Unstable intertrochanteric fracture of the femur is one of the most commonly encountered orthopaedic injuries in the United States. A 63-year-old female sustained a highly unstable intertrochanteric fracture of the femur (OTA 31-A 3.3) and she was treated with a long cephalomedullary nail. Four months later, a solid union occurred at the fracture site with minimal limb length discrepancy and the patient regained her pre-operative functional status. This case report highlights the important points which must be considered in the treatment of an unstable intertrochanteric fracture with emphasis on preoperative evaluation, intraoperative management and post-operative protocol for a good outcome.

Key Words: unstable intertrochanteric fractures, cephalomedullary nail

INTRODUCTION

Unstable intertrochanteric (IT) fractures are relatively common injuries among the geriatric population. As per the most commonly used Evans classification, loss of posteromedial integrity, IT fractures with subtrochanteric extension, and the reverse oblique pattern are considered unstable. The complications after internal fixation include hardware failure, nonunion, malunion, limb length discrepancy, and diminished abductor lever strength. The increase in the incidence of complications has led to an extension of the definition of instability to include lateral wall blow out, greater trochanteric fracture, and osteoporosis. The preoperative identification of an unstable pattern is of utmost importance in reducing complications.

Many fixation methods have been described to treat IT fractures, of which the sliding hip screw and intramedullary devices (IMDs) have stood the test of time. Biomechanical and clinical studies show a clear advantage of IMDs over sliding hip screws in fixation of unstable fracture patterns. The evolution of nailing systems began with the first-generation gamma nail (Stryker, Mahwah, NJ) in the 1980s and has progressed to current fourth-generation nails.

CLINICAL SCENARIO

A 63-year-old woman presented to the emergency department with 10/10 pain in her left hip subsequent to fall at home. She had a known diagnosis of osteoporosis for which she was on regular calcium, vitamin D supplements, and once yearly bisphosphonates. She was nonhypertensive, nonsmoker, and denied any other significant past medical or surgical illnesses. A focused clinical examination revealed a left lower extremity in extreme external rotation, shortening, and generalized hip pain.

DIAGNOSTIC ASSESSMENT

Plain radiographs anteroposterior (AP) view and cross-table lateral view of the left hip, traction-internal rotation view, and a computed tomography scan (CT) scan with 3D reconstruction were obtained. These revealed a loss of posteromedial continuity, subtrochanteric extension, greater trochanteric comminution, and a fracture line extending up to the femoral neck, making this injury highly unstable (Figs. 1A–E).
TREATMENT

Considering the highly unstable nature of the fracture, the authors chose to proceed with long intramedullary nailing. Closed reduction was attempted with longitudinal traction followed by internal rotation but was unable to correct posterior sag and medialization of the femoral neck. Based on this, the decision was made to perform an open reduction. The posterior sag was corrected using a posteriorly placed Cobb elevator, and the medialization of the femoral neck was corrected using a bone hook. The reduction thus obtained was maintained by a coaxial clamp (Fig. 2A). The intraoperative fluoroscopic images revealed an acceptable alignment of the femoral head and neck with the shaft without any varus or medialization of the femoral neck. An incision was made proximal to the tip of the greater trochanter, and an entry wire was placed 1 mm medial to the tip of greater trochanter to avoid damage to abductors and to promote valgus reduction. The entry wire position was confirmed on AP and true lateral fluoroscopic views and advanced into the medullary canal. After advancement of the wire, the position was confirmed on AP and true lateral fluoroscopic views. The entry reamer was then used to gain access to the medullary canal, and the entry wire was removed. The reduction was maintained with the reduction forceps throughout the procedure, and a ball-tipped guide wire was introduced into the proximal femoral canal and advanced down the distal femur. Its position was confirmed distally on AP and lateral views. The femoral canal was sequentially reamed up to 11 mm, and a 9 × 360 mm nail was then placed over the guide wire and seated distally by hand. At this point, central–central position of a compression screw guide wire in the femoral head was obtained, screw length was determined, a step drill was used over the guide wire, and an

FIGURE 1. AP (A), lateral (B), traction–internal rotation (C), radiographic images and CT scan with 3D reconstruction (D and E) of the left hip show an IT fracture femur with the comminution of greater trochanter, subtrochanteric extension, and a separate anteromedial and posteromedial fragment.

FIGURE 2. Note the correction of medialization of the femoral neck after the placement of a bone hook, and the reduction was held with a coaxial clamp (A). The ball-spiked pusher was placed laterally to impact the fracture (B).
appropriate sized compression screw was placed. Because of concern for possible rotational instability, the guide wire for a derotation screw was placed to provide provisional stability during compression screw advancement. The compression screw was rotationally locked with a set screw device but was allowed to collapse. A ball-spiked pusher was placed laterally to impact the fracture (Fig. 2B). At this point, traction was released and compression was achieved, which further increased rotational stability. The construct then underwent live fluoroscopic evaluation on the lateral view, and rotational stability was confirmed. Based on this, it was believed that the compression screw alone would provide adequate rotational stability and a derotation screw was not required. Finally, a single distal interlock screw was placed. The intraoperative images after the placement of the nail showed excellent neck shaft alignment, minimal fracture gap, and no significant medialization of the femur neck (Figs. 3A, B).

**FOLLOW-UP AND OUTCOMES**

Postoperatively, the patient was made weight bearing as tolerated. Radiographs obtained at 6 weeks showed further impaction at the fracture site as anticipated. The patient was encouraged to continue to mobilize and began outpatient physical therapy stressing aerobic conditioning, gait training, and balance exercises, as the fracture showed excellent evidence of healing and well-positioned hardware. At 1 year postoperatively, there was minimal limb length discrepancy without any obvious deformity, and radiographs showed overall excellent alignment with a well-healed fracture (Figs. 4A, B).

**DISCUSSION**

Intertrochanteric fractures are considered unstable when any of the following features are present: posteromedial discontinuity, subtrochanteric extension, reverse oblique pattern, greater trochanter comminution, and lateral wall insufficiency. In addition, osteoporosis leads to further instability. IT fractures occur in metaphyseal regions, so healing is rarely a major problem, but late complication including malunion, shortening of the limb, and external rotation deformity can significantly affect postsurgical ambulation.

In this patient, the initial plain radiographs revealed a peritrochanteric fracture, but the specifics of the injury pattern were difficult to assess (Figs. 1A, B). The addition of a traction view and CT scan with 3D reconstruction was of great value in evaluating this injury (Figs. 1C, D). CT scan is not advisable in each case, but we recommend only if there is a complex fracture where specifics of injury pattern cannot be defined even on a traction view. Ideal preoperative planning begins with classification, and as per the OTA classification, this case belongs to the unstable IT 31-A3.3 group. To address the complexity and instability in this injury, a long cephalomedullary nail was chosen. A major key to success in this case was the intraoperative reduction of the fracture as described earlier and utilization of the dynamic property of the implant that led to solid union. In this case, further collapse at the fracture site could be seen at 6 weeks, as was anticipated, and complete healing was evident at the end of 4 months (Figs. 4A, B).

Historically, displacement osteotomies were considered as standard treatment for unstable IT fractures; however, later studies showed no advantage in comparison with anatomic fixation. To restore the medial buttress, extra screws or...
cerclage wire would be necessary if a sliding screw was the implant of choice, but this is associated with significant soft tissue stripping and only a 17% increase in the fixation strength. The greater trochanter constitutes the lever arm of the abductor mechanism, so near anatomic fixation is necessary for normal hip function. In this case, although the greater trochanter appeared to be comminuted, it was believed that the abductor mechanism was intact. If components of the greater trochanter are widely displaced, we would advise open reduction and suture fixation of fragments to whatever implant is chosen.

The cost-effective analysis, biomechanical studies, and clinical outcomes suggest that IMFs are better devices for unstable IT fractures. The earlier generation nails were associated with multiple problems including shaft fracture at the end of nail, screw cutout, and femoral neck fracture after hardware removal. The newer generation nails are associated with significantly fewer complications; however, some issues such as femoral neck fracture after implant removal continue to exist. The advantage of an IMF also includes earlier mobilization and less limb shortening, both of which may enhance the patient’s general well-being.

In conclusion, preoperative identification of the unstable fracture pattern with proper radiologic investigations, selection of the most suitable implant based on fracture pattern, achieving and maintaining reduction during nail placement, and early postoperative mobilization will maximize the patient’s recovery in an unstable IT fracture.

REFERENCES
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