Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Treatment of Femoral Neck Fractures in the Young

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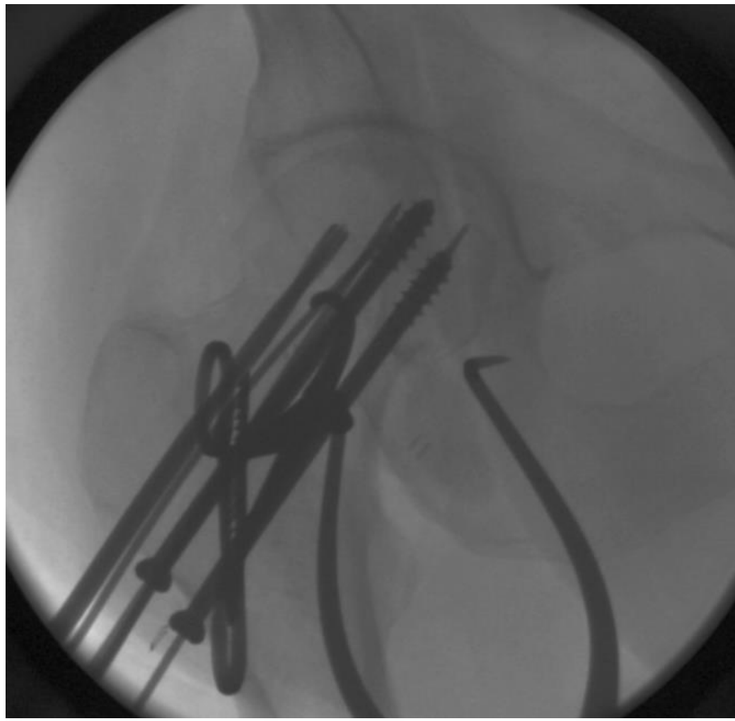


Disclosures

- Nothing to disclose relevant to this presentation
- Acknowledgments – mentors and patients who have taught me

Learning Objectives

- Understand anatomy
- Open reduction techniques
- Closed reduction techniques
- Achieve a QUALITY reduction!!!

Femoral Neck fractures in the Young

- Mechanism - High energy (Axial load + abduction)
- Association with Shaft - 2-6%
- Pattern - More often distal and vertical in orientation

Case Example

28-year-old software engineer

Motorcycle collision

Isolated injury

Healthy non-smoker

When should I operate?

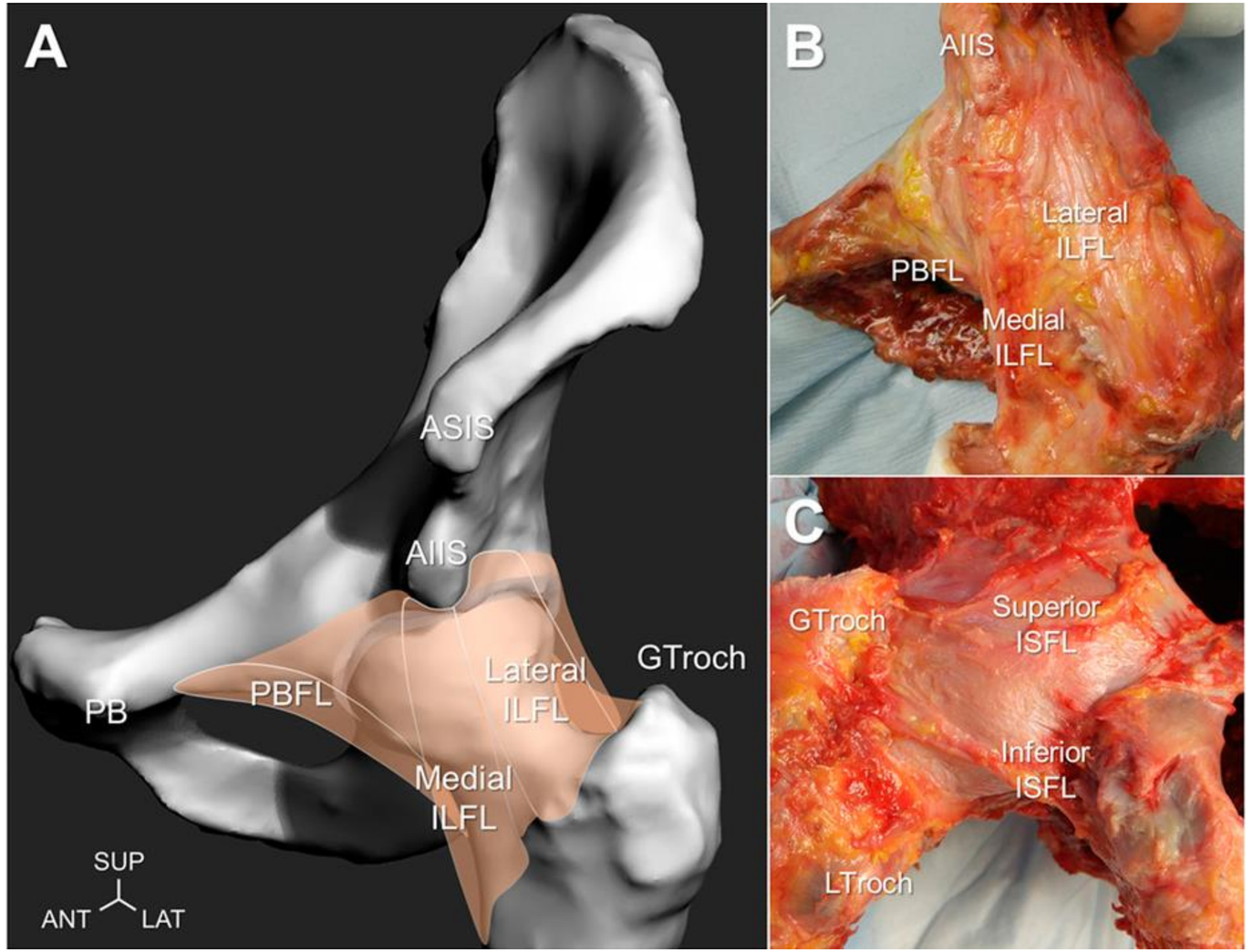
What approach?

How do I obtain and maintain reduction?

Which implant?

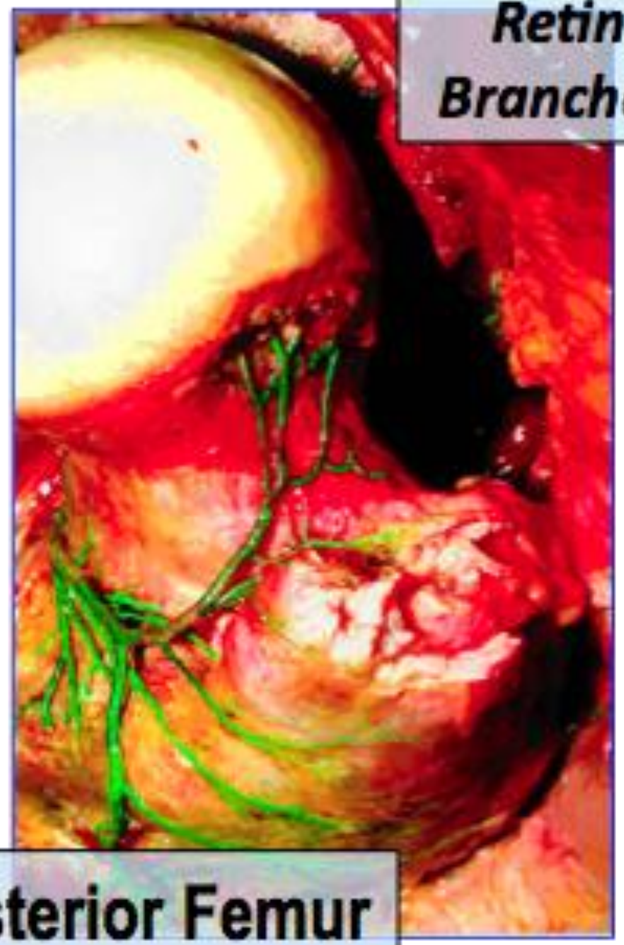
Anatomy

Anatomy – Capsular Ligaments

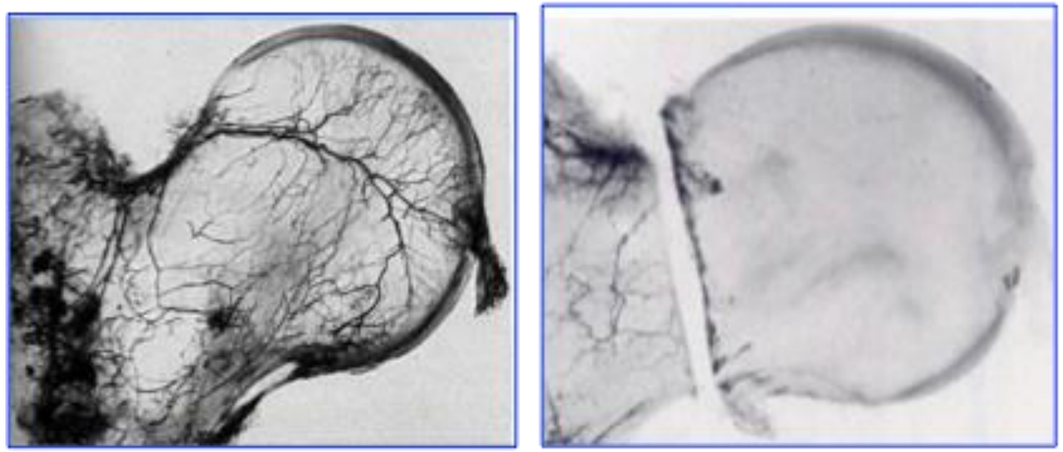


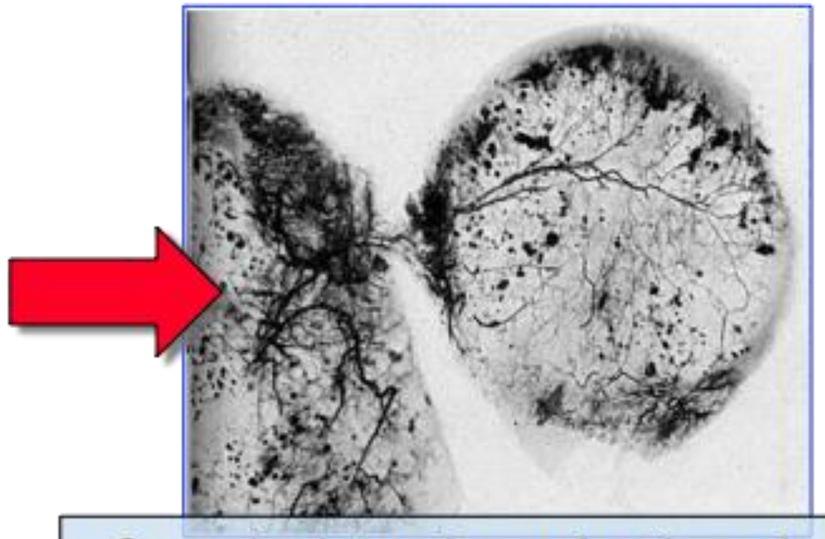
Ng *JBJS* 2019

Anatomy - Blood Supply



Complete disruption of the arterial supply through the femoral neck





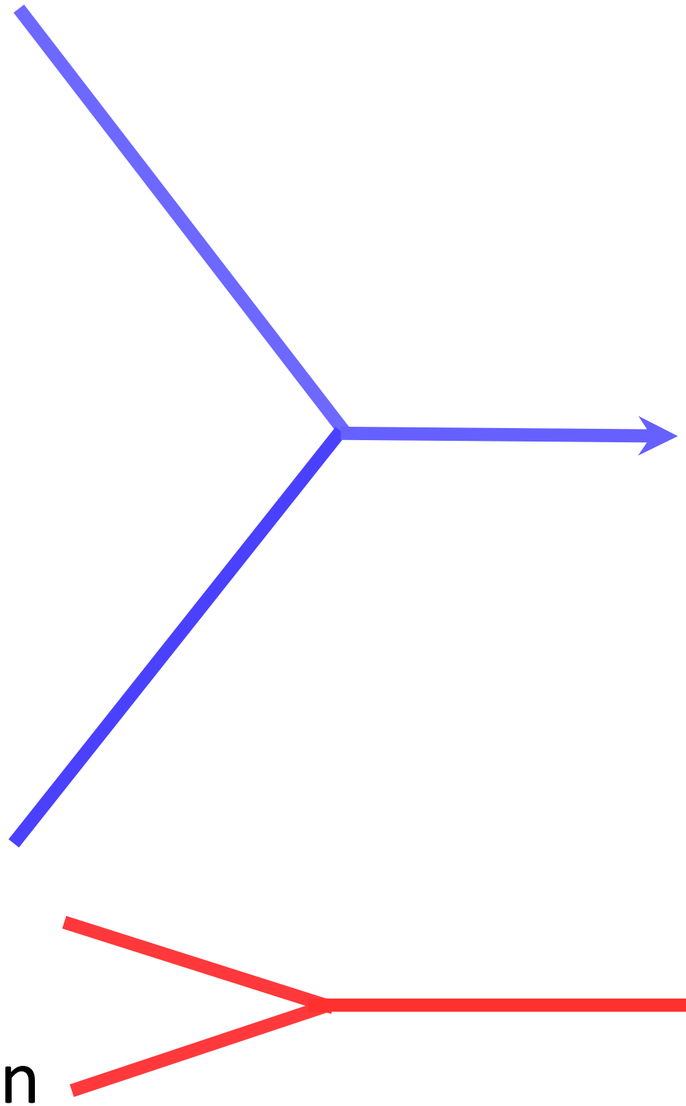
- Capsular integrity and retinacular blood supply may remain intact
- Reversible kinking/stretch on vessels

Sevitt *JBJS 1965*

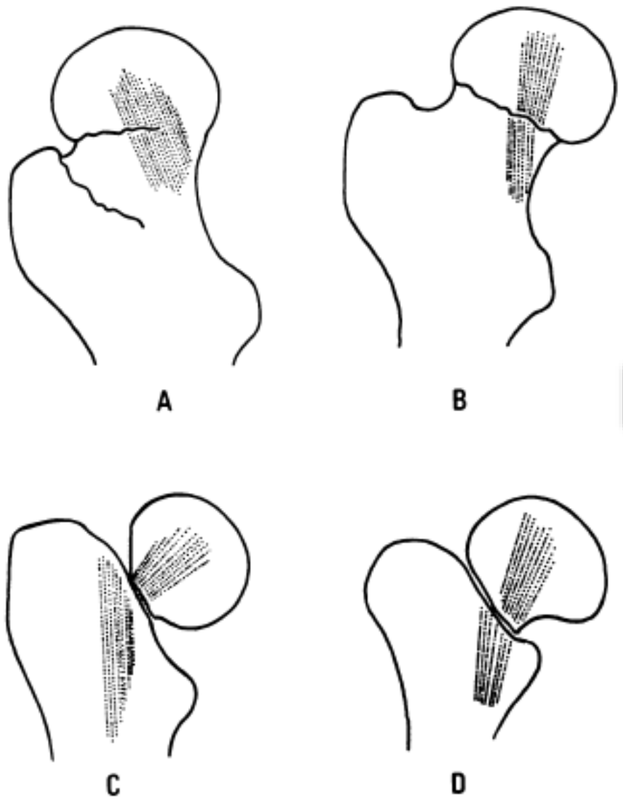
What factors prognosticate outcome?

- Injury Factors
  - Pauwels's Angle
  - Initial Displacement
  - Posterior Comminution

- Technical Factors
  - Quality of Reduction
  - Method of Fixation
  - Capsular Decompression



Fracture Classification



Garden

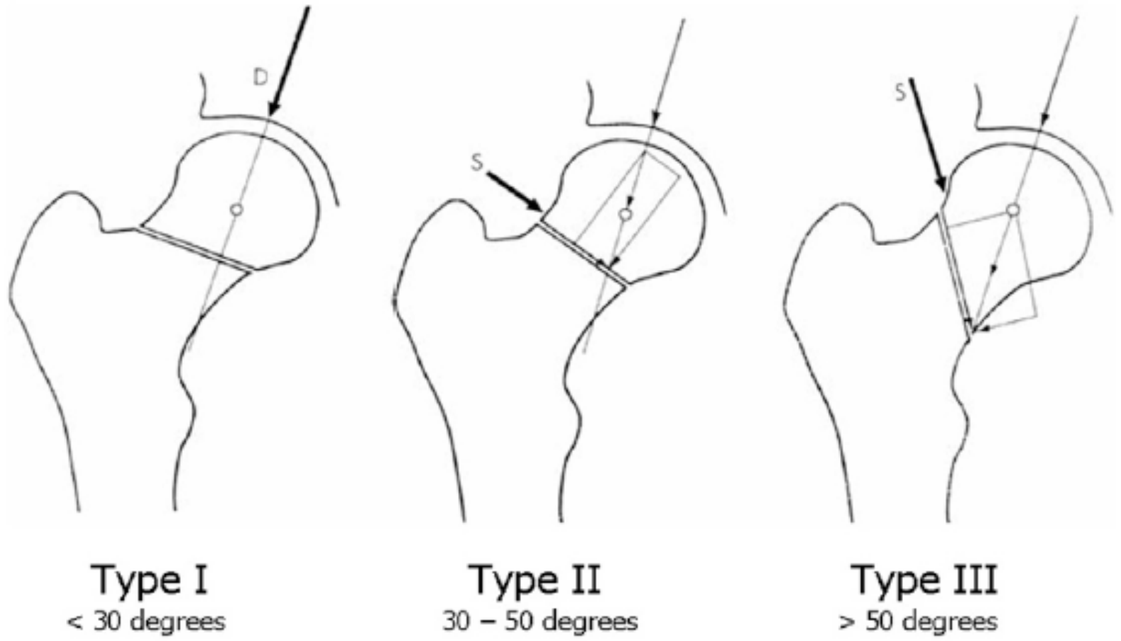


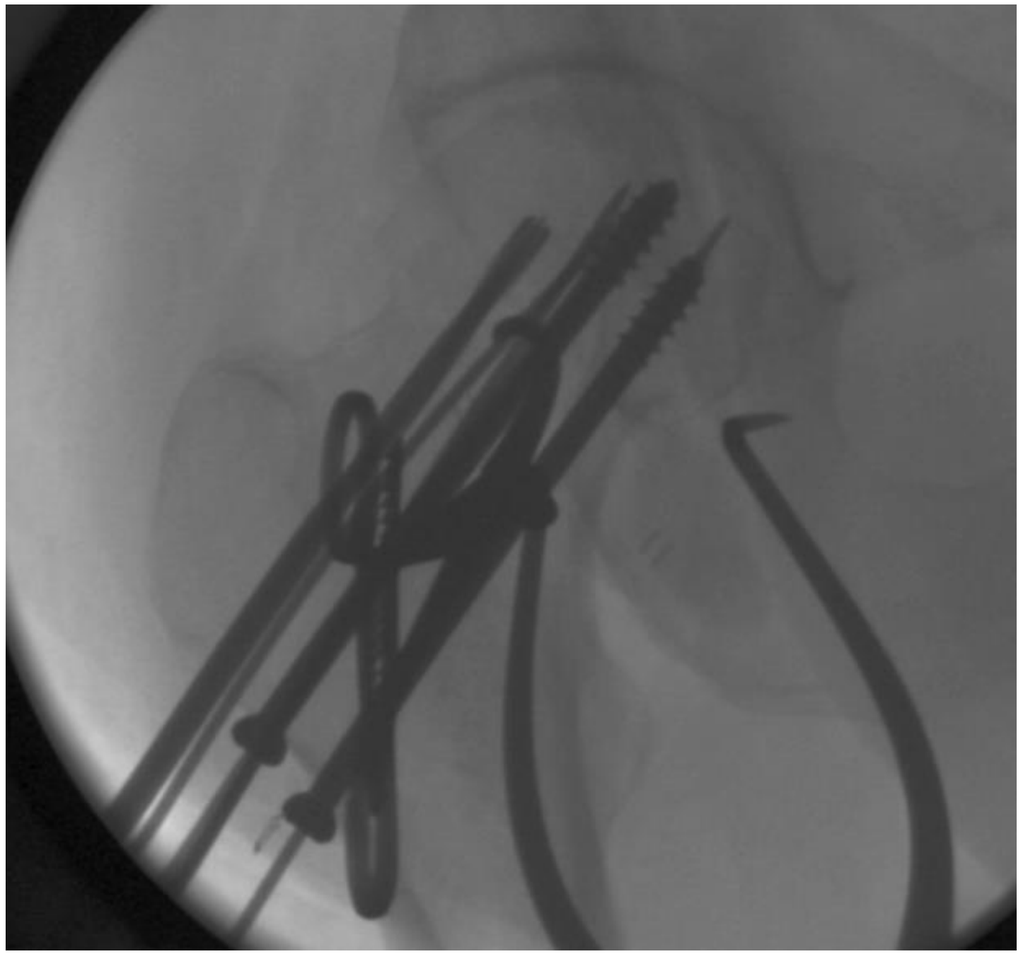
Fig. 1
Pauwels classification. (Reproduced, with modification, from: Bartoníček J. Pauwels' classification of femoral neck fractures: correct interpretation of the original. J Orthop Trauma. 2001; 15:358-60. Reprinted with permission.)

Increased rate of implant failure
Increased risk of nonunion

Compressive → **Shear**

Liporace *JBJS* 2008

Fracture Reduction



Quality of Reduction is the most strongly correlated predictor of healing

Swiontkowski *JBJS* 1984
Tooke *JBJS* 1985
Haidukewych *JBJS* 2004
Upadhyay *JBJS* 2004
Liporace *JBJS* 2008

Fracture Reduction – ORIF Paradox

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Evidence based update: Open versus closed reduction

Pouriya Ghayoumi [a,1], Utku Kandemir [b,2], Saam Morshed [b,*]

[a] University of California, San Francisco School of Medicine, United States
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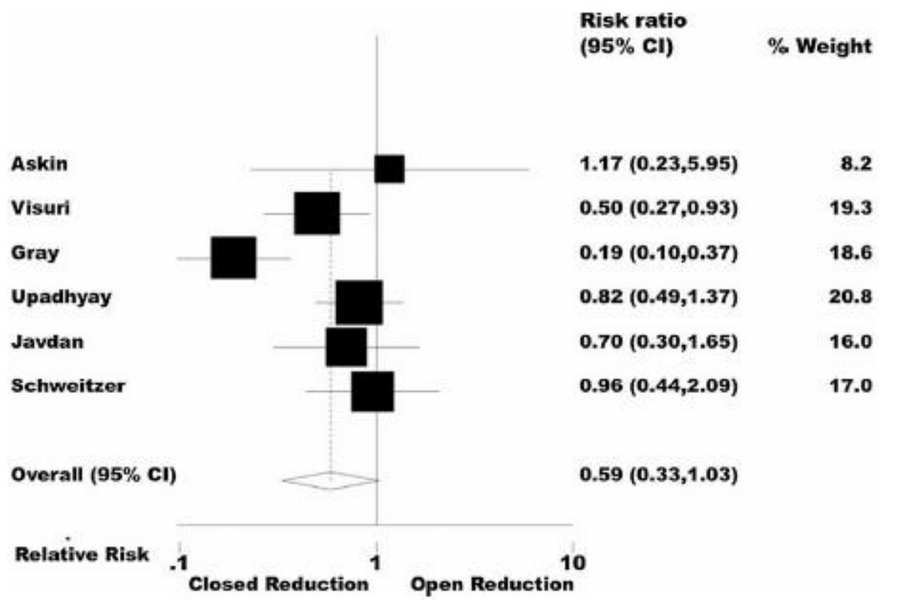

Fracture Reduction – My recommendation

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Evidence based update: Open versus closed reduction

Pouriya Ghayoumi [a,1], Utku Kandemir [b,2], Saam Morshed [b,*]

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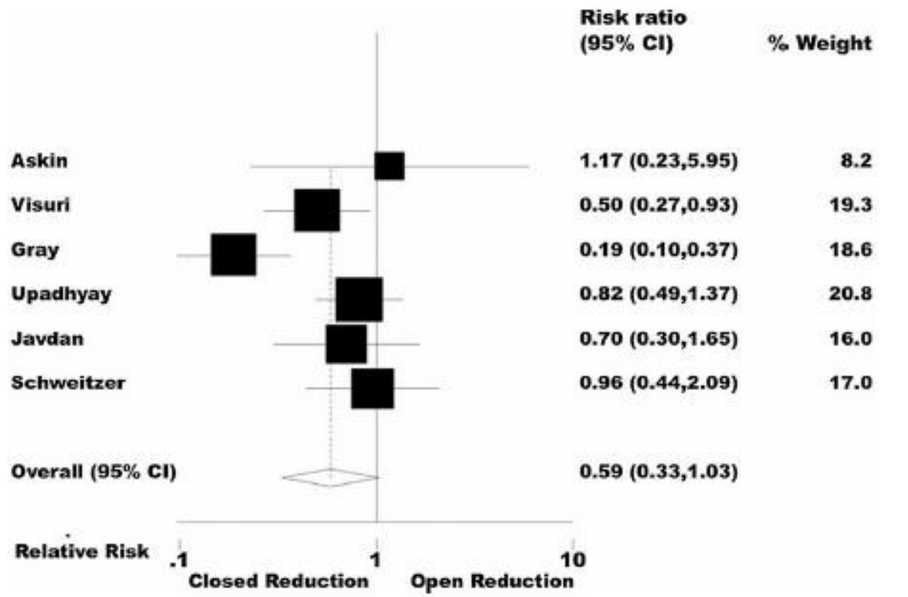

First, master the **open** reduction!!!

Then, adapt **closed** manipulative reduction and **percutaneous** techniques

Open Reduction

- Indications –
  - Fracture reduction not satisfactory in any plane by closed means
  - *All displaced femoral neck fractures in young patients???*

Acceptable

Not Acceptable

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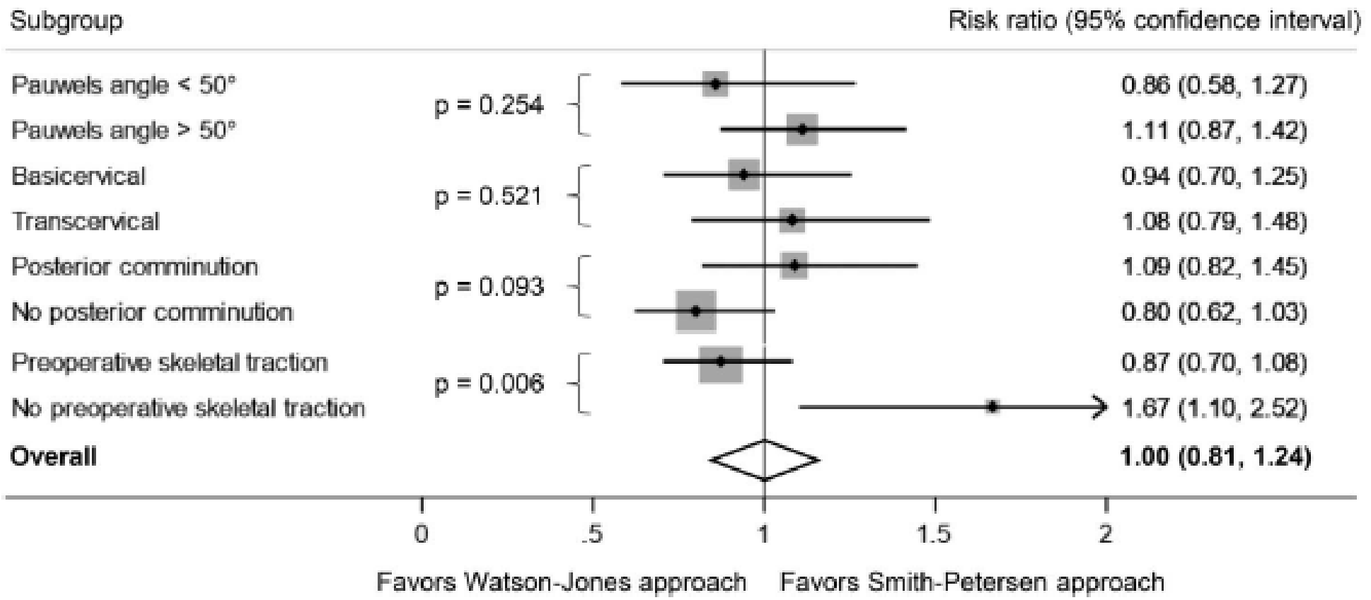
Open Reduction – Surgical Approach

Smith–Petersen Versus Watson–Jones Approach Does Not Affect Quality of Open Reduction of Femoral Neck Fracture

Joseph T. Patterson, MD,[a] Keisuke Ishii, MD,[b] Paul Tornetta III, MD,[c] Ross K. Leighton, MD, FRCSC, FACS,[d] Darin M. Friess, MD,[e] Clifford B. Jones, MD, FACS,[f] Ari Levine, MD,[g] Jeffrey J. Maclean, MD,[b] Theodore Miclau III, MD,[b] Brian H. Mullis, MD,[h] William T. Obremskey, MD, MPH,[i] Robert F. Ostrum, MD,[j] J. Spence Reid, MD,[k] John A. Ruder, MD,[l] Anas Saleh, MD,[g] Andrew H. Schmidt, MD,[m] David C. Teague, MD,[n] Antonios Tsismenakis, MD,[c] Jerald R. Westberg, BA,[m] and Saam Morshed, MD, PhD[b]



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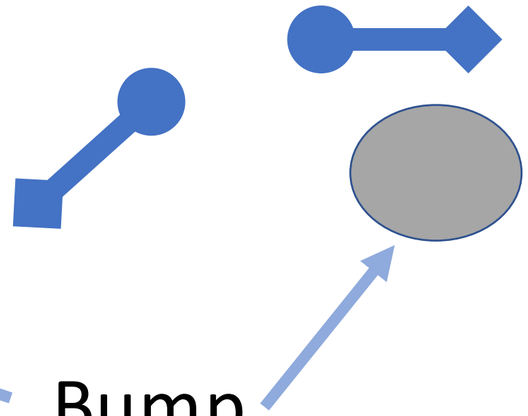
Open Reduction – Positioning and OR Set-up

Prepare the leg ***free***



Radiolucent table

Open Reduction - Tools

Modified Weber

2-2.5mm Schantz Pin

Jungbluth

Case example

- Patient taken to surgery that afternoon
- Open reduction performed by way of a modified Smith Peterson Approach
- Inferior neck buttress plate+ three canulated screws
- TTWB for 12 weeks

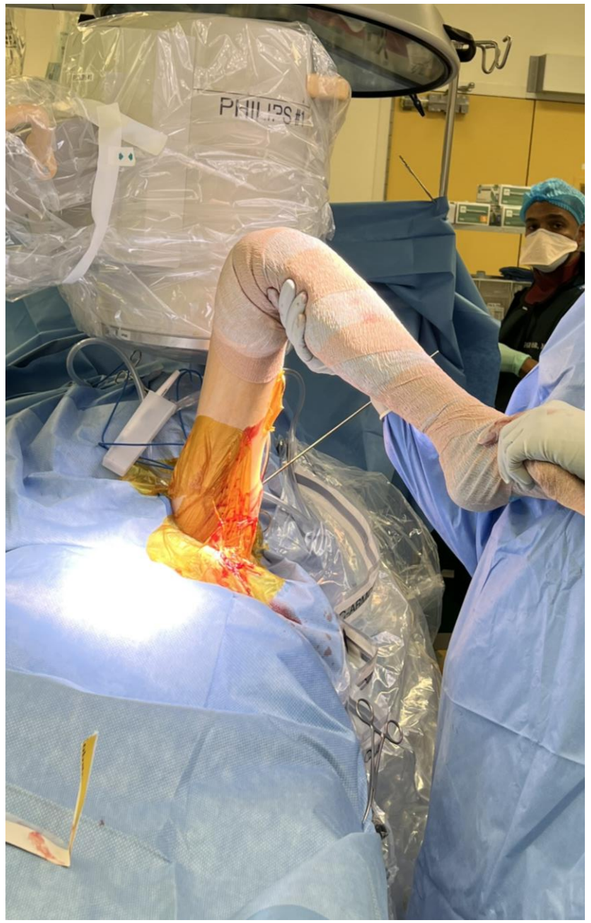
Closed Reduction Technique

- Indications -
  - Minimal or Valgus Impacted fracture
  - Highly comminuted or un-reconstructable
  - Contra-indication for open surgery
  - *Any fracture deemed by surgeon to be amenable to satisfactory reduction by closed means*

55-year-old HSMVC

Closed Reduction Technique

1



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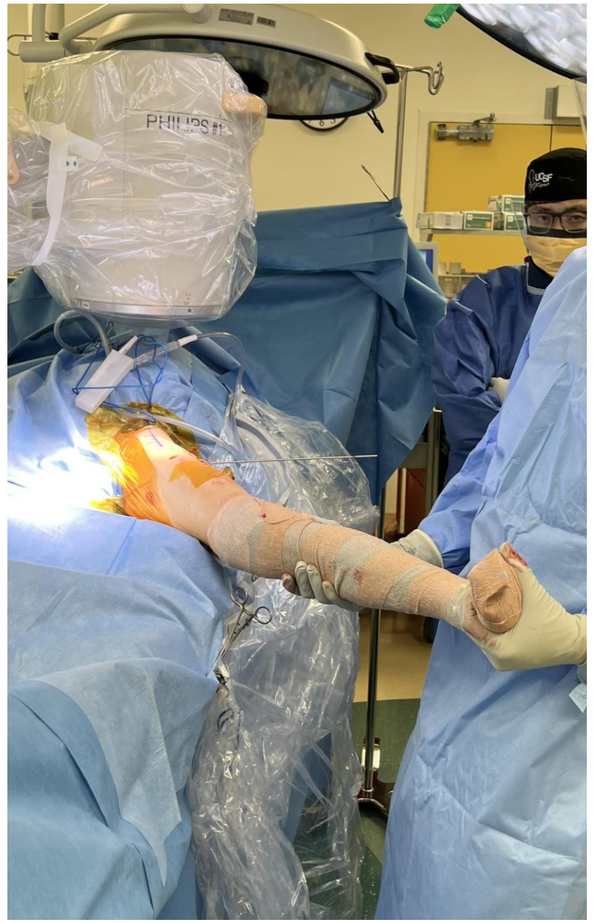

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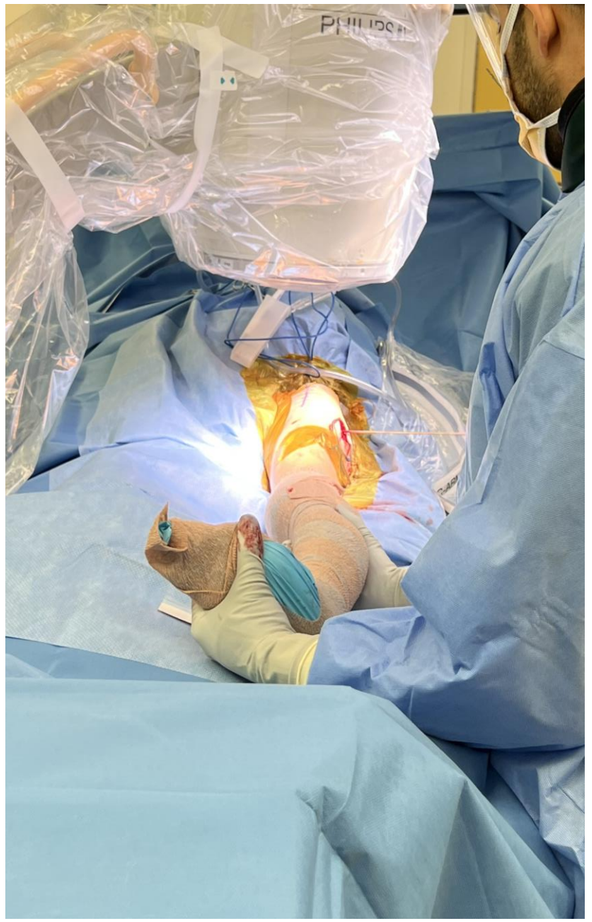


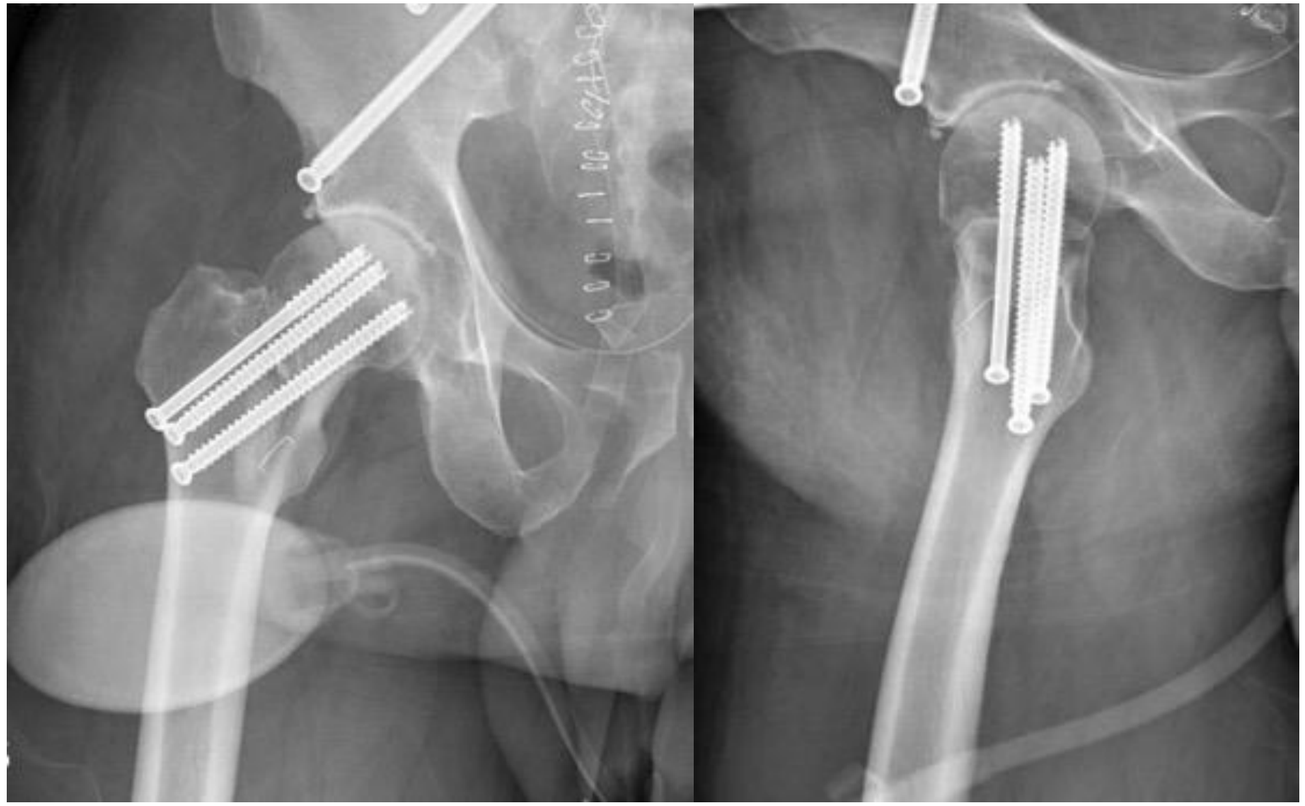
4

Closed Reduction Technique – Case Conclusion

Hospital Day 1

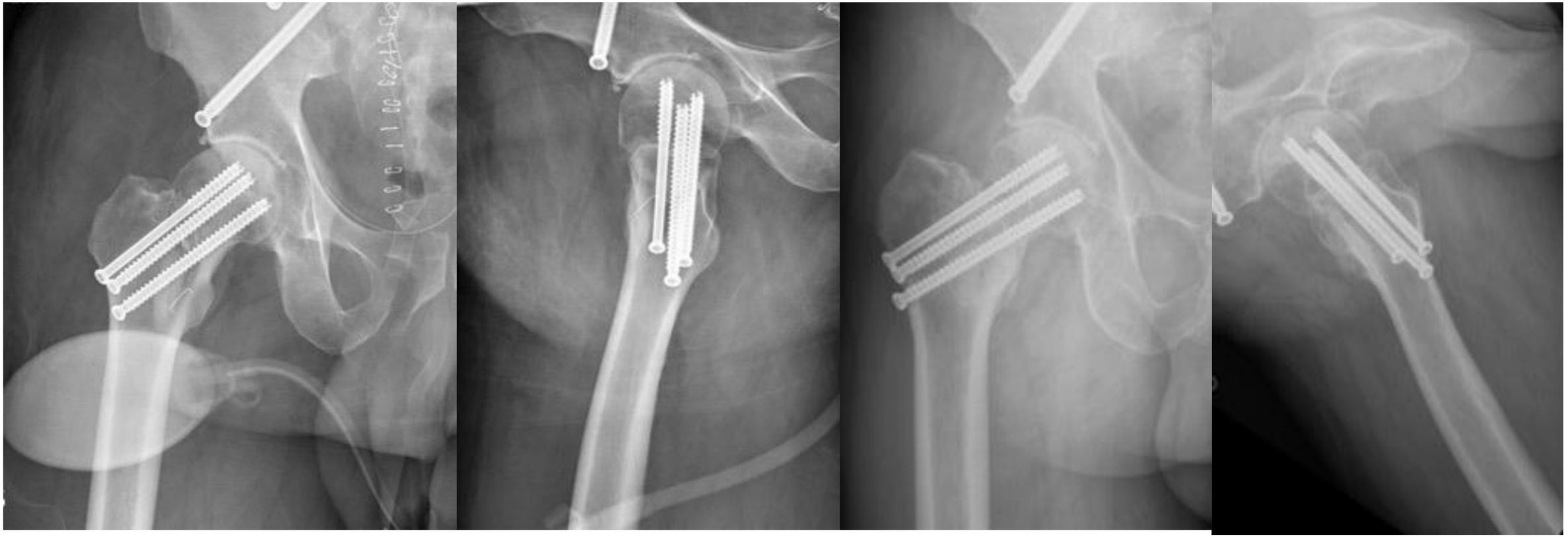
Closed Reduction Technique – Case Conclusion

Hospital Day 1



Post-operative

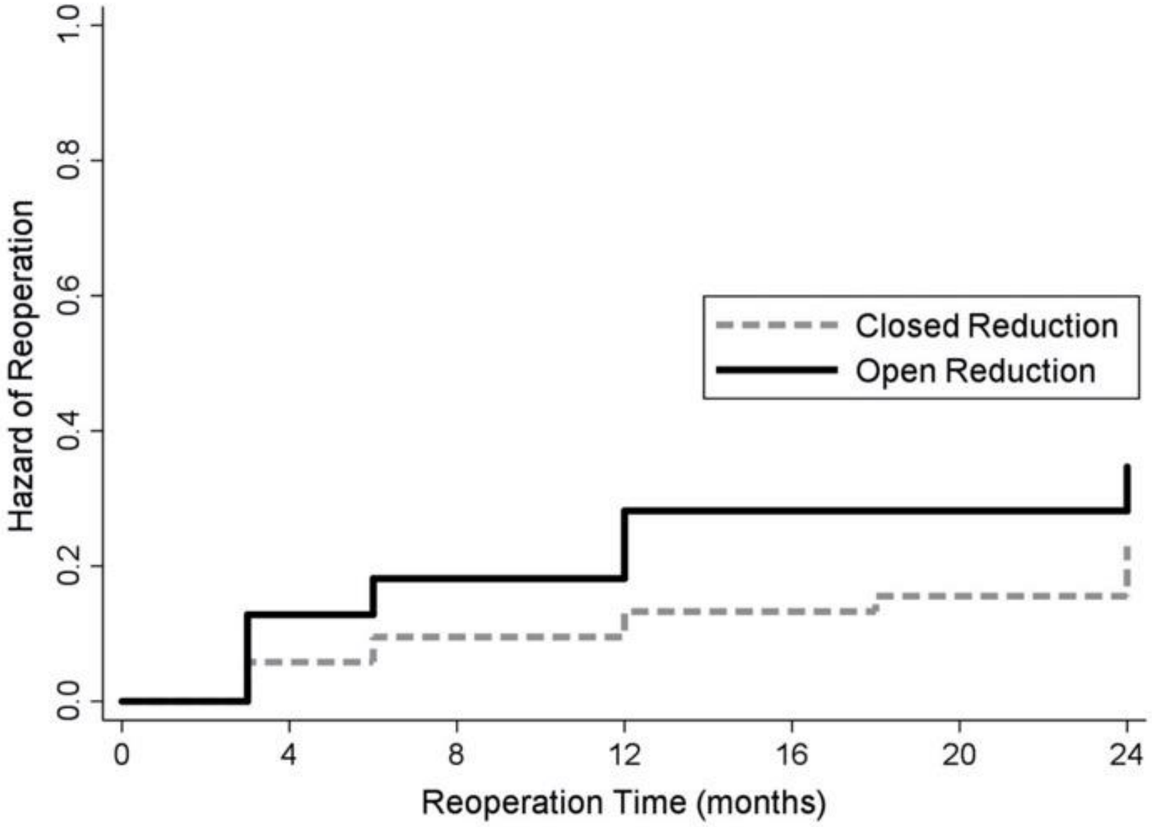
Closed Reduction Technique – Case Conclusion



Post-operative

2.5 years later

Open reduction associated with higher rates of complication and reoperation



Open Reduction Is Associated With Greater Hazard of Early Reoperation After Internal Fixation of Displaced Femoral Neck Fractures in Adults 18–65 Years

Joseph T. Patterson, MD, Keisuke Ishii, MD,* Paul Tornetta III, MD,†*
Ross K. Leighton, MD, FRCSC, FACS,‡ Darin M. Friess, MD,§ Clifford B. Jones, MD, FACS,‖
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Adjusted HR =
2.4 [1.32– 4.35]

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Young Femoral Neck Fracture Working Group

Scope of the Problem

(Collinge et al. JOT 2022, n=492, 26 centers, age <50):

- **32% required major reconstructive surgery** (100 THA, 45 osteotomies, 12 revisions)
- **>5-fold increase risk of revision with poor reduction (>5mm displacement or >10-degrees of angulation)**

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Fixed-Angle Constructs Superior for displaced (avg. Pauwels' angle 55deg)

(Roser et al. JOT 2024, n=565, age <60):

- **55% failure – cannulated screws**
- **36% failure- fixed angle implants (p<0.001)**
- **11% failure** (p<0.036)

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Failure Increases With Age

(Collinge et al. JOT 2024, by decade):

- <30 yrs: 36% | 30s: 40% | 40s: 48% | 50s: **57%**

Femoral Neck Shortening Paradox

Is shortening a mediator of poor outcomes?

⬇ length and offset = ⬇ abductor moment-arm

Will locking length and angle of reduction help?

Berkes *JOT* 2012

Will locking length and angle of reduction help?

- 17/18 patients anatomically reduced
- **37% catastrophic failure** (locking screw breakage most common)
- Among the 11 that healed, *no difference* in shortening or varus vs historical controls

Berkes *JOT* 2012

New angle-stable implants for ”controlled” compression -

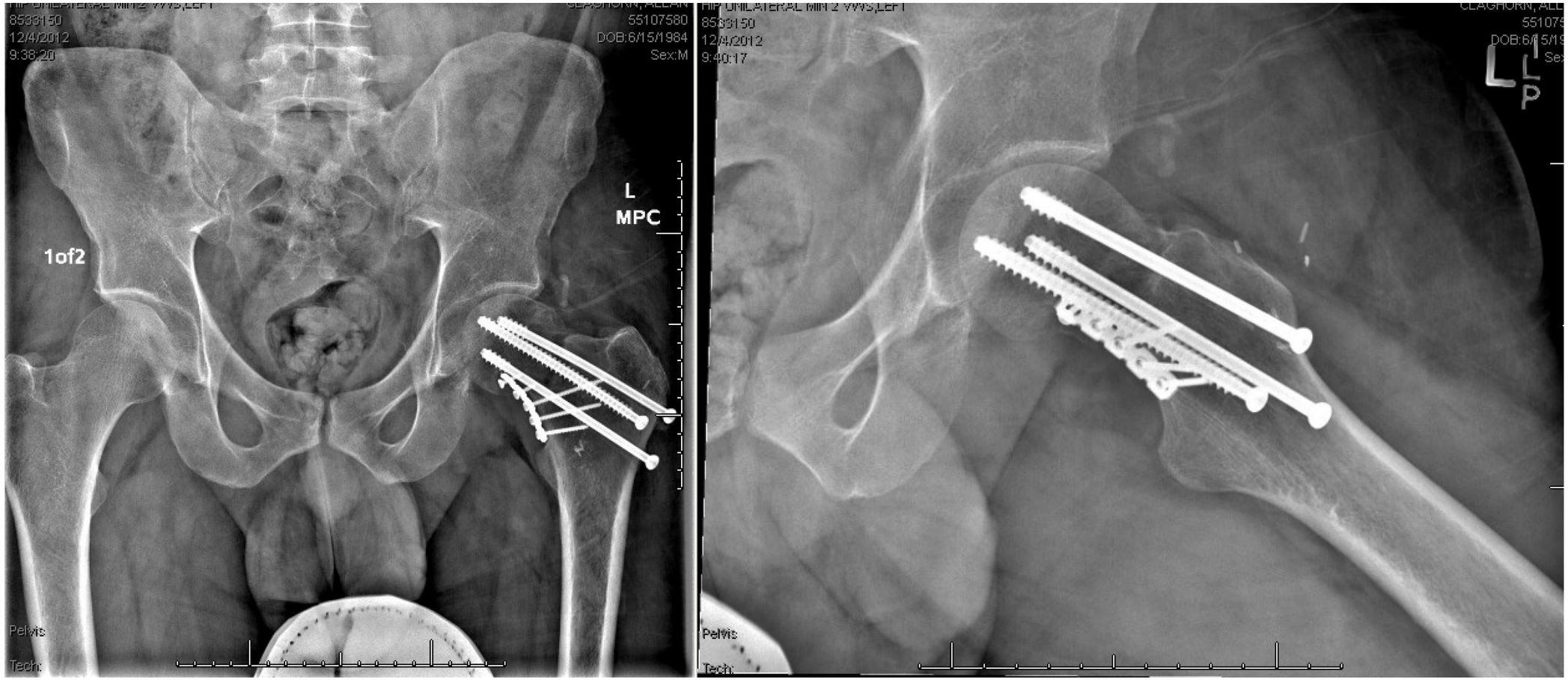
Registry data now available:
FNS vs CS in patients **≥60 years**: No difference in revision
HR 0.92 (p=0.79), n=2,038
Kaiser Permanente Registry

Young adults (18-65):
FNS ≈ CS for major endpoints;
FNS advantages in OR efficiency & Pauwels III

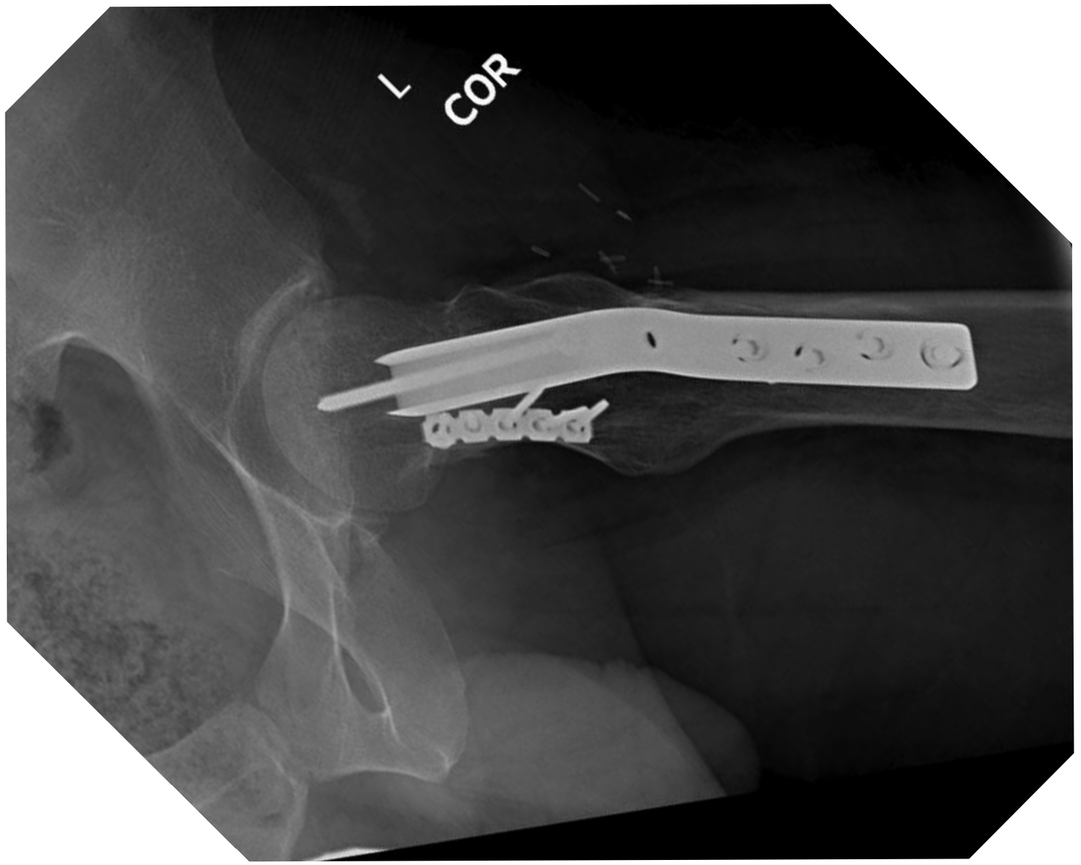
Mallon *JBJS* 2025; Roser/Collinge *JOT* 2024; Zhang *Front Surg* 2025; Song *Front Surg* 2026; Wen *JOSR* 2025;

What is the mechanical and biological cost of this?

4.5 month Follow-up

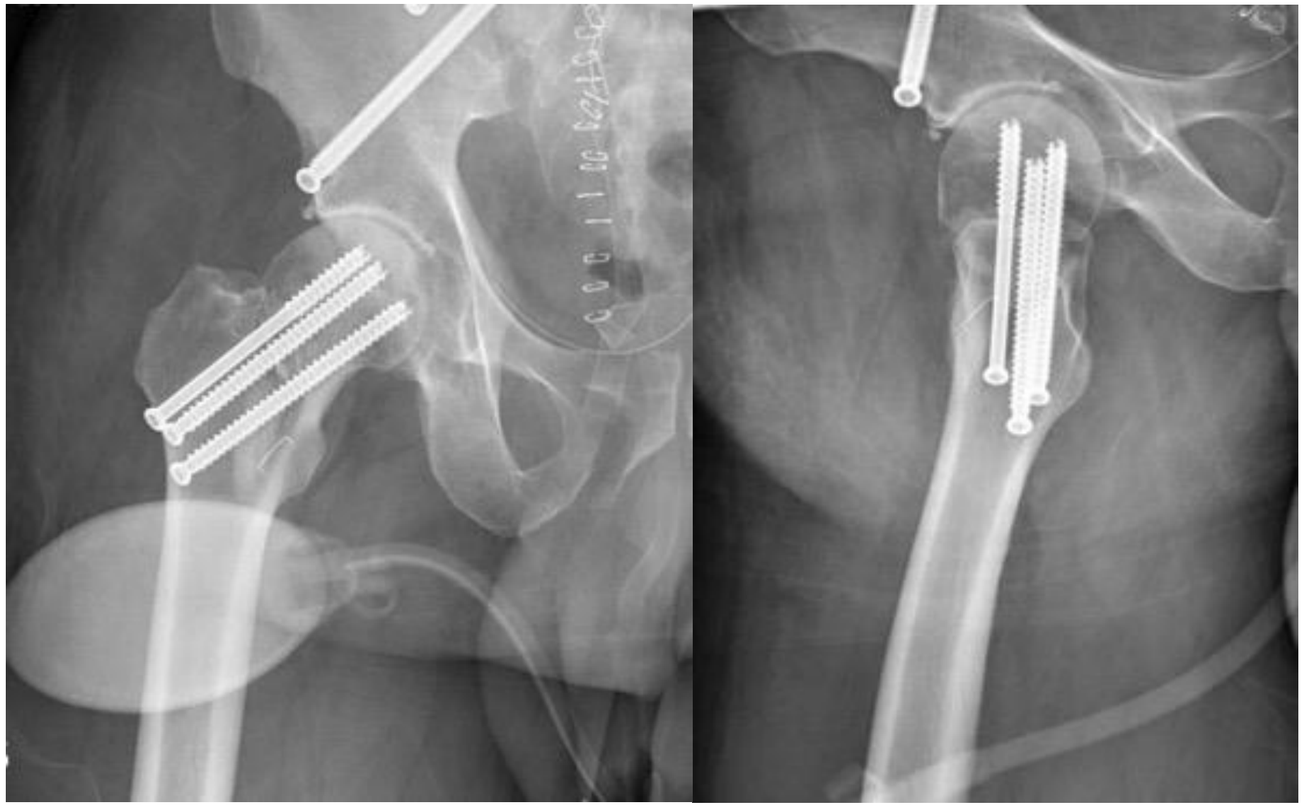


10-year follow-up



Achieve a **quality** reduction . . .

- Goal: < 2mm displacement or <5 degrees angulation in any plane
- Accept: <5mm displacement, <10 degrees angulation in any plane



Conclusions

- Understand anatomy
- Familiarize yourself with both open and closed reduction techniques
- The goal of surgery is a QUALITY reduction . . . There are many ways to get there.

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