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## **Neurologic Emergencies**

### **1. Altered Mental Status**

#### Background:

- Altered mental status is characterized by the failure to respond to verbal or physical stimulation in a manner appropriate to a child's developmental level.
- Coma is a state of altered consciousness in which a person appears to be asleep, cannot be aroused, and shows no awareness of the environment.
- Lethargy, obtundation, and stupor refer to states in which arousal is somewhat less impaired.
- Delirium is a state of consciousness with reduced ability to focus or sustain attention.
- Differential mnemonic: **AEIOU TIPS**
  - Alcohol, epilepsy, insulin, overdose, (lack of) oxygen, underdose, uremia, trauma, infection, poison, psychoses, sepsis, shock, stroke. Also hypoglycemia, hyponatremia.

#### Signs and Symptoms:

- Change from baseline mental status, may include altered respiratory pattern, abnormal perfusion and hemodynamics, focal neurologic abnormalities.

#### Evaluation:

- Altered mental status is a medical emergency whose evaluation requires a rapid, comprehensive, and systematic approach given the broad range of possible etiologies.
- Pediatric Advanced Life Support (PALS) evaluation is critical for initial stabilization and may provide insight into the underlying etiology.
- Physical exam: Vital signs, complete physical and/or trauma exam, neurologic exam and GCS.
- Labs: CBC, electrolytes and glucose, blood and urine culture, blood gas, LFTs, urinalysis, urine drug screen, ammonia level (must be from free flowing sample).
- Co-oximetry to evaluate for carbon monoxide exposure if suspected.
- Consider head CT if intracranial pathology is suspected.
- Consider lumbar puncture for suspected meningitis.

#### Management:

- Pediatric Advanced Life Support (PALS) for initial evaluation and stabilization.
- For poor perfusion or shock: See Sepsis and Septic Shock section in Infectious Emergencies.
- For suspected toxic ingestion or drug overdose: See Ingestions & Toxic Exposures.
- Consider endotracheal intubation for respiratory insufficiency/failure or GCS  $\leq 8$ .
- Consult Pediatric Neurology.
- For suspected trauma: See Trauma.
- Obtain IV/IO access.
- Supplemental oxygen to keep oxygen saturation  $>92\%$ .
- For seizure activity: See Seizure and Status Epilepticus section in Neurologic Emergencies.
- For suspected dysrhythmia: 12 lead ECG.
- For suspected infection: See Sepsis and Septic Shock section in Infectious Emergencies.
- For suspected HSV encephalitis: Acyclovir ( $<10$  kg: 20 mg/kg/dose;  $>10$  kg: 10 mg/kg/dose) IV once.
- For symptomatic hyponatremia: 3% hypertonic saline [2.5 mEq/kg/dose (~5 mL/kg/dose)] IV once over 20 minutes.
- For suspected cerebral edema or elevated ICP: mannitol (1 gm/kg/dose) IV once over 20 minutes [in-line filter set ( $\leq 5$  micron) should always be used for mannitol concentrations  $\geq 20\%$ ].
- For hypoglycemia: See Hypoglycemia section in Endocrine Emergencies.
- Prevent hypothermia and treat hyperthermia.

## 2. Seizure and Status Epilepticus

### Background:

- A seizure represents the clinical manifestation of abnormal, excessive, synchronous discharges of neurons primarily in the cerebral cortex.
- Partial seizures are typically limited to one hemisphere (focal), and are classified as *simple* if consciousness is maintained, or *complex* when consciousness is impaired.
- Generalized seizures indicate involvement of both hemispheres.
- Approximately 1% of children experience at least one afebrile seizure by 14 years of age.
- Approximately 3-5% of children will experience a single febrile seizure by 5 years of age, with 30% of these patients experiencing additional febrile seizures.
- The most common etiologies are development/birth related, idiopathic, vascular, traumatic, infectious, neoplastic, metabolic, electrolyte imbalance, and drug exposure.
- Status epilepticus is defined as a seizure lasting >30 minutes or seizures repeated frequently enough that the patient does not regain consciousness between seizures.
- Seizures lasting more than 5 minutes have a high risk of lasting 30 minutes or more, which may be associated with delayed/refractory treatment response.
- The mortality rate of status epilepticus ranges from 3-9% depending on the underlying etiology.

### Signs and Symptoms:

- Altered consciousness, focal neurologic abnormalities; disturbance of sensorium, motor activity (stereotypic, uncontrollable, repetitive), sensation and/or autonomic function.

### Evaluation:

- Physical exam: Vital signs, general appearance, serial neurologic exams.
- Blood pressure and heart rate frequently rise due to catecholamine release and sympathetic discharge during the initial phase of seizure activity, but blood pressure may decrease with continued seizures or after initiation of antiepileptic drug (AED) therapy.
- Labs: Serum electrolytes including magnesium and ionized calcium, glucose, blood gas, CBC, urine drug screen, serum AED levels.
- Consider head CT if intracranial pathology is suspected.
- If febrile: Blood and urine cultures, and consider lumbar puncture.

### Management:

- Pediatric Advanced Life Support (PALS) for initial evaluation and stabilization.
- Consult Pediatric Neurology and Pediatric Critical Care.
- For hypoglycemia: See Hypoglycemia section in Endocrine Emergencies.
- For symptomatic hyponatremia: 3% hypertonic saline [2.5 mEq/kg/dose (~5 mL/kg/dose)] IV once over 20 minutes.
- For seizure activity:
  - Lorazepam (0.1 mg/kg/dose; max 4 mg/dose) slow IV push once; may repeat once if seizures persist.
- For persistent seizure activity refractory to lorazepam x2 doses:
  - Fosphenytoin [20 mg phenytoin equivalents (PE)/kg/dose] IV once over 10 minutes.
  - If seizures persist: Consider additional fosphenytoin (10 mg PE/kg/dose) IV once over 5 minutes.
- For seizure activity without IV/IO access: Diazepam (0.3 mg/kg/dose; round dose to nearest 2.5 mg increment) PR once.
- Escalating doses and number of AEDs increases the risk of respiratory failure and/or hypotension.
  - For impending respiratory failure: See Supplemental Oxygen & Airway Management section in Preparing to Transport.
  - For hypotension: See Sepsis and Septic Shock section in Infectious Emergencies.
- Prevent hypothermia and treat hyperthermia.