Overuse Injuries

The Sports Medicine Core Curriculum Lecture Series
Sponsored by an ACEP Section Grant
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The Basics

Incidence: 30-50 % all sports injuries

Sport Specific

Age specific

Gender specific: Controversial

Arendt vs. DeHaven

Herring, SA et al. *Introduction to Overuse Injuries*. Clin Sports Med. 1987:6(2):225-232.

Arendt EA. *Common musculoskeletal injuries in women.* Phys Sportsmed. 1996:24(7):39-48.

DeHaven KE et al. *Athletic Injuries: comparison by age, sport and gender.* Am J Sports Med. 1986:14(3):218-224.

Risk Factors

Intrinsic

- Malalignment
- Muscle imbalance
- Muscle weakness
- Inflexibility
- Instability

Extrinsic

- Training errors
- Equipment errors
- Environment
- Technique
- Sports acquired deficiency

Management Principles

Make a pathoanatomic diagnosis

Control inflammation

RICE--->PRICEMM

Promote healing

Increase fitness

Control abuse

O'Connor FG et al. *Five Step Treatment of Overuse Injuries* Phys Sportsmed. 1992:20(10):128-142.

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Assessing pain: Nirschl Pain Scale

Phase 1: Sore after activity

Phase 2: Mildly sore before activity

Phase 3: Moderately sore before activity

Phase 4: More intense pain than phase 3

Phase 5: Significant pain during and after activity

Phase 6: Pain at rest and with activities of daily living

Phase 7: Pain disrupts sleep

O'Connor FG et al. *Five Step Treatment of Overuse Injuries* Phys Sportsmed. 1992:20(10):128-142

Pediatric Specific Concerns

35 million U.S. children play organized sports

Incidence: 49.5 % of all pediatric sports injuries

No gender differences

Sport specific differences

Landry GL. *Sports injuries in childhood.* Pediatr Ann. 1992:7(1):32-41

Stanitiski CL. *Common injuries in pre-adolescent and adolescent athletes: recommendations for prevention.* Sports Med. 1993:20(3):63-9.

Watkins, J et al. *Sports Injuries in Children and Adolescents Treated at a Sports Injury Clinic.* J Sports Med Phys Fitness. 1996:36(1):43-8.

Baxter-Jones A et al. *Low injury rates in elite athletes.* Arch Dis Child. 1993:68(1): 130-132

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Pediatric Specific Concerns

Long Bone Growth

- Bones grow faster than muscles and tendons

Cartilage

- Weak relative to tendon
- Poor flexibility
- Increased traction during growth spurts
- Highest susceptibility at knee, ankle and elbow

DiFiori JP *Overuse Injuries in Children and Adolescents*. Phys Sportsmed. 1997:27 (1)

Lateral Epicondylitis

Misnomer = tennis elbow

Common extensor tendinosis

Anatomy

- Extensor carpi radialis brevis
- Extensor carpi radialis longus
- Long extensor of extensor digitorum communis tendon
- Extensor carpi ulnaris

Lateral Epicondylitis

Mechanism

- Prolonged use of wrist extensors
- Sustained gripping
- Impact forces from repetitive striking
- Change in activity or equipment
- Racquet sports: grip, grip size, string tension, racquet stiffness, bad strokes, off-center hits
- Rotator cuff weakness

Lateral Epicondylitis

Symptoms

- Lateral elbow pain
- Resolves after warmup
- Stiffness after play
- Progresses to pain at rest

Physical Exam

- Point tenderness over/just distal to lateral epicondyle and/or
- Pain with resisted wrist or finger extension

Lateral Epicondylitis

Treatment

- RICE/PRICEMM
- "Relative rest"
- NSAIDs
- Ultrasound
- Tennis elbow forearm band
- Corticosteroid injections
- Volar splint
- Rehabilitation
- Operative intervention

Stahls, S and kaufman T. *The Efficacy of an injection of Steroids for Medial Epicondylitis.* J Bone and Joint Surg 79A:n0v 97: 259-278

Medial Epicondylitis

Misnomer = Golfer's elbow

Common flexor tendinosis

Anatomy

- Flexor pronator mass
  - – Flexor carpi ulnaris
  - – Palmaris longis
  - – Flexor carpi radialis
  - – Pronator teres
- Flexor digitorum superficialis

Medial Epicondylitis

Symptoms

Medial elbow pain and/or pain over the flexor mass

Physical Exam

Point tenderness distal to medial epicondyle

Pain with resisted wrist flexion

Medial Epicondylitis

Treatment

- "Relative rest"
- Ice
- NSAIDs
- Corticosteroid/ anesthetic injections
- Ultrasound
- Physical therapy
- Rehabilitation
- Sling

Medial Elbow Stress

Delivery Stages in Baseball Pitching:

Wind up, Stride, Arm Cocking, Arm Acceleration, Arm Deceleration, and Follow Through

Mechanism of Excess Stress

- Marked valgus force during throwing motion
- Repetitive bone vs bone trauma can cause
  - ligament attenuation or loose bodies
- Sidearm delivery

Ulnar Collateral Ligament Tear

Treatment

- Surgery→ 'Tommy John' procedure
- Reconstruction of medial collateral ligament using palmaris longus graft

Little League Elbow

AKA: medial epicondylar apophysitis

Mechanism

- Too much throwing!!!
- Poor mechanics
- Inflammation of epiphyseal growth plates at medial apophysis

Symptoms

- Pain at medial elbow
- Pain, “pulling” or “popping” with throwing
- Tenderness along medial epicondyle

Little League Elbow

Physical Exam

- Tenderness along medial epicondyle
- Difficulty extending elbow
- Reproducible pain with valgus stress
- +/- Positive Tinel's test

Whiteside, JA et al. *Elbow Injuries in Young Baseball Players*. Phys Sportsmed. 1999:27(6)

Little League Elbow

Diagnostic Tests

Radiographs

- Depend upon severity of symptoms
- Avulsion fracture of medial epicondyle
- Radiolucency
- Capitellum - osteochondritis from lateral compartment loading
- +/- Loose bodies

MRI

Bone Scan

CT

Little League Elbow

Treatment

- Stop throwing
- "Real" Rest!!!
- Ice
- NSAIDs
- Stretching
- Strengthening
- Surgery if epiphysis is avulsed

Little League Elbow: Prevention

Limit type of pitches

Lyman et al:
Prospective cohort
476 male pitchers, ages 9-14
Slider has 86 % increased risk elbow pain

Limit number of pitches

Iwase T et al:
Prospective cohort
153 male pitchers, ages 11-13
Incidence of elbow pain increases with increasing number of pitches thrown

Lyman S et al. *Effect of Pitch, Type, Pitch Count and Pitching Mechanics on Risk of Elbow and Shoulder pain in Youth Baseball Pitchers*. Am J Sports Med. 30(4):463-8.2002
Iwase T et al. *Baseball Elbow of Young Players*. Tokushima J Esp Med. 1985(2)57-64
http://www.asmi.org/asmiweb/youthpitchcounts.htm- CURRENT LITTLE LEAGUE PITCH RULES

Rotator Cuff Injuries

Mechanism: Repetitive overhead activities leading to strains, tendinitis, tendinosis, and even degenerative tearing

Fraying of tissues
Impingement
Typically supraspinatus, infraspinatus
Baseball, tennis, volleyball, swimming

Rotator Cuff Injuries

Symptoms

- Pain related to activity, especially overhead activity
- Pain not well localized
- Pain often referred to lateral aspect of upper arm
- Progression of symptoms to pain at rest
- Weakness
- Decreased range of motion (due to pain, passive motion intact)

Rotator Cuff Injuries

Physical exam

- Point tenderness
  - greater tuberosity
  - lesser tuberosity
- Manual muscle testing
  - weakness
  - reproduce symptoms
- Impingement sign
- Impingement test

Rotator Cuff Injuries

Diagnosis

- Plain X-Ray
  - High Riding Humeral Head
  - Greater Tuberosity cystic change
- MRI
  - Full thickness tear: 100% sensitivity, 95% specificity
  - Partial thickness tear: 82% sensitivity, 85% specificity

Iannotti, JP et al. *Magnetic resonance imaging of the shoulder: sensitivity, specificity and predictive value*. J Bone Joint Surg (Am). 1991:73(1):17-29

Rotator Cuff Injuries

Treatment

- "Relative rest"
- RICE
- NSAIDs
- Physical therapy/strengthening
- Sport specific adaptations (e.g. swim stroke, throwing)
- Corticosteroid injections

Swimmer's shoulder

73% college swimmers with current shoulder pain or history of

Average 5,000-10,000 meters per day (75-90 % freestyle)

Increased risk of injury with butterfly

McMaster, WC and Troup, J. *A surey of interferring shoulder pain in US competitive swimmers* Am J Sports Med 1993:21(1):67-70.

Greipp JF. *Swimmer's shoulder: the influence of flexibility and strength training*. Phys Sportsmed. 1985:13(8):92-105.

Swimmer's shoulder

Risk factors

- Pulling too far to midline (underwater)
- Breathing to one side only
- Shoulder laxity
- Muscle imbalance
- Decreased flexibility

Treatment

- Same as general rotator cuff disorders
- Stroke variety
- General strengthening

Iliotibial Band Syndrome

Incidence: 12 % running overuse injuries

Mechanism: Friction as ITB slides over lateral femoral condyle

Maximum friction immediately after foot strike

(knee flexed to 30 degrees)

Iliotibial Band Syndrome

Risk Factors

- Inexperienced runners
- Track running
- Weak knee flexion/extension
- Hip adductor weakness
- Excess pronation: Controversial
  - *James SL vs. Barber FA et al*

James SL. *Running Injuries to the Knee*. J Am Acad Orthop Surg. 1995:3(6):309-18
Barber FA et al. *Iliotibial Band Syndrome*. Sports Med. 199214(2):144-8

Iliotibial Band Syndrome

History/Presentation

- Sharp, burning pain along lateral aspect of leg/knee
- Symptoms start after certain time/distance
- Chronic: pain at rest, especially walking up stairs

Physical exam

- Tenderness over distal ITB
- Ober's test

Iliotibial Band Syndrome

Acute Treatment

- Ice
- Activity modification
- NSAIDs

Subacute Treatment

- Stretching
- Strengthening
  - iliopsoas
  - gastrocnemius/soleus
  - rectus femoris
- Gradual return to activity

Patellofemoral Pain Syndrome

AKA

- Runner's knee
- Chondromalacia patellae
- Patellar subluxation
- Quadriceps insufficiency
- Patellar compression syndrome

Presentation

- Anterior knee pain
- Activity related increase in pain
- Increased pain after hills, stairs
- Positive theater sign

Patellofemoral Pain Syndrome

Physical Exam

- Hip exam
- Q angle
- General alignment/symmetry
- Squat/stand
- Hindfoot pronation
- Tubercule sulcus angle
- Patellar tracking
- Flexibility
- Range of motion

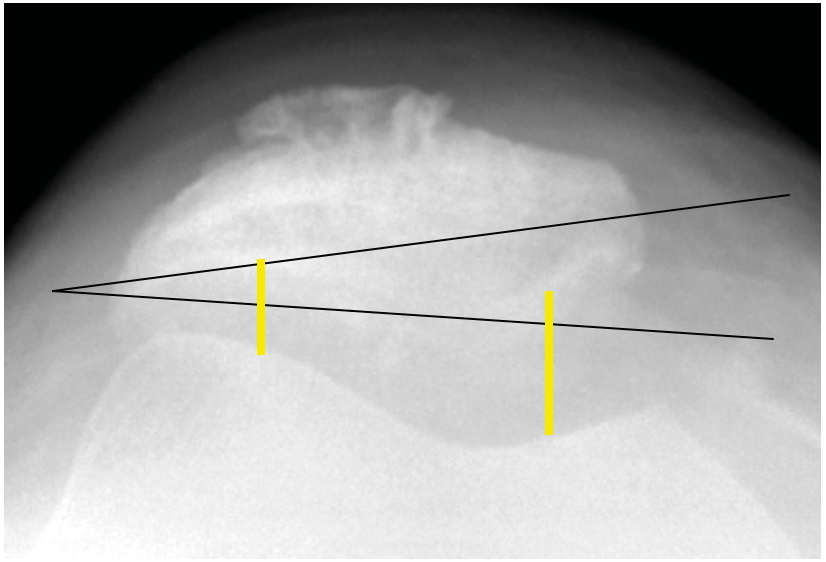
Patellofemoral Pain Syndrome

Diagnosis

- Clinical
- Merchant's view
- Patellar tilt

Treatment

- Quadriceps strengthening
- Taping
- Orthotics
- NSAIDs



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Osgood-Schlatter Disease

Traction apophysitis due to chronic avulsion of patellar tendon at distal insertion on tibial tuberosity

Common after growth spurt
Bilateral in 20-30 % patients
Incidence: 21 % athletes, 4.5 % general population

Kujola UM et al. *Osgood Schlatter's disease in adolescent athletes: retrospective study of incidence and duration*. Am J Sports Med. 1985:13(3):226-241.
Mital MA et al. *The so-called unresolved Osgood Schlatter's lesion*. J Bone Joint Surg. 1980:62A:732-740.

Osgood-Schlatter Disease

Physical exam

- Pain and edema over proximal tibia
- Hypersensitivity over tibial tuberosity
- Tenderness to palpation
- Increased prominence of tibial tuberosity
- Pain with resisted extension

Diagnosis

- Clinical
- Plain X-rays
- MRI

Osgood-Schlatter Disease

Treatment

- Rest
- Hamstring stretching
- Quadriceps strengthening
- (rarely) Removal of ossicle

Sinding Larsen Johansson

Inflamatory reaction of the patellar tendon origin
Caused by repetitive stress
Age = 10-14
Boy > girls
Painful, swollen inferior patella
Worse with activity, improves with rest

Plantar Fasciitis

Incidence

- 10 % runners
- Basketball, tennis, soccer, gymnastics

Risk Factors

- Improper footwear
- Excess pronation
- Decreased strength/flexibility
- Uneven surfaces
- Rapid increase in training

Plantar Fasciitis

Presentation

- Pain at insertion site on calcaneus or along medial border
- Heel pain with foot strike often worse upon waking, resolves with activity

Physical exam

- Rule out Achilles pathology (70 % patients with unilateral symptoms have tight heel cord)
- Tender to palpation
- Reproducible pain with dorsiflexion/standing on toes

Plantar Fasciitis

Treatment

- Stretch
- NSAIDs
- Taping/orthotics
- Night splints- bracing: controversial
- Corticosteroids of little benefit
- Orthopedic referral for chronic cases

Batt ME et al *Plantar Fasciitis: a prospective random clinical trial of the tension night splint.* Clin J Sports Med. 1996:6(3):158-162

Probe RA. *Night Splint Treatment for Plantar Fasciitis*. Clin Orthop. 1999:368(Nov)190-5

Crawford F et al. *Steroid Injection for heel pain*. Rheumatology (Oxford) 1999:38(10):974-77

Exertional Compartment Syndrome

Presentation
- Pain free at rest
- Pain in calf muscles during activity
- Predictable onset of pain
  - i.e. mileage or time
- Tense muscle compartments after exercise
- Paresthesias fit nerve distribution of compartment affected
  (e.g. deep peroneal n.- anterior compartment;
  posterior tibial n.-deep posterior compartment)
- Normal neurological exam at rest

Diagnosis
- Compartment Pressure Testing pre/post exercise

Treatment
- Fasciotomy

Medial Tibial Stress Syndrome

AKA Shin splints

3 Theories

- Soleus fascial inflammation at insertion on posterior medial tibia
- Periosteum inflammation under tibialis posterior
- Periosteal mediated chronic bone remodeling

Incidence

- 10-15 % all running injuries
- 60 % all exercise related leg pain

Clanton D et al. *Chronic Leg Pain in the Athlete*. Clin Sports Med. 1994:13(4):743-59

Medial Tibial Stress Syndrome

Presentation

- Dull pain in middle/distal 1/3 tibia
- Pain at beginning of activity, decreases during activity, alleviated by rest (initially)
- Tenderness over entire distal posteromedial border of tibia
- No neurovascular deficits

Treatment

- Strengthening
- Taping
- Change surfaces
- Heat before activity, ice after

STRESS FRACTURES

Repetitive Stress

Microfractures

Complete Fracture

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Significance of Stress Fractures

Common problem

Delay in diagnosis (months)

Misdiagnosis (bursitis, tendinitis, etc)

High risk stress fractures untreated or with delayed diagnosis have poor outcomes

Stress Fractures-Risk Factors

Abnormal lower limb alignment
Leg length discrepancies
Conditioning, Muscle fatigue
Eating disorders
Training surface
Footwear
Biomechanics

Low bone mineral density
Calcium and Vitamin D deficiency
Metabolic bone disease
Hormone deficiency (amenorrhea)
Nutrition- low BMI, caloric deficiency
Collagen abnormalities
Vascular supply (location in bone)

*Training errors (increase intensity or mileage >10% per week, no rest periods)

*22% of stress fx from training errors. Matheson et al 1987 AJSM
**Stress fx patients unconditioned-both ♂ and ♀. Beck et al 2000 Bone.

Stress Fractures

Incidence

- 21 % runners
- 1.9 % all sports
- 31 % military recruits

Presentation/Physical Exam

- Gradual onset of well localized pain
- Pain with activity
- Pain at rest with advanced cases
- Tuning fork test
- Any bone can be affected

Bennell KL et al. *The Incidence and Distribution of Stress Fractures in Competitive Track and Field* Athletes. Am J Sports Med. 1996:24(2):211-7

Goldberg B. *Stress Fractures: a risk of increased training in* Freshmen. Phys Sportsmed. 1994:22(3): 68-78.

Milgron C et al. *Stress fractures in military* recruits. J Bone Joint Surg (Br). 1985:67(5):732-5.

Stress Fractures

Diagnosis

- Plain x-rays
- Bone Scan/MRI

Treatment

- REST for 6-12 weeks (depends on location and severity)
- Splinting/crutches if limping or high risk area
- Ultrasound stimulation or bone stimulator
- Non-weight bearing exercise only (swimming)

Sullivan D et al. *Stress fractures in 51 runners*. Clin Orthop. 1984:187(Jul-Aug)188-192

Case: 17 yo F Thigh Pain in a High School Lacrosse Player

No trauma

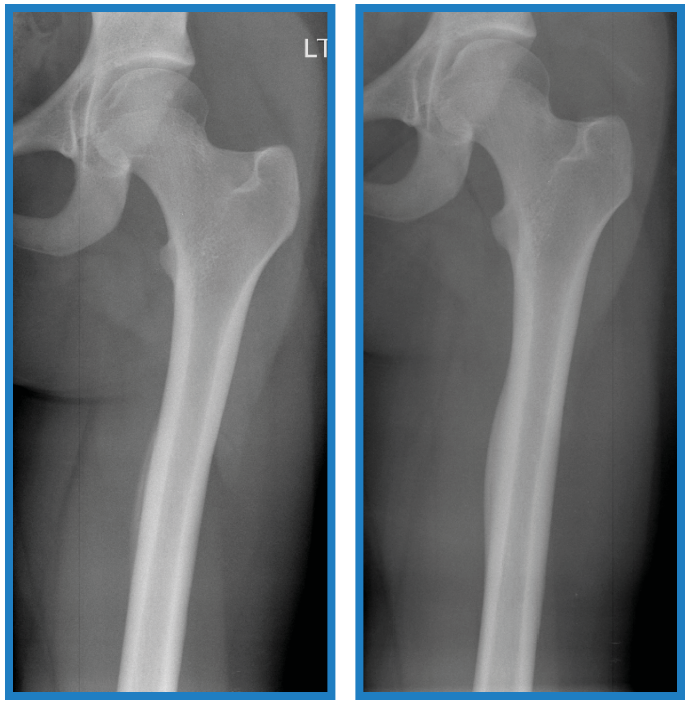
Limping

?Differential diagnosis

'thigh contusion'

'muscle strain'

Periosteal elevation=stress fracture



Initial film Follow-up

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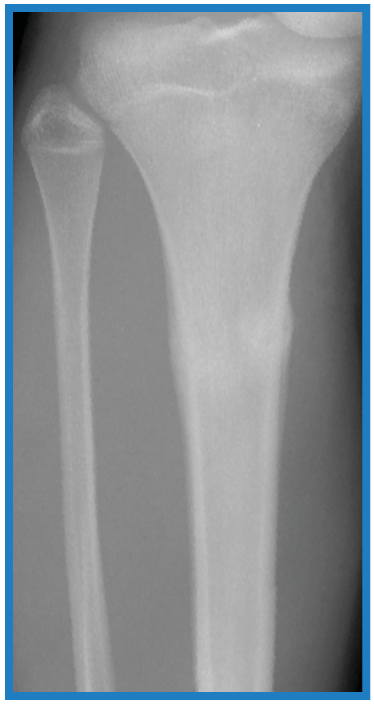
14 y.o. runner with leg pain
Periosteal elevation=stress fracture



Initial films MRI Followup xray

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Case: 18 yo F Anterior Tibial Pain in a Ballet Dancer

Unable to leap, jump, run

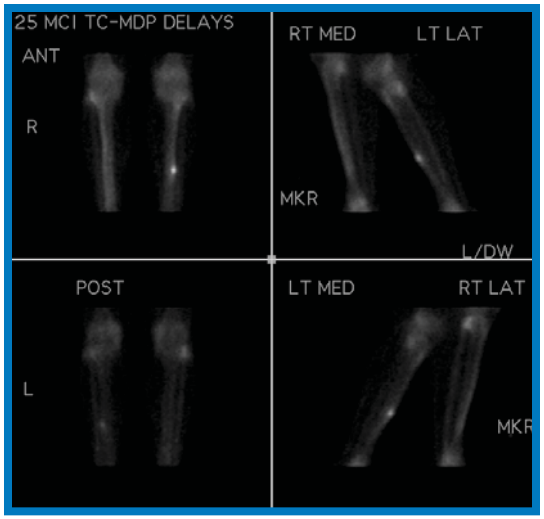
Pain with walking

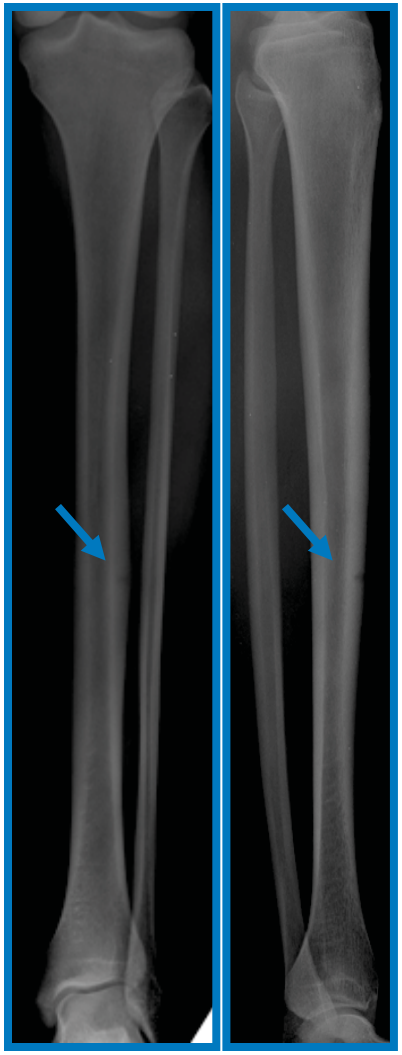
? ‘shin splints’

Anterior cortex black line =stress fracture

Confirmed on bone scan

These have a high risk of nonunion





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Case: 33 yo F Acute Medial Knee Pop and Pain in Runner

Difficulty walking-limps

Pain medially w/

palpation @ 'pes bursa'

Xrays in the ER 'negative'

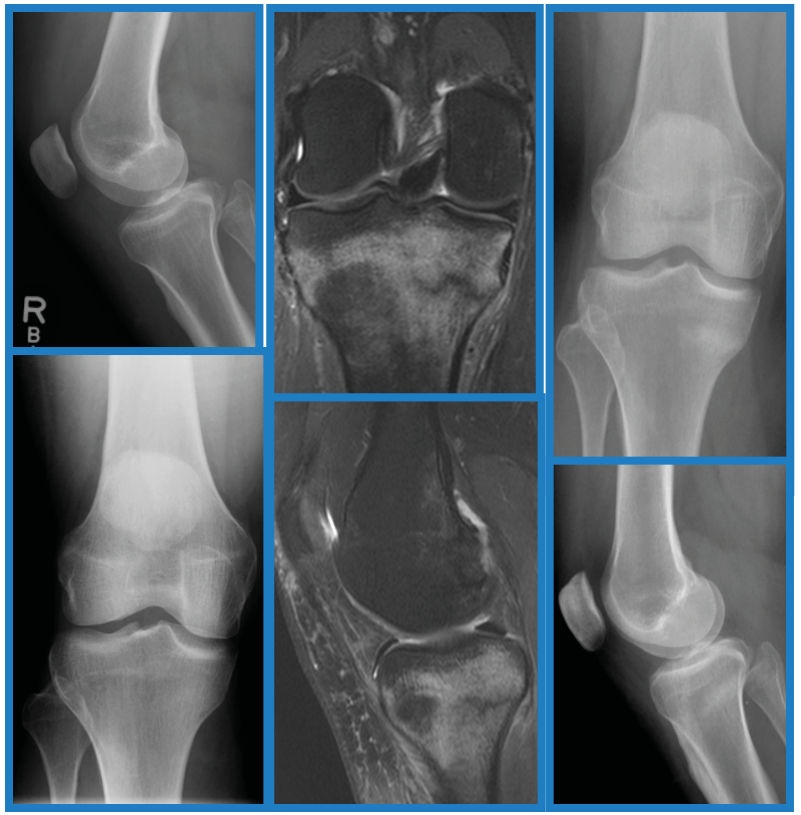
?Differential diagnosis

MCL sprain

Pes anserine bursitis

Sports clinic MRI and followup

xray show the stress fracture



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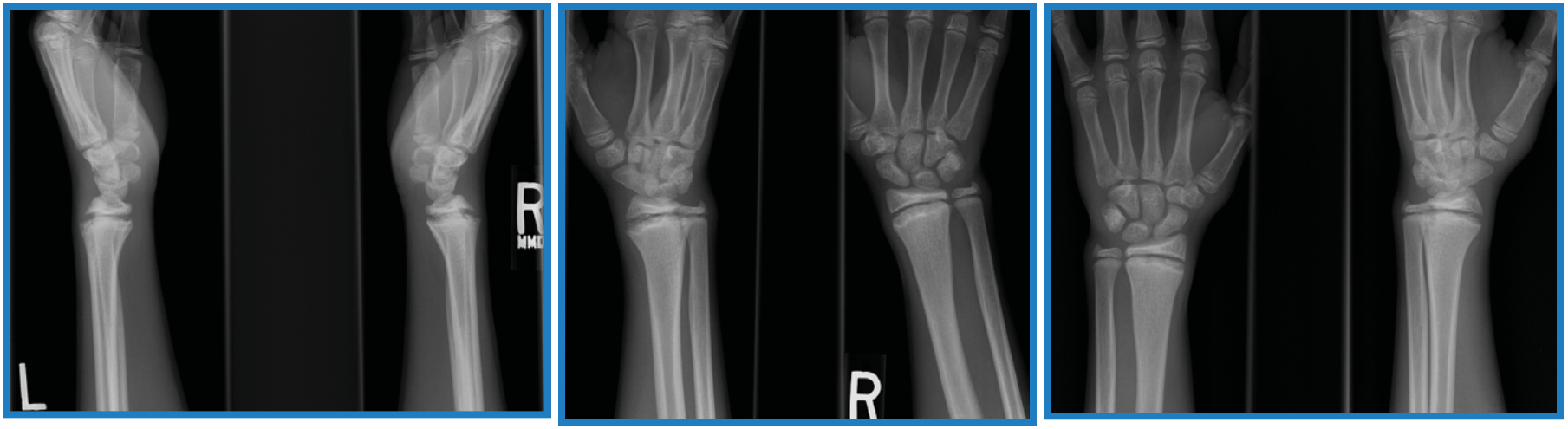
Case: 12 yo F Bilateral wrist pain and swelling in a gymnast x 1 week

Dx: chronic bilateral distal radial physis stress fracture with sclerosis and widening



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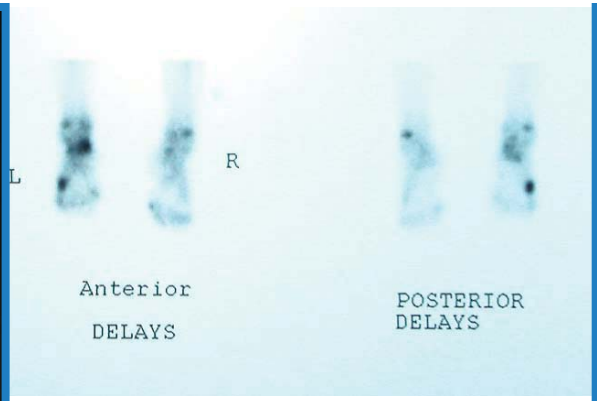
Case: R foot pain at 5th metatarsal in a Division I College Basketball Player

Stress fracture became completed fracture



Initial radiograph

Bone scan

Followup xray

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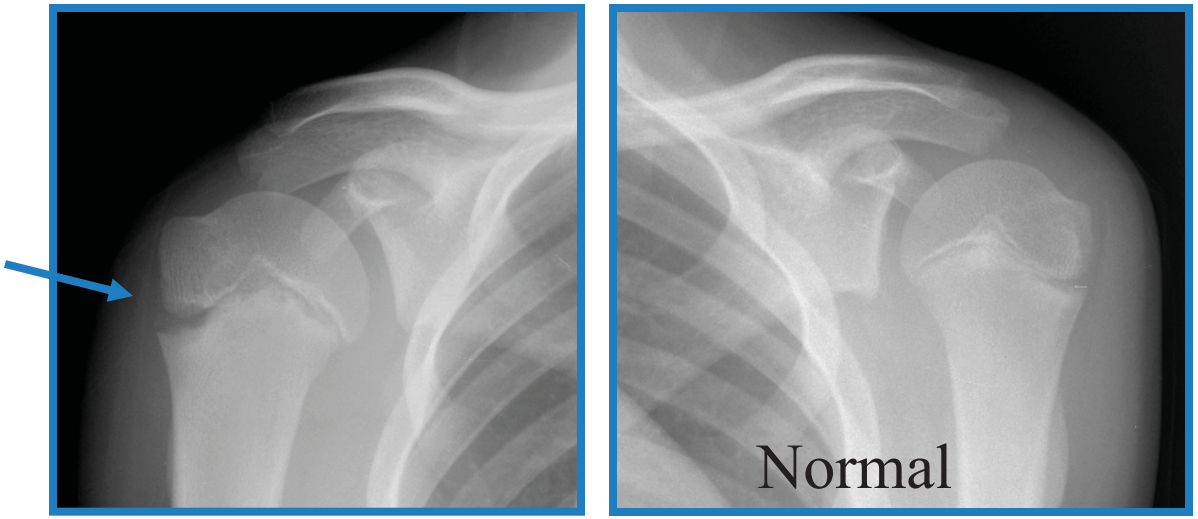
Case: 13 yo M RH baseball player w/ R shoulder pain

Stress fracture/ epiphysitis- widening, fragmentation
Proximal physis=80% of humeral growth
*Clinical diagnosis-radiographs can be normal



» 'Little Leaguer's Shoulder'

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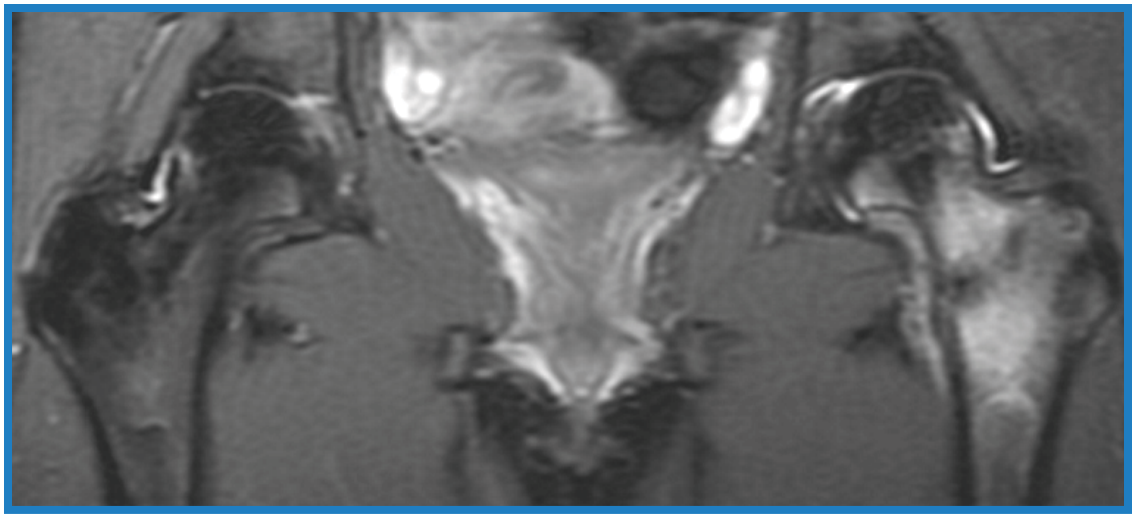
Case: 19 yo F L Groin Pain in a Division I College Basketball Player

PE: groin pain with internal/external rotation

Xray ‘negative’

?Differential diagnosis: ‘hip flexor tendinitis’; ‘groin strain’



Left intertrochanteric stress fracture

Johansson et al. Stress fractures of the femoral neck in athletes: The consequence of a delay in diagnosis. *Am J Sports Med 1990; 18:524-528*

Average diagnostic delay of 14 weeks

Displacement: the main determinant of outcome
60% w/ displaced fx *appropriately* treated were unable to return to preinjury activity level

30% incidence of avascular necrosis

*Tension vs Compression Side -> tension side has higher rate of fracture completion
Suspected stress fracture in this location requires MRI in the E.D.

Take Home Points

All athletes need periods of rest for the body and tissues to recover

Stress Fractures:

- address volume and intensity of training
- address biomechanics
- adequate caloric intake

Overuse Soft Tissue Injuries:

- reduce repetition
- correct biomechanics- strength, posture