

KP National Orthopaedic Conference 2010

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Evidence-Based Treatment of Proximal Femur Fractures

A proximal femur fracture in an elderly patient remains a true orthopedic urgency. Even those of us with highly sub-specialized practices will confront these injuries during weekend or evening on-call responsibilities. We may refer other more elective fractures to our colleagues, but hip fractures are different: they are abundant and inescapable. It is worth reviewing some of the recent trends in the treatment of proximal femur fractures as well as the literature-based evidence supporting these trends.

Extracapsular Fractures

The main recent trend has been the evolution in treatment of extracapsular fractures of the proximal femur using intramedullary nails which allow fixation into the femoral head by incorporating a sliding hip screw (cephalomedullary nails). These devices are designed according to the biomechanical principle that the neutral axis of the femur lies within the medullary canal. Anchoring fixation in the canal ought to decrease implant stress and failure. This construct is theoretically superior to placing the fixation implant along the lateral cortex, which is under tension. In addition to this biomechanical advantage, these nails allow percutaneous, minimally invasive operative technique.

These versatile cephalomedullary nails can be used to successfully treat intertrochanteric and subtrochanteric fractures of the proximal femur. For fractures that extend below the lesser trochanter, intramedullary nailing has long been accepted as a superior method of fixation compared to lateral plating. Cephalomedullary nails have extended the definition of a “nail-able” femur fracture to the intertrochanteric region as well however. Today, there is a trend toward treating intertrochanteric fractures proximal to the lesser trochanter with these nails, instead of using the hip screw and side plate.

What is driving this trend? Medicare data from 2000 through 2002 reflecting the work of 15,091 surgeons stabilizing 192,365 intertrochanteric fractures in 3,480 hospitals were analyzed for predictors of cephalomedullary nail use. Teaching hospital status, particularly if residents were involved in the case, was associated with higher use of nails. Other factors were surgeon age under 45 and those operating at more than one hospital.¹ Perhaps a portion of this trend is attributable to the adoption of the new technology by orthopedic residents in teaching hospitals.

The cost of treating an intertrochanteric fracture with an intramedullary nail instead of a hip screw and side plate can be anywhere from two to four times greater. The adoption of this more expensive technology ought to be based on evidence of improved outcomes and decreased morbidity. In a Cochrane Database review of 36 studies involving 5506 patients with extracapsular hip fractures, no differences in post-operative mortality or functional outcomes were found. There were, however, more fracture fixation complications and reoperations when intramedullary nails were used. The main conclusion of this meta-analysis was that sliding hip screws were superior to intramedullary nails for trochanteric fractures.² Furthermore there is limited evidence from randomized trials to determine whether there are important differences in outcome between different designs of intramedullary nails used in the treatment of extracapsular hip fractures.³

In conclusion, the adoption of cephalomedullary nailing for proximal femur fractures has provided significant advantages in treatment. These devices can be successfully applied to both intertrochanteric and subtrochanteric fracture patterns; in particular, nails have become the implant of choice when fracture extension below the lesser trochanter is present or suspected, or when a reverse oblique intertrochanteric fracture pattern is present. Nails often allow a percutaneous, minimally invasive surgical technique. However, nail insertion does not guarantee fracture reduction, and open reduction is sometimes necessary for proper nail insertion. Finally, nails are being used more and more for simple intertrochanteric fracture patterns, above the lesser trochanter,

that can still be successfully treated with the much less expensive hip screw and side plate.

Intracapsular Fractures

Treatment of the displaced femoral neck fracture continues to be an active subject of investigation in the world-wide orthopedic literature. Current treatment options include reduction and cannulated screw fixation, reduction and fixation with a sliding hip screw, cemented or un-cemented unipolar or bipolar hemiarthroplasty, and total hip replacement.

Using data on 162,257 fractures from the Nationwide Inpatient Sample Database, treatment trends for femoral neck fractures in the United States were examined over the period 1990 through 2001. Over this time period, use of hemiarthroplasty increased from 67.8% to 75.3%, and the use of total hip arthroplasty decreased from 11.6% to 6.6%.⁴

A more refined reflection of the current trend in treatment of femoral neck fractures was obtained through a 2005 international preference survey of 298 surgeons. The typical survey respondent was a trauma-fellowship trained surgeon, in academic practice, over 40 years old. The main findings of the survey were that surgeons preferred internal fixation of displaced femoral neck fractures in patients less than 60 years old, but preferred arthroplasty in patients over 80 years old, or in patients with severely displaced (Garden IV) fractures. Most surgeons also preferred arthroplasty for Garden III fractures, but a significant (25%) number still preferred internal fixation for this group, particularly in more active patients. There was no consensus regarding the superiority of internal fixation or arthroplasty when considering mortality, quality of life, function, infection rates, and pain.⁵

It is instructive to examine the literature data that have supported this trend. A 1994 meta-analysis of 106 published studies reported a non-union rate of 33% and an osteonecrosis rate of 16% after internal fixation of a displaced femoral neck fracture.

The relative risk of reoperation within two years was 2.6 times greater for internal fixation than for hemiarthroplasty (with a 95% confidence interval of 1.4 to 4.6). No significant differences in perioperative mortality were found.⁶

The past 15 years has seen more investigations into the relative merits of these two basic treatment options. A randomized controlled trial of fixation with three cannulated screws versus hemiarthroplasty with an un-cemented Austin Moore prosthesis was published in 2000. 208 patients were followed for three years. There was no difference in functional assessment between the groups. There was a marginally lower mortality rate among the patients treated with internal fixation, as well as shorter surgery time, less blood loss, fewer transfusions, and fewer infections. However the internal fixation group had a ten-fold higher reoperation rate, and suffered 25% nonunions and 7% osteonecrosis.⁷

The results of a 2003 meta-analysis are also illuminating. All randomized clinical trials published between 1969 and 2002 were queried. However, only 14 studies involving 1162 patients met inclusion criteria for the analysis. The main conclusions were that when compared to internal fixation, arthroplasty for the treatment of a displaced femoral neck fracture reduced the risk of revision surgery, but led to greater infection rates, blood loss, and operative time. Arthroplasty also may result in an increase in early mortality rates.⁸

A multi-center randomized controlled trial was published in 2006. 207 patients were randomized into treatment with screw fixation, cemented bipolar hemiarthroplasty, or cemented total hip arthroplasty. Results of this trial echoed some of the previous data: no differences in mortality were found between the groups, and reoperation was significantly higher for the internal fixation group (39% versus 5% for hemi and 9% for total hip arthroplasty). At two year follow up, the total hip replacement group had significantly better functional outcome scores than either of the other groups. The authors concluded that, “Although fixation was initially the least costly procedure, this

short-term advantage was eroded by significantly higher costs for subsequent hip-related hospital admissions.”⁹

The main results of the above studies are neatly summarized in a 2006 Cochrane Database review of 17 trials involving 2,694 participants. Length of surgery, operative blood loss, need for blood transfusion, and risk of deep wound infection were significantly less for internal fixation compared with arthroplasty. Internal fixation was associated with higher rates of reoperation though.¹⁰

It is noteworthy that none of the above investigations produced conclusions regarding pain relief or residual disability after either method of treatment for a displaced femoral neck fracture. Since all historical data point to increased risk of mortality after hip fracture, regardless of treatment, it is important to know what treatment method is more likely to achieve a good outcome as soon as possible. Recent data from the Norwegian Hip Fracture Register on 1,569 patients over 70 years old suggested that four months after surgery, patients with hemiarthroplasty had less pain and were more satisfied with the results of the operation than patients treated with internal fixation.¹¹

In conclusion, there are minimal data regarding patient function, pain relief, and satisfaction after internal fixation versus hemiarthroplasty for displaced femoral neck fractures. However, the data consistently have shown that internal fixation is associated with less initial operative trauma, but with greater risk of reoperation. Patient comorbidities, anesthetic risk, and other factors such as current use of anti-platelet agents may also affect surgical decision making.

¹ Virnig, Beth A., PhD, MPH1; Robert L. Kane, MD1; Sara Durham, MS1; Mohit Bhandari, MD, MSc2; Roger Feldman, PhD1); Marc F. Swiontkowski, MD3 Scientific Poster #66 Geriatrics OTA-2008 Surgeon and Hospital Factors Associated with the Use of Intramedullary Nails for Intertrochanteric Hip Fractures Mary L. Forte, DC1

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¹⁰ Parker MJ, Gurusamy KS. Internal fixation versus arthroplasty for intracapsular proximal femoral fractures in adults. *Cochrane Database of Systematic Reviews* 2006, Issue 4. Art. No.: CD001708. DOI: 10.1002/14651858.CD001708.pub2.

¹¹ Gjertsen J-E, Vinje T, Lie SA, Engesaeter LB, havelin LI, Furnes O, and Fevang JM. Patient satisfaction, pain, and quality of life 4 months after displaced femoral neck fractures. A comparison of 663 fractures treated with internal fixation and 906 with bipolar hemiarthroplasty reported to the Norwegian Hip Fracture Register. *Acta Orthopaedica* 2008; 79(5):594-601.