Summary: Femoral neck fractures in young and middle-aged patients are a challenging clinical scenario. They have a high complication rate and behave distinctly differently than those found in an elderly population. Historically, there were limited fixation options for this age group; however, the recent introduction of the femoral neck system offers a new tool to manage these fractures. This system may have advantages over previously available methods, and the capabilities of this device may offer increased stability and improved outcomes for challenging femoral neck fractures.

Key Words: femoral neck system, trauma, femoral neck, fracture

INTRODUCTION

Displaced femoral neck fractures in the active, healthy, middle-aged patient remain a clinically challenging scenario. It is estimated that 2%–11% of hip fractures occur in the nonelderly, and the mechanism of injury, urgent management, and complications associated with elderly hip fractures may differ from those found in a younger population. In the fragility fracture patient, stable fractures undergo fixation that allows for compression of the fracture on implants that will slide, including the sliding hip screw or partially threaded cannulated screws. This achieves stability by an indirect means as the sliding provides adequate compression to allow for healing.

The goal of treatment in the younger patient is to preserve the femoral head, avoid osteonecrosis, achieve union, and return to full activity. To return to full activity, special attention must be paid, in these fractures, to preserving native hip anatomy and biomechanics that may be of less concern when treating elderly patients. These goals are made more challenging because of the unique anatomy of the femoral neck. The femoral neck is intracapsular and does not reliably form callus, because of the lack of a cambium layer. Therefore, fracture reduction to achieve absolute stability and eventual primary bone healing is required. Additionally, these fractures are known to be subject to high rates of avascular necrosis and nonunion. Multiple surveys of practicing orthopedic surgeons demonstrate significant variability in the management of these fractures, suggesting that controversy remains about the ideal method of fixation.

Thoughtful choice of implant to obtain fixation is of particular importance to surgeons because the literature indicates that should initial fixation fail, revision to a valgus intertrochanteric osteotomy or conversion to total hip arthroplasty is reasonable salvage options (Fig. 1). However, in these cases, outcomes are generally less favorable when compared with primary total hip arthroplasty. A number of new systems to manage these fractures have recently become available to orthopedic surgeons. One of the these, the Femoral Neck System (FNS) (DePuy Synthes, Monument, CO) provides angular stability with minimal soft tissue compromise. This system uses a small fixed-angle side plate and a combined bolt with antirotation screw construct that allows for controlled fracture collapse up to 2 cm along the plate barrel while providing rotational and angular stability. In the present report, we detail a case of a young femoral neck fracture that was managed with the FNS.

PATIENT INFORMATION

A 56-year-old otherwise healthy man was seen in the emergency department following a fall downstairs. Imaging at
that time demonstrated a displaced left femoral neck fracture (Fig. 2). Given the patient’s age, discussion of treatment modalities included both open reduction internal fixation and total hip arthroplasty. The patient was an active 56-year-old man with a previous left subtrochanteric femur fracture that was treated with minimally invasive measures many years before this injury. This resulted in a malunion that would require correction to perform a total hip arthroplasty. Before his femoral neck fracture, he had no symptoms consistent with hip arthritis. At 56 years of age, cannulated screw stabilization, fixed-angle device stabilization, and total hip replacement were all reasonable choices for surgical intervention given the success of arthroplasty in this age group. However, the minimally displaced nature of this fracture, risks of arthroplasty dislocation, infection, and wear were discussed, and the patient decided to undergo operative fixation of his femoral neck fracture. Operative fixation using the FNS was performed without incident (Fig. 3). Of note, the preoperative discussion did outline the possibility of nonunion, and the decision was to convert to arthroplasty if it occurred.

**SURGICAL TECHNIQUE**

The FNS was selected for this case to minimize rotation of the closed reduction during bolt placement that can occur with the sliding hip screw and provide rigid fixed angle slidding for compression. The technique of placement is similar to that of a sliding hip screw. The patient was positioned supine on a fracture table. The fracture was reduced using longitudinal traction while in external rotation followed by internal rotation and adduction. Biplanar fluoroscopy was demonstrated acceptable fracture reduction.

A 4-cm incision was made over lateral proximal femur from the level of the intertrochanteric ridge distally. The incision was carried through the fascia, and the vastus lateralis was elevated off the bone using a Cobb elevator. Multiple threaded guide wires were driven through the lateral cortex across the fracture site and into the neck and head as provisional fixation. A guide wire was inserted through the center of the femoral neck on biplanar fluoroscopy using the 130 degrees guide from the FNS. The initial wire was noted to be a few millimeters posterior to the ideal position, so the parallel adjustment guide was used to move the wire anteriorly. The central bolt was then measured to be 97 mm, so a 90-mm bolt was selected in accordance with the manufacturer’s recommendation. The preparation for the bolt was performed with the complete reamer, which consists of a 10.2-mm drill bit and the 12.5-mm reamer. The proximal femur was reamed to 90 mm. A 2-hole 130-degree femoral neck system plate with 90-mm bolt was inserted attached to the lateral guide. The lateral guide was used to insert 2 bicortical 5-mm locking screws into the proximal femur with the torque limiting screwdriver. It is critical to apply this screw in the center of the femur in the sagittal plane to avoid a stress riser in the subtrochanteric region. This was followed by insertion of a 90-mm antirotation screw through the bolt into the subchondral bone of the femoral head. Final fluoroscopic imaging showed that fracture reduction was maintained. The wound was then thoroughly irrigated and closed in standard fashion.

**POSTOPERATIVE COURSE**

The postoperative course was uncomplicated. The patient was prescribed 25-lb weight-bearing to the operative extremity and prophylactic apixaban (Eliquis, Bristol-Myers Squibb, New York, NY) for 5 weeks. He was discharged on postoperative day 2. At 2 weeks postoperatively, he was noted to have little pain and ambulating without assistive device at times despite limited weight bearing recommendations. At 6 weeks, his weight-bearing was advanced to full weight-bearing, and he was prescribed outpatient physical therapy. He returned to all activities at approximately 3 months.

**DISCUSSION**

The femoral neck continues to be an extremely difficult region of the body to achieve bony consolidation. The lack of
cambium layer requiring formation of intramedullary callous necessitates near anatomic reduction and the ability to achieve active compression. There are many factors that play into a successful outcome. When treating the active middle-aged patient, consideration must be made to the bone quality and the requirement of the patient to have a successful functional outcome. Implant selection in fixation of femoral neck fractures remains of great importance because the rate of failure associated with other devices remains unacceptably high.

Historically, the methods of fixation for these younger patients were similar to the elderly patient–cannulated screws or sliding hip screw. These devices work by allowing the femoral neck to shorten to gain compression. This way of reliably achieving union in an elderly patient is less than ideal in a younger more active individual because this shortening may lead to poor functional outcomes. Stockton et al reviewed 65 patients younger than 60 years with femoral neck fractures treated with either cannulated screws or sliding hip screw. They demonstrated that 54% had 5 mm or more of shortening and 32% shortened greater than 1 cm.15

One of the contributing factors to this increased shortening, as well as the high failure rates seen in the younger patients has to do with the nature of the fracture itself. Fractures in this age group tend to be a result of high-energy trauma, and the subsequent fracture tends to be more vertical with high shear forces. Collinge et al16 found that these fractures had additional features, including oblique major fracture planes, comminution, and loss of the calcar’s inferomedial cortical buttress that all contribute to its overall instability and point to why traditional devices fail to provide adequate stability.

Newer implants seek to address these deficiencies. The goal of the FNS described in this case was to combine the advantages of multiple different existing constructs.17 Biomechanical studies demonstrate that this system resists shear forces better than cannulated screws (with similar effects to the sliding hip screw), but its insertion requires less soft tissue dissection, and the system alleviates the risk of creating a rotational deformity with lag screw insertion.

The case presented demonstrates a fracture met with all the difficulties of the middle-aged femoral neck fracture. The FNS provided the requisite fixed-angle construct that was able to resist the vertical shear forces and varus displacement during fracture collapse. It also avoided the placement of cannulated screws at the level of the calcar in a patient with prior deformity of the femur that could have increased the risk of postoperative fracture. The patient was able to return to all activities within a few months of his femoral neck fracture.

CONCLUSIONS

Femoral neck fractures in young and middle-aged patients remain a challenging clinical situation. Historically, these have been managed with either a sliding hip screw or percutaneous cannulated screw stabilization after open reduction; however, the emergence of new fixed-angle implants may offer safe and effective options. Although the case cited here is only a single patient, it does demonstrate the successful outcomes that have been noted with the use of this implant at one institution. This case emphasizes the need for further research into the effectiveness of the FNS for various ages and fracture patterns, as well as long-term outcomes, to help guide treatment in these challenging fractures.

REFERENCES


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