Hip fracture fixation: the radiographic parameters that matter!

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Femoral Neck Fractures

Basic radiographic parameters matter a lot!

• Diagnosis?

• Fracture pattern?

• Acceptable reduction?

• Acceptable implant position?

Diagnosis

• Is the fracture complete or incomplete?

• Is the fracture undisplaced or displaced?

- What type and what level?
 - ? Subcapital vs basicervical
 - ? Vertical fracture line











- Need to make the Diagnosis!
- Consider whether compression or tension stress fracture
- Tension fractures always require surgery!







Undisplaced fractures

Traditional thinking:

- Arthroplasty not usually necessary with undisplaced fractures
- Displacement determined on AP via Garden Classification



SCIENTIFIC ARTICLES

Not All Garden-I and II Femoral Neck Fractures in the Elderly Should Be Fixed

Effect of Posterior Tilt on Rates of Subsequent Arthroplasty

The Journal of Bone and Joint Surgery: October 16, 2019 - Volume 101 - Issue 20 - p 1852-1859

 Posterior tilt ≥20° at higher risk of arthroplasty vs <20° (22.4% vs 11.9%)



Displacement makes a difference!



Table 5

Pooled complications stratified by fracture displacement,

Outcome	Displaced fractures			Undisplaced fractures		
	Incidence (%)	95% CI	l ² statistic (%)	Incidence (%)	95% CI	l ² statistic (%)
Reoperation	17.8	12,4-24,9	15,4	6,9	2,6-17,1	0
AVN	14.7	12,3-17,5	0	6,4	3.4-11.8	0
Nonunion	10.0	6.9-14.3	0	5.2	2.0-13.1	0

Risk factor: Reduction

J Orthop Trauma. 1998 May;12(4):230-4.

Predictors of early failure of fixation in the treatment of displaced subcapital hip fractures.

Chua D¹, Jaglal SB, Schatzker J.





Fracture Reduction

Reduction is the most strongly correlated predictor of healing



Swiontkowski et al., JBJS (Am), 1984 Tooke, JBJS (Am), 1985 Haidukewych et al., JBJS (Am), 2004 Upadhyay et al., JBJS (Br), 2004 Liporace et al., JBJS (Am), 2008

Reduction

- Avoid Varus
- Avoid distraction
- Avoid translation
- Minimize angulation





Technical factors: CS

- Satisfactory reduction
- Two critical screws

 -<3mm from inferior cortex
 -<3mm from posterior cortex



 Screw Tips within 5 mm of subchondral bone

Optimal Technical Factors During Operative Management of Low-Energy Femoral Neck Fractures

Patrick C. Schottel, MD,^a Michael Blankstein, MD, MSc, FRCSC,^a Sheila Sprague, PhD,^{b,c} Marc Swiontkowski, MD,^d Sofia Bzovsky, MSc,^c Mohit Bhandari, MD, PhD, FRCSC,^{b,c} and Emil H. Schemitsch, MD, FRCSC^e on behalf of the FAITH Investigators

JOT 2020

 The 3-screw inverted triangle pattern had a significantly lower revision surgery rate than a 3-screw triangle formation (P =0.004).

Technical factors: SHS

- Satisfactory reduction
- Tip-Apex Distance (<25mm) good predictor of outcome
- Sliding hip screws better for Vertical shear fractures and Basicervical: MAKE THE DX!

























A Trial of Fracture Fixation in the Operative Management of Hip Fractures

FAITH Investigators

Lancet 2017



Subgroup Analysis

Sliding hip screws significantly reduced reoperations among

- Displaced (43% risk reduction, p=0.04)
- Basicervical (76% risk reduction, p=0.04)
- Smokers (61% risk reduction, p=0.02)

No suggestion of other subgroup effects



Intertrochanteric Fractures

Things to consider

• Fracture pattern?

• What is an acceptable reduction?

• What is acceptable implant position?

What to worry about pre-op

- Unstable patterns
- Reverse obliquity
- Subtroch extension
- Thin lateral wall
- Significant displacement
- Femoral bow

Dictate implant choice and approach





TRAUMA Lateral femoral wall thickness

A RELIABLE PREDICTOR OF POST-OPERATIVE LATERAL WALL FRACTURE IN INTERTROCHANTERIC FRACTURES

C-E. HSU, C-M. SHIH, C-C. WANG, K-C. HUANG THE BONE & JOINT JOURNAL VOL. 95-B, No. 8, AUGUST 2013

- 208 patients AO/OTA 31-A1 and -A2 intertrochanteric fractures
- Lateral wall thickness < 20.5 mm should not be treated with SHS alone



Significant displacement requires open reduction





No open reduction



Significant displacement



Requires open reduction



Femoral bow



Ensure nail ROC is appropriate for femur

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

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

Meir Marmor^{a,*}, Guy Guenthner^b, Arash Rezaei^c, Morshed Saam^a, Amir Matityahu^a

- Reduction is critical
- Focus has been on implant and less on reduction
- 51% of papers found association between better immediate postop reduction and improved outcomes









Acceptable reduction

- Anteromedial calcar reduced
 - Avoid translation
 - Avoid negative medial cortical support
- Restore neck shaft angle
 - Avoid varus
- Avoid distraction

Calcar reduction

- Chang et al, AOTS 2015
 - Positive medial cortical support reduction had the least loss in neck-shaft angle and neck length

Positive

Negative

















Varus: Image opposite limb





Distraction



Tips for Success...

- Reduce before reaming
- Ensure correct entry point
- Reaming: must avoid further comminution and lateral drift
- Be aware of lag screw angle
- Beware distal nail perforation
- Check for Rotational deformity
- Atraumatic manual nail insertion











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





I HIP

Predictors of failure for cephalomedullary nailing of proximal femoral fractures

Retrospective review of 170 fractures treated with cephalomedullary nailing



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.

Cut-out

- Cut-out is related to improper surgical technique:
 - -Quality of reduction, implant application

 No pivotal RCTs have shown superior fixation with any specific device or method

Conclusions

- Make the diagnosis!
- Understand the fracture pattern
- Understand potential pitfalls
- Understand radiographic criteria for acceptable reduction and implant position
- Surgeon experience and understanding of radiographic parameters play a large role in outcome following chosen fixation method

Thank you

