Current Strategies in the Management of Traumatic Brain Injury

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DISCLOSURES

None of the planners or presenters of this session have disclosed any conflict or commercial interest
Objectives

- Background
- Definition of terms
- Mechanism of Injury
- Patterns of Trauma
- Diagnostic Work Up
- Management Strategies
- Follow Up Recommendations
• National Estimates (CDC)
  – 2.5 million people sustain TBI’s annually
  – TBI contributes to 31% of all injury-related deaths in the US
  – About 75% of the TBI’s that occur each year are concussions or other minor forms of mild TBI
  – Direct and indirect cost $12 billion in US in 2000
  – Unknown number of people with mild TBI that are not seen by health care providers
Breakdown of those most likely to sustain a TBI

- Children 0–4 years old
- Adolescents between 15–19 years old
- Adults 65 years and older
- In every age group TBI is greater in males than in females
- ½ million ED visits for TBI in children 0–14
- Highest rates of TBI – related hospitalization & deaths are in those ≥ 75
Functions of the Brain

- Frontal lobe:
  - Attention/concentration
  - Self monitoring
  - Expressive language/speaking
  - Awareness of abilities and limitations
  - Personality
  - Inhibition of behavior
  - Emotions
Parietal lobe:
- Sense of touch
- Spatial perception
- Differentiation of size/shape/colors
- Visual perception

Temporal lobe:
- Memory
- Understanding language
- Hearing
- Organization
- Occipital lobe:
  - Vision

- Cerebellum Function
  - Balance/coordination
  - Skilled motor activity

- Brain Stem Function:
  - Arousal/consciousness
  - Sleep/wake cycles
  - Heart rate/breathing
Mechanism of Injury

- MVC’s (14.3%)
- Falls (40.5%)
- Sports related (15.5%)
- Assaults (10.7%)
- Other (19%)
  - Blast effect
  - Non-accidental
## Severity Rating for TBI

<table>
<thead>
<tr>
<th>Severity</th>
<th>GCS</th>
<th>Alteration of Consciousness</th>
<th>Loss of Consciousness</th>
<th>Post-traumatic amnesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>13–15</td>
<td>≤ 24 hrs</td>
<td>0–30 minutes</td>
<td>≤ 24 hrs</td>
</tr>
<tr>
<td>Moderate</td>
<td>9–12</td>
<td>&gt; 24 hrs</td>
<td>&gt; 30 min but &lt; 24 hrs</td>
<td>&gt; 24 hrs but &lt; 7 days</td>
</tr>
<tr>
<td>Severe</td>
<td>3–8</td>
<td>&gt;24 hrs</td>
<td>≥ 24 hrs</td>
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</table>
Symptoms of Mild/Minor TBI

- Headache/Nausea
- Fatigue
- Sleep Disturbance
- Irritability
- Sensitivity to light or noise
- Balance problems
- Decreased concentration/attention span
- Slower cognitive processing
Symptoms of Moderate TBI

- Loss of consciousness
- Episodes of confusion last for days
- S & S of mild TBI – extended
- Cognitive or behavioral impairments that last for weeks/months
Symptoms of Major TBI

- Prolonged LOC – coma
- Significantly altered cognitive response
- Inability to protect airway
Rancho los Amigos Scale

I: no response
II: generalized response
III: localized response
IV: Confused–Agitated
V: Confused, Inappropriate, Non-agitated
VI: Confused–Appropriate
VII: Automatic–Appropriate
VII: Purposeful
Definition of Terms

- Concussion
- Cerebral Contusion
- SAH
- EDH
- SDH
- Diffuse Axonal Injury
What is a Concussion?

- The terms ‘Mild TBI’ and ‘Concussion’ are often used interchangeably
- “a complex patho-physiologic process affecting the brain, induced by traumatic biomechanical forces secondary to direct or indirect forces” CDC
- The degree of force or energy transfer to create a concussion varies for each person
“Unlike more severe TBI’s, the disturbance of brain function from mild TBI is related more to dysfunction of brain metabolism rather than to structural injury or damage. The current understanding of the underlying pathology of minor TBI involves a paradigm shift away from a focus on anatomic damage to an emphasis on neuronal dysfunction.”
Neuronal Dysfunction

- Complex cascade:
  - Ionic
  - Metabolic
  - Physiologic events
Signs & Symptoms

- Brief loss of consciousness
- Amnesia
  - Retrograde – memory loss before the injury
  - Anterograde – memory loss for events after the injury
- Poor memory and processing
- Repetitive questions
- Dizziness
- Fatigue
- Seizures – extremely unusual
Acute Concussive Evaluation (ACE)

Three major components of ACE:
- Characteristics of the injury
- Types and severity of the symptoms
- Risk factors that can lead to a protracted period of recovery
Diagnostic Work Up

- Comprehensive interview – mechanism of injury
  - No energy transfer should be considered ‘too small’ to cause a minor TBI
  - Onset or recognition of symptoms
  - Do symptoms worsen with physical or cognitive activity
  - Previous diagnosis of head injury
  - Categorize how the patient tells the ‘story’
    - Word finding, confused about history, slow to respond
- Complete neuro exam
When do we need to order a ‘test’?
- Index of suspicion
- Organize assessment
- Monitor – how long? 4, 6, or 8 hours?

Head CT – non contrast

MRI

fMRI

SPECT

PET scan

Monitoring
Management Strategies

- Treat the symptoms
- Prevent secondary insult
- Assess environment
  - Supervision
  - Maturity
  - ADL’s
  - Work – school – sports
- Hospitalization
Medications:
- Analgesics
- Anti anxiety agents
- Anti convulsants
- Anti depressants
- Anti psychotic agents
- Muscle relaxants
- Sedative/hypnotic agents
- Stimulants
Post Concussive Syndrome

- When does this begin?
  - Immediately after the injury?
  - Is there a period of ‘wellness’ between injury and the development of post concussive syndrome?

- ICD –10 diagnostic criteria
  - History of trauma
  - 3 or more symptoms
## Signs & Symptoms

<table>
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<tr>
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<th>Sleep</th>
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<td>Nausea or vomiting (early on)</td>
<td>Sadness</td>
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</tr>
<tr>
<td>Difficulty concentrating</td>
<td>Sensitivity to noise or light&lt;br&gt;Balance problems</td>
<td>More emotional</td>
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Cognitive Assessment

- Neuropsychological testing
  - Timing
- Categories of neuropsych testing
  - Intelligence
  - Memory
  - Language
  - Executive function
  - Visuospatial
  - Dementia specific
  - Combination of tests
When Do You See Them Again?

- If hospitalized:
  - Resolution of ‘some’ symptoms?
  - Able to tolerate ‘some symptoms’ with meds?
  - Able to maintain hydration?

- If in your office or clinic:
  - How long can you safely watch them?
  - Who is watching them?
  - Who will be watching them at home?
Prevent Secondary Injury Syndrome
http://www.cdc.gov/concussion

Guidelines for:
1. MD’s
2. School Nurses
3. Coaches
4. Parents
Brain Trauma Foundation
- Severe Brain Injury Guidelines
- www.braintrauma.org

Joint venture between:
- BTF
- American Association of Neurological Surgeons
- Congress of Neurological Surgeons
- Joint Section of Neurotrauma & CC
- Defense and Veterans Brain Injury Center (DVBIC)
  - www.dvbic.org

- Brain Injury Association
  - Focus is on Mild/Moderate Brain Injury
  - Community Based recommendations

- Brain Injury Association of NH
  - www.bianh.org
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Resources Available
Commonwealth of Massachusetts

- State law effective August 19, 2010
- Mandatory action:
  - Remove student from sporting event
  - Requires evaluation for students following injury
  - ‘approved’ return to activities
Summary

- Large number of victims
- Financial burden on society
- Difficult assessment
- Varying degree of symptoms
- Often under diagnosed
- Clinical burden may last a long time and often interferes with the patient returning to normal activities