Child Neurology

Objectives

- Recognize most common causes of Altered Mental Status in Childhood
- Address management and understand when to transport the child

Altered Mental Status and Coma

Altered Mental Status

- This condition is not a disease, but a condition caused by a variety of diseases or clinical states, it is a medical emergency to understand the cause

Examination of the child

1) ABC's

2) Neurologic Exam
   - Cranial Nerves
   - Deep Tendon Reflexes
   - Sensory
   - Motor
   - Cerebellar
   - Mental Status
Altered Mental Status

Neurologic Exam
Cranial Nerves
Eye movements
Doll's Eyes
Cold Water Calorics

Altered Mental Status

Neurologic Exam
Cranial Nerves
Pupillary light reflex

Altered Mental Status

Neurologic Exam
Cranial Nerves
Corneal Sensation

Altered Mental Status

Neurologic Exam
Cranial Nerves
Gag

Altered Mental Status

• Motor Exam

Comparing decerebrate and decorticate postures

Decerebrate posture results from damage to the upper brain due to the proximity to the area of white matter. The upper brain injury also causes loss of function in the lower brain areas. The eyes are fixed in the upper starting position, the face is neutral, and the head is extended with upper limbs flexed. In the decorticate posture, due to the damage, the upper brain function is lost, the head is extended, and the arms and legs are flexed. The legs are more flexed than the arms.
Arousal Function

- Reticular activating system
  - Midbrain
  - Pons
  - Medulla

Definitions:

- **Lethargy** – Difficult to arouse
- **Obtundation** – Responsive to stimuli other than pain
- **Stupor** – Responsive only to pain
- **Coma** – Unresponsive to pain

Altered States of Consciousness

- **Encephalopathy** – diffuse disorder
  - Altered state of consciousness
  - Altered cognition or personality
  - Seizures
- **Encephalitis**
  - Encephalopathy plus CSF pleocytosis

<table>
<thead>
<tr>
<th>Motor Response</th>
<th>Example</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commands</td>
<td>Follows simple commands</td>
<td>6</td>
</tr>
<tr>
<td>Localizes Pain</td>
<td>Pulls examiner's hand away when pinched</td>
<td>5</td>
</tr>
<tr>
<td>Withdraws from Pain</td>
<td>Pulls a part of body away when pinched</td>
<td>4</td>
</tr>
<tr>
<td>Abnormal Flexion</td>
<td>Flexes body inappropriately to pain</td>
<td>3</td>
</tr>
<tr>
<td>Abnormal Extension</td>
<td>Body becomes rigid in an extended position when examiner pinches him</td>
<td>2</td>
</tr>
<tr>
<td>No Response</td>
<td>Has no motor response to pinch</td>
<td>1</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Eye-Opening</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Spontaneous</td>
<td>Opens eyes on own</td>
<td>4</td>
</tr>
<tr>
<td>To Voice</td>
<td>Opens eyes when asked to in a loud voice</td>
<td>3</td>
</tr>
<tr>
<td>To Pain</td>
<td>Opens eyes when pinched</td>
<td>2</td>
</tr>
<tr>
<td>No Response</td>
<td>Does not open eyes</td>
<td>1</td>
</tr>
</tbody>
</table>
Verbal Response

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Oriented</td>
<td>Carries on a conversation correctly and tells examiner where he is, who he is, and the month and year</td>
</tr>
<tr>
<td>Confused Conversation</td>
<td>Seems confused or disoriented</td>
</tr>
<tr>
<td>Inappropriate Words</td>
<td>Talks so examiner can understand him but makes no sense</td>
</tr>
<tr>
<td>Sounds</td>
<td>Makes sounds that examiner cannot understand</td>
</tr>
<tr>
<td>No Response</td>
<td>Makes no noise</td>
</tr>
</tbody>
</table>

Causes of Lethargy, Stupor and Coma:
- Intracranial Hematoma
- Cerebral Edema
- Postictal State
- Hypoxic Brain Injury
- Hypoglycemia
- Toxin Ingestion
- Meningitis/Encephalitis

Evaluation of Lethargy, Stupor and Coma:
- Intracranial Hematoma: CT Scan
- Cerebral Edema: CT Scan
- Postictal State: Hx of Sz, EEG
- Hypoxic Brain Injury: Hx of Hypoxic event
- Hypoglycemia: Chemistries
- Toxin Ingestion: Tox Screen/ Medication levels
- Meningitis/Encephalitis: CBC/ LP

Delirium
- Acute confusional state with impaired alertness
  - Alerting functions
    - Overworking or underworking
    - Difficulty focusing, shifting or sustaining attention
  - Formal definition includes:
    - Fluctuating confusion
    - Disturbed sleep wake cycle
### Pathophysiology

- 4 general causes
  1. Primary intracranial disease
  2. Systemic disease affecting CNS
  3. Exogenous toxins
  4. Drug withdrawal

### Clinical Features

- Onset is within days
- 3 general variants of activity and alertness
  1. Hypoalert-hypoactive
  2. Hyperalert-hyperactive
  3. Mixed
    - May cycle rapidly between hyperactive and hypoactive.

### Clinical Features

- Altered sleep wake cycles
- “Sundowning”
- Tremor, tachycardia, diaphoresis, outbursts, delusions, hallucinations may occur

### Diagnosis

- Diagnosis primarily by history
- Physical exam to look for causes
- Additional testing to identify a cause
  - Labs: CMP, CBC, UA
  - +/- lumbar puncture
  - Radiology: CXR and head CT
  - MMSE

### Treatment

- Treat the underlying cause
  - Infections: pneumonia, UTI, meningitis, sepsis
  - Metabolic: hypoglycemia, electrolytes, hepatic, thyroid disorders, ETOH, or drugs
  - Neurologic: CVA, TIA, seizure, intracranial hemorrhage or mass
  - Cardiopulmonary: CHF, MI, PE, hypoxia
  - Drug related: Narcotics, sedatives, muscle relaxants, antiemetics, digoxin

- Sedation
  - Haloperidol
  - Lorazepam

- Confinement or restraints as appropriate

- Admit unless rapidly reversible cause is identified
Coma

- State of reduced alertness and responsiveness from which you cannot be aroused
- Glasgow Coma Scale
  - Motor, verbal, eye opening

Pathophysiology

- Global
  - Hypoglycemia, hypoxia
- CNS
  - Brainstem disease
  - Bilateral cortical disease
  - Unilateral should not present as coma

Mass Lesions Causing Coma

- Secondary to compression of the brainstem
- Primarily uncal vs. central

Uncal herniation

- Medial temporal lobe compresses brainstem
- Decreased responsiveness going into a coma
- Ipsilateral pupil dilated and nonreactive

Central Herniation

- Progressive loss of consciousness
- Decorticate posturing
- Irregular respirations
### Clinical Features
- Coma secondary to hemispheric hemorrhage may still have localizing features
- Pupillary, muscle, and cranial nerve exam to determine central vs. focal
- Pupillary response generally preserved in toxic metabolic coma

### Diagnosis
- Stabilization diagnosis and treatment overlap
- ABC’s
- Lab, +/- LP
- CT head
- Examination
  - Focal vs. diffuse

### Specific Issues
- C-spine immobilization if trauma suspected
- Pediatric coma commonly ingestion, infection, or abuse
- Seizures
  - Coma s/p seizure activity
  - “electromechanical dissociation of the brain and body”

### Treatment
- Reverse identifiable causes
- Glucose
- Naloxone
  - If signs or history of opioid use
- Flumazenil
  - Only recommended if history of benzo use not as routine.

### Special Situations:
- Brain Death vs. “No hope of Meaningful Recovery”