

UPDATE ONCONCUSSION MANAGEMENT IN SPORTS

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OBJECTIVES

- ◆ To be able to recognize a concussed athlete and perform a proper history and physical exam
- ◆ To be able to appropriately manage concussions in athletes
- ◆ To be able to implement safe return to competition
- ◆ To be aware of future trends, changes and considerations

“If ever I need a brain transplant, I want one from a sports writer, ‘cause I know it’s never been used.”

-Joe Paterno, Penn State Nittany Lions Football Coach

HISTORICAL PROBLEM

- ✦ Too many definitions
- ✦ Too many grading scales
- ✦ No uniform consensus, guidelines, etc
- ✦ 2001 1st International Conference on Concussion in Sport (ICCS) Vienna
- ✦ 2004 2nd ICCS Prague
- ✦ 2008 3rd ICCS Zurich

SO WHERE ARE WE NOW?



DEFINITION

- ✦ International Conference on Concussion in Sport (ICCS in Vienna 2001, Prague 2004, Zurich 2008):

"A complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces."

ICCS: Common Features

- ✦ Direct blow to head/body with an impulsive force transmitted to the head
- ✦ Rapid onset of short-lived impairment of neurologic function that resolves spontaneously
- ✦ May result in neuropathological changes but acute clinical symptoms largely reflect functional disturbance rather than structural injury

ICCS: Common Features (Cont)

- ✦ Results in a graded set of clinical syndromes that may or may not involve LOC. Resolution of clinical and cognitive symptoms typically follows a sequential course.
- ✦ Typically associated with grossly normal structural neuroimaging studies.
- ✦ Post-concussive symptoms may be prolonged or persistent in a small %.

INCIDENCE (Football)

- ✦ 1.5 million high school and college players
- ✦ 250,000 head injuries/year (20%)

SPORTS WITH GREATEST RISK

- ◆ Football
- ◆ Gymnastics
- ◆ Ice Hockey
- ◆ Wrestling
- ◆ Boxing
- ◆ Soccer
- ◆ Lacrosse

PATHOPHYSIOLOGY

- ◆ No existing animal/experimental model that accurately reflects a sporting concussive injury
- ◆ Experimental models of severe brain injury demonstrate a complex cascade of biomechanical, metabolic and gene expression changes (functional rather than structural)

PATHOPHYSIOLOGY (Cont)

- ◆ NEWTON'S LAW: Force = Mass x Acceleration
- ◆ Acceleration and deceleration forces acting on the brain
- ◆ Rotational (angular) and translational (linear) forces
- ◆ Coup vs.. Contra-coup

PATHOPHYSIOLOGY (Cont) Stresses

- ◆ Compression
- ◆ Tensile
- ◆ Shearing (rotational forces)
 - Poorly tolerated due to dissipation of cerebral spinal fluid (CSF) which normally acts as the brain's shock absorber

DIFFERENTIAL DIAGNOSIS:

- ◆ Concussion
- ◆ Contusion
- ◆ Skull Fracture (linear vs. depressed)
- ◆ Epidural Hematoma
- ◆ Subdural Hematoma
- ◆ Subarachnoid Hemorrhage
- ◆ Intracerebral Hemorrhage

DIFFERENTIAL (Cont)

- ◆ C-spine injury
- ◆ Vaso-vagal syncope
- ◆ Seizure
- ◆ Hypoglycemia
- ◆ Cardiac
- ◆ Dehydration
- ◆ Heat exhaustion/stroke

FEATURES OF CONCUSSION FREQUENTLY OBSERVED

- ✦ Vacant stare
- ✦ Delayed verbal and motor responses
- ✦ Confusion and decreased concentration
- ✦ Disorientation (game situations)
- ✦ Incoordination

FEATURES OF CONCUSSION FREQUENTLY OBSERVED (cont)

- ✦ Slurred speech
- ✦ Memory deficits
- ✦ Labile emotions
- ✦ LOC
- ✦ Concussive convulsion

EARLY SYMPTOMS

- ✦ Headache
- ✦ Post-traumatic amnesia (retrograde or anterograde)
- ✦ Dizziness or vertigo
- ✦ Tinnitus
- ✦ Confusion
- ✦ Nausea or vomiting

LATE SYMPTOMS

- ◆ Headache
- ◆ Light-headedness
- ◆ Poor attention and concentration
- ◆ Memory dysfunction
- ◆ Easy fatigability
- ◆ Irritability and frustration

LATE SYMPTOMS (cont)

- ◆ Photophobia and/or blurred vision
- ◆ Phonophobia and/or tinnitus
- ◆ Anxiety
- ◆ Depression
- ◆ Sleep disturbance
- ◆ Cognitive impairment (slowed reaction time)

LOC and Amnesia (ICCS)

- ◆ LOC does not necessarily imply severity
- ◆ Amnesia alone may not be as important as the degree of clinical post-concussive symptoms
- ◆ Retrograde amnesia is poorly reflective of severity
- ◆ Anterograde amnesia more predictive of post-injury cognitive deficits and prolonged symptoms

IMMEDIATE CARE

- ✦ ABC's
- ✦ Level of consciousness (Glasgow Coma Scale: 3-15)
- ✦ History (athlete, teammates and officials)
- ✦ Brief Neurological examination
- ✦ Backboard and transport if unconscious, neuro deficit or suspect c-spine injury

SIDELINE EVALUATION

- ✦ Additional history
- ✦ Vitals
- ✦ Detailed Neuro exam/MMSE
- ✦ SCAT2
- ✦ Provocative Testing/Balance Testing
- ✦ Close serial monitoring
- ✦ Home instructions (parents/coaches)

WARNING SIGNS

- ✦ Impairment of consciousness (or changes in mental status/behavior, increasing or continued)
- ✦ Nausea and vomiting (persistent)
- ✦ Motor activity decreased, unequal or pathologic posturing
- ✦ Seizures

WARNING SIGNS (cont)

- ⚡ Vital Signs (Cushing response)
- ⚡ Headache, increasing or persistent
- ⚡ Dizziness
- ⚡ Pupillary inequality
- ⚡ WARNING SIGNS SHOULD PROMPT TRANSPORT VIA EMS TO HOSPITAL TO R/O STRUCTURAL BRAIN INJURY

GRADING SCALES

- ⚡ Numerous
- ⚡ Cantu, Colorado Medical Society, American Academy Neurology most popular
- ⚡ Scales not to be used anymore
- ⚡ ICCS recommends individualized treatment

ICCS

- ⚡ 1st ICCS: Abandon scales in favor of individual and comprehensive assessment
- ⚡ 2nd ICCS: Determine simple vs complex concussion retrospectively
- ⚡ 3rd ICCS: Abandon simple vs complex
- ⚡ Linear spectrum of severity vs. subtypes based on symptoms, anatomic location, biomechanical forces, genetic phenotype, neuropathological changes?

ICCS: Overview

- ◆ Progressively resolves w/out complication over 7-10 days
- ◆ Neuroimaging not needed
- ◆ Rest until all symptoms resolved
- ◆ Graded program of exertion before return to sport
- ◆ PCP/ATC can usually manage together

ICCS: Management

- ◆ Remove from current game/practice WITHOUT allowing return
- ◆ Monitor frequently; Don't leave alone
- ◆ Take away equipment
- ◆ Discuss with coach, athlete and family
- ◆ No driving, EtOH, sleep aids
- ◆ No ASA or NSAID
- ◆ Physical and cognitive rest essential

ICCS: Return to Play

- ◆ Stepwise progression of activity over the course of one week
- ◆ Athlete must be asymptomatic (w/out use of medication) before beginning the progression
- ◆ 24 hours in between steps
- ◆ Full clinical and cognitive recovery is mandatory before return to sport

ICCS: Return to Play (Cont)

- 1. No same day return to play
- 2. No activity. Once asymptomatic (no signs/symptoms) to 2.
- 3. Light exercise (stationary bike @ <70% MPHR (220-age); no weight lifting)
- 4. Sport specific exercise (skating/running)

ICCS: Return to Play (Cont)

- 5. Resistance training and non-contact drills requiring multi-task (run and catch)
- 6. Full-contact practice
- 7. Game play
- During progression, if symptoms recur then rest 24 hours and re-start at previous asymptomatic level

MODIFIERS AFFECTING MANAGEMENT

- Multiple
- Prolonged duration
- Convulsions
- LOC > 1 min
- Progressively less force required to induce repeated concussions
- Age
- Medications
- Co-Morbidities
- High risk sport
- High risk style of play

CAVEATS

- ✦ These guidelines can be applied to children down to age 10
- ✦ Pre-season baseline testing desirable
- ✦ No single test can be used as a stand-alone tool for the diagnosis and on-going management of concussion

COMPLICATIONS

- ✦ Second Impact Syndrome
 - Sustaining a second head injury when still recovering from the first
 - Disruption of vascular autoregulation in the brain
 - Rapid development of severe edema, brain herniation and death
 - Does it really exist? (CJSM: July 2001 - Volume 11 - Issue 3 - pp 144-149)
 - <http://video.cdc.gov/asxgen/ncipc/TBI/HeadsUp.wmv>

COMPLICATIONS (cont)

- ✦ Post-Concussive Syndrome
 - May last up to 6 months or longer
 - Wide variety of symptoms such as headache with exertion, dizziness, fatigue, irritability, decreased concentration and impaired memory
 - Athletes should probably get neuropsych testing and imaging studies
 - No return to play until all symptoms gone

COMPLICATIONS (cont)

- ✦ Those who sustain a concussion are 4-6 times more likely to sustain another (due to concussion itself or the player's style of play?)
- ✦ Neuropsychological effects of repeated concussions are cumulative
- ✦ Chronic traumatic encephalopathy (Punch Drunk Syndrome)

PREVENTION (cont)

- ✦ Rule changes (head checking; unduly penalizing teams)
- ✦ Rule enforcement (referees/league)
- ✦ Protective equipment (risk compensation?)
- ✦ Baseline neuro-psych testing? (SAC, SCAT2, formal testing)

PREVENTION

- ✦ EDUCATION/SCREENING (PPPE)
- ✦ Neck strengthening
- ✦ Proper tackling techniques
- ✦ Regular equipment checks
- ✦ Proper communication
- ✦ Work as a team

FUTURE CONSIDERATIONS

- ◆ Neuropsychological testing and standard of care
- ◆ Apolipoprotein E epsilon-4 genotype (ethics?)
- ◆ PET/SPECT/fMRI/trans-cranial doppler
- ◆ EEG
- ◆ Pediatric and gender differences

CONCLUSION

- ◆ INDIVIDUALIZE
- ◆ BE CONSERVATIVE IF NOT SURE
- ◆ "When in doubt, sit them out!"
- ◆ No same day return to play
- ◆ Physical and mental rest
- ◆ Do not begin gradual progressive return to play until fully asymptomatic

HELPFUL LINKS

- ◆ http://www.cdc.gov/ncipc/tbi/physicians_tool_kit.htm
- ◆ http://journals.lww.com/cjsportsmed/Fulltext/2009/05000/Consensus_Statement_on_Concussion_in_Sport_3rd.1.aspx
- ◆ Randolph C, McCrea M, Barr WB. Is neuropsychological testing useful in the management of sport-related concussion? J Athl Train 2005; 40(3): 139-154. (good review of the different types of NP computer-based testing programs)
