Coma

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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  - reverts back to sleep when stimulus withdrawn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

Consciousness is Dependent on an Intact Reticular Activating System!

The RAS and Essential Neurotransmitters

- Epinephrine Locus Coeruleus
- Serotonin: Median Raphe
- Acetylcholine: Basal Nucleus

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

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
  - hypothryoid (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 Narcotic OD suspected, give
  - naloxone 1 - 2 amps
  - repeat in 15 minutes
- If benzodiazepine overdose suspected,
  - flumazenil .2 mg
  - repeat q 1 minute up to 1.0 mg, may produce seizures.
- If ETOH withdrawal (72-96 hrs post ETOH)
  - (confusion, hallucinations, tremor, tachycardia, HTN)
  - thiamine 100 mg/IM
  - librium 25-100 mg q8hrs
  - For ETOH seizures
    - (12-24 hours post withdrawal)
      - give thiamine 100mg
      - stat fingerstick for dextrose
      - lorazepam 2 mg IV q 6-8 hours
- If bacterial menigitis or SAH suspected
  - For SAH, STAT CT of brain
    - 90% 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 - 0/138 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