Intertrochanteric Fractures: When and How to Open Reduce

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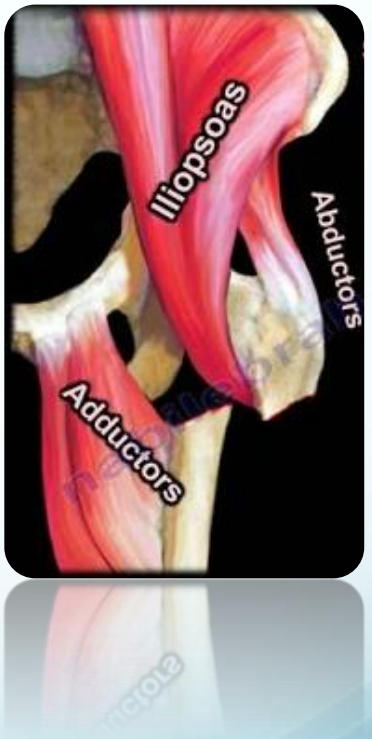
Intertrochanteric Femur Fractures

- **Goal:** restore femoral length, alignment and rotation,
  - providing adequate stability for early ROM and WB,
  - preserving local blood supply to support fracture healing,
- **Rationale:** mal-reductions/malunions/nonunions of intertrochanteric hip fractures lead to compromised outcomes,
  - Nonunion, implant “cut-out”, implant failure

Obstructions to Reduction

- Muscular forces: **Proximal** fragment
  - Gluteus medius/minimus – abduction = varus
  - Piriformis/conjoint m. = external rotation
  - Iliopsoas m. = flexion
  - Iliopsoas m. = shortening and adduction of distal
- Muscular forces: **Distal** fragment
  - Iliotibial band – shortening
  - Gluteus maximus – extension/shortening
  - Adductors – varus/shortening



Obstructions to Reduction

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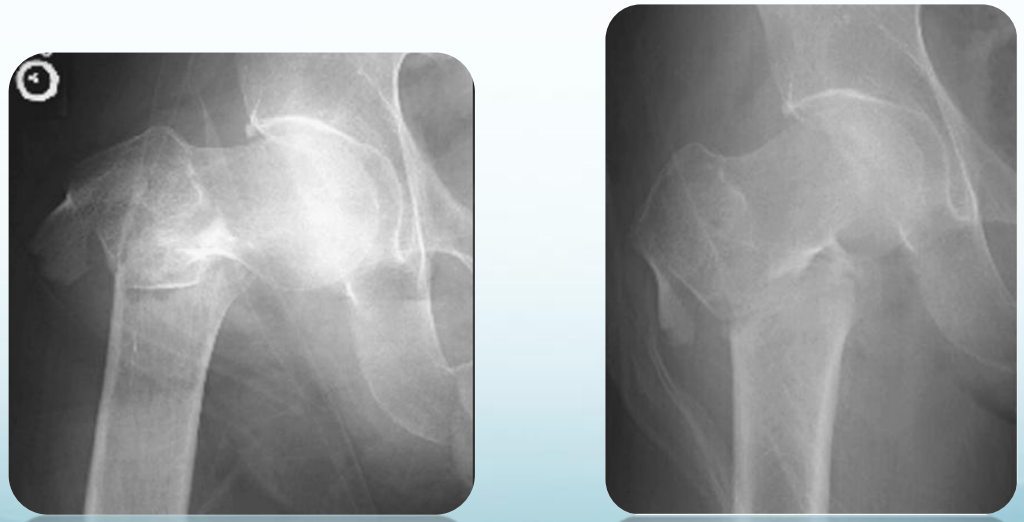
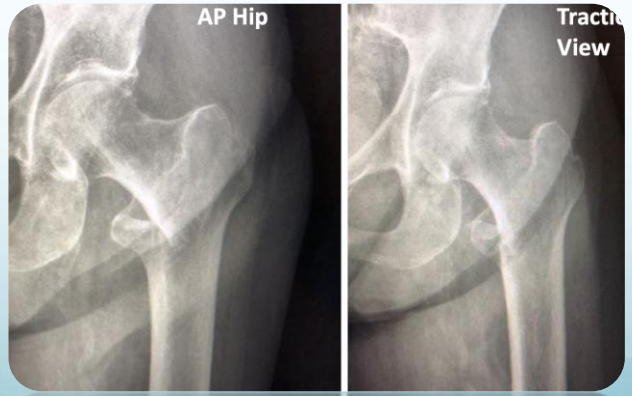
  - Gluteus medius/minimus – abduction = varus
  - Iliopsoas muscle flexion = flexion
  - Piriformis/conjoint muscle = ext. rotation



Closed Reduction

- Patient positioning – Generally supine w/traction,
  - setup labor intensive, length and rotation typically obtainable and less difficult to maintain then “leg-free” position,
  - must allow acquisition of optimal entry point, intra-operative reduction and visualization,
  - guard against “sag” at the fracture site,
  - beware of the potential for “well-leg-compartment syndrome”



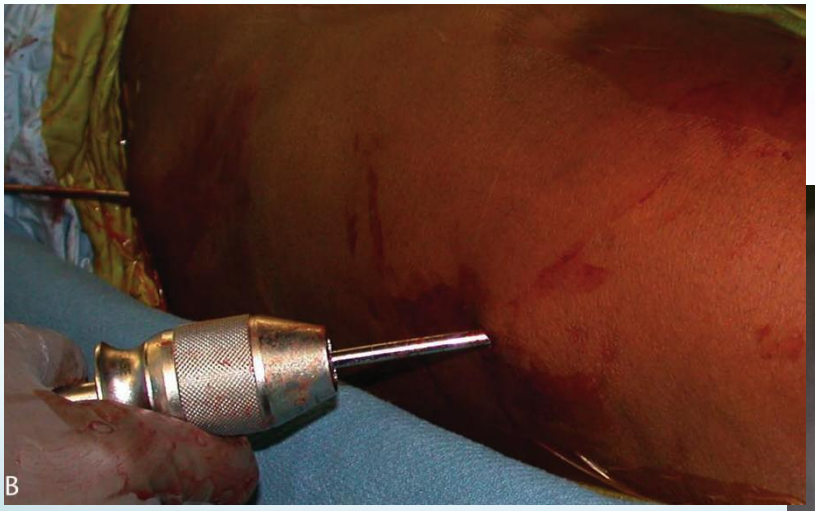
Intertrochanteric Hip Fractures: Un-acceptable Reduction

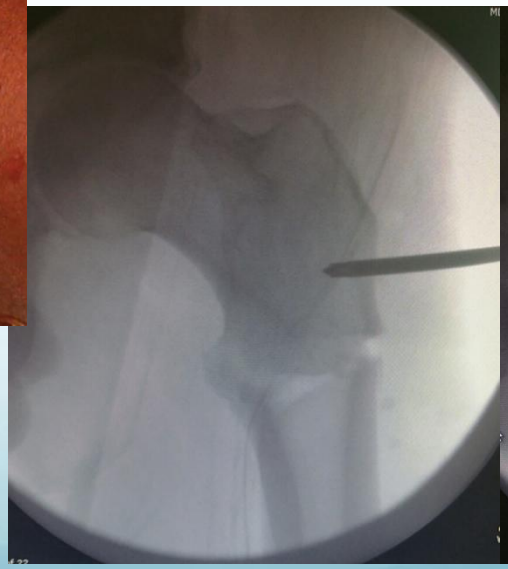
Semi-open Reduction Techniques

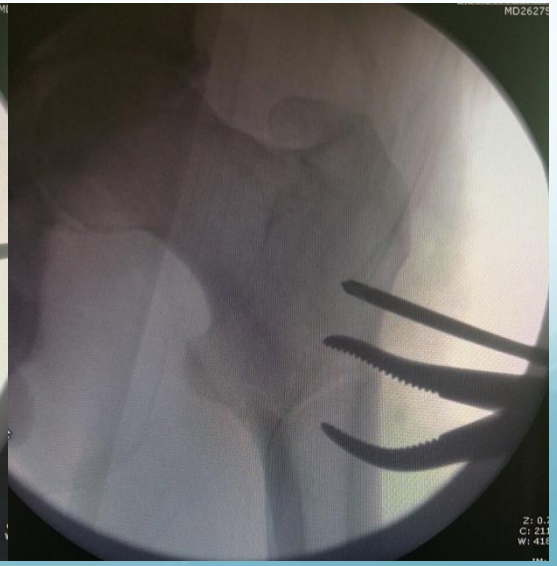
- Schanz(s) screws, Picador (ball spike pusher), bone hook, “joystick” or intramedullary reduction tool,
  - can be used to facilitate fracture reduction by counter-acting deforming forces,
  - “blocking screws” limit the placement of the ball tipped guide wire,

Intertrochanteric Hip Fractures: Un-acceptable Reduction

Semi-open Reduction Techniques





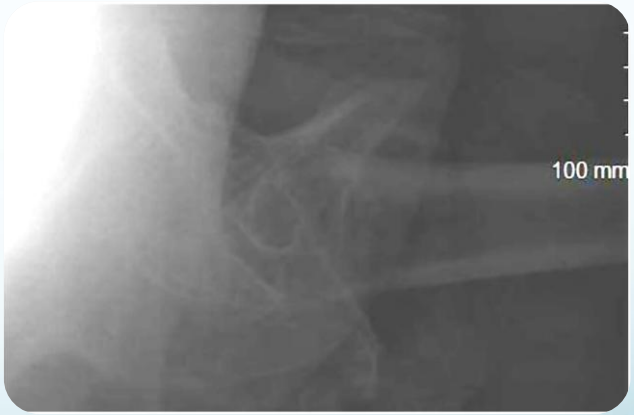


Intertrochanteric Hip Fractures: Un-acceptable Reduction

Semi-open Reduction Techniques

Injury

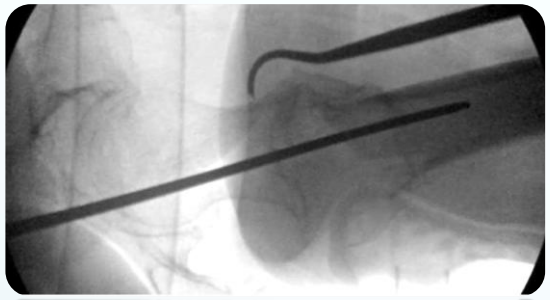
Axial Traction

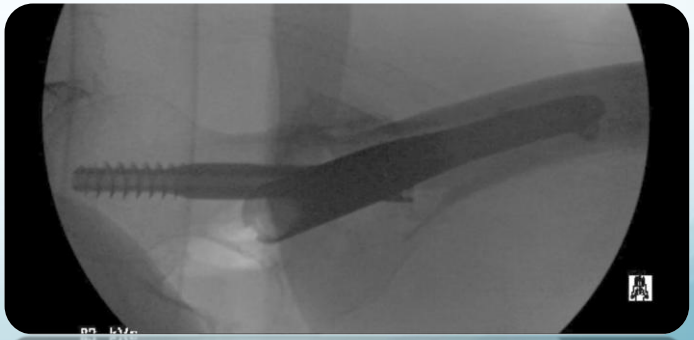


Axial Traction

Intertrochanteric Hip Fractures: Un-acceptable Reduction by Closed Reduction

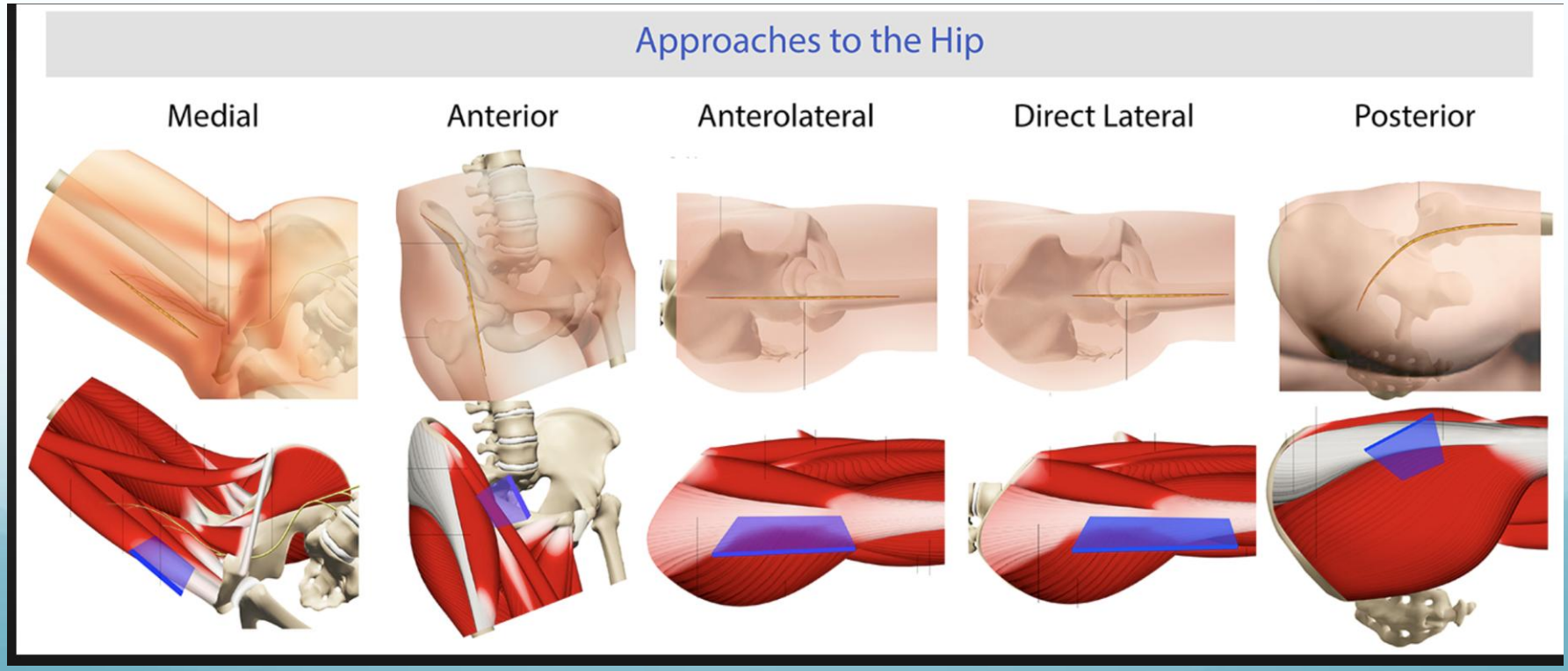
Semi-open Reduction Techniques





Open Reduction Techniques

- Open - reduction forceps, collinear reduction clamps, cerclage wires/cables, intra-cortical plates,
  - Care should be taken to minimize soft tissue striping,



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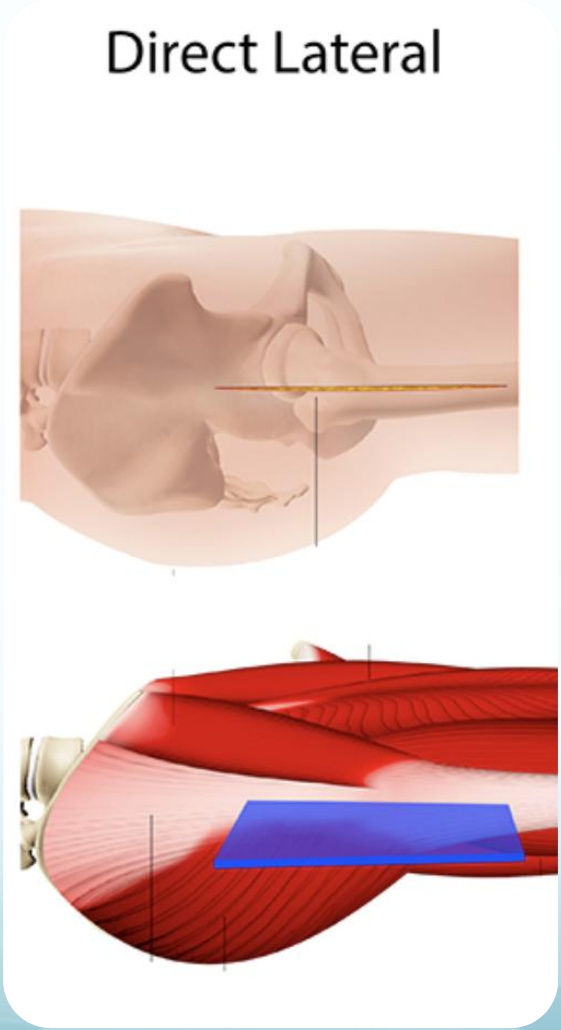
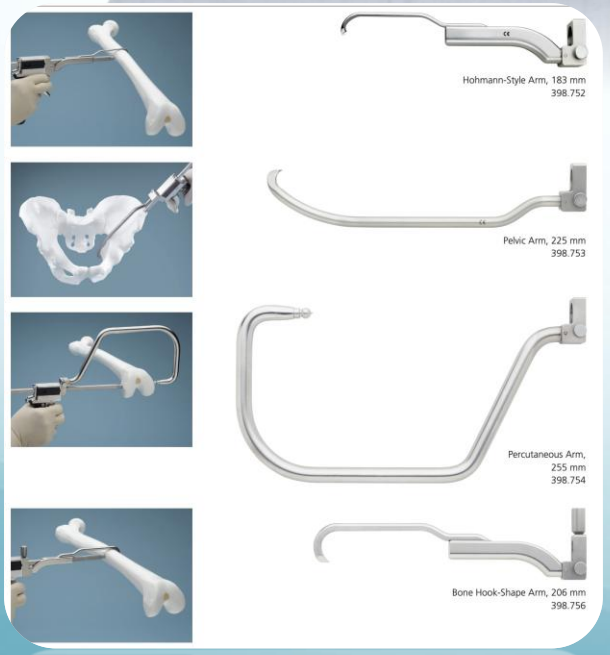


Open Reduction Techniques



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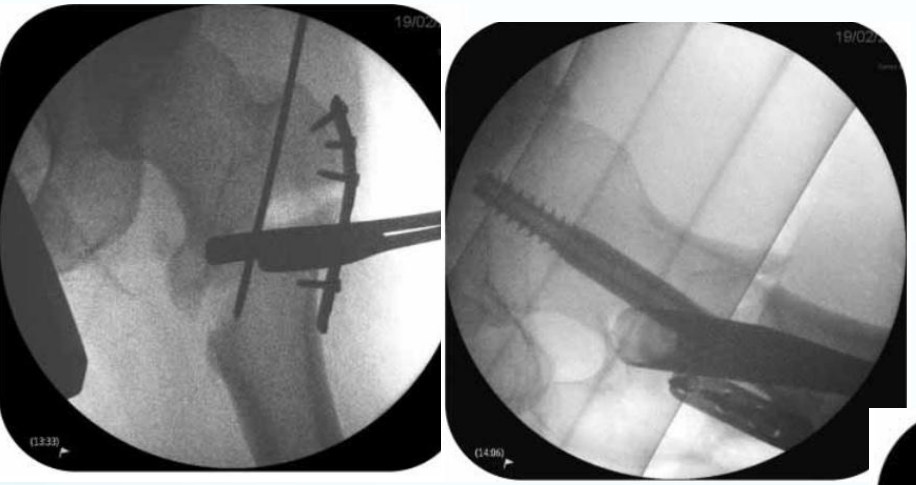
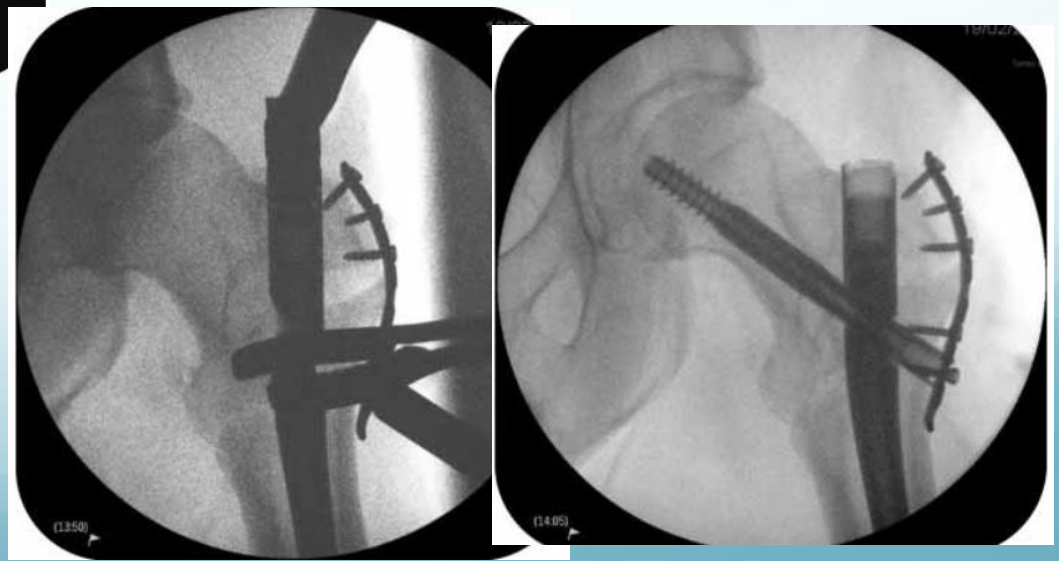
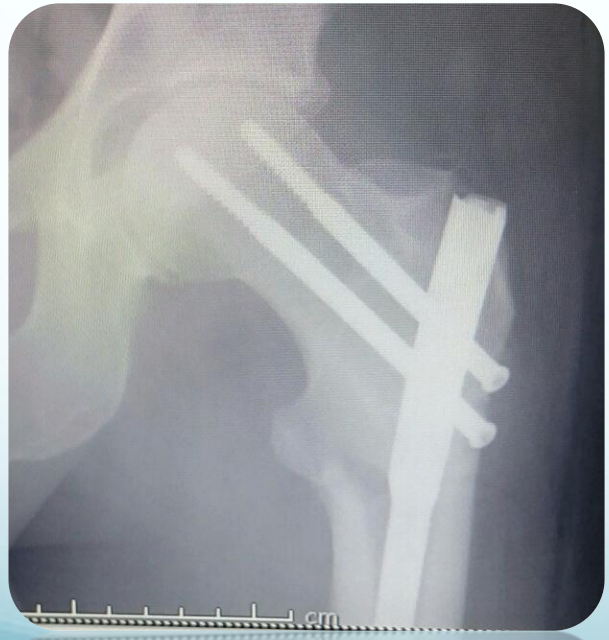




Reduction Techniques

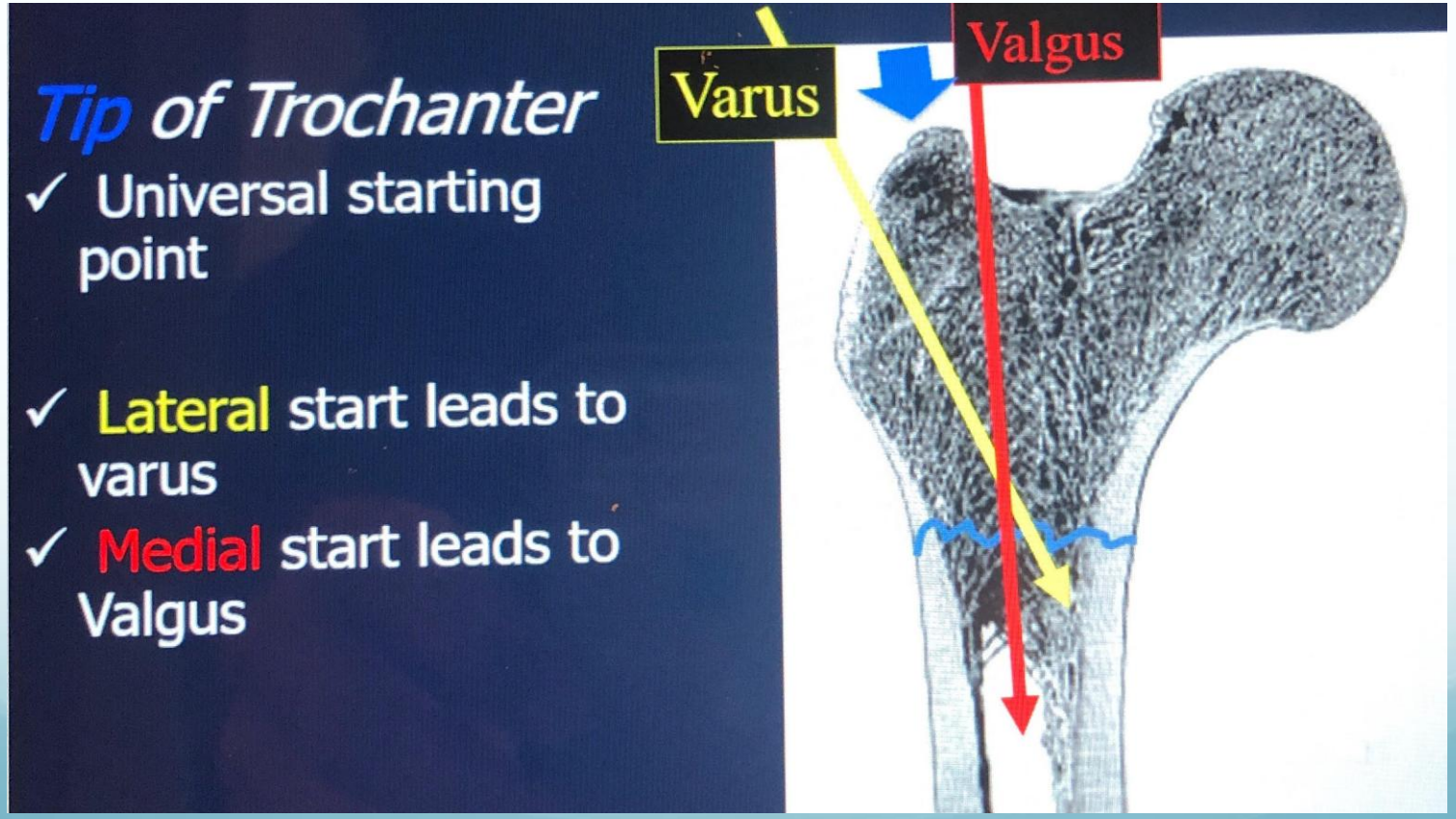
- Combinations – often time it is necessary to employ more than one of these techniques/instruments to secure an adequate reduction to permit intra-medullary nailing,



Starting Point

Once reduction is obtained it is critical to choose the correct starting point

Several factors: nail geometry, patient anatomy, fracture pattern



J Orthop Trauma. 2005 Nov-Dec;19(10):681-6.

A critical analysis of the eccentric starting point for trochanteric intramedullary femoral nailing.

Ostrum RF[1], Marcantonio A, Marburger R.

Author information

Abstract

OBJECTIVES: Antegrade femoral intramedullary nailing through a greater trochanteric insertion site has been proposed for the treatment of subtrochanteric fractures. The currently available trochanteric nails have dissimilar characteristics, and the most appropriate insertion site for satisfactory subtrochanteric fracture alignment has not been determined. This study is an analysis of 5 different trochanteric femoral nails and 3 different insertion sites using a cadaveric model of a reverse obliquity subtrochanteric femur fracture to determine the optimal trochanteric entry site.

SETTING: OSHA-approved cadaveric laboratory with an OEC 9800 (General Electric Company, Fairfield, CT) fluoroscopic C-arm.

METHODS: Twenty-one embalmed human cadaveric femurs were stripped of soft tissues. Three different starting points on the anteroposterior radiograph were used: at the tip of the greater trochanter, and 2 to 3 mm medial and lateral to the tip. A reverse obliquity subtrochanteric fracture was created. The Trochanteric Antegrade Nail (TAN), Gamma nail (2nd and 3rd generations), Trochanteric Fixation Nail (TFN), and the Holland Nail were then inserted. The proximal bend and radius of curvature were calculated for each nail. Varus and valgus angulation as well as lateral gapping were measured on radiographs; also calculated were the mean, range, and standard deviation. Statistical analysis was performed on angulation and gapping at the fracture site by using Fisher least significant differences analysis, based on a 2-way ANOVA test.

RESULTS: The Holland nail had a proximal bend of 10 degrees and a radius of 300 cm. TAN was 5 degrees and 350 cm, TFN was 6 degrees and 150 cm, Gamma 2 was 4 degrees and 300 cm, and Gamma 3 was 4 degrees and 200 cm. The tip starting point led to the most neutral alignment regardless of nail. The lateral starting point led to varus with all nails. The medial starting point led to valgus of >6 degrees with the Holland and TFN; Gamma and TAN had better alignment with <4 degrees of valgus. Gapping of the lateral cortex was greatest with a lateral starting point.

CONCLUSIONS: An analysis of 5 trochanteric intramedullary nails with different proximal bends and 3 different starting points in the greater trochanter showed that the tip of the trochanter is close to the "universal" starting point. In this cadaveric subtrochanteric fracture model, the tip starting point led to the most neutral alignment regardless of nail used. The lateral starting point led to varus and gapping of the lateral cortex with all nails.

Starting Point

Is There a Standard Trochanteric Entry Site for Nailing of Subtrochanteric Femur Fractures?

Philipp N. Streubel, MD, Ambrose H.W. Wong, MD, William M. Ricci, MD, and Michael J. Gardner, MD

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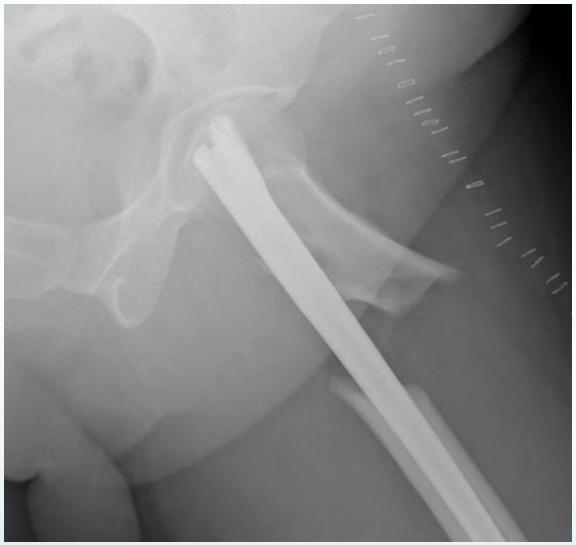
Objectives: To evaluate the variability of the ideal trochanteric starting point as a possible cause for malreduction of subtrochanteric fractures and to analyze the accuracy of contralateral templating to predict correct entry site.

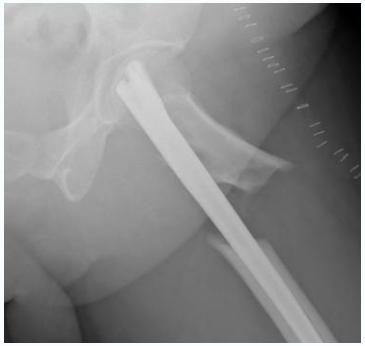
Methods: Standardized anteroposterior pelvis radiographs of 50 patients were evaluated by two independent reviewers. Patients with advanced osteoarthritis, severe hip deformity, and radiographs with asymmetric hip rotation were excluded. Ideal nail entry site was established using a template for a trochanteric nail with a 6° proximal bend. The distance from the greater trochanteric tip to the ideal nail entry site was measured. Additionally, offset of the greater trochanter tip from the femoral longitudinal axis was measured. Interobserver reliability and accuracy of contralateral templating were evaluated.

Results: The ideal entry point ranged from 16 mm medial to 8 mm lateral to the trochanteric tip (mean, 3 mm medial; standard deviation, 5 mm). In 70% of patients, the ideal entry point was medial to and in 23% lateral to the tip of the greater trochanter. Ideal entry points were located within 2 mm of the trochanteric tip in 29% and within 4 mm in 44% of patients.

Conclusion: A high degree of variability exists for the ideal trochanteric entry site. The trochanteric tip represents the ideal starting point in only the minority of cases. Preoperative contralateral templating provides an accurate means for establishing a patient-specific entry point to minimize fracture malreduction.

Complications





Summary

- Attention to detail is a must for successful intramedullary nailing of intertrochanteric femur fractures,
- Restoration of length, alignment and rotation **must be** achieved **prior to** intramedullary reaming
- Understanding the personality of the fracture and the surrounding soft tissues (muscles) envelop
  - dictates the plan of care and strategies employed to promote an accurate intra-operative reduction.
- Multiple reduction techniques and instruments are available,
  - Use the best reduction tool for the fracture which maintains the maximal soft tissue attachments,
- Choosing the correct starting point based upon the nails geometry and the patient's anatomy a must!!