

Femoral Neck Fractures in Young Adults – Timing and Technique

2023 San Francisco Orthopaedic Trauma Course

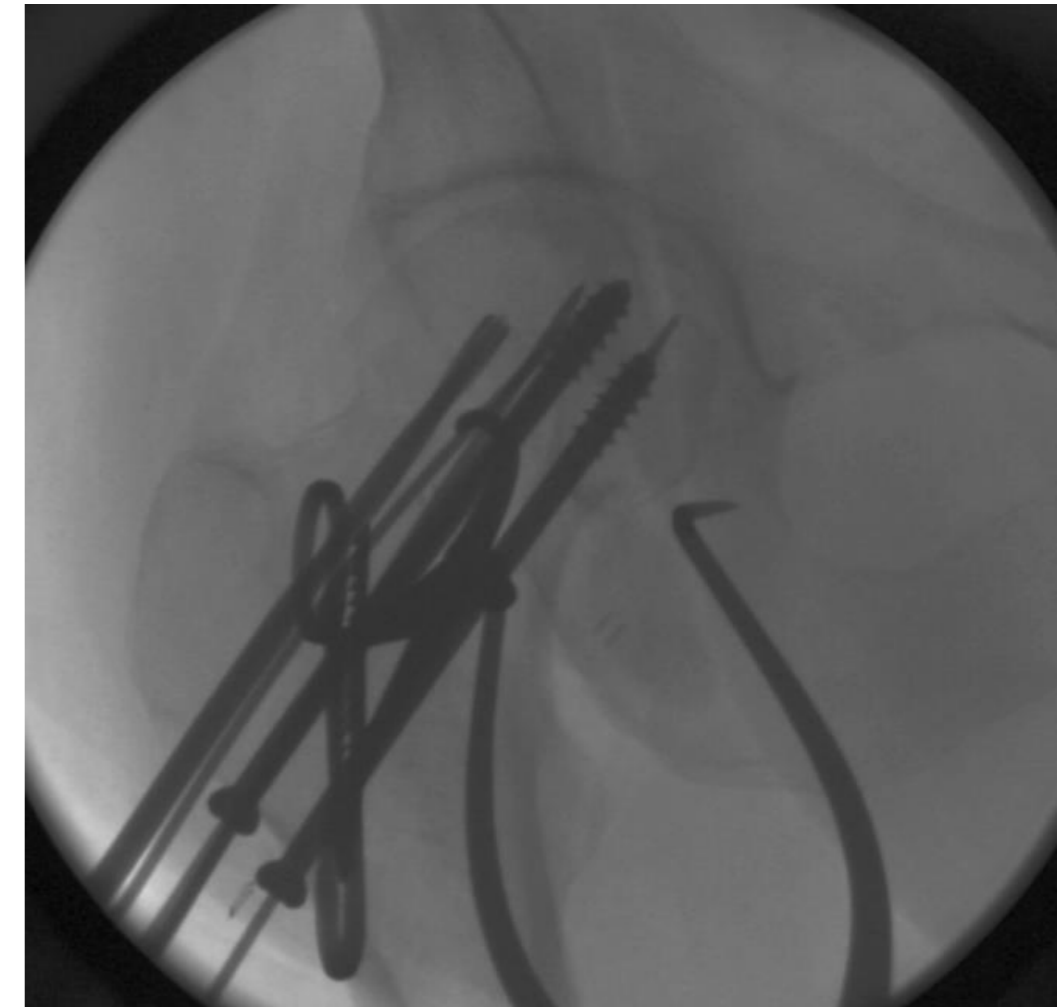
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I have something to disclose.

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Learning Objectives

- Understand anatomy
- Treat *urgently*, not emergently
- Review open and 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?

When should I operate?

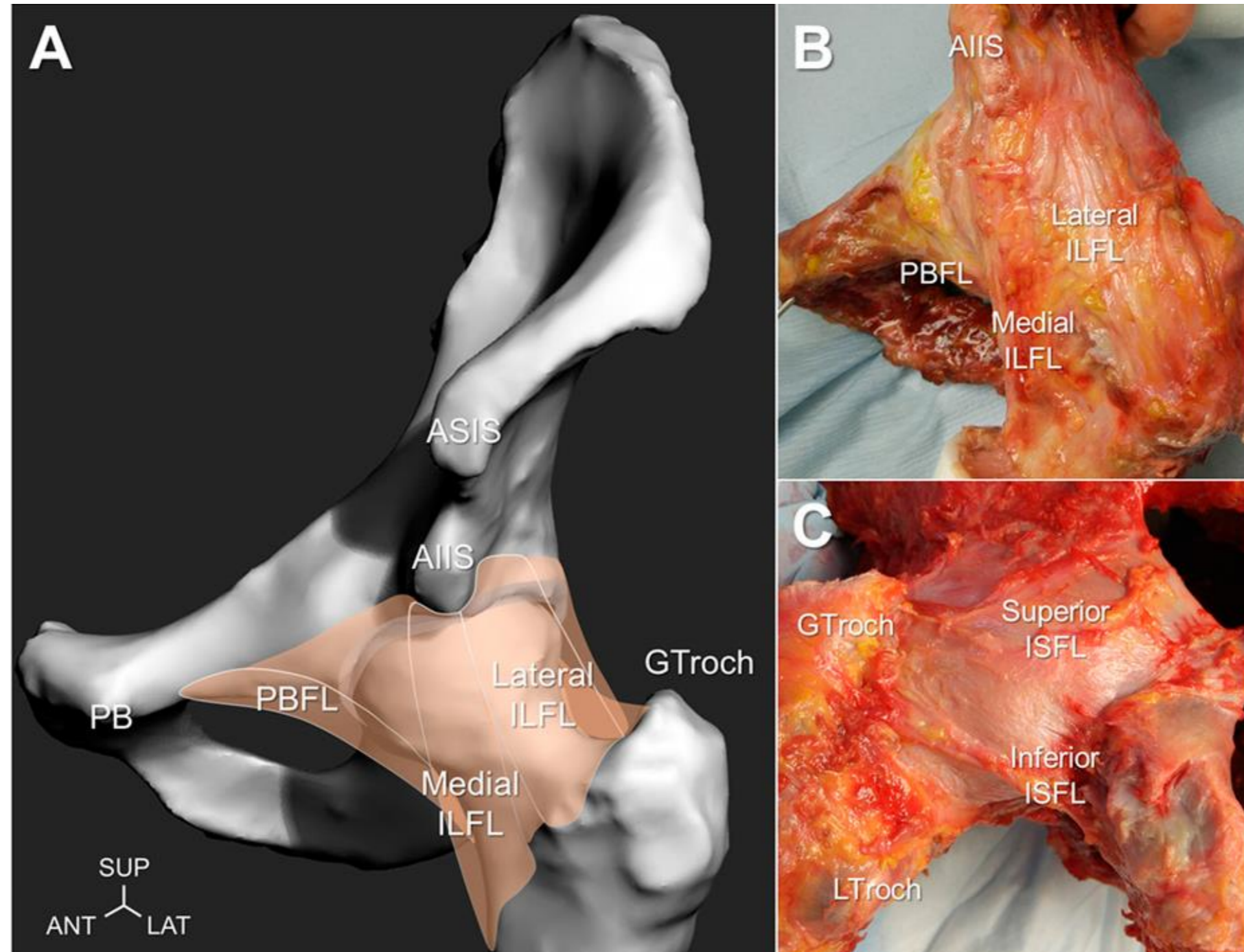
What approach?

How do I obtain and maintain reduction?

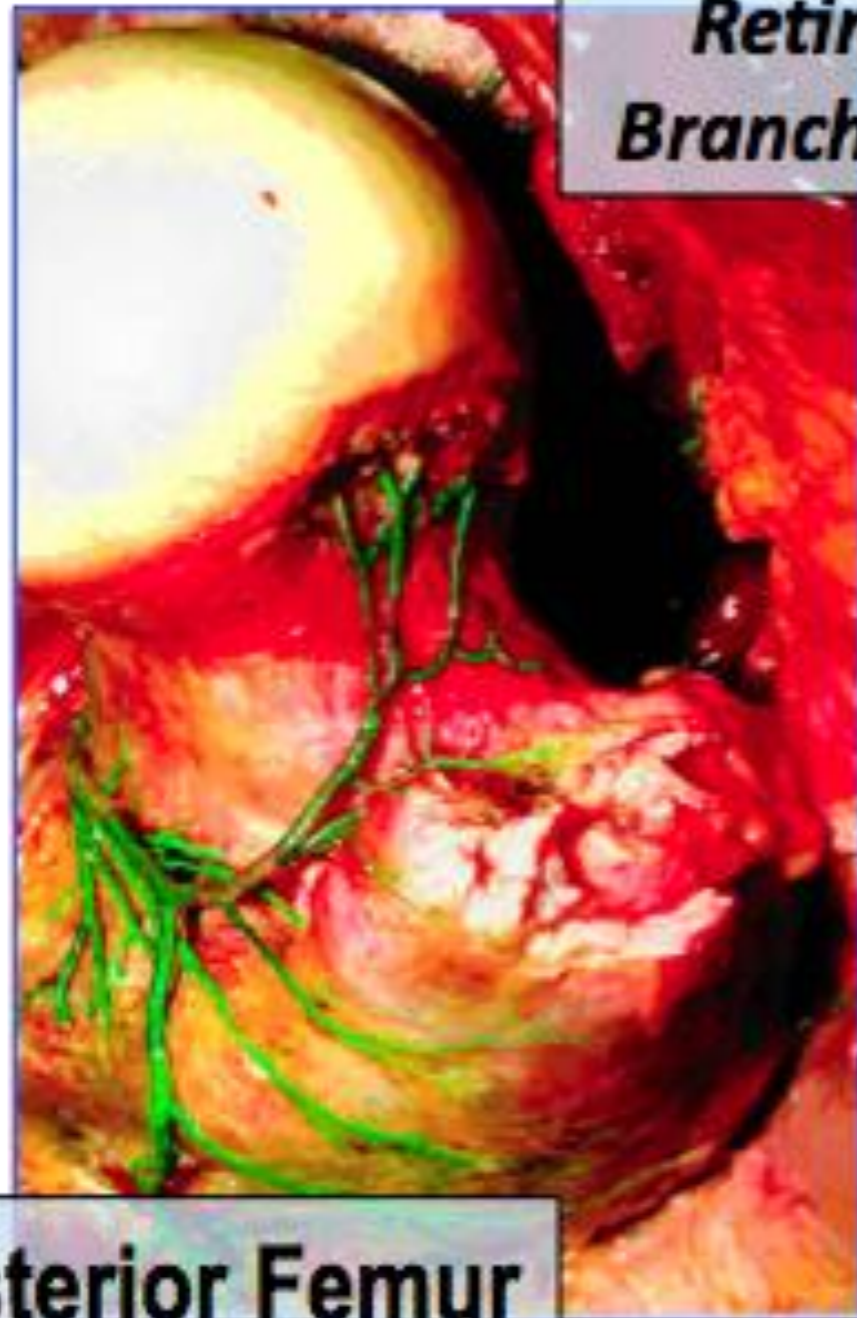
Which implant?

Anatomy

Anatomy – Capsular Ligaments



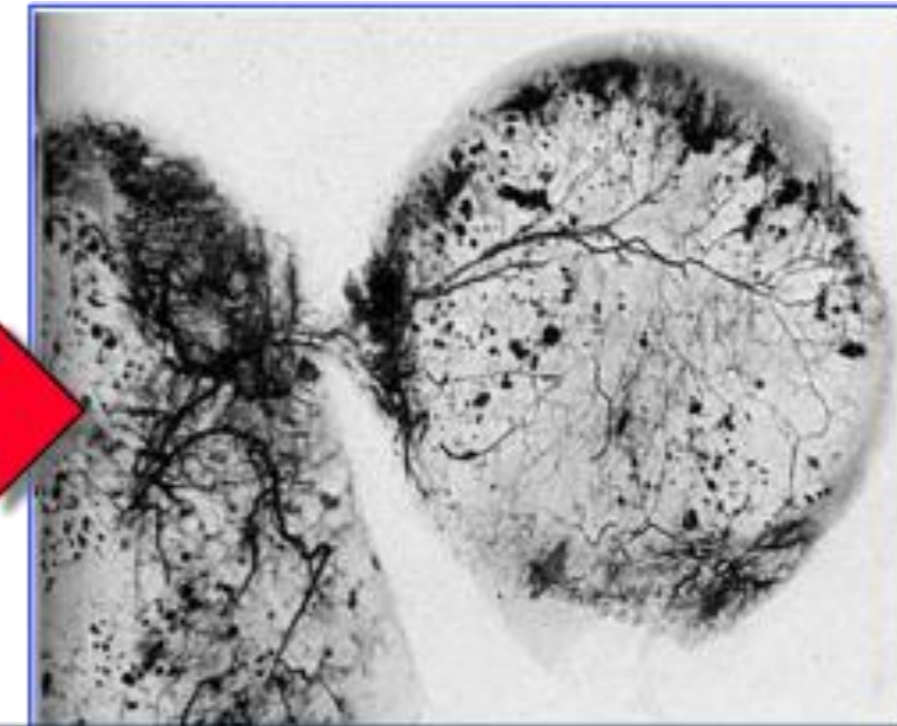
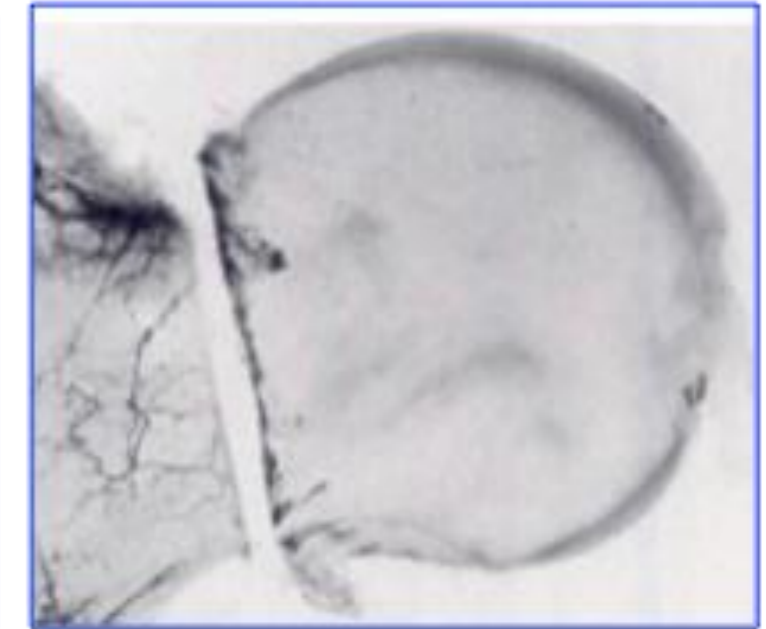
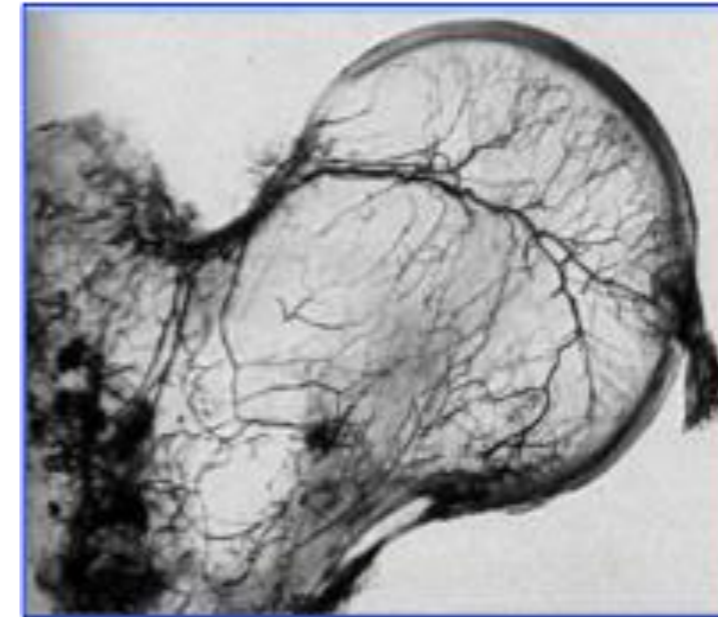
Anatomy - Blood Supply



**Retinacular
Branches MCFA**

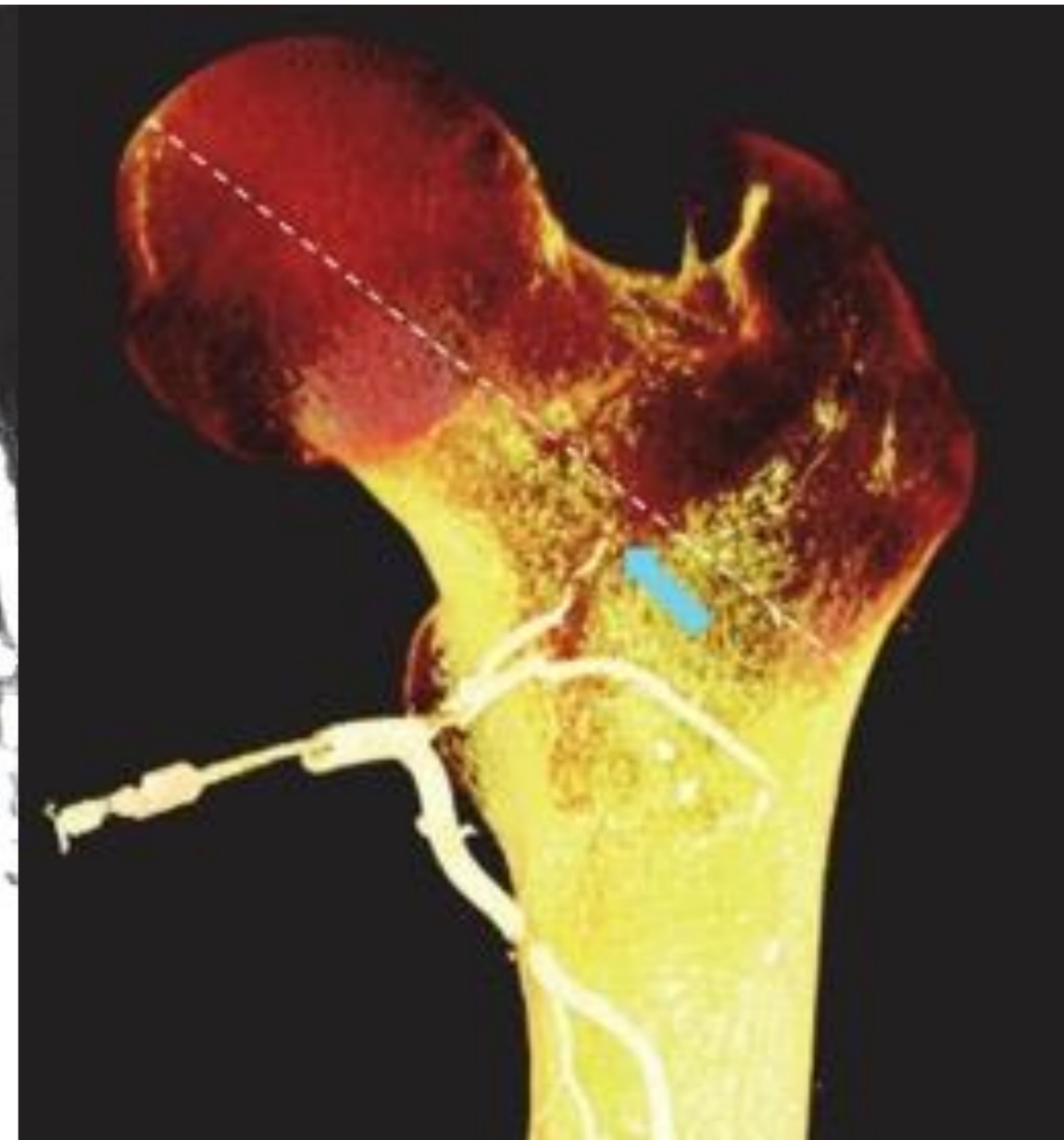
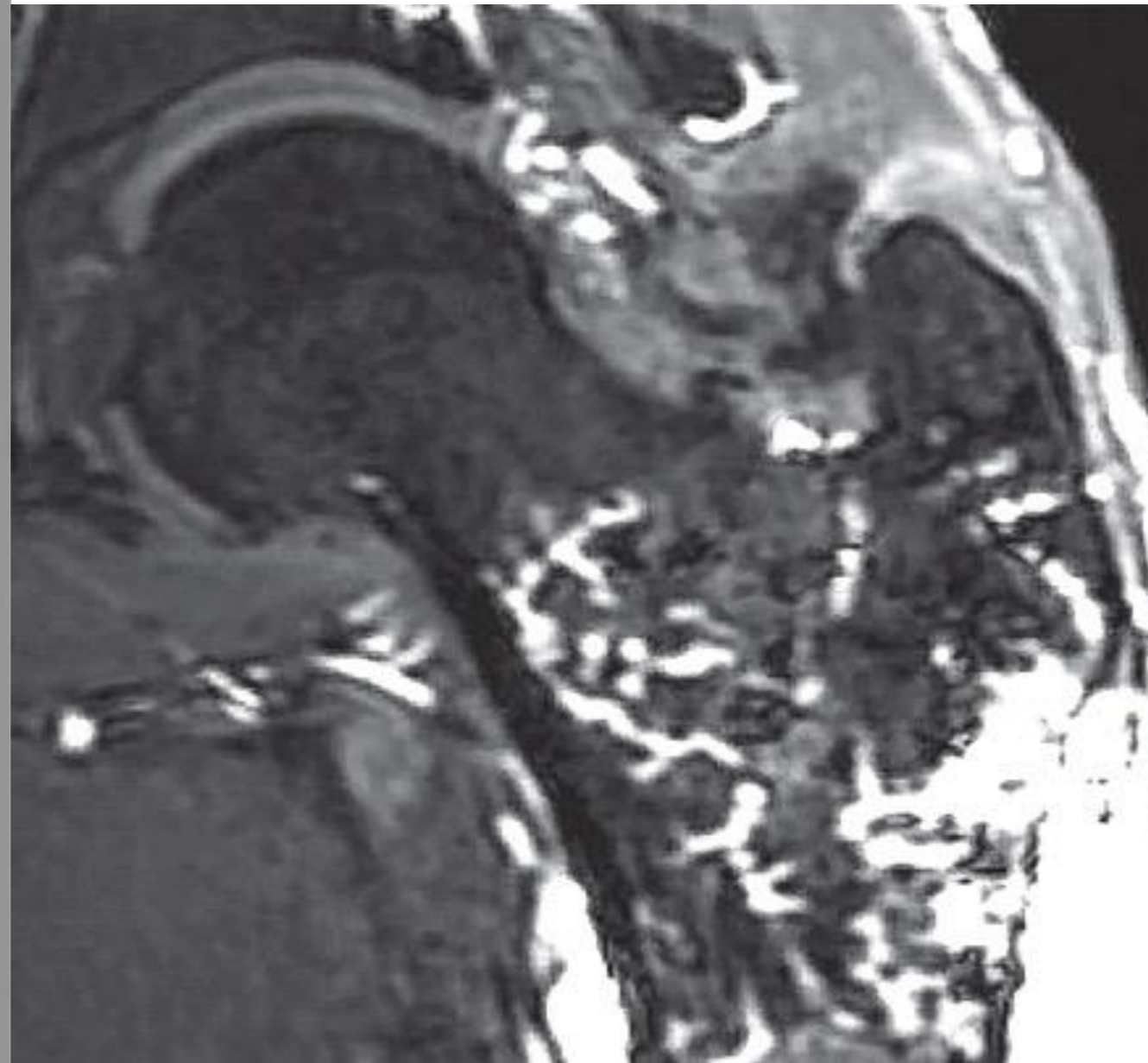
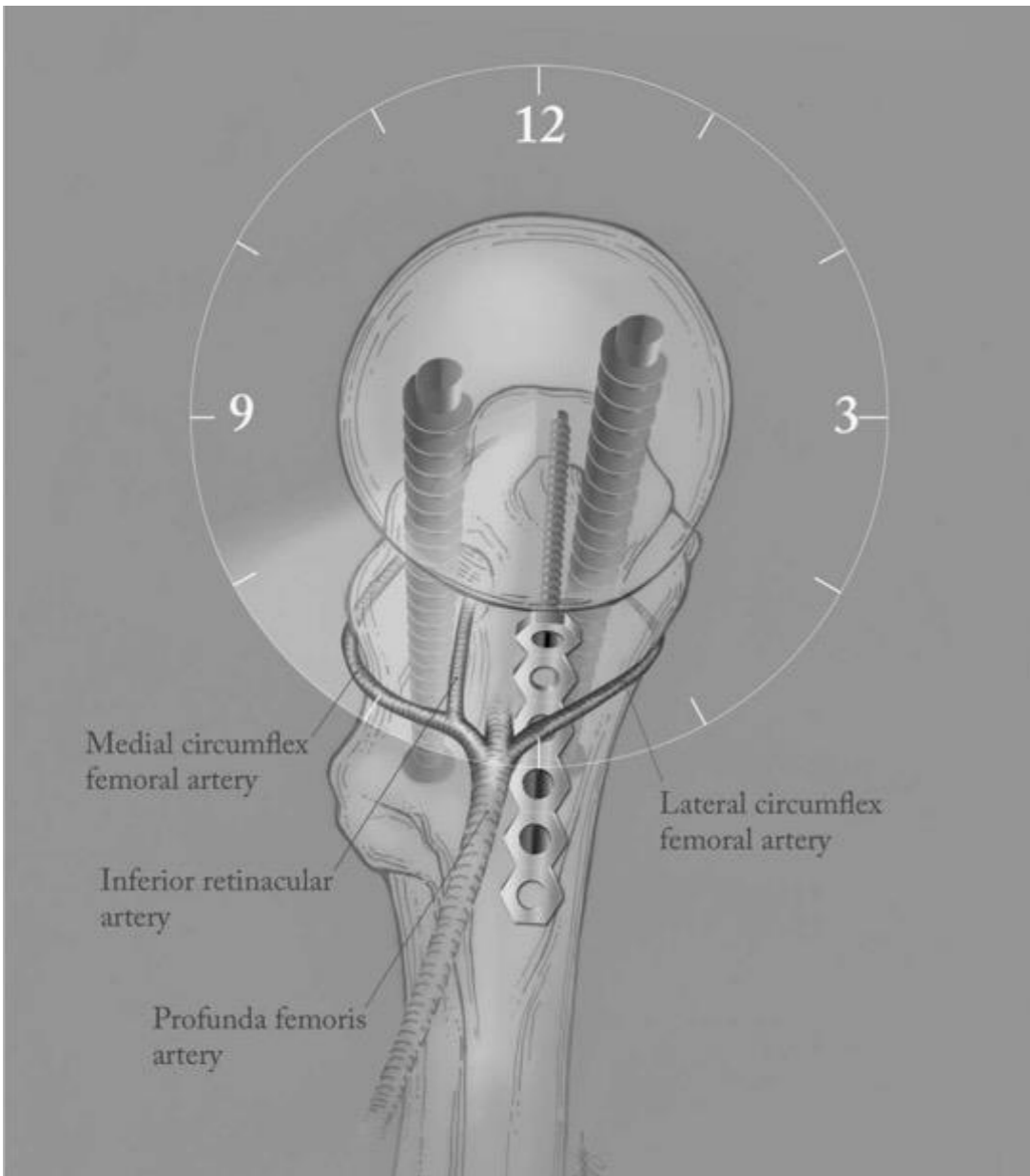
Posterior Femur

***Complete disruption of the arterial
supply through the femoral neck***



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

Blood Supply to the Anterior/Inferior Neck

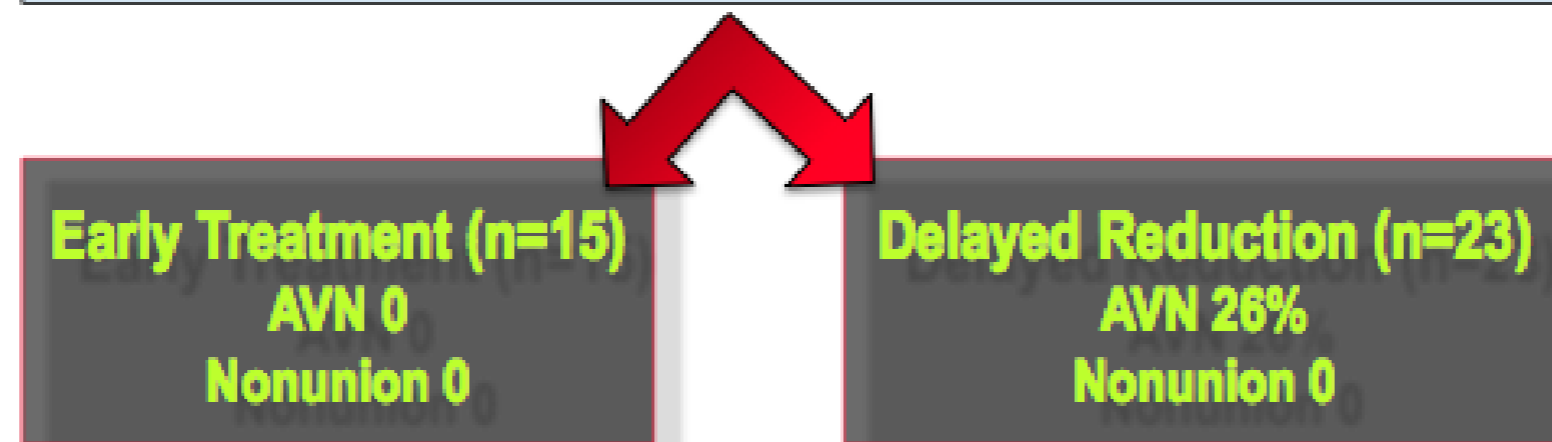


Putnam *J Orthop Trauma* 2019

Dewar *Bone Joint J* 2016

Surgical Timing (<12hrs Matters)

		AVN	Nonunion
Swiontkowski 1984	(n=25)	20%	0
Gerber 1993	(n=37)	11%	18%
Robinson 1995	(n=32)	21%	16%
Jain 2002	(n=38)	*	*




Surgical Timing Does Not Matter

			Early		Late	
			AVN	Nonunion	AVN	Nonunion
Damany	2005	(t=12, n=36)	14%	0	9%	9%
Haidukewych	2044	(t=24, n=73)	23%	7%	20%	10%
Upadhyay	2004	(t=48, n=92)	14%	18%	19%	17%

“Neglected” Fractures - Do support treatment delay

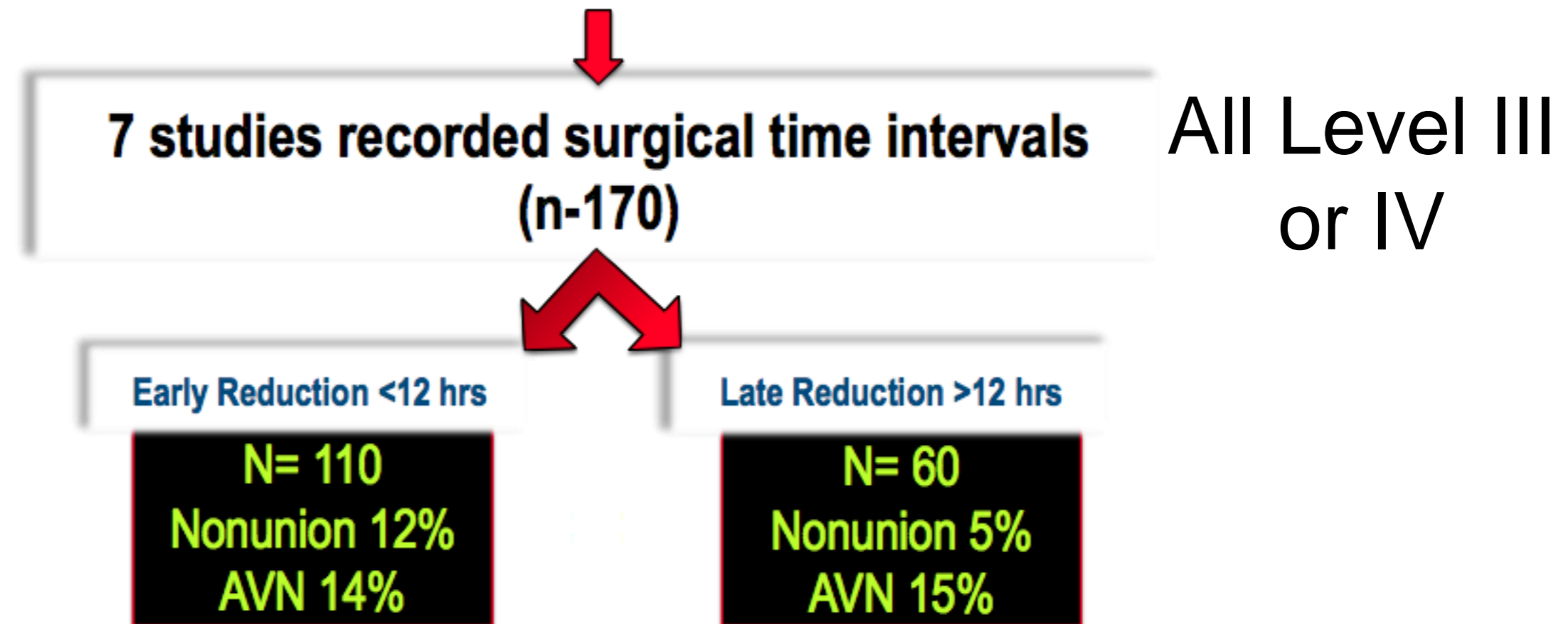
		Time Interval	AVN	Nonunion
Butt et al., India	(n=52)	2-9 days	13%	9%
Roshan, UK	(n=32)	3-6 months	0%	9%
Huang, China	(n=16)	3-24 months	25%	0%

**Delayed fixation in young adults
with “neglected” femoral neck
fractures**



**Comparable to “early”
fixation prevalence**

Damany 2005 : Meta-analysis, young (15-50) patient with >12months of follow-up



“Early reduction does not decrease the incidence of nonunion or AVN”

Treat with *urgency* (12-24 hours). . . not as an emergency

What factors prognosticate outcome?

- Injury Factors

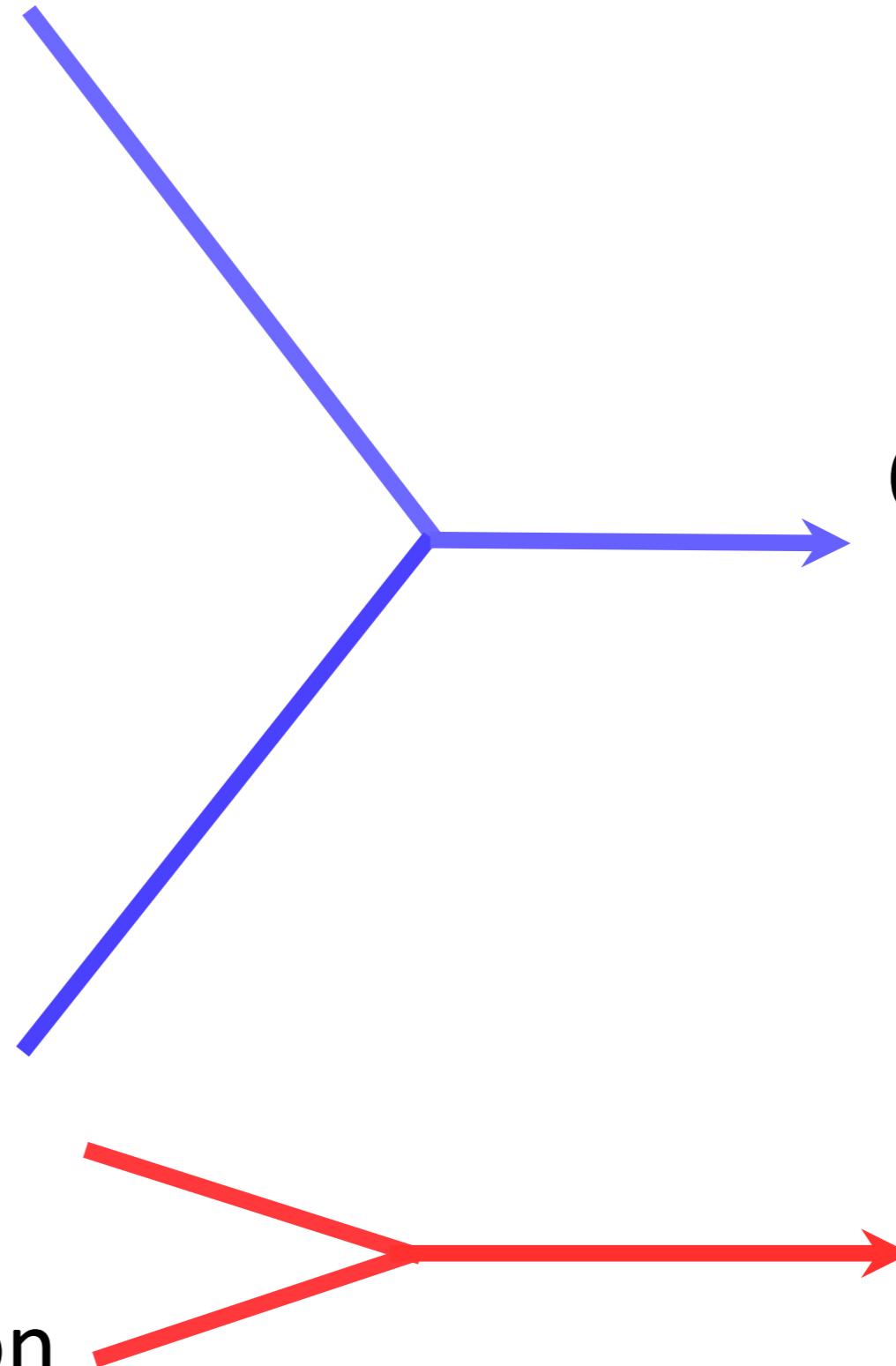
- Pauwels's Angle
- Initial Displacement
- Posterior Comminution

- Technical Factors

- Quality of Reduction
- Method of Fixation
- Capsular Decompression

Consistently
Shown

Conflicting
Data

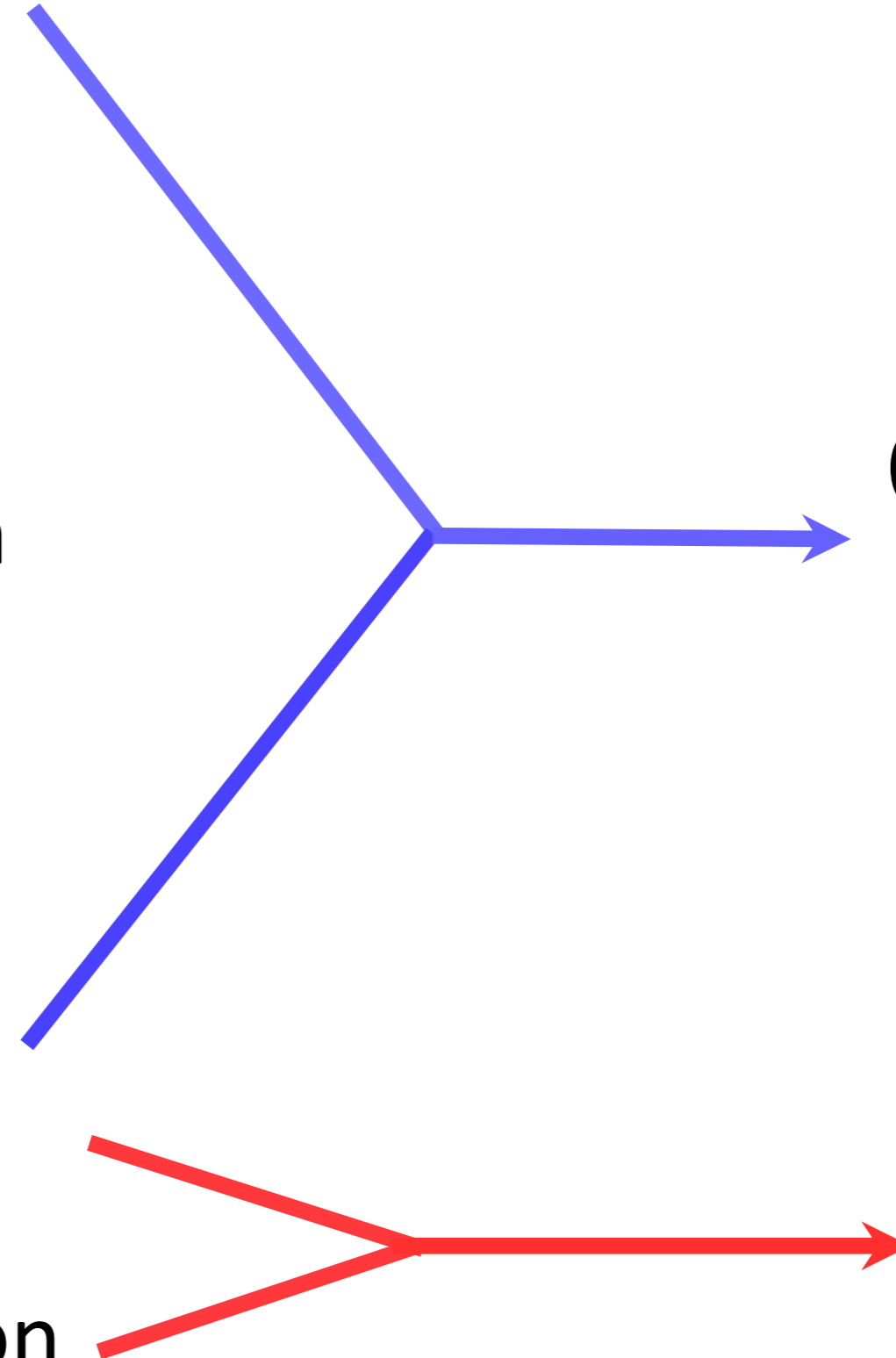


What factors prognosticate outcome?

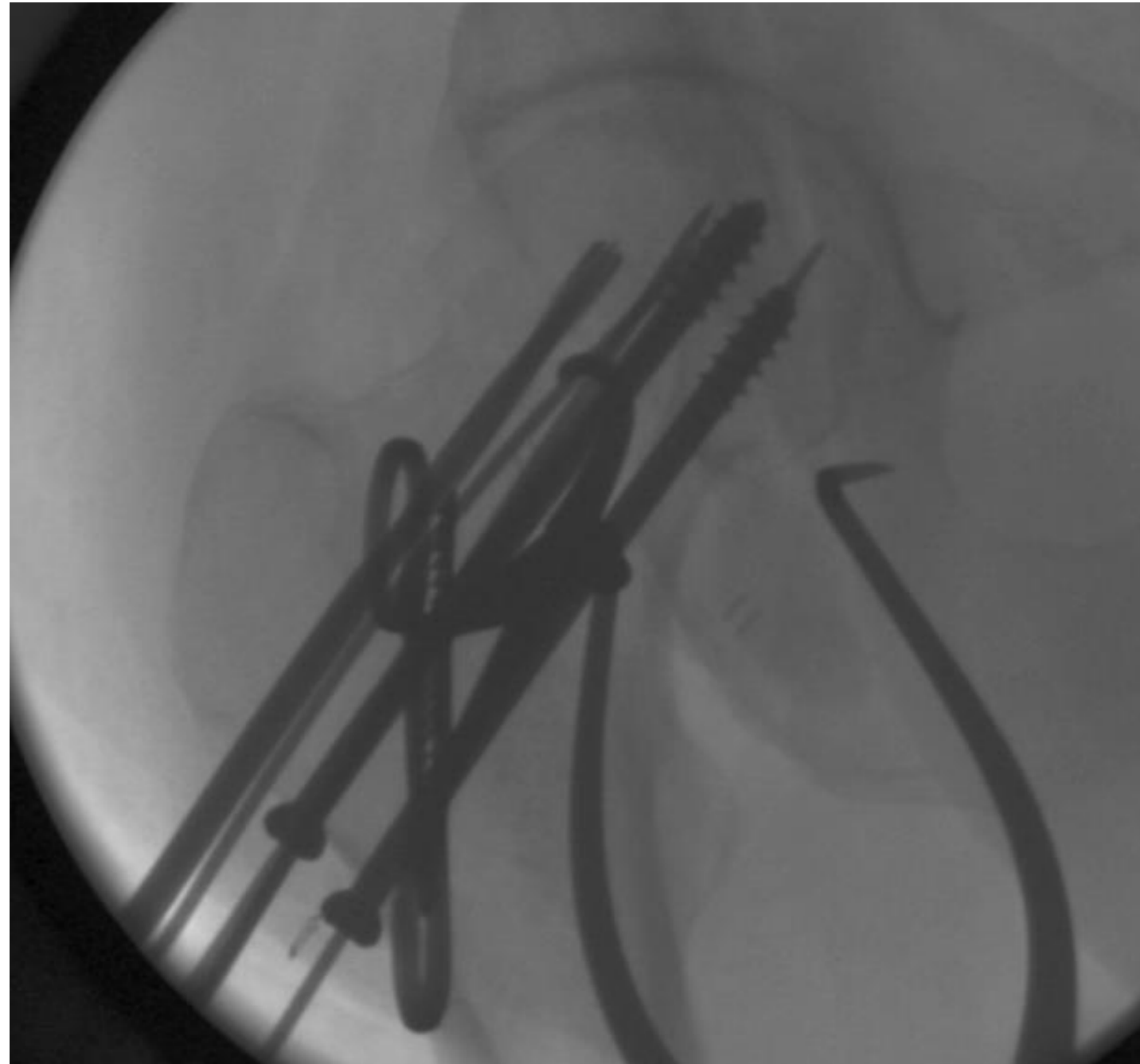
- Injury Factors
 - Pauwels's Angle
 - Initial Displacement
 - Posterior Comminution
- Technical Factors
 - Quality of Reduction
 - Method of Fixation
 - Capsular Decompression

Consistently
Shown

Conflicting
Data



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 – Open vs. Closed

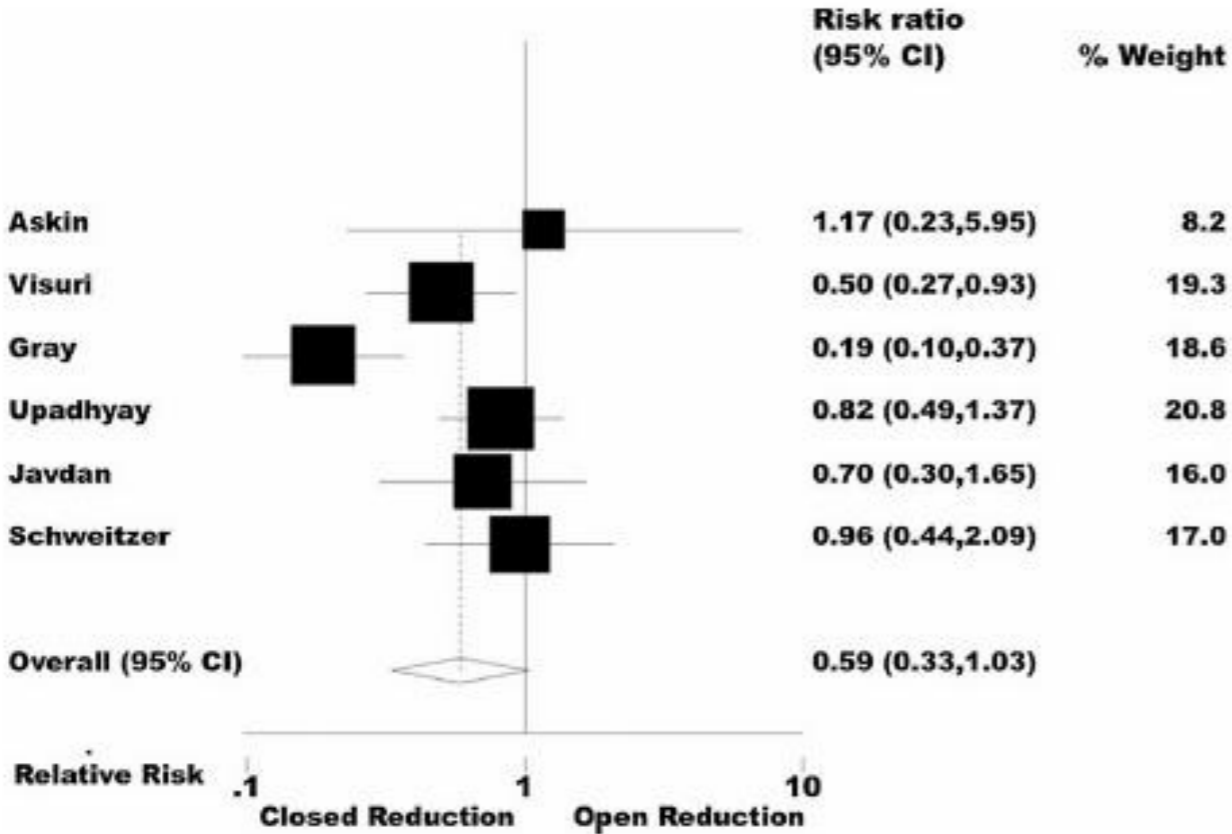


Evidence based update: Open versus closed reduction

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Fracture Reduction – My recommendation



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???*



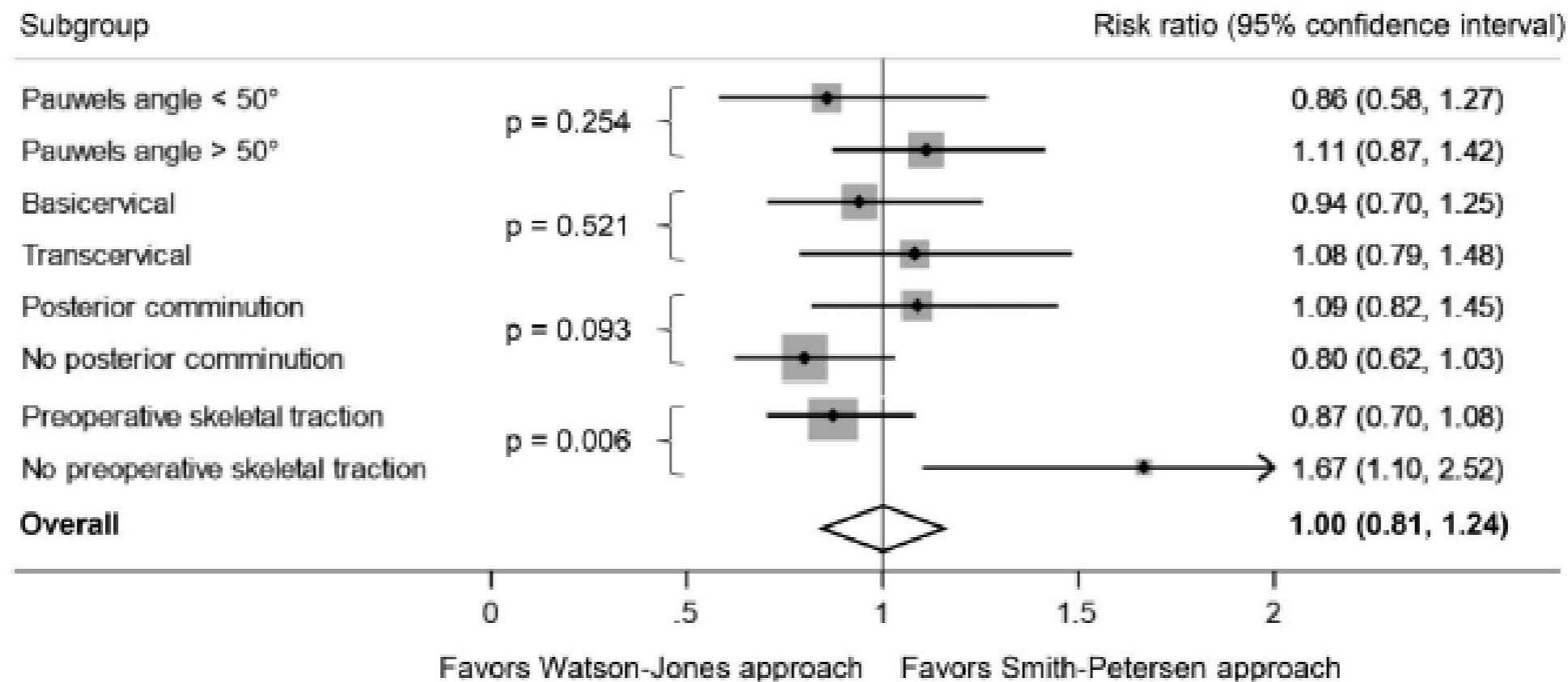
Acceptable

Not
Acceptable

Open Reduction – Surgical Approach

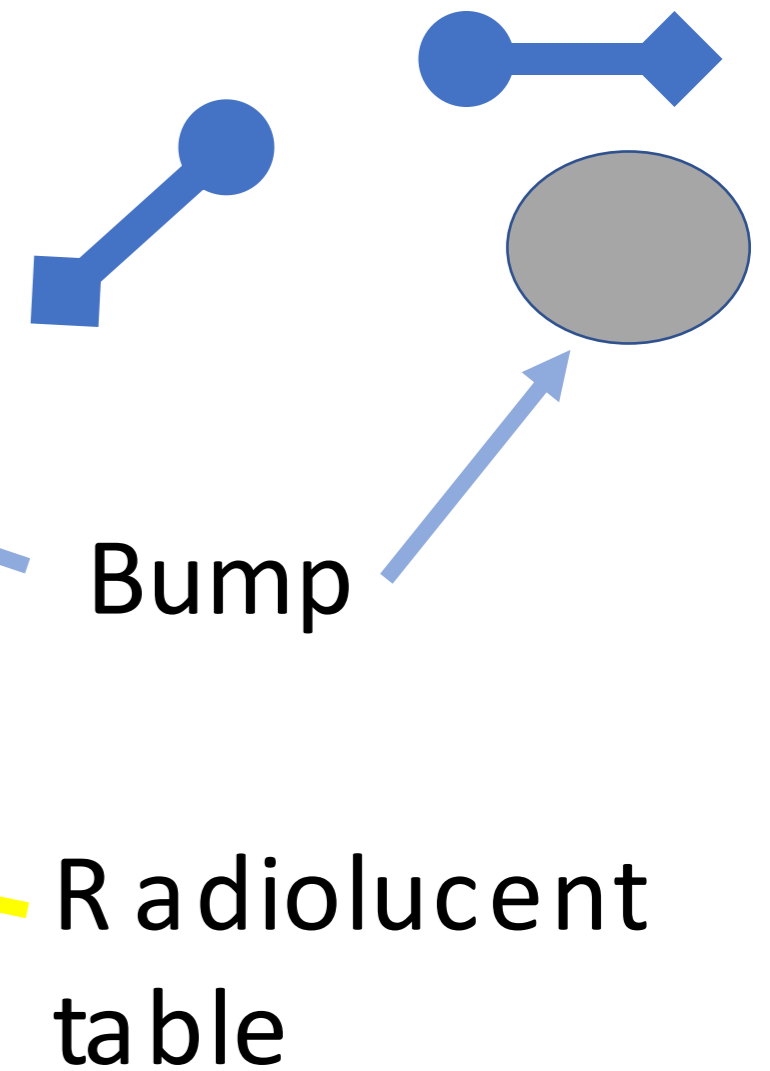
Smith–Petersen Versus Watson–Jones Approach Does Not Affect Quality of Open Reduction of Femoral Neck Fracture

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



Open Reduction – Positioning and OR Set-up

Prepare the leg free



Open Reduction – Positioning and OR Set-up

Neuro-
muscular
paralysis



Prep in
the iliac
crest

Open Reduction - Tools



Modified
Weber



2-2.5mm Schantz
Pin

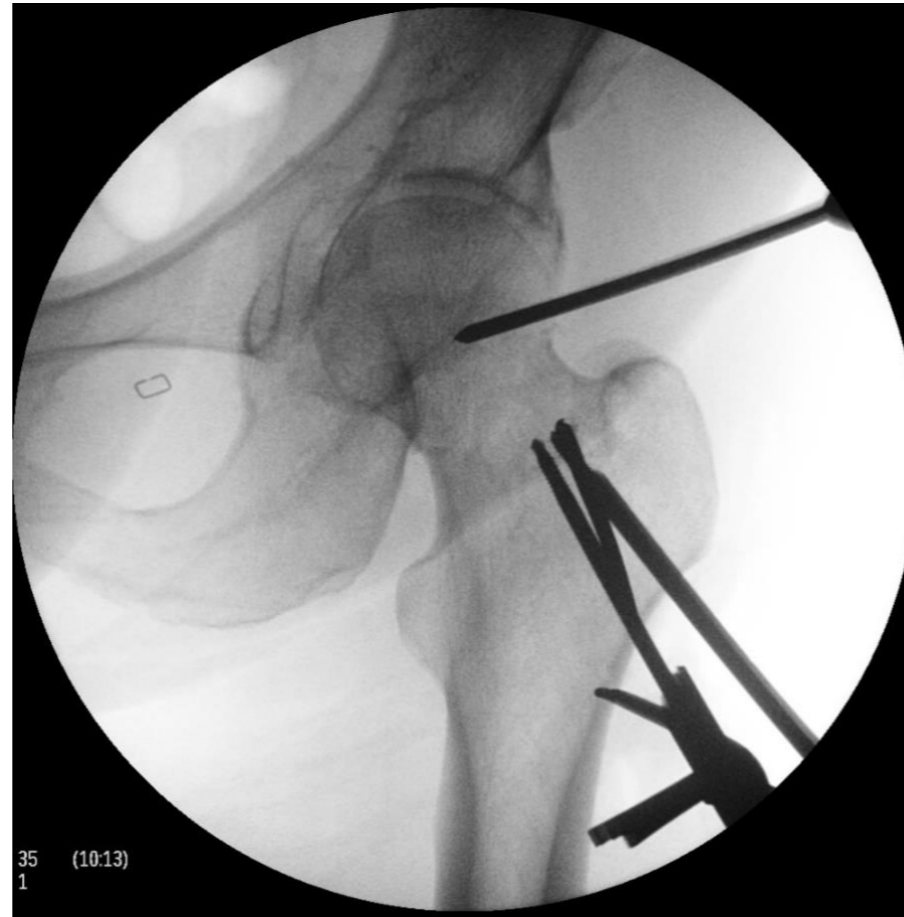


Jungbluth

Open Reduction - Tactics



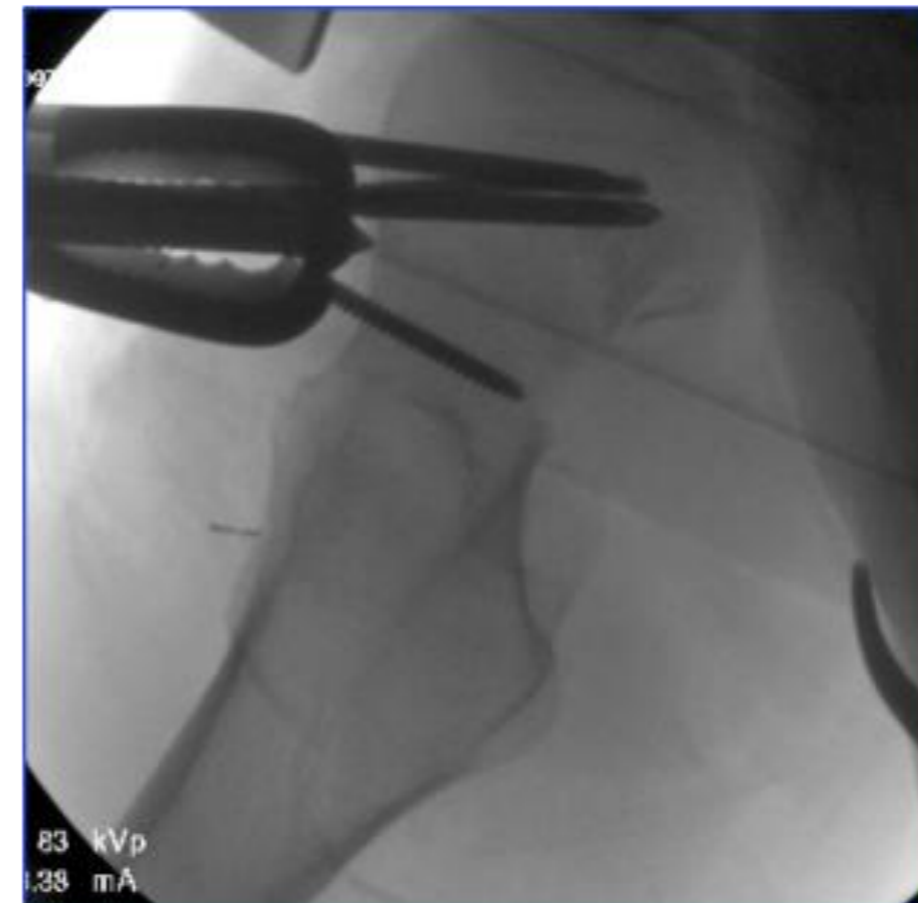
Open Reduction - Tactics



Don't forget
to ***preload***
your wires! !
!



Open Reduction - Tactics



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 unreconstructable
 - 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



Closed Reduction Technique



1



2

Closed Reduction Technique



1



2



3

Closed Reduction Technique



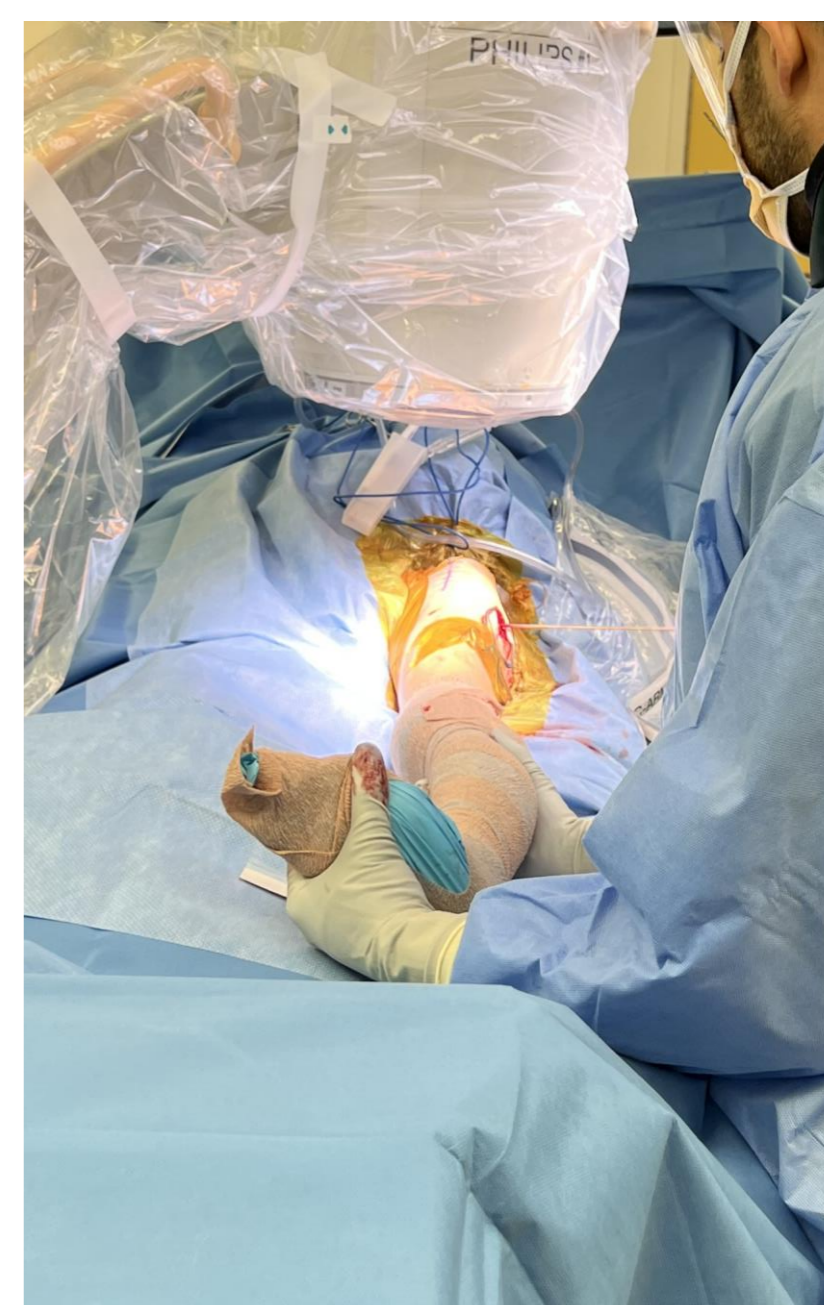
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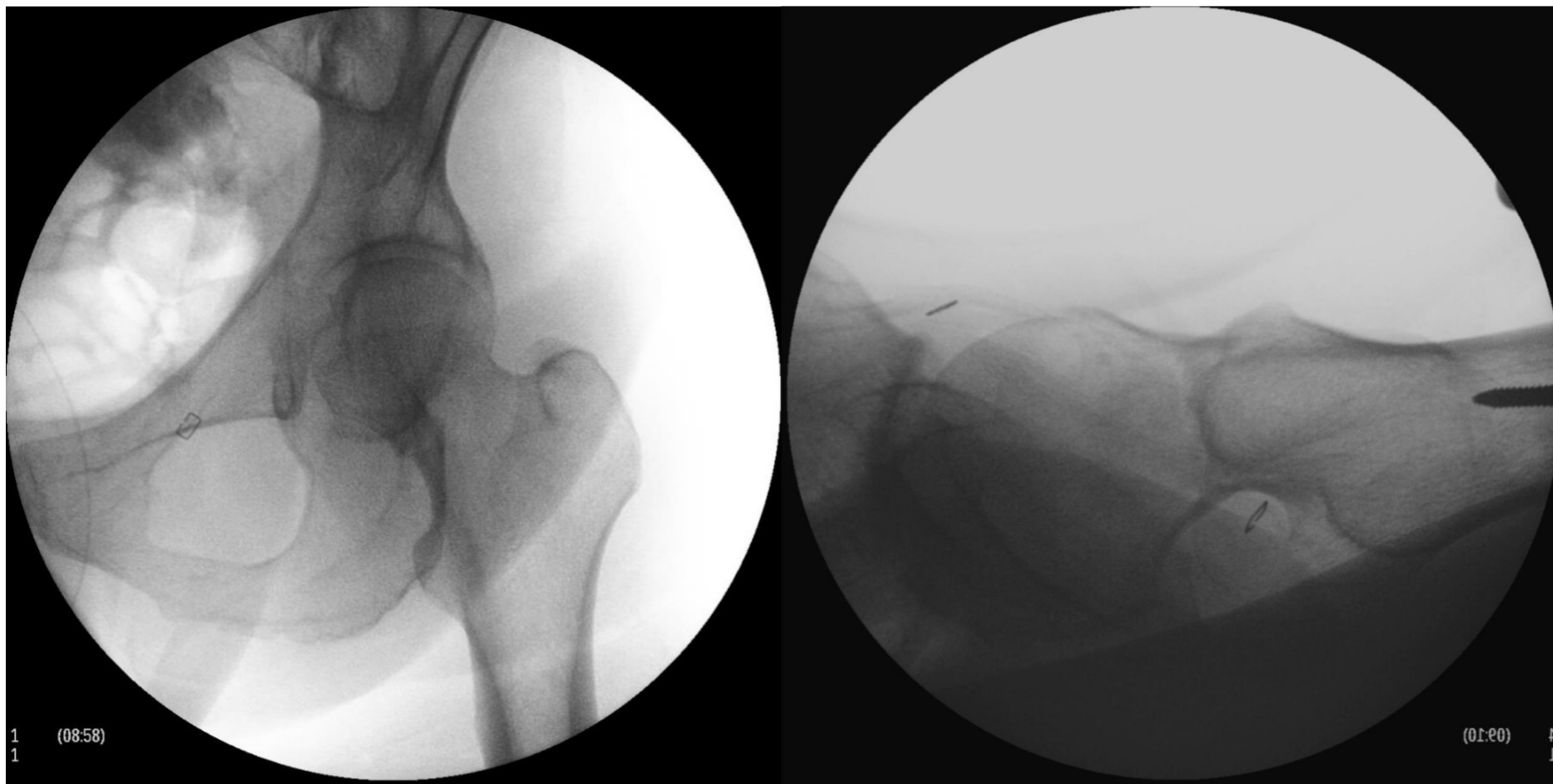


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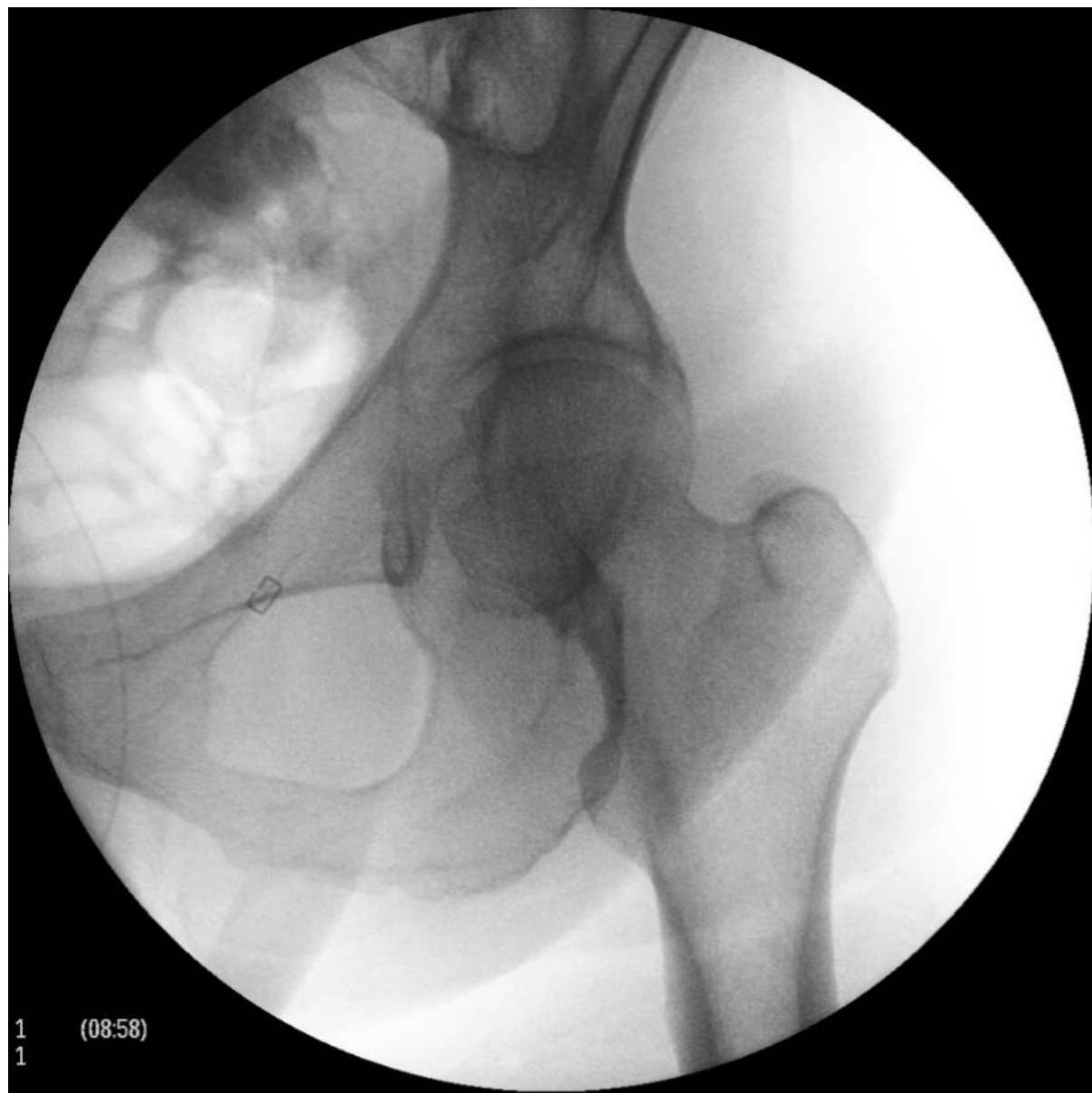


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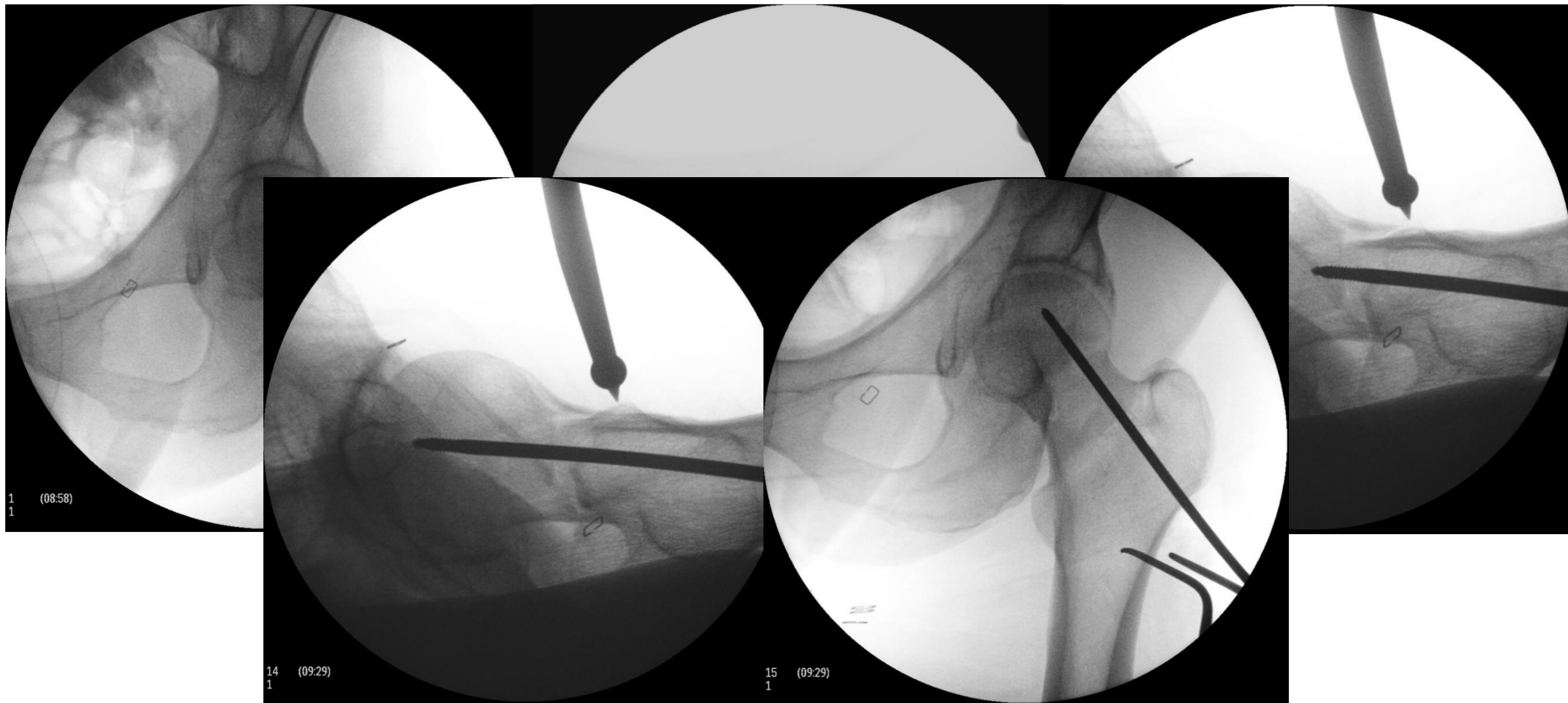
Percutaneous Reduction Techniques



Percutaneous Reduction Techniques



Percutaneous Reduction Techniques



Closed Reduction Technique – Case Conclusion



Hospital Day
1

Closed Reduction Technique – Case Conclusion

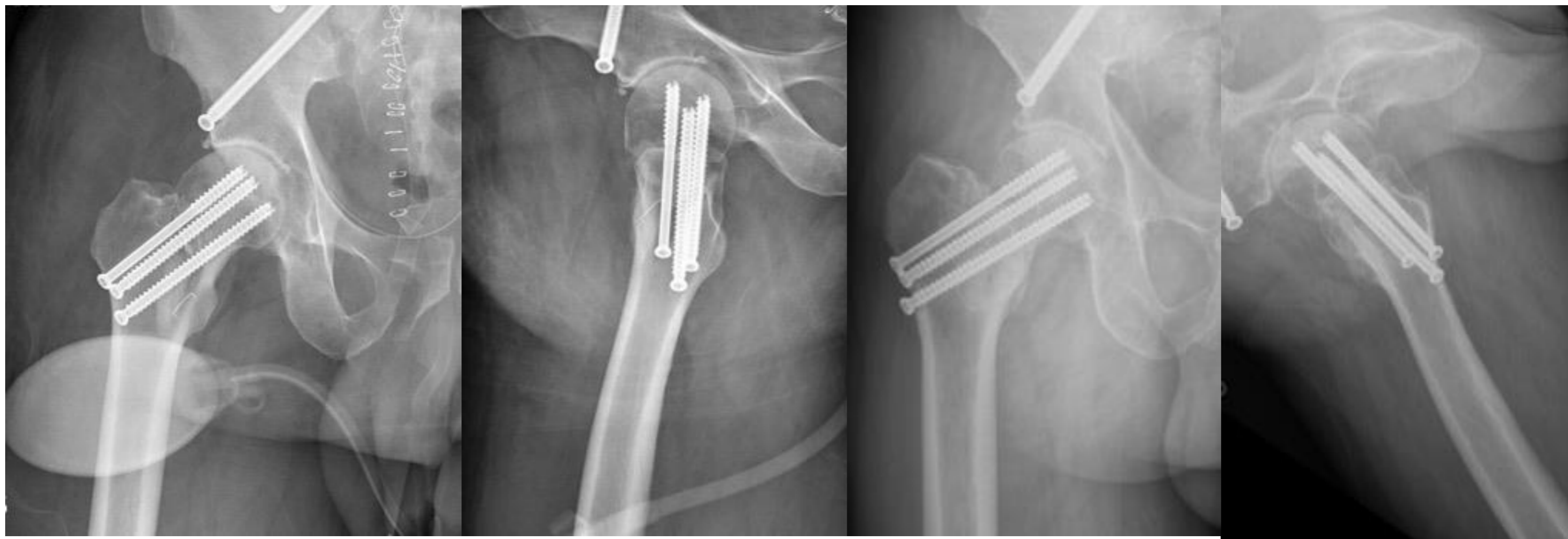


Hospital Day
1



Post-
operative

Closed Reduction Technique – Case Conclusion



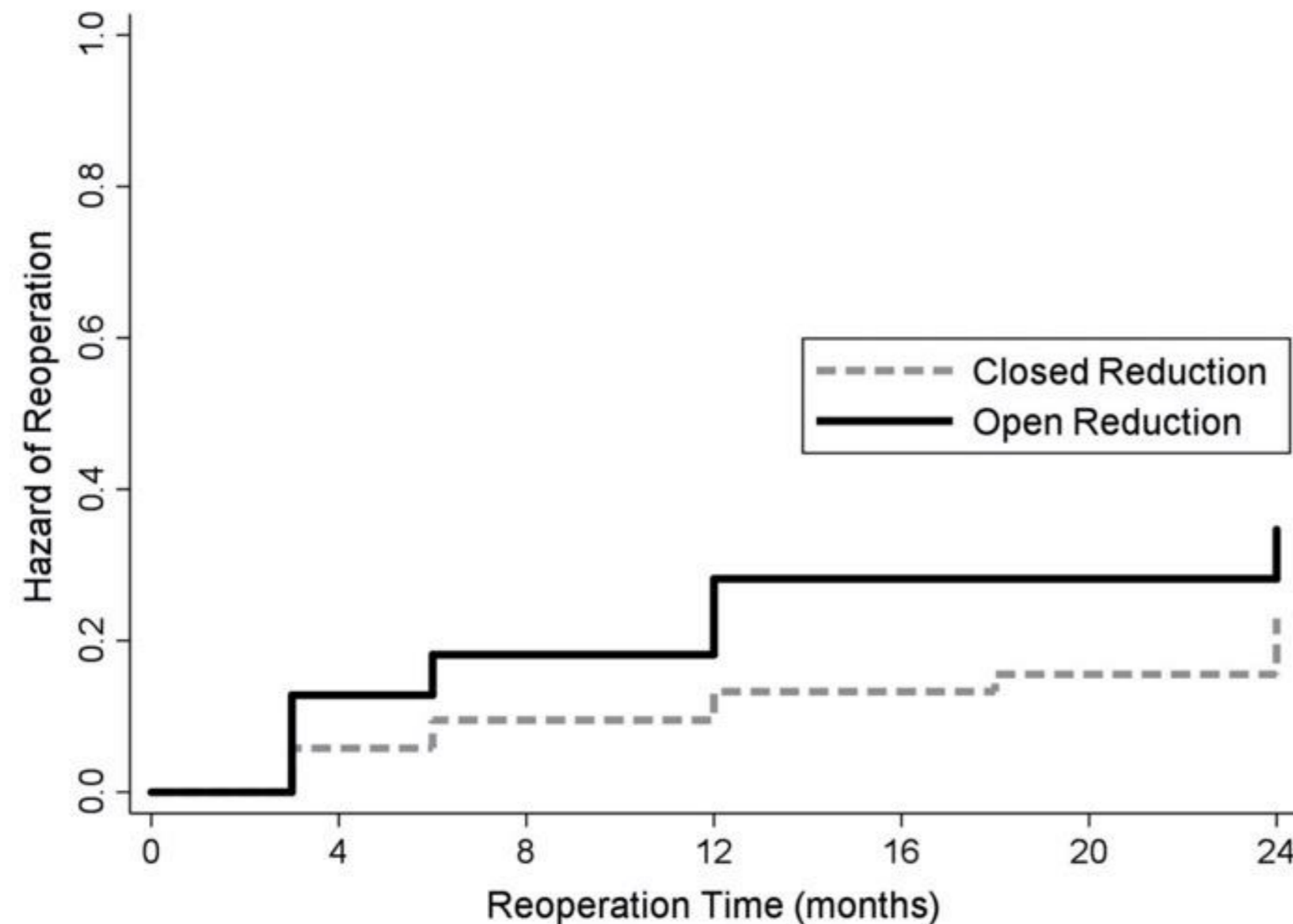
Post-
operative

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]

Achieve a **quality** reduction!!!

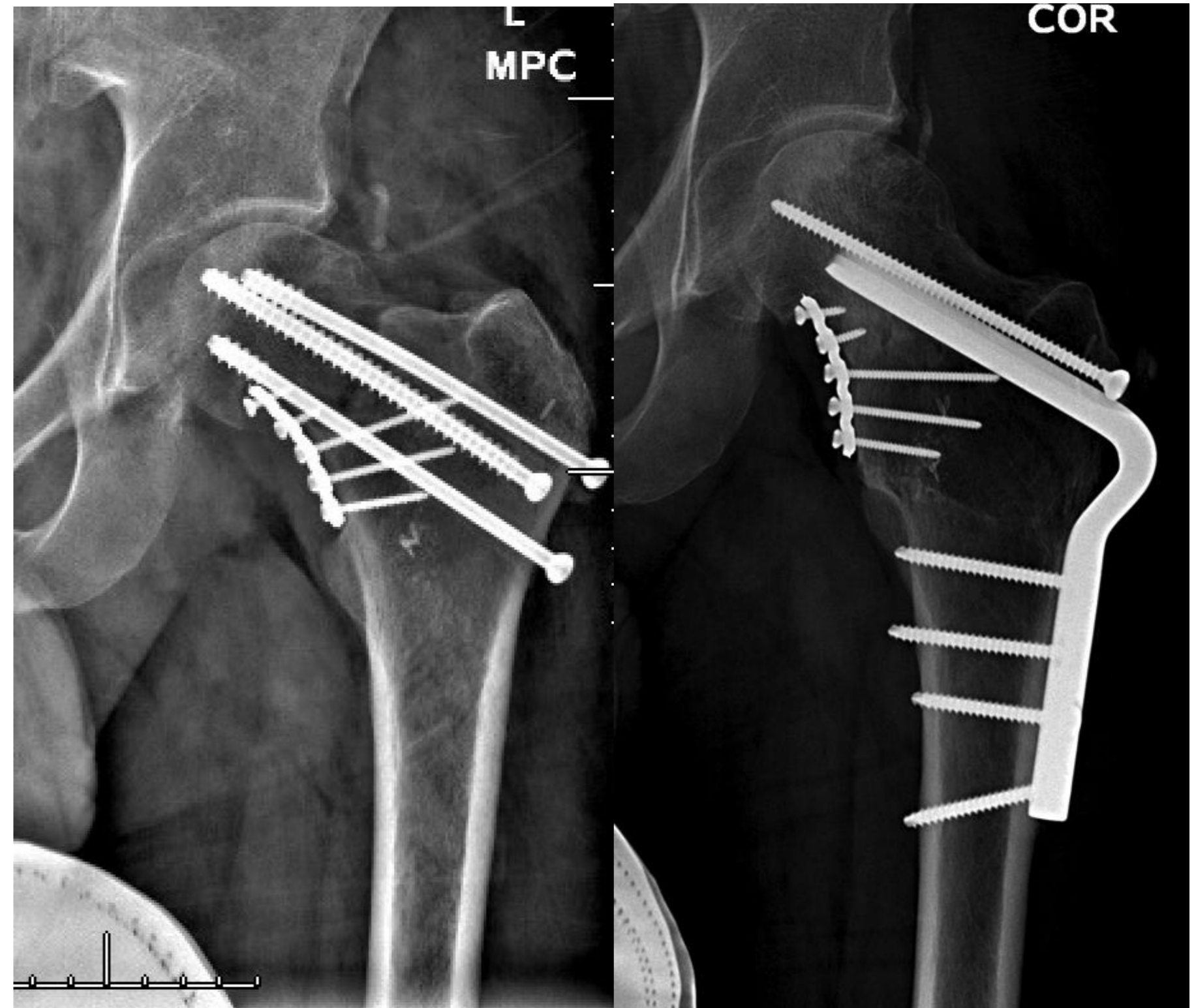
- Goal: $< 2\text{mm}$ displacement or < 5 degrees angulation in any plane
- Accept: $< 5\text{mm}$ displacement, < 10 degrees angulation in any plane



Outcomes

Collinge *JOT* 2022 – 492 femoral neck fractures in adults less than 50 years of age

- 45% major complications
- 32% major reconstructive surgeries
- 23% nonunion
- 12% AVN



Remember

- Timing is ***urgent*** . . . Not emergent
- Familiarize yourself with ***both*** open and closed reduction techniques
- The goal of surgery is a ***QUALITY*** reduction . . . There are many ways to get there.

End

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