Injuries in the Young Athlete

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### Sports Injuries

- **30 million sports participants between ages of 6-21**
  - 7.2 million high school students involved in sports

### Table 31-1: National Electronic Injury Surveillance System (NEISS) Data Highlights—2008

<table>
<thead>
<tr>
<th>Sport</th>
<th>Ages 0–4</th>
<th>Ages 5–14</th>
<th>Ages 15–24</th>
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<tbody>
<tr>
<td>Basketball</td>
<td>1653</td>
<td>156,115</td>
<td>229,487</td>
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<tr>
<td>Football</td>
<td>1351</td>
<td>214,492</td>
<td>192,778</td>
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<tr>
<td>Soccer</td>
<td>1088</td>
<td>82,707</td>
<td>80,732</td>
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<tr>
<td>Hockey</td>
<td>219</td>
<td>18,555</td>
<td>29,786</td>
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<td>Lacrosse, rugby, ball games</td>
<td>2108</td>
<td>37,891</td>
<td>32,905</td>
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<td>Baseball</td>
<td>4539</td>
<td>109,202</td>
<td>80,879</td>
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<tr>
<td>Volleyball</td>
<td>52</td>
<td>16,785</td>
<td>23,761</td>
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<td>Racket sports</td>
<td>52</td>
<td>4623</td>
<td>6767</td>
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<tr>
<td>Track and Field</td>
<td>17</td>
<td>8655</td>
<td>9688</td>
</tr>
</tbody>
</table>

*Estimated Number of Injuries: Because NEISS is a probability sample, each injury case has a statistical weight. These are national estimates of the number of persons treated in U.S. hospital emergency departments with consumer product-related injuries and are derived by summing the statistical weights for the appropriate injury cases. The data system allows for reporting of up to two products for each person's injury, so a person’s injury may be counted in two product or sports groups.*

*Lovell & Winter's Pediatric Orthopaedics 2013*
Sports Injuries

- Severe injuries account for 15% of all injuries
  - Loss of participation for ≥ 21 days
  - 1:4 required surgery
    - Most frequent site is knee

- Injuries occurred more frequently in females

- Knee (30%) → Ankle (12.3%) → Shoulder (10.9%)
Benefits

- Documented health benefits outweigh the risks associated with sports participation
  - Weight management
  - Increased strength
  - Improved flexibility
  - Endurance
  - Improved self-esteem
Prevention

- Prevention of injuries is lagging behind the treatment of sport injuries

- Pre-participation physical exam should ensure a certain level of general health and physical fitness

- The coach should be qualified in sport-specific methods of training, injury prevention, injury recognition and rehabilitation
Rehabilitation

- Process in which a series of structured activities enable an athlete to return to normal activities & function

- Supervised formal PT sessions and/or home exercise programs
  - Physical therapy is an activity not a location!

- Benefits of therapy
  - Return the athlete to play quicker
  - Prevent further or repetitive injuries
  - Decrease reinjury rates
Rehabilitation

- Phases of rehab
  - Initial phase consists R-I-C-E
    - Control pain and inflammation
  - Intermediate phases
    - Stage 1 focuses on resolution of pain and restoration of ROM and strength
    - Stage 2 consists of progressive strengthening, functional/sport-specific drills, and proprioceptive exercises
  - Maintenance phase involves injury prevention
Strength Training

• Controversial topic for adolescents

• Concern for possible injury to joints or physes
  ○ Distal radius fractures, PF pain, apophyseal & low back injuries

• Studies have shown that strength increases up to 40% can be obtained with a low risk of injury
  ○ Well-supervised program ensuring movements are performed in a slow and controlled fashion with submaximal weight

• Power lifting and Olympic-style lifting are NOT recommending for growing athletes
  ○ Most reported injuries are associated with ballastic movements
Anabolic Steroids

• Increasing concern for younger athletes
  ○ Up to 10-15% of high school male athletes, 2-4% of females

• Can produce increase in muscle size and strength
  ○ Has NOT been shown to improve performance or aerobic capacity

• Associated with numerous negative health effects
  ○ Reports of single injections causing early epiphyseal closures

• Must focus on encouragement and implementation of proper strength training programs
Injuries
Anterior Knee Pain

- Idiopathic anterior knee pain
  - Chondromalacia Patella
  - Pain in the knee due to increased pressure from the patella
- Commonly occurs without injury to the knee
  - Usually bilateral, although one side may be more symptomatic
- Pain is diffuse about the knee
  - I tend to see kids draw it out superiorly and lateral to the patella
- Described as achy
  - May worsen with prolonged sitting or with activities
- May have catching or giving out episodes
- Minimal or no swelling present
Anterior Knee Pain

- Physical Exam
  - ROM maintained
  - Pain with compression or manipulation of the patella
    - Diffuse TTP
  - No significant effusion
  - NO pain with ROM of hip
  - Tight hamstrings and quads
    - Decreased popliteal angles (straight leg raise) and prone knee flexion

- Treatment
  - Activity modifications
  - NSAIDs
    - I typically ask them to take these as a scheduled Rx for 2-3 wks
  - Ice/heat
  - Stretching & Strengthening

- Natural history of disorder is resolution of pain
Anterior Knee Pain

Hamstring Stretches

Quadricep Stretches
Hemarthrosis

- 131 adolescents (10-18 y/o) presenting with an acute, traumatic knee effusion
  - PE difficult secondary to guarding, pain, swelling
- MRIs performed to identify presumed intra-articular injury
  - All MRIs revealed some type of injury
- Patellofemoral & ACL injuries predominate
- Recommended MRI after negative XRAYS due to high rate of injuries not identified by PE
  - 41% of patients underwent surgery
Hemarthrosis

- Females have more ACLs & PF injuries
  - Males sustain more meniscus injuries
- Trend toward younger patients sustaining more PF dislocations & older patients sustaining ACL injuries
- *Other* includes chondral defects, bone bruises, loose bodies, etc
Acute Patellar Dislocations

- Commonly occurs in 14 – 20 y/o
  - Frequently seen in high-level, adolescent athletes

- 11% of musculoskeletal complaints seen in the office setting

- Typical mechanism is an indirect force applied to a planted lower extremity
  - Knee is partially flexed and in a valgus position while internal rotation occurs
    - Basketball, football, soccer, baseball, gymnastics, falls
Acute Patellar Dislocations

• **History**
  - Usually describes a twisting injury
    - **Similar mechanism to ACL tears**
  - <50% report feeling something in the knee “popped out” then “popped back” into position
  - Quick onset effusion/swelling
  - Report of pain with attempts at knee movement

• **Physical Exam**
  - Almost always reduced at presentation
    - If not, gentle passive knee extension with medial pressure on palpable patella reduces the dislocation
  - Large hemarthrosis typically present
  - Perform Lachmans/Anterior drawer to assess for ACL tear
    - **Similar mechanism**
Acute Patellar Dislocation

- **Imaging**
  - AP
  - Lateral
  - Merchant

- **Treatment**
  - Non-operative tx
    - Indicated for 1st time dislocators without an osteochondral fracture
      - Associated fracture rates of 5-50%
    - No difference in redislocation rates in surgical repair vs conservative tx
Acute Patellar Dislocation

- **Conservative tx**
  - Compressive dressing and knee immobilizer for 3 weeks
    - If effusion significantly improved, transition to patellar sleeve and begin PT x 4-6 weeks
    - If large effusion persists at 3 weeks → consider MRI to evaluate for osteochondral fragment
  - 50% chance of redislocation with non-op tx

- **Surgical Intervention**
  - Arthroscopic surgery for loose osteochondral fragments
    - Fixation vs excision based on size and quality of the fragment
  - Reconstructive procedures for recurrent dislocators
Patellofemoral Instability

- Typically occurs without injury
- 2:1 Female to Male ratio
- Can be secondary to quadricep weakness and/or bony deformity
  - Genu valgum
  - Ligamentous laxity
  - 2% of population has trochlear dysplasia
    - 85% of instability patients have trochlear dysplasia
- PE reveals increased lateral translation and a positive apprehension test
Patellofemoral Instability

- Non-op tx for first time dislocators
  - 50% chance of redislocation with non-op tx
- Discuss surgery if repeat dislocations occur
  - Tibial tubercle transfer
  - MPFL (medial patellofemoral ligament) repair/reconstruction,
  - Extensor mechanism realignment
  - Etc
Anterior Cruciate Ligament Tears

- **Recent dramatic increase in incidence**
  - Increased athletic involvement
  - Increased recognition of the condition

- **Frequently seen in noncontact activity**
  - Twisting injury
  - "Heard/felt a pop"

- **Typically associated with immediate, large effusion**
  - Up to 47% preadolescents with a traumatic knee effusion
  - Up to 65% adolescents with a traumatic knee effusion

- **PE reveals increased translation with Lachmans test**
Anterior Cruciate Ligament Tears

**Imaging**
- MRI confirms dx
  - Allows identification of associated meniscal, cartilage and ligamentous injuries
    - 50-60% have associated meniscus tear

**Treatment**
- Non-op tx associated with further intra-articular injury and accelerated degeneration
- Surgical reconstruction recommend if patient desires to return to pivoting/cutting activities
  - Open physes require special thought/consideration
Meniscal Tears

- Isolated tears are not commonly seen
  - Incidence increasing with increase in athletic participation
  - Occur in 50% of ACL injuries
- Typically occur during twisting injury
  - C/o joint line pain and knee swelling
- PE reveals joint line TTP
  - + effusion
  - + McMurray test
  - + Apley compression test
  - Sensitivity 50-60%
  - Specificity 80-89%
Meniscal Tears

- **XRAYS** are required to rule out other injuries
  - Fracture, osteochondral defect, ...

- **MRI** typically provides diagnosis
  - Increased sensitivity & specificity compared to PE
  - Increased vascularity in children can be misinterpreted as a tear
Meniscal Tears

- Tx is arthroscopic repair in most cases
  - 50-90% of meniscal tears in children are amendable to repair
  - Greater potential for healing than adults
    - Increased healing rates with simultaneous ACL reconstruction
  - Poor long-term outcomes with meniscectomy
    - Increased contact forces
    - Early OA
      - High rates within 10-20 years

- Still awaiting long-term data to confirm prolonged joint health after repair
Discoid Meniscus

- Thickened, block-shaped, enlarged meniscus
  - Covers a larger percent of the lateral joint surface
  - 97% are lateral
  - 20% are bilateral
  - Congenital variant
- Most are asymptomatic
- Some present early with a snapping knee syndrome
  - Painless snapping during flexion & extension
- Can present with pain if a tear occurs
Discoid Meniscus

- PE can reproduce the snapping during ROM
  - Lateral joint line bulge may occur + clunk w/ McMurray testing

- Discoid meniscus are prone to tearing
  - Consists of poorer quality tissue in a disorganized arrangement
  - Presents with complaint of a loud snapping sensation
Discoid Meniscus

- **Treatment**
  - Asymptomatic patients are managed with observation
  - Symptomatic knees are treated with surgery
    - Arthroscopic saucerization
      - Preserve as much meniscus as possible
      - Create a natural, anatomic contour

- **Results**
  - Mid-term results show good to excellent outcomes with saucerization
  - Long term studies are lacking
Tibial Spine Fractures

- Relatively rare injury most commonly occurring in 8-14 y/o
- Consists of an avulsion of the ACL insertion on the tibia
  - Associated with a stretching of the ACL fibers
- Most common mechanism is fall from a bicycle
  - Increasing incidence associated with sports participation
- PE reveals a painful, swollen knee with limited ROM
  - Lachmans confirms increased laxity
    - Can be difficult due to pain
    - Must assess other side b/c of laxity seen in kids
Tibial Spine Fractures

- **Radiographs**
  - Lateral and notch views are diagnostic and can guide treatment
  - Advanced imaging (CT, MRI) is typically not needed

- **Treatment**
  - Non-displaced or minimally displaced fractures can be treated with casting
    - Persistent laxity is common
  - Displaced fractures should undergo fixation
    - Arthroscopic vs open
    - Persistent laxity can be present after healing

- **Outcomes**
  - Most have excellent outcomes
    - Despite some residual laxity
Juvenile Osteochondritis Dissecans (OCD)

- Acquired & potentially reversible lesion of subchondral bone
  - Concern regards risk of injury to overlying cartilage
- Etiology unknown
- Males more commonly affected 2-3:1
- Chief complaint is typically nonspecific knee pain
  - Commonly activity related
  - Can lead to locking, giving away or swelling in advanced disease
- PE reveals tenderness with deep palpation of the involved femoral condyle
  - PE is notoriously poor for identifying lesions
Juvenile Osteochondritis Dissecans (OCD)

- **Imaging**
  - Radiographs allow identification of the lesion
    - Classic location is lateral aspect of the MFC
  - MRI details condition of the cartilage and can aid in treatment decisions
    - Aid in determining stability of the lesion

- **Prognosis** best in *stable* lesions found in the *classic* location of a knee with *open* physis
Juvenile Osteochondritis Dissecans (OCD)

- **Treatment**
  - **Nonsurgical treatment**
    - Initially pursued for skeletally immature patients with stable lesions
      - Restrict high impact activities
      - Short-term immobilization & weightbearing restrictions
      - Sports are restricted for 3-6 months
        - Average healing time is 4-5 months, confirmed by radiographs
  - **Surgical intervention**
    - Unstable lesions
    - Stable lesions that do not heal with conservative management after 6m trial
      - Arthroscopic evaluation of cartilage
        - Arthroscopic drilling
        - Fixation
        - Osteochondral transplantation
Quadricep Contusion

- **Results from blunt trauma to the anterior thigh**
  - Muscle hemorrhage is followed by formation of granulation tissue
  - Dense scarring can occur and lead to significant disability if early treatment is not instituted
- **PE demonstrates thigh swelling, pain and loss of knee flexion**
- **Radiographs are required to rule out fracture**
  - Must include femur, hip and knee
Quadricep Contusion

- Initial treatment consists of R-I-C-E
  - Crutches & bracing can be used for comfort
- Gentle *active* ROM is begun when pain subsides
  - *Passive* ROM can exacerbate bleeding and subsequent scarring
- Strengthening exercises are initiated once 90° of knee flexion can be performed
- Can take 4-6 weeks of healing before returning to sports
- Return to sports when knee flexion > 120° and 80% strength is obtained
  - Patient must pass functional agility drills
  - Thigh guards are worn for protection
Quadricep Contusion

- **Complications**
  - **Compartment syndrome**
    - Severe pain and swelling
    - Increased risk when associated bleeding disorder is present
    - Requires emergent fasciotomy
  - **Myositis ossificans traumatica**
    - Can occur in up to 20% of contusions
    - Higher risk in severe contusions and reinjuries
    - Identified by flocculent densities within quadricep in 2-4 weeks
    - Excision indicated only if painful or associated with loss of ROM
Ankle Sprains

- More frequent in adolescents and young adults
  - Younger patients are more likely to suffer from a distal fibular physeal injury
- Caused by a planterflexion/inversion mechanism
- Diagnosis of physeal fracture vs ligamentous injury is based on location of tenderness
  - Obtain XRAYs if tenderness is over distal fibula or location cannot be determined
- PE includes anterior drawer test & calcaneal inversion test
Ankle Sprains

- Classified according to severity of injury
  - Grade I → pain only, no disruption of tissues, minimal loss of function
  - Grade II → partial disruption of tissue and partial loss of function
  - Grade III → complete tears of ligamentous structures

- Grade III and syndesmosis sprains (high ankle sprains) are more likely to involve osteochondral lesions & chronic instability

- Syndesmosis injuries reveal a positive squeeze test
  - Pain at the ankle with squeeze of proximal leg
Ankle Sprains

- **Rehabilitation**
  - **Phase I** → R-I-C-E, protection (brace, cast, splint, crutches, wrap)
    - Early weightbearing is associated with quicker recovery
  - **Phase II** → reduction of lingering swelling, restoration of ROM & strength, participation in low-impact aerobic training
  - **Phase III** → proprioceptive exercises, sport-specific drills, gradual return to sports
  - Taping or brace may be used when returning to activities
    - No evidence of decreased reinjury rates
- **Surgery is not typically indicated for acute ankle sprains**
Chronic Ankle Sprains

- Uncommon in skeletally immature
- Secondary to incompetent ligaments
- PE reveals laxity with anterior drawer & calcaneal inversion testing
  - Check ROM of ankle & subtalar joints to rule out tarsal coalitions
- MRI useful to rule out osteochondral lesions, peroneal tendon pathology
- Initial non-op treatment consists of proprioceptive exercises, peroneal strengthening and bracing
- Ligamentous repair or reconstruction can be used if non-operative methods fail
Pelvic Avulsion Fractures

- Occurs typically in 14-25 y/o
  - Nearing physeal closure
    - Ischial apophysis can remain open until 25
- Commonly from a sudden/forceful muscle contraction
  - Occurs during rapid acceleration/deceleration
  - Equivalent to an adult muscle strain
- Patient present with c/o pain at location of avulsion
  - Occasionally prodromal symptoms are present
    - Preceding apophysitis
Pelvic Avulsion Fractures

- **PE reveals localized pain, swelling & TTP at site of fracture**
  - Pain is reproduced by active contraction and passive stretch of involved muscle
- **Plain radiographs display fracture**
  - Delayed XRAYs of healing fractures can be misinterpreted as malignancy
Pelvic Avulsion Fracture

- Non-operative treatment is recommend for most fractures
  - Rest/ice/analgesics
  - Gentle A/PROM
  - Resistance exercises (begun once 75% ROM obtained)
  - Stretching/strengthening focusing on sport-specific exercises
  - Return to competition
    - At least 6wks before return, can be as long as 4-6m