

Proximal Femur Fracture Fixation Challenges and Solutions

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Risk factors for Complications in Prox Femur Fx

- Patient
comorbidities, osteoporosis
- Fracture
CF: posterior comminution, displacement,
vertical fracture line, fracture of calcar/
TF: comminution of calcar, lesser trochanter fracture, metaphyseal
comminution, lateral cortex fracture, greater trochanter comminution
- Treatment
CF: screw fixation or screw-plate
TF: all implants suitable for simple fractures, cervicomedullary implants for
complex fractures
- Surgical technique
quality of reduction, implant positioning

Kokoroghiannis C Injury 2012;43(6):686–93.

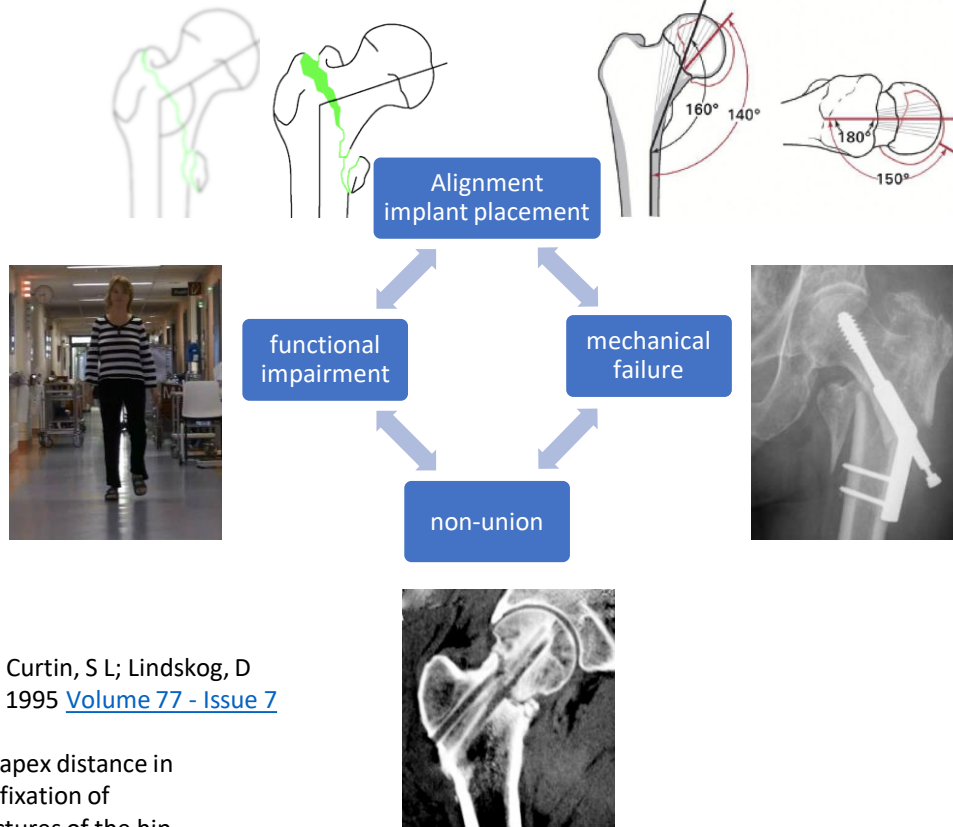
Norris R, Injury 2012;43(6):706–11.

Lenich A, Injury 2010;41(12):1292–6.

Kennedy M, Injury 2011;42(11):1317–21.

Liodakis E, Injury 2011;42(11):1342–5.

Vicious Circle for Complications



$$TAD = \left(X_{ap} \times \frac{D_{pos}}{D_{ap}} \right) + \left(X_{lat} \times \frac{D_{pos}}{D_{lat}} \right)$$

Baumgaertner, M R; Curtin, S L; Lindskog, D M; Keggi, J M JBJS-A 1995 [Volume 77 - Issue 7 - p 1058-1064](#)

The value of the tip-apex distance in predicting failure of fixation of peritrochanteric fractures of the hip.

Andruszkow H, Frink M, Fromke C, Matityahu A, Zeckey C, Mommsen P, Krettek C et al. Tip-apex index, hip screw placement, and neck-shaft angle as potential risk factor for cutout failure of hip screws after surgical treatment of intertrochanteric fractures. Int Orthop 2012;36:2347–54.

Zubairi A, Rashid R, Zahid M, Hashmi PM, Noordin S. Proximal femur locking plate for surtrochanteric femur fractures: factors associated with failure. OpenOrthop J 2017;11:1058–65.

Dealing with Challenges after failed Internal Fixation – what are the options?

- observation
- hip conserving surgical treatment
 - revision of internal fixation or
 - valgization osteotomy
- secondary arthroplasty



Torsion Problem

25y skiing accident

1st hospital 01/07

proximal femur nail fixation

discharge letter ... ,correct alignment'

2nd hospital 09/07

patient presents with pain, gluteal insufficiency

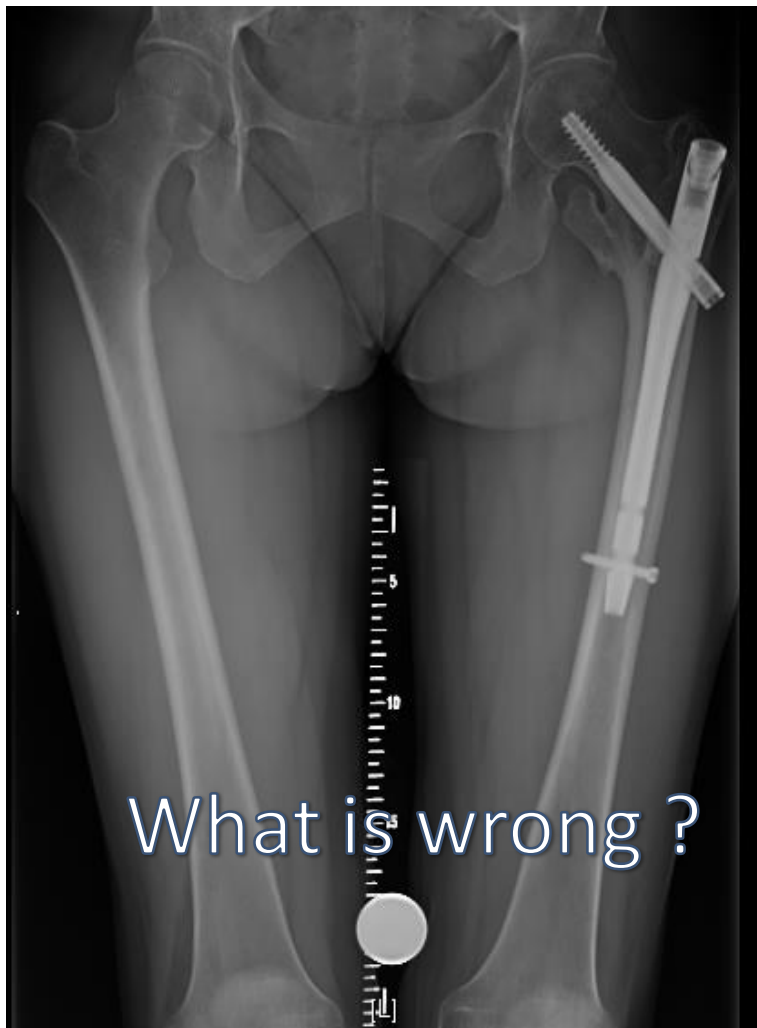
33° IR deformity, 12° varus deformity

09/07 revision (,alignment correction')

3rd hospital MHH 04/08

pain, gluteal insufficiency

24° ER, 12° varus



Torsion ... difficult to judge

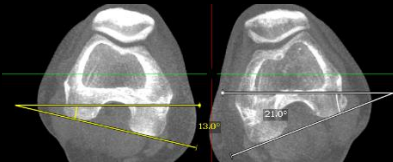
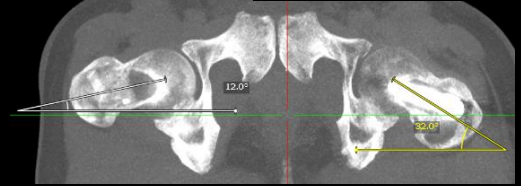
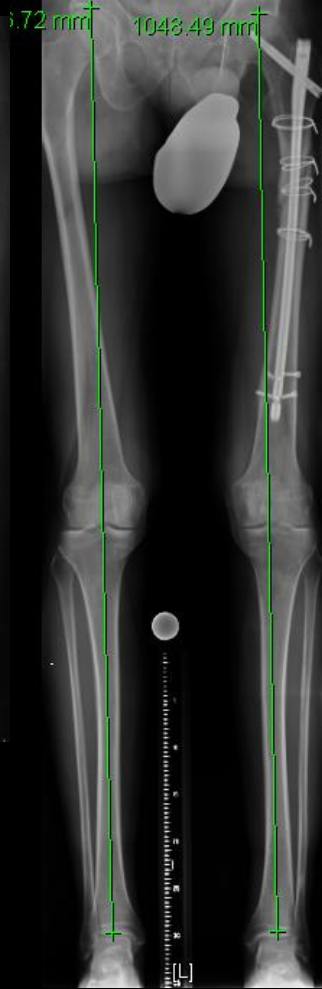


- not easily visible on plain films
lesser troch often fractured
- Patient tends to actively compensate
- clinical ROM testing postoperatively
painful
- lack of awareness
- routine check ROM in the OR
under anaesthesia
- postop
Lift off test
sit-test
watch the patient walking
- CT scan where it would have consequences



Varus / Starting Point Problem

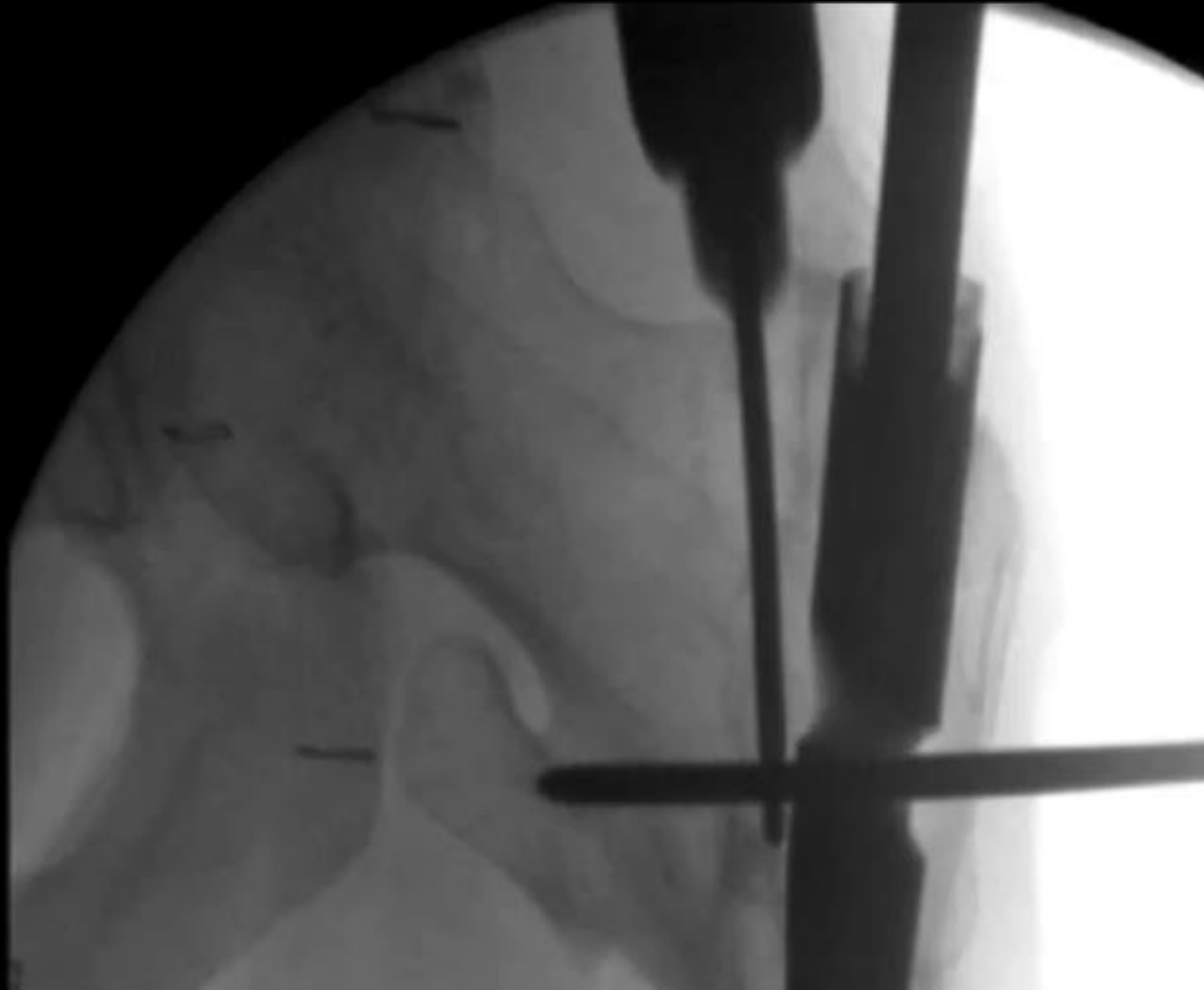
6 month after
proximal femur nailing
pain, limping,
abductor weakness
non union



28° IR
8° varus
deformity

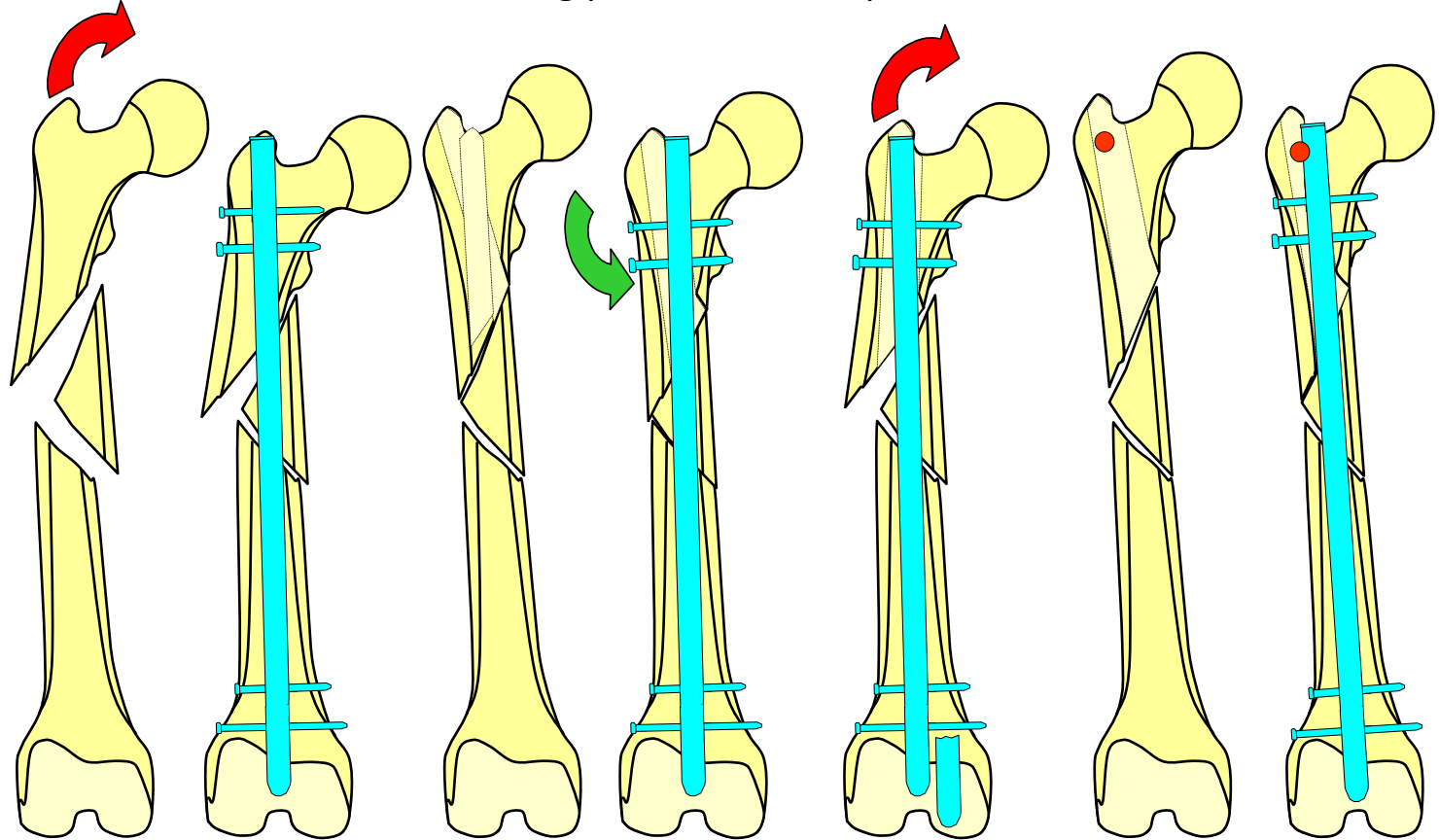
Varus / Starting Point Problem

6 month after
proximal femur nailing
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Create not only new entry but also block wrong entry

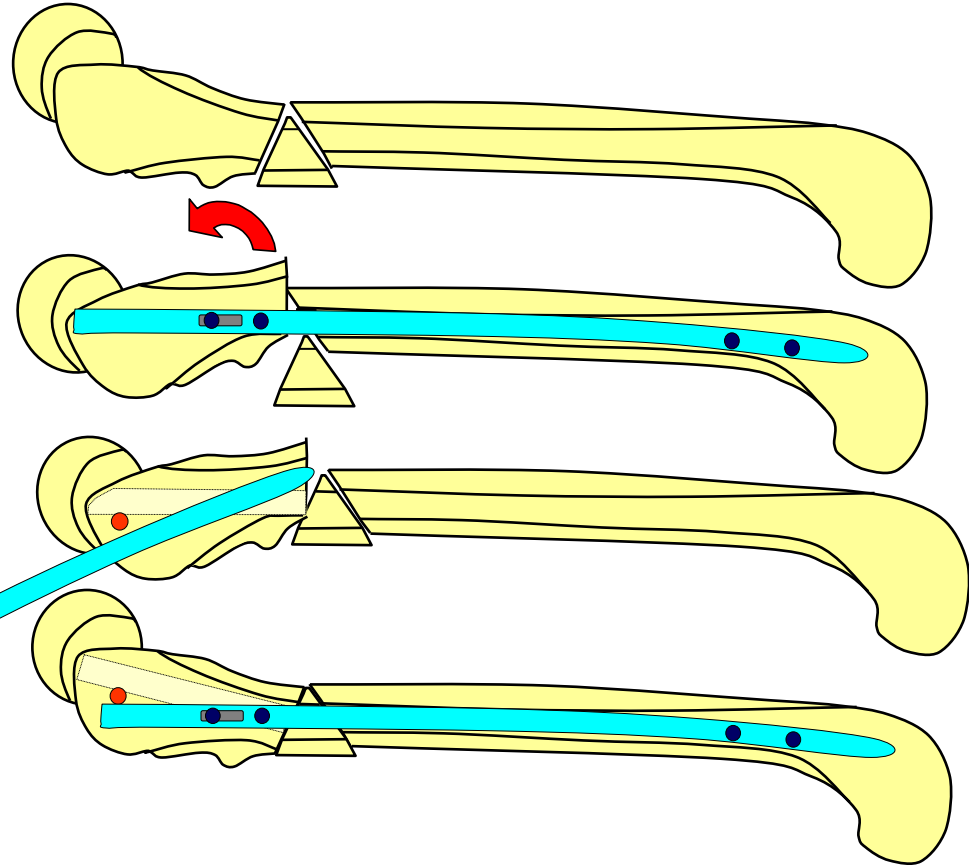
even if we make a new starting point, the nail slips back



Krettek C. Intramedullary nailing:
Techniques of relative stability.
In: AO Principles of Fracture
Management, ed by TP Rüedi et
al 2001.

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- starting point often too lateral
- reasons
 - convenience
 - asymmetric reaming
 - lateral softer than medial
 - soft tissue forced shift
- better start slightly more medial
- correction to lateral is easy in contrast to vice versa

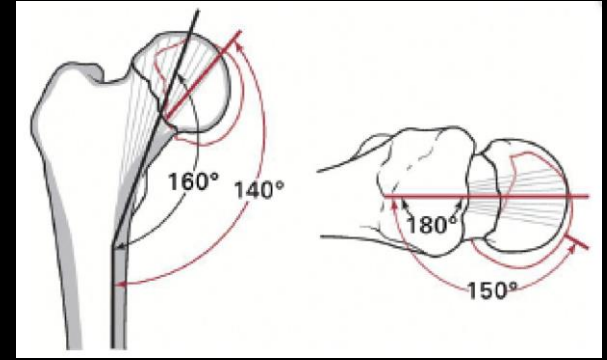
36 y, female
ski accident



01/01/2001



01.2001
postop



Criteria for good reduction according to Garden A/P angle of 160° (axis between diaphysis and neck-head trabeculae) and lateral angle of 180° (alignment of trabeculae).

Zubairi A, Rashid R, Zahid M, Hashmi PM, Noordin S. Proximal femur lockingplate for sur-trochanteric femur fractures: factors associated with failure. *OpenOrthop J* 2017;11:1058–65.



20.06.2001

pain, non-union

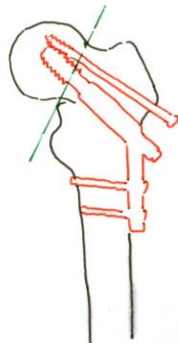
shortening, abductor weakness

Q: would revising the fixation solve the problem?

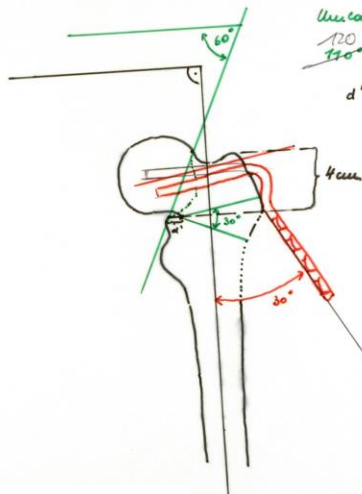
Pagels Mitha * 7.2.67

Zg: Schenkelhalsprothesen nach Schenkelschale G.

Th: Umlagerungsprothesen 26.7.01



fi

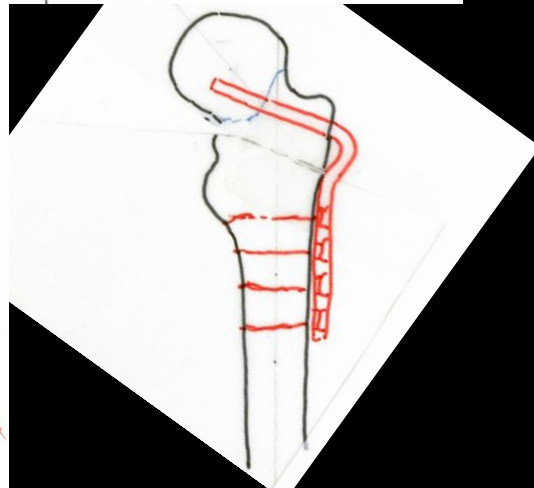
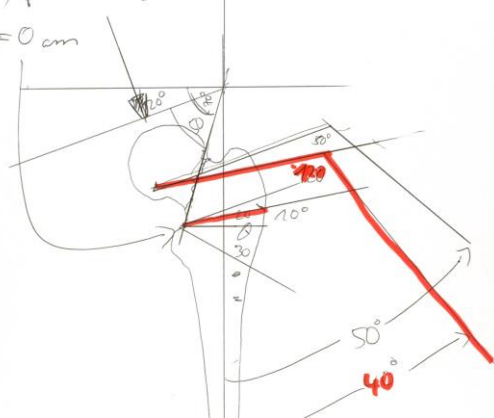


Umlagerungsrichtung = 50°
 20°
 70° Osteotomie flach, Länge 65 mm

d' = 1 cm

1. J.B. DHS, Schraube
2. 4 cm distal Troch. major
 5D parallel Calcar
3. 30° α, 5D prox. Fem.
 dist. 2 cm } → d'
4. d' = 1 cm lat. Calcar
5. parallel prox. 3D Einbringen
 3D im Kopf
6. Einbringen Platten-
 instrument, dann Winkelstift
7. Osteotomie, Entfernen Keil
8. Mobilisation Bein, Schrauben-
 ost. Femur

PA 70° → 20° → 50° Umlagerung
 d = 0 cm





2y after Pauwels OT
FWB, no pain, active

all good?



Fx healed ...but for the price of new problems

- shortening now 35mm
feels balanced with 20mm block
LLD before accident - 10mm
- left ab-ductor weakness despite intense rehab

Gait analysis
Increased step length (76 vs 70 cm = +6cm) left,
Increased pelvic ant rotation (20°) left Stand-/Abrollphase





Fx healed ...but for the price of new problems

- shortening now 35mm
feels balanced with 20mm block
LLD before accident - 10mm
- left ab-ductor weakness despite intense rehab

Gait analysis
asymmetric gait pattern
Increased step length
(76 vs 70 cm = +6cm) left,
Increased pelvic ant rotation (20°)
left Stand-/Abrollphase



Geometric Analysis

healthy side
as reference

projected
contour of
healthy side

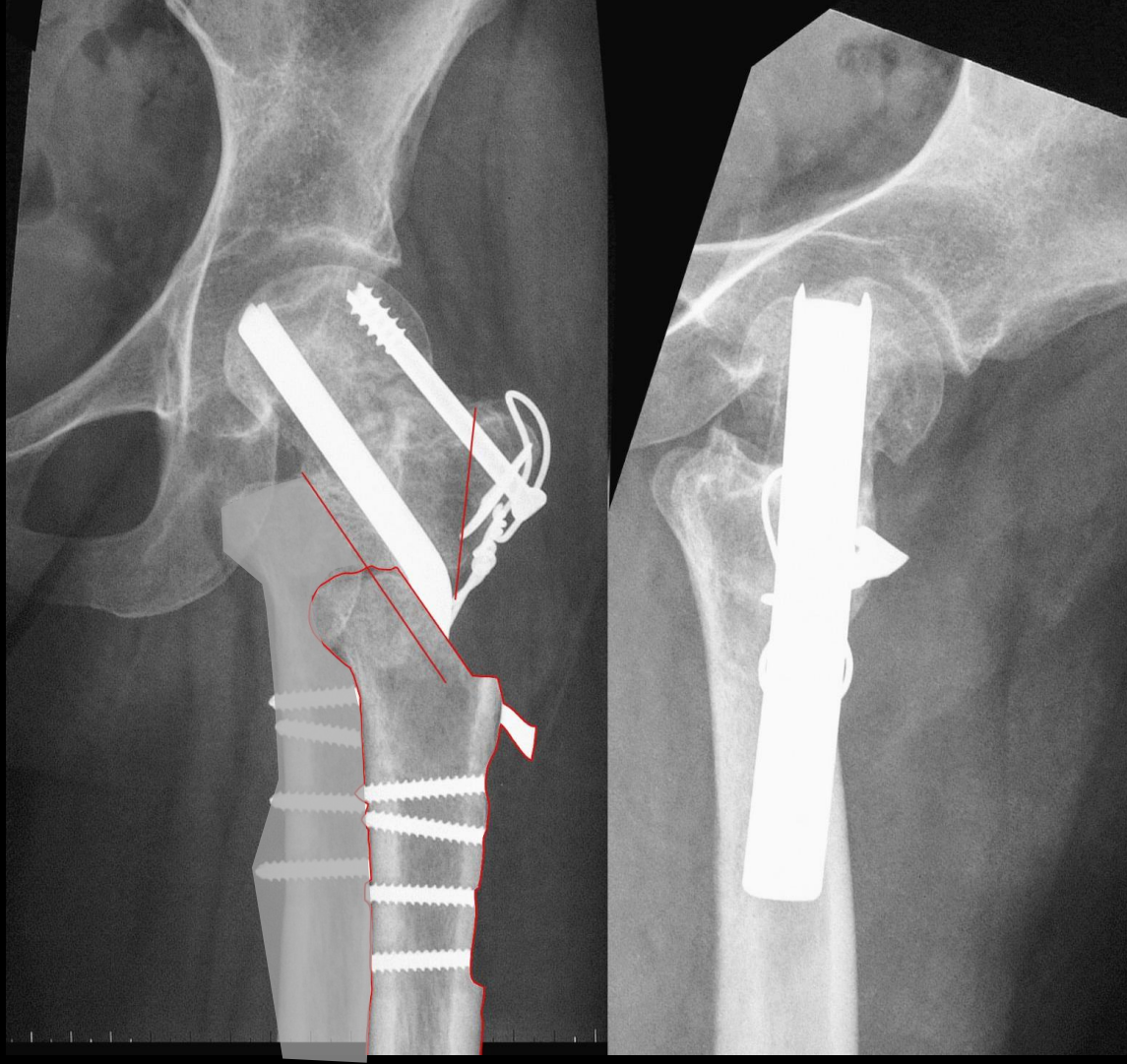
- Pauwels Osteotomie
- Shortening 35 mm
- External torsion 15°
- Genu valgum 5°
- Abductor lever arm -23mm
35mm vs 58mm
- Rekurvatum 15°

Surgical Option 1

1) oblique osteotomy
(Morscher) for shaft
lengthening & shaft
lateralization &

2) sagittal osteotomy for
trochanter lateralization

not suitable



Morscher Osteotomy Through Surgical Dislocation Approach
for True Femoral Neck Lengthening with Greater Trochanter
Transposition

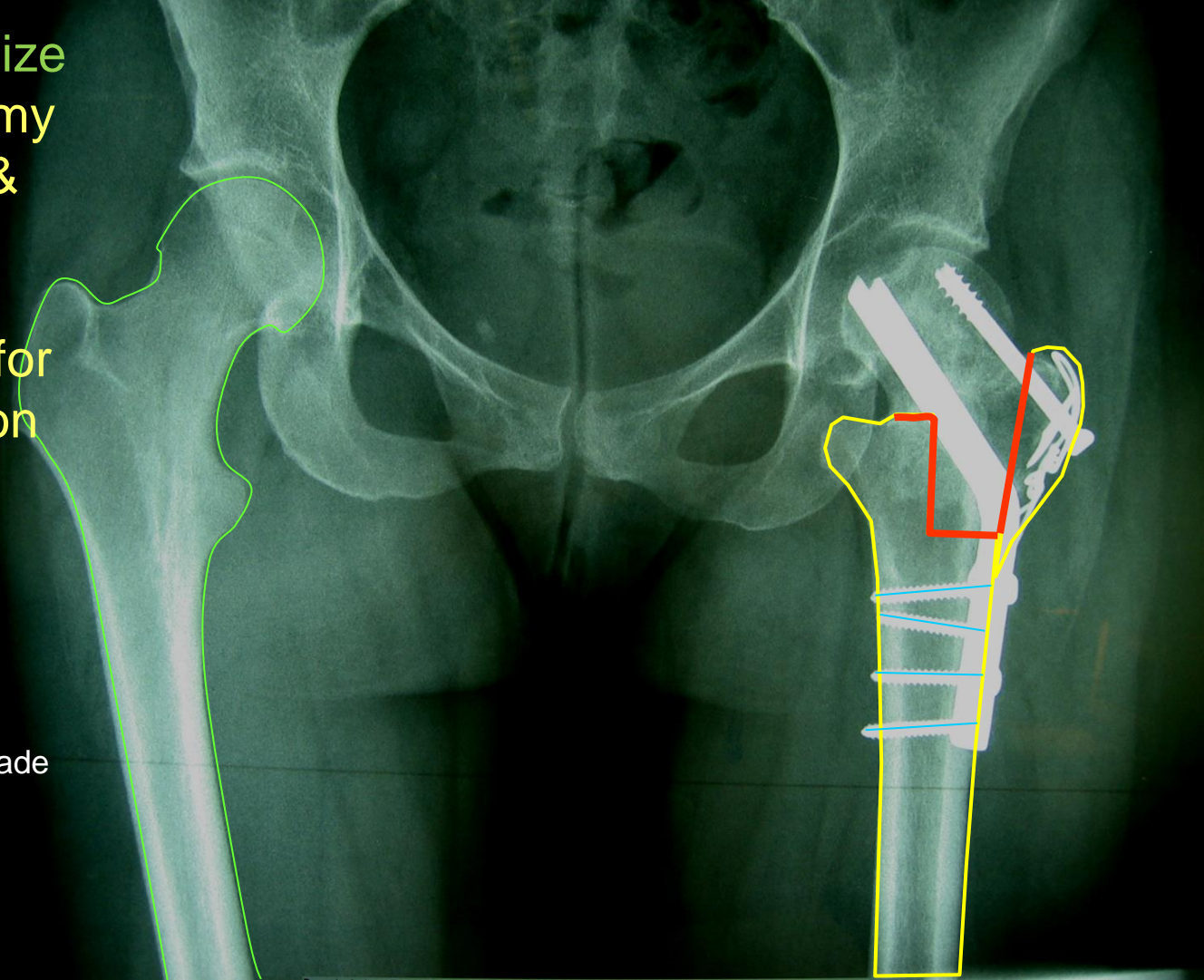
P. A. Faure, I. Zaltz, K. Cote, S. Pelet, C. Forsythe, P. E.
Beaule, et al. J Bone Joint Surg Am 2020 Vol. 102 DOI:
10.2106/JBJS.20.00405

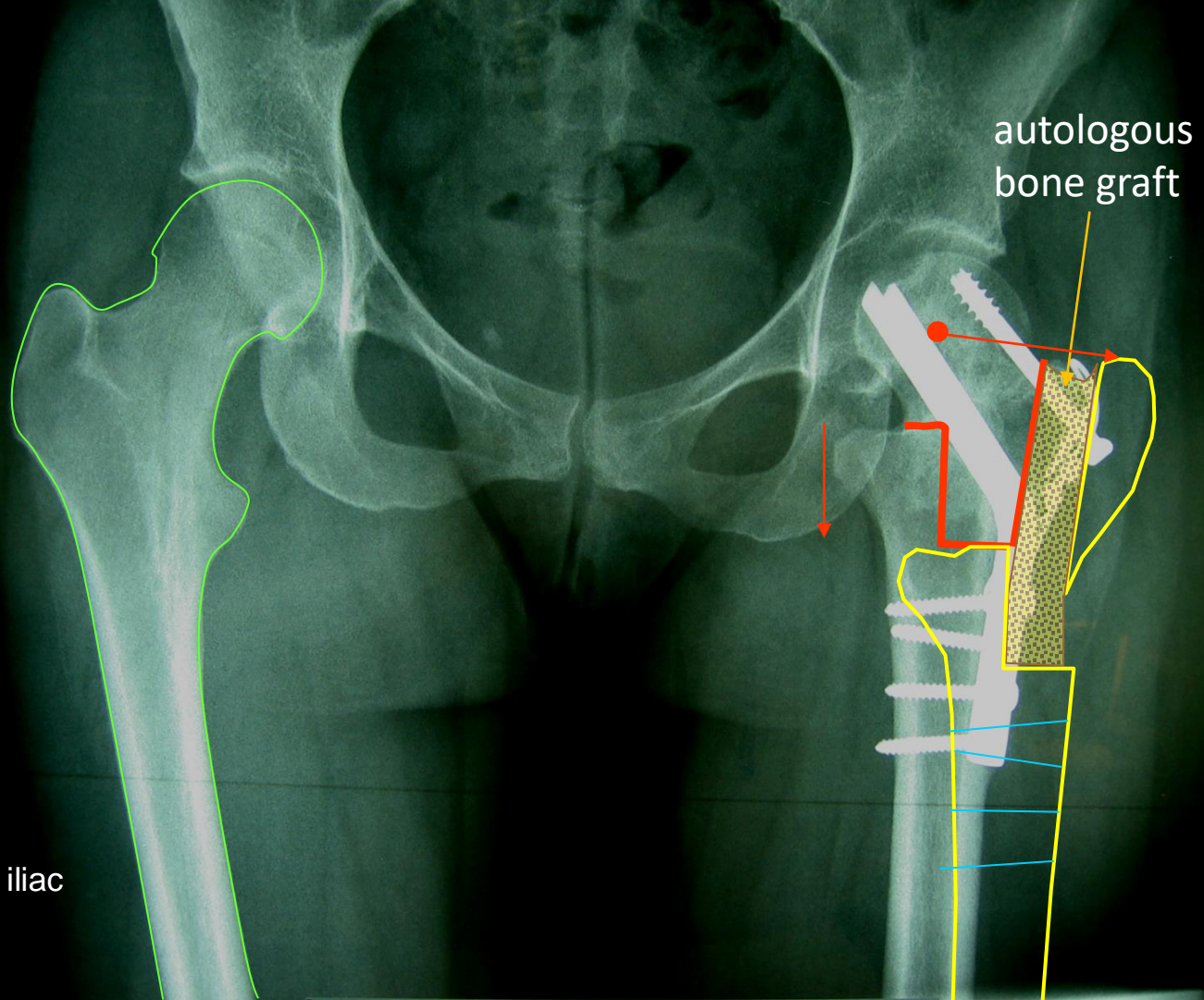
Option 2 better to realize
1) transverse osteotomy
for shaft lengthening &
shaft lateralization

2) sagittal osteotomy for
trochanter lateralization

surgical steps

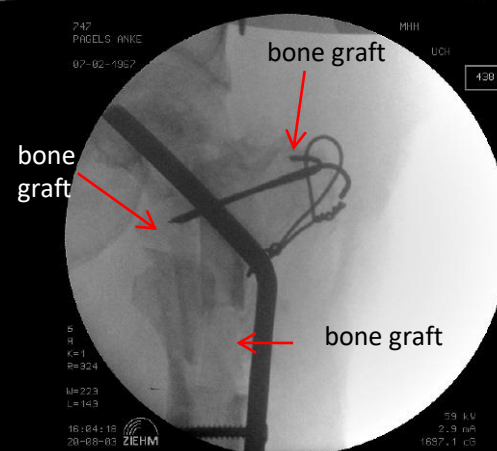
- Implant removal
- placement of torsion marker
proximal & distal
- Trochanter osteotomy
- Blade seat for 95° Condylar blade
- Z-type osteotomy
- filling of old blade channel

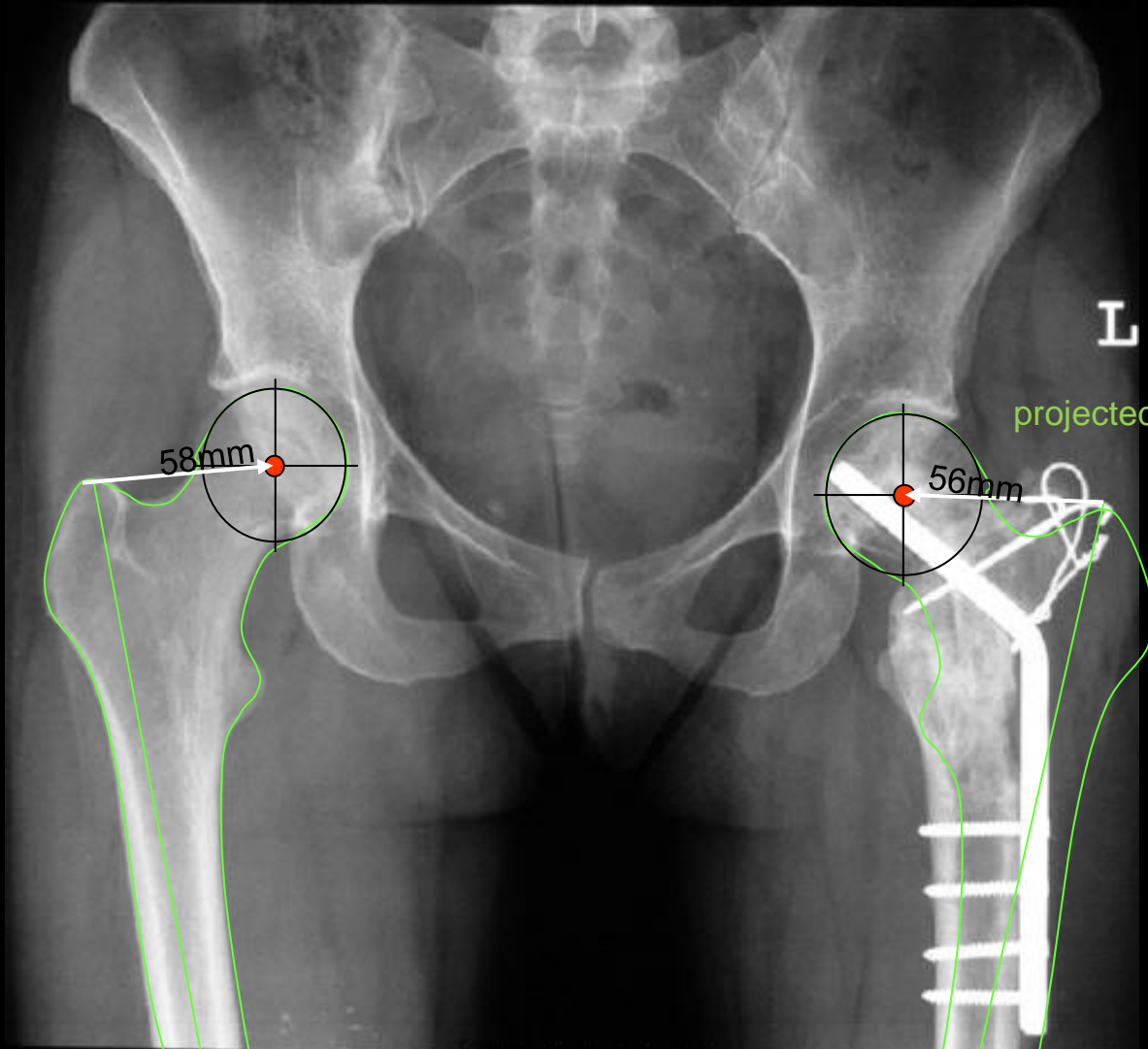




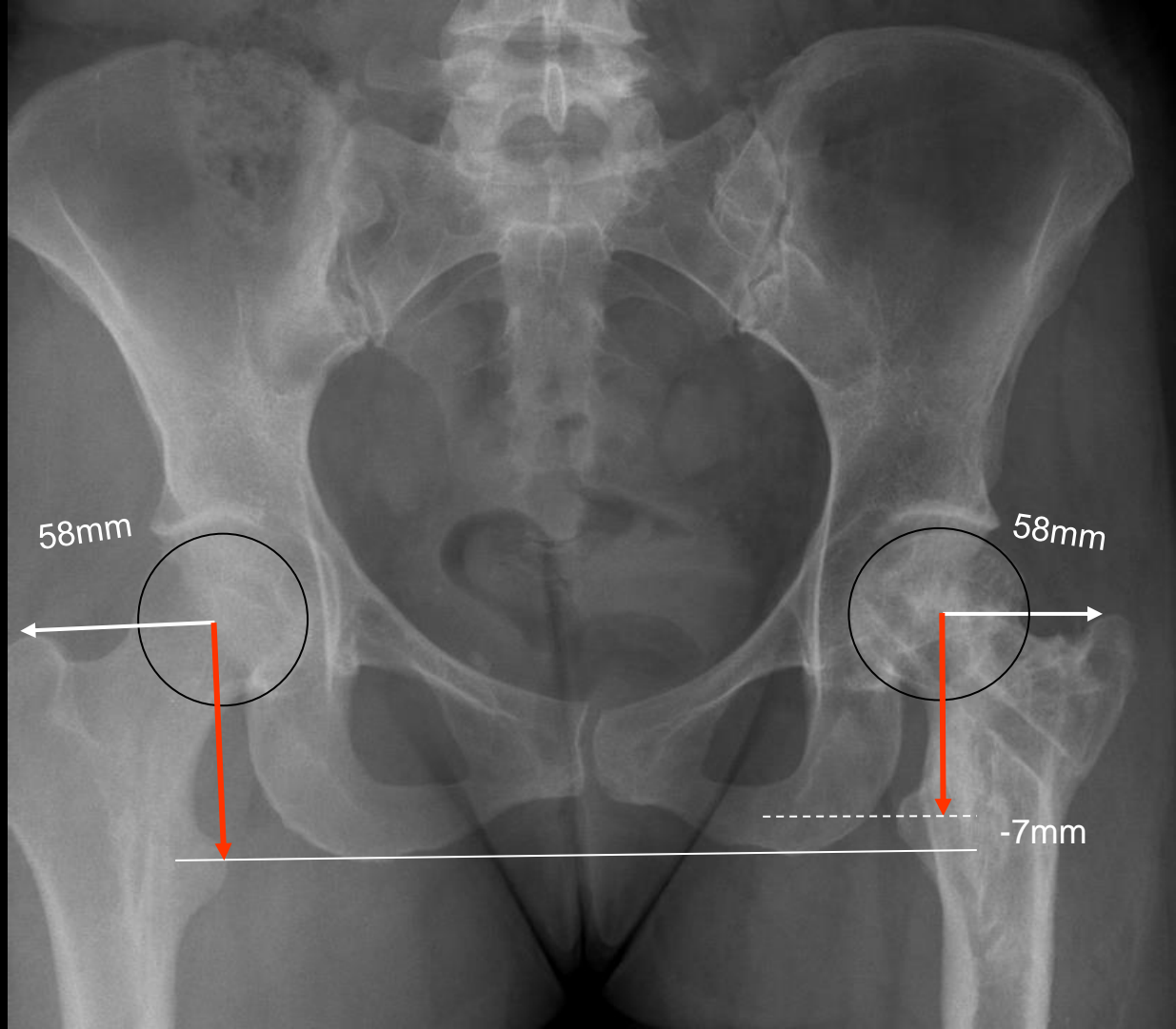
- Distraction with plate tensioner
- Large bone graft from posterior iliac crest

Intraoperative steps





projected contralateral side

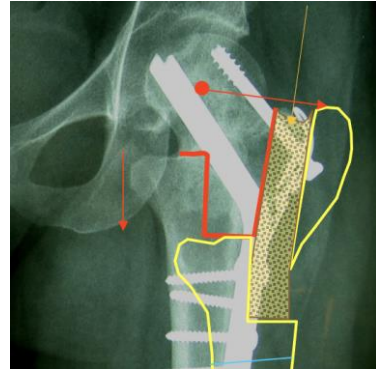


4yFU



Summary...

- proximal femur fractures challenging
there are many biological factors we cannot influence
- So the surgical factors should get even more attention, since it makes a difference
- Implant placement and fracture alignment are a key factors
- Varus is our enemy but don't forget the torsion
- Valgus osteotomy solves one problem but at the same time creates new problems. Solving these is possible but complex



Proximal Femur Fracture Fixation Challenges

- older patients
- increased co-morbidities and predisposing factors like osteoporosis
- mortality (10% at 30 days / 31% at 3m (Theodorides 2011))
- Despite various attempts like NICE guidelines, no broad significant improvement last 40y (Smith 2011)

Proximal Femur Fracture Fixation

Current Treatment

> [J Arthroplasty](#). 2013 Sep;28(8):1386-90. doi: 10.1016/j.arth.2012.09.007. Epub 2013 Mar 25.

Surgical treatment of trochanteric and cervical hip fractures in the United States: 2000-2009

[Sunny H Kim](#) ¹, [John P Meehan](#), [Mark A Lee](#)

Affiliations + expand

PMID: 23535286 DOI: [10.1016/j.arth.2012.09.007](#)

Trochanteric fractures

internal fixation 96%-98%

Cervical fractures

hemiarthroplasty (HA) 61% or total hip arthroplasty (THA) 5%

internal fixation 33% (variation by age < 60y 2/3 internal fixation)

Patient 25y

skiing accident

1st hospital 01/07

proximal femur nail fixation

discharge letter ... ,correct alignment'

2nd hospital 09/07

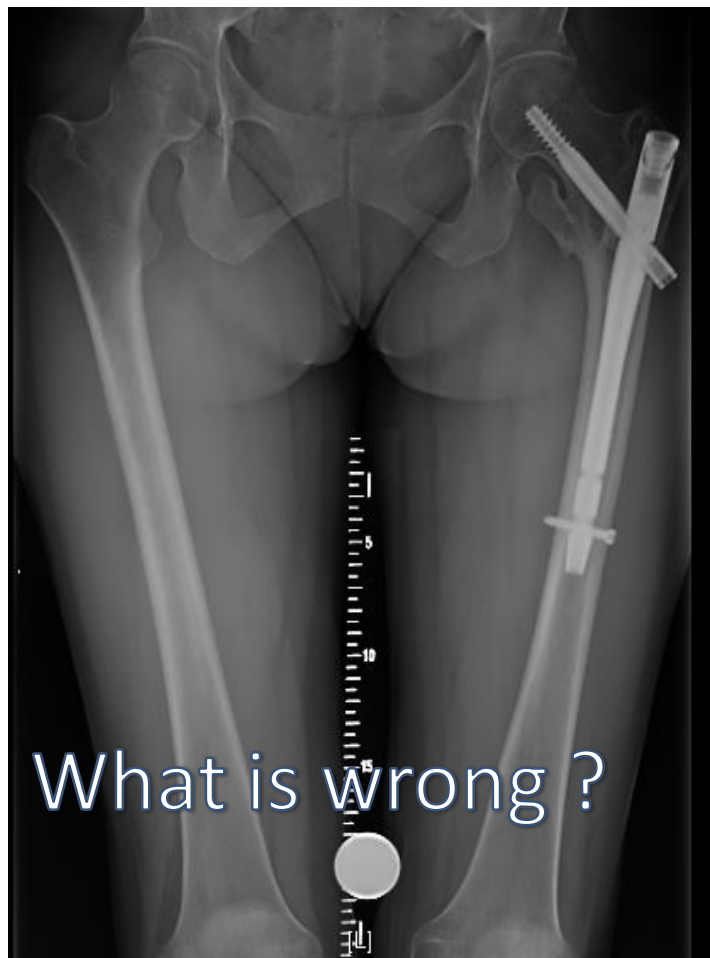
patient presents with pain, gluteal insufficiency

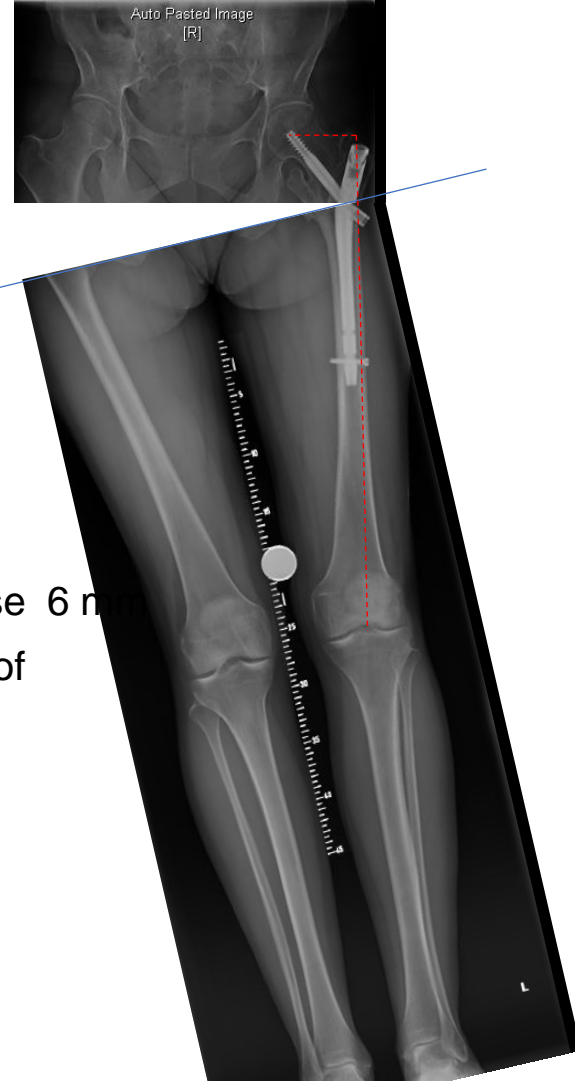
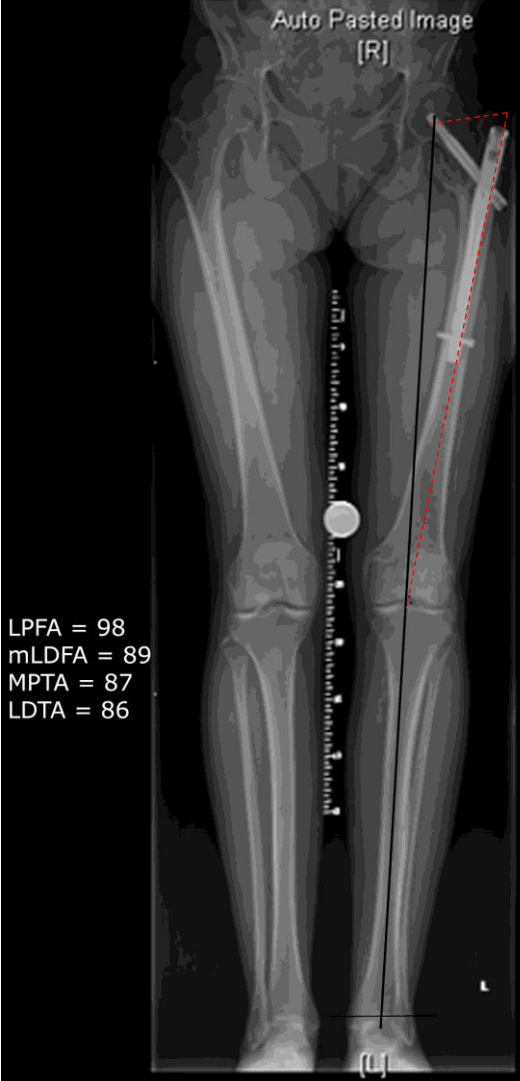
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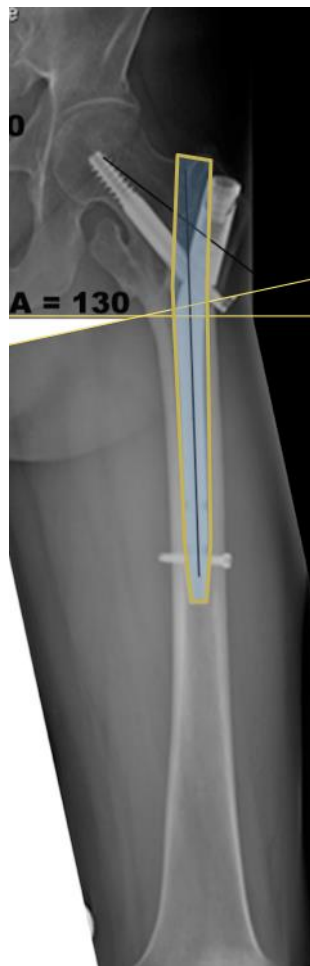
pain, gluteal insufficiency **24° ER, 12° varus**







- Wedge 12°
- Wedge Base 6 mm
- Correction of rotation 24°





Lessons to learn ...

- vertical shear neck fx in young patients risk for non-union
- ‚healed‘ non-union – don’t trust x-rays
- Pauwels osteotomy has a price
 - abductor leverarm
 - shortening
 - knee valgus

*07.02.67

SP FWD STILL
TCR * 23:58:51:21



Proximal Femur Fracture Fixation Challenges in Implant Selection

- trochanteric fractures: sliding hip screw (SHS) versus nail
SHS: no difference for stable trochanteric fractures
- reverse oblique fractures: nail fixation most appropriate implant of choice

Kokoroghiannis C Injury 2012;43(6):686–93.
Norris R, Injury 2012;43(6):706–11.
Lenich A, Injury 2010;41(12):1292–6.
Kennedy M., Injury 2011;42(11):1317–21.
Liodakis E, Injury 2011;42(11):1342–5.

iPhone supported torsional correction

concept:

analyze Schanz screw angulation before (27°) & after (?) correction (off-label)

