Intertrochanteric Hip Fracture

plate versus nail

Dr CF Chan
Specialist in Trauma
Queen Mary Hospital
- The incidence of hip fractures is increasing in number worldwide.

- Intertrochanteric hip fracture comprises about half of the hip fracture

- The standard care for intertrochanteric fracture today is operative internal fixation.
Aims

- Short term operative goals are to provide a construct that is stable enough to withstand early transfers, mobilization, and at least some weight bearing.

- The long term operative goal is to restore the patient’s previous level of independence and function.
History

- Plate-type device was popularized in the 1903s by Jewett.
- This fixed-angle triflanged nail allowed immediate fracture stability and early mobilization.
This static device often failed to maintain the fixation of the fracture fragment if there was any collapse.
Sliding Hip Screws

- Lag screw
- Side plate
Sliding hip screw

- Provide controlled collapse and impaction of the intertrochanteric fracture.
- Help to achieve a position of stability while maintaining a constant neck-shaft angle
Can fail, why
F/88 A1 fracture of left Hip
Operative procedures for the fixation of the intertrochanteric fracture are challenging.

Re-operation rate of 4-12% have been reported following “Gold standard” fixation technique of a sliding hip screw.
The common complication of sliding hip screws are **varus malreduction**

- **A varus malreduction**
  - leads to increased load on the proximal femur by increasing the moment arm on the implant
  - Also predispose patients to postoperative abductor weakness
Factors correlate with varus cut out

- Age of the patient
- Quality of bone
- Pattern of fracture
- Stability of the reduction
- Position of the implant
The importance of proper screw positioning in the femoral head is well established.

Proper position of the screw depends on two factors:

- Location of screw within the femoral head
- The depth of screw insertion with respect to articular surface
Gustilo and Kyle

- Ideal position of the screw should be in center-center position

<table>
<thead>
<tr>
<th>Position</th>
<th>Incidence</th>
<th>Number</th>
<th>Percent</th>
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</thead>
<tbody>
<tr>
<td>2/2</td>
<td>34</td>
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<tr>
<td>2/3</td>
<td>22</td>
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<td>4.5</td>
</tr>
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<td>2/1</td>
<td>4</td>
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<td>0</td>
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<tr>
<td>1/2</td>
<td>6</td>
<td>2</td>
<td>33</td>
</tr>
<tr>
<td>1/3</td>
<td>4</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>3/3</td>
<td>4</td>
<td>1</td>
<td>25</td>
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</table>
Tip-Apex Distance
Prediction of femoral head cut-out rate:

Significant less cut out rate resulted when TAD < 25mm
8 weeks... 4 months...

- TAD: 28mm
Unstable intertrochanteric fracture

What implant?
F/76
A2 Fracture of Right Hip
Unstable Fracture

- Common
- Kyle and associates: 43% intertrochanteric fracture are unstable

- Including fractures with
  - Comminution of the posteromedial buttress
  - Fracture with subtrochanteric extension
  - Reverse obliquity fracture pattern/loss of integrity of the lateral femoral wall
Limitation of Sliding hip screw

- Jacobs et al: the average settling of stable fracture was 5.3mm and that of unstable fracture was 15.7mm

- Steinberg: the mean sliding was 9.3mm and sliding $> 15$mm correlated with a higher prevalence of fixation failure
- Parker: medialization of the femoral shaft by greater than 1/3 diameter of the femur is associated with a 7x increase in fixation failure.

- **EXCESSIVE SLIDING** is the major factor causing failure of fixation.
Excessive sliding $\rightarrow$ loss of further sliding capability $\rightarrow$ leads to a functionally a rigid construct $\rightarrow$ higher failure rate
In reverse Obliquity fracture (A3):

The fracture line is perpendicular to the intertrochanteric line.

The sliding of the compression hip screw will apply a “shearing” force across the fracture.

The greater trochanter fragment will shift laterally and the shaft of femur will translate medially.
Reverse Obliquity Fractures of the Intertrochanteric Region of the Femur

By George J. Haidukewych, MD, T. Andrew Israel, MD, and Daniel J. Berry, MD

Investigation performed at the Mayo Clinic and Mayo Foundation, Rochester, Minnesota

- Retrospective study
- Between 1988 and 1998
- 2472 patients with hip fracture were included
- Reverse obliquity fracture accounted for 2% of all hip fracture and 5% of all intertrochanteric fracture
- 32% (15/47) reverse obliquity fracture failed to heal or had a failure of fixation

- Failure rate:
  - (9/16) Sliding hip screws
  - (2/15) Blade plate
  - (3/10) Dynamic condylar screw
  - (1/3) Cephalo-medullary nails
  - (0/3) Intramedullary hip screws
Conclusion:

- 95 degree fixed-angled internal fixation devices performed significantly better than did a sliding hip screws

- Results were worse for fracture with poor reduction and those with a poorly placed implant
Other plating system

- Controlled biaxial compression
  - 1. Standard sliding hip screw
  - 2. Side plate with inner and outer sleeve, allow fracture to impact parallel to the longitudinal axis of the femur

Medoff Plate
Prospective randomized study

Watson:

- **Stable fracture:** fractures united without complications
- **Unstable fracture:** complication rate: 14% in SHS versus 3% in Medoff plate

- **Disadvantages:**
  - longer surgical time
  - Greater blood loss
Trochanteric stabilization plate

- As a lateral buttress to prevent lateralization of the greater trochanter

- Lower rate of collapse and medialization in comparison to the use of compression hip screw alone
Intramedullary devices

- Can be inserted proximal to distal (cephalomedullary) or from distal to proximal.

- Cephalomedullary nails are inserted through the greater trochanter of the femur and secured by a cross pin or screw which is passed up in the femoral neck into the femoral head.
Intramedullary devices

- Advantages:
  - Insertion can be done in closed and percutaneous manner
  - Preserves fracture biology
  - Reduces blood loss
Potential mechanical advantages

- Reduced lever arm (bending moments) and limiting the amount of collapse of the fracture
The nail acts as an intramedullary Buttress to prevent excessive Shaft medialization (like TSP).

Impaction in the axis of the shaft can be Obtained if the nail is not distally Interlocked (or impaction can be done Before interlocking).
DESIGN of the nail

First generation nail  

Second Generation Nail
Intramedullary nail

PFNA  IMHS  Gamma nail
- F/78

- Fall on level ground

- Sustained A2 intertrochanteric hip fracture
1 week post op...
4 months........

NO hip pain and walks with one stick only
F/88 A3 fracture
Comparison between sliding hip screws and second Generation intramedullary nail

<table>
<thead>
<tr>
<th>Comparison between sliding hip screws and second Generation intramedullary nail</th>
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</table>

**TABLE 1 Results of Studies Comparing Sliding Hip Screws and Second-Generation Intramedullary Nails**

<table>
<thead>
<tr>
<th>Prospective Randomized Study/Device</th>
<th>Operative Time (min)</th>
<th>Blood Loss (mL)</th>
<th>Outset (%)</th>
<th>Femoral Fracture (%)</th>
<th>Return to Prefracture Mobility (%)</th>
<th>Pain Postop. (%)</th>
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<tbody>
<tr>
<td>Adams et al.**</td>
<td>Dynamic hip screw</td>
<td>61.3</td>
<td>260</td>
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<td></td>
<td>Gamma nail</td>
<td>55.4*</td>
<td>244</td>
<td>4</td>
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<td>Ahnengart et al.**</td>
<td>Compression hip screw</td>
<td>50</td>
<td>250</td>
<td>1.8</td>
<td>0.4</td>
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<td>Gamma nail</td>
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<td>300</td>
<td>6.6</td>
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<td>Baumgartner et al.**</td>
<td>Stable fractures</td>
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<tr>
<td></td>
<td>Sliding hip screw</td>
<td>80</td>
<td>340</td>
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<tr>
<td></td>
<td>Intramed. hip screw</td>
<td>72</td>
<td>245*</td>
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<tr>
<td></td>
<td>Unstable fractures</td>
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<tr>
<td></td>
<td>Sliding hip screw</td>
<td>94</td>
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<tr>
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<td>Intramed. hip screw</td>
<td>72*</td>
<td>230*</td>
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<td>Stable and unstable fractures</td>
<td>Sliding hip screw</td>
<td>3</td>
<td>0</td>
<td>†</td>
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<td>Intramed. hip screw</td>
<td>3</td>
<td>4</td>
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<tr>
<td>Hardy et al.**</td>
<td>Compression hip screw</td>
<td>57</td>
<td>198</td>
<td>1.2</td>
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<td>79.6*</td>
<td>144</td>
<td>0.9</td>
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<tr>
<td>Saudan et al.**</td>
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<td>65</td>
<td>1</td>
<td>0</td>
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<tr>
<td></td>
<td>Prox. fem. nail</td>
<td>64</td>
<td>2</td>
<td>0</td>
<td>†</td>
<td>†</td>
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</table>

* There was a significant difference between the devices. † There was no significant difference between the devices. †† The result was better at one and three months, but there was no significant difference between the devices at six and twelve months.
TREATMENT OF REVERSE OBLIQUE AND TRANSVERSE INTERTROCHANTERIC FRACTURES WITH USE OF AN INTRAMEDULLARY NAIL OR A 95° SCREW-PLATE

A PROSPECTIVE, RANDOMIZED STUDY

BY CHRISTOPHE SADOWSKI, MD, ANNE LÜBBEKE, MD, MARC SAUDAN, MD, NICOLAS RIAND, MD, RICHARD STERN, MD, AND PIERRE HOFFMEYER, MD

Investigation performed at the Orthopaedic Service, University Hospital of Geneva, Geneva, Switzerland

- 39 patients with AO/OTA 31-A3 intertrochanteric hip fracture
- Fu for at least 1 year
- 19 patients treated with Dynamic condylar screws
- 20 patients treated with intramedullary nail (PFN)
RESULT:

- Patients treated with IM nail had
  - Shorter operative times
  - Fewer blood transfusion
  - Shorter hospital stay

- Implant failures/nonunion
  - DCS: 7/19 (37%)
  - PFN: 1/20 (5%)
214 patients with intertrochanteric hip fracture was treated with compression hip screws

3% of 168 patients with intact lateral wall postoperatively need re-operation within 6 months

22% of 46 patients with a fractured lateral wall were operated again
- The lateral femoral wall was the main independent risk factor for a re-operation.

- The implant position (tip-apex distance) was also found to have an important effect on the outcome in the multivariate regression analysis.
A2.2 fracture
Recommendations

- For stable fracture patterns the sliding hip screw (DHS) is the implant of choice.
For unstable fracture including, especially reverse obliquity fracture, intra-medullary nail definite have a beneficial outcome for fixing this group of fracture.
BUT....

- GOOD implant choice cannot compensate for POOR reduction