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Comparative Evaluation of Functional Outcomes in Unstable Intertrochanteric Fractures Treated with Bipolar Hemiarthroplasty Versus Dynamic Hip Screw Fixation in the Elderly: A Prospective Analysis

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Abstract

Background: Unstable intertrochanteric fractures in the elderly present a clinical challenge due to osteoporosis, comminution, and a high risk of post-operative complications. Early mobilization and optimal functional recovery are key goals in their management. This study compares bipolar hemiarthroplasty (BPHA) with dynamic hip screw (DHS) fixation in treating these fractures.

Objective: To analyse and compare the short-term clinical, radiological, and functional outcomes in elderly patients with unstable intertrochanteric fractures treated with BPHA and DHS.

Methods: This prospective study included 40 patients aged 56–75 years with AO Type A2 intertrochanteric fractures treated at a tertiary care hospital from March 2017 to October 2018. Patients were randomly assigned to two groups: BPHA (Group A, n=20) and DHS fixation (Group B, n=20). All patients were evaluated using the Harris Hip Score (HHS) at 9 months post-operatively. Data on intraoperative blood loss, operative time, complications, transfusion requirements, and hospital stay were recorded.

Results: Group A had significantly lower blood loss (mean: 111 mL vs. 148 mL, p=0.031), fewer transfusions (mean units: 1.4 vs. 1.9, p=0.0276), and a shorter hospital stay (14.7 vs. 18.9 days, p=0.032). Functional outcomes were superior in Group A, with HHS at 9 months averaging 89.66 compared to 77.66 in Group B (p=0.046). The BPHA group experienced fewer complications (10%) versus the DHS group (20%).

Conclusion: Bipolar hemiarthroplasty provides better functional outcomes, fewer complications, and facilitates early mobilization in elderly patients with unstable intertrochanteric fractures compared to DHS fixation.

KEYWORDS: Unstable intertrochanteric fractures, Bipolar hemiarthroplasty, Dynamic hip screw, Harris Hip Score, Elderly hip fractures.

INTRODUCTION

Intertrochanteric fractures represent nearly half of all hip fractures and are increasingly prevalent due to the rising elderly population and associated osteoporosis. These fractures significantly impact patient mobility, independence, and overall quality of life, often resulting in prolonged hospitalization and increased morbidity and mortality rates if inadequately managed. Among these, unstable intertrochanteric fractures pose a particular therapeutic challenge due to comminution, impaired bone quality, and complex fracture geometry【1】.

Conservative management is no longer preferred in elderly patients as it leads to complications associated with prolonged immobilization, including deep vein thrombosis, pulmonary embolism, pneumonia, pressure sores, and deconditioning【2】. Therefore, surgical intervention aimed at early mobilization and stable

fixation has become the standard approach【3】. Dynamic Hip Screw (DHS) fixation, once considered the gold standard, has demonstrated significant limitations in unstable patterns, particularly with osteoporotic bone, where it is associated with complications such as screw cut-out, varus collapse, and failure of fixation【4】.

Bipolar hemiarthroplasty (BPHA) has emerged as a viable alternative for such cases. It allows for immediate post-operative weight-bearing, reduces the risk of implant failure, and bypasses the need for fracture union by replacing the femoral head【5】. Several recent studies have suggested that BPHA results in better functional outcomes and fewer reoperations compared to DHS in unstable intertrochanteric fractures in the elderly【6,7】. However, higher surgical invasiveness and increased intraoperative blood loss with arthroplasty remain concerns, necessitating a careful patient selection and comparison based on objective outcomes【8】.

This study aims to provide a comparative analysis of the clinical, functional, and radiological outcomes of BPHA and DHS fixation in elderly patients with unstable intertrochanteric fractures. By analysing short-term outcomes, including operative parameters, post-operative complications, and functional recovery using the Harris Hip Score, this study seeks to contribute to the evidence base guiding the optimal management of this challenging fracture type.

MATERIALS AND METHODS

Study Design and Setting

This was a prospective comparative study conducted at the Department of Orthopaedics, Sree Balaji Medical College and Hospital, Chennai, from March 2017 to October 2018. The objective was to assess the short-term functional and clinical outcomes of elderly patients with unstable intertrochanteric fractures treated with either bipolar hemiarthroplasty (BPHA) or dynamic hip screw (DHS) fixation.

Study Population

A total of 40 patients aged between 56 and 75 years presenting with osteoporotic, unstable intertrochanteric fractures classified as AO/OTA Type A2.1 to A2.3 were included. The patients were divided equally into two groups of 20 each: Group A (BPHA) and Group B (DHS). Recruitment occurred from March 2017 to February 2018, ensuring a minimum postoperative follow-up of 8 months (range: 8–20 months).

Inclusion Criteria

- Age between 56 to 75 years
- Both genders
- Unstable intertrochanteric fractures (AO/OTA Type A2.1–A2.3)
- Osteoporotic fractures based on Singh's Index
- Injury duration less than 2 weeks

Exclusion Criteria

- Age <56 or >75 years
- Stable intertrochanteric fractures (AO Type A1 or A3)
- Pathological fractures
- Associated ipsilateral lower limb fractures

Preoperative Evaluation

All patients underwent detailed clinical evaluation and radiographic assessment, including anteroposterior and lateral X-rays of the pelvis and femur. CT scans were used selectively to assess comminution and fracture geometry. Routine blood investigations and physician/cardiology clearance were obtained prior to surgery.

Operative Techniques

Group A (Bipolar Hemiarthroplasty):

Surgery was performed under spinal or general anaesthesia. Patients were positioned laterally, and a lateral or posterior approach was used based on surgeon preference. The femoral head and neck were excised, and the canal was reamed. Femoral stem implantation was done using bone cement in all cases. Any calcar deficiency was reconstructed using autograft from the excised femoral head or supported with cerclage wiring. Greater trochanteric fractures were stabilized using tension band wiring. A suction drain was placed, and wounds were closed in layers.

Group B (Dynamic Hip Screw Fixation):

Patients were placed supine on a fracture table. Under fluoroscopic guidance, closed reduction was attempted. If unsatisfactory, open reduction was performed. A lateral incision was made, and the DHS lag screw was placed using a 135-degree angle guide. After confirming correct positioning, a side plate (four or five-hole) was fixed to the femoral shaft. Trochanteric fragments were secured using tension band wiring when necessary.

Postoperative Protocol

All patients received third-generation cephalosporins perioperatively and for five days postoperatively. Drain removal was done on postoperative day (POD) 2. Group A patients were mobilized with toe-touch weight bearing from POD 5 using a walker. Group B patients were initially non-weight bearing and progressed to partial or full weight bearing by 4–6 weeks, depending on fracture healing.

Follow-up and Outcome Assessment

Patients were followed bi-weekly for the first 2 months and monthly for the next 6 months. At each visit, clinical and radiological assessments were done. Functional outcome was assessed at 9 months using the Harris Hip Score (HHS), which evaluates pain, function, absence of deformity, and range of motion. Based on the score, outcomes were classified as: Excellent (≥90), Good (80–89), Fair (70–79), and Poor (<70).

Statistical Analysis

Data were compiled in Microsoft Excel and analysed using SPSS software. Chi-square and t-tests were used for comparison. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 40 elderly patients with unstable intertrochanteric fractures were included and randomized equally into two groups: Group A (Bipolar Hemiarthroplasty - BPHA) and Group B (Dynamic Hip Screw - DHS). Both groups were comparable in terms of baseline demographics and comorbidities.

Demographic Distribution

The majority of patients (40%) were in the age group of 56–60 years. Female patients were predominant in both groups: 60% in Group A and 55% in Group B. Right-sided fractures were more common in both groups (65% in Group A and 75% in Group B).

Table 1. Demographic and Clinical Characteristics

Parameter	Group A (BPHA)	Group B (DHS)
Mean Age (years)	61.3	62.8
Sex (M/F)	8 / 12	9 / 11
Right-sided fractures	13 (65%)	15 (75%)
Osteoporosis Grade 3	13 (65%)	13 (65%)
Most common AO type	A2.2 (55%)	A2.2 (50%)
Most common mechanism	Accidental falls (50%)	Accidental falls (55%)

Operative and Postoperative Variables

Group A had a slightly shorter mean operative time (99.5 min) compared to Group B (101 min). Blood loss was significantly lower in the BPHA group (111 mL vs 148 mL, p=0.031). Blood transfusion requirement was also less in the BPHA group (mean 1.4 units vs 1.9 units, p=0.028). Mean hospital stay was shorter in the BPHA group (14.7 days vs 18.9 days, p=0.032).

Table 2. Intraoperative and Postoperative Comparison

Variable	Group A (BPHA)	Group B (DHS)	*p*-value
Operative time (min)	99.5	101	0.0004
Blood loss (mL)	111	148	0.031
Blood transfusion (units)	1.4	1.9	0.028
Hospital stay (days)	14.7	18.9	0.032

Complications

Group A had a lower complication rate (10%) compared to Group B (20%). Superficial infection and limb shortening were observed equally in both groups, while implant failure and pulmonary complications occurred only in the DHS group.

Table 3. Complications

Complication	Group A (BPHA)	Group B (DHS)
Superficial infection	1 (5%)	1 (5%)
Shortening	1 (5%)	1 (5%)
Pulmonary issues	0	1 (5%)
Implant failure	0	1 (5%)
Total	2 (10%)	4 (20%)

Functional Outcome

At 9 months follow-up, the Harris Hip Score was significantly higher in the BPHA group (mean 89.66) than the DHS group (mean 77.66, p=0.046). Seventy-five percent of patients in Group A had excellent or good results compared to 55% in Group B.

Table 4. Harris Hip Score Outcome at 9 Months

Outcome Category	Group A (BPHA)	Group B (DHS)
Excellent (≥90)	7 (35%)	4 (20%)
Good (80–89)	8 (40%)	7 (35%)
Fair (70–79)	5 (25%)	7 (35%)
Poor (<70)	0	2 (10%)

Table 5. Mean Harris Hip Score

Group	HHS at 9 Months	*p*-value
Group A (BPHA)	89.66	0.046
Group B (DHS)	77.66	

Summary

- Both surgical options provided satisfactory results.
- BPHA had significantly better early functional outcomes.

- DHS was associated with more complications, especially implant-related failures.
- BPHA patients had earlier mobilization, reduced hospital stay, and improved quality of life post-surgery.

DISCUSSION

Management of unstable intertrochanteric fractures in the elderly remains complex due to the interplay of osteoporotic bone, fracture comminution, and the need for early mobilization. Dynamic Hip Screw (DHS) fixation, once widely used, is now scrutinized for its limitations in such fracture patterns [1]. Bipolar hemiarthroplasty (BPHA), on the other hand, bypasses the need for fracture healing and allows for immediate post-operative mobilization. This study compared DHS and BPHA in elderly patients, focusing on functional outcomes, perioperative variables, and complications.

Our findings demonstrate that patients who underwent BPHA had significantly better short-term functional outcomes, as evidenced by higher Harris Hip Scores at 9 months (mean 89.66 vs 77.66 in DHS; p=0.046). This is consistent with several recent studies. A meta-analysis by Tian et al. concluded that BPHA leads to superior early functional recovery, particularly in elderly patients with Comminuted fractures [7]. Similarly, Kim et al. reported that BPHA yielded better post-operative mobility and fewer complications than internal fixation in unstable fracture patterns [3].

The superior outcomes in the BPHA group can be attributed to its ability to provide immediate mechanical stability, enabling early weight-bearing and reduced post-operative bed rest. This contrasts with DHS, where the need for partial or delayed weight-bearing often leads to deconditioning and higher complication rates. In our study, patients in the DHS group mobilized later and had longer hospital stays (18.9 vs 14.7 days; p=0.032), in line with the findings of Nayak and Acharya, who reported a mean stay of 20.2 days in DHS vs 14.8 in BPHA-treated patients [8].

Perioperative variables also favoured the BPHA group. Intraoperative blood loss was significantly lower (111 mL vs 148 mL; p=0.031), and fewer units of blood transfusion were needed (1.4 vs 1.9; p=0.028). While hemiarthroplasty is traditionally viewed as more invasive, recent literature suggests that meticulous surgical technique and optimization can reduce bleeding and transfusion requirements [5].

Complication rates were higher in the DHS group (20%) compared to BPHA (10%), with implant failure and pulmonary complications exclusively noted in the former. This again reflects the biomechanical disadvantage of internal fixation in osteoporotic, comminuted settings. Shah et al. emphasized the mechanical superiority of arthroplasty in such fractures, noting that BPHA reduces implant-related failures seen with DHS [5]. Furthermore, early mobilization associated with BPHA helps reduce complications such as pneumonia and pressure sores, which are more frequent in prolonged bed rest scenarios [6].

Despite these advantages, BPHA is not without its challenges. Risk of dislocation, heterotopic ossification, and periprosthetic fracture exist, although none were observed in our cohort. Careful surgical technique, proper restoration of leg length and offset, and secure trochanteric fixation minimize such risks. In our study, greater trochanter fragments were stabilized using tension band wiring, contributing to the absence of dislocations, and aiding in abductor function preservation.

Singh's index showed grade III osteoporosis in 65% of both groups, reinforcing the importance of implant choice based on bone quality. Osteoporosis compromises screw purchase in DHS, leading to complications like screw cut-out and varus collapse [9]. In contrast, BPHA does not rely on bone healing or fixation strength, offering a reliable alternative in such cases.

The AO classification further revealed a dominance of A2.2 fractures (55% in BPHA, 50% in DHS), indicating moderate comminution. These fracture types, particularly when associated with a disrupted medial calcar, pose significant fixation challenges and are often better managed with arthroplasty [9].

Notably, the literature reveals some disagreement. Egol et al. advocate for continued use of DHS even in unstable fractures, citing lower invasiveness and cost [4]. However, they acknowledge the importance of patient selection and surgeon expertise. In our experience, BPHA required a slightly longer learning curve, especially for proper version alignment and trochanteric fixation, but yielded superior outcomes.

In terms of functional grading, 75% of patients in the BPHA group achieved good to excellent outcomes versus 55% in DHS. This aligns with findings by Ozkayin and Aktuglu, who noted higher satisfaction and better hip scores in arthroplasty-treated patients with similar fracture types [6]. Pain relief and return to pre-injury mobility were markedly better in the BPHA group in our study, underscoring the role of stable, load-sharing constructs in functional rehabilitation.

The present study has limitations. The sample size was small, and follow-up limited to 9 months. Long-term complications such as acetabular erosion, prosthesis loosening, or heterotopic ossification could not be evaluated. Future studies with larger cohorts and longer follow-up are needed to validate these findings.

Nonetheless, this study adds to the growing body of evidence supporting BPHA in unstable intertrochanteric fractures in the elderly. In settings where patient mobility, early discharge, and reduced complication risk are critical, BPHA offers a clear advantage over DHS fixation.

CONCLUSION

This short-term prospective study demonstrates that bipolar hemiarthroplasty (BPHA) offers significant advantages over dynamic hip screw (DHS) fixation in managing unstable intertrochanteric fractures in elderly patients. Patients treated with BPHA experienced better functional outcomes, as evidenced by higher Harris Hip Scores, earlier mobilization, and shorter hospital stays. Additionally, BPHA was associated with reduced intraoperative blood loss, fewer blood transfusions, and lower complication rates. In contrast, DHS fixation showed limitations in osteoporotic bone due to higher risks of fixation failure and delayed rehabilitation. These findings suggest that BPHA is a more reliable and effective surgical option for improving recovery and quality of life in this vulnerable patient population.

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Bipolar images

Radiological Outcome

Pre-operative X-ray.

Post-operative X-ray.

X-ray at 9 months follow-up.

CLINICAL OUTCOME AT 9 MONTHS OF FOLLOW-UP

Standing.

Flexion.

Abduction.

Adduction.

Internal Rotation.

External Rotation.

DHS images

Radiological outcome

Pre-operative X-ray.

Post-operative X-ray.

X-ray at 9 months follow up.

CLINICAL OUTCOME AT 9 MONTHS OF FOLLOW-UP

Standing.

Flexion.

Abduction.

Adduction.

Internal Rotation.

External Rotation.