FRACTURES ABOUT THE HIP

Femoral neck fractures

A CHANGING PARADIGM

Surgical interventions consisting of internal fixation (IF) or total hip replacement (THR) are required to restore patient mobility after hip fractures. Conventionally, this decision was based solely upon the degree of fracture displacement. However, in the last ten years, there has been a move to incorporate patient characteristics into the decision making process. Research demonstrating that joint replacement renders superior functional results when compared with IF, in the treatment of displaced femoral neck fractures, has swayed the pendulum in favour of THR. However, a high risk of dislocation has always been the concern. Fortunately, there are newer technologies and alternative surgical approaches that can help reduce the risk of dislocation. The authors propose an algorithm for the treatment of femoral neck fractures: if minimally displaced, in the absence of hip joint arthritis, IF should be performed; if arthritis is present, or the fracture is displaced, then THR is preferred.

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There appear to be several factors contributing to an ever-increasing number of femoral neck fractures, including an increased patient lifespan, activity level, and incidence of osteoporosis. There has conventionally been a single factor that determined surgical treatment of these injuries based upon whether the fracture was displaced or not. When fractures were relatively undisplaced they were fixed and when displaced, hemiarthroplasty (HA) was the recommended treatment. Total hip replacement (THR) was seldom performed because of a high dislocation rate. However, in more recent years, there appears to be a trend towards THR because of evidence of better functional outcomes and a lower revision rate than HA. Also new technological advances such as larger diameter heads, highly-cross linked polyethylene, and ‘dual-mobility’ designs that have two articulations, have made it possible to perform THR with improved stability.

Surgical considerations

The goals of hip fracture management are to restore patient function to as close to their pre-operative state as possible with the lowest possible complication rate, including any subsequent need for revision. Although the majority of patients sustaining hip fractures are > 75 years old, they are a very heterogeneous group and include the active elderly, through to the institutionalised, frail patient, often with dementia. Inevitably the treatment offered needs to take this spectrum into account, which we represent as an algorithm.

Hip fractures are also a marker of declining health. Li et al found that 20% to 30% of hip fracture patients died within one year of surgery. Age, pre-operative activity status, American Society of Anesthesiologists (ASA) scores influenced the likelihood of death. Others have shown a 3% in-hospital mortality rate. In longer term survivors, up to 30% of hip fracture operations will require revision surgery at some point.

During decision making for the type of operative treatment, questions should include: what was the patient’s pre-fracture activity level? what co-morbidities are present? and will the patient be able to comply with post-operative restrictions including partial weight bearing?

Internal fixation (IF)

IF is generally performed for minimally displaced femoral neck fractures, in younger patients (Fig. 1) and principally aims to retain the patient’s own hip joint. This option is clearly preferable if the joint has little or no arthritis, the femoral head is viable, and the patient will be able to comply with post operative limitations of weight-bearing if necessary. Asnis et al reported on the rates of development of osteonecrosis with different degrees of displacement, according to Garden’s classification: stages 2 and 3 had a 20% risk;
and stage 4 (complete displacement) had a risk of at least 30%.15 These figures can be used in conjunction with patient comorbidities and lifestyle to determine whether IF can be a reasonable option for that particular individual.

The benefits of IF include the preservation of a patients’ own hip joint, less invasive surgery, and freedom from activity restrictions typically imposed by a THR. The disadvantages include a longer healing time, the possible development of arthritis or osteonecrosis, and the potential loss of fixation due to inadequate bone strength (Figs 2 and 3). With these considerations in mind, the authors believe that IF should be performed in minimally displaced femoral neck fractures in younger patients. We believe definite contraindications include pre-existing hip joint arthritis and the presence of a displaced fracture in older patients. What defines older and younger, however, is subjective and takes into account more than simply chronological age.

Choosing THR
THR for managing femoral neck fractures has the potential to be a definitive operation especially if arthritis is already present. Historically, however, THR has had a higher dislocation rate when performed for a femoral neck fracture when compared with elective surgery for osteoarthritis.2,4 It has been speculated that this may be due to greater soft-tissue trauma around the hip joint, but may also be due to patients experiencing and making use of a greater pre-operative hip range of movement when compared with having an osteoarthritic hip. Of course the high dislocation rate may be related to the experience and frequency in which the operating surgeon performs THR.16

There is an increasing interest in using THR for femoral neck fractures, as IF and HA have lower functional scores and higher rates of future revision surgery.5,6,17,18 With the advent of new implant technologies that improve joint stability, surgeons may be better equipped to counteract higher dislocation rates. This includes the availability of larger femoral head sizes with highly cross-linked polyethylene bearing surfaces; ‘dual-mobility’ type heads, and alternative surgical approaches made possible with specially designed operating room tables. A larger femoral head size of 32 mm or 36 mm allows for a greater jump distance before dislocation,19 and a ‘dual-mobility’ head has two articulations for movement, thus enhancing stability.8,20 Alternative surgical approaches such as the anterolateral and direct anterior approaches preserve the posterior structures of the hip, conferring stability to the joint.21,22

The advantages of THR as treatment for a femoral neck fracture includes the ability to immediately weight bear, and for it to be the definitive treatment of both the fracture and any future conditions such as osteonecrosis or arthritis. The disadvantages include the possibility of dislocation, the functional limitations imposed by a THR, and the more
invasive nature of the surgery. Given this risk/benefit profile, the authors believe the definite indications for THR include pre-existing osteoarthritis or inflammatory arthritis; and displaced fractures in elderly patients. The more difficult and marginal decisions are typically the younger patient (< 65 years old) with a displaced femoral neck fracture; and whether to perform THR or HA in an elderly patient.

Evidence comparing IF with arthroplasty
Rogmark and Johnell17 performed a meta-analysis examining 14 studies containing over 2000 patients with displaced femoral neck fractures, randomised to either IF or arthroplasty (including THR and HA), performed between 1996 and 2004. The authors found arthroplasty to have fewer complications and fewer re-operations compared with IF, with no significant difference in mortality at 30 days or one year. In another meta-analysis, Gao et al18 examined 20 randomised trials with over 2500 patients comparing IF versus arthroplasty (both THR and HA) for displaced femoral neck fractures between the years 1979 and 2010. They found that arthroplasty reduced the risk of major complications with a relative risk (RR) of = 0.33, when compared with IF. The risk of further surgery at five years was lower for the arthroplasty group. Pain relief in arthroplasty patients was superior to the IF group with similar mortality rates at three years post operatively. This supports our view that cognitively intact patients should receive a THR. In a recent retrospective study examining over 12 000 patients treated with either arthroplasty or IF, Neuman et al12 found that arthroplasty patients had a 60% greater likelihood of inpatient mortality. However, this study did not control for the degree of displacement of the fracture, which could be a confounding variable. Cornwall et al,20 in a previous study, found that patients with displaced femoral neck fractures had a significantly higher six month mortality rate than those with non-displaced fractures.

Comparisons between THR and HA
Yu, Wang and Chen6 performed a meta-analysis of 12 randomised controlled trials comparing the results of THR versus HA for the treatment of femoral neck fracture. In all, 1320 patients were examined for differences in mortality, complications, and function. THR was associated with a lower risk of re-operation (RR = 0.53) and higher Harris hip scores at one year, however, the THR group had a higher rate of dislocation than the HA group (RR = 1.99).6 Zi-Sheng et al23 examined nine trials with a total of 1208 patients undergoing either THR or HA. THR patients had similar mortality rates, but a lower re-operation rate and better pain relief when compared with HA. However, the THR group had a greater risk of post-operative dislocation.

A prospective, multi-centre, randomised trial compared the outcomes of THR and HA in 40 patients with displaced femoral neck fractures.24 Macaulay et al24 found that the THR patients had significantly less pain and had higher function scores that HA patients without any greater incidence of complications.

Hemiarthroplasties have either a monopolar or so called ‘bi-polar’ heads. The theoretical advantage of a bipolar head is that with two articulating surfaces, there is a reduced friction upon the native acetabular cartilage, possibly leading to a slower progression of arthritis and better pain relief.25 Another potential advantage is a lower dislocation rate because of the two bearings.26 However, the disadvantage of a bipolar HA is the possibility of prosthetic wear, and the higher cost.

Several studies have compared over 600 patients with either a bipolar or unipolar HA, and found no difference with respect to re-operation, mortality, or infection.27-30 A more recent prospective, randomized, controlled study comparing the use of unipolar versus bipolar heads did find a significantly lower dislocation rate in the bipolar group (6.8% versus 2.3%).26 Therefore, we believe when performing HA, a bipolar head may be advantageous when available.

New surgical developments
With the advent of highly cross-linked polyethylene in THR, wear of the bearing surface has been greatly reduced at mid-term clinical follow-up.31 This facilitates the use of larger head sizes in the belief that polyethylene liners can be thinner and so the larger head sizes contribute to lower rates of dislocation.19,32

Tarasevicius et al7 examined the results of conventional articulation versus dual mobility THR performed via a posterior approach, and found a significantly lower rate of dislocations using the dual mobility construct. In a study specifically examining the treatment of femoral neck fractures with HA, the dual mobility construct had a 1.4% dislocation rate.8

The direct anterior total hip approach for THR has become more widespread in the last several years due to greater availability of operating tables and equipment designed to facilitate this approach. Studies have demonstrated a reduced dislocation rate in THR performed with an anterolateral or direct anterior approach as compared with posterior approaches.21,33

Treatment recommendations
We propose a simple algorithm for the treatment of femoral neck fractures (Fig. 4). For non-displaced fractures of the femoral neck and in the absence of hip joint arthritis, IF should be performed as it is less invasive and avoids the imposition of movement restrictions. However, if there is significant hip joint arthritis, THR should provide a superior functional result.

In cases of displaced femoral neck fractures, patient characteristics must be taken into account. In patients < 55 years, reduction and IF should be considered in order to preserve the native hip joint. In patients > 65 years, THR is preferred because of the greater likelihood of osteonecrosis.
if one attempts to preserve the native hip. Between the ages of 55 and 65 years, patient characteristics such as activity level, bone quality, and compliance may play a role; unless the patient plans to return to an activity level that would not be supported by an artificial joint, the authors favour THR in this population.

When considering arthroplasty for treatment of a displaced femoral neck fracture, the literature supports THR for the superior functional result and lower re-operation rate. However, the dislocation rate is higher than that of HA, so in the cognitively impaired patient, a unipolar or bipolar HA is warranted.

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Algorithm for treatment of femoral neck fractures. IF, internal fixation, THR, total hip replacement.

References


