Subcapital fractures

A CHANGING PARADIGM

Options for the treatment of subcapital femoral neck fractures basically fall into two categories: internal fixation or arthroplasty (either hemiarthroplasty or total hip arthroplasty). Historically, the treatment option has been driven by a diagnosis-related approach (non-displaced neck fractures versus displaced neck fractures). More recently, the traditional paradigm has changed. Instead of a diagnosis-related approach, it has become more of a patient-related approach. Treatment options take into consideration the patient’s age, functional demands, and individual risk profile. A simple algorithm can be helpful in terms of directing the treatment. Non-displaced fractures, regardless of age of the patient, should be treated with closed reduction and internal fixation. For displaced femoral neck fractures, the treatment differs depending on the age of the patient. The younger patient should be treated with urgent ORIF with the goal of an anatomic reduction. For displaced femoral neck fractures in the elderly, cognitive function should be determined. For those who are cognitively functioning, total hip arthroplasty appears to be the best option. In the cognitively dysfunctional, a bipolar hemiarthroplasty or a total hip arthroplasty with use of larger heads (32 mm or 36 mm) and/or constrained sockets are a viable option.

The new paradigm

Conventional wisdom was such that if the articular cartilage was still viable, it was better to keep your native cartilage than to replace it with metal and plastic (or ceramic). The reasoning was that the best hip mechanics were that of a normal hip.

Non-displaced fractures. Non-displaced femoral neck fractures are treated the same, regardless of patient age. There is no paradigm change in this situation. Closed reduction and internal fixation with screws is still the benchmark procedure. Accurate screw placement to provide good peripheral bony support is important.

Displaced fractures in younger patients. It is debatable what the age cut-offs should be in terms of the younger patient. Whether it is 50 or 60 years old is not as important as looking at the overall patient (physiologic age as well as chronologic age) in conjunction with the functional demands they have. These younger patients typically have excellent bone quality. ORIF with urgent and accurate reduction has become a shift in the paradigm. There are some important considerations to ensure proper internal fixation. Accurate screw placement is vital. Peripheral calcar support and a lateral starting point above the lesser trochanter is important to prevent another fracture below that area. Thus, on an anteroposterior view of the hip, screw placement at the margin of the inferior femoral neck is important. In addition, in terms of placement of the screws, a triangular arrangement with two superiorly and one inferiorly has been shown to provide excellent fixation. Finally, additional fixation of the fracture may be warranted. A good example of this scenario would be in cases of vertical femoral neck fractures (Pauwels type 3). In addition to using screws for fixation, a screw and side-plate may be needed to ensure fixation and to minimise fracture shear.

Displaced fractures in elderly patients. This is the group where the paradigm has shifted. Before evaluating the evidence for a shift in the
paradigm, it is important to keep in mind the potential concerns as well as the historical advantages of internal fixation for femoral neck fractures. Potential concerns are: a difficult conversion later to a total hip arthroplasty, osteonecrosis, non-union, or mal-union of the fracture. Historical advantages include: restoration of bone anatomy with more normal hip kinematics, return to pre-morbid level of function, minimal dislocation risk, and a better hip.

Recent randomised controlled trials comparing internal fixation and total hip arthroplasty for the treatment of displaced femoral neck fractures in the elderly have reported superior results in the arthroplasty group.2-6 Most of these studies are early results and the patients were mentally competent.

Rogmark et al3 performed a multi-center randomised controlled trial involving 12 hospitals and 450 patients to evaluate the treatment of displaced femoral neck fractures in the elderly. They compared internal fixation with arthroplasty (THA or hemiarthroplasty). All patients were aged over 70 years and all had intact mental status. At 12 months, the internal fixation cohort had a 43% failure rate with non-union and osteonecrosis being the main problems, while the arthroplasty cohort had a 6% failure rate with dislocation and fracture being the major concerns. In addition, the arthroplasty cohort had higher function as well. In a further long term follow-up of this cohort at 10 years, the internal fixation cohort had 45.6% failures and the arthroplasty cohort had 8.8%.7

Tidermark et al12 performed a randomised controlled trial evaluating 102 patients (all aged 70 years or over, and cognitively intact) with displaced femoral neck fractures treated by either internal fixation or by total hip arthroplasty. All operations were performed by two surgeons. At 24 months, the internal fixation cohort had 36% mechanical failure and 19% mortality, compared with the arthroplasty cohort which had 4% failure and 10% mortality. In a continuation of that study, at 4 years, there were no additional complications in the arthroplasty cohort, but the internal fixation cohort increased to 42% failures.8 Once again, the arthroplasty cohort had better function.

Thus the literature supports the conclusion that arthroplasty is the preferred treatment method for displaced femoral neck fractures in the cognitively intact and independently ambulating elderly patient. In terms of the arthroplasty option, which option is better in terms of bipolar hemiarthroplasty versus total hip arthroplasty?

Blomfeldt et al9 reported on the one year results of a randomised controlled trial of 120 elderly patients with displaced femoral neck fractures. They compared bipolar hemiarthroplasty with total hip arthroplasty. Hip ratings were higher in the total hip arthroplasty group. The trends held and became even greater at four year follow-up of the same cohort.10

Keating et al11 reported on a prospective randomised trial of 298 patients randomised into three cohorts for the treatment of femoral neck fractures. The cohorts were treated either with internal fixation, bipolar hemiarthroplasty, or total hip arthroplasty. The total hip arthroplasty cohort had the highest function. When they examined cost, the lowest initial cost was in the internal fixation cohort, but when the cost of all the complications and reoperations were considered, the highest cost was in the internal fixation group. Ravikumar et al6 similarly reported better results with total hip arthroplasty versus internal fixation or hemiarthroplasty.
All the studies that have been discussed thus far have been in cognitively intact elderly patients. What about cognitively dysfunctional patients with displaced femoral neck fractures? Soderqvist et al\textsuperscript{12} have reported on the influence of cognitive function on hip fracture outcomes. They had good results using the Short Portable Mental Status Questionnaire (a 10 question validated instrument) in determining the level of cognitive function in elderly hip fracture patients. In their study, cognitively dysfunctional patients had a one year mortality rate of 48\%. In addition, Johansson et al\textsuperscript{18} reported a dislocation rate of 32\% in cognitively dysfunctional patients who were treated for femoral neck fracture with a total hip arthroplasty.

Knowing the risk of having increased adverse outcomes when treating displaced femoral neck fractures in the elderly cognitively dysfunctional patient with total hip arthroplasty, what factors can improve those outcomes? Some of the factors that the surgeon can take into account are surgical approach, type of arthroplasty, implant fixation, head size, and capsular repair. Historically, anterolateral approaches are recommended in this population to avoid dislocation. More recently, the posterior approach has become popular. One of the senior authors (JJC) prefers the posterior approach with a capsular repair in conjunction with a larger head size, when appropriate. The caveat for the surgical approach is that we need more studies to see if there really is a difference in approach in treating patients in this population.

In terms of head size, larger head sizes have an improved head-neck ratio and should be considered in most of these cognitively impaired patients. There are many options available today in terms of the types of implants available. Constrained cups and dual mobility sockets are also options. We have had experience using constrained cups in demented patients, but our experience with the dual mobility sockets are more limited. No matter what combination of options are used, the goal is still the same: provide a good functioning total hip while minimizing complications as well as the need for re-operation.

Algorithm

In summary, a simple algorithm can be helpful in terms of directing the treatment of subcapital femoral neck fractures (Fig. 1). Non-displaced fractures, regardless of age of the patient, should be treated with closed reduction and internal fixation. Typically, three screws should be used and they should be spread out (triangular formation), with calcar support, starting above the lesser trochanter. For displaced femoral neck fractures, the treatment differs depending on the age of the patient. In the younger patient (aged between 50 and 60 years), displaced femoral neck fractures should be treated with urgent ORIF using a fixation device determined by the verticality of the fractures (screws alone for low Pauwels grades, and sideplate based devices for high Pauwels grades). The goal should be an anatomic reduction and stable internal fixation.

For displaced femoral neck fractures in the elderly, cognitive function should be determined. For those who are cognitively functional, total hip arthroplasty appears to be the best option. In the cognitively dysfunctional, a bipolar hemiarthroplasty or a total hip arthroplasty with use of larger heads (32 mm or 36 mm) and/or constrained sockets are a viable option.

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This paper is based on a study which was presented at the Winter 2011 Current Concepts in Joint Replacement meeting in Orlando, Florida, 7th – 10th December.

References