

# Uncemented bipolar hemiarthroplasty with trochanteric clip and cable stabilisation as primary treatment for unstable intertrochanteric fractures in elderly patients with major comorbidities

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## Research Article

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# Abstract

## Purpose

Intertrochanteric hip fractures are common among the elderly and frequently require surgical intervention, because non-surgical treatment carries substantial morbidity. Unstable patterns are difficult to treat and have a high failure rate. This study evaluates the effectiveness of uncemented bipolar hemiarthroplasty for unstable intertrochanteric fractures in elderly patients with significant comorbidities.

## Methods

We analysed the medical records of patients who underwent bipolar hemiarthroplasty for unstable intertrochanteric fractures between June 2015 and June 2022. Patients with complete records were included. Analysis used IBM SPSS Statistics version 27, and clinical evaluation used the Harris Hip Score.

## Results

Forty-six patients met the inclusion criteria (mean age  $67.86 \pm 3.32$  years; 34.8% male, 65.2% female). Mean injury duration and discharge time were  $3.80 \pm 1.42$  and  $3.26 \pm 0.57$  days, respectively. Uncontrolled diabetes mellitus (37%) and ischaemic heart disease (26.1%) were the commonest comorbidities. Mean Harris Hip Score was  $67.75 \pm 10.48$  at six weeks,  $81.12 \pm 4.51$  at 12 weeks, and  $85.28 \pm 3.25$  at six months. At six months, 15.2% had a fair, 78.3% a good, and 6.5% an excellent outcome, giving a success rate of 84.78%.

## Conclusion

Bipolar hemiarthroplasty may be a viable primary treatment for unstable intertrochanteric fractures in elderly patients with significant medical conditions, allowing early full weight-bearing mobilisation immediately after surgery.

## INTRODUCTION

Hip fractures are becoming increasingly common, particularly in the elderly worldwide, and usually require surgical treatment [1]. The unstable variety of intertrochanteric fractures is difficult to treat surgically despite the availability of multiple implant options [1–4]. Unstable intertrochanteric fractures are frequently observed in elderly patients who have osteoporotic bone and multiple comorbidities [4]. Non-surgical treatment leads to numerous complications and morbidities, whereas surgical failure in the elderly is also notable [1–4]. Osteosynthesis is an effective option for stable intertrochanteric fractures

and can produce favourable outcomes with minimal difficulty. However, osteoporosis combined with an unstable fracture pattern carries a high rate of non-union, malunion, and implant failure [5, 6]. When the primary aim of fixation is not achieved, full weight-bearing mobilisation is delayed, and complications tend to develop rapidly.

To prevent complications such as pulmonary embolism, deep venous thrombosis, and pressure sores in elderly patients with hip fractures and comorbidities, early mobilisation is necessary. Delaying mobilisation can worsen their condition and increase the likelihood of further complications, so prompt mobilisation should be prioritised in the management plan. The primary aim of fixation of intertrochanteric fractures has always been to allow mobilisation as early as possible while permitting weight-bearing. However, when bone quality or the fracture pattern does not permit mobilisation and weight-bearing, fixation loses its importance. As previously reported, hemiarthroplasty and total hip arthroplasty are also relevant in the management of these fractures [4–10]. Previous studies have compared conventional treatment with cemented and uncemented hemiarthroplasty for unstable intertrochanteric fractures; however, this aspect needs further attention in elderly and morbid patients [11, 12].

This study assesses the efficacy of uncemented bipolar hemiarthroplasty and the use of a trochanteric clip and cable for stabilising trochanteric fragments as the primary treatment for elderly patients with significant comorbidities.

## **MATERIALS AND METHODS**

This study was conducted in the Department of Orthopaedics at the host institution [name blinded for peer review]. It included patients who underwent bipolar hemiarthroplasty for unstable intertrochanteric fractures between June 2015 and June 2022. The study received ethical approval from the institutional ethics committee, and data were collected from medical records and analysed. Patients with open intertrochanteric fractures, multiple injuries, age below 60 years, or those considered unfit for surgery were excluded. Preoperative data collected included age, sex, comorbidities, fracture type, and mode of injury. Postoperative data included time to full weight-bearing, average length of hospital stay, and the Harris Hip Score measured at six weeks, three months, and six months. Radiographs were obtained on the first postoperative day and at six weeks, three months, and six months, and complications were recorded. Functional outcome was measured with the Harris Hip Score.

All surgeries were performed by the same surgeon, usually within twenty-four to forty-eight hours of admission after optimisation. Data were recorded in a pre-designed questionnaire. Patients with incomplete data or who were lost to follow-up were excluded.

Data analysis was performed using IBM SPSS Statistics version 27. Mean and standard deviation were calculated for quantitative variables, and frequency and percentage for qualitative variables. Stratification was applied, and the post-stratification Fisher's exact test was used. Univariate binary logistic regression was used to calculate odds, and a p-value  $\leq 0.05$  was considered significant.

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments. Ethical approval was obtained from the institutional ethics committee.

## RESULTS

A total of 46 patients who underwent bipolar hemiarthroplasty using this method for unstable intertrochanteric fractures were included. There were 34.8% male and 65.2% female patients, with a mean age of  $67.86 \pm 3.32$  years. The overall mean injury duration and discharge time were  $3.80 \pm 1.42$  days and  $3.26 \pm 0.57$  days, respectively. Chronic renal failure was present in 15.2%, ischaemic heart disease in 26.1%, obesity in 8.7%, diabetes mellitus in 37%, and asthma in 17.4%. Mean Harris Hip Score at six weeks, 12 weeks, and six months was  $67.75 \pm 10.48$ ,  $81.12 \pm 4.51$ , and  $85.28 \pm 3.25$ , respectively, with a significant increase over time ( $p < 0.0001$ ).

At six months, 15.2% of patients had a fair, 78.3% a good, and 6.5% an excellent outcome by Harris Hip Score. Patients with a good or excellent outcome were considered to have a successful outcome, which was 84.78% in our study. Detailed characteristics of the study population are presented in Table 1.

We found no significant association of successful outcome with gender ( $p = 0.394$ ), age ( $p = 0.160$ ), injury duration ( $p = 0.106$ ), side ( $p = 0.682$ ), chronic renal failure ( $p = 1.000$ ), ischaemic heart disease ( $p = 0.064$ ), obesity ( $p = 0.496$ ), diabetes mellitus ( $p = 1.000$ ) or asthma ( $p = 1.000$ ), as presented in Table 2.

By univariate logistic regression, male patients were more likely to have a successful outcome than female patients ( $OR = 3.750$ ,  $p = 0.242$ ). Patients aged  $\leq 70$  years were also more likely to have a successful outcome than those aged  $> 70$  years. Detailed odds are presented in Table 3.

**Table 1** Characteristics of the study population

| <b>Variable</b>                             | <b>Subgroup</b> | <b>n (%) / Mean <math>\pm</math> SD</b> |
|---------------------------------------------|-----------------|-----------------------------------------|
| <b>Gender</b>                               | Male            | 16 (34.8)                               |
|                                             | Female          | 30 (65.2)                               |
| <b>Age (years)</b>                          | Mean $\pm$ SD   | 67.86 $\pm$ 3.32                        |
|                                             | $\leq$ 70 years | 41 (89.1)                               |
|                                             | > 70 years      | 5 (10.9)                                |
| <b>Injury duration (days)</b>               | Mean $\pm$ SD   | 3.80 $\pm$ 1.42                         |
|                                             | $\leq$ 3 days   | 21 (45.7)                               |
|                                             | > 3 days        | 25 (54.3)                               |
| <b>Discharge time (days)</b>                | Mean $\pm$ SD   | 3.26 $\pm$ 0.57                         |
|                                             | 3 days          | 37 (80.4)                               |
|                                             | 4 days          | 6 (13.0)                                |
|                                             | 5 days          | 3 (6.5)                                 |
| <b>Side</b>                                 | Right           | 27 (58.7)                               |
|                                             | Left            | 19 (41.3)                               |
| <b>Chronic renal failure</b>                | Yes             | 7 (15.2)                                |
|                                             | No              | 39 (84.8)                               |
| <b>Ischaemic heart disease</b>              | Yes             | 12 (26.1)                               |
|                                             | No              | 34 (73.9)                               |
| <b>Obesity</b>                              | Yes             | 4 (8.7)                                 |
|                                             | No              | 42 (91.3)                               |
| <b>Uncontrolled diabetes mellitus</b>       | Yes             | 17 (37.0)                               |
|                                             | No              | 29 (63.0)                               |
| <b>Asthma</b>                               | Yes             | 8 (17.4)                                |
|                                             | No              | 38 (82.6)                               |
| <b>Harris Hip Score (6 weeks)</b>           | Mean $\pm$ SD   | 67.75 $\pm$ 10.48                       |
| <b>Harris Hip Score (12 weeks)</b>          | Mean $\pm$ SD   | 81.12 $\pm$ 4.51                        |
| <b>Harris Hip Score (6 months)</b>          | Mean $\pm$ SD   | 85.28 $\pm$ 3.25                        |
| <b>Outcome (Harris Hip Score, 6 months)</b> | Fair            | 7 (15.2)                                |

| Variable | Subgroup  | n (%) / Mean $\pm$ SD |
|----------|-----------|-----------------------|
|          | Good      | 36 (78.3)             |
|          | Excellent | 3 (6.5)               |

SD standard deviation

**Table 2** Association of successful outcome with demographic and risk factors

| Variable                              | Subgroup        | Successful – Yes, n (%) | Successful – No, n (%) | p-value |
|---------------------------------------|-----------------|-------------------------|------------------------|---------|
| <b>Gender</b>                         | Male            | 15 (38.5)               | 1 (14.3)               | 0.394   |
|                                       | Female          | 24 (61.5)               | 6 (85.7)               |         |
| <b>Age</b>                            | $\leq 70$ years | 36 (92.3)               | 5 (71.4)               | 0.160   |
|                                       | $> 70$ years    | 3 (7.7)                 | 2 (28.6)               |         |
| <b>Injury duration</b>                | $\leq 3$ days   | 20 (51.3)               | 1 (14.3)               | 0.106   |
|                                       | $> 3$ days      | 19 (48.7)               | 6 (85.7)               |         |
| <b>Side</b>                           | Right           | 22 (56.4)               | 5 (71.4)               | 0.682   |
|                                       | Left            | 17 (43.6)               | 2 (28.6)               |         |
| <b>Chronic renal failure</b>          | Yes             | 6 (15.4)                | 1 (14.3)               | 1.000   |
|                                       | No              | 33 (84.6)               | 6 (85.7)               |         |
| <b>Ischaemic heart disease</b>        | Yes             | 8 (20.5)                | 4 (57.1)               | 0.064   |
|                                       | No              | 31 (79.5)               | 3 (42.9)               |         |
| <b>Obesity</b>                        | Yes             | 3 (7.7)                 | 1 (14.3)               | 0.496   |
|                                       | No              | 36 (92.3)               | 6 (85.7)               |         |
| <b>Uncontrolled diabetes mellitus</b> | Yes             | 15 (38.5)               | 2 (28.6)               | 1.000   |
|                                       | No              | 24 (61.5)               | 5 (71.4)               |         |
| <b>Asthma</b>                         | Yes             | 7 (17.9)                | 1 (14.3)               | 1.000   |
|                                       | No              | 32 (82.1)               | 6 (85.7)               |         |

Fisher's exact test;  $p < 0.05$  considered significant

**Table 3** Odds ratios for a successful outcome (univariate binary logistic regression)

| Variable                              | Subgroup    | p-value | Odds ratio (95% CI)  |
|---------------------------------------|-------------|---------|----------------------|
| <b>Gender</b>                         | Male        | 0.242   | 3.750 (0.410–34.290) |
|                                       | Female®     |         | 1                    |
| <b>Age</b>                            | ≤ 70 years  | 0.128   | 4.800 (0.637–36.146) |
|                                       | > 70 years® |         | 1                    |
| <b>Injury duration</b>                | ≤ 3 days    | 0.102   | 6.316 (0.694–57.467) |
|                                       | > 3 days®   |         | 1                    |
| <b>Side</b>                           | Right       | 0.463   | 0.518 (0.089–3.002)  |
|                                       | Left®       |         | 1                    |
| <b>Chronic renal failure</b>          | Yes         | 0.941   | 1.091 (0.111–10.759) |
|                                       | No®         |         | 1                    |
| <b>Ischaemic heart disease</b>        | Yes         | 0.056   | 0.194 (0.036–1.045)  |
|                                       | No®         |         | 1                    |
| <b>Obesity</b>                        | Yes         | 0.575   | 0.500 (0.044–5.637)  |
|                                       | No®         |         | 1                    |
| <b>Uncontrolled diabetes mellitus</b> | Yes         | 0.620   | 1.562 (0.268–9.101)  |
|                                       | No®         |         | 1                    |
| <b>Asthma</b>                         | Yes         | 0.814   | 1.312 (0.136–12.698) |
|                                       | No®         |         | 1                    |

® reference group; CI confidence interval;  $p < 0.05$  considered significant

## DISCUSSION

Hip fractures have a major impact on both morbidity and mortality worldwide [13]. Good surgical outcomes are essential for elderly patients; however, osteoporosis and the inherent instability of these fractures are the main contributors to poor outcomes. Beyond quality of life, morbidity and mortality depend heavily on early mobilisation of the elderly patient after hip surgery. Patients with unstable intertrochanteric fractures are at high risk of complications, including non-union, malunion, and implant failure [14]. Although surgical options such as the dynamic hip screw and intramedullary devices are available [15], a significant number of patients present with implant failure and non-union with either implant [16]. Such complications are difficult to manage, and the general health status of patients with

multiple comorbidities such as hypertension, diabetes, and ischaemic heart disease is a major problem, as these patients cannot tolerate multiple surgeries if the primary procedure fails [17].

To address these issues, many surgeons consider hemiarthroplasty or total hip arthroplasty to minimise complications in elderly patients with unstable fracture patterns and poor bone quality. Previous research has shown favourable results for primary hemiarthroplasty or total hip arthroplasty in intertrochanteric fractures among older populations. Stern et al. [18] reported considerable outcomes at eight months postoperatively in 94% of their patients. Haentjens et al. [19] compared internal fixation and bipolar arthroplasty for intertrochanteric fractures and reported good outcomes in three-quarters of their cases, with fewer postoperative problems after hemiarthroplasty. Gierer et al. [20] used an uncemented prosthesis for intertrochanteric fracture replacement, observed sufficient osseointegration, and concluded that an uncemented prosthesis can be used effectively for inherently unstable intertrochanteric fractures. All of these studies [18–20] showed a positive impact on full weight-bearing time with arthroplasty in this older age group. Some authors who compared total hip arthroplasty with hemiarthroplasty found that, although total hip replacement gives better pain relief, bipolar hemiarthroplasty is a better option in terms of stability and a lower dislocation rate [21].

We focused only on elderly and very sick patients with multiple anaesthetic risk factors and a high risk of complications related to prolonged immobilisation. In our study, bipolar hip arthroplasty appeared to be a better option for achieving good functional outcomes than would be expected with internal fixation, as shown by our results. Outcomes improved progressively within the first three months. Although we did not assess patient satisfaction, the majority of patients showed good functional outcomes despite their advanced age.

## CONCLUSION

Patients with unstable intertrochanteric fractures and poor bone quality or major coexisting medical conditions may benefit from bipolar hemiarthroplasty as a treatment option. This procedure allows quicker rehabilitation with minimal risk of mechanical failure. We recommend the use of uncemented bipolar hemiarthroplasty in the unstable variety of intertrochanteric fractures, especially in patients with comorbidities, and further large-scale comparative studies with internal fixation.

## Declarations

Participant Consent Statement: Informed consent was obtained from all individual participants included in the study.

## Author Contribution

MIJ, MSBAA, BPL, and HI contributed to the study conceptualization and study design. AZ, NHK, DH, and AN were responsible for primary data acquisition, patient follow-up, and clinical investigation. MIJ, AZ,

DH, and MSBAA conducted the formal data analysis and interpretation of the clinical results. BPL, HI, NHK, and AN drafted the original manuscript. All authors participated in the critical revision of the manuscript. Furthermore, all authors read and approved the final version of the manuscript for submission

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