



Received: 2025.12.26

Accepted: 2026.02.13

Available online: 2026.04.23

Published: 2026.XX.XX

# Comparison of Outcomes Between Total Hip Arthroplasty and Hemiarthroplasty for Osteoporotic Femoral Neck Fractures, Along With Factors Affecting Postoperative Hip Joint Functional Recovery

Authors' Contribution:  
Study Design A  
Data Collection B  
Statistical Analysis C  
Data Interpretation D  
Manuscript Preparation E  
Literature Search F  
Funds Collection G

ABCDEF **Yun Zan\***  
ABCDEF **Yinlong Zuo\***  
ACDEFG **Yunping Deng**

Department of Orthopedics, The People's Hospital of Dazu,  
The Affiliated Dazu Hospital of Chongqing Medical University, Chongqing, PR China

APPROVED GALLEY PROOF

\* Yun Zan and Yinlong Zuo contributed equally to this work as co-first authors

**Corresponding Author:** Yunping Deng, e-mail: [Dyp1988m@163.com](mailto:Dyp1988m@163.com)  
**Financial support:** None declared  
**Conflict of interest:** None declared

**Background:** Osteoporotic femoral neck fractures cause substantial disability in older adults. Although joint replacement is the standard treatment, the choice between total hip arthroplasty (THA) and hemiarthroplasty (HA) remains controversial. This study compared outcomes of THA and HA and identified factors influencing postoperative hip functional recovery.

**Material/Methods:** This retrospective study included 98 patients, with 52 in the THA group and 46 in the HA group. Surgical parameters and outcomes were compared, including hip function assessed by the Harris Hip Score (HHS), pain evaluated using the visual analog scale (VAS), and physical performance measured by the Short Physical Performance Battery (SPPB) at 3, 6, and 12 months postoperatively. Postoperative complications were recorded. Good functional recovery was defined as HHS ≥80 at 1 year. Univariate and multivariate logistic regression analyses were performed to identify factors associated with functional recovery.

**Results:** The THA group had significantly longer operative time, greater intraoperative blood loss, and higher postoperative drainage volume than the HA group ( $P<0.01$ ). At 6 and 12 months, THA patients showed significantly better hip function, physical performance, and lower activity-related VAS scores ( $P<0.05$ ). Overall complication rates were similar ( $P>0.05$ ); however, acetabular wear-related pain occurred in 4 patients only in the HA group. Multivariate analysis showed that younger age, higher bone mineral density T-score, THA, and good rehabilitation compliance independently predicted favorable functional recovery ( $P<0.05$ ).

**Conclusions:** THA provides superior medium- to long-term functional outcomes compared with HA. Surgical decisions should consider age, bone quality, functional demands, and rehabilitation compliance, prioritizing THA when appropriate.

**Keywords:** **Arthroplasty, Replacement, Hip • Comparative Study • Hip Fractures • Orthopedics • Osteoporosis • Postoperative Recovery**

**Full-text PDF:** <https://www.medscimonit.com/abstract/index/idArt/952590>

3256 3 6 24



Publisher's note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher

## Introduction

The progression of global population aging has elevated osteoporosis to a significant public health concern worldwide. Among its most serious consequences are osteoporotic fractures [1]. Femoral neck fractures are common in older adults, particularly postmenopausal women and older men. The underlying cause lies in a substantial reduction in bone mineral density combined with deterioration of bone microstructure, which leads to increased bone brittleness and a higher likelihood of fracture even after mild physical impact, such as a fall [2]. These fractures are associated with high disability rates and substantial healthcare costs and can cause loss of mobility and functional independence [3,4]. In the surgical management of osteoporotic femoral neck fractures, hip arthroplasty is currently recognized as an effective treatment strategy. It aims to rapidly relieve pain, restore joint stability, and facilitate early recovery of patient mobility, thereby avoiding the risks associated with prolonged bed rest [5]. In clinical practice, 2 principal techniques are employed: total hip arthroplasty (THA) and hemiarthroplasty (HA). In THA, both the femoral head and the acetabular articular surface are replaced through the implantation of prosthetic components, thereby restoring hip joint biomechanics [6,7]. This procedure is generally associated with better long-term joint function and a lower incidence of residual hip pain, and is particularly suitable for relatively younger patients, those with higher activity demands, longer life expectancy, or pre-existing acetabular degenerative disease, such as osteoarthritis. In contrast, hemiarthroplasty, typically referring to bipolar femoral head replacement, involves replacement of only the femoral head while preserving the native acetabulum. This procedure generally requires a shorter operative time, is associated with less intraoperative blood loss, and involves lower surgical trauma. Consequently, it is often considered the preferred option for older patients, individuals with comorbidities, low functional demands, or limited surgical tolerance [8]. However, preservation of the native acetabular cartilage carries a risk of accelerated postoperative wear, which can result in pain or even necessitate revision surgery, particularly in younger or more active patients. Although both procedures are widely used in clinical practice, the optimal surgical choice for treating osteoporotic femoral neck fractures remains a topic of ongoing debate [9].

This investigation was designed to systematically assess the clinical outcomes of THA and HA in the surgical treatment of osteoporotic femoral neck fractures and to comprehensively examine the key factors influencing postoperative hip joint functional recovery. By identifying independent predictive factors through multivariate analysis, this study aims to establish a reliable prognostic evaluation framework. The findings are expected to provide evidence-based support for surgical decision-making and individualized rehabilitation strategies,

ultimately contributing to improved patient outcomes and more precise clinical management.

## Material and Methods

### Ethics Statement

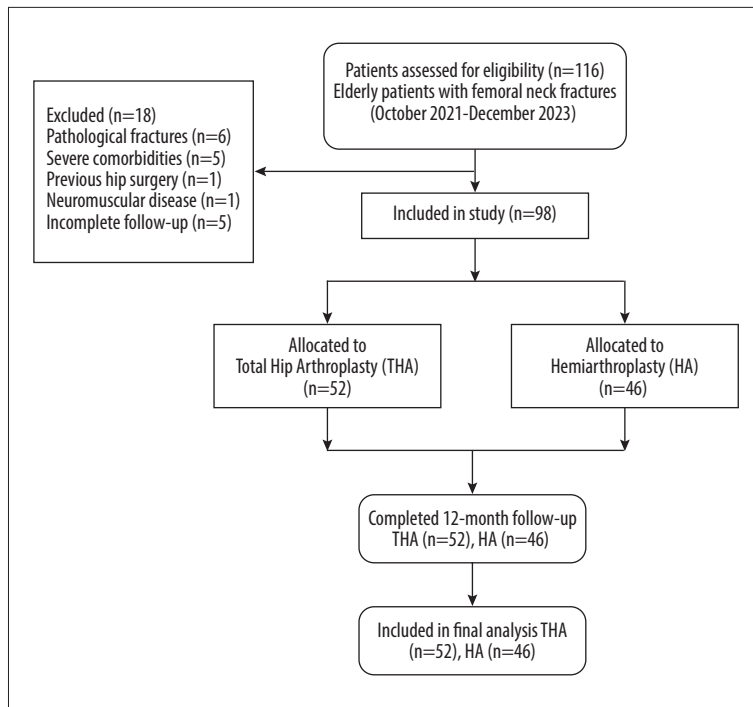
This retrospective study was conducted in accordance with the ethical principles of the Declaration of Helsinki. The study protocol was reviewed and approved by the Ethics Committee of the People's Hospital of Dazu (Approval No. 2024-074). Owing to the retrospective design of the study and the use of anonymized clinical data, the requirement for written informed consent was waived by the ethics committee.

### Study Subjects

Older adults diagnosed with osteoporotic femoral neck fractures and treated in the orthopedic department of our hospital between October 2021 and December 2023 were retrospectively enrolled in this study. The inclusion criteria were: (1) age  $\geq 65$  years; (2) a diagnosis of osteoporosis confirmed by dual-energy X-ray absorptiometry (DXA) or quantitative computed tomography (QCT), defined as a T-score  $\leq -2.5$ ; (3) radiographic evidence of a displaced femoral neck fracture classified as Garden type III or IV according to the Garden classification system [10]; (4) treatment with primary unilateral total hip arthroplasty or hemiarthroplasty; and (5) availability of complete clinical data with a minimum follow-up duration of 12 months. The exclusion criteria were pathological fractures, severe underlying medical conditions rendering surgery intolerable, previous surgical history involving the affected hip, severe neuromuscular disorders that could interfere with postoperative functional assessment, and loss to follow-up or incomplete follow-up data. A total of 98 patients met the inclusion criteria and were included in the final analysis. According to the surgical procedure performed, patients were divided into a total hip arthroplasty group (THA group,  $n=52$ ) and a hemiarthroplasty group (HA group,  $n=46$ ). The flow diagram of the study is presented in **Figure 1**.

### Justification for Sample Size

All consecutive patients who met the eligibility criteria during the study period from October 2021 to December 2023 were included in this analysis. Therefore, the sample size was determined by the available patient population rather than by an a priori sample size calculation. The final cohort of 98 patients was considered sufficient to allow meaningful comparison of clinical outcomes between the THA and HA groups and to support multivariate logistic regression analysis for identifying factors associated with postoperative hip joint functional recovery.



**Figure 1.** Flow diagram illustrating patient selection, exclusion criteria, surgical allocation to total hip arthroplasty (THA) or hemiarthroplasty (HA), follow-up, and final analysis of elderly patients with osteoporotic femoral neck fractures.

## Surgical Methods

All surgical procedures were performed by the same team of experienced joint surgeons using either general anesthesia or combined spinal–epidural anesthesia. For total hip arthroplasty, patients were placed in the lateral decubitus position, and a posterolateral surgical approach was used. Sequential incisions were made through the skin, subcutaneous tissue, and fascia lata. The gluteus maximus muscle was bluntly separated, the external rotator tendons were incised, and the joint capsule was exposed and opened. An osteotomy of the femoral neck was performed approximately 1.0 to 1.5 cm proximal to the lesser trochanter. Soft tissue and ligamentum teres remnants within the acetabulum were removed. The acetabulum was progressively reamed until uniform bleeding of the subchondral bone was observed. A cementless acetabular cup of appropriate size was implanted, followed by insertion of the liner. The femoral medullary canal was then prepared, and an uncemented femoral stem and appropriately sized femoral head were implanted. After reduction of the hip joint, stability and range of motion were assessed. The incision was irrigated, closed in layers, and a drainage tube was placed. For hemiarthroplasty, the surgical approach and femoral-side procedures were identical to those used in the THA group. After removal of the femoral head, the acetabulum was cleaned without reaming to preserve the native acetabular cartilage. A bipolar femoral head prosthesis was then implanted, followed by joint reduction. Hip joint stability and range of motion were assessed, after which the incision was irrigated and closed, and a drain was inserted. Implants used for total hip arthroplasty

and hemiarthroplasty were obtained from different manufacturers, based on availability during the study period.

All patients received routine postoperative antibiotic prophylaxis. Drainage tubes were removed within 24 to 48 h after surgery. Beginning on postoperative day 1, patients were instructed to perform ankle pump exercises and quadriceps isometric contractions and to gradually initiate ambulation with partial weight-bearing using walking aids.

## Observation Indicators

Baseline data collected included age, sex, body mass index (BMI), Garden classification of the fracture, and time from injury to surgery. Perioperative indicators included operative time (from skin incision to completion of wound closure), intraoperative blood loss (estimated by suction volume and sponge weighing), postoperative drainage volume, blood transfusion rate, and postoperative hospital stay (from the day of surgery to fulfillment of discharge criteria). Postoperative hip joint function and quality of life were assessed at 3, 6, and 12 months after surgery. The Harris Hip Score (HHS) was used to evaluate hip function, with a maximum score of 100 points comprising pain, function, range of motion, and absence of deformity [11]. Scores were categorized as excellent ( $\geq 90$ ), good (80–89), fair (70–79), or poor ( $< 70$ ). The visual analog scale (VAS) was used to assess hip pain at rest and during activity on a scale from 0 (no pain) to 10 (worst imaginable pain). Physical performance was assessed using the Short Physical Performance Battery (SPPB), which evaluates lower-extremity function,

**Table 1.** Comparison of baseline demographic and clinical characteristics between the total hip arthroplasty and hemiarthroplasty groups.

Variable	THA group (n=52)	HA group (n=46)	P value
Age (years)	75.6±6.3	78.2±7.1	0.056
Sex (male/female), n (%)	21/31	19/27	0.912
Body mass index (kg/m <sup>2</sup> )	23.8±3.2	23.4±3.5	0.534
Garden classification (III/IV), n	24/28	22/24	0.847
Time from injury to surgery (days)	3.6±1.2	3.8±1.3	0.418

Continuous variables are expressed as mean±SD; categorical variables are expressed as number (percentage). There were no statistically significant differences in baseline characteristics between the 2 groups.

balance, and mobility [12]. Postoperative rehabilitation compliance was evaluated based on adherence of patients to the prescribed rehabilitation program during follow-up visits and was reflected through functional outcome measures, including the HHS and SPPB. Compliance was assessed retrospectively using physiotherapy records and follow-up documentation. Patients were categorized as having good rehabilitation compliance if they attended ≥80% of scheduled rehabilitation sessions and completed the prescribed rehabilitation program, and poor compliance if attendance or participation was <80%. All postoperative complications were recorded and analyzed, including perioperative complications (such as surgical site infection, hematoma, deep vein thrombosis, and pulmonary embolism), mid-term complications (such as prosthetic dislocation, periprosthetic fracture, and periprosthetic joint infection), and long-term complications (including aseptic loosening, acetabular wear in the HA group, and heterotopic ossification). Reoperations or revision surgeries related to these complications were documented.

### Statistical Analysis

Statistical analyses were performed using SPSS version 26.0. Continuous variables with a normal distribution were expressed as mean±standard deviation and compared using independent-samples *t* tests. Non-normally distributed data were expressed as median (interquartile range) and analyzed using the Mann-Whitney U test. Categorical variables were presented as numbers (percentages) and compared using the chi-square ( $\chi^2$ ) test or Fisher's exact test, as appropriate. Univariate and multivariate logistic regression analyses were conducted to identify factors associated with postoperative hip joint functional recovery, defined as achieving an HHS ≥80 at 1 year after surgery. Variables included age, sex, bone mineral density T-score, surgical method, and rehabilitation compliance. A *P* value <0.05 was considered statistically significant.

## Results

### Comparison of Patient Baseline Characteristics

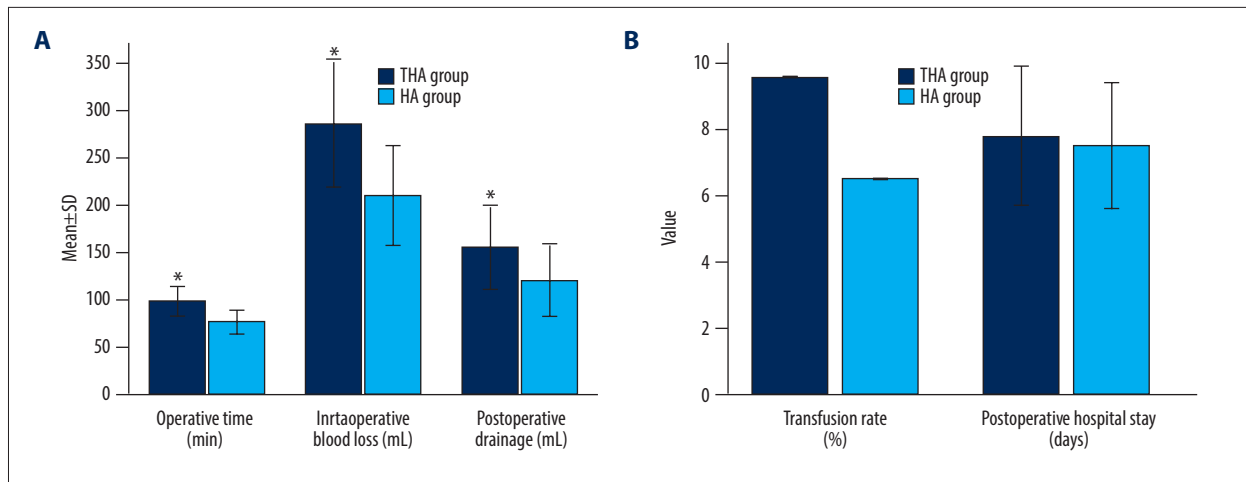
A total of 98 patients were included in the study, comprising 52 patients in the THA group and 46 patients in the HA group. There were no statistically significant differences in baseline demographic or clinical characteristics between the 2 groups, including age, sex, BMI, Garden fracture classification, or time from injury to surgery (all *P*>0.05), indicating good comparability between groups. Detailed baseline data are presented in **Table 1**.

### Comparison of Perioperative Indicators

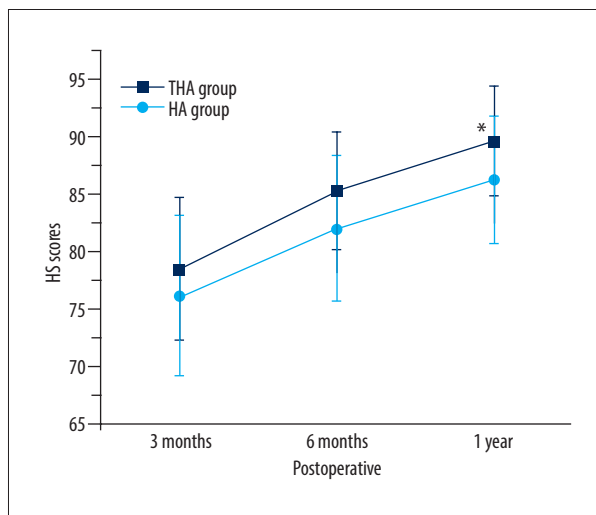
The mean operative time in the THA group was 98.5±15.2 min, which was significantly longer than the 76.8±12.4 min observed in the HA group (*P*<0.05). Intraoperative blood loss (285.6±68.3 mL) and postoperative drainage volume (155.3±45.1 mL) were also significantly greater in the THA group compared with the HA group (210.4±52.7 mL and 120.8±38.6 mL, respectively; both *P*<0.01). In contrast, there were no significant differences between the 2 groups in blood transfusion rate (9.6% [5/52] in the THA group vs 6.5% [3/46] in the HA group) or postoperative hospital stay (7.8±2.1 days for THA vs 7.5±1.9 days for HA; both *P*>0.05). These results are summarized in **Figure 2**.

### Postoperative Hip Function and Quality-of-Life Outcomes

Both groups demonstrated progressive improvement in hip function and quality-of-life measures during the postoperative follow-up period. At 3 months postoperatively, the mean HHS was 78.5±6.2 in the THA group and 76.1±7.0 in the HA group, with no statistically significant difference between groups (*P*>0.05). At 6 months, the THA group achieved a significantly higher mean HHS (85.3±5.1) compared with the HA group (82.0±6.3; *P*<0.05). This difference persisted at the 12-month follow-up, with mean HHS values of 89.6±4.8 in the



**Figure 2. Comparison of perioperative indicators between groups.** (A) Operative time, intraoperative blood loss, and postoperative drainage volume. (B) Blood transfusion rate and postoperative hospital stay. Data are presented as mean ± standard deviation or number (%), as appropriate. \*  $P < 0.05$  compared with the HA group.



**Figure 3. Comparison of postoperative Harris hip scores (HHS).** Mean HHS values in the total hip arthroplasty (THA) and hemiarthroplasty (HA) groups at 3, 6, and 12 months after surgery. Data are presented as mean ± standard deviation. \*  $P < 0.05$  compared with the HA group.

THA group and  $86.2 \pm 5.5$  in the HA group ( $P < 0.05$ ) (Figure 3). VAS scores at rest remained low throughout the follow-up period in both groups, with no significant intergroup differences at any time point (all  $P > 0.05$ ) (Figure 4A). During activity, at 3 months postoperatively, the THA group showed a statistically significantly lower VAS pain score compared with the HA group ( $3.2 \pm 1.0$  vs  $3.8 \pm 1.2$ ;  $P < 0.05$ ). At 6 months, activity-related pain further decreased in the THA group ( $2.1 \pm 0.8$ ) and remained significantly lower than in the HA group ( $2.8 \pm 1.0$ ;  $P < 0.05$ ). At 12 months, activity-related VAS scores were comparable between the THA and HA groups ( $1.5 \pm 0.7$  vs  $1.7 \pm 0.8$ ,

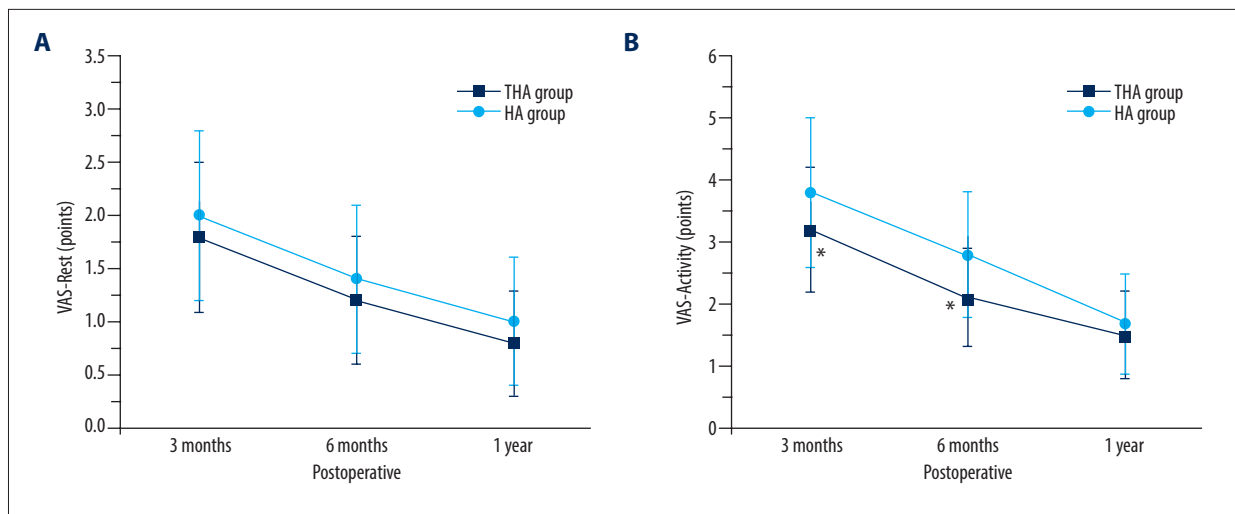
respectively;  $P > 0.05$ ) (Figure 4B). No significant difference in SPPB scores was observed between groups at 3 months postoperatively ( $P > 0.05$ ). At 6 months, the THA group demonstrated significantly higher SPPB scores ( $9.2 \pm 1.5$ ) than the HA group ( $8.3 \pm 1.7$ ;  $P < 0.05$ ). This advantage persisted at 12 months, with mean scores of  $10.1 \pm 1.3$  in the THA group and  $9.0 \pm 1.6$  in the HA group ( $P < 0.05$ ) (Figure 5).

### Comparison of Postoperative Complications

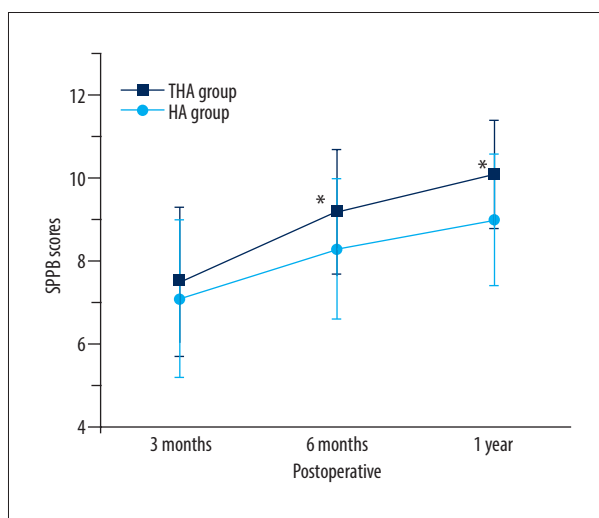
The overall incidence of postoperative complications was 15.4% (8/52) in the THA group and 19.6% (9/46) in the HA group, with no statistically significant difference between groups ( $P > 0.05$ ). In the HA group, 4 patients (8.7%) experienced acetabular wear-related pain, which was identified based on persistent activity-related groin pain during follow-up in combination with radiographic evidence of acetabular cartilage degeneration, whereas no such cases were observed in the THA group. Each group had 1 case of prosthetic dislocation, both of which were successfully managed with closed reduction. No cases of periprosthetic joint infection or aseptic loosening requiring revision surgery were observed during follow-up. Detailed complication data are shown in Figure 6. The category 'other complications' included superficial surgical site infection, postoperative hematoma, and deep vein thrombosis, none of which required revision surgery or resulted in long-term functional impairment.

### Factors Influencing Postoperative Hip Joint Functional Recovery

Using a 1-year postoperative HHS  $\geq 80$  as the criterion for good functional recovery, 61 patients met this threshold (37 in the THA group and 24 in the HA group), while 37 patients did not (15 in the THA group and 22 in the HA group). Univariate logistic



**Figure 4. Comparison of postoperative visual analog scale (VAS) pain scores. (A)** VAS scores at rest. **(B)** VAS scores during activity. Pain intensity was assessed at 3, 6, and 12 months postoperatively. Data are presented as mean±standard deviation. \*  $P<0.05$  compared with the HA group at the same time point



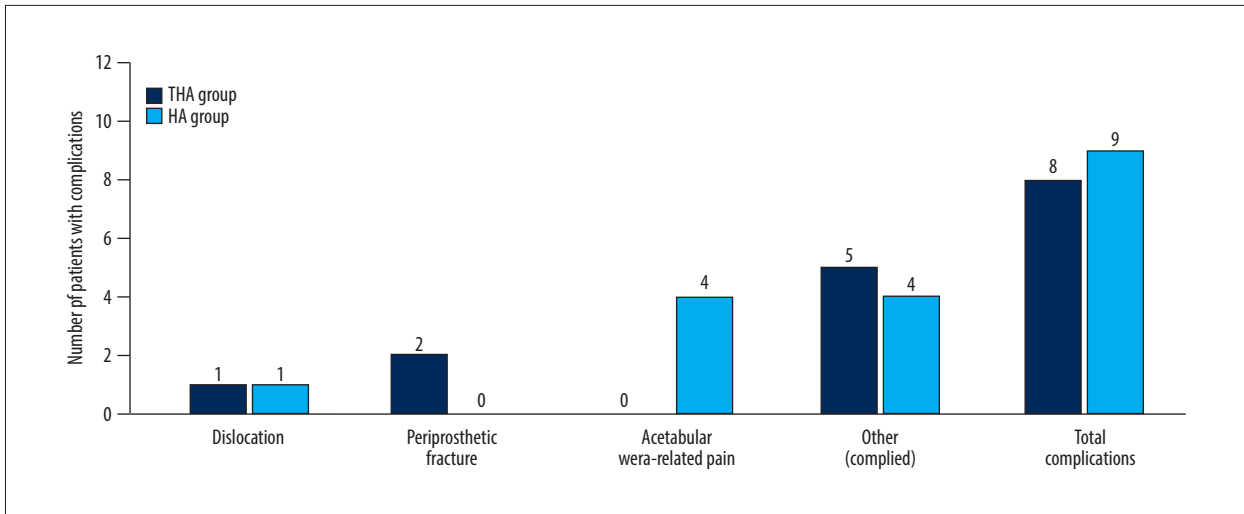
**Figure 5. Comparison of postoperative Short Physical Performance Battery (SPPB) scores.** SPPB scores in the THA and HA groups at 3, 6, and 12 months after surgery. Higher scores indicate better physical performance. Data are presented as mean±standard deviation. \*  $P<0.05$  compared with the HA group.

regression analysis indicated that age, preoperative bone mineral density T-score, surgical method (THA), and high postoperative rehabilitation compliance were potential factors associated with good functional recovery ( $P<0.10$ ). In contrast, sex, BMI, Garden fracture classification, and time from injury to surgery were not significantly associated with functional recovery ( $P>0.10$ ). Detailed univariate results are presented in **Table 2**. Variables with  $P<0.10$  in univariate analysis were included in the multivariate logistic regression model. Multivariate analysis identified age (OR=0.92, 95% CI: 0.86-0.99,  $P=0.028$ ), surgical

method (THA vs HA; OR=2.88, 95% CI: 1.20-6.93,  $P=0.018$ ), and rehabilitation compliance (OR=4.32, 95% CI: 1.85-10.09,  $P=0.001$ ) as independent factors influencing postoperative hip joint functional recovery. Higher bone mineral density T-score was also an independent protective factor (OR=2.15, 95% CI: 1.10-4.20,  $P=0.024$ ). These results are summarized in **Table 3**.

## Discussion

Osteoporotic femoral neck fractures constitute a major clinical challenge in older patients. Total hip arthroplasty (THA) and hemiarthroplasty (HA) are the principal surgical treatment options, each with distinct characteristics and ongoing areas of debate [13-15]. By retrospectively analyzing data from 98 patients, this study aimed to compare the clinical outcomes of these 2 surgical approaches and to identify key factors influencing postoperative hip joint functional recovery. The results demonstrated clear differences in perioperative parameters between the THA and HA groups. Patients undergoing THA experienced significantly longer operative times, greater intraoperative blood loss, and greater postoperative drainage volumes compared with those treated with HA. These findings are consistent with the more complex surgical technique and greater soft tissue manipulation required for THA. Nevertheless, despite the increased surgical invasiveness associated with THA, no significant differences were observed between the 2 groups with respect to blood transfusion requirements or postoperative length of hospital stay. This may be attributed to advances in perioperative management, including optimized anesthesia, blood conservation strategies, and enhanced recovery protocols, which effectively mitigate perioperative risks and facilitate early mobilization. These



**Figure 6. Comparison of postoperative complications.** Comparison of complication profiles between the THA and HA groups, including perioperative complications, mid-term complications, long-term complications, and total complications. Data are presented as number (%).

**Table 2.** Univariate logistic regression analysis of factors associated with postoperative 1-year hip joint functional recovery (Harris Hip Score  $\geq 80$ ).

Variable	Odds ratio (OR)	95% CI	P value
Age (per 1-year increase)	0.937	0.882-0.996	0.038
Sex (male vs female)	1.214	0.512-2.876	0.658
Body mass index (kg/m <sup>2</sup> )	1.067	0.934-1.218	0.333
BMD T-score (per 1-unit increase)	2.321	1.224-4.401	0.010
Garden classification (IV vs III)	0.842	0.361-1.964	0.694
Surgical method (THA vs HA)	2.533	1.087-5.900	0.031
Rehabilitation compliance (high vs low)	4.105	1.812-9.297	0.001

Rehabilitation compliance was categorized as good or poor based on attendance at  $\geq 80\%$  or  $< 80\%$  of prescribed rehabilitation sessions, respectively. Variables with  $P < 0.10$  in univariate analysis were entered into multivariate logistic regression.

**Table 3.** Multivariate logistic regression analysis of independent factors associated with postoperative hip joint functional recovery.

Variable	B value	Std. error	Wald $\chi^2$	P value	Odds ratio (OR)	95% CI for OR
Age (per 1-year increase)	-0.083	0.038	4.821	0.028	0.92	0.856-0.991
Bone mineral density T-score (per 1-unit increase)	0.765	0.340	5.062	0.024	2.15	1.105-4.198
Surgical method (THA vs HA)	1.058	0.447	5.602	0.018	2.88	1.199-6.928
Rehabilitation compliance (high vs low)	1.463	0.423	11.942	0.001	4.32	1.885-10.090
Constant	-2.105	1.234	2.913	0.088	0.122	–

Rehabilitation compliance was categorized as good or poor based on attendance at  $\geq 80\%$  or  $< 80\%$  of prescribed rehabilitation sessions, respectively.

results suggest that, in carefully selected patients with adequate physiological reserve, THA does not confer a substantially higher perioperative risk burden compared with HA [16]. With respect to functional recovery, this study revealed important time-dependent differences between the 2 surgical approaches. During the early postoperative period (3 months), improvements in pain relief and basic hip function were comparable between groups. However, the advantages of THA became increasingly evident over time. At both 6 months and 1 year postoperatively, patients in the THA group achieved significantly better hip function scores (HHS), lower activity-related pain levels, and superior physical performance as measured by the SPPB. By replacing the damaged acetabular cartilage, THA eliminates a major source of joint-related pain and restores a biomechanical environment that more closely approximates normal hip anatomy and kinematics. This biomechanical advantage likely contributes to improved joint stability, smoother motion, and enhanced long-term functional outcomes [17,18]. In contrast, the 4 cases (8.7%) of acetabular wear-related pain observed in the HA group underscore the vulnerability of the preserved native acetabulum to progressive cartilage degeneration under sustained metal-on-cartilage articulation, particularly in patients with higher postoperative activity levels. Regarding postoperative complications, although the overall incidence did not differ significantly between the 2 groups, the nature of complications varied. Acetabular wear-related pain constituted a notable proportion of mid-term complications in the HA group, whereas the THA group experienced complications such as periprosthetic fracture (2 cases in this study). These findings are closely related to the compromised bone quality and reduced bone-implant interface strength characteristic of osteoporotic patients [19,20]. Therefore, regardless of the surgical strategy employed, effective management of osteoporosis, through appropriate anti-osteoporotic pharmacotherapy and perioperative bone health optimization, is essential to minimize complication risk and ensure long-term prosthetic stability.

Multivariate regression analysis further identified independent predictors of postoperative hip joint functional recovery. Age and bone mineral density T-score emerged as key intrinsic patient-related factors. Older age was associated with a lower likelihood of achieving favorable functional outcomes, reflecting the combined effects of diminished physiological reserve, higher comorbidity burden, and reduced rehabilitation capacity in older individuals [21]. Conversely, higher bone mineral density T-scores, indicative of better bone quality, were strongly associated with improved functional recovery. This shows that bone health optimization is not only critical for fracture prevention but also is fundamental to surgical success and postoperative functional restoration [22]. Among modifiable clinical factors, the choice of surgical method and postoperative rehabilitation compliance played particularly

important roles. Undergoing THA significantly increased the likelihood of achieving good functional recovery at 1 year postoperatively, even after adjustment for age and bone density, providing quantitative support for favoring THA in appropriately selected patients [23,24]. Moreover, rehabilitation compliance demonstrated the strongest predictive value among all assessed variables, emphasizing the central role of structured, standardized, and actively engaging rehabilitation programs in postoperative recovery. These findings suggest that optimal management of osteoporotic femoral neck fractures should extend beyond surgical decision-making alone and incorporate comprehensive patient education, individualized rehabilitation planning, and ongoing supervision as integral components of a holistic treatment strategy.

Despite producing some interesting results, this study has several limitations that should be acknowledged. Its retrospective design and single-center setting may have introduced inherent selection bias and limit the generalizability of the findings. Although the sample size was sufficient to support comparative analyses and multivariate modeling, larger multicenter studies with longer follow-up periods are needed to further validate these results. In addition, prostheses from different manufacturers were used for total hip arthroplasty and hemiarthroplasty, which may have introduced implant-related variability that could not be fully controlled in this retrospective analysis. Furthermore, unmeasured confounding factors related to patient comorbidities and rehabilitation intensity may have influenced postoperative functional outcomes.

## Conclusions

This study demonstrates that, in patients with osteoporotic femoral neck fractures, total hip arthroplasty provides superior mid- to long-term outcomes compared with hemiarthroplasty in terms of hip joint function, activity-related pain relief, and overall physical performance, despite slightly longer operative time and greater perioperative blood loss. Younger age, higher preoperative bone mineral density, use of the THA procedure, and good postoperative rehabilitation compliance were identified as independent predictors of favorable functional recovery. These findings show the importance of individualized surgical selection based on patient characteristics and functional demands when managing osteoporotic femoral neck fractures.

## Institution Where the Work Was Performed

Department of Orthopedics, the People's Hospital of Dazu, the Affiliated Dazu Hospital of Chongqing Medical University, Chongqing, PR China

## Patient Permission/Consent Statement

This retrospective study was approved by the Ethics Committee of the People's Hospital of Dazu. Written informed consent was obtained from all patients or their legal representatives prior to inclusion. All patient data were anonymized, and confidentiality was strictly maintained.

## References:

1. Subarajan P, Arceo-Mendoza RM, Camacho PM. Postmenopausal osteoporosis: a review of latest guidelines. *Endocrinol Metab Clin North Am.* 2024;53: 497-512.
2. Xia W, Zhang A, Qiu B, Chen Y, Kong M. Femoral neck fracture after femoral head necrosis: A case report and review of the literature. *BMC Musculoskelet Disord.* 2023;24:853
3. Mei J. [Disastrous triad of femoral head: Femoral neck fracture meeting fracture-dislocation of femoral head.] *Zhongguo Gu Shang.* 2023;36:216-21 [in Chinese]
4. Zhu XZ, Zhu Y, Mei J. [Review of closed reduction techniques for femoral neck fracture.] *Zhongguo Gu Shang.* 2023;36:273-78 [in Chinese]
5. Walker MD, Shane E. Postmenopausal osteoporosis. *N Engl J Med.* 2023;389:1979-91
6. Shepard S, Bartholomew A, Houserman D, et al. Assessing osteoporosis screening compliance in total joint surgery: A retrospective chart review. *J Osteopath Med.* 2024;124:537-41
7. Cosman F, de Beur SJ, LeBoff MS, et al. Clinician's guide to prevention and treatment of osteoporosis. *Osteoporos Int.* 2014;25:2359-81
8. Gao L, Han Z, Xiong A. Total hip arthroplasty or hemiarthroplasty for hip fracture. *N Engl J Med.* 2020;382(11):1072-73
9. Burgers PTPW, Van Geene AR, Van den Bekerom MPJ, et al. Total hip arthroplasty versus hemiarthroplasty for displaced femoral neck fractures: A systematic review and meta-analysis. *Arch Orthop Trauma Surg.* 2012;132:1689-96
10. Garden RS. Low-angle fixation in fractures of the femoral neck. *J Bone Joint Surg Br.* 1961;43:647-63
11. Harris WH. Traumatic arthritis of the hip after dislocation and acetabular fractures: Treatment by mold arthroplasty. *J Bone Joint Surg Am.* 1969;51:737-55
12. Guralnik JM, Simonsick EM, Ferrucci L, et al. A short physical performance battery assessing lower extremity function. *J Gerontol.* 1994;49:M85-M94
13. Yao Y, Cai X, Chen Y, et al. Estrogen deficiency-mediated osteoimmunity in postmenopausal osteoporosis. *Med Res Rev.* 2025;45:561-75
14. Yu L, Wang Y, Chen J. Total hip arthroplasty versus hemiarthroplasty for displaced femoral neck fractures: Meta-analysis of randomized trials. *Clin Orthop Relat Res.* 2012;470:2235-43
15. Frihagen F, Nordsletten L, Madsen JE. Hemiarthroplasty or total hip arthroplasty for intracapsular displaced femoral neck fractures: randomized controlled trial. *BMJ.* 2007;335:1251
16. Li H, Liu H, Wang B, et al. Joint replacement for rheumatoid arthritis: When, why, and how. *Best Pract Res Clin Rheumatol.* 2025;39:102034
17. Binkley N, Nickel B, Anderson PA. Periprosthetic fractures: An unrecognized osteoporosis crisis. *Osteoporos Int.* 2023;34:1055-64
18. Keating JF, Grant A, Masson M, Scott NW, Forbes JF. Randomized comparison of reduction and fixation, bipolar hemiarthroplasty, and total hip arthroplasty. *J Bone Joint Surg Am.* 2006;88:249-60
19. Higuchi R, Uemura K, Kono S, et al. Osteoporosis screening using X-ray assessment and osteoporosis self-assessment tool for Asians in hip surgery patients. *J Bone Miner Metab.* 2025;43:158-65
20. Liu C, Shi L, He J, et al. Effects of depressive symptoms on osteoporotic bone metabolism and prognosis of joint replacement surgery in elderly male patients with femoral neck fracture. *Asian J Surg.* 2023;46:3687-92
21. Bashir K, Yousuf A, Shahzad T, et al. Benign paroxysmal positional vertigo after joint replacement surgeries: Case series. *Cureus.* 2024;16:e51839
22. Daher M, Mekhael E, El-Othmani MM. Osteoporosis in the setting of knee arthroplasty: A narrative review. *J Arthroplasty.* 2024;6:50
23. Tang Y, Jin Z, Lu Y, et al. Efficacy of antiosteoporotic drugs in preventing periprosthetic bone loss following total hip arthroplasty: A Bayesian network meta-analysis. *Orthop Surg.* 2024;16:2344-54
24. Harris AB, Lantieri MA, Agarwal AR, et al. Osteoporosis and total knee arthroplasty: Higher 5-year implant-related complications. *J Arthroplasty.* 2024;39:948-953.e1