Pediatric Sports and Recreation Injuries
Epidemiology

- Injury Surveillance
  - Reliable data lacking
- 40 million people > age 6 participate in organized sports
- 2.6 million ED visits related to sports
  - Ages 5-24
  - 5x ED visits is estimated to be # injuries related to sports
- Under age 10, most injuries are secondary to recreational activities rather than organized sports
High School Sports with Highest Injury Rates

- Football--boys
- Cross Country--girls

Body Part Most Likely Injured

- Ankle
- Knee
- Wrist, hand, elbow
- Shin, calf
- Thigh, Groin
- Head, Neck, Clavicle
Epidemiology

Catastrophic Injuries

- Most common non-traumatic death in sports is cardiovascular (e.g. hypertrophic cardiomyopathy)
- Among H.S. athletes, 90% of traumatic deaths involved head, neck
  - Football historically the sport with the most fatal traumatic deaths
Developmental and Physiological Differences Between Child and Adult Athletes
Development

Differences in musculoskeletal system
- Pediatric bone has a higher water content and lower mineral content
  - less brittle than adult bone
  - Thick periosteum in children
  - Rich blood supply in pediatric bone
- The physis (growth plate)
  - cartilaginous structure that is weaker than bone
  - predisposed to injury
Development

Ligaments in children are functionally stronger than bone; therefore children are more likely to sustain fractures rather than sprains.
Development

- Most commonly fractured bone in children: Clavicle
- Younger children fracture upper extremities
- As children get older, more risk for lower extremity fractures
- Closed reductions of fractures more common in children
Development

Greenstick fracture

Torus fracture
Development

The Physis

Salter-Harris Classification of Fractures

High risk for growth arrest
If a child is tender over her physis, but x-ray appears “negative” for fracture, splint and have child follow-up with sports medicine physician or orthopedist.
Ossification Centers of the Elbow

CRIMeTOLE

- Capitellum
- Radius
- Internal (medial) epicondyle
- Trochlea
- Olecranon
- External (lateral) epicondyle
Supracondylar fractures of the Humerus
- Most common mechanism--fall onto outstretched hand
  - 98% are extension type
- Seen in 3-11 year olds
- Gartland Classification
  - Type I—non-displaced
  - Type II—displaced with intact posterior cortex
  - Type III—complete displacement; usually posteromedial or posterolateral
Development

Pearl

Check for posterior fat pad in child with swollen elbow

Type II Supracondylar fracture
Children with type II and III need immediate referral/transfer to pediatric orthopedist.
Development

- Apophyses
  - Are growth plates that add *shape and contour* rather than length to a bone.
  - Are often sites of muscle attachment
  - Avulsions at the apophysis are not uncommon in older children and adolescents
    - Diagnosis by x-ray
    - Conservative management
Common Overuse Injuries in Children

- Traction Apophysitis
  - Sever’s Disease (age 8-12)
    - Osteochondrosis of the heel
  - Osgood-Schlatters (age 11-15)
    - Apophysitis of the tibial tubercle
  - Sinding-Larsen Johansson (age 10-15)
    - Apophysitis of the inferior pole of the patella
  - Little League Elbow (age 10-15)
    - Apophysitis of the medial epicondyle of the elbow

Treatment = relative rest & strengthening
Sever’s Disease
Osgood Schlatter’s

Avulsion of tibial tubericle
Sinding-Larsen-Johansson

Distal pole of patella
Little League Elbow

Medial epicondyle
Specific Sports and Their Injuries
Soccer

- Ankle sprains
- Bruises

**ACL Injuries**
- Mechanism of injury is plant and twist of knee
- Usually non-contact
- Higher incidence in girls
- Knee effusion common
Soccer

- ACL Injuries
  - Diagnosis can be made clinically on examination with Lachman’s test
Soccer

- ACL Injuries
  - Anterior Drawer
Soccer

- ACL injuries
  - Radiography in the ED
    - AP/Lateral x-rays
    - Look for tibial plateau fractures
    - ACL is soft tissue so may not have radiologic findings
Soccer

ACL Injuries
- Best to allow sports medicine consultant or orthopedist to order MRIs
- MRIs are performed to rule out associated injuries such as meniscal tears
Football

- Head and Neck
- Acromioclavicular Sprains
- Stingers, Burners
- Finger injuries
  - Jersey finger
  - Mallet finger
Mechanism of C-Spine Injury

C-Spine straight with axial loading on top of head.

Figure 2. Head-down contact poses significant risks of catastrophic cervical spine injury. This defensive back (dark jersey) sustained fractures of his 4th, 5th, and 6th cervical vertebrae. The hit resulted in quadriplegia.
Football

Incidence of cervical fractures and dislocations in high school athletes. Data from the National Football Head and Neck Injury
Acromioclavicular Sprains ("AC Sprains")
- Mechanism is direct hit to top of shoulder
- Point tenderness at AC joint

Rx: Ice, Anti-inflammatories, active rest
Football

- **Burners, Stingers**
  - Stretch or compression of the brachial plexus
  - Sudden pain, tingling radiating from neck to fingers
  - Typically transient
  - Tx = ROM, strengthening, protective gear (e.g. neck roll, cowboy collar)
Football

- **Finger Injuries**
  - “Jersey finger”—injury to flexor digitalis profundus (FDP)
  - FDP causes flexion of the DIP joints
  - Occurs during tackling in football
    - History of failure to grab an object (e.g., football jersey or car door handle)
    - Painful, swollen finger, especially at the volar DIPJ
    - Ring finger commonly involved
Football

- Finger Injuries—"Jersey Finger"
  - Inability to flex at the DIPJ
  - PIPJ and MCPJ flexion preserved
  - Radiographs (AP, lateral, oblique) to assess for tendinous rupture or bony avulsion fracture
  - Splint finger in comfortable position; refer to hand surgeon as soon as possible.
Football

**Mallet Finger**
- Flexion deformity of the DIPJ
- Painful, swollen fingertip
- May have occurred when trying to catch a ball
- Inability to extend the distal phalanx at the DIPJ
- Radiographs (AP, lateral, oblique)
- Two forms of mallet finger:
  - Tendinous--extensor tendon rupture
  - Bony--bony avulsion fracture of the distal phalanx
Football

Mallet Finger Treatment

- Continuous splinting 6 to 8 weeks
  - DIPJ must not be allowed to drop in flexion
- Bony avulsions < 1/3 of articular surface can be reduced with dorsal pressure and dorsal splinting - 6 to 8 weeks.
- Post-reduction radiographs are essential
- Refer failed non-surgical treatment, bony avulsions that are irreducible or involve 1/3 or more of the articular surface, or volar subluxation of the distal phalanx
Elbow Injuries

- Little league elbow (age 10-15)
  - Apophysitis of the medial epicondyle
  - Overuse injury secondary to throwing mechanics
  - Tender directly over the medial aspect of elbow
  - Will often elicit a history of child pitching “too many” innings or “too many” pitches per week (> 200)

- Need to differentiate Little league elbow from Panner’s disease and OCD
Baseball/Softball

Panner’s Disease (< age 12)
- Avascular necrosis of the capitellum of the humerus
- Affects mostly boys
- Common symptoms
  - Pain and stiffness
  - Restricted extension motion of the elbow
  - Local tenderness over the capitellum
Baseball/Softball

- **Panner’s Disease**
  - Usually resolves on own
  - Need to differentiate between this and OCD (MRI)
Osteochondritis Dissecans (OCD)
- usually affects adolescents and young adults
- involves separation of a segment of cartilage and subchondral bone
- The area most frequently affected is the anterolateral surface of the humeral capitellum
Baseball/Softball

- **Osteochondritis Dissecans (OCD)**

  **Dx:** initial radiographs, MRI for staging, loose body

  **Rx:** Rest, refer to sports medicine specialist
Basketball

- ACL injuries
- Patellar tendonitis ("Jumper’s knee")
- **Ankle sprains**
  - very commonly injured joint
    - Most common is lateral ankle sprains
  - In child with open physes, if tender over lateral malleolus, then splint and refer for follow-up
Basketball

- Lateral ankle sprains
  - Mechanism is inversion, plantar flexed
Basketball

- "High ankle sprain"
  - Syndesmosis injury
    - ligament between tibia and fibula tears
    - Mechanism is outward twisting of ankle
Basketball

- **Syndesmosis Injury**
  - Associated injury—maisonneuve fracture
  - Radiographs: AP, Lateral and Mortise views

- **Treatment**
  - Most of the time surgery necessary
  - Refer to orthopedist
Gymnastics

- **Back Injuries**
  - **Spondylolysis**
    - stress fracture or defect of the pars interarticularis in a vertebra
    - due to repetitive increase in shear forces in the lumbar spine
  - **Spondylolisthesis** movements of extension and rotation leading to
    - slipping of all or part of one vertebra forward on another
    - slippage occurs as a result of repetitive hyperextension which causes a shear stress at the pars interarticularis.
Gymnastics

- Symptoms include:
  - Insidious onset
  - Pain with hyperextension (e.g., back walkover)
  - Initially pain with sports, then increases to pain with ADLs and progressing to pain interfering with sleep
  - A hyperlordotic (increased curvature, not scoliotic) lower back
  - Relative tightness of the hamstring muscles.
Gymnastics

Spondylolysis

Spondylolisthesis
Gymnastics

- **Diagnosis**
  - X-rays: AP, Lateral and oblique
  - If neg., CT, spect scan or MRI

- **Treatment**
  - Rest, analgesics
  - Referral to orthopedist
Gymnastics

Back pain in children less than 18 is always pathologic until proven otherwise
Pediatric Sports Injuries:

 позвонок General management principles for treatment of sports medicine injuries in the ED/Office:
- Ice is a sports medicine drug—use liberally
- When in doubt, immobilize, consult
- Best to have athlete rest until reevaluated
- Refer child and adolescent athletes to sports medicine specialists
Sporting Injuries
Types of Injuries
Acute vs. Chronic

- Both types usually involve muscle & bone
- **Acute**
  - Result from a collision or sudden twist
  - Examples = Sprains/Strains, Contusions, Fractures
- **Chronic / Overuse**
  - Repetitive, small injuries due to repeat motions
  - Increased today as children strive for excellence at younger ages
  - Examples = Pitching a baseball, Running cross country
Sprain or a Strain??!!

- Sprain - overstretching one or more ligaments through twisting or wrenching
- Strain - a tendon or muscle is overstretched
Knee Injuries

- femur (thighbone)
- patella
- posterior cruciate ligament (PCL)
- anterior cruciate ligament (ACL)
- lateral collateral ligament (LCL)
- meniscus
- medial collateral ligament (MCL)
- fibula
- tibia (shinbone)
Knee Injuries

The most common knee injuries are:
- a sprain or a strain
- torn ligaments
- a torn meniscus
- bleeding in your knee joint - this is usually caused by a torn ligament

The symptoms for most ligament injuries will be similar, no matter which one has been damaged. These include:
- pain
- swelling
- instability
First Aid: Initial Assessment

If you happen to come across a casualty, you will need to assess the situation before anything else;

- **Danger**- ensure that you or the casualty aren't in any danger.
- **Response**- Check the casualty to see if they are conscious.
- **Airway**- open the airway by putting one hand on the casualty's forehead whilst gently tilting their head back.
- **Breathing**- Look, feel and listen and for a maximum of 10 seconds to see if the casualty is breathing
- **Circulation**- is there a pulse? Is the heart beating? Is the pulse weak / strong / racing
RICE – Rest, Ice, Compression, Elevation

RICE is the principle you should follow for the initial treatment of any sprains and strains. If you pull a muscle or sprain a joint, you’ll get yourself off to the best possible start in terms of recovery by following RICE.
RICE

• Rest - The injured area should be in complete rest for 24-48 hours following the injury.

• Ice - Ice should be applied immediately, bringing the ice to the injured limb (not limb to ice) and keeping a thin towel or a plastic bag between the ice and the skin to avoid burns.

• Compression - A bandage or taping/strapping should be applied as soon after the injury as possible – either with or after the first application of ice. Compression will physically restrict movement in the injured area and constrict it, bringing down swelling.

• Elevation - By elevating the injury site above the heart level gravity comes in to assist in reducing blood flow to the injured area and helps reduce swelling.
**Concussion**
- Concussion is an injury to the brain that usually occurs following a blow or jolt to the head. In most instances, the person doesn’t lose consciousness.

**What are the symptoms?**
The symptoms of concussion may include:
- Headaches, which may be severe and persistent
- Dizziness
- Nausea
- Vision disturbance
- Poor balance

**What's the treatment?**
- The treatment for concussion is rest. Painkillers are often used to relieve headaches. Admission to hospital for observation is sometimes necessary.
Dangerous conditions....

**Shock**
- If the circulatory system fails, and insufficient oxygen reaches the tissues, the medical condition known as shock occurs. Shock is made worse by fear and pain.

**Recognition of Shock**
- Initially, a flow of adrenaline causes:
  - A rapid pulse.
  - Pale, grey skin, especially inside the lips. If pressure is applied to a fingernail or earlobe, it will not regain its colour immediately.
  - Sweating, and cold, clammy skin (sweat does not evaporate).

**Treatment of Shock**
- DO NOT let the casualty move unnecessarily, eat, drink, or smoke.
- DO NOT leave the casualty unattended. Reassure the casualty constantly.
- Treat any cause of shock which can be remedied
- Lay the casualty down, keeping the head low.
- Raise and support the casualty’s legs
- Loosen tight clothing, braces, straps or belts, in order to reduce constriction.
On the Field Emergency Management
Fractures/Dislocations

- Evaluate ABC’s
- Understand Mechanism
- Immediate reduction techniques (ONLY if no circulation present)
- Knowledge of common complications
- Plan for aftercare
- When in doubt…IMMOBOLIZE
Cervical Spine Injuries

- Always treat unconscious patients as having potential spinal injury
- Helmets and shoulder pads should not be removed in prehospital management of the football player with potential spine injury unless absolutely necessary.
Action Plan for Cervical Spine injury

Stabilize the Head AND Neck

Do Not Move Athlete

- *unless absolutely necessary to do primary survey*
- *Log roll patient if lying prone*

Primary Survey

- Check airway, breathing, and circulation
- Remove Mouthpiece
- Call 911 (EMS)
- If stable move on to Secondary Survey
- If not breathing proceed with facemask removal
Action Plan for Cervical Spine injury

Facemask Removal
- Remove facemask completely (all clips from facemask via screwdriver, pruning shears, or trainer’s angel)
- **LEAVE HELMET AND SHOULDERS PADS ON**
- Re-check ABC’s

Secondary Survey – Head to Toe
- Neurological screening
- Assess motor and sensory function in extremities
- Cranial nerve assessment as complete as possible

Transport
- Maintain control of the head during spine board process
- Secure helmet to spine board with tape or EMS straps
**Action Plan for Concussions**

**Concussion Assessment**

1) **Orientation**
   - Time
   - Date
   - Place
   - Surroundings
   - Recall injury event

2) **Immediate Memory**
   - Item Recall
     - Ball
     - Sailboat
     - Computer
     - Honesty
     - Purple

3) **Concentration**
   - repeat series of digits backward, progress with level of difficulty
     - 4-9-3
     - 3-8-1-4
     - 6-2-9-7-1
     - months in reverse order

4) **Delayed Recall**
   - recall items given earlier
     - Ball
     - Sailboat
     - Computer
     - Honesty
     - Purple
Action Plan for Concussions

Concussions- Physician Referral Checklist

**Immediate Emergency**
- Loss of consciousness > ?min
- Decreased level of consciousness
- Abnormal neurological function
- Seizure activity
- Mental status changes
- lethargy, confusion, agitation worsen
- Decrease of irregularity in respirations

**Delayed Transport**
- Vomiting more than once
- Post traumatic confusion lasting longer than 15 min
- Cranial nerve deficits
- Increase in blood pressure
- Post concussion symptoms that or do not improve over time
- Increase in the number of symptoms reported over time

**Other considerations:**
- Unequal, dilated, or un-reactive pupils
- Signs or symptoms of associated injuries, spine or skull fracture,
- Other considerations: social barriers, parental awareness, length of travel, language barriers
Action Plan for Dental Issues

**Tooth Avulsion** (Entire tooth knocked out)

- Avoid additional trauma during handling of tooth. Do NOT handle by root. Do Not scrub tooth. Do NOT sterilize tooth.
- Gently rinse with water if debris is on tooth.
- If possible, re-implant tooth and stabilize by gently biting down on towel.
- If unable to re-implant, you should do one of the following:
  - A. Place tooth in saline solution (Best Option)
  - B. Place tooth in cold milk
  - C. Wrap tooth in saline soaked gauze
  - D. Place tooth in cup of water
- Putting tooth back in socket within 30 minutes gives best chance to save tooth. Transport to dentist or emergency room immediately
Action Plan for Dental Issues

Tooth Luxation (Tooth in socket, but wrong position)

- Extruded Tooth (tooth is hanging out of gums)
  - Reposition tooth in socket using finger pressure
  - Stabilize tooth by gently biting on towel
  - Transport to dentist or emergency room
- Lateral Displacement (tooth is pushed back or pulled forward)
  - Reposition tooth using finger pressure.
    May require local anesthesia to reposition; if so, stabilize by gently biting down on towel
  - Transport to dentist or emergency room immediately.
- Intruded Tooth (tooth pushed into gum- looks short)
  - DO NOTHING – AVOID REPOSITIONING OF TOOTH
  - Transport to dentist or emergency room.
Action Plan for Dental Issues

Tooth Fracture (Broken Tooth)

- If tooth is broken in half, save broken portion and transport to dentist. Stabilize portion of tooth left in mouth.
- Limit contact with other teeth, air, and tongue. Pulp nerve may be exposed, which is extremely painful to athlete.
- Immediately transport tooth and patient to dentist or emergency room.