

# Similar Short Term Outcomes with Press-fit Bipolar Hemiarthroplasty and Cemented Total Hip Replacements in Femoral Neck Fractures

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*There is limited data of short-term outcomes comparing press-fit bipolar and cemented total hip replacements in patients with femoral neck fractures. We therefore aimed to compare the perioperative incidents and immediate outcomes between press-fit stem bipolar head hemiarthroplasty and cemented total hip replacement in elderly patients with displaced femoral neck fractures. We reviewed prospectively collected data from 115 consecutive patients over 12 months. There were 21 cemented total hip replacements and 33 bipolar head press-fit stem hemiarthroplasties, with a male to female ratio of 1:1.84 and an average follow-up of 9.9 months (range 3-15). There were no differences between the two groups with respect to age (mean 77.4 years old), cortical index (0.77/ 0.82,  $p=0.087$ ), hospitalization (17.7/ 16.7 days,  $p=0.59$ ), bleeding, blood transfusions (14.3/ 18.2%,  $p=1.00$ ) and Barthel index preoperatively, at discharge and 3 months (5.67/ 5.48,  $p=0.62$ ; 10.57/ 10.47,  $p=0.89$ ; 13.81/ 13.28,  $p=0.47$ ). For all 54 patients the hemoglobin dropped from 13 to 11.2 g/dL after surgery without difference between implants. The mean duration of surgery was 21minutes ( $p<0.01$ ) shorter for the press-fit hemiarthroplasty group compared to cemented total hip replacements. Our findings show comparable blood loss and functional outcomes with press-fit bipolar hemiarthroplasty and cemented total hip replacements for treating displaced femoral neck fractures in the elderly. Both were safe and allowed early recovery, with the only significant difference being the longer duration of surgery for the total arthroplasty.*

**Key words:** femoral neck; hip fracture; press-fit bipolar hemiarthroplasty; cemented total hip replacement; Barthel index

The impact of intracapsular hip fractures in the elderly population influences independence, morbidity, quality of life and increases mortality [1]. They have a high incidence in the aging population yet there is still debate regarding the best surgical therapy [2]. Treatment options are not standardized and may vary widely between osteosynthesis, hemiarthroplasty or total hip replacement. The most commonly used methods of treatment after an intracapsular hip fracture are hemiarthroplasty (HA) and total hip arthroplasty (THA). It has been shown that arthroplasty yields better results than internal fixation in the case of femoral neck fractures regarding limb function, revision rates and quality of life [3]. There are adepts for each type of arthroplasty that found both advantages as well as drawbacks. While HA allows for a quick recovery being a less invasive procedure, THA lowers the chance of revision caused by acetabular wear in active people that may develop hip arthritis.

There is limited data in the literature available for short-term outcomes comparing press-fit bipolar (HA) and cemented total hip replacements (THA) in patients with intracapsular hip fractures. We therefore aimed to compare the perioperative incidents and immediate postoperative outcomes between press-fit stem bipolar head hemiarthroplasty and cemented total hip replacement in elderly patients with displaced femoral neck fractures.

## Experimental part

We reviewed prospectively collected data from 115 consecutive patients admitted to our Orthopedics and Trauma Center for a displaced intracapsular hip fracture over a 12 month period. Patients who underwent

conservative treatment, osteosynthesis (cannulated screws), uncemented THA, Austin Moore type implants and preoperative deaths were excluded.

All surgeries were performed under combined spinal epidural anesthesia. Prophylactic antibiotherapy was administered for 48 h. The lateral transgluteal approach (modified Hardinge) was done with the patients in dorsal decubitus. A passive subcutaneous drain was kept for in place 24-48 h. Patients received prophylactic a single subcutaneous daily dose of low molecular weight heparin from hospital admission until a minimum of 12 h prior and after surgery. The drop in hemoglobin from the last preoperative to the first postoperative value was used to determine total bleeding [4]. Both implants were manufactured by Biomet (Warsaw, Indiana, USA) (fig.1). Physical therapy was started on the second postoperative day with full weightbearing for the cemented implants and partial for the press-fit respectively.

We recorded: age and gender; transfusion requirements, neurological status of the patient including dementia, stroke sequelae and Parkinson's disease, life-threatening comorbidities (malignancy, hemodialysis, heart failure defined by ASA grade higher than IV), length of hospitalization, duration of surgery, surgical approach. The Dorr type and cortical thickness index of the proximal femur was determined as the ratio of outer cortical width minus medullary canal (inner) width divided to the cortical width at a level of 10cm below the tip of the lesser trochanter on anteroposterior radiographs [5].

We evaluated the outcome through adverse events: intraoperative fractures, dislocations, periprosthetic joint infection and death. We used the Barthel Index to document and evaluate patient's function with activities

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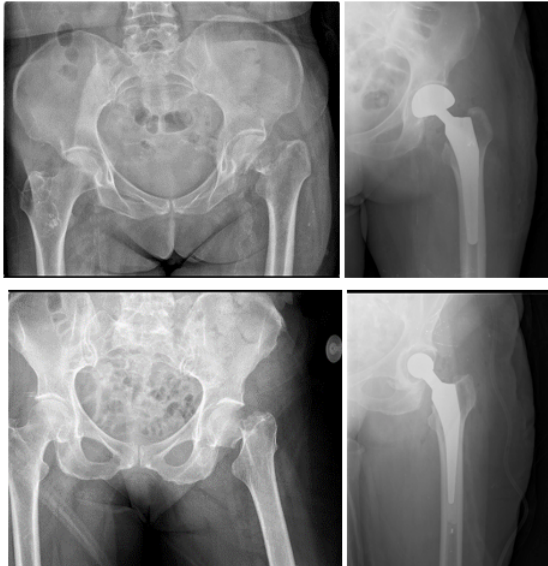


Fig.1 Pre and postoperative AP X-rays of relevant examples from the two groups; press-fit stem with bipolar head hemiarthroplasty and cemented total hip replacement respectively.

of daily living (ADL) preoperatively, at discharge and at 3 months after surgery quantified for a minimum of 0 and maximum of 20 points [6]. The unpaired t test was used to compare means and the Fisher's test for categorical data. Clinical significance was determined by a two - tailed p value of less than 0.05.

### Results and discussions

The inclusion criteria have been met for a total of 54 patients with femoral neck fractures. There were 21 cemented THA and 33 bipolar press-fit HA. The male to female ratio was 1.84:1, while the mean age of our patients was 77.4 years old (range 54-91) with no difference between groups (table 1). The average follow-up was 9.9 months (range 3-15). Sixteen patients had documented osteoporosis, 10 cases had neurologic pathology (Alzheimer dementia, Parkinson's disease and stroke sequelae) and 6 cases had malignancies (either newly discovered or previously known). Based on the Dorr classification of the proximal femur shape we had a total of 8 type A, 24 type B and 22 type C patients with similar distribution between the two groups (table 1).

The mean duration of surgery was significantly shorter for the HA compared to THA. The posterior hip approach was used in 8 patients and one THA dislocation was recorded in that group, 8 weeks after index surgery. We had one preoperative death (patient not included) and one postoperative death (after 2 weeks) in the THA group, both cases being over 80 years old and with severe comorbidities. For all 54 patients the hemoglobin dropped

from 13g/dL preoperatively to 11.2 after the surgery without a significant difference between HA and THA ( $p < 0.001$ ). Three patients in the HA group and 6 in the THA received blood transfusions without significant difference (table 1). Preoperatively there was no difference in the Barthel index between THA and HA and the values revealed severe impairment. The same was found at discharge and 3 months follow-up when function associated with ADL improved remarkably (table 1).

Fragility hip fractures pose a great social and economic burden. Recent studies from our region showed an ascending trend for such incidents caused mainly by a rise of fractures in males. The mean age as well as the age adjusted incidence in the target population increases which exposes more frail patients to traumatic events. Most patients recover and have a favorable outcome but there is a high mortality of over 20% in the first year, aggravated if the index surgery is delayed [1]. It is therefore highly relevant to identify the best form of treatment. This should be easily performed by low volume surgeons, inexpensive, with reduced operative stress and produce favorable short and midterm outcomes that will allow early mobilization with a low reoperation rate [7, 8]. Post-operative mortality in the first day was found to be closely related to the comorbidities of the patients and was increased for cemented hemiprosthesis [9].

The general assumption is to perform arthroplasty as opposed to osteosynthesis if the fracture is intracapsular, as this will produce a quicker recovery and decrease the need for reintervention. Osteosynthesis also produces unpredictable results and failures can lead to more technically difficult joint replacements and increased risk of infection [2, 3, 10]. Biomaterials have not proven utility in hip fractures, as they have in other fields such as sports medicine and cartilage surgery [11-14].

The current trends have abandoned old, monoblock designs such as the Austin-Moore in favor of newer, modular implants. Hemiarthroplasties are regarded as being less stressful for the patients, less expensive but with inferior outcomes compared to total hip replacements [15,16]. They are easier to insert, are closer shaped to the local anatomy and offer better restoration of biomechanically relevant parameters such as off-set and leg length. Personalized implants are not used routinely in femoral neck patients [17]. In the case of hemiarthroplasties, modular implants can also be converted to total replacements without necessarily removing the stem. The bipolar head has not proved superior compared to the unipolar constructs and this might lead to a paradigm shift that can already be seen in clinical practice. If the structure of the proximal femur is weakened by osteoporosis the tendency is to favor cemented stem fixation.

**Table 1**  
COMPARATIVE PARAMETERS BETWEEN THE THA AND HA GROUPS; (SD = STANDARD DEVIATION)

Group	N	Age	Cortical Index	Hospital ization (days)	Surgey (minute s)	Transfu sions %	Barthel index		
							Preoper atively	Dischar ge	3 months
THA	21	78.7 (7.51)	0.77 (0.09)	17.7	88.9 (19.7)	14.3	5.67 (1.32)	10.57 (2.71)	13.81 (2.44)
HA	33	76.1 (8.85)	0.82 (0.11)	16.76	67.5 (12.3)	18.2	5.48 (1.3)	10.47 (2.63)	13.28 (2.76)
p		0.28	0.087	0.59	<0.01	1.00	0.62	0.89	0.47

The THA led to similar blood loss and mobility at discharge compared to HA; at the same time we did not have any intra or immediately postoperative fracture in all 33 press-fit stems. This differs slightly from data reported in the literature, which shows somewhat better functional outcomes with total hip replacements and increased risk for periprosthetic fracture with the press-fit stems. The increased risk for fracture is maintained long term due to the presence of stress risers at the contact points between the metallic stem and the frail, osteoporotic cortical bone [16]. Other than the small sample (33) and short follow-up period, we cannot identify reasons for not having any periprosthetic fractures in our study population. The strong point of our comparison was that both groups had comparable proximal femur thickness, which is inversely linked to the risk of periprosthetic fracture in uncemented arthroplasty. However, the cortical index was measured on preoperative AP radiographs which showed an externally rotated femur due to the fracture, which may have given falsely decreased values of bone thickness.

Out of all 54 cases, one from the HA group had a contralateral trochanteric fracture. No patient developed a periprosthetic joint infection. The dislocation was in the THA group and had surgery through a posterior approach. This is similar to data gathered from large samples which found that the direct lateral approach reduces the need for secondary surgery compared to posterior approach in patients over 75 years old [17].

Ultimately, this component may be more important that restoration of hip architecture in determining outcomes of elderly cohorts treated for femoral neck fractures. By using the Barthel index we obtained a combined estimate of reintegration. This should have been associated more with the hip fracture component due to the short follow-up and traumatic event. We used a variant of the form with a floor of 0 and ceiling of 20. Such a narrow interval may have affected the sensibility of the instrument which in turn attenuated the difference between HA and THA outcomes.

## Conclusions

Our findings show comparable blood loss and functional outcomes with press-fit bipolar hemiarthroplasty and cemented total hip replacements for treating displaced femoral neck fractures in the elderly. Both were safe and allowed early recovery, with the only significant difference being the longer duration of surgery for the total arthroplasty.

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