



TRAUMATIC BRAIN INJURY

Managing Long Term Residuals

Common Acute Symptoms of TBI

- **Physical** - headache, nausea, vomiting, blurred or double vision, balance difficulties, dizziness, tinnitus
- **Behavioral/Emotional** - drowsiness, fatigue/lethargy, irritability, depression, anxiety, insomnia
- **Cognitive** - feeling "slowed down or in a fog", difficulty concentrating, difficulty remembering

TRAUMATIC BRAIN INJURY

- **Traumatic brain injury (TBI) is a non-degenerative, non-congenital insult to the brain from an external mechanical force, possibly leading to permanent or temporary impairment of cognitive, physical, and psychosocial functions, with an associated diminished or altered state of consciousness.**
- **The definition of TBI has not been consistent and tends to vary according to specialties and circumstances. Often, the term brain injury is used synonymously with head injury, which may not be associated with neurologic deficits. The definition also has been problematic with variations in inclusion criteria**

CONCUSSION

- **Mild form of TBI**
- **1.6-3.8 million sports related concussions each year in the US.**
- **Although the majority of concussions are self limited injuries, catastrophe can occur and the long term effects of concussion are not known.**
- **A history of prior concussion significantly increases the risk for recurrent concussions**
- **The effect of concussion on developing brains is of particular concern as children are at particularly high risk for retaining headaches, memory problems, diminished cognitive function, inattention or other behavioral changes as a result.**

CONCUSSION

Dr. Robert Cantu: (1986)

-  **Grade I - injury associated with no loss of consciousness and less than 30 minutes of post-traumatic amnesia**
-  **Grade II -Injury associated with loss of consciousness for less than 5 minutes or experiences amnesia for between 30 minutes and 24 hours.**
-  **Grade III - Injury associated with loss of consciousness lasting longer than 5 minutes or amnesia lasting longer than 24 hours.**

CONCUSSION

- 📌 **Colorado Medical Society (1991)**
 - 📌 **Grade 1 - confusion only**
 - 📌 **Grade 2 - confusion and post-traumatic amnesia**
 - 📌 **Grade 3a - LOC for seconds**
 - 📌 **Grade 3b - LOC for minutes**

CONCUSSION

Colorado Medical Society (1991) - Return to play criteria:

 <u>GRADE</u>	<u>FIRST CONCUSSION</u>	<u>SUBSEQUENT CONCUSSION</u>
 1	15 minutes	1 week
 2	1 week	2 weeks with MD OK
 3a	1 month	6 months with MD OK
 3b	6 months	1 year with MD OK

CONCUSSION

- 📌 **AAN - 1997 (based on Colorado Medical Society classification)**
 - 📌 **Grade 1 (mild) - No LOC, transient confusion, post concussive symptoms resolve in < 15 minutes**
 - 📌 **Grade 2 (moderate) - No LOC, but confusion and other post concussive symptoms may last longer than 15 minutes**
 - 📌 **Grade 3 (severe) - LOC for seconds (3a), LOC for minutes or longer (3b)**
- 📌 **Athletes with Grade 1 or 2 could return to play in as few as 15-30 minutes**

CONCUSSION

- LIMITATIONS OF THE 1997 AAN Guidelines:**
 - By today's standards of concussion recognition and concern about recurrent events and second impact syndrome, did not fully protect the athletes.**
 - They did draw attention to the injured athlete and allowed many to recover more fully before acquiring an additional concussion.**
 - Some athletes who sustained LOC recovered more quickly than those without LOC creating some concern over the validity of the scale and Return to Play guidelines**

CONCUSSION



AAN - MARCH 2013 REVISION:



Changed to symptom based, multi-faceted review using both signs and symptoms of cognitive dysfunction and physical deficits for Dx and removal from athletics



Eliminated same-day return to play no matter how quickly symptoms resolved



Uses grades symptom-limited exercise protocol for return to participation



Measures symptoms (headache), physical exam (balance), and neurocognitive function, thus best evaluated by licensed and experienced health care professional

CONCUSSION

 **AAN - MARCH 2013 REVISION:**

 **ENDORSED BY:**

 **NFLPA**

 **American Football Coaches Association**

 **Child Neurology Society**

 **National Association of Emergency Medical Service Physicians**

 **National Association of School Psychologists**

 **National Athletic Trainers Association**

 **Neuro Critical Care Society**

CONCUSSION

PRACTICAL MATTERS FOR THE YOUNG ATHLETE:

PRE-PARTICIPATION COUNSELING

-  **Individuals should be informed of activities that place them at risk for adverse health consequences**
-  **School-based professionals should be educated by experienced licensed health professionals designated by their organization to understand the risks of experiencing a concussion so that they may provide accurate information to the parents and athletes.**
-  **Licensed health care professionals should inform athletes and their parents of the evidence concerning concussion risk factors**

CONCUSSION

PRE-PARTICIPATION COUNSELING RECOMMENDATIONS:

Type of sport - Among commonly played team sports there is strong evidence that concussion risk is greatest in football, rugby, hockey and soccer

Gender - No clear differences in concussion demonstrated yet, but seems to be higher risk for female athletes in soccer and basketball

Prior Concussion - There is strong evidence indicating that a history of concussion/mild traumatic brain injury is a significant risk factor for additional concussions. There is moderate evidence that a recurrent concussion is more likely to occur within 10 days after a prior concussion.

CONCUSSION

PRE-PARTICIPATION COUNSELING RECOMMENDATIONS

Equipment - There is moderate evidence that use of a well fitting helmet reduces but does not eliminate risk of concussion and more serious head trauma in hockey and rugby. Similar effectiveness is inferred for football. There is no evidence supporting greater efficacy of one particular type of football helmet nor is there evidence of efficacy of soft head protectors in sports such as soccer and basketball.

Age or competition level - do not affect overall concussion risk

Position - insufficient data to determine risk stratification

CONCUSSION

AVAILABLE DIAGNOSTIC TOOLS

-  **SCREENING TOOLS - No best tool. Graded Symptom Checklist (GSC) and Standardized Assessment of Concussion (SAC) have high sensitivity and specificity in identifying sports concussions and can be administered by non-physicians on the sidelines but proper use requires training by LHCP as well as recognition that these tools are only an adjunct to clinical assessment. Once identified, the athlete should be removed from play and not returned until cleared by experienced LHCP with training in both diagnosis and management of concussion and more severe TBI.**
-  **NEUROIMAGING - CT imaging not necessary for suspected concussion and should be used only to identify serious complications of TBI in patients with LOC, amnesia, persistently altered mental status (GCS<15), focal deficit, evidence of skull fracture or deteriorating clinical status.**

CONCUSSION

- **RETURN TO PLAY - GENERAL CONSIDERATIONS:**
- **CLINICAL FEATURES SUGGESTING INCREASED RISK (After concussion due to cognitive impairments and delayed reaction time creates increased risk for recurrent concussion)**
 - **Thus: Individuals supervising athletes should prohibit the athlete from returning to play until a LHCP has judged that the concussion has resolved AND that there are no concussion symptoms off all medications.**
 - **Age effects - Post concussive symptoms and cognitive impairments are longer lasting in younger athletes (though there are no comparative studies of athletes younger than high school age), also the assessment tools have not been validated in pre-teen athletes.**

CONCUSSION

RETURN TO PLAY - GENERAL CONSIDERATIONS:

CONCUSSION RESOLUTION

There is no single diagnostic test to determine resolution. Decision best made on basis of neurological history, exam and cognitive assessment. Some tests such as symptom checklists, neurocognitive testing and balance testing are helpful in monitoring recovery.

Graded Physical Activity - Preliminary evidence suggests that return to moderate physical activity is associated with better performance on visual memory and reaction timed tests that no activity or high activity groups. There is also suggestive evidence that progressive physical activity is preferred for athletes with prolonged symptomatology. There is insufficient data to support recommendations for a graded activity program to normalize physical, cognitive and academic functional impairments.

CONCUSSION

AAN MARCH 2013 RECOMMENDATIONS:

WHAT INTERVENTIONS ARE AVAILABLE FOR ENHANCING RECOVERY, REDUCING RISK OF RECURRENT CONCUSSION AND MINIMIZING LATE NEUROBEHAVIORAL IMPAIRMENT?

-  **There are no studies available drawing conclusions regarding the effect of post-concussive activity level on the recovery from sport related concussion or the likelihood of developing chronic post-concussion symptoms.**
-  **There are no medications with convincing benefit.**
-  **There may be some overlap of pre-concussive Sx such as headache, inattention, memory lapses and fatigue which may be related by the athlete instead to their concussion.**

CONCUSSION

- 📌 **AAN MARCH 2013 RECOMMENDATIONS:**
- 📌 **RETIREMENT FROM PLAY AFTER MULTIPLE CONCUSSIONS:**
 - 📌 **Professional athletes with multiple concussions retaining persistent neurobehavioral impairments may be referred for neuropsychological assessment.**
 - 📌 **Amateur athletes with a history of multiple concussions and persistent subjective neurobehavioral impairments may be assessed with formal neurologic/cognitive tools to guide retirement from play decisions.**

CONCUSSION

AAN MARCH 2013 RECOMMENDATIONS:

RETIREMENT FROM PLAY AFTER MULTIPLE CONCUSSIONS:

-  **Athletes with multiple concussions and persistent neurobehavioral impairment should be counseled about risk factors for permanent impairments.**
-  **Professional contact sports athletes who show objective evidence for persistent neurologic/cognitive impairments should be recommended to retire from contact sports to minimize risk for chronic neurobehavioral impairments.**

Residuals of Concussion

- **Headache reported in 55%**
- **Cognitive Disorders in 73%**
- **Epilepsy**
- **Dementia in 10%**
- **Sleep Disruption**
- **Psychiatric Consequences -Depression in 28-77%, more prevalent in mild TBI**

TBI Severity:

Based upon LOC, duration of post- amnesia, and GCS at time first seen in Hospital

- **Mild - GCS 13-15, LOC <30 minutes if at all, and post-traumatic amnesia of <24 hours.**
- **Moderate-severe - GCS < 13 and either LOC >30 minutes or post traumatic amnesia >24 hours.**

Persistent Symptoms after TBI

- Occur in 10-24% beyond the normal recovery time of 3 months.
- Who is at risk for persistent symptoms?
- (History of prior TBI, previous neurological or psychiatric disorders, and arising from MVA's - ? Litigation)

Long term complicating features of TBI

- **Litigation, Employment**
- **Untreated depression, Insomnia**
- **Marital discord**
- **Loss of self esteem**
- **Dementia fear, PTSD**
- **Lack of validation of injury with negative Px, MRI**

Psychiatric residuals of TBI

- Overall 3x more likely to develop a psychiatric disorder:
- Aggression in 30%
- Anxiety in 10-70%
- Depression in 25-,%
- Mania/psychosis 3-10%
- PTSD
- Family Dysfunction

Treatment of Depression following Mild TBI

- **Selective serotonin reuptake inhibitors are first line, and tricyclics agents are also considered. Sertraline or citalopram preferred over fluoxetine and paroxetine (inhibits Cytochrome p450 enzymes), and bupropion (lowers seizure threshold).**
- **Improving depressive symptoms can also help other symptoms such as headache, fatigue, sleep disturbances, and perhaps memory and processing speed.**
- **Some comparative studies also compared methylphenidate to the SRI's and found that methylphenidate provided equal efficacy for reduction of depressive symptoms but greater improvement in cognition and daytime fatigue than SSRI's.**

Treatment of Depression following Mild TBI

- **Psychotherapy - in general, education regarding TBI and recovery expectations, reassurance, and frequent support provide better outcomes.**
- **Cognitive behavioral therapy may help with depression, anxiety, and anger.**
- **Family therapy for caregivers, and working on family dysfunction will have benefit.**

Post Concussive Headache

- **Acute and Chronic**
- **May take any form and are similar to non-traumatic headaches**
- **Causes: Dangerous vs. non-threatening**
- **Evaluation: history, physical, neurimaging**
- **Treatment: Same as for non-traumatic origin HA**

Cognitive Impairment

- **Memory**
- **Processing/Problem Solving**
- **Organizational Skills (Ideational Apraxia)**
- **Distractibility**
- **Non-Restorative Sleep**
- **Medications**

Memory Difficulties after TBI

- **May persist >3 months in 3-10%**
- **May be perceived but related to cause other than cognitive origin.**
- **May be related to other cognitive difficulties.**
- **Injury to medial temporal-hippocampal pathways create amnestic syndrome. Poor recovery and outcomes.**

Pharmacologic Treatment of Cognitive Dysfunction after Mild TBI: **NOT RECOMMENDED**

- **Executive function - some studies have shown benefit from use of non-stimulant catecholminergics - bromocriptine, pramipexole, carbidopa/levodopa, or amantadine (200 - 400 mg daily)**
- **Memory - responds to cholinesterase inhibitors - donepezil (5 mg daily for 4 weeks, the 10mg daily), rivastigmine, or galantamine**
- **Processing speed - methylphenidate (0.3 mg/kg twice daily) or perhaps dextroamphetamine**

Non-Pharmacologic Treatment of Cognitive Dysfunction after Mild TBI

- **Team approach by Occupational Therapy and Speech and Language Pathologists.**
- **1) Memory retraining = repetitive practice of memorization, 2) Compensatory strategies = memory aids, notebooks, mnemonics, 3) Tapping residual memory abilities**
- **Neuropsychological testing and treatment**
- **Symptomatic management of other interfering residuals - sleep disruption, vocational planning, self esteem issues.**

Non-Pharmacologic Treatment of Cognitive Dysfunction after Mild TBI

- **Adapted from the Defense and Veterans Brain Injury Center. Concussion/mild traumatic brain rehabilitation. 10 ways to improve your memory:**
- **Use checklists. Prioritize. Keep a cheat sheet of important information with you. Get >7 hours of sleep. Avoid alcohol, tobacco and excessive caffeine. Use a pill organizer. Stay physically active. Maintain a healthy diet. Avoid further brain injury. Focus on one thing at a time. Get a routine. Keep mentally active. Decrease your stress level. Write it down.**

Epilepsy

- **Incidence - not common after mild TBI but up to 50% of individuals with missile wounds (structural injury) will suffer seizures. Relates to the severity of the trauma more than anything else. Seizure common, epilepsy not.**
- **Management - same as for non-traumatic origin. Prophylaxis not recommended.**

Sleep Disruption

- **Insomnia, PTSD, Non-Restorative Sleep, REM Disorders**
- **The incidence of sleep disorders in the general population is also high and sleep disruption may not be due to the TBI. Best treated non-pharmacologically with sleep hygiene education:**
 - **1) adapt a fixed bedtime 2) stop watching TV 1 hour before bedtime and engage in relaxing activities such as reading or intimacy 3) sleep only when sleepy and avoid sleeping during the day 4) avoid caffeine 5) do not exercise within 4 hours of bedtime 6) take a hot bath or shower 1 hour before bedtime 7) eat a snack before bedtime**

Residuals of Repeated Concussion

- **Chronic Traumatic Encephalopathy**
- **ALS**

Prevention

- "It is estimated that one in four journeys in the Netherlands take place by bicycle. And while the nation is awash in bike lanes, accidents do happen. Hence, the Hovding, an airbag for cyclists that sits as a discreet collar around your neck, and only inflates when you need it most. Available in stores in the designers' native Sweden or on their website: hovding.com"
- KLM travel magazine - October 2012

