



TO COMPARE THE FUNCTIONAL OUTCOME OF FRACTURE NECK OF FEMUR IN ELDERLY MANAGED BY TOTAL HIP ARTHROPLASTY VS HEMI ARTHROPLASTY

Orthopaedics

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ABSTRACT

Introduction: Fracture neck of femur is a common injury among the elderly and is associated with significant morbidity, mortality, and reduced independence. Displaced intracapsular fractures in this population are best treated surgically to enable early mobilization and minimize complications of prolonged immobilization. Hemiarthroplasty (HA) and total hip arthroplasty (THA) are widely used treatment options; however, the optimal procedure remains controversial, particularly regarding functional recovery, pain relief, gait restoration, and complications. **Aim And Objectives:** This study aimed to compare functional outcomes in elderly patients with displaced fracture neck of femur treated with THA versus HA. The primary objective was assessment using the Modified Harris Hip Score (mHHS). Secondary objectives included evaluation of pain, gait, Trendelenburg sign, range of motion, limb length discrepancy, radiological findings, operative time, blood loss, hospital stay, and complications. **Methodology:** A prospective comparative study was conducted in the Department of Orthopaedics at Rajshree Medical Research Institute, Bareilly, including 40 patients aged over 60 years, randomized into THA (n=20) and HA (n=20). Groups were comparable demographically and clinically. Surgeries were performed using Moore's posterior approach, with follow-up to one year. Statistical significance was set at $p < 0.05$. **Results:** Operative duration and blood loss were significantly higher in the THA group ($p < 0.001$). Functional outcomes favored THA, with significantly higher mHHS at all follow-ups up to one year. Pain relief, gait, and abductor function improved earlier in THA. Acetabular erosion was more common in HA, while dislocation occurred only in THA. **Conclusion:** THA provides superior functional outcomes and mid- to long-term benefits despite longer surgery and greater blood loss, whereas HA remains suitable for low-demand elderly patients.

KEYWORDS

Fracture neck of femur, elderly, total hip arthroplasty, hemiarthroplasty

INTRODUCTION

Fracture neck of femur is one of the most common and disabling injuries in the elderly and is often termed the "unsolved fracture" because of its complex management and long-term consequences. With increasing life expectancy and a rising prevalence of osteoporosis, it has become a major global public health concern. Femoral neck fractures constitute nearly half of all hip fractures and are associated with substantial morbidity, mortality, and functional decline [1]. Most occur after trivial falls in osteoporotic individuals, leading to prolonged hospitalization, loss of independence, and significant socioeconomic burden. The incidence doubles with each decade after the age of fifty, with a lifetime risk of approximately 17% in women and 6% in men. Globally, about 1.6 million hip fractures occur annually, a number projected to exceed 6 million by 2050 [2]. In India, demographic transition and lifestyle changes are contributing to a steadily increasing burden. One-year mortality ranges from 15% to 30%, and nearly half of survivors fail to regain pre-injury mobility [3]. Anatomically, the femoral neck connects the femoral head to the shaft and plays a critical role in weight transmission. Its intracapsular location makes fractures vulnerable to disruption of the retinacular branches of the medial and lateral femoral circumflex arteries, predisposing to avascular necrosis and non-union, particularly in the elderly with compromised vascularity [4]. Classification systems such as Garden and Pauwels remain essential in guiding management decisions. Displaced intracapsular fractures (Garden III and IV) in elderly patients are generally managed with prosthetic replacement, as internal fixation carries high risks of failure and ischemic complications [5].

The primary goals of treatment are pain relief, early mobilization, and restoration of functional independence. While internal fixation is preferred in younger individuals to preserve the femoral head, arthroplasty has become the standard of care in elderly patients to avoid fixation-related complications and facilitate rehabilitation. Arthroplasty options include hemiarthroplasty and total hip arthroplasty (THA), each with distinct benefits and limitations [6].

Hemiarthroplasty replaces the femoral head while retaining the native acetabulum and may be performed using unipolar or bipolar prostheses. It is technically less demanding, involves shorter operative time, less blood loss, and lower cost, making it suitable for low-demand elderly patients [7]. However, long-term complications such

as acetabular erosion, groin pain, and protrusio acetabuli may necessitate revision surgery [8].

Total hip arthroplasty replaces both the femoral head and acetabulum, restoring hip biomechanics more accurately and eliminating acetabular cartilage wear. It is particularly indicated in active elderly individuals or those with pre-existing acetabular pathology [9]. Evidence suggests that THA provides superior pain relief, functional outcomes, and higher Harris Hip Scores compared to hemiarthroplasty [10]. Nevertheless, THA is technically more demanding, associated with longer operative time, increased blood loss, higher dislocation rates, and greater cost [11].

Keating JF, et. al; 2005, demonstrated better long-term pain relief and function with THA but with increased dislocation risk compared to hemiarthroplasty. Meta-analyses indicate improved quality of life with THA, although at the expense of higher surgical complexity and perioperative risks [12]. Early mobilization is essential to prevent complications such as deep vein thrombosis and pressure ulcers, and both procedures allow immediate weight-bearing, though THA often results in better long-term mobility and independence [13].

Thus, management of displaced femoral neck fractures in the elderly requires individualized decision-making. While hemiarthroplasty remains practical and cost-effective, especially in resource-limited settings, THA offers superior functional and radiological outcomes in appropriately selected, physiologically active patients. The choice should be guided by patient characteristics, comorbidities, life expectancy, activity level, and available surgical expertise [14].

The aim of this study was to compare the functional outcomes of elderly patients with fracture neck of femur managed by total hip arthroplasty and hemiarthroplasty. The objectives were to evaluate and compare postoperative functional outcomes using standardized scoring systems such as the Harris Hip Score; assess postoperative complications including dislocation, infection, acetabular erosion, limb length discrepancy, and prosthetic loosening; compare operative duration, intraoperative blood loss, and hospital stay; evaluate radiological outcomes including implant positioning and stability; and assess overall patient satisfaction and quality of life following both procedures.

MATERIAL AND METHODS

This prospective observational study was conducted at the Department of Orthopaedics, Rajshree Medical Research Institute, Bareilly (U.P.) from 2023-2026. Ethical approval has been obtained from the Ethical Approval Committee of Rajshree Medical Research Institute, Bareilly (U.P.).

Study Population

The minimum sample size required for this study was 20 patients; however, 40 patients meeting the eligibility criteria were enrolled and randomly allocated into two equal groups using computer-generated randomization: Group A (n=20) underwent total hip arthroplasty, and Group B (n=20) underwent hemiarthroplasty. Included were patients over 60 years with radiologically confirmed displaced femoral neck fractures, ambulatory before injury, fit for surgery and anesthesia, and consenting; exclusions comprised preexisting hip arthritis, pathological fractures, non-ambulant status, severe cognitive or psychiatric illness, polytrauma, or unfit.

Data Analysis

All data were recorded in structured datasheets and analyzed using SPSS software version 25. Continuous variables were compared using the unpaired t-test, categorical variables were analyzed with the chi-square test, and serial assessments of functional scores were evaluated using the paired t-test. A p value of less than 0.05 was considered statistically significant. Ethical approval was obtained from the Institutional Ethics Committee, and confidentiality was maintained per Helsinki Declaration (2013). Written informed consent was secured.

RESULTS

The study included 40 elderly patients with displaced femoral neck fractures, equally divided into total hip arthroplasty (THA) and hemiarthroplasty (HA) groups, with complete follow-up up to one year. Both groups were comparable at baseline regarding mean age (73.4 vs 74.6 years; p=0.58), age distribution (p=0.91), gender predominance of females (p=0.75), fracture side (p=0.75), and Garden classification (p=0.76), confirming well-matched cohorts. Operative duration and intraoperative blood loss were significantly higher in the THA group (p<0.001), while hospital stay was similar (p=0.21). Functional and radiological outcomes were assessed comprehensively using clinical evaluation, validated scoring systems, gait analysis, and serial radiographs.

Table 1: Trendelenburg Sign At Various Follow-up Intervals

Follow-up interval	THA (n = 20)	HA (n = 20)	p-value
5-7 days	6 (30%) positive	8 (40%) positive	0.51
1 month	4 (20%) positive	7 (35%) positive	0.29
3 months	2 (10%) positive	5 (25%) positive	0.21
6 months	1 (5%) positive	4 (20%) positive	0.15
1 year	0 (0%) positive	3 (15%) positive	0.07

The incidence of a positive Trendelenburg sign progressively decreased in both groups over one year. THA showed lower rates at all follow-ups (30% to 0%) compared to HA (40% to 15%), though differences were not statistically significant.

Functional outcomes were assessed using the Modified Harris Hip Score, incorporating pain, limp, support requirement, walking distance, sitting, stair climbing, ability to wear shoes and socks, use of public transportation, absence of deformity, and range of motion. Both groups showed progressive improvement over one year. Pain relief was significantly better in the THA group from one month onward, with sustained superiority at subsequent follow-ups. Limp, need for walking support, walking distance, sitting ability, stair climbing, and activities of daily living improved steadily in both groups, with THA consistently demonstrating earlier and better functional trends, although most differences were not statistically significant. Range of motion recovery was comparable, with a greater proportion of THA patients achieving higher degrees at later follow-up. Absence of deformity was maintained in all patients. Overall Modified Harris Hip Scores were significantly higher in the THA group from one month to one year, confirming superior functional recovery compared to hemiarthroplasty.

All patients in both groups had poor Modified Harris Hip Scores (HHS <70) at 5-7 days postoperatively. Progressive improvement was observed over time in both groups, with the THA group consistently

showing a higher proportion of good-to-excellent outcomes from three months onward. At one year, 65% of THA patients achieved excellent outcomes compared to 40% in the HA group, indicating better long-term functional recovery with THA, although the differences were not statistically significant at any follow-up interval.

Table 2: Modified Harris Hip Score (HHS) Outcome Grades at All Follow-up Intervals

Follow-up Interval	HHS Grade	THA (n = 20)	HA (n = 20)	p-value
5-7 Days	Poor	20 (100.0%)	20 (100.0%)	1.000
	Fair	0 (0.0%)	0 (0.0%)	
	Good	0 (0.0%)	0 (0.0%)	
	Excellent	0 (0.0%)	0 (0.0%)	
1 Month	Poor	12 (60.0%)	15 (75.0%)	0.301
	Fair	6 (30.0%)	4 (20.0%)	
	Good	2 (10.0%)	1 (5.0%)	
	Excellent	0 (0.0%)	0 (0.0%)	
3 Months	Poor	4 (20.0%)	7 (35.0%)	0.269
	Fair	6 (30.0%)	6 (30.0%)	
	Good	7 (35.0%)	5 (25.0%)	
	Excellent	3 (15.0%)	2 (10.0%)	
6 Months	Poor	1 (5.0%)	3 (15.0%)	0.221
	Fair	3 (15.0%)	5 (25.0%)	
	Good	7 (35.0%)	6 (30.0%)	
	Excellent	9 (45.0%)	6 (30.0%)	
1 Year	Poor	0 (0.0%)	2 (10.0%)	0.118
	Fair	1 (5.0%)	3 (15.0%)	
	Good	6 (30.0%)	7 (35.0%)	
	Excellent	13 (65.0%)	8 (40.0%)	

Table 3: Gait Outcome At All Follow-Up Intervals

Follow-up	Gait Pattern	THA (n = 20)	HA (n = 20)	p-value
5-7 days	Normal	0 (0%)	0 (0%)	-
	Mild limp	6 (30%)	5 (25%)	0.72
	Moderate limp	14 (70%)	13 (65%)	0.74
	Severe limp	0 (0%)	2 (10%)	0.15
1 month	Normal	6 (30%)	3 (15%)	0.29
	Mild limp	10 (50%)	9 (45%)	0.75
	Moderate limp	4 (20%)	6 (30%)	0.47
	Severe limp	0 (0%)	2 (10%)	0.15
3 months	Normal	10 (50%)	6 (30%)	0.19
	Mild limp	7 (35%)	8 (40%)	0.74
	Moderate limp	3 (15%)	4 (20%)	0.67
	Severe limp	0 (0%)	2 (10%)	0.15
6 months	Normal	12 (60%)	7 (35%)	0.11
	Mild limp	6 (30%)	7 (35%)	0.74
	Moderate limp	2 (10%)	4 (20%)	0.38
	Severe limp	0 (0%)	2 (10%)	0.15
1 year	Normal	14 (70%)	8 (40%)	0.04
	Mild limp	4 (20%)	6 (30%)	0.46
	Moderate limp	2 (10%)	4 (20%)	0.38
	Severe limp	0 (0%)	2 (10%)	0.15

Gait improved progressively in both groups over time, with the THA group consistently demonstrating earlier recovery and a higher proportion of normal gait at each follow-up interval. Severe limp was observed only in the HA group throughout the study period. At one year, normal gait was achieved in 70% of THA patients compared to 40% of HA patients, showing a statistically significant advantage for THA (p = 0.04) and indicating superior functional recovery.

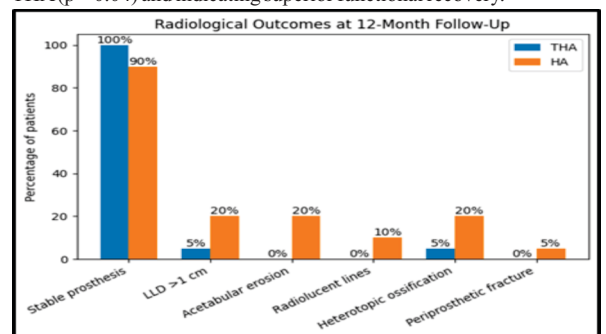


Figure 1: Radiological Outcome Assessment At All Follow-Up Intervals

Serial radiographs up to one year showed excellent implant stability in the THA group, with no cases of loosening, acetabular erosion, migration, or periprosthetic fracture, while early radiological findings were comparable between groups. In the HA group, late complications such as acetabular erosion (20% at 12 months, $p = 0.03$), limb length discrepancy >1 cm, heterotopic ossification, and radiolucent lines were more frequent, indicating superior long-term radiological outcomes with THA.

Table 4: Limb Length Discrepancy (LLD) At Different Follow-Up Intervals

Follow-up	LLD Category	THA (n = 20)	HA (n = 20)	p-value
5-7 days	≤ 1 cm	17 (85%)	14 (70%)	0.26
	> 1 cm	3 (15%)	6 (30%)	0.26
1 month	≤ 1 cm	18 (90%)	15 (75%)	0.22
	> 1 cm	2 (10%)	5 (25%)	0.22
3 months	≤ 1 cm	18 (90%)	16 (80%)	0.39
	> 1 cm	2 (10%)	4 (20%)	0.39
6 months	≤ 1 cm	19 (95%)	16 (80%)	0.15
	> 1 cm	1 (5%)	4 (20%)	0.15
1 year	≤ 1 cm	19 (95%)	16 (80%)	0.15
	> 1 cm	1 (5%)	4 (20%)	0.15

Limb length discrepancy improved progressively in both groups, with most patients achieving ≤ 1 cm discrepancy by six months and one year. Discrepancy >1 cm was consistently more frequent in the HA group at all follow-ups, though the differences were not statistically significant. At one year, 95% of THA patients had ≤ 1 cm discrepancy compared to 80% in the HA group, indicating better restoration and maintenance of limb length with THA.

Table 5: Complications At Different Follow-up Intervals

Complication	Follow-up	THA (n = 20)	HA (n = 20)	p-value
Surgical site infection	5-7 days	1 (5%)	2 (10%)	0.55
	1 month	0	1 (5%)	0.31
Prosthesis dislocation	1 month	2 (10%)	0	0.14
	3 months	1 (5%)	0	0.31
Periprosthetic fracture	6 months	0	1 (5%)	0.31
	1 year	0	1 (5%)	0.31
Implant loosening	6 months	0	1 (5%)	0.31
	1 year	0	2 (10%)	0.15
Heterotopic ossification	3 months	1 (5%)	2 (10%)	0.55
	6 months	1 (5%)	3 (15%)	0.29
	1 year	1 (5%)	4 (20%)	0.15
Re-operation required	1 year	1 (5%)	2 (10%)	0.55

Overall complication rates were comparable between groups. Early prosthesis dislocation occurred only in the THA group, while late complications such as implant loosening, heterotopic ossification, and periprosthetic fracture were more frequent in the HA group, though none reached statistical significance. This pattern suggests a higher early instability risk with THA and a greater tendency for late mechanical complications with HA, with reoperation rates remaining low in both groups at one year.

DISCUSSION

Displaced fracture neck of femur in the elderly continues to generate debate regarding the optimal arthroplasty procedure. Traditionally, hemiarthroplasty (HA) has been preferred because of its shorter operative time and lower surgical burden, whereas total hip arthroplasty (THA) is increasingly recommended for active, ambulatory elderly patients due to its potential for superior functional recovery and joint preservation. **Chatterji G, et. al; 2022**, evaluated these two approaches using uniform inclusion criteria, standardized surgical technique, identical rehabilitation protocols, and serial follow-up up to one year, thereby enabling a balanced comparison [15].

Both groups were comparable at baseline with respect to age, sex distribution, fracture side, and Garden classification, with no statistically significant differences. The mean age was similar between groups, consistent with other comparative studies such as those by **Sharma V, et. al; 2016**. This demographic equivalence strengthens the validity of postoperative comparisons and aligns with previously published literature emphasizing matched cohorts for accurate functional assessment [8].

Operatively, THA required significantly longer surgical time and resulted in greater intraoperative blood loss ($p < 0.001$), findings consistent with reports by **Tang X, et. al; 2020 & Sharma V, et. al; 2016** [16,8]. Despite these intraoperative disadvantages, hospital stay was comparable between groups, mirroring observations from **Wang F, et. al; 2015**, suggested that increased operative demands did not adversely influence early recovery [17].

Pain relief was consistently superior in the THA group from one month onward, with statistically significant differences at all subsequent follow-ups. **Zi-Sheng A, et. al; 2012**, analysed demonstrating better medium- and long-term pain outcomes following THA. Improved pain control likely contributed to enhanced mobility and patient satisfaction [18].

Functional recovery, measured by the Modified Harris Hip Score, showed comparable early results but significantly higher scores in the THA group from one month to one year. This trend aligns with studies by **Burgers PT, et. al; 2012**, and **Muslim SM, et. al; 2023**, which reported superior functional scores after THA [19,20]. **McCafferty J, et. al; 2025**, analysed have found no significant difference, concerns about statistical fragility have been raised. The present findings supported a meaningful functional advantage of THA in appropriately selected elderly patients [21].

Gait outcomes further favored THA, with a significantly greater proportion achieving normal gait at one year. Similar improvements in walking capacity have been reported by **Muslim SM, et. al; 2023**. Although abductor function differences did not reach statistical significance, trends favored THA, likely reflecting better restoration of hip biomechanics [20].

Radiologically, acetabular erosion was observed exclusively in the HA group at one year, a statistically significant finding consistent with prior studies highlighting this long-term limitation of hemiarthroplasty. THA demonstrated superior acetabular preservation, reinforcing its biomechanical advantages **Liu Y, et. al; 2020** [22].

Complication patterns differed: early dislocation occurred only in THA, whereas late complications such as acetabular erosion and loosening were more frequent in HA. Overall complication rates, however, were comparable, suggesting that THA can be performed safely in selected elderly patients **Ekhtiari S, et. al; 2020** [23].

In synthesis, while THA is associated with longer operative time and increased blood loss, it offers superior pain relief, functional recovery, gait outcomes, and radiological stability. Hemiarthroplasty remains suitable for frail, low-demand individuals, but for medically fit, active elderly patients, THA appears to provide more favorable medium- and long-term outcomes [22,23].

CONCLUSION

This study compared recovery in elderly patients with displaced femoral neck fractures treated by total hip arthroplasty (THA) and hemiarthroplasty over one year. Both procedures were effective, with comparable baseline characteristics. THA involved longer operative time and greater blood loss but did not increase hospital stay or complications, while hemiarthroplasty was shorter and simpler, favoring frail patients. Functionally, THA showed superior pain relief, higher Modified Harris Hip Scores, better gait restoration, earlier abductor recovery, improved implant stability, and no acetabular erosion, making it preferable for active elderly individuals.

REFERENCES:

- Bhandari M, Devereaux PJ, Swiontkowski MF, Tornetta III P, Obreskey W, Koval KJ, Nork S, Sprague S, Schemitsch EH, Guyatt GH. Internal fixation compared with arthroplasty for displaced fractures of the femoral neck: a meta-analysis. *JBJS*. 2003 Sep 1;85(9):1673-81.
- Dhanwal DK, Dennison EM, Harvey NC, Cooper C. Epidemiology of hip fracture: worldwide geographic variation. *Indian journal of orthopaedics*. 2011 Feb;45(1):15-22.
- Magaziner J, Simonsick EM, Kashner TM, Hebel JR, Kenzora JE. Predictors of functional recovery one year following hospital discharge for hip fracture: a prospective study. *Journal of gerontology*. 1990 May 1;45(3):M101-7.
- Rogmark C, Johnell O. Primary arthroplasty is better than internal fixation of displaced femoral neck fractures: a meta-analysis of 14 randomized studies with 2,289 patients. *Acta orthopaedica*. 2006 Jan 1;77(3):359-67.
- Mears SC, Kates SL. A guide to improving the care of patients with fragility fractures, edition 2. *Geriatric orthopaedic surgery & rehabilitation*. 2015 Jun;6(2):58-120.
- Florschutz AV, Langford JR, Haidukewych GJ, Koval KJ. Femoral neck fractures: current management. *Journal of orthopaedic trauma*. 2015 Mar 1;29(3):121-9.
- Baker RP, Squires B, Gargan MF, Bannister GC. Total hip arthroplasty and hemiarthroplasty in mobile, independent patients with a displaced intracapsular fracture

- of the femoral neck: a randomized, controlled trial. *JBJS*. 2006 Dec 1;88(12):2583-9.
8. Sharma V, Awasthi B, Kumar K, Kohli N, Katoch P. Outcome analysis of hemiarthroplasty vs. total hip replacement in displaced femoral neck fractures in the elderly. *Journal of Clinical and Diagnostic Research: JCDR*. 2016 May 1;10(5):RC11.
 9. Hedbeck CJ, Enocson A, Lapidus G, Blomfeldt R, Törnkvist H, Ponzer S, Tidermark J. Comparison of bipolar hemiarthroplasty with total hip arthroplasty for displaced femoral neck fractures: a concise four-year follow-up of a randomized trial. *JBJS*. 2011 Mar 2;93(5):445-50.
 10. Edelman AI, Dillingham TR, McGinley EL, Pezzin LE. Hemiarthroplasty versus total hip arthroplasty for femoral neck fracture in elderly patients: twelve-month risk of revision and dislocation in an instrumental variable analysis of medicare data. *JBJS*. 2023 Nov 1;105(21):1695-702.
 11. Berry DJ, von Knoch M, Schleck CD, Harmsen WS. The cumulative long-term risk of dislocation after primary Charnley total hip arthroplasty. *JBJS*. 2004 Jan 1;86(1):9-14.
 12. Keating JF, Grant A, Masson M, Scott NW, Forbes JF. Displaced intracapsular hip fractures in fit, older people: a randomised comparison of reduction and fixation, bipolar hemiarthroplasty and total hip arthroplasty. *Health Technology Assessment (Winchester, England)*. 2005 Oct 1;9(41):iii-v.
 13. Khan RJ, MacDowell A, Crossman P, Keene GS. Cemented or uncemented hemiarthroplasty for displaced intracapsular fractures of the hip—a systematic review. *Injury*. 2002 Jan 1;33(1):13-7.
 14. Avery PP, Baker RP, Walton MJ, Rooker JC, Squires B, Gargan MF, Bannister GC. Total hip replacement and hemiarthroplasty in mobile, independent patients with a displaced intracapsular fracture of the femoral neck: a seven-to ten-year follow-up report of a prospective randomised controlled trial. *The Journal of Bone & Joint Surgery British Volume*. 2011 Aug 1;93(8):1045-8.
 15. Chatterji G, Shukla S, Singhania S, Singh MP, Mohanty SS, Jaiswal A, Mishra D, Singhania Sr S, Singh Sr M, MOHANTY Jr SS. A prospective study comparing the functional outcome of bipolar hemiarthroplasty versus total hip replacement in elderly patients with fracture of the neck of femur. *Cureus*. 2022 Sep 24;14(9).
 16. Tang X, Wang D, Liu Y, Chen J, Zhou Z, Li P, Ning N. The comparison between total hip arthroplasty and hemiarthroplasty in patients with femoral neck fractures: a systematic review and meta-analysis based on 25 randomized controlled trials. *Journal of Orthopaedic Surgery and Research*. 2020 Dec 10;15(1):596.
 17. Wang F, Zhang H, Zhang Z, Ma C, Feng X. Comparison of bipolar hemiarthroplasty and total hip arthroplasty for displaced femoral neck fractures in the healthy elderly: a meta-analysis. *BMC musculoskeletal disorders*. 2015 Aug 28;16(1):229.
 18. Zi-Sheng A, You-Shui G, Zhi-Zhen J, Ting Y, Chang-Qing Z. Hemiarthroplasty vs primary total hip arthroplasty for displaced fractures of the femoral neck in the elderly: a meta-analysis. *The Journal of arthroplasty*. 2012 Apr 1;27(4):583-90.
 19. Burgers PT, Van Geene AR, Van den Bekerom MP, Van Lieshout EM, Blom B, Aleem IS, Bhandari M, Poolman RW. Total hip arthroplasty versus hemiarthroplasty for displaced femoral neck fractures in the healthy elderly: a meta-analysis and systematic review of randomized trials. *International orthopaedics*. 2012 Aug;36(8):1549-60.
 20. Muslim SM, Lingayat MB, Bansode P, Kesharwani A. Comparative outcome assessment of total hip arthroplasty versus bipolar hemiarthroplasty in intracapsular neck of femur fracture in old age. *Int J Res Orthop*. 2023 Sep;9(5):956-61.
 21. McCafferty J, Bragg J, Quindlen K, Driscoll A, Pagani N, Gordon M, Salzler M. Hip Hemiarthroplasty vs Total Hip Arthroplasty for Femoral Neck Fractures: Reverse Fragility of Reoperation Rates in Randomized Controlled Trials. *Arthroplasty Today*. 2025 Oct 1;35:101805.
 22. Liu Y, Chen X, Zhang P, Jiang B. Comparing total hip arthroplasty and hemiarthroplasty for the treatment of displaced femoral neck fracture in the active elderly over 75 years old: a systematic review and meta-analysis of randomized control trials. *Journal of orthopaedic surgery and research*. 2020 Jun 11;15(1):215.
 23. Ekhtiari S, Gormley J, Axelrod DE, Devji T, Bhandari M, Guyatt GH. Total hip arthroplasty versus hemiarthroplasty for displaced femoral neck fracture: a systematic review and meta-analysis of randomized controlled trials. *JBJS*. 2020 Sep 16;102(18):1638-45.