

# COMA

(Last updated 02/13/2019; Reviewer: Yuliya Pinevich, MD)

**PRESENTING COMPLAINT:** loss of consciousness

## FINDINGS

- **A** Check airway
- **B** ↑RR (central hyperventilation), Cheyne-Stokes (↑RR with periods of apnea), apneustic breathing, ataxic and irregular periodic breathing
- **C** ↓HR and ↑BP (suggests increased ICP)
- **D** AVPU, GSC, RASS or FOUR score  
Pupils (size and reactivity), corneal reflexes, gaze, fundoscopy (for papilledema), calorics, doll's eyes, cough/gag reflexes, muscle tone, lateralization and meningeal signs  
Presence of abnormal movements (myoclonus, asterixis, focal or generalized seizures)
- **E** Evidence of trauma (ecchymosis, hemotympanum, orthopedic injuries), intoxication (cherry red color mucous membranes (CO poisoning), needle tracks (IV drug abuse), metabolic disorder (pallor, hypo/hyperglycemia glucose level; hypo/an-oxia; tremor, asterixis prior to coma onset, confusion and stupor commonly precede motor signs, history of liver, thyroid, kidney, heart disease), infection (signs of sepsis, meningitis, encephalitis, shock; petechiae), cerebrovascular disease (signs of hypertensive encephalopathy/PRES, intracranial hemorrhage, stroke, seizure, postictal/post cardiac arrest state), hyper/hypo-thermia
- **L<sub>PC</sub>** Glucose level , ABG, hematocrit, serum lactate, osmolar gap, urinalysis, electrolytes, toxicology screen , ammonia level
- **U<sub>PC</sub>** NA

\***V** (verbal), **P** (pain), **U** (unconsciousness), **D** (delirious)

**U<sub>PC</sub>** (point of care ultrasound) **L<sub>PC</sub>** (point of care labs)

**OTHER HISTORY:** Time course and prodrome; History, medications and substance abuse

## DIFFERENTIAL DIAGNOSIS

- Locked-in syndrome, akinetic mutism, psychogenic unresponsiveness, catatonia

## OTHER INVESTIGATIONS

- Imaging:
  - CT head: rule out mass lesions, hemorrhage, brain edema, herniation
  - Ultrasound: ocular ultrasound for detecting increased intracranial pressure (ICP)
- Lumbar Puncture: Rule out CNS-infection

## THERAPEUTIC INTERVENTIONS

- General:
  - Airway protection: semirecumbent position, consider intubation
  - Balance blood pressure to maintain adequate cerebral perfusion pressure (~70-80 mmHg); MAP: 70 mmHg; ICP<20 mmHg
  - Treat hyperthermia and severe hypothermia
  - Treat rapidly progressive metabolic disorders, hypoglycemia, hypoxemia, hypercapnia, hypotension, hypernatremia, severe hyponatremia
  - Drug reversal/antidote (naloxone)
- Specific to suspected cause:
  - Hypoglycemia: 50% dextrose
  - Opioids/benzo overdose: Naloxone/Flumazenil
  - Raised intracranial pressure:
    - Elevate head of bed (HOB)
    - Avoid compressing head venous drainage
    - Intravenous mannitol (0.5 to 1.0 mg/kg IV q6hr – hold for osmolar gap > 10)
    - Hypertonic saline (75-150cc 10% saline IV every 6hr or 30cc 23.4% as needed – hold for serum sodium >160mmol/L))
    - Hyperventilation
  - Brain mass, subdural or epidural hematoma:
    - Consider surgical removal and drainage
    - Possible use of steroids for vasogenic edema (tumor, abscess)
  - Alcoholics, chronic loop diuretics or malnourished state:
    - Glucose IV, with thiamine 100mg
  - Trauma: Immobilize cervical spine, traumatic Brain Injury management
  - Intoxication:
    - Consider activated charcoal only if within the 1st hour of ingestion; airway protection (intubation) needed in comatose patients and must be considered when high dose used in awake patients
    - Cholinergic agents: Atropine, pralidoxime
    - Salicylates: bicarbonate, hemodialysis
    - Methanol, ethylene glycol: Fomepizole, bicarbonate, hemodialysis
  - CO poisoning: 100% oxygen, consider hyperbaric oxygen

- Meningitis: Early empiric antibiotics (cerebral dosing: ceftriaxone + vancomycin+ampicillin) and/or antiviral therapy (acyclovir); Consider dexamethasone 10 mg IV q6hr for 4 days
- Hepatic encephalopathy:
  - Lactulose orally, consider NGT to administer if unable to swallow or lactulose enema
  - Rifaximin and Zinc
- Hyperammonemia without liver disease (malnutrition, post gastric-bypass, drugs, ornithine-cycle enzyme deficiency): lactulose ineffective, consider sodium-benzoate
- Renal failure: consider dialysis
- Correct other reversible conditions as needed: Oxygen, CO<sub>2</sub>, electrolytes, hemostasis, overdiuresis, hypokalemia, sepsis
- **Consult:** Neurology, neurosurgery, infectious disease, poison control/toxicology

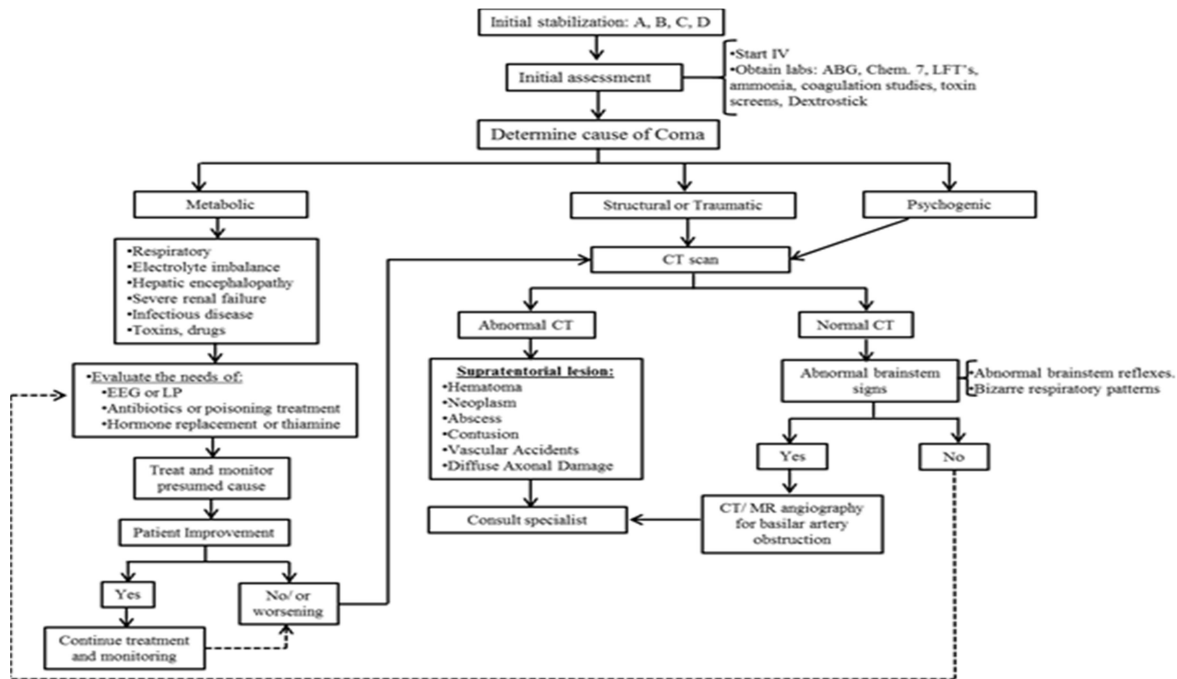
### **ONGOING TREATMENT**

- Further Tests (based on suspected etiology):
  - Additional labs (blood count, electrolytes and glucose, liver and renal function tests, ABG, coagulation, drug screen; +/- blood cultures, adrenal and thyroid function tests, blood smear, HbCO
  - EEG
  - Repeat CT head (+/- angiography), MRI
  - Lumbar puncture (after CT head to exclude intracranial mass, and coagulation tests) preferably before or soon after starting antimicrobial treatment
- Specific management to reduce secondary brain injury:
  - Mannitol if impending herniation
  - Treat seizures: phenytoin/fosphenytoin or levetiracetam or valproic acid
  - TBI: Levetiracetam for 7 days
  - Avoid/Prevent fever; post-cardiac arrest target body temperature of 36 degrees Celsius
  - Consider Hyperbaric Oxygen if suspicion of CO intoxication or air embolism
- Prophylaxis: consider DVT prophylaxis in the absence hemorrhage or bleeding risk. Generally safe to start on 48-72 hr after TBI, ICH, SAH, ischemic stroke
- Nutrition: Early enteral nutrition
- Communication: with the family about prognosis and goals of care
- Palliative care consult

### **CAUTION**

- CT head should be done before lumbar puncture (can precipitate herniation)
- Close follow up for rapidly evolving ICP changes (TBI, meningitis, epidural hematoma)

## ALGORITHM



## REFERENCES & ACKNOWLEDGMENTS

Acknowledgement: Benjamin Bonneton, MD; Lisbeth Garcia Arguello, MD; Enrique Octavio Ortiz-Diaz, MD; Pablo Moreno Franco, MD; Sanjay Subramanian, MD; Alejandro A. Rabinstein, MD

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