Occupational Injuries and Diseases of the Hip and Pelvis

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Disclosures

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Introduction

• Many conditions masquerade hip joint and pelvic
• Non-occupational cases of pelvis and hip joint
• Work-related cases of the pelvis and hip joint
Non-occupational hip cases
Avascular necrosis
Avascular necrosis

• 48-year-old, right-hand dominant male logger and choker setter for 20 years was pinned between a tree stump and a vehicle initially complaining of bilateral shoulder pain

Avascular necrosis

I’ve felt left hip and thigh pain for several years.

I had the pain when stepping over logs on the ground in deep snow.

But it wouldn’t hurt all the time and if I didn’t work it so hard, then it would go away.

Photo source: https://sites.google.com/site/loggingandkudzu/
Avascular necrosis

• Past medical history
  – right carpal tunnel syndrome
  – right elbow fracture
  – Hypertension
  – Hypercholesterolemia
  – right hand gunshot wound
  – right knee injury
Avascular necrosis

- Past surgical history
  - right knee arthroscopy x 2
  - right carpal tunnel release
  - right elbow open reduction and internal fixation
  - left shoulder arthroscopy x 2
Avascular necrosis

• His habits
  – No smoking
  – No chewing tobacco
  – Occasional alcohol consumption

• His hobbies and interests
  – Fishing
  – Hunting
  – Watching spectator sports
Avascular necrosis

• Physical exam
  – Painful left hip flexion, internal rotation, and external rotation
  – Pain-free right hip passive range of motion
Avascular necrosis

• MR scan of the left hip bilateral avascular necrosis of the femoral heads
• Subchondral ischemia in both femoral heads was observed
• No evidence of fracture or deformity to the articular surface of either femoral head or femoral neck
Blood supply of the femoral head

http://www.physio-pedia.com/Legg-Calve-Perthes_Disease
Risk factors for avascular necrosis

- Systemic lupus erythematosus (SLE)
- Sickle cell disease
- Renal transplants
- Fat emboli
- Bone disease and neoplasms
- Osteomyelitis
- Pancreatitis
- Pheochromocytoma
- Long-term high-dose corticosteroid treatment
- Alcoholism
- Femoral neck fractures
- Decompression sickness
- High dose radiation exposures
- Legg-Calve-Perthes disease
Avascular necrosis

- Kang et al. (2013)
- Fraitzl et al. (2013)
Osteonecrosis can progress from a normal, healthy hip (Stage I) to the collapse of the femoral head (Stage IV).

http://orthoinfo.aaos.org/topic.cfm?topic=a00216
Avascular necrosis

• Medical laboratory tests revealed antinuclear antibody (ANA) screen was positive with a titer of 1:160 and a speckled pattern
• Diagnosed with unspecified auto-immune arthropathy (likely systemic lupus erythematosus)
• Recommended rheumatology evaluation
Femoroacetabular impingement
Femoroacetabular impingement

- 44-year-old right hand dominant female who developed right hip pain which she associated with her employment as a long haul trucker

Photo source: www.redrockcollisionrepair.com/st-george-heavy-equipment/semi-trucks/
Femoroacetabular impingement

- 44-year-old right hand dominant female who developed right hip pain which had she associated with her employment as a long haul trucker.
Femoroacetabular impingement

• She reported pain in the right groin wrapping around the hip and into the right sacral region
• She also reported muscle spasms in the right buttock
Femoroacetabular impingement

• Pelvic MR scan
  – Moderate osteoarthritic changes with right side worse than left
  – Slight lateral subluxation of the right hip
  – Enlargement of the superior labrum
  – Right hip joint effusion
Femoroacetabular impingement
Femoroacetabular impingement

Femoroacetabular impingement

• History from medical records contradictory
  – Several years earlier, she slipped on the ice and landed on her right hip, and had low back and right hip pain
  – MRI showed revealed a right hip acetabular labral tear
  – She underwent a right hip arthroscopy labral debridement and arthroscopic decompression of a cam lesion of the femur
Femoroacetabular impingement

- Medical records clearly showed a longstanding hip problem dating back to her fall on ice
- Most recent right hip MRI
  - significant right hip degeneration
  - no bone marrow edema
  - no new or recurrent labral tear
- No indication either a new injury or an aggravation of the pre-existing labral tear
Occupational hip cases
Femoroacetabular impingement (FAI)
Femoroacetabular Impingement

FAI Case

- 57-year-old right-hand dominant male who was injured when he fell off a 6 ft ladder landing on his right hip

FAI Case

I had pain from my groin through my bottom to my right butt cheek.

Sometimes my hip will feel unstable and I’ll have a sharp abrupt pain.

After the hip joint injection they gave me, I had a lot less pain.
FAI Case

• Radiographs of the right hip
  – mild bony overgrowth of femoral head and neck
• Findings consistent with cam-type femoral acetabular impingement
FAI Case

- Right hip MR arthrogram
  - complex horizontal tear from the 12 o’clock position through the 1:30 position
  - paralabral cartilage irregularity with fissuring and adjacent delamination
FAI Case

• In femoroacetabular impingement, bone spurs develop around the femoral head and/or along the acetabulum
• The bone overgrowth causes the hip bones to hit against each other, rather than to move smoothly
• Over time, this can result in the tearing of the labrum and breakdown of hip joint cartilage
Femoroacetabular impingement

• Three types of femoroacetabular impingement
  – Pincer
  – Cam
  – Mixed FAI
Pincer-type FAI

- Pincer type impingement occurs because extra bone extends out over the normal rim of the acetabulum.
- The labrum can be crushed under the prominent rim of the acetabulum.
Cam-type FAI

- In cam type impingement, the femoral head is not round and cannot rotate smoothly inside the acetabulum.
- A bony outgrowth forms on the edge of the femoral head and neck that grinds the cartilage inside the acetabulum.
Mixed FAI

• Combined impingement just means that both the pincer and cam types are present
Risk factors for aggravated FAI

• Some people may live long, active lives with FAI and never have problems
• Femoroacetabular impingement can become aggravated by vigorous athletic activity (e.g., tennis, racquetball, ballet, martial arts, etc.) and by traumatic injury
FAI Case

• The evidence suggested cam-type impingement, based upon the irregularity of the femoral head, decreased femoral head-neck offset, and evidence of labral fissuring and adjacent delamination.
FAI Case

- Trauma from the fall off a 6 foot ladder onto the right hip was the likely cause of aggravated FAI
Gluteal nerve axonotmesis
Gluteal nerve axonotmesis

- 67-year-old left hand dominant male who was working for cattle company; he "attempted to get on his horse, horse must have spooked, was thrown into fence."

Photo source: https://boydranch.net/available-horses/
Gluteal nerve axonotmesis

• Past medical history
  – peripheral neuropathy
  – Morton's neuroma
  – carpal tunnel syndrome
Gluteal nerve axonotmesis

• Past surgical history
  – left total knee arthroplasty
  – left hip arthroplasty
  – right foot surgery
Gluteal nerve axonotmesis

• Initial diagnoses
  – left 2\textsuperscript{nd} – 8\textsuperscript{th} ribs fractured
  – left pneumothorax
  – left humeral head dislocation with a Hill-Sachs deformity and glenoid rim displaced fracture
  – non-displaced left acetabular rim fracture
  – small fatty-containing left inguinal hernia
  – left mid-clavicle fracture
Acetabular rim fracture
Gluteal nerve axonotmesis
Gluteal nerve axonotmesis

• During hospitalization, he underwent:
  – open reduction and internal fixation of left humeral head fracture
  – left thoracostomy tube
  – open reduction and internal fixation of left inferior glenoid rim fracture
Gluteal nerve axonotmesis

• Within 1 ½ months, he complained of
  – worsening lumbar region
  – worsening left hip pain
  – burning in left leg and buttock
  – fluid collection in his low back and that moved into the left buttock
Gluteal nerve axonotmesis

• Lumbar radiographs
  – disc degeneration at L2-3, L3-4, L4-5, and L5-S1
  – no subluxation on flexion and extension views
Gluteal nerve axonotmesis

- Lumbar spine MRI
  - L1-2: mild bilateral facet degeneration
  - L2-3: there was a symmetric disc bulge, mild facet
  - L3-4: disc bulge causing mild spinal canal narrowing, right lateral recess effacement of right L4 nerve root, mild bilateral L3 neural foraminal encroachment
  - L4-5: disc-osteophyte complex causing mild spinal canal stenosis, and osteophytes causing bilateral foraminal stenosis
  - L5-S1: osteophytes causing left foraminal narrowing
Gluteal nerve axonotmesis

• Symptoms
  – superior left gluteal muscle pain and "there’s a big knot"
  – gluteal pain provoked by prolonged sitting
  – gluteal numbness that did not extend into the thigh
  – pain moved through the buttock, wrapped the left greater trochanter, then through the anterolateral thigh stopping at the mid-thigh level
  – No right leg numbness, tingling, weakness, or pain
Gluteal nerve axonotmesis

• Physical exam
  – thoracic spinous process tenderness at approximately T5,
  – right parathoracic muscle tenderness at approximately T10,
  – left > right posterior superior iliac spine tenderness
  – Bilateral sacroiliac joint tenderness
  – FABER test was positive on the left
Gluteal nerve axonotmesis

• Physical exam
  – strength was 4+/5 in all muscle groups of both legs
  – deep tendon reflexes were symmetric
  – no ankle clonus
  – obvious left buttock muscle atrophy
Gluteal nerve axonotmesis

- A contrast-enhanced pelvic MR scan
  - asymmetric atrophy and edematous signal within the left gluteus maximus muscle with minimal increased enhancement
Gluteal nerve axonotmesis

• Electrodiagnostics considered abnormal with evidence of a left lower extremity peroneal motor neuropathy
  – non-contributory findings
  – no weakness on great toe extension
  – no weakness on ankle dorsiflexion
Gluteal nerve axonotmesis

- Diagnosed with axonotmetic injury of left inferior nerve gluteal nerve with subsequent gluteal muscle atrophy
What’s the difference between axonotmesis and neuropraxia?
Neuropraxia

• Mild injury
  – ischemia, mechanical compression, metabolic or toxic factors
• Results in focal demyelination, but no loss of axonal integrity
• Weakness and sensory loss are due to conduction block
• No muscle atrophy
• Excellent recovery is expected
Axonotmesis

• Severe injury
  – motor vehicle accidents, falls or percussion injuries (e.g., gunshot wounds)
• Axon and myelin sheath degenerates, a process is known as Wallerian degeneration
• Muscle atrophy occurs within weeks
• Partial recovery is the expected outcome, but the time course is significantly protracted as compared with neurapraxia
Gluteal nerve axonotmesis

- Diagnosed with axonotmesis injury of left inferior nerve gluteal nerve with fairly severe gluteal muscle atrophy
- Likely cause was the severe left hemipelvic blunt trauma which also caused left acetabular rim fracture
- Unlikely L5 or S1 radiculopathy because no hip extension weakness
- Unlikely superior gluteal nerve injury because no gluteus medius weakness

Photo source: http://thinklikeahorse.org/index-2.html/
Avascular necrosis
Avascular necrosis

• Obese 54-year-old male computer technician had to replace internet broadcast antenna on a 300 foot tall grain silo in January

• Used an interior elevator to reach top of silo

Photo source: https://bobsmisanthropicadventures.wordpress.com/category/silo/
Avascular necrosis

- After installing the antenna, he found the elevator didn’t work; he had to climb down using an exterior ladder.
- He was out of breath after about 30 feet.

Photo source: https://www.tennessean.com/story/money/2017/03/23/massive-mural-planned-grain-silo-nations/99506626/
Avascular necrosis

- He wore a harness that he clipped onto the ladder while he caught his breath
- He had to stop repeatedly because of shortness of breath
Avascular necrosis

• He said that he thought he might develop hypothermia and die on the ladder

• The descent required over an hour
Avascular necrosis

- When he finally got to the ground, his whole body was aching, but this resolved in a couple of hours
Avascular necrosis

- A week later
  - right groin and medial thigh pain traveling to the knee
  - lateral hip pain extending through the lateral thigh to the lateral knee
  - shooting pain in the right leg to the foot
  - right leg buckling and falls
Avascular necrosis

• Symptoms
  – Right leg pain in the medial and lateral thigh, sharp pain in the right groin
  – Right leg buckling
  – Nocturnal awakening with right groin cramping,
  – Right hip externally rotates when walking (i.e., Trendelenburg gait)
Avascular necrosis

• Physical exam
  – right hip with limited passive flexion, internal rotation, and external rotation
  – moderate pain with all of these movements
  – Pain on Stinchfield’s test
  – no evidence of inguinal hernia
• Why did I worry about a hernia?
• What is a hernia?
Avascular necrosis

• What’s Stinchfield’s test?
  – aka Stinchfield Resisted Hip Flexion Test
  – Tests for a pain response caused by an increase in hip joint reactive force
  – Is a way to distinguish between intra-articular and extra-articular hip pathology causing groin, thigh, buttock, and even pretibial leg pain
Avascular necrosis

• What’s Stinchfield’s test?
  – From a supine position with the knee extended, the patient is asked to actively elevate the leg against
  – Positive test is reproduced pain in groin
Avascular necrosis

• Right hip x-rays
  – Narrowing of the femoral acetabular joint with mild sclerosis and spurring present
  – Flattening and irregularity of the femoral head with increased sclerosis suggesting avascular necrosis
  – Cam-type femoroacetabular impingement with hypertrophic change of the femoral neck
Avascular necrosis

• Bone scan
  – increased activity in the right hip most pronounced at the femoral head
  – no evidence of fracture
Avascular necrosis

- Hip MR arthrogram
  - Large right hip joint effusion
  - Diffuse abnormal signal intensity in the right femoral head, neck, and subtrochanteric region
  - Femoral head articular surface cortical defect
  - Overall appearance of avascular necrosis of the femoral head
Avascular necrosis

- Medical lab
  - Glycosylated hemoglobin level was slightly elevated at 5.7%
  - Slightly low calcium level
  - Vitamin D deficiency
Avascular necrosis

• Diagnosis
  – Right hip avascular necrosis
  – Type 2 obesity (BMI=38.5 kg/m²)
Avascular necrosis

- Risk factors of avascular necrosis:
  - Systemic lupus erythematosus
  - Rheumatoid arthritis
  - Gaucher’s disease (heritable lipid storage disease caused by glucocerebrosidase enzyme deficiency)
  - Legg-Calvé-Perthes syndrome (childhood osteonecrosis)
  - Long-term (months-years) high-dose steroid treatment
Avascular necrosis

- Risk factors of avascular necrosis:
  - HIV infection (100-fold increased risk)
  - Caisson disease (decompression sickness)
  - Work in high pressure environments (divers)
  - Alcoholism, tobacco smoking
  - Untreated hypertension
  - Vasculitis, arterial embolism and thrombosis
  - Bisphosphonates (jaw only)
  - Chemo and radiation therapy for cancer
  - Sickle cell disease
Avascular necrosis

• Discussion:
  – Kang et al. (2013)
  – Fraitzl et al. (2013)
Cam-type FAI

• In cam type impingement, the femoral head is not round and cannot rotate smoothly inside the acetabulum

• Prolonged hip flexion while resting during hour-long ladder descent combined with cam-type FAI likely caused avascular necrosis
Compromised blood supply of the femoral head

Blood supply of the femoral head

http://www.physio-pedia.com/Legg-Calve-Perthes_Disease
Osteonecrosis can progress from a normal, healthy hip (Stage I) to the collapse of the femoral head (Stage IV).

http://orthoinfo.aaos.org/topic.cfm?topic=a00216
(Left) An x-ray of a healthy hip joint. (Right) In this x-ray, the osteonecrosis has progressed to collapse of the femoral head.

http://orthoinfo.aaos.org/topic.cfm?topic=a00216
Conclusion

• Hip and groin pain are common and can have lots of causes
  – Inguinal hernia
  – Avascular necrosis of femoral head
  – Labral tear
  – Iliopsoas muscle tear from its insertion at the lesser trochanter
  – L1-2 or L2-3 disc herniation
  – Pelvic muscle tendinopathy
  – Hip fracture
Conclusion

• History can provide clues to cause of problem
  – Congenital abnormality
  – Lifestyle choices
  – Other diseases
  – Previous injuries
  – Medical treatments
Conclusion

• Mechanism of injury can provide clues to cause of pain
  – Severe blunt trauma
  – Abrupt strain/sprain
  – Overuse/repetitive use
Conclusion

• Accurate diagnosis is absolutely necessary for successful treatment
Questions?

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