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_

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

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

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

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

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/PRICEMMM
- “Relative rest”
- NSAIDs
- Ultrasound
- Tennis elbow forearm band
- Corticosteroid injections
- Volar splint
- Rehabilitation
- Operative intervention

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

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 of 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

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

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
Greipp JF. Swimmer’s shoulder: the influence of flexibility and strength training.
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

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**

<table>
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<tr>
<th>Hip exam</th>
<th>Hindfoot pronation</th>
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<td>Tubercule sulcus angle</td>
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<td>Patellar tracking</td>
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<td>Flexibility</td>
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<td>Range of motion</td>
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Patellofemoral Pain Syndrome

Diagnosis

Clinical
Merchant’s view
Patellar tilt

Treatment
Quadriceps strengthening
Taping
Orthotics
NSAIDs
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

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

Inflammatory 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

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

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
Repetitive Stress

\[ \downarrow \]

Microfractures

\[ \downarrow \]

Complete Fracture

\[ \text{STRESS FRACTURES} \]
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
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)

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

American College of Emergency Physicians
ADVANCING EMERGENCY CARE

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

Initial films  MRI  Followup xray
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
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
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
Case: R foot pain at 5th metatarsal in a Division I College Basketball Player
Stress fracture became completed fracture
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'
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

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