PATIENT DIE

• Not unique

• ACLS, ATLS, ENLS, other strategies common to all emergency medical care

• ABCs
  • MORE – not less – important
  • Hypotension and hypoxemia exacerbate CNS injury
  • Hypercapnia elevates intracranial pressure
NEUROLOGIC EMERGENCIES ARE COMPLEX

• CNS exquisitely vulnerable to ischemia and hypoxia
  • **Normal** CBF: 50-100 mL/100g/min
  • **Ischemia** (loss of function): 20 mL/100g/min
  • **Infarction**: 10 mL/100g/min

• CNS heals poorly
  • Tissue that dies is not replaced
  • Function never returns to normal
CEREBRAL RESUSCITATION: ACUTE CATASTROPHIC NEUROLOGIC INJURY

• Catastrophic neurologic injury: ↑ICP ➔ hemiation
CRANIAL VAULT MECHANICS

- **Monroe and Kellie**
  - Skull is a rigid container
  - Cranial contents (brain, blood, CSF) are viscous gel and incompressible
  - Additional volume (pathologic or expansion of the 3 normal contents) will lead to the displacement of another content

CEREBRAL RESUSCITATION: HERNIATION SYNDROMES

Subfalcine Herniation
Cerebral cortex under falx
Ipsi/contra leg weakness
Upward Herniation
Brainstem up through tentorium
↓ mental status
Dilated pupil (CNIII), ophthalmoplegia

Tonsillar Herniation
Cerebellar tonsils in foramen magnum
Awake, quadriplegia
Arrhythmia/cardiac arrest
Respiratory arrest

Central Herniation
Brainstem down through tentorium
↓ mental status
Dilated pupil (CNIII), ophthalmoplegia
Ipsi paresis/posturing (contra cerebral)

Uncal Herniation
Uncus over tentorial notch
↓ mental status
Dilated pupil (CNIII), ophthalmoplegia
Ipsi paresis/posturing (contra cerebral)
ICP MANAGEMENT – OVERVIEW

• General
  - HOB to 30 degrees
  - Head midline
  - Loosen neckties
  - Sedation/opiates
    - Coughing
    - Shivering
  - Hyperglycemia mg’mt
  - Intubate/ eucapnia

• Tier I
  - Heavy sedation
  - Paralysis
  - CSF Drainage
  - Osmotic Tx
  - Hyperventilation

• Tier II
  - Barbiturate tx
  - Hypothermia
  - Surgical decompression
- Coma
- Acute Ischemic Stroke
- Intracerebral Hemorrhage
- Subarachnoid Hemorrhage
- Elevated Intracranial Pressure
- Meningitis
- Neuromuscular disorders
- TBI/TSCI
INITIAL ASSESSMENT

• ABCs
• Mental status
• Cranial nerves
• Motor

• Do it fast!
## GLASGOW COMA SCORE

<table>
<thead>
<tr>
<th>Eyes</th>
<th>Verbal</th>
<th>Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = no eye opening</td>
<td>1 = no verbal output</td>
<td>1 = no response</td>
</tr>
<tr>
<td>2 = opens to noxious stimuli</td>
<td>2 = grunts</td>
<td>2 = extension</td>
</tr>
<tr>
<td>3 = opens to voice</td>
<td>3 = inappropriate words</td>
<td>3 = flexion</td>
</tr>
<tr>
<td>4 = spontaneously open</td>
<td>4 = disoriented, confused</td>
<td>4 = withdraws</td>
</tr>
<tr>
<td></td>
<td>5 = oriented, appropriate</td>
<td>5 = localizes</td>
</tr>
<tr>
<td></td>
<td>6 = follows commands</td>
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</table>
One of the goals of Neuro exam in an unresponsive patients is to localize coma to cortex or brainstem.
MENTAL STATUS

• Level of alertness/arousal:
  • Alert, Lethargic, Stupor, Coma

• Orientation
  • Orientation, fund of knowledge

• Language
  • If able to participate: comprehension, fluency, naming
CRANIAL NERVES

• 5 things: Blink to threat, Pupillary reflex, corneal, Doll’s eyes, Cough/gag

• CN 2
  • Blink to threat, Pupillary response

• CN 3, 4, 6 and 8
  • Tracking, otherwise oculocephalics (if C spine ok)

• CN 5 & 7
  • Corneal

• CN 9/10
  • Tongue movement or cough/gag
MOTOR EXAM

• If able to participate:
  • Pronator drift

• If unable to participate
  • Response to noxious stimulation - Start central and then peripheral
    • Central: Sternal rub, Supraorbital pressure, TMJ stimulation, mastoid pressure and nostril stim
    • Peripheral: Nailbed pressure: Could elicit reflex

• Tone
THE REST...

- Sensory
  - If able to participate, usually only test light touch grossly in each limb and/or trunk in spinal cord injury
  - Otherwise, motor exam = sensory exam

- Cerebellar
  - If able to participate and suspect posterior fossa pathology

- Reflexes
  - Useful mainly in spinal cord disease or some neuromuscular diseases (ex: GBS)