J. Tracy Watson M.D.
Professor Orthopaedic Surgery
Saint Louis University School of Medicine
Chief, Division of Orthopaedic Traumatology

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ORTHOPAEDIC TRAUMA BOOTCAMP

Subtrochanteric Fractures: Techniques for Reduction and Fixation

A. Starting Point: Piriformis
- The piriformis start can be much more technically challenging compared to the trochanteric entry, especially in obese patients.
- Too anterior on the femoral neck , risk of anterior cortical blow out from excessive hoop stresses.
- Correct starting position can be blocked by abnormal anatomy such as trochanteric overhang or bulky short rotator muscles which will force the entry portal too far medially and risk iatrogenic femoral neck fracture
- Cadaveric studies, it has been shown that the piriformis entry portal damaged the anterior branches of the ramus profunda of the medial femoral circumflex artery which could potentially compromise the blood supply to the femoral head.
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B. Starting Point: Trochanteric Start
- implants with a lateral proximal bend and anteverted locking configurations prevent noted varus malalignment, and trochanteric lateral wall "blow out".

C. How to choose?
- Factors to evaluate include propagation of the fracture with associated comminution or extension into the femoral neck, piriformis fossa or lateral trochanteric buttress. Patient morphology, and the overall patient's condition with regard to supine or lateral positioning

D. Fracture pattern issues
Internal rotation-traction views
- CT scan
  - Determine and concede portal competency when a reamer and subsequent nail is passed thru this region.
  - Propagation into fossa or trochanter
    - *portal reconstruction by using specific open techniques with adjunctive reduction clamps , locking screws., and lag screws*
    - REDUCTION IS THE KEY….avoid extension "ball spike pusher"
      Bone hook for varus reduction.
      OPEN AND CLAMP IF YOU CAN"T GET IT…..!!!

E. Patient Morphology
- Obese patient or those with trochanteric overhang, (best seen on transverse CT cuts) make a piriformis entry difficult if performed in the supine position.

- Easier to use this portal if the patient is in the ***lateral position*** because the mass of the hips and abdomen "falls" away from the trochanter and allows a direct in-line trajectory into the fossa.

- Supine position where a large body habitus, protruding abdominal girth and hip mass, impinges into the troch area and precludes the ability to properly obtain the inline trajectory. Adducting the body, operative leg and extending the insertion incision are all tricks utilized to gain an "in line" trajectory in these instances.

- Trochanteric entry portal is much easier to use for obese patients if a supine nailing is selected. With the eccentric trajectory, the abdominal impingement and trochanteric mass is often avoided without having to extend the incision. Likewise these advantages are also realized for troch nailing an obese patient in a lateral position.

D. Fx Table vs Radiolucent table
   - With obese patients, supine nailing on a fracture table locks in the position of the leg and abdomen making either portal trajectory difficult.
   - Radiolucent table to achieve un-encumbered visualization of the entry portal. A bean bag and/or blanket bumps helps to position the patient in a "floppy" lateral position.
     - Either entry portal can be easily accessed with this position as the trochanteric "habitus" falls away from this area for easier x-ray visualization and thus portal access. This position allows free manipulation of the leg below the fracture. Reducing the distal limb segment to the proximal segment simply by flexing or extending the femur. *In the lateral position, the extension of the proximal segment is not as accentuated as it is in the supine position. Thus, this technique helps to avoid the varus and extension deformity commonly seen when nailing in the supine position,* especially when the confines of a fracture table is also used.

E. Intra-Operative Imaging
   - A common problem with proximal fractures is nailing them in extension. This is caused by assuming the proximal fragment is parallel to the floor, and not visualizing adequately the proximal fragment in the lateral view. *In most instances the proximal segment is flexed slightly and the entry trajectory is NOT parallel to the floor. (In the supine position)*
   - The ideal start point is the one that results in reaming the trochanteric region to properly accommodate the bend of the nail once the nail is fully seated, without coronal malalignment.
   - No matter which portal is utilized, body mass and configuration of the proximal femur is such that there is always a tendency to *lateralize* the reaming process even if you are in a lateral position. One must be diligent during reaming to consciously prevent this lateralization tendency and avoid resultant varus

F. Screw Configuration
   - Reconstruction nails consist of two parallel screws coursing into the femoral neck. This construct has been shown to be stronger in axial load to failure in unstable subtrochanteric femur fractures. There is a potential difficulty of placing two parallel screws, especially in smaller patients with narrower femoral necks. The inter -screw distance may be too large to accommodate using both axially aligned screws, especially if the vertical height of the neck is narrow, as may be the case in short statured individuals. If the nail is improperly seated (too high or too low), this will also preclude the successful placement of both screws unless the nail is carefully repositioned.
   - Cross locking screw configuration which consists of the standard retrograde screw into the femoral neck and an antegrade screw aimed at the lesser trochanter. This cross screw construct has been shown to have greater stiffness and a higher load to axial failure compared to the parallel screw configuration. It has the additional benefit of being technically less demanding but still allowing for the stability of 2 screws into the proximal segment.
      - Newer cross locking designs allow choice of proximal femoral fixation based on the proximal extent of the fracture. the region around the lesser trochanter must be in continuity with the proximal segment if this cross locking orientation is selected. A pre-operative CT scan is often helpful in these cases, to determine the proximal extent of the fracture line.
      - A single screw coursing into the femoral head and neck is an unstable situation, as this area can rotate around the solitary screw especially if the region below the segment is highly comminuted with no inherent cortical stability.

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