Concussion in the Student-Athlete

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Unlike a UK Basketball Coach, I have no financial relationships with any product discussed in this presentation.
Objectives

1. Evaluate the recent trends in sports-related concussion
2. Recognize the symptoms and typical timeline of concussion
3. Implement a team approach for getting the student-athlete back to the field and the classroom following a concussion
Sports

Nathan Stiles collapses and dies after taking a hit during a Spring Hill football game

By Justin Kendall, Fri., Oct. 29 2010 @ 11:00AM
Categories: News, Sports

Spring Hill senior Nathan Stiles died after suffering an injury a football game at Osawatomie last night.

KSHB Channel 41 reports that Stiles intercepted an Osawatomie pass and took a hard hit on the play. The senior linebacker walked to the sidelines afterward but collapsed. The Miami County EMS responded to a "traumatic injury" call around 8:23 p.m. Thursday. Stiles was unconscious and was flown to the University of Kansas Medical Center where he died early this morning.

Photo via KSHB

Spring Hill football player Nathan Stiles died after collapsing at last night's game.
Why all the fuss?

- 1999 - estimated 300,000 concussions/yr

- 2009 - 3.8 million sport-related concussions
Why such a change?

- Original estimates only included concussions with loss of consciousness (<10% have any LOC)
- Improved recognition of symptoms
- Concerns about long-term consequences and deaths related to head injury
- Maybe sports have changed too...
- Still underestimated?
• Incidence highest in football (6/10,000)
• Increasingly recognized in all sports, including non-contact sports like baseball
• Also marked increases in girls soccer, basketball, lacrosse, wrestling, and ice hockey
• Concussions now represent 9% of all high school athletic injuries
What we know ➡

What we don’t know ➡
• A complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces.

• Concussion may be caused either by a direct blow to the head, face, neck, or elsewhere on the body with an “impulsive” force transmitted to the head.
Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously.

Concussion may result in neuropathological changes, but the acute clinical symptoms largely reflect a disturbance rather than structural injury.
Concussion Analogy

- Old fashion phone switchboards
- Bang the console and all the plugs fall out temporarily
- Slowly put all the plugs back into their proper location
- May be no permanent harm, but service has definitely been disrupted
• “Metabolic mismatch”
  • Hovda, 1999
• Higher energy demand and glucose metabolism
• Decrease in energy supply and cerebral blood flow
Case #1

• One of your coaches comes to the office and asks if you can give some advice on what to do with players who might have a concussion.

• The school has no trainer and you’re only available during regular school hours. What advice can you offer?
The Sideline/Event Evaluation
On-field and Sideline Evaluation

- Keep the helmet on!
- Determine level of consciousness
- Assess ABC’s
- Maintain C-spine in neutral position
- Transfer to sideline if stable or call EMS for medical facility
Secondary Survey

• Establish some dialogue...Score of game? Who did we play last week? Score? Months of the year? Serial 7’s?

• Headache?
• Amnesia?
• Dizziness/nausea?
• Neck Pain?
Initial Symptoms

- Headache - most common feature (83%)
- Dizziness - frequent (65%)
- Confusion - (57%)
  - Answers slowly, forgets plays, dazed, etc
- Amnesia - (25%)
- Loss of consciousness (<10%) **
- Nausea/vomiting/convulsions
Who Needs to Visit the ED?

- Focal neurologic signs
- Severe symptoms such as vomiting, severe headache, declining mental status
- Loss of consciousness
- Seizure
- Any progressive worsening of condition
Pocket SCAT2
Derived at 3rd Int’l Conf. on Concussion in Sport (Zurich ‘08)

Pocket SCAT2

Concussion should be suspected in the presence of any one or more of the following: symptoms (such as headache), or physical signs (such as unsteadiness), or impaired brain function (e.g. confusion) or abnormal behaviour.

1. Symptoms
   Presence of any of the following signs & symptoms may suggest a concussion.
   - Loss of consciousness
   - Seizure or convulsion
   - Amnesia
   - Headache
   - “Pressure in head”
   - Neck Pain
   - Nausea or vomiting
   - Dizziness
   - Blurred vision
   - Balance problems
   - Sensitivity to light
   - Sensitivity to noise
   - Feeling slowed down
   - Feeling like “in a fog”
   - “Don’t feel right”
   - Difficulty concentrating
   - Difficulty remembering
   - Fatigue or low energy
   - Confusion
   - Drowsiness
   - More emotional
   - Irritability
   - Sadness
   - Nervous or anxious

2. Memory function
   Failure to answer all questions correctly may suggest a concussion.
   “At what venue are we at today?”
   “Which half is it now?”
   “Who scored last in this game?”
   “What team did you play last week? game?”
   “Did your team win the last game?”

3. Balance testing
   Instructions for tandem stance
   “Now stand heel-to-toe with your non-dominant foot in back. Your weight should be evenly distributed across both feet. You should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes.”
   Observe the athlete for 20 seconds. If they make more than 5 errors (such as lift their hands off their hips, open their eyes; lift their forefoot or heel; step, stumble, or fall; or remain out of the start position for more than 5 seconds) then this may suggest a concussion.

Any athlete with a suspected concussion should be IMMEDIATELY REMOVED FROM PLAY, urgently assessed medically, should not be left alone and should not drive a motor vehicle.
Concussion Assessment Tools

Phone Apps
Designed for coaches, ATC’s, parents, and health care professionals
• If concussion is suspected...

NO RETURN TO PLAY !!

• Current laws state any player suspected of a concussion cannot return to play until properly cleared by a healthcare professional
• Do not leave alone for 24-72 hrs!
• Avoid ibuprofen, naproxen, alcohol, sleeping aids
• Cognitive and physical rest – avoid tv, text, computer, music, physical activity, sports, and cognitive stress
• NO driving or sports!
Give ‘em a Plan...

- ?? School
- Provide expectations - 90% recover in 2-4 weeks
- Review return-to-play requirements and return-to-school recommendations!
- Emphasize proper medical supervision
The Concussion Toolbox...
Concussion is a functional injury and *not* a structural injury

Rarely of any benefit

Head CT when less than 72 hours
  - Any neurologic deficit
  - Worsening headache or symptoms
  - Prolonged LOC > 1 minute

Consider MRI if subacute or more chronic - identifies structural abnormalities
Spring Hill football player died from subdural hematoma

By JIM SULLINGER

The Kansas City Star

PEC Sports

Nathan Stiles
Neurocognitive Testing

- First used in 1982 on athletes
- Attempts to measure attention span, memory, problem solving capabilities, and reaction time
- ?? change in outcomes
- Baseline testing in football would cost $44 million/yr
- Needs unbiased research
Case #2

- 15 yo athlete returns to school a week after sustaining a suspected concussion.
- Her doctor diagnosed a Grade I concussion and said she could go back to play in 2 weeks.
- You are concerned because she comes into your office still reporting some headaches.
- Does it sound right that she’ll be back in a week?
### Table 1. Cantu Grading System for Concussion**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No loss of consciousness; posttraumatic amnesia less than 30 minutes</td>
</tr>
<tr>
<td>2</td>
<td>Loss of consciousness less than 5 minutes in duration or posttraumatic amnesia lasting longer than 30 minutes but less than 24 hours in duration</td>
</tr>
<tr>
<td>3</td>
<td>Loss of consciousness for more than 5 minutes or posttraumatic amnesia for more than 24 hours</td>
</tr>
</tbody>
</table>


### Table 2. Colorado Medical Society Grading System for Concussion10

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Confusion without amnesia; no loss of consciousness</td>
</tr>
<tr>
<td>2</td>
<td>Confusion with amnesia; no loss of consciousness</td>
</tr>
<tr>
<td>3</td>
<td>Loss of consciousness</td>
</tr>
</tbody>
</table>

### Table 3. AAN Practice Parameter (Kelly and Rosenberg) Grading System for Concussion*

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Transient confusion; no loss of consciousness; concussion symptoms or mental status abnormalities on examination resolve in less than 15 minutes</td>
</tr>
<tr>
<td>2</td>
<td>Transient confusion; no loss of consciousness; concussion symptoms or mental status abnormalities on examination last more than 15 minutes</td>
</tr>
<tr>
<td>3</td>
<td>Any loss of consciousness, either brief (seconds) or prolonged (minutes)</td>
</tr>
</tbody>
</table>


### Table 4. Nelson Grading System for Concussion7

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Head struck or moved rapidly; not stunned or dazed initially; subsequently complains of headache and difficulty in concentrating</td>
</tr>
<tr>
<td>1</td>
<td>Stunned or dazed initially; no loss of consciousness or amnesia; sensorium clears in less than 1 minute</td>
</tr>
<tr>
<td>2</td>
<td>Headache; cloudy sensorium longer than 1 minute in duration; no loss of consciousness; may have tinnitus or amnesia; may be irritable, hyperexcitable, confused, or dizzy</td>
</tr>
<tr>
<td>3</td>
<td>Loss of consciousness less than 1 minute in duration; no coma (arousable with noxious stimuli); demonstrates grade 2 symptoms during recovery</td>
</tr>
<tr>
<td>4</td>
<td>Loss of consciousness for more than 1 minute; no coma; demonstrates grade 2 symptoms during recovery</td>
</tr>
</tbody>
</table>

### Table 5. Ommaya Grading System for Concussion12

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Confusion without amnesia (stunned)</td>
</tr>
<tr>
<td>2</td>
<td>Amnesia without coma</td>
</tr>
<tr>
<td>3</td>
<td>Coma lasting less than 6 hours (includes classic cerebral concussion, minor and moderate head injuries)</td>
</tr>
<tr>
<td>4</td>
<td>Coma lasting 6 to 24 hours (severe head injuries)</td>
</tr>
<tr>
<td>5</td>
<td>Coma lasting more than 24 hours (severe head injuries)</td>
</tr>
<tr>
<td>6</td>
<td>Coma, death within 24 hours (fatal head injuries)</td>
</tr>
</tbody>
</table>

Concussion Grading since 2008

• Unanimous agreement to abandon all grading systems

• Individualized care emphasized over any grading system!
Why do we worry so much about concussions?
Second-Impact Syndrome

- Controversy exists ???
- Theory is:
  - Loss of autoregulation, edema, herniation
  - Delayed recovery & more sensitive during this period
  - Almost exclusively adolescent athletes
- 90% of deaths from sports-related head injury occur in high school age athletes or younger.
- Catastrophic football head injuries are 3x greater in high school athletes than in college athletes.
- Relationship with concussion?
Chronic traumatic encephalopathy (CTE) described in the brains of former professional athletes

- Ongoing research
- Risks appear to be in repeat concussions
Post-Concussion Syndrome

- Clear definition does not exist
- 3 or more persistent symptoms
- ?? Timeline to make diagnosis anywhere from 6 weeks - 3 months
Concussion Modifiers

- Age
- # of concussions
- Frequency of concussions
- Co-morbidities
- Severity of symptoms
- Sport played
- Gender (Female?)**
Retirement from Sports?

• No evidence based guidelines
• Proposed that 3 concussions in a season or >3 months of post-concussive symptoms should be strongly considered for a prolonged period away from sports
• Recommend referral to a specialist or neuropsychologist
The Game Plan for Returning an Athlete to School and Play
Essential Equipment
A myriad of symptoms...

<table>
<thead>
<tr>
<th>Physical</th>
<th>Cognitive</th>
<th>Emotional</th>
<th>Sleep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>Feeling mentally &quot;foggy&quot;</td>
<td>Irritability</td>
<td>Drowsiness</td>
</tr>
<tr>
<td>Nausea</td>
<td>Feeling slowed down</td>
<td>Sadness</td>
<td>Sleeping more than usual</td>
</tr>
<tr>
<td>Vomiting</td>
<td>Difficulty concentrating</td>
<td>More emotional</td>
<td>Sleeping less than usual</td>
</tr>
<tr>
<td>Balance problems</td>
<td>Difficulty remembering</td>
<td>Nervousness</td>
<td>Difficulty falling asleep</td>
</tr>
<tr>
<td>Visual problems</td>
<td>Forgetful of recent information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fatigue</td>
<td>Confused about recent events</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity to light</td>
<td>Answers questions slowly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity to noise</td>
<td>Repeats questions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dazed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stunned</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What can a school nurse do?

- Educate, educate, educate
  - Teachers, Coaches, Students, Families

- Help assess symptoms 2-3x per week and keep all parties aware

- Help support adjustments in cognitive and academic demands
Return-to-Sports Guidelines

• Must be *asymptomatic at rest* before starting any return to play protocol
• No medications for post-concussive symptoms
• Beware of symptom minimization in athletes!
• Step-wise return to play - *each step takes at least 24 hours or longer*
• Consider more gradual return in younger athletes & repeat concussions
Return-to-Play Protocol

Cognitive & physical rest until asymptomatic

- Light aerobic exercise - e.g. stationary bike (<70% max HR)

- Sport-specific exercise (>70% max HR)

- Non-contact drills (light resistance training)

- Full contact drills after medical clearance!

Return to competition (game play)
Summary on Youth Concussions

- Substantial evidence that youth athletes take longer to recover (2-4 weeks) **
- May need to use more conservative & gradual return-to-play guidelines
- May need modified learning plans for school if prolonged symptoms - consider 504 plans and IEPs
- Consider neurocognitive testing with comorbidities such as ADHD/learning disorders
Teen, family reach settlement for brain injury
By Matt Markovich & KOMO Staff

MAPLE VALLEY, Wash. -- A teen on a long road to recovery from a debilitating injury has finally reached a settlement to the Tahoma School District.

Nearly three years ago, Zack Lystedt suffered a concussion on the football field while making a tackle for his his team at Mount Tahoma Junior High.

Even though the 13 year old grabbed his head in pain, his coaches, who had been hired by the district, put him back in the game several plays later.

Lystedt’s brain began bleeding, but no one noticed until he started losing his balance near the end of the game. He eventually collapsed at the end of the game.

• As of May 2012 - 38 states (KS & MO)
• Requires evaluation by a healthcare professional before return-to-play
• Develops educational materials for athletes, coaches, and parents
The Frontier...

- Genetic testing and biochemical markers
- $f$ MRI - shows activation patterns that correlate with symptom severity and recovery
- Improved studies - validation of neurocognitive testing?
- Pharmacologic therapies?
The role of the PPE
  - Screen for previous concussions
  - Education about symptoms & need for care
  - Establish baselines

Protective equipment
  - Mouthguards
  - Helmets
The “Concussion Team”

- Coach
- Teammates
- Parents
- Teachers
- Athletic Trainers
- Nurses
- Physicians
Excellent Resources:

1. CDC “Heads-Up” Campaign - Lots of free posters for office and locker room along with educational materials for players, coaches, and families

2. National Federation of State High School Associations (free, online training) - www.nfhs.org

3. www.childrens-mercy.org/sportsmedicine