Child Neurology

Altered Mental Status and Coma

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

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

Altered Mental Status

Examination of the child
1) ABC’s
2) Neurologic Exam
   - Cranial Nerves
   - Deep Tendon Reflexes
   - Sensory
   - Motor
   - Cerebellar
   - Mental Status
Neurologic Exam
Cranial Nerves

Eye movements
Doll’s Eyes
Cold Water Calorics

Neurologic Exam
Cranial Nerves

Papillary light reflex

Pupillary light reflex

Neurologic Exam
Cranial Nerves

Corneal Sensation

Gag

Neurologic Exam
Cranial Nerves

Respiratory Drive

• Motor Exam

Comparing decerebrate and decorticate postures

Decerebrate: Posture in which the upper extremities are flexed, while the lower extremities are extended.

Decorticate: Posture in which the upper extremities are extended, while the lower extremities are flexed.
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

Motor Response | Example | Score
--- | --- | ---
Commands | Follows simple commands | 6
Localizes Pain | Pulls examiner's hand away when pinched | 5
Withdraws from Pain | Pulls a part of body away when pinched | 4
Abnormal Flexion | Flexes body inappropriately to pain | 3
Abnormal Extension | Body becomes rigid in an extended position when examiner pinches him | 2
No Response | Has no motor response to pinch | 1

Eye-Opening

| | |
--- | --- |
Spontaneous | Opens eyes on own | 4 |
To Voice | Opens eyes when asked to in a loud voice | 3 |
To Pain | Opens eyes when pinched | 2 |
No Response | Does not open eyes | 1 |

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

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Score</th>
</tr>
</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>
<td>5</td>
</tr>
<tr>
<td>Confused Conversation</td>
<td>Seems confused or disoriented</td>
<td>4</td>
</tr>
<tr>
<td>Inappropriate Words</td>
<td>Talks so examiner can understand him but makes no sense</td>
<td>3</td>
</tr>
<tr>
<td>Sounds</td>
<td>Makes sounds that examiner cannot understand</td>
<td>2</td>
</tr>
<tr>
<td>No Response</td>
<td>Makes no noise</td>
<td>1</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

Treatment

- 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
Increased Intracranial Pressure

- Localized vs. generalized
- Cerebral blood flow constant with MAP of 50-100 mm of Hg
- CPP = MAP – ICP
- Cushing reflex of hypertension and bradycardia

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
  - Thiamine prior if alcoholic
- Naloxone
  - If signs or history of opioid use
- Flumazenil
  - Only recommended if history of benzo use not as routine.