

A. Volna

# Вертельные переломы. Аугментация – универсальное решение проблемы?

Избранные вопросы лечения около и внутрисуставных переломов  
Волгоград, 15 декабря 2017 года



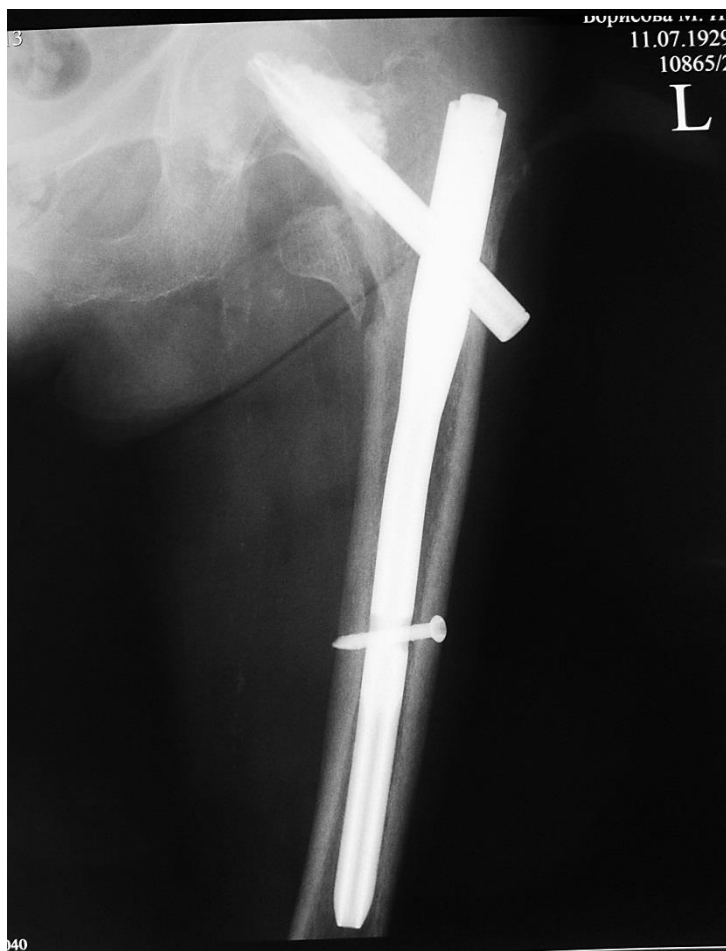
# Clinical case. Female, 83.5 yo, pertrochanteric fracture



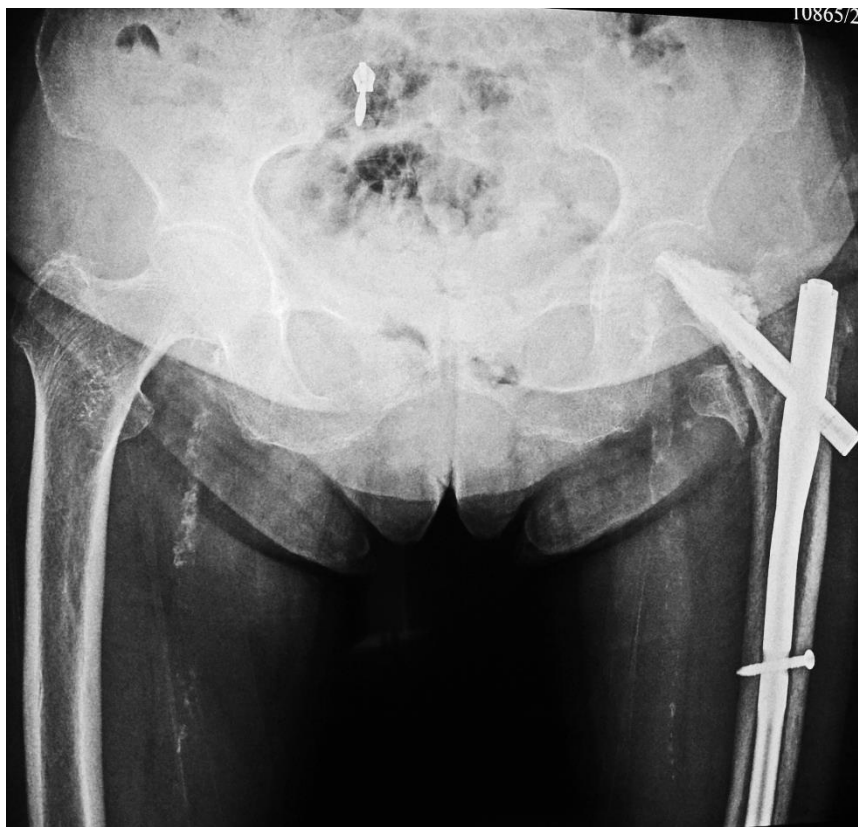
# Clinical case. Female, 83.5 yo, pertrochanteric fracture



# Clinical case. Female, 83.5 yo, pertrochanteric fracture, 6 m follow-up, no pain, full w-b



**Clinical case. Female, 83.5 yo, pertrochanteric fracture, 6 m follow-up, no pain, full w-b. Next?**



**Clinical case. Female, 83.5 yo, pertrochanteric fracture, 9 m follow-up, no pain, full w-b. Next?**



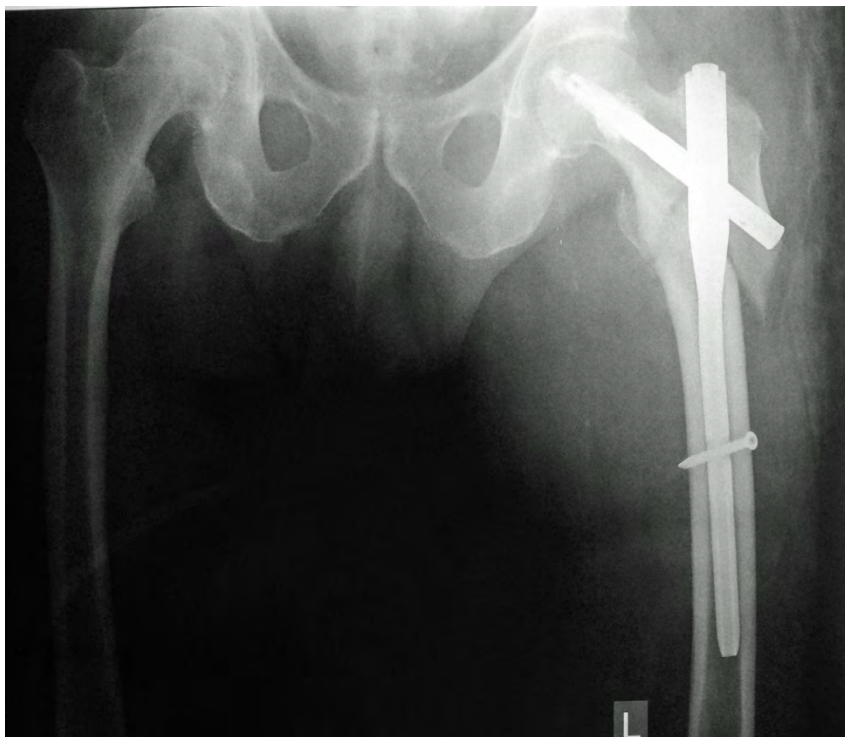
# Clinical case. Female, 83.5 yo, pertrochanteric fracture, 9 m follow-up, no pain, full w-b



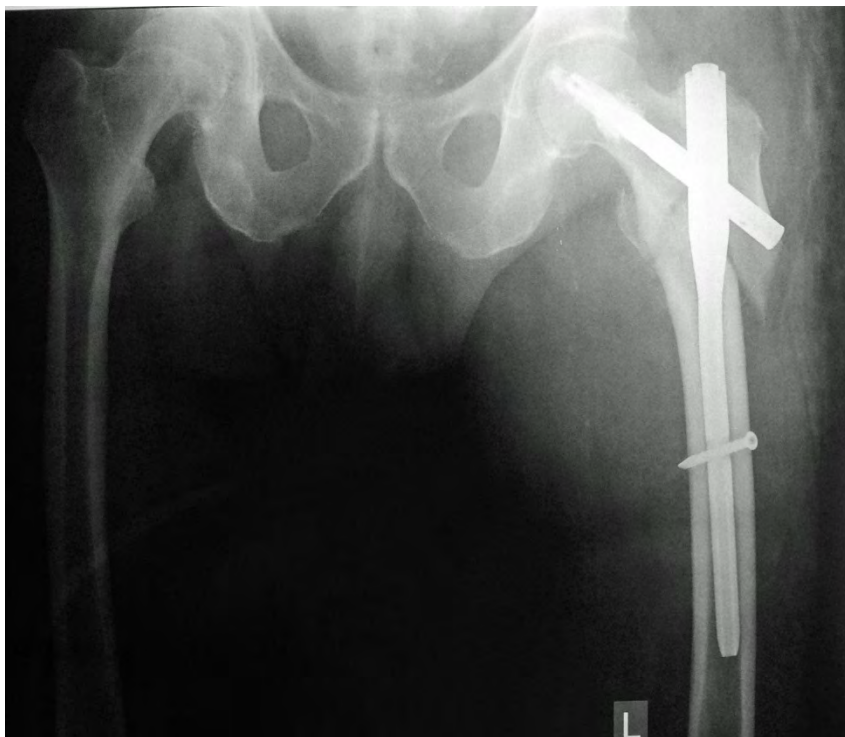
**Clinical case. Female, 83.5 yo, pertrochanteric fracture, 9 m follow-up, no pain, full w-b. Next?**



# Clinical case. Male, 90 yo, intertrochanteric fracture. Husband



# Clinical case. Male, 90 yo, intertrochanteric fracture. Husband. Next?



# Clinical case. Female, 72 yo, trochanteric fragility fracture



- Nursing home resident
- Schizophrenia
- 1 months after injury
- Before the fracture walked only with assistance within the home
- Cachexia
- After fracture taken the “pose of embryo”
- Anemia Hb72

# Clinical case. Female, 72 yo, trochanteric fragility fracture



- Treatment options:

- HR

- PFN

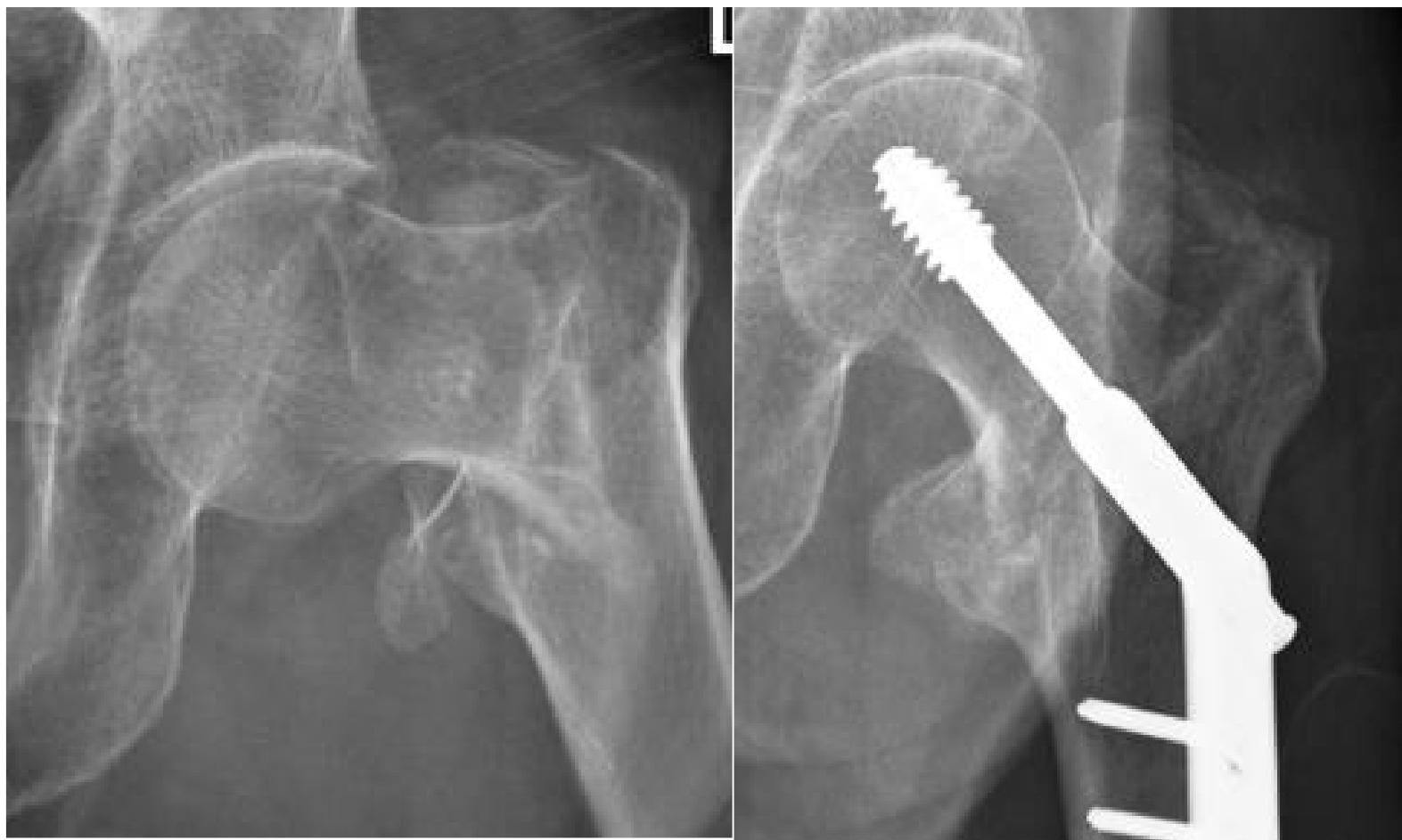
- Plating

- Conservative

# Learning outcomes

- Assess injury patterns
- Compare treatment options and define principles of fixation
- Identify parameters that are associated with poor outcome
- Discuss TAD
- Recognize how augmentation of the blade can improve outcomes

## DHS – “Gold standard”



## Disadvantages of DHS with unstable fractures

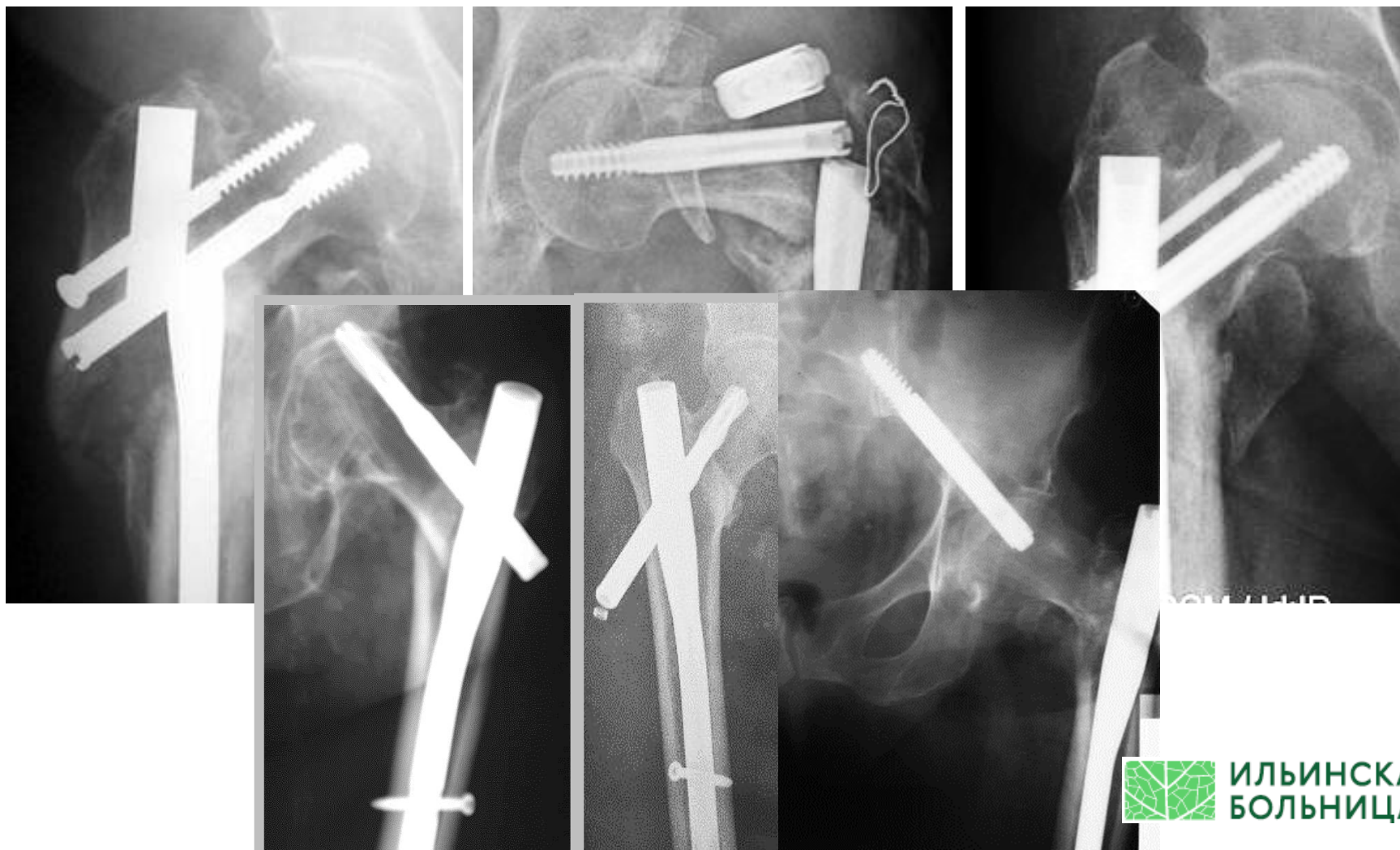
- **Shortening >1 cm - 47%**
- **Fixation failure**
- **Only 28% walk unaided in 6 m.**



# Is nail the best way out for all fractures?



# Is everybody satisfied with current surgical techniques for 31 A2 and A3 type fractures?



## First generation of nails

Thicker nails – 17mm

Fracture below the tip –  
up to 17%

Cut-out – up to 4.3%

Thigh pain - up to 20%



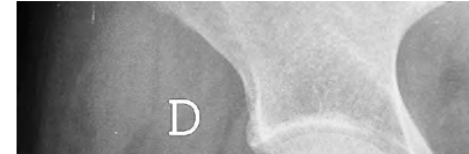
## Second generation of nails

Design changes – thinner nails

Fracture below the tip – up to 4.5% (17%)

Cut out – 1.7%

Thigh pain – up to 14%



**Compared to DHS  
and first generation:  
- fewer complications  
- better function**



## Current generation of nails

- Improved mechanical properties (anchorage and buttressing)
- Tapered (anti-stress ) end
- Static and dynamic locking
- Allow immediate weight bearing



**AND...**  
**Nails fail as well**

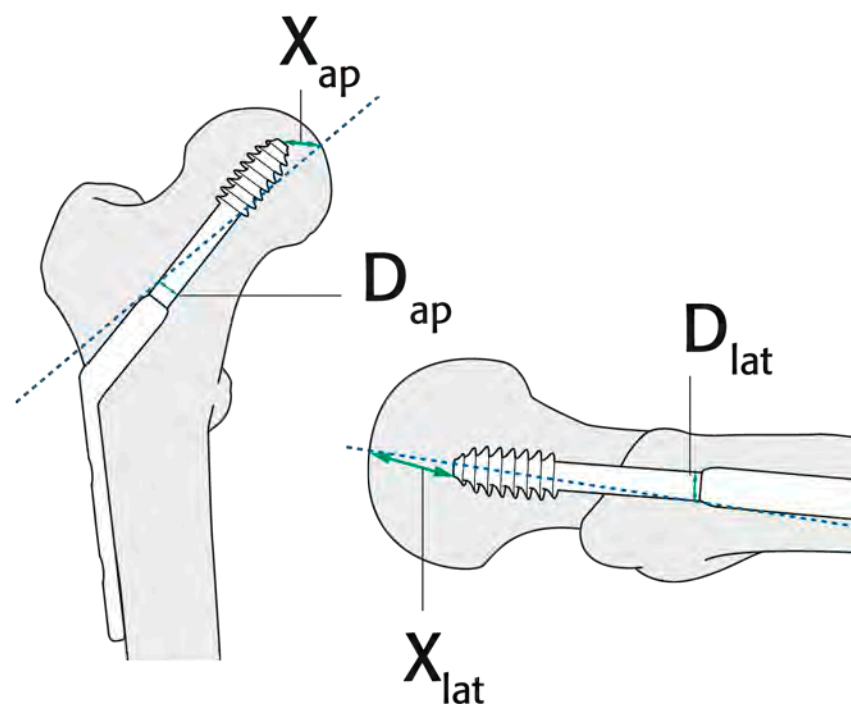




# Tip-apex-distance

In single screw devices:

- Tip-apex-distance (TAD) should be less than 25 mm



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

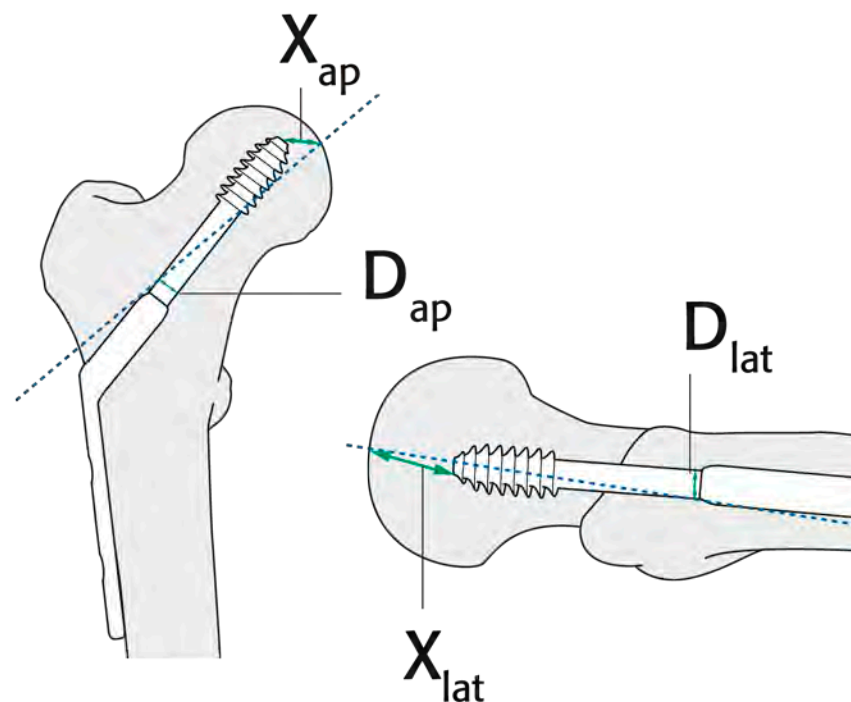
# Tip-apex-distance

In single screw devices:

- Tip-apex-distance (TAD) should be less than 25 mm

In IMN with screw device:

- Tip-apex-distance (TAD) should be less than 25 mm



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

# Tip-apex-distance

**In single screw devices:**

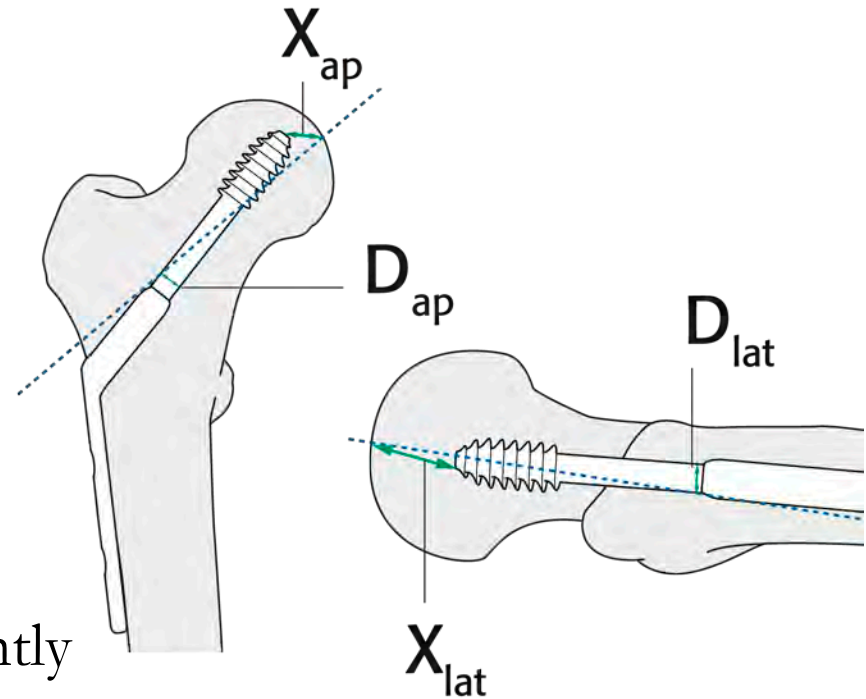
- Tip-apex-distance (TAD) should be less than 25 mm

**In IMN with screw device:**

- Tip-apex-distance (TAD) should be less than 25 mm

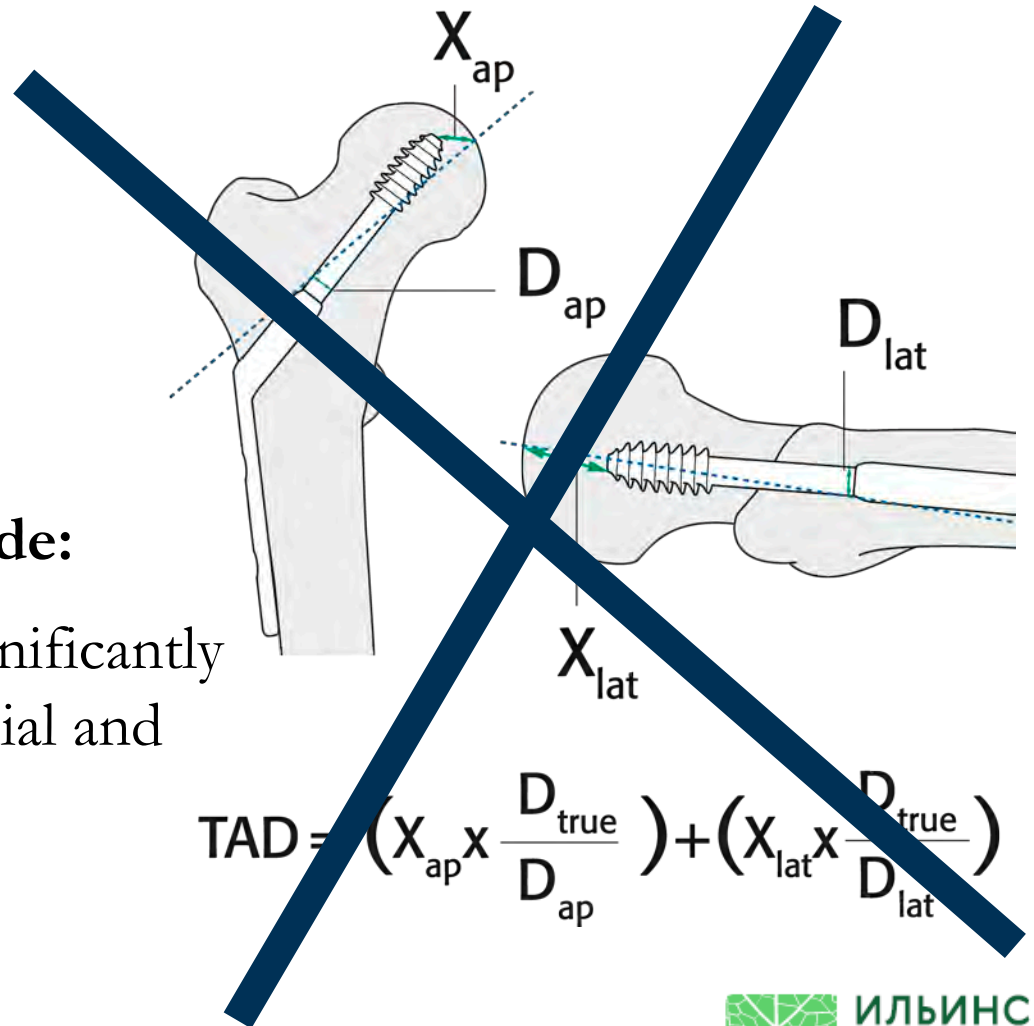
**In IMN with helical blade:**

- TAD 0–20 mm was significantly associated with both axial and varus cutout



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

# Tip-apex-distance



## In IMN with helical blade:

- TAD 0–20 mm was significantly associated with both axial and varus cutout

# Why do we need new methods?

- **Dramatic increase in life expectancy**
- **Many more fracture patients with much more severe osteoporosis**
- **Complications**

# Augmentation? Objective benefits

**Significantly improved anchorage of implants in osteoporotic bone**

# What is the rationale?

- Augmentation of femoral heads yielded a significantly superior rotational stability, as well as an enhanced pull-out resistance, compared to the non-augmented state.



## Biomechanical effect of bone cement augmentation on rotational stability and pull-out strength of the Proximal Femur Nail Antirotation™

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### ARTICLE INFO

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### ABSTRACT

**Introduction:** After surgical treatment of osteoporotic hip fractures, complications such as implant cut-out are reported to be high and implant failure often is associated with poor bone quality. As augmentation is reported to enhance implant anchorage, the aim of our study was to investigate the effect of bone cement augmentation on the rotational stability and the pull-out resistance of the Proximal Femur Nail Antirotation™ (PFNa) blade.

**Materials and methods:** A total of 18 fresh-frozen femoral heads (mean age 68 years, standard deviation (SD) 8.2) were scanned with quantitative computed tomography (qCT) for bone mineral density (BMD) measurements and instrumented with a PFNa blade. Nine specimens were augmented with a mean volume of 4.4 ml Traumacem V+. After cement consolidation, the blade was rotated for 60° for the rotational test. Subsequently, the blade was extracted from the specimens. Force, torque, displacement

- However, the higher the BMD of the specimens, the lower was the effect of augmentation on the rotational stability.

# PFNa adaptation. Perforated blade

- **blade has small side holes to allow injection of PMMA cement through the cannulation of the blade**
- **exactly the same general design as standard PFNA blade**
- **also indicated for use without augmentation**



# PFNa adaptation. Bone cement and delivery system

- **trauma specific PMMA cement for a safe application**



- **injection Kit: Syringes to transfer the PMMA cement from a mixer to a special needle**

# Clinical case. Female, 87 yo, intertrochanteric fracture



# Indications for augmentation

1. **Unstable fragility fracture + High age (> 80 year)**

# Indications for augmentation

1. **Unstable fragility fracture + High age (> 72 – 75 year)**

# Clinical case. Female, 72 yo, trochanteric fragility fracture, medically unstable



- Nursing home resident
- Schizophrenia
- 1 months after injury
- Before the fracture walked only with assistance within the home
- Cachexia
- After fracture taken the “pose of embryo”
- Anemia Hb72

# Clinical case. Female, 72 yo, trochanteric fragility fracture, medically unstable

- Treatment options:

- HR

- PFN

- Plating

- Conservative



# Clinical case. Female, 72 yo, trochanteric fragility fracture, medically unstable



# Clinical case. Female, 72 yo, trochanteric fragility fracture, medically unstable



# Clinical case. Female, 72 yo, trochanteric fragility fracture, medically unstable



# Clinical case. Female, 72 yo, trochanteric fragility fracture, medically unstable



- In 4 months:
  - She left the “pose of embryo”
  - She can sit



# Indications for augmentation

1. **Unstable fragility fracture + High age ( $> 72 - 75$  year)**
2. **Salvage of suboptimal reduction**

# Clinical case. Male, 74 yo, intertrochanteric fragility fracture R



- stump of tibia L
- hemiparesis R
- chronic renal insufficiency
- severe diabetes
- blind
- obesity
- still active. Professor at the University

# Clinical case. Male, 74 yo, intertrochanteric fragility fracture R



- PFN, long version, augmentation



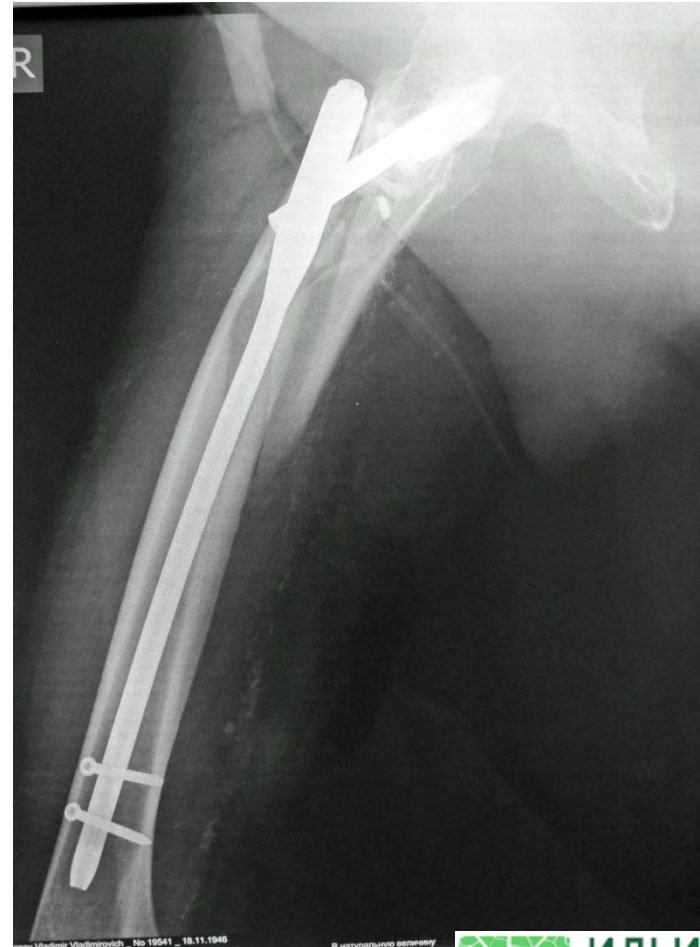
# Clinical case. Male, 74 yo, intertrochanteric fragility fracture R



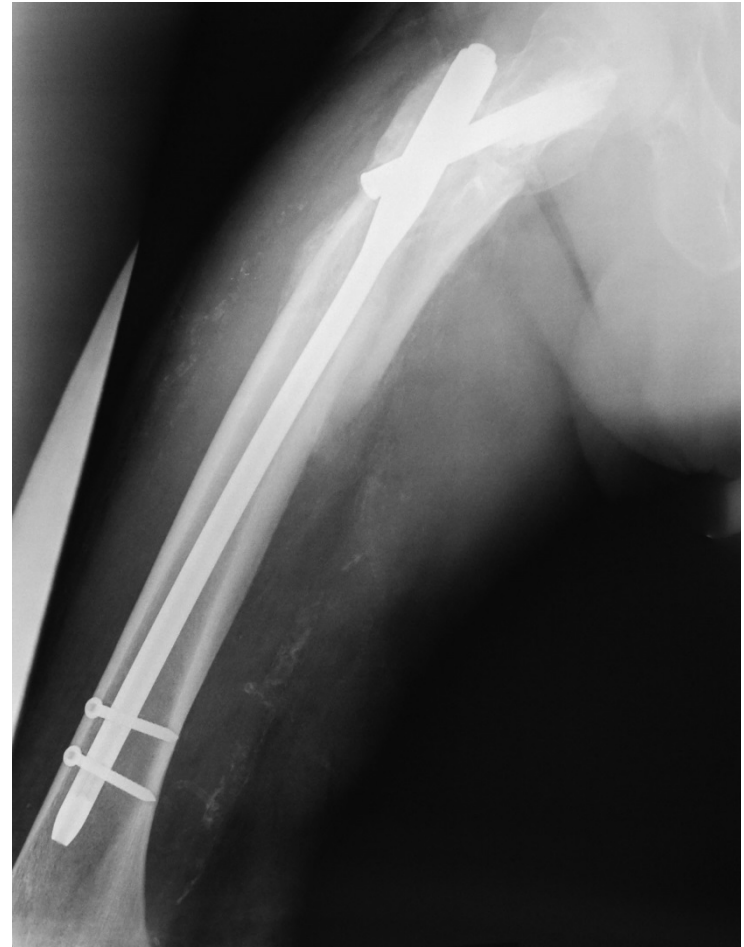
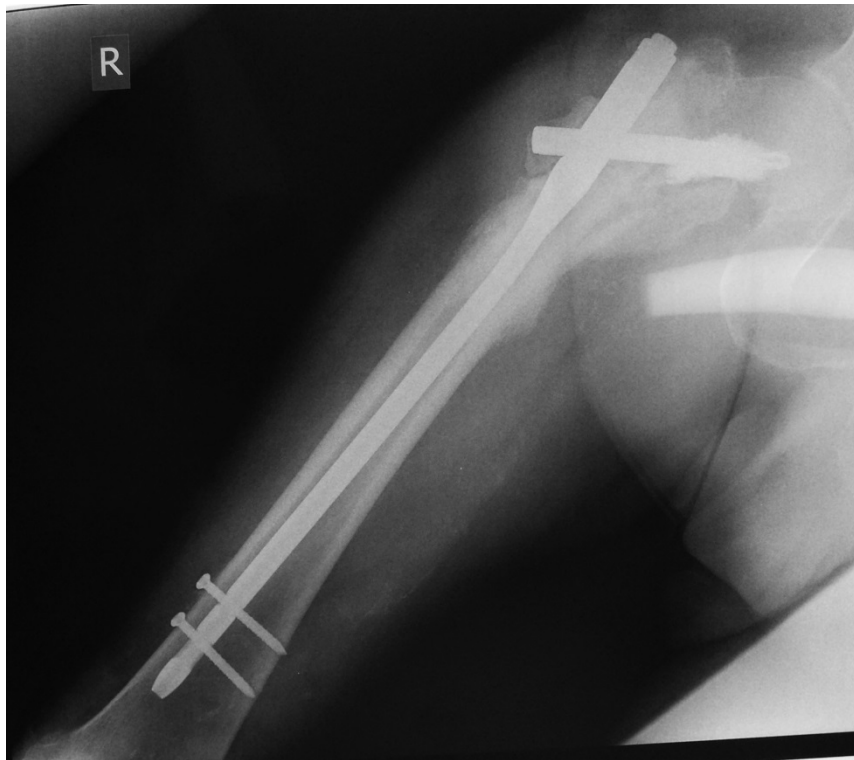
- PFN, long version, augmentation



# Clinical case. Male, 74 yo, subtrochanteric fragility fracture R



# Clinical case. Male, 74 yo, subtrochanteric fragility fracture R, 6 ms



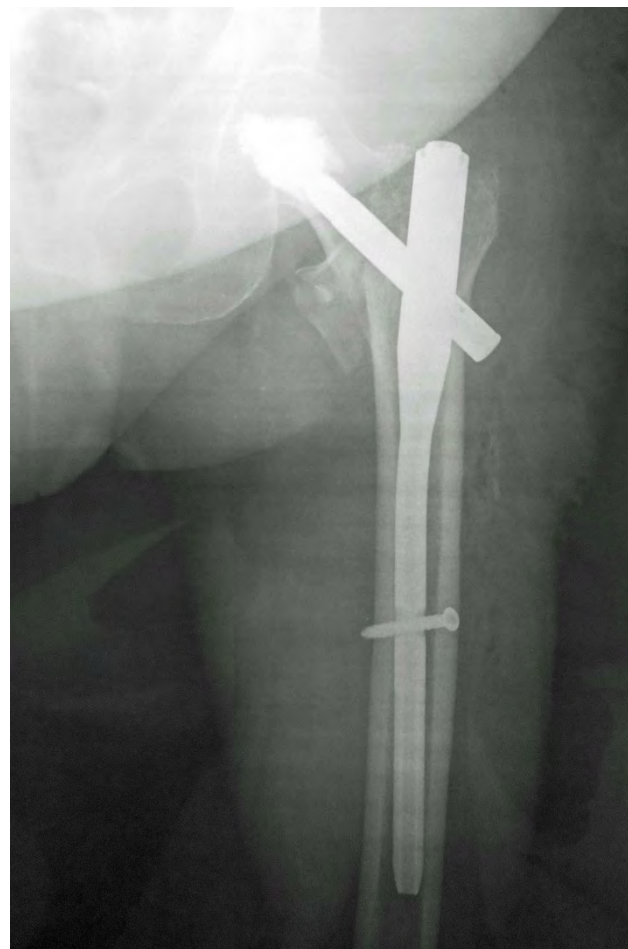
# Indications for augmentation

1. **Unstable fragility fracture + High age (> 72 – 75 year)**
2. **Salvage of suboptimal reduction**
3. **Salvage of suboptimal implant position**

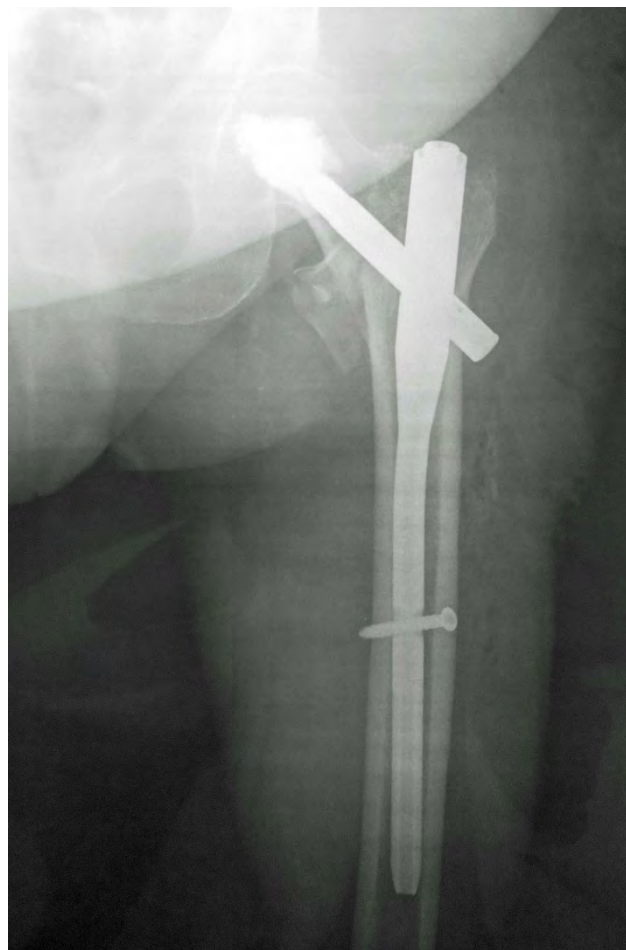
# Clinical case. Female, 90 yo, pertrochanteric fragility fracture



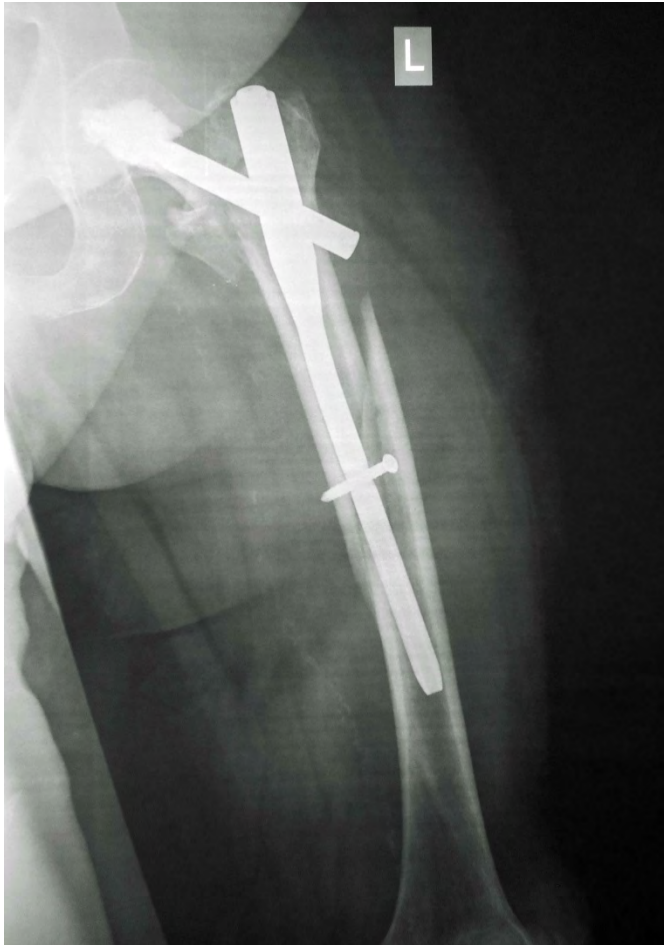
# Clinical case. Female, 90 yo, pertrochanteric fragility fracture



## Clinical case. Female, 90 yo, pertrochanteric fragility fracture

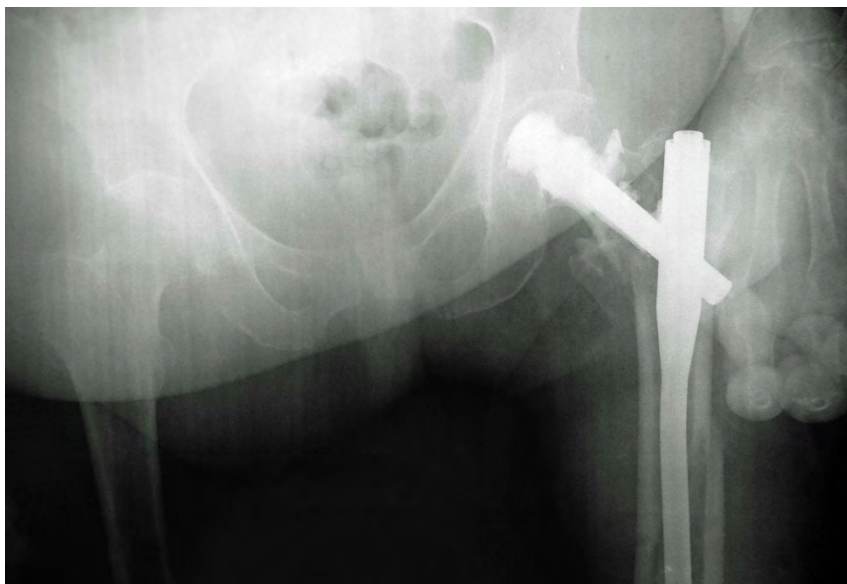
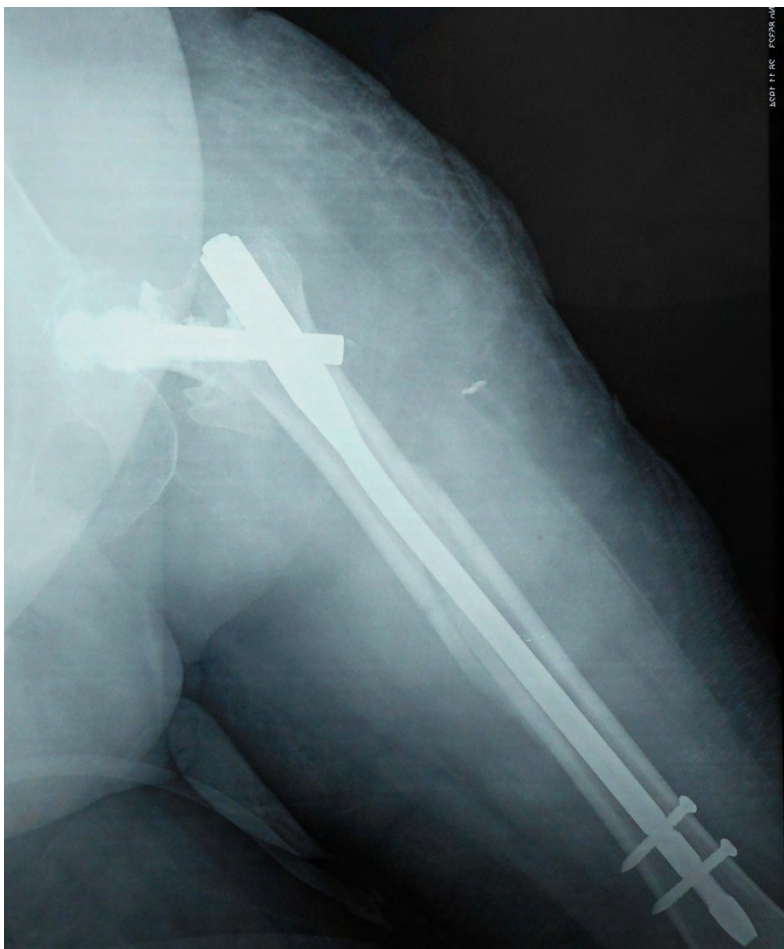


## Clinical case. Female, 90 yo, pertrochanteric fragility fracture, 4 w

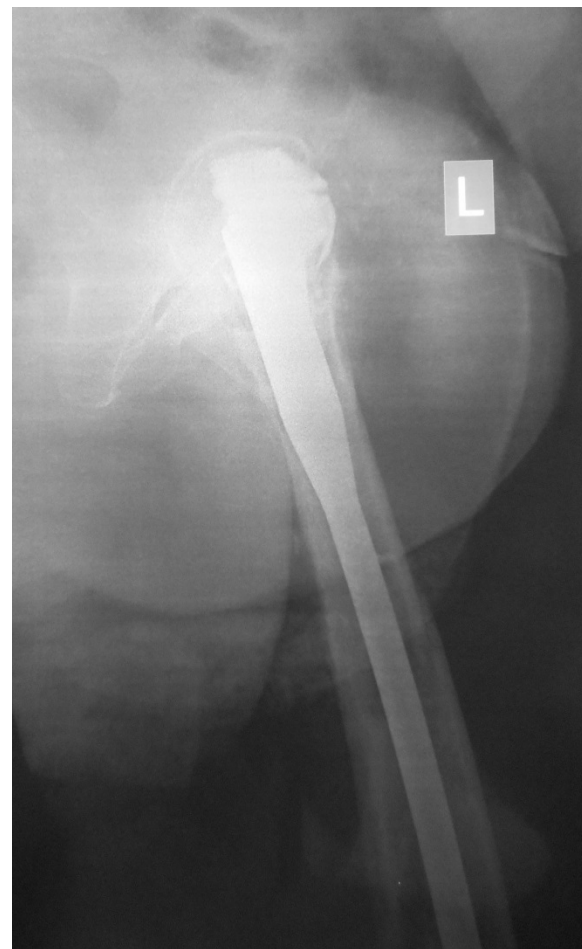


- Treatment options?

# Clinical case. Female, 90 yo, pertrochanteric fragility fracture, 4 w



# Clinical case. Female, 90 yo, pertrochanteric fragility fracture, 4 w, 3ms



# Indications for augmentation

1. **Unstable fragility fracture + High age (> 72 – 75 year)**
2. **Salvage of suboptimal reduction**
3. **Salvage of suboptimal implant position**
4. **Revision surgery**

# Indications for augmentation

1. **Unstable fragility fracture + High age (> 72 – 75 year)**
2. **Salvage of suboptimal reduction**
3. **Salvage of suboptimal implant position**
4. **Revision surgery**
5. **Combination of factors**
6. **Pathological fractures**

## Summary

- Stable trochanteric fractures are well treated with a sliding hip screw
- So far intramedullary devices seem to be the preferred implant for most unstable proximal femoral fractures
- In single screw devices and IMN with screw Tip-apex-distance (TAD) **should be less** than 25 mm
- In IMN with helical blade Tip-apex-distance (TAD) **should be not less** than 20 mm
- Augmentation of the PFNa blade reduces the risk of cut-out in cases of severe osteoporosis

