HIP & GROIN PAIN IN ATHLETES

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Introduction

- Athletic injuries about hip & groin occur at a low frequency relative to injuries at the more distal lower extremities.
- Injuries to the hip region compose 5-9% of injuries in high-school athletes.
- Broad differential diagnosis & prolonged rehabilitation times make early & accurate diagnosis essential.
- Many athletes with hip and groin pain may have multiple coexisting pathologies spanning several disciplines.
- Must consider both musculoskeletal and non-musculoskeletal causes.
Table 1

Groin Pain Differential Diagnosis: Musculoskeletal Disorders

<table>
<thead>
<tr>
<th>Intra-articular</th>
<th>Extra-articular</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetabular labral tears</td>
<td>Apophyseal avulsion fracture</td>
</tr>
<tr>
<td>Osteonecrosis of the femoral head</td>
<td>Facet joint abnormalities</td>
</tr>
<tr>
<td>Chondrolysis</td>
<td>Iliofemoral ligament sprain</td>
</tr>
<tr>
<td>Femoroacetabular impingement</td>
<td>Lumbar radiculopathy</td>
</tr>
<tr>
<td>Femoral neck stress fracture</td>
<td>Pubic ramus stress fracture</td>
</tr>
<tr>
<td>Instability</td>
<td>Muscle strain: adductors/sartorius, rectus femoris, iliopsoas, or rectus abdominis</td>
</tr>
<tr>
<td>Legg-Calvé-Perthes disease</td>
<td>Nerve entrapment: genitofemoral (L1, L2, L3), iliohypogastric (T12, L1), ilioinguinal (T12, L1), lateral femoral cutaneous (meralgia paresthetica, ventral rami [L2–L4]), obturator, or pudendal</td>
</tr>
<tr>
<td>Oncologic processes</td>
<td>Osteitis pubis</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>Psoas muscle abscess</td>
</tr>
<tr>
<td>Osteochondritis dissecans</td>
<td>Sacroiliac joint disorders</td>
</tr>
<tr>
<td>Septic arthritis</td>
<td>Snapping hip syndrome</td>
</tr>
<tr>
<td>Slipped capital femoral epiphysis</td>
<td>Sports hernia/pubalgia (eg, hockey player syndrome)</td>
</tr>
<tr>
<td>Synovitis</td>
<td>Trochanteric bursitis</td>
</tr>
</tbody>
</table>

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Characterize pain in terms of onset, location, quality, severity, alleviating vs. exacerbating factors.

Location/quality → Intra-articular vs. Extra-articular source of pain
Intra-articular – anterior groin or inguinal pain felt deep within hip joint +/- radiation to knee

- Pain with weight bearing and during pivoting & twisting activities (golf, baseball, racquet sports, MMA, etc.)
- Presence of mechanical symptoms (catching / locking)
Extra-articular — pain radiating to buttocks or posterior trochanteric region.

- Consider SI joint and spinal pathology (lumbar radiculopathy).
- Associated symptoms of weakness, parasthesias, numbness, back pain, etc.

- Inquire about known congenital disorders & conditions such as hip dysplasia, SCFE, Legg-Calvé-Perthes disease.

- History of EtOH abuse, excessive steroid use, coagulopathy, blood dyscrasia, HIV, systemic inflammatory disease ➔ Osteonecrosis
Physical Exam

- Upright examination to evaluate gait, pelvic obliquity and single-leg stance.
- Trendelenburg gait = abductor weakness
  - Gluteus medius/minimus not strong enough to keep pelvis level → pelvis drops on contralateral side.
- Pelvic obliquity may reflect underlying scoliosis or LLD
Single-Leg Stance / Trendelenburg Test

- Identify abductor weakness → Pelvis drops contralateral to stance leg to compensate for abductor weakness on the side of stance leg
- Single-leg stance with contralateral knee/hip flexed.
Palpation

- ASIS – origin of Sartorius, a common location of apophyseal avulsion fractures in adolescent athletes.
- LFCN crosses under inguinal ligament just medial to ASIS ➔ dysesthesias over the proximal anterolateral thigh = *Meralgia Parasthetica*
- AIIS – origin of Rectus Femoris. Tenderness may suggest apophyseal avulsion injury.
- Tenderness / swelling over iliac crest following direct trauma can be caused by hematoma formation ➔ “Hip Pointer”
Range of Motion Evaluation

[A] [B] [C] [D]
Range of Motion Evaluation
Thomas Test

- Unaffected hip is flexed
- Flexion contracture is present if contralateral lower extremity cannot remain extended and lifts off table
Log-Roll Test

- Used to assess for intra-articular hip joint irritability
FABER – Patient placed in a “figure-4” position with knee flexed and ipsilateral ankle resting on contralateral thigh. Downward force exerted on flexed knee. If maneuver produces posterior hip pain SI joint pathology should be suspected. May illicit true intra-articular groin pain which may suggest labral pathology.
Useful for diagnosis of ITB contracture. Tight ITB is associated with trochanteric bursitis and external snapping hip syndrome. Performed in lateral decubitus position with affected side facing up. Knee is flexed to 90° and hip is brought into maximal extension. Knee flexion & hip extension is maintained while the leg is adducted. Inability to adduct the hip past midline ➔ ITB contracture.
Resisted Sit-up

- Resisted sit-up test helpful in diagnosing a sports hernia. Positive test produces pain at the rectus abdominis or in the groin. Resisted sit-up repeated with both knees flexed to 90° - may provoke pain at adductor longus tendon origin.
### Examination: Intra-articular Pathology

#### Table 3

<table>
<thead>
<tr>
<th>Test</th>
<th>Examination Procedure</th>
<th>Results</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic external rotary impingement⁴, ²６</td>
<td>Supine position with the contralateral leg held in flexion beyond 90°. The examined</td>
<td>Pain</td>
<td>FAI/labral pathology</td>
</tr>
<tr>
<td></td>
<td>hip is brought to 90° of flexion and passively taken through a wide arc of abduction and</td>
<td></td>
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<tr>
<td></td>
<td>external rotation.</td>
<td></td>
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</tr>
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<td>Dynamic internal rotary impingement⁴, ²⁶</td>
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<td>hip is brought to 90° of flexion and passively taken through a wide arc of abduction</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>and internal rotation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexion adduction internal rotation³, ⁴, ²⁶, ²⁶</td>
<td>Lateral or supine position. The hip is brought into flexion, adduction, and internal</td>
<td>Pain</td>
<td>FAI/labral pathology</td>
</tr>
<tr>
<td></td>
<td>rotation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foveal distraction³</td>
<td>Supine position. The leg is actively abducted to 30°, and the examiner applies passive</td>
<td>Relief of pain</td>
<td>Nonspecific intra-articular source</td>
</tr>
<tr>
<td></td>
<td>axial traction (ie, pulls the leg away from the body).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heel strike⁴, ²⁶</td>
<td>Supine position. Strike heel firmly.</td>
<td>Pain</td>
<td>Femoral neck stress fracture</td>
</tr>
<tr>
<td>Log roll (passive supine rotation)³, ²⁶</td>
<td>Supine position. The leg is internally and externally rotated.</td>
<td>Guarding, laxity,</td>
<td>Intra-articular pathology suggestive of inflammation (eg, synovitis, sepsis)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>or pain</td>
<td></td>
</tr>
<tr>
<td>McCarthy⁴, ²⁵, ²⁶</td>
<td>Supine position. The hip is moved from maximal flexion, adduction, and internal</td>
<td>Pain in specific</td>
<td>Acetabular labral tear</td>
</tr>
<tr>
<td></td>
<td>rotation to full extension. The hip is moved from maximal flexion, abduction, and</td>
<td>position</td>
<td></td>
</tr>
<tr>
<td></td>
<td>external rotation with movement to full extension.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stinchfield⁴, ²</td>
<td>Supine position. The leg is actively raised to 30°. The examiner exerts passive</td>
<td>Pain or weakness</td>
<td>Intra-articular pathology (eg, arthritis, synovitis, femoral neck fracture). iliopeas tendinitis.</td>
</tr>
<tr>
<td></td>
<td>downward force on the leg.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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</tr>
</thead>
<tbody>
<tr>
<td>Arch and twist maneuver&lt;sup&gt;12&lt;/sup&gt;</td>
<td>Stand and hyperextend the trunk while rotating toward and away from the symptomatic</td>
<td>Twisting away from the affected side recreates symptoms</td>
<td>Suggestive of nerve entrapment</td>
</tr>
<tr>
<td>Ely&lt;sup&gt;4,6&lt;/sup&gt;</td>
<td>Prone position. The knee is passively flexed.</td>
<td>Involuntary compensatory hip flexion</td>
<td>Rectus femoris contracture</td>
</tr>
<tr>
<td>FABER (ie, Patrick)&lt;sup&gt;3,4,25,26&lt;/sup&gt;</td>
<td>Supine position with the hip flexed, abducted, and externally rotated</td>
<td>Posterior hip pain</td>
<td>Ipsilateral sacroiliac joint pathology</td>
</tr>
<tr>
<td></td>
<td>The ipsilateral knee is flexed so that the lateral ankle rests on the contralateral thigh</td>
<td>Groin pain</td>
<td>Iliopsoas pathology</td>
</tr>
<tr>
<td></td>
<td>just proximal to the patella (figure-of-4 position)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The contralateral AII is stabilized, and the knee is lowered to the table</td>
<td>Lateral hip pain</td>
<td>Femoroacetabular impingement</td>
</tr>
<tr>
<td>Femoral nerve traction&lt;sup&gt;27&lt;/sup&gt;</td>
<td>Prone position, with the knee flexed to 90° and the hip fully extended</td>
<td>Pain in the anterior or lateral thigh</td>
<td>L2–L4 nerve root impingement</td>
</tr>
<tr>
<td>Gaenslen&lt;sup&gt;4&lt;/sup&gt;</td>
<td>Supine position with both knees flexed and one thigh extended over the edge of the table</td>
<td>Pain</td>
<td>Chronic inflammation of the lumbar vertebrae and SI joint (eg, spondyloarthrisis, arthritis, sciatica)</td>
</tr>
<tr>
<td>Ober&lt;sup&gt;3,4,25,26&lt;/sup&gt;</td>
<td>Lateral position with the knee flexed to 90°. The hip is brought into maximal extension and the leg is adducted.</td>
<td>Unable to adduct past the midline</td>
<td>IT band contractures or tight hip abductors</td>
</tr>
<tr>
<td>Pubic symphysis stress tests&lt;sup&gt;4,5&lt;/sup&gt;</td>
<td>Recreate shearing force with one hand at the superior border of the pubis and the other hand at the contralateral inferior border. Press two hands together or recreate compression force by directing downward force on the iliac crest.</td>
<td>Pain</td>
<td>Pelvic pathology</td>
</tr>
<tr>
<td>Single-leg stance phase (ie, Trendelenburg)&lt;sup&gt;3,4,25,26&lt;/sup&gt;</td>
<td>Standing, with the feet shoulder width apart. The hip and knee are flexed to 45° and the position is held for 6 seconds.</td>
<td>Pelvic shift or decrease &gt;2 cm</td>
<td>Weak contralateral abductors/poor neural loop of proprioception</td>
</tr>
<tr>
<td>Thomas&lt;sup&gt;25,26&lt;/sup&gt;</td>
<td>Both hips are flexed at the same time and one leg is brought back down to the table</td>
<td>Thigh cannot reach the table</td>
<td>Hip flexor contraction</td>
</tr>
</tbody>
</table>
Overview – Major Topics

- FAI
- Labral Tears
- Femoral Neck Stress Fractures
- Athletic Pubalgia
- Coxa Sultans & Trochanteric Bursitis
- Avulsion Fractures in Adolescent Athletes
Femoroacetabular Impingement (FAI)

- FAI likely represents one of most common mechanisms leading to development of early cartilage & labral damage in young athletes.

- FAI – process by which misshapen hip joint secondarily leads to breakdown of intra-articular structures ➔ pain & dysfunction ➔ osteoarthritis.
Femoroacetabular Impingement (FAI)

- Three different types: CAM, PINCER & COMBINATION

  - Overgrowth of the anterior edge vs. acetabular retroversion.
  - Cyclical repetitive micro-trauma leads to breakdown & failure of acetabular labrum as normal femoral neck impinges on abnormal area of focal acetabular overcoverage.
FAI: Pincer

- Bony overcoverage of anterior labrum → Pincer impingement.
- Hip flexion → anterior labrum crushed by pincer lesion against femoral neck
On well-aligned AP XR w/ neural tilt & rotation, focal antero-superior overcoverage may present as a crossover and/or ischial spine sign.

Focal rim lesions need to be distinguished from global overcoverage & impingement which can result from coxa protrusion or true acetabular retroversion.
FAI: Pincer

- AP Hip XR: Focal rim lesion with cephalad retroversion of the acetabulum
Superior portion of anterior rim lies lateral to the posterior rim ➔ acetabular overcoverage. Anteriorly, it assumes a more normal medial position, creating the crossover sign ➔ pincer impingement.
Femoroacetabular Impingement (FAI)

- Cam impingement – cam effect caused by non-spherical femoral head rotating inside acetabulum. Common in young athletic males. “Pistol-grip deformity”
  - Sequela of SCFE
  - Subtle form of aspherical femoral head

- Hip flexion ➔ aspherical portion of the head rotates into acetabulum ➔ shearing force on anterolateral edge of acetabular articular cartilage ➔ articular delamination
  - Preferential articular pathology with relative initial labral presentation
FAI: Cam

- Bony prominence centered on anterolateral femoral head-neck $\Rightarrow$ Cam impingement.
- Hip flexion $\Rightarrow$ Cam lesion glides under the labrum engaging edge of articular cartilage $\Rightarrow$ delamination.
- Initial preservation of labrum with 2° failure over time.
Sphericity of femoral head assessed on both AP and lateral views.

40° Dunn view most predictably demonstrates cam lesion.

Frog lateral view
FAI: Cam

- Herniation pit may be present in the region of anterolateral femoral head-neck junction
Labral tears with cam-type of impingement result from compression of labrum between aspherical femoral head and acetabular rim.

Alpha angle – radiographic measure defining the concavity of the head-neck jnx by measuring the point of deviation of femoral-head sphericity relative to the central head-neck axis.
**FAI: Cam Lesion & Alpha Angle**

- $\alpha \angle$: Quantifies severity of cam lesion. A circle is placed over the femoral head. The $\alpha$ angle formed by a line along the axis of the femoral neck (1) and a line (2) from the center of the femoral head to the point where the head diverges outside of the circle.
Purpose: Evaluate presence of XR abnormalities and hip pathology hip XR at NFL scouting combine & correlate XR findings with history of or current athletic-related hip & groin pain.

Results/Conclusions:
- 90% of players (112 of 125) had evidence of FAI.
- Increasing alpha angle was associated with increased symptom prevalence and was the only independent XR predictor of hip and groin pain.
- Symptoms more prevalent for hips with cam-type FAI and mixed types (cam & pincer) compared to the cohort, but these FAI types were not independently predictive of symptoms.
Increasing Alpha Angle is Predictive of Athletic-Related "Hip" and "Groin" Pain in Collegiate National Football League Prospects

Symptoms

- Activity-related groin or hip pain, exacerbated by hip flexion
- Difficulty with sitting
- Mechanical hip symptoms

Exam

- Limited hip flexion (<90 degrees), especially with internal rotation (<5 degrees)
- Anterior impingement test (FADDIR) elicits pain - sensitive but not specific for impingement.
- + Log-roll test
MRI is the best modality to evaluate for articular cartilage and labral degeneration and tears
- If labral injury is evident → probably articular damage
- Increased signal on T2 weighted images in anterior acetabulum.
- Paralabral cysts → associated labral lesions
- Subchondral cysts → articular damage

MR Arthrogram – demonstrates increased sensitivity at detecting intra-articular abnormalities. Improved detection of labral lesions.

The most useful aspect of MRA is concomitant injection of long-acting anesthetic along with contrast. Does athlete experience a temporary period of pain relief?
FAI: Treatment

- **Non-operative Treatment**
  - Activity modification, NSAIDs, abductor strengthening.
  - Individualize PT program to athletic demands, ROM restriction.

- **Rehabilitation program**
  - Improve soft-tissue mobility
  - Restore hip abductor strength
  - Improve neuromuscular control & postural balance
FAI: Treatment

- Operative Treatment
- Primarily address all contributory mechanical factors of impingement and secondarily address resultant intra-articular pathology.

- Open surgical approaches
  - Surgical dislocation of hip (Smith-Peterson)
    - Complications: trochanteric osteotomy non-union, HO, femoral head osteonecrosis, hip abductor weakness
  - Anteversion periacetabular osteotomy — uncommon procedure for treatment of pincer-type impingement due to acetabular retroversion
    - Technically difficult
FAI: Treatment

- Hip Arthroscopy
  - Labral and articular management and acetabuloplasty are performed as dictated by pathology. In general, labral preservation is preferred.
FAI: Outcomes

- Byrd and Jones (AJSM 2011) – published largest series of athletes undergoing surgical correction for FAI, reporting on their first 200 consecutive athletes with a minimum 1-year follow-up, treated with an arthroscopic technique.

- The median preoperative modified Harris Hip Score was 72, improving to 96 postoperatively. Ninety-five percent of professional athletes and 85% of intercollegiate athletes were able to return to their previous level of competition.
Philippon et al. (2007) provided the first publication on arthroscopic management of FAI among athletes (45 professional athletes with average follow-up of 1.6 years)

- 93% were able to resume their sport, with a decline to 78% over the follow-up period.

In a subsequent publication (Philippon et al. AJSM 2010) on the correction of FAI in 28 professional hockey players, all were able to return to hockey activities.
Labral Tears

- Acetabular labrum anatomy
  - Horseshoe-shaped structure attached to articular rim with inferior portion composed of transverse acetabular ligament
  - Triangular cross-section (≈ meniscus)
  - Osseous rim of acetabulum penetrates into this triangle for attachment to the labrum.
Labrum Function

- Increases articular surface area & socket depth
- Maintenance of synovial fluid flow $\Rightarrow$ negative pressure w/in joint $\Rightarrow$ stability and resistance to femoral head distraction.
- Loss of labrum $\Rightarrow$ increased femoral head translation $\Rightarrow$ instability and accelerated degeneration.
- Maintains uniform distribution of synovial fluid $\Rightarrow$ articular cartilage nutrition & low friction environment.
Labral Tears – MR Arthrography

- A – Paralabral cyst ➔ labral injury
- B – Subchondral cysts ➔ articular damage
Athlete with Hip Pain

Pain with palpation or resisted muscle contraction → Physical Exam → Radiographs to rule out avulsion injury/FAI

Radiographs to evaluate for impingement

-FAI: Rest Gradual PT → Return to sports

+FAI: MRI to evaluate labral tear or cartilage injury

MRI to evaluate labral tear or cartilage injury

+ → Intra-articular injection

- → No Relief

Transit Relief

Complete Relief: Consider surgery for labral tear

Rest Gradual PT Return to sports

No rectus/adductor tear

Rest Gradual PT Return to sports

Rectus/adductor tear

Relief: Consider evaluation for rectus/adductor repair

No Relief
Femoral Neck Stress Fractures

- Stress fractures are common injury in runners.
- Stress reactions occur when repeated abnormal bone stress without appropriate rest causes osteoclastic activity to outstrip osteoblastic activity.
- Stress fractures typically occur in athletes with low bone mineral density.
- Female Athlete Triad = Low BMD, eating disorder, amenorrhea
Stress Fracture Risk Factors

- Female long-distance runners – highest risk of stress fractures
- Amenorrhea ➔ Normal osteoblastic/osteoclastic response to repetitive stress if disrupted secondary to lack of estrogen.

**Risk Factors for Stress Fracture**

*Intrinsic*
- Poor pre-participation physical conditioning
- Female gender
- Hormonal or menstrual disorder
- Decreased bone density
- Decreased lower body muscle mass
- Genu Valgum deformity
- Leg length discrepancy

*Extrinsic*
- Participation in running or jumping sports
- Rapid increase in physical training program
- Running on irregular or angled surfaces
- Poor footwear
- Running shoes older than 6 months
- Nutrition (Vitamin D and Calcium)
- Smoking
Femoral Neck Stress Fractures

- History of anterior hip or groin pain that worsens with activity. Activity with the characteristic triad of being new, strenuous, and highly repetitious.

- Vague physical exam - log rolling and active straight leg raise sometimes provocative.

- XR may not always reveal fracture until several weeks after injury, MRI is generally recommended to screen for and rule out other possible causes of hip and groin pain.
Femoral Neck Fractures

- Treatment dictated by location ...
  - Compression side (inferior-medial neck) → NWB + activity restriction + close follow-up
  - Tension side (superior-lateral neck) → ORIF
    - Greatest risk of displacement
Femoral Neck Fractures - MRI
Athletic Pubalgia

- Syndrome of chronic lower abdominal and groin pain.
- Commonly referred to as "sports hernia"
- Anterior pelvic pain or groin pain caused by weakness or tearing of rectus abdominis and/or adductor longus insertion onto the pubic symphysis
- Athletes commonly diagnosed with athletic pubalgia participate in sports like soccer, football, ice hockey, hurdling, running, and skiing.
Athletic Pubalgia Presentation

- Kachingwe and Grech (J Orthop Sports Phys Ther 2008) described 5 signs most indicative of a sports hernia …
  - 1. Subjective complaint of deep groin/lower abdominal pain
  - 2. Pain exacerbated by sport-specific activities (sprinting, kicking, cutting, and/or sit-ups) and is relieved with rest.
  - 3. Palpable tenderness over the pubic ramus at the insertion of the rectus abdominis.
  - 4. Pain with resisted hip adduction at 0, 45 and/or 90 degrees of hip flexion
  - 5. Pain with resisted abdominal sit-up.
Athletic Pubalgia – Treatment Modalities

- Treated by a variety of medical professionals including orthopaedic surgeons, sports medicine physicians, general surgeons, and physical therapists with various degrees of success.

- Non-operative
  - Rest and physical therapy for 6-8 weeks
  - U/S-guided corticosteroid vs. PRP injections

- Operative
  - Pelvic floor repair w/ reinforcement of posterior wall+/− mesh (hernia operation) vs. adductor / rectus recession
  - Meyers – surgical reattachment (broad) of inferolateral edge of rectus abdominis muscle to pubis & anterior ligaments.
Coxa Sultans

- A condition characterized by a snapping sensation in the hip
  - Caused by motion of muscles and tendons over bony structures around the hip joint

- Epidemiology
  - Common in athletes and dancers in their teens or twenties

- 3 types of snapping hip exist with different causes
  - External snapping hip
    - Iliotibial tract sliding over greater trochanter
  - Internal snapping hip
    - Most common
    - Iliopsoas tendon sliding over
      - femoral head
      - prominent iliopectineal ridge
      - exostoses of lesser trochanter
      - iliopsoas bursa
Coxa Sultans (Internal)
Coxa Sultans (External)
Coxa Sultans

- **Symptoms**
  - Snapping sensation in and around hip joint
    - Painful vs. painless
    - Reproducibility of snapping sensation
    - Aggravation by activity

- **Physical exam**
  - **External snapping hip**
    - Palpate greater trochanter as hip is actively flexed
      - applying pressure will likely stop snapping, confirming diagnosis
    - TFL tightness - Ober's Test
  - **Internal snapping hip**
    - Snapping is reproduced by passively moving hip from a flexed/externally rotated position to a extended/internally rotated position
Examination Maneuver: Snapping Iliopsoas tendon
Coxa Sultans - Treatment

- Nonoperative
  - Activity modification
    - Indications
      - Acute onset (<6 months) of internal or external snapping hip
  - Physical therapy + corticosteroid injection
    - Indications
      - Persistent, painful snapping interfering with activities of daily living

- Operative
  - Excision of greater trochanteric bursa with ITB Z-plasty
    - Indications
      - Failed non-operative management
  - Release of iliopsoas tendon
    - Indications
      - Failed non-operative management
Avulsion Fractures

- Avulsion injuries are common among skeletally immature athletes because of inherent weakness across the open apophysis.
- Incidence of avulsion fractures is increasing among 14- to 17-year old as a result of growth in competitive sports participation.
- Intense training exposes the epiphyseal plate to repetitive tensile stress while simultaneously enhancing muscle contractility & power.
Avulsion Fractures

- Three most common sites of avulsion injuries in adolescent athletes include ASIS, AIIS and ischial tuberosity due to contraction of sartorius, rectus femoris and hamstrings.
- Avulsion fractures of lesser trochanter can occur from IP.
- Localized pain & swelling following trauma or strenuous exercise with exacerbation with passive stretch of involved muscle.
- XR – determine size of avulsed fragment + displacement
- Avulsion fractures at ischial tuberosity can be problematic if they are large fragments that are widely displaced.
  - Difficulty with sitting and hamstring function.
  - Sciatic nerve irritation.
  - Large displaced fragments (> 2 cm) may require surgical fixation.
Avulsion Fractures
The End