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Common Pediatric Sports Injuries

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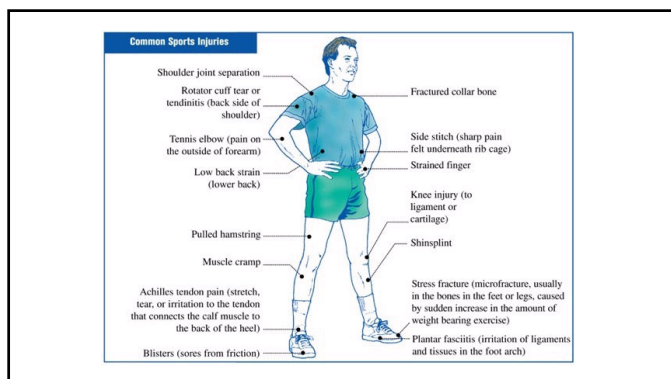
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Overview :

- Introduction
- Concussion
- Back
- Upper Extremity
- Lower Extremity
- Miscellaneous Topics

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Introduction



Pediatric Sports Medicine



- Estimated that over 30-45 million children ages 6-18 participate in athletics annually
- Nearly 75% of US households have at least one child that participates in organized sports
- Sports participation is more accessible with increased variety
 - Increasing sports specialization
 - More year-round and concurrent sports
- Drive for success, college scholarships, going professional
 - NCAA stats demonstrate that less than 0.5-1.6% of high school athletes will earn partial scholarships to D1 schools
 - 1% of college athletes go professional

Pediatric Sports Medicine

- Over 70% of children under age 14 who seek medical care for injuries are due to overuse injuries
 - Most common injuries
 - Sprains, strains, bone growth plate injuries, repetitive motion and overuse injuries, heat-related illness
 - 62% of injuries occurring during practice
 - Most organized sports related injuries (62 percent) occurring during practices rather than games. Despite this fact, a third of parents often do not take the same safety precautions during their child's practices as they would for a game.



- Over 1 in 10 will have an emergency room visit for a sports related injury

Problem with Surveillance

- Difficult to track injuries
 - All injuries don't get reported
 - Best data from team physicians and trainers
- No standard method of reporting
 - May report by
 - Body part injured
 - Amount of time a player missed practice or a game
 - Type of injury sustained

Most Common Causes of Injury

- Failure to Warm UP
- Overtraining
- Excessive loading on the body
- Not taking safety precautions
- An Accident
- Inappropriate equipment
- Poor Exercise Technique
- Reoccurring injury
- Genetic Factors
- Muscle weakness or imbalance
- Lack of flexibility
- Joint laxity

Magnitude of the Problem

- 3.5 million sports injuries for children < 15 years of age treated in medical settings
 - ¼ of all Emergency Department visits
- For children involved in organized sports
 - 770,000 physician visits
 - 90,000 hospitalizations /year
 - 70-80% injuries are minor (< 1wk of practice missed)
 - 60% occur during practice
 - Injuries associated with participation in sports and recreational activities account for 21 percent of all traumatic brain injuries among children in the United States.

Injury Mechanisms

- < 10 years of age
 - Often injured during individual recreational activities
 - Usually within the first week of the activity
 - Examples = bike riding, rollerskating, sledding
- Pubertal child
 - Greater weights, greater force = more severe collision
 - Usually occur during organized sporting events
 - Examples = Football, Wrestling, Basketball
 - Children ages 5 to 14 account for nearly 40 percent of all sports-related injuries treated in hospital emergency departments. The rate and severity of sports-related injury increases with a child's age.

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Concussion

(courtesy of Calvin Spellman, MD - primary care sports med)

What is a concussion?

- First International Conference on Concussion in Sport defined concussion as a complex pathophysiologic process affecting the brain, induced by traumatic biomechanical forces



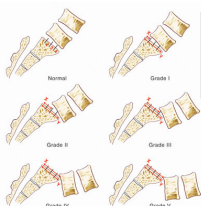
Treatment/RTP Guidelines

- REST/REMOVE FROM SPORT
- Tylenol, Benadryl, melatonin, fish oil/DHA, multivitamin
- Want to avoid second impact syndrome
- Gradual return to play once symptoms resolve
 - Day 1: light jogging
 - 2:30 minute jog/run
 - 3: sport specific drills
 - 4: contact drills
 - 5: full contact practice

Important to refer concussions unless you conventionally treat these in your practice

Back Injuries

Spondylolysis/Spondylolisthesis



Grade 1 is 0-25%
 Grade 2 is 25-50%
 Grade 3 is 50-75%
 Grade 4 is 75-100%
 Over 100% is Spondylolysis, when the vertebra completely falls off the supporting vertebra

Spondylolysis/Spondylolisthesis

- PE:
 - Stork test
 - Thorough neurologic exam
 - Acute TTP
- Further in aging: SPECT vs MRI
- Treatment:
 - Rest
 - HS stretching, core strengthening
 - +/- bracing

• When to acutely refer: abnormal neurologic exam or high grade spondylolisthesis



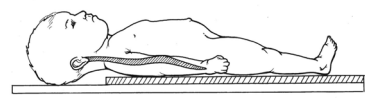
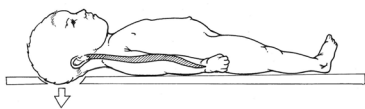
Spinal Column Fractures

Fractures of the spine in children and adolescents are rare and cause 0.2% of all fractures in the pediatric population whereas structural lesions account for 0.6-3% of all spinal damages.

These should be referred

- Take into account underlying diagnoses that may be associated with spinal conditions
 - Achondroplasia
 - Goldenhar's
 - Spondyloepiphyseal dysplasia
 - NF
 - Mucopolysaccharidoses (Mucopolis)
 - OI
 - Larsen's
 - Down's

Spinal Column Fractures

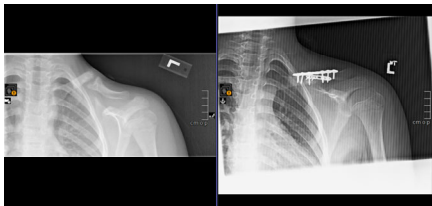


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Pediatric Clavicle Fractures

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- Mostly treated nonoperatively; would still recommend referral

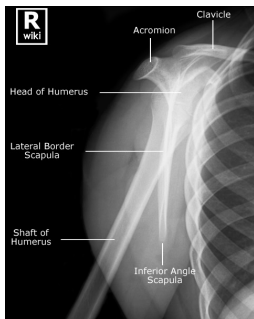
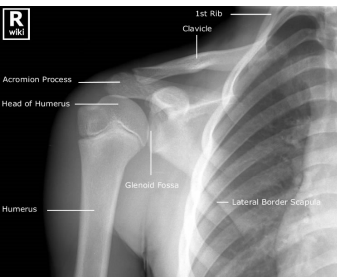


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Shoulder



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Shoulder Separation

1

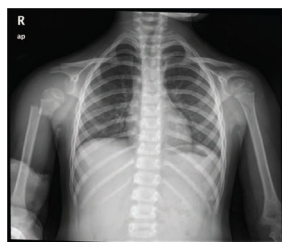
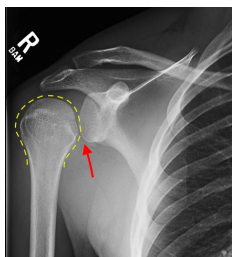


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Radbpediatrics

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Shoulder Dislocation/Extraphyseal Fracture



Radford et al

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Little Leaguer's Shoulder



A Little League Shoulder



B Normal

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Shoulders - WHEN TO REFER

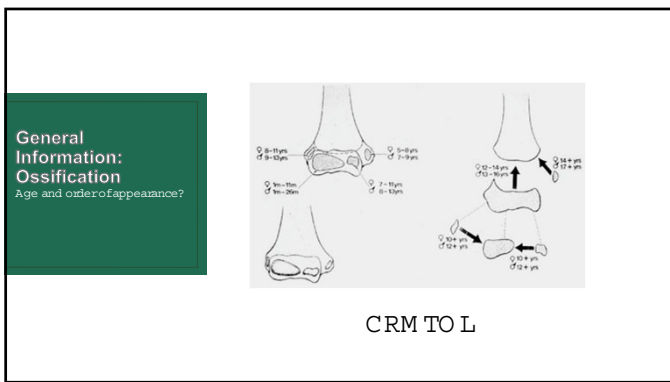
- Fractures/separations/dislocations/overuse injuries
- Continued, sustained pain which has not improved over a week of rest
- Subjective/objective shoulder instability
- We treat most shoulder pathologies conservatively but have become more aggressive about athletic, first time dislocations



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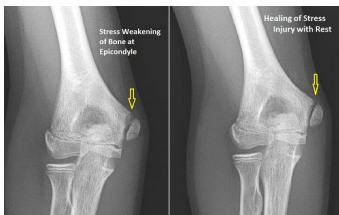
Elbow - lateral condyle fracture



Elbow - medial epicondyle fracture



Elbow - medial epicondylitis



Elbow - Supracondylar Humerus Fracture

This slide illustrates a supracondylar humerus fracture. It includes three images: a lateral X-ray of the elbow showing a fracture line above the condyles, a photograph of the surgical site with the fracture exposed, and a circular inset showing a close-up of the fracture site with surgical pins or wires.

Elbow - WHEN TO REFER

- Fractures/dislocations/overuse injuries
- Elbow instability; subjective or objective
- Medial/lateral sided pain in throwing athlete
- ANY SUSPICION OR CONFIRMED FRACTURE OF THE ELBOW - would tend to refer prior to getting CT/MRI etc.

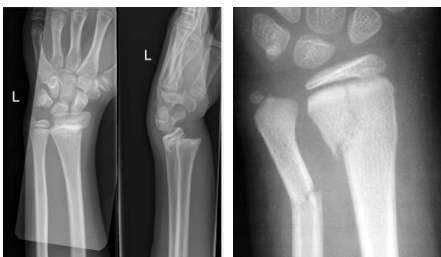
The slide includes a diagram of the throwing cycle with phases: Start, Wind-up, Hands apart, Early cocking, Late cocking, Acceleration, Follow-through, Ball release, and Finish. Below the diagram is an X-ray of the elbow joint.

Wrist/Hand

This slide shows the anatomy of a growing bone and the wrist. The 'Parts of a Growing Bone' diagram labels the Epiphysis, Physis (Growth Plate), Metaphysis, and Diaphysis. The 'Wrist Bones' diagram labels the Ulna and Radius.

Wrist/Hand - Common Fractures

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Carpus

- Scaphoid fx
- Most common fx carpal bone, peak age 15yo
- Delay in diagnosis is common
- FOOSH
- Go by PEXE
- Snuffbox tenderness



Phalangeal Neck

- Doorslamming injury
- Usually displaced
- Adjacent to joint
- Block to flexion
- Clinical deformity
 - Colossal
 - Rotational



Wrist/Hand - Jersey Finger

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Jersey Finger - similar to mallet finger except the flexor tendon tears due to forcible flexion at the DIP joint (ie. gripping a hand full of jersey and having it pulled forcefully from your grip)

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Seymour Fracture

- Crush injury with nailbed laceration
- Geminal matrix incarcerated within flexor blocking reduction
- Physeal or juxtaepiphyseal distal phalanx fracture



Mallet finger splint



Jersey Finger - similar to mallet finger except the flexor tendon tears due to forcible flexion at the DIP joint (ie. gripping a hand full of jersey and having it pulled forcefully from your grip)

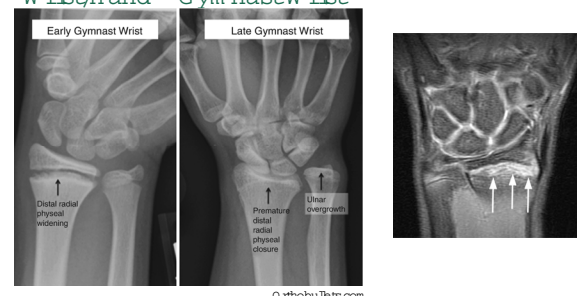
Boxer's Fracture

- Fracture of the neck of the 5th metacarpal
- BEWARE OF FIGHTBITE LACERATION



Wrist/Hand - Gymnast Wrist

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Wrist/Hand - WHEN TO REFER

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- Fractures/dislocations/overuse injuries
- I would recommend referral for nearly all fracture patterns unless you are comfortable with treating the complications associated with said fracture pattern
- OK to reduce fingers in clinic if you are comfortable
- Finger deformities/lacerations that may indicate tendon/neurologic injuries
- Pain which persists in wrist/hand > 1-2wk; could be consistent with additional diagnosis including TFCC tear, ulnar impaction syndrome, Gamekeeper's thumb, tenosynovitis, or other pathologies



Overuse injuries

Common sites of overuse injury, their associated sports and their popular (eponymous) names.

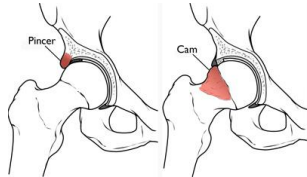
Site	Associated Sports	Eponym
Tibial tubercle	Jumping, sprinting, skiing, weight training, soccer, horse riding	Osgood-Schlatter disease
Patella (inferior pole)	Soccer, rugby, jumping, skiing, sprinting, dancing	Sinding-Larsen-Johansson Syndrome
Calcaneus	Running, sprinting, aerobics, soccer, rugby, fencing, dancing	Sever's disease
Navicular	Sprinting, running, aerobics, dancing	Kohler's disease
Olecranon	Javelin/throwing sports, tennis, gymnastics, weight lifting	Palmer's disease
Lunate	Tennis, throwing sports, martial arts	Keinbock's disease
Thoracic spine	Rugby, weight lifting, gymnastics, swimming (butterfly)	Scheuermann's disease
Second metatarsal head	Dancing, martial arts ("kicking" sports)	Freiberg's disease
Third metatarsal head	Dancing, soccer, martial arts	Kohler's Type 2

Hip/Pelvis - Avulsion Fractures/Strains

Labels in diagram:
 Iliac crest
 Iliopsoas tendons
 Anterior superior iliac spine
 Sartorius
 Anterior inferior iliac spine
 Rectus femoris
 Greater trochanter
 Gluteus medius & minimus
 Lesser trochanter
 Iliopsoas
 Symphysis
 Adductor
 Ischial tuberosity
 Hamstrings
 Ischiopectineal ligament

Hip/Pelvis - Femoroacetabular Impingement (FAI) | 53

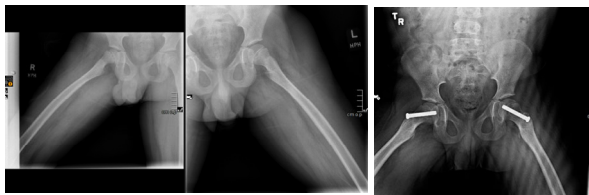
- Groin pain mostly in active individuals with activity and certain movements
- Can be treated conservatively, but also can lead to accelerated arthritis if severe



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Hip/Pelvis - SCFE | 54

- Limp, altered gait, progressive external rotation of extremity
- Common only in 8-12yo obese children, but can present in other demographics
- Necessitates urgent referral, phone call



Hip/Pelvis - Hip Dislocation | 55



Hip/Pelvis - WHEN TO REFER

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- Fractures/dislocations - sprains/stains around the hip with decreased weight bearing are indications for hip imaging such as an AP/lateral
- These can be consistent with pelvic avulsion fractures, FAI, or even SCFE (and Perthes)
- Negative imaging or suspected FAI can be treated conservatively and referred if pain not improved in 1-2wk
- Would recommend referral for any non-weight bearing relatively urgently over the course of 1-2d and urgently if associated with any fevers/imaging abnormalities

Knee

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Figure 27.3 Anteroposterior view of left knee at 4 years, 8 years, 12 years, and 15 years. There are changes in the shape of the distal femoral physis with skeletal growth. The central ridge (black arrows) decreases in height relative to the metaphyseal-epiphyseal junction (white arrows). There is progressive cupping of the epiphysis such that the metaphyseal-epiphyseal junction is higher than the central ridge at skeletal maturity.

Ratelle Beahm - Parkh

Knee - Physeal Fractures/Tibial Spine/Tibial Tubercle

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Knee - Patellar Instability

- Difficult entity to diagnose/treat with large spectrum of pathology
- Can be traumatic/traipathic/congenital or syndromic
- Refer most instances of this to peds sports

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Knee - WHEN TO REFER

- Fractures/dislocations (be mindful of patellar instability)
- ANY KNEE EFFUSION SUBJECTIVE/OBJECTIVE
- Mechanical symptoms (clicking/popping/locking), anterior knee pain, or otherwise diffuse achiness which persists > 1-2wk with conservative treatment
- Conservatively treated with home/PT-based exercise program, bracing, icing, and most importantly REST

REMEMBER: KNEE PAIN CAN BE HELP PAIN AND INDICATE HIP PATHOLOGY SUCH AS SCFE

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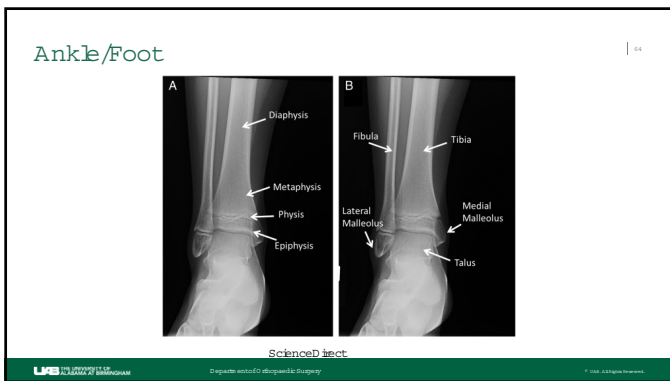
Ankle/Foot

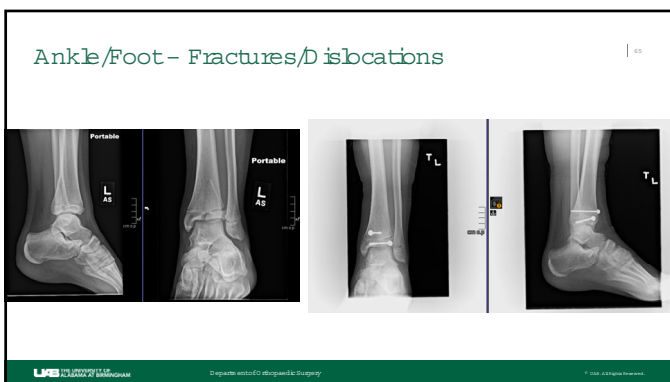
"Well Doctor, I think I've bent it like Beckham."

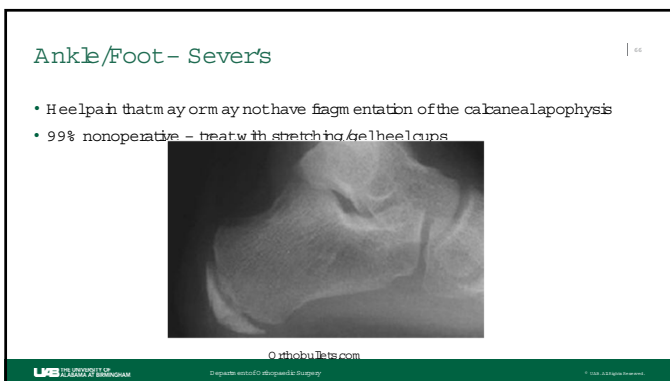
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Ankle/Foot - Additional Stress Injuries

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Ankle Sprain

Most Common: Plantar Flexion or Inversion

- Anterior tibiofibular ligament
- Calcaneofibular ligament
- Posterior tibiofibular ligament
- Tibiofibular ligament (severe injury)

Ankle/Foot

PEDIATRIC FOOT & CLEAT INJURIES

WHAT PARENTS NEED TO KNOW

10% of children sustain ankle sprains
83% of children sustain ankle sprains
90% of children sustain ankle sprains

Most ankle sprains occur during sports activities. The most common mechanism is inversion of the ankle.

When is a sprain really bad? | **1** Mild | **2** Moderate | **3** Severe

FIRST DEGREE	SECOND DEGREE	THIRD DEGREE
<ul style="list-style-type: none"> • Swelling • Mild pain at site of ankle and sprain • No loss of ability 	<ul style="list-style-type: none"> • Moderate swelling and some loss of ability • Moderate pain • Moderate loss of range of motion • Moderate loss of ability 	<ul style="list-style-type: none"> • Significant swelling • Moderate to severe pain • Moderate to severe loss of range of motion • Moderate to severe loss of ability

The heel is where it's at | The heel is where it's at. The heel is where it's at. The heel is where it's at.

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Ankle/Foot - WHEN TO REFER

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- Fractures/dislocations/ovense injuries - especially those associated with radiographic abnormalities
- Any stress fractures/injuries creating concern - V iam in D, Ca, in mobilization, and REST very important - history usually indicative of pathology
- Subjective/objective ankle instability that fails conservative treatment w th exercises/bracing/rest > 3-4wk

M iscellaneous

Sports Specialization

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- Single sport specialization
- >8-9 months per year of training/competition



Sports Specialization | 73

- 1190 injured adolescent athletes
- 26% single-sport specialized
- Lower proportion of acute injuries (29% vs 14%)
- Higher proportion of overuse injuries (44% vs 32%)

Phys Sportsmed. 2017 Sep;45(3):344-352. doi: 10.1080/00913847.2017.1313077. Epub 2017 Apr 10.
Specialization patterns across various youth sports and relationship to injury risk
Jacqueline Pasulka^{1,2}, Nenu Jayanthi^{3,4}, Ashley McCann⁴, Lara R. Dugas⁵, Cynthia LaBella^{1,6}

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Sports Specialization | 74

- 5 studies met inclusion criteria
- Sport specialization athletes at increased risk of sustaining overuse injury RR 1.81
- Overall finding of sport specialization with increased risk of overuse M SK injury (grade B)

Meta-Analysis. Pediatrics. 2018 Sep;142(3):e20180657. doi: 10.1542/peds.2018-0657. Epub 2018 Aug 22.
Sport Specialization and Risk of Overuse Injuries: A Systematic Review With Meta-analysis
David R Bell^{1,2,3}, Eric G Post^{4,5}, Kevin Biese^{4,5}, Curtis Bay⁶, Tamara Valovich McLeod⁷

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Sports Specialization | 75

- 2011 athletes completed a questionnaire
- Highly specialized athletes (>8m o/year) were more likely to report overuse injuries (OR 1.68 for UE; 1.66 for LE)
- Athletes who report participation of more hours per week than age were more likely to report any injury

Am J Sports Med. 2017 May;45(5):1405-1412. doi: 10.1177/0363546517690848. Epub 2017 Mar 13.
The Association of Sport Specialization and Training Volume With Injury History in Youth Athletes
Eric G Post^{1,2}, Stephanie M Tagliente^{1,2}, Jeremy W Reikema^{2,3}, Scott Hetzel⁴, Timothy A McGuire⁵, M Alison Brooks⁶, David R Bell^{1,2,3}

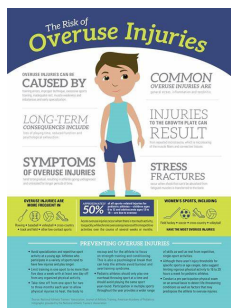
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Overuse

Location	Conditions
Upper extremity	Distal clavicle osteolysis Proximal humeral physal separation Rotator cuff tendinitis Olecranon stress fractures Capitellum osteochondritis dissecans Ulnar collateral ligament strain/tear Medial epicondyle apophysitis/fracture Chronic exertional compartment syndrome Gymnast wrist

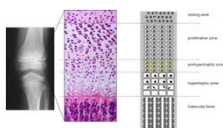
Overuse

- 50% of sports-related injuries occur from overuse
- 50% result in loss of more than 1 week of play time
- Stress fractures most common
- Majority occur in the lower extremity



Overuse

- Hypertrophic zone is weakest portion of physis
- Muscle and tendon adaptations < bone growth => apophyseal stress
- Repetitive physal stress => disruption of metaphyseal blood supply, altered endochondral ossification, chondrocyte proliferation, possible physal arrest
- Decreased bone mineral density occurs prior to peak growth velocity coupled with low vitamin D increases risk of osseous injury

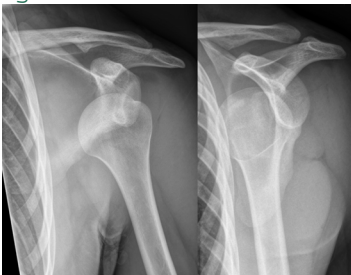


Overuse

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- Decreased bone mineral density occurs prior to peak growth velocity coupled with low vitamin D increases risk of osseous injury


Question - What is the diagnosis?

- Shoulder Separation
- Shoulder Dislocation
- Little Leaguer's Shoulder
- Clavicle Fracture




Question - What is this structure?

- Lateral Condyle
- Medial Epicondyle
- Olecranon
- Xiphoid



Question - Sever's disease is best treated with

- Surgery
- Cast
- **Stretching/HeelCups**
- It should not be treated




Growth Plate

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Question - Knee pain can be hip pain in children?

True - I am worried about SCFE


- False



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Thank you! Questions?

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