Head Injury Workshop

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Head Injury Workshop

Agenda

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Pediatric Head Trauma:
A Significant Burden

- Deaths: 7,000/yr
- Hospitalizations: 95,000/yr
- ED Visits: > 500,000/yr
- Primary Care Office Visits: Assume numerous, No data
- 60%↑ in ED visits in last 10 years
- Hospital care costs alone exceed 1 billion/year
- 29,000 permanent disabilities annually

Clinical Challenges

- Identification of children with significant intracranial injury
- Identify and assess patients with Concussion
- Improve concussion recovery

PECARN Head Injury Study
Methods and Subjects

- Prospective Cohort Study, < 18 yo
- Presented within 24 hrs blunt head injury
- mTBI = GCS 14 - 15
- “ci TBI” (“clinically important”)
  - Defined as Death, Neurosurgery, Intubation, Hospital admission > 2 nights

Study Results

- N = 42,412 patients from 25 EDs

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<th>Derivation Set</th>
<th>Validation Set</th>
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<td>33,765</td>
<td>8,627</td>
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- GCS = 15 in 97%
- CT performed in 35.3% (n = 14,969)
- ciTBI in 0.9% (n = 376)
  - Surgery in 0.1% (n = 60)
  - No Deaths

### Prediction Rules for No “ciTBI”

**Age younger than 2 years**

- Normal Mental Status
- No palpable skull fracture
- No scalp hematoma - except frontal
- No LOC or LOC < 5 seconds
- Non-severe injury mechanism
- Acting normally according to parents

(NPV 100%; Sensitivity 100%)


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**Age 2 years and older**

- Normal Mental Status
- No LOC
- No vomiting
- Non-severe injury
- No basilar fracture
- No severe headache

(NPV 99.95%; Sensitivity 96.8%)


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### Imaging Cases

- Case 1
- Case 2
- Case 3
- Case 4

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**PECARN Imaging Guidelines (<2 y/o)**

- GCS>13 or other signs of altered mental status, or palpable skull fracture
  - Yes → CT recommended
  - No → Observation vs. CT on the basis of other clinical factors including:
    - Physician experience
    - Multiple versus isolated findings
    - Worsening symptoms or signs after emergency department observation
    - Age < 3 months
    - Parental preference

- Occipital or parietal or temporal scalp hematoma, or history of LOC < 5 s, or severe mechanism of injury, or not acting normally per parent
  - Yes
  - No
    - 12.8% of population
    - 97.2% risk of CT

- CT not recommended


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**PECARN Imaging Guidelines (>2 y/o)**

- GCS>13 or other signs of altered mental status, or signs of basilar skull fracture
  - Yes → CT recommended
  - No → Observation vs. CT on the basis of other clinical factors including:
    - Physician experience
    - Multiple versus isolated findings
    - Worsening symptoms or signs after emergency department observation
    - Parental preference

- History of LOC, or history of vomiting, or severe mechanism of injury, or severe headache
  - Yes
  - No
    - 6.0% of population
    - 94.0% risk of CT

- CT not recommended


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**Imaging Cases**

- Man Down…

You are at the sidelines of a Friday night football game. During the 2nd half kickoff return, the tight end attempts to tackle a wide receiver. The instant the 2 hit, the tight end falls and he lays face down motionless on the ground.
What Do You Do?

- What happened?
- How are you going to approach this athlete?

Collapse During Collision Sports

- **Head injury**
  - Traumatic Brain Injury
  - Concussion
- **Cervical Spine Trauma**
- **Other Causes**
  - Cardiac Event: Arrhythmia
  - Hypoglycemia / Electrolyte derangement
  - Heat Stroke
  - Drug ingestion

Sports-Related Concussion

The Sideline: On-Field Recognition

- **Signs Observed**
  - Appears dazed
  - Confused about game
  - Forgets plays
  - Unaware of game, score, opponent
  - Moves clumsily
  - LOC
  - Behavior change

- **Symptoms Reported by Athlete**
  - Headache
  - Nausea
  - Off-balance or dizzy
  - Double/blurred vision
  - Sensitivity to light/noise
  - Feels sluggish
  - Feels foggy

Sports-Related Concussion: The Sideline

- **On-Field Mental Status Evaluation**
  - Orientation
    - Game, period, opponent, score, stadium, city
  - Amnesia
    - Anterograde: Repeat "Girl, Dog, Green"
    - Retrograde: Recall the hit and events prior
  - Concentration
    - Repeat days of week backward (starting w/ today)
  - Word List Memory
    - Repeat the 3 words "Girl, Dog, Green"

Sports-Related Concussion: The Sideline

- **Signs of Deteriorating Neurologic Function**
  - Worsening headache
  - Seizures
  - Neck pain
  - Focal neurologic signs
    - e.g. Focal weakness, numbness
  - Repeated vomiting
  - Behavior change
  - Drowsy appearance
  - Increased confusion or irritability
  - Slurred speech

Back to Our Case

So How do you approach the man down?
3-25% of patients with SC injury develop neurological deficits associated with manipulation during resuscitation or transport.

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<tr>
<th>Scenario</th>
<th>Level of Consciousness</th>
<th>Cardiorespiratory Status</th>
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<tr>
<td>1</td>
<td>Abnormal</td>
<td>Compromised</td>
</tr>
<tr>
<td>2</td>
<td>Abnormal</td>
<td>Normal</td>
</tr>
<tr>
<td>3</td>
<td>Normal</td>
<td>Normal</td>
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Scenario 1: Altered LOC and Unstable CRS
- Rare event
- Respiratory distress due to
  - Obstruction of the airway can be caused by a foreign body, facial fractures, or laryngeal/tractal injury
  - Depressed level of consciousness.
  - Upper cervical spinal cord injury
  - Other: pneumothorax, asthma, and anaphylaxis.
- Circulatory collapse due to
  - Primary cardiac event is uncommon
  - Spinal Shock
  - Hypovolemia (spleenic rupture)

Scenario 1
- ENACT EMERGENCY PLAN
- Clear the air way while maintaining neutral head position (no chin lift)
- Move from prone to supine
- Remove face mask
- Oral airway if needed
- Assist ventilations if needed (BVM)
- Intubation if patient is apneic, unable to oxygenate, aspiration risk, severe TBI
- Should you remove his helmet?

Equipment Removal Guidelines
- Immobilize C-spine with helmet and shoulder pads in place.
- Helmet should be removed if:
  - The face mask, helmet or chin strap interfere with CPR
  - Helmet interferes with immobilization for transport
  - Shoulder pads are removed
- Shoulder Pads should be removed if:
  - Multiple injuries requiring full access to the shoulder area
  - Shoulder pads don’t fit
  - CPR is inhibited by shoulder pads
  - Helmet is removed

Management of Protective Equipment
- Football and ice hockey helmets with the shoulder pads maintain a neutral alignment to the cervical spine.
- Athlete is best cared for by immobilization of the cervical spine with the helmet and shoulder pads in place.
- Palumbo et al
  - Removal of the helmet or the shoulder pads from a cadaveric model with C5-6 instability resulted in a significant change in cervical lordosis
- Waninger et al
  - Backboard immobilization of helmeted ice hockey and lacrosse players effectively limited cervical motion during transportation.
Scenario 2: Altered LOC and Stable CRS

- After primary survey perform a brief on field neuro exam
  - GCS, Pupils, EOM, visual fields, gross motor and sensory exam
- Carefully log rolled to supine
- Altered LOC= remove face mask
- LOC is usually related to CHI
  - consider other causes hypoglycemia, hyperthermia, drug overdose
- All unconscious athletes are presumed to have a C spine fracture

Scenario 3: Normal LOC and Stable CRS

- Primary survey, Stabilize C spine and assess for C-Spine injury

Assessment

Improving Assessment of Injury:

- Useful higher level neurocognitive testing can take over an hour to complete
- Efficient products may lack predictive utility
- Better assessment of risk factors for prolonged recovery
- Better assessment of Balance and Visual motor control

Risk factor assessment

- Many conflicting risk factors for recovery have been reported.
  - older children with loss of consciousness, headache, and/or nausea/vomiting, initial dizziness, and premorbid conditions
- Zemek et. al conducted the 5P study
  - Multicenter derivation and validation model
  - Recruited 3063 patients 5-17 years with concussion
  - Subject completed a survey of predictive factors
  - Primary outcome: (31%, N=801)
    - Proportion with persistent concussion symptoms at 1 month
5 P Clinical Risk Score

- Risk increases:
  - Age
  - Gender
  - Past Concussion*
  - H/o Migraine
  - Answers questions slowly
  - BESS errors
  - Headache
  - Sensitivity to noise
  - Fatigue

Assessment

SCAT3 / NECK

- Sports Concussion Assessment Test
- Cervical spine assessment

Assessment

Acute Balance Assessment

- ~36% of concussed athletes will have a balance problem in first 24 hrs post-injury
- How to assess
  - BESS
  - Tandem Gait

Assessment

Vestibular/Oculomotor Assessment

- Emerging evidence suggests up 50% may experience dizziness post-injury
- How to assess
  - Vestibular Ocular-Motor Screening (VOMS)
    1. Smooth pursuits
    2. Saccades
    3. Vestibular ocular reflex
    4. Visual motion sensitivity
    5. Near-point-of-convergence distance

Assessment

Concussion Is Treatable

Individualized approach is key!
- Step 1: "When in doubt, sit them out"
- Step 2: Resume Activities of Daily living
- Step 3: Get back to school (+/- support)
- Step 4: Get back to sport (w/ clearance)

Not recovering fast enough, see a specialist
- Tx: Rehab, PT, OT, CBT, Medications

Assessment

Symptom Management

- There is no standardized approach to the management of acute concussion symptoms.
- Sleep and Rest may be the most effective strategy to acute symptom management
Physical

- Nausea
  - Not usually a sustained symptom
  - May be secondary to headaches or medications
- Dizziness
  - Often resolves in days
  - Persistent dizziness
    - Vestibular rehabilitation
    - Consider meclizine, scopolamine
- Neck Pain
  - Ensure not more significant injury
  - PT
  - Medications
  - Ergonomic fixes
- Photo & Phonophobia
  - Sunglasses/hat
  - Ear plugs
  - Avoid loud classes
    - Choir, music, lunchroom, etc.

Emotional

- Awareness!
  - Expect frustration, sadness, etc.
- Highest risk
  - Pre-existing condition
  - Psychosocial problems
  - Family issues
- School psychologist/counselor
- Cognitive Behavioral Therapy
- Medications

Sleep

- Schedule breaks (school, home & work)
- Sleep
  - Very important for recovery
  - Do not wake at night
  - Power nap (30-40min)
  - Good sleep hygiene
    - No cell phone or electronics in room
    - Consistent bedtime
    - Keep on school bedtime
    - Aim for 8-10hrs per night
  - Medications
    - Melatonin, Trazodone, zolpidem, amitriptyline, gabapentin

Emotional

- Awareness!
  - Expect frustration, sadness, etc.
- Highest risk
  - Pre-existing condition
  - Psychosocial problems
  - Family issues
- School psychologist/counselor
- Cognitive Behavioral Therapy
- Medications

Activity

- It’s hard to find the right balance

Other Considerations in Concussion Management

- Support outside the athletic arena
  - Alert and educate key school personnel
  - Gradual reintegration back to school
  - Educational Support
- Informal accommodations for most
- Formal interventions in few cases
Improving Post-injury Management:
Stepwise return-to-play for high risk activities

1. Rest until asymptomatic
   - No signs or symptoms at rest
2. Stepwise return to play
   1. Light aerobic activity (e.g. walking, stationary bike)
   2. Sport-specific activity (e.g. running in soccer, skating in hockey)
   3. Non-contact training drills
   4. Full-contact practice training
   5. Game Play

*International Symposia, Vienna (2001); Zurich (2012)

Return to Play

• Not evidence based
  – Ideal for first time concussion without prolonged recovery
  – Repeat injuries & prolonged recovery should be extended
• Asymptomatic for 24+ hrs
  – Watch for excuses to be asymptomatic
  – Full academics
  – No meds
  – Normalized neuropsychological evaluation
• Usually Progress 1 step per day
  – If symptoms return, stop and call (go back 1 step)
### How Many Are Too Many?

- Retirement is tricky & unique
  - Should be seen by experienced provider
  - Consideration to prolonged time away from contact/collision sports
- Chronic Traumatic Encephalopathy
  - Relationship between concussion, sub-concussive blows and CTE is unclear
  - Begins in mid-life (usually after retirement)

### When to Discuss Retirement

or at least significant time away from contact

- Athlete/parental concern
- Rapidly occurring (3 in 9 months?)
- Lower injury threshold
- Prolonged symptoms (?6+ months)
- Persistent symptoms (post-traumatic migraine or loss of cognitive function)
- Psychosocial implications
  - Are there worse things then potential concussions?