Coma

Lewis B. Eberly, MD
Alfaneurology
VCU School of Medicine Inova Campus

Definitions and Descriptions of Altered Mental Status

- Lethargy
- Obtundation
- Stupor
- Coma
- Delirium
- Dementia
- Brain Death

Levels of altered mental status / coma

- Delirium - confusional state, may be marked by agitation or lethargy or waxing and waning mental status
  - DT's
  - complex partial seizures
  - drug induced delirium
  - hypoxia

Levels of altered mental status / coma

- Obtundation
  - lethargic, blunted cognition
  - awake but somnolent or slowed
  - arousable
- Stupor
  - asleep/semi comatose
  - only arouses when stimulated
  - reverts back to sleep when stimulus withdrawn

Definition of Coma

- Unresponsive to the environment
- Unable to communicate
- Unarousable

Unconsciousness occurs when either:

- Both cerebral hemispheres are depressed
- The reticular activating system is dysfunctional
Etiologies of Coma

- Supratentorial mass lesions
  - intracerebral hematoma
  - subdural hematoma
  - large ischemic infarction
  - brain tumor
  - brain abscess
  - epidural hematoma

- Infratentorial lesions
  - brainstem infarction
  - pontine hemorrhage
  - brainstem demyelination
  - cerebellar tumor
  - cerebellar abscess
  - cerebellar hemorrhage

- Metabolic and other diffuse disorders
  - drug toxicity
  - anoxic-ischemic encephalopathy
  - hepatic encephalopathy
  - endocrine disorders
  - acid-base disorders
  - encephalitis and encephalomyelitis
  - subarachnoid hemorrhage
  - hyper- hypothermia
  - uremic encephalopathy

- Drug Overdose: Mortality 5-10%
- Metabolic: Mortality 50%
- Head Trauma: Mortality 50%
- Anoxia: Mortality 90%
- Stroke: Mortality 80%

Consciousness is Dependent on an Intact Reticular Activating System!

The RAS and Essential Neurotransmitters

- Epinephrine Locus Coeruleus
- Serotonin: Median Raphe
- Acetylcholine: Basal Nucleus
Initial Neurological Exam: Primary Question

- **Is the coma due to:**
  - toxic, infectious, metabolic coma?  
  OR  
  - acute neurosurgical cause?  
    - bleed  
    - neoplasm  
    - infection  
    - increased intracranial pressure

Exam points

- **Nuchal rigidity**
  - sub arachnoid hemorrhage  
  - meningitis
- **Rash**
  - meningococcus,  
  - spiders  
  - drug reaction
- **Ecchymosis over orbit or mastoid**
- **Papilledema**
- **Subhyaloid hemmorhage**

Initial Exam

- **Pupils - Unilateral Dilated Pupil - R/o herniation**
- **Fundi - r/o Papilledema**
- **Oculocephalic and oculovestibular**
- **Motor response**  
  - withdrawal  
  - decortication  
  - decerebration
- **Progression suggests**  
  - expanding or worsening mass

Abnormal postures in a comatose patient

- **Bilateral dilated pupils**
  - transtentorial herniation of both temporal lobes  
  - anticholinergic of sympathomimetic drug intoxication
- **Bilateral pinpoint pupils**
  - mophine poisoning  
  - pontine hemorrhage  
  - organophosphates or eye drops (miotic)

Initial Exam

- **Asymmetric pupils (anisocoria)**
  - difference of 1mm or less and normal constriction may be normal  
  - if the dilated pupil does not react or reacts slowly, suggests rapidly expanding ipsilateral mass compressing midbrain or oculomotor nerve
Initial Exam

- **Extraocular Movements**
  - oculocephalic (doll's eyes), and oculovestibular (cold caloric) reflexes
  - normal – full doll's eye movements and tonic conjugate eye movement to side of ice water irrigation
  - abnormal – lesions of oculomotor nerve or midbrain
    - no response – structural lesion or metabolic (sedative drugs)

Etiologies-toxic metabolic

- **Drug overdose**
  - narcotics, tricyclics, stimulants
- **Metabolic**
  - sepsis
  - hepatic encephalopathy
  - uremic encephalopathy
  - hypoglycemia
  - hypothyroid (myxedema coma)
  - ETOH withdrawal/intoxication
  - anoxic encephalopathy

Metabolic Coma

- **Signs and symptoms of toxic - metabolic coma**
  - pupils small - narcotics
  - pupils large - tricyclics
  - nystagmus - dilantin, pcp
  - respiratory depression - narcotics
  - tremor / asterixis - uremia, etoh, hepatic

Locked-in State

- **Quadriplegia**
- **Paralysis of lower cranial nerves**
- **Lesion of basis pontis (RAS not affected)**
- **Preservation of consciousness**

Signs of increased ICP / Herniation

- **Pupils**
  - unilateral dilated pupil is a sign of?
  - bilateral small poorly reactive pupils are a sign of?
- **Eye movements**
  - third nerve palsy?
  - sixth nerve palsy?
  - can be assessed by cold caloric
- **Fundoscopy**
  - signs of papilledema?
- **Respiratory pattern?**
Signs of herniation (cont’d)

- Can be detected by a deterioration in mental status, pupils, or motor exam
  - withdrawal to pain transitioning to flexor withdrawal
  - flexor withdrawal to extensor posturing
    - decortication - flexor withdrawal - lesion above red nucleus
    - decerebration - extensor posturing - lesion below red nucleus

Initial Management

- Protect airway - Support vitals
- If evidence of trauma, immobilize spine, get stat c-spine
- IV, Pulse ox, frequent vitals and neurochecks
- Intubate if GCS < 10 or if any question of ability to protect airway
- Stat
  - fingerstick for dextrose
  - CBC, electrolytes, BUN/Cr, Calcium, ABG, LFT's, ammonia, UA, serum and urine tox screen, blood cultures if febrile
- Dextrose (1 amp = 25 grams dextrose)
  - always follow with Thiamine 100 mg IM
  - improves recovery of Wernicke’s, if delayed, increased risk of Korsakoffs

If bacterial meningitis or SAH suspected

- For SAH, STAT CT of brain
  - 50% yield for SAH
  - notify neurosurgery stat if suspected
- If bacterial meningitis suspected, do not delay for CT - Start empiric therapy
  - ceftriaxone 2 grams q12 hours IV
  - vancomycin 750-1000 mg q 12 hours IV
  - ampicillin 2 grams q 4 hours IV age > 65 or if immunocompromised
- LP: L3-L4 interspace
  - obtain opening pressure
  - cell count tubes 1 and 4
  - tubes 2 and 3, gram stain, Cocci, AFB, india ink,
  - protein and glucose

 Increased ICP

- Hyperventilation: Reduces ICP immediately, peak effect 1-2 hours
  - NO BENEFIT TO drop PCO2 < 25, Ideal = 30
- Mannitol: Onset in 30 minutes lasts 4-6 hours
- Mannitol and lasix are synergistic.
  - 1 - 2 grams/kg bolus
  - 0.5 - 1 gram/kg q 6 hours
  - monitor sodium, osmolality, BUN, carefully
**Increased Intracranial Pressure: Hyperventilation**

- Hyperventilation reduces ICP acutely, but ICP returns to baseline within 1-2 hours.
- Reduction of CO2 beyond a pCO2 of 30 has little benefit.

**The prognosis of coma is primarily dictated by etiology**

**Predictors of Awakening / Good Outcome**

- **EEG:**
  - strong predictor only for poor outcome in coma
  - 0/158 good recovery if:
    - burst suppression
    - low voltage
    - PLEDS
- **EP’s: Median Nerve**
  - strong predictor only of poor outcome
  - absent cortical potential to median nerve stimulation (N20)
  - poor prognosis >95%

**Persistent Vegetative State**

- Preserved vegetative functions (sleep-wake cycle, autonomic and respiratory control)
- No awareness
- No appropriate response to the environment
- Spontaneous movements, but no purposeful or voluntary responses to stimulation
- Preservation of hypothalamic and brainstem function

**Persistent Vegetative State**

- Recovery of consciousness is rare after 3 months
- May survive for years
- Mortality rate is 80% in 3 years, 95% in 5 years