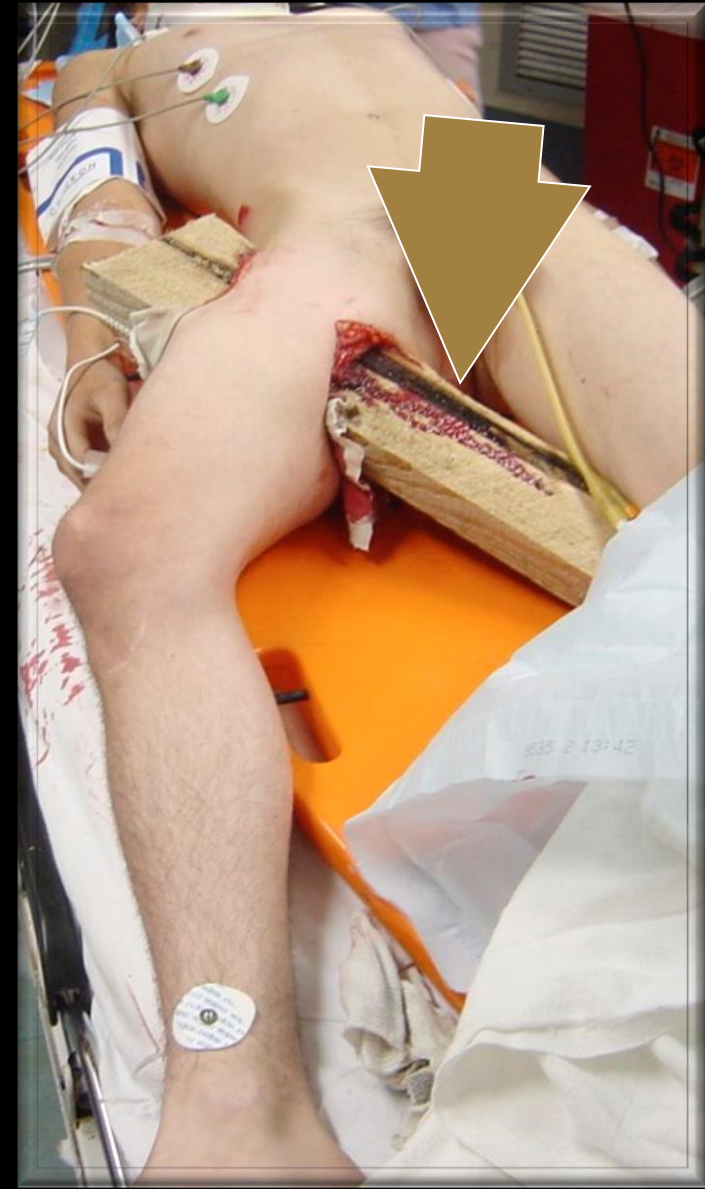


Proximal Femur Fractures Avoiding Malreductions Inter and Subtrochs

Amir Matityahu, MD
Professor of Orthopaedic Surgery
UCSF and SFGH Departments of Orthopaedic Surgery



Conflict of Interest

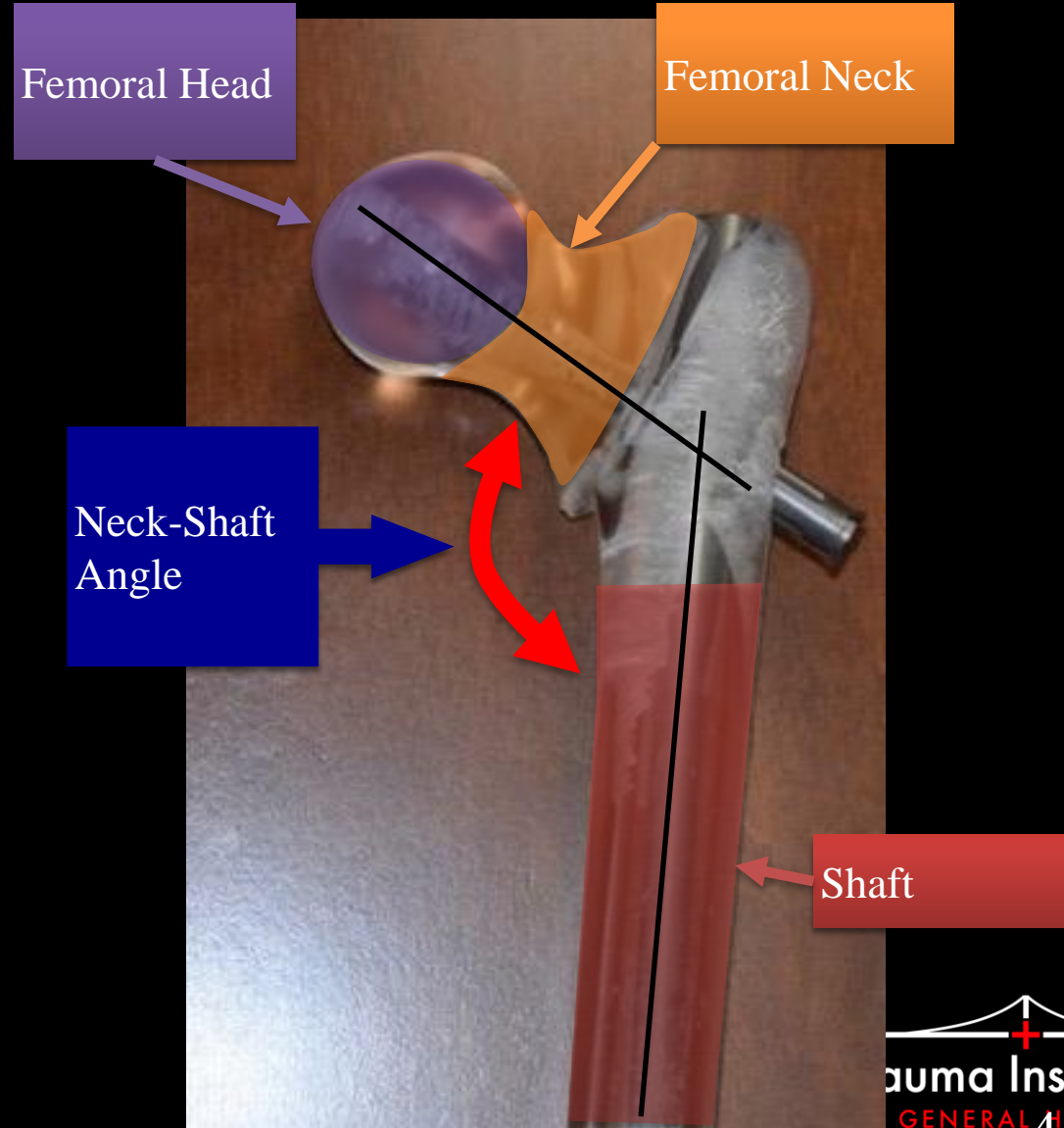
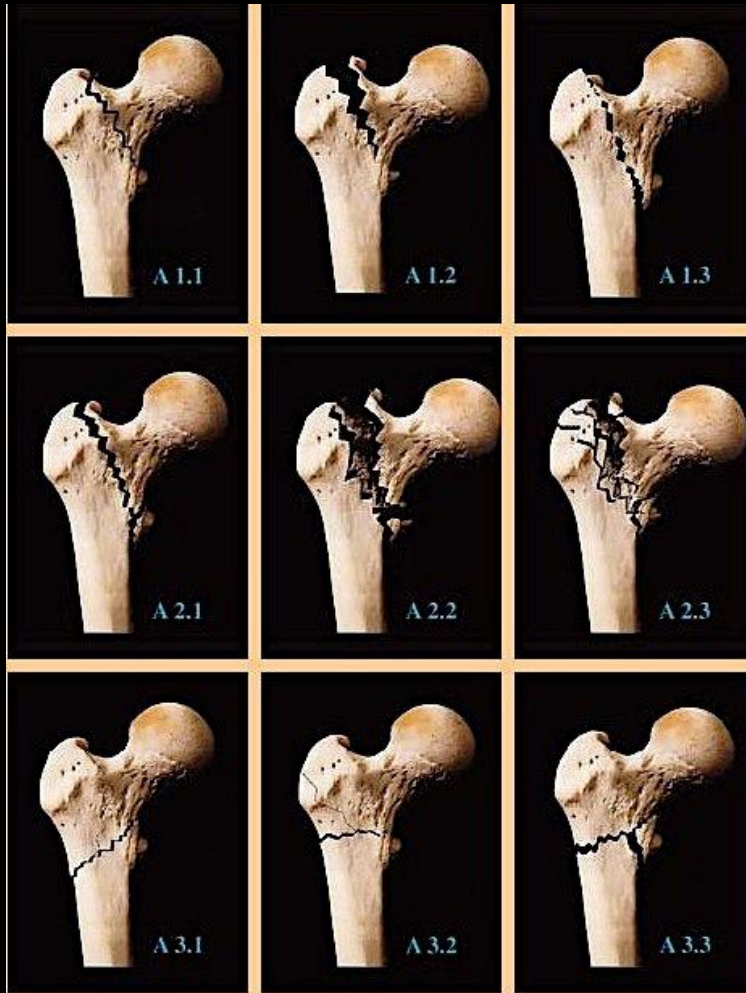
- ❑ Designed variable angle cephalomedullary femoral nail
- ❑ Ownership EPIX Orthopaedics



Malalignment

- Associated with
 - **Proximal 1/3 fx**
 - Distal 1/3 fx
 - Comminuted segmental fx
- Less Likely in
 - Middle 1/3 fx
 - Stable fx pattern
- Not due to Method of treatment
- Anterograde vs Retrograde
- Troch vs Piriformis

Intertrochanteric Fractures



Anatomy

Normal Variability between patients

Neck-Shaft Angles

120 deg



140 deg

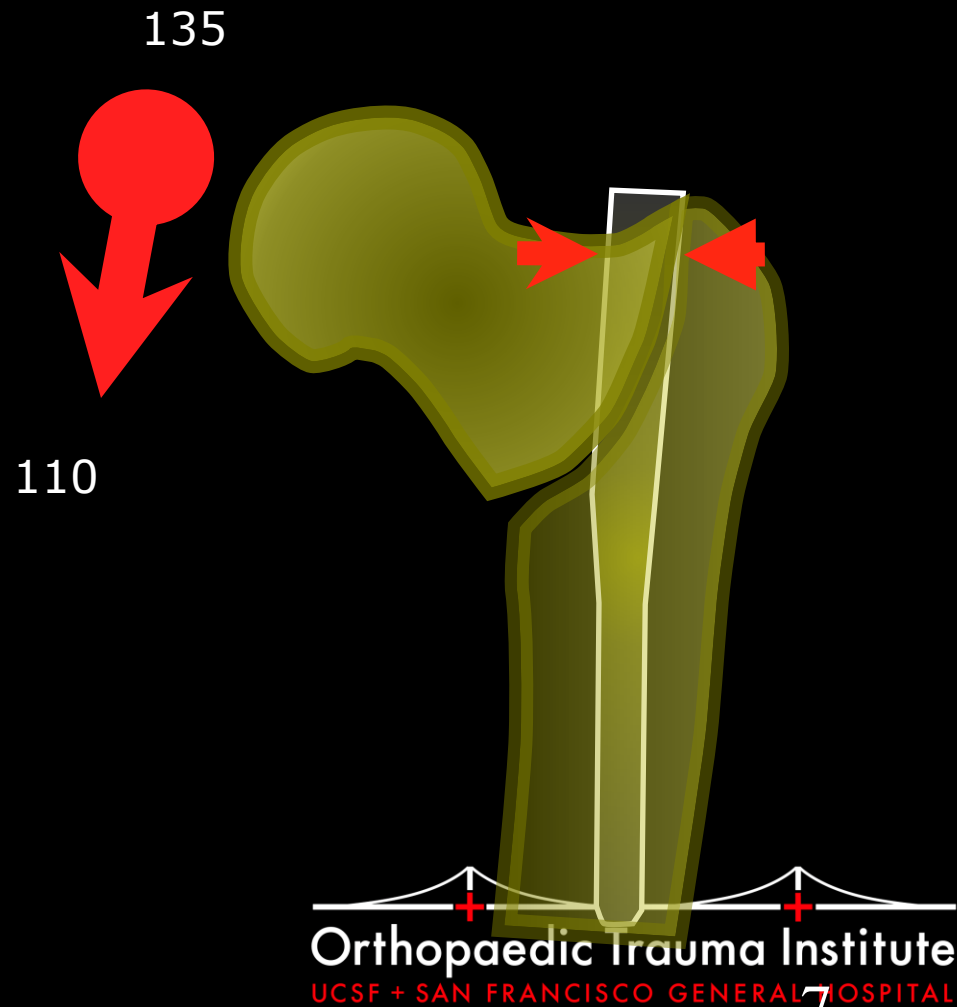


Why Do You get Varus?

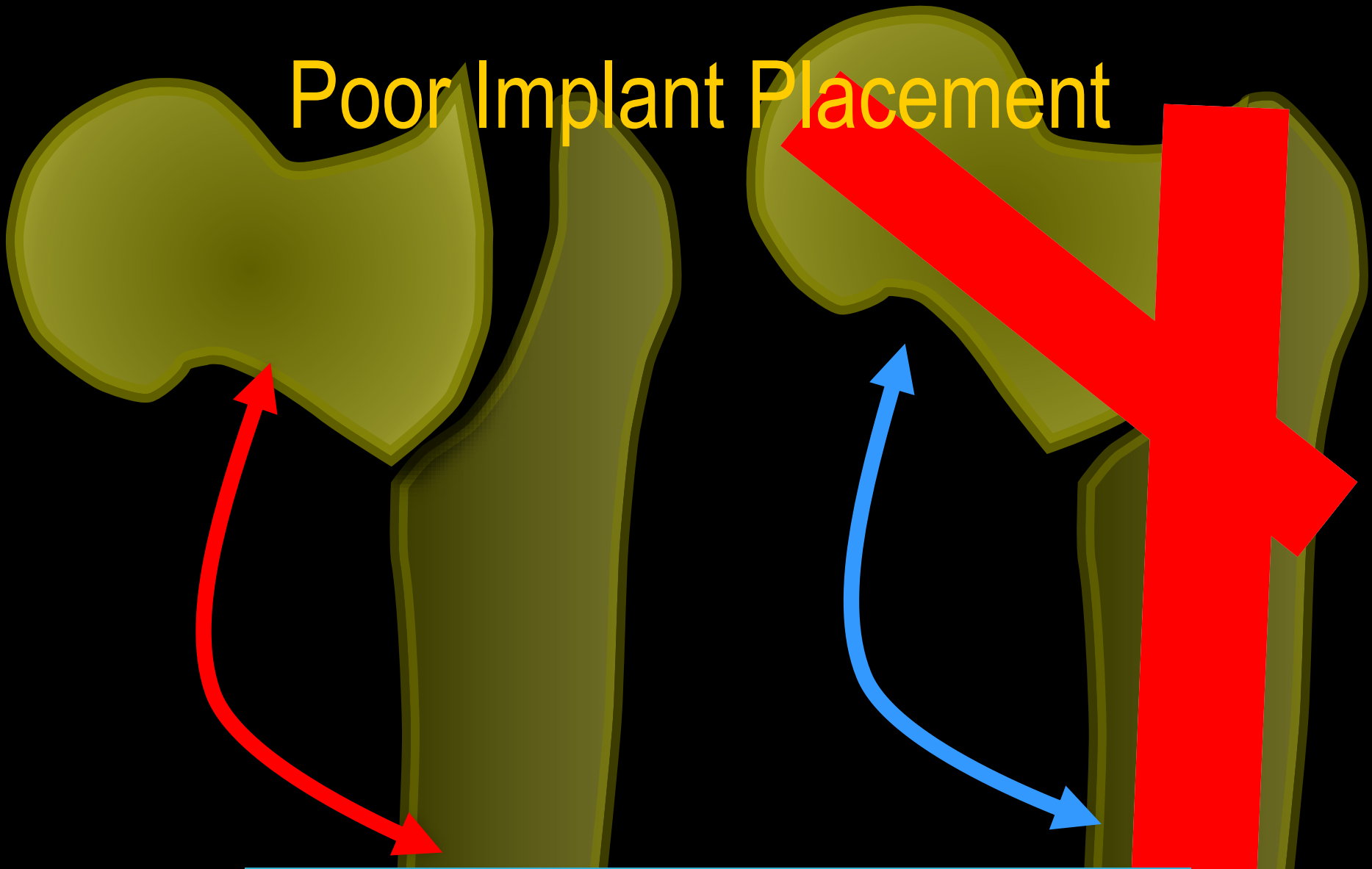
- Nail-Neck Impingement
- Medial Cortical Abutment
- Ovalization of Entry Hole
- Not Enough Traction
- Attention to Detail
- Not Comparing to Other Side



Nail-Neck Impingement



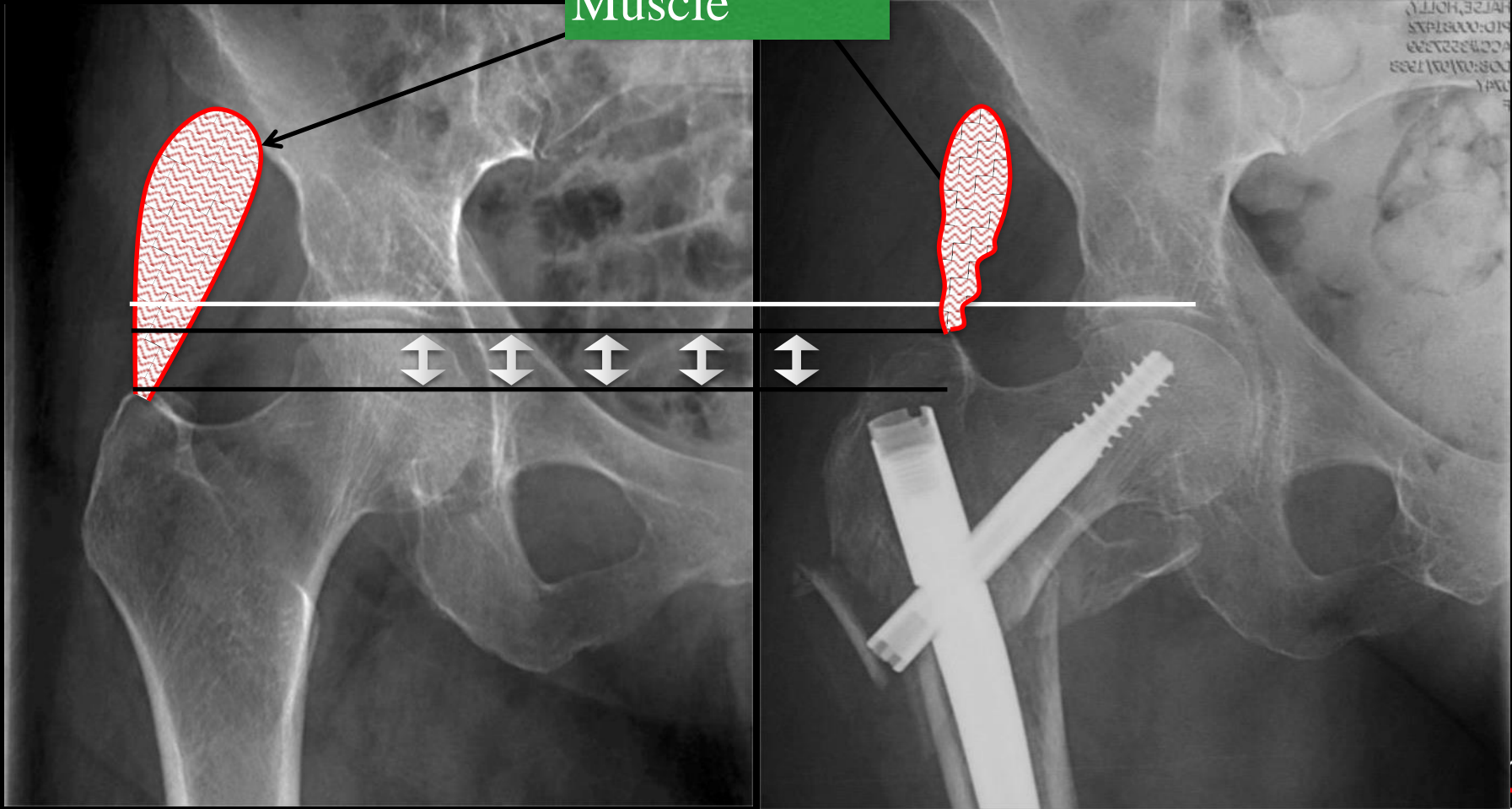
Poor Implant Placement



A Decrease in Neck-Shaft angle = Varus
Poor Implant Placement = Increased Tip-Apex Distance
Neck of femur is more horizontal
Leg is shorter

Abductor muscle short and weak

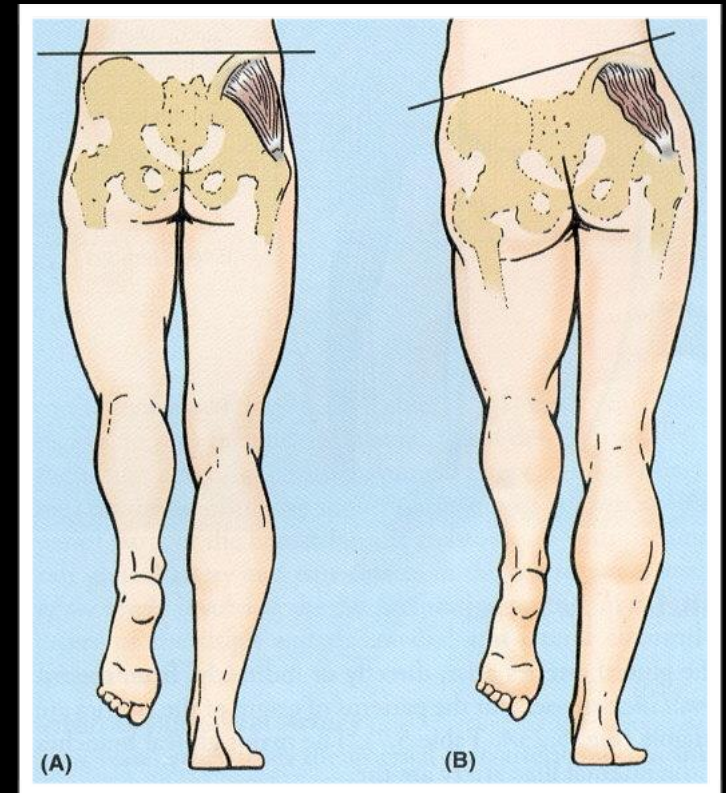
Abductor Muscle



Hip Abductor Weakness

Up to 50% of patients have decreased strength, power, and function can't return to pre-injury ambulatory status

Altered hip biomechanics
Varus of the hip causes abductor muscle weakness



Song KM, Halliday SE, Little DG. The effect of limb-length discrepancy on gait. *J Bone Joint Surg Am.* 1997;79:1690-1698.

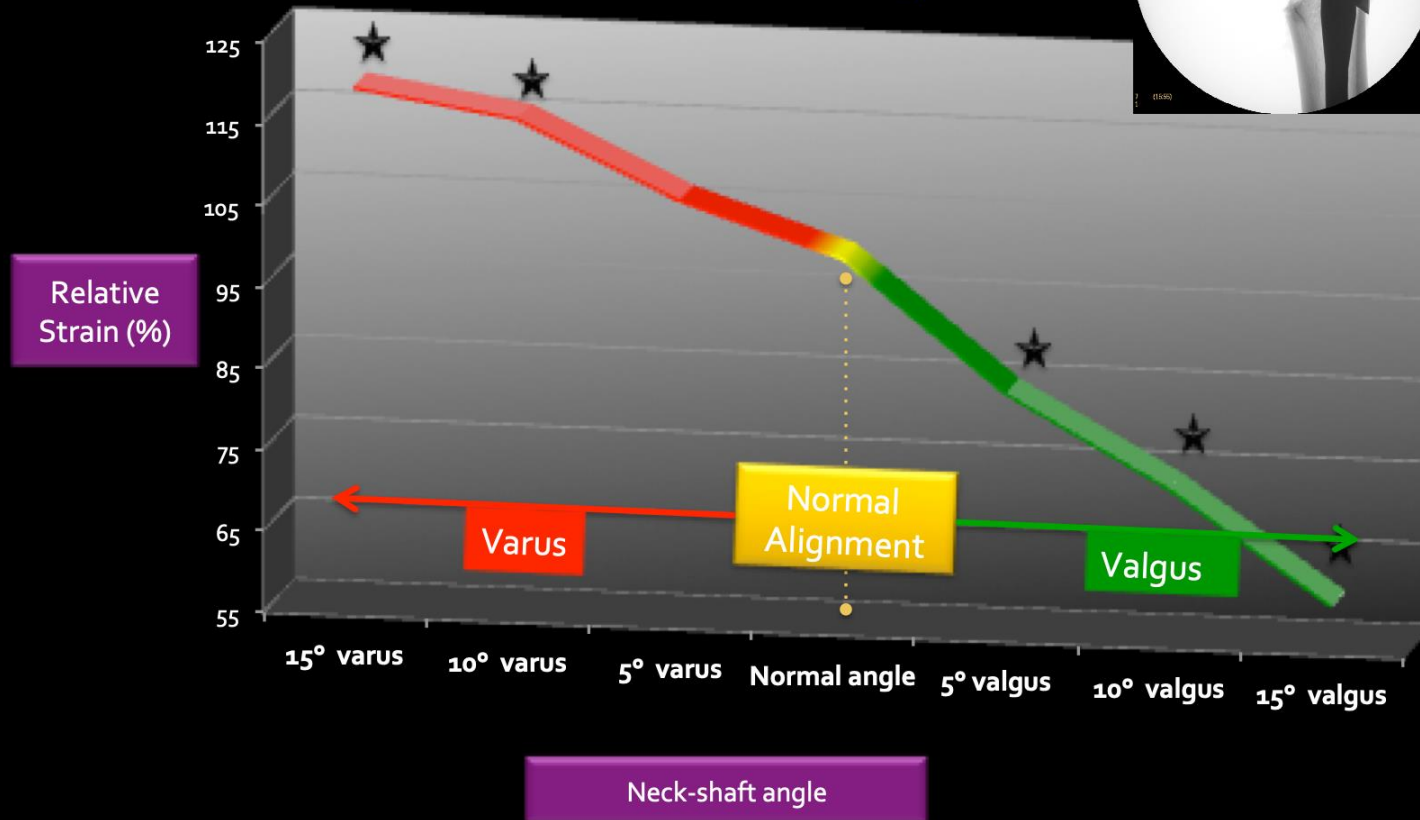
Lecerf G, Fessy MH, Philippot R, et al. Femoral offset: anatomical concept, definition, assessment, implications for preoperative templating and hip arthroplasty. *Orthop Traumatol Surg Res.* 2009;95:210-219. McGrory BJ, Morrey BF, Cahalan TD, et al. Effect of femoral offset on range of motion and abductor muscle strength after total hip arthroplasty. *J Bone Joint Surg Br.* 1995;77:865-869.

How Does Varus Affect Implants?

How does varus affect the implants?

Hip Nail Biomechanical Study

Strain on implant relative to intra-operative anatomic re-alignment of an intertrochanteric fracture with different neck-shaft angles



With Anatomic Reduction

- Excellent outcomes
- Near normal function
- Reoperation rates <1%

Anatomy of Subtroch Fractures

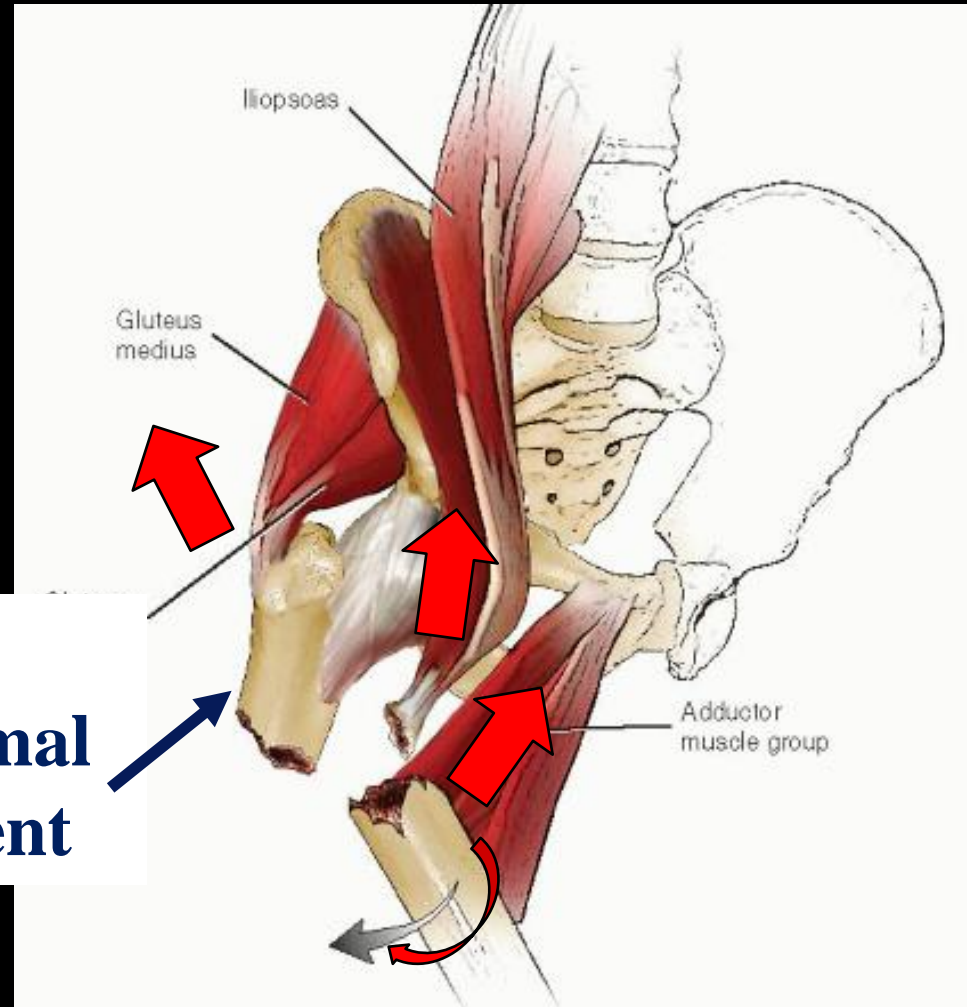
□ Muscle Pull

– Proximal

- Abduction
- Flexion
- External rotation

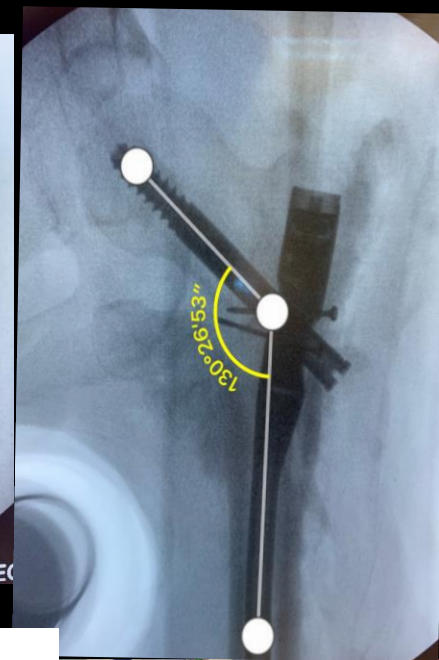
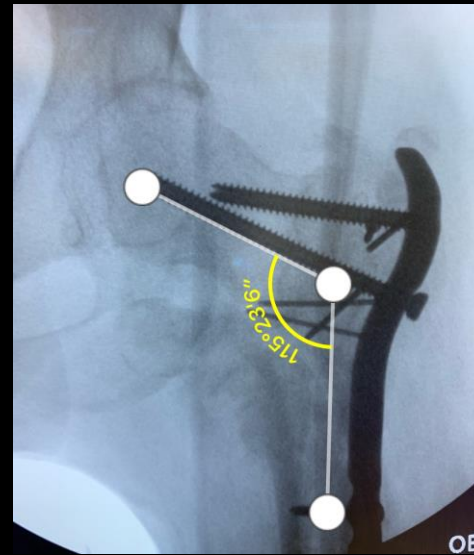
– Distal

- Short
- Medial
- External rotation



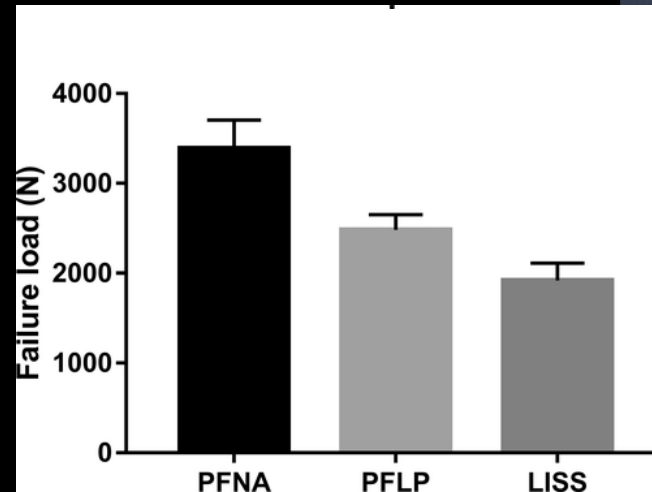
Treatment options

- Cephalomedullary nail
 - Axially Stiff
 - Increased Load to failure
 - Increased Cycles to failure



- Fixed angle plate

- More lateral position
 - Greater bending forces
 - Decreased load to failure
 - Decreased number of cycles to failure



Kuzyk, P et al. Intramedullary Versus Extramedullary Fixation for Subtrochanteric Femur Fractures. J OrthopTrauma. 2009;23(6):465-470

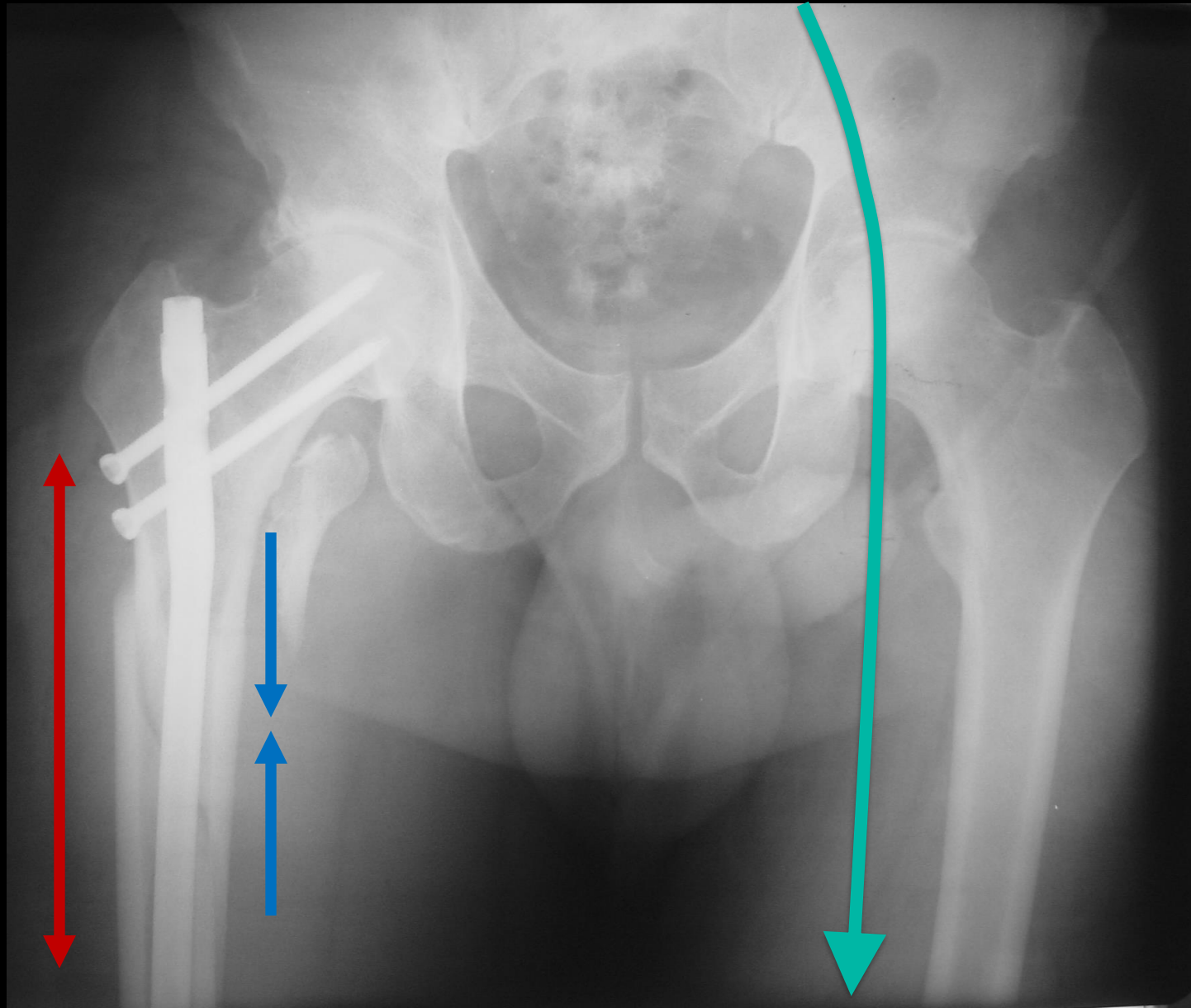
2009;23(6):465-470

Biomechanical Study of Intramedullary Versus Extramedullary Implants for Four Types of Subtrochanteric Femoral Fracture

Jie Wang MD, Haobo Jia MD, Xinlong Ma MD, Jianxiang Ma MD, Bin Lu MD, Haohao Bai MD, Ying Wang MD

Orthopaedic Surgery

Forces after fixation



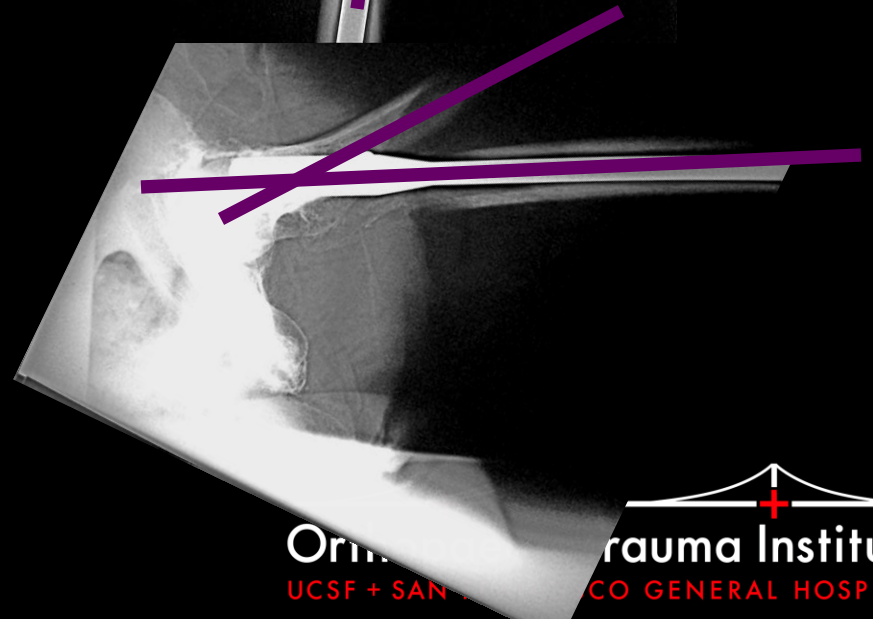
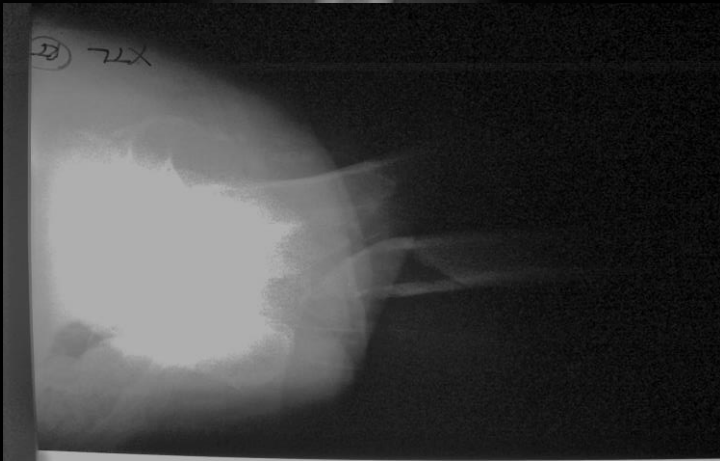
Malalignment and Varus in Subtroch Fx is Common

- Factors that lead to nonunion
- Varus and Anterior Apex Angulation $\approx 10-20\%$
- Medial Cortical abutment
- Nail autodynamization

Varus and Apex Anterior in Subtroch fractures

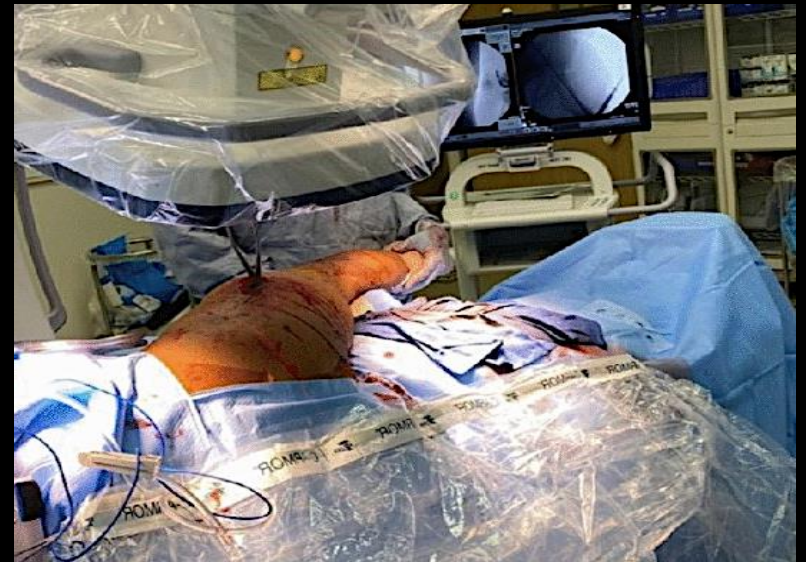


Nail without reduction



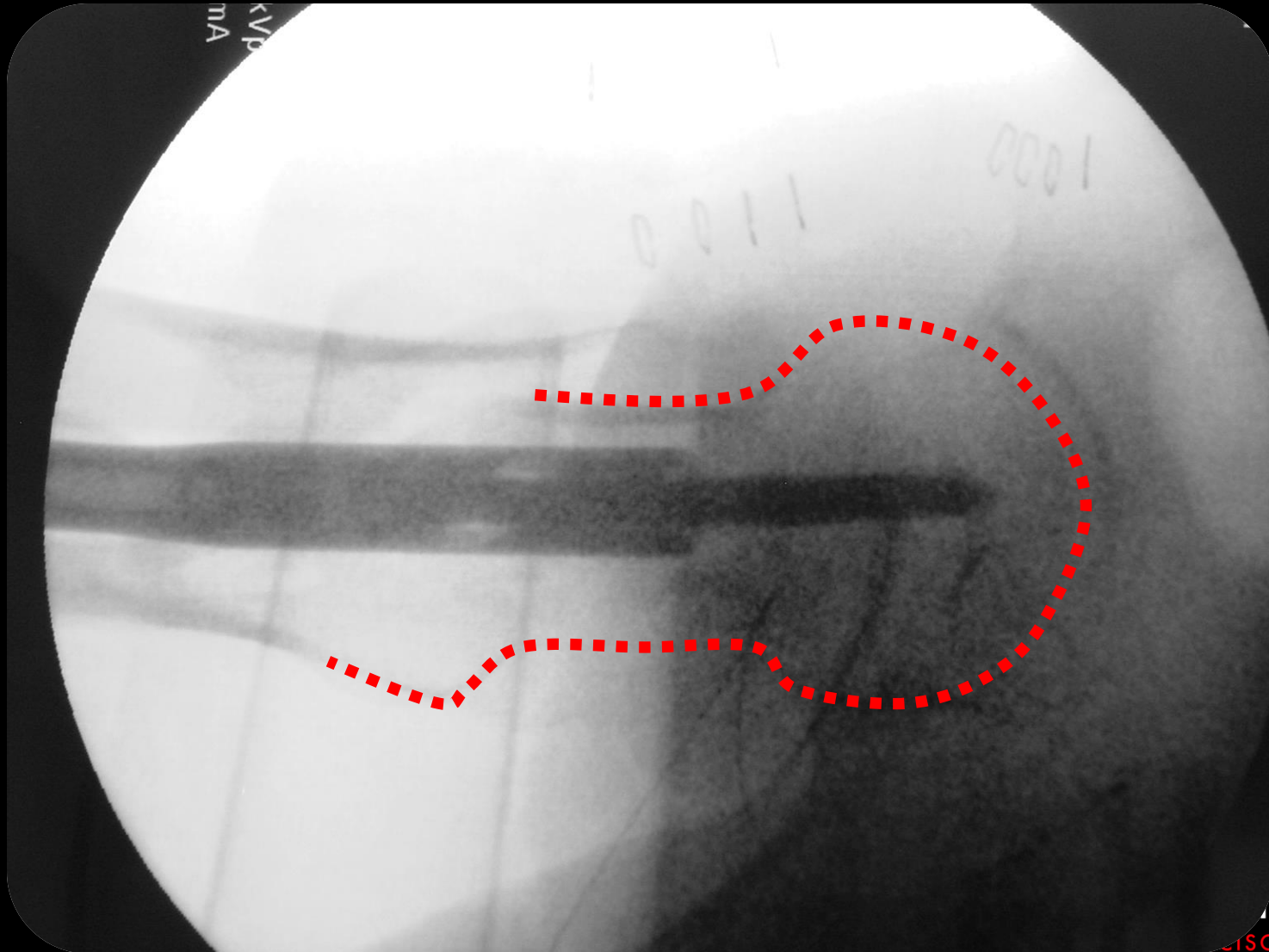
OR Setup

Scissor Position or Lateral Decubitus

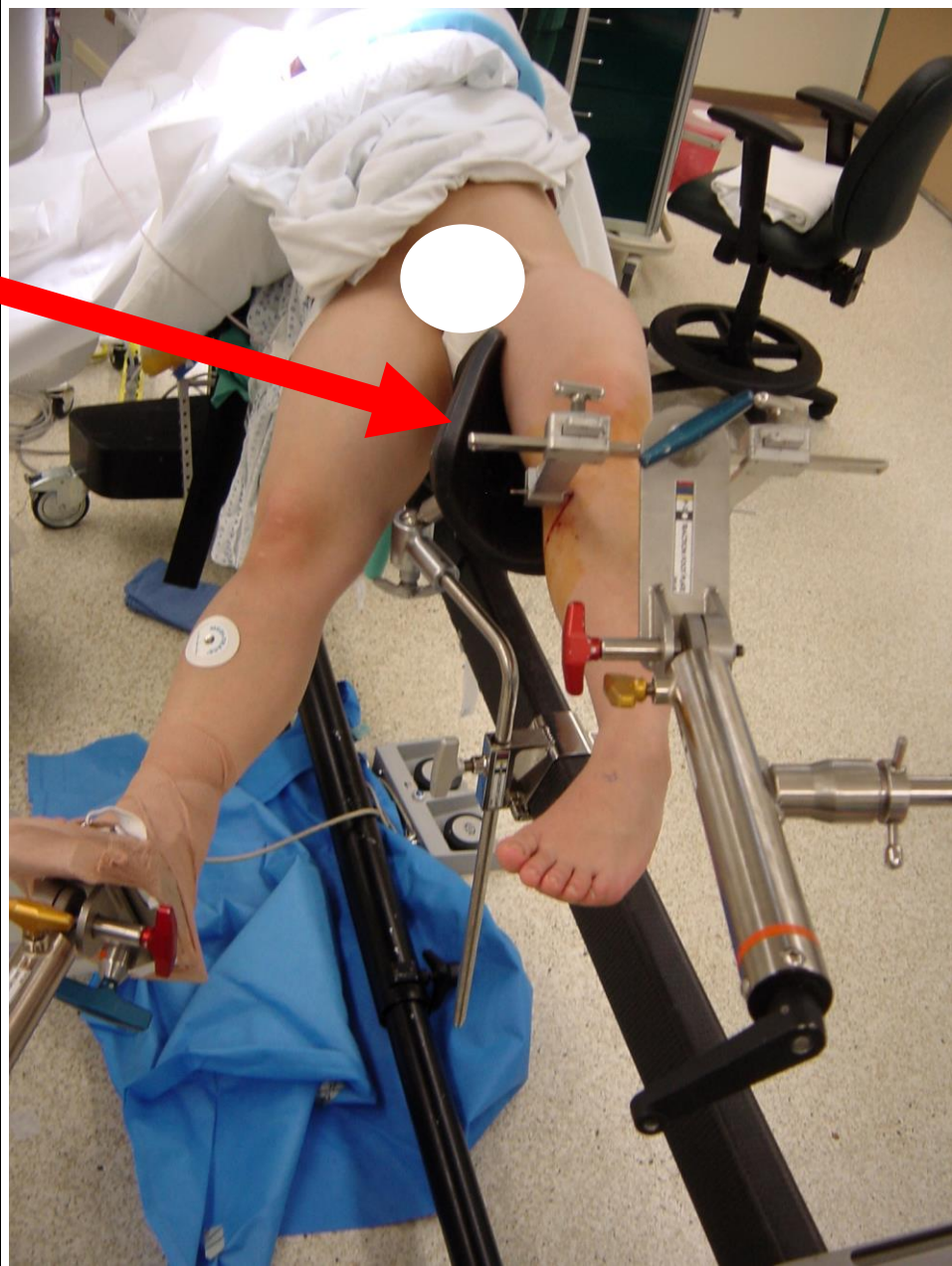
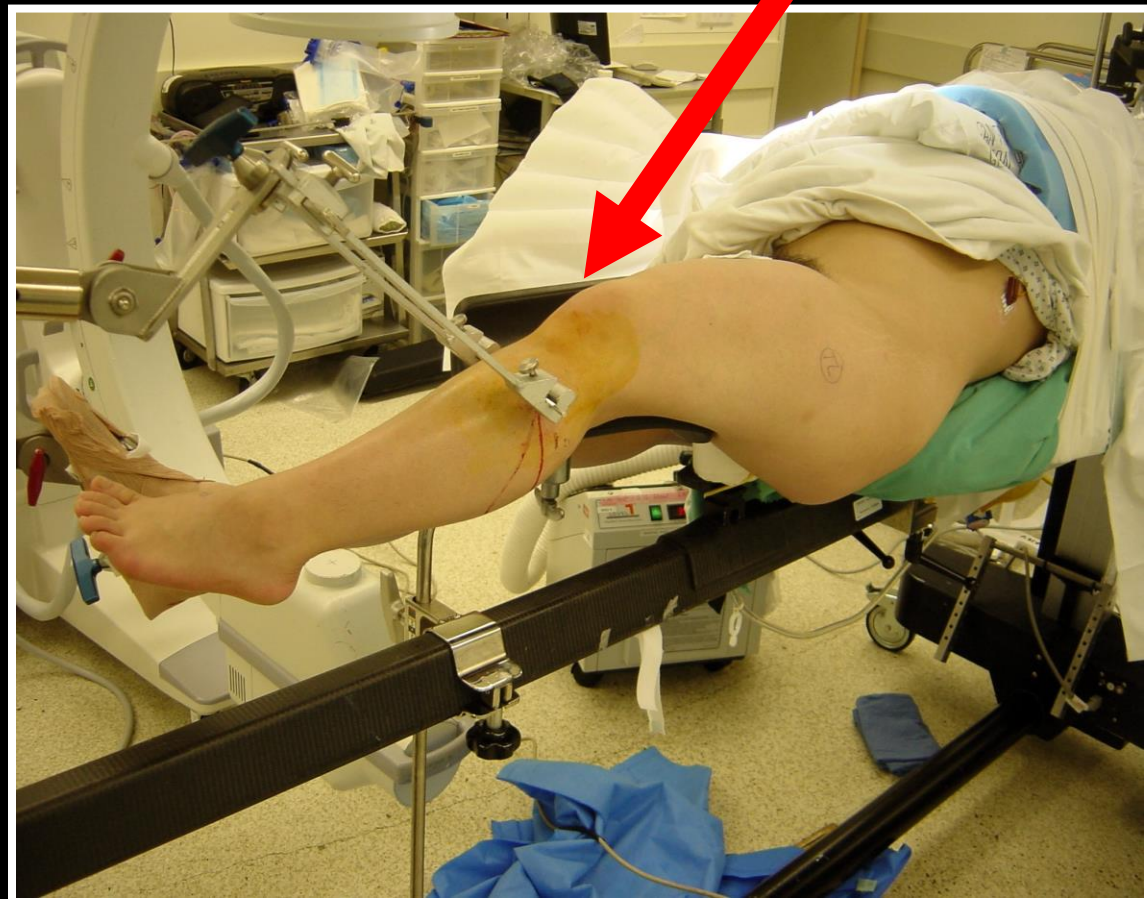


preop c-arm

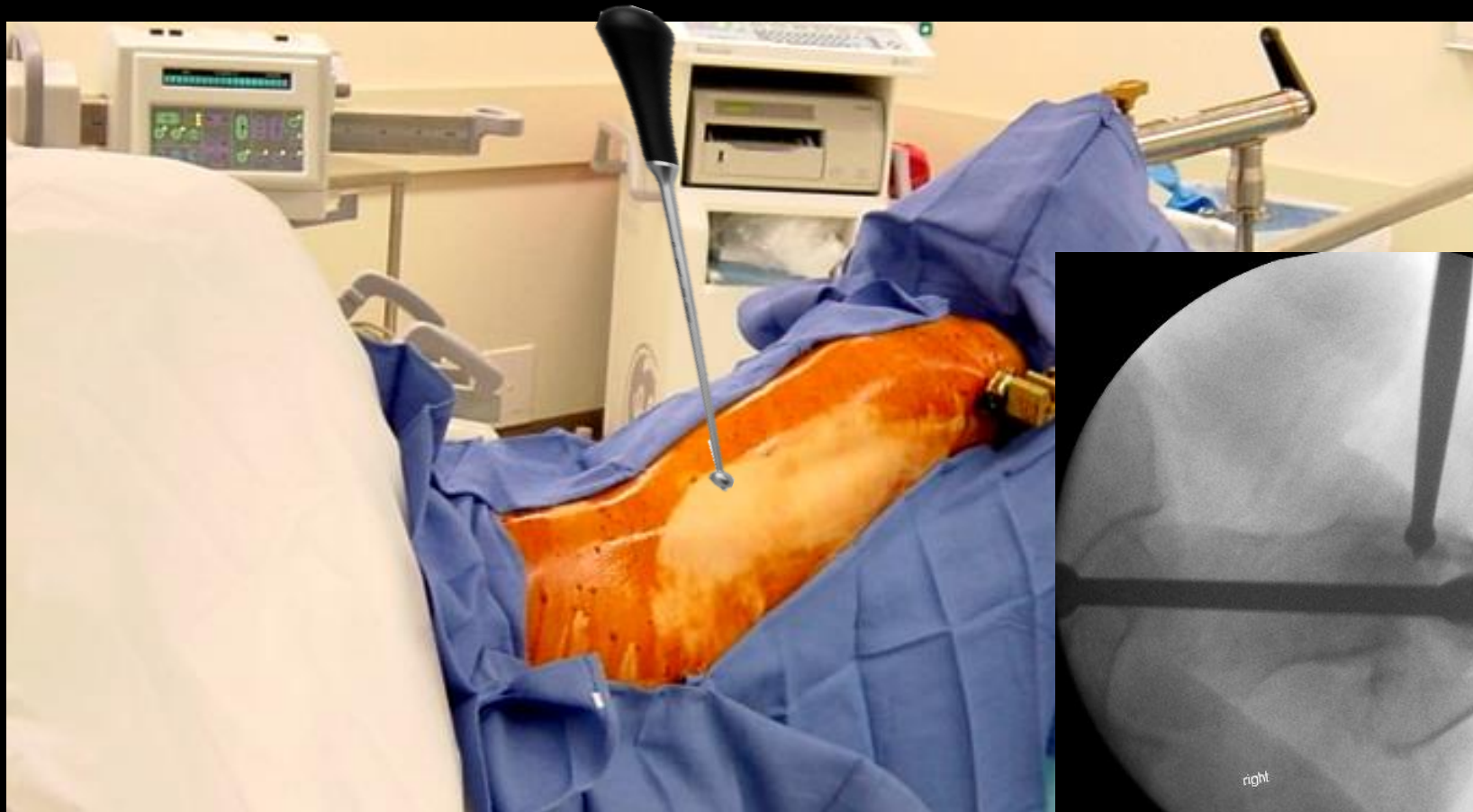
Make sure you can get a perfect lateral of head and neck



OR Set up EM reduction



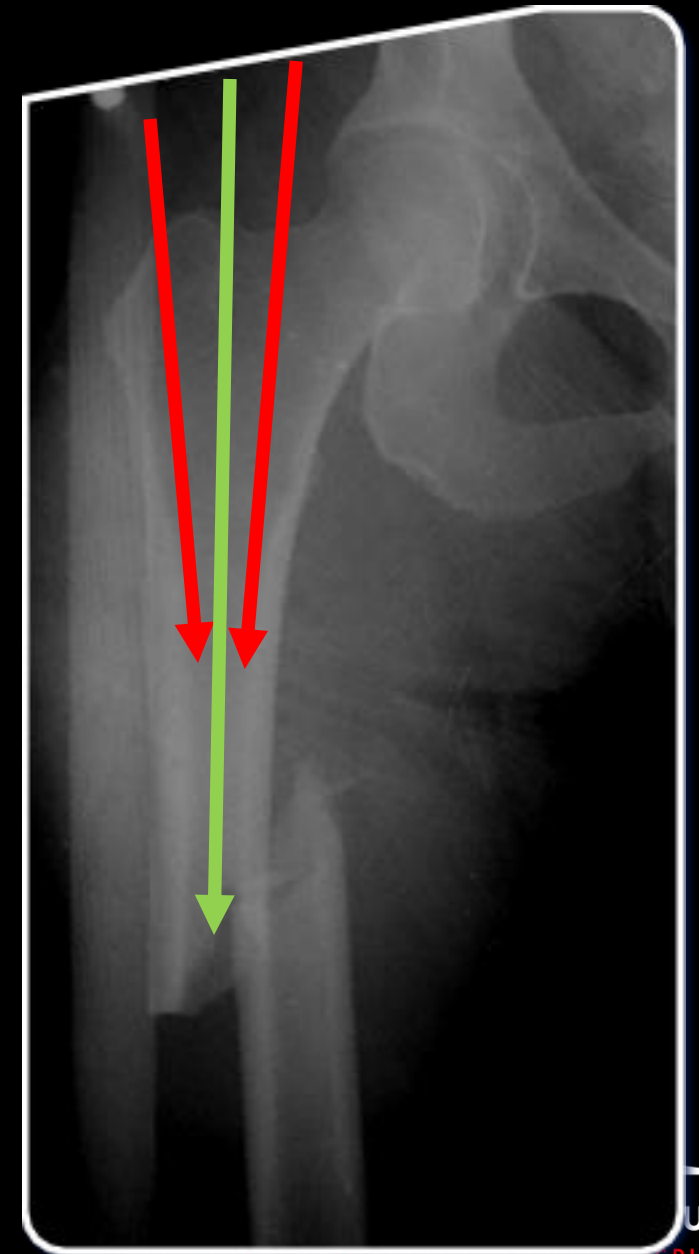
Prep anteriorly in case you need to push down



Subtrochanteric nails

Avoiding Varus

- Proper insertion point
 - Trochaformis start site
- Reduction before reaming



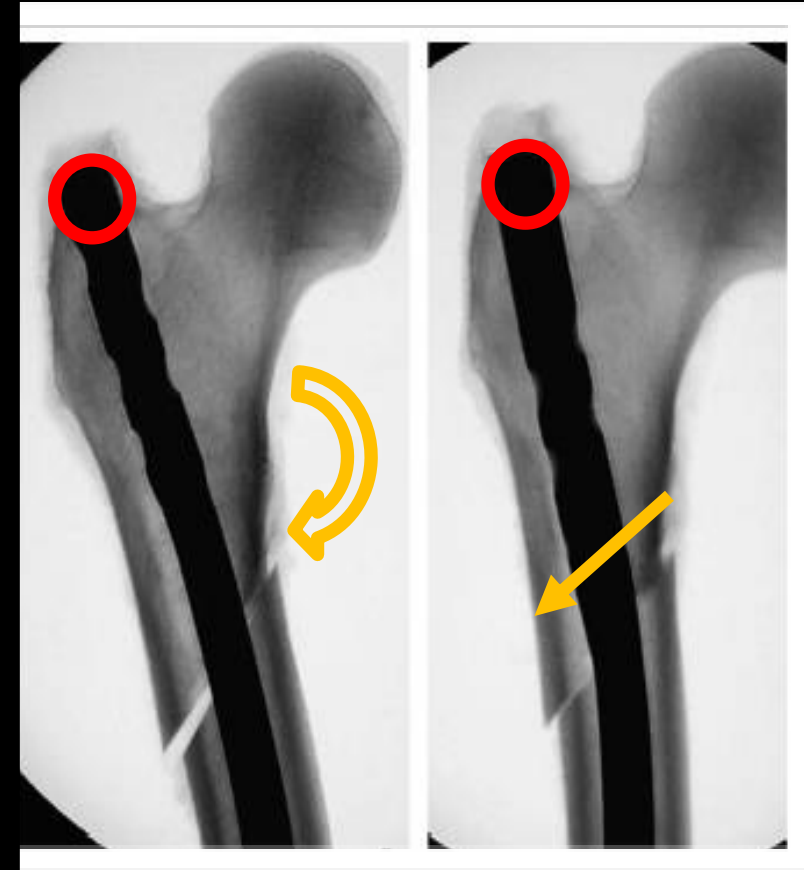
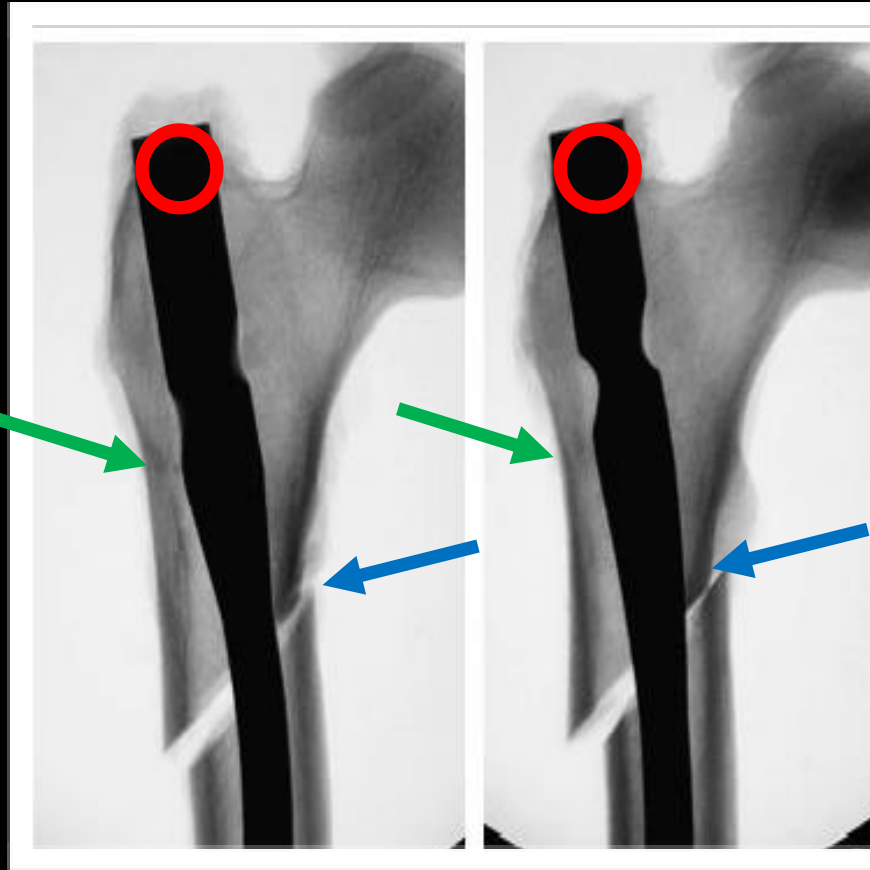
Too Lateral Entry Site

Large Nail Head
Proximal Fragment **Rotates into Varus** by
Implant Head

Small Nail Head
Proximal fragment **rotates into varus or translated** until the proximal fragment abuts medially

Lateral Proximal
Cortical Abutment

Medial Distal
Cortical Abutment



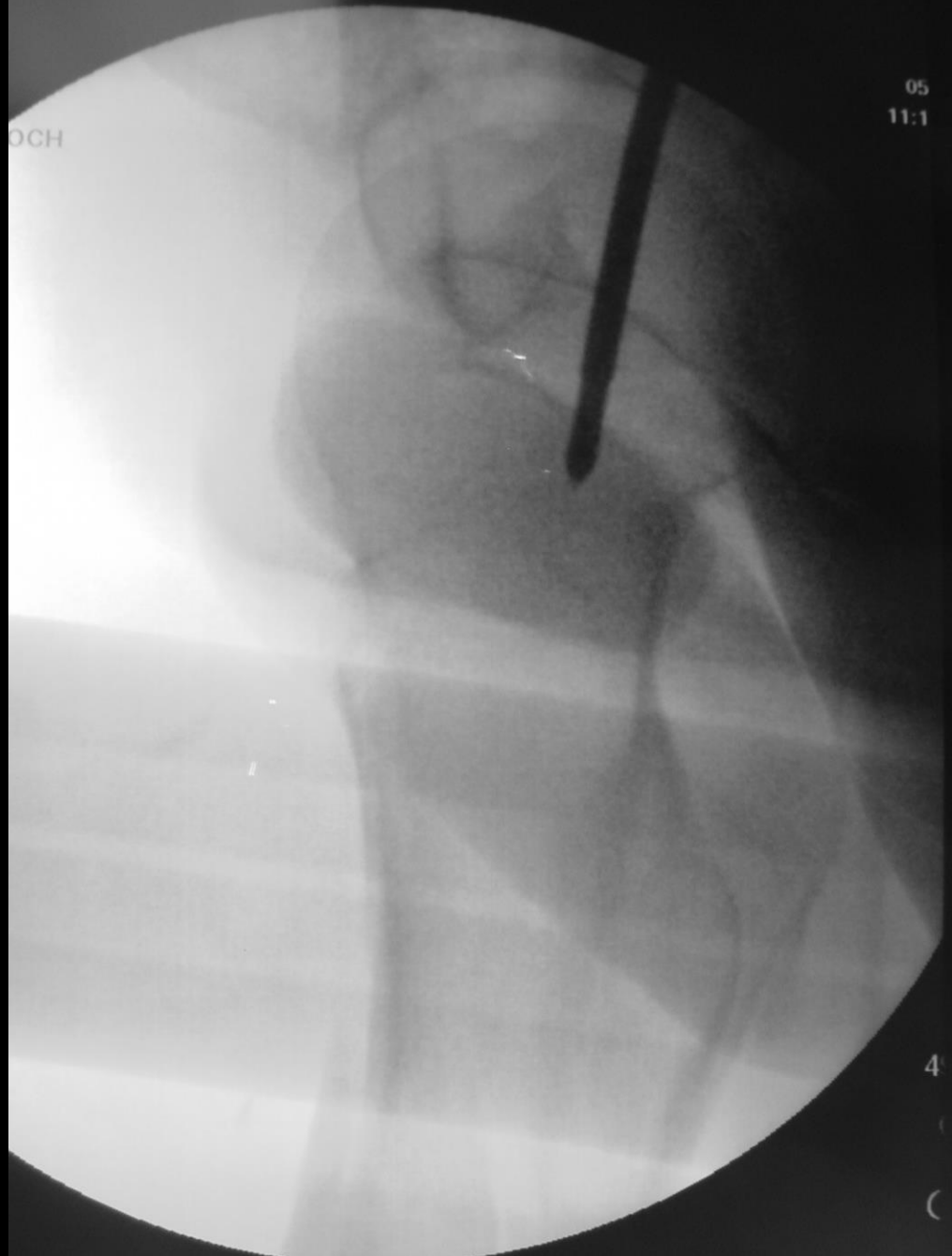
Ostrum et al JOT 2005






Academic Trauma Institute

UCSF + SAN FRANCISCO GENERAL HOSPITAL



DCH

05
11:1

4



Medical Trauma Institute

UCSF + SAN FRANCISCO GENERAL HOSPITAL

11:1

YAHU
IL L PERITROCH



49

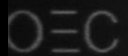
1 kVp
3 mA

48 
51 



Institute

MATTI TARI
IM NAIL L PERITROCH



91 kVp
4.03 mA
21



IM NAIL L PERITROCH

11:16:52 AM



91 kVp

4.06 mA

22

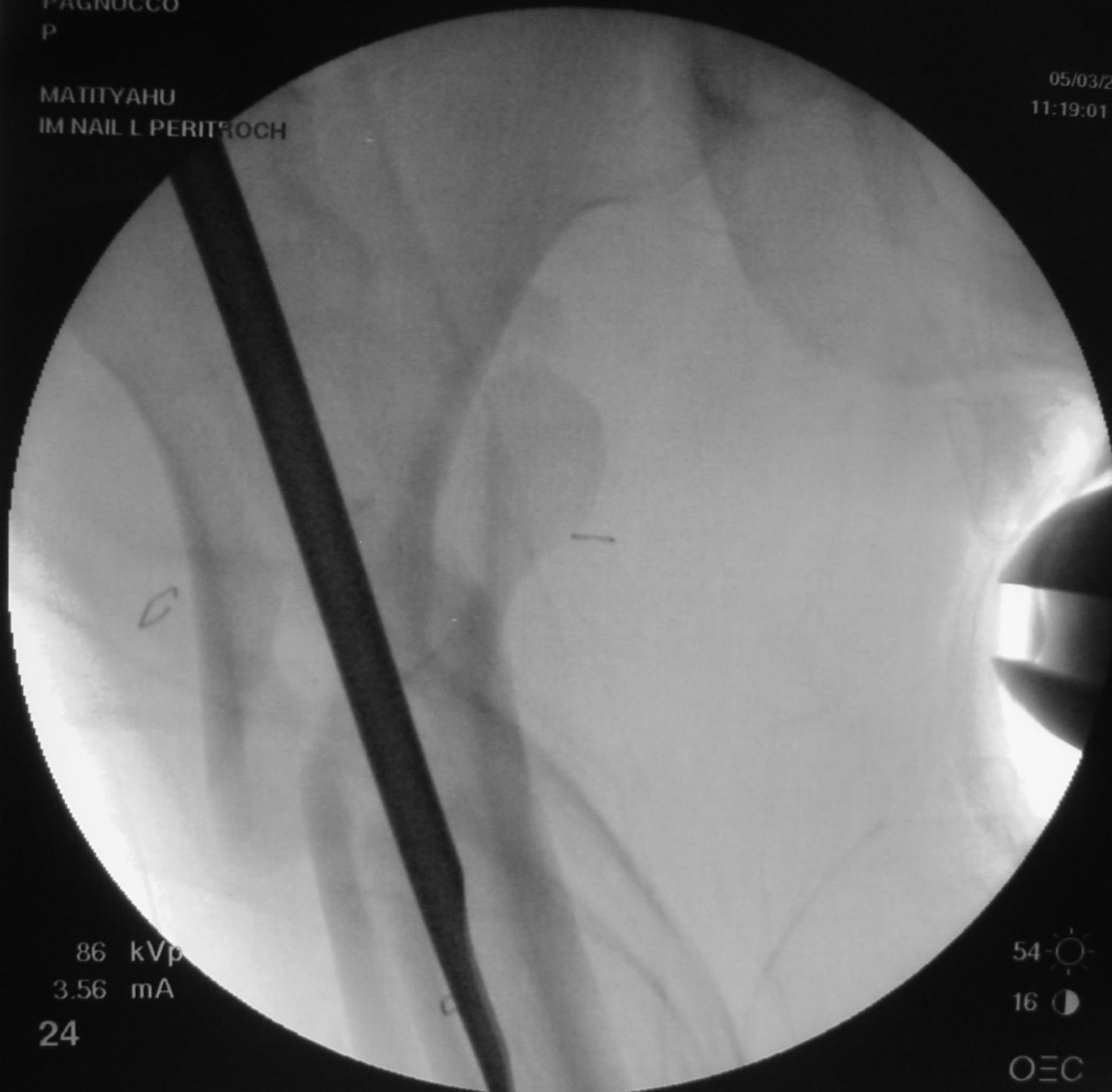
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27

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PAGNUCCO
P

MATITYAHU
IM NAIL L PERITROCH



86 kVp
3.56 mA
24

54 ☀
16 ●
OEC

94 kVp
4.18 mA
23

PAGNUCCO
P

05/03/2001
11:19:01 AM
MATITYAHU
IM NAIL L PERITROCH

PAGNUCCO

D

MATITYAHU

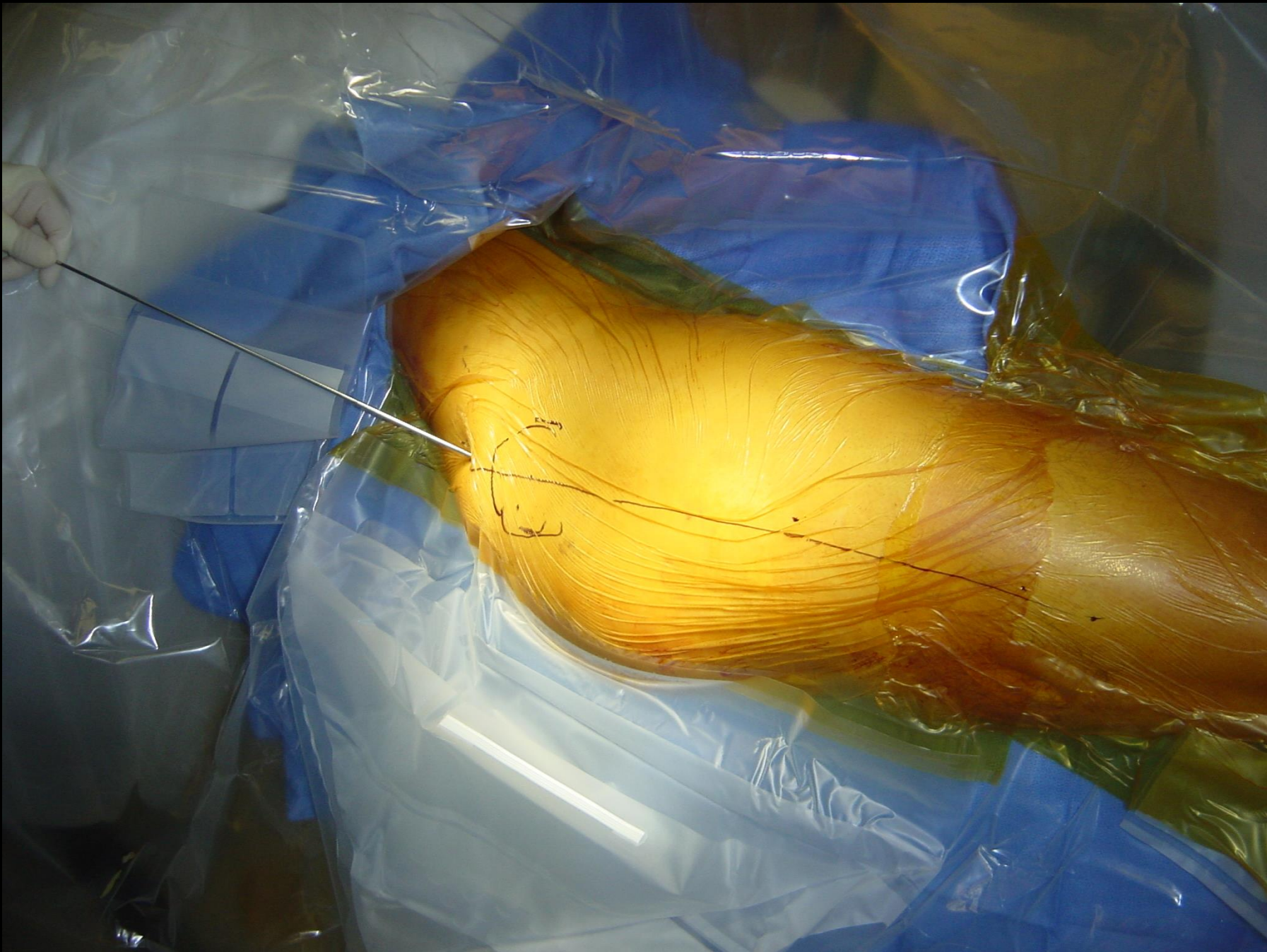
IM NAIL L PERITROCH



94 kVp

4.18 mA

23



05/03/2006
17:57 AM

05/03/2006
11:44:36 AM

P
MATITYAHU
IM NAIL L PERITROCH



46 
0 

87 kVp
3.65 mA
25

59 
22 
OEC

MATITYAHU
IM NAIL L PERITROCH

05/03/20 P
12:20:17 P P

MATIT
IM NAI



96 kVp
1.36 mA
31

55 
27 
OEC

94 kV
1.31 mA
32

P

MATITYAHU
IM NAIL L PERITROCH

05/03/2006
12:20:38 PM



55 ☀
27 ◐

94 kVp
1.31 mA

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32

51 ☀
2 ◐


nstitute

SNUCCO

ITYAHU
AIL L PERITROCH

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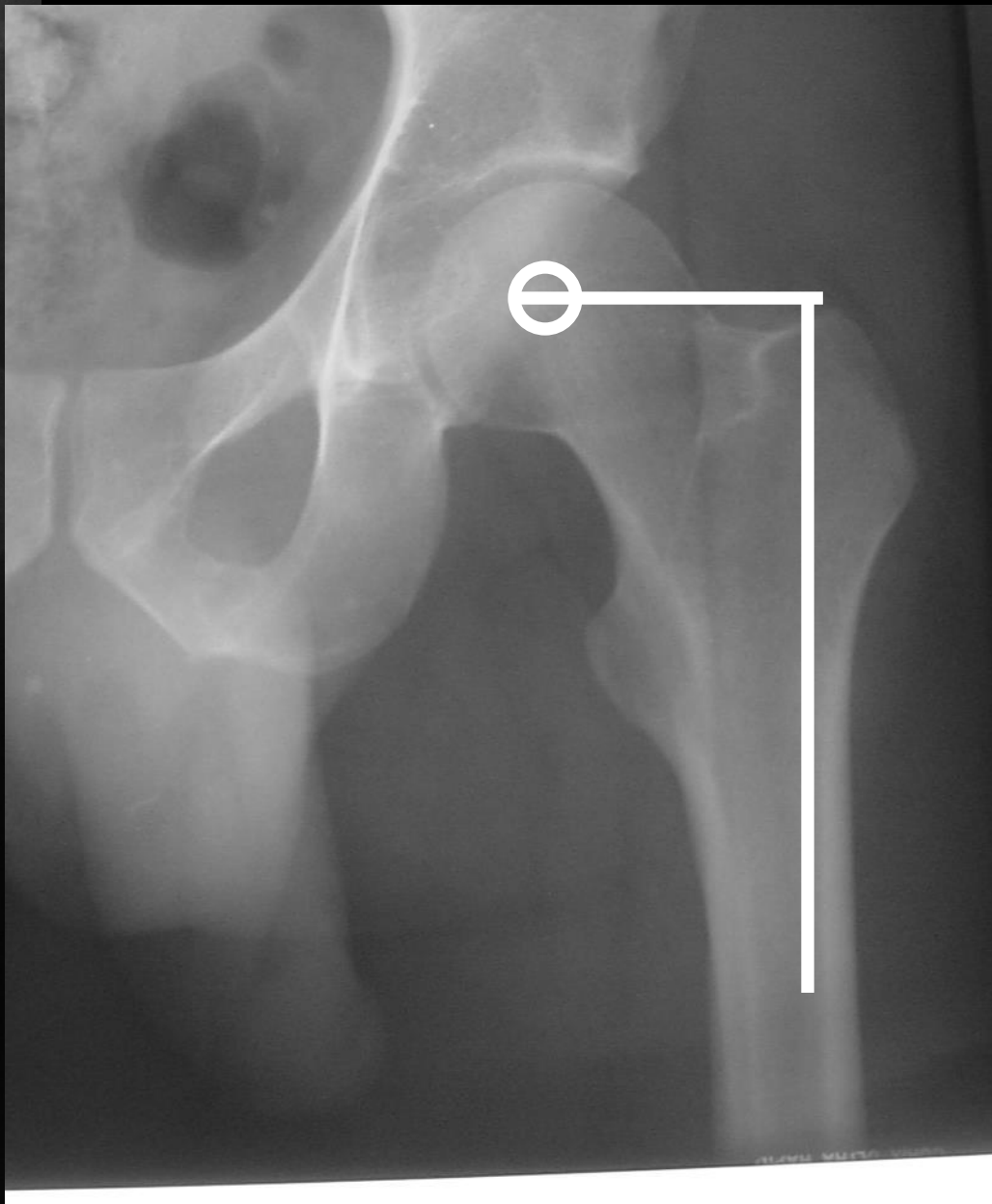
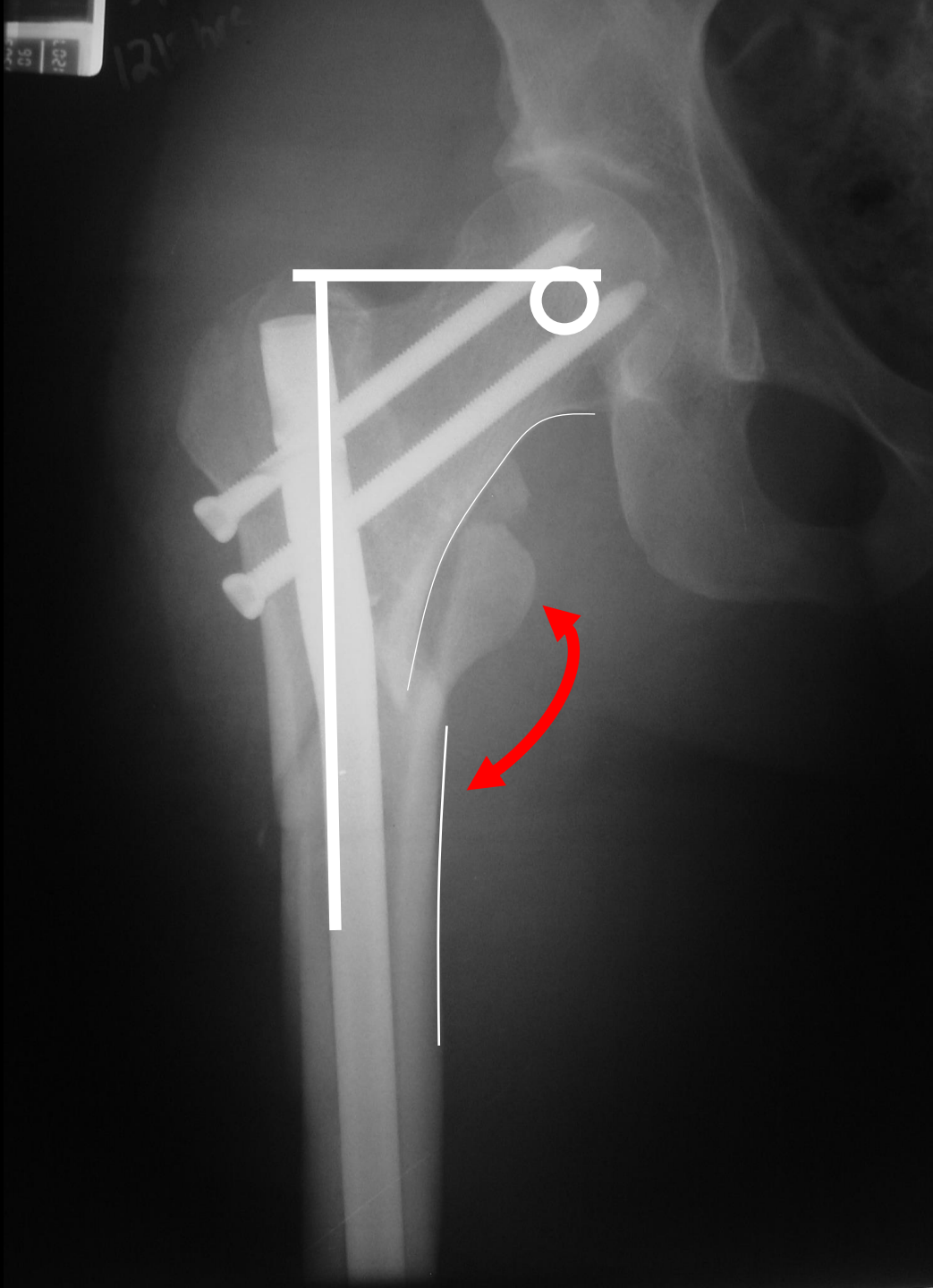


90 kVp
21 mA

53
2
OEO

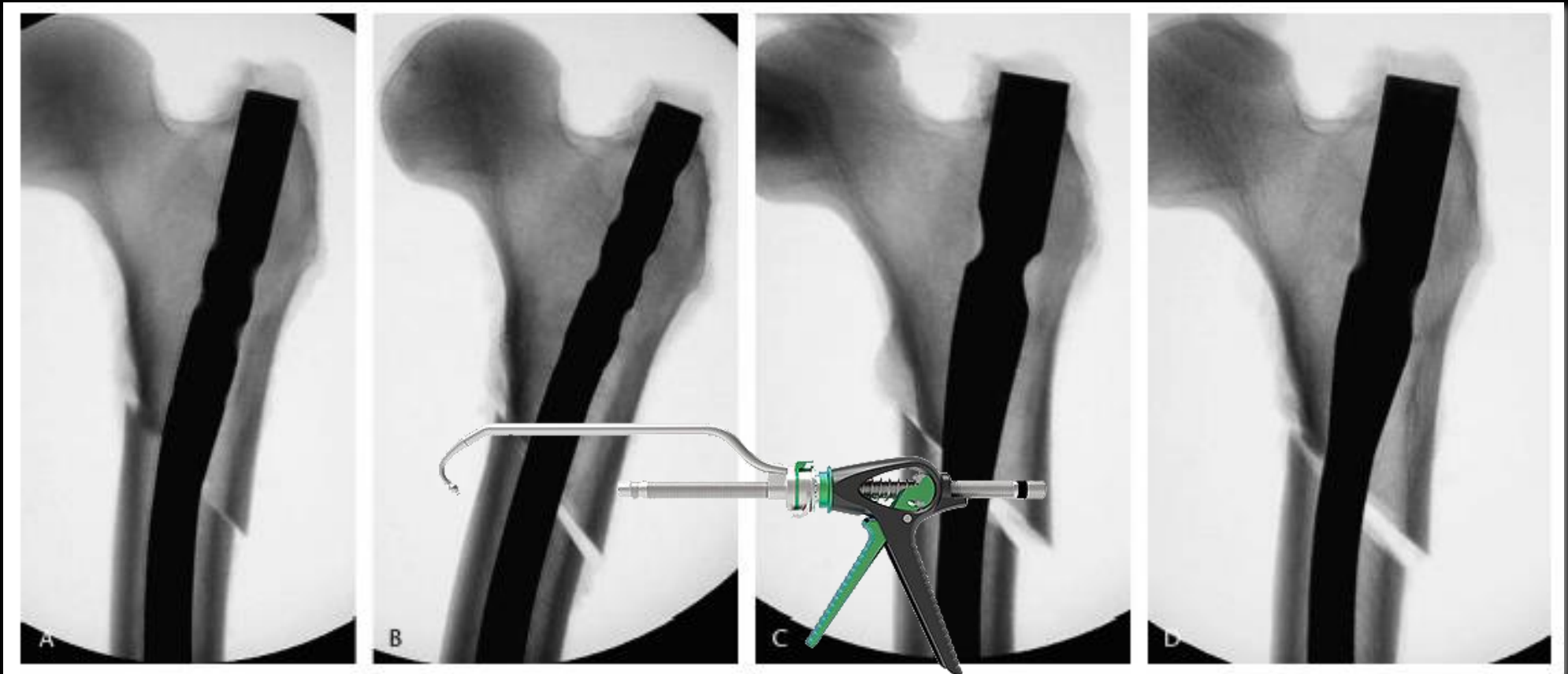
ROCH







Know your nail's anatomy
variable proximal bend and thickness
Tip of the greater troch may be too lateral



Holland

TAN

Gamma

TFN

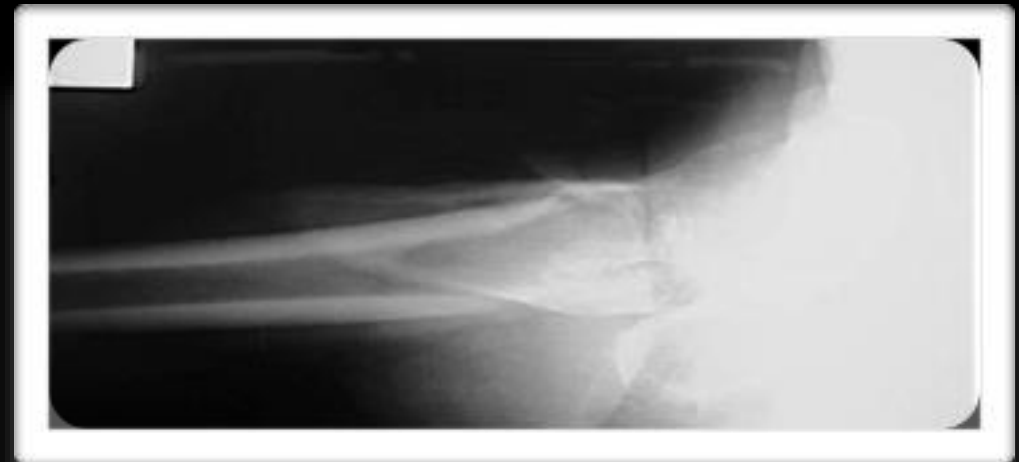
Ostrum et al JOT 2005

Avoid Varus with correct entry!
Avoid reaming laterally!
Avoid Oval by Use of one step reamer!



85 year old female post PVA

Sup/peritrochanteric fracture Jan 2006



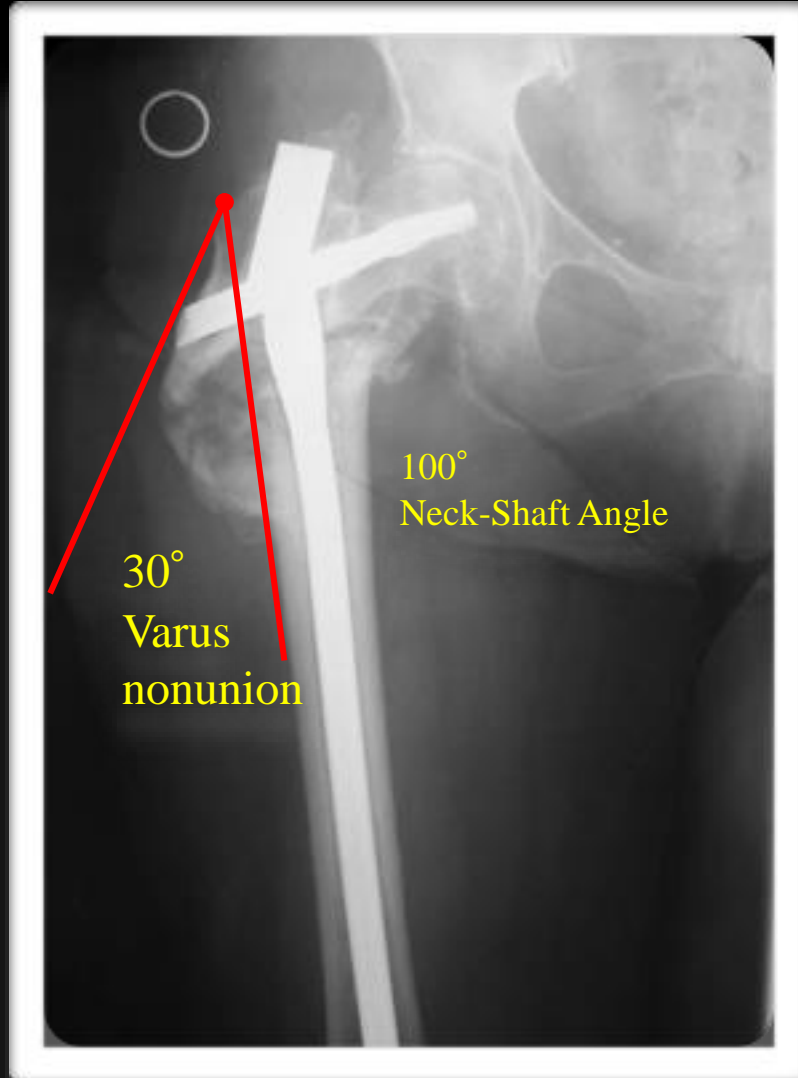




14° VARUS Medial Translation



2 years post op Nonunion and Hardware Failure

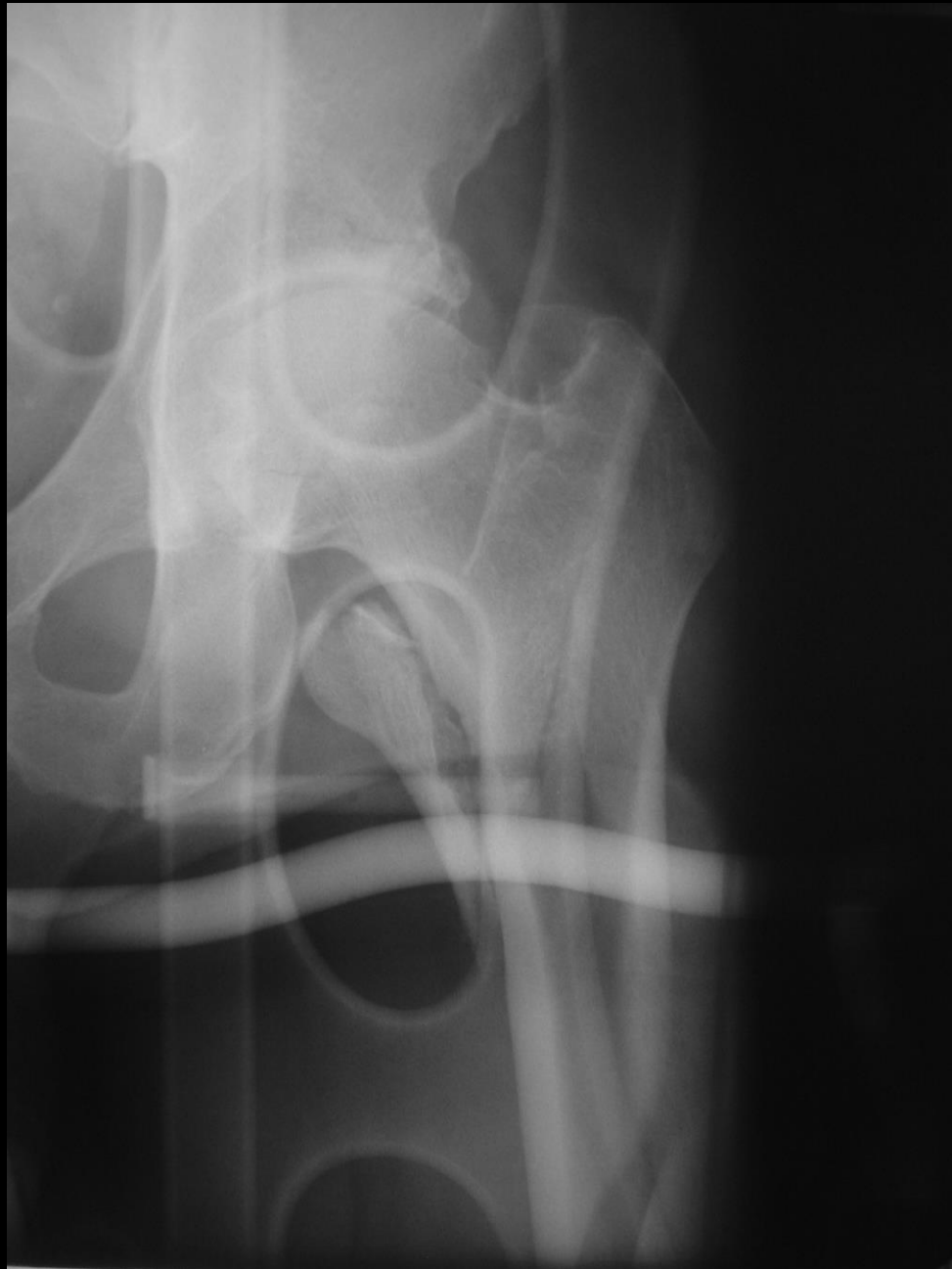


Lateral Decubitus Position





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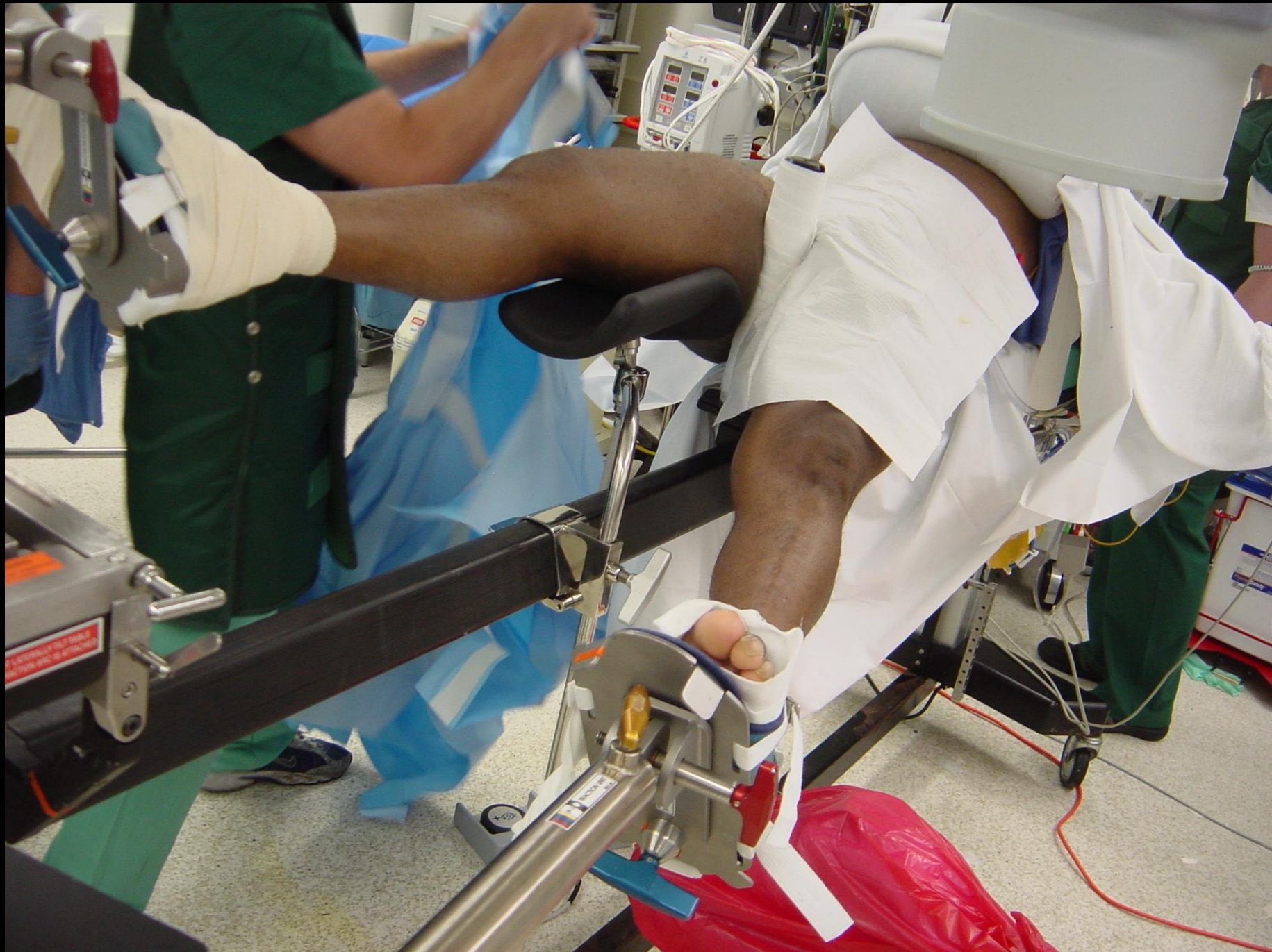




paediatric Trauma Institute

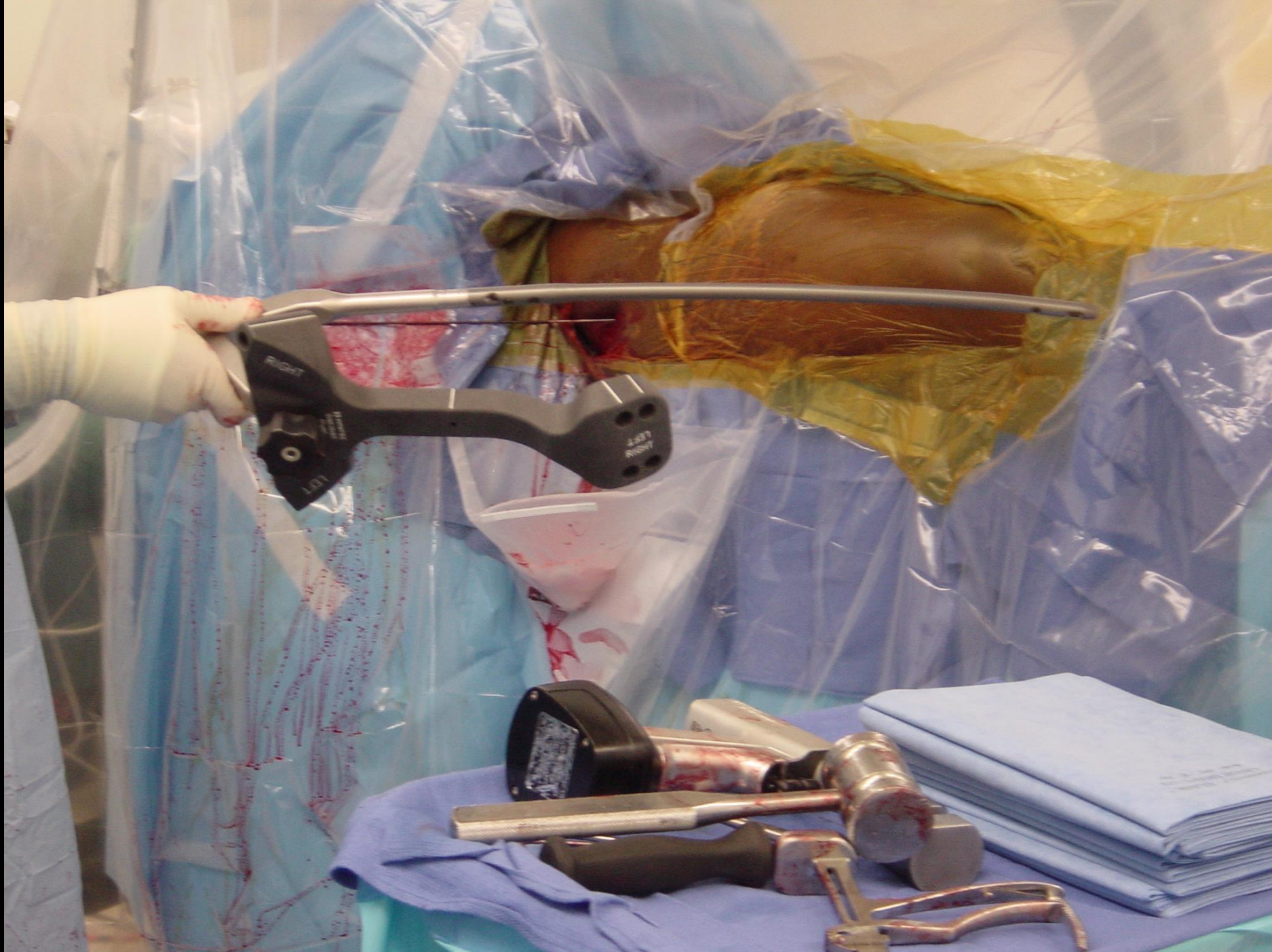
UCSF + SAN FRANCISCO GENERAL HOSPITAL

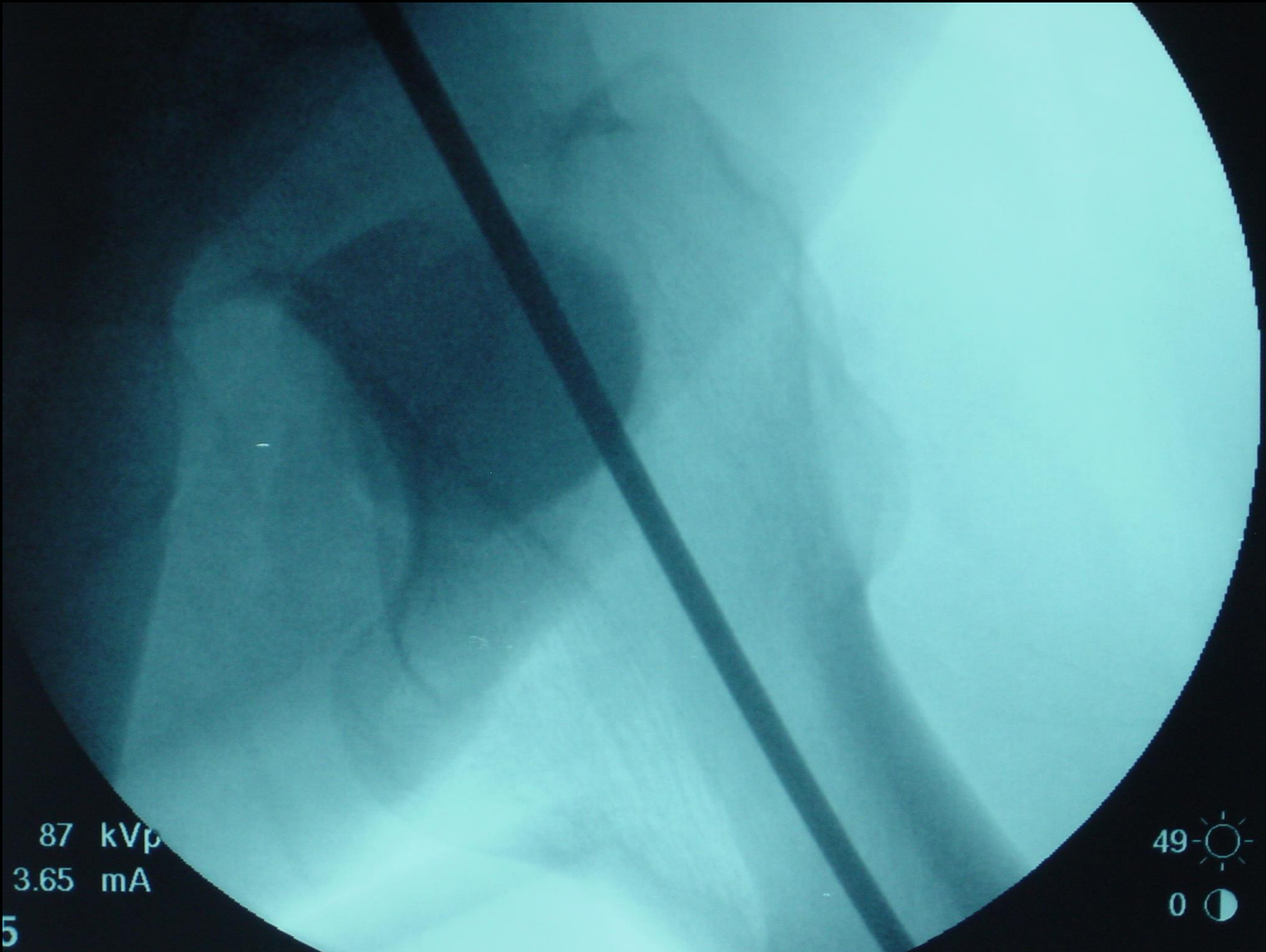






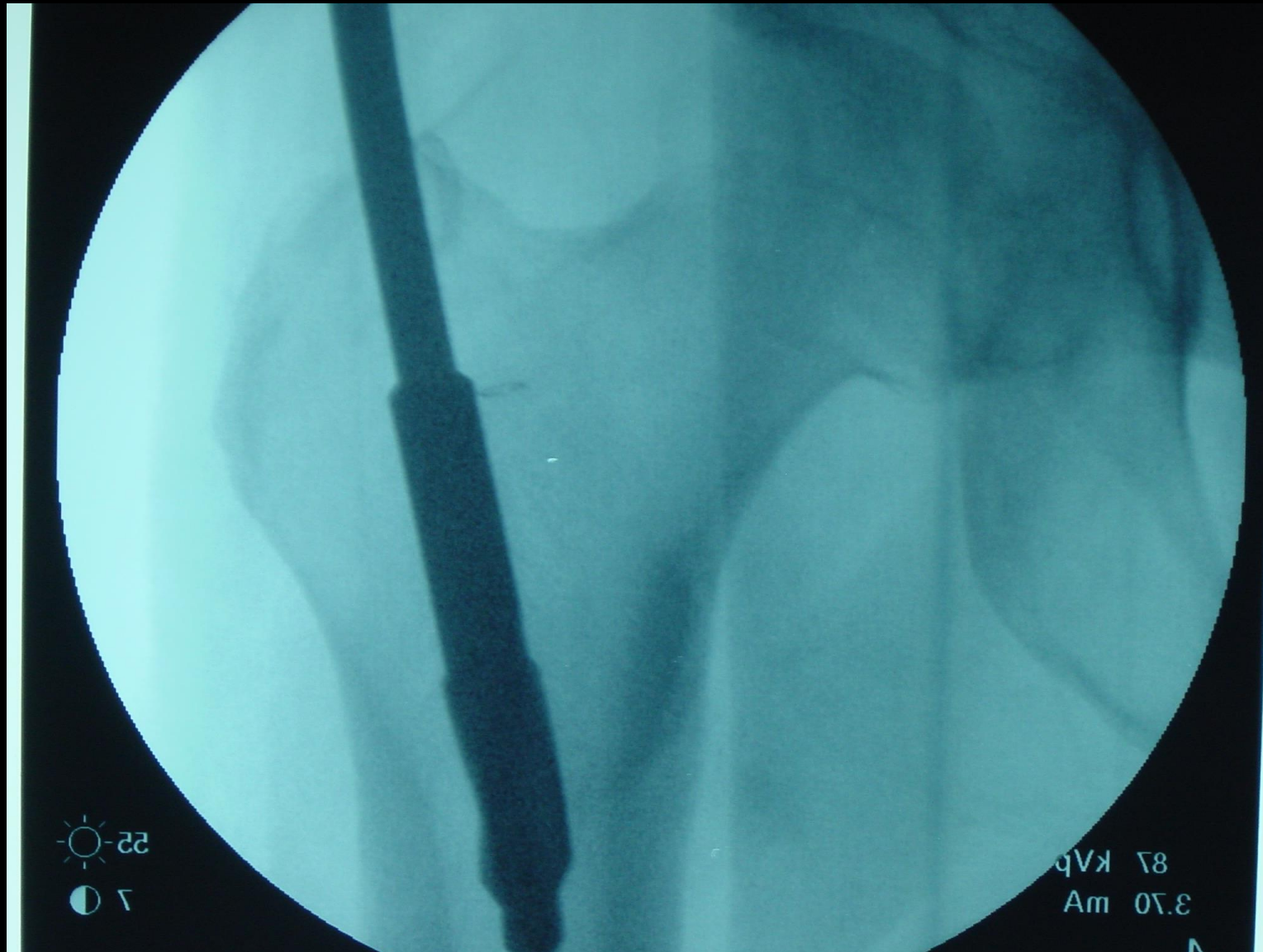






87 kVp
3.65 mA
5

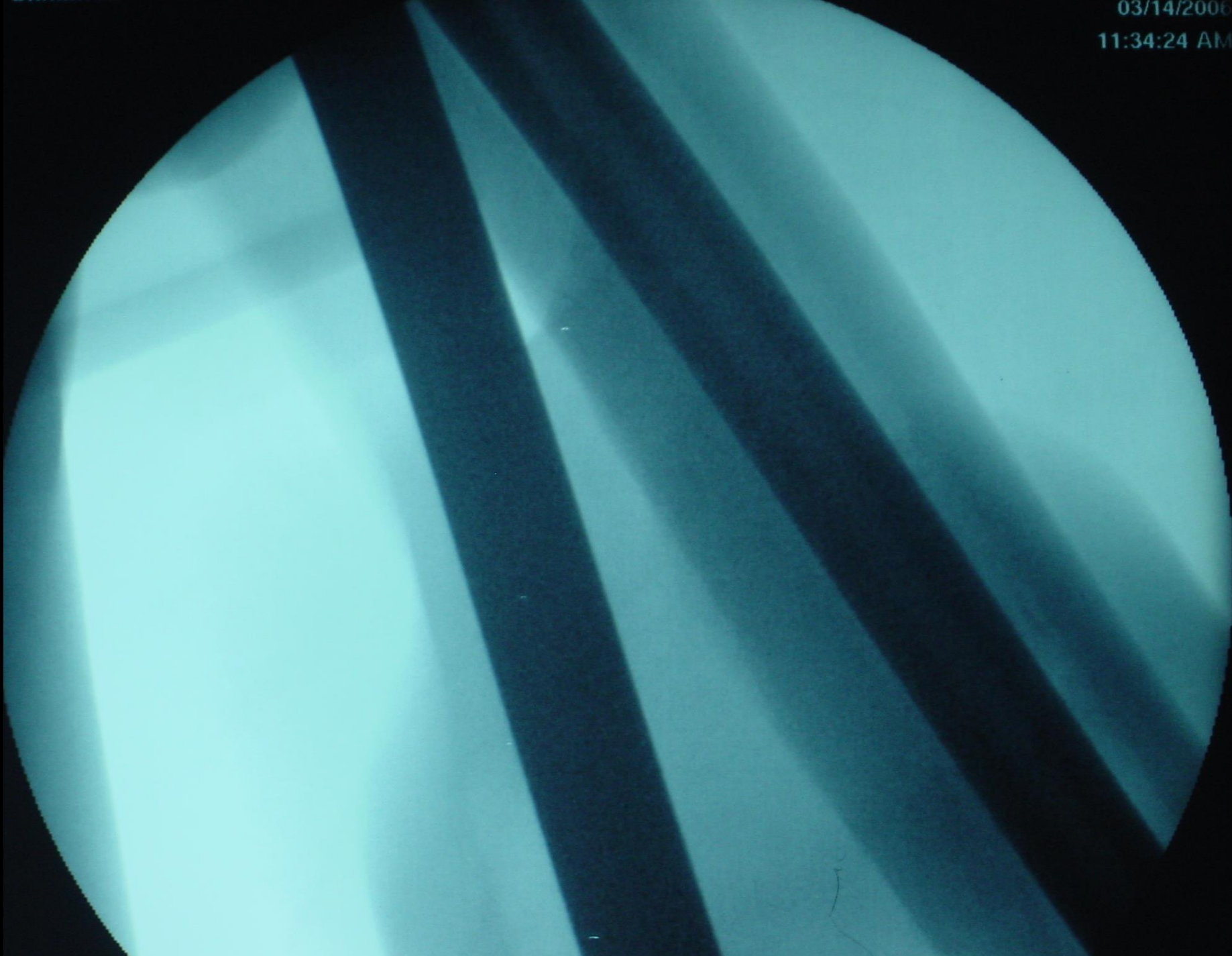
49 
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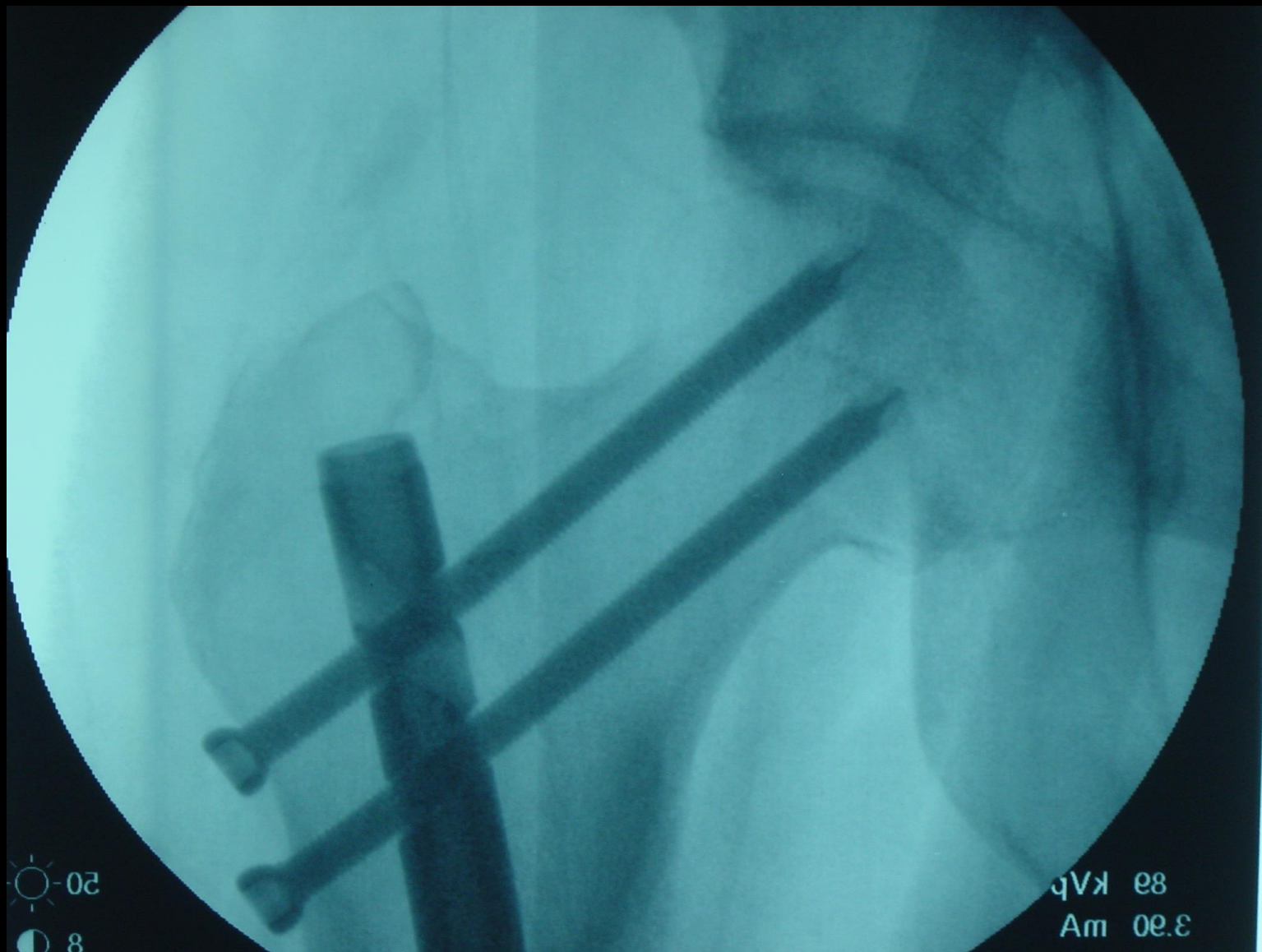
87 kVp
3.70 mAs

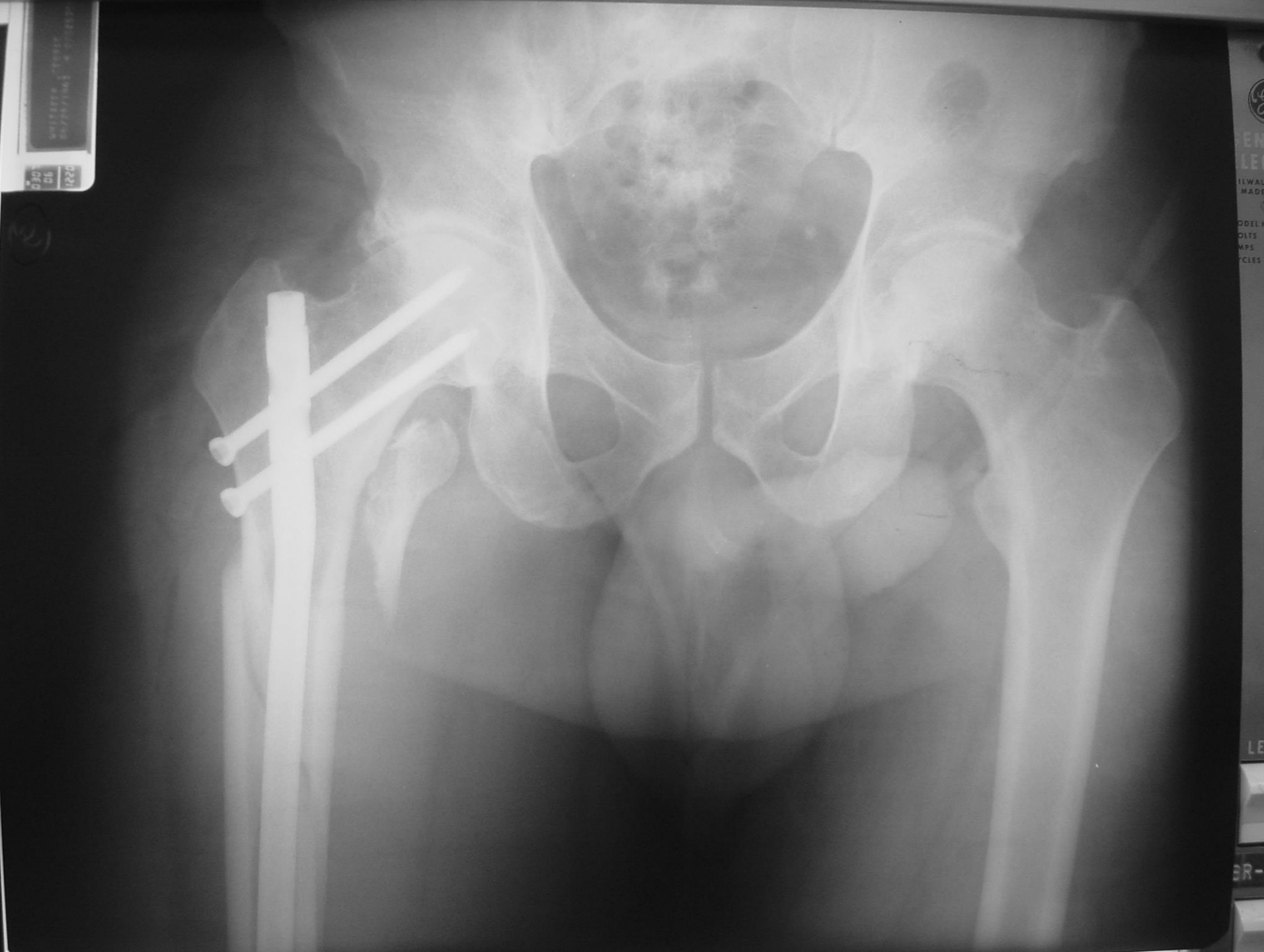
03/14/2006
11:34:24 AM



74 kVp
51 mA

55 

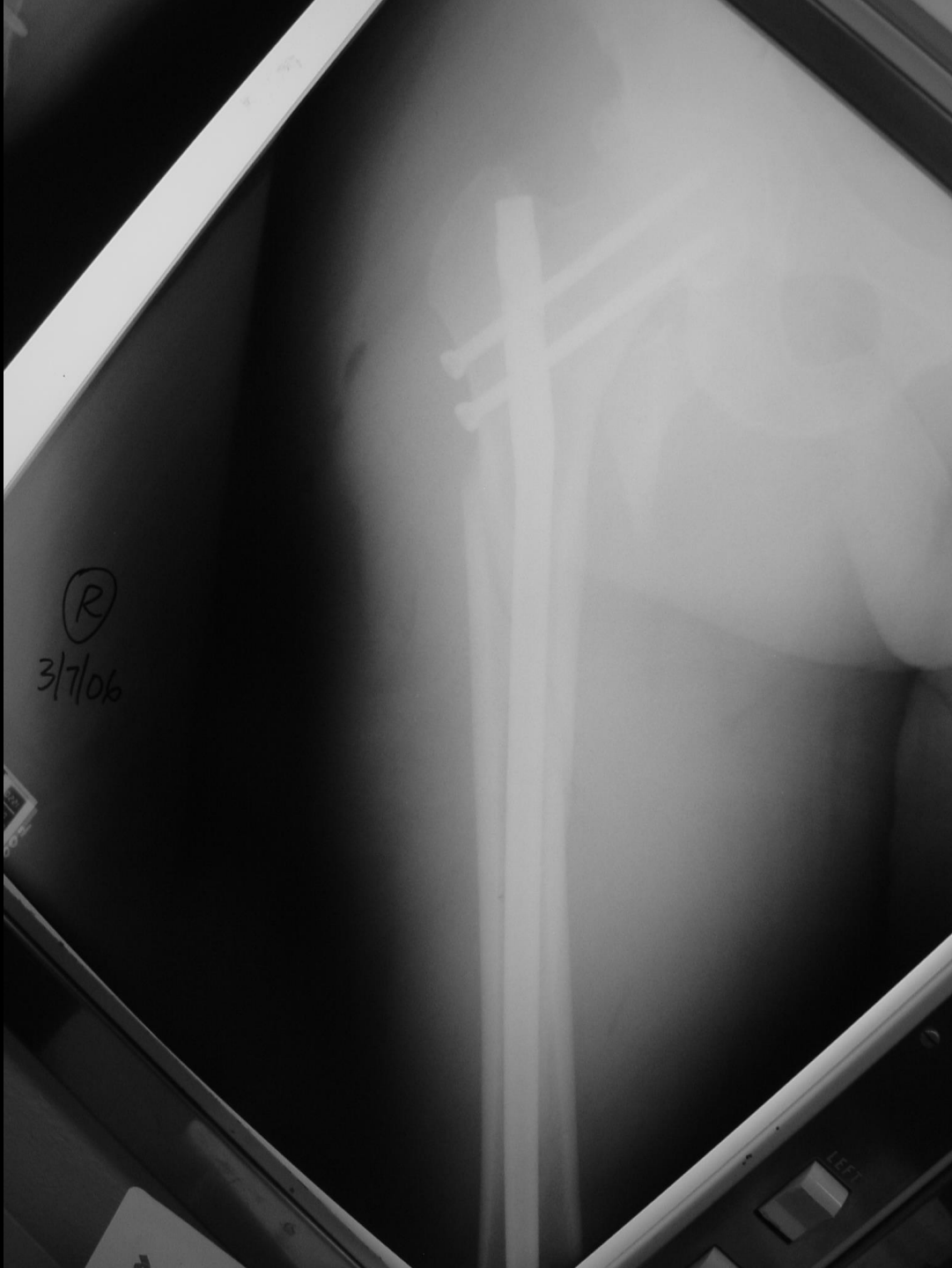




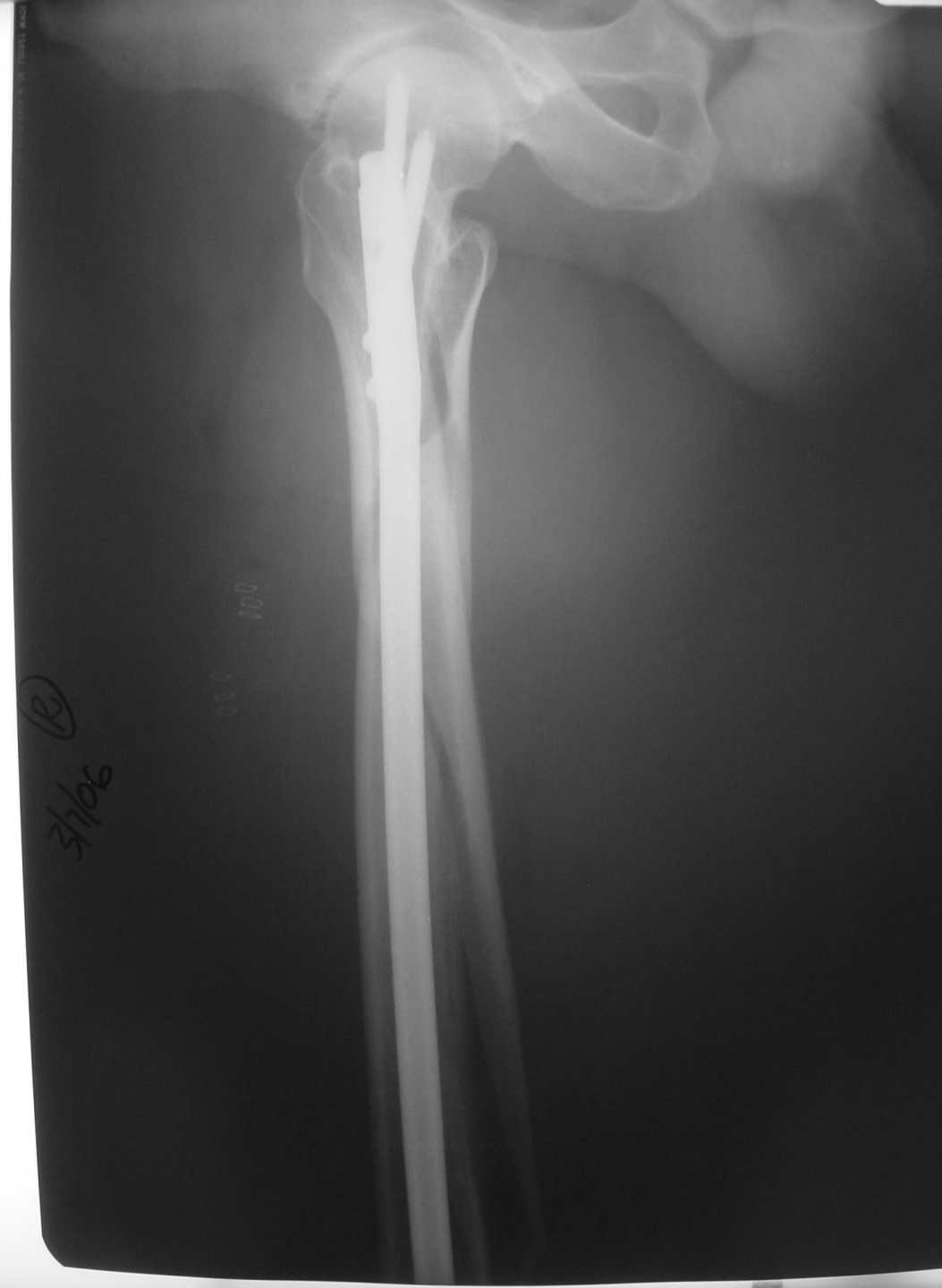
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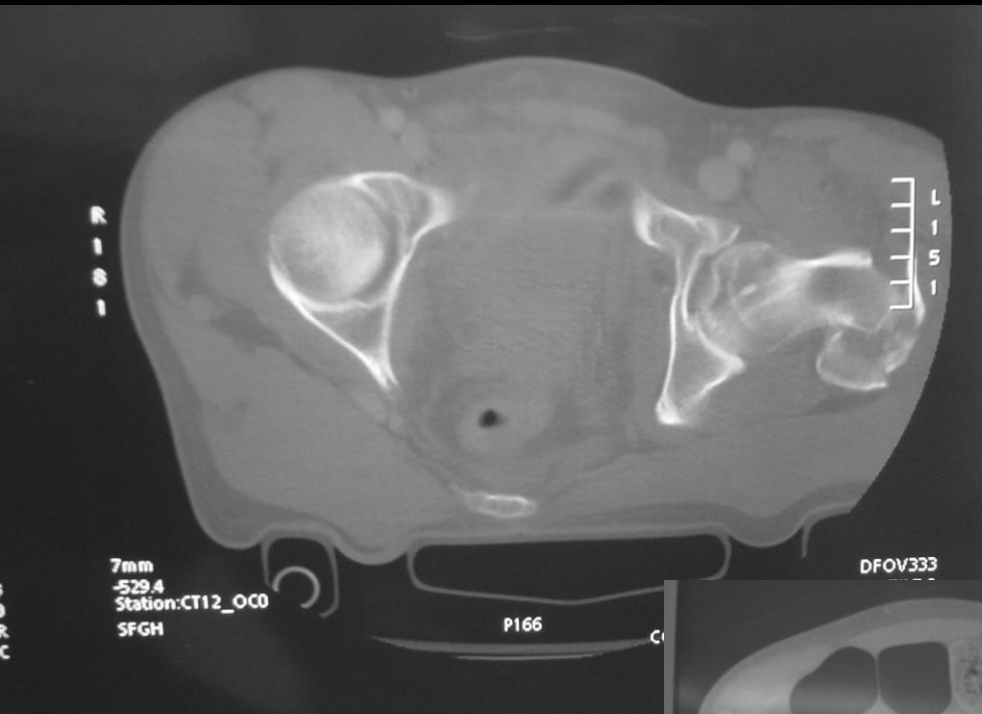
(R)
3/7/06



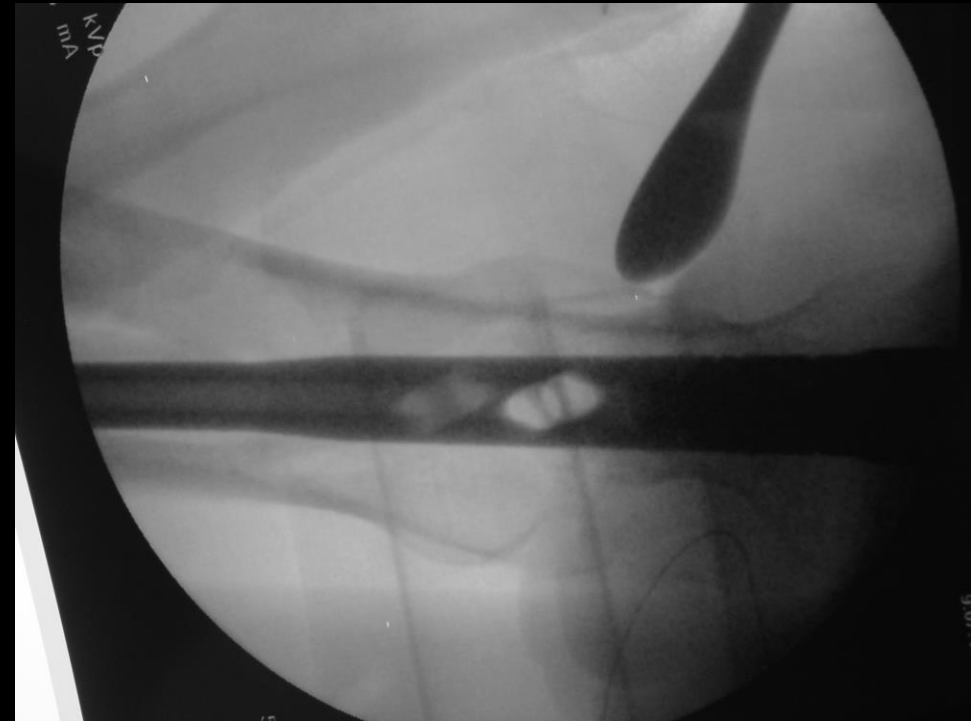
Short Segment Femur Fracture

54 yo male jumper 30ft

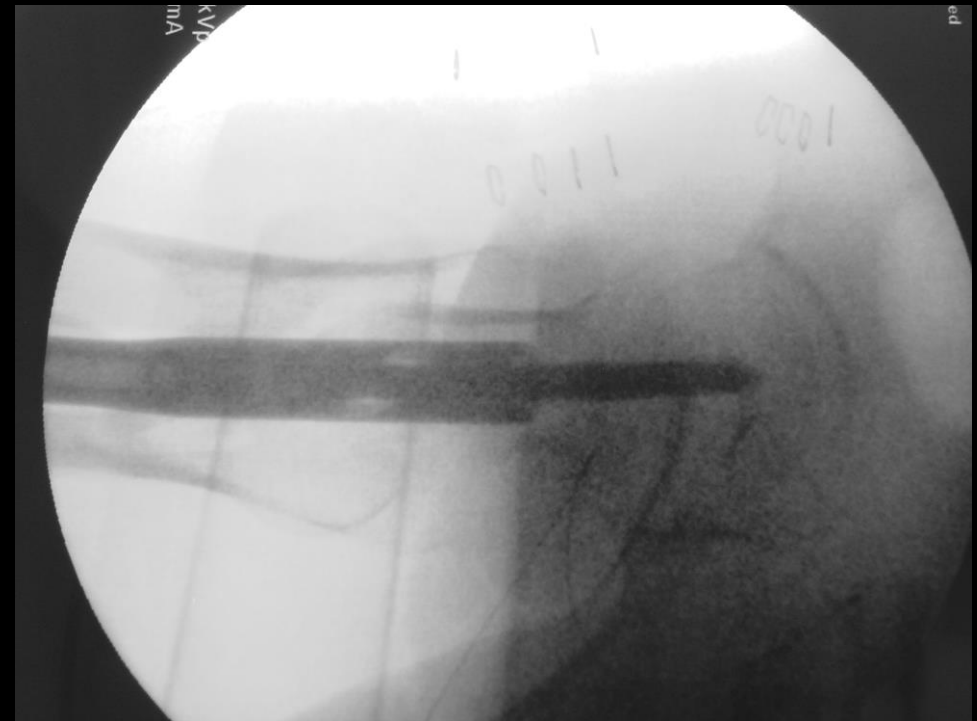


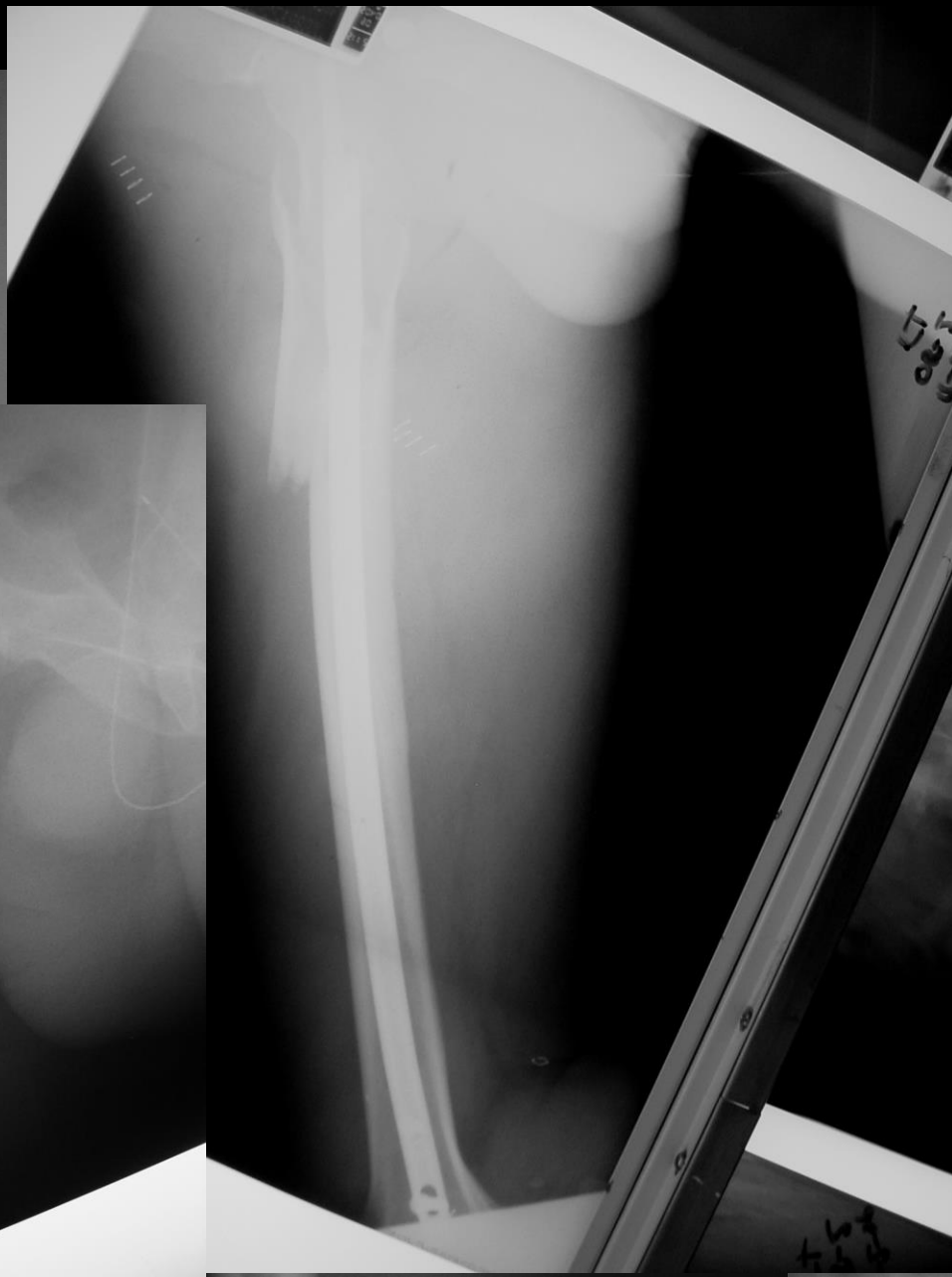


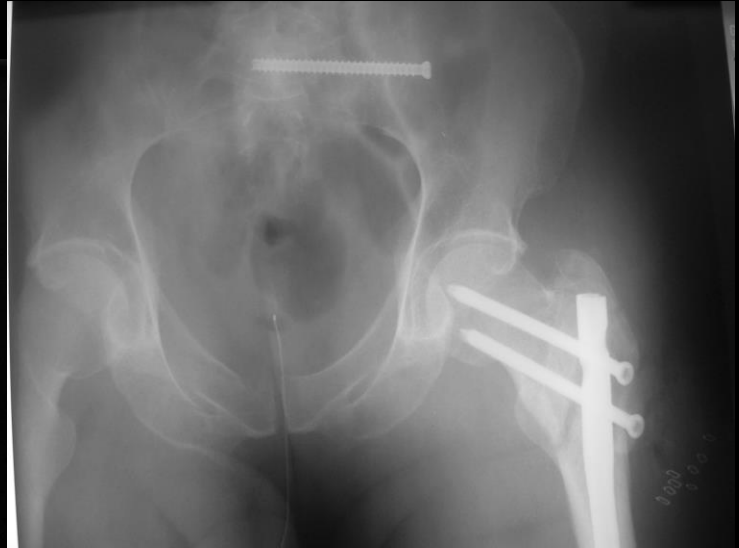
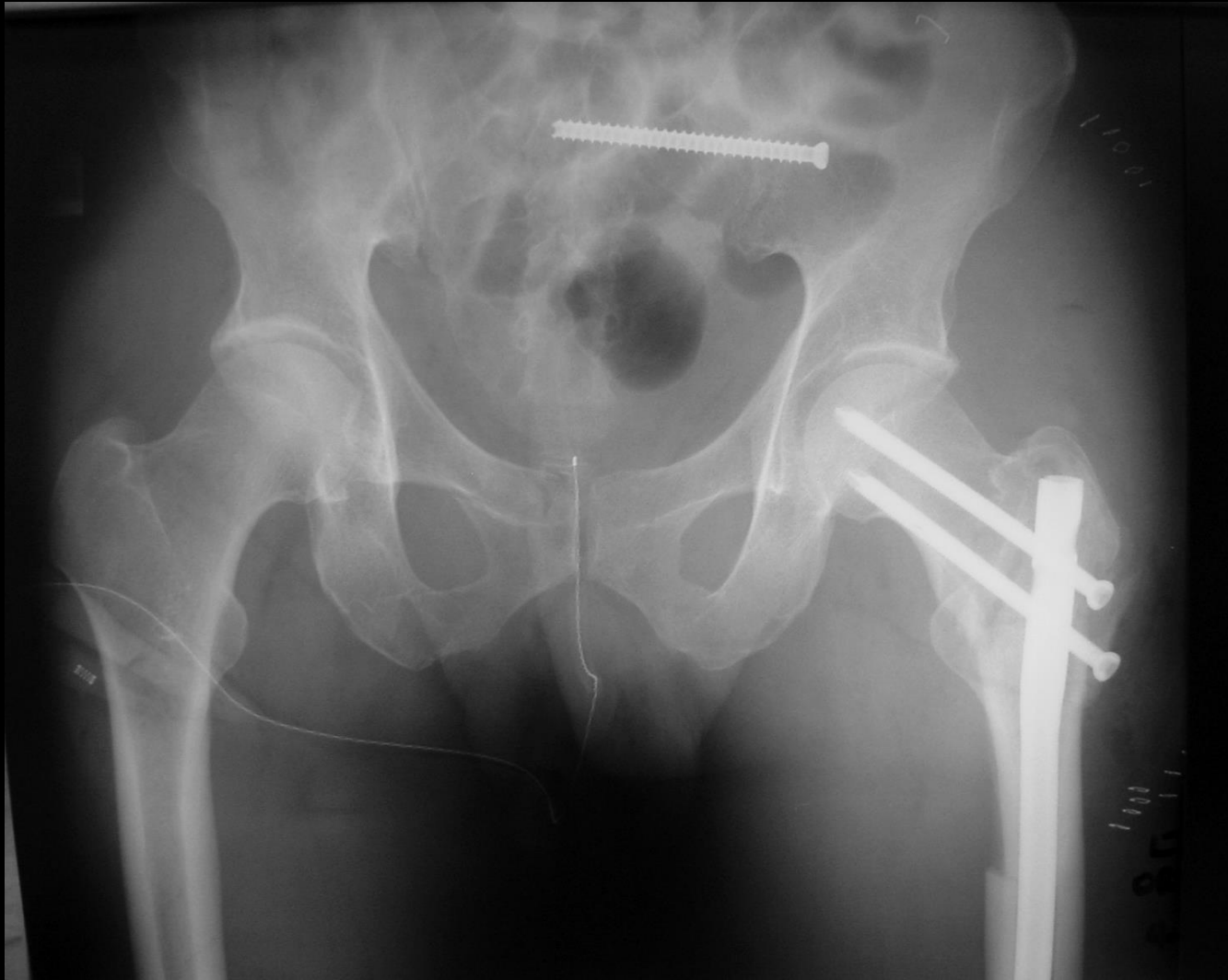
TEN 38cm x 11 mm



Two screws into head



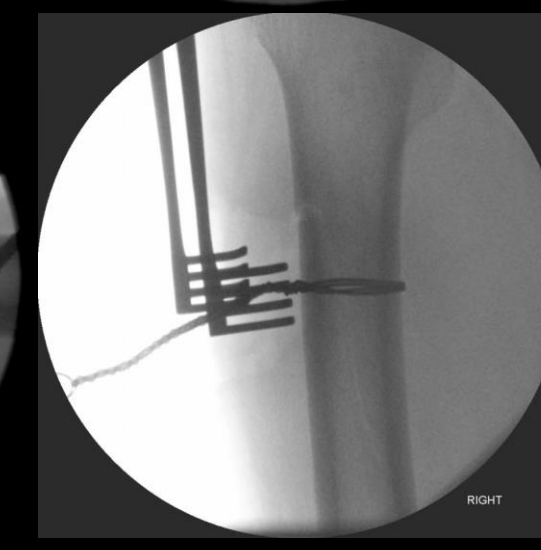
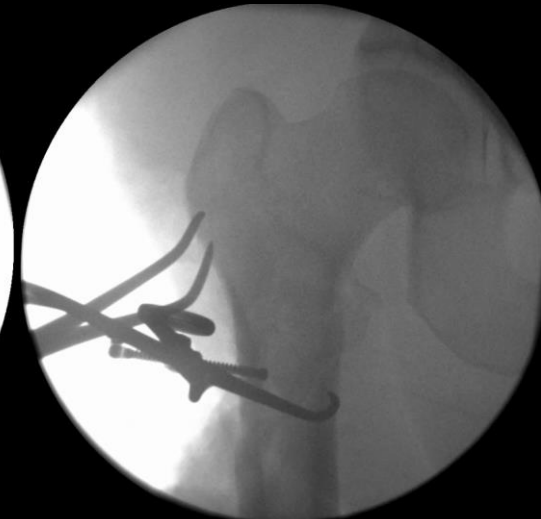
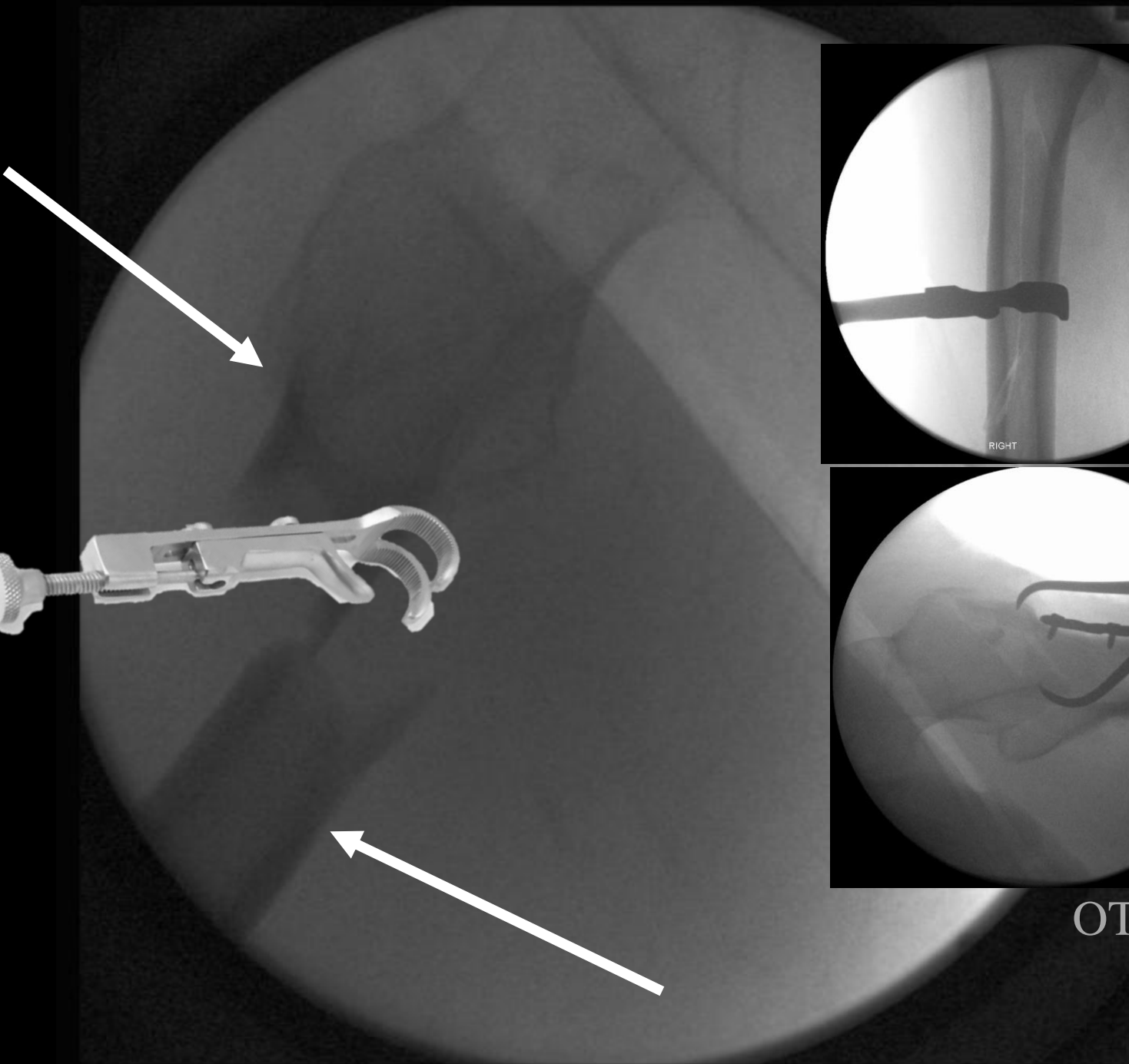






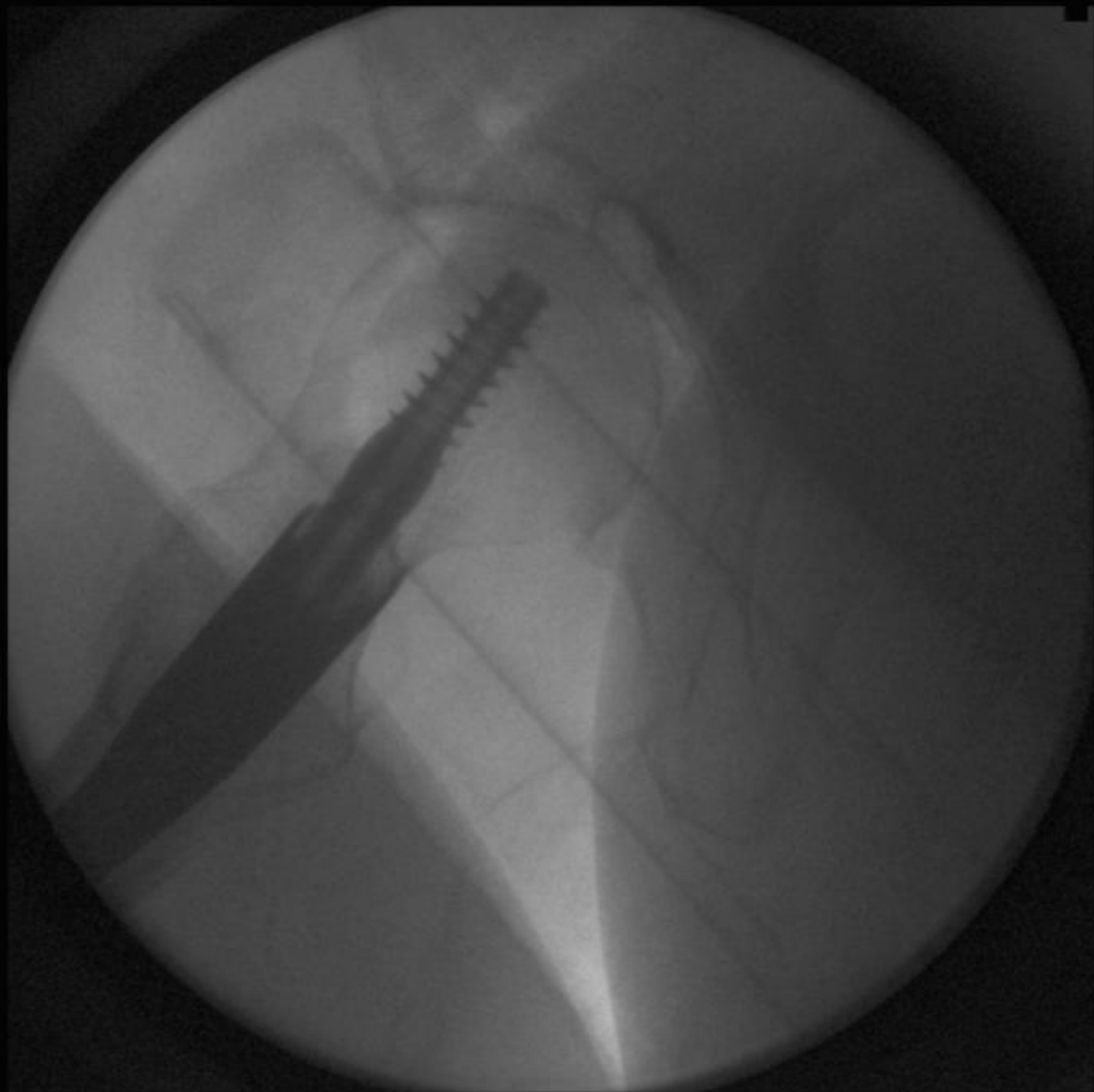
67 year old cyclist

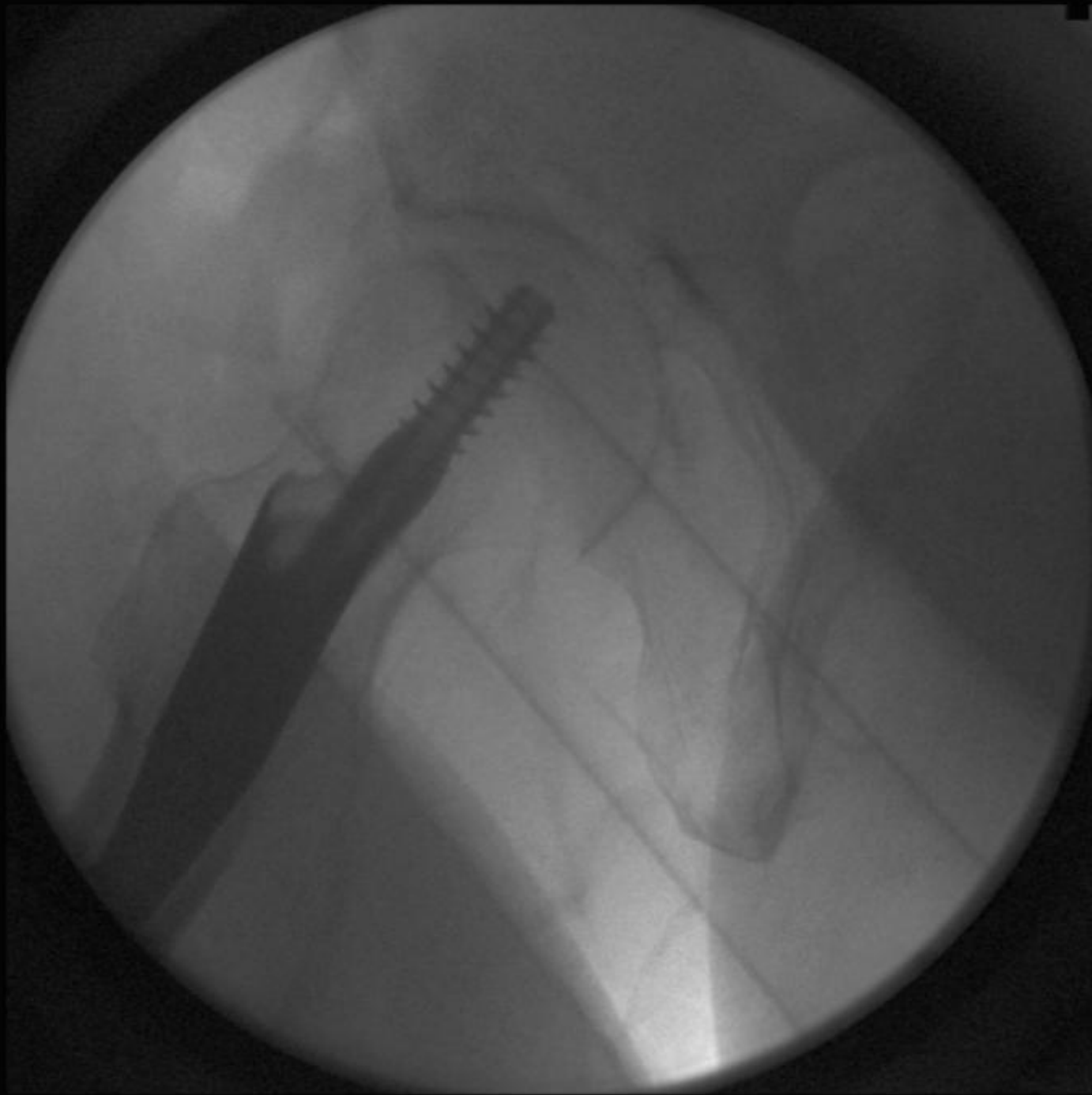




OTA Resident Lecture











R

OR #4



Thank You