Pediatric Sports Injuries

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THE MICHELI CENTER FOR SPORTS INJURY PREVENTION
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Today

• Growth plate injuries
• Patellar sleeve fracture
• Hand injuries
• Spinal injuries
• Concussion and potential long term effects
Apophysitis

- Traction apophysitis
- Where tendon inserts on secondary ossification center
- Repetitive stress
- Especially during growth spurts
- All over body, same process
  - Sever’s
  - Osgood Schlatter’s
  - Sindig, Larsen, Johansson
Apophysitis - Treatment

- Rest
- Ice
- NSAIDs
- Physical therapy – flexibility
- Release tension
  - Heel cups
  - Counterforce straps
- Immobilization (rare)
Avulsion fractures

- Traction injury to physis
- Acute moment, snap, pop
- Often pelvic
- Rest, ice, NSAIDs, protected weight bearing
- Physical therapy
- Weeks/months
- If >2cm displaced, ortho consultation
Patellar Sleeve Fracture

• Most common patella fx <16yo
• 3:1 boys, peak at 12yo
• Sleeve of periosteum +/- cartilage and/or bone avulses
• Periosteum forms new bone, elongating or duplicating patella
Patellar Sleeve Fracture

• History
  – Forced quadriceps contraction on flexed knee.
  – Usually explosive activity (jumping, skateboarding, etc.)
  – No traumatic contact
Patellar Sleeve Fracture

• Physical examination
  – Could be normal if minimal disruption
  – Palpable gap at lower (usually) pole of patella
  – Patella alta
  – Loss of straight leg raise

• Imaging
  – Could be normal
  – Might have bony fragment distal to patella
  – Ultrasound or MRI preferable
Patellar Sleeve Fracture

- **Treatment**
  - Most commonly surgery
  - If minimally displaced, long leg cast
  - If delayed can lead to permanent disability

- **Keys to catching**
  - Forceful quad contraction on flexed knee
  - No traumatic contact, but impressive pain
  - Patella alta or palpable defect
  - If uncertain – immobilize, crutches and follow up
Jersey Finger

- Loss of DIP flexion
- Forced extension during grasp
- Pain at volar aspect of DIP
- Loss of strong flexion (not always all flexion)
- Plain Radiographs
- Requires urgent surgical consultation
Mallet Finger

- Loss of DIP extension
- Forcible flexion while attempting to extend
- Stack or make shift splint in full extension
- Splint full extension 24h per day
- X 6 weeks if fracture; 8 weeks without fx
- If DIP flexes, restart clock
Gamekeeper’s Thumb

- Sprain of ulnar collateral ligament of thumb
- Forced abduction of thumb
- Pain on ulnar aspect MCP
- Stress at 0 and 30 degrees of flexion
- Thumb spica splint with follow up
- 6 weeks cast vs. surgery
Currently

- 9% of all spinal cord injuries result from sport

- In pediatric patients (0-18 years), 16% of all blunt cervical spine injury results from sport

- 23% of all cervical spine fracture in 6-18 year olds are sport-related
Fracture Mechanism

& Spear Tackling
Prevention

• Spear tackling was banned in 1976
Prevention

Events of sport-related quadriplegia per year

Spear Tackler’s Spine

1. Stenosis
2. Straightening
3. Radiographic abnormalities
4. Spear tackling
Spear Tackler’s Spine

1. Stenosis
2. Straightening
3. Radiographic abnormalities
4. Spear tackling
Proper Tackling
Burners and Stingers

- Transient neurological injury
  - Pain
  - Paraesthesias
  - Weakness

- High School
- College
Burners and Stingers

- Unilateral
- < 15 minutes 90-95%
Cervical Cord Neuropraxia and Transient Quadriparesis

• More than one extremity
Cervical Cord Neuropraxia and Transient Quadriparesis
Cervical Cord Neuropraxia and Transient Quadriplegia
Cervical Canal Stenosis
Cervical Canal Stenosis

TrioTim 3T SYS#MRC35201
MR-Cervical Spine w/o Contrast
SAG T2-CSP OPTIMIZED 52410 NO FS
SE: 2
IM: 10
--- LOCI 3.53
BW: 260
Protocol: SAG T2-CSP OPTIMIZED 52410 NO FS
Spondylolysis

Back pain is not normal in children

• Extension based pain

• Stress reaction/fracture: pars interarticularis

• Growth spurts – increased lordosis

• Due to repetitive extension (gymnasts)
  – or loading (weight lifters),
  – or combo (football/hockey)

• Tight hamstrings
Spondylolysis

- Bones grow first
Spondylolysis

Normal spine  Lordosis of the spine

Exaggerated lumbar curve
Spondylolysis
Spondylolysis
Spondylolysis
Spondylolysis
Spondylolysis

- Activity restriction
- Physical therapy
- BOB brace
- 23 hours/day for 16 weeks
- Duration can vary
- Return to athletics in brace, possible at times
- Treatment is controversial
Spondylolysis / Spondylolisthesis
Spondylolysis / Spondylolisthesis

- Spondylolysis
  - Fracture
- Spondylolisthesis
  - Slide
Spondylolysis / Spondylolisthesis

- Spondylolysis
- Spondylolisthesis
Structural Neuroplasticity in the Sensorimotor Network of Professional Football Players
Jurgen Hanggi,* Susan Koeneke, Ladina Bezzola, and Lutz Jancke

Abstract: We investigated brain volumes using magnetic resonance imaging (MRI) in 10 professional football players compared with 10 swimmers. In football players compared with swimmers, decreased brain volumes were observed in the left premotor cortex, SMA, putamen, superior frontal gyrus, corticospinal tracts, both internal capsules, corpus callosum, and left anterior cingulum. Hum Brain Mapp 31:1196–1206, 2010
Normal Physiology

Cell Body

Axon

Sodium
Potassium
Sodium
Potassium
Sodium
Potassium
Sodium
Potassium
Sodium
Potassium
Sodium
Normal Physiology
Signs and Symptoms

- Loss of Consciousness
- Amnesia, retrograde or antegrade
- Disorientation
- Appearing dazed
- Acting confused
- Forgetting game rules or play assignments
- Inability to recall score or opponent
- Inappropriate emotionality
- Physical incoordination
- Imbalance
- Seizure
- Slow verbal responses
- Personality changes

- Headache
- Dizziness
- Nausea or vomiting
- Difficulty balancing
- Vision changes
- Photophobia
- Phonophobia
- Feeling “out of it”
- Difficulty concentrating
- Tinnitus
- Drowsiness
- Sadness
- Hallucinations
Neurocognitive Testing

Percentile

Baseline  Post Injury  Post Injury  Post Injury
6 Days Post  16 Days Post  23 Days Post

Verbal Memory  Visual Memory  Processing Speed  Reaction Time
Management

- Physical rest (24-48 hours)*
- Cognitive rest (24-48 hours)*
- RTP stages
- Contact only after
  - Sx-free at rest, with exertion
  - Caught up in school, sx-free with full cognitive exertion
  - Pre-injury data back to baseline

Table 1  Graduated return-to-sport (RTS) strategy

<table>
<thead>
<tr>
<th>Stage</th>
<th>Aim</th>
<th>Activity</th>
<th>Goal of each step</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Symptom-limited activity</td>
<td>Daily activities that do not provoke symptoms</td>
<td>Gradual reintroduction of work/school activities</td>
</tr>
<tr>
<td>2</td>
<td>Light aerobic exercise</td>
<td>Walking or stationary cycling at slow to medium pace. No resistance training</td>
<td>Increase heart rate</td>
</tr>
<tr>
<td>3</td>
<td>Sport-specific exercise</td>
<td>Running or skating drills. No head impact activities</td>
<td>Add movement</td>
</tr>
<tr>
<td>4</td>
<td>Non-contact training drills</td>
<td>Harder training drills, eg, passing drills. May start progressive resistance training</td>
<td>Exercise, coordination and increased thinking</td>
</tr>
<tr>
<td>5</td>
<td>Full contact practice</td>
<td>Following medical clearance, participate in normal training activities</td>
<td>Restore confidence and assess functional skills by coaching staff</td>
</tr>
<tr>
<td>6</td>
<td>Return to sport</td>
<td>Normal game play</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: An initial period of 24–48 hours of both relative physical rest and cognitive rest is recommended before beginning the RTS progression. There should be at least 24 hours (or longer) for each step of the progression. If any symptoms worsen during exercise, the athlete should go back to the previous step. Resistance training should be added only in the later stages (stage 3 or 4 at the earliest). If symptoms are persistent (eg, more than 10–14 days in adults or more than 1 month in children), the athlete should be referred to a healthcare professional who is an expert in the management of concussio.
Recent Concern

• Risk
• Cumulative
• Second Impact Syndrome
• Chronic Traumatic Encephalopathy
Chronic Traumatic Encephalopathy: What We See and Hear

- CTE is common in Football

Concussion Expert: Over 90% of NFL Players Have Brain Disease

Time
Sean Gregory
Dec 22, 2015
Chronic Traumatic Encephalopathy: What We See and Hear

- CTE is common in Football
- CTE causes aggression

Concussion Expert: Over 90% of NFL Players Have Brain Disease

5 things to know about CTE

CTE CAN ALSO RESULT IN AGGRESSION LACK OF IMPULSE CONTROL
Chronic Traumatic Encephalopathy: What We See and Hear

• CTE is common in Football

• CTE causes aggression, depression, headaches, memory problems, dementia, substance use, etc.

• CTE causes suicide
Chronic Traumatic Encephalopathy: What We See and Hear

American football is too dangerous, and it should be abolished

Dave Bry
Chronic Traumatic Encephalopathy: 
What We See and Hear

Don’t Let Kids Play Football

By BENNET OMALU  DEC. 7, 2015

dangerous,
Chronic Traumatic Encephalopathy: What We See and Hear

Don’t Let Kids Play Football

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Let’s ban rugby, and all school sports

There isn’t much in the modern curriculum that is designed as torture: except sport

Sat, Mar 12, 2016, 06:12

Donald Clarke

Health experts from the UK and US wrote to the Minister for Sport, the Chief Medical Officer and the Children's Ombudsman in Ireland calling for a ban on tackling in school rugby. Photograph: Eric Luke
There isn’t much in the modern curriculum that is designed as torture: except sport
Chronic Traumatic Encephalopathy: What We See and Hear

A Modest Proposal: Let’s Ban All Sports!

In the aggregate, sports cost society a tremendous lot of money.

A. Barton Hinkle | December 27, 2011

Isn’t it about time America banned soccer? Not because of British hooligans or the vuvuzela that has now made it into your local dollar store, although Heaven knows soccer has plenty to answer for on both those scores. No, the question at hand is whether soccer should be banned because of the other costs it imposes on society.
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What Medical Community Says

• Risk of neurodegenerative disease unlikely

• Association between trauma and pathology unclear

• Suicide less common
What Medical Community Says

- Association between pathology and symptoms unclear

- International Conference on Concussion in Sports

A cause-and-effect relationship has not yet been demonstrated between CTE and SRCs or exposure to contact sports. As such, the notion that repeated concussion or subconcussive impacts cause CTE remains unknown.

With this in mind, statements such as "Participating in a contact sport is now thought to increase an individual's risk for later-life impairment and possibly developing CTE" [37] (p. 304) and "CTE is the only known neurodegenerative dementia with a specific identifiable cause; in this case, head trauma" [47] (p. 184) are problematic. These statements are based on highly selected case evidence and equate all symptomology with one primary mechanism. It is clear, from a thorough review of the scientific literature, that the development of symptoms post-athletic career is multi-factorial in nature and at minimum includes career transition stress mediated by athletic identity, chronic pain, and substance use/abuse.
Concussion, dementia and CTE: are we getting it very wrong?  

Alan Carson

A little less conversation, a little more science please

Studies examining a connection between sporting head injury and outcome are necessary but it's unhelpful when the results are rushed to mainstream media outlets before proper consideration to interpretation, limitations and replication. This is unfair on the public who are often unfamiliar with the technical problems in these studies, such as reproducibility. We need to recognise that fear of CTE has led to recorded suicides (where the autopsy has shown no evidence of CTE), and researchers should exercise appropriate caution and responsibility in how they present, and more importantly disseminate, results.
I THINK I HAVE CTE. WHAT DO I DO?

If you are concerned that you or someone you care about has CTE, don’t lose hope. Many people live happy and productive lives despite having CTE. It is also important to know that many treatable disorders can cause symptoms of CTE, and in fact people who appeared to have CTE while alive have been found not to have CTE upon post-mortem examination of their brain.

“More work needs to be done to understand if there is truly a link,” says Christopher Nowinski, a former professional wrestler who is co-founder and CEO of the Concussion Legacy Foundation, which focuses on brain trauma in athletes and people in other groups.
Does CTE call for an end to youth tackle football?

Despite press about a recent study, a link between hits to the head and CTE isn't clear-cut. More data and a risk-benefit analysis are needed.

By Jason Chung, Peter Cummings and Uzma Samadani  |  FEBRUARY 10, 2018  —  8:37AM

On Jan. 18, an article by Dr. Lee Goldstein of Boston University and colleagues in Brain, a leading neurological journal, was released and touted as proving the link between subconcussive hits to the head and chronic traumatic encephalopathy (CTE) (“Real risk of CTE comes from repeated hits to the head, study shows,” Feb. 4). That same day the CTE advocacy group — the Concussion Legacy Foundation — announced a national campaign called F14G Football to convert all under-14 football into flag football, thereby eliminating tackle football.
Primum non nocere: a call for balance when reporting on CTE

As clinicians and researchers in traumatic brain injury and neurodegeneration, we are concerned by the tone of reporting on chronic traumatic encephalopathy (CTE) that has developed over the past decade, highlighted in an article in The New York Times. Misleading reporting can have unintended, negative consequences and we call for balance from the medical and scientific communities and the media when communicating on issues related to CTE.
Contrary to common perception, the clinical syndrome of CTE has not yet been fully defined, its prevalence is unknown, and the neuropathological diagnostic criteria are no more than preliminary. We have an incomplete understanding of the extent or distribution of pathology that has developed over the past decade, highlighted in an article in *The New York Times*. Misleading reporting can have unintended, negative consequences and we call for balance from the medical and scientific communities and the media when communicating on issues related to CTE.

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This distorted reporting on CTE might have dire consequences. Specifically, individuals with potentially treatable conditions, such as depression or post-traumatic stress disorder, might make decisions on their future on the basis of a misplaced belief that their symptoms inevitably herald an untreatable, degenerative brain disease culminating in dementia.
Risk factors for CTE

Risk factors for CTE


- 35% of bodies in routine neuropathology service
Risk factors for CTE


- 35% of bodies in routine neuropathology service
- 48% of those with h/o head trauma
Risk factors for CTE


- 35% of bodies in routine neuropathology service
- 48% of those with h/o head trauma
- 42% of those with h/o substance abuse
Risk factors for CTE


- 35% of bodies in routine neuropathology service
- 48% of those with h/o head trauma
- 42% of those with h/o substance abuse
- 55% of those with h/o both
Risk factors for CTE


- 35% of bodies in routine neuropathology service
- 48% of those with h/o head trauma
- 42% of those with h/o substance abuse
- 55% of those with h/o both
- 20% of those with no h/o of either
- 3,904 men (65yo) -
- Measured depression and cognition
- Football players vs 1) non-collision and 2) non-sport
- Football players lower depression scores than non-collision
- No other significant associations on any outcomes
Challenge

• Primer on epidemiology

• Read the studies yourself

• Read methods and results (skip introduction and discussion)

• Decide for yourselves what the data shows
Summary – Evidence So Far Suggests

- No benefit to repeat trauma to the brain
- Concussions can have a cumulative effect
- Concussion risk factor for abnormal tau, harmful
- Furthermore, risks in sports besides concussion
- Preliminary studies do not support an effect of subconcussive blows, but research not conclusive
- Benefits of sports are substantial
- Athletes need to weigh risks against benefits and decide
Guest Commentary: In youth sports, rewards outweigh risks

My wife and I will let our children play any of these sports. If they begin getting multiple concussions, we will re-evaluate the sensibility of participation with their pediatrician and medical specialists.

The scientifically established benefits of participation in organized sports outweigh the known concussion risks for my own kids. Playing youth sports today is apt to be less dangerous than ever given the broad increase in risk awareness and greater emphasis on player safety in rule-making, coaching and officiating.

*Michael Kirkwood is a pediatric neuropsychologist at Children’s Hospital Colorado.*
Children’s Sports Medicine Foundation

Dedicated to encouraging sports and exercise, especially among children and young adults, while simultaneously preventing sports injuries.
Other Services

• Running Program
• Concussion Preparation and Prevention
• ACL Injury Prevention Class
• Coaching and Community Clinics
• Activity for Sedentary Kids
• Dance Program
• Training (Independent and 1 on 1)

• Scholarships for Underserved Athletes
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Thanks for listening.