Athletic Hip Injuries

Joseph P. McCormick, M.D.
Affinity Orthopaedics & Sports Medicine
2015
The Hip

- There has been a growing appreciation of hip & core issues that contribute importantly to athletics.
Someday when scientists discover the center of the universe, a lot of people will be unhappy to find out it’s not them.
Is the hip the center of the sports universe?

There has been a growing appreciation of hip & core issues that contribute importantly to athletics

Today, we will cover:
- Femoroacetabular impingement
- The hip-spine connection
- The hip and ACL injuries
- The hip and rotator cuff?
Hip Overview

- Is the hip the center of the sports universe?
  - **Femoroacetabular impingement**
  - The hip-spine connection
  - The hip and ACL injuries
  - The hip and rotator cuff?
The Hip

- Imaging modalities have improved
- Our approach to surgical hip repair has changed
  - ie, the hip arthroscopy boom
- More women in sports have brought hip pathology to light
Women in Sports?

- Title IX was passed in 1972
  - Increased involvement in sports for women
  - Also, as these women age they continue to remain active (into their 40s & 50s)

- Women have important differences from men when it comes to medical issues
  - Sports-related medicine is no different
  - For example, a 3-11x higher incidence of ACL injuries
Quiz: The Female Athletic Triad?

- Eating disorders
- Amenorrhea
- Osteoporosis
Clinicians in Sports Medicine

- Currently women account for ~2.5% of practicing orthopaedists
- The field is growing as more women physicians consider ortho/sports medicine as a specialty
- There have been changes in how the female athlete is defined
  - Additionally, there have been a greater number of nonelite women athletes being referred for orthopaedic care
Hip Pain in Sports

• Labral tears/loose bodies
  – Associated with FAI
• Slipped Capital Femoral Epiphysis (SCFE)
  – Assoc with higher BMI, adolescent presentation & 20% are bilateral
• Iliopsoas tendinitis
• Iliotibial band syndrome/trochanteric bursitis
• “Hip pointer”
Femoroacetabular Impingement (FAI)

- Caused by subtle morphologic abnormalities about the hip joint
- This leads to pathologic contact between the femoral head-neck & the acetabular cartilage and labrum
  - Cam in younger men, pincer in middle-aged women
- Evidence has long shown that untreated FAI leads to the development of early OA
  - The underlying question of whether early treatment of FAI can slow/prevent the development of OA remains unanswered
FAI in Sports

- The original concern in impingement was related to sports such as gymnastics or dance
  - Extremes of motion
- Now our evaluation includes assessing the planted leg against a truncal flexion/extension/torsion
  - This occurs in multiple sports-related
    - Deceleration, cutting, landing
    - Pitching, catching, planting, throwing, blocking, tackling
FAI

- Cam-type: pistol grip deformity, asphericity
- Pincer-type: acetabular overcoverage
- Mixed
• FAI can present as activity-related hip pain in adolescents and young adults
• Groin pain is predominant
  – Pain can also be worsened by prolonged sitting
  – These athletes hate sitting on the basketball bench!
• Typically, PE reveals limited passive IR
  – And a positive impingement sign
Cam-type FAI

- Radiographic imaging
  - Cam will likely show a pistol grip
  - Lateral film is very helpful
  - MRI with contrast (v 3T) will show delamination at the chondrolabral junction
  - Asphericity plays a role in creating contact from the inside outward
Pincer-Type FAI

- Acetabular retroversion or coxa profunda (short neck) directly damages the anterior labrum when the excess rim contacts the proximal femur
  - “Crossover sign” on AP radiograph
  - Overcoverage of the anterior rim
Understanding MRI Findings in FAI

- Labral tearing/chondrolabral delamination
- Posterior cartilage damage
- Pincer cyst?
FAI Treatment

- Activity modification
- NSAIDs
- PT
- Intra-articular injections
- Recalcitrant cases: arthroscopic vs SHD
  - Similar outcomes, with better results seen when labrum is repaired
  - Reconstructions are even performed with allograft or a rolled fascia lata autograft
FAI Results

- Return to sport fairly nicely, including return to full impact
- Long-term hip preservation is unknown at this time
FAI: Men v. Women

- Finding a pistol-grip deformity is 3x higher in men
- "Crossover sign" is equal
- Bilaterality in FAI is twice as likely in men
- For women patients, expect to see sx with anatomically smaller lesions
  - Differences in muscle mass about the hip (mass contributes to dynamic hip stability)
  - Differences in ligamentous laxity (component of static hip stability)
  - Women have increased hip flexion during drop landings in sport

Hip Overview

- Is the hip the center of the sports universe?
  - Femoroacetabular impingement
  - The hip-spine connection
    - The hip and ACL injuries
    - The hip and rotator cuff?
The Hip-Spine Connection

- The hip & lumbar spine can create similar patterns of pain /dysfunction
- Symptom overlap is common
- Specifically, I’m describing the relationship that exists prior to ANY degenerative changes
The Hip-Spine Connection

- In asymptomatic individuals, lumbar muscles lengthen as the athlete bends forward to 45 degrees
  - Beyond 45, further flexion is facilitated by pelvic/hip rotation
  - The rigidity of the spinal column ligamentous structures determines the endpoint of spinal flexion
  - Lateral bending was mostly muscular (with little contribution from the hips)
  - Twisting of the trunk was nearly all hips!
The Hip-Spine Connection

• In symptomatic hip patients, groin pain is 80-90% 
  – Hip pain that radiates to the knee is felt to be from the 
    saphenous branch of the femoral nerve, which 
    innervates the hip capsule also.
• Sacroiliac joint and additional lumbar spine 
  pathology 
  – Roughly 30% of radiculopathies follow a dermatome 
  – L4-5 is usually buttock and trochanter 
  – L2-L5 (medial branches) groin
The Hip-Spine Connection

• In hip OA, a flexion contracture places additional pressure in lumbar lordosis
  – This leads to increased loading for the lumbar facets and ligaments

• With additional hip stiffness in gait, there is increased lumbar side bending during swing phase

• However, in sports it becomes necessary to eval the hip-spine connection prior to true degenerative changes

Thurston, Spine, 1985
The Hip-Spine Connection

- In the setting of a golf swing or a tennis stroke, limited hip motion leads to increased compensatory lumbopelvic motion
  - Prospectively a study of Div I athletes with either lig laxity or overuse injuries were at an increased risk of LBP the following year
  - Retrospectively, a study of hip extension strength (think Supermans!) showed that when asymmetry was noted, there was a higher likelihood of LBP in the year prior

Nadler, Clin J Sport Med, 2000
Tennis Players

- Rotational sports are thought to place unique forces on the hip-spine, especially in relation to hand dominance
  - 100 pro tennis players were evaluated, and with limited hip IR there was a significant development of LBP, thought to be due to increased lumbopelvic motion
  - Interestingly enough, a slight loss of dominant shoulder IR was also noted (perhaps evidence that the hip deficits affected those shoulders as well)

Professional Golfers

- Rotational sports place unique forces on the hip-spine, especially in relation to hand dominance
  - 42 golfers
  - Lead hip rotation was measured and correlated to the incidence of LBP
  - There was a statistically significant lack of lead hip IR
  - A corollary study was completed on amateur golfers with matched controls (age, height, handedness, and handicap, and rounds played)

Vad, *AJSM*, 2004
Murray, *Phys Ther Sport*, 2009
Evaluating Hip-Spine

- Use of specific provocative flexibility testing
  - These can be difficult to complete in the office
  - Often intra-articular injections are helpful

- Extra-articular hip problems
  - Palpate near iliopsoas, gr trochanter
  - Diagnostic injections
  - When gluteus medius could be a source, the U/S machine will be the game changer!
Hip-Spine Rx Algorithms

- PT for evaluation, modalities, apply corrections
- Low risk/low reward
  - Hip injection, ESI
  - Diagnostic hip arthroscopy
- Low risk/high reward
  - Hip replacement
  - Microdiskectomy
- High risk
  - Medical comorbidities, spinal decompression, spine surgery without a definite diagnosis
Hip Overview

• Is the hip the center of the sports universe?
  – Femoroacetabular impingement
  – The hip-spine connection
  – The hip and ACL injuries
  – The hip and rotator cuff?
ACL Injury

- 3-11x higher incidence in women
  - 6x higher incidence in age-matched women v. men
  - Soccer players during a typical indoor soccer season
    >70% noncontact

- Multiple theories:
  - Anatomic, hormonal, biomechanical
  - Does a hip deficit contribute?

ACL Injury

- Hormonal: estrogen receptors in ACL
  - Fewer injuries occur during the follicular phase of cycle (as estrogen levels begin to rise)
  - More injuries just prior to ovulation (midcycle)
  - Does estrogen affect tensile strength of collagen fibers by altering collagen synthesis
  - Does estrogen affect knees in other ways
  - Will we ever advocate hormone manipulation as a means of protecting the knees in female athletes
ACL Injury

Biomechanic

1. Muscle firing patterns, noted in gait analysis lab
   Men: hamstring dominant
       Run, cut & land with moderate bent knee position, 30-60°
       Aligned closer to 5° valgus
   Women: quadriceps dominant
       Run, cut & land with relative straight knee position, 0-30°
       Aligned closer to 10° valgus

ACL Injury

Figure 3. Correcting for proper landing technique

Poor execution

Proper execution

Figure 1. The biomechanics of safe landing

Quadriceps muscle

Hamstring muscles

Anterior shear

Posterior shear

15° flexion

High anterior shear

ACL injury

60° flexion

Reduced anterior shear

ACL injury
Biomechanic

2. Quad-directed forces (typically eccentric) in landing
Will place a higher strain on ACL in the relative straight position
Notch impingement
Weaker medial/lateral hamstring counterforces
ACL Injury

Biomechanic

3. Valgus knee position in landing
Strain to MCL/ACL complex
Countered by the quad, but countered more effectively by the medial hamstring/hip stability
ACL Injury

Biomechanics

4. Trunk conditioning
Differences in hip flexors
Hip abductors/gluteals
Abdominals

(Always view the LE as a kinetic chain)
ACL Injury Prevention

Plyometric ACL Program

Hewett et al, 1999

>1200 HS athletes

Minimum four-week involvement

BB, VB, Soccer

Hamstring contributions improved, esp medial

20-50% reduction knee forces

Figure 4. How training prevents knee injuries in young female athletes

Injury incidence per 1,000 player exposures

Untrained female athletes

Trained female athletes

Untrained male controls

Contact injuries

Noncontact injuries
The Hip & ACL Injuries

- For non-contact specifically, a cutting, landing or deceleration component is seen.
- Valgus (inward) knee collapse puts the ACL at risk.
  - 30 healthy athletes were tested.
  - Peak abductor torque & knee valgus.
  - Landing kinematics.
  - Women had lower hip strength & greater valgus in landing, exacerbated by endurance.

The Hip & ACL Injuries

• Valgus (inward) knee collapse puts the ACL at risk
  – In single leg squat testing, athletes with weaker hip abductors demonstrate increased knee valgus
  – In a prospective study of collegiate athletes, Leetun et al studied healthy vs injured athletes
  – When comparing LE injuries, increased hip strength in abduction and ER was considered protective

The Hip & ACL Injuries

- Affinity Orthopedics
  - Tested 84 female, trained teenage dancers v BB players
  - These were felt to be low v high risk athletes
  - Collected data on hip abductor strength, body weight and femoral length
  - Dancers measured significantly smaller body weight compared to basketball players, yet generated a statistically significant increased torque

McCormick et al, in publication, 2114
Hip Overview

- Is the hip the center of the sports universe?
  - Femoroacetabular impingement
  - The hip-spine connection
  - The hip and ACL injuries

- **The hip and rotator cuff?**
The Hip & Rotator Cuff

• A newer notion at this time
• There is a decidedly longer kinetic chain in this scenario
  – Could hip abductor weakness, which leads to knee valgus in single leg stance create stress on the shoulder joint?
  – Could a subtle loss of IR at the hip cause additional torque to the shoulder, poss leading to early injury?
The Hip & Rotator Cuff

- AJSM, 2014
- 347 professional pitchers prospectively followed after lumbopelvic control was measured in a standardized fashion
  - Days missed due to injury was measured during the season
  - The weakest tertile of players tested were 3 times more likely to miss >30 days
  - A corollary 2011 study found lumbopelvic control to be predictive of pitching performance (same author)

Chaudhari, AJSM, 2014
The Hip & Rotator Cuff

• JAAOS, 2015 review article
• Tennis players
• The kinetic chain links UE, LE and core muscle segments by transmitting coordination sports activity
• Evolution in equipment and playing surfaces have affected the type and frequency of injuries
  – Addressing muscle imbalances may be future key!
More research is needed

Throwing injuries are an easy start, but what about blocking, tackling, rebounding?

- Remember, formerly hip injuries were discussed in extreme flexibility sports such as gymnastics and dance
- Now, we’ve moved into mainstream
Someday when scientists discover the center of the universe, a lot of people will be unhappy to find out it's not them.
Summary

- Formerly hip problems in sports were felt to be related to “tightness”
- IT band issues
- Sports which relied on extreme flexibility (gymnastics, dance, figure skating) had a small amount of data & research ongoing
Today, we have data on FAI and outcomes
Hip-spine connection
ACL prevention & even recovery protocols enhanced by concentrated hip training
Could improved hip training lead to less rotator cuff injuries in pitchers? Tennis? Golf?
Thank You