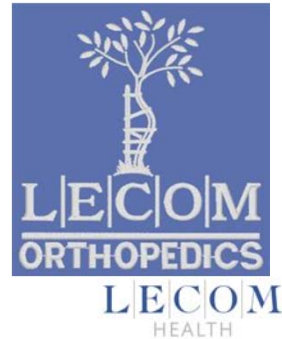


Hip Fractures: Continuum of Care

Anthony J. Ferretti, D.O., MSHA



Background

- Treatment of hip fractures in the elderly has a major impact on the healthcare system in the United States.
- An estimated 258,000 fractures in 2010 projected to increase to >289,000 in 2030 as the population ages and life expectancies increase.
- The annual United States economic burden for managing hip fractures estimated at \$17 - \$20 billion in 2010.
- Hip fracture treatment was ranked #13 of the top 20 most expensive diagnoses for Medicare in 2011.



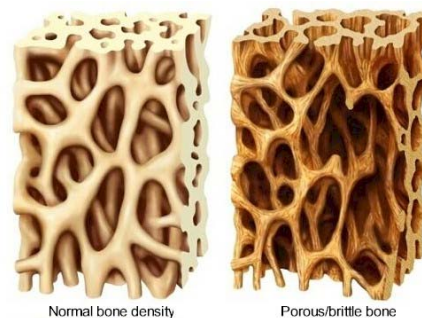
Hip Fracture Mortality

- ~ 25% at one year
 - Males – 30% mortality
 - Females – 20% mortality
- ~ 20% at two years
- ~ 45% at two years postoperatively in patients with chronic renal failure
- Surgery within 48 hours decreases 1 year mortality
- Predictors of mortality –
 - pre-injury mobility is the most significant determinant for post-operative survival
- Factors that increase mortality –
 - Male gender
 - Intertrochanteric fracture (vs femoral neck fracture)
 - Operative delay of >2 days
 - Age >85 years
 - 2 or more pre-existing medical conditions
 - ASA classification (ASA III and IV increases mortality)



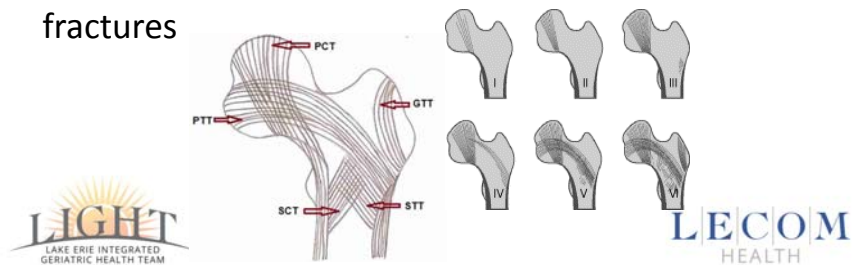
Osteoporosis

- Defined by WHO as a T score of < -2.5
- A quantitative vice qualitative disorder of bone loss
- 1.2 million osteoporotic fractures occur each year
 - 700,000 are vertebral fractures (60-70 years old)
 - 300,000 are hip fractures (70-80 years old)
 - 200,000 are wrist fractures (50-60 years old)



Singh Index

- Decreased BMD not apparent on x-ray until >30% loss.
- The Singh index describes the trabecular patterns of proximal femur
- X-rays are graded 1-6 according to the disappearance of the normal trabecular pattern
- Singh Index of < 3 have higher incidence of fragility fractures



DEXA

(Dual energy x-ray absorptiometry)

- The WHO has adopted DEXA derived BMD measurements to define normal bone, osteopenia, and osteoporosis in both the axial and appendicular skeleton.
- performed in lumbar spine:
 - measures BMD from L2 to L4 and compiles scores
- Performed in hip:
 - measure BMD from femoral neck, trochanter, and intertrochanteric region and compiles scores
- sensitivity and specificity – most accurate with the least radiation exposure



FRAX

(World Health Organization Fracture Risk Assessment Tool)

- Pharmacologic treatment for osteoporosis should be considered if patients are postmenopausal women or men >50 yo AND meet one of the following criteria:
 - (1) prior hip or vertebral fracture
 - (2) T score -2.5 or less at the femoral neck or spine
 - (3) T score between -1.0 and -2.5 at the femoral neck or spine AND a
 - 10-year risk of hip fracture >3% or
 - 10-year risk of major osteoporosis-related fracture >20%.



<https://www.shef.ac.uk/FRAX/tool.jsp>

FRAX[®] WHO Fracture Risk Assessment Tool

Home Calculation Tool Paper Charts FAQ References English

Calculation Tool

Please answer the questions below to calculate the ten year probability of fracture with BMD.

Country: **UK** Name/ID:

Questionnaire:

1. Age (between 40 and 90 years) or Date of Birth
 Age: Date of Birth: Y: M: D:

2. Sex Male Female

3. Weight (kg)

4. Height (cm)

5. Previous Fracture No Yes

6. Parent Fractured Hip No Yes

7. Current Smoking No Yes

8. Glucocorticoids No Yes

9. Rheumatoid arthritis No Yes

10. Secondary osteoporosis No Yes

11. Alcohol 3 or more units/day No Yes

12. Femoral neck BMD (g/cm²)
 Select BMD:

Weight Conversion

Pounds ↔ kg

Height Conversion

Inches ↔ cm

03760144

Individuals with fracture risk assessed since 1st June 2011

www.nos.org.uk

Risk factors



AMERICAN ACADEMY OF ORTHOPAEDIC SURGEONS

Hip Fractures in the Elderly Clinical Practice Guidelines September 5, 2014



AAOS Hip Fractures in the Elderly Clinical Practice Guidelines

- General Themes
 - Optimal care of the geriatric hip fracture patient occurs in the setting of a multidisciplinary team of providers with a patient-centered focus.
 - Early surgical intervention portends to better patient outcomes
 - Avoidance of delirium with multimodal pain control
 - Focus on overall nutrition and bone health



AAOS Hip Fractures in the Elderly CPG Interdisciplinary Team

- Strong evidence supports use of an interdisciplinary care program in those patients with mild to moderate dementia who have sustained a hip fracture to improve functional outcomes.



AAOS Hip Fractures in the Elderly CPG Advanced Imaging

- Moderate evidence supports MRI as the advanced imaging of choice for diagnosis of presumed hip fracture not apparent on initial radiographs.
 - CT scan =
 - administration of ionizing radiation
 - not as sensitive as MRI for detecting occult fractures
 - Bone Scan =
 - suboptimal spatial resolution compared to MRI
 - identifies occult fractures *after* 72 hours from time of injury
= results in surgical delay



AAOS Hip Fractures in the Elderly CPG
Preoperative Traction

- Moderate evidence does not support routine use of preoperative traction for patients with a hip fracture.
 - No difference with regards to decreased pain or quantity of analgesia administered.



AAOS Hip Fractures in the Elderly CPG
Surgical Timing

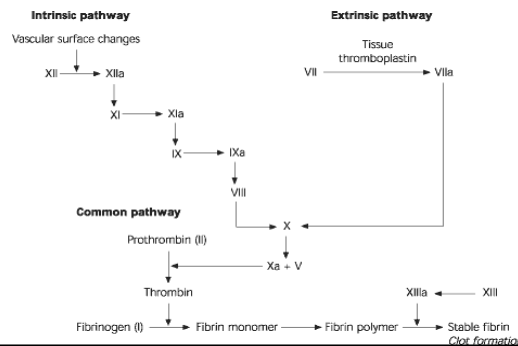
- Moderate evidence supports that hip fracture surgery within 48 hours of admission is associated with better outcomes.
 - Challenging because the sickest patients often have the longest delays.
 - Patients delayed because of medical reasons have the highest mortality rate, and it is this subset of patients that could potentially benefit the most from earlier surgery.



AAOS Hip Fractures in the Elderly CPG

Aspirin & Plavix

- Limited evidence supports not delaying hip fracture surgery for patients on aspirin and/or clopidogrel.
 - Systematic review suggests that at worst that there is no advantage to this practice
 - Advantage for patients may be in that surgery is not delayed.
- Recommend delaying surgery for 24-hours minimum from last dose of Xa inhibitors
 - Xarelto
 - Pradaxa
 - Eliquis
 - Arixtra



AAOS

Hemiarthroplasty vs. Total Hip Arthroplasty

- Moderate evidence supports a benefit of total hip arthroplasty in properly selected patients with unstable (displaced) femoral neck fractures.
- Total Hip Arthroplasty =
 - Lower pain related scores
 - Lower revision rates for acetabular wear



AAOS Hip Fractures in the Elderly CPG Transfusion Threshold

- Strong evidence supports a blood transfusion threshold of no higher than 8g/dl in asymptomatic postoperative hip fracture patients.
- FOCUS Trial (Carson et al. (2006). NEJM)
 - (n=2016) Restrictive transfusion threshold of hemoglobin 8g/dl in asymptomatic hip fracture patients with cardiovascular disease or other risk factors resulted in no significant difference in primary or secondary outcomes at 30 or 60 days including mortality, independent walking ability, residence, other functional outcomes, cardiovascular events, or length of stay.




AAOS Hip Fractures in the Elderly CPG Nutritional Status/Bone Health

- Moderate evidence supports that nutritional supplementation in patients with underlying deficiency improves functional outcomes and reduces mortality.
- Moderate evidence supports use of supplemental vitamin D and calcium in patients following hip fracture surgery.
- Admission laboratories should include:
 - Albumin
 - Vitamin D
- Multivitamin started on admission
- 20 gram protein supplement started on admission
- Dietary requirements
 - Calcium → 1200-1500mg po daily
 - Vitamin D → 800-1000 IU daily (titrate according to Vitamin D obtained on admission)
- Dietician consultation obtained upon admission.
- Evaluate at first outpatient follow-up appointment for bisphosphonate therapy.



AAOS Hip Fractures in the Elderly CPG
Intensive Physical Therapy

- Strong evidence supports intensive physical therapy post-discharge to improve functional outcomes in hip fracture patients.
- ~1/3 of patients with hip fractures return to their previous level of function
- Intensive Physical Therapy s/p hospital discharge shown to improve:
 - Functional Outcomes
 - Leg Strength
 - Balance
 - Mobility
 - Performance of ADLs
 - Overall health status



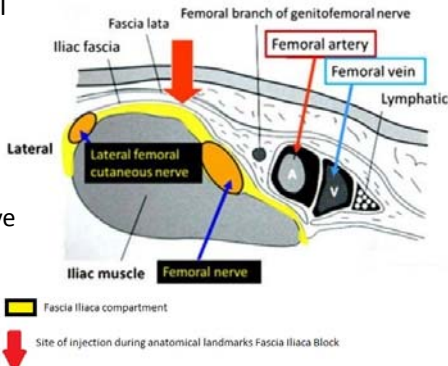
LECOM
Senior Living Center & Institute for Successful Aging
THERAPY GYM

LECOM
HEALTH

LIGHT
LAKE ERIE INTEGRATED GERIATRIC HEALTH TEAM

AAOS Hip Fractures in the Elderly CPG
Postoperative Multimodal Analgesia

- Strong evidence supports multimodal pain management after hip fracture surgery.
 - Local Anesthesia
 - Regional Anesthesia – Fascia Iliacus Block
 - Axial Anesthesia – Epidural/Spinal
 - Narcotics – avoid narcotics with active metabolites (Morphine & Codeine)
 - IV Tylenol
 - IV Toradol
 - Tramadol
 - Neuromodulators – Lyrica, Neurontin
- The multimodal approach results in pain control with lower doses of each individual agent, thereby reducing the deleterious side-effects seen at higher dosages.










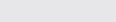





LECOM
HEALTH

LIGHT
LAKE ERIE INTEGRATED GERIATRIC HEALTH TEAM

AAOS Hip Fractures in the Elderly CPG VTE Prophylaxis

- Moderate evidence supports use of venous thromboembolism prophylaxis (VTE) in hip fracture patients.
- Recommendations from 3 major Academies
 - OTA (Orthopedic Trauma Association)
 - ACCP (American College of Chest Physicians)
 - AAOS (American Academy of Orthopedic Surgery)



Current Guidelines for venous Thromboembolism Prophylaxis in Orthopaedics	
Source	Guidelines
Orthopaedic Trauma Association ^{1,a}	Major orthopaedic surgery  LMWH is considered the agent of choice and should be initiated within 24 hr provided there are no contraindications (Strong)
	 Combined LMWH and calf pneumatic compressive devices over either regimen alone (Strong)
	 Continuation of VTE prophylaxis for at least 1 mo after discharge (Limited)
	 Recommend against routine screening protocols for DVT in asymptomatic trauma patients (Strong)
	Isolated lower extremity injury Do not recommend routine chemical prophylaxis in patients who do not have additional risk factors and are independently mobile (Moderate) Recommend against routine screening protocols for DVT in asymptomatic trauma patients (Strong)
American College of Chest Physicians ^{2,b}	Major orthopaedic surgery  Extend outpatient prophylaxis for up to 35 d postop (2B)
	 Dual prophylaxis with pharmacologic agent and IPCD while inpatient (2C)
	 Recommend against screening Doppler ultrasonography before discharge (1B)
	Hip fracture surgery  Prophylaxis for a minimum of 10-14 d (1B) Start LMWH either 12 h or more preop or 12 h or more postop (1B) Recommend use of LMWH, fondaparinux, LDUH, adjusted-dose aspirin (1B) or IPCD (1C)
	 LMWH is preferred to other agents (2B/2C)
American Academy of Orthopaedic Surgeons ^{3,c}	Isolated lower extremity injury No prophylaxis in patients who require leg immobilization (2C)
	Elective total joint arthroplasty  Pharmacologic agents and/or mechanical compressive devices for VTE prevention for those who are not at elevated risk (Moderate)
	 No specific agent recommended (Inconclusive)
	 Patients and physicians discuss duration of treatment (Consensus)
	 Recommend against routine duplex ultrasonography screening postoperatively (Strong)

INR Reversal



- Most hospitals do not have an official policy for INR reversal for patients presenting with a hip fracture
- Controversy & dogma exist regarding optimal management
 - Preoperative administration of Vitamin K lends to difficulty in obtaining postoperative therapeutic INR?



Longer hospital admissions with reversal?



Ashouri, Al-Jundi, Mangwani. (2011). Hematology

- Retrospectively identified 1797 Femoral Neck Fractures
- 57 patients on Coumadin at admission (mean INR = 2.9)
- Divided into two cohorts
 - A = 16 patients cessation of coumadin only
 - B = 41 patients received Vitamin K and FFP
- Average time to Surgery
 - A = 4.4 days
 - B = 2.4 days
- Reversal of high INR is important to avoid significant delay in surgery



Tal, Rubin, Rozen. (2013). Israeli Medical Association

- Retrospectively reviewed 21 patients with hip fractures taking Coumadin on hospital admission
- Two cohorts
 - Vitamin K reversal – 11 patients
 - Reversal without intervention – 10 patients
- Patients who received vitamin K:
 - had less preoperative time (2.64 days vs. 5.10 days) when compared with patients who did not receive vitamin K.
 - had had statistically significantly shorter hospitalization stays (9.4 days vs 13.2 days).
- Conclusions – Treatment with vitamin K for hip fracture patients who receive warfarin shortens preoperative time and reduces the length of hospitalization.



Gleason, Mendelson, Kates, & Friedman. (2014). Journal of the American Geriatric Society

- Retrospectively reviewed 1,080 hip fractures
- 84 patients on Coumadin at admission (mean INR 1.7)
- Vitamin K, FFP, or both administered to patients with INR >2.0
- Longer time to surgery in those taking warfarin than in those not taking warfarin (28.9 vs 21.7 hours).
- Length of stay was longer for those taking warfarin than those not taking warfarin (4.8 vs 4.2 days).
- Neither time to surgery nor length of stay were significantly different after adjustment for baseline comorbidity.
- No significant differences with regards to:
 - Thromboembolic event rates
 - Bleeding complications rates
 - Mortality
 - 30-day readmission after surgery



Hip Fractures



Hip Fracture Types

- Five Types of Hip Fractures
 - Isolated Greater Trochanteric / Lesser Trochanteric
 - Femoral Neck
 - Intertrochanteric
 - Subtrochanteric
 - Pathologic



Isolated Greater Trochanteric and Lesser Trochanteric Fractures

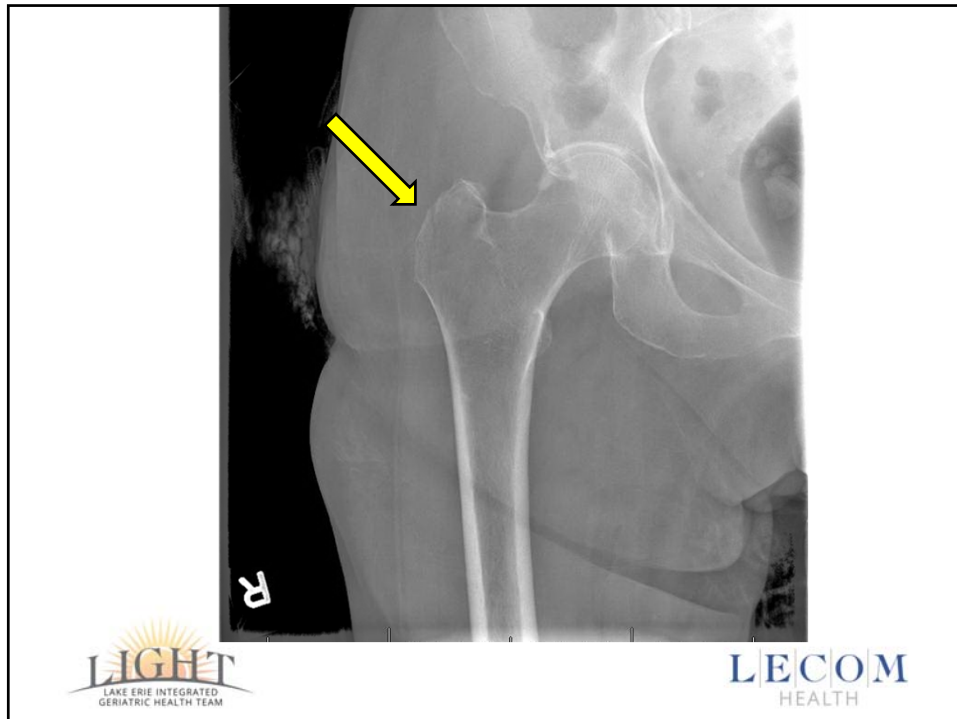
- Rarely occur in isolation in the elderly
- Should raise suspicion for occult fracture extension and prompt further evaluation
- ~33% of isolated Lesser Trochanteric Fractures are associated with metastatic disease



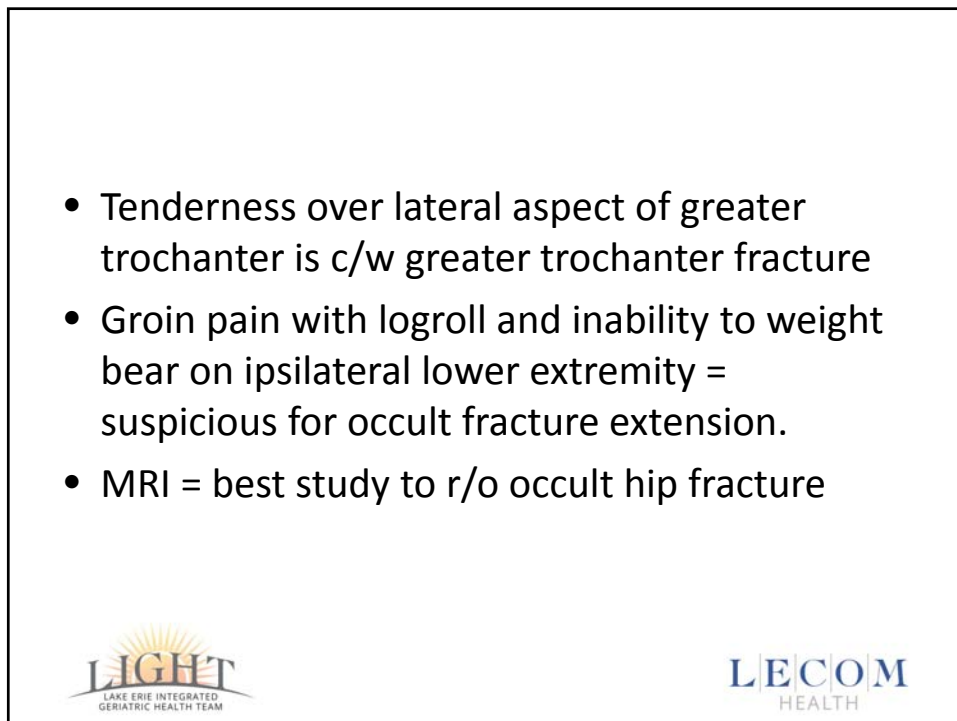
Isolated Greater Trochanteric Fracture Case

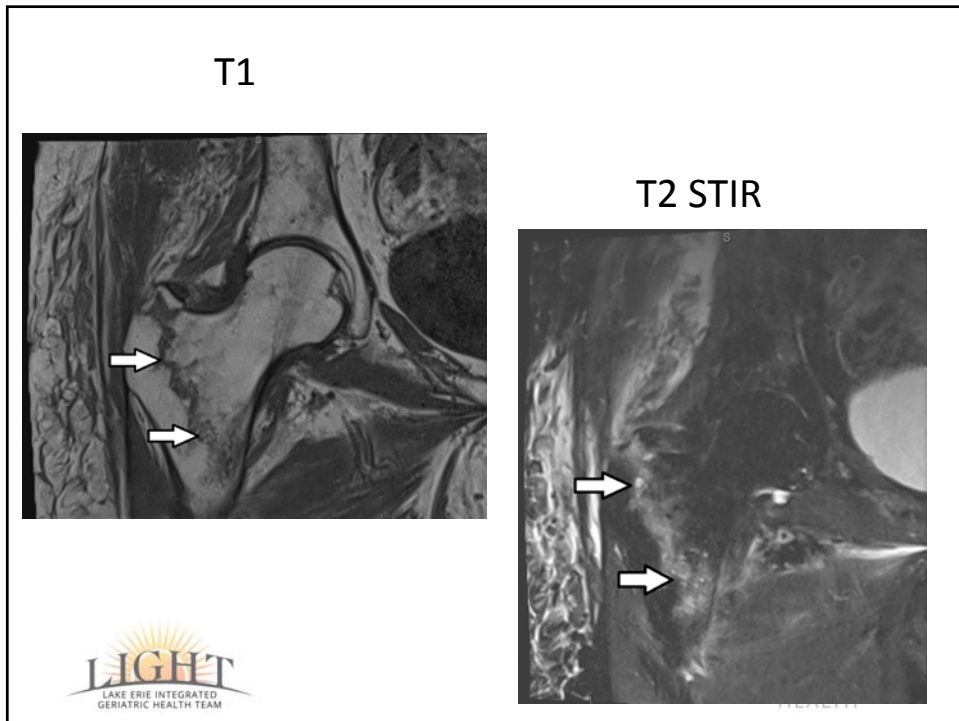
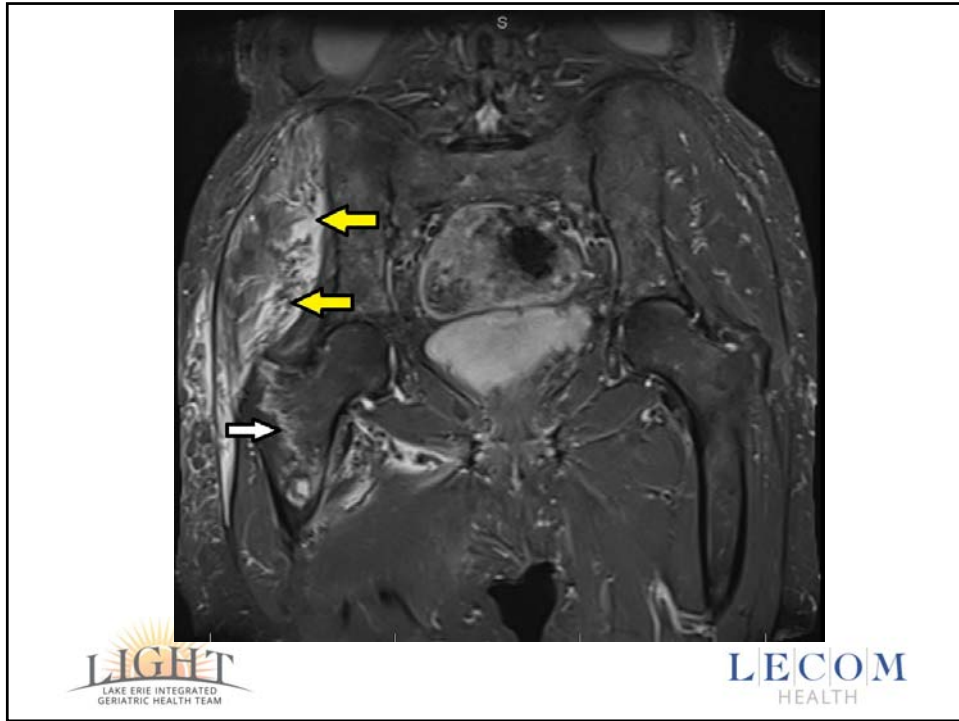
- 83yo female falls from standing height. Exquisite tenderness over lateral aspect of right hip. Pain with logroll. Unable to weight bear on right lower extremity.





- Tenderness over lateral aspect of greater trochanter is c/w greater trochanter fracture
- Groin pain with logroll and inability to weight bear on ipsilateral lower extremity = suspicious for occult fracture extension.
- MRI = best study to r/o occult hip fracture

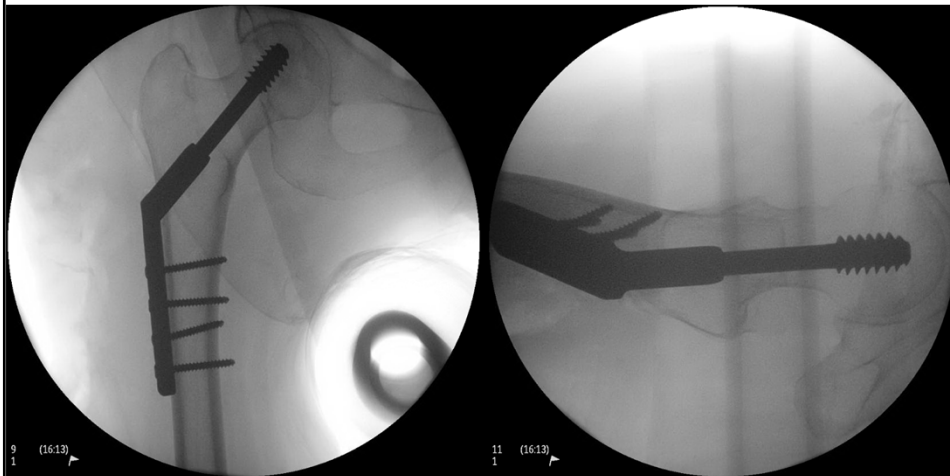




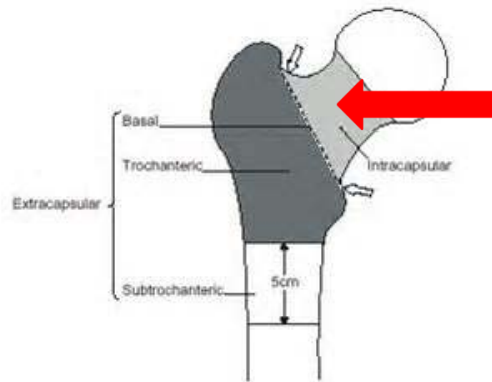
Operative Setup



s/p DHS Fixation

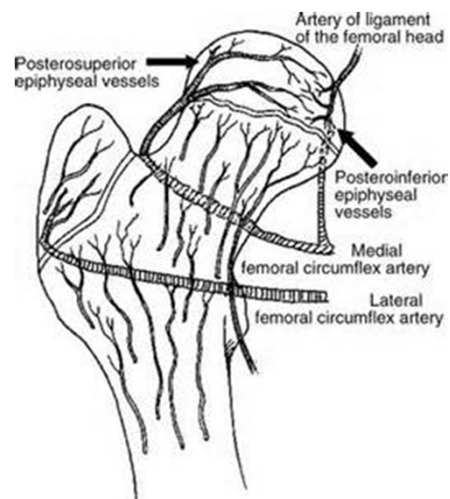


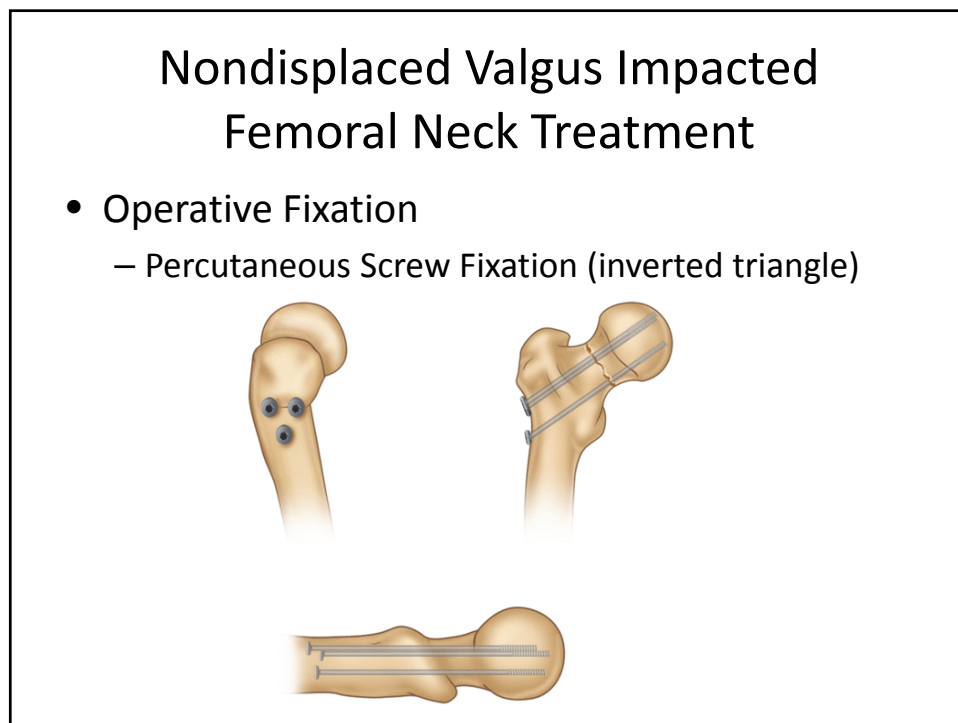
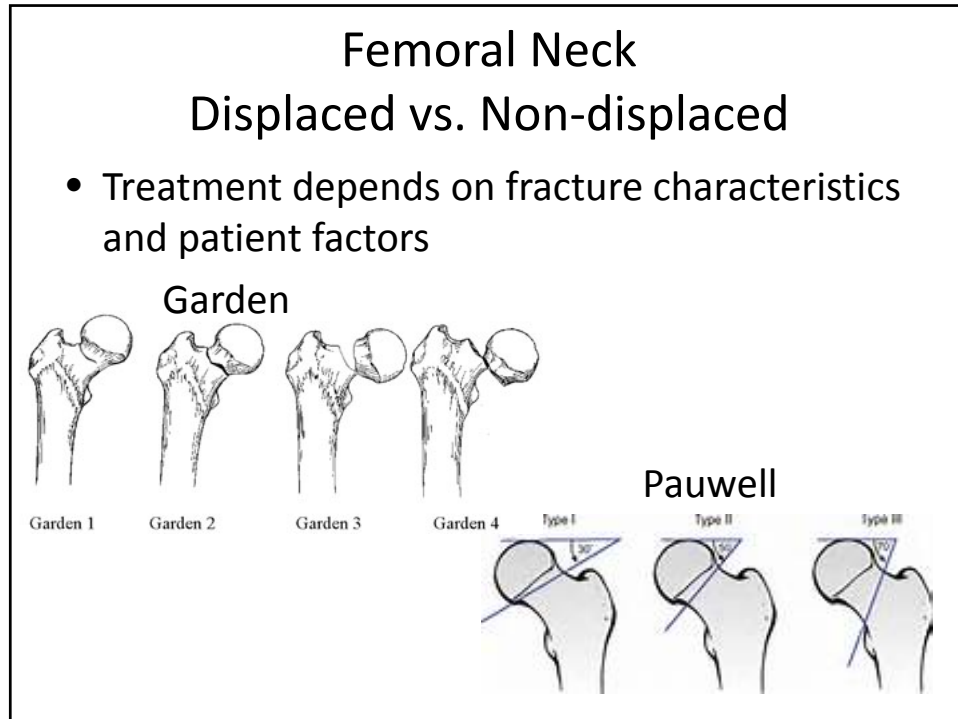
Femoral Neck Fracture



Femoral Neck Fracture

- Intracapsular –
 - High rates of non-union
- Tenuous vascular supply
- High rates of avascular necrosis
 - Femoral head – 100%
 - Subcapital – 75%
 - Transcervical – 50%
 - Basicervical – 25%
 - Intertrochanteric - Rare





Displaced Femoral Neck Fracture Treatment

- < 50 yo – ORIF (Displaced & Non-displaced)
- 65 – 85 yo (high demand) – THA
- > 85 yo (low demand; neuromuscular disease; cognitive impairment) – Hemiarthroplasty

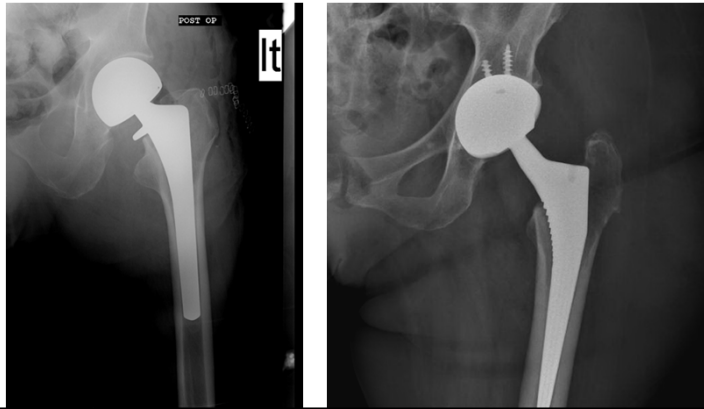


Table I. The Sernbo score. A sum of 15 or more indicates that the patient should have a THA, less than 15 a hemiarthroplasty

	Points
Age (yrs)	
70 to 80	5
> 80	2
Habitat	
Own home	5
Sheltered home	2
Walking aids	
One cane or none	5
Canes, walking frame	2
Mental status	
Alert	5
Slight confusion	2

Cement vs. Non-cemented

- Cement Femoral Component = ideal for osteoporotic bone
- Osteoporotic bone = density decreased d/t loss of trabecula. Osteoporotic bone is MORE porous.
- Increased porosity of osteoporotic bone allows cement to interdigitate with bone creating a strong interface resistant to fracture
- Cement pressurization/tight press-fit of the femoral canal risks fat embolization

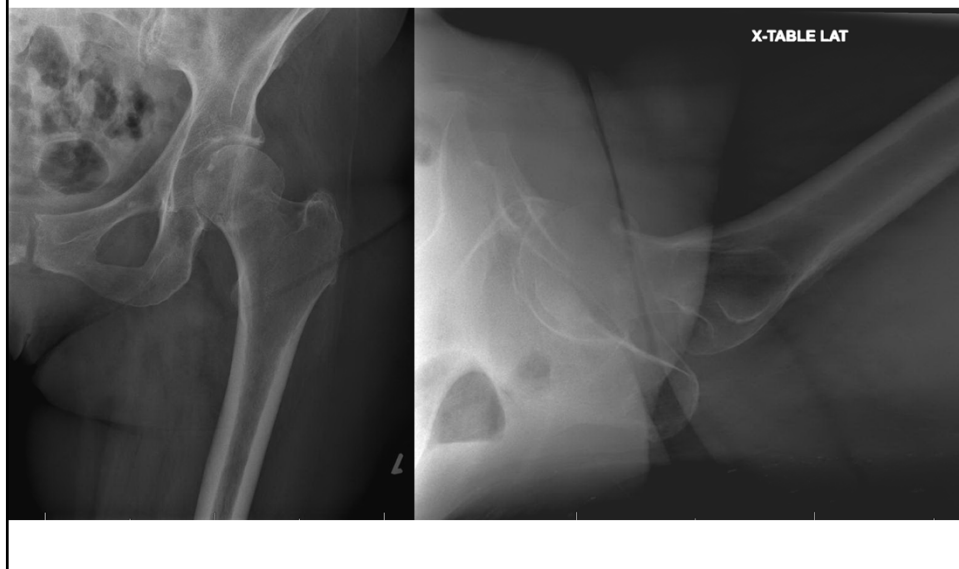


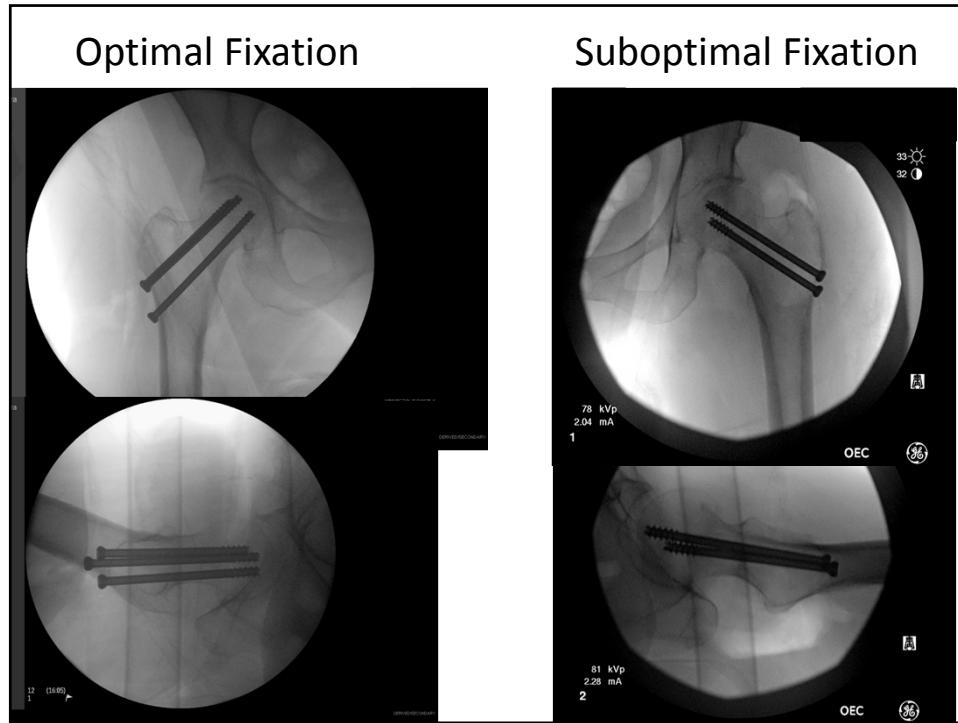
Femoral Neck Fracture Case

- 79yo female with medical history significant for myasthenia gravis and “forgetfulness” fall from standing height and left hip pain.

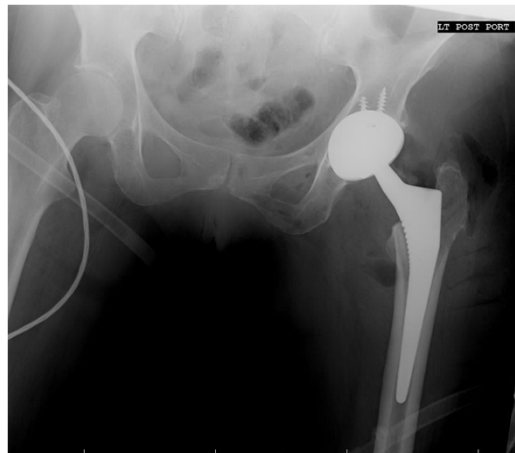


Valgus Impacted Femoral Neck Fracture



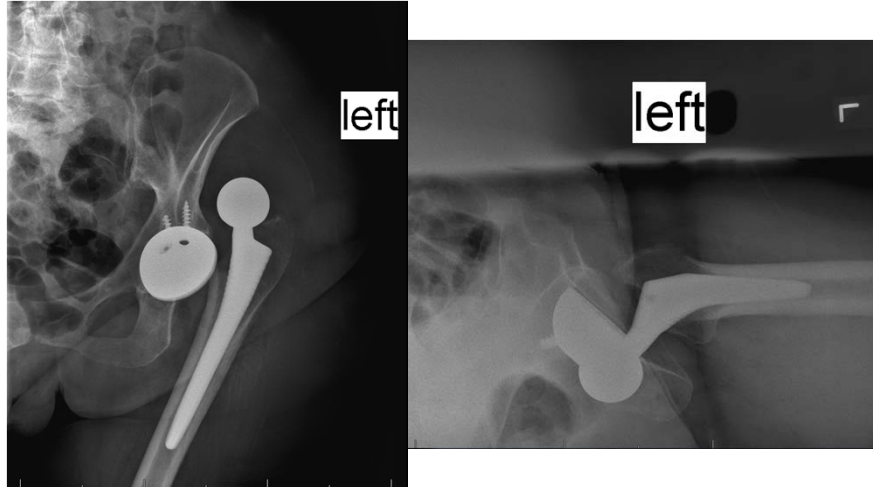


- Unfortunately, poor bone quality and suboptimal fixation led to failure of fixation necessitating conversion to Total Hip Arthroplasty (THA).



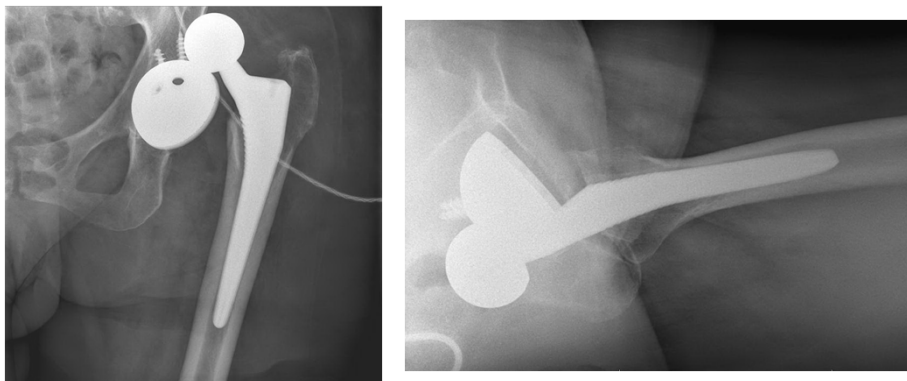
s/p THA - 2 weeks out

- Leaned forward hyper-flexing hip getting OOB
- Closed reduced in Emergency Department



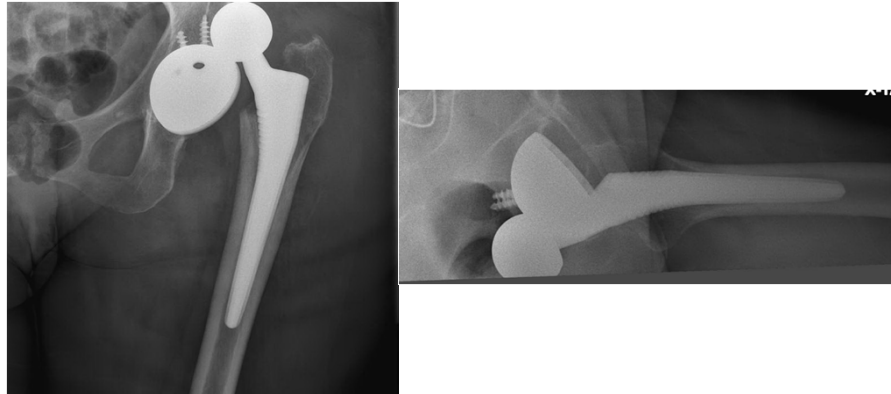
s/p THA – 3 weeks out

- Leaned forward hyper-flexing hip getting off shower seat
- Closed reduction performed in OR after unsuccessful attempt in ED



s/p THA – 4 weeks out

- Leaned forward getting into bed while wearing hip abduction brace
- Closed reduction performed in OR after unsuccessful attempt in ED

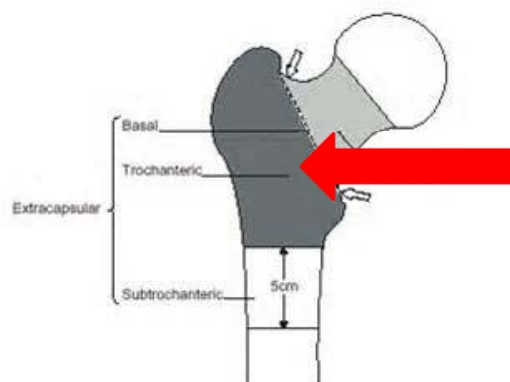


- Examination under fluoroscopy during Closed Reduction in OR revealed:
- Hip was stable at simultaneous 90 degrees flexion and 60 degrees internal rotation
- Patient's Component Placement
 - Acetabular Component
 - 50° abduction angle (normal)
 - 25° anteversion (normal)
 - Femoral Component
 - 15° anteversion (normal)

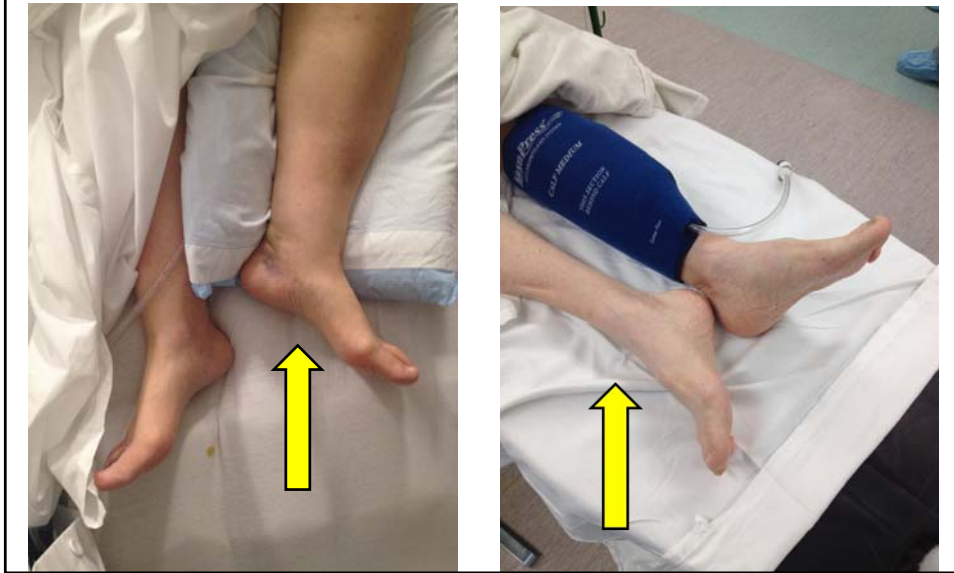
Factors Portending to a less than optimal Clinical Outcome

- Uncontrolled Myasthenia Gravis
- Posterior Approach
- Total Hip Arthroplasty for Fracture Revision
- Cognitive Decline
- Inability/Unwillingness to understand or remain compliant with posterior hip precautions
- Total Hip Arthroplasty in setting of severe lumbar spondylosis

Intertrochanteric Hip Fracture



Shortened & Externally Rotated



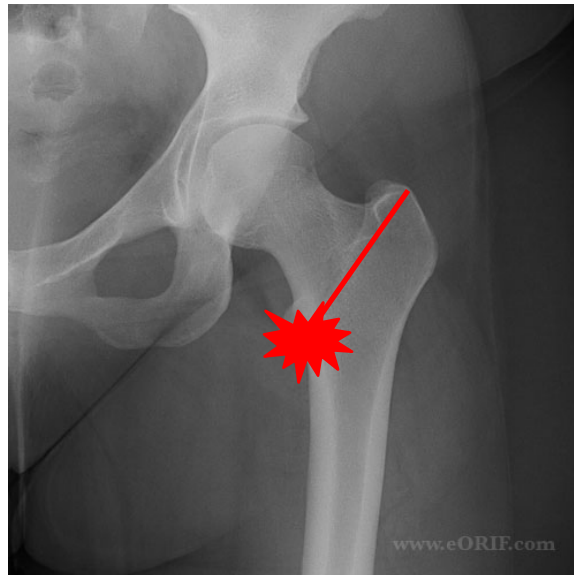
What makes an Intertrochanteric Hip Fracture Unstable?

- Calcar Comminution
- Reverse Obliquity Fracture Pattern
- Subtrochanteric Extension
- Lateral Cortex Comminution

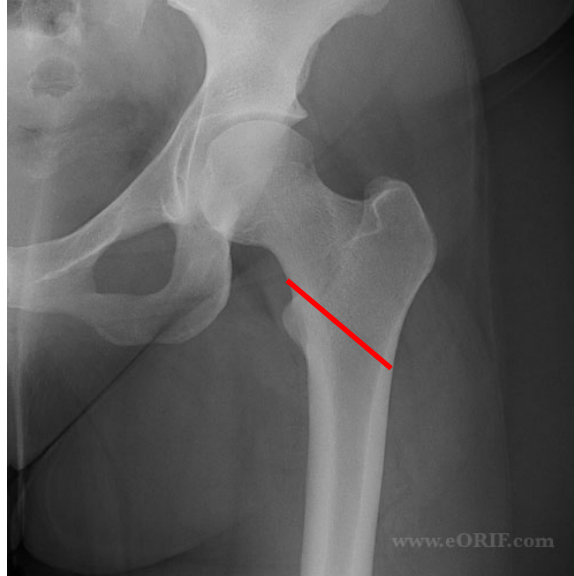
Stable Intertrochanteric Hip Fracture



Calcar Comminution



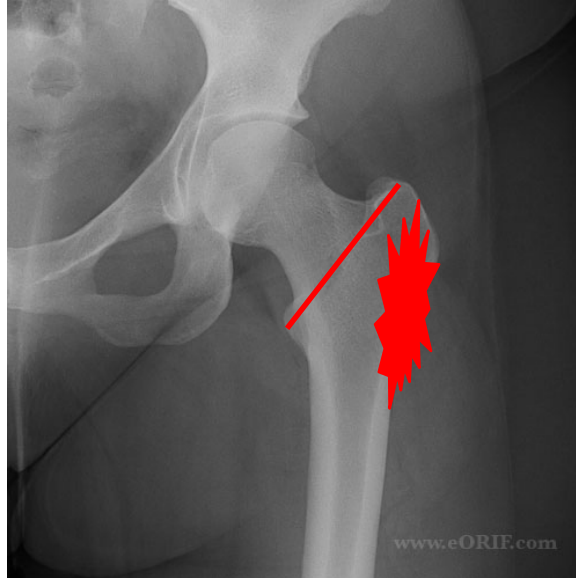
Reverse Obliquity Fracture Pattern



Subtrochanteric Extension



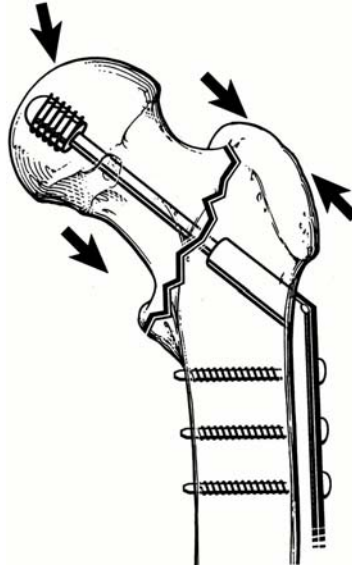
Lateral Cortex Comminution



Intertrochanteric Hip Fracture Treatment

- Stable
 - Sliding Hip Screw
 - Cephalomedullary Nail (short)
- Unstable
 - Cephalomedullary Nail (long)
 - Condylar Blade Plate
 - Dynamic Condylar Plate

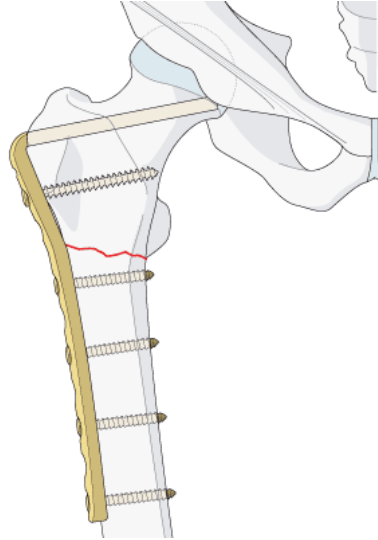
Sliding Hip Screw



Cephalomedullary Nail



Blade Plate

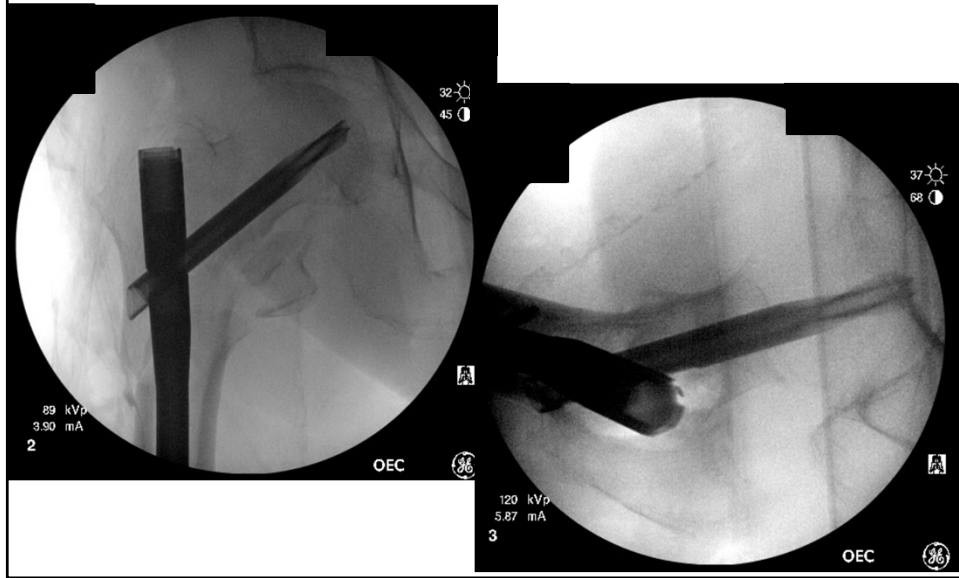


Intertrochanteric (unstable) Hip Fracture Case

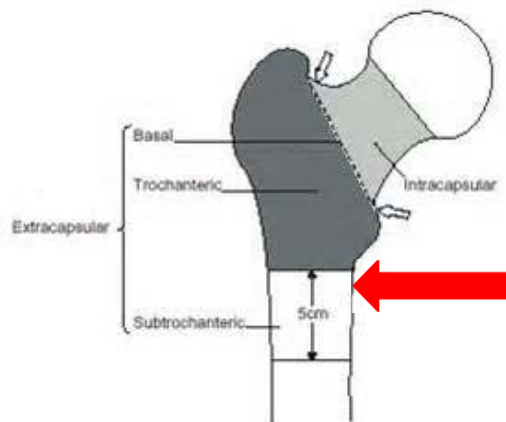
- 88yo male fall from standing height. Unable to weight bear on RLE.
- Closed DNVI



s/p TFN fixation



Subtrochanteric Hip Fracture



Subtrochanteric Fractures

- Subtrochanteric typically defined as area from lesser trochanter to 5cm distal
 - intertrochanteric fractures may have subtrochanteric extension
- Epidemiology
 - younger patients with a high-energy mechanism
 - elderly patients from a low-energy mechanism
 - rule out pathologic or atypical femur fracture
 - bisphosphonate use, particularly alendronate, can be risk factor (~6-7% incidence with alendronate)



Atypical Subtrochanteric Femur Fracture Case

- 53yo female transfer from outside hospital for left thigh radicular pain to neurosurgery service.
- No h/o trauma
- Prednisone 5-6 years for RA



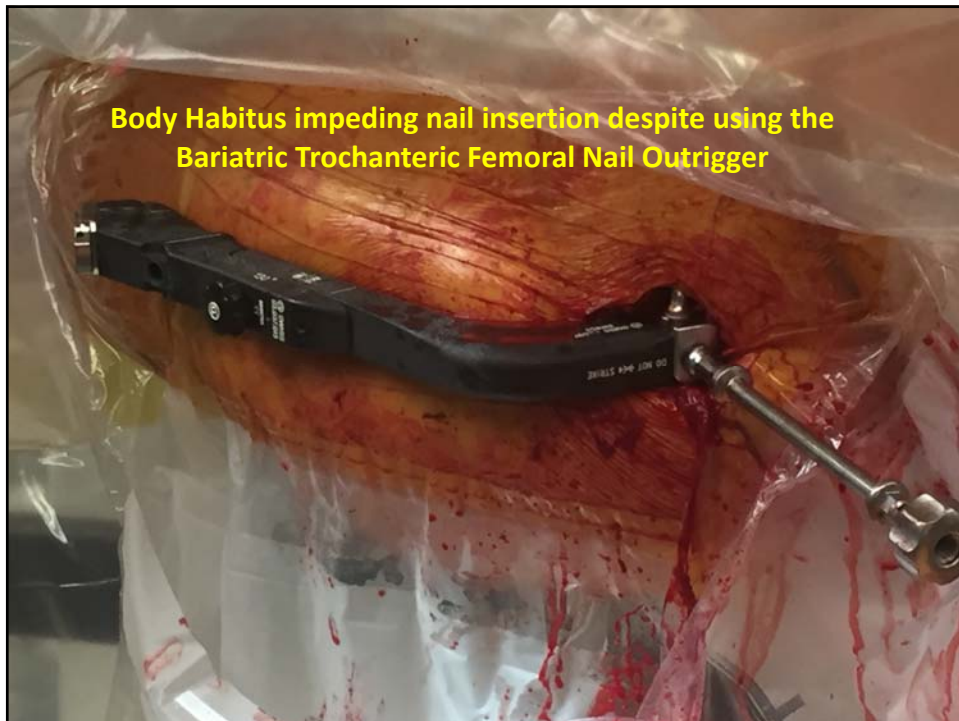


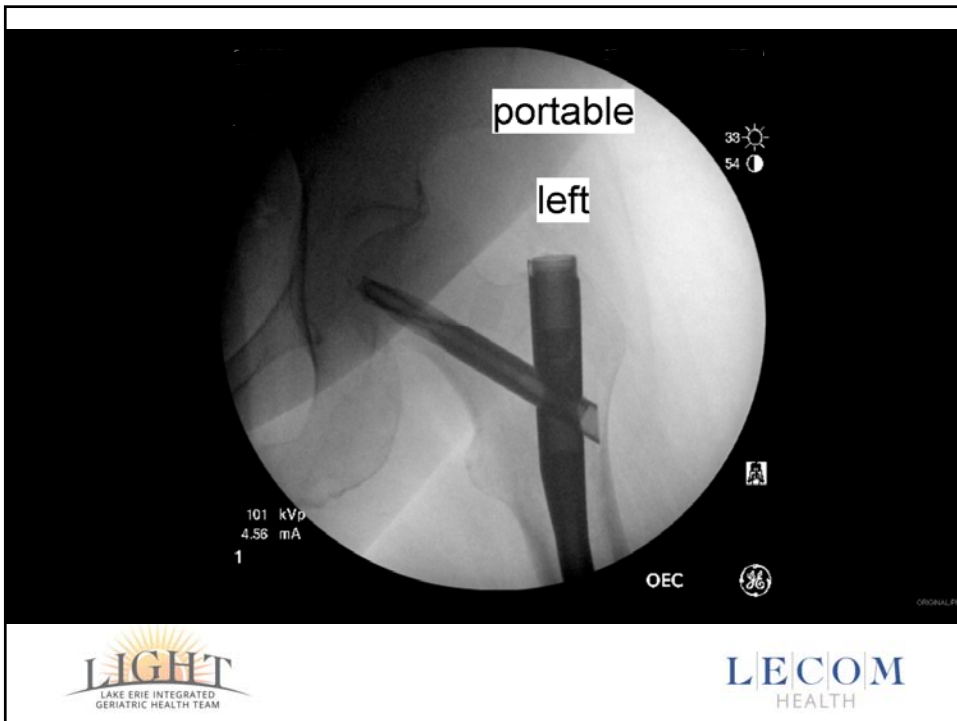
- Atypical Subtrochanteric Fractures mandate imaging of the contralateral extremity.
- ~ 30% incidence of bilaterality

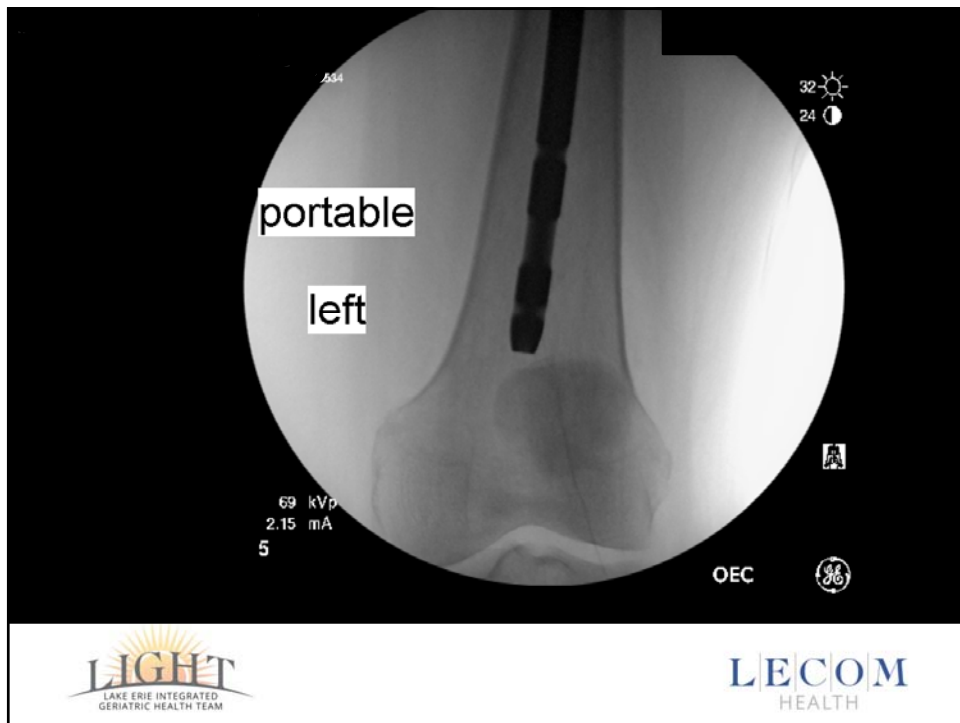


Contralateral = pain with Fulcrum Test





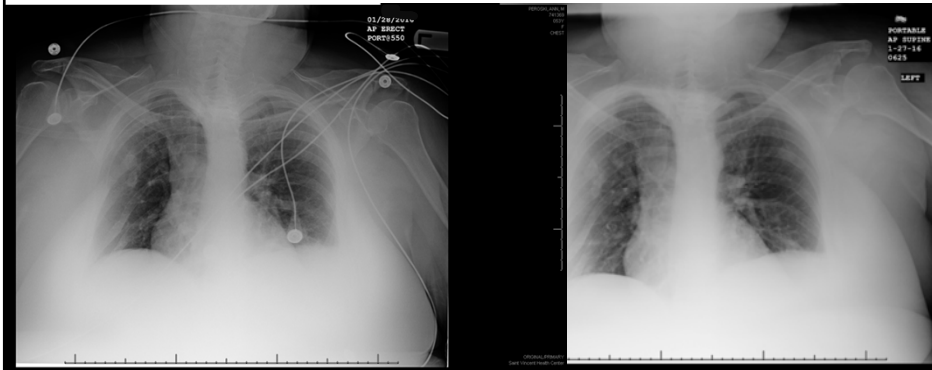




- Upon insertion of nail O2 sats dropped from 100% to 89% on 100% O2 via ET tube



Preop – Postop ??? Fat Emboli ???



Pathologic Fractures



Pathologic Fractures

- Prophylactic fixation is preferred to fixation of actual pathological fracture secondary to
 - shorter operative time (technically less demanding)
 - decreased morbidity
 - quicker recovery
 - Relaxed postoperative weightbearing restrictions



Pathologic Fractures

- Five Cancers have a predilection to metastasize to bone
 - Prostate – Blastic
 - Breast – Blastic or Lytic
 - Renal – Lytic (extremely vascular)
 - Thyroid – Lytic
 - Lung - Lytic



Mirels Criteria

Mirels Criteria Prophylactic Fixation Indicated Lower Extremity > 8 Upper Extremity > 7			
Score	1	2	3
Site	Upper Extremity	Lower Extremity	Peritrochanteric
Pain	Mild	Moderate	Functional
Lesion	Blastic	Mixed	Lytic
Size	< 1/3	1/3 – 2/3	> 2/3

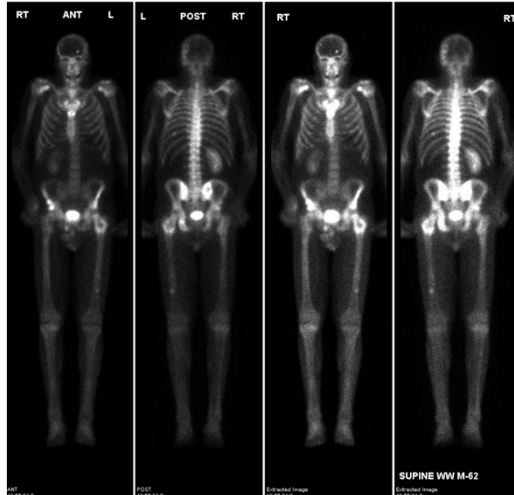


Pathologic Fracture Case

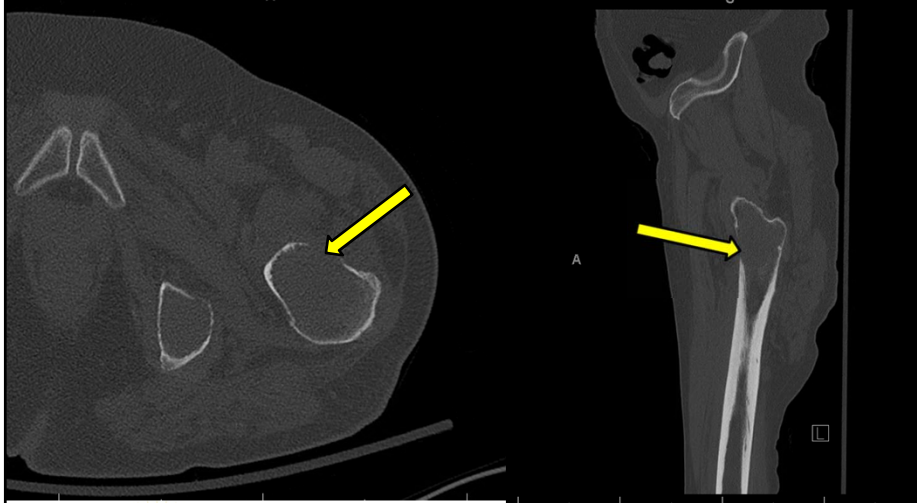
- 53yo male s/p nephrectomy approximately 16 years ago for renal carcinoma. 3 weeks of progressively worse left hip pain. Now unable to ambulate.



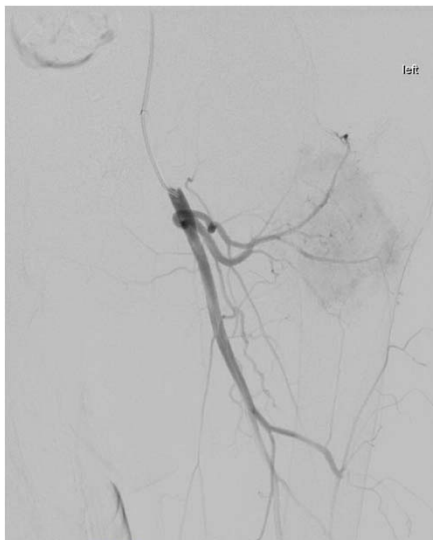
Left Hip Lytic Lesion



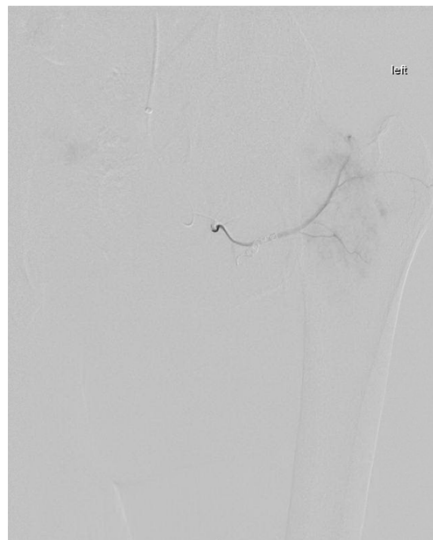
Erosion of Anterior Cortex



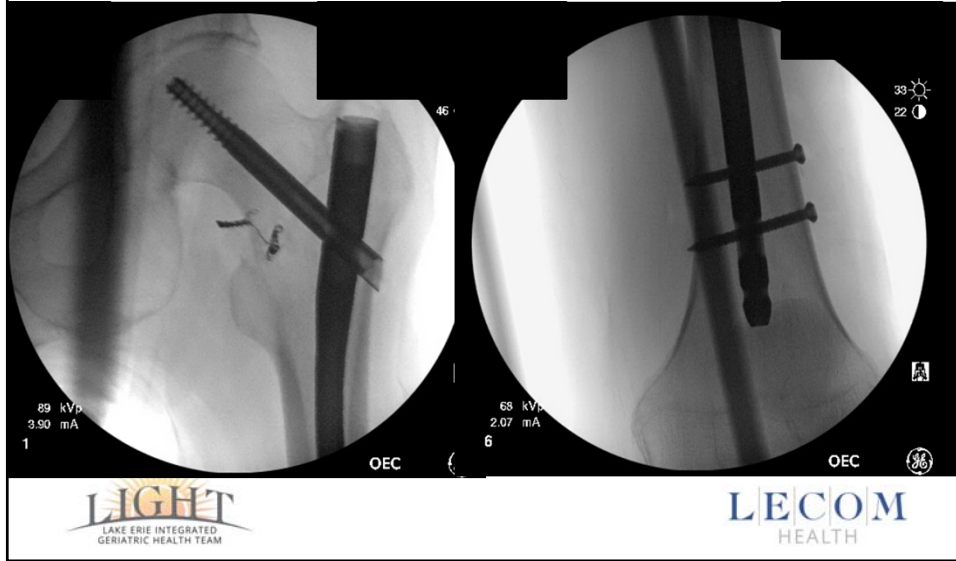
Extensive Vascular Supply



s/p Embolization



s/p Prophylactic Fixation (protect the entire bone)



Thank You



"I told you on the phone she had a lot of hair."

