Clinical Implications for the Traumatic Brain Injury

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Objectives

• Describe patient presentation with appropriate tools recommended by the TBI EDGE task force
• Discuss treatment strategies and supporting evidence for complex brain injury patients
• Document objectively and appropriately based on current patient level

Describing Brain Injury

• Ranchos Los Amigos Scale
  – Most commonly used functional description for brain injury
  – Revised from the previous 8 stages to include 10 looking at return to independence
• Glasgow Coma Scale
  – Most common emergent description for brain injury

Rancho Los Amigos Scale of Cognitive Functioning

Disorders of Consciousness

• Level I: No Response- Total Assistance
• Level II: Generalized Response- Total Assistance
• Level III: Localized Response- Total Assistance

Post Traumatic Amnesia (PTA)

• Level IV: Confused & Agitated- Maximal Assistance
• Level V: Confused & Inappropriate- Maximal Assistance
• Level VI: Confused & Inappropriate- Moderate Assistance

Community Reintegration

• Level VII: Automatic & Appropriate- Minimal Cues for ADLs
• Level VIII: Purposeful & Appropriate- Stand By Assistance
• Level IX: Purposeful & Appropriate- Stand By Assist by Request
• Level X: Purposeful & Appropriate- Modified Independence
Severity of Brain Injury

- **Glasgow Coma Scale - Gold Standard**
  - Used in field, ER, ICU
  - Limitations

- **Mild 13-15**
- **Moderate 8-13**
- **Severe < or = 8**

Glasgow Coma Scale

<table>
<thead>
<tr>
<th>glasgow</th>
<th>open</th>
<th>verbal</th>
<th>motor</th>
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<td>score</td>
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Coma

- Represents a state of unarousable responsiveness in which the eyes remain continuously closed and there is no understandable response to environmental or intrinsic stimuli
  - No sleep/wake cycles
  - Reflexive activity only
  - Temporary—usually become vegetative or minimally conscious

Measures: TBI Edge Recommendations

- Highly recommended measures
  - Inpatient only: Cosmos Recovery Scale-Red, Moss Attention Rating Scale
  - Outpatient only: High Level Mobility Assessment

- Recommended measures (both in- and outpatient):
  - Agitated Behavioral Scale
  - Behavioral Rating Scale
  - Coping (Coping Orientation) Log
  - Disorientation Scale
  - Functional Assessment Measure
  - Modified Ashworth Scale
  - Patient Health Questionnaire
  - Quality of Life after Brain Injury
  - Reaction Levels of Cognitive Function
### Vegetative State (VS)

- A state with no sign of conscious awareness of self or environment but with preserved autonomic or ‘vegetative’ functions, typically including eye opening and sleep/wake cycles
  - No purposeful or reproducible responses to stimuli
  - No command following
  - Sleep-wake cycles present
  - Autonomic system intact for basic functions

### Minimally Conscious State (MCS)

- A condition of severely altered consciousness in which minimal, but definite behavioral evidence of self or environmental awareness is demonstrated
  - Inconsistent
  - May include following commands, verbalization, yes/no responses, movement in response to environment not reflexive (objects, visual, auditory)

### Generalized vs. Localized Responses

<table>
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<tr>
<th>Generalized</th>
<th>Localized</th>
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<tbody>
<tr>
<td>Increased Tone</td>
<td>Tracking</td>
</tr>
<tr>
<td>Eye Movement</td>
<td>Visual Attention</td>
</tr>
<tr>
<td>Lip Smacking</td>
<td>Object Manipulation</td>
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<tr>
<td>Increased HR/vitals</td>
<td>Swatting at noxious stimuli</td>
</tr>
<tr>
<td>Non-meaningful vocalizations</td>
<td>Meaningful Verbalizations (yes/no, automatic speech)</td>
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</table>

### Examination of the Low-Level Patient

- History and physical from chart
- Attend to labs and vitals
- Observation at rest before interacting is very important
  - Determine what is spontaneous for this patient
  - Determining signs of over-stimulation vs baseline
Examination of the Low-Level Patient

- Skin
- ROM
- Assistance with mobility when facilitated
- Oral care
- Tone and spasticity

Examination of the Low-Level Patient

- Sensation
- Arousal
- Attention
- Positioning
- Reflexes
- Cranial nerves

Measuring Function in DoC

- DRS
- CRS-R
- Consistent Measuring
  - Same data collection throughout day/week
  - Avoid reflexive activity
  - Cover all forms of stimuli
  - Environment
- Involve family for consistency

Disability Rating Scale (DRS)

- Measures coma to community
  - Less sensitive to small change
- Higher score = more involved
- Quick
- High inter-rater reliability
- Highly correlated with GOS
  - Predictive of employability
Coma Recovery Scale – Revised (CRS-R)

- Shown to be valid, reliable and predictive in the TBI population
- Visual and auditory function component
  - not on DRS scale
- Requires training to administer
  - Can be done via COMBI
- Behaviors indicate Minimally Conscience State and Emergence

Treatment in DoC

- Considerations
  - Commands must be short and direct
  - Leave plenty of time for response
  - Limit extra cues initially
  - Avoid spontaneous activity
  - Utilize family and familiarity when able

Response Evaluation Program

- Measures attention/arousal, command following, expressive communication, object manipulation, visual and motor responses
- Important to track responses consistently
  - At least 37% of DoC misdiagnosed depending on source

Case

- D.F. is a 39 y.o. male who sustained a CHI while practicing motocross jumps on 3/11. While he was wearing his helmet, he struck his chin upon contact and severely lacerated his tongue. Because of this, they had difficulty ventilating in the field, and was eventually emergently trached at the scene.
Case

- Initial exam significant for rib fractures with pneumothorax, small SDH L, small parenchymal contusion, subarachnoid hemorrhage. He also was observed with some decerebrate posturing initially.

Case

- Pt was admitted to IRF on 3/30 and was deemed to be minimally conscious.
- On 4/3, amantadine was started in his medication list. Other medications included: propranolol and dilantin

Treatment in DoC

- Encourage motor activity
  - Upright mobilization in most aggressive manner
    - BWSTT
    - FES Bike
    - Stander
    - Sitting EOB
- Goal: as aggressive as possible
Mobilization in DoC

<table>
<thead>
<tr>
<th></th>
<th>Mobilized as VS</th>
<th>Mobilized as MCS</th>
<th>Not mobilized</th>
<th>Totals</th>
</tr>
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<tbody>
<tr>
<td>Emerged</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Not Emerged</td>
<td>1</td>
<td>3</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3</strong></td>
<td><strong>8</strong></td>
<td><strong>14</strong></td>
<td><strong>25</strong></td>
</tr>
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Support for Mobilization

- Assessment and intervention in DoC relies on motor output
- Debility occurs from prolonged acute hospitalization
- Preliminary data shows antidotal improvement in attention following mobilization
- Neurophysiological support for exercise

Biomarkers

- BDNF may be predictor of early recovery post stroke
- Polymorphism creating reduced BDNF reduced plasticity in normal adults
  - Greater error
  - Poor retention of short-term motor learning
- BDNF induced by exercise
  - Demonstrated increase in circuit training in acute BI population

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Developing New Learning

- Requires basic orientation: O-log
- Self-reflection and safety awareness are more abstract processes
- Practice for learning and recovery
  - Start with automatic tasks then work to refine
- Engaging patients can require creative processing

Basic Cognitive Hierarchy
AOROME

- Attention
- Orientation
- Reasoning/Awareness
- Organization
- Memory
- Executive Function

O-log

- Great serial measure for orientation progress
- Score >24 3 days in a row=emerged from PTA
  - Correlated with longer gold standard measures for orientation and cognitive function
- Not sensitive to less incorrect answers

Cognition

- ACRM developed a cognitive rehabilitation manual in 2012
  - Follows sequence of awareness, compensation, recovery of function, generalization
    - Like other impairments with regard to progression
  - Executive function improvement requires self-awareness and enlisting patient to create goals and self-assess
Cognition

• ACRM continued
  – Memory deficits benefit from either external cues for more severe, internal cues for milder
  – Social impairments: egocentricity and other frontally mediated brain
    • Group interventions, leaders model behavior

• Once memory is established, attention can be addressed
  • Moss Attention Rating Scale
  • Semi-automatic scoring:
    – http://mrri.org/innovations/moss-attention-rating-scale-mars/

Interview and Observation

• Interview
  – Introduce me to the person(s) here with you today.
  – Tell me a little bit about why you are in the hospital.
  – What do you like to do for fun?
  – What is your highest level of education?
  – What do you do for work/What did you do before you retired?
  – What do you hope to get out of rehabilitation?

• Functional Observation
  – Use of Schedule
  – Wheelchair Manipulation
  – Route Finding
  – Environmental Sabotage

Implicit Learning

• Bypass the centers responsible for memory retrieval and storage

  • Demonstrates ability to produce motor learning

  • Action observation training
Agitation

- 25%-33% of patients exhibit after moderate to severe BI
  - ⅓ will continue to have symptoms long term
- Associated with frontal injury or possibly subcortical or brainstem

Agitation

- Behavior Modification – ABC’s
  - Antecedent: what’s causing behavior(s)?
  - Behavior: use ABS or standard measure to describe
  - Consequence: must be consistent across all individuals and settings for targeted behavior

- Relies on implicit learning

Common Antecedents

- Stimulation
- Confusion
- Cognition
- Restlessness
- Task Demands
**Distraction / Redirection**

- Move attention from an upsetting stimuli
  - Focus on something more neutral
  - Visual distraction
  - Bring in a new person
  - Change the scene
  - Introduce a new topic of conversation

- When you observe that the patient is distracted from the upsetting stimulus, then redirect him or her to an appropriate task

**Responding to Target Behavior**

- Reduce desirable outcomes for target behavior
- Prevent escalation of target behavior
- Teach alternative appropriate behavior
  - Provide positive reinforcement for appropriate behavior
- Ignore mild inappropriate behaviors and redirect to task
  - Neutrally block attempts to pull tubes etc
  - Do not verbally attend to inappropriate behavior

**Agitation**

- Measure using ABS
- Gives definition to behaviors

- Treatment
  - TBM
  - FBA
    - Specific testing and data collection done by neuropsychologist

**ABS**

- 3 subcomponents scored
- Normative data:
  - <22 no problem
  - 22-28 mild
  - 29-35 moderate
  - >35 severe
- High inter-rater reliability when scored after 10 min observation
Pharmacology for Agitation

- Most medications were not developed to treat agitation
- Stimulants such as Ritalin typically increase agitation
  - More recent studies suggest the opposite
- Intended to be temporary assistance for behavior management

Is the Message Clear?

Documenting Participation

- Outcomes
  - RITS
  - MARS
- Describe behavior
- Demonstrate improvement

Documenting Behavior

“Attempted to engage patient for ADL tasks, standing balance at sink. Pt able to complete approximately 30 seconds standing balance with upper extremity support before becoming distracted and wanting to return to bed. Improvement noted from yesterday’s session where pt participated for 20 seconds”

“Pt refused participation in standing balance stating, ‘leave me alone!’ Will attempt again next session”
RITS
- Provides a way to measure patient participation over time, across disciplines
- Demonstrates change when functional differences may be minimal

MARS
- Attention difficult to measure due to complexity of multiple cognitive constructs
- Appropriate for Rancho IV and above
- Good reliability across therapy staff
- Ongoing assessment for validity
  - Correlates with Cog FIM and DRS at 1 year

Case

Walking Adaptability

Balintromatos, 2014
Walking Adaptability

<table>
<thead>
<tr>
<th>Domain</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>Obstacle negotiation</td>
<td>Navigating obstacles in the environment present a conflict between the least fail and the obstacle, such a stepping over or an obstacle.</td>
</tr>
<tr>
<td>Impaired</td>
<td>Time constraints imposed on walking, such as walking to meet a train at a station or being in a crowded mall.</td>
</tr>
<tr>
<td>Cognitive dual-tasking</td>
<td>Walking while attending to two tasks such as engaging in conversation while walking.</td>
</tr>
<tr>
<td>Ambient demands</td>
<td>Factors such as level of light, temperature, weather conditions, noise levels, and familiarity with surroundings.</td>
</tr>
<tr>
<td>Protocol transitions</td>
<td>Varying posture during walking, such as bending down to pick up an object while walking or sitting.</td>
</tr>
<tr>
<td>Motor dual-tasking</td>
<td>Walking while attending to two motor tasks such as holding a glass of water while walking, picking up an object from the floor, and so forth.</td>
</tr>
<tr>
<td>Physical load</td>
<td>Carrying or interacting with a weighted object while walking, such as carrying a loaded back pack, walking up or down a steep terrain, and so forth.</td>
</tr>
<tr>
<td>Measurement in skills</td>
<td>Monitoring the entire body, such as walking around poles, pits, and so forth.</td>
</tr>
</tbody>
</table>

Questions

References