SPORTS RELATED CONCUSSION & MILD TBI: DEVELOPMENTS IN TREATMENT & MANAGEMENT

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Concussion 101: Basics and Background

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Workshop Learning Objectives

• Recognize background information on concussion management
• Identify proper sideline and clinic assessment of suspected concussions
• Explain the utility of neuropsychological assessment for pre-injury and post-injury assessment
• Receive information pertaining to risk factors associated with concussion recovery
• Discuss the role of medications in the management of concussion symptoms and return to play
Epidemiology of Sports-Related MTBI in the United States

- CDC study estimated 300,000 sports and recreation-related TBIs resulting in loss of consciousness (LOC) occur each year (Thurman et al, 1999).

- Other studies show TBIs resulting in LOC account for only 8% to 19% of sports-related TBIs (Collins et al, 2003; Fazio, et al., 2006; Schultz et al, 2004).

- Suggests that approximately 1.6 to 3.8 million sports-related concussions occur each year.

CDC Physicians Tool Kit: Langlois, Collins, Gioia, Mitchko
Concussion: Definition

- A complex pathophysiological process affecting the brain
  - Disruption of neurochemical, ionic, and transport processes
  - Increase metabolism to restore balance, Increase energy-demanding processes to re-establish ionic concentrations
- Metabolic mismatch
  - Increased metabolism to restore balance
  - Decreased blood flow
    - Insufficient glucose to power increased metabolism
  - Disruption of autoregulation of blood flow
    - Supply isn’t increased to meet demands
  - Last days to weeks
- No damage to brain anatomy
  - As far as we can tell

Giza & Hovda, 2001; Lodovici, 2007
Sports Related Concussion: Topics of Concern

Return to Play
- Guidelines have not always been data driven.
- CT and MRI insensitive to subtleties of injury.
- Self-report predicates management directives.
- **Variability in physician recommendations.**

Long-Term Effects of Concussion
- Are effects of concussion cumulative?
- Are athletes at long-term risk?
- When should an athlete retire?
COMMON CONCUSSION
Myths and Facts
HOW WELL DO YOU KNOW CONCUSSION???

• “If you didn’t get knocked out you don’t have a concussion.”
• “The CT scan was OK, and the ER doctor said I could return to play in a week. I don’t need anything else.”
• “The Athlete is only complaining of a little light-headedness. She just got her bell rung. Coach, she is ok to return in the second half.”
• “Concussions only happen in contact sports like hockey and football.”
• “It is Thursday, my headache is mostly gone. I will suit up in play in Friday’s football game.”
• “Every athlete recovers from concussion at the same rate and it usually takes a week.”
• “Helmets prevent concussions”
THE SIDELINE EVALUATION

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THE SIDELINE EVALUATION

• On the field evaluation
  • Any athlete that is unable to get up on his own after a hit should be assumed to have a cervical spine injury and evaluated as such
    • Remember ABCD
    • Stabilize the neck first
  • If concern for spinal cord or severe head trauma, board and transport from the field
THE SIDELINE EVALUATION

• The initial identification of a concussed athlete can be difficult
  • Signs can be vague
  • Other problems can give similar symptoms
    • Not every headache is a concussion
    • Not every concussion has headache as a symptom
  • Culture of toughness
    • Hiding the injury
## THE SIDELINE EVALUATION

- **Signs observed**
  - Appears dazed or stunned
  - Confused about assignments
  - Forgets plays
  - Is unsure of game, score or opponent
  - Answers questions slowly
  - Behavior or personality changes
  - Can’t recall events before or after the injury
THE SIDELINE EVALUATION

• Symptoms Reported by the athlete
  • Headache
  • Nausea
  • Balance problems or dizziness
  • Blurred vision
  • Light or noise sensitivity
  • Feeling sluggish
  • Feeling foggy or groggy
  • Concentration or memory troubles
  • Confusion
THE SIDELINE EVALUATION

• If you or someone on the team suspects that an athlete is concussed
  • Remove them from play
    • Does not mean they are out for the game, just need to evaluate
  • Evaluate for concussion symptoms and test memory and cognitive function
THE SIDELINE EVALUATION

• Multiple tools are available to assist in the evaluation
  • Modified Maddox Questions
  • SAC
    • Tests memory, concentration and orientation
  • SCAT
    • Adds symptom list and neurological screening
  • SCAT2
    • Adds Balance and coordination
    • Not useful on sidelines in total
The reality is....

- There is no gold standard diagnostic test
- An athlete can pass all of the questions and still be concussed
- The most sensitive indicator is the athlete saying “I’m not right”
- Clinical judgment is necessary
- We are there for the protection of the athlete
THE SIDELINE EVALUATION

• When you make the diagnosis of a concussion
  • The athlete is done for the day **period**
  • Watch for signs of deterioration
  • Reassess frequently thru the game
  • Hide his helmet
  • Inform the coach
THE SIDELINE EVALUATION

• Signs of deterioration
  • Worsening headache
  • Seizure
  • Focal neurological deficits
  • Altered level of consciousness
  • Repetitive vomiting
  • Slurred speech
  • Increasing confusion or irritability
THE SIDELINE EVALUATION

• Indications for emergent ER transport
  • Loss of consciousness greater than 30 seconds
  • Weakness or numbness in arms or legs
  • Rapidly deteriorating level of consciousness
  • Unequal pupils
  • Seizure
THE SIDELINE EVALUATION

• Summary
  • There is no longer the ability to say “he just got his bell rung, he’s ok”
  • The diagnosis of concussion on the sidelines can be very difficult
    • In reality it is usually obvious
  • Remember to check the athlete frequently for signs of deterioration
  • No same day return to play
NEUROCOGNITIVE ASSESSMENT: THE CORNERSTONE OF PROPER CONCUSSION MANAGEMENT

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The Roots of Neuropsychology

- Roots of modern neuropsychology are based in the study of brain-behavior relationships
- Began with the validation and development of tests sensitive to detecting and localizing a variety of neurological conditions
- Following TBI, neuropsych assessment documents cognitive strengths and weaknesses
Evolution of Neuropsychological Assessment in Sports

• Traditional assessment of athletes using baseline testing (paper-pencil tests) began in 1984 with University of Virginia studies facilitated by Barth PhD and colleagues.

• Mark Lovell, PhD and colleagues spearheaded the Pittsburgh Sports Concussion Program initiating pilot baseline and post-injury testing of the Pittsburgh Steelers

  • Paper-Pencil “Steelers Battery”
    • Trail Making A & B
    • Hopkins Verbal Learning Test
    • Brief Visual Memory Test
    • Symbol Digit Modalities Test
    • Controlled Oral Word Association Test
    • Cancellation Tasks
Evolution of Neuropsychological Assessment in Sports

- Late 1990s Computerized neurocognitive assessment evolved due to time constraints and need for efficient pre-season group testing
- Most widely used computerized measures
  - Immediate Post-Concussion Assessment and Neuropsychological Assessment (ImPACT)
  - Automated Neuropsychological Assessment Metrics (ANAM)
  - CogSport
  - Headminder CRI
  - CNS Vital Signs
Evolution of Neuropsychological Assessment in Sports

- Evaluation of athlete’s mental status on the sideline using the Standardized Assessment of Concussion (SAC) (McCrea & Colleagues)
  - 5 orientation questions, 5 word list learning test, digits backwards, month reversal, and delayed recall of word list
- SCAT-II
  - Various versions (i.e., pocket, NFL)
  - Tool that includes orientation, cognitive assessment (SAC), balance and coordination, and symptom scale
  - Baseline also recommended
NHL Protocol For Concussion Evaluation & Management

- Baseline neuropsychological assessment start of season during team camp supervised by team neuropsychologist
- Player removed from play immediately if symptoms are reported or player exhibits observable signs of concussion
- Evaluated in quiet place from distraction using acute evaluation tool (SCAT-II)
- Referred to neuropsychologist for cognitive assessment (ImPACT and paper-pencil tests) once symptom free at rest and upon exertion
- Gradual return to exertion as tolerated
NFL Establishes Concussion Program

- Injury to well-known players
- Concern regarding long-term functioning of athletes
NFL Concussion Program

• 5/2007 NFL Commissioner, Roger Goodell mandates baseline testing for all NFL players
• No designated test identified for this purpose
• 12/2009 NFL adopts stricter statement on return-to-play following concussions
  - Concussed athletes should not return to practice or play in same day he shows symptoms
  - Athlete should not be considered for return to play until he is fully asymptomatic, both at rest and with exertion, has normal neurological evaluation, normal neuropsychological testing, and has been cleared to return to play by team physicians and an independent neurological consultant
Major League Soccer Concussion Protocol

- Established Spring 2011
- Mandated Baseline testing utilizing ImPACT as supervised by Neuropsychologist
- Post Injury cognitive testing utilizing ImPACT and battery of paper-pencil tests with Neuropsychologist when symptom free at rest and with exertion
- Step wise progression back activity. Track progress using SCAT-II
Major League Baseball Protocol

- Concussion management protocol adopted in 2001
- Promoted after several incidences of injury and variable management
- 10 MLB Teams started baseline testing in the 2006 season
- Feb 2011 MLB and Player’s union announced set of protocols for dealing with concussion
  - Mandatory baseline testing for players and umpires
  - Off field assessment completion of SCAT-2
  - Cleared when asymptomatic, normal ImPACT assessment, asymptomatic with exertion and baseball related activities
  - Cleared by team physician with approval from MBL Medical Director
  - Teams designate a concussion specialist independent of team that have demonstrable experience with MBTI care
Why Bother with Cognitive Testing??
Concussion: The Diagnostic and Return to Play Dilemma

How to recognize the moods of an Irish setter
The Utility of Neuropsychological Testing in Sports Concussion Management

- Provides objective information rather than relying solely on athlete self-report

- Sensitive to cognitive deficits in attention, working memory, and processing speed

- Helpful in safely returning athletes to play

- A means to track athletes over time
Concussion Management Timeline

**INJURY**

- **Baseline NP Testing**
  - **PRE SEASON**

- **Sideline Testing**
  - 1-2 DAYS AFTER INJURY

- **NP Testing**

- **Return to Play?**
Immediate Post-Concussion Assessment and Cognitive Testing

Computerized Neurocognitive Testing

Mark Lovell, PhD - UPMC Dept. of Orthopaedic Surgery (Developer)
Micky Collins, PhD - UPMC Dept. of Orthopaedic Surgery
Joseph Maroon, MD - UPMC Dept. of Neurological Surgery
ImPACT: Post-Concussion Evaluation

- Demographic / Concussion History Questionnaire
- Concussion Symptom Scale
  - 21 Item Likert Scale (e.g. headache, dizziness, nausea, etc)
- 8 Neurocognitive Measures
  - Measures Domains of Memory, Working Memory, Attention, Reaction Time, Mental Speed
  - Verbal Memory, Visual Memory, Reaction Time, Processing Speed Summary Scores
- Detailed Clinical Report
  - Outlines Demographic, Symptom, Neurocognitive Data
  - Automatically Computer Scored
Wheel
X's and O's

After the X's and O's are displayed, you will be asked to do a REACTION TIME or SPEED TEST. Below are the directions for the SPEED TEST. Remember, this is a sample. Do the following for each shape that you see:

Press this key on your keyboard as quickly as you can when you see:

Press this key on your keyboard as quickly as you can when you see:

PLEASE RESPOND AS FAST AS YOU CAN!

Click the Continue button to start the sample.

Continue
Click on the number that corresponds to the following symbol:
SHORT TERM COGNITIVE EFFECTS FOLLOWING SPORTS-RELATED CONCUSSION
Short Term Effects

• Most athletes recover from concussion within one month

• Age related responses to concussive injury

• Gender related responses

• History of multiple concussion may lengthen cognitive recovery period
Unique Contribution of Neurocognitive Testing to Concussion Management

Testing reveals cognitive deficits in asymptomatic athletes within 4 days post-concussion

N=215, MANOVA p<.000000 (Lovell et al., 2004; in press)
Unique Contribution of Neurocognitive Testing to Concussion Management

MANOVA p<.000000 (ImPACT Test Battery)
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<th>Exam Type</th>
<th>Baseline</th>
<th>Post-Injury 1</th>
<th>Post-Injury 2</th>
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<th>Composite Scores</th>
<th>Percentile scores if available are listed in small type.</th>
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<td>Memory composite (verbal)</td>
<td>92 77% 82 41% 93 80%</td>
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<tr>
<td>Memory composite (visual)</td>
<td>77 53% 74 44% 93 96%</td>
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<tr>
<td>Visual motor speed composite</td>
<td>36.6 39% 38.17 45% 36.55 38%</td>
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<tr>
<td>Reaction time composite</td>
<td>0.51 83% 0.58 49% 0.54 69%</td>
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<tr>
<td>Impulse control composite</td>
<td>7 6 6</td>
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<tr>
<td>Total Symptom Score</td>
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Cognitive Efficiency Index: 0.52 0.39 0.52

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# ImPACT™ Clinical Report

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### Composite Scores

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<tr>
<td>Memory composite (verbal)</td>
<td>75 13%     84 41%     88 51%</td>
</tr>
<tr>
<td>Memory composite (visual)</td>
<td>82 78%     78 63%     86 88%</td>
</tr>
<tr>
<td>Visual motor speed composite</td>
<td>26.88 &lt;1% 42.9 66%   44.7 75%</td>
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<tr>
<td>Reaction time composite</td>
<td>0.72 5%    0.48 92%   0.44 99%</td>
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<tr>
<td>Impulse control composite</td>
<td>0          9       13</td>
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<tr>
<td>Total Symptom Score</td>
<td>8           0       0</td>
</tr>
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Cognitive Efficiency Index: 0.35 0.42 0.53
Examining Relevance of “Bell Ringers” in High School Athletes

64 high school athletes with “mild” concussion

Two groups compared in terms of outcome

- Athletes with <5 min of signs/symptoms
- Athletes with 5-15 min of signs/symptoms

- No athlete in sample sustained LOC
- All athletes met AAN Grade 1 criteria

No athlete returned to contest

ImPACT evaluation obtained at baseline, day 2, day 4, and day 7 post-injury
ImPACT Memory Composite Scores
Brief versus Prolonged On-field Mental Status Changes

N = 64
High School Athletes

ImPACT Memory-Percent Correct

Lovell, Collins, Iverson, Johnston, Bradley; Amer J Sports Med; 32;47-54,2004
ImPACT Symptom Scale Scores
Brief versus Prolonged On-field Mental Status Changes

N = 64
High School Athletes

Lovell, Collins, Iverson, Johnston, Bradley; Amer J Sports Med; 32;47-54, 2004
Recovery from Concussion in Athletes: Does Age Matter?
ImPACT MEMORY and SPEED TEST PERFORMANCE AT FIRST FOLLOW-UP
Within 2 days for Pro’s 3 days for HS

MEMORY MEASURES

SPEED MEASURES

VERBAL MEMORY VISUAL MEMORY REACTION TIME PROCESSING SPEED

P. < .03, d = .49
P. < .06, d = .41

P. < .0008, d = .76
NS, d = 21

Pellman, Lovell et al., Neurosurgery, 2006
ImPACT MEMORY and SPEED TEST PERFORMANCE AT SECOND FOLLOW-UP
Within 5 days for Pro’s, 7 days for HS

MEMORY MEASURES

VERBAL MEMORY    VISUAL MEMORY

SPEED MEASURES

REACTION TIME    PROCESSING SPEED

N.S., d=.34       N.S., d=.21
N.S., d=.37       N.S., d=.23

Pellman, Lovell et al, 2005
Does Gender Matter?

(Colvin, Mullen, Lovell, West, Collins and Groh. AJSM, 2009)
Gender as a Risk Factor for Sports Concussion?

Males vs. Females Concussed Soccer Athletes
Computerized Neurocognitive Memory Measures

Decline relative to Baseline (SD’s)

All athletes seen within 5 days post concussion

(Colvin, Mullen, Lovell, West, Collins and Groh. AJSM, 2009, N=218 (92 Males, 126 Females)
LONG TERM COGNITIVE EFFECTS FOLLOWING SPORTS-RELATED CONCUSSION
Long Term Effects

• Research has produced mixed results

• A majority of the research has included male boxers and football players

• Once concussed, an athlete is statistically at a increased risk (4-6 times more likely) for future concussion (Guskiewicz et al., 2003)
HIGH SCHOOL & COLLEGIATE FOOTBALL PLAYER LONG TERM EFFECT STUDIES

• Iverson et al. (2004) matched HS and collegiate athletes on concussion hx
  - significant difference on memory scores post concussion for athletes with a history of multiple concussions
  - athletes with history of multiple concussions were 7.7 times more likely to demonstrate major decline in post concussion memory performance than athletes with no concussion history

• Moser, Schatz, & Jordan (2005) studied HS athletes who underwent paper-pencil baseline assessment
  - Found that athletes with two or more concussions performed similarly to those athletes with recent concussion
  - Athletes with rich concussion hx also had lower GPAs compared to those with no concussion hx
HIGH SCHOOL & COLLEGIATE FOOTBALL PLAYER LONG TERM EFFECT STUDIES

• Collie, McCrory, and Makdissi (2006) studied Australian footballers
  - Authors found no significant differences on CogSport reaction time and total error rates among groups leading to the conclusion that there is no association between number of previous concussions and current neurocognitive performance.

• Broglio et al. (2006) retrospectively studied 235 college athletes with HeadMinder CRI baseline test, and 264 athletes with ImPACT baseline test.
  - Results revealed no effect for concussion hx on neurocognitive test performance on either baseline measure.
  - Authors concluded there is either no effect of multiple concussions on cognitive test performance or decrements may be so subtle that they are undetectable by the aforementioned measures.

• Macciocchi et al. (2001) match a group of grade 1 concussed college athletes to a group of player with 2 grade 1 concussions. All had paper-pencil baselines.
  - There was no statistical differences in test scores between the two groups. There was also no difference scores reported.
HIGH SCHOOL & COLLEGIATE FOOTBALL
PLAYER LONG TERM EFFECT STUDIES

• In a sample of multi-sport college athletes, Bruce & Echemendia (2009) investigated self-reported concussion hx and cognitive test performance

• 3 parts to their study
  • 1st group administered computer assessment (ImPACT)
  • 2nd group administered paper-pencil tests
  • 3rd group received paper-pencil and computer test

• There was no significant association found between self-reported hx of concussion on either computerized or traditional neuropsych tests
FACTORS THAT MIGHT BE CONTRIBUTING TO MIXED FINDINGS

• Tremendous variability amongst athletes and response to recovery
• Inclusion criteria for the sample of athletes that were studied
  - previous cognitive functioning
  - proper management
  - length of time out of play
  - spacing between concussions
    - same season vs. years apart
• Reliance on athlete self-report
• Variety of neurocognitive tests used
  - paper pencil tests vs. computerized tests
Cognitive Rest & Recovery

Cognitive rest - Rationale

- Cognitive “work” → increase neuronal functioning, demands for oxygen & glucose

- Exacerbates problems of inefficient neural functioning & reduced blood flow

- Can exacerbate symptoms & potentially delay recovery
Cognitive Rest & Recovery

• Cognitive Rest
  • Theoretically makes sense, but…
    • No data to support claims
  • No clear definition or standardized curriculum
• Cognitive Rest & Recovery Project
  Blake, M. & Ott, S. (in-progress)
Recommendations for Cognitive Rest and Recovery

- Decreased cognitive activity
  - May need to miss school
  - Attend ½ days
- Academic accommodations
  - Un-timed tests, no examinations, pre-printed class notes, tutoring, modified homework assignments, frequent breaks, etc.
  - Limit video games, texting etc.
  - May need to restrict driving
PROPER CONCUSSION MANAGEMENT & RETURN TO PLAY

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PROPER CONCUSSION MANAGEMENT

• Return play criteria & protocol
  • Mandated by law in 33 states now
  • Starts when all symptoms have resolved and the athlete has returned to normal cognitive functioning
  • In Texas, athlete must be seen and released by a physician before beginning
  • 24 hours between stages
  • If symptoms recur, they need to return to the lowest asymptomatic level and start over or return to day 1 activity
PROPER CONCUSSION MANAGEMENT

• Day 1 activity
  • Cognitive and physical rest until asymptomatic
    • Limit school work
    • Testing
    • Video games
    • Texting
    • Any unnecessary physical work
PROPER CONCUSSION MANAGEMENT

- Day 2
  - Light Aerobic Exercise
    - Stationary bike
    - Jog
    - Usually about 15 – 20 minutes max
PROPER CONCUSSION MANAGEMENT

• Day 3
  • Sport specific exercise
    • Moderate intensity
    • Limited time frame
    • No heavy weights
    • No extreme exertion
    • No contact
PROPER CONCUSSION MANAGEMENT

• Day 4 activity
  • Heavy non contact drills
    • Full exertion
    • OK for heavy weights
    • Full practice time
PROPER CONCUSSION MANAGEMENT

• Day 5 activity
  • Full contact practice
    • After medical clearance
    • May be granted automatically
PROPER CONCUSSION MANAGEMENT

• Day 6
  • Full release and return to play
  • Risk of recurrent injury felt to be at that athletes baseline
PROPER CONCUSSION MANAGEMENT

• Evaluate symptoms at each day
  • Symptom checklist
  • Signed by athlete and athletic trainer
Pharmacologic Management of Concussion

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Associate Director, Primary Care Sports Medicine Fellowship
Methodist Orthopedic Specialists of Texas
Team Physician, Houston Dynamo
Member, MLS Concussion Protocol Committee
"... Splints. Tape. Ice pack. Bandages. ... Wait! Here it is — spare brain."
Acute Management

• Most athletes with mild concussions have spontaneous resolution within 7-10 days

• Analgesics for headaches are appropriate
  • Watch for symptom triggers: avoidance is best medicine
  • Narcotics may confuse assessment of mental status, mainly in acutely symptomatic

• Muscle relaxers can be helpful as well, but can also be sedating

• Antiemetics

• Trigger point injections
Pharmacologic Management

• Research in this area is lacking
  • Most information is anecdotal
  • Evidence of efficacy is equivocal
  • Most research lacks true double blinding and/or randomization
  • Most studies include subjects with more severe injury than seen in sports
Pharmacologic Management

• Each type of treatment is associated with risk of potential adverse effects
• Many treatments are considered off-label and need to be explained as such
Subacute/Chronic Management: Principles

• Most symptoms resolve spontaneously within days to weeks
  • If still symptomatic beyond an acceptable recovery period
• Symptoms creating negative impact on quality of life
  • Always need to balance risk:benefit ratio
• Make sure you are comfortable with the medication used and its potential effects on the concussed individual
• No medication has been proven to hasten recovery
• Injury mechanism and symptom presentation are highly variable
• No standardized approach available
Subacute/Chronic Management

• Categorization of symptoms
  • Sleep disturbances
  • Physical symptoms
    • Mainly headaches, dizziness
  • Emotional difficulties
    • Anxiety, depression
  • Cognitive
    • Memory, slow processing speed, attentional issues
• Need to consider pre-morbid conditions in all cases
Sleep Disturbance

• Prior to initiating medication, discuss sleep hygiene
  • Eliminate distractions:
    • TV, computer, iPad, texting, iPods
  • Make room dark
  • Avoid or eliminate caffeine and/or nicotine
Sleep Disturbance

• Melatonin
  • Hormone produced by pineal gland
    • Derived from serotonin
    • Secreted during sleep hours
  • Nontoxic
  • ? Benefits for brain injury recovery?
    • In mice with induced brain trauma, neurologic deficits reduced with treatment
  • ? Antioxidant capacity
    • Journal Pineal Research 2007 Mesenge et al
Sleep Disturbance

- Trazodone
  - Antidepressant in serotonin reuptake inhibitor class
  - Commonly used in treatment of more severe traumatic brain injury
  - Sometimes mentioned as first line
- TCAs
- Benzodiazepines
  - Most recommend against due to negative effects on cognition and mental status/alertness
- Zolpidem and other newer hypnotics
- Psychotherapy, phototherapy, chronotherapy also mentioned
Somatic Symptoms: Headache

- Most common symptom following mTBI
- Sometimes most difficult to treat
- NSAIDs and analgesics are often used
  - Need to watch for rebound headaches
- Classified according to International Headache Society system to help with treatment
  - Most are tension or migraine
Somatic Symptoms: Headache

- TCAs commonly used (amitriptyline most popular and studied)
  - At least moderately successful
  - Can be used for both migraine and tension headache management
  - Sedating effects can help with sleep issues
Somatic Symptoms: Headache

- Others
  - Beta blockers (usu propranolol)
  - Calcium channel blockers (dihydropyridines)
  - Valproic acid (Depakote)
  - Topiramate
  - Gabapentin
  - Dihydroergotamine
- Biofeedback, physical therapy, trigger point injections, psychotherapy
- All listed are utilized in management of headaches NOT induced by head injury
Somatic Symptoms: Headache

- Symptoms can persist for months to years
- Challenge: are these headaches a new problem if all other postconcussive symptoms resolve, or a lingering symptom of recovery
  - Difficult return to play decision
Somatic Symptoms: Dizziness

- Can be subjective (unmeasurable) or objective (positive neurologic eval tests like Rhomberg, BESS, Dix-Hallpike, etc.)
- Generally not advised to treat vertigo symptoms with medication (adaptation)
  - If Rx, mainstay is meclizine
  - Benzodiazepines can also be effective, but watch for sedating side effects on mental status
- Physical/Vestibular therapy is often best method in my experience
Emotional Symptoms: Depression

• Depression most common of the symptoms reported
  • Can be direct or indirect (physical and academic restrictions)
  • If short-lived with rest of concussion symptoms, then management with coping strategies without medication is appropriate
• TCAs and SSRIs are the most recommended
Emotional Symptoms: Depression

- Sertraline (SSRI) has been studied in TBI
  - ? Improvements in psychomotor speed, memory, and cognitive efficiency in one study (Am J Psych 2009, Fann, Silver and McAllister)
- Amitriptyline
  - Effective for headaches and primary depression, but maybe not for mTBI depression
- Others with value:
  - Citalopram and fluoxetine (SSRIs) have also been studied and potentially helpful
Cognitive Symptoms

• Includes troubles with
  • Memory
  • Concentration
  • Processing speed
• Can at least be identified with computerized neuropsychological testing
• If unclear can proceed with formal neuropsychological testing
Cognitive Symptoms

• Cognitive rehabilitation
  • Not necessary in most cases due to relatively short recovery
  • Can be helpful for those with prolonged symptoms

• Medications
  • Again, routine use not prudent due to short and predictable recovery in most cases
  • If with prolonged cognitive deficits, consider treatment
Cognitive Symptoms

• Methylphenidate
  • Studied in TBI
  • Randomized controlled trials suggest benefit
  • Treats attentional deficits and slow processing speeds
  • With more traumatic brain injury, could be risky due to lower seizure threshold
Cognitive Symptoms

- Amantadine
  - Dopaminergic, neuroexcitatory
  - Initially anti-influenza antiviral
  - Discovered in 1969 to be mildly helpful with Parkinsonism
  - Several studies suggest improvement in processing speed and executive function, but not overwhelmingly convincing
  - Safe in pediatric patients
Cognitive Symptoms

- Others tried but without proof:
  - Donepezil
  - Fluoxetine
  - Cytidine diphosphoryl choline
  - Sertraline
  - Pramiracetam
  - Bromocriptine
  - Atomoxetine
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Primary Care Sports Medicine Fellowship Director
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Sports Medicine at Willowbrook
Future Directions: Possible and Identified Risk Factors That Influence Protracted Recovery

• The majority of concussed high school athletes will recover within 3 weeks
  • Resolution of symptoms and return to baseline or better neuropsychological functioning
  • Very few that we see in clinic will return within a week
  • Understanding risks for prolonged recovery will help us identify those at risk and make better return to play decisions
Future Directions: Possible and Identified Risk Factors That Influence Protracted Recovery

- Gender
- Genetics
- Pre and Post Injury Migraines
- Pre and Post Injury Psychological Functioning
- Pre-existing Learning disability
Future Directions: Possible and Identified Risk Factors That Influence Protracted Recovery

- Gender
  - 10 prospective studies
    - Soccer, basketball and ice hockey
  - Females had a higher incidence of concussion
  - Women reported more post concussive symptoms and performed worse on neurocognitive testing
    - Colvin et al 2009
  - Women at high risk of post concussive symptoms 3 months s/p injury
Future Directions: Possible and Identified Risk Factors That Influence Protracted Recovery

• Genetics
  • APOE promoter allele
  • Conflicting studies
  • ApoE E4 associated with Alzheimer’s
  • Subtype G-219T TT subtype had 3 fold increase in risk
  • No indication to screen now, but more research is needed
Future Directions: Possible and Identified Risk Factors That Influence Protracted Recovery

• Migraines
  • Difficult to define as there is a large overlap
  • May be a common pathophysiological pathway
  • Possible to misdiagnose migraine as concussion and concussion as migraine
Future Directions: Possible and Identified Risk Factors That Influence Protracted Recovery

- Pre existing psychological disorders
  - Mood disorders are common in post concussion syndrome
  - Military research currently shows that depression and PTSD are common findings in post concussed military athletes
  - There is a postulated connection neuronal dysfunction that connects the two.
  - Uncovering a pre existing problem
Future Directions: Possible and Identified Risk Factors That Influence Protracted Recovery

• ADHD and Learning disability
  • Again may be a pre-existing problem uncovered by the injury
  • ADHD has the concomitant problem of impulse control leading to more risk-taking behaviors
  • More difficult to determine return to baseline functioning
Future Directions: Possible and Identified Risk Factors That Influence Protracted Recovery

- Chronic Traumatic Encephalopathy
  - Neurofibrillary tangles similar to that seen in Alzheimer's disease
  - Likely the etiology of dementia pugalistica
  - Seen in very high frequency in athletes who have a history of concussion and progress to dementia, depression and suicide

- Tau Protein deposition
  - Also seen in CTE
Future Directions-Assessment & Treatment

• As more is understood about injury, more focused treatment will arise
  • Functional MRI
  • PET scans
  • Biomarkers of injury
  • Premorbid genetic markers
• Need for more research on pharmacologic management
• Helmet Technology
• Use of accelerometers in detecting concussion
REMEMBER THE GOOD OLD DAYS WHEN WE PLAYED SPORTS AND NEVER WORRIED IF WE GOT CONCUSSIONS?

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NO.
SUMMARY

- Proper diagnosis and acute management is essential
- Individualized approach to concussion management
- Athletes should be returned to play following conservative approaches
- Educate athletes on concussion and potential risk for detrimental effects
- Neurocognitive assessment is the cornerstone of proper concussion management
NATASHA’S LAW
HB 2038

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Overview of HB 2038

- Defines Concussion
- Immediate Removal from Play
- Concussion Oversight Committee
- New paperwork/documentation
  - UIL Concussion Acknowledgement Form PRIOR to play
  - Concussion injury paperwork:
    - Medical info release (HIPAA/FERPA)
    - Notice of Immunity
    - Signs/ Symptoms & management information (school & home)
    - Notification of School Personnel
    - MD referrals & notes
- RTP protocol
  - Management during the RTP
  - MD release form after completing RTP
- UIL RTP Form
  - Informed & consented
    - RTP guidelines
    - Risks
- Training/ Education
• This bill applies to **interscholastic athletic activity**, including practice and competition, sponsored or sanctioned by a **school district**, a **public school**, including a **charter school**, or the **University Interscholastic League (UIL)**.

• **does not apply to private schools** that are members of TAPPS

• Or **Club sports**
If it is determined that a concussion has occurred, the student-athlete shall:

- **NOT be allowed to return** to participation that day regardless of how quickly the signs or symptoms of the concussion resolve.
- Be kept from activity until a **physician** indicates they are **symptom free** and gives **clearance to return to activity**.
- **Must complete the District’s RTP Protocol**
  - A coach of an interscholastic athletics team may not authorize a student’s return to play.

- Inform the student-athletes parent/guardian about the possible concussion and give them information on concussion. *(PAPERWORK-Packet!)*
Concussion Oversight Team (COT)
- Appointed & Approved by each school district or charter school
- Headed by at least one physician with concussion management training.
- To the greatest extent possible, COT must also include one or more:
  - An athletic trainer; *If the school district employs an athletic trainer they must be a member*
  - An advanced practice nurse;
  - A neuropsychologist; or
  - A physician assistant
  - Administrators, coaches or other school officials can not serve on the COT
- All COT need to show proof of Concussion Training
- Physicians are not required to take specific training or submit proof however they shall to the greatest extent practicable, periodically take an appropriate continuing education course in concussions

Establish a Return to Play Protocol
- based on peer-reviewed scientific evidence
In developing a RTP Protocol,

- at a minimum—adopt the UIL Concussion Management Protocol
  - [http://www.uiltexas.org/health/info/concussions](http://www.uiltexas.org/health/info/concussions)
- If the local COT wishes to be more restrictive than the UIL Concussion Management Protocol, that is within their local discretion.

- Each Athlete MUST complete the districts’ approved RTP protocol prior to being able to participate.
  - Examples:
    - Klein ISD, Friendswood ISD, Mesquite ISD
• If the school district or charter school employs an athletic trainer, he/she is responsible for the compliance of the athlete with the return to play protocol.
  • A coach of an interscholastic athletics team may not authorize a student’s return to play.
• AT not available:
  • a supervising adult approved by the school district with appropriate training in the recognition of the signs and symptoms of a concussion in athletes could serve in that capacity.
  • This person is also then responsible for creating the appropriate documentation related to the injury event.
• UIL approved continuing concussion education required for coaches, licensed health care professionals and recommended for physicians
• **Must be at least 2 hours, every 2 years.**
• Must be done by Sept, 1, 2012
  • This CME event qualifies
• **Concussion education**
  • Parent
  • Student-Athlete
  • Teachers/ School Personnel
    • *In-service prior to school*
  • And even to other Medical Professionals
Paperwork!

• Prior to Athletic Participation
  • UIL Concussion information and acknowledgement form (April 15th)
  • written information about concussions and relevant safety policies was received and read (signature required)
  • Complete a new form each academic year.

• Post Head Injury
  • the student athlete, parent/guardian, and other appropriate school employees must receive a written copy of the concussion oversight team’s RTP protocol.
  • Post concussion Instructions / Management Plan
UIL Concussion Management
Standardized Protocol

Phase 1:
No exertional physical activity until student-athlete is symptom free for 24 hours and receives written clearance from a physician and submission of the required documentation following the concussion injury.

Phase 2:
Step 1. When the athlete completes Phase 1, begin light aerobic exercise 5 – 10 minutes on an exercise bike, or light jog; no weight lifting, resistance training, or any other exercise.
UIL Concussion Management

Standardized Protocol

**Step 2.** Moderate aerobic exercise - 15 to 20 minutes of running at moderate intensity in the gym or on the field without a helmet or other equipment.

**Step 3.** Non-contact training drills in full uniform. May begin weight lifting, resistance training, and other exercises.

**Step 4.** Full contact practice or training.

**Step 5.** Full game play.
When Can I Play?

- **4 Basic Steps Involved are:**

1. **The student has been evaluated by Physician**
   - using established medical protocols based on peer-reviewed scientific evidence
   - chosen by the student/parent/guardian
     - KISD- “a physician skilled in Concussion Management”
     - ImPact/ Cognative Testing

2. **The student has successfully completed each requirement of the RTP protocol**
   - Previous Examples
   - Varies per athlete
     - Many things cause headaches
     - handle each student-athlete individually
(3) The **treating physician** has provided a written statement indicating that, in the physician's professional judgment, it is safe for the student to return to play.

(4) the student and parent/guardian:

- **(A) Acknowledgement form** stating they **completed** the requirements of the **RTP protocol**;
- **(B) provide the AT with the MD note**
- **(C) have signed a consent form** indicating *(UIL Form)*:
  - informed about the **RTP protocol**;
  - understands the **risks** of athletic participation
  - will **comply** with any ongoing requirements of the RTP protocol;
  - consents to the disclosure to appropriate persons *(HIPAA/ FERPA)*
  - understands the **immunity** provisions
CASE PRESENTATION

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Slides for Natasha’s Law  (HB 2038)

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THE END