Hip/Pelvis Injuries in Athletes

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I. Is it a hip joint problem?
A. Not always evident
   - Among athletes, 60% of intraarticular disorders treated for an average of
     7 months for extraarticular diagnosis¹
B. History and physical exam most important²
   - Exam skills often not emphasized
C. Presentation
   1. History of trauma or acute precipitating event variable
   2. Characteristic exacerbating features
      a) Straight plane activities relatively well tolerated
      b) Torsional/twisting activities more problematic
      c) Prolonged hip flexion (sitting) uncomfortable
      d) Rising from seated position often painful (catching)
      e) Inclines more difficult than level surfaces
      f) Symptoms with entering/exiting automobile
      g) Dyspareunia
      h) Difficulty with shoes, socks, hose, etc.
D. Localization of symptoms
   1. Hilton’s law³
      - “The same trunks of nerves whose branches supply the groups of
        muscles moving a joint furnish also a distribution of nerves to the skin
        over the insertion of the same muscles, and the interior of the joint
        receives its nerves from the same source.”
        (1) Ensures physiologic harmony & aids synchronous motion
        (2) Explains why muscle spasms & cutaneous sensations may
            accompany joint irritation
   2. Classically anterior groin radiating to medial thigh
      a) Principal innervation is L3 nerve root (contributions from L2-S1 of
         lumbosacral plexus)
      b) Symptoms referred to L3 dermatome
   3. “C-sign”⁴
      a) Very characteristic of hip joint pathology
      b) Hand cupped above greater trochanter with thumb over posterior aspect
         of trochanter and fingers gripping into groin
      c) Can occur (substantiated by relief with intraarticular injection)
   4. Posterior pain
      a) Rarely characteristic of hip joint pathology
      b) Even posterior intraarticular pathology usually refers symptoms
         anteriorly or anterolateral
      c) Can occur (substantiated by relief with intraarticular injection)
E. Physical examination

1. Log rolling
   a) Most specific for intraarticular pathology (less sensitive)
   b) Rotates only femoral head in relation to acetabulum and capsule

2. “Impingement” test: pain elicited with flexion/adduction/internal rotation
   a) More sensitive and typically should produce anterior groin or deep anterolateral symptoms
   b) Not specific for impingement as most irritable hips are painful with this maneuver
   c) Compare to uninvolved hip as normally may produce mild discomfort
   d) Should reproduce patient’s symptoms (sharp pain, sense of catching, etc.)

3. Posterior impingement test: extension/abduction/external rotation
   a) Less common
   b) Painful isolated external rotation
      Think adhesive capsulitis, especially in middle-aged females

F. Ultrasound guided intraarticular injection

1. Diagnostic value is real time assessment of hip contribution as pain generator
   a) Opportunity to test pre- and post-injection
   b) Useful for clinician but may be especially helpful to educate patient on how much hip is contributing source of pain

2. Potential therapeutic value of cortisone under appropriate circumstances

II. Assessment clouded by co-existent or compensatory disorders

A. Lumbar spine disorder
   1. May co-exist with hip disease
   2. High correlation in sports where rotational velocity is a premium (i.e., golf & baseball)
   3. Breakdown of one results in reduced compensatory capacity for other

B. Athletic pubalgia
   1. May mimic or co-exist with hip disorders
   2. Reduced hip rotational motion compensated by increased pelvic motion resulting in increased stress on pelvic stabilizers and subsequent breakdown

C. Readily differentiated from external causes of “snapping hip”
   1. Iliopsoas tendon
      a) Characteristic and reproducible clunk elicited by bringing hip from flexed, externally rotated position to extension with internal rotation
      b) Symptoms in deep anterior groin with audible clunk
      c) Historically evaluated with iliopsoas bursography and fluoroscopic examination
      d) Ultrasonography more advantageous
         (1) Imaging of iliopsoas
         (2) Diagnostic/therapeutic injections
   2. Iliotibial band
      a) Symptoms located laterally
      b) Visible and palpable snap
      c) Visual impression of hip subluxation (“pseudo subluxation”)
III. Imaging

A. Radiographs
1. Standard views
   a) AP pelvis including both hips
      (1) Properly centered to assess radiographic indices
      (2) Allows comparison of contra-lateral hip for subtle variation
      (3) Allows assessment of surrounding areas (ilium, ischium, pubis, sacrum, and SI joints)
   b) Frog lateral of affected hip
      (1) Lateral of proximal femur (not a true lateral of joint)
      (2) Simple to obtain consistent image
      (3) Other lateral views (i.e., Dunn view) variously proposed for assessing cam
      (4) False profile, cross-table lateral, other views useful for certain settings
2. Poorly indicative of most problems amenable to arthroscopic intervention
3. Insensitive indicator of early osteoarthritis
4. Subtle changes often significant
5. Rapid radiographic progression (joint space loss) not uncommon - Always repeat plain films!
6. Useful for assessing morphological variants (predisposing to intraarticular pathology)
   a) Femoroacetabular impingement
      (1) Pincer type
         (a) Cross-over sign
         (b) Posterior wall sign
      (2) Cam type
         (a) Developmental (i.e. childhood capital physeal growth disturbance; “pistol-grip” deformity; SCFE, etc.)
         (b) Acquired (“Kissing lesion” secondary to pincer type)
   b) Dysplasia
      - Reduced CE-angle

B. MRI
1. Necessitates high resolution study
   a) 1.5 Tesla magnet; Surface coil; small field of view images
   b) Small magnets & open scanners unreliable
2. Still up to 42% false negative for intraarticular pathology
3. Indirect evidence most reliable finding
   a) Effusion
      – Specific for intraarticular process; non-specific for nature of lesion
   b) Paralabral cyst
      – Pathognomonic of labral pathology
   c) Subchondral cyst
      – Indicative of articular damage
4. dGEMRIC MRI
   a. Investigational studies demonstrate superior ability to detect articular damage
   b. Greatest value may be eventual predictive ability in determining candidates for surgical intervention
C. Gadolinium arthrography with MRI (MRA)$^2$
   1. Greater sensitivity: 8% false negative
   2. 20% false positive (double that of MRI)
   3. Always inject long-acting anesthetic with contrast!
      – Response to injection 90% reliable indicator of presence of joint pathology
   4. Caveats:
      a) Contrast sequencing may obscure subchondral & soft tissue edema
      b) Anecdotal evidence that contrast may negate anesthetic effect

D. Computed tomography
   1. Better at assessing bony architecture/integrity
   2. 3-D reconstruction is especially useful for bony morphology (i.e. FAI)

E. Radionuclide scans
   1. Inexpensive
   2. Sometimes sensitive indicator of altered homeostasis
   3. Useful survey tool

IV. Femoroacetabular Impingement
   A. Overview$^{13,14,15}$
      1. FAI is not a cause of hip pain!
      2. FAI is a morphologic condition that predisposes hip to intraarticular pathology that then becomes painful
         a) Pincer type
            (1) Primary labral pathology
            (2) Secondarily develop articular breakdown
         b) Cam type
            (1) Preferential articular delamination
            (2) Associated labral pathology variable
      3. Arthroscopic observations of secondary damage important part of treatment algorithm
         - Impingement morphology may exist as coincidental finding in absence of observations of impingement pathology
   B. Pincer Type
      1. Due to prominent anterior lip of bone or acetabular retroversion
         - Labrum crushed against femoral neck by prominent acetabular bone
      2. Radiographs (i.e. cross over sign & posterior wall sign) can be insensitive indicator of acetabular impingement
      3. Arthroscopic parameters more sensitive
         a) Presence of anterior labral pathology
            - Labral damage present in order to be symptomatic
         b) Difficulty with anterior portal placement despite adequate distraction
            - Hindrance from bony lip
         c) Lip of bone overhangs damaged portion of labrum
            - Normally should reveal capsulolabral reflection
4. Rim trimming & labral refixation method
   a) Early experiences of favorable results of refixation compared to debridement\textsuperscript{16,17}
   b) Criteria
      (1) Tear or impending failure due to pincer
      (2) Quality of labral tissue sufficient to warrant repair
      (3) Would not violate normal appearing labrum
   c) Technical considerations
      (1) Labrum released from capsular side
         (a) Requires adequate release to assure proper acetabular recontouring
         (b) Care to avoid inadvertent resection of mobilized labrum
      (2) Anchor placed from capsular margin of labrum
         (a) Anchor placed near articular edge for anatomic approximation of labrum and optimal reconstitution of labral seal function
         (b) Care is needed to avoid perforation of articular surface
            - Usually requires more distal portal entry site to assure divergence of anchor from articular surface
      (3) Sutures passed to optimize reapproximation of good quality tissue
         (a) Simple suture through lateral half of labrum adequate for small size labrum, especially when chondrolabral junction is patent
         (b) Modified single limb mattress sutures necessary for larger labrum to avoid distortion and to reapproximate disrupted chondrolabral junction
         (c) Avoid interposing suture between labrum and femoral articular surface if possible

C. Cam Type
1. Impingement from bony prominence of anterolateral femoral head/neck junction
   - Acetabular articular surface fails due to shear effect
2. Anterolateral epicenter variable
   a) May be more anterior or more lateral
   b) Thus may be more evident on lateral or AP radiograph
   c) No lateral radiographic view is “ideal”
      - Optimal view of lesion depends on its epicenter
   d) Radiographs present poor two-dimensional image of three-dimensional problem
   e) 3-D CT scan excellent (!) at revealing bony architecture
      - Especially helpful in arthroscopic approach where visualization is suboptimal compared to open technique
3. Arthroscopic findings
   a) Important determinant for performing femoroplasty
      - Variable proximal femoral morphology may exist in absence of pathological FAI
   b) Anterolateral acetabular articular failure due to shear forces from cam lesion
      (1) Articular delamination
         - Peel back phenomenon
      (2) Closed chondral blistering
         - “Wave sign”; indicator of impending articular failure from shear forces
   c) Relative labral preservation
      - Variable amount of damage may be present

4. Technique
   a) Cam impingement addressed from peripheral compartment after addressing intraarticular pathology with traction
   b) Capsulotomy created by connecting anterior & anterolateral portals
      - Allows mobility of instruments to transition from central to peripheral compartment
   c) Traction released & hip flexed 35°
      (1) Flexion relaxes anterior capsule opening space in peripheral compartment
      (2) Excessive flexion blocks access to femoral lesion within acetabulum
   d) Capsular window enlarged as necessary to assure complete visualization of cam lesion
      (1) Extent of capsulotomy titrated based on pathology
         (a) Extensive capsulectomy may be therapeutic in stiff hips
         (b) Minimize capsulotomy when instability a concern
            - i.e. borderline dysplasia in association with correction of cam lesion
      (2) Capsular closure not routinely necessary
      (3) T-shaped capsulotomy preferable when planning for capsular closure
         - Sutures used to close vertical limb of capsulotomy
   e) Cephalad anterolateral portal facilitates access to cam lesion
   f) Visualize and protect lateral retinacular vessels
      - Lateral synovial fold arthroscopic landmark of these vessels
   g) Overlying soft tissue debrided
      (1) Often covered in mature fibrocartilage similar to native hyaline cartilage
      (2) Define margin of resection at normal head/neck junction
   h) Resection begins at edge of articular surface and tapered distally
      (1) Remove abnormal bone as indicated by preoperative studies (3D CT)
      (2) Recreate normal concave relationship of head/neck junction
      (3) Avoid notching of bone distally on cortical neck of femur; creating stress riser!
   i) Must be especially careful to avoid inadequate or excessive bony resection
D. Results

1. First 200 athletes with minimum one-year follow up (100% follow up)\textsuperscript{19}
   a) 159 cam; 31 combined; 10 pincer
   b) 23 professional; 56 intercollegiate; 121 high school or recreational
   c) Average age 29 years (range 11-60)
   d) 148 males; 52 females
      (1) Cam type: male/female ratio 2.8:1
      (2) Pincer type: male/female ratio 1:1
   e) Secondary damage
      (1) 96% acetabular articular damage (75 Grade IV; 101 Grade III; 1
           Grade II; 14 Grade I)
      (2) 20% combined femoral damage (13 Grade IV; 27 Grade III)
      (3) 89% (178) labral tears
   f) Median improvement 24 points (preop 72; postop 96)
      (1) 49 microfractures: median improvement 26 points
      (2) 20 bipolar chondral damage: median improvement 16 points
   g) 181 (90%) returned to sport
      (1) 95% professional
      (2) 85% collegiate
   h) Four (2%) underwent repeat arthroscopy
   i) One (0.5%) revised to THA
   j) Complications
      (1) Five transient neurapraxias (all resolved uneventfully)
      (2) One mild HO (no treatment; no effect on outcome)

2. Numerous other reports of successful outcomes in arthroscopic treatment of FAI
   among athletes\textsuperscript{20,21,22}

E. Steps to successful arthroscopic management of FAI

1. Patient selection
   a) FAI amenable to arthroscopic intervention
   b) Reasonable joint preservation
   c) Reasonable patient expectations

2. Patient positioning
   - Important for safety & efficacy of procedure

3. Portal placement
   - Important for assuring access in atraumatic fashion

4. Identify pathology
   - Important to document damage indicative of pathological impingement
     and thus warranting correction

5. Proper exposure
   a) Fully visualize the abnormal bone before beginning correction
   b) Next to poor patient selection, poor visualization is root of all evil in hip
      arthroscopy

6. Match the procedure to the pathology
   a) Labral debridement vs. repair/refixation
   b) Acetabuloplasty vs. femoroplasty vs. both

7. Rehabilitation
   - For most, properly structured rehab critical to successful outcome
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V. Hip Luxation
A. Most commonly posterior subluxation or fracture subluxation (posterior rim lesion)
B. Relatively low velocity injuries
C. High incidence of pre-existing FAI
   - Fulcrum that levers hip posteriorly, predisposing to subluxations
D. Initial symptoms often not severely disabling
   1. Athletes may attempt to, or actually, return to play
   2. Belies serious nature of injury
E. Posterior rim fracture easily overlooked on plain radiographs
F. MRI often interpreted as posterior labral tear
   - Avascular cortical bone hypointense on MRI
G. Secondary posttraumatic signal changes femoral head common but not necessarily indicative of AVN or poor outcome
H. Many respond conservatively
I. Requires thoughtful treatment strategy
   1. Uncertain long-term prognosis
   2. Most do well but few may demonstrate rapid deterioration
J. Return to play ~ 8 weeks

VI. Personal perspective on hip disorders in sports
A. Significant prevalence of hip disorders
   1. Many silent
   2. Must establish clinical relevance
      a) H&P most important
      b) Diagnostic injections may add to clinical assessment
         - Portion of hip contribution as pain generator
B. High prevalence of compensatory disorders, especially 2° to FAI
   1. Especially common in sports where rotational velocity is a premium (i.e., baseball & golf)
   2. Athletic pubalgia/sports hernia; low back disorder; hamstring issues(?)
   3. Underlying FAI may be silent
   4. Challenge to distinguish contribution of each
C. Contributing factors
   1. Prevalence of FAI morphology in athletic population
   2. Complex kinematic linkages
   3. Repetitive microtrauma more common than macrotrauma
D. “Asymptomatic” is relative
   1. On close questioning, many athletes may recount earlier symptoms or reduced flexibility indicative of hip problems
   2. Slow, insidious onset due to childhood developmental disorder of FAI may allow substantial secondary damage to occur before it becomes clinically noticeable to the athlete
      - High incidence of significant articular damage at time of arthroscopic intervention
E. How soon to operate?
1. If asymptomatic, cannot recommend surgery but warrant watchful approach
2. If symptoms are stable, cautious observation appropriate
3. If symptoms are worsening, better to be proactive in surgical management instead of waiting until forced due to disability
4. If athlete can no longer effectively compete, then discussion is simpler
   - Accept what they have or recommend surgery with good, but not certain, likelihood of success
5. With advancing disease, arthroscopy becomes purely palliative and not preventative
   - Advanced joint space loss may eventually contraindicate arthroscopy even for athletes still functioning at a high level

F. Role of conservative management
1. Cannot change what they do in sports
2. Can modify training & conditioning program
   a) Avoid loading hip in flexion beyond 45° (ie, squats, lunges, etc.)
   b) Avoid impact loading aerobic conditioning
3. Pelvic stabilization & core strengthening exercises
   - Can selectively open anterior pelvis, partially unloading for FAI
4. Identify and rehabilitate for compensatory disorders
   a) Significant dysfunction may accompany compensatory disorders secondary to FAI
   b) As compensatory abilities fail, this may exacerbate symptoms of FAI
5. Judicious use of intraarticular injections (i.e., corticosteroids; visco supplements; plasma products, etc.)
   a) May be appropriate under select circumstances
   b) Purpose, goals and precautions must be discussed with athlete

G. With proper patient selection, 90° likelihood of returning to sports
- Important to discuss advisability of returning to activities that can continue to be detrimental to hip
REFERENCES