Chapter 10

The medial femoral neck fracture: is there still a place for conservative treatment?

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ABSTRACT

Non-displaced fractures of the femoral neck are generally internally fixated with preservation of the femoral head. The current guideline states that conservative treatment of non-displaced (impacted) femoral neck fractures may be considered in patients with a 'healthy' patient profile and in patients who have already borne weight on the broken hip.

This literature review shows that conservative treatment of patients with impacted hip fractures fails in approximately 30% of the cases. Most patients in whom conservative treatment has failed will receive a femoral neck prosthesis or total hip replacement.

The placement of femoral neck prosthesis is known to carry a higher surgical and anaesthesiological risk compared to internal fixation of the non-displaced femoral neck fracture.

Given the quality of surgical techniques and improvement in perioperative care, the operative risk of primary internal fixation is limited and direct internal fixation should be strongly considered for non-displaced femoral neck fractures in all patients whose life expectancy is longer than 2 weeks.

INTRODUCTION

Annually, approximately 17,000 patients (2005) in the Netherlands and 615,000 patients in the European Union (2010), are admitted in the hospital with a hip fracture. This number is expected to continue to rise to reach 815,000 in 2025.[1] Complications in hip fracture patients occur frequently and cause high morbidity rates. Moreover, 30% of these patients, older than 55, decease within one year after the fracture.[1, 2]
Surgical fixation of hip fractures of hip fractures occurred even before World War II. As a result of introduction of new, improved, and often percutaneous surgical techniques, the treatment of hip fracture patients, and in particular those with a non-displaced femoral neck fracture, is a continuing subject of discussion.

Classification of hip fractures

Hip fractures can be classified as intra- or extra-capsular hip fractures. Intra-capsular hip fractures are known as femur neck fractures and femoral head fractures. Femoral neck fractures constitute about half of all hip fractures and are subdivided in non-displaced fractures (Garden classifications I and II) and displaced fractures (Garden classifications III and IV) (Figure 1). The 'impacted' fracture, which occurs in 10-33% of patients with a hip fracture, is classified in the group of the non- or minimally displaced fractures as the head of the hip is in slight valgus.

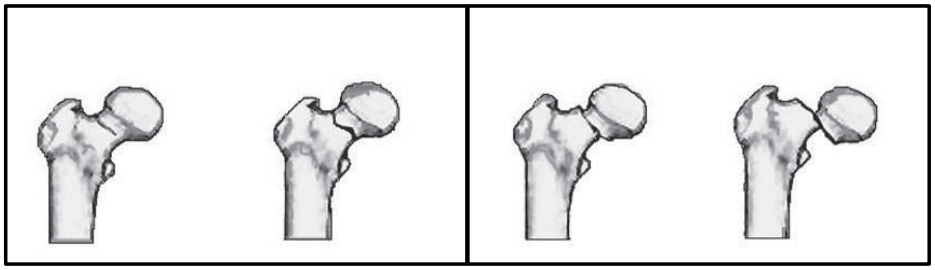

Figure 1
Classification of neck of femur fractures

Surgical treatment of femoral neck fractures

If treated surgically, patients with non-displaced femoral neck fractures are usually treated using internal fixation, with the intention to preserve the femoral head. This implies that the fracture is treated with osteosynthesis, for example with a dynamic hip screw

Figure 2

Femoral neck fracture treated with dynamic hip screw (DHS)

(DHS) or three cannulated screws (CS) (Figure 2). These are short, low impact operations, even for the elderly patients. The most important complications include wound infection (<3%), break-out of the implant (2%), avascular necrosis of the femoral head (2-4%) and non-union (4 to 8.5%). A second surgery is performed in 8-15% of the patients.[3, 4]

Young patients are treated by osteosynthesis, but in patients over 70-80 years, in general, a total or hemi-prosthesis is used for treatment of displaced femoral neck fractures. In this group of older patients with displaced fractures, head preservation is prone to result in complications such as avascular necrosis, dislocation and non-union due to compromised and damaged vascularity.

The placement of a prosthesis, especially a total hip replacement is a major operation with a high complication rates. The most common complications include dislocation (total hip arthroplasty: 9%; hemi-prosthesis: 3%) and revision of the prosthesis within one year (total hip replacement: 4%; hemi-prosthesis: 7%). Severe post-operative complications, such as pulmonary embolism, myocardial infarction, or a deep wound infection, are described, for approximately 25% of the operated patients.[5]

CONSERVATIVE TREATMENT IN NON-DISPLACED FEMORAL NECK FRACTURES

The guideline "The treatment of proximal femur fractures in the elderly ", which was drafted in 2008 by the Dutch Society for Surgery, states that conservative treatment of non-displaced femoral neck fractures may be considered in patients with a "healthy" patient profile, i.e. ASA (American Society of Anesthesiologists) class 1 or 2, and in patients who have already walked on the broken hip.[6] If conservative treatment for this fracture was intended, it is preferably, with early mobilization and by full load bearing.

In clinical practice, the choice of whether or not to treat patients with non-displaced fractures or impacted fractures, non-operatively, often leads to debate. In The Netherlands, approximately 5% of the patients with a non-displaced femoral neck fracture is treated non-operative. This is especially the case for the disabled, elderly or demented patients or patients with a bad overall health (ASA class 3 or 4).[7]

The conservative treatment may fail because of secondary displacement. In that case, surgical treatment will take place. As a result of the compromised blood supply to the femoral head due to fracture dislocation, after failure of the non-operative treatment younger patients will often receive a total hip replacement and in elderly patients a hemi-prosthesis will be placed.

In this article we will provide an overview of current insight on the non-operative treatment of patients with a non-displaced femoral neck fracture.

Selection of the articles

In Medline we searched for all the studies published in Dutch, English or German with a combination of search terms for "neck fracture" and "non-operative treatment" (Figure 3). We also searched for relevant studies in the reference lists of the included articles of the Guideline.[6] We excluded letters to the editor, guidelines, recommendations, comments, editorials and patient descriptions. Studies with subject pathological fractures, periprosthetic fractures, stress fractures or fractures in children were also excluded.

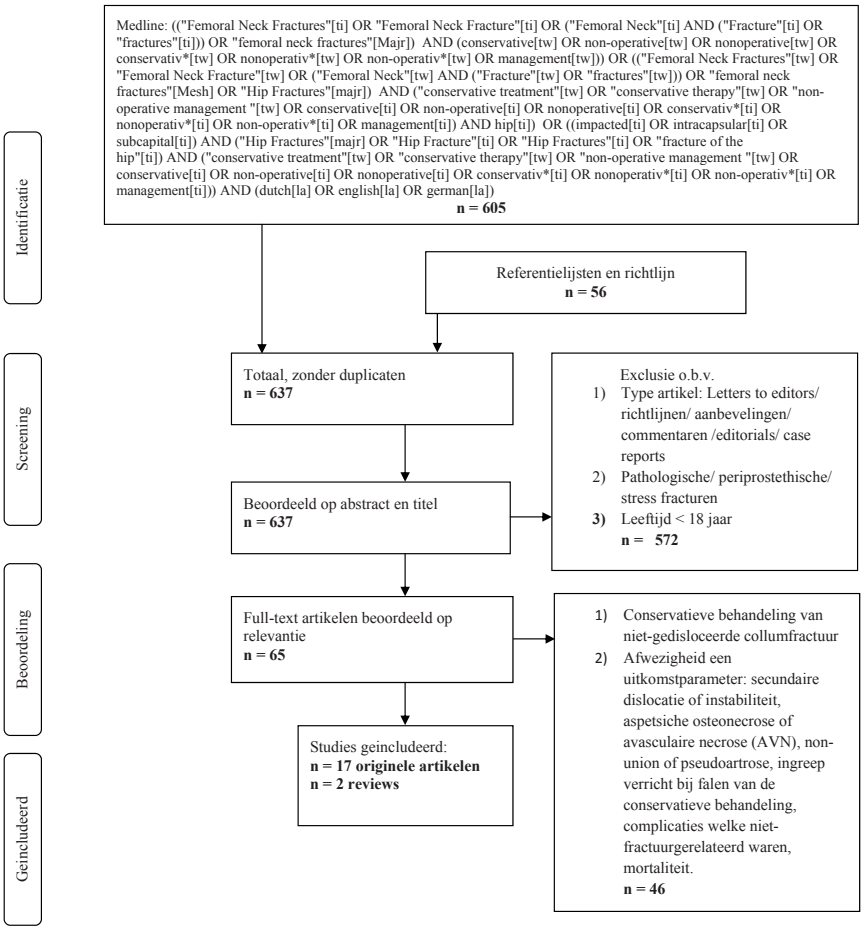

Figure 3

(in Dutch) Schematic diagram of this literature study including the Medline search terms. After the selection and adding several publications 19 articles were included.

Original publications

Concerning the conservative treatment of patients with non-displaced femoral neck fractures we found a total of 17 original studies[8-24], and 2 reviews.[4, 25] Table 1 lists the main results of 1560 conservatively treated patients in the 17 original studies displayed. The scientific evidence of the original articles was low, there were two prospective cohort studies with evidence level 3. The remaining trials involved retrospective cohorts with evidence level 4 and 1 patient series with an evidence level of 5.26 Most of the studies were older than 20 years (see Table 1), whereby the usefulness of these studies to the standards of this time is debatable. For example, the patient characteristics, were not or

Table 1

Author	Year	Study type	N	Age (mean)°	Sec. displacement N (%)	After care	Follow-up	Level of evidence ∞
B Crawford*[4]	1960	CS	50	66	4 (8%)	4 months non-weight bared	mean 3,5 years	5
AL Flatmark[5]	1962	RC	51		4 (8%)	2-4 weeks non-weight bared	15 months -10 years	4
J W Hilleboe*[6]	1970	RC	37	70	4 (11%)	12-16 weeks non-weight bared	mean 2,5 years	4
BA Hansen*[7]	1978	RC	42	74 /82 **	8 (19%)	direct belast	3 years	4
G Bentley[8]	1980	RC	43	72	7 (16%)	8 weeks non-weight bared	3 years	4
M Famos*[9]	1982	RC	75	75	24 (32%)	direct belast		4
J Jensen*[10]	1983	RC	128	73	35 (27%)	weight-bared belast after 1-4 weeks	3-48 months	4
J Riedl*[11]	1989	RC	123	73	11 (9%)	10 days non-weight bared		4
J Manninger[12]	1990	RC	64		8 (13%)		3 years	4
I Otremski*[13]	1990	RC	123	66	11 (9%)	94 patienten directly weight bared, 29 after 2 months (dep. weight)	mean 3 years	4
P Cserháti*[14]	1996	RC	122	75	24 (20%)	3 months partially weight bared	3-7 years	4
ELFB Raaymakers*[15]	2002	PC	319	72	95 (30%)	8 weeks partially weight bared	2 years	3
J Tanaka*[16]	2002	RC	38	81	14 (37%)	2 weeks non-weight bared	6 months	4
L Helbig[17]	2005	RC	54	71	28 (52%)	direct belast	6 years	4
CPM Verheyen*[18]	2005	RC	105	78	48 (46%)	direct		4
Ma Shuqiang[19]	2006	RC	129	71	48 (37%)	Traction until callus formation		4
JM Buord[20]	2010	PC	57	83	19 (33%)	48 uur non-weight bared	1 years	3
Total			**1560**		**392 (25%)**			

CS: case series, RC: retrospective cohort, PC: prospective cohort.

* Articles named in Guideline.

** The mean age of the group without displacement was 74 years and the group with displacement had a mean of 82 years.

° In the articles by AL Flatmark[5] and J Manninger[12] the different ages are presented in a figure and table (resp.).

∞Level of evidence I: systematic review, II: randomized controlled trial, III: non-randomized prospective cohort, IV: non-randomized retrospective cohort study, V: case series.[26]

ill-defined. The earliest study dated from 1960[8] and 6 of the 17 enrolled original studies were published after 2000.
Of the articles that are listed in the table, 13 studies were in the literature table of the Guideline.[6] Two other studies mentioned in the Guideline have not been selected for this review: one due to the Danish language and one because of the inclusion of the same group of patients in two studies.[19]

Failure of conservative therapy: secondary dislocation and avascular necrosis

In the selected literature the highest percentage of patients with secondary fracture dislocation of the fracture after non-operative treatment was 52% .21 The lowest rate was 8%, and was described in the two earliest studies.[8, 9] The six studies after 2000 (702 patients), all showed a dislocation rate of 30% or higher.
Avascular necrosis was not described in five studies. The remaining 12 studies showed an avascular necrosis incidence ranging from 2-14% after non-operative treatment.[9, 21]
The presence or absence of non-union or pseudoarthrosis was described in eight studies [9, 10, 15, 17, 18, 20, 21, 24] and occurred in one patient in three studies [9,18,21] these disorders were characterized as rare (incidence <1%).

After care

In four of the six studies published since 2000 rapid postoperative mobilization was described.[20-22, 24] In older studies, the conservatively treated patients started to put weight on the broken hip until there were signs of consolidation. In one study, in which weight bearing was allowed depending on the position of fracture and the psychological state of the patient, no difference was found in the risk of secondary dislocation in early and late mobilization and an increased risk was seen for secondary displacement in the group of non-weight baring patients.[14]

Operations after failure of non-operative therapy

In 11 studies it was stated that an operation was performed after failure of the conservative therapy, but in the majority of the studies the operative treatment was not specified, nor were the results of these operations. In more recent studies, the main operative treatment after failure of conservative treatment was a total hip replacement or hemi-prosthesis.[21, 23, 24]

Other complications

Despite the impact of postoperative complications in the elderly patients, complications not related to the fracture, such as pneumonia, were only described in 5 of the 17 studies.[18, 20, 21, 23, 24] Mortality rates ranged from 2-19% and in a large part of the studies, the time of death after the fracture was not reported.

Reviews

In a review of 2004, with an evidence level of 1, a group of 1887 patients with non-displaced femoral neck fractures and mean age of 73 years, was treated with internal fixation and compared with a conservatively treated group of patients, obtained from literature.[4] The authors found a non-union and secondary dislocation rate of 4% after surgical treatment of a non-displaced femoral fracture. In the non-operative group, which was composed of nine studies with a total of 1,003 participants with an average age of 72 years, the risk of secondary displacement and non-union was 20%. The incidence of avascular necrosis after both treatment strategies was similar: 2% after internal fixation versus 3% after non-operative treatment.

The Cochrane review of 2008, with an evidence level of 1, described five RCTs in which the outcomes of conservative and surgical treatment of patients with hip fractures were compared.[25] One trial involved the treatment of intra-capsular hip fractures, but the results of this study were never published. The authors of the Cochrane review argue that there is insufficient evidence to make a judgment about the benefits of surgical treatment compared to non-operative treatment. They conclude that the surgical treatment was introduced and became the preferred method before a good randomized-controlled trial (RCT) could be performed. They explained the lack of RCTs was in this review explained by the fact that non-operative therapy is associated with a much higher risk of secondary displacement.

The role of age and comorbidity

Patient age and comorbidity are important in the discussion about whether or not a non-displaced femoral neck fracture should be treated non-operatively. The influence of age and comorbidity on the risk of failure of non-operative treatment is described in two studies.[19, 23] These show that patients older than 70 have significantly greater risk of secondary dislocation of a non-operatively treated Garden I fracture. These studies also show that in patients with extensive comorbidity the risk of failure of conservative treatment increases. Other studies have shown that the functional outcome of patients with a hip fracture aged 90 years and older is better if they were operated.[27] Moreover, in disabled patients it seems that internal fixation of non-dislocated fractures results in better pain relief and self-reliance.[28]

There are exceptions: in patients with a hip fracture and a very high surgical risk (ASA class 4 moribundus) who for example, must undergo volume resuscitation upon arrival at the emergency department, there is no difference in mortality and functional outcome between surgical and non-operative treatment of a hip fracture.[29] Further, terminally ill patients with an advanced malignancy after hip surgery rarely ever return home. In this category of patients, non-surgical treatment should be considered, as surgery might not be the preferred choice.[30]

Finally, most important, early mobilization seems to be the key factor in good patient outcome, both after surgery and as after non-operative treatment.[31]

THE SUPPORTERS AND OPPONENTS

As is apparent from the foregoing discussion of the literature, the question whether or not patients with a non-displaced femoral neck fracture can be treated non-operatively is not easy to answer. The problem can be substantiated in several ways.

Supporters of conservative treatment state that this treatment is associated with an acceptable risk of displacement. From our review of recent literature it shows that at least 30% of the conservatively treated patients will get a secondary displacement of the fracture and subsequently will undergo extensive surgery. This chance on secondary surgery rises in the presence of risk factors such as high age and comorbidity. On average, about one-third of the patients will, in the second instance, have to undergo a more extensive surgery after initial conservative treatment. This implies that an extensive operation and concomitant risks can be avoided successfully in two-thirds of the patients, by primary internal fixation of the still non-displaced fracture.

Opponents of non-operative treatment state that the displacement risk after internal fixation is much lower than with non-operative treatment.[4] The surgical risk of internal fixation is low due to the simple surgical technique and improved pre-and postoperative care.[3,32] When secondary displacement occurs after non-operative treatment in most patients hemi-prosthesis will be placed. This procedure brings along higher complication risks. If the patient needs to undergo surgery because of secondary displacement, there is on average a longer duration of surgery, longer hospital stay, more complications and a higher 1-year mortality (19% for internal fixation; 26% in head-neck prosthesis).[3]

Other considerations

There is only one study on the cost-effectiveness of surgical versus conservative treatment of patients with hip fractures. It demonstrates that no cost advantage exists for surgical treatment of non-displaced femoral neck fractures. For all other types of hip fractures surgery is more cost-effective than non-operative treatment.[33]

LIMITATIONS

Most of the available literature is dated and of poor quality. Many follow-up data are lacking. Also, the characteristics of the patient population, such as comorbidity, are insufficiently described, so the question of *which* patients may or may not be treated

conservatively, remains unanswered. Further, there is a great diversity in the definition used of the non-displaced or 'impacted' femoral neck fractures.
Given the retrospective nature of most studies, there may have been selection biases. The incidence of secondary dislocation appears to be increasing over time, but this is undoubtedly an artifact due to incomplete registration of complications in earlier years. Since more than half of the studies are older than 20 years and the quality of the studies included has improved substantially in the course of time, the reliability of these earlier results is questionable.

CONCLUSION

Although the 2008 Guideline 'Treatment of proximal femur fractures in the elderly' of the Dutch Society for Surgery states that the relatively young and healthy patients can be treated conservatively, clinical practice seems to show the opposite. Based on the currently available literature there is insufficient evidence to support the non-operative treatment of patients with non-displaced femoral neck fractures. However, the solid scientific evidence to support the primary operative treatment is also lacking. But we do know that higher patient age and more comorbidities, reduce the chances of successful conservative treatment. The development of the current percutaneous surgical techniques, the short duration of surgery, the improvement of perioperative care and the substantially higher surgical risk of the placement of prosthesis, render the primary internal fixation of a non-displaced femoral neck fracture a justifiable treatment for all age groups.

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