

# Better Short-term Outcomes after Total Hip Arthroplasty Compared to Hemiarthroplasty in Active Elderly Patients with Displaced Intracapsular Femoral Neck Fracture

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**ABSTRACT** **Background:** Hip fractures are a public health problem that disproportionately affects the elderly. Displaced femoral neck fractures were treated historically with hemiarthroplasty, but the use of total hip arthroplasty (THA) is increasing showing superior long-term results.

**Objectives:** To assess whether THA has superior short-term results compared to bipolar hemiarthroplasty for displaced femoral neck fractures.

**Methods:** Two groups of active older patients underwent either cementless bipolar hemiarthroplasty or THA for displaced femoral neck fracture. All patients were operated on using the direct lateral approach to the hip joint. Patients were assessed using the Harris Hip Score at hospital discharge and at 6 weeks follow-up.

**Results:** We included 40 patients ages 65–85 years; 18 underwent bipolar hemiarthroplasty and 22 THA. The number of women in each group was similar, as was mean age:  $73.1 \pm 4.2$  years in the hemiarthroplasty group and  $71.0 \pm 3.7$  in THA. Harris Hip Score on hospital discharge was similar in both groups. Walking ability at discharge was better in the THA cohort and they were discharged sooner:  $5.2 \pm 1.3$  vs.  $6.4 \pm 1.7$  days following hemiarthroplasty ( $P = 0.021$ ). At 6 weeks follow-up, the mean Harris Hip Score was higher in the THA group ( $78.6 \pm 11$  vs.  $61.5 \pm 17$  for hemiarthroplasty,  $P < 0.001$ ). Patients in the THA group walked longer distances, needed less support while walking, and reported less pain.

**Conclusions:** Better short-term results at hospital discharge and at 6 weeks follow-up after THA contributed to earlier patient independence and shorter hospital stays.

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**KEY WORDS:** bipolar hemiarthroplasty, femoral neck fracture, hospital stay, short-term clinical results, total hip arthroplasty

Hip fractures are an international public health problem. The number of fractures continues to rise as the population ages, and it is estimated that the number of hip fractures worldwide will increase to 4.5 million by 2050 [1]. Nearly half (45–50%) of hip fractures occur in the subcapital (femoral neck) region [Figure 1], and the majority are displaced [2]. Surgical intervention remains the main treatment for displaced femoral neck fractures. The main challenge is the postoperative rehabilitation, including gaining back independence, walking abilities, and physical function.

Displaced femoral neck fractures have historically been treated with hemiarthroplasty, in which the femoral head is replaced with an implant. Recent data showed increased use of total hip arthroplasty (THA), in which both the femoral head and the acetabulum are replaced with implants [3–6].

The best choice for orthopedic management of patients who are 60 years of age or older and are other-

**Figure 1.** A displaced femoral neck fracture of the right femur



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wise healthy remains controversial [4]. Some evidence has suggested that THA leads to better functional outcomes than does hemiarthroplasty [3,4,6-17]. However, it has been described with some disadvantages such as implant dislocation [15,17-19] and a higher bleeding rate [10,15,20,21].

We investigated whether THA led to superior short-term functional results compared to bipolar hemiarthroplasty for displaced femoral neck fractures.

## PATIENTS AND METHODS

The study was approved by the hospital Ethics Committee on 8 December 2020, approval number MMC-0339-20. Informed consent was not required, as the study was retrospective.

### INCLUSION CRITERIA

We retrospectively assessed two cohorts of active elderly patients aged 65–85 years who presented with a displaced femoral neck fracture and were operated in our department during 2015 (hemiarthroplasty) and 2016 (THA). All patients were operated on within 48 hours following arrival at the hospital. All the patients who were included in the study were active, independent, and used to walk with no walking aids prior to the surgery.

### SURGERIES AND IMPLANTS

Patients underwent either cementless bipolar hemiarthroplasty (Pavi cementless stem and bipolar head, Groupe Lépine, Genay, France) or THA (Corail cementless stem and Pinnacle cementless cup, Depuy Synthes, Warsaw, IN, USA).

### SURGEONS

All THAs were conducted by a senior surgeon from our arthroplasty team (MM, YSB). All the hemiarthroplasties were conducted by either a senior resident or a senior surgeon from our trauma unit (RBE, BK, EY).

### SURGICAL APPROACH

Patients were positioned in a lateral decubitus position on a regular operating table. The direct lateral approach was performed by placing the incision over the greater trochanter and dividing the underlying fascia lata. The abductor mechanism was divided up to its middle third, retracting the anterior half anteriorly. A capsulotomy was performed, and the femoral neck fracture was exposed. A femoral neck osteotomy was performed, and the femoral

head and neck were removed. With THA, the acetabulum and the femoral canal were prepared in the conventional manner. With hemiarthroplasty, the femoral canal was prepared in the conventional manner.

### MEASUREMENTS

Data for this study were collected retrospectively from electronic files that saved patient hospitalization records or patient follow-up in our outpatient clinic.

The following measurements were assessed using the Harris Hip Score (HHS): pain, support, limp, walking distance, and total score [6]. We also assessed blood loss after surgery and length of hospital stay. The patients were evaluated at discharge by a physiotherapist and at 6 weeks in the outpatient clinic by one of the authors.

### STATISTICAL ANALYSIS

Data were described as mean  $\pm$  standard deviation for continuous variables and as numbers and percentages for nominal variables. These data were analyzed using chi-square or Fisher's exact test and *t*-test or Mann-Whitney for metric data, according to the distribution of the variable. *P*-values  $< 0.05$  were considered statistically significant. Statistical analyses were performed using IBM Statistical Package for the Social Sciences statistics software, version 25 (SPSS, IBM Corp, Armonk, NY, USA).

**Table 1.** Demographic data of the study cohort

Variable	Hemiarthroplasty (n=18)	Total hip arthroplasty (n=22)	P-value
Sex, women	12 (66.7%)	16 (72.7%)	0.67
Age, years	73.2 $\pm$ 4.3	70.6 $\pm$ 4.4	0.07
Body mass index, kg/m <sup>2</sup>	24.5 $\pm$ 4.0	25.4 $\pm$ 3.8	0.485
<b>Co-morbidities</b>			
Cardiovascular accident	1 (5.6%)	1 (4.5%)	1
Ischemic heart disease	3 (16.7%)	2 (9.1%)	0.642
End-stage renal disease	1 (5.6%)	1 (4.5%)	1
Diabetes mellitus	7 (38.9%)	4 (18.2 %)	0.73
Chronic obstructive pulmonary disease	1 (5.6%)	2 (9.1%)	1
Malignancy	1 (5.6%)	2 (9.1%)	1

Data are presented as mean  $\pm$  standard deviation or n (%)

Table 2. Operative data

Variable	Hemiarthroplasty (n=18)	Total hip arthroplasty (n=22)	P-value
Operated within 48 hours	100%	100%	1
Approach: direct lateral	100%	100%	1
Pre-operative hemoglobin	13.03 ± 1.16	12.99 ± 1.23	0.923
Blood loss, ml	2.17 ± 0.76	2.28 ± 1	0.706
Length of hospital stay, days	6.4 ± 1.7	5.2 ± 1.3	0.021
Dislocation during the 6-week follow-up	0	0	1

RESULTS

A total of 40 patients were included in the study; 18 underwent bipolar hemiarthroplasty and 22 THA. Women comprised 66.7% of the hemiarthroplasty cohort and 72.7% of the THA cohort. The mean age was similar in both cohorts, 73.2 ± 4.3 and 70.6 ± 4.4 years in the hemiarthroplasty cohort and THA groups, respectively. There were no differences in background co-morbidities or body mass index between the groups. Patient demographic data are summarized in Table 1.

All patients underwent surgery within 48 hours after admission to the hospital using a direct lateral approach.

There was no significant difference between groups in blood loss. Hospital stay was shorter for the THA group 5.2 ± 1.3 days compared to 6.4 ± 1.7 days for the hemiarthroplasty group (*P* = 0.021). Operative data are summarized in Table 2. Fortunately, during the study period we had no wound healing problems in either cohort.

At discharge, pain levels and HHS were similar in both groups. Patients who underwent THA walked with less limp (6.9 ± 1.5 vs. 5.7 ± 2, *P* = 0.039) and needed less support than those who had hemiarthroplasty (1.2 ± 1 vs. 1.7 ± 0.7, respectively, *P* = 0.069) at discharge. Patients were discharged either to their homes or to a rehabilitation center without correlation to the HHS at discharge, but according to their supporting environment.

At 6 weeks follow-up, the mean total HHS was significantly higher in the THA group than in the hemiarthroplasty group (81.2 ± 7.9 vs. 69.5 ± 10, respectively, *P* < 0.0001). At 6 weeks, patients in the THA cohort reported less pain (42.73 ± 1.9 vs. 36.2 ± 8.37, *P* = 0.001), they needed less support to walk (5.41 ± 2.5 vs. 3.22 ± 2.1, *P* = 0.006), and they could walk for longer distances (6.9 ± 2.4 vs. 4.3 ± 1.9, *P* = 0.001). Clinical results at discharge and 6 weeks later are summarized in Table 3.

DISCUSSION

We compared short-term outcomes among active older patients who were managed with either THA or hemi-

Table 3. Postoperative clinical results according to Harris Hip Score

Interval	Variable	Hemiarthroplasty (n=18)	Total hip arthroplasty (n=22)	P-value
At discharge	Pain	25.6 ± 6.2	26.8 ± 8.9	0.664
	Support	1.2 ± 1	1.7 ± 0.7	0.069
	Limp	5.7 ± 2	6.9 ± 1.5	0.039
	Walking distance	2.0 ± 0	2.4 ± 1.1	0.109
	Total HHS	43.4 ± 8.8	45.2 ± 9.3	0.197
At 6-week follow-up	Pain	36.2 ± 8.4	42.7 ± 1.9	0.001
	Support	3.2 ± 2.1	5.4 ± 2.6	0.006
	Limp	6.8 ± 1.8	7.7 ± 1.8	0.132
	Walking distance	4.3 ± 1.9	6.9 ± 3.0	0.001
	Total HHS	69.5 ± 10.0	81.2 ± 7.9	< 0.0001

HHS = Harris Hip Score

arthroplasty for an intracapsular femoral neck fracture. Patients who received THA had better short-term outcomes compared to hemiarthroplasty. THA patients were able to walk farther, even at discharge from the hospital. The differences were even more significant at the 6-week follow-up assessment, with better walking abilities that included longer walking distances, as well as less limp and need for walking aids [Table 3].

Total hip arthroplasty for femoral neck fracture was first reported in 1980 [8] and its use has been increasing since then [9]. THA is preferred over hemiarthroplasty for active older patients with displaced femoral neck fractures. Studies in the last decade have reported better long-term outcomes in terms of postoperative pain and walking abilities for patients with intracapsular fracture of the femur treated with THA compared to patients treated with hemiarthroplasty, but is this true for short-term outcomes, as well?

Baker and co-authors [6] reported a longer walking distance for THA patients at the 3-year follow-up. Seo and colleagues [10] showed better walking abilities for THA patients at the 1-year postoperative evaluation. In a prospective randomized study, Macaulay and his team [11,12] also found that THA patients walked better at 24-months follow-up. Similar to these findings, our results show better walking abilities already at discharge from the hospital and at 6 weeks postoperatively.

Recent studies have shown that THA patients have less pain compared to hemiarthroplasty patients over the long-term. Avery and co-authors [13] found that patients in the hemiarthroplasty cohort had more pain compared to THA patients, mainly due to acetabular erosion. Seo et al. [10] also reported higher pain levels among patients who underwent hemiarthroplasty compared to THA at the one-year postoperative evaluation. Macaulay and associates [11,12] found less bodily pain at 12 and 24 months after surgery in the THA group. A meta-analysis conducted by Zi-Sheng and colleagues [14] also revealed better short- and long-term pain rates in patients who underwent THA compared to hemiarthroplasty. Better pain scores for THA patients were also mentioned in the HEALTH study, although its conclusion did not support THA for active older patients with femoral neck fractures [22]. Our study found better pain scores at the 6-week follow-up, as well as at discharge from the hospital.

The THA patients in our study had shorter hospital stays than the hemiarthroplasty patients. We encourage shorter stays for our patients to avoid potential in-hospital complications. Other studies also showed shorter stays for THA compared to hemiarthroplasty patients [9,10,16]. We as-

sumed that THA patients have a shorter postoperative hospitalization due to their better pain scores, which may result in improved ambulation and function during the first postoperative days. Shorter hospitalization has been recognized as a protective factor against perioperative complications [23].

Dislocation is a major concern after primary total hip arthroplasty for the treatment of intracapsular femoral neck fractures [18]. Tidermark et al. [19] reported a very low dislocation rate (2%) for total hip arthroplasty following intracapsular femoral neck fractures using the direct lateral approach. We used the same operative approach in our cohort and none of our patients experienced a dislocation. Our standard postoperative protocol for preventing dislocation included the use of an abduction pillow, patient education, and physiotherapy supervision in activities of daily living. It appears that the direct lateral approach is safe for treating femoral neck fractures.

Bleeding is a major concern, especially when treating older patients with co-morbidities. Several studies demonstrated higher bleeding rates among THA patients but no difference in transfusion rates [10,20,21]. Our data showed no difference in hemoglobin loss in either group, similar to other studies, with no difference in transfusion rates.

Many authors have suggested that the long-term functional results of THA for femoral neck fractures are superior to those of hemiarthroplasty [3,6,11,13,14]. Yet, short-term results have not been evaluated as often. We assessed short-term, postoperative functional results using the HHS. The HHS evaluates pain, walking abilities, function, and range of motion of the operated hip joint. Since pain scores and walking abilities were better for the THA group, the total HHS was significantly better within 6 weeks following the surgical repair. The two groups were similar in co-morbidities and age. Hence, the only difference between them was the surgical procedure. Our results suggest that THA results in better postoperative outcomes even in the short-term.

The study had several limitations. The patients were not randomized, and data were collected retrospectively. The sample size was small (n=40), although this could also be a strength of the study as we found significant results. In addition, THA were performed by the same two surgeons, but hemiarthroplasty by different senior surgeons.

## CONCLUSIONS

Active elderly patients who sustain a displaced femoral neck fracture should be treated with total hip arthroplasty to achieve shorter hospital stays and better clinical outcomes in the short-term as well as in the long-term.



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## Capsule

## Nudging thymic T cell fate

T helper cells develop in the thymus from double-positive (DP) precursors that express both CD4 and CD8 cell surface coreceptors. The transcription factors that control the induction of the CD4+ lineage gene expression program remain poorly defined. **Chopp** et al. demonstrated that the paralog transcription factors Zfp148 and Zfp281 promote CD4+ T cell differentiation in mice by inducing the expression of key CD4+ lineage genes, including *Thpok*. In addition to their effects in DP thymocytes, loss of Zfp148 and Zfp281

in postthymic T cells impaired T helper 2 (TH2) cell effector functions in response to airway allergens. Zfp281 interacted with the transcription factor Gata3 and was recruited to Gata3-binding sites within genes encoding *Thpok* and type 2 cytokines. These findings identify Zfp148 and Zfp281 as key factors that cooperate with Gata3 to promote CD4+ lineage commitment and support TH2 responses.

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