

Original Research Article

Clinical Outcome of Cemented Bipolar Hemiarthroplasty in AO Type II and Type III Peritrochanteric Fractures of the Femur in Elderly Patients: A Prospective Clinical Study

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ABSTRACT

Background: Peritrochanteric fractures in elderly osteoporotic patients are associated with significant morbidity, prolonged immobilization, and increased mortality. Internal fixation in unstable fractures often results in complications such as implant failure and delayed rehabilitation. Cemented bipolar hemiarthroplasty has emerged as an alternative treatment that facilitates early mobilization and functional recovery. This study aimed to evaluate the clinical outcomes of cemented bipolar hemiarthroplasty in elderly patients with AO Type II and Type III peritrochanteric fractures, while assessing functional outcomes, re-surgery rates, mortality, and limb length discrepancies.

Methods: A prospective longitudinal study was conducted at the Department of Orthopaedics, JSS Academy of Higher Education and Research, Mysuru, over 18 months (November 2019-May 2021). Thirty patients aged ≥ 65 years with AO Type II or Type III peritrochanteric fractures underwent cemented bipolar hemiarthroplasty. Functional outcome was assessed using the MHHS (Modified Harris Hip Score) at regular follow-up intervals up to one year. Demographic details, perioperative variables, complications, limb length discrepancy, ambulation time, duration of hospitalization, and mortality were recorded. Statistical analysis was performed using SPSS version 18.0, with $p < 0.05$ considered statistically significant.

Results: The mean age of the participants was 73.4 ± 8.3 years, with females comprising 63.3% of the study population. Trauma was the predominant mode of injury (80%), and hypertension was the most common comorbidity (46.7%). The mean MHHS was significantly higher in Type II fractures than Type III fractures (86.0 ± 3.96 vs. 81.36 ± 5.77 ; $p = 0.016$). Overall, 76.7% of patients achieved good functional outcomes, 6.7% had excellent outcomes, and 13.3% had fair outcomes. Patients were mobilized after a mean of approximately 4 days, with an average hospital stay of about 8 days. Complications occurred in 26.7% of patients, mainly superficial infections (13.3%) and bed sores (10%), while one intraoperative mortality (3.3%) was reported. No patient required revision surgery, and limb shortening was generally less than 2 cm.

Conclusion: Cemented bipolar hemiarthroplasty provides satisfactory functional outcomes, early ambulation, and effective rehabilitation in elderly patients with AO Type II and Type III peritrochanteric fractures. The procedure demonstrated low re-surgery rates, acceptable complication rates, and favorable postoperative recovery, making it a reliable treatment option for unstable osteoporotic peritrochanteric fractures. Larger randomized controlled trials are recommended to further validate these findings.

Keywords: Peritrochanteric Fracture, Cemented Bipolar Hemiarthroplasty, Elderly, Osteoporosis, Modified Harris Hip Score, Ao Type Ii, Ao Type Iii, Functional Outcome.

INTRODUCTION

Femoral neck fractures are among the most common injuries in the elderly and are associated with substantial postoperative morbidity and mortality.^[1] These fractures commonly result from low-energy falls in older adults with osteoporosis, whereas younger individuals usually sustain them following high-energy trauma such as road traffic accidents or falls from height.^[2] Trochanteric and peritrochanteric fractures, involving the extracapsular region of the proximal femur, are also frequently encountered in the elderly and are often associated with osteoporotic bone.^[3,4] Despite advances in surgical techniques, unstable comminuted intertrochanteric fractures continue to present a significant challenge because they require stable fixation and early rehabilitation while minimizing implant-related complications such as cut-out, excessive collapse, implant failure, and Z-effect phenomena.^[5,6]

The primary goal in managing femoral neck fractures in elderly patients is to restore pre-fracture mobility, facilitate early ambulation, and improve quality of life while reducing complications and mortality.^[7] Internal fixation techniques, including dynamic hip screw and proximal femoral nail, have shown high failure rates due to nonunion, avascular necrosis, and the need for revision surgery, particularly in displaced intracapsular fractures.^[8] Consequently, hemiarthroplasty has become the preferred treatment for displaced femoral neck fractures in the elderly because it provides better functional outcomes, fewer reoperations, and allows early mobilization.^[7]

Hemiarthroplasty may be performed using unipolar or bipolar prostheses and with either cemented or uncemented femoral stems.^[7] Cemented stems generally provide superior initial fixation, less postoperative thigh pain, and lower rates of prosthetic loosening and periprosthetic fractures.^[7] However, cement use may increase the risk of bone cement implantation syndrome, cardiopulmonary complications, and perioperative mortality.^[8] In contrast, uncemented hemiarthroplasty offers shorter operative time, reduced intraoperative blood loss, and avoids cement-related complications but has been associated with higher rates of prosthetic loosening, stress shielding, thigh pain, and periprosthetic fractures.^[7]

Despite numerous comparative studies, the optimal choice between cemented and uncemented hemiarthroplasty remains controversial. Therefore, further evaluation of their functional outcomes, complications, and survivorship is essential to guide the management of displaced femoral neck fractures in the elderly.^[7]

Aims and Objectives

The aim of this study was to evaluate the clinical outcomes of cemented bipolar hemiarthroplasty in elderly osteoporotic patients with Type II and Type III peritrochanteric fractures of the femur. The objectives were to assess the functional and clinical outcomes following the procedure, determine the rate of re-surgery, evaluate mortality within one year of sustaining the fracture, and measure postoperative limb length discrepancy to determine the effectiveness and safety of cemented bipolar hemiarthroplasty in the management of these fractures.

MATERIALS AND METHODS

Study Design

The present study was a prospective longitudinal study conducted in the Department of Orthopaedics, JSS Academy of Higher Education and Research, Mysuru, Karnataka, over a period of 18 months (November 2019 to May 2021). A total of 30 elderly patients aged more than 65 years with Type II or Type III peritrochanteric fractures were enrolled using a convenient sampling technique and were followed prospectively to evaluate the clinical outcomes of cemented bipolar hemiarthroplasty.

Inclusion and Exclusion Criteria

The study included elderly patients aged more than 65 years with AO Type II or Type III peritrochanteric fractures of the femur who were willing to participate and presented within three weeks of injury. Patients were excluded if they had a history of rheumatoid arthritis or other arthropathies, were non-ambulatory prior to the injury, had associated systemic illnesses or injuries that could interfere with postoperative rehabilitation, were unfit for anaesthesia, had suspected pathological fractures, or had cognitive impairment as assessed by the MMSE (Mini-Mental State Examination).

Sample Size Calculation

According to previous literature, an estimated proportion of fair to excellent results/

functional outcomes among the study subjects who underwent bipolar hemiarthroplasty was reported to be 94.44~94.0%. (37) With 95% confidence interval and absolute precision (d) of 10%, sample size of 22 was calculated using the formula $n = z^2(pq/d^2)$, where $z = 1.96$ at a 95% confidence interval, $p = 94.0\%$ (estimated proportion of fair to excellent outcome), $q = 100 - p$ (6.0%) and $d =$ absolute precision (10%). Considering 10% of 22 as lost to follow-up, i.e. $2.2 \approx 3$, a total sample size of 25 was estimated and was rounded off to 30.

Data Collection Tool

Data were collected after obtaining written informed consent using a semi-structured questionnaire (printed format or Google Form). The questionnaire included socio-demographic details, medical history, mechanism and duration of injury, side of fracture, comorbidities, clinical examination findings, and relevant investigation results. Functional assessment was performed using the Modified Harris Hip Score, and fractures were classified according to the AO/OTA classification based on standardized anteroposterior and lateral radiographs. Routine laboratory investigations, including a complete haemogram, bleeding and clotting time, and pre-anaesthetic evaluation, were also recorded.

Data Collection Procedure

Eligible patients underwent detailed clinical and radiological evaluation before surgery. All patients received standard preoperative care, including antibiotic prophylaxis, thromboprophylaxis, and anaesthetic assessment. Cemented bipolar hemiarthroplasty was performed under spinal

anaesthesia by surgeons from the same orthopaedic unit using a standardized posterior approach with PMMA bone cement. Operative details, including blood loss and intraoperative findings, were documented. Postoperatively, patients received standardized rehabilitation with early mobilization and weight bearing as tolerated, along with routine wound care and clinical monitoring. Patients were followed up at 6 weeks, 3 months, 6 months, and 12 months, during which functional outcomes were assessed using the Modified Harris Hip Score, and radiological evaluation was performed to assess implant stability, loosening, and fracture healing.

Statistical Analysis

The collected data were entered into Microsoft Excel and analysed using SPSS version 18.0. Continuous variables, such as age, duration of hospitalization, and duration of ambulation, were expressed as mean $\pm$ standard deviation (SD), while categorical variables, including gender, comorbidities, side and mode of injury, complications, limb length discrepancy, range of hip movements, and functional outcomes, were presented as frequencies and percentages. Comparisons between fracture types (AO Type 31-A1 and Type 31-A2) were performed using the independent t-test for continuous variables and the chi-square test or Fisher's exact test for categorical variables, as appropriate. The association between good-to-excellent functional outcomes and variables such as age, gender, comorbidities, mode of injury, and side of injury was also assessed using the chi-square test or Fisher's exact test. A p-value < 0.05 was considered statistically significant.

RESULTS

Variable	Type II (N=19)	Type III (N=11)	Total (%)
Mean Age (In Years)	72.84 $\pm$ 7.00	74.36 $\pm$ 10.45	73.40 $\pm$ 8.29
≤ 70 Years	10 (52.6)	4 (36.4)	14 (46.7)
71–80 Years	6 (31.6)	4 (36.4)	10 (33.3)
≥ 80 Years	3 (15.8)	3 (27.3)	6 (20.0)
Male	7 (36.8)	4 (36.4)	11 (36.7)
Female	12 (63.2)	7 (63.6)	19 (63.3)
Left Side	12 (63.2)	4 (36.4)	16 (53.3)
Right Side	7 (36.8)	7 (63.6)	14 (46.7)
Trauma	16 (84.2)	8 (72.7)	24 (80.0)
Fall	3 (15.8)	3 (27.3)	6 (20.0)

Table 1. Baseline Demographic and Clinical Characteristics of Study Participants (N = 30)

Table 1 illustrates the demographic profile and injury characteristics of the study population.

Females (63.3%) predominated, with a mean age of 73.4 years. Trauma was the

commonest mechanism of injury (80%) and (53.3%).
left-sided fractures were slightly more frequent

Variable	Frequency	Percentage
Any Comorbidity	17	56.7
No Comorbidity	13	43.3
Hypertension	14	46.7
Diabetes Mellitus	11	36.7
Old CVA	2	6.7
Obesity	1	3.3
Hypothyroidism	1	3.3
Parkinsonism	1	3.3
Table 2. Distribution of Comorbidities among Study Participants (N = 30)		
Multiple Comorbidities Were Present in Some Patients		

Table 2 shows that more than half of the patients had pre-existing medical illnesses. Hypertension was the most prevalent comorbidity, followed by diabetes mellitus.

Variable	Type II	Type III	P-Value
MHHS Score	86.00 ± 3.96	81.36 ± 5.77	0.016
Prosthesis Size (Cm)	45.00 ± 2.49	44.64 ± 2.50	0.70
Time To Ambulation (Days)	4.05 ± 1.51	4.20 ± 1.23	0.79
Hospital Stay (Days)	7.89 ± 3.12	8.10 ± 2.47	0.86
Table 3. Comparison of Operative Characteristics between Type II and Type III Fractures			

Table 3 demonstrates that only the Modified Harris Hip Score differed significantly between fracture groups, whereas prosthesis size, ambulation time, and duration of hospitalization were comparable.

Variable	Type II N (%)	Type III N (%)	P-Value
Preoperative Blood Transfusion	8 (42.1)	7 (63.6)	0.45
Postoperative Blood Transfusion	12 (63.2)	8 (72.7)	0.70
Any Complication	4 (21.1)	4 (36.4)	0.42
Table 4. Blood Transfusion Requirement and Postoperative Complications			

Table 4 presents perioperative transfusion requirements and complications. Although blood transfusion was more common in Type III fractures, no statistically significant differences were observed.

Variable	Frequency	Percentage
Limb Shortening (<2 Cm)	12	40.0
External Rotation (<20°)	5	16.7
Internal Rotation (<20°)	1	3.3
Limb Lengthening	0	0
Table 5. Postoperative Limb Parameters (n = 29)		

Table 5 illustrates postoperative limb alignment. Mild limb shortening was the commonest finding, while limb lengthening was not observed in any patient.

Functional Outcome	Frequency	Percentage
Excellent	2	6.9
Good	23	79.3
Fair	4	13.8
Poor	0	0
Table 6. Functional Outcome after Cemented Bipolar Hemiarthroplasty (N = 29)		

Table 6 shows that most patients achieved good to excellent functional outcomes (86.2%), with no patient demonstrating a poor result according to the Modified Harris Hip Score.

Outcome	Type II	Type III	P-Value
Excellent + Good	17 (89.5%)	8 (80.0%)	0.49
Fair	2 (10.5%)	2 (20.0%)	

Table 7. Functional Outcome According to Fracture Type

Table 7 compares functional outcomes between fracture types. Although Type II fractures showed a higher proportion of good-

to-excellent outcomes, the difference was not statistically significant.

Variable	Good/Excellent (%)	Fair (%)	P-Value
Age ≤ 75 Years	88.9	11.1	0.62
Male Gender	81.8	18.2	0.62
Right-Sided Injury	100	0	0.11
Trauma	87.0	13.0	1.00
Type II Fracture	89.5	10.5	0.59
No Comorbidity	92.3	7.7	0.61

Table 8. Association of Functional Outcome with Clinical Variables (N = 29)

Table 8 demonstrates the association between functional outcome and potential prognostic factors. None of the evaluated variables showed a statistically significant association with postoperative functional outcome.

DISCUSSION

The present prospective study demonstrated favourable clinical and functional outcomes following cemented bipolar hemiarthroplasty in AO Type II and Type III peritrochanteric fractures, with the majority of patients achieving good to excellent functional recovery. The available literature similarly supports hemiarthroplasty as a reliable treatment option for unstable osteoporotic intertrochanteric fractures, particularly in elderly patients requiring rapid restoration of mobility.

The mean age of patients in the present study was 73.40 ± 8.29 years, with females accounting for 63.3% of the study population. These findings are consistent with the established epidemiology of osteoporotic hip fractures, where advanced age and female sex remain the principal risk factors. Sancheti et al. reported a mean age of 77.1 years, with females constituting nearly three-fourths of their study population undergoing primary hemiarthroplasty for unstable osteoporotic intertrochanteric fractures.^[9] Likewise, Choy et al. observed a mean patient age of 78.8 years, whereas Kumar et al. reported similar demographic characteristics in their prospective evaluation of bipolar hemiarthroplasty in unstable intertrochanteric fractures.^[10,11] These observations reinforce

that unstable peritrochanteric fractures predominantly affect elderly osteoporotic women because of progressive reduction in bone mineral density and increased susceptibility to low-energy trauma.

Although trauma constituted the most frequent mode of injury (80%) in the present study, the majority of elderly patients sustained fractures following relatively low-energy mechanisms. Similar observations have been reported in previous series where trivial domestic falls represented the predominant mechanism of injury in elderly osteoporotic patients.^[9-11] The increasing prevalence of osteoporosis together with impaired balance, reduced muscle strength and multiple medical illnesses contributes substantially to the occurrence of these fractures. These findings emphasize that the biological quality of bone rather than the magnitude of trauma remains the principal determinant of fracture occurrence in the geriatric population.

More than half of the patients (56.7%) in the present study had associated systemic comorbidities, with hypertension (46.7%) and diabetes mellitus (36.7%) being the most common. Similar patterns have been consistently reported in previous investigations evaluating hemiarthroplasty in elderly patients. Sancheti et al., noted that most patients presented with one or more chronic medical illnesses requiring careful perioperative optimization before surgery.^[9] A systematic review comparing cemented and cementless bipolar hemiarthroplasty also demonstrated that cardiovascular disease, diabetes and other age-related illnesses were highly prevalent

among patients undergoing surgery for unstable intertrochanteric fractures.^[12] The high burden of comorbidities further supports selecting a surgical procedure that minimizes prolonged immobilization and enables early functional recovery.

An important observation in the present study was the relatively higher requirement for blood transfusion among patients with Type III fractures, although the difference was not statistically significant. Greater fracture comminution and technically demanding reconstruction probably contributed to increased perioperative blood loss in these patients. Similar findings have been reported by Abdelkhalek et al., who observed increased operative complexity in unstable fracture patterns despite satisfactory postoperative functional recovery.^[13] Likewise, comparative studies evaluating cemented and cementless hemiarthroplasty have reported slightly greater operative time and blood loss with cemented stems, although these differences were generally outweighed by superior implant stability and earlier mobilization.^[12,14] Therefore, increased blood transfusion requirements should not preclude the use of cemented bipolar hemiarthroplasty when adequate perioperative optimization is achieved.

Postoperative complications remain an important determinant of outcome following hip fracture surgery. In the present study, only 13.3% of patients developed superficial surgical site infection, 10% developed pressure sores, and there was one intraoperative mortality (3.3%). No cases of prosthetic loosening, dislocation or revision surgery were encountered during follow-up. These findings compare favourably with previously published studies. Sancheti et al., reported only isolated cases of superficial infection and pressure sores with no implant-related failures requiring revision surgery.^[9] Similarly, Grimsrud et al., demonstrated that cemented bipolar hemiarthroplasty using cerclage fixation resulted in excellent implant stability with only occasional complications such as deep infection or dislocation.^[15] More recently, systematic reviews have concluded that complication rates following cemented bipolar hemiarthroplasty remain acceptable and are comparable with those observed after cementless procedures.^[12] Collectively, these observations indicate that cemented bipolar hemiarthroplasty is a safe procedure with

predictable postoperative outcomes in carefully selected elderly patients.

The principal objective of treatment in elderly patients is restoration of painless mobility and functional independence. In the present study, the mean Modified Harris Hip Score was significantly higher in Type II fractures (86.00 ± 3.96) than in Type III fractures (81.36 ± 5.77 , $p=0.016$). Nevertheless, 86.2% of all patients achieved good or excellent functional outcomes, while no patient demonstrated a poor result. These findings are highly comparable with those reported by Sancheti et al., who documented a mean Harris Hip Score of 84.8 with satisfactory functional outcomes in over 90% of patients.^[9] Choy et al., reported a mean Harris Hip Score of 80.6, whereas Abdelkhalek et al., observed a mean score of approximately 83, further supporting the ability of bipolar hemiarthroplasty to provide durable pain relief and satisfactory hip function following unstable intertrochanteric fractures.^[10,13] A recent systematic review also concluded that cemented bipolar hemiarthroplasty consistently achieves favourable functional outcomes with acceptable complication rates in elderly osteoporotic patients.^[12]

Restoration of limb length and hip biomechanics is an important determinant of postoperative gait and functional recovery. In the present study, 40% of patients demonstrated limb shortening of less than 2 cm, while only 16.7% and 3.3% had mild external and internal rotational deformities, respectively. None of these parameters showed a significant association with fracture type. These findings indicate that careful reconstruction of the proximal femur combined with appropriate prosthesis selection can minimize clinically significant limb length discrepancy. Similar observations were reported by Rodop et al., who found only minimal postoperative limb shortening that had little influence on final functional outcome following bipolar hemiarthroplasty for unstable intertrochanteric fractures.^[16] Likewise, Sinno et al. reported satisfactory restoration of limb alignment with acceptable radiological outcomes and favourable Harris Hip Scores in elderly patients treated with primary bipolar hemiarthroplasty.^[12] Collectively, these studies suggest that minor limb length discrepancies rarely compromise postoperative function when stable prosthetic reconstruction is achieved.

One of the major advantages observed in the present study was early postoperative ambulation. The mean time to ambulation was 4.05 days in Type II fractures and 4.20 days in Type III fractures, with no statistically significant difference between the groups. Early mobilization is a major objective in the management of elderly patients because prolonged recumbency substantially increases the risk of pulmonary complications, pressure sores, venous thromboembolism and muscle wasting. Sancheti et al. reported ambulation at a mean of 3.2 days, whereas Choy et al. demonstrated that bipolar hemiarthroplasty permitted early full weight bearing with satisfactory functional recovery in elderly patients with unstable intertrochanteric fractures.^[9,10] A systematic review comparing cemented and cementless bipolar hemiarthroplasty similarly concluded that hemiarthroplasty consistently facilitates earlier rehabilitation than conventional internal fixation, particularly in severely osteoporotic fractures.

The mean duration of hospitalization in the present study was approximately 8 days, which is comparable to previously published reports. A shorter hospital stay reflects rapid functional recovery, fewer postoperative complications and early achievement of independent ambulation. Sinno et al. reported a mean hospital stay of approximately 6 days, while Sancheti et al. demonstrated satisfactory discharge following early rehabilitation protocols without increasing complication rates.^[9,12] Although duration of hospitalization may vary depending on institutional rehabilitation practices and associated medical illnesses, the present findings further support the role of cemented bipolar hemiarthroplasty in facilitating early recovery among elderly patients.

Only one intraoperative mortality (3.3%) was observed in the present study, with no additional mortality during the follow-up period. Bone cement implantation syndrome remains a recognized concern during cemented arthroplasty, particularly in frail elderly patients with significant cardiopulmonary disease. Nevertheless, contemporary evidence suggests that when meticulous anaesthetic monitoring and modern cementing techniques are employed, cemented hemiarthroplasty can be performed safely with acceptable perioperative mortality. Comparative analyses have shown that although cemented procedures may be

associated with slightly longer operative time and greater blood loss, they provide superior implant stability, reduced postoperative thigh pain and improved early functional recovery compared with cementless stems.^[12] Therefore, careful patient selection and multidisciplinary perioperative care remain essential to optimize surgical outcomes.

An important observation in the present study was that demographic variables such as age, sex, side of injury, mode of injury and presence of comorbidities were not significantly associated with functional outcome. Instead, favourable results appeared to depend primarily on stable prosthetic reconstruction, early mobilization and standardized postoperative rehabilitation. Similar conclusions have been drawn by Kayali et al., who compared hemiarthroplasty with internal fixation and demonstrated superior early functional recovery with arthroplasty despite comparable baseline patient characteristics.^[17] Likewise, Fan et al. reported that arthroplasty enables rapid restoration of function and reduces complications associated with prolonged immobilization in elderly osteoporotic patients with unstable intertrochanteric fractures.^[18]

The findings of the present study demonstrate that cemented bipolar hemiarthroplasty provides reliable pain relief, early postoperative mobilization and satisfactory functional recovery in elderly patients with AO Type II and Type III peritrochanteric fractures. The significantly higher Modified Harris Hip Scores observed in Type II fractures probably reflect the relatively less complex fracture morphology; however, both fracture groups achieved predominantly good to excellent outcomes. The low incidence of postoperative complications, absence of revision surgery and acceptable mortality further support the effectiveness of this procedure. These observations are consistent with contemporary literature, which increasingly recognizes bipolar hemiarthroplasty as an effective alternative to internal fixation for unstable osteoporotic intertrochanteric fractures, particularly in elderly patients requiring immediate weight bearing and rapid rehabilitation.

Limitations

The present study has certain limitations that should be acknowledged. Bone mineral density was not assessed using osteodensitometry (DEXA) scans, and patients were classified as osteopenic based solely on standard

radiographic findings, which may have limited the accuracy of osteoporosis assessment. Additionally, the study was conducted with a relatively small sample size and a short follow-up period, which may limit the generalizability of the findings and the evaluation of long-term clinical and functional outcomes.

CONCLUSION

The present study concludes that peritrochanteric fractures of the femur predominantly occurred in patients aged 70 years and above, with a higher incidence among females. The left femur was more commonly affected, and trauma was the leading mode of injury, while hypertension was the most frequently observed comorbidity. None of the patients experienced postoperative limb lengthening, and the majority achieved excellent functional outcomes. Overall, cemented bipolar hemiarthroplasty proved to be an effective treatment modality for elderly osteoporotic patients with peritrochanteric fractures, providing early painless mobilization, facilitating rehabilitation, enabling an early return to daily activities, and demonstrating promising short-term clinical and functional results.

Author Contributions

Dr. K. Jeevan Ravi (First author) contributed to the conceptualization of the study, investigation, case management, supervision, and critical review and editing of the manuscript. Dr. Prakash M. (Second author) was responsible for data collection and patient management. Dr. Sujana Theja J.S. (Third author) contributed to the literature review and provided supervision throughout the study. Dr. Purushotham Sastry (Fourth author) oversaw project administration and prepared the original draft of the manuscript. All authors reviewed the manuscript, approved the final version, and agree to be accountable for all aspects of the work.

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