Acutely Depressed Mental Status in Children

Pediatric Night Float Curriculum

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Definitions

• **Coma:** "unarousable unresponsiveness." The most profound degree to which arousal and consciousness are impaired.
  – Traumatic and nontraumatic causes have roughly equal annual incidences ~ 30/100,000 children.

• **Lethargy, Obtundation & Stupor:** arousal is less impaired than coma. These patients have some difficulty maintaining attention during an examination, tend to fall asleep when not stimulated, and respond poorly (if at all) to questions and commands. These terms are imprecise.

• **Delirium:** disturbance of consciousness with reduced ability to focus, sustain, or shift attention. Confusion, excitement, hallucinations, and irritability are common..

• **Brain Death (1-18 y.o.):** criteria include coma, apnea, and absent brainstem reflexes. Brain death specifically implies no opportunity for recovery.
Depressed Mental Status

**Physiology**

- **Arousal** depends on intact communication between the ascending reticular activating system (ARAS) and its targets in the hypothalamus, thalamus, and cerebral cortex.

- **Awareness** is based on an even more widely distributed network of connections between cortical and sub-cortical structures.

- **Consciousness** can be diminished or abolished by dysfunction within the brainstem, impairment of both cerebral hemispheres, or by insults that globally depress neuronal activity.

**Mimickers**

- **Complete paralysis** (“locked in”) from acute lesions of the brainstem, usually the pons. Patients may be unable to move or speak but retain awareness.
  - Voluntary vertical eye movements and blinking may be retained.
  - Other causes of severe motor paralysis (eg. Guillain Barre syndrome, botulism) may also lead to a similar condition.

- **Akinetic-mutism** or **abulia** may be produced by lesions in the frontal lobe responsible for initiating movement.
  - Patient retains awareness, often follows with the eyes but does not initiate other movements or obey commands.
  - Tone, reflexes, and postural reflexes usually remain intact.

- **Psychiatric unresponsiveness** and **catatonia**
  - Patients often resist passive eye opening, move to avoid noxious stimuli, turn the eyes towards the floor regardless of which side they are lying on, or demonstrate non-epileptic seizures.
  - Catatonia is distinguished from coma by the patient's preserved ability to maintain posture, even to sit or stand.
Etiology of Non-Traumatic Pediatric Coma from UK Prospective Study


Table 4  Age specific aetiology

<table>
<thead>
<tr>
<th>Age band</th>
<th>Accident</th>
<th>Congenital</th>
<th>Epilepsy</th>
<th>Infection</th>
<th>Intoxication</th>
<th>Metabolic</th>
<th>Others</th>
<th>Unknown</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant</td>
<td>3.2%</td>
<td>17.2%</td>
<td>4.3%</td>
<td>50.5%</td>
<td>0.0%</td>
<td>4.3%</td>
<td>6.5%</td>
<td>14.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>1–5 years</td>
<td>11.2%</td>
<td>3.4%</td>
<td>13.5%</td>
<td>33.7%</td>
<td>10.1%</td>
<td>6.7%</td>
<td>4.5%</td>
<td>16.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>6–12 years</td>
<td>5.6%</td>
<td>7.4%</td>
<td>16.7%</td>
<td>31.5%</td>
<td>7.4%</td>
<td>5.6%</td>
<td>13.0%</td>
<td>13.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>13–16 years</td>
<td>6.5%</td>
<td>0.0%</td>
<td>4.3%</td>
<td>28.3%</td>
<td>2.2%</td>
<td>10.9%</td>
<td>13.0%</td>
<td>13.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Total</td>
<td>6.7%</td>
<td>8.2%</td>
<td>9.6%</td>
<td>37.9%</td>
<td>10.3%</td>
<td>5.0%</td>
<td>7.8%</td>
<td>14.5%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
Workup

• Depressed mental status is a medical emergency with a *broad* differential
• Evaluation requires a rapid, comprehensive, and systematic approach
• Early identification of the cause can be crucial for management and prognosis.
Symmetrical, nonstructural
• Toxins
  – Lead, Thallium, Mushrooms, Cyanide, Methanol, Ethylene glycol, Carbon Monoxide
• Drugs
  – Sedatives, Hypnotics, Tranquilizers, Bromides, Anticholinergics, Salicylate, Psychotropics, Lithium, Phencyclidine, MAOIs
• Metabolic
• 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

Symmetrical, structural
• 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

Infratentorial structural
• Basilar occlusion*, Midline brainstem tumor, Pontine hemorrhage*, Central pontine myelinolysis

Infratentorial
– Brainstem infarction, Brainstem hemorrhage, Brainstem thrombencephalitis

* Relatively common asymmetrical presentation.
• Relatively symmetrical presentation
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

- **ABC’s (including cardio-respiratory exam)**
- **Vitals**
  - Temperature, Heart rate, Respirations, Blood pressure, O2 Sat
- **Neurologic examination**
  - Necessarily brief and directed at determining whether the pathology is structural or metabolic
  - Asses:
    - Level of consciousness
    - Motor responses
    - Brainstem reflexes (pupillary light, extraocular, and corneal reflexes)
- **Meningismus**
  - Passive resistance to neck flexion (nuchal rigidity), involuntary knee flexion with forced hip flexion (Kernig's sign), or involuntary hip and knee flexion with forced neck flexion (Brudzinski's sign).
  - These signs are often absent in infants and young children.
- **Skin**
  - hypoxia (blue), jaundice (yellow), anemia (pale), and CO poisoning (cherry-red).
  - Bruising and evidence of other orthopedic injury suggests trauma.
  - Particular rashes may suggest various infections.
- **Fundoscopy**
  - Papilledema suggests increased ICP of more than several hours duration.
  - Retinal hemorrhages are a sign of shaken baby syndrome.
### Pediatric Glasgow Coma Scale

#### Table II: Glasgow Coma Score or PGCS

<table>
<thead>
<tr>
<th></th>
<th>Infant &lt;1 yr</th>
<th>Child 1-4 yrs</th>
<th>Age 4–Adult</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>
Labs

- All patients without readily identifiable cause should have:
  
  - Bedside blood glucose  
  - Transaminases, ammonia  
  - Electrolytes, Ca, Mg  
  - Complete blood count  
  - BUN, creatinine  
  - Urine drug screen  
  - Arterial blood gas  
  - Blood culture

- In suspected metabolic abnormalities, or if the diagnosis remains obscure:
  
  - UA, urine porphyrins, ketone bodies, plasma free fatty acids, carnitine, creatine kinase, lactate, pyruvate, serum amino acids, and urine organic acids should be obtained.
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 should be performed in children with coma of unknown etiology.
  – EEG is often the only means of recognizing nonconvulsive status epilepticus.
Management

• ABCs / PALS
  – Stabilize C-Spine
  – Intubate for GCS ≤ 8
  – Supplemental O2
  – Support BP PRN
  – CR Monitor
• D10 2.5 mL/kg IV
• Lorazepam (0.1 mg/kg) for definite seizures
• Empiric Antibiotics
  – Ceftriaxone, Vancomycin
  – Acyclovir

• If Possible Narcotic Ingestion
  – Naloxone 0.1 mg/kg IV
• If Possible increased ICP
  – Mannitol 0.5-1g/kg IV
• If Possible non-convulsive status epilepticus
  – Lorazepam or Fosphenytoin IV

Treat Underlying Cause
Case 1

16 year old girl brought in unconscious by friends from a party. Physical exam notable for smell of alcohol, tachycardia to 178, fever to 39.8, diaphoresis and BP 185/107.

MDMA (ecstasy) intoxication

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

Antichololnergic Intoxication
Case 2

3 year old boy with past medical history of OTC deficiency is brought into the emergency by EMS after being found unresponsive in the broom closet at preschool.

Please provide a DDx and workup.
A summary from UpToDate for the emergency evaluation and management of stupor and coma in children

<table>
<thead>
<tr>
<th>EVALUATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vital signs and general and trauma examination</td>
</tr>
<tr>
<td>Neurologic examination and GCS</td>
</tr>
<tr>
<td>Screening laboratories (CBC, glucose, electrolytes, BUN, creatinine, blood cultures, LFTs, urinalysis, urine drug screen)</td>
</tr>
<tr>
<td>Head CT scan: do emergently if focal neurologic signs, papilledema, fever - consider rapid MRI instead if available.</td>
</tr>
<tr>
<td>Lumbar puncture: do emergently after CT scan if fever, elevated WBC, meningismus; otherwise do according to level of suspicion for diagnosis or if cause remains obscure</td>
</tr>
<tr>
<td>Other laboratory tests: for metabolic conditions (see text), coagulation tests, carboxyhemoglobin, specific drug concentrations - do according to level of suspicion for diagnosis or if cause remains obscure</td>
</tr>
<tr>
<td>EEG: for possible nonconvulsive seizure, or if diagnosis remains obscure</td>
</tr>
<tr>
<td>Brain MRI with DWI, if cause remains obscure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MANAGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABCs:</td>
</tr>
<tr>
<td>Intubate if GCS ≤8 or respiratory failure</td>
</tr>
<tr>
<td>Stabilize cervical spine</td>
</tr>
<tr>
<td>Supplement O2</td>
</tr>
<tr>
<td>IV access</td>
</tr>
<tr>
<td>Blood pressure support as needed</td>
</tr>
<tr>
<td>Dextrose 0.25 g/kg (2.5 mL/kg of 10 percent dextrose solution) after blood glucose drawn, before results back; do NOT delay pending results</td>
</tr>
<tr>
<td>Treat definite seizures. Initial treatment with lorazepam (0.1 mg/kg, maximum single dose 5 mg). If seizures continue treat as for status epilepticus.</td>
</tr>
<tr>
<td>Empiric treatments:</td>
</tr>
<tr>
<td>For possible infection:</td>
</tr>
<tr>
<td>Ceftriaxone 100 mg/kg (maximum single dose 2 grams) and Vancomycin (age-specific dose)</td>
</tr>
<tr>
<td>Acyclovir (age-specific dose)</td>
</tr>
<tr>
<td>For possible ingestion:</td>
</tr>
<tr>
<td>Naloxone 0.1 mg/kg IV in patients up to 20 kg or ≤5 years; maximum 2 mg IV (use if opioid toxidrome: miosis, respiratory depression, hypotonia)</td>
</tr>
<tr>
<td>For possible increased ICP:</td>
</tr>
<tr>
<td>Mannitol 0.5 to 1 gram/kg IV</td>
</tr>
<tr>
<td>For possible nonconvulsive status:</td>
</tr>
<tr>
<td>Lorazepam (0.1 mg/kg, maximum single dose 5 mg). If suspicion of seizures continue treat as for status epilepticus.</td>
</tr>
<tr>
<td>Phenytoin (10 to 20 PB equivalents/kg). If suspicion of seizures continue treat as for status epilepticus.</td>
</tr>
</tbody>
</table>
References


