OUTLINE

• 40 MIN - DISCUSS CLINICAL AND FUNCTIONAL CHARACTERISTICS OF PERITROCHANTERIC SPACE

• 10 MIN BREAK

• 40 MIN - DISCUSSIONAL AND FUNCTIONAL CHARACTERISTICS OF DEEP GLUTEAL SPACE

• 10 MIN - QUESTIONS

OUR CASE STUDY

HISTORY

MHO 21-year-old, active duty airborne infantry

Past medical history of:
- Rotator cuff injury fractures in 2013 from high volume and load of training
- Ankle sprain/Arthritis in 2012
- Achilles rupture in 2012

MRI:
- 2-year history of right hip pain with radiologic course. Complaints of pain, stiffness and
- Structural weakening deep in the right hip, groin area
Our Case Study


Ortiz-Declet et al. Diagnostic accuracy of a new clinical test (resisted internal rotation) for detection of gluteus medius tears: Journal of Hip Preservation Surgery Vol. 6, No. 4, pp. 398-405

Contents
- Trochanteric bursa
- Insertion gluteus medius and minimus
- Origin of vastus lateralis
- Tendinous insertion of gluteus maximus on proximal femur

Peritrochanteric space

Boundary:
Deeper
Greater trochanter
Superficially:
Sleeve of gluteus maximus, tensor fascia lata, IT band

Contents
- Rotator cuff of the hip - stability vs movement
- Disruption of this mechanism may result in weakened abductor function
- Rotators + abduction - Internal rotation by tensor fasciae latae and gluteus medius
- External rotation by gluteus maximus

Glutei, tensor fascia lata, and iliotibial band functioned as a pelvic deltoid

Henry’s Pelvic Deltoid

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- External rotation by gluteus maximus

Gluteal vessels, sciatic nerve, iliac vessels

IAOM-US
**Gluteus minimus:**
- Important in stabilizing the hip
- Modulates joint capsule stiffness
- "prevents anterior dislocation and superomedial migration of the femoral head"
- Proprioceptive role.
- Active in both prone hip extension and in late stance phase, acting presumably to provide anterior support to the joint, rather than as a hip extensor for which it has no moment arm

"Subscapularis of the hip"


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**Gluteus medius:**
- Primary abductor of the hip and important stabilizer of the pelvis (contracting prior to and after foot contact)
- Three segments: anti, post, middle or superficial.
- Amplitude of activity in any of the segments highly dependent upon the task
- During gait: posterior portion - stabilizer of the femoral head
- Middle subdivision helps initiate hip abduction
- Anterior subdivision contracts to cause pelvic rotation.
- Minimizes anterior femoral head translation (nonWB)


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**Greater trochanteric pain syndrome**

Chronic pain and tenderness over the lateral aspect of the hip
- Any age group (40-60 years, women)
- 10% to 25% of the general population
- Most common: gluteus minimus or medius tendinosis or tears
- Also: "Trochanteric burr" or external coxa saltans (younger, active patient)

Gluteus minimus or medius abnormalities most commonly occur near the tendon insertions and include tendinosis and partial or full-thickness tendon tears (tendinopathy).
- Repetitive microtrauma, degeneration, or weakening from systemic conditions such as gout, diabetes mellitus, or collagen vascular disease
- Hydroxyapatite deposition disease or seronegative spondyloarthritides

Risk factors:
- LBP 20-62%
- ITB tenderness and knee OA
- Athlete:
  - Shoe wear, running on a cambered or crowned surface
  - Unreasonably rapid progression in the intensity, duration, or frequency of training
  - Inadequate core stability, gluteal weakness.
- Functional limb-length discrepancies
- Alterations in the pronation-supination sequence
- Runners:
  - Those who adduct the hip beyond midline (particularly if they routinely run on cambered surfaces)


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Greater trochanteric pain syndrome

**History:**
- Pain (intermittent, yet persistent) and tenderness in the low back, buttocks, or lateral thigh
- Non-dermatomal pattern
- Exacerbated by lying on the affected side, sitting with the legs crossed, prolonged weight-bearing in unilateral stance, and a reduced tolerance for physical exercise


Greater trochanteric pain syndrome

**Physical Examination:**
- Rule out intra-articular injuries/conditions
- Abnormal gait (Trendelenburg)
- Tenderness to palpation of the greater trochanter
- Pain with resisted abduction in the lateral position
- Pain with resisted internal rotation test
- Faber / Ober may be painful

Clinical cluster:
- Snapping pain in the lateral hip and distinct tenderness in the proximity of the greater trochanter
- At least one of the following: 1) pain at the end range of motion for hip abduction and adduction or internal and external rotation; 2) a positive FABER (flexion, abduction, external rotation position) test; 3) pain with resisted hip abduction; or 4) non-radicular pattern of pain extending down the lateral thigh.


Greater trochanteric pain syndrome

**External Coxa Saltans (snapping ITB)**

- Found incidentally in 5% of population
- Tensor fascia lata flips back and forth over greater trochanter
- Usually voluntary
- Patient experiences a "sense of subluxation": pseudosUBLUXATION

**Treatment**
- Reassure patient, stop voluntary snapping
- Surgical options:
  - Corect a window in band
  - Corticosteroid injection to relax band (longitudinal and transverse incisions)

Surface Anatomy - Lateral

- TFL (anterior superior)
- Piriformis
- Gluteus Med [1/3 posterio superior]
- Gluteus Min [anteroinferior]
- Superior Infratrochanteric Bursa
- Lateral
- Superior
- Inferior
- Greater Trochanter

"...the proximal region (containing the TFL) is more likely to undergo elongation in response to a clinical stretch force when compared to the middle or distal regions." 

Wilhelm M et al. DEFORMATION RESPONSE OF THE ILIOTIBIAL BAND - TENSOR FASCIA LATA COMPLEX TO CLINICAL GRADE LONGITUDINAL TENSION LOADING IN VITRO. The International Journal of Sports Physical Therapy | Volume 12, Number 1 | February 2017

"Clinical stretches to the ITB most likely fall within the elastic region of the tissue’s load-deformation curve and do not likely result in permanent tissue deformation. Consequently, the mechanisms related to positive symptom relief from ITB stretching may be influenced by additional underlying factors."


Gluteus medius and minimus tendons are prone to trigger points, tendon degeneration, or tendon failure.
## Greater trochanteric pain syndrome

### Classification

<table>
<thead>
<tr>
<th>Type</th>
<th>Exam</th>
<th>Intra-Op</th>
<th>MRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>None vs GT TTP</td>
<td>Bursitis</td>
<td>Trochanteric Bursitis</td>
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<tr>
<td>II</td>
<td>GT TTP with maintained abductor strength</td>
<td>Bursitis and surface fraying of the gluteus medius or minimus tendons</td>
<td>Tendinosis</td>
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<tr>
<td>III A</td>
<td>Mild abductor weakness</td>
<td>Partial-thickness tear &lt; 25%</td>
<td>Partial tear low-grade</td>
</tr>
<tr>
<td>III B</td>
<td>Moderate abductor weakness</td>
<td>Partial-thickness tear &gt; 25%</td>
<td>Partial tear high-grade</td>
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<tr>
<td>IV</td>
<td>Trendelenburg testing</td>
<td>Full-thickness tear</td>
<td>Full-thickness tear</td>
</tr>
<tr>
<td>V</td>
<td>Severe abductor weakness, Trendelenburg testing non-ambulatory</td>
<td>Full-thickness tear retraction</td>
<td>Full-thickness tear, retracted fatty atrophy</td>
</tr>
</tbody>
</table>

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**References**

Let's take a break...

Deep gluteal space

Boundaries:
- Gluteus maximus muscle (posteriorly)
- Posterior acetabular column, hip joint capsule and proximal femur (anteriorly)
- Lateral lip of linea aspera and greater trochanter (laterally)
- Sacrotuberous ligament and falciformis fascia (medially)
- Inferior margin of the sciatic notch (superiorly)
- Proximal origin of the hamstrings and ischial tuberosity (inferiorly).

Deep gluteal space

Content:
- Sup/Inf gluteal nerves
- Vessels ACFM
- Ischium
- Sacrotuberous/sacrospinous ligaments
- Sciatic nerve
- Periformis
- Obturator Int/Ext
- Gemelli
- Quadratus femoris
- Hamstrings


Deep gluteal muscles

- Close proximity to the axis of rotation
- Muscle length does not change to joint position
- Rotational control without otherwise affecting joint position
- When combined with their rotational antagonists (gluteus minimus, pectineus, and adductors), these muscles appear to provide a stabilizing role to the hip joint
- Simultaneous IR and ER contraction, a medial compressive force is created to balance the lateralizing force of the abductors.

Such balance may facilitate dynamic stabilization of the hip joint.


Deep gluteal syndrome

- Symptoms:
  - Hip or buttck pain
  - Tenderness in the gluteal and retro-trochanteric region
  - Sciatic-like pain
  - Often unilateral but sometimes bilateral
  - Exacerbated with rotation of the hip in flexion and knee extension

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Fibrous bands
- Diminished or absent sciatic mobility during hip and knee movements
- Sciatic neuropathy (ischemic neuropathy)
  1. Compressive or bridge-type bands
  2. Adhesive or horse-strap bands
  3. Undefined distribution

Look for asymmetries in Neural Testing.


Sciatica of extraspinal origin (sub-gluteal space)

- Dysfunctions:
  - Intolerance of sitting more than 20-30 min
  - Limping, disturbed or loss of sensation in the affected extremity
  - Lumbago and pain at night getting better during the day

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Deep gluteal syndrome

Piriformis Syndrome

- 10.17% in LBP and Radicular pain
- 13 anatomical variations - relation with sciatic nerve
- Nerve passes beneath piriformis in 85.2% of individuals
- Insertion onto the greater trochanter
- Join the tendons of the superior gemellus and obturator internus (29.3%) or the tendon of obturator internus and gluteus medius (13.4%)
Deep gluteal syndrome

Gemelli-obturator internus syndrome

- Assist in ER hip and abduction of the hip while in a flexed position
- Rare condition
- Dynamic compression
- Differential diagnosis of non-discogenic sciatica
- Sacral-like effect with paresthesia
- The nerve is attached to the gemelli-obturator internus complex by connective tissue, which can lead to sciatic entrapment.
- Muscular spasm or myofascial pain syndrome, acute strain, haematoma, abscess/pyomyositis, tendinitis, and bursitis of the obturator internus can cause posterior hip pain.

- Peak strength at 60-90 of hip flexion
- Highly active in maximum isometric hip external rotation and extension
- Highly active in the stance phase of running
- Intricate functional relationship between QF and the biarticular hamstring muscles (synergistic)
- Consider screening QF dysfunction as a differential diagnosis of hamstring related injuries and QF rehabilitation as a potential intervention to accelerate recovery and minimize the risk of injuries.
- Dynamic stabilizing effect


Deep gluteal syndrome

Quadratus femoris

- 2nd larger physiological cross-sectional area
- "Piriformis-like syndrome"
- Potential cause of posterior leg pain in case of ischiofemoral impingement
- Compression of the muscle between the ischial tuberosity and the lesser trochanter.
- Edema, cystic changes, and deterioration (atrophy and rupture) are diagnostic features of this condition.

- Contributes minimally to ER, and should be more properly considered a "primary" extensor of the flexed hip
- Most seen in female
- Nerve close to the posterior capsule of the hip and enters the posterior thigh
- Muscular, tendon and neural changes
- Persistent pain in the medial thigh and groin following total hip arthroplasty
- Snapping, clunking or locking sensation of the hip joint during long-stride walking
- This impingement can result in edema or tearing of quadratus femoris or the hamstring tendon.


Deep gluteal syndrome
Quadratus femoris and ischiofemoral pathology

- Worsening of pain during running or taking larger steps
- Underlying pathologies in the ischiofemoral impingement syndrome include:
  - Hip abductor insufficiency
  - High femoral/acetabular version and neck-shaft angle
  - Developmental dysplasia of the hip
  - Varus intertrochanteric osteotomy
  - Inflammatory myositis
  - Intramuscular lesions of quadratus femoris, ischial tuberosity avulsion fracture, and exostosis


Proximal Hamstring Syndrome

- Sciatic nerve runs superficial to the adductor magnus, but deep to the hamstring muscle complex consisting of biceps femoris, semitendinosus, and semimembranosus.
- Lies approximately 1.2 cm lateral to the ischial tuberosity or the outer border of the semimembranosus tendon.
- Can cause irritation or entrapment associated with repetitive stress on the hamstring tendon and reported in sporting activities involving running, kicking, or jumping.
- Ischial pain during the initial heel strike


Sciatic Nerve Mobility Test

**Emphasis at the Ischial Tuberosity:**

**Modified SLR**

- Extension Foot
- Flexion Hip
- Extension Knee
- Adduction Hip
- Internal Rotation Hip
**Hamstring Syndrome**

Test: Resisted Knee Flexion from prepositioned SLR

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**Synovitis … Muscle Inhibition**

- Decreased voluntary contraction capacity
- Delayed onset (muscle activation)
- Inadequate muscle relaxation

\[ \text{Relaxation} \rightarrow \text{Activation} \rightarrow \text{Strengthening} \]

- Inhibition

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**Gluteal Tendinopathy**

- Considerations:
  - Gluteal Tendinopathy - Bilateral hip abductor weakness
  - Be careful when using asymptomatic side as “normal” comparison in clinical assessment.
  - Weight reduction and control to prevent body mass generated overload of the hip abductor tendons.
  - Consider isometric hip abductor exercise as a treatment.
  - Strengthening exercise promotes tendon remodeling, and potentially provides an anagelic effect.
  - Maximal isometric hip abduction results in low-to-moderate pain provocation —> Hip abductor strengthening might be an appropriate exercise for this group.
Microinstability:

Traumatic or non-traumatic. Controversy in diagnosis, imaging, and management.
Repetitive external rotation and axial loading = capsular redundancy over time.

History:
- Locking, catching, giving way, pain elicited without defined injury.
- Sports with high incidence of dislocation.
- History family: Ehlers-Danlos syndrome, Marfan syndrome, and Down syndrome.
- Differential diagnosis: lumbar, gastrointestinal, vascular genitourinary, snapping hip.

Physical Examination:
- Increased ROM with capsular laxity and symptoms = true instability.
- Audible Pop: when taking the hip from flexion into extension.
- Positive dial test (indicative of a capsular laxity), axial distraction/apprehension test.
- May be accompanied by iliacos tendinitis, iliobial band syndrome (internal/external snapping hip).

Greater trochanteric pain syndrome

Suggested Management
- Re-Activity (neuromotor) deep gluteal musculature somatosensory training in static (first) postures.
- Consider unloading specific involved musculature.
- Read the kinetic chain.
- Lumbar/hip (foundation) knee/A/P segments for control.
- Activity modification: Environment factors.

General

Suggested Management
- Regional interdependence model.
- Lumbopelvic impairments.
- Pain-free ROM and submaximal isometrics targeted at hip (early stages).
- Minimize load in gluteal maximus and tensor fascia latae (TFL).
- Avoid positions of hip adduction, unilateral stance positions, crossing their legs, foam rolling over the affected region, long strides and exercises that over activate the TFL.
- Manual therapy for the joint and soft tissues in a comprehensive treatment program.
- Traction from a resting position and posterior glides moving towards end range.
- Soft tissue mobilization to the deep rotators and distal ITB may decrease pain and improve mobility.
- Sensory motor control — starting from deep gluteal musculature.

SUMMARY

• Precise diagnosis – Effective treatment
• Internal stability – External mobility
• Treat perpetuator factors (case specific)