Hip Impingement Syndromes

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EOY Presentation
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Inspiration
Introduction

• Epidemiology:
  – 5-24% of athletic injuries
    • Pediatric >> adults
  – 5-9% of high school athlete injuries
  – 12% of football/soccer/hockey players
  – 70% yearly incidence in runners
Hips Are Bringing More Athletes to Their Knees

By MICHAEL S. SCHMIDT
Published: May 31, 2009

The quest to build ever more proficient athletes keeps hitting unexpected snags, and perhaps nowhere is this more vivid than in Major League Baseball. Several top players have been hampered by a hip ailment that was unheard of in the sport a decade ago.
Which Athletes?

- Repetitive twisting, kicking, turning
  - Ballet
  - Football, soccer, hockey
  - Basketball, tennis
  - Martial arts
  - Breaststroke swimmers

- Repetitive Impact
  - Runners
  - Track & field

- Supermarket Shoppers*
Supermarket hip: an unusual cause of injury to the hip joint.

Yamamoto Y¹, Villar RN, Papavasileiou A.

Abstract
Sporting activity can be a significant cause of injury to the hip joint, in particular tears of the acetabular labrum and, less commonly, tears of the ligamentum teres. Femoroacetabular impingement and acetabular dysplasia are also commonly associated with labral tears. However, shopping in a supermarket would not normally be regarded as an at-risk activity for the hip joint. Despite this, we report 3 separate cases of hip injury (2 labral tears, 1 partial avulsion of the ligamentum teres), each of which was sustained while shopping in a supermarket. None of the 3 patients involved had radiographic evidence of acetabular dysplasia or arthroscopic evidence of femoroacetabular impingement. All patients were successfully treated by arthroscopic surgery of the hip. We therefore suggest that shopping in a supermarket may need to be reclassified as an at-risk activity for the hip joint.
Under-recognized/diagnosed

• After workup, 30% of hip pain remains with no firm diagnosis pre-op

• Hip not recognized as the source of pain in upto 60% of pts presenting w hip pathology
<table>
<thead>
<tr>
<th>Orthopaedic Etiologies</th>
<th>Nonorthopaedic Etiologies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Muscle</strong></td>
<td><strong>Hemla</strong></td>
</tr>
<tr>
<td><em>Adductor strain/tendonitis</em></td>
<td><em>Inguinal hemla</em></td>
</tr>
<tr>
<td><em>Rectus femoris strain/tear</em></td>
<td><em>Femoral hemla</em></td>
</tr>
<tr>
<td><em>Illopoas strain/tear</em></td>
<td><em>Preperitoneal lipoma</em></td>
</tr>
<tr>
<td><em>Rectus abdominis strain/tear</em></td>
<td></td>
</tr>
<tr>
<td><em>Muscle contusion</em></td>
<td><em>Urologic</em></td>
</tr>
<tr>
<td><em>Gracils syndrome</em></td>
<td><em>Prostatitis</em></td>
</tr>
<tr>
<td><em>Athletic hernia</em></td>
<td><em>Epididymitis</em></td>
</tr>
<tr>
<td><strong>Bone/Joint</strong></td>
<td><em>Urethritis/UTI</em></td>
</tr>
<tr>
<td><em>Osteitis pubis</em></td>
<td><em>Testicular neoplasm</em></td>
</tr>
<tr>
<td><em>Degenerative joint disease: hip</em></td>
<td><em>Ureteral colic</em></td>
</tr>
<tr>
<td><em>Avascular necrosis: hip</em></td>
<td><em>Testicular torsion</em></td>
</tr>
<tr>
<td><em>Labral tear: hip</em></td>
<td><em>Hydrocele/Varicocele</em></td>
</tr>
<tr>
<td><em>Femoral neck fracture/stress fracture</em></td>
<td></td>
</tr>
<tr>
<td><em>Pubic ramus stress fracture</em></td>
<td></td>
</tr>
<tr>
<td><em>Mycositis ossificans, adductors</em></td>
<td></td>
</tr>
<tr>
<td><em>Slipped capital femoral epiphysis</em></td>
<td></td>
</tr>
<tr>
<td><em>Avulsion fracture: ASIS/iliac/ischium</em></td>
<td></td>
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<tr>
<td><strong>Nerve</strong></td>
<td></td>
</tr>
<tr>
<td><em>Lumbar radiculopathy</em></td>
<td></td>
</tr>
<tr>
<td><em>Lliloinguinal neuropathy</em></td>
<td></td>
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<tr>
<td><em>Obturator neuropathy</em></td>
<td></td>
</tr>
<tr>
<td><strong>Other Orthopaedic</strong></td>
<td></td>
</tr>
<tr>
<td><em>Bone/soft tissue neoplasm of hip/pelvis</em></td>
<td></td>
</tr>
<tr>
<td><em>Seronegative spondyloarthropathy</em></td>
<td></td>
</tr>
</tbody>
</table>
Now, lets go through each one...
Focus on Impingement Syndromes

<table>
<thead>
<tr>
<th>SITE</th>
<th>SYNDROME</th>
<th>JOINT POSITION</th>
<th>STRUCTURES</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIP</td>
<td>CAM–TYPE FEMORO-ACETABULAR</td>
<td>FLEXION, VARIABLE (IR/ER/ABD/ADD)</td>
<td>LABRUM, ARTICULAR CARTILAGE</td>
<td>BONE, SOFT TISSUE</td>
</tr>
<tr>
<td></td>
<td>PINCER–TYPE FEMORO-ACETABULAR</td>
<td>FLEXION, VARIABLE (IR/ER/ABD/ADD)</td>
<td>LABRUM, ARTICULAR CARTILAGE</td>
<td>BONE, SOFT TISSUE</td>
</tr>
<tr>
<td></td>
<td>ISCHIOFEMORAL</td>
<td>ADDUCTION</td>
<td>QUADRATUS FEMORIS</td>
<td>BONE, SOFT TISSUE</td>
</tr>
<tr>
<td></td>
<td>SNAPPING HIP</td>
<td>VARIABLE</td>
<td>Iliopsoas, Gluteal, Iliotibial Tract</td>
<td>BONE, SOFT TISSUE</td>
</tr>
</tbody>
</table>

Resnick, D. Mechanisms of impingement: concepts and controversies. ISS. 2011;Combined Session.
FEMOROACETABULAR IMPINGEMENT
FAI Is An Important Risk Factor for Hip OA

I come to bury Caesar, not to praise him.

-Mark Antony
(also, David Rubin)
“The controversies regarding the concept of femoroacetabular impingement are analogous to the “chick and egg” scenario- that is, which comes first? Do structural alterations of the femoral head or acetabuli, or both, relate to developmental modifications or are they related to an underlying disorder, such as osteoarthrosis…”

— Words of Wisdom

Resnick, D. Mechanisms of impingement: concepts and controversies. ISS. 2011;Combined Session.
FAI

• Epidemiology
  – 10-15% of general population
    • Possibly as high as 25% in young adult males
  – Young, athletic patients
  – Symptomatic 2\textsuperscript{nd}-4\textsuperscript{th} decade
  – Major cause of early osteoarthrosis

• Cause:
  – Early pathologic contact of acetabulum & femur
  – Limiting physiologic hip motion
  – Repetitive microtrauma
  – Labral degeneration/chondral damage
FAI

• Initially, limited range of motion

• Then, pain:
  – Groin pain with hip rotation
    • Sitting position or after sports activities
  – Trochanteric pain radiating to lateral thigh
FAI

• Physical Exam:
  – Restricted flexion & IR
  – Positive Impingement sign:
    • A. Anterior:
      – Pain w forced IR/Adduction w hip in 90 deg flexion
    • C. Posterior:
      – Pain w forced ER w hip in extension
  – B. Drehmann’s sign:
    • Unavoidable passive ER rotation of hip while flexing hip

Tannast M, Siebenrock KA, Anderson SE. Femoroacetabular Impingement: radiographic diagnosis- what the radiologist should know. AJR. 2007;188:1540-52.
FAI: Types

- **Cam**: Young active men (14:1 M:F)
  - Aspherical femoral head
  - Lateral (pistol-grip) vs Anterosuperior osseous bump
  - Chondral damage to anterosuperior acetabular cartilage
    - Large area of cartilage involved
    - Separation bet labrum & cartilage

- **Pincer**: Middle aged women (3:1 F:M)
  - Acetabular overcoverage of the hip
    - General vs focal
  - Circumferential peripheral chondral loss near labrum
  - Labrum crushed bet acetabular rim & femoral neck

- Majority (86%) have mixed cam/pincer type
Importance of early diagnoses

- Imaging plays key role
- Early phase without findings of OA
- Important to detect in this phase
- Institute surgical intervention early
Role of Imaging

• **XR:**
  - Evaluate for pincer/cam
    FAI
  - Exclude arthritis
  - Exclude AVN

• **CT:**
  - Evaluate acetabular/femoral
    version

• **MR/MR Arthrography**
  - Labral damage
  - Cartilage loss
  - $\alpha$-angle measurement
Imaging: XR

- **AP Pelvis:**
  - Evaluate acetabulum
  - Evaluate femoral head-neck junction
  - Evaluate for coxa vara
- **Axial/Cross-table Lateral:**
  - Evaluate anterior femoral head-neck junction
- **Faux Profile:**
  - Evaluate anterior coverage of acetabulum
  - Evaluate posteroinferior joint space (contrecoup lesion)
Importance of True AP View of Pelvis

• Normal Pelvis Tilt/Rotation
  – Tip of coccyx in line with symphysis pubis
  – Distance between superior aspect of symphysis pubis & mid portion of sacroccocygeal joint
    • 3.2 cm in men; 4.7 cm in women
Femoroacetabular Impingement

- Pincer
- Cam
Pincer: General Acetabular Overcoverage

- Correlated with radiologic depth of acetabular fossa
  - NL:
    - Acetabular fossa line lateral to ilioischial line
  - Coxa Profunda:
    - Acetabular fossa touches/overlaps ilioischial line
  - Protrusio Acetabuli:
    - Femoral head overlaps ilioischial line

Can only evaluate on pelvis radiographs.
Hip radiographs can overdiagnose profunda/protrusio
Pincer:
General Acetabular Overcoverage

Lateral Central Edge Line
- NI: 25-39 deg

Acetabular Roof Angle
- NI: 0-10 deg
Pincer: Focal Acetabular Overcoverage

• Anterior Focal Acetabular Retroversion
  – Vs. Deficient Posterior Wall

• Prominent Posterior wall
Cross-Over Sign

Courtesy: Dr. Brady Huang
Posterior Wall Sign

Courtesy: Dr. Brady Huang
Pincer:
Occasional Finding
Femoroacetabular Impingement

- Pincer
- Cam
CAM:
Primary vs Secondary

- **Primary:**
  - Growth abnormality of capital femoral epiphysis

- **Secondary:**
  - Subclinical SCFE
  - Legg-Calve-Perthes disease
  - Coxa Vara
  - Retrotorsion/version of femoral head
    - S/P femoral neck fracture
    - Need CT for evaluation
“The last useful thing I published”

- Tilt deformity
  - =Mild SCFE
    - Murray, 1965
  - =Remodelling from OA
    - Resnick, 1976

CAM:
Measurements on Cross-table Lateral

- $\alpha$-angle:
  - Angle between femoral neck axis & line connecting head center and head-neck junction asphericity
  - $>50 \, ^\circ$ is abnormal
- Anterior Offset:
  - Diff in radius bet ant fem head & ant fem neck
  - $<10 \, \text{mm}$ is abnormal
Anterosuperior Osseous Bump

- Dunn View
- Hips flexed 90 deg
- Hips abducted 20 deg
- Neutral rotation
Lateral bump/Pistol Grip

Courtesy: Dr. Brady Huang
Alpha Angle (CAM type)

- Axial oblique MRI
- >50 degree is abnormal
  - ≤55 degree
Acetabular Depth (Pincer Type)

- Normal: 0 to +5mm
- Pincer FAI: <=-5mm
Axial Oblique MR Arthrogram

Courtesy: Dr. Brady Huang
Secondary Findings
Counter Argument: 2 Longitudinal Studies

- Bardakos NV et al. (2009)
  - 43 hips with cam morphology & mild OA
  - 1/3rd had no progression of OA after 10 years

- Hartofilakidis G et al. (2011)
  - 96 asymptomatic hips with FAI morphology
    - 17 cam, 34 pincer, 45 mixed
  - 82% did not develop OA
    - 18-19 y mean followup
  - $\alpha$-angle of those that developed OA was no diff than those that did
  - Only contralateral OA was predictive
Treatment

• Nonsurgical:
  – Relative rest & NSAIDs
  – Activity modification
    • Avoiding provocative positions
    • Muscle strengthening
  – Physical therapy

• Surgical:
  – Address labrochondral pathology
  – Address underlying bony deformity
  – Open surgical dislocation of hip
    • Ganz et al
  – Arthroscopic
  – Address labrochondral pathology
  – Address underlying bony deformity

  • Cam:
    – Arthroscopic:
      • Anterosuperior deformity
    – Open:
      • Posterolateral deformity
      • Complex proximal femoral deformities
        • Legg-Calve-Perthes disease
  • Pincer:
    – Periacetabular osteotomy:
      • Severe retroversion w deficient posterior coverage
    – Acetabular rim trimming w labral refixation
      • Retroversion w nl posterior coverage
      • Risk for postoperative dislocation
    – Open surgical dislocation:
      • Global overcoverage
Nonsurgical

• Emara et al.
  – 37 pt w FAI & mild deformity (α-angle<60°)
  – Tx: Physical Therapy & activity modification
  – At 2 yr:
    • 11% had surgery
    • 89% had improvement in mean Harris hip score
      – 72 → 91

• Hunt et al.
  – 6/17 pts improved w/o surgery
  – Those who picked surgery had higher activity levels
Surgical

• Surgical Dislocation:
  – Ganz et al
  – Trochanteric osteotomy
  – Hip dislocated anteriorly
  – Allows circumferential access to acetabulum/proximal femur

• Complications:
  – Trochanteric pain
    • 46% of pts
  – Symptomatic intra-articular adhesions
    • 6%
Surgical

• Arthroscopy:
  – 10/12 studies: Good to excellent outcomes in >75% pts

• Complications:
  – Low:
    • 1-6%
  – Iatrogenic labral/cartilage damage
COXA SALTANS
Coxa Saltans

• “Snapping Hip”
• Audible snap of hip w/ flexion & extension or normal activities

• General population
  – 5-10% asymptomatic
• Certain professional athletes
  – Participate in extremes of hip motion
  – Higher incidence & more symptomatic
Elite Athletes

• Survey of Ballet Dancers:
  – 90% by report
  – Hip external rotation/abduction >90 degrees

• Wahl et al.
  – 2 footballers & 1 soccer player
  – Hip flexion >90 degrees

• Also seen in weight-lifters & runners
Coxa Saltans

- Mayer L. Snapping hip.
  - Surg Gynecol Obstet
  - 1919;29:425–4293

- Categories
  - Externa
  - Interna: Most common
  - Intraarticular
Imaging Evaluation

- **XR:**
  - Coxa vara
  - DDH
- **MRI:**
  - Soft tissue edema about involved structure
  - Bursitis
- **MRA:**
  - Investigate intra-articular causes
- **Bursography:**
  - Not commonly used anymore
  - Historical imaging test of choice
- **Ultrasound:**
  - Newer modality & imaging test of choice
Coxa Saltans

- Externa
- Interna
- Intraarticular
Coxa Saltans Externa

• Iliotibial tract slides over the greater trochanter with flexion/extension

• ITT is posterior with hip extension & moves anterior with hip flexion
Iliotibial Tract

Iliotibial Tract

- TFL & Glut max keep ITT taut whether hip is flexed or extended
- As taut throughout, any small anatomic change would precipitate snapping over GT
- Greater trochanteric bursa lies between ITT & GT
  - Predisposed to bursitis
Coxa Saltans Externa: Physical Exam
Coxa Saltans Externa: ITT

Coxa Saltans Externa: ITT

Coxa Saltans Externa: ITT
Coxa Saltans

- Externa
- **Interna**
- Intraarticular
Coxa Saltans Interna

• Iliopsoas tendon moving over the:
  – Classically:
    • Femoral head/anterior hip capsule
    • Prominent iliopectineal ridge
    • Exostoses of lesser trochanter
    • Iliopsoas bursa
  – Newer:
    • Medial fibers of iliacus
CSI: Physical Exam

- Supine patient
- Reproduce snapping by flexing/extending hip
- Block snapping by finger pressure over iliopsoas tendon at femoral head
Anatomical View of the Iliopsoas Muscle

- PMT = psoas major tendon
- MFI = medial fibers of iliacus
- LFI = lateral fibers of iliacus
- IIT = ilioinfratrochanteric bundle
- * = iliopsectineal eminence

Dynamic Ultrasound

Courtesy: Dr. Tudor Hughes
Coxa Saltans Interna

Coxa Saltans Interna

http://musculoskeletalmri.blogspot.com/2008/08/snapping-hip-internal-or-external.html
Sounds Painful

• 26 cases of extra-articular coxa saltans
  – 24: Underlying cause identified
  – 22: Coxa Saltans Interna
  – 14: Painful
Rare Cause: XR
Rare Cause: US
Rare Cause: CT
Coxa Saltans

- Externa
- Interna
- Intraarticular
Coxa Saltans Intra-articular

- Clicking sensation
- Labral tear
  - Cause pain >>> snapping hip
  -Usu posterosuperior
- Loose body
- Synovial chondromatosis
- Femoral head subluxation
- Synovial fold (Atilihan et al. 2003)

Treatment of Coxa Saltans

• Conservative
  – Avoid inciting activities
  – Rest
  – Corticosteroid injection
  – Therapy emphasizing stretching

• Surgical
  – External – excision of greater trochanteric bursa w/ IT band lengthening
  – Internal – iliopsoas release &/or lengthening
Treatment

• **External:**
  - Provencher et al. (2004)
    - 9 hips treated by ITT Z-lengthening
    - All had resolution of snapping
    - 1 had persistent groin pain
    - 11 hips treated by diamond excision of ITT over GT
    - 10 had full resolution of symptoms
    - 1 had mild snapping but no pain at 2 year followup

• Most common complication:
  - Mild to moderate Trendelenburg gait
    - Caused by abductor weakness
Treatment

• Internal:
    • 85 patients fractional lengthening of iliopsoas
    • 20 patients had return of snapping by 1 year
    • Arthroscopic repair in 15 athletes
    • Incidental note of 12 athletes having labral tear
    • 0 had return of snapping
    • Theory: Iliopsoas dysfunction leads to labral tear

• Most common complication:
  – Hip flexor weakness
ISCHIOFEMORAL IMPINGEMENT
Ischiofemoral Impingement

• First reported in 1977 in 2 pts after total hip arthroplasty and 1 pt after proximal femoral osteotomy

• Radiographs: Narrowing between ischium & lesser trochanter

• Relief with resection of the lesser trochanter
Epidemiology

• Hip/Groin pain
  – Usu posterior
  – Pain radiates distally
  – Snapping/locking

• F >>>> M
  – 84-100% female
  – Middle aged-elderly

• Bilateral: 25-40%
Risk Factors

• Superomedial migration of femur 2/2 OA

• Osteochondroma

• Prominent lesser trochanter

• Enlarged ischium from prior fracture
Ischiofemoral Impingement
Ischiofemoral Impingement
Measuring for IFI

- A: Ischiofemoral Space (IFS)
  - 12.9 (±5) vs 22 (±8) mm
- B: Quadratus Femoris Space (QFS)
  - 6.7 (±3) vs 13.5 (±4) mm

Quadratus Femoris

- Square muscle of the thigh
- Origin: Superior aspect of lateral surface of ischial tuberosity, just anterior to origin of semimembranosus tendon
- Insertion: Posteromedial aspect of proximal femur
- NL width bet ischium & proximal femur: 2 cm

Ischiofemoral Impingement

Courtesy: Dr. Erica Chu
Hamstring Tendons

- Associated with hamstring tendon edema (50%) or partial tears (25%)

- Seagull Wing Sign of QFM
  - Hamstring tendinopathy/area contributes to IFI

Grading QFM Edema

- Tosun et al. 2012

- 0: NI muscle signal
- I: Focal edema where IFS/QFS are narrowest
- II: Diffuse edema confined to muscle
- III: Edema extending to surrounding soft tissues
  - Can cause irritation of adjacent sciatic nerve → sciatica
Grading QFM Fatty Replacement

- Tosun et al. 2012

- 0: NL muscle signal
- I: Tiny linear fat signal between muscle fibers
- II: Linear & globular fat signal <50% of QFM
- III: Globular fat signal >50% of QFM
SUMMARY
Hip Impingement

• FAI
  – Pincer vs Cam
• Ischiofemoral Impingement
• Coxa Saltans
  – Externa, Interna, Intra-articular
Bibliography

GENERAL


FEMORAL ACETABULAR IMPINGEMENT

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ISCHIOFEMORAL IMPINGEMENT