



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

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### Abstract

**Background:** Displaced femoral neck fractures were treated historically with Hemi-Arthroplasty (HA), but the use of Total Hip Arthroplasty (THA) is increasing, with superior long-term results.

**Objectives:** This study assessed whether THA has superior short-term results when compared to bipolar HA for displaced femoral neck fractures.

**Methods:** We assessed two groups of active older patients who underwent cementless bipolar HA or THA for displaced femoral neck fracture. All patients were operated 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:** Forty patients, ages 65 to 85 were included. Eighteen underwent bipolar HA and 22 THA. The number of women in each group was similar, as was mean age:  $73.1 \pm 4.2$  years in the HA group and  $71.0 \pm 3.7$  in THA. Harris Hip Score before 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 HA ( $p=0.021$ ).

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 HA;  $p<0.001$ ). Patients in the THA group walked longer distances, needed less support while walking, and reported less pain.

**Conclusion:** We found better short-term results at hospital discharge and at 6 weeks follow-up after THA, which contribute to earlier patient independence and shorter hospital stays. Therefore, we recommend treating active older patients who sustain a displaced femoral neck fracture with THA.

**Keywords:** Bipolar hemiarthroplasty; Femoral neck fracture; Hospital stay; Short-term clinical results; Total hip arthroplasty

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### Introduction

Hip fractures account for 350,000 hospitalizations annually in the United States, and this number is estimated to grow to 650,000 by 2050. About 50% are displaced intracapsular fractures [1]. Displaced femoral neck fractures have been treated historically with Hemi-Arthroplasty (HA), but recent data show increased use of Total Hip Arthroplasty (THA) for this injury [2-5].

The best choice for orthopedic management of patients who are 60 years of age or older and are otherwise healthy remains controversial [3]. Some evidence has suggested that THA leads to better functional outcomes than does HA [3].

The aim of this study was to assess whether THA leads to superior short-term functional results compared to bipolar HA for displaced femoral neck fractures.

### Patients and Methods

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

Data were obtained from the electronic medical records. We assessed two cohorts of active older who underwent either cementless bipolar HA (Pavi cementless stem and bipolar head, Groupe Lépine, Genay, France), or THA (Corail cementless stem and Pinnacle cementless cup,

Depuy Synthes, Warsaw, IN, USA) for a displaced femoral neck fracture. The two cohorts included active older patients ages 65 to 85, who suffered a displaced femoral neck fracture and were operated in our department. The THA cohort were operated on in 2016 and the bipolar HA in 2015.

The following measures 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 (SD) for continuous variables and as numbers and percentages for nominal variables. These were analyzed using Chi-Square or Fisher 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. The data were analyzed using SPSS-25 software package (IBM Corp., Armonk, NY, USA).

The name of institutional review board which approved the IRB statement of this study is the Helsinki Board, IRB Committee, Meir Medical Center. Number of approval is MMC-0339-20, approved on the 01/12/2020.

### Results

A total of 40 patients were included in the study, 18 underwent bipolar HA and 22 THA. The percentage of women in each group was 66.7% in the HA cohort and 72.7% in the THA cohort. The mean age was also similar in cohorts,  $73.2 \pm 4.3$  and  $70.6 \pm 4.4$  years in the HA cohort and THA groups, respectively. There were no differences in background comorbidities or BMI between the groups. The patients' demographic data are summarized in Table 1.

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

Variable	Hemi-arthroplasty (N=18)	Total hip arthroplasty (N=22)	P-value
Sex, women (n, %)	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	$24.5 \pm 4.0$	$25.4 \pm 3.8$	0.485
Comorbidities			
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
COPD	1 (5.6%)	2 (9.1%)	1
Malignancy	1 (5.6%)	2 (9.1%)	1

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

**Table 2:** Operative data.

Variable	Hemi-arthroplasty (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	$13.03 \pm 1.16$	$12.99 \pm 1.23$	0.923
Blood loss, ml	$2.17 \pm 0.76$	$2.28 \pm 1$	0.706
Length of hospital stay, days	$6.4 \pm 1.7$	$5.2 \pm 1.3$	0.021
Dislocation during the 6-week follow-up	0	0	1

All the THA patients were operated by two of the co-authors. Bipolar HA were performed by one of the senior surgeons in the orthopedic department. The data were abstracted retrospectively from patients' files from the hospital stay and ambulatory checkup.

All patients were operated within 48 h 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  $5.2 \pm 1.3$  days, as compared to  $6.4 \pm 1.7$  days for the HA group ( $p=0.021$ ). Operative data are summarized in Table 2.

At discharge, pain levels and Harris hip scores were similar in both groups. Patients who underwent THA walked better with less limp ( $6.9 \pm 1.5$  vs.  $5.7 \pm 2$ ;  $p=0.039$ ) and needed less support than those who had HA ( $1.2 \pm 1$  vs.  $1.7 \pm 0.7$ , respectively;  $p=0.069$ ) at discharge.

Clinical results at discharge and 6-week follow-up are summarized in Table 3. At 6 weeks follow-up, the mean total HSS was significantly higher in the THA group than in the HA group ( $81.2 \pm 7.9$  vs.  $69.5 \pm 10$ , respectively;  $p<0.0001$ ). According to the HSS, at 6 weeks, patients in the THA cohort had less pain ( $42.73 \pm 1.9$  vs.  $36.2 \pm 8.37$ ;  $p=0.001$ ). They needed less support to walk ( $5.41 \pm 2.5$  vs.  $3.22 \pm 2.1$ ;  $p=0.006$ ) and they could walk for longer distances ( $6.9 \pm 2.4$  vs.  $4.3 \pm 1.9$ ;  $p=0.001$ ).

### Discussion

The current study compared short-term outcomes among active older patients who were managed with either THA or HA for intracapsular fracture of the femur. Patients who received THA had better short-term outcomes as compared to HA. 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).

**Table 3:** Post-operative clinical results according to Harris Hip Score.

Interval	Variable	Hemi-arthroplasty (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

Total hip arthroplasty for femoral neck fracture was first reported in 1980 [7] and its use have been increasing since then [8]. THA is preferred over HA 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 as compared to patients treated with hemiarthroplasty, but is this true for short-term outcomes, as well?

Baker et al. reported a longer walking distance for THA patients at the 3-year follow-up [5]. Seo et al. showed better walking abilities for THA patients at the 1-year post-operative evaluation [9]. In a prospective randomized study, Macaulay et al. also found that THA patients walked better at 24-months follow-up [10,11].

Recent studies show that THA patients have less pain compared to HA patients, over the long-term. Avery et al. described that patients in the HA cohort had more pain compared to THA patients, mainly due to acetabular erosion [12]. Seo et al. [9] also reported higher pain levels among patients who underwent hemiarthroplasty compared to THA at the one-year post-operative evaluation. Macaulay et al. found less bodily pain at 12 months and 24 months after surgery in the THA group [10,11]. A meta-analysis conducted by Sheng et al. also revealed better short- and long-term pain rates in patients who underwent THA compared to HA [13]. 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 [14]. 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 HA patients did. We encourage shorter stays for our patients to avoid potential in-hospital complications. Other studies also showed shorter stays for THA, as compared to HA patients [8,9,15]. We assume that THA patients have a shorter post-operative hospitalization due to their better pain scores, which may result in improved ambulation and function during the first post-operative days. Shorter hospitalization has been recognized as a protective factor against perioperative complications [16].

Dislocation is a major concern after primary total hip arthroplasty for the treatment of intracapsular femoral neck fractures [17]. Tidermark et al. [18] 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 this study and none of our patients experienced a dislocation. Our

standard postoperative protocol for preventing dislocation includes 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 comorbidities. Several studies demonstrated higher bleeding rates among THA patients but no difference in transfusion rates [9,19,20]. Our data showed no difference in hemoglobin loss in either group or similar amounts as in other studies, with no difference in transfusion rates.

Finally, and most importantly the functional results. Many authors suggest that the long-term functional results of THA for femoral neck fractures are superior to those of HA [2,5,10,12,13]. Yet, short-term results have not been evaluated as often. We assessed short-term, post-operative 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 comorbidities and age. Hence, the only difference between them was the surgical procedure. Our results suggest that THA results in better post-operative 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 HA by different senior surgeons.

## Conclusion

Active older 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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