


**Brain Injury Course**

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**Emergency Department Approach to  
Coma**


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**Objectives**

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- Review the neurologic evaluation of the patient in coma
- Review the differential diagnosis of coma
- Discuss the indications for diagnostic testing in the patient with coma of undetermined etiology



**Definitions**

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- Lethargy – decreased responsiveness but arousable
- Stupor – diminished awareness, arousable only with vigorous stimulation and patient does not interact in a meaningful way
- Coma – diminished awareness, patient can not be aroused even with vigorous stimulation. Response to noxious stimulation tends to be stereotyped or reflexive



**Case Study: Patient in Coma**

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- 56 year old male found by family on couch unresponsive; last seen “normal” one half hour earlier; 60 minutes prior to ED arrival.
- Brought by EMS; intubated in the field without drugs
- Past history: hypertension, diabetes
- No history of trauma
- Meds: atenolol, HCTZ, insulin,
- ROS: negative



**Case Study: Coma cont'd**

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- 150/90, 16, 80, 37 R, BS 160, intubated 100% pulse ox
- Head – atraumatic
- No gag; no spontaneous swallowing
- Neck – supple
- Cardiopulmonary – normal
- Abdomen – soft
- Skin – no rashes, warm and dry



**Case Study: Coma cont'd**

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- No distress; non verbal
- Eyes closed
- No posturing; no asymmetry of face
- Pupils 2 mm
- Decreased muscle tone, no rigidity
- No response to painful stimuli
- DTRs absent
- Toes – no extensor planter reflex
- Rectal absent



**Key questions in coma**

- What is the differential diagnosis
  - What are the diagnoses you might not think of . . . But don't want to miss
- Does the GCS score predict outcome in this patient
- What are the physical findings that help localize the lesion, identify the etiology, direct management



**The Exam in Coma**

- Assess ABC's, pupils, and skin:
  - Toxic syndromes
- Assess for responsiveness: AVPU
- Assess GCS score
  - Eye opening, verbal, motor
    - Posturing
    - Asymmetry
    - Automatism



**Decorticate posturing in comatose patient**

*Lesion above the red nucleus*

*Lower limbs extend, upper limbs flex following stimulus*

*Activity in the brainstem flexor center, the red nucleus*



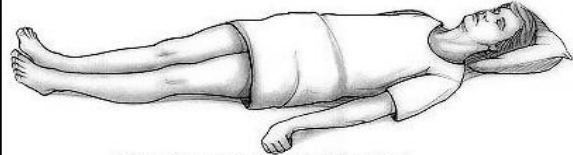
B. Decorticate : upper limbs flex, lower limbs extend

**Decerebrate posturing in comatose patient**

*Upper and lower limbs extend following stimulus (pain, startle, or auditory)*

*Normal inhibition by cortex on the extensor facilitation part of retic form is missing, so extensors hyperactive*

*Lat vest nuclei involved, ablate and extensor posturing reduce*



A. Decerebrate : upper and lower limbs extend

**Classification - GCS**

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• Eyes           <ul style="list-style-type: none"> <li>• 4 opens spontaneously</li> <li>• 3 opens to verbal</li> <li>• 2 opens to pain</li> <li>• 1 do not open</li> </ul> </li> <li>• Verbal           <ul style="list-style-type: none"> <li>• 5 oriented</li> <li>• 4 confused</li> <li>• 3 inappropriate</li> <li>• 2 incomprehensible</li> <li>• 1 none</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• Motor           <ul style="list-style-type: none"> <li>• 6 obeys</li> <li>• 5 localizes</li> <li>• 4 withdraws</li> <li>• 3 abnormal flex</li> <li>• 2 extensor response</li> <li>• 1 none</li> </ul> </li> <li>• Scoring           <ul style="list-style-type: none"> <li>• Mild &gt;12</li> <li>• Moderate 9-12</li> <li>• Severe &lt;9</li> </ul> </li> </ul> |
|---|---|

**Classification - GCS - Mortality**

- Developed for prognosis in severe TBI
- Timing of score is not standardized
- One score not sufficient - perform serial exams
  - Prognosis worse if score does not improve or it worsens
- Does not account for drugs, seizures, or metabolic problems




Chestnut et al. Neurosurg 1994;34:840

### The Eye Exam in Coma

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- Pupils: size, reactivity, deviation, nystagmus
  - Toward a cortical lesion; away from sz
- Fundoscopic exam
  - Limited value in acute processes
- Pupil asymmetry: < 1 mm normal
- Pupil asymmetry: > 1mm sens 40% spec 67% for space occupying lesions
  - Anisocoria: ipsilateral in 21%,
  - Of 51 patients with assym >3mm, 57% did not have a mass lesion



### The Eye Exam in Coma

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- Pupils generally remain reactive in coma from metabolic or infectious etiologies
  - Pin point pupil(s)
    - opioid, alpha adrenergic, chol od
    - Carotid / vertebral artery dissection
    - pontine infarct
      - ✓locked in syndrome
  - Dilated pupil(s)
    - anticholinergic, sympath od
    - herniation



### AMS/Coma Physical Exam *Oculovestibular Reflex*

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- Cold calorics
  - Normal = slow to and fast away from cold water
- Slow phase intact, no fast phase = intact brainstem
- No movement = brainstem injury



### Differential Diagnosis

Diagnoses you don't want to miss

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- Anoxic injury
- Metabolic / hypoglycemia / hyperosmolar
- Space occupying lesion / trauma
- Infection
- Toxic / overdose
- Seizure
  - Nonconvulsive status
- Stroke / subarachnoid
  - Carotid / vertebral artery dissection
  - Locked in syndrome

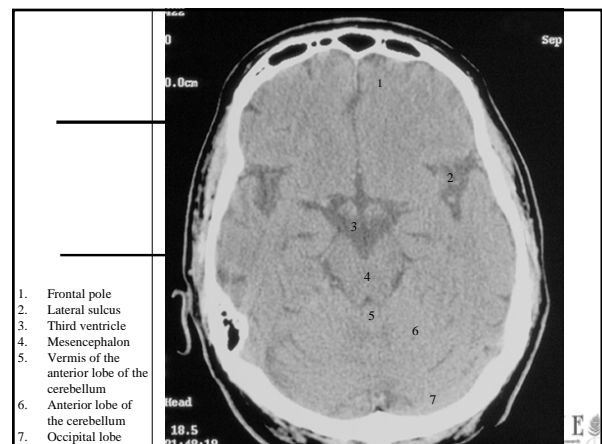


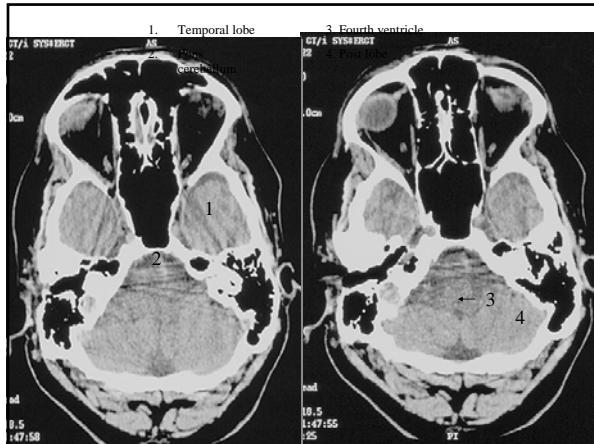
### Diagnostic Testing

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- Metabolic profiles
- Neuroimaging
  - Non contrast head CT
    - Acute blood / mass lesion
  - MRI
    - Posterior fossa / Early infarct
- LP
  - Xanthochromia / Infection
- EEG







### The Subpoena

- All labs “normal”
- CT done 4 hours after ED admission
  - Read as “normal”
- Admitted to MICU
- Neurology consult finds:
  - Vertical gaze intact on command
  - Cold calorics: no movement



### Final Diagnosis: Locked-In Syndrome

- Basilar artery occlusion
- Bilateral lesions of the ventral pons
  - Interrupts corticobulbar and corticospinal tracts
  - Awake, quadriplegia, bilateral facial and oropharyngeal palsy, preserved vertical gaze
  - May present comatose if reticular activating system is involved



### The Subpoena

- ED physician accused of:
  - Failure to do a proper exam
  - Failure to obtain a timely CT
  - Failure to activate hospital’s stroke team
  - Failure to administer t-PA
  - Failure to provide appropriate care to prevent pain and suffering



### Conclusions

- Approach to the patient in coma requires a systematic exam that will then direct diagnostic testing
- The exam in coma should focus on pupils, GCS score with attention to motor posturing, asymmetry, and automatisms
- Emergency physicians play a critical role in diagnosing and managing patients in coma; decision making in the ED has significant impact on outcomes.

