Acutely Depressed Mental Status in Children

National Pediatric Nighttime Curriculum
Written by Terry Platchek, MD
Lucile Packard Children’s Hospital, Stanford University
Objectives

- Be able to recognize children with acutely depressed mental status
- Know the major causes of acutely depressed mental status in children
- Initiate the workup for depressed mental status in children
- Initiate management of depressed mental status in children
Definitions

- **Coma:**
  - Unarousable unresponsiveness
  - The most profound state of depressed mental status

- **Stupor, Lethargy, Difficult to Arouse, Obtunded:**
  - All of these terms are imprecise and describe a decreased level of consciousness
  - May be marked by absence of spontaneous movement and diminished responsiveness to stimulation
  - Awareness is generally impaired before arousal

- **Brain Death (1-18 y.o.):**
  - Criteria include coma, apnea, and absent brainstem reflexes
  - Brain death specifically implies no opportunity for recovery
Physiology

- **Arousal:** The physiology of arousal is dependent on the reticular activating system (RAS). The RAS is a poorly localized network of cells in the brainstem with projections to the thalamus, hypothalamus and cortex.

- **Awareness:** Awareness is mediated by the cerebral cortex in widely distributed neuronal networks. Awareness is the product of cortical function that resides within both hemispheres and then projects down to the thalamus and then out, for either motor or sensory functions.
Etiology of Non-Traumatic Pediatric Coma from UK Prospective Study

Workup

- Depressed mental status is a medical emergency with a *broad* differential
- Determination of etiology is essential for optimal treatment
- Workup requires a systematic approach
Etiology of Depressed Mental Status (from Berger et al)

<table>
<thead>
<tr>
<th>Nonstructural, Symmetrical</th>
<th>Structural, Symmetrical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxins</td>
<td>Supratentorial</td>
</tr>
</tbody>
</table>

### Toxins
- Lead
- Thallium
- Mushrooms
- Cyanide
- Methanol
- Ethylene glycol
- Carbon Monoxide

### Drugs
- Sedatives
- Barbiturates
- Hypnotics
- Tranquilizers
- Bromides
- Alcohol
- Opiates
- Paraldehyde
- Salicylate
- Psychotropics
- Anticholinergics
- Amphetamines
- Lithium
- Phencyclidine
- MAOi's

### Metabolic
- Hypoxia
- Hypercapnia
- Hypernatremia
- Hypoglycemia
- Hyperglycemic nonketotic coma
- Diabetic ketoacidosis
- Lactic acidosis
- Reye's encephalopathy
- Aminoacidemia
- Wernicke's encephalopathy
- Porphyria
- Hepatic encephalopathy
- Uremia
- Dialysis
- Addisonian crisis
- Hypothyroidism

### Infections
- Sepsis
- Bacterial meningitis
- Viral encephalitis
- Postinfectious encephalomyelitis
- Syphilis
- Typhoid fever
- Malaria
- Waterhouse-Friderichsen syndrome

### Other
- Postictal
- Diffuse ischemia (MI, heart failure, arrhythmia)
- Hypotension
- Fat embolism
- Hypertensive encephalopathy
- Hypothyroidism
- Nonconvulsive status epilepticus
- Heat stroke

<table>
<thead>
<tr>
<th>Structural, Asymmetrical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supratentorial</td>
</tr>
</tbody>
</table>

### Supratentorial
- Bilateral internal carotid occlusion
- Bilateral anterior cerebral artery occlusion
- Sagittal sinus thrombosis
- Subarachnoid hemorrhage
- Thalamic hemorrhage
- Trauma-contusion
- Concussion
- Hydrocephalus

### Infratentorial
- Basilar occlusion
- Midline brainstem tumor
- Pontine hemorrhage
- Central pontine myelinolysis

### Structural, Asymmetrical
- TTP
- DIC
- Nonbacterial thrombotic endocarditis
- Subacute bacterial endocarditis
- Fat emboli
- Unilateral hemispheric mass (tumor, abscess, bleed) with herniation
- Subdural hemorrhage
- Bilateral intracerebral bleed
- Pituitary apoplexy
- Massive or bilateral supratentorial infarction
- Multifocal leukoencephalopathy
- Creutzfeldt-Jakob disease
- Adrenal leukodystrophy
- Cerebral vasculitis
- Subdural empyema
- Thrombophlebitis
- Multiple sclerosis
- Leukoencephalopathy from chemotherapy
- Acute disseminated encephalomyelitis (ADEM)

### Broad Differential! Manageable in Categories

Infratentorial
Focused History

**AMPLE History**

A: Allergy/Airway  
M: Medications  
P: Past medical history  
L: Last meal  
E: Event - What happened?
  - Rapid or Gradual Onset?
  - Preceding Headache or Neurologic Symptoms?
  - Ingestions?
  - Vague or inconsistent history from caregiver is suspicious for non-accidental trauma.
Focused Physical Exam (suggested by Michelson et al.)

- ABC’s (including cardio-respiratory exam)
- Vitals
- Neurologic examination
  - Brief and to the point
  - Differentiate structural from non-structural causes
  - Assess: Level of consciousness/responsiveness, Motor responses, Brainstem reflexes
- Meningismus / Nuchal Rigidity
  - Brudzinski’s sign - Involuntary hip & knee flexion with forced neck flexion
  - Kernig’s sign - Involuntary knee flexion with forced flexion of the hip
- Fundoscopy
  - Papilledema suggests increased ICP of more than several hours duration.
  - Retinal hemorrhages in an infant are a sign of non-accidental trauma
- Skin
  - Bruising may suggest trauma, rashes may suggest infection
<table>
<thead>
<tr>
<th></th>
<th>Infant &lt; 1 yr</th>
<th>Child 1-4 yrs</th>
<th>&gt; 4 years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EYES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Open</td>
<td>Open</td>
<td>Open</td>
</tr>
<tr>
<td>3</td>
<td>To voice</td>
<td>To voice</td>
<td>To voice</td>
</tr>
<tr>
<td>2</td>
<td>To pain</td>
<td>To pain</td>
<td>To pain</td>
</tr>
<tr>
<td>1</td>
<td>No response</td>
<td>No response</td>
<td>No response</td>
</tr>
<tr>
<td><strong>VERBAL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Coos, babbles</td>
<td>Oriented, speaks, interacts, social</td>
<td>Oriented and Alert</td>
</tr>
<tr>
<td>4</td>
<td>Irritable cry, consolable</td>
<td>Confused speech, disoriented, consolable</td>
<td>Disoriented</td>
</tr>
<tr>
<td>3</td>
<td>Cries persistently to pain</td>
<td>Inappropriate words, inconsolable</td>
<td>Nonsensical speech</td>
</tr>
<tr>
<td>2</td>
<td>Moans to pain</td>
<td>Incomprehensible, agitated</td>
<td>Moans, unintelligible</td>
</tr>
<tr>
<td>1</td>
<td>No response</td>
<td>No response</td>
<td>No response</td>
</tr>
<tr>
<td><strong>MOTOR</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Normal spontaneous movement</td>
<td>Normal spontaneous movement</td>
<td>Follows commands</td>
</tr>
<tr>
<td>5</td>
<td>Withdraws to touch</td>
<td>Localizes pain</td>
<td>Localizes pain</td>
</tr>
<tr>
<td>4</td>
<td>Withdraws to pain</td>
<td>Withdraws to pain</td>
<td>Withdraws to pain</td>
</tr>
<tr>
<td>3</td>
<td>Decorticate flexion</td>
<td>Decorticate flexion</td>
<td>Decorticate flexion</td>
</tr>
<tr>
<td>2</td>
<td>Decerebrate extension</td>
<td>Decerebrate extension</td>
<td>Decerebrate extension</td>
</tr>
<tr>
<td>1</td>
<td>No response</td>
<td>No response</td>
<td>No response</td>
</tr>
</tbody>
</table>
Management (adapted from Thompson and Williams)

- **ABCs / PALS**
  - Stabilize C-Spine if indicated
  - Intubate for GCS ≤ 8

- **D10% - 2.5 mL/kg IV**

- **Lorazepam (0.1 mg/kg) for clinical seizures**

- **Antidote or reversal agent if known/suspected ingestion**

- **For Infection**
  - Ceftriaxone, Vancomycin
  - Acyclovir

- **For increased ICP**
  - Mannitol 0.5-1g/kg

- **For non-convulsive status epilepticus**
  - Lorazepam or Fosphenytoin

**Treat Underlying Cause**
Labs (adapted from Michelson et al.)

- If cause for depressed mental status is not readily apparent send:
  - Bedside blood glucose
  - Urine drug screen
  - Electrolytes with Ca, Mg
  - Complete blood count
  - BUN, creatinine
  - Blood culture
  - Transaminases
  - ABG/VBG, ammonia

- If suspected metabolic abnormality send:
  - UA, urine ketones, plasma amino acids, urine organic acids, plasma free fatty acids, carnitine profile, lactate, pyruvate
Diagnostic Studies

- CT is the initial neuro-imaging test of choice.
  - MRI with DWI can be considered as an adjunct.

- LP after increased ICP has been ruled out

- EEG to rule out nonconvulsive status epilepticus should be performed in children with depressed mental status where etiology remains elusive.
Case 1

A 16 year old girl is brought in unconscious by friends from a party. Physical exam notes the smell of alcohol, tachycardia to 178, fever to 39.8, diaphoresis and BP 185/107. You are called to consult in the ED. What is the most likely etiology of her altered mental status?

MDMA (ecstasy)/Amphetamine intoxication

What if the same patient has absent sweating and dilated pupils?

Anticholinergic Intoxication
Case 2

A 3 year old boy with a past medical history of OTC deficiency is admitted with cellulitis. He is found unresponsive in the child life room. As the pediatrics resident, you are called for urgent evaluation.

Please provide a DDx and workup.

**DDx** includes hyperammonemia, hypoglycemia, sepsis, ingestion, trauma, or sub-clinical seizures.

**Workup** should include a focused physical exam, chemistries, free flowing ammonia, glucose, CBC, cultures and possible ABG. Evidence of trauma should prompt an immediate head CT.
References

- Thompson L, Williams E. Treatment and Prognosis of Coma in Children. UpToDate. 2010.