What Predicts Health-Related Quality of Life for Patients With Displaced Femoral Neck Fractures Managed With Arthroplasty? A Secondary Analysis of the HEALTH Trial

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Background: Total hip arthroplasty (THA) has been argued to improve health-related quality of life (HRQoL) and function in femoral neck fracture patients compared with hemiarthroplasty (HA). The HEALTH trial showed no clinically important functional advantages of THA over HA. The current analysis explores factors associated with HRQoL and function in this population.

Methods: Using repeated measures regression, we estimated the association between HRQoL and function [Short Form-12 (SF-12) physical component score (PCS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) function score] and 23 variables.

Results: THA as compared to monopolar HA, but not bipolar HA, was more likely to improve PCS scores (adjusted mean difference [AMD] 1.88 points, $P = 0.02$), whereas higher American Society of Anesthesiologists score (AMD −2.64, $P < 0.01$), preoperative use of an aid (AMD −2.66, $P < 0.01$), and partial weight-bearing status postoperatively (AMD −1.38, $P = 0.04$) demonstrated less improvement of PCS scores over time. THA improved WOMAC function scores over time compared with monopolar HA (but not bipolar HA) (AMD −2.40, $P < 0.01$), whereas higher American Society of Anesthesiologists classification (AMD 1.99, $P = 0.01$) and preoperative use of an aid (AMD 5.39, $P < 0.01$) were associated with lower WOMAC function scores. Preoperative treatment for depression was associated with lower functional scores (AMD 7.73, $P < 0.01$).

Conclusion: Patients receiving THA are likely to receive small and clinically unimportant improvements in health utility and function compared with those receiving monopolar HA and little improvement compared with those receiving bipolar HA. Patient-specific characteristics seem to play a larger role in predicting functional improvement among femoral neck fracture patients.

Key Words: health-related quality of life, function, femoral neck fractures

Level of Evidence: Prognostic Level II.

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INTRODUCTION

Arthroplasty is the gold standard for displaced femoral neck fractures in the elderly.[1–4] It is justified by predictable good outcomes, satisfactory joint function, early full weight-bearing, and rapid recovery,[5,6] which are believed to be the foundations for successful rehabilitation in the elderly. Although a partial joint replacement [hemiarthroplasty (HA)] has historically been the treatment of choice, there has been an increase in use of total joint replacements [total hip arthroplasty (THA)] for treatment of femoral neck fractures.[7] Nevertheless, there is a lack of consensus among orthopaedic surgeons in regards to technical considerations and whether a partial joint replacement or a total joint replacement is the most appropriate treatment for patients with displaced femoral neck fractures.[8–13]

The most recent evidence suggests shorter operation time[10–12] and lower dislocation rate in favor of HA for the first 4 postoperative years,[8,10–13] at the expense of late acetabular erosion.[10,12] Both implants demonstrate similar length of hospitalization,[9,10,12] infection rate,[8,10,11] patient survivorship,[8,10–12] and overall complication rate.[8–11] HA is associated with a lower revision rate in the 5 years after surgery,[12] but is expected to surpass the revision rate of THA beyond 5 years.[10,12] Although it is unclear whether THA brings any additional functional benefits,[8–13] some argue that the lower reoperation rates with THA in patients expected to live more than 5 years will lead to meaningful improvements in the patient's health-related quality of life (HRQoL) and function.

Using data prospectively collected as part of the Hip Fracture Evaluation with Alternatives of Total Hip Arthroplasty versus Hemiarthroplasty (HEALTH) trial data (ClinicalTrials.gov NCT00556842),[14,15] we aimed to investigate the effect of THA, monopolar HA, and bipolar HA, along with other demographic and perioperative factors, on the patients' HRQoL and functional outcomes. Although significant research has been performed to investigate the difference between HA and THA, we believe that factors other than implant choice play a larger role in predicting HRQoL and physical function in patients aged 50 years and older presenting with a low-energy, isolated, displaced, femoral neck fracture.

METHODS

Health-Related Quality of Life

The HEALTH trial prospectively collected HRQoL and hip function assessment as secondary outcomes for participants. HRQoL was measured using the Short Form-12 Health Survey, from which the physical component summary scores (SF-12 PCS) were obtained. The SF-12 measures self-reported HRQoL through an eight-domain profile of functional health and well-being and physical and mental health summary measures.[16] Each domain was scored separately from 0 (lowest level of health) to 100 (highest level of health) using standardized scoring methods to calculate a norm-based physical component score (PCS). The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) questionnaire is a 24-item instrument used to assess pain, stiffness, and physical function in patients with hip or knee osteoarthritis and has been validated in patients who sustained a femoral neck fracture.[17] Hip function was assessed using the physical function subcomponent score from the WOMAC questionnaire, which ranges from 0 to 68 with higher scores indicating more functional limitations. The minimally important difference (MID) of 4 for the SF-12 and 7 for the WOMAC was determined a priori in the HEALTH trial.[14,15] All questionnaires were administered by research personnel at baseline (recollection of prefracture status), 1 week, 10 weeks, and 6, 9, 12, 18, and 24 months after surgery.

Selection of Baseline Factors

We selected baseline factors a priori based on biologic rationale and previous reports in the literature. For each potential factor, we proposed a priori a hypothesized effect for each dependent variable (ie, SF-12 PCS and WOMAC function score). To avoid an overfitted or unstable model, we used a rule of thumb that there should be at least 10 times the number of observations as there are factors in a regression model. Given that there were more than 900 participants with multiple observations included in each model, we were not at high risk of overfitting. We classified all baseline factors into 1 of 3 groups (participant characteristics, perioperative characteristics, and postoperative characteristics). Participant characteristics included age, sex, body mass index (BMI), American Society of Anesthesiologists (ASA) classification, prefracture living setting, prefracture functional status, and the following comorbidities requiring treatment: diabetes, respiratory disease, rheumatoid arthritis, cardiac disease, depression, renal disease, hematologic disease (incl. anemia), and cancer. Perioperative characteristics included type of anesthetic, surgical approach, implant type, time from injury to surgery, and use of cement in either acetabulum or femur. Postoperative characteristics initially included postoperative weight-bearing status, postoperative living status, and postoperative ambulatory status.

Definition of Baseline Factors

Participant Characteristics

We analyzed age and BMI as continuous variables. We analyzed all other baseline participant characteristic variables categorically, ie, sex (male vs. female), ASA classification (ie, class I/II vs. class III/IV/V), prefracture living setting (ie, institutionalized vs. not institutionalized), prefracture functional status (using ambulatory aid vs. independent ambulator), and all medical comorbidities as either requiring treatment or not (those without disease also were counted as not requiring treatment).

Perioperative Characteristics

We analyzed most perioperative characteristic variables categorically [eg, type of anesthetic (ie, general anesthetic vs. spinal/other), surgical approach, treatment group, and use of cement]. Surgical approach was analyzed as direct anterior approach (DAA), anterolateral/lateral, or posterolateral/posterior. Treatment group was monopolar HA, bipolar HA, or THA. Time from injury to surgery was analyzed as a continuous variable.

Postoperative Characteristics

We analyzed all postoperative characteristics as categorical variables (eg, postoperative weight-bearing status). Postoperative weight-bearing status was analyzed as full weight-bearing, partial weight-bearing, or non weight-bearing.

Statistical Analysis

Our statistical analysis plan was determined a priori. We included HEALTH trial participants with complete data for all factors and respective baseline HRQoL and hip function measures in each model. We used descriptive statistics to summarize all factors (frequencies and percentages for categorical variables and mean values, medians, and ranges for continuous variables). Before performing the multivariable analysis, we evaluated each pairwise association or correlation between the independent variables. We decided a priori that if any variables were highly correlated (ie, 0.7 or higher), only 1 variable would be included in the model.

We conducted 2 repeated measures models with participant variable as the random effect. Analyses were conducted to account for clustering within participants across multiple time points. We used SF-12 PCS and WOMAC function scores as the dependent variables (1 for each model). We included all factors specified above as independent variables in fixed effects, as well as time of HRQoL or function assessment (6, 12, and 24 months after surgery). Moreover, we used an autoregressive correlation structure to inform the model that each patient observation was expected to be correlated with their previous observation.

We decided a priori that the SF-12 PCS and WOMAC function would be parallel primary outcomes. We anticipated that the results would be similar across the SF-12 PCS and WOMAC analyses as they measure similar attributes. Overall, we considered factors that were associated with outcome in both models as being more plausible (and those which were inconsistently associated to be less plausible). Results were presented as adjusted mean differences (AMDs), 95% confidence intervals (CIs), and *P* values. All tests were 2-tailed with alpha = 0.05. A *P* value less than 0.05 was considered statistically significant. Generalized linear models were created with Gaussian distributions. In addition, a generalized estimated equation model was undertaken as a sensitivity analysis. Goodness of fit of the model was evaluated through assessment of deviance. We used R (v3.6.1 open access online) for statistical analyses.

RESULTS

Baseline Characteristics

From the 1441 patients randomized to THA (n = 718) or HA (n = 723) included in the final analysis as part of the HEALTH trial, 927 patients met the inclusion criteria for at least 1 model in the current analysis from which 471 were treated with an HA and 453 with a THA. As shown in Table 1, the mean age of included participants was 78.2 years (SD = 10.14) with the majority being women (73.5%, n = 681). Most patients were independently mobile (78.5%, n = 727) and living independently (97.4%, n = 903/927). An approximately equivalent number of relatively healthy patients (ASA classes I and II) and patients with 1 or more moderate to severe diseases (ASA classes III, IV, and V) were included in the analysis. Instructions of partial weight-bearing or non–weight-bearing were given to 43.5% of the participants (n = 403). The median time from injury to surgery was 32.2 hours (range: 4.4–1268 hours). The incidence of depression before injury in this population was 9.9% (n = 89). The majority of orthopaedic surgeons used the anterolateral/lateral approach (60%, n = 555), followed by posterior/posterolateral approach (37.5%, n = 347) and finally the DAA (2.5%, n = 23). In this secondary analysis, 73 patients (8%) underwent a second operation and 281 (30.4%) suffered serious adverse events.

Factors Associated with Postfracture SF-12 PCS

A total of 756 participants met the inclusion criteria for the SF-12 PCS model. After adjusting for baseline SF-12 PCS scores, the use of THA was associated with increased self-perceived global physical health as measured by the SF-12 PCS (AMD 1.88 compared with those who received monopolar HA, 95% CI: 0.25–3.51, *P* = 0.024) (Table 2). There was no measured difference in SF-12 PCS scores between those who received THA or bipolar HA (*P* = 0.07). The following factors were associated with significantly lower mean postfracture SF-12 PCS (indicating worse HRQoL): ASA class III/IV/V (AMD −2.64 compared with class I/II, 95% CI: −3.89 to −1.38, $P < 0.001$), preoperative use of an aid (AMD −2.66 compared with those who did not use an aid, 95% CI: −4.26 to −1.06, $P < 0.001$), and restricted weight-bearing status postoperatively (AMD −1.38 compared with those who were fully weight-bearing, 95% CI: −2.71 to −0.04, *P* = 0.04). None of the statistically significant AMDs reached the MID for the SF-12 PCS, and no other factors were found to be significantly associated with postfracture SF-12 PCS (age, sex, BMI, living status preoperatively, diabetic disease, respiratory disease, rheumatoid disease, cardiac disease, renal disease, hematologic disease, depression, and cancer). Consequently, although a statistically significant difference was observed among some of the hypothesized predictors of HRQoL, none could be considered to produce clinically important differences to patient care.

Factors Associated With Postfracture WOMAC Functional Scores

A total of 707 participants met the inclusion criteria for the WOMAC function model. After adjusting for baseline WOMAC physical function scores, the use of THA reduced postoperative WOMAC function scores (representing better function), but not to a clinically important difference (AMD −2.40 compared with those who received monopolar HA,

TABLE 1. Characteristics of all Patients Included in the HRQoL Analysis (n = 927)

	Incidence of Factors
Participant Baseline Characteristics	
Mean age, yrs (SD)	78.25 (0.14)
Sex, n (%)	
Male	246 (26.5)
Female	681 (73.5)
Mean BMI, kg/m^2 (SD)	25.31 (4.7)
ASA classification, n (%)	
Class I/II	461 (49.8)
Class III/IV/V	466 (50.2)
Prefracture functional status, n (%)	
Any ambulatory aid	200 (21.5)
Independent ambulation	727 (78.5)
Prefracture living, n (%)	
Not institutionalized	903 (97.4)
Institutionalized	24 (2.6)
Comorbidities, diabetes, n (%)	
Yes	129 (14.8)
No	740 (85.2)
Respiratory disease	
Yes	94 (10.7)
No	778 (89.3)
Rheumatoid arthritis	
Yes	20 (2.1)
No	902 (97.9)
Cardiac disease	
Yes	207 (25.0)
No	621 (75.0)
Kidney disease	
Yes	33 (3.8)
No	845 (96.2)
Hematologic disease	
Yes	33 (3.7)
No	861 (96.3)
Depression	
Yes	89 (9.9)
No	815 (90.1)
Perioperative characteristics	
Type of anesthetic, n (%)	
GA	367 (40.0)
Spinal/other	555 (60.0)
Surgical approach, n (%)	
DAA	23 (2.5)
Anterolateral/lateral	555 (60.0)
Posterior/posterolateral	347 (37.5)
Treatment group, n (%)	
Monopolar HA	211 (22.8)
Bipolar HA	260 (28.1)
THA	453 (49.1)
Time from injury to surgery, hours (range)	57.4 (4.35 to 1268)
Cement for the acetabulum, n (%)	
Yes	120 (26.5)
No	333 (73.5)
Cement for the femur, n (%)	
Yes	576 (62.2)
No	350 (37.8)
Postop weight-bearing status, n (%)	
Full weight-bearing	524 (56.5)
Partial weight-bearing/non–weight-bearing	403 (43.5)
Postoperative characteristics	
Reoperation, n (%)	
No	854 (92.0)
Yes	73 (8.0)
Serious adverse events, n (%)	
No	646 (69.6)
Yes	281 (30.4)
Readmission (any cause), n (%)	
No	240 (88.6)
Yes	31 (11.4)

Missing data were found in all categories except sex, ASA classification, prefracture functional status, prefracture living situation, postop weight-bearing status, reoperation, serious adverse event, and readmission (any cause).

ASA, American Society of Anesthesiologists; BMI, body mass index; DAA, direct anterior approach; GA, general anesthesia; HA, hemiarthroplasty; SD, standard deviation; THA, total hip arthroplasty.

95% CI: −4.49 to −0.31, $P = 0.024$) (Table 3). By contrast, use of THA did not improve WOMAC functional scores over bipolar HA ($P = 0.273$). The following factors were associated with significantly higher mean postfracture WOMAC functional scores (indicating worse function): ASA class III/IV/V (AMD 1.99 compared with class I/II, 95% CI: 0.41–3.58, $P = 0.014$), preoperative use of an aid (AMD 5.39 compared with those who did not use an aid, 95% CI: 3.29–7.49, $P < 0.001$), and receiving treatment for depression (AMD 7.73 compared with those not diagnosed or not receiving treatment, 95% CI: 2.12–13.34, $P = 0.007$). No other factors were found to be significantly associated with postfracture WOMAC function scores (age, sex, BMI, living status preoperatively, diabetic disease, respiratory disease, rheumatoid disease, cardiac disease, renal disease, hematologic disease, and cancer). Of the statistically significant AMDs, only patients receiving treatment for depression reached the MID for the WOMAC function scores.

DISCUSSION

The HEALTH trial is one of the largest multicenter randomized controlled trials comparing the use of THA versus HA in the treatment of isolated, displaced femoral neck fractures in patients aged 50 years and older.[14,15] This secondary analysis reports prospectively collected data investigating predictors of HRQoL and functional outcomes in this population when treated with arthroplasty. Prognostic factors of functional independence have been only scarcely determined after arthroplasty treatment of femoral neck fractures. The use of THA compared with monopolar HA, but not bipolar HA, was associated with a statistically significant improvement over time in SF-12 PCS and WOMAC physical function component scores. Functional outcomes were negatively influenced by severe systemic disease (ASA classification III, IV, and V), preoperative use of walking aids, depression, and the surgeons' postoperative partial weight-bearing orders. Importantly, none of these associations exceeded the MID, except for presence of depression preoperatively. In other words, only the presence of depression had enough influence to lead to an observable and important deterioration in function that would be considered clinically meaningful from the patient's perspective.

Presence of depressive symptoms preoperatively had a strong influence on the WOMAC physical function outcome score, although it did not influence the SF-12 PCS. The WOMAC physical function score does not specifically assess mental health; yet, it is inherently influenced by the patient's psychological status,[16–18] whereas the SF-12 PCS correlates poorly with mental health status.[16,19] The WOMAC also has greater power than the short-form questionnaire to detect minimal changes in the context of hip or knee joint pathologies.[20] Depression strongly affects one's perception of functional status,[21] and patients with depressive symptoms often describe themselves as more impaired than what is reflected from objective performance measures.[22] However, objectively, they are less likely to engage in rehabilitation,[23,24] have poorer functional independence, and demonstrate slower recovery.[25–28] Furthermore, the incidence of depression in this study was found to be twice the prevalence found in the general population.[29] These patients may benefit from early psychological intervention to achieve potential functional gains. Some interventions have been proven to be effective such as comprehensive and interdisciplinary care efforts for hip fracture patients which have been associated with a lesser risk of depression,[30–33] while 2 randomized controlled trials have shown that simple psychological counseling significantly improved recovery and physical function at the 1-month and 6-month follow-ups.[34,35]

The presence of each individually considered comorbidity did not influence functional outcomes. However, patients with ASA classification III to V, which refers to severity rather than presence or absence of comorbidities, were more likely to report worsening physical function and global physical health over time after a hip fracture. Reuling et al[36] found that the presence of comorbidities negatively affected functional outcomes, but their results did not show an association with ASA classification. Previous reports have identified high severity ASA to be an independent risk of mortality,[37,38] although its effect on HRQoL and function after arthroplasty has not been consistent.[36,39–41] It is likely a complex interplay between disease severity and the additive effect of multimorbidity that adversely influences functional outcomes.

Preinjury functional level,[41] cognitive function,[40–42] and preinjury ambulatory status[43,44] are the most established predictors of functional recovery. In this study, participants with prefracture mobility impairment were more likely to report a decline in function and global physical health compared with preinjury independent ambulators. As defined by the MID, the deterioration in function over the postoperative period of 24 months was not sufficient to affect patients in a clinically meaningful way. Undeniably, patients with limited mobility before injury are likely to experience less functional improvement from their baseline limitation over the course of rehabilitation as compared to fully ambulatory patients.

Age may give a general indication of expected recovery after a hip fracture,[36,41,43,45] but only to a certain extent.[39,40] Similarly, BMI,[43,46] sex,[39,40,45] and time from injury to surgery[36,43] have limited predictive value in regard to medium- and long-term functional outcomes. Our study did not reveal an association with functional outcomes and any of these characteristics after treatment with arthroplasty. We believe this population of older patients with hip fractures to be highly complex. Functional outcomes are most likely the results of a combination of the individual's characteristics, but also of other social health determinants, such as environment, education, community and more, which are not considered here.

Here, we report a statistically significant, but clinically nonmeaningful, increase in global physical health and physical function after THA for a displaced femoral neck fracture, as compared to monopolar HA, but not bipolar HA, at least for the first 2 years postoperatively. In general, THA may be considered to be equivalent to HA from the patient's perspective in this patient population, but this is a highly controversial topic, and several RCTs in the past 20 years have been conducted to determine the influence of implant choice on functional outcomes.[15,37,38,47–60] The functional improvement seen with THA in these studies is debatable, and careful examination reveals a difference in mean function of less than 5 points between HA and THA at 2–3 years postoperatively. Ultimately, our results align with previous research and suggest that THA will offer a small yet unimportant benefit to patients receiving treatment for displaced femoral neck fractures, when compared with either bipolar or monopolar HA.

Other surgical parameters included the surgical approach and the use of cement. Both factors were not associated with any effect on functional outcomes in our study. Similar to the literature for primary THA, benefits observed with some surgical approaches, if any, disappear by 6 months postoperatively.[61] Barenius et al[57] reported improved functional outcomes with cemented femoral components, regardless of the type of arthroplasty. This study randomized THA and HA as the surgical treatment for femoral neck fracture, regardless of use of cement, which may explain the absence of any observed effect on HRQoL measurements. Surgeons were free to decide which patients would require additional fixation with cement, and they likely chose whom would benefit most from it.

Early, unrestricted weight-bearing is the gold standard after joint replacement for a hip fracture.[62] It is simple and safe,[63] promotes better and earlier recovery,[42,43,64] and seems to be one of the only factors under the control of the orthopaedic surgeon. Delayed weight-bearing leads to a higher incidence of any complications,[65] is associated with poor

TABLE 2. Determinants of Global Physical Health Using Repeated Measures Multilevel Model Regression With the SF-12 PCS as the Dependent Variable for 756 Patients, Adjusted for Baseline SF-12 PCS

Independent Variable	AMD (99% CI)*	P
Baseline characteristics		
Age (10-y increments)	−0.62 (−1.43 to 0.18)	0.128
Female	−1.33 (−2.70 to 0.03)	0.56
BMI (5-point increments)	−0.14 (−0.76 to 0.47)	0.643
ASA classification III–V (ref. class I and II)	−2.64 (−3.89 to −1.38)	**<0.001**
Dependent ambulator	−2.66 (−4.26 to −1.06)	**<0.001**
Institutionalized	−2.16 (−6.22 to 1.91)	0.299
Comorbidities		
Diabetic	1.98 (−2.14 to 6.10)	0.346
Respiratory disease	0.52 (−3.48 to 4.53)	0.797
Rheumatoid disease	−2.37 (−13.90 to 9.07)	0.685
Cardiac disease	−3.49 (−8.19 to 1.20)	0.144
Renal disease	−2.22 (−5.18 to 0.73)	0.140
Hematologic disease	−0.59 (−4.30 to 3.12)	0.755
Depression	−2.38 (−6.56 to 1.79)	0.262
Cancer	0.97 (−1.56 to 3.50)	0.452
Perioperative characteristics		
Surgical approach (reference: DAA)		
Anterolateral/lateral	−3.17 (−7.37 to 1.02)	0.138
Posterior	−2.17 (−6.38 to 2.03)	0.311
Implant (reference: THA)		
Bipolar HA	−1.25 (−2.6 to 0.11)	0.07
Monopolar HA	−1.88 (0.25 to 3.51)	**0.024**
Time from injury to surgery (hours)	−0.00 (−0.01 to 0.00)	0.204
Cemented femoral component	−0.43 (−1.74 to 0.87)	0.518
Postoperative characteristics		
Partial weight-bearing (ref. weight-bearing as tolerated)	−1.38 (−2.71 to −0.04)	**0.043**

*MID was set at 4 points for the 12-item Short-Form Health Survey PCS (SF-12 PCS).
Significance = p values < 0.05.
AMD, adjusted mean difference; ASA, American Society of Anesthesiologists; BMI, body mass index; CI, confidence interval; DAA, direct anterior approach; HA, hemiarthroplasty; SD, standard deviation; THA, total hip arthroplasty.

TABLE 3. Determinants of Physical Function Using Repeated Measures Multilevel Model Regression With the WOMAC Physical Function as the Dependent Variable for 707 Patients, Adjusted for Baseline WOMAC Physical Function Score

Independent Variable	AMD (99% CI)*	P
Baseline characteristics		
Age (10-y increments)	−0.41 (−1.44 to 0.62)	0.432
Female	0.65 (−1.11 to 2.42)	0.467
BMI (5-point increments)	0.19 (−0.60 to 0.98)	0.644
ASA class III–V (ref. class I and II)	1.99 (0.41 to 3.58)	**0.014**
Dependent ambulator	5.39 (3.29 to 7.49)	**<0.001**
Institutionalized	0.54 (−6.05 to 4.97)	0.848
Comorbidities		
Diabetic	1.02 (−4.19 to 6.23)	0.701
Respiratory disease	−0.25 (−5.48 to 4.98)	0.924
Rheumatoid disease	5.63 (−8.56 to 19.81)	0.436
Cardiac disease	4.74 (−1.38 to 10.87)	0.129
Renal disease	3.39 (−0.41 to 7.19)	0.08
Hematologic disease	3.88 (−1.06 to 8.81)	0.123
Depression	7.73 (2.12 to 13.34)	**0.007**
Cancer	−2.01 (−5.32 to 1.29)	0.232
Perioperative characteristics		
Surgical approach (reference: DAA)		
Anterolateral/lateral	3.26 (1.82 to 8.34)	0.208
Posterior	4.16 (−0.93 to 9.26)	0.109
Implant (reference: THA)		
Bipolar HA	1.12 (−0.63 to 2.87)	0.209
Monopolar HA	2.40 (−4.49 to −0.31)	**0.024**
Time from injury to surgery (hours)	0.00 (−0.01 to 0.01)	0.673
Cemented femoral component	−0.04 (−1.71 to 1.64)	0.966
Postoperative characteristics		
Full weight-bearing post-operatively	−0.37 (−2.08 to 1.34)	0.672

*MID was set at 7 points for the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC).
Significance = p values < 0.05.
AMD, adjusted mean difference; ASA, American Society of Anesthesiologists; BMI, body mass index; CI, confidence interval; DAA, direct anterior approach; HA, hemiarthroplasty; SD, standard deviation; THA, total hip arthroplasty.

compliance,[66,67] and was associated with statistically significant worse global physical health in our study, although it did not reach the MID. Although it is unknown why close to 45% of participants in this study were given instructions for partial weight-bearing or non–weight-bearing, we recommend reconsideration of any instructions around restricted weight-bearing in this patient population.

The influence of complications, readmissions, reoperations, or dislocations on functional outcomes could not be assessed. It is likely that any reoperation or complication will have an impact on functional outcomes. In the HEALTH trial, the rate of overall reoperations was 7.9% in 718 THA patients and 8.3% in 723 HA patients and was not significantly different. Consequently, although the rate of reoperation may negatively influence functional outcomes, the effect on each group may be similar. From the results of this study, we are unable to predict outcomes beyond 2 years and are, therefore, unable to determine whether the rate of acetabular erosion or conversion of HA into THA is significant. Six RCTs reported long-term follow-up and found no difference in functional outcomes between HA and THA at 3 years,[53,55] 4 years,[50] 5 years,[49] 8 years,[68] and 12 years.[59] Two reported worse functional outcomes with HA at 3 years[69] or 5 years,[58] but again, they reported a difference in mean score of less than 5 points between the 2 groups. Furthermore, despite best possible practices, missed follow-ups may have weakened the strength of correlation between time points and may explain some of the nonstatistically significant findings.

Elderly patients who suffer a displaced femoral neck fracture can be successfully treated with either HA or THA. Although we agree that the surgeon may use his clinical judgment in the choice of implant, patients can expect similar functional outcomes at 2 years with either treatment strategy. A hip fracture is a life-changing event, and the absence of definitive and strong predictors affecting functional outcomes in this study indicates that health determinants other than surgical parameters are of greater consequence. The critical event here is the hip fracture itself and all the circumstances leading to the injury, not the surgery. Further refinement of surgical techniques may not lead to improvement in patients' outcomes without addressing the highly complex issue of hip fractures with interdisciplinary and comprehensive care teams focusing on recovery and global care.

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