RAPID BEDSIDE NEUROLOGIC ASSESSMENT

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Director, Neurocritical Care
Mount Sinai Health System
Classic Neurological Examination

1. Mental Status
2. Cranial Nerves
3. Motor Exam
4. Coordination
5. Reflexes
6. Sensory Exam
7. Gait and Station
Classic Neurological Examination

1. Mental Status
2. Cranial Nerves
3. Motor Exam
4. Coordination
5. Reflexes
6. Sensory Exam
7. Gait and Station
The Good News: Stuff You Will NEVER Need to Do!

1. Calculations, serial 7’s, similies, clock drawing, interpretation of proverbs, fund of knowledge, and all that stuff

2. Reading and Writing

3. Cranial nerves 2, 8, 9, 10, 11 or 12

4. Sterognosis and Graphesesia

5. Detailed graded muscle testing

6. Vibratory Sensation

7. Ankle Jerks
ICU and ER Neurological Examination

1. Mental Status (80%)

2. Sensory-Motor Exam (20%)

Etcetera:

- Cranial nerves
- Reflexes
- Gait and Station
Four basic ICU neurology problems

- Reduced LOC
- Focal
- Seizing
- Agitated or confused
Level of Consciousness

- Altered
- Obtunded
- Somnolent
- Drowsy
- Unresponsive
- Sleepy
How to Describe Level of Consciousness

- Describe LOC in terms of a specific stimulus and response
Is the Patient responsive?

- **The patient responds to voice**
  - Puts down the NY Times and asks for some orange juice?
  - Opens eyes and coughs on his ETT?
<table>
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<th>Eye opening</th>
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<tr>
<td></td>
<td>To voice</td>
<td>3</td>
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<tr>
<td></td>
<td>To pain</td>
<td>2</td>
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<tr>
<td></td>
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<td>1</td>
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<tr>
<td>Best motor response</td>
<td>Obey commands</td>
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<tr>
<td></td>
<td>Localizes to pain</td>
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<tr>
<td></td>
<td>Withdraw to pain</td>
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<tr>
<td></td>
<td>Flexor posturing</td>
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<td></td>
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<tr>
<td></td>
<td>None</td>
<td>1</td>
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<td>Best verbal response</td>
<td>Conversant and oriented</td>
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<td></td>
<td>Conversant and disoriented</td>
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<tr>
<td></td>
<td>Inappropriate words</td>
<td>3</td>
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<td>Incomprehensible sounds</td>
<td>2</td>
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<tr>
<td></td>
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<tr>
<td>Total score</td>
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Four official terms for rapid communication

- **Alert**
- **Lethargic**
- **Stuporous**
- **Comatose**
Level of Consciousness

- **Alert**
  - Hopefully all of you are!

- **Lethargic**
  - Acts sleepy but cannot wake up

- **Stuporous**
  - Best motor or verbal response requires pain

- **Comatose**
  - GCS ≤8 (doesn’t obey or talk)
Hello new student
orientation
Level of Consciousness Pyramid

LOC

Alert, lethargic, stuporous, or comatose?

Attention

Initiate, maintain and shift visual and motor attention

Concentration

20 → 1
Dec → Jan

Level of Consciousness Pyramid
Attention: Does the Patient Initiate, Maintain, and Switch Attention?

- **Visual Attention**
  - Ocular Tracking

- **Motor Attention**
  - Finger taps, raise arms, FTN
  - “Requires multiple verbal prompts”
  - Motor impersistence
  - Motor perseveration

- **Verbal Attention**
  - Staying with the conversation?
ICU Sensorimotor Examination

- Gentle Facial Stroke
- Limb Tone and Passive Motion
- Sheet Over the Face
- Fingerpads on the Sternum
- Sternal rub
- Nailbed Pressure
- Medial Arm Pinch
Quantification of lethargy in the neuro-ICU

The 60-Second Test

S.A. Mayer, MD; L.J. Dennis, MD; S. Peery, MA; B.-F. Fitsimmons, MD; Y.E. Du, PhD; G.L. Bernardini, MD, PhD; C. Commichau, MD; and M. Eldaief, MD

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<td>Intact, &lt;15 secs</td>
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<td>3</td>
<td>Intact, 16-30 secs</td>
<td>Intact, 16-30 secs</td>
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<tr>
<td>2</td>
<td>Error or time out after 15</td>
<td>Error or time out after Sept</td>
</tr>
<tr>
<td>1</td>
<td>Error or time out before 15</td>
<td>Error or time out before Sept</td>
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Neurology, 2003
Stupor and Coma

- Stupor and coma refer, respectively, to moderate and severe depression of the level of consciousness.

- Management should focus on stabilizing the patient, establishing a diagnosis, and treating the underlying cause.
What causes coma?

- Stupor and coma result from diseases affecting either both of the cerebral hemispheres or the brain stem.

- As a rule, **unilateral hemispheric lesions** do not produce stupor or coma unless there is mass effect sufficient to raise the intracranial pressure, or compress either the contralateral hemisphere or the brain stem.

- **Focal brain stem lesions** produce coma by disrupting the reticular activating system.

- **Metabolic disorders** impair consciousness by diffuse effects on both the reticular formation and the cerebral cortex.
Lesions sufficient to produce coma
How brain shifting produces coma

Figure 5-1 □ Types of brain herniation that can occur in patients with compartmentalized intracranial pressure.
LATERAL BRAIN SHIFT CORRELATES WITH LEVEL OF CONSCIOUSNESS
Clinical Signs

• **Increased ICP**
  – Depressed level of consciousness
  – Pressor response
  – Projectile vomiting
  – CN 6 palsies

• **Brainstem shifting**
  – CN 3 palsey
  – Motor posturing
  – Lower extremity rigidity
  – Loss of lateral EOMs
  – Hyperventilation
ICU **Coma** Examination

- **Cranial Nerves**
  - Pupils
  - EOMs
  - Corneals
  - Gag

Helps you identify a focal process producing coma in the brainstem!
Dolls Eyes

Vestibulo-Ocular Reflex
ICU Coma Examination

- **Dolls Eyes (Vestibuloculcular Reflex)**
  - Presence implies bilateral hemispheric dysfunction
  - It is a “hard” sign indicating the presence of encephalopathy
Patients can exhibit “fragments” of motor posturing early after a noxious stimulus and then “break through” and exhibit cortically-mediated withdrawal, localization, or command following activity.
What wakes up people from coma?

- Surgical decompression of mass effect
  - MCA infarction
  - Massive ICH
- Treatment of CNS infection
  - Encephalitis
  - Bacterial meningitis
- Treatment of a diffuse, damaging CNS process
  - BP control and removal of toxin for PRES
  - Cooling for hypoxic-ischemic encephalopathy
- Termination of status epilepticus
  - Midazolam infusion
- Removing a toxin or fixing a metabolic derangement
Metabolic encephalopathy

- Common in the setting of critical illness and MOF
  - Occurs in 30% of MOF patients
  - In up to 70% of septic patients
- Usually **multifactorial**
- Hepatic encephalopathy often overdiagnosed or overemphasized
  - *Lactulose*?
- Diagnosis of exclusion
- Improvement occurs with improvement of overall clinical condition
Encephalopathy

The Common Causes

- Oversedation
- Hypoxia-Ischemia
- Medication toxicity
- Metabolic and septic encephalopathy
- Complex-partial seizures
- Stroke
- Meningitis or encephalitis
Encephalopathy

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The Common Causes

- Oversedation
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What if?

• Are there electrical ways to enter into coma?
  – *Ventricular fibrillation of the brain?*

• What if these electrical rhythms are treatable?
  – *Is early treatment essential, like it is for VF?*

• Once a patient is in coma with PEDs, is it too late?
  – *How far is too far?*
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## Who Doesn’t?

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A large proportion of comatose patients are in electrographic status epilepticus.
Even more have abnormal EEG rhythms that lie in the “ictal-interictal continuum”
Time to record the first seizure comparing non-comatose and comatose patients.

Claassen 2004
Predictors of cEEG-documented seizures

1. **Coma on neuro exam at start of cEEG**
   - 56% vs 12%

2. **Age < 18 years**
   - 36% vs 17%

3. **Past medical history of epilepsy**
   - 41% vs 16%

4. **Convulsive seizures prior to monitoring**
   - 43% vs 12%

5. **Periodic epileptiform discharges**
   - 37% vs 14%

Claassen 2004
Physical Clues to Minimally Convulsive Status Epilepticus

- Eye blinking
- Subtle facial or limb twitching
- Directional nystagmus
- Gaze deviation
- Focal weakness with no CT correlate
- Stimulus-induced clonic twitching
Altered
Confused
Agitated
Talking Funny
Out of It
Nonsensical
ICU Non-Coma Neuro Examination

- **Mental status**
  - Orientation
  - Attention (visual, motor, verbal)
  - Concentration
    - 20 to 1
    - December to January
  - Language and Memory

- **Lateralized motor signs**
  - Pronator drift
  - Arm roll
Neuro-ICU **Standard** Examination

- **Visual:** “Follow my Finger, Look at My Face”
  - Smooth sustained pursuit
  - Broken pursuit of finger
  - Tracks face, not finger
  - Brief visual orienting response

- **Motor:** “Show me 2 Fingers, Gimme Thumbs Up”
  - Rapid commands
  - Obeys slowly and inconsistently
  - Pulls sheet off face
  - Localizes and fends off to sternal rub
  - Extremity nail pressure
  - Medial arm pinch
Delirium:  **KEY FEATURES**

- Sudden
- Loss of capacity for clear and coherent thought
- Inattention
Delirium

- Sudden onset
- Profound inattention
  - With or without lethargy
- Psychomotor agitation
- Dysautonomia (sympathetic activation)
- Fluctuating course
- Altered sleep wake cycles
- Perceptual disturbances
- High mortality
Richmond Agitation Sedation Scale (RASS) *

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<tr>
<th>Score</th>
<th>Term</th>
<th>Description</th>
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<tr>
<td>+4</td>
<td>Combative</td>
<td>Overtly combative, violent, immediate danger to staff</td>
</tr>
<tr>
<td>+3</td>
<td>Very agitated</td>
<td>Pulls or removes tube(s) or catheter(s); aggressive</td>
</tr>
<tr>
<td>+2</td>
<td>Agitated</td>
<td>Frequent non-purposeful movement, fights ventilator</td>
</tr>
<tr>
<td>+1</td>
<td>Restless</td>
<td>Anxious but movements not aggressive vigorous</td>
</tr>
<tr>
<td>0</td>
<td>Alert and calm</td>
<td>Not fully alert, but has sustained awakening (eye-opening/eye contact) to voice (≥10 seconds)</td>
</tr>
<tr>
<td>-1</td>
<td>Drowsy</td>
<td>Not fully alert, but has sustained awakening (eye-opening/eye contact) to voice (&lt;10 seconds)</td>
</tr>
<tr>
<td>-2</td>
<td>Light sedation</td>
<td>Briefly awakens with eye contact to voice (&lt;10 seconds)</td>
</tr>
<tr>
<td>-3</td>
<td>Moderate sedation</td>
<td>Movement or eye opening to voice (but no eye contact)</td>
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<tr>
<td>-4</td>
<td>Deep sedation</td>
<td>No response to voice, but movement or eye opening to physical stimulation</td>
</tr>
<tr>
<td>-5</td>
<td>Unarousable</td>
<td>No response to voice or physical stimulation</td>
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Verbal Stimulation

- “Look at my face”
- “Shake the shoulder”
- Rub the sternum

Physical Stimulation

Procedure for RASS Assessment

1. Observe patient
   a. Patient is alert, restless, or agitated. *(score 0 to +4)*
2. If not alert, state patient’s name and say to open eyes and look at speaker.
   b. Patient awakens with sustained eye opening and eye contact. *(score –1)*
   c. Patient awakens with eye opening and eye contact, but not sustained. *(score –2)*
   d. Patient has any movement in response to voice but no eye contact. *(score –3)*
3. When no response to verbal stimulation, physically stimulate patient by shaking shoulder and/or rubbing sternum.
   e. Patient has any movement to physical stimulation. *(score –4)*
   f. Patient has no response to any stimulation. *(score –5)*


Delirium: CAUSES

- Drug withdrawal
  - EtOH
  - Nicotine
- Drug intoxication
- Sleep and/or sensory deprivation
  - “ICU psychosis”
- Any medical illness
- Pain
- Brain injury (trauma, stroke, encephalitis)
Do Commonly-Used ICU Analgesedative Agents Actually Cause Delirium?
Dexmedetomidine vs Midazolam for Sedation of Critically Ill Patients
A Randomized Trial

Prevalence of delirium during treatment
54% with *dexmedetomidine*
77% with *midazolam*
(Absolute reduction of 23%, P=0.001)

Main Outcome Measures  Percentage of time within target RASS range. Secondary end points included prevalence and duration of delirium, use of fentanyl and open-label midazolam, and nursing assessments. Additional outcomes included duration of mechanical ventilation, ICU length of stay, and adverse events.

Results  There was no difference in percentage of time within the target RASS range (77.3% for dexmedetomidine group vs 75.1% for midazolam group; difference, 2.2% [95% confidence interval (CI), −3.2% to 7.5%]; P=.18). The prevalence of delirium was 54% in the dexmedetomidine group vs 77% in the midazolam group (absolute reduction of 23%, P=0.001).
Thank You