

Maui 2011
 Current Concepts in
 Emergency Care

Pediatric Sport Trauma

Dr. Jim Kyle, FACSM
 Director ED, Beckley ARH Hospital, WV
 Associate Clinical Professor
 Marshall University School of Medicine

Sports Medicine in the ED

- **Hand and Wrist**
 Mallet finger
 Coach's finger
 Skiers thumb
 Scaphoid Fx
 TFCC injury
- **Elbow and Shoulder**
 Tennis elbow
 Radial head Fx
 Rotator cuff strain
 Impingement syndrome
 A-C separation
- **Low Back, Pelvis, Hip**
 Spondylolysis
 Apophyseal Avulsions
 Femoral neck Stress Fx
 SCFE
- **Knee Injuries**
 Meniscal Tears
 Anterior Cruciate Ligament
 Medial Collateral Ligament
 Adolescent knee
- **Ankle Injuries**
 Lateral sprain
 Deltoid sprain
 High-Ankle sprain
 Jones Fx
- **Head, Lung, and Heart**
 Concussion
 Exercise Induced Asthma
 Cardiac Concussion
 HCM

Pediatric Sport Injury

- Apophyseal Injuries ED Diagnosis
- Adolescent Knee Pain Review
- Concussion – new return to play guidelines
- Cardiac Concussion Update
- Exercise Induced Asthma awareness

Osgood Schlatter' s Disease

- Most common Apopyseal injury
- Partial avulsion of tibial tubercle

Osgood Schlatter' s Disease

- Most common Apopyseal injury
- Partial avulsion of tibial tubercle

Osgood Schlatter' s Disease



Osgood Schlatter's Disease



Osgood Schlatter's Disease

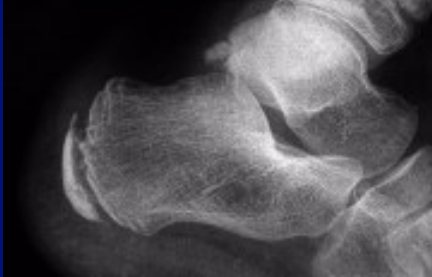


Severs Disease

- Heel pain, usually unilateral
- Recent growth spurt
- Tip toes, Squeeze Test



Foot Fracture Imposters



Commonly Missed Sports Fractures

10

Foot Fracture Imposters



Commonly Missed Sports Fractures

11

Severs Disease

- Treatment with heel cups and Calf, Achilles flexibility



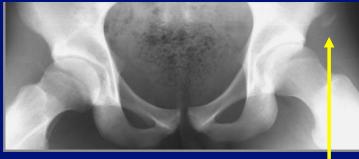
Case Study: Football Hip Injury

- A 14 yo football player is transferred from the local high school by EMS for a suspected left hip fracture. The injury occurred running the football on a left sided sweep when he planted his left foot to turn downfield.
- Athlete reports that he had sudden onset of left hip pain as he fell to the ground without direct contact. He was unable to stand, had severe pain and was transported to the ED on a backboard.

Adolescent Hip Injury

Hip Examination:

- * No pain with passive ROM
- * Pain with resisted hip flexion
- * Point tender over anterior pelvis

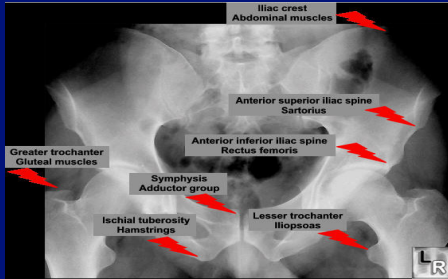


ASIS Apophyseal Avulsion

- ASIS avulsion with sartorius muscle (hip flexor) injury
- Treatment: Limited crutch walking with early range of motion. Return < 1 month.



Pelvic Region Apophyseal Injury

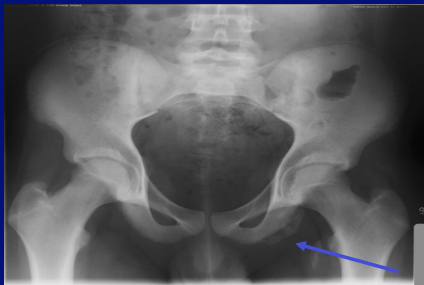


Hip Apophyseal Avulsion

- Other Hip apophyseal injury sites in order of frequency: Ischial tuberosity, iliac crest, lesser trochanter.



Ischial Tuberosity Avulsion



Iliac Crest Avulsion



Lesser Trochanter Avulsion



Adolescent Knee

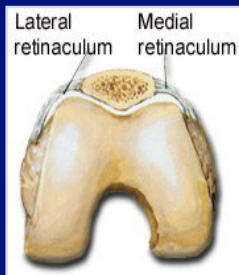
- Osgood Schlatter' s Disease
- Patello-Femoral Dysfunction
- JOCD
- SLJ

Patello-Femoral Pain

Extensor Mechanism Injuries:

- Patello-Femoral Dysfunction
- Patellar tendinitis
- Pre-patellar bursitis
- Chondromalacia
- Distal quadriceps strain
- Patella dislocation / subluxation

Patello-Femoral Anatomy



“The Terrible Triad”

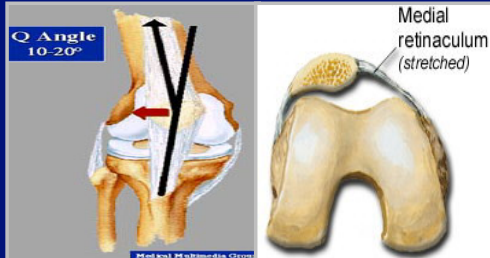
Female Patella Pain

- Wide Pelvis
- Genu valgum
- Flat Feet

Q angle > 15 %



Patello-Femoral Subluxation

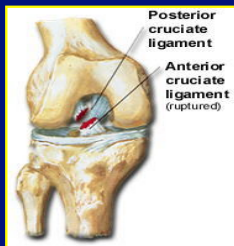


Anterior Cruciate Ligament Mechanism of Injury



Non-contact ACL

- 2-8 X incidence compared to men
- Epidemic soccer, basketball
- Sudden stop with audible pop and hemarthrosis



Female Athlete ACL Prevention



ACL Prevention Female Soccer Training Program

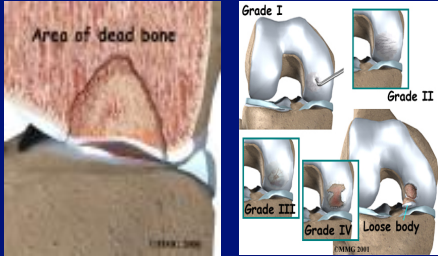
Mandelbaum, B.E. Garrett W. et al. *The American Journal of Sports Medicine*: 2005

- 1885 female soccer players (age 14-18) received a sports-specific neuromuscular and proprioceptive training program
- 2 year study (control group N =3818)
- Result: 2000 season - 85% reduction
2001 season - 74% reduction

JOCD

- Osteochondritis of Medial Femoral Condyle
- Typically sub-acute presentation with recurrent pain and swelling
- Notch X-ray best

JOCD



Subtle Knee Radiographs



Commonly Missed Sports Fractures

32

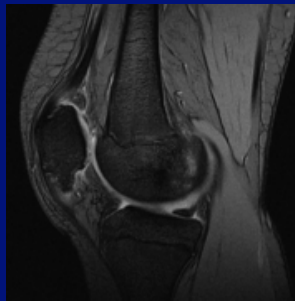
SLJ

- Osteochondritis of inferior pole of Patella
- Clinical Dx not Radiographic
- Unlike OSD, difficult to treat with early RTP

SLJ



SLJ

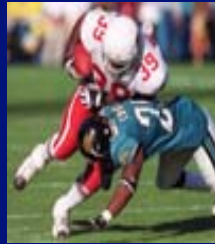


Sports Medicine in the ED

- **Hand and Wrist**
 - Mallet finger
 - Coach's finger
 - Skiers thumb
 - Scaphoid Fx
 - TFCC injury
- **Elbow and Shoulder**
 - Tennis elbow
 - Radial head Fx
 - Rotator cuff strain
 - Impingement syndrome
 - A-C separation
- **Low Back, Pelvis, Hip**
 - Spondylolysis
 - Apophyseal Avulsions
 - Femoral neck Stress Fx
 - SCFE
- **Knee Injuries**
 - Meniscal Tears
 - Anterior Cruciate Ligament
 - Medial Collateral Ligament
 - Adolescent knee
- **Ankle Injuries**
 - Lateral sprain
 - Deltoid sprain
 - High-Ankle sprain
 - Jones Fx
- **Head, Lung , and Heart**
 - Concussion
 - Exercise Induced Asthma
 - Cardiac Concussion
 - HCM

Case Study: 2000 Head Injury

- A 14yo junior high football player arrives in the ED on a backboard with a history brief loss of consciousness
- Paramedics covering the game report the athlete was injured making a tackle with his head.



Adolescent Concussion

- Parents report this is his first head injury, team captain
- Complains of mild headache and dizzy at the field
- CT head and C-spine series negative
- Romberg test positive
- Coaching staff in waiting room ask when he can return to practice

? Grade on Concussion

- 1st Degree
- 2nd Degree
- 3rd Degree



Concussion Grading

ACSM
(Cantu-1985)

➤ 1st Degree

➤ 2nd Degree

➤ 3rd Degree

2nd Degree

- LOC less than 5 minutes
- Post traumatic amnesia > 30 minutes

Concussion Grading

AAN (1997 - American
Academy Neurology)

➤ 1st Degree

➤ 2nd Degree

➤ 3rd Degree

2nd Degree

- Concussion symptoms > 15 minutes

3rd Degree

- LOC of any duration

Concussion ED Management

- Management of first concussion historically based on Grade: 1st, 2nd or 3rd degree
- **3 grading guidelines:** ACSM, Colorado Medical Society, AAN
- Early RTP risk Second Impact Syndrome
- Return for multiple concussion: Neurology consultation

Return to Play Guidelines

- ACSM 2nd degree: miss one game
- Colorado 2nd degree: miss two games
- AAN 3rd degree: miss two games



2005
PARADIGM SHIFT

Return to Play Guidelines



ED discharge instructions:

- Physician follow-up in 72 hrs for repeat exam
- No date for return to contact
- Sports medicine team should provide protocol for gradual return to activity

International Symposia on Concussion in Sport

- First ISC **Vienna** 2001
- Second ISC **Prague** 2005
Simple vs Complex, SCAT2 sideline tool
- Third ISC **Zurich** 2008
Removed Simple vs Complex grading, RTP based on progression

FIFA, IOC, IIHA

**“Sudden Death in Young Athletes”
Maron NEJM 2003,**

Causes of Sudden Death in 387 Young Athletes

- 1. Hypertrophic Cardiomyopathy – 34 %
- 2. Commotio Cordis – 20%
- 3. Coronary-artery Anomalies – 14%

**Little League Baseball
Sudden Death**

- A 12 yo player was struck in the chest by the baseball thrown from home plate as he attempted to steal third base. Shortly after standing he collapsed with seizure like activity and stopped breathing.

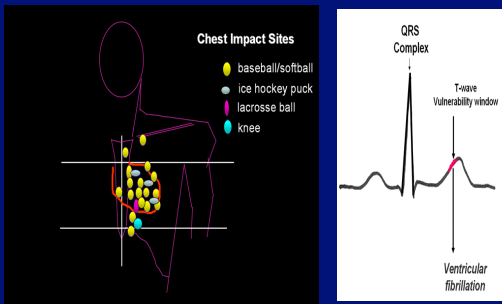
**Little League Baseball
Sudden Death**

- The coach initiated CPR and local EMS documented arrival of an ACLS team 8 minutes after receiving the call from the field. Attempts to resuscitate were unsuccessful.

Cardiac Concussion

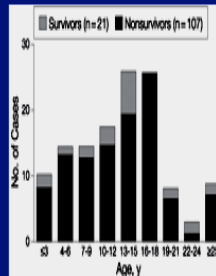
- Commotio Cordis - sudden death during sports play after a blunt blow to the chest [Maron, NEJM, 1995](#)
- 25 case 1977-95, Average Age = 11 (3-19) 18 playing baseball or softball, “**Little League Sudden Death**” 24 male
- Vulnerable window 15-30 msec prior to peak of T wave inducing V- Fib [Link, NEJM, 1998](#)

Sudden Death: Commotio Cordis



Commotio Cordis Update

- Cardiac Concussion most common in youth and adolescent athletes
- 2001 update - 128 cases 84% cases fatal
- Early defibrillation with on site AED only effective treatment
- AED documented in 41 cases, 19 survived = 46%



Public School AED Program

- 1999: Planning for Scholastic Cardiac Emergencies, *WV Med Jour*. **The Ripley Project**
- 2000: Milwaukee City school after 4 case SCA **Project ADAM**
- 2001: Long Island schools lacrosse focus **Acompora Foundation** (www.la12.org)
- 2007: 91% College, 35% High School with AED



Commotio Cordis Update

- Cardiac Concussion most common in youth and adolescent athletes
- 2001 update - 128 cases 84% cases fatal Documented cases also in softball (14), hockey (10), and lacrosse (5)
- Early defibrillation with on site AED only effective treatment

Public School AED Program

- 2000: Milwaukee City school after 4 case SCA **Project ADAM**
- 2001: Long Island schools lacrosse focus **Acompora Foundation** (www.la12.org)
- 2002: Pa. State wide mandate



Sports Medicine in the ED

- **Hand and Wrist**
 - Mallet finger
 - Coach's finger
 - Skiers thumb
 - Scaphoid Fx
 - TFCC injury
- **Elbow and Shoulder**
 - Tennis elbow
 - Radial head Fx
 - Rotator cuff strain
 - Impingement syndrome
 - A-C separation
- **Low Back, Pelvis, Hip**
 - Spondylolysis
 - Apophyseal Avulsions
 - Femoral neck Stress Fx
 - SCFE
- **Knee Injuries**
 - Meniscal Tears
 - Anterior Cruciate Ligament
 - Medial Collateral Ligament
 - Adolescent knee
- **Ankle Injuries**
 - Lateral sprain
 - Deltoid sprain
 - High-Ankle sprain
 - Jones Fx
- **Head, Lung, and Heart**
 - Concussion
 - Exercise Induced Asthma
 - Cardiac Concussion
 - HCM

Exercise Induced Bronchospasm

Symptoms include:

- Shortness of breath
- Chest tightness without wheezing
- Chest pain
- Cough post exercise

Exercise Induced Bronchospasm

- "Hidden Syndrome" in adolescent with no history of asthma
- Elite Athlete initial report: 10% USA Olympic Team 1984, 1988: Voy, Med. Sci. Sports Exerc.
- Adolescent Athlete Prevalence: 15-20% with cough post exercise as predictor: Kyle, et al, Med. Sci. Sports Exerc. 1991

EIB: Definition

- Reactive airway response after strenuous exercise with mild to moderate bronchospasm
- Airflow reduction typically occurs 5-15 minutes post exercise
- Triggers: dry air, cold air, mouth breathing, pollutants

EIB: Athletes at Risk

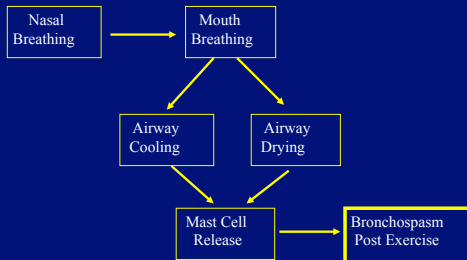
Pre Season Physical Examination

- Athletes with current asthma **80%**
- Environmental Allergies **40%** (allergy shots, antihistamine)
- Cough post exercise “*locker room coughing*” **85%**
- Adolescent Athletes **20%**

EIB Pathophysiology

- **Nasal Airway** effectively helps condition inhaled air with aveolar air moist, body temperature
- **Mouth Breathing:** Airway heat and water loss
- Cold, Hyperosmolar Air results in bronchial Mast Cell release of chemical mediators (histamine, leukotienes, prostaglandins)

EIB Pathophysiology



EIB Diagnosis

- Diagnosis made by medical history
- Exercise Challenge Testing
 - Treadmill
 - Free running
- Pulmonary Lab Provocative Test

EIB Diagnosis History

High Index of Suspicion for Athletes reporting:

- Prior or current inhaler use
- Unusual shortness of breath
- Chest tightness without wheezing
- Chest pain
- Cough post exercise

Exercise Challenge Test

Diagnosis:

10 - 15% reduction of
PEFR or FEV1 after
6 minutes treadmill
exercise at 85-90%
maximal heart rate



Exercise Challenge Test

Diagnosis:

10 - 15% reduction of
PEFR or FEV1 after
6 minutes treadmill
exercise at 85-90%
maximal heart rate



Exercise Challenge Test

Test Protocol

- Resting PEFR or FEV1
- 10% grade, 6 mph start
- 2 min PEFR
- 3 measurements at intervals for 20 mins
- Calculate maximal decrease from baseline (5-15 mins)



EIB Classification

- **Mild:** 10 – 15% reduction PEFR
- **Moderate:** 25 – 35% reduction PEFR
- **Severe:** > 35% reduction PEFR

- With Spirometer: 12% Reduction FEV1 or 20% reduction FEF 25-75

EIB Treatment

- Athlete Education
- Non-pharmacologic Treatment
- Drug Therapy
- Repeat Exercise Challenge Testing

EIB Treatment Athlete Education

- Initial component of effective treatment
- Initiate at the time of testing
- Emphasize that EIB is not the medical condition asthma or criterion for exclusion
- EIB is an exaggerated, reversible airway response to exercise

EIB TREATMENT

- Athlete Education
- Non-pharmacologic Treatment
- Drug Therapy
- Repeat Exercise Challenge Testing

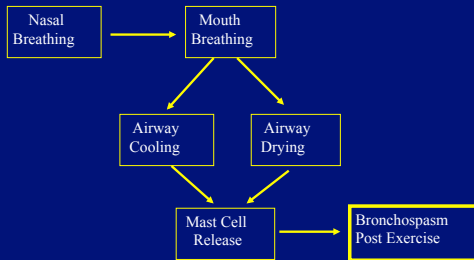
Non-pharmacologic Treatment

- Valuable option in mild, seasonable EIB
- Exercise prescription first step of management if low aerobic fitness
- Prolonged warm-up before event can decrease symptoms
- Refractory period after initial bout EIB with resistant to additional episodes

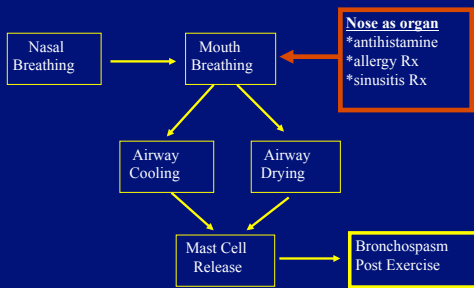
EIB TREATMENT

- Athlete Education
- Non-pharmacologic Treatment
- Drug Therapy
- Repeat Exercise Challenge Testing

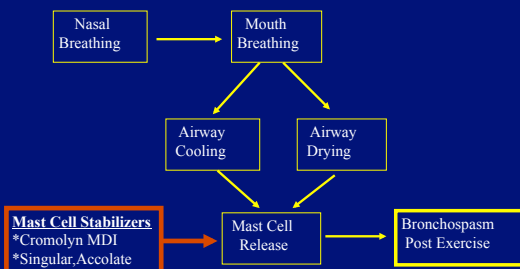
EIB Treatment Strategies



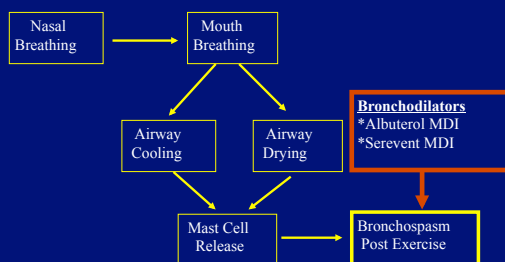
EIB Treatment Options



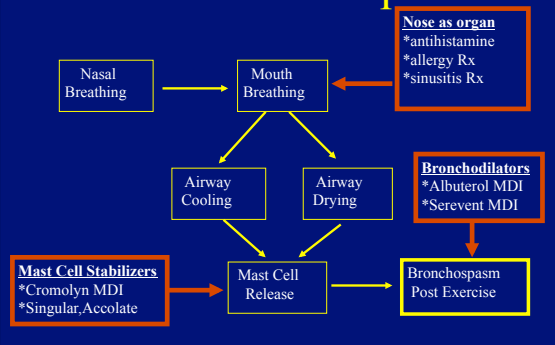
EIB Treatment Options



EIB Treatment Options



EIB Treatment Options



EIB: Drug Therapy

- Albuterol MDI: 2 puffs before exercise
- Cromolyn MDI: 2 puffs before exercise
- Antihistamine for allergic symptoms
- Combo Albuterol / Cromolyn for moderate to severe class
- Singular or Steroid MDI for in season asthma

EIB TREATMENT

- Athlete Education
- Non-pharmacologic Treatment
- Drug Therapy
- Repeat Exercise Challenge Testing

Repeat Exercise Challenge Test

- Promotes athlete understanding of EIB
- Provide documentation of effectiveness of current treatment
- Observe athlete inhaler use prior to test
- 50% or greater PEFr result with subjective improvement constitute successful Rx
- Persistent post exercise PEFr greater than 10% are candidates for additional interventions

EIB: Treatment Failure

- MDI misuse most common, add spacer
- Screen for aerobic fitness
- Consider combo Rx with Albuterol and Cromolyn
- Sinusitis treatment with antibiotics and/or nasal corticosteroids
- Consider use of refractory period

EIB: "The Hidden Syndrome"
Goals for Treatment

- Improve sport performance



EIB: "The Hidden Syndrome"
Goals for Treatment

- Enhance sport enjoyment



EIB: "The Hidden Syndrome"
Goals for Treatment

- Improve sport performance
- Enhance sport enjoyment
- Promote life long sport play



EIB Summary

- High index of suspicion for ED diagnosis
- Most athletes will deny a history of asthma
- Cough post exercise best predictor for positive exercise challenge test
- 90% can be successfully treated with pre exercise MDI
- Return to play usually safe
