

# **Hip fracture augmentation: Indications and Techniques**

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<http://www.aaos.org/disclosure>

Research Article | [Free Access](#)

## Cement augmentation of implants—no general cure in osteoporotic fracture treatment. A biomechanical study on non-displaced femoral neck fractures

Ladina Hofmann-Fliri, Tomas I. Nicolino, Jorge Barla, Boyko Gueorguiev, R. Geoff Richards, Michael Blauth, Markus Windolf 

- Consider femoral neck vs intertrochanteric
- Femoral neck:
  - evidence poor for augmentation
  - good alternatives to fixation: arthroplasty

# Intertrochanteric hip fractures

- Trochanteric fractures are a common injury in the older population
- Lack of conclusive evidence supporting any one treatment type but fixation is almost universal
- IMN designs have improved resulting in significantly increased use for managing trochanteric fractures

# Advantages of Modern Nails

- Smaller
- High cut-out resistance
- Excellent stability of Lag Screw
- Smaller distal screws
- Dynamization capability
- Titanium
- Better instrumentation



# **Intramedullary Nailing vs. Sliding Hip Screw In Trochanteric Fracture Evaluation:**

## **The INSITE Randomized Clinical Trial**

The INSITE Investigators

# METHODS

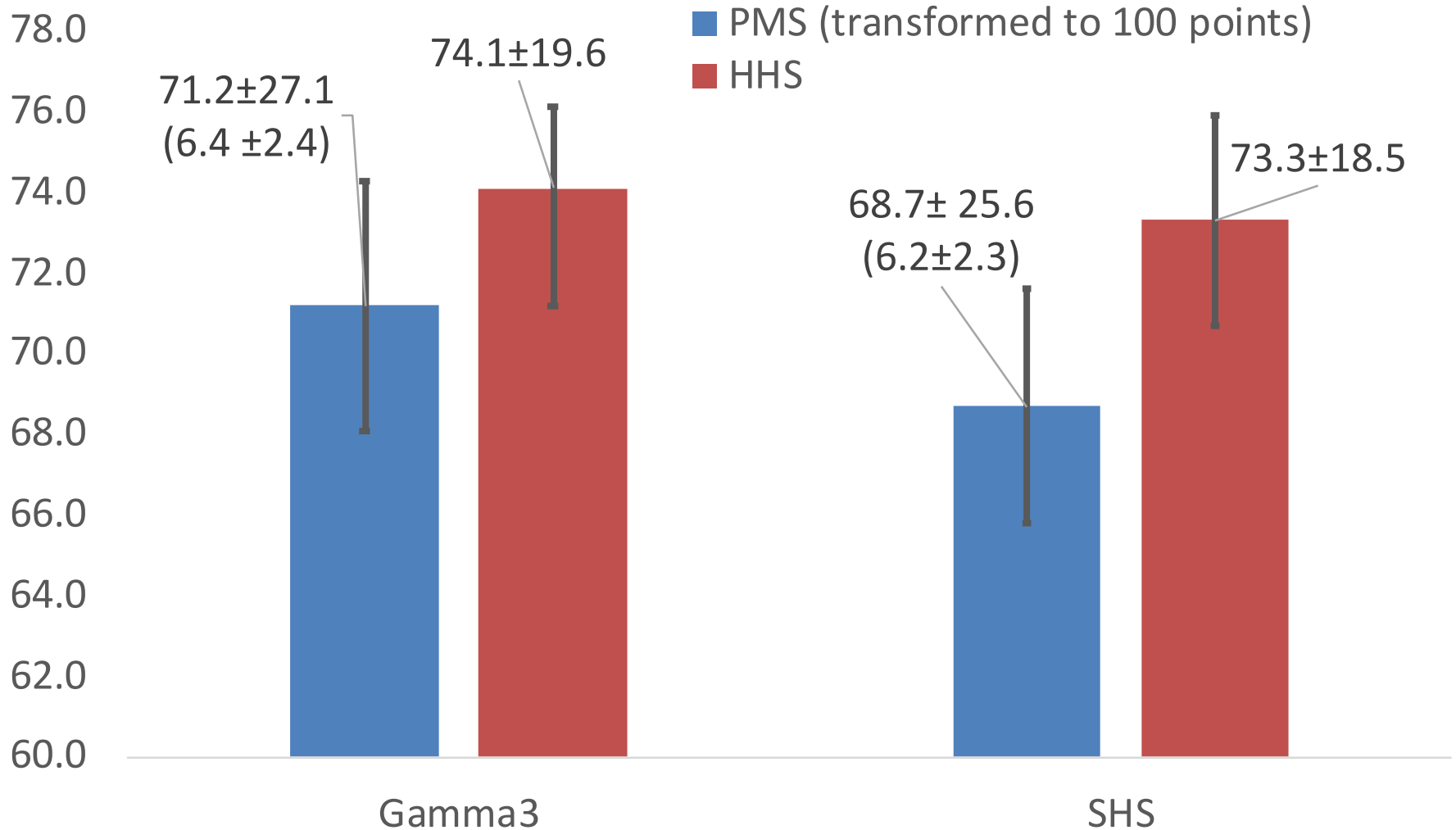
## Design:

- Multicenter, international RCT
- Randomized 850 patients across 25 sites

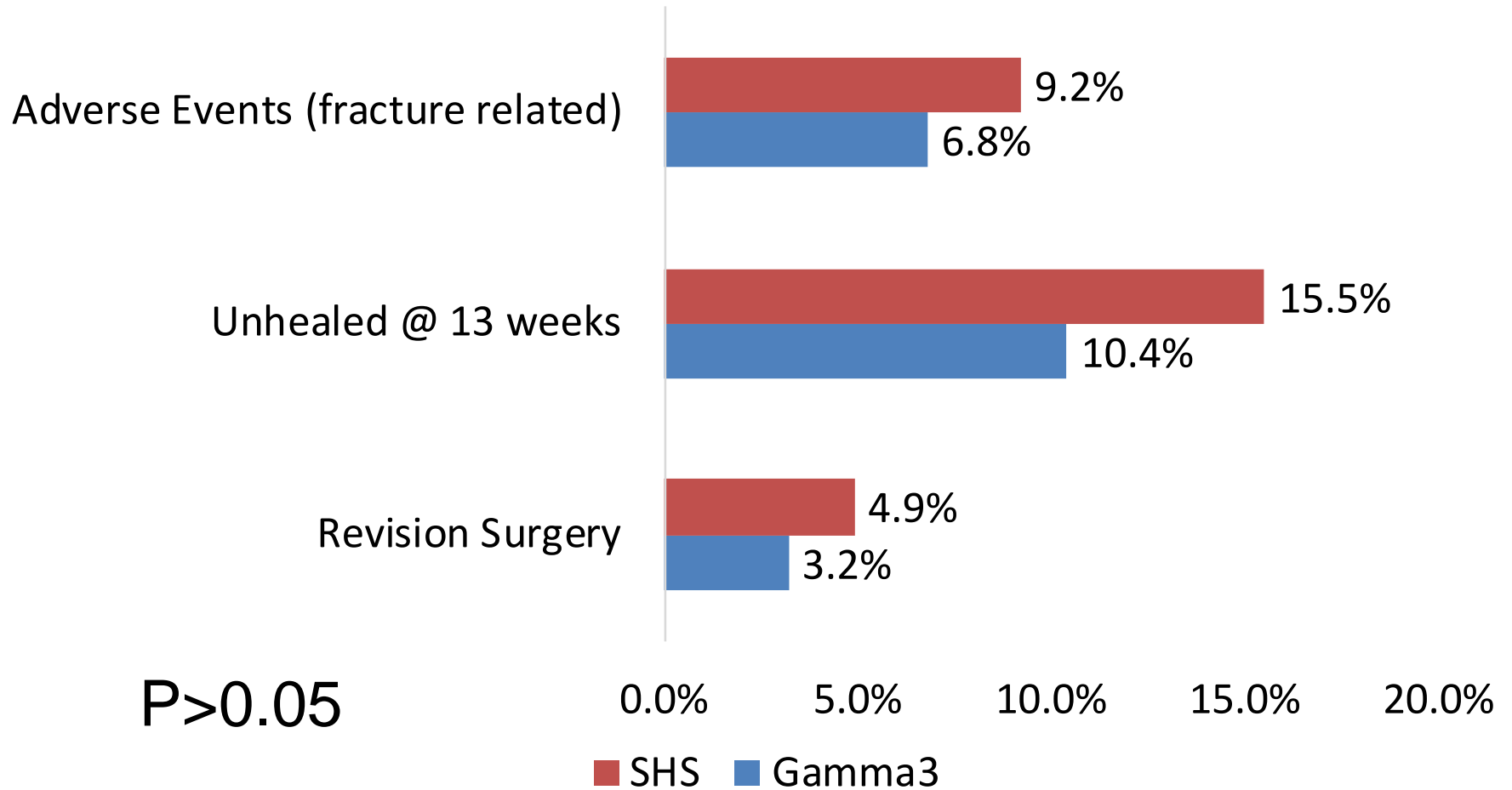
## Eligibility Criteria:

- Inclusion: Ambulatory,  $\geq 18$  years, low-energy # (AO type 31-A1 or A2), surgery within 7 days
- Exclusion: Associated major injuries of lower extremity, retained hardware, pathologic #, obesity, dementia, severe Parkinsons

# RESULTS: Mobility and Function



# RESULTS: Other



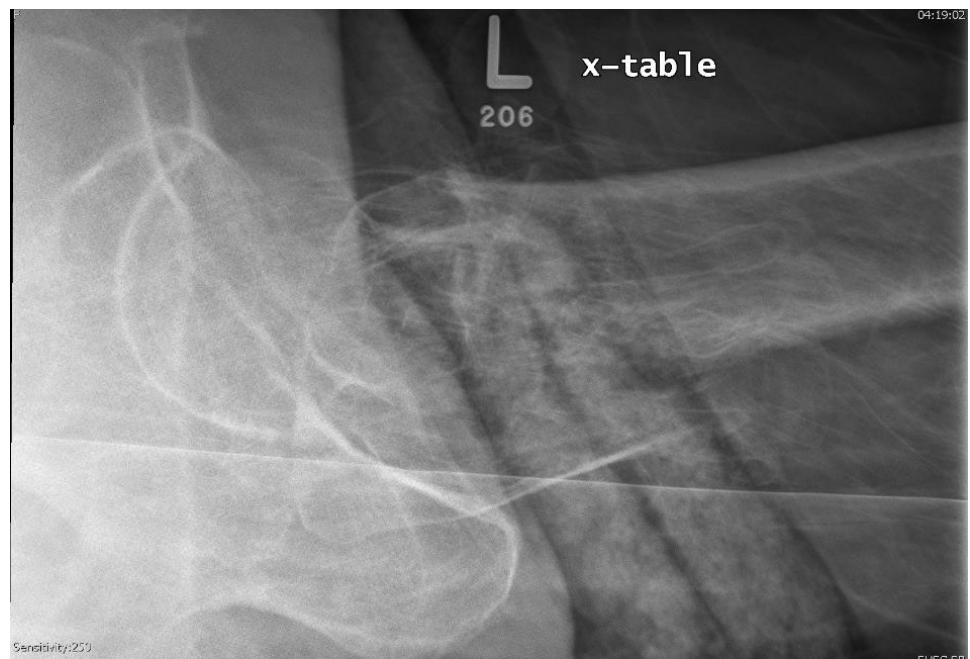
# Screw cut-out is still a problem!

- Up to 8-15% in some series
- Implant and/or bone problem
- Best method to achieve stable fixation of elderly osteoporotic hip fractures is unknown



# Questions

- Can the rate of cut-out be reduced?
- Is there an optimal device for femoral head fracture fixation?
- Does biological augmentation of the femoral head work?



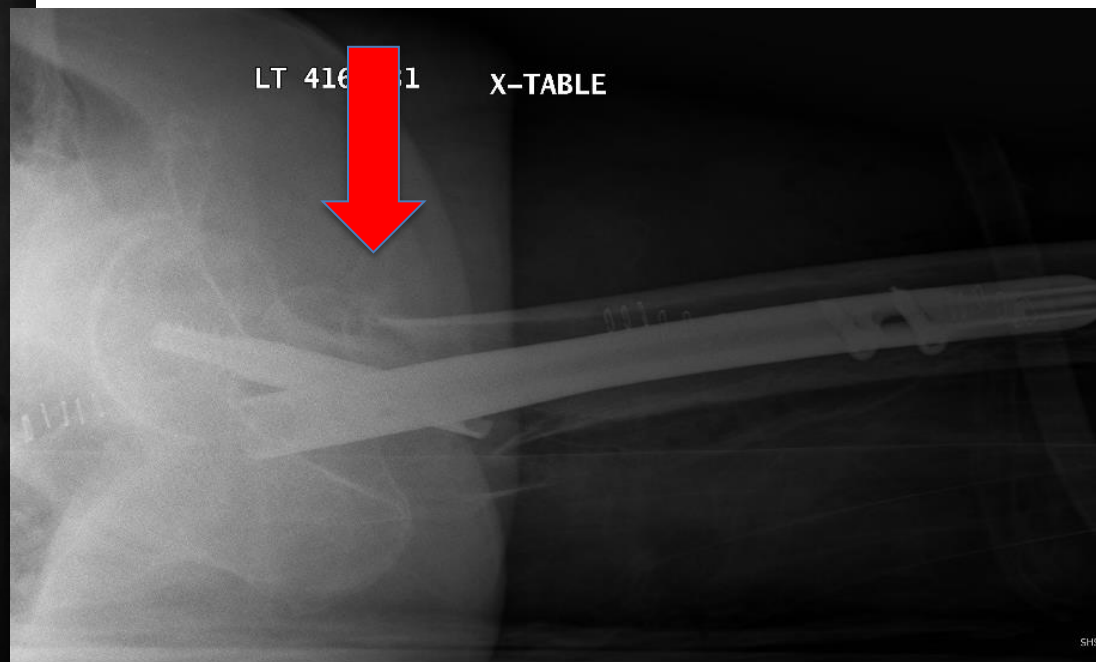
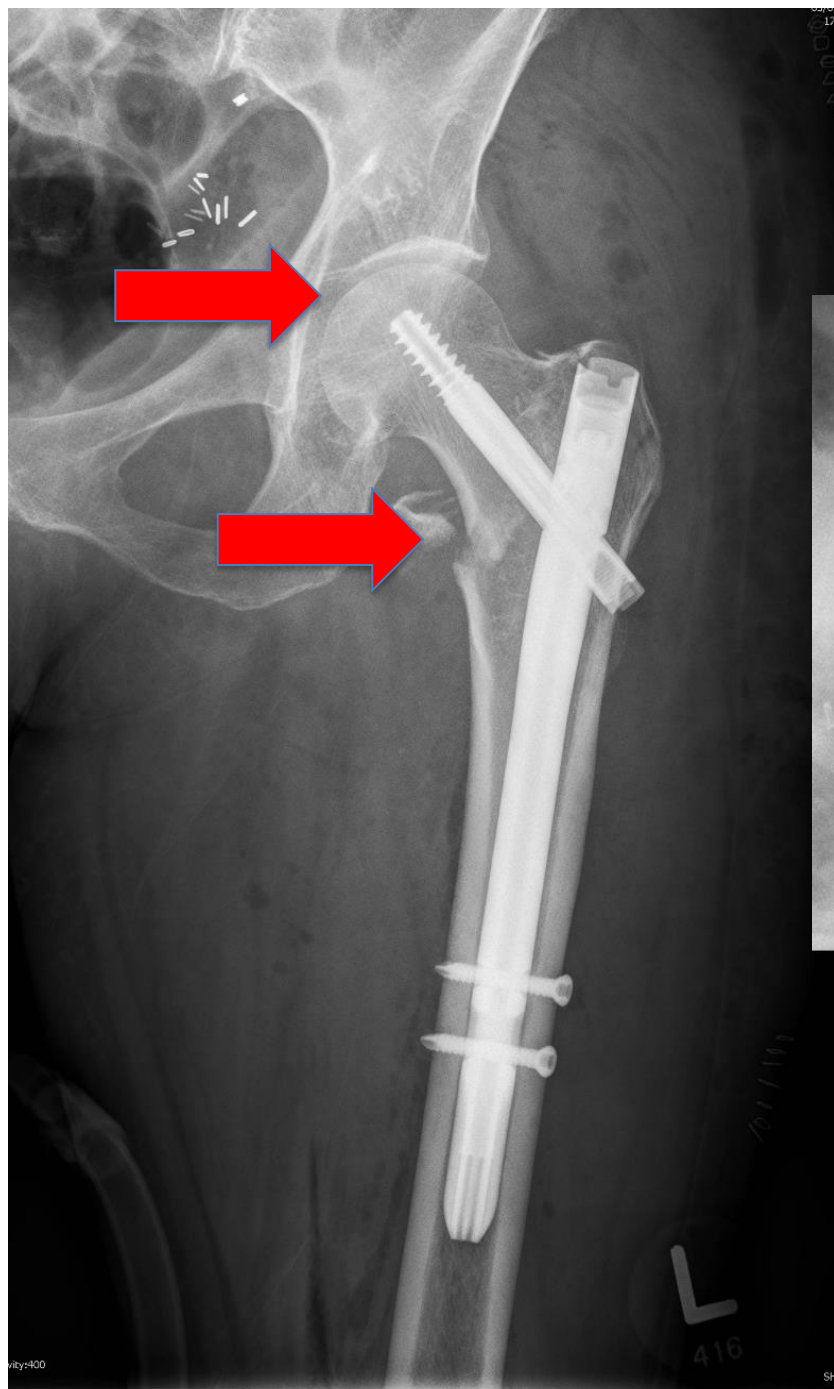
Sensitivity: 25.5

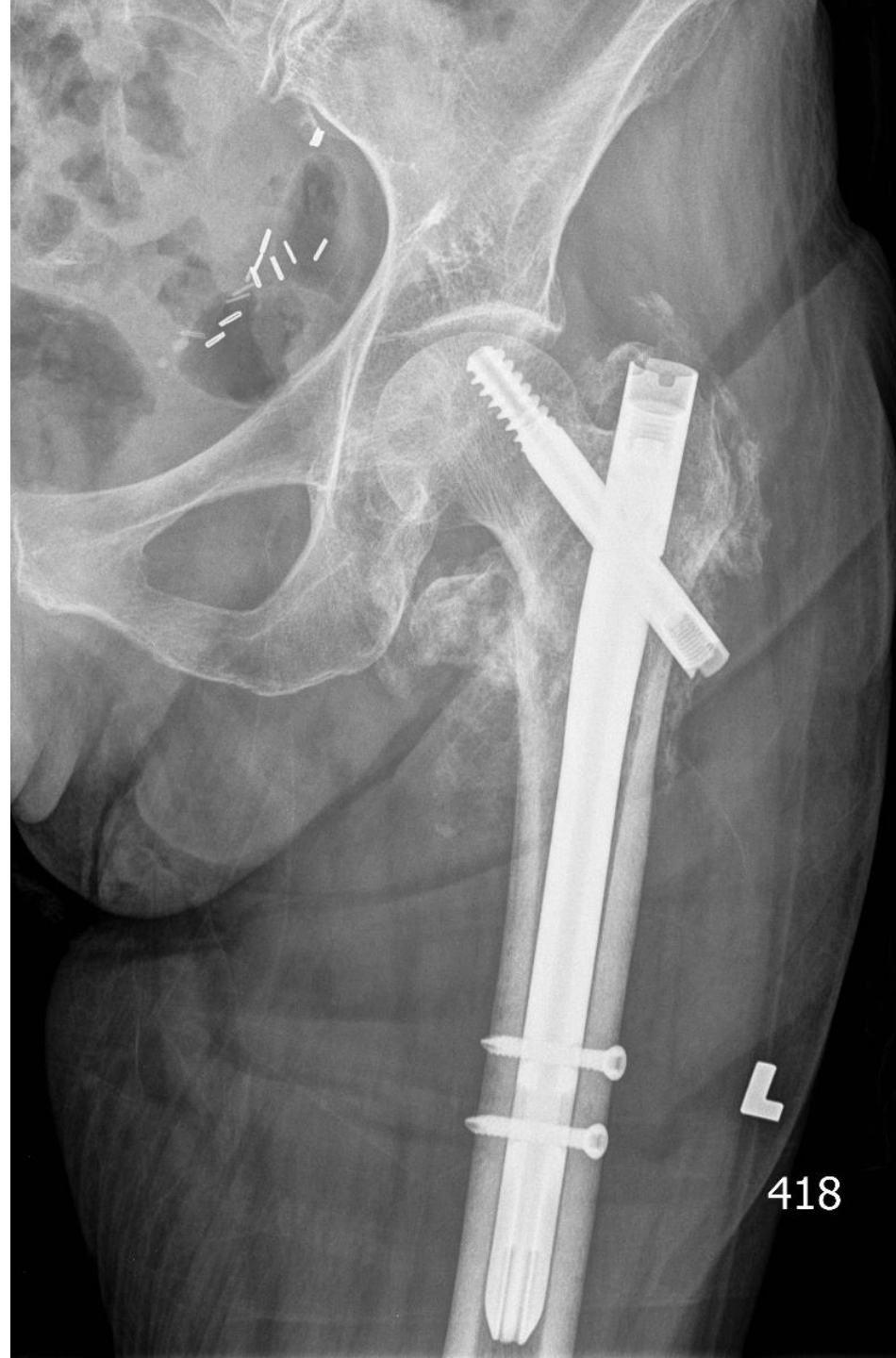


LT 416/131

X-TABLE

SHSC 5





418



D  
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Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

**Injury**

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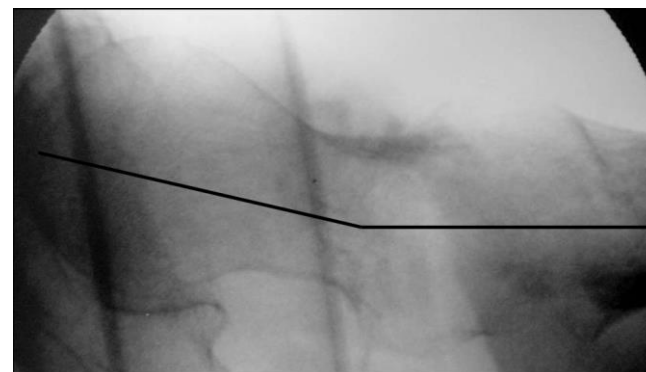


## Reporting on quality of reduction and fixation of intertrochanteric fractures–A systematic review



Meir Marmor<sup>a,\*</sup>, Guy Guenther<sup>b</sup>, Arash Rezaei<sup>c</sup>, Morshed Saam<sup>a</sup>, Amir Matityahu<sup>a</sup>

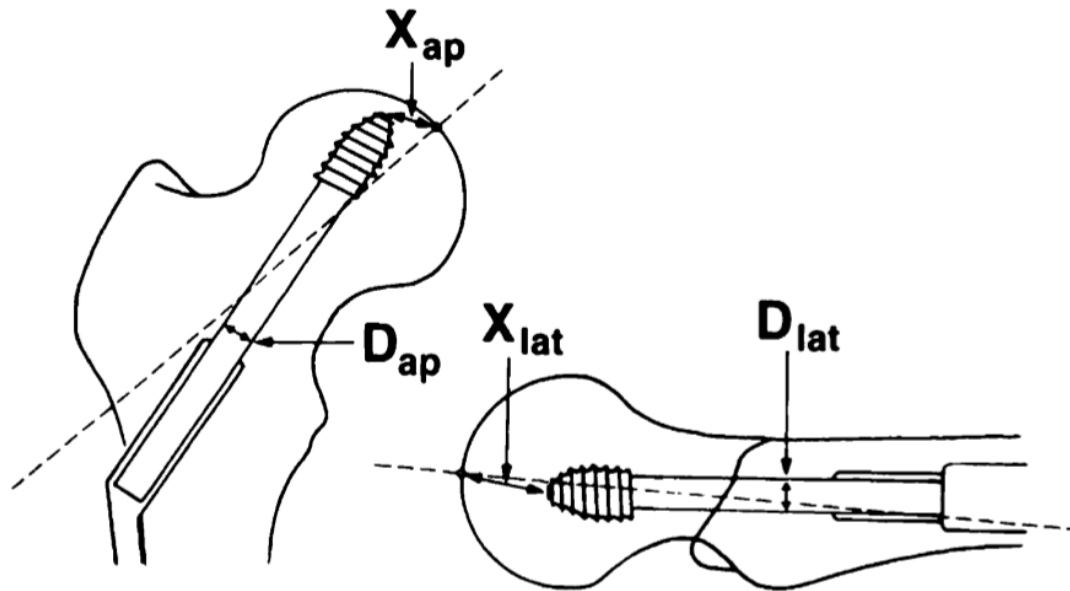
- Focus has been on implant and less on reduction
- 51% of papers found association between better immediate post-op reduction and improved outcomes



# The Value of the Tip-Apex Distance in Predicting Failure of Fixation of Peritrochanteric Fractures of the Hip\*

BY MICHAEL R. BAUMGAERTNER, M.D.†, STEPHEN L. CURTIN, M.D.†, DIETER M. LINDSKOG, B.A.†,  
AND JOHN M. KEGGI, M.D.‡, NEW HAVEN, CONNECTICUT

*Investigation performed at the Department of Orthopaedics and Rehabilitation, Yale University School of Medicine, New Haven*

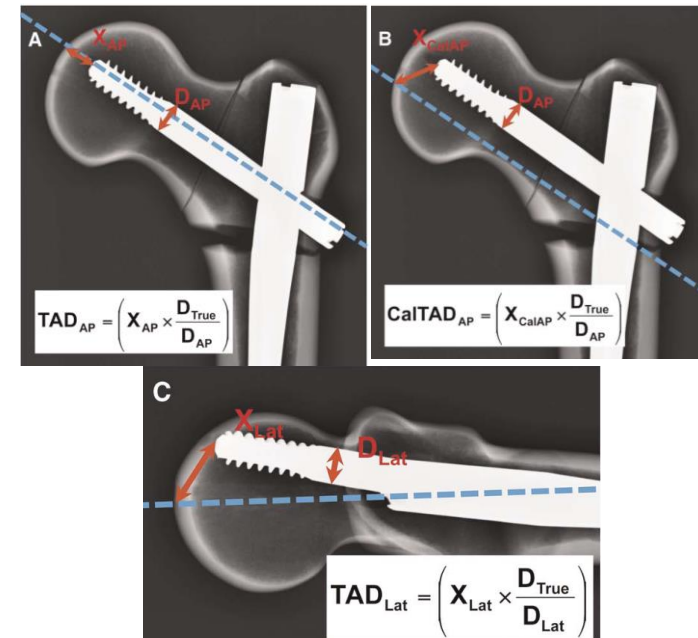


$$\text{TAD} = \left( X_{\text{ap}} \times \frac{D_{\text{true}}}{D_{\text{ap}}} \right) + \left( X_{\text{lat}} \times \frac{D_{\text{true}}}{D_{\text{lat}}} \right)$$

# Femoral Head Lag Screw Position for Cephalomedullary Nails: A Biomechanical Analysis

*Paul R. T. Kuzyk, BSc(Eng), MASc, MD, FRCS(C), \* Rad Zdero, PhD, †† Suraj Shah, MEng Candidate, †† Michael Olsen, PhD, † James P. Waddell, MD, FRCS(C), \* and Emil H. Schemitsch, MD, FRCS(C)\*†*

- Inferior lag screw position produced highest stiffness
- Anterior and posterior lag screw position produced lowest stiffness and load to failure
- Inferior lag screw placement on the AP radiograph and central placement on the lateral recommended



■ HIP

# Predictors of failure for cephalomedullary nailing of proximal femoral fractures

Retrospective review of 170 fractures treated with cephalomedullary nailing

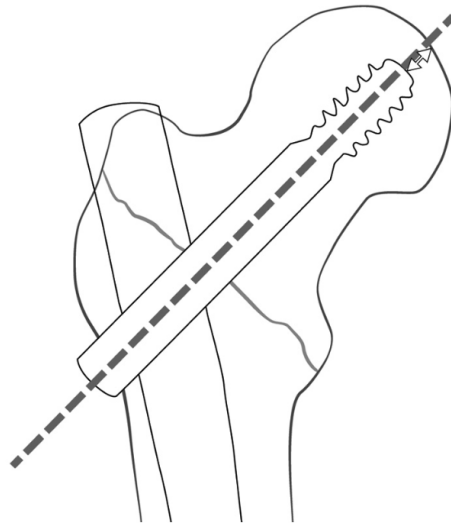


Fig. 1a

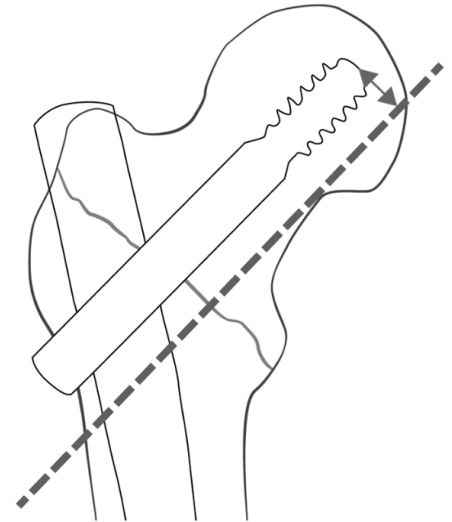
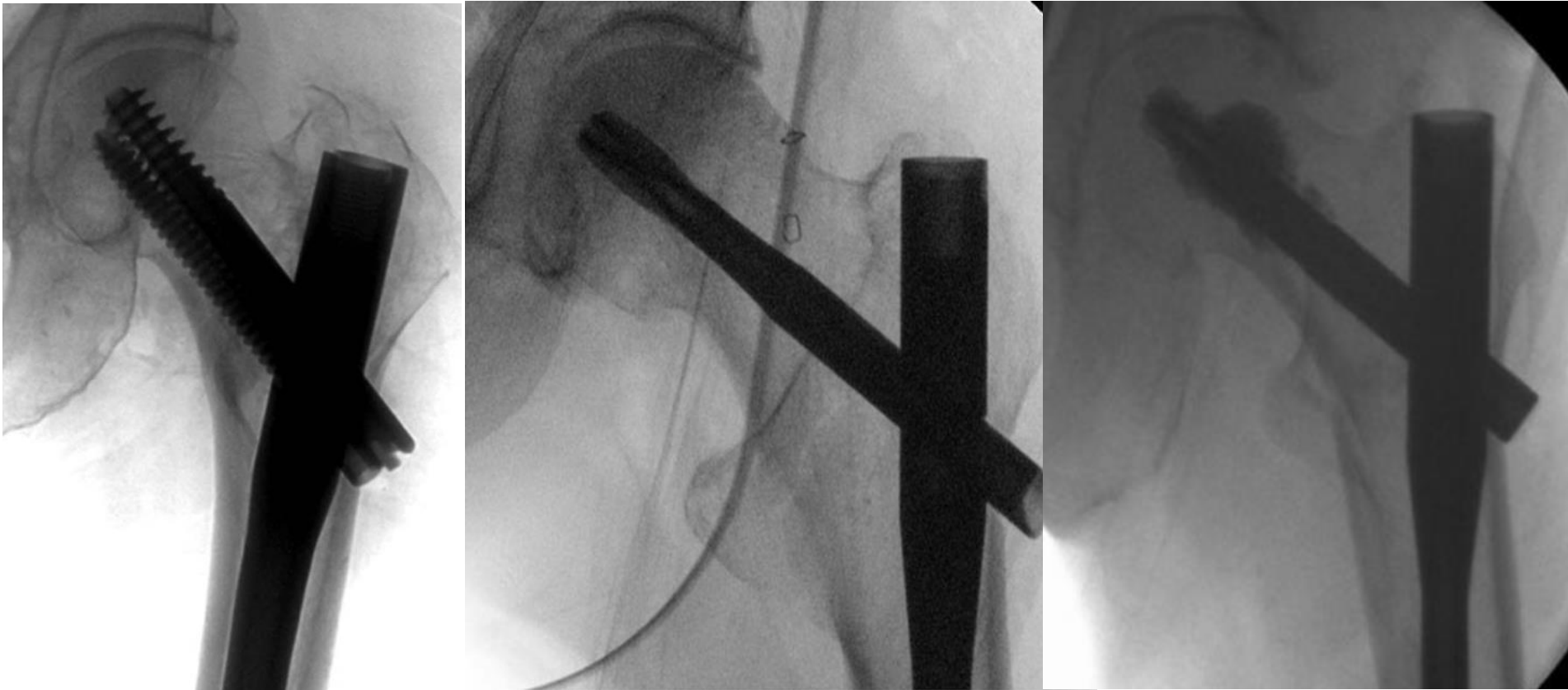


Fig. 1b

**Our data provide the first reported clinical evidence that CalTAD is a predictor of cut-out. The finding of CalTAD as the only significant parameter in the multivariate analysis, along with the univariate significance of Parker's ratio index in the AP view, suggest that inferior placement of the lag screw is preferable to reduce the rate of cut-out.**

# Can we get even better fixation?

- Newer implant designs or fixation techniques



# Evidence for the Device 2022

- Conflicting results regarding ideal implant choice for femoral head fixation
- Biomechanical results not supported by clinical results at long term follow-up
- No pivotal prospective randomized trials have shown superior femoral head fixation with any specific device

# Calcium phosphate cements

## Questions?

- Is it injectable
- How fast does it set?
- What is the stability in a wet field?
- Is it isothermic?
- Does the volume change over time?
- What is the resorption rate?



**Evidence: These cements work for subchondral defects**

# Cement Augmentation

- Enhanced fixation via cement bone interdigitation
- Aims to resist cut-out
- Augment away from fracture
- Biomechanically superior
- Safety studies performed



# Injection: Where and HOW?

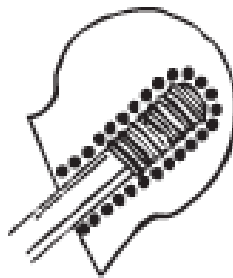


Fig. 1a

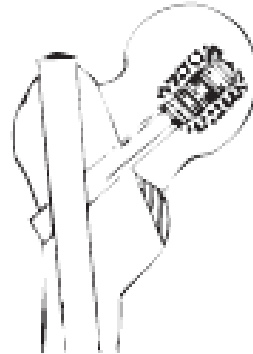


Fig. 1b

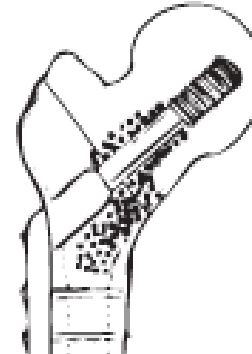


Fig. 1c

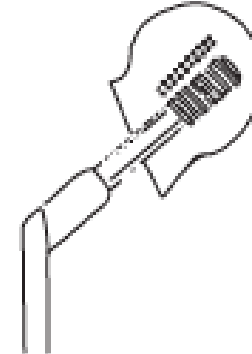


Fig. 1d

Diagrams showing examples of application sites of bone substitutes from *in vitro* (experimental) studies showing a) von der Linden et al.<sup>58</sup> polymethylmethacrylate (PMMA), b) Augat et al.<sup>59</sup> PMMA, c) Yetkinler et al.<sup>60</sup> calcium-phosphate cement and d) Stoffel et al.<sup>61</sup> PMMA.



## ■ ANNOTATION

### Fractures of the hip and osteoporosis

#### THE ROLE OF BONE SUBSTITUTES

T. Lindner,  
N. K. Kanakaris,  
B. Marx,  
A. Cockbain,  
G. Kontakis,  
P. V. Giannoudis

From Leeds General

Failure of fixation is a common problem in the treatment of osteoporotic fractures around the hip. The reinforcement of bone stock or of fixation of the implant may be a solution. Our study assesses the existing evidence for the use of bone substitutes in the management of these fractures in osteoporotic patients. Relevant publications were retrieved through Medline research and further scrutinised. Of 411 studies identified, 22 met the inclusion criteria, comprising 12 experimental and ten clinical reports. The clinical studies were evaluated with regard to their level of evidence. Only four were prospective and

# Higher Rate AVN/NU With Norian High Volume & Pressure Augmentation

*Acta Orthopaedica* 2006; 77 (2): 251–256

251

## Calcium phosphate cement for augmentation did not improve results after internal fixation of displaced femoral neck fractures

2006

A randomized study of 118 patients

Per Mattsson and Sune Larsson

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Submitted 04-12-06. Accepted 05-06-13

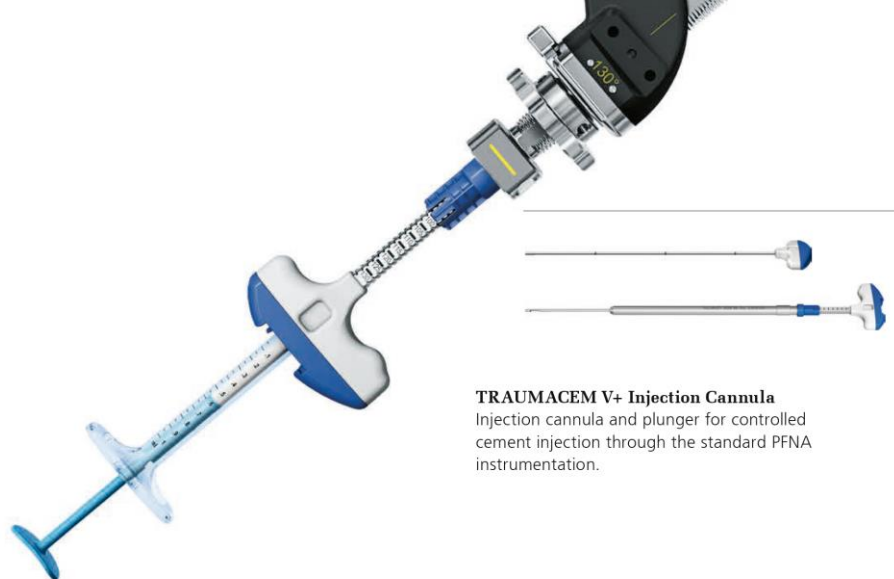


Higher AVN Rate  
Norian CaPO<sub>4</sub> compared  
to control group



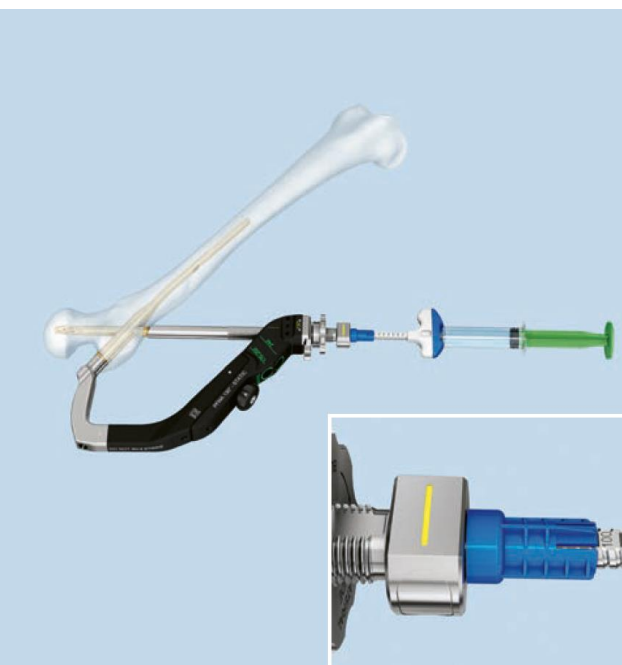
#### Cement placement

Controlled placement of cement around the implant, through the perforated blade with the injection cannula.



#### TRAUMACEM V+ Injection Cannula

Injection cannula and plunger for controlled cement injection through the standard PFNA instrumentation.



# Augmentation with Calcium Phosphate cement



- No consensus on material properties and surgical application
- Long term follow-up lacking
- No pivotal RCTs

# What is the Evidence for?

- **Improved outcomes / less fixation failure**
  - Rompen 2021
  - Goodnough 2022
  - Yee 2020
- **No cutouts**
  - Yee 2020
  - Schuetze
- **No impact on mortality**
  - Rompen 2021
  - Yee 2020
  - Schuetze 2021
- **Improved weight-bearing**
  - Keppler 2021

# **What is the Evidence against?**

- **Effect of cement augmentation uncertain**
  - Yamamoto 2022
- **Greater need for vasoactive medication**
  - Schuetze 2021
- **Longer surgery**
  - Rompen 2021
- **Increased cost and lack of Level 1 evidence**
- **Risk of cement leakage**

# Conclusions

- Cut-out is related to improper surgical technique:
  - Quality of reduction, implant application
- Conflicting results for ideal implant choice
- No pivotal RCTs have shown superior femoral head fixation with any specific device or fixation method
- Surgeon experience and familiarity should dictate implant choice and fixation method

# Thank you

