Common Youth Injuries
(and What You Don’t Want to Miss)

JP Darche, MD
Assistant Professor, Primary Care Sports Medicine
University of Kansas Health System Center for Sports Medicine
Team Physician, Kansas City Chiefs
Objectives

1. Recognize common youth injuries and the proper initial management
   a. Wrist injury
   b. Knee injury
   c. Back injury
   d. Head injury

2. Identify and rule out potentially devastating differential diagnoses
Case #1 Wrist Pain

- 10 y.o. male presents after suffering a fall off his bike yesterday. He landed on outstretched Right hand and felt sudden pain at right wrist. He has been guarding his arm and is unable to use his hand due to pain.

Imaging
Torus “Buckle” fracture

- **Treatment:** (Jiang et al. 2016)
  - Volar splint for 1 week
  - At 1 wk f/u: Splinting vs short arm cast for 2-3 weeks
  - 3-4 wk f/u: d/c if pain free on exam. Volar splint for sports x 2 wks
  - Stable; but one study showed 7% displacement
Greenstick Fracture

• Imaging:
  – cortical disruption
  – Look for angulation (<10-20°)

• Treatment:
  – Short arm cast x 4-6 weeks.
  – Can still displace after 2 weeks

• If complete fracture:
  – Sugar thong splint and Long arm cast
  – Ortho Referral
Physeal Fractures - Distal Radius

- Non-displaced Salter-Harris I/II: short arm cast x 3-4 weeks
- Refer all others
Scaphoid Fracture

• + Snuffbox tenderness
  – + with radial deviation
• 3% of pediatric wrist fractures
  – Most common carpal fx

• Imaging:
  – Need Scaphoid view
  – 13% of fractures do not appear until 1-2 wks post-injury
  – MRI vs repeat x-ray
Scaphoid Fracture

• **Treatment:**
  – Long arm thumb spica x 2 weeks ➔ short arm thumb spica
  – Need to be pain-free and **radiologically healed**
  – 0.8% non-union (waist)

• **Duration of immobilization:**
  – Distal pole- 4-6 weeks
  – Waist- 10-12 weeks
  – Proximal pole- 12-20 weeks
Case #2 Knee pain

13 yo male with acute onset of right knee pain after falling directly on his knee during a basketball game. Has a history of intermittent knee pain during activities in the past year. Noticed a bump on his knee and is now reporting knee swelling.

Imaging
Osgood Schlatter’s Disease

- Traction Apophysitis at Tibial Tuberosity
  - Boys (10-15 yo) > Girls (8-12 yo)
  - Tight extensor mechanism

- Treatment: (self resolving)
  - Stretch extensor mechanism
  - Anti-inflammatories, icing
  - Patellar strap, chopat strap, knee sleeve

- Need for imaging?
Sinding-Larsson-Johansson (SLJ)

- Traction Apophysitis of inferior patellar pole
- Treatment:
  - Self-resolving with skeletal maturity
  - Quadriceps stretching
  - NSAIDs, sleeve, straps,…
Tibial Tuberosity Avulsion Fracture

- Boys >>> Girls
- Near end of skeletal maturity (12-15yo)
- Usually forceful eccentric quad contraction
- Exam:
  - Knee effusion, severe pain, ecchymosis
  - Inability to ambulate
- Risk of compartment syndrome, meniscal injuries
- Treatment:
  - Closed reduction if needed then Long Leg Cast x 6 weeks
  - Surgery if displaced
  - Knee immobilizer is OK
Patellar Sleeve Fracture

- Rare, usually 8-12 y.o.
- Separation of cartilage from ossified patella
- Exam:
  - Soft tissue swelling with effusion common
  - High riding patella

- Treatment:
  - Non-displaced: Long leg cast x 6 weeks
  - Displaced: Surgical fixation
  - Knee immobilizer
Case #3: Knee pain

- 11 yo with intermittent knee pain for at least 6 months. Location of pain is ill-defined but does have some pain at tibial tuberosity. Was diagnosed with Osgood-Schlatter in the past. Pain is worsening with activity, does not improve with warming up. Parents noted he has been walking with leg in slight external rotation.

- Exam: Mild prominence of tibial tuberosity with mild pain but different from complaint. Trace effusion. Ligamentous exam normal, +McMurray’s at medial side.

- Recent knee x-rays were unremarkable
Imaging

- Get Tunnel ("Notch") view (30-50° flexion)
Osteochondritis Dessicans (OCD)

• Lesion of articular cartilage and subchondral bone

• Epidemiology:
  – 10-15 yo Boys> Girls (Juvenile form)
  – 70% at posterior-lateral aspect of medial femoral condyle

• Pathophysiology:
  – Traumatic vs Hereditary vs Vascular
Osteochondritis Dessicans (OCD)

- **Diagnosis:**
  - X-ray with Tunnel view
  - Need MRI to stage lesion

- **Prognosis:**
  - Better with younger age, stable lesion
OCD-Treatment

• Stable lesion, open physes:
  – Protected weight bearing x 6 weeks
  – Avoid impact and shearing forces
  – Followed by 6 weeks Physical Therapy
  – Repeat MRI at 3 months

• Unstable or closing physes:
  – Surgery: screw fixation, microfracture, osteochondral graft

• What about incidental OCD??
Knee pain-Summary

• Almost always get x-ray!
  – Standing AP, Lateral, Merchant and Tunnel

• Knee effusion is Bad!
  – Almost always need MRI

• Rarely use knee immobilizer!
Case #4 Back Pain

• 16 y.o. gymnast with left lower back pain for 3 weeks. Initially mild but now unable to practice and difficulty walking. Sometimes radiates to left buttocks and posterior thigh. Exacerbated with activity, improved with rest. Diagnosed with lumbar back strain but no improvement with rest and stretches.

• Physical Exam: Very uncomfortable. Mild pain on forward flexion, more severe with extension. + Stork test on left. +TTP left paralumbar muscles. Equivocal straight leg test on left with tight hamstring. Strength testing seems symmetrical but limited on left due to pain, DTRs 1+ symmetrical, Sensation normal.

• Imaging: X-Ray unremarkable
Back pain in Adolescent Athlete

• 10-15% of young athletes
  – Up to 50% in football and 86% in gymnastics
  – Extension based sports stress posterior bony elements

• Differential: Disk disease, muscle strain, Pars injuries, malignancy, infection, rheumatic

• Different Etiology than Adults: (Micheli L.J., and Wood R)
  – 47% Pars injuries (vs 5% in adults)
  – 11% Disk disease (vs 48% in adults)
  – 6% lumbosacral strain (vs 27% in adults)
Spondylolysis (Pars Injuries)

- Factors that predispose adolescents
  - Young healthy disks much less likely to be injured
  - Neural arch weakness?
  - Rapid growth may lead to muscle and tendon imbalance
  - Ossification of posterior column may be incomplete at superior pars of lower vertebrae
    - Increases risk of pars stress fractures
Spondylolysis (Pars Injuries)

• Risk factors:
  – Lower extremity injuries and muscle imbalances
  – Previous back pain
  – High volume of activities-extension and rotational sports
  – Poor technique
  – Hamstring tightness, weak core/hip abductors, thoracic kyphosis—increase posterior element stress
Back to our case…

- Ordered MRI
  - greatly affects management
  - X-ray usually normal
  - Is lesion "hot"?
Why do we need MRI?

- Early diagnosis to prevent:
  - nonunion +/- chronic pain
  - spondylolisthesis (if bilateral)
  - Need for surgical treatment

- Return to Sports:
  - No increase risk of listhesis with sports participation (Deluigi et al)
Management of Spondylolysis

- Activity Modification with +/- Bracing
- Rest → PT progression → f/u at 6 weeks
- Can progressively return to sports as tolerated
  - At 3 months or earlier if continue wearing brace

- No Good Data
Pars injuries- Summary

• Extension-based back pain is a Pars injury unless proven otherwise!!

• Pain worsened with activity, improved with rest

• Get MRI
  – Early recognition is important

• Management:
  – Shutdown and return when pain-free
  – Brace vs no brace
Case # 5 Head injury

- 17 y.o. High School football player presents to clinic 2 days after getting tackled during a football game. Immediately after the hit he felt “wobbly” and had a headache. Since then he has had intermittent headaches and feels “not like himself”.
- He was removed from game and told to see a doctor for clearance prior to return to play.
Concussion Definition

- Traumatic brain injury induced by **biomechanical forces** caused either by a **direct blow** to the head, or by transmission of impulsive force **transmitted** to the head causing a short-lived **neurological impairment**.
- It is a **functional disturbance, not a structural one**.

(McCrory et al. 2016)
## Concussion Symptoms

<table>
<thead>
<tr>
<th>Thinking/Remembering</th>
<th>Physical</th>
<th>Emotional/Mood</th>
<th>Sleep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty thinking clearly</td>
<td>Headache</td>
<td>Irritability</td>
<td>Sleeping more than usual</td>
</tr>
<tr>
<td></td>
<td>Fuzzy or blurry vision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feeling slowed down</td>
<td>Nausea or vomiting (early on)</td>
<td>Sadness</td>
<td>Sleep less than usual</td>
</tr>
<tr>
<td></td>
<td>Dizziness</td>
<td>More emotional</td>
<td></td>
</tr>
<tr>
<td>Difficulty concentrating</td>
<td>Sensitivity to noise or light</td>
<td></td>
<td>Trouble falling asleep</td>
</tr>
<tr>
<td></td>
<td>Balance problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty remembering new information</td>
<td>Feeling tired, having no energy</td>
<td>Nervousness or anxiety</td>
<td></td>
</tr>
</tbody>
</table>
Imaging?

**STEP 1: RED FLAGS**

**RED FLAGS:**

- Neck pain or tenderness
- Double vision
- Weakness or tingling/burning in arms or legs
- Severe or increasing headache
- Seizure or convulsion
- Loss of consciousness
- Deteriorating conscious state
- Vomiting
- Increasingly restless, agitated or combative
Clinic Evaluation

- Concussion Symptom Checklist
- Physical Exam
- Neurocognitive testing
## Concussion Symptom Checklist

### STEP 2: SYMPTOM EVALUATION

The athlete should be given the symptom form and asked to read this instruction aloud and then complete the symptom scale. For the baseline assessment, the athlete should rate his/her symptoms based on how he/she typically feels and for the post-injury assessment the athlete should rate their symptoms at this point in time.

Please select: [ ] Baseline  [ ] Post-Injury

Please hand the form to the athlete.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>none</th>
<th>mild</th>
<th>moderate</th>
<th>severe</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>&quot;Pressure in head&quot;</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Neck Pain</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Nausea or vomiting</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Dizziness</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Blurred vision</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Balance problems</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Sensitivity to light</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Sensitivity to noise</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Feeling slowed down</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Feeling like &quot;in a fog&quot;</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>&quot;Don't feel right&quot;</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Difficulty concentrating</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Difficulty remembering</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Fatigue or low energy</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Confusion</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Drowsiness</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>More emotional</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Irritability</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Sadness</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Nervous or Anxious</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Trouble falling asleep (if applicable)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

**Total number of symptoms:** 22

**Symptom severity score:** 132

- Do your symptoms get worse with physical activity? [ ] Yes [ ] No
- Do your symptoms get worse with mental activity? [ ] Yes [ ] No

*If 100% is feeling perfectly normal, what percent of normal do you feel?*
Physical Exam

• Balance:
  – Single leg balance (hands on hip; eyes closed) x 20 sec
  – Tandem stance (hands on hip; eyes closed) x 20 sec

• Vestibular/ Ocular-motor Screen
  – Smooth pursuit, saccades and near convergence
  – VOR and Visual motion sensitivity

• Neurocognitive testing (Impact test)
  – Supplemental tool only; No good studies
Natural History

- Symptoms usually last less than 72 hours
- Most concussions (>90%) resolve spontaneously within 7-10 days
- Almost all will recover by 4 wks (Post-concussion Syndrome)
- Children and adolescent may be at higher risk of prolonged recovery
- Predictors of longer recovery: (Iverson et al. 2017)
  - Most consistent predictor is severity of acute and subacute symptoms.
  - Hx of previous concussions
  - Post- injury amnesia
  - Hx mental health problems (ADHD, Learning disabilities are debatable)
Management

- **No return to play** on same day if suspected

- Relative rest 24-48 hrs- allow activity as long as sub-symptomatic. Early activity is beneficial.

- RCT compared strict 5-day vs 24-48 hrs rest (Thomas et al. 2015)
  - No benefit to strict rest (at 3 and 10 days post-injury)
  - Increased symptom reporting in strict rest

- RCT for early exercise testing with Buffalo treadmill test (Leddy et al. 2018)
  - 54 adolescents randomized: early exercise testing vs no testing
  - No difference in rate of recovery between groups
  - HRt strongly correlated to recovery time-potentially helps planning for school and team
  - Exercise prescription with HR targets??
Return to Learn/Play

- Start with Return to School

### Consensus statement

#### 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 concussion.

(McCrory et al. 2016)
How About CTE??

What do we know?

- It is a PATHOLOGICAL Dx only
- Concussions are a risk factor for Tau protein deposition
- Likely Proportional to Trauma burden
  - Age of first trauma
  - Cumulative trauma

What do we not know?

- True incidence and prevalence
- How to diagnose
- Cause and effect between pathology and symptomatology
- Does Tau protein deposition mean anything??
References

Thank you!