**Lateral Wall Failure**

**Proximal Femoral Fractures**

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**COI Disclosure**

ZimmerBiomet: Consultant, Inventor, Trauma, ETEX, Knee Creations

Smith & Nephew: Nails and Plates, Memphis, TN

Intellectual Property Contracts


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**Modern Failure Model**

**If Fixation/Reduction Permits Excessive Rotation**

Rotation Combined With Sliding = Bone Erosion

Instability

Collapse

Distortion of Hip Mechanics

Pain, Disability and Death
Pantrochanteric Hip Fracture: Lateral Wall Failure
Gotfried. J Ortho Trauma 2012

Conversion of A1 or A2 to A3 Fracture

What Is Lateral Wall Failure?
“You Never See What Your Not Looking For”

- Not New
- Rediscovery of A Complication
- Surgically Induced
- Specific Implant Related Morbidity
- Fracture Can Be Neutralized By Implant Selection

COMPRESSION HIP SCREWS – THE GOLD STANDARD Vs. IM Nails
1980's Company Technique Manual

CHS: Collapse to Stability
Medialization of the Shaft

Lateral Disruptive Trochanteric Insertion
Varus of Hip
Fracture and Dislocation Classification Compendium
J. Orthop Trauma 21(10) Supplement 2007 OTA/AO Classification

No Lateral Evaluation

3 Part Intertrochanteric Fx
My Initiation 1998

Note Initial Compression and Sliding At 6 Wks
Something Happening At Greater Trochanteric Region

2 Years Post Injury
Unusual Non-Union: No Cut Out
Implant Collapse and Shaft Screw Failure

Non-Union of Femoral Neck And Greater Trochanter From an IT Fracture?
Hardy Et al
JBJS 1998

Level I
Evidence
CHS Vs.
IMHS

Hardy et al Results
Unstable Fractures 1998

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Nail</th>
<th>CHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking 1 Year Hip Score</td>
<td>5.3 +/- 3.0</td>
<td>3.4 +/- 3.4</td>
</tr>
<tr>
<td>Sliding Collapse</td>
<td>91 +/- 46 cm</td>
<td>2.01 +/- 70 cm</td>
</tr>
<tr>
<td>Length Discrepancy Mean</td>
<td>1.0 +/- 4 cm</td>
<td>0.7 +/- 60 cm</td>
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<tr>
<td></td>
<td>R (0-1.9 cm)</td>
<td>R (0-3.4 cm)</td>
</tr>
</tbody>
</table>

19 mm Sliding Mean?

The Difference
Garden. Structure and Function of The Proximal Femur JBJS 43B 1961

High Risk With Triple Reamer and Thickness of Lateral Wall 20 mm

Proximal Femur Metaphysis
Most of Fill In Metaphysis

Head Is Best Bone
**40% Failure With Unstable Fractures:**
- Medial Penetration
- Superior Cut-Out
- Plate Breakage

**Taylor, Neufeld, Janzen (CA)**
JBJS 1944 Vol. 26

**Historical Perspective: Impaction Nails**

**Trochanteric Buttress Plates**
Boyd and Richardson 1949

- Invention of Trochanteric Buttress Technique For Boyd Type III (Reverse Obliquity) By Resident Dr. Richardson

**Sliding Compression Hip Screw**
Pohl 1953 Kiel, Germany
E. P. Holt 1963
Rotation Not Important?

- First To Hypothesize No Rotational Stability With Trochanteric Fractures
- Reamed to Size 12.5mm Round Nail

“All flanges on the nail were eliminated since it seemed unlikely that the proximal fragment of an intertrochanteric fracture could rotate after the fracture was reduced. … No evidence of rotation was seen on lateral roentgenograms in the follow-up of the 100 fractures included in this study.”

Jensen Classification
Effect of Reduction With CHS 1980

- J. S. Jensen Comparative Classification Study. Added Lateral Evaluation of Fracture To Evans Acta Ortho Scand
- Relates Ability to Reduce Fracture and Secondary Displacement Risk With CHS Device
- Anatomic Reduction Both Planes Stable Medial Cortex: No Secondary Displacement
- Non-Anatomic and/or Unstable Fracture: 25-69% Rate of Secondary Displacement

InterTan Vs. CHS +TSP
Matre et al JBJS 2013; 95:200-8

56% of Nails and 51% of Plated Hip Fractures Were Reduced in a Potentially Unstable Position

| TABLE 1-2 Radiographic Findings | INTERTAN® | 50-Hip Screw® | P Value
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<tr>
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</thead>
<tbody>
<tr>
<td>Total</td>
<td>135 (100%)</td>
<td>135 (100%)</td>
<td>0.244</td>
</tr>
<tr>
<td>Good</td>
<td>147 (84%)</td>
<td>147 (84%)</td>
<td></td>
</tr>
<tr>
<td>Acceptable</td>
<td>141 (49%)</td>
<td>141 (49%)</td>
<td></td>
</tr>
<tr>
<td>Fail</td>
<td>44 (31%)</td>
<td>44 (31%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>135 (100%)</td>
<td>135 (100%)</td>
<td>0.244</td>
</tr>
</tbody>
</table>
1960-70's Osteotomies For Unstable Pertrochanteric Fractures Discontinued in 1980's

- The desire to increase stability of unstable fractures with proactive valgus osteotomy was popularized by Dimon and Houston, Sarmiento, Harrington and others in the 1960-70's.  

31A CHS Treated Rotational Instability Failures
Lustenberger, Bekic, et al 1995
Unfallchirug 98(10):514-7
22 Years After HOLT

1. Lateral Impaction (Sliding)  (P < 0.001).
2. Cut-out
3. Delayed Union
4. Varus Angulation

“We Conclude That Rotational Instability of a Gliding Implant System Is a Severe Complication in the Treatment of Trochanteric fractures.”

Lateral Wall Fracture
Y. Gotfried
CORR 2004, 425:82-86

Fracture of The Lateral Wall - Prolonged Morbidity
Fracture Around Implant From Defect Induced by Rotational Stress

Collapse Of Fracture Results In Loss Of Lower Extremity Shortening And Abductor Weakness Note Fracture Of Lateral Wall
Instability With CHS
Moroni et al 2004
Italy

- Varus Collapse CHS vs None With HA CHS
- Improved Functional Result With No Collapse (Harris Hip Score)
- Moroni et al JBJS 2005
  - Single Screw Compression Plate
  - HA Coated External Fixation Pin
  - Average Migration 4 mm Of Screw In Head In Cases Which Healed With Progression of Varus of 6 Degrees Post Op In CHS Group

Implant Etiology for Instability With CHS
Im et al 2005

- 66 Patients With 31-A1 Stable Fractures.
- Ten (15.1%) Were Noted To Lose Reduction While Developing Excessive Medialization Of The Femoral Shaft In The Postoperative Period.
- Of These Patients, A Fracture With Displacement Of The Lateral Cortex Occurred In All Cases Within 4 Weeks After Surgery.
- A Significant Difference In Mobility Score Was Noted Between Patients Who Lost Fracture Stability After The Operation And Those Who Did Not


Rotational Instability Caused Cut-Out??

JOT 18:36:361-368, 2004

A Laboratory Model to Evaluate Cutout Resistance of Implants for Femoral Fracture Fixation

Mark W. Lafferty, MD, *Ellie Dressler, MD, **Robert B-MM, MD, MB, BS, *Carrie E. Funk, MD, MPH
Loren W. Eldred, MD, *James C. Herring, MD, *Dena M. Doerflinger, MD, PhD, **Mark Michael Orthopaedic Hospital

The Degree Of Varus Collapse (8.5+/-7.7 Degrees) And Rotation (7.2+/-6.4 Degrees) In Cadaveric Specimens Were Comparable To That In Surrogate Specimens

Clinically Realistic Multiplanar Loading Vectors Significantly Affects Implant Migration, And Therefore Should Be Considered When Evaluating The Fixation Strength Of Hip Screw Implants.

Implant Etiology for Instability With CHS?
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Laufer, Y. et al., Functional recovery following pertrochanteric hip fractures fixated with the Dynamic Hip Screw vs. the percutaneous compression plate. Scientific World Journal, 2005
Integrity of the Lateral Femoral Wall in Intertrochanteric Hip Fractures: An Important Predictor of a Re-operation 2007

- 74% of Lateral Wall Fractures Occur During Surgery
- Fracture Lateral Wall Causes a Re-Op Rate of 22%
- ‘IT Fractures With Lateral Wall Fractures Should Not Be Treated With Sliding Compression Hip-Screw Devices


Gotfried PCCP
Less Iatrogenic Lateral Wall Failures 2011

- There was an overall lateral wall fracture incidence of 20% in the SHS group versus 1.4% in the PCCP group (P < 0.01). For the unstable 31A2 fracture types, there was a lateral wall fracture incidence of 29.8% in the SHS group versus 1.9% in the PCCP group (P < 0.01).


Problem Solved? Don’t Use A CHS

Next Generation SHS?
3 Screw Sliding Fixation In Head

Linear Compression Device

Lateral Wall Fragments

- External Rotation: Stable With Nail
- Cephalad Retraction: Reduce & Fix
- Lateral Wall Failure: Nail or Trochanteric Buttress Fixation
Conclusions

- Anteromedial Component Reduction Critical
- Select the Implant:
  - Best Fatigue Life
  - Stability in All Planes in Head and Shaft
- Recognize The Lateral Wall Problem
  - Prevention with Modern Implant
    - ORIF Buttress Plate
    - Cephalomedullary Nail Bypass
- Recognize Bone Quality Insufficiency