Proximal Femur Fractures

Tips &Tricks for Intramedullary Nailing

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Shock Trauma Orthopaedics

1

Many Choices in Femoral Nailing

- Antegrade
  - Gold standard for mid-shaft
  - Sub-troch/pertroch
  - Piriformis vs troch starting point
- Retrograde
  - OK for some subtrochs (proximal shafts)
  - Good choice in certain clinical settings

2

Many Choices in Femoral Nailing

- Choice of:
  - Implant systems
  - Position of patient
    - Supine or lateral
  - Table
    - Fracture table or radiolucent table
  - Adjuncts
    - Open nailing
    - Schantz pins
    - Intramedullary reduction tool
    - Universal distractor

3

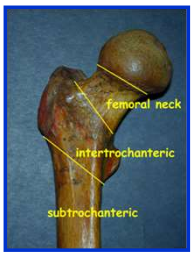
Proximal Femur Fractures: Fixation Options

- Intertrochanteric
  - Stable (plate or CMN)
  - Unstable (CMN)
- Peri-trochanteric
  - CMN
  - Fixed angle plate (blade, locking)
  - Both technically-demanding
- Subtrochanteric
  - CMN
  - Standard nail
  - Retrograde?
- Proximal shaft
  - Antegrade
  - Retrograde

4

Subtrochanteric/Peri-trochanteric Fractures

- Lesser trochanter to 5 cm distal
- Extension Proximal
  - Intertroch
  - Lesser troch
  - Piriformis fossa
- Distal Extension



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Proximal Femur Fractures: Fixation Options

- Regardless of fixation strategy, reduction is key
- Adjuncts can be very useful
- Goal is to avoid this:

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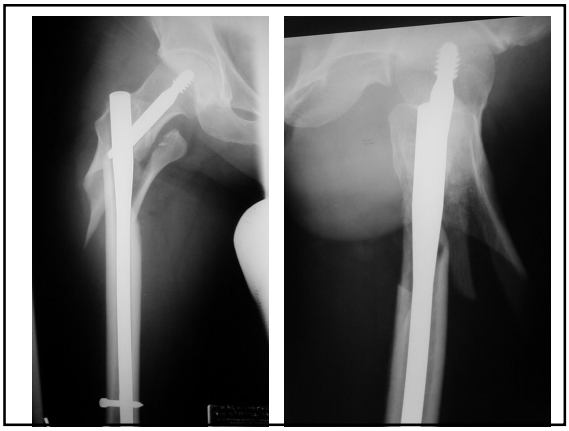

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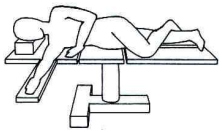
Patient Position

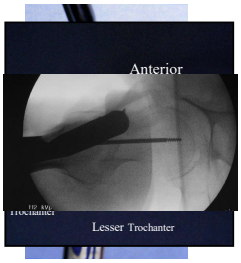
- Supine
  - Ease of position
  - Multiple trauma
  - Obese patients
  - Nail insertion point can be difficult (piriformis)
- Lateral
  - Insertion point easier
  - More difficult positioning



8

Insertion Point: The critical Beginning

- Piriformis fossa, for standard antegrade IMN: Gold standard
  - Co-linear with shaft
  - Visualized on AP X-Ray
- Anterior piriformis for original recon nail
- Tip of trochanter for most currently available recon nails
  - Anterior/posterior position still important, especially for cephalomedullary devices



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Piriformis vs Troch

- Why choose one over the other?
- What are advantages/disadvantages of each?

10

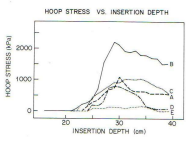
Piriformis Starting Point

- Original antegrade nails designed for this starting point
- Based upon anatomy of proximal femur
- Posterior piriformis fossa in line with proximal femoral canal
- Minimizes hoop stresses
- More important with stainless steel nails

11

Tips & Techniques

- Anatomy of the proximal femur
- Hoop stresses

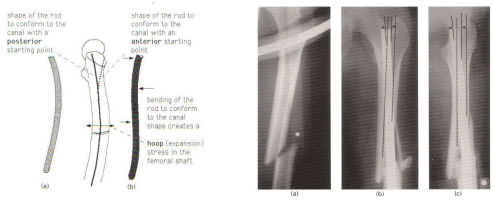


Graph depicts variation in hoop stresses generated by various nail types, A-E

Johnson KD, Tencer AF. Biomechanics in Orthopaedic Trauma, Martin Dunitz Ltd, 1994.

12

Tips & Techniques



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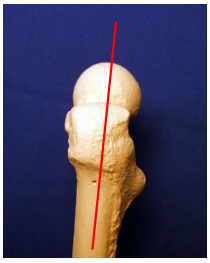
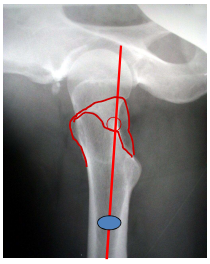
13

Tips & Techniques



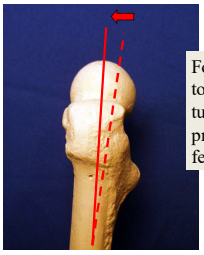
Piriformis starting point



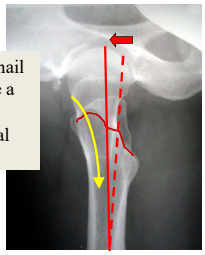
In line with canal

14

Tips & Techniques



Forces nail to make a turn in proximal femur



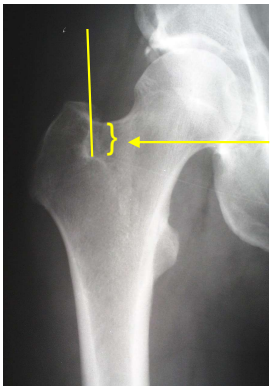
Trochanteric starting point

15

Tips & Techniques

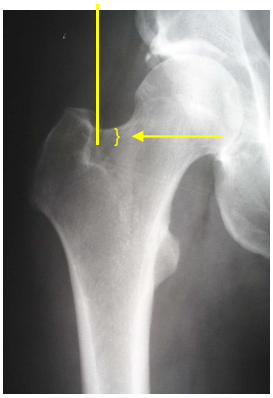
- Advantage of trochanteric starting point: easier to access
- Can also be difficult
  - Piriformis starting point may be accurately defined on single flouroscopic view (AP) for either standard or cephalomedullary nail
  - Troch start requires lateral view to determine anterior-posterior position
  - Tactile feedback of seating tip of guidewire in fossa lost with troch starting point

16



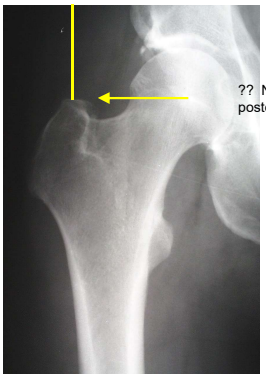
Degree of overlap indicates posterior position in piriformis fossa

17



Less overlap indicates more anterior position in piriformis fossa, appropriate for piriformis cephalomedullary device

18



19

So Why Troch Starting Point?

- Obese patients
  - Easier to access
- Community surgeons
  - No assistant available, supine on fracture table
- Subtroch, pertroch, reverse obliquity intertroch fractures
  - Most currently available cephalomedullary devices have troch starting point

20

Trochanteric Starting Point

- Other considerations?
- OTA 2006
  - 3 podium presentations, 2 posters
  - 2 prospective randomized trials
  - All but one present good evidence supporting trochanteric nailing over piriformis

21

Trochanteric Starting Point

- Stannard, et al
  - Prospective, randomized study
  - 27 piriformis, 28 trochanteric
  - Functional eval @ 6 and 12 months
  - Troch significantly better in terms of surgical time, flouro time, EBL, incision length, and time to clinical union
  - Trend toward better functional results (Womack scores)

22

Trochanteric Starting Point

- Archdeacon, et al.
  - Prospective, randomized study
  - 34 patients followed for minimum 1 year
  - 100% union rate both groups
  - Significantly worse hip mechanics based upon 3 parameters measured in the piriformis group

23

Trochanteric Starting Point

- Ricci, et al.
  - Prospective, randomized, multi-center study
  - 38 trochanteric, 53 piriformis
  - 37/38 and 52/53 union rate
  - Operative time 21% greater piriformis group ($p=0.08$), flouro time 61% greater piriformis group ($p<0.05$).
  - Differences magnified in obese patients
  - No differences in functional recovery

24

Trochanteric Starting Point

- Perez, et al
  - Cadaveric study
  - Describes modified medial trochanteric starting point
  - Avoids damage to gluteus medius tendon

25

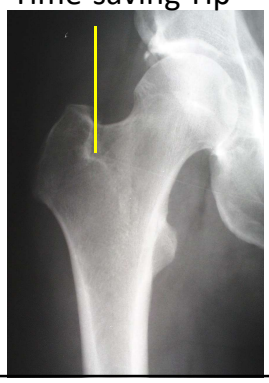
Trochanteric Starting Point

- Ostrum, et al.
  - Cadaveric study
  - Attempted to define “perfect” trochanteric starting point
  - Concluded that no such “perfect” starting point exists due to wide variability among manufacturers in terms of nail design and geometry
  - Potential disadvantage over piriformis for which starting point is universal regardless of nail design

26

Time-saving Tip

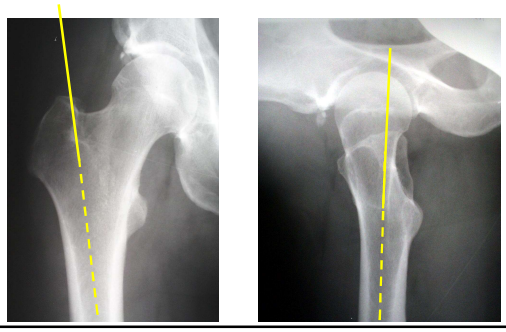
Starting position of guidewire



27

Time-saving Tip

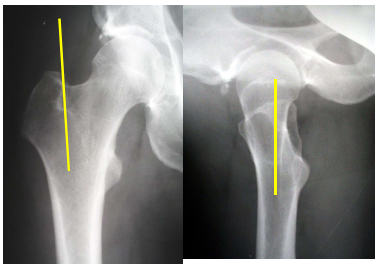
Guidewire insertion



28

Time-saving Tip

Can avoid checking lateral if you limit depth of initial reamer.

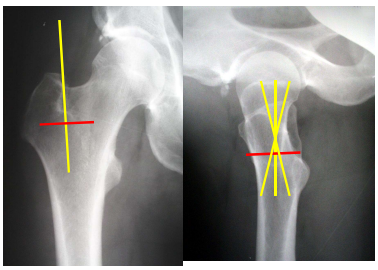


29

Time-saving Tip

All you need is a correct starting point based on single AP view. Just make a hole with your starting reamer.

Orientation on lateral doesn't matter.



30

Time-saving Tip

Next, use T-handled reamer as a canal-finder.

31

Time-saving Tip

- Advantages of this technique
  - Saves time repositioning C-arm
  - Decreases flouro time
  - T-handled reamer not sharp enough to breach cortex with false tract
  - Rigid enough to allow aiming where you want it
  - Opens tract for ball-tipped guide wire in dense cancellous bone facilitating passage

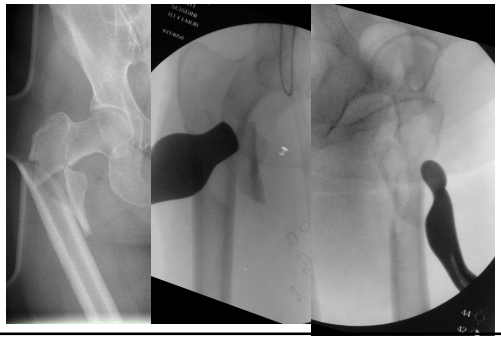
32

Tips & Tricks

- Open nailing
  - Proximal fractures often difficult to reduce closed
  - Tendency toward varus and apex anterior angulation
  - Open nailing techniques can help avoid problems
    - Tenaculum
    - Bone hook
    - Co-linear clamp
    - K-wires
    - Provisional plate fixation

33

Unicortical plates



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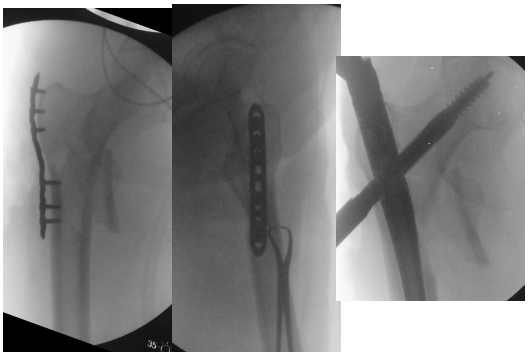

Reduction obtained and maintained, no disruption of medial blood supply

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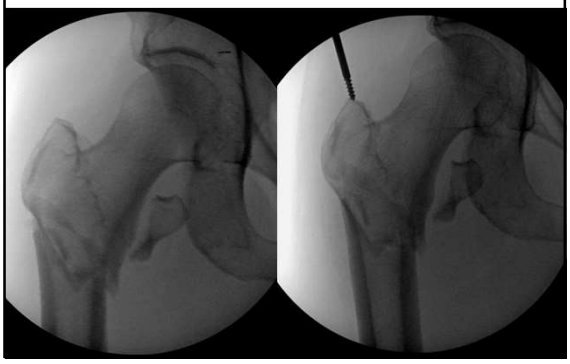
36

- Colinear Clamp



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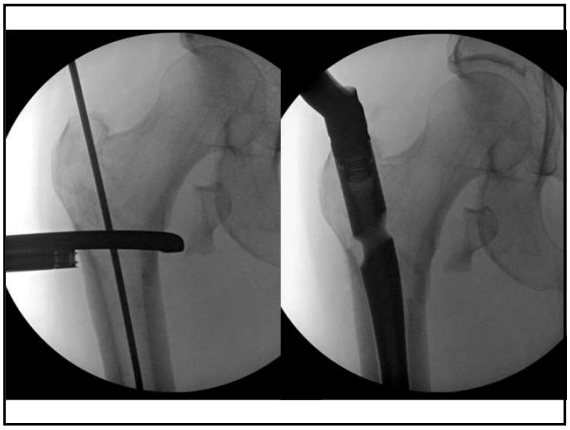

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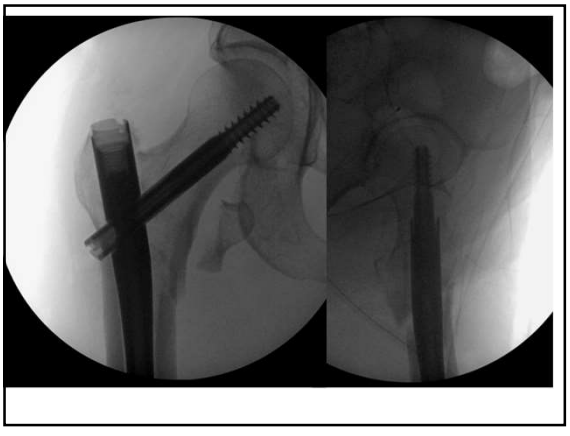
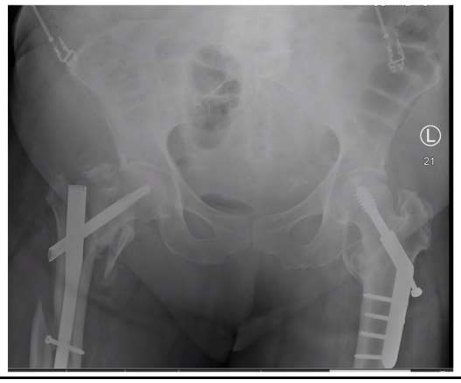


39

- Colinear clamp, tenaculum, blocking device



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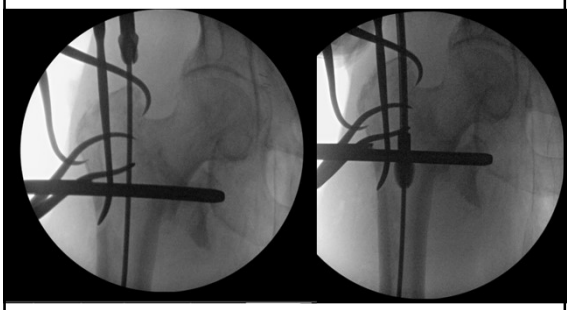

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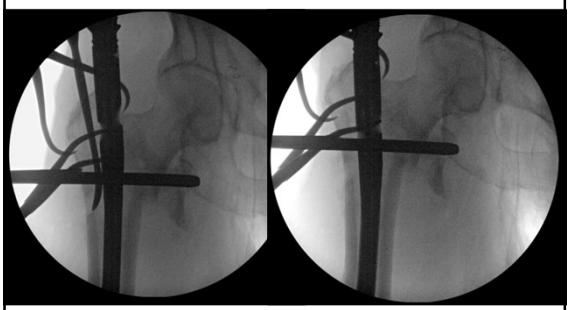
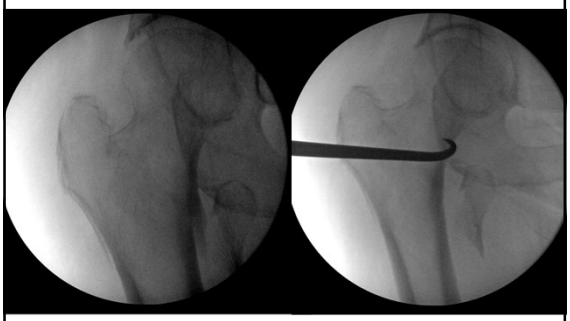


42

- Bone hook

43

- Bone hook



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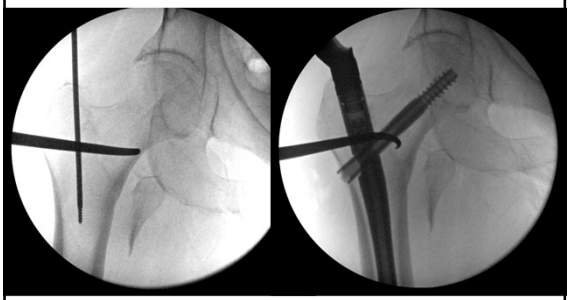
- Bone hook



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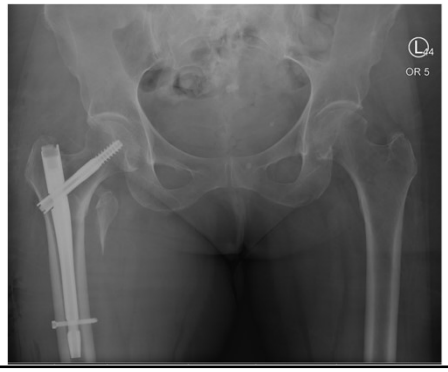
- Bone hook

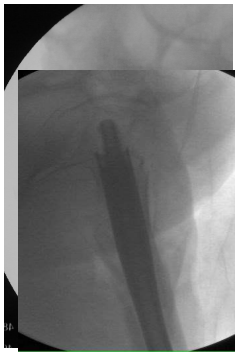


46

Tips & Tricks

- Cephalomedullary nailing
- How to judge anteversion of nail?
  - Trial and error: guess, insert guidewire, check radiographically, adjust, repeat
  - Get it right 1st time: rotate nail so that nail, insertion guide, femoral neck and femoral head superimposed on perfect lateral image….then insert guidewire.

47

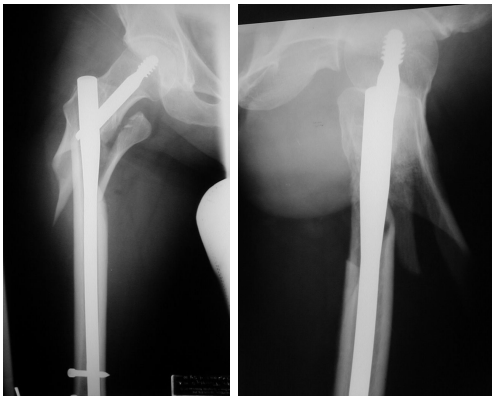


48

Summary

- Reduction is key
- Have low threshold for open nailing, use of adjunctive techniques and devices to avoid……

49



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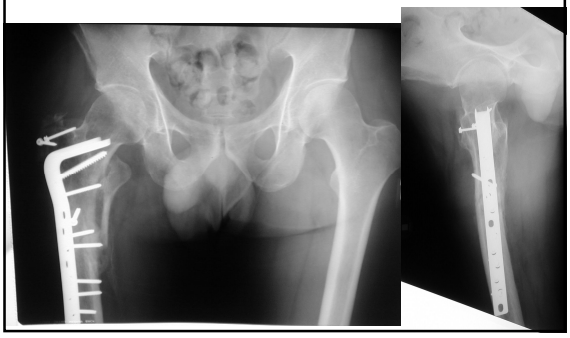
- ….and need for this!



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52