

The management of subcapital fractures in the elderly population

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Abstract This paper is a general review concerning the subcapital fractures of the femur. The authors made a careful bibliographic research in order to define the optimum economic and medical attitude in cases of subcapital fractures in elderly. All the therapeutical options are declined, including conservative and operative treatment, from osteosynthesis to arthroplasty. The paper includes the recommendations of the authors from the Birmingham Orthopedic Service.

Keywords Subcapital fracture neck of femur · Management of neck of femur fractures

Introduction

The incidence of fractured neck of femur in the United Kingdom is estimated to be around 85,000 fractures per year with an annual increase of around 2% [1, 2]. The expenditure resulting from acute hospitalization of hip fractures amounts to £750 million each year representing only half of the total care cost. Hip fractures are currently an enormous economic burden to the health service.

The pathway of patients with fractured neck of femur can be very complex and our role is to find interventions that, in combination will reduce the length of stay, hasten the rehabilitation process and improve patients' function. In a recent paper, Iorio [5] notes that when patients with

femoral neck fracture are grouped without regard to treatment option, 50–60% regains prefracture ambulatory status. Of patients with femoral neck fractures, 10–20% change status from ambulatory to non-ambulatory during the first year after injury. This decrease in independence and ambulatory capacity is devastating to patients on a personal level, and it is expensive for the healthcare system on a socioeconomic level.

We feel that the concept of management of patients with fractured neck of femur is tridimensional: Prevention of fractures, the surgical management and the health economics/managerial aspects of the pathology. Optimizing this triad can only be achieved through a close interaction among clinicians (orthopedic surgeons and ortho-geriatricians), physiotherapists, nurses, managers and health economists.

In our paper, we focus on the model of subcapital fractures in the elderly population. Despite a growing number of randomized control trials looking at this fracture, controversies still exist, especially regarding the optimal treatment of displaced fractures. Furthermore, the management of demented and institutionalized patients is still ambiguous. In the first part of our paper, we will describe the problem of subcapital fractures and the challenges that they pose. Then, we will discuss the evidence and guidelines for the management of these fractures in the elderly population. We also feel that secondary prevention of fragility fractures is underestimated in our health care system and we will allude to that.

The problem

In 1964, Garden [4] wrote about subcapital fractures: 'Many surgeons are now convinced that the "unsolved" fracture should be renamed the "Unsolvable" fracture and

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the defeatist attitude of Sir Astley Cooper still lingers in present-day practice. This is reflected by the increasing tendency to abandon treatment by reduction and fixation, and to replace the femoral head with prosthesis. This policy, which amounts to a confession of failure, would be fully justified if every subcapital fracture failed to unite. But non-union does not always occur, and many such fractures heal with modern methods of treatment. There must be a scientific explanation for the fact that union occurs in some, but not in all, subcapital fractures, and it would seem more logical to search for this explanation than to accept the widespread belief that there is something unfathomable about these injuries.'

Since this statement, despite a growing number of randomized trials in the literature, the management of subcapital fractures in the elderly population is still controversial. In a recent survey, orthopedic surgeons were shown the AP radiograph of a displaced subcapital fracture in a 75-year-old lady. The patient was fit and well and previously independently mobile. When asked about the management plan; 30% voted for a hemiarthroplasty, 30% for internal fixation and 30% for total hip replacement. When shown the same X-ray later, 10% changed their mind between internal fixation and arthroplasty (Figs. 1, 2).

The recognized treatment alternatives are arthroplasty and internal fixation. There are different complications associated with each operation. The principal criticism of internal fixation is the high rate of non-union. In fact, published series demonstrate rates of non-union of undisplaced fractures between 5 and 10% compared with 33% in

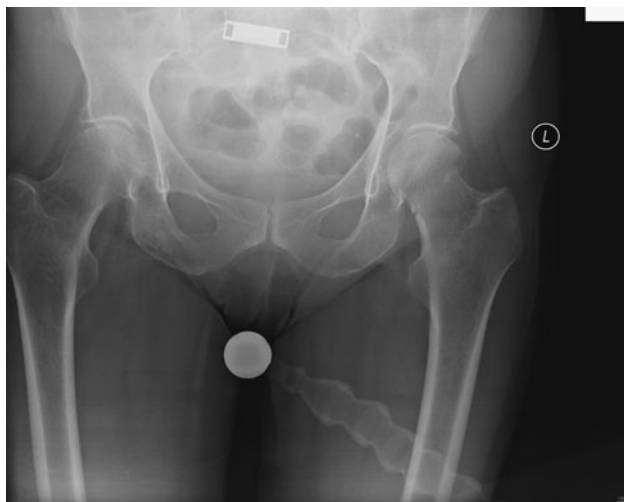


Fig. 1 AP radiograph of an intracapsular fractured neck of femur on the left side. The joint capsule extends from the acetabulum to the intertrochanteric line anteriorly and to the junction of the middle and distal thirds of the femoral neck posteriorly. Subcapital fractures are therefore intracapsular injuries. This distinction is important because intracapsular fractures are more prone to osteonecrosis because the blood supply to the femoral head originates from the circumflex femoral arteries

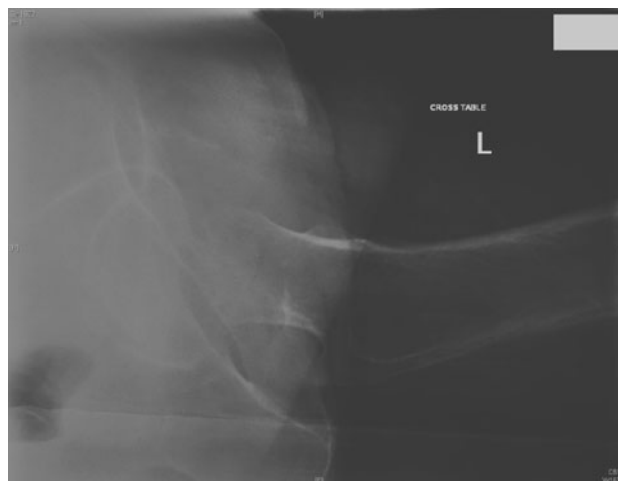


Fig. 2 Lateral radiograph of a subcapital fractured neck of femur

displaced fractures. The rate of avascular necrosis is 2.2 and 16%, respectively. However, only one-third of patients with avascular necrosis will develop symptoms. On the other hand, hemiarthroplasty carries significant complications with 3% deep infection, 3% periprosthetic fracture, 5% dislocation, 10% loosening and 20% late acetabular wear.

Operative management

There is now evidence that the management of subcapital fractures depends on whether the fracture is displaced and on the age of the patient. It is clear that the disruption of the blood supply following a displaced fracture will increase the rate of non-union. Over a hundred years ago Gurlt, who believed that old age, does not retard the progress of union, said: 'There is no specific tendency to non-union in any form of fracture. If the ends of the broken bones can be kept in accurate apposition, union by bone will take place'. Several studies have since confirmed that a good reduction was a key factor to reduce the non-union rate but have also shown that age played a major contribution in the process of bony union. The Barnes [1] paper in 1976 is a landmark study that constitutes the foundations to the management of subcapital fractured neck of femurs. Barnes's work highlighted that the union rate was influenced by several factors including patient's age, patient's pre-morbid activity status with fit and active patient having a union rate considerably higher than bedridden patients and the quality of reduction being a positive predictive factor for bony union. In a recent study to be published in Clinical orthopedics related research, M Parker looked at the correlation between union rate and age for subcapital fractures treated by internal fixation. Parker shows that there is a progressive increase in the incidence of non-union with age for patients with displaced and undisplaced fractures.

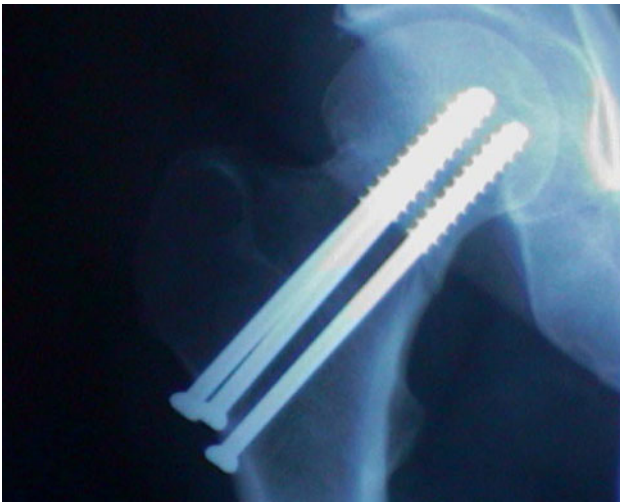


Fig. 3 Management of a subcapital fractured neck of femur with three cannulated screws, antero-posterior radiograph

In patients with undisplaced fractures, the non-union rate at 1 year is around 15% for the older age group. This complication rate is acceptable in comparison with the hemiarthroplasty complications with 3% deep infection, 3% periprosthetic fracture, 5% dislocation, 10% loosening and 20% late acetabular wear. On that basis, these subcapital undisplaced fractures should all be fixed if the patient is fit enough for surgery (Fig. 3). The controversy and challenge remain for displaced fractures. Displaced subcapital fractures in the elderly patients may be treated by internal fixation but there will be an increased re-admission and re-operation rate in comparison with arthroplasty. Functional results and mortality are essentially similar for the two procedures [5]. The reported expected re-operation rate after internal fixation for a displaced intra-capsular fracture is between 10 and 50%, mainly for fracture non-union and redisplacement, compared with figures of 10–24% for arthroplasty [1] (Fig. 4). Re-operation rates tend to be higher in the more elderly patients because of the increased risk of fracture re-displacement. The evidence is in favor of arthroplasty for the management of elderly patients with displaced subcapital fractured neck of femur. Internal fixation may also be appropriate for those at increased risk of sepsis or bleeding complications and in addition may be used for the very frail where the operation can even be done under local anesthesia.

Which arthroplasty?

When arthroplasty is chosen for the management of subcapital fractured neck of femur, the choice is usually between unipolar hemiarthroplasty, bipolar arthroplasty or total hip replacement.



Fig. 4 AP radiograph of a hemiarthroplasty done for an intracapsular fracture neck of femur

There is evidence that the Austin Moore prosthesis should be abandoned when compared to a cemented hemiarthroplasty. In fact, several authors (Foster et al.—INJURY) have shown worse functional outcome, higher peri-prosthetic fractures and higher revision rates when compared to cemented hemiarthroplasty. The Australian hip registry in 2003 and Parker et al. (Cochrane 2003) [8] reported similar results, with later mobilization and worse pain control. No difference in mortality was noted though.

Cemented hemiarthroplasty though, has been shown to carry high complication rates and poor long term results. Philips [9] reported a series of 49 patients of a mean age of 80 living in their own home managed with a cemented hemiarthroplasty: 69% had acetabular erosion with pain and disability at 3–14 years. Furthermore, revising a cemented hemiarthroplasty to a total hip replacement can be a complicated task with serious complications (although one has to mention the growing popularity of cement in cement revision that can be achieved easily with some of the most modern hemiarthroplasty stems), as shown in the Mayo clinic series (45% major complication rate) and the Bristol experience (48% major complications). In addition, a dislocated cemented hemiarthroplasty carries a 50% mortality rate.

The evidence for bipolar arthroplasty is not clear. There are several advantages to a second articulation, variation in stem sizes and offset, ease of revision to THR, but potential of polyethylene particles and higher costs. To date, there is no evidence to support the use of bipolar arthroplasty in fractured neck of femur.

The role of primary total hip replacement in the acute phase of a subcapital fractured neck of femur is growing with recent randomized trials showing less complication,

reduced re-operation rates, functional scores at least as good as internal fixation and hemiarthroplasty and favorable cost effectiveness.

Blomfeldt et al. [3] from the Karolinska institute compared internal fixation with THR for the treatment of displaced intracapsular fractured of the neck of femur. One hundred and two patients with a mean age 80, all mobile independently, had normal cognitive function. At 48 months from the fracture, hip complications were 4% in the arthroplasty group versus 42% in the internal fixation group. The reoperation rate was 4% for the arthroplasty group versus 47% for the fixation group. Hip function and health-related quality of life were at least as good in patients treated with THR.

Later, Keating et al. [7] published a randomized control trial comparing reduction and fixation, bipolar hemiarthroplasty and total hip replacement in displaced intracapsular fractures of the hip in healthy elderly patients. A total of 207 patients were randomized to one of the previously treated three treatment options, while 91 patients were randomized to internal fixation or bipolar hemiarthroplasty. The mean age of patients was 75. At 48 months follow-up, there was no difference in mortality. Thirty-nine percent of the internal fixation group, 5% of bipolar and 9% of the total hip replacement group had undergone a second surgical procedure. The Euroqol and hip function were significantly better for the total hip replacement group at 24 months. The cost effectiveness analysis was in favor of total hip replacement. Weaknesses of the study have been highlighted though, especially regarding the study design. In fact, the treating surgeons were provided with substantial latitude with respect to determining eligibility. Another area of concern includes the potential impact of total hip arthroplasty being performed by more “senior surgeons”, while other procedures were less likely to have a senior surgeon involved [3].

Management of demented and institutionalized patients

The demented patient with a displaced femoral neck fracture poses a special problem because of the higher risk of dislocation of the prosthesis and higher mortality after a femoral neck fracture. In a study by Rogmark et al. [10], primary cemented hemiarthroplasty was compared to internal fixation in old and demented patients. The arthroplasty group required more blood transfusions, a longer operation and had more superficial infections. No differences were detected as regards other complications, length of hospital stay, in-hospital mortality or ability to return home. The 1-year mortality rates were similar in the arthroplasty (29/103) and control groups (28/69). Within 1 year, they found a lower failure rate in the arthroplasty

group (6/103) than in the control group (18/69). In the arthroplasty group, 2/103 had dislocations. Of the surviving arthroplasty patients at 12 months, 31/74 could walk as well as before the fracture and 55/74 had no pain.

Blomfeldt et al. [3] compared internal fixation to uncemented hemiarthroplasty for displaced fractures of the femoral neck in elderly patients with severe cognitive impairment. They looked at 60 patients with a mean age of 84. No difference in mortality was noted between the 2 groups at 2 years (42%). Hip complications were 30% in the internal fixation group versus 23% in the arthroplasty group, while the reoperation rate was 33% and 13%, respectively. There was no difference in mobility status. The generic health questionnaires (Euroqol) showed significantly worse function in the hemiarthroplasty group.

Johansson et al. [6] looked at internal fixation versus total hip replacement in displaced subcapital fractures. When the results were stratified according to the patients' mental function, significant differences were found within the 2 groups with respect to both morbidity and mortality. The 1-year mortality rate was 44% in patients with mental dysfunction compared with 11% in patients with normal cognitive function. After internal fixation, the complication rate was 73% in lucid patients compared with 25% in demented patients. After total hip arthroplasty, the dislocation rate was 12% in normal patients compared with 32% in demented patients. The majority of patients with redislocation (80%) were demented.

Our treatment algorithm

See Fig. 5.

Preventative measures as part of the management

Our work on the management of subcapital fractures of the neck of femur in the elderly would not be complete without the mention of prevention of fragility fractures. In fact, following a study done last year in our trauma department (University Hospital Coventry and Warwick), out of 850 patients admitted in our wards with a fracture over a 1-year period, 122 patients were above 75 years of age. The recently published NICE guidelines emphasizes that for these patients, bisphosphonates should be started without the need for DEXA scan screening. We had no patients started on the above medication. We are currently re-auditing our practice. Other authors [3] have recently highlighted a similar issue in the United States of America.

It is clear that the risk of osteoporotic hip fracture can be reduced by using a combination of therapeutic strategies. A preventive program that effectively combines

Fig. 5 Treatments algorithm for subcapital fractures of the neck of femur



bisphosphonates, calcium supplements, adequate vitamin D intake and appropriate attention to exercise and to hazards in the patient's environment can significantly reduce the incidence of hip fracture and associated morbidity and mortality.

In elderly women, 90% of hip fractures are attributable to osteoporosis. Most hip fractures result from relatively minor traumas, such as falls out of bed or from a standing height or lower. One in five people die within a year after sustaining a hip fracture, and only 40% of patients recover their prefracture mobility. Treatment of patients with hip fracture accounts for most of the healthcare spending associated with osteoporosis (about \$14 billion annually in the United States).

Adequate calcium and vitamin D intake and exercise are fundamental to any program for bone loss prevention or osteoporosis treatment. Fall prevention programs, weight-bearing and resistance exercise and calcium and vitamin D supplementation can reduce hip fracture risk. Among the available antiosteoporosis agents, the bisphosphonates risedronate and alendronate have produced the greatest reductions in hip fracture risk in postmenopausal women. Nasal calcitonin and raloxifene have not demonstrated significant reductions in non-vertebral or hip fracture risk. The role of parathyroid hormone (1–34) in the treatment of

hip fractures remains uncertain until more experience is gained about its use and studies with sufficient statistical power are performed. Data indicate that bisphosphonates consistently reduce hip fracture risk in patients with osteoporosis, especially those with an existing vertebral fracture. In addition to pharmacologic intervention, adequate non-pharmacologic preventive strategies should be included to ensure maximal reduction in risk of hip fracture [3].

Unfortunately, there is a lack of structure in our health care system to pick up patients at risk for fragility fractures and despite the availability of evidence based guidelines, it is still unclear as to who should start the treatment and who should follow patients up.

The management of subcapital fractures in the elderly is still debated. In this article, we have attempted to summarize the evidence available. There is agreement that patients with undisplaced fractures should be treated with fixation independent of their age. Patients with displaced fractures should benefit from fixation if they are in the young age group (<70 years) or with a life expectancy that will outlive a total hip replacement. Older patients should have a total hip replacement or a cemented hemiarthroplasty if they are institutionalized or demented. Our work would not be complete without a discussion on the prevention of these fractures, which is poor in our country.

There is a lack of structure in our health care system to pick up patients at risk for fragility fractures and despite the availability of evidence based guidelines, it is still unclear as to who should start the treatment and who should follow patients up. On the other hand, the consequences of the long term use of bisphosphonates are still unknown and this will have to be elucidated.

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