Sports Medicine in the Office: You Make The Call

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Case History #1

- 14 year old soccer player comes into the office
- "Hit in the Head" during game
- 2 days after injury
- Headache
- When do you return to competition?

The Adolescent Brain

Concussion

- A complex pathophysiological process affecting the brain brought on by biomechanical forces
- "Concussion" comes from the Latin verb concutere "to shake violently"
- Spectrum of injury

Concussion Definition

- Traumatically induced alteration in brain function manifested by
  - Alteration in awareness
    - Dinged, dazed, stunned, woozy, foggy, amnesic, LOC, etc
  - Signs of symptoms of post-concussive syndrome
    - Headache, vertigo, light-headedness, balance disturbance, cognitive dysfunction, memory disturbance, hearing loss, tinnitus, vision disturbance, personality changes, drowsiness, lethargy, fatigue, inability to perform daily activities
Each Athlete With A Concussion is Different

- Age of athlete
- Gender
- Sport
- Return to activity is an individual decision
- Zackery Lystedt law

Concussion Epidemiology

- Are we seeing more concussions or recognizing them more effectively?
- Until recently difficult to define and monitor
- Teen concussions
  - School based reporting
  - Pediatrician office reporting
  - Emergency department reporting

Concussion Epidemiology in Children/Adolescents

- Estimated 44 million children and adolescents participate in organized sports in the US
- Estimated 170 million adults participate in physical activities including sports
- Estimated 1.7 million TBI’s in the US annually
- CDC estimates 1.6 to 3.8 million concussions occur annually in sports and recreational activities and has deemed it a public health issue

Classification of Symptoms

- Physical
  - Headache
  - Nausea
  - Vomiting
  - Visual Problems
  - Fatigue
  - Light and Noise Sensitivity
- Cognitive
  - Foggy
  - Slowed down
  - Difficulty concentrating
  - Forgetful
  - Confused

Classification of Symptoms

- Emotional
  - Irritability
  - Sadness
  - Emotional lability
- Sleep
  - Drowsiness
  - Sleeping more than usual
  - Sleeping less than usual

How Do Concussions Affect Your Practice?

- Sideline Care
- Office Based Management
- Parental Anxiety
- Sport Selection
- Prevention?
Post-concussive Symptoms

- Headache
- Irritability
- Sleeplessness
- Dizziness
- Anxiety

Sideline Evaluation

- What is the diagnosis?
  - Is it a concussion
- What is the severity of the injury?
  - Does it matter
- Can the athlete return to play safely?
  - That event
  - When
- Do they need further evaluation?
  - Now
  - Later

Concussion in the Office Neuropsychiatric Testing

- Paper and pencil
  - 6 to 8 hours
  - Expensive
- Simplified computer tests
  - ImPACT most popular
  - 20 minutes
  - Program measures multiple aspects of cognitive functioning
  - Concerns regarding validation and use in children/adolescents

ImPACT Testing

- Widely used
  - NFL, NHL, NCAA, etc
- Is it useful?
  - Identifying athletes that are lying about their symptoms or truly having no symptoms but not fully recovered from their injury
- Baseline data critical
- Looks promising
  - Attempt to more objectively and quickly assess and monitor concussions

ImPACT

- Is it validated clinically?
  - One prospective study (poor control group) with original version and none with current version
- Is it validated psychometrically?
  - Broglio et al ’07 – in a normal cohort tested at baseline, day 45, and day 50 there was a measured impairment of 40% on day 45 and 20% on day 50 controlling for effort (false positive)
  - Maelender et al ’10 - study comparing ImPACT to a two hour neuropsych test and there conclusion was that ImPACT is limited as a screening tool

Concussion: What Your Patients Need to Know

Not every hit in the head is a concussion
1) What Sport Is The Most Dangerous?

Collegiate Data on Concussion per 1,000 exposure hours

**Men’s**
- Spring FB .54
- Ice hockey .41
- Football .37
- Soccer .28
- Lacrosse .25
- Wrestling .25
- Basketball .16
- Baseball .07

**Women’s**
- Ice hockey .91*
- Soccer .41
- Lacrosse .25
- Basketball .22
- Field hockey .18
- Gymnastics .16
- Softball .14
- Volleyball .09

2) Are Pediatric and Adult Concussions the Same?

**Effect of Growth and Maturation**
- High school aged children (14-18) may have prolonged cognitive recovery when compared with young adults (18-25 years), although symptom recovery is equivalent – Field 2003
- No information available for younger children

**Recovery Times from Adolescent Concussion**
- Sport-related concussion and age: number of days to neurocognitive baseline
  - Zuckerman SL et al, Neurosurgery, Aug 2012
  - 200 “adolescent” concussions, subjects matched based on previous number of concussions
    - 100 – group 13-16
    - 100 – group 18-22
  - Verbal memory, visual memory, reaction time, and post concussive symptom time all greater in 13-16 year old group

3) Concussion, What’s The Worst That Can Happen?
Second Impact Syndrome

- First described in 1973 (Schneider)
- 1980 to 1993 the National Center for Catastrophic Sports Injury Research identified 35 probable cases among American football players
- Malignant cerebral edema exists in case reports after head trauma
- Rare but devastating occurrence

Adolescent Sport Fatality

- Epidemiology of Sudden Death in Young, Competitive Athletes Due to Blunt Trauma, *Pediatrics*, 2011
- 1980-2009, National Registry of Sudden Death in Young Athletes
- 1827 deaths from sport under age 21
  - 281 (14%) involved head and neck, 1139 were cardiovascular
  - Football, 148, (57%) 17 second impact syndrome

Head Injury Death Rates As Compared to Injury Death Rates

- Comparison of trauma-related (n = 261) and cardiovascular (n = 1139) deaths in competitive athletes aged 21 and younger, 1980–2009.

4) How Do I Return An Athlete Back to Activity?
Concussion Rehabilitation/Stepwise Return to Play

<table>
<thead>
<tr>
<th>Rehabilitation Stage</th>
<th>Functional Exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. No activity</td>
<td>Complete physical and cognitive rest</td>
</tr>
<tr>
<td>2. Light aerobic activity</td>
<td>Walking, swimming, stationary cycling at 70% maximum heart rate, no resistance exercises</td>
</tr>
<tr>
<td>3. Sport-specific exercise</td>
<td>Specific sport-related drills but no head impact</td>
</tr>
<tr>
<td>4. Noncontact training drills</td>
<td>More complex drills, may start light resistance training</td>
</tr>
<tr>
<td>5. Full-contact practice</td>
<td>After medical clearance, participate in normal training</td>
</tr>
<tr>
<td>6. Return to play</td>
<td></td>
</tr>
</tbody>
</table>

Case #2 – Hip Pain in the Soccer Player

- 15 year old soccer player
- Kicking ball
- Feels “pop” in hip
- Limps into office next day for evaluation
- **Hey Doc, Can I play?**

Sports Injuries in the Athletic Patient

- **Acute Traumatic**
  - Fractures
  - Ligament Injury
  - Concussion
- **Overuse**
  - Stress Fracture
  - Osteochondritis Dissecans

Developmental Anatomy

- **Physis**
- **Epiphysis**
- **Apophysis**

Acute Apophyseal Injury

- Acute injury
- Index of suspicion
- Rapid skeletal growth
- Loss of flexibility

Differential Diagnosis of Hip Pain in the Adolescent

- **Acute Injury**
  - SCFE
  - Apophyseal Injury
  - ? Labrum tear
- **Overuse Injury**
  - Muscular (Iliopsoas tendonitis)
  - Stress fracture (Femoral, Pelvic)
  - ? Labrum tear
- **Referred Pain**
  - Spondylolysis
- **Others**
  - Neoplasm (Osteoid Osteoma)
Apophyseal Injuries

- Reviewed 1,238 XRs of pts with focal hip pain related to sport (ap/lat/oblique; 15-35y/o; ’76-’98)
- 203 (16.4%) apophyseal avulsion fxs identified
- Avg age: 13.8yrs (11-17)
  - 139 males (68.5%), 64 females (31.5%)
- All injuries sports induced and distribution was sport related

### Acute Avulsion Fractures of the pelvis in adolescent competitive athletes:
Prevalence, Location and Sports distribution of 203 cases

**Prevalence of Injuries in Each Sport**

<table>
<thead>
<tr>
<th>Sport</th>
<th># of Fxs</th>
<th># Reviewed</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soccer</td>
<td>74</td>
<td>418</td>
<td>18%</td>
</tr>
<tr>
<td>Gymnastics</td>
<td>55</td>
<td>111</td>
<td>50%</td>
</tr>
<tr>
<td>“Athletics”</td>
<td>23</td>
<td>176</td>
<td>13%</td>
</tr>
</tbody>
</table>

### Apophyseal Injuries

- IT (109)
  - Gymnastics-45
  - Soccer-34
- AIIS (45)
  - Soccer-18
- ASIS (39)
- SCPS (7)
- IC (3)

### Ischial Tuberosity (109)

- Others-3
- Pentathlon-2
- Handball-3
- Athletics-4
- Tennis-6
- Fencing-13
- Gymnastics-45
- Soccer-34

### Others

- Fencing-2
- Wrestling-2
- Gymnastics-3
- Tennis-10
- Soccer-18
- Athletics-10
Apophyseal Injuries

<table>
<thead>
<tr>
<th>IT</th>
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<td>109</td>
<td>45</td>
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<td>3</td>
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</table>

Apophyseal Injuries

- ASIS (39)
- Tennis (4)
- Fencing (4)
- Athletics (9)
- Soccer (15)

Apophyseal Injuries

Superior Corner of Pubic Symphysis (7)

- Fencing (1)
- Soccer (6)

Apophyseal Injuries

Iliac Crest (3)

- Tennis (1)
- Soccer (1)
- Gymnastics (1)
Apophyseal Injuries

Acute Avulsion Fractures of the pelvis in adolescent competitive athletes: Prevalence, location and sports distribution of 203 cases

- Conclusions:
  - Not rare injuries
  - IT avulsions most common
  - Most prevalent in soccer, gymnastics and "athletics"

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Patient History

- Mechanism
- Presentation
- Pain with walking
- Acute injury
- Stage of skeletal development

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Case A

- 15 year old gymnast
- 3 weeks of worsening hamstring pain
- Able to perform bar exercises
- Pain with running on floor exercise

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Adolescent Apophyses of the Hip

- Iliac Crest: a: 13-15y, f: 16-17
- AIIS: a: 13-15y, f: 15-17y
- Femoral Head: a: 4-6M, f: 16-18y
- Greater Troch: a: 2-5y, f: 16-18y
- Lesser Troch: a: 8-12y, f: 16-18y

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Site Treatment

<table>
<thead>
<tr>
<th>Site</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iliac Crest</td>
<td>Non-op</td>
</tr>
<tr>
<td>ASIS</td>
<td>Non-op</td>
</tr>
<tr>
<td>AIIS</td>
<td>Non-op</td>
</tr>
<tr>
<td>LT</td>
<td>Non-op</td>
</tr>
<tr>
<td>GT</td>
<td>Sx &gt; 1cm</td>
</tr>
<tr>
<td>IT</td>
<td>Sx &gt; 2cm</td>
</tr>
</tbody>
</table>

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Injuries about the hip and pelvis in the young athlete


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Apophyseal Injuries

• Most common from age of appearance to age of fusion
  - Ability to resist tension weakest at time of appearance
  - Mechanism:
    - Sudden violent eccentric contracture
    - Chronic traction/microtrauma

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Injuries about the hip and pelvis in the young athlete

Rossi and Dragoni, Skel Radiology, 2001
Physical Exam

- Normal gait
- Pain free with passive motion of hip
- Pain with flexion of knee
- Pain on palpation of ischial tuberosity on right side

Ischium - Hamstring, Adductors

Case B

- 16 year old football player
- History of hamstring “strain” 6 months ago
- Still trying to play
- Mild pain with running, loss of acceleration
- Comes to office with parents

Physical Exam

- Normal gait
- Absence of pain with passive rotation of hip
- Absence of pain with palpation of ischial tuberosity
- Difficulty/weakness with knee flexion on right side lying prone
Hamstring Avulsion

Case C
- 16 year old fencer
- Fencing at school
- Lunges at opponent and feels “pop” in hip
- Falls to floor
- Unable to walk

Physical Exam
- Unable to ambulate
- Pain with passive motion of hip
- Unable to flex hip
- Pain with palpation of ASIS

Case D
- 15 year old soccer player
- Kicking ball
- Feels pop in left hip
- Tries to keep playing
- Diagnosed with “hip flexor” injury
- Tries to play without success for next 7 days

Physical Examination
- Slight limp
- Moderate pain with passive rotation in seated position (IR>ER)
- Moderate pain with passive flexion of hip
- Accentuated pain with active flexion of hip
4 week follow up visit

- Patient PWB for 4 weeks
- Moderately compliant
- Pain disappeared
- Still with slight limitation of IR in affected side
Return to Activity and Acute Traumatic Injury

- Able to walk
- Able to run
- Able to do sports-specific skills
- “Ready” to return?