



Low conversion rates toward total hip arthroplasty after hemiarthroplasty in patients under 75 years of age

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Abstract

Introduction An intracapsular fracture of the femoral neck is frequent in the elderly. Patients can be treated with either total hip arthroplasty or hemiarthroplasty. There is a continuous discussion about the treatment in elderly patients who are still healthy, active and mentally untroubled. A potential consequence of hemiarthroplasty, especially in the relatively young elderly, could be conversion to total hip arthroplasty. The conversion rate must be acceptable, and clinical outcome must be sufficient to justify the treatment with hemiarthroplasty in this group of patients. This study evaluates the conversion rate of hemiarthroplasty to total hip arthroplasty and clinical outcome in patients under 75 years of age.

Methods This study identified 248 patients, younger than 75 years at time of operation, with a fracture of the femoral neck treated with hemiarthroplasty. Patient-reported outcome measurements (VAS pain during rest and activity and WOMAC) were assessed by telephone interviews. Furthermore, radiographic evaluation for the presence of acetabular wear was performed.

Results At a follow-up of 5.1 (0.9–9.6) years, the conversion rate was 7.3%. Mean VAS pain in rest was 0.89 (0–10), the mean VAS pain during activity was 2.2 (0–10), and the WOMAC showed a mean of 16.51 (0–64). At time of follow-up, 38.7% of patients had died. Radiographic evaluation of the unrevised group showed in one patient signs of acetabulum wear.

Conclusion Hemiarthroplasty in the relatively young elderly after a fracture of the femoral neck demonstrates an acceptable conversion rate. Furthermore, unrevised patients show low complaints of pain. To prevent one conversion to total hip arthroplasty, 13.7 patients should be treated with total hip arthroplasty that will not undergo a conversion at a later stage. Therefore, hemiarthroplasty remains a viable treatment of femoral neck fractures in relatively young patients. There seems to be no space for standardized decision making concerning the choice of treatment. An individual approach is required.

Keywords Femoral neck fractures · Hemiarthroplasty · Conversion · Under 75 years

Introduction

An intracapsular fracture of the femoral neck frequently occurs in the elderly. A fracture of the femoral neck can be treated with internal fixation, hemiarthroplasty or total hip prosthesis. The type of treatment depends on different factors such as, but not limited to, the patient's age, the level of cognitive function, the degree of fracture displacement, the degree of physical fitness and the functional state of the patients. All treatments have certain advantages and disadvantages, and therefore, all target groups require a specific

treatment [1–6]. Internal fixation is used in young healthy patients with a fracture that is not displaced [3]. Total hip arthroplasty is often used in patients with a fracture of the femoral neck in combination with osteoarthritis or rheumatoid arthritis [3]. Finally, hemiarthroplasty is commonly used in fragile elderly with low functional demands, who do not suffer from rheumatoid arthritis or osteoarthritis of the hip [3, 7]. Advantages of hemiarthroplasty compared to total hip replacement are decreases in surgery complexity, blood loss, operation time and chance of dislocation [2, 4, 6, 8–10]. Protrusion of the femoral prosthesis into the acetabulum over time is a potential disadvantage of hemiarthroplasty [2, 4–6, 8, 11–13]. Pressure and movement of the head of the prosthesis into the acetabulum can cause damage of the cartilage of the acetabulum. This acetabular wear can cause complaints of pain. A potential consequence

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of hemiarthroplasty is therefore the need for a conversion to total hip arthroplasty over time. Only a few articles investigated the results of hemiarthroplasty in patients younger than 75 years [1, 8, 13, 14]. These studies show variable conversion rates. Of course, the conversion rate must be acceptable to justify the treatment of hemiarthroplasty in this group of patients. In this paper, we evaluate the conversion rate after hemiarthroplasty when placed in relatively young patients (75 years) over time. Furthermore, patient-reported outcome measurements (PROM's) are evaluated.

Methods

For this retrospective cohort study, we identified all patients younger than 75 years, treated in our institution, between June 2008 and December 2017 with monopolar hemiarthroplasty of the hip, due to a displaced intracapsular fracture of the femoral neck. Patients were treated with cemented hemiarthroplasty through a posterolateral approach. As a start, we screened the medical files of all patients. We searched for patient characteristics, presence of revision and reason for revision. We calculated the conversion rate as the percentage of revised patients of the total number of patients. Patients with a fracture caused by an oncological origin were excluded. Approval from the local ethics committee was obtained (2018-1175).

PROM's

Patients who were still alive and unrevised were contacted by phone and were asked to complete questionnaires. These consisted of a visual analogue scale (VAS) for pain in rest and during activity [15, 16] and the validated Dutch version of the Western Ontario McMaster Universities osteoarthritis index (WOMAC) [17, 18]. Patients were asked whether a revision of their hemiarthroplasty in another hospital had taken place and about their current living situation as well. Questionnaires by regular mail were sent to patients who were not able to answer telephone interviews. Patients with severe mental disorders were thought not to be eligible for telephone interviews because of the chance of unreliable results.

Radiographic evaluation

The most recent pelvic radiographic images available were used to evaluate the presence of acetabular wear. The radiographic follow-up was the time from operation to the date of the most recent image. There was no standardized follow-up sequence of this type of surgery. According to Baker et al., the images were scored as: normal, no erosion (grade 0), no bone erosion (grade 1), acetabular bone erosion and early

migration (grade 2) and protrusion acetabuli (grade 3). Pre-operative images were scored as well.

Statistical analysis

The statistical analysis was performed with SPSS 24.0 (SPSS Inc. Chicago, IL). The variables were examined for normal distribution by means of the Shapiro–Wilk test. Statistical significance is set at $p < 0.05$. The analysis took paired data into account.

Results

We identified 248 patients with a fracture of the femoral neck younger than 75 years, treated with hemiarthroplasty. At the time of operation, the mean age of the patients (23.8% men) was 70.5 (54.3–74.9) years. After a mean follow-up of 5.1 years (range 0.9–9.6), 18 of 248 (7.3%) patients were converted to a total hip arthroplasty after a mean of 1.6 (0–6.5) years. Among the revised patients, one patient was deceased. At the time of follow-up, 96 of 248 (38.7%) patients had died. Among those patients, the cumulative incidence of death was 47.9% at 1 year, 56.3% at 2 years, 68.8% at 3 years and 86.5% at 5 years. After 81 months, 100% of these 96 patients were deceased. Furthermore, 28 patients were not eligible for telephone interviews due to severe mental disorders and two patients were not approached due to severe physical disorders (Fig. 1).

This has resulted in a group of 105 patients who were contacted by phone. As shown in Fig. 1, a total of 81 patients responded (response rate 77%). No additional responses came after sending questionnaires by regular mail.

At the time of follow-up, an independent living situation was reported in 85% of the patients, a home for elderly in 10% and a nursing home in 5%.

PROM's

The mean VAS pain in rest and during activity was 0.89 (range 0–10, SD = 2.1) and 2.2 (range 0–10, SD = 2.8), respectively. The WOMAC showed a mean of 16.51 (range 0–64, SD = 15.62) (Table 1). The radiographic evaluation according to Baker et al. after a mean follow-up of 1.5 years (range 0–10) showed in 78 patients a score of 0, in 1 patient a score of 1 and no patients scored 2 or 3. The patient with a score of 1 scored a 0 on the preoperative X-ray.

Conversion

In total, 18 of the 248 patients (7.3%) were converted to total hip arthroplasty, of which one patient was deceased at time of follow-up. Among those patients, four conversions

Fig. 1 Flowchart inclusion

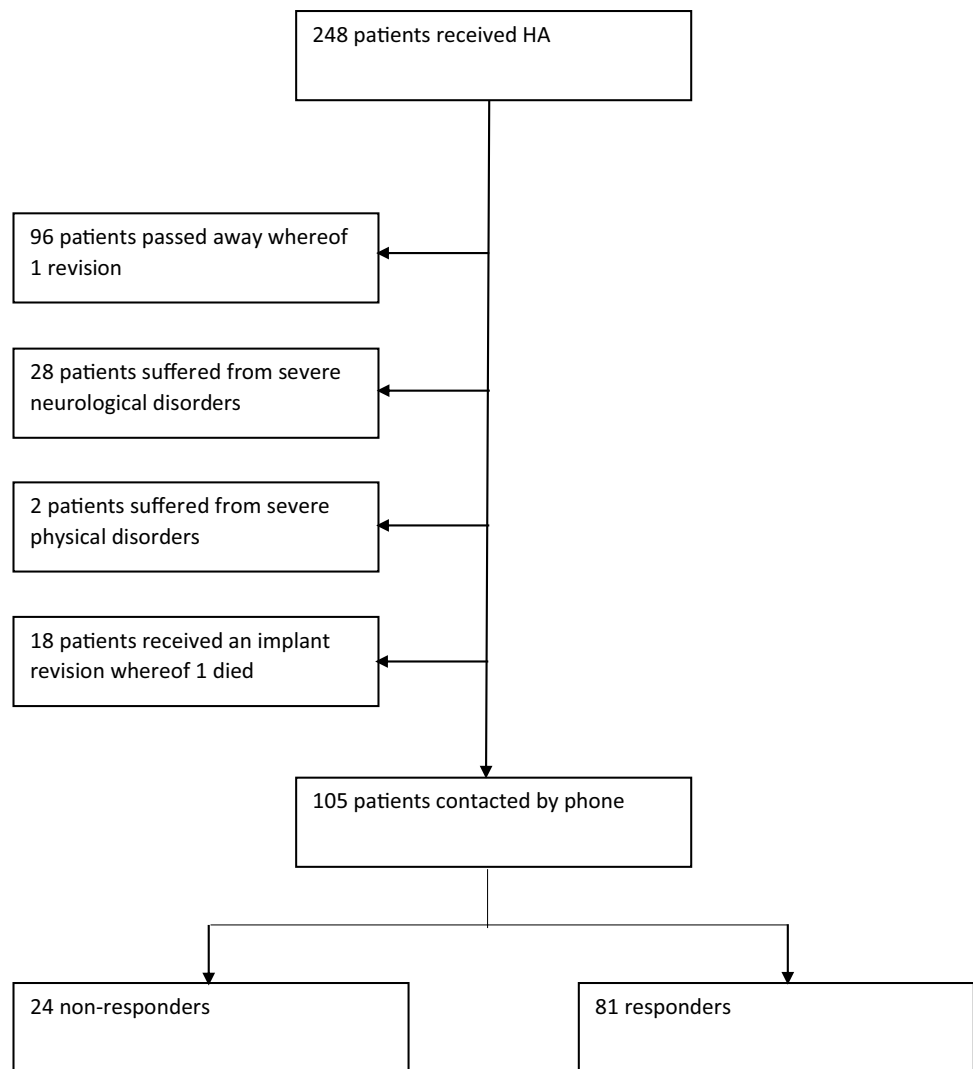


Table 1 Clinical outcome scores

	Follow-up mean (std. deviation)
VAS pain rest	0.89 (2.1)
VAS pain activity	2.2 (2.8)
WOMAC pain	2.17 (3.5)
WOMAC stiffness	0.91 (1.8)
WOMAC functioning	13.42 (12.1)
WOMAC total	16.51 (15.6)

Table 2 Revision

	Revision (% of total amount of revisions)
Acetabulum wear	5/248 (2.0%)
Pain without abnormalities X-ray	9/248 (3.6%)
Dislocation	3/248 (1.2%)
Deep infection	1/248 (0.4%)
Superficial infection	0/248 (0%)
Periprosthetic fracture	0/248 (0%)
Total	18/248 (7.3%)

to total hip arthroplasty had taken place in another hospital. With this conversion rate, the number needed to treat is 13.7. Reason for conversion was in 14 (5.6%) patients suspected wear of the acetabulum and pain (Table 2). When scoring the last X-rays before conversion according to Baker et al., in only five (2.0%) patients acetabular wear was found: a score of 1 in three patients and a score of 2 in

two patients. Thus, in nine (3.6%) patients the implant was revised due to complaints of pain without any abnormality seen on the X-rays. Besides, two patients were converted because of a dislocation and one patient was revised due to a deep infection.

Complications

The overall complication rate was 13/248 (5.2%): 6 dislocations, 5 deep infections, 1 superficial infection and 1 periprosthetic fracture. Among the unrevised, in four patients a deep infection had occurred, in one patient a superficial infection, in three patients a dislocation and one patient had suffered from a periprosthetic fracture.

Discussion

Conversion rate

In this cohort study concerning hemiarthroplasty after femoral neck fractures in relatively young patients (75 years), we found a conversion rate of 7.3% after a mean follow-up of 5.1 years. Reason for revision was in three patients a dislocation and in one patient an infection. After correction for infection and dislocation, reason for conversion was in 5.6% suspected wear of the acetabulum. Correction is justified, since dislocations are more common in total hip arthroplasty compared to hemiarthroplasty [2, 4, 5, 10, 19].

There is no consensus on the best treatment in patients with femoral neck fractures younger than 75 years and research is scarce [4, 19]. In comparison with the few published reports, our conversion rate of 7.3% is relatively low. Murena et al. described 137 patients with hemiarthroplasty under the age of 70 with a mean follow-up of 20 years [8]. At follow-up, the conversion rate was 12/37 (32%) which was only measured in living patients. Van den Bekerom et al. followed 302 patients until conversion or death [13]. The conversion rate was 38% in patients younger than 75 years compared to 6% in patients older than 75 years. The study did not mention the total amount of patients younger than 75 years of age. The higher revision rates of Murena and Van den Bekerom can be explained by the long follow-up and the low survival rates. Kannan et al. studied arthroplasty in femoral neck fractures in national registries of Sweden, Australia and Italy [1]. Conversion rates, in the group of patients under 75 years of age, were 8.1%, 17.4% and 8.1% with a mean follow-up of 5, 7 and 9 years, respectively. Furthermore, Grosso et al. described a study with 686 patients after hemiarthroplasty with a mean follow-up of 1.9 years [14]. The conversion rate in patients younger than 75 years old was 5.3% compared to 1.4% in the older cohort.

A conversion rate of 7.3% shows a high number needed to treat. Hence, 13.7 patients should be treated to prevent one conversion to total hip arthroplasty. Furthermore, the unrevised patients show a mean VAS pain in rest of 0.87 (0–10) and a mean VAS pain during activity of 2.14 (0–10). The acceptable conversion rate of this study together with low scores of pain

demonstrates that hemiarthroplasty remains a viable treatment option in the young elderly with femoral neck fractures.

Acetabular erosion

A major disadvantage of hemiarthroplasty in young patients in particular is wear of the acetabulum [2, 4–6, 8, 11–13]. In this study, in only 5/18 revised hips X-ray showed signs of acetabular wear (in three patients Baker 1 and two patients Baker 2). Furthermore, nine patients were converted due to suspected wear of the acetabulum without any abnormality seen on the X-rays. These results suggest that the correlation between clinical and radiographic signs of acetabular wear seems to be low.

Periprosthetic fracture

In this study, only one of the 248 patients (0.4%) suffered from a periprosthetic fracture. In a Dutch register study, Moerman et al. described a periprosthetic fracture in 52/183 (28%) of uncemented hemiarthroplasties compared to 5/243 (2%) of cemented hemiarthroplasties [20]. Grosso et al. found a significantly lower rate of periprosthetic fractures in the cemented implant group (0.4 vs 3.5%, *p* value 0.02) as well [14]. Since all patients in our study are treated with a cemented fixation of the hemiarthroplasty, the low amount of periprosthetic fractures is therefore probably explained.

Limitations

There are a number of limitations to our study and still important lessons can be learnt. First, this study has a retrospective aspect and no standardized follow-up sequence is used. Next, the choice of treatment at the time of injury could be influenced by the characteristics and comorbidities of the patients. Despite this, we probably studied a healthy group of patients, since 61.3% of patients are still alive and 85% of patients still live independently. Furthermore, the radiographic follow-up is relatively short. However, apparently the patients did not visit our department with complaints of their hip anymore. Another limitation of this study is the response rate of 77% since there is a possibility that the non-responded patients show better results of the PROM's. Nevertheless, there is no reason for this motivation because only three non-responders showed signs of acetabular wear (Baker 0: 24 patients, Baker 1: 2 patients, Baker 2: 1 patient).

Conclusion

This study provides important lessons that can be used in the process of decision making between total hip arthroplasty and hemiarthroplasty in relatively young elderly

with femoral neck fractures. The conversion rate of 7.3% found in this study is acceptable, and the unrevised patients show low complaints of pain. Therefore, it is concluded that hemiarthroplasty remains a viable treatment of femoral neck fractures in relatively young patients. There seems to be no space for standardized decision making concerning the choice of treatment. Hence, an individual approach is needed.

Compliance with ethical standards

Conflict of interest All authors declare that they have no conflict of interest.

Ethical statement The procedures followed were in accordance with the ethical standards of the institutional and/or research committee and with the 1964 Helsinki Declaration and its later amendments.

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