Introduction

Many Causes of Hip Pain in the Pediatric / Adolescent Pt / Athlete

- Traumatic
- SCFE & Residuals
- LCP & Residuals
- Instability w/ & w/o DDH
- FAI
- Sepsis
- Tumor
  - Osteoid Osteoma
  - PVNS
- Toxic Synovitis
- Systemic Arthritis
  - JRA
- Other: Sickle, etc

Outline

- History
- Relative Prevalence
- Less Common Indications
- Focus on Indication & Outcomes
  - FAI
  - Instability

History of Ped Hip A/S

- Some of Earliest Reports of Clinical Use of Hip A/S Were Treatment of Adolescent & Pediatric Patients
- Minimally Invasive
  - Gross (1977): 2.2-mm A/S for Kids w/ DDH, LCP, SCFE, Post Sepsis, Neuropathic Subluxation (Orthop Rev)
  - Holgersson (1981): JRA (JPO)
  - Bowen (1986): A/S Chondroplasty of Unstable Lesions of FH in LCP (CORR)

Introduction

Many Causes of Hip Pain in the Pediatric / Adolescent Pt / Athlete

- Toxic Synovitis
- Sepsis
- DDH

My Practice

Of My Last 1,000 Hip Arthroscopies

- 10% Are Pediatric
- # 1 FAI (46%)  
  - 2 Instability (36%)
    - More Than Adults
  - # 3 Residuals of LCP or SCFE
  - # 4 Tumor – PVNS / Osteoid Osteoma
  - # 5 Sepsis Residuals
Hip Arthroscopy in Kids
- No Different Than in Adults
- Maybe Less Traction
- Young Kids – Smaller Space
- < 5 y/o May Not Need To Use Fracture Table
- Remember Version Change w/ Age
- Complication Rate Similar To Adults

Hip A/S in Kids: Outcomes
- Results of Hip A/S
- Various Hip Pathologies
- 42 Adolescent Pts
- 28 F (67%); 14 M (33%)
- 15.2 y/o (5.9 – 18.9)
- mHHS 57.6 → 89.2 For Isolated Labral Tears

Osteoid Osteoma
- Rarely Need To Do w/ Arthroscope
- Usually Image Guided RF Ablation
- Allows For Tissue Diagnosis
- 1st A/S Rx in 2001

PVNS
- Most of My Patients w/ Hip PVNS
- 20 – 40 years of Age
- 17 y/o w/ FAI

Trauma
- Subluxation
- 18 y/o Tennis Player
- Stopping Short After Trying for a Low Volley

Trauma
- Subluxation
- 18 y/o Tennis Player
- Stopping Short After Trying for a Low Volley
Trauma

- Subluxation
- 26 y/o Field Hockey Player
- Stopping Short To Change Direction

Indications
- Hip Pain Following Trauma
- MRI
  - Effusion
  - Labral Tear
  - Femoral Head Injury
  - Ligamentum Teres Tear

Sepsis

- 1 of My 1st Hip Scope Cases – 1995
- 15 y/o w/ Bilateral Hip Pain & Fever x 3 wks
- Aspiration – “Pus”
- Partner On Call – Open Debridement Did Scope Washout

Comparative Study: A/S vs Arthrotomy

- Mean Duration Hospital Stay:
  - 6.4 days (4–9) Arthrotomy Group
  - 3.8 days (3–6) Arthroscopy Group [p=0.0001]

Clinical Results:
- Arthrotomy: 70% Excellent & 30% Good
- Arthroscopy: 90% Excellent & 10% Good

NSS (p = 0.852)
- Poor Results – Late Dx & Delayed Treatment
- Shorter Stay Due To Less Invasive w/ Arthroscopy

Sepsis - Kids

- Residual Of Sepsis
- Legg Calve Perthes
  - Not For Use in Children w/ Active LCP
**Legg Calve Perthes**

- Adolescents & Young Adults May Have Mechanical Signs & Symptoms Due to Sequelae of Earlier LCPD
- Residuals LCP Often Amenable to A/S
  - Labral Tears
  - Ligamentum Teres Tears
  - Loose Bodies
  - OCD
  - Chondral Flaps
  - Acetabular Overcoverage

- Bowen CORR 1986;
- Medlock Arthroscopy 1999;
- Kulko Arthroscopy 1999;
- Roy, JPO, 2005

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**Legg Calve Perthes**

- 15 y/o
- LCP @ 10 y/o
- FB, Track Wrestling
- Pain w/ WB

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**Legg Calve Perthes**

- 13 y/o
- LCP @ 8 y/o
- Troch Advance 12 y/o
- Plays Baseball
- Hip Pain w/ WB
- Mechanical Sx

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**SCFE**

- Many Think FAI is a Subclinical Slip
- Most Data Suggests That is Not The Case
- However Residuals of SCFE Long Have Been Known to Cause Symptomatic Impingement

- From Heyman, et al JBJS 1957
Residuals of SCFE

- 17 y/o Male
- FB Player
- SCFE
- Missed
- Progressed
- Pain
- Limited ROM

Most Common Indications

- Focus
  - Indications
  - Outcomes
- FAI
- Instability

FAI in Kids

- FAI
  - Cam, Pincer, Combined
  - AIIS
  - Already Spoke About Result of LCP & SCFE
- Instability
  - DDH
  - No DDH
  - Iatrogenic

Most Common Indications

- FAI
  - Cam, Pincer, Combined
  - AIIS
- Instability
- DDH
- No DDH
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Physis & Athletes

- Premature Degenerative Joint Disease in Athletes
  - Tilt Deformity
  - Physeal Study Showing Cam Lesions Occur At Physeis
  - 16/17 were Athletes
- Cam Deformity Only Seen in Kids w/ Closed Physeis Suggests Forces on Physeis May Be Causative Factor

FAI in Kids

- Cam Lesions Occur At Physeal Scar
- Cam Further From Physeis in Skeletally Mature vs Those w/ Lots Growth Remaining

Carter, et al, JPO, 2014

16 y/o Male Soccer Player Pre Op Surgery April 2015
**Prevalence**

**Athletic Population - Soccer**
- Elite Pre-Professional (12 – 19 y/o)
  - Alpha Angle > 60° AntSup Flattening; Prominence
- Higher vs Controls
- Continued FAI Growth w/ 2 yr f-u
- No Increased in Skeletally Mature
- Fewer Normal X-Rays at 2 yr f/u

Agricola, et al AJSM 2012

**Prevalence**

**Athletic Population - Ice Hockey**
- Youth Hockey vs Skiers
  - 4.5 x Higher Risk Alpha Angle vs Skier (79% vs 40%)
- Incr Alpha Angle w/ Incr Age Hockey
- No Change w/ Skiing

Philippon, et al AJSM 2013

**Prevalence**

**Athletic Population - Basketball**
- 10 x Greater Chance of Cam vs Control
- 89% Cam in Basketball
- Alteration in Growth Plate
  - (Not Reactive Bone)

Siebenrock, et al CORR 2011
Siebenrock, et al CORR 2013

**Athletes Over Time**

“...Cam Deformity Developed and Continued To Evolve Over Time in Adolescent Hips w/ An Open Growth Plate At Baseline.”
- Head Neck Offset:
  - Concave at 12 y/o
  - Flattened Around 14 y/o
  - Convexity Around 16 y/o

Agricola, et al; AJSM 2014

**Pincer Impingement**
- Etiology Unclear
- Commonly Occurs w/ Cam
- Can Be Isolated

**Subspinous Impingement**
- My Practice
- More Common in Soccer Players & Kicking Athletes
- Traction Phenomenon @ Rectus Origin

17 y/o Male Soccer Player
Subspinous Impingement

15 y/o Male Soccer Player – Residual of AIIS Avulsion

AIIS

- What Is Normal?
- What is Abnormal?
- 50 CT scans (100 AIIS)
- No Hip Pain
- 25 Males, 25 Females
- Age 21-40

AIIS – Defining Normal

Men
- Vertical Distance Between AIIS & Acet Rim
- 13.5 mm
- 4.6 - 21.4 mm

Women
- Vertical Distance Between & Acet Rim
- 11.4 mm
- 6 - 17.3 mm

AIIS – Imaging

- XR: Some Low Crossing Is Low AIIS
- 3D CT - Best

AIIS - Arthroscopy

- Ant-Lat Labral Damage (tear, bruising)

AIIS – Defining Normal

- 3 AIIS variants

Type I
- Flexion: 120
- IR: 21

Type II
- Flexion: 107
- IR: 11

Type III
- Flexion: 93
- IR: 8

Hetzroni et al CORR Aug 2013
**AIIS - Arthroscopy**

- Ant-Lat Labral Damage (tear, bruising)
- Adjacent Wave Sign

**Subspinous Impingement**

- Is More Common Than You Think
- The Impingement Occurs More Distally on Femur
- Hx / PE: Pain, ROM, Rectus Stretch
- Normal AIIS: 11.4 mm in F; 13.5 mm in M
- Type II & III – At or Distal to Acet Rim
- 3D CT Best To Evaluate
- A/S: Wave Sign, Close to Acet Rim, Tear at AIIS

**Indications for Surgery**

- Groin Pain
- Radiographic Anatomy of FAI
- Pain Relief w/ Anesthetic Injection
- MRA
- Intra-Operative Findings Consistent w/ Pathophysiology of FAI

**Outcomes of FAI in Kids**

- 16 pts w/ Mean Age 15 y/o (11-16 years)
- 2 Pts w/ Open Femoral Physis
- 4 Pts w/ Partially Closed Physis
- Minimum 1-year f/u
- Signif Improvements in Pain & Functional Outcome (HOS ADL & Sport & MHHS)
- MHHS Score Comparable w/ Adult Pts (90 vs 87)
Outcomes of FAI in Kids

- Cam Type FAI
- 34 Active Pts (41 Hips) Under 18 y/o
- 15.7 y/o (11 – 18)
- Follow Up 14 mos (1 – 2 years)
- mHHS 77 → 94
- NAHS 76 → 93
- 78% of Pts Able To Return to Full Sporting Ability

Tran, et al ANZ J Surg 2012

Outcomes of FAI in Kids

- Outcomes 2 – 5 yrs s/p Hip A/S for FAI
- 60 Pts (65 Hips) 11 - 16 y/o; 69% F
- Mean f/u 3.5 years
- Femoral Physis Open in 10% (6)
- Physis Partially Closed in 18% (11)
- Physis Closed in 72% (43)
- mHHS 57 → 91
- 8 Females: Revision A/S For Adhesions

Philippon et al Arthroscopy 2012

Outcomes of FAI in Kids

- 122 Consecutive Hips in 108 Adolescents (<18 y/o) w/ > 1 yr f/u
- Comparison: 122 patients 18-50 y/o
- F/u Avg 30 mo Both Groups (12-60 mos)
- Study Group: Avg Age 16 y/o (12-17 yr)
- 55 M; 67 Females
- Control Group: Avg Age = 36 y/o (18-50)
- 71 Males; 51 Females

Byrd et al, Presented AOSSM & AANA 2015

Outcomes of FAI in Kids

- Study Group: 4 Pts Underwent Repeat Hip Arthroscopy & 1 Underwent a PAO
- Control Group: 1 Pt w/ Repeat A/S
- Favorable Outcomes More Than Comparable to Adults & Higher Absolute Scores
- Concomitant EA Procedures & Revision More Common Among Adolescents

Byrd et al, Presented AOSSM & AANA 2015

FAI Resection in Kids

What About The Physis in Cam Resection?

- Since The Cam Is At The Physis
- Many Situations is Open
- No Reported Physeal Arrests / Growth Disturbances

Instability

- Ligamentously Lax
- MicrolInstability
- Associated w/ DDH
- Iatrogenic
  - Capsular Defect
  - Labral Insufficiency / Removal
- Kids Seem To Be More Loose Jointed Than Adults
**Diagnosing Hip Instability**

- Have a suspicion
- Confirm intra op

**History**

- No injury
- Diagnosed with
  - Ehler’s Danlos Syndrome
  - Benign Hypermobility Syndrome
  - Hip Dysplasia

**Sports That Require**

- Laxity
- Ballet
- Gymnastics
- Syncro Swimming
- Repetitive ER
- Golf

**History**

- May complain their hip comes out of joint
  - Usually think external snapping hip
  - Gymnast on high bar / uneven bars

**Radiographs**

**DDH**

- CE < 25 deg
- AP Pelvis
- Deficient Ant Wall
- High Tonnis Angle
  - Acetabular Index > 10 deg

**Radiographs**

**DDH**

- Lequensne
- ACE < 25 deg
Radiographs
- Cliff Sign

Radiographs
- Distal Sclerosis

MRI
Sekiya’s Criteria
- Wide Ant Hip Joint Recess (>5mm) Lateral to the ZO
- Thinning of Adjacent Joint Capsule (<3mm) Lateral to ZO

MRI
Capsular Defect s/p Open or A/S FAI Surgery

Intra Op
Traction
- Easy Distractibility
- Depends on Table
- Less Than 10 Turns for >8mm

Intra Op
Traction
- Not Fully Reducing After Traction Taken Off
**Intra Op**

**Arthroscopic Findings - Acetabulum**
- Labral Tear at L-C Junction @ 3 o'clock
- Inside Out Chondral Wear @ Acetabular Rim @ 3 o'clock
- Lateral Chondral Wear @ 12 o'clock

**Arthroscopic Findings - Femur**
- Chondral Damage Central Femoral Head

**Arthroscopic Findings - Capsular Defect**
- Chondral Damage Central Femoral Head
- Lig Teres Tear

**Management**

- **Thermal Capsulorrhaphy**
  - 12 pts
  - 6 mo f/u

Philippon, CSM 2004
**Management**

### Capsular Plication
- Borderline DDH
- 26 pts w/ 28 mo f/u
- Plication w/ Bony Resection in 41%
- Advancement & Closure of Iliofemoral Ligament

Domb et al, AJSM 2013

### Capsular Plication
- All Improved
  - 2 Revision Surgery
  - 2 instability
- ER 59° → 48°

Domb et al, AJSM 2013

**Capsular Plication - RICH**

### RICH Procedure
- 32 pts
- F/U 20 mo (12 – 46 mo)
- All Females, Age 27
- 35% - College or Pro
- Significant Improvement (@ final f/u)
  - mHHS: 67 → 97 (p < 0.001)
  - iHOT: 41 → 85 (p < 0.001)
- No Re-operation
- No Loss of Motion
- All Athletes Returned To Sports

**RICH**

No Difference In Outcomes with Mild – Borderline DDH
- CEA 18° – 25°
- Tonnis >10°

Or Labral Repair vs Partial Labrectomy

**Labral Defect**

- Labral Reconstruction
- If Labral Defect
  - Especially in
    - Lax Pts
    - Borderline DDH
Conclusion

- Hip Arthroscopy Is Safe & Effective
- Treat A Variety of Pathologies About The Hip In Young Athletes
- Outcomes & Complications Comparable To Adults