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New-Generation Femoral Neck Fixation for the Treatment of a Nondisplaced Femoral Neck Fracture in an Elderly Patient

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Summary: Femoral neck fractures are challenging fractures to treat. Anatomic fracture reduction drives outcomes in all patient populations. In the elderly with nondisplaced or stable valgus-impacted fracture patterns, success hinges on a construct’s ability to maintain reduction. New-generation femoral neck fixation constructs may decrease failure rates by providing increased mechanical stability. This case explores the use of a new-generation femoral neck fixation construct to stabilize a femoral neck fracture in an elderly patient.

Key Words: femoral neck fracture, femoral neck fixation, elderly, hip fracture

INTRODUCTION

The management of intracapsular femoral neck fractures in young and elderly patients presents challenges to the treating surgeon. The demanding biomechanical environment of the proximal femur, a tenuous vascular supply, and a lack of periosteal fracture response all contribute to making femoral neck fractures at risk for complications.

For displaced femoral neck fractures in younger populations, complication rates in the literature approach 64% if you combine rates of reoperation, malunion, nonunion, avascular necrosis, infection, and implant failure. These rates of complication are similarly high in elderly populations. For this reason, there is clear consensus that displaced femoral neck fractures in cognitively intact elders should undergo arthroplasty.

However, there is controversy as to the ideal treatment of nondisplaced intracapsular fractures in the elderly. Even nondisplaced femoral neck fractures in older cohorts have a 10% reoperation rate. Most cases of failure result from secondary displacement and nonunion due to inadequate implant stability provided by traditional constructs. In fact, multiple studies have shown that rates of reoperation for displaced fractures treated with hemiarthroplasty are lower than reoperation rates of nondisplaced fractures treated with internal fixation. This is compounded by evidence that patients converted to arthroplasty after failed internal fixation have inferior outcomes to those undergoing immediate arthroplasty.

There are, however, benefits to internal fixation in nondisplaced fractures both to health systems and more importantly to the patient. From the standpoint of direct and indirect costs, traditional implants used for internal fixation are cheaper than prosthetic options and the operative time necessary to fix versus replace may be shorter. Moreover, few would argue there is inherent value in maintaining the native hip joint in patients without pre-existing arthritis.

With the current case, we will examine a patient with a valgus impacted femoral neck fracture treated with a new generation of femoral neck fixation (NGFNF). Specifically, we will pose but not seek to answer the question, “Can newer-generation implants lessen failure and complications in elderly nondisplaced femoral neck fractures?”

CASE REPORT

A 79-year-old man sustained an unwitnessed ground-level fall at home. His medical history was significant for chronic alcohol abuse with resultant dementia, hypertension, coronary artery disease, history of lacunar cerebrovascular accident, as well as several documented falls at home.
The patient was found down by emergency medical services personal with a laceration over his eye and chief complaints of left hip pain and inability to bear weight. Before this fall, he walked without an assistive device. Plain radiographs, three-dimensional computed tomography (CT) reconstruction, and an axial CT slice obtained at initial consultation are shown in Fig. 1. At our institution, elders with femoral neck fractures that could either be treated with internal fixation or arthroplasty, a CT scan is obtained to assure sagittal plane displacement and fracture complexity are fully understood.

Based on his imaging, his fracture pattern and displacement operative fixation were considered. After a lengthy discussion with the patient’s family, the decision was made to proceed with operative fixation. A NGFNF was chosen to allow for minimally invasive insertion while maximizing mechanical fixation and stability when compared with previous generation implants.

**SURGICAL TECHNIQUE**

The patient required a preoperative echocardiogram and correction of electrolyte abnormalities and was medically cleared on hospital day 2. Spinal anesthesia and a fracture table were used. Care was taken to gently manipulate his left leg to avoid disimpacting the impacted valgus position of his fracture. The ability to obtain adequate anteroposterior and lateral radiographs was confirmed.

After standard surgical prep and draping, a lateral incision was made centered at the level of the mid to distal aspect of the lesser trochanter (Fig. 2). Dissection was taken down to the level of the iliotibial band. The iliotibial band was incised in line with the skin incision. The vastus lateralis can then be elevated from posterior to anterior, or the muscle fibers of the lateralis can be split in line with the skin incision. We prefer and performed the former.

The guide for the NGFNF used in this case is used to place a guide pin in a center–center position in the femoral head. In the authors’ opinion, surgeons familiar with sliding hip screw placement will find this portion of the technique quite familiar. One difference to point out is that placing the pin slightly inferior in the femoral head prevents placing the second antirotation screw in a too cranial position (Fig. 3).

After confirmation of appropriate pin placement in both the coronal and sagittal planes, a triple reamer is used to create a path for the blade. Insertion in a minimally invasive manner is facilitated by the insertion jig (Fig. 4). It is critical at this juncture to assure that the small lateral foot print of the plate is centered on the lateral aspect of the shaft (Fig. 5). This needs to be completed before placing the antirotation screw that prevents any further sagittal plane correction. This will be a difference for surgeons accustomed to making rotational corrections of the plate after lag screw insertion with the traditional sliding hip screw (SHS). There are currently 2 plate options—1 hole and 2 hole. It is the authors’ preference to use the 1-hole plate as it allows for insertion through a smaller incision and is easier to center on the lateral femur. It is critical to avoid placing the distal aspect of the plate too posterior or anterior to avoid creating a stress riser in the subtrochanteric region.

Finally, the locking plate screw was placed. Final anteroposterior and lateral radiographs of the proximal femur demonstrated appropriate fracture reduction and placement of fixation device (Fig. 6). The wound was irrigated and closed in a layered fashion.
the authors’ hands, operative time with this device is comparable or shorter than the time needed for placement of 3 cannulated screws.

The patient was made weight bearing as tolerated postoperatively. Our postoperative protocol for hip fractures involves physical therapy on postoperative day 1, deep venous thromboses (DVT) prophylaxis with aspirin, and outpatient referral to our osteoporosis clinic. He was discharged on hospital day 5. His postoperative course was uncomplicated. He returned to the office at 3 months. He was ambulating without pain or limp. Radiographs showed maintenance of reduction with slight shortening of the fracture (Fig. 7).

**DISCUSSION**

In the current case, we chose to use a NGFNF to fix a valgus-impacted femoral neck fracture in an elderly patient. We chose this implant because we felt it would potentially lessen failure by providing increased mechanical stability compared to screws with, in our opinion, simpler insertion than a sliding hip screw construct.

The ideal treatment of valgus impacted or nondisplaced femoral neck fractures is debatable. Failure rates of internal fixation with traditional implants (cannulated screws or sliding hip screws) are
These failures are higher than once believed in this population.7,8 These failures are often due to loss of mechanical support with postoperative displacement leading to nonunion.8 It therefore makes intuitive sense that fixation constructs, which provide increased stability, may decrease this failure rate.

The ideal manner of mechanically stabilizing these fractures has yet to be elucidated.12 Implants widely available today include fully and partially threaded cannulated screws and fixed-angle sliding hip screw devices. Sliding hip screw devices have been shown to have a lower short-term failure rate than cannulated screws.13 However, there is not enough evidence to recommend an optimal method of internal fixation regarding long-term outcome.12

Screws may be advantageous in terms of reduction. For example, a partially threaded cannulated screw placed at the cranial aspect of a traditional inverted triangle pattern can compress the cranial neck and lessen varus. At worst, screws do not disrupt a good provisional reduction or nondisplaced fracture because they exert less of a rotational force on insertion than sliding hip screws. This was important in the current case because disrupting the impacted and valgus position of the fracture could have increased failure risk. However, screws are not as effective at preventing varus collapse, retroversion, and combating the shear forces that lead to failure.11

Fixed-angle sliding hip screw devices resist shear and varus collapse; however, in the authors’ experience, they have a higher propensity to disrupt an impacted or nondisplaced fracture. This is especially true in the rotational plane because the sliding screw is advanced in transcervical or subcapital fracture patterns. Sliding hip screw devices exert a strong rotational force on the head segment, which may cause inadvertent rotational malreduction. Even in cases where this malreduction is realized and corrected, it is conceivable that irreversible damage to the femoral head blood supply may occur. Although the fixed-angle sliding hip screw device has been shown to be biomechanically superior,14 this advantage has not been realized in clinical studies.12 This may be due to disruption of a provisional anatomic reduction, which mitigates the biomechanical advantage. This rotational disruption of reduction may be one factor that explains the increased rates of avascular necrosis.15

A new generation of implants is emerging, which may leverage the mechanical strengths of fixed-angle devices without the shortcomings of SHS insertion. The NGFNF used in this case has an articulated bolt and screw construct, which exerts no rotational moment on the head segment during insertion, unlike a sliding hip screw, and therefore may avoid displacing a nondisplaced or impacted fracture pattern during implant insertion. Moreover, the insertion instruments allow this implant to be placed more efficiently. Finally, the implant is designed to limit more than 1 cm of fracture compression and may limit the excessive shortening that can occur postoperatively that leads to worse functional outcomes.16

CONCLUSIONS

Currently, there is controversy as to the ideal treatment of minimally displaced intracapsular femoral neck fractures in elderly populations.7 NGFNF, such as the one used in this case, may improve fracture stability when compared with traditional fixation constructs11 and could decrease the risk of failure in these elderly patients.

REFERENCES


