

Femoral Neck Fractures in patients Over 50 (Fix or Replace)

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Disclosures

- **Synthes**
 - consultant
- **Imagen**
 - consultant, stock
- **Orthodevelopment**
 - consultant, IP

*****All figures in the talk belong to David Wellman, MD unless otherwise indicated**

A quick case to begin:

- 56 year old healthy surgeon
 - Struck by car while cycling
 - Fix or Replace?
 - Approaches planned?
 - Fixation Method?



Objectives

- **Scope of the problem**
- **Relevant Anatomy**
- **Indications part 1**
 - **Elderly “Nondisplaced Fractures”**
- **Indications part 2**
 - **Elderly “Displaced Fractures”**
- **Indications part 3**
 - **The gray zone between youth and “elderly”**
- **Fixation Constructs**
- **Outcomes**

Scope of the Problem

- Femoral Neck Fractures per Year
 - 1.66 million 1990 up to 6.26 million by 2050
- Mortality Risk
 - 14-58% within 1 year of injury

• Source: Bzovsky S. Factors Associated With Mortality After Surgical Management of Femoral Neck Fractures. J Orthop Trauma Volume 34, Number 11 Supplement, November 2020

Factors Associated With Mortality After Surgical Management of Femoral Neck Fractures

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Marc Swiontkowski, MD,^c Diane Heels-Ansdell, MSc,^d Frede Frihagen, MD, PhD,^e
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Investigators*

- Older age
- Low BMI
- High ASA score
- Use of ambulatory aid
- Kidney disease

• Source: Bzovsky S. Factors Associated With Mortality After Surgical Management of Femoral Neck Fractures. J Orthop Trauma Volume 34, Number 11 Supplement, November 2020

On the issue of timing

- Timing appears to matter
- Delay for Anticoagulants?
 - Antiplatelets: not associated with increased risk
 - Warfarin: INR above 1.5 (up to 3) appear to have similar bleeding complication to INR < 1.5

Sources: Abdulhamid AK.. Evaluation of the use of anti-platelet therapy throughout the peri-operative period in patients with femoral neck fracture surgery. A retrospective cohort study. International Orthopaedics volume 44, pages1805–1813(2020)

Cohn MR, Levack AE Trivedi KN, et al. The Hip Fracture Patient on Warfarin: Evaluating Blood Loss and Time to Surgery J Orthop Trauma. doi: 10.1097/BOT.0000000000000857.

Relevant Anatomy

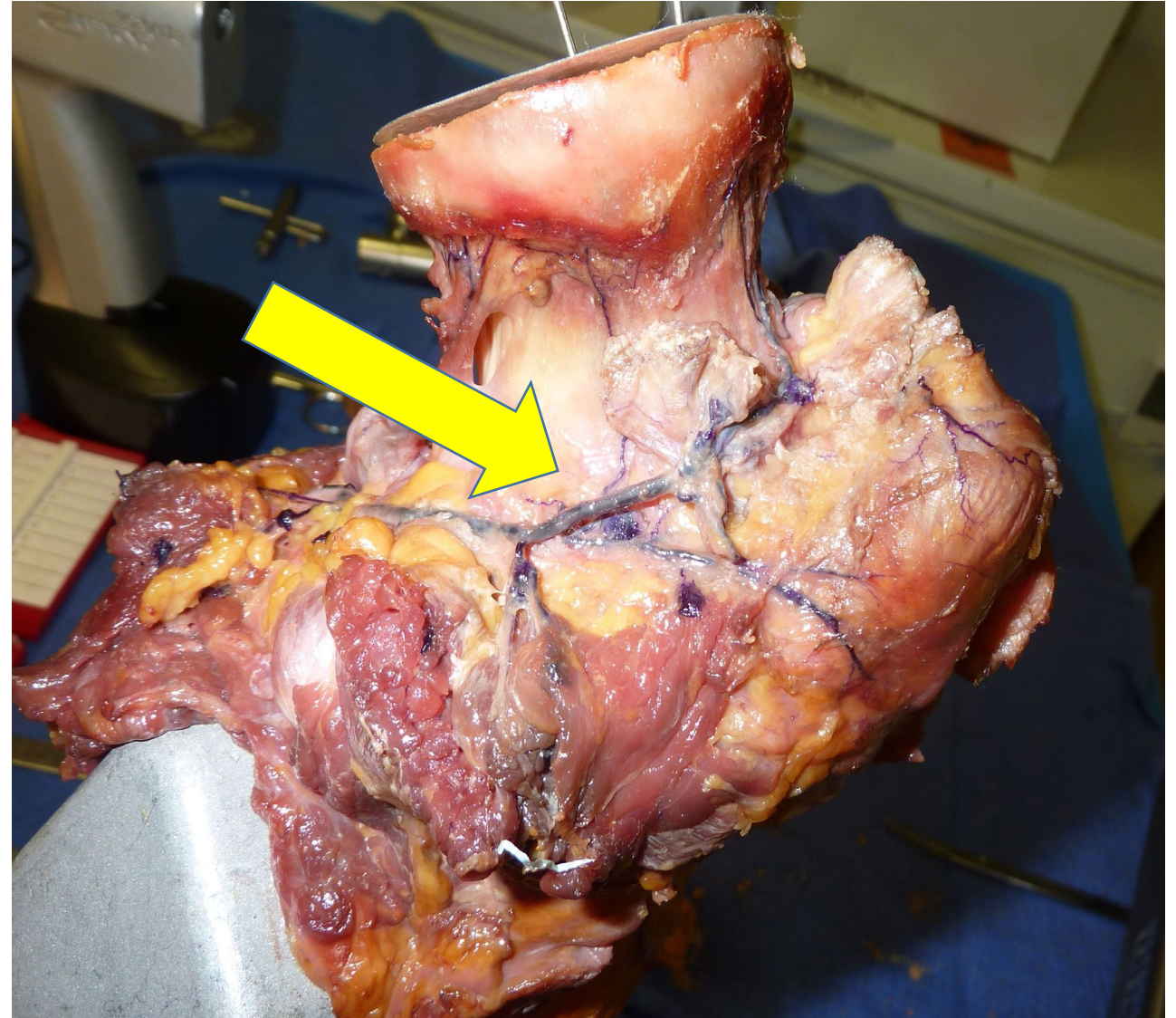
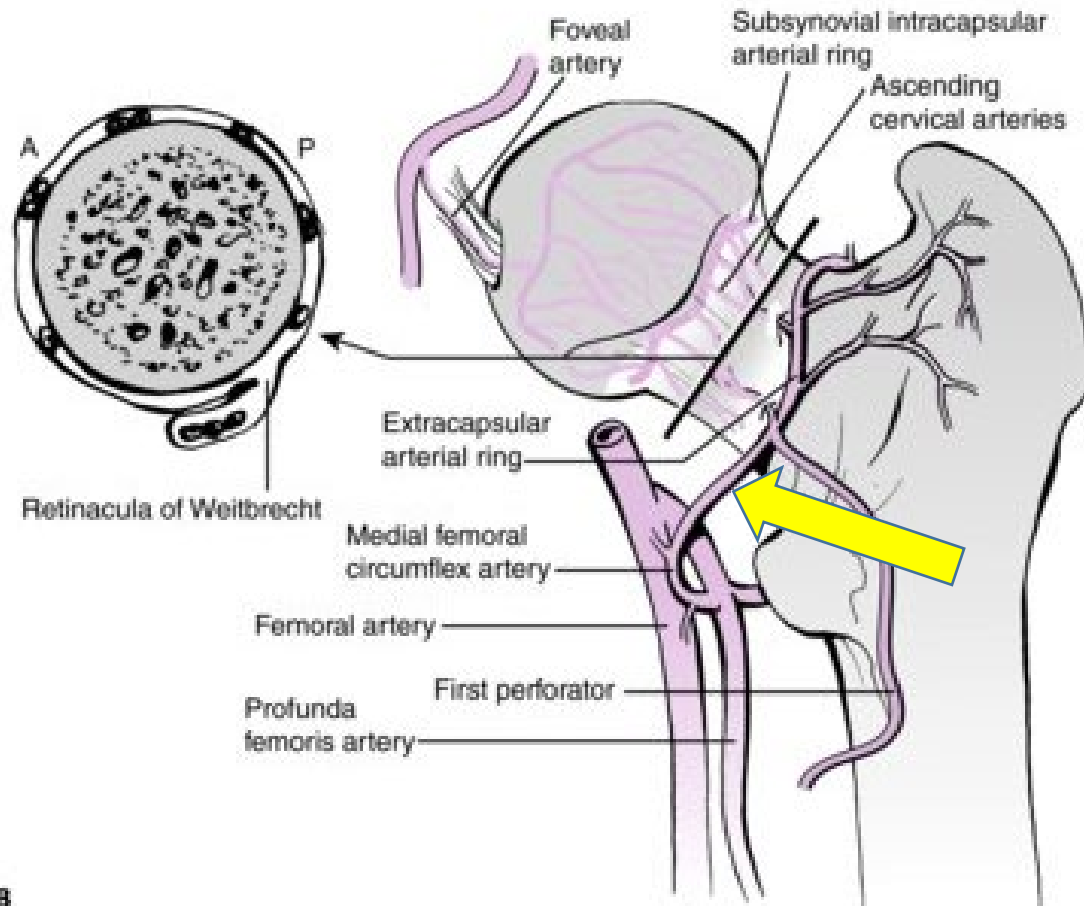


Figure 52-8 . Keating JF. Femoral Neck Fractures. In: Tornetta P, Ricci WM, eds. Rockwood and Green's Fractures in Adults, 9e. Philadelphia, PA. Wolters Kluwer Health, Inc; 2019.

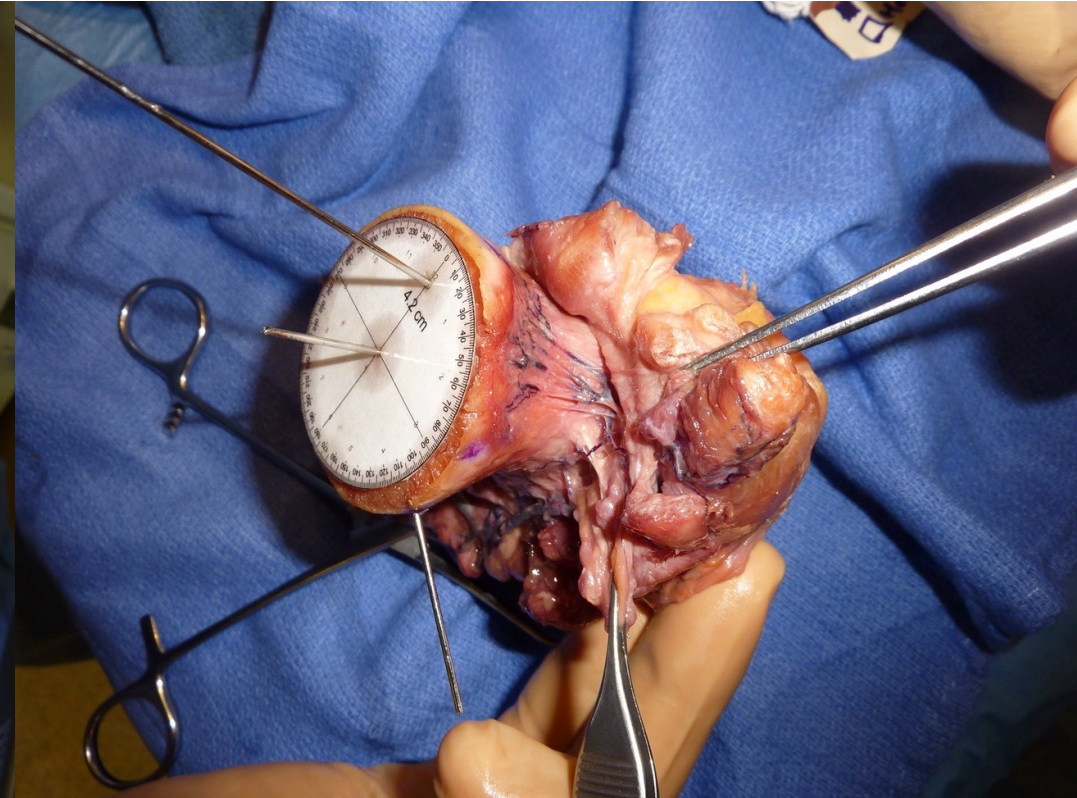
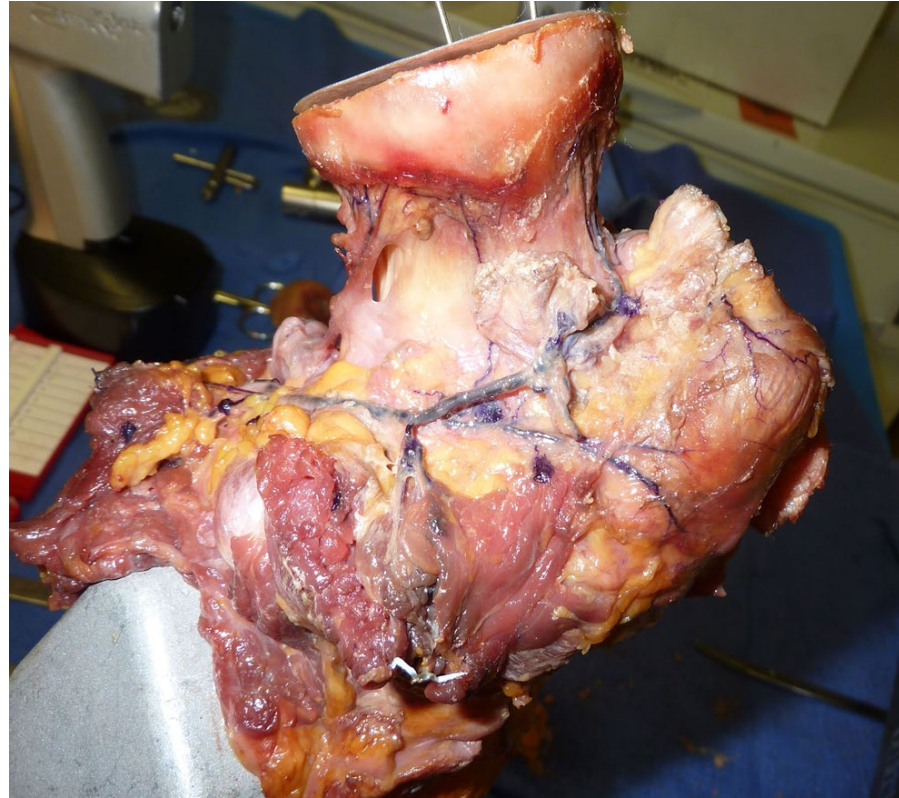
Relevant Anatomy

- **Intraosseus**
- **Foveolar**
- **Retinacular**
 - **MFCA - 82% head, 67% neck**
 - **LFCA – 48% of the anteroinferior neck**

- DewarDC, Lazaro LE, Klinger CE , et al., The relative contribution of the medial and lateral femoral circumflex arteries to the vascularity of the head and neck of the femur: a quantitative MRI-based assessment. Bone Joint J 2016 Dec;98-B(12):1582-1588. doi: 10.1302/0301-620X.98B12.BJJ-2016-0251.R1.

Anatomy of the MFCA

- Transverse
- Ascending
- Deep



- Lazaro LE, Klinger CE, Sculco PK, et al. The terminal branches of the medial femoral circumflex artery: the arterial supply of the femoral head. Bone Joint J. 2015 Sep;97-B(9):1204-13. doi: 10.1302/0301-620X.97B9.34704.

Indications Part 1 – Nondisplaced Fractures

- Garden 1



Garden 2



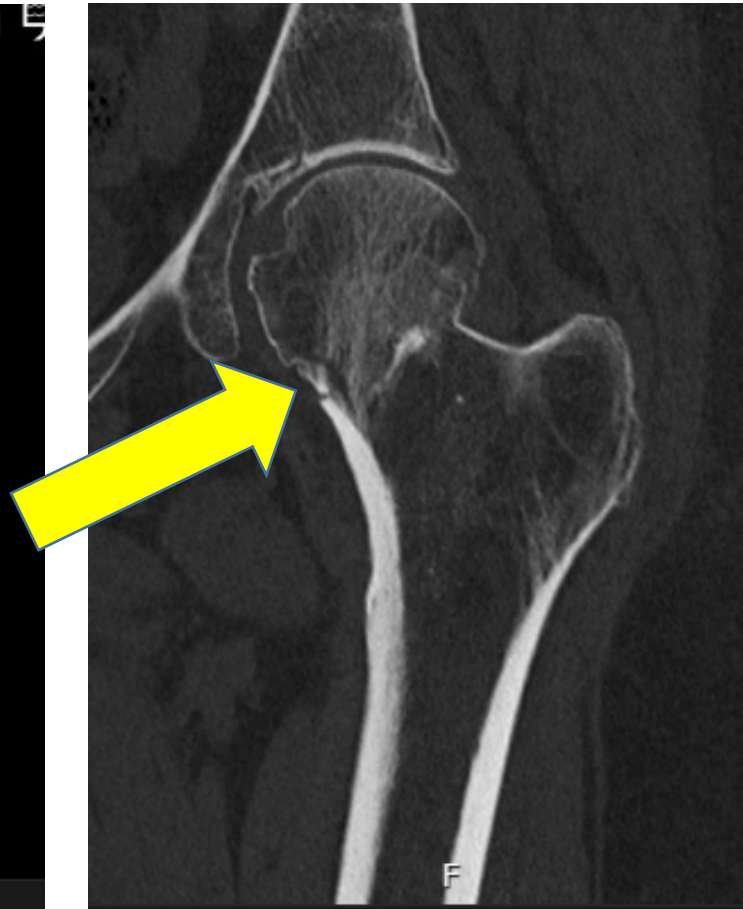
Classic teaching...

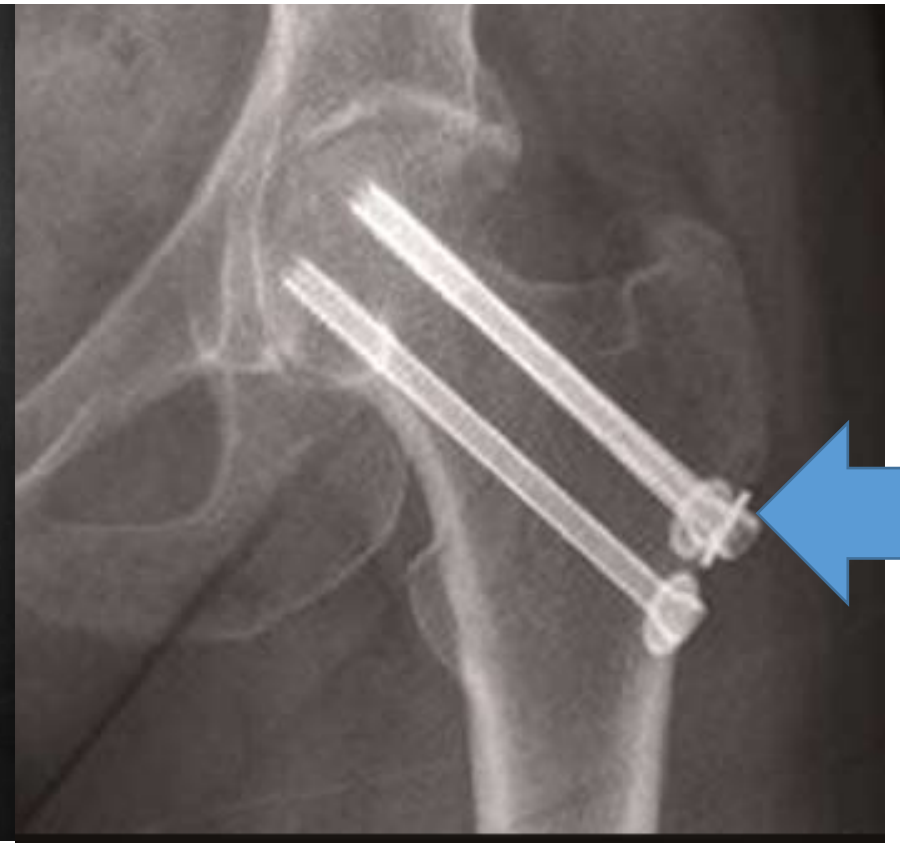
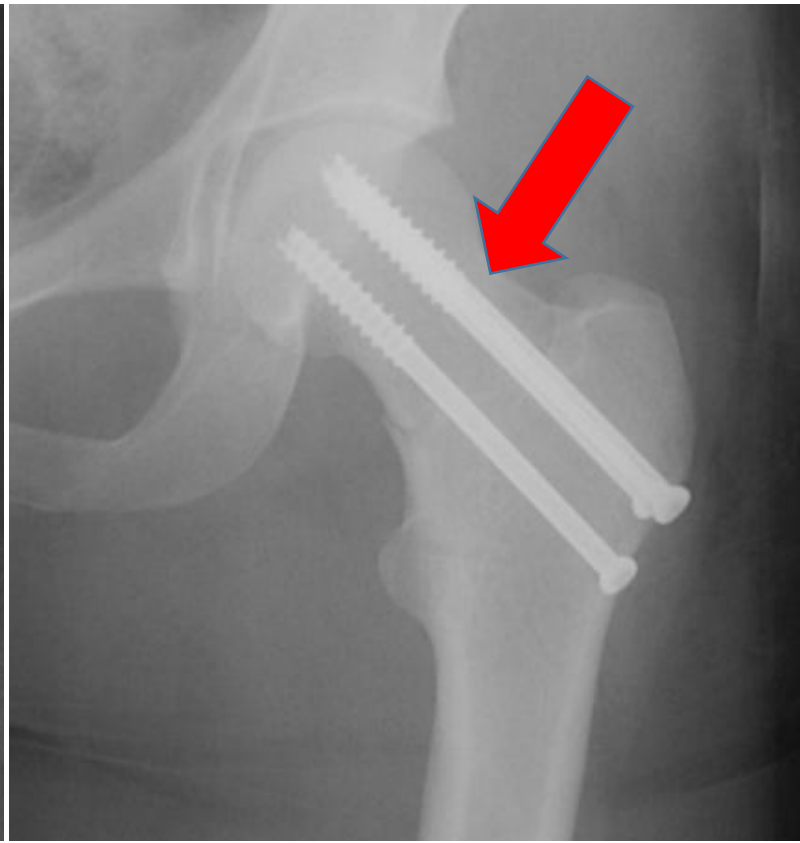
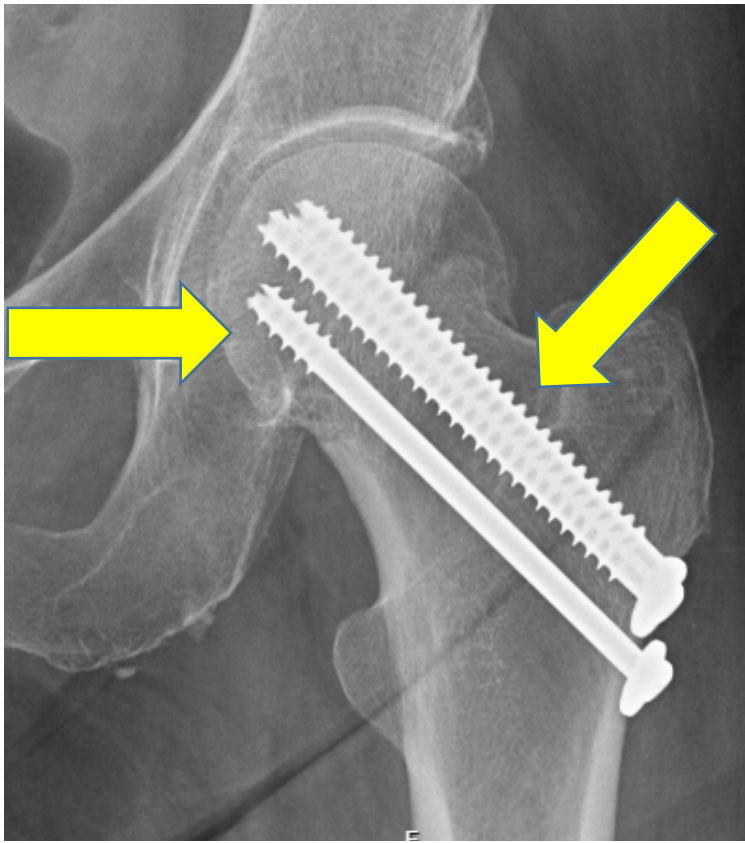
- 3 partially threaded cannulated screws
- Immediate weight bearing

A case...

- 80 year old ambulatory female, uses a cane for long distance ambulation
- Mild dementia
- No other significant medical history

CT Ordered to evaluate displacement at the calcar and posterior roll-off of the head.





Note the Differences in these Similar Constructs:

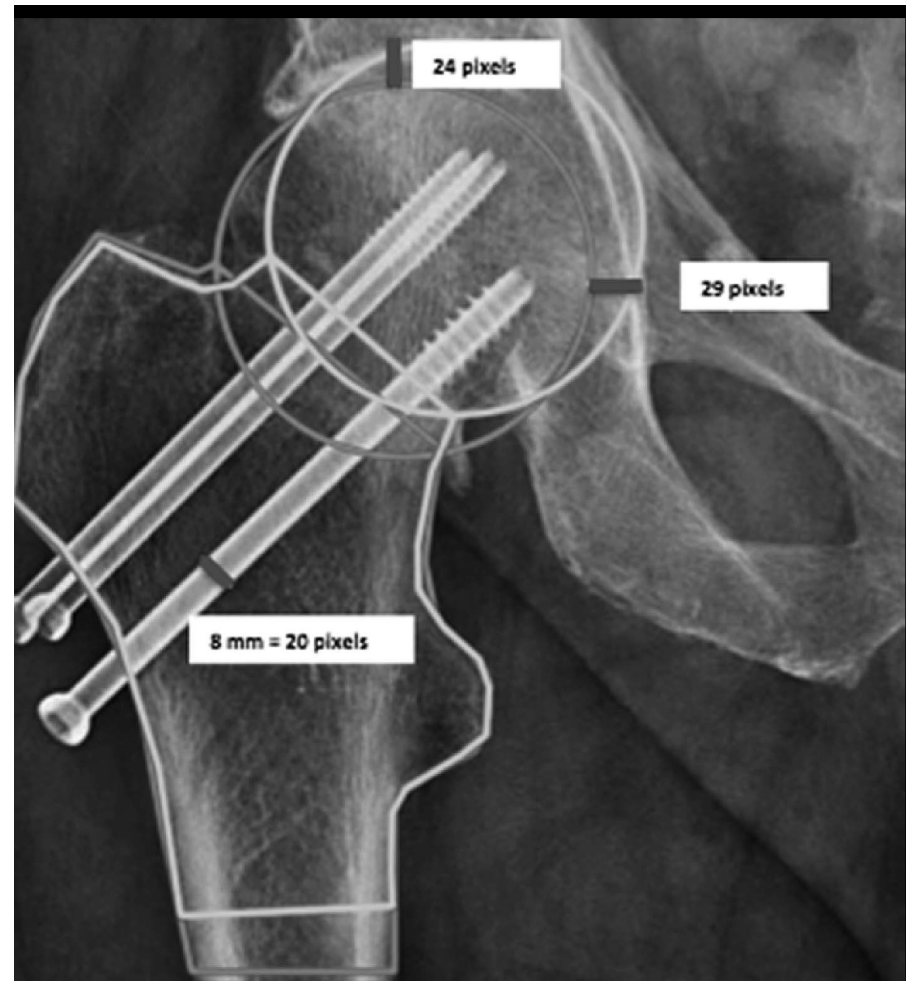
- 1) Thread length - yellow arrow
- 2) Cranial placement of screws - red arrow
- 3) Washer use - blue arrow

Nondisplaced fracture hot topics:

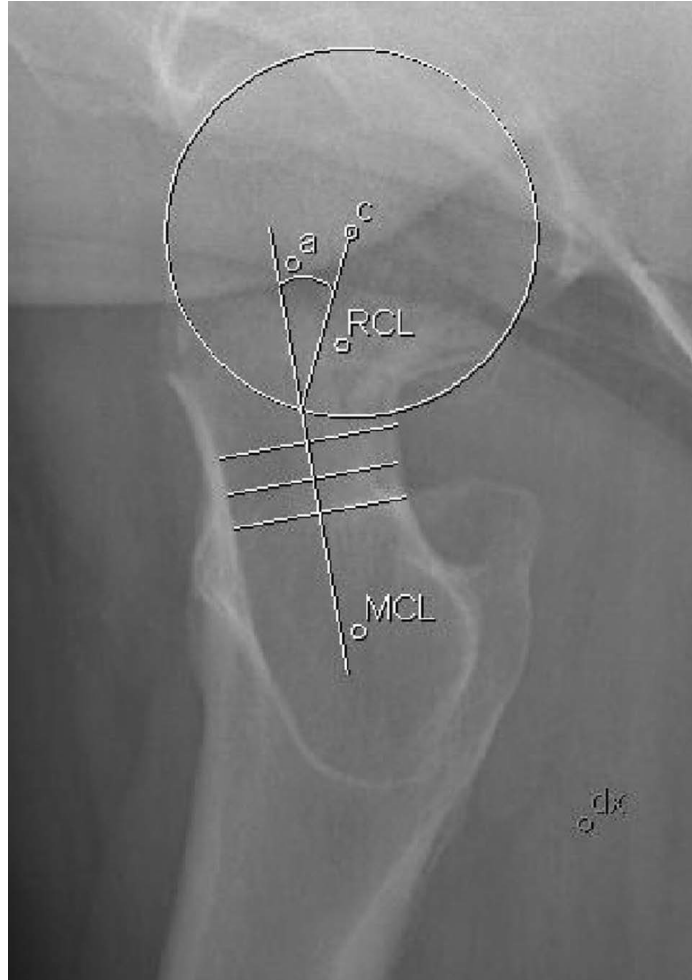
- Failure Potential:
 - 1) Collapse in the plane of the screws with excessive SHORTENING
 - 2) Cutout with NONUNION

Garden 1 and 2 Femoral Neck Fractures Collapse More Than Expected After Closed Reduction and Percutaneous Pinning

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Andrew J. Marcantonio, DO, MBA,† Daniel S. Horwitz, MD,† and Paul Tometta III, MD**



Nondisplaced fracture hot topic: Posterior roll off



- Sources:

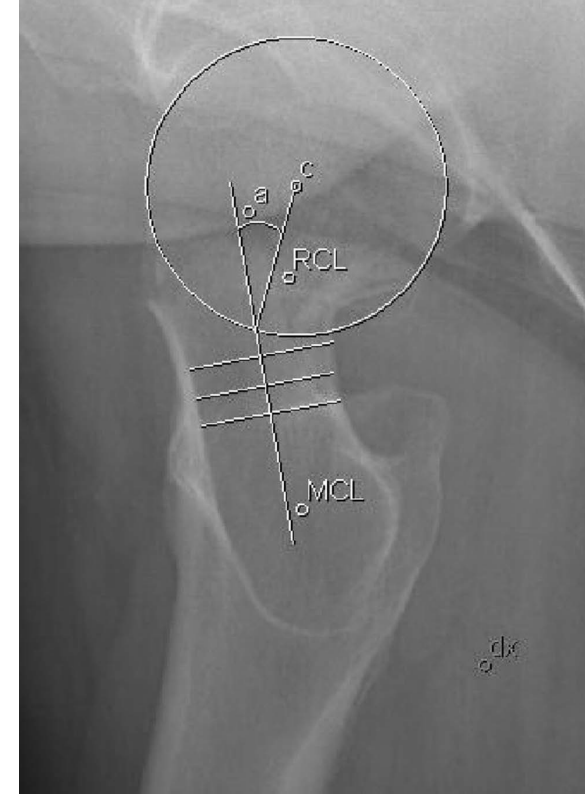
- Okike K, Udogwu UN, Isaac M, et al. Not All Garden-I and II Femoral Neck Fractures in the Elderly Should Be Fixed: Effect of Posterior Tilt on Rates of Subsequent Arthroplasty. The Journal of Bone and Joint Surgery: October 16, 2019 - Volume 101 - Issue 20 - p 1852-1859. doi: 10.2106/JBJS.18.01256



Lapidus LJ, Charalampidis A, Rundgren J, et al. Internal fixation of garden I and II femoral neck fractures: posterior tilt did not influence the reoperation rate in 382 consecutive hips followed for a minimum of 5 years. J Orthop Trauma. 2013 Jul;27(7):386-90; discussion 390-1. doi: 10.1097/BOT.0b013e318281da6e.

Is posterior roll off an issue?

- Apex anterior angulation through the neck
- (Little) Controversy
 - **Palm:** >20 degrees associated with reoperation
 - **FAITH:** >20 associated with conversion to arthroplasty
 - **Lapidus:** no association



- Sources:
- Okike K, Udogwu UN, Isaac M, et al. Not All Garden-I and II Femoral Neck Fractures in the Elderly Should Be Fixed: Effect of Posterior Tilt on Rates of Subsequent Arthroplasty. The Journal of Bone and Joint Surgery: October 16, 2019 - Volume 101 - Issue 20 - p 1852-1859. doi: 10.2106/JBJS.18.01256
- Lapidus LJ, Charalampidis A, Rundgren J, et al. Internal fixation of garden I and II femoral neck fractures: posterior tilt did not influence the reoperation rate in 382 consecutive hips followed for a minimum of 5 years. J Orthop Trauma. 2013 Jul;27(7):386-90; discussion 390-1. doi: 10.1097/BOT.0b013e318281da6e.

FAITH Trial key findings – Things that Matter

- Displacement
- Female Sex
- BMI
- Fixation with a Sliding Hip Screw
 - smokers, base of neck fx, displaced fx
- 3 screw construct choices
 - Inverted triangle optimal



- Schottel PC, Blankstein M, Sprague S, et al. Optimal Technical Factors During Operative Management of Low Energy Femoral Neck Fractures. J Orthop Trauma. 2020 Jul 8. doi: 10.1097/BOT.0000000000001891.
- Sprague S, Emil H, Schemitsch EH, Swiontkowski M, et al. Factors Associated with Revision Surgery Following Internal Fixation of Hip Fractures. J Orthop Trauma. 2018 May; 32(5): 223–230. doi: 10.1097/BOT.0000000000001162.

FAITH Trial – Things that do not seem to matter

- Screw Cohort
 - Long vs Short Threads
 - Long threads may be protective
 - Washers
 - **Zlowodzki's** evidence differs
 - Screw Diameter
 - Parallel vs Not Parallel
- Sliding Hip Screw Cohort
 - Screw Position (tip apex distance)
 - Number of holes in sideplate
 - Supplemental screws

Sources: Schottel PC, Blankstein M, Sprague S, et al. Optimal Technical Factors During Operative Management of Low Energy Femoral Neck Fractures. J Orthop Trauma. 2020 Jul 8. doi: 10.1097/BOT.0000000000001891.

Shin KH, Hong SH, Han SB. Posterior fully threaded positioning screw prevents femoral neck collapse in Garden I or II femoral neck fractures. Injury. . 2020 Apr;51(4):1031-1037. doi: 10.1016/j.injury.2020.01.032. Epub 2020 Jan 24.



Nondisplaced fracture hot topics:

- Optimum Construct?



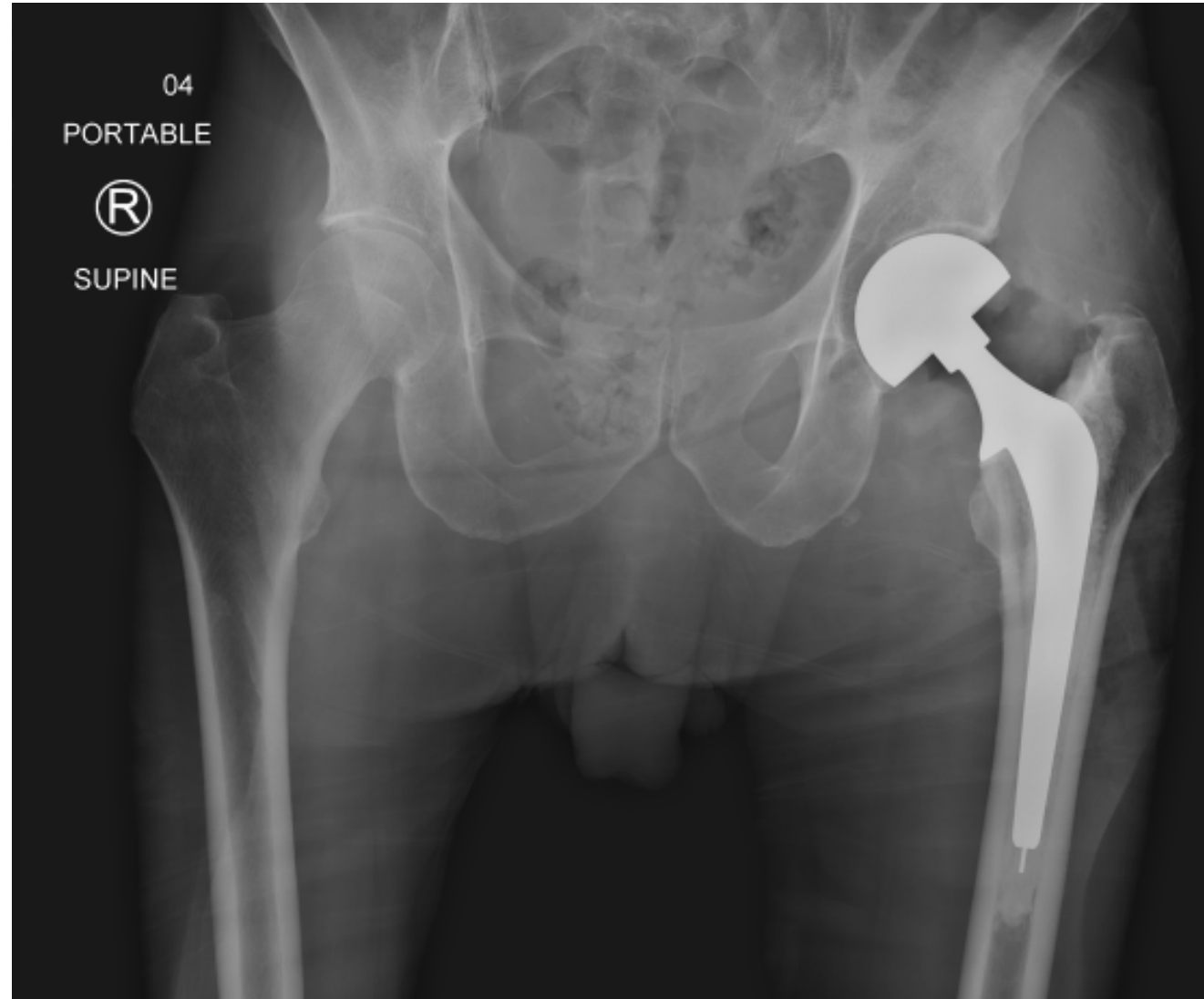
What have we learned?

- Garden 1 and 2 based on AP radiographs
 - Scrutinize the calcar
 - Scrutinize the lateral x-ray

Not every “Nondisplaced” Garden 1/2 fracture should be fixed!!!

Nondisplaced fracture hot topics:

- Is Arthroplasty Superior?



Internal Fixation Versus Arthroplasty for the Treatment of Nondisplaced Femoral Neck Fractures in the Elderly: A Systematic Review and Meta-Analysis

- **No difference in Mortality**
- **Outcome scores overall similar**
- **Internal Fixation: 13% reoperation rate**
- **Hemiarthroplasty: 5.8% reoperation rate (70% reduction)**

Indications Part II - Elderly Displaced Fractures

Indications Part II - Elderly Displaced Fractures

- Another case...
 - 79 year old male
 - Mild dementia
 - COPD, Current Smoker
 - Low energy fall



- Cemented Bipolar Hemi
- Hardinge Approach
- WBAT
- No posterior hip precautions



Rates of Revision Surgery in Eight Randomized Trials

☆Favorite

Author	Total No. of Patients	Fixation	Hemiarthroplasty	Total Hip Replacement
Ravikumar [237]	271	33%	24.2%	6.7%
Rogmark [246] , ^a	450	48.8%	10.4%	
Parker and Dynan [212]	455	39.8%	5.2%	N/A
Tidermark [280]	110	41.5%	N/A	4.1%
Keating et al. [140]	298	39.0%	5.4%	8.7%
Frihagen et al. [83]	222	50%	14.5%	N/A
Blomfeldt et al. [22]	120	N/A	0	3.3%
Baker et al. [10]	81		14.6%	2.5%
Total		41.2%	9.6%	5.4%

^aThe revision rates for hemiarthroplasty and THR in the trial of Rogmark et al. are not included in the

Table 52-3. Keating JF. Femoral Neck Fractures. In: Tornetta P, Ricci WM, eds. Rockwood and Green's Fractures in Adults, 9e. Philadelphia, PA. Wolters Kluwer Health, Inc; 2019.

Arthroplasty Hot Topics

- Hemi versus Total Hip
- Bipolar versus Monopolar
- Cemented versus Uncemented
- Choice of Approach

HEALTH investigators: Total Hip versus Hemiarthroplasty

- No significant difference in secondary procedures
- No significant differences in serious adverse events
 - THA dislocated twice as often as hemiarthroplasty
- No clinically significant differences in outcome scores
 - THA trended better (clinically insignificant)

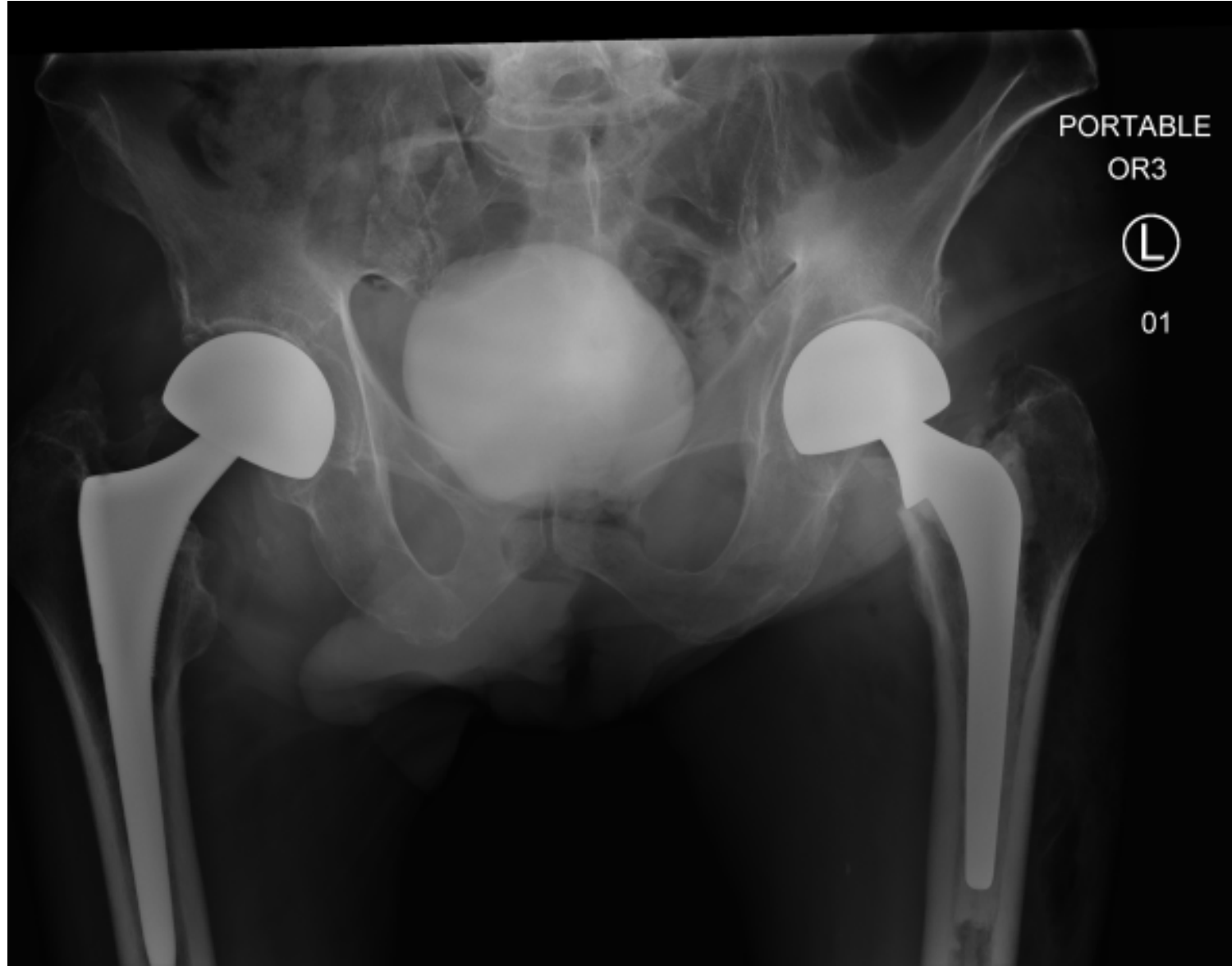
The HEALTH Investigators. Total Hip Arthroplasty or Hemiarthroplasty for Hip Fracture. *n engl j med* 381;23 nejm.org December 5, 2019.

Journal of Arthroplasty 2019 - Meta-Analysis

- 1364 patients
- THA superior in terms of:
 - Reoperation
 - Harris Hip Score
 - Quality of Life
- Hemiarthroplasty recommended for:
 - Live expectancy of less than 4 years
 - Age > 80

Arthroplasty Hot Topics:

- Cemented vs Uncemented



Cemented = Less complications

- Less fractures and dislocations
- No difference in functional scores or thigh pain

- Fenelon C, Murphy EP, Pomeroy E, et al. Perioperative Mortality After Cemented or Uncemented Hemiarthroplasty for Displaced Femoral Neck Fractures-A Systematic Review and Meta-analysis. J Arthroplasty. 2020 Aug 27;S0883-5403(20)30951-7. doi: 10.1016/j.arth.2020.08.042

Bone Cement Implantation Syndrome

- Occurs with ANY surgery on breaching the femoral medullary space
 - Exaggerated in frail patients receiving cement
- GRADE 1
 - 20% - saturation falls below 94%, 20% drop in systolic Blood Pressure
- GRADE 2
 - 3% - saturation falls below 88%, 40% drop in systolic BP
- GRADE 3
 - <1% - Resuscitation required

Bipolar vs Unipolar

- Unipolar advantages: Cost
- Bipolar Advantages:
 - hip function
 - range of motion
 - reoperation rate
 - Improved rates of acetabular erosion

- Imama MA, Shehata M, Abdallah AR, et al. Unipolar versus bipolar hemiarthroplasty for displaced femoral neck fractures: A pooled analysis of 30,250 participants data. Injury 50 (2019) 1694–1708

Approach Technique

- Direct Lateral
 - Less dislocations
 - More abductor weakness
 - Advantage in movement disorders and severely demented
- Posterolateral
 - Increased risk of posterior dislocation
 - Better QOL scores

Future Directions: Direct Anterior Approach

- Reduction in Dislocation Risk
- Less Damage to Abductors



- Anterior Approach
- Courtesy: OTA Video Library

Putting it all together – current trends

- When performing hemiarthroplasty :
 - Cemented
 - Bipolar
 - Consider “Alternate Approaches”
- Consider Total Hip for younger/active patients

Indications part 3

- Physiologically young, active patients over 50 with a displaced femoral neck fracture

Back to the first case of the talk...

- 56 year old healthy surgeon
- Struck by car while cycling
 - Fix or Replace?



How to indicate:

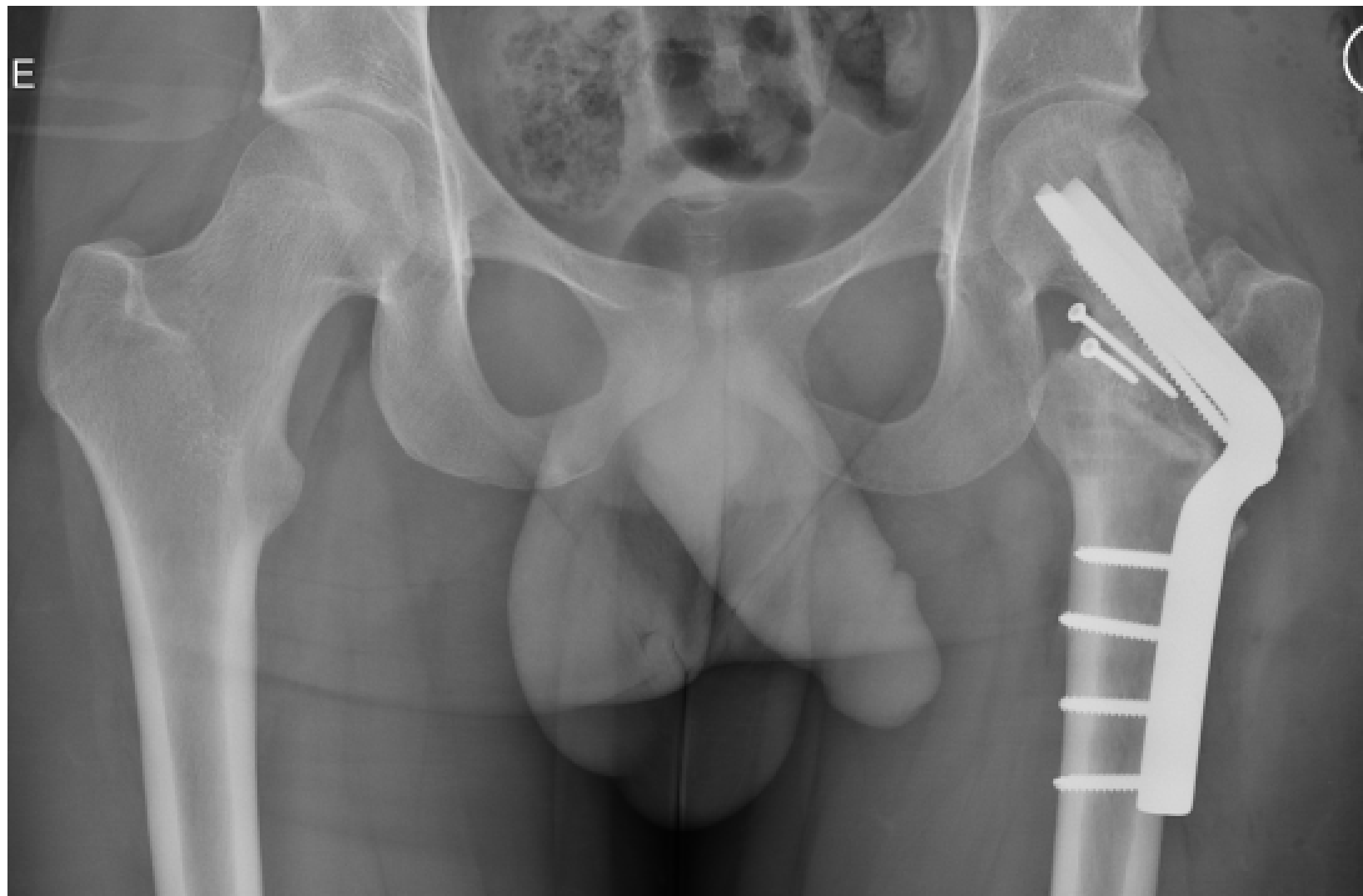
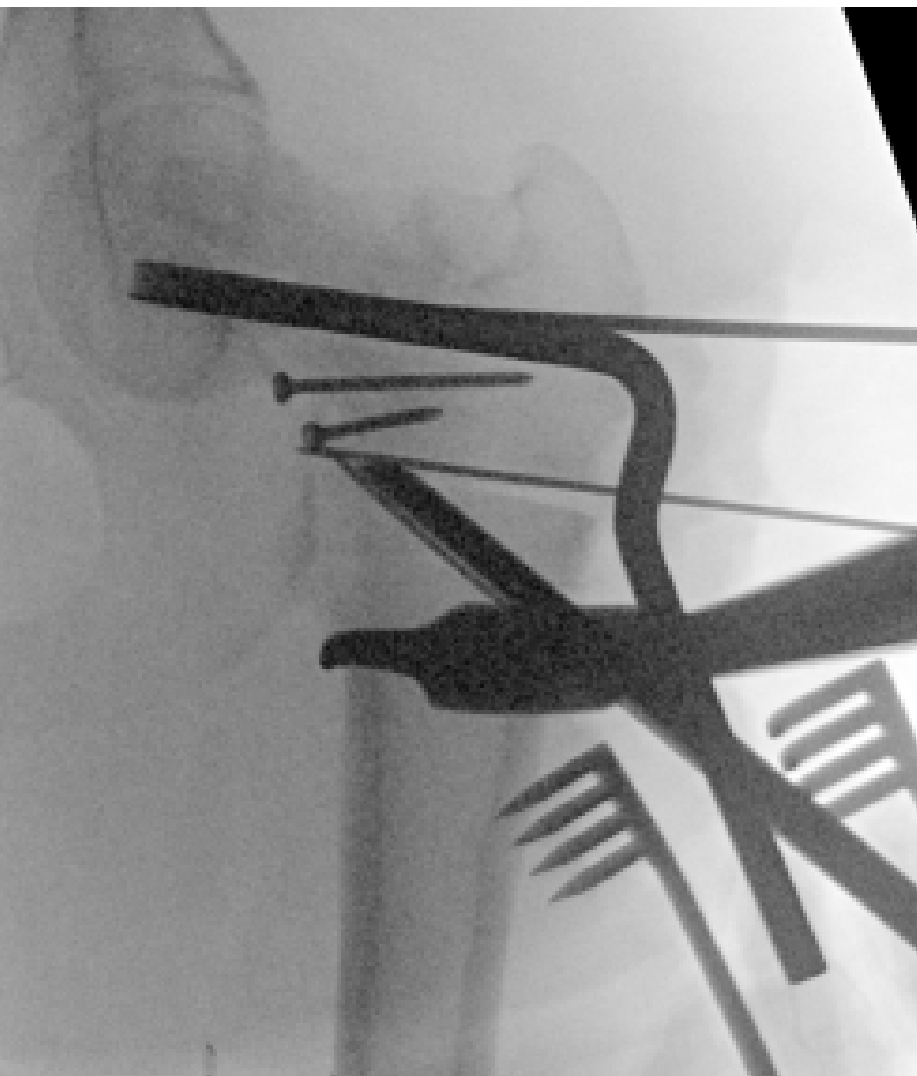
- 1) What are the demand levels of the patient?
- 2) What is the fracture pattern?
 - Subcapital, transcervical, basicervical
 - Pauwels Angle
 - Comminution and bone quality

Predicting failures

- Neutral up to 15 deg valgus **acceptable**, 0-15 deg anteversion **acceptable**
- No varus
- No retroversion
- No inferior offset







Preferable Implants

- Pauwels 3, Basicervical, High degree comminution
 - Sliding hip screw +/- antirotation screw



Outcomes

In the setting of good to excellent reduction

- Osteonecrosis rate 21%
- Nonunion rate 4%
- 10 year rate of survival 85%

Florschutz AV, Langford JR, Haidukewych GJ, et al. Femoral Neck Fractures: Current Management. J Orthop Trauma Volume 29, Number 3, March 2015

HAIDUKEWYCH GJ, ROTHWELL WS, JACOFISKY DJ, et al. Operative Treatment of Femoral Neck Fractures in Patients Between the Ages of Fifteen and Fifty Years. J Bone Joint Surg Am. 2004 Aug;86(8):1711-6. doi: 10.2106/00004623-200408000-00015.

Evaluate the Xray and CT scan closely

56 year old male, fall mountain biking



79 year old male, low energy fall



Rates of Revision Surgery in Eight Randomized Trials

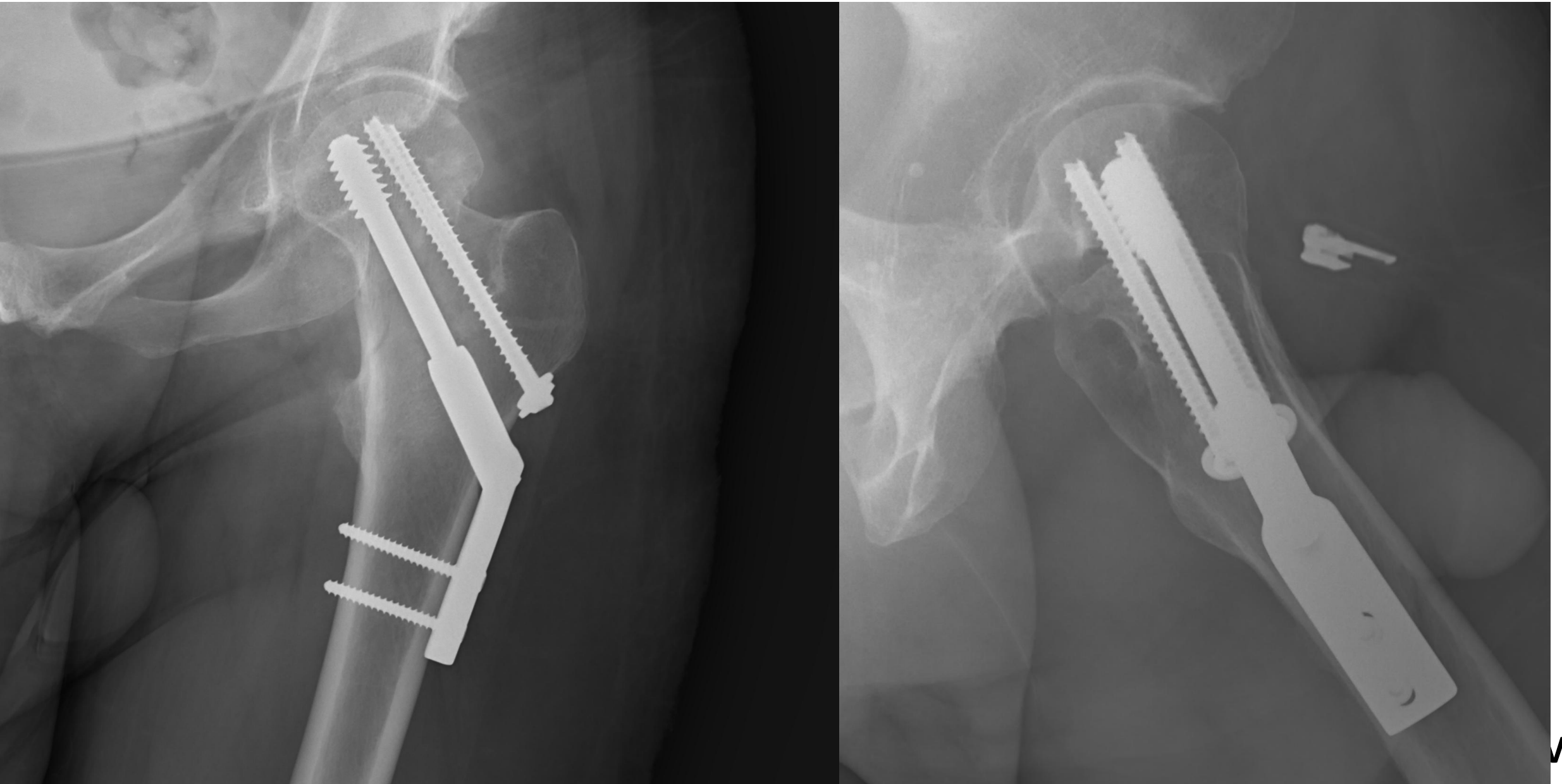
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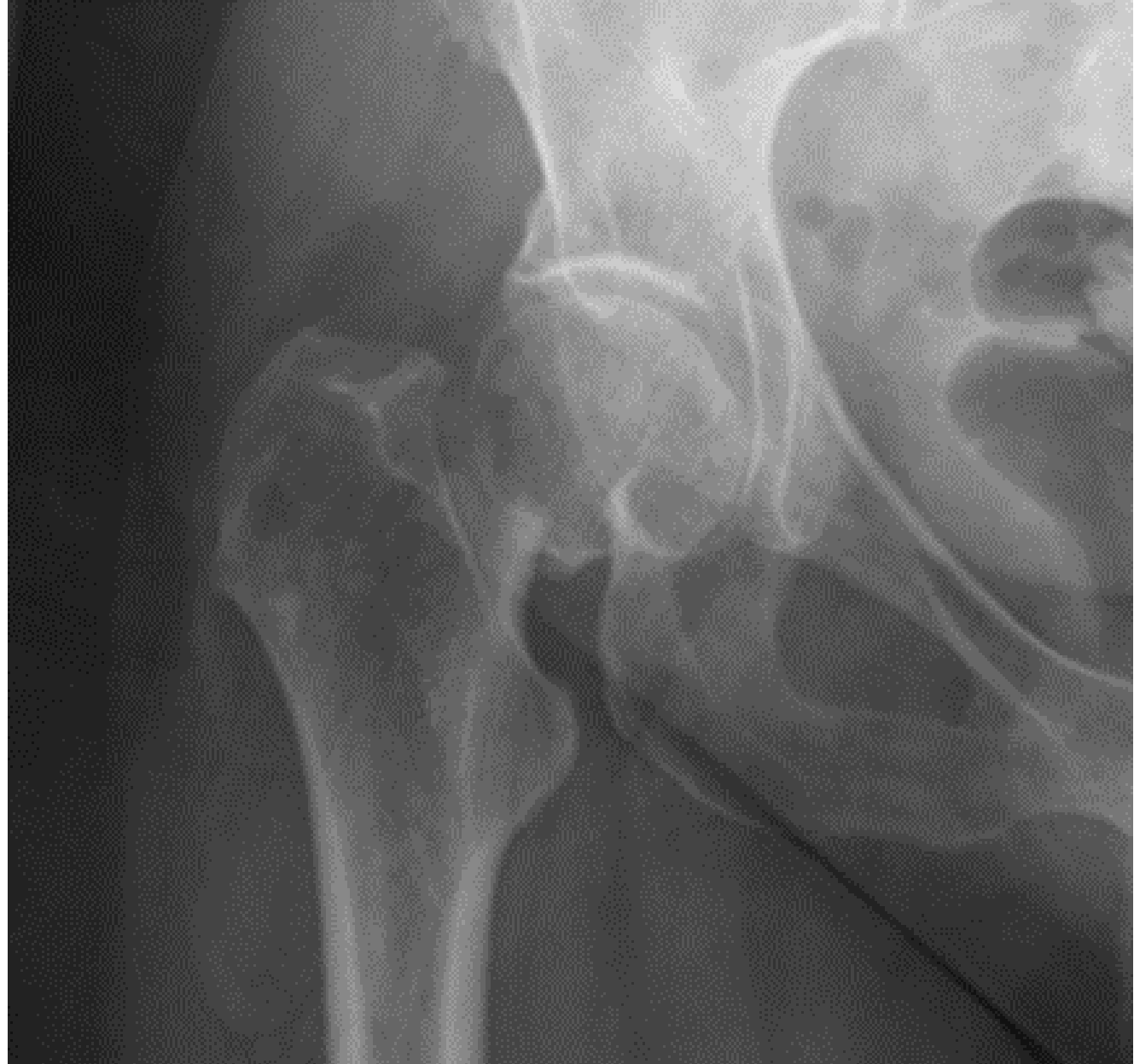
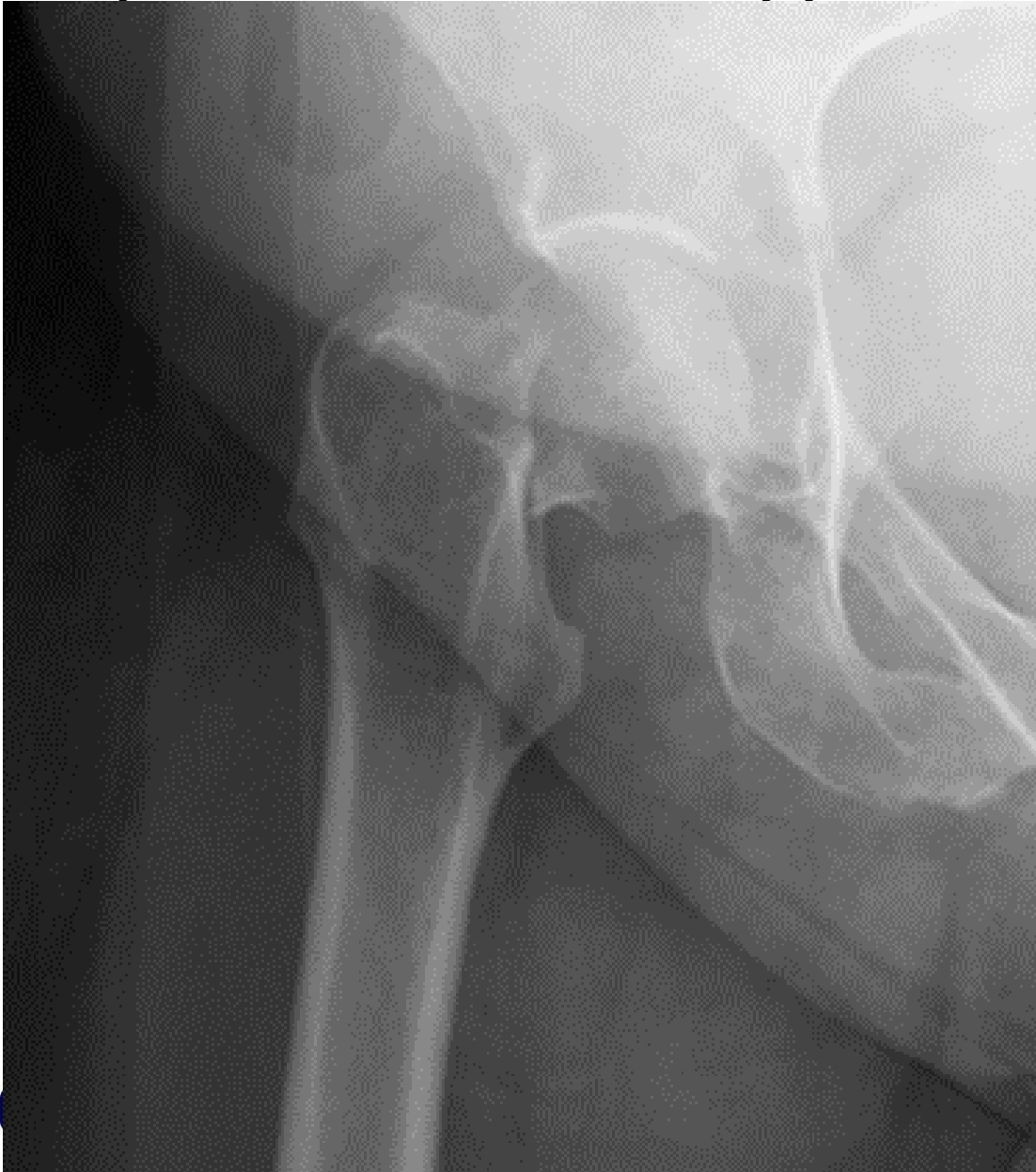
No Algorithm for the “gray area” patient

What happened to our 56 year old surgeon?



Another case...

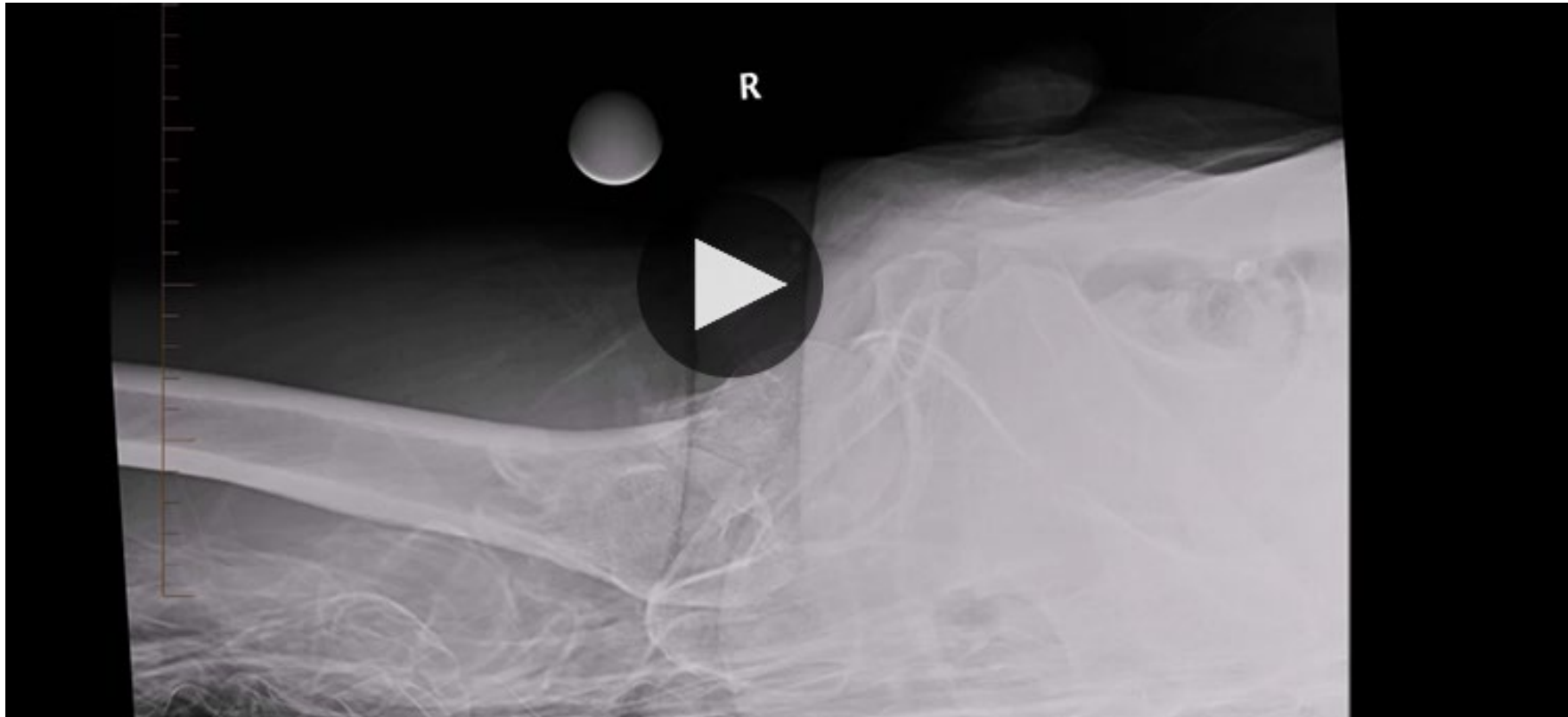
61 year old with hyperthyroidism, slip and fall





Quality of Reduction: ORIF when in doubt

- Smith Petersen vs Watson Jones
 - Smith Petersen = benefit of exposure of subcapital neck



Summary

- **Indications part 1**
 - **Elderly “Nondisplaced Fractures” – Careful scrutiny of films, fixation when appropriate**
- **Indications part 2**
 - **Elderly “Displaced Fractures” – Arthroplasty offers superior outcomes. Be critical of the literature when deciding approach and implant type**
- **Indications part 3**
 - **The gray zone between youth and “elderly” – Risk of re-operation must be outweighed by the benefits of avoiding arthroplasty in an active patient**

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