Ensuring Correct Placement of Proximal Fixation in Reconstruction Intramedullary Nailing for Subtrochanteric Femur Fractures

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Abstract: Subtrochanteric femur fractures present a challenge to orthopedic surgeons. Anatomic reduction and stabilization can be technically difficult. A variety of intramedullary and extramedullary devices have been used to stabilize these fractures. The authors describe a novel technique for easier proximal interlock fixation for reconstruction intramedullary nailing to ensure proper placement into the nail. This will likely save time in a patient population that may be either frail and elderly or young with high-energy polytrauma, and it may reduce radiation exposure for both patients and surgeons. [Orthopedics. 2014; 37(2):107-110.]

Subtrochanteric femur fractures account for 7% to 34% of all femoral fractures.1,2 The incidence of these fractures occurs in a double-peeked age curve. Younger patients experience subtrochanteric femur fractures during high-energy trauma, typically from axial compression and rotation. High-energy trauma has been reported as the cause of as many as 77% of subtrochanteric fractures.3 In older individuals, falling directly onto the hip usually leads to a subtrochanteric fracture. Low-energy trauma causing subtrochanteric fractures is less common.4

Patients taking bisphosphonate for more than 5 years have been found to have a higher risk of either subtrochanteric or femoral shaft fracture.5 Although bisphosphonate prevents a significant number of fractures, its use for more than 5 years leads to severe suppression of bone turnover. The absolute risk of bisphosphonate-related fractures is low. The pattern seen in these fractures is a thickened cortex with either a transverse or slightly oblique fracture with minimal comminution.6

The subtrochanteric region is the area below the inferior border of the lesser trochanter to the proximal and middle third of the femoral shaft.6 Short proximal fracture fragments can be flexed, abducted, and externally rotated.7 The combination of the strong deforming forces and the poor vascularity of the region of the femur complicates fixation and healing. There are numerous classification systems for subtrochanteric fractures.

Intramedullary nailing has been performed successfully using the gamma nail or using the reconstruction nail in either reconstruction or antegrade mode. Closed reductions and intramedullary nailing techniques are less invasive due to less surgical dissection with periosteal and soft tissue damage.2 There is less risk of infection and less intraoperative blood loss with intramedullary nailing.4 Second-generation intramedullary nails have superior biomechanical properties when compared with extramedullary plating for unstable fracture patterns.2 Fifty-two closed intertrochanter-subtrochanteric fractures were treated with long gamma nails. There was a 100% union rate in this series with negligible mechanical complications.8 Equivalent outcomes were seen with dynamic condylar screws and Russell-Taylor reconstruction nailing.2 For Russell-Taylor reconstruction nailing, 2 proximal and 2 distal statically locked screws are placed. Failure of fixation or nonunion can be salvaged with arthroplasty techniques.9

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The ultimate goal of fixation is to restore femoral length and rotation. Care must be taken to correct femoral head and neck angulation. Intramedullary fixation can lead to quicker recovery, increased walking ability, earlier range of motion, and possible immediate weight bearing for some patients. The average time to healing has been reported as 25 weeks. The rate of repeat surgery for any reason has been approximately 10%. Efficient proximal and distal interlock placement decreases surgical time and the duration of anesthetic. In the population with subtrochanteric femur fractures, either young patients with high-energy injuries or frail elderly patients, operative efficiency is desired. However, reconstruction nailing has difficulties and complications. The authors have found the placement of proximal interlocks outside of the nail despite using a guide to be a problem. Figure 1 shows the placement of the proximal interlock screw anterior to the nail. Figure 2 is an intraoperative fluoroscopic view of the case where the surgeon did not obtain perfect lateral to confirm placement.

SURGICAL TECHNIQUE

The patient is placed supine either on a fracture table or free on a flat table. Fluoroscopy is then positioned. The patient may or may not be in skeletal traction. If a fracture table is not being used during surgery, the authors typically prepare the Steinmann pin to use for traction. After a standard preparation and drape, closed reduction is attempted. A variety of noninvasive closed reduction maneuvers should be attempted. If the reduction cannot be performed closed, either joystick pins or wires are used to attempt closed reduction. If adequate reduction cannot be obtained,
the surgeon should proceed with open reduction. Once satisfactory reduction is obtained, a lateral hip incision is made to enter with the guide pin to find the greater trochanteric entry point. Once a satisfactory starting point is found, the conical reamer is used.

While maintaining anatomic reduction of the fracture, the surgeon passes the ball-tip guidewire through the fracture site and to the level of the distal femoral epiphyseal scar. Reaming is performed in increments until cortical contact occurs, typically reaming to at least 2 mm more than the diameter of the selected nail. Next, the chosen nail is inserted and the ball-tip guidewire removed. If the fracture has more proximal extension or if the decision has been made to protect the femoral neck, the nail is placed in reconstruction mode. The ball-tip guide wire is removed. The reconstruction guide and sleeves are used to make skin incisions for the proximal screws.

A K-wire is drilled through the lateral cortex and appropriately up into the femoral head through the distal guide hole and is left in the femoral head. The ball-tip guidewire is passed back down the nail. This ball tip is prevented from passing distally due to the K-wire blocking its path, ensuring the drill path is through the nail (Figure 3). The guidewire is removed, and a drill bit is drilled through the more proximal hole of the reconstruction guide in reconstruction mode. Again, the drill is removed but the drill bit is retained; an attempt is made to pass the guidewire down farther, confirming it is within the nail (Figure 4). The guidewire is removed and the proximal screw for reconstruction mode fixation placed (Figure 5). The K-wire is removed and the drill bit passed through the distal hole up into the femoral head; the depth is measured and the screw subsequently placed. The proximal screw for reconstruction mode is again checked using the ball-tip guidewire (Figure 6). Placement is confirmed by anteroposterior and lateral fluoroscopic imaging (Figures 7-8).

Once adequate rotation is confirmed, the perfect circle technique is used to place 2 distal interlocks in either static or dynamic mode depending on the fracture pattern (Figure 9). The set screw is placed and the target device removed. The patient’s wounds are irrigated and closed in layers. Depending on the fracture pattern, the patient is either weight bearing as tolerated or partial weight bearing.

**CONCLUSION**

Subtrochanteric femur fractures can be challenging to treat. Reconstruction nails are commonly used to treat them. An uncommon complication with reconstruction nails is proximal screw placement outside of the nails. The technique presented here ensures that both the drill and screws are passed appropriately through the nail without repeated anteroposterior and lateral fluoroscopic imaging. This technique may reduce the duration of surgery and radiation exposure for patients and surgeons.

**REFERENCES**

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