TRAUMA

Unstable intertrochanteric fracture in elderly patients: outcome of primary cemented bipolar hemiarthroplasty versus internal fixation

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Abstract

Background: The aim of this study was to evaluate the outcome of internal fixation in comparison with primary cemented bipolar (PCB) hemiarthroplasty in elderly patients with unstable intertrochanteric fracture.

Methods: A prospective cohort multicentre study compared cemented bipolar (n=60) to osteosynthesis (n=57) in unstable intertrochanteric fracture (AO/OTA classification) in the elderly. Peri-operative mortality, complications and functional outcome were used as main outcome measures.

Results: The two groups were comparable in age, sex, comorbidity, mode of trauma, and classification of fracture. In hemiarthroplasty, 93.3% of patients were able to start partial weight bearing on post-operative day 1, while in the internal fixation group, 75.4% of patients started partial weight bearing after two weeks post-operatively. At the final follow-up, one year after surgery, the mortality rate did not differ between the two groups, but general and mechanical complications were more common in the internal fixation group. The mean Harris Hip Score at final follow-up was better in the hemiarthroplasty group (91.14 vs 74.33).

Conclusion: Primary cemented bipolar hemiarthroplasty was superior to internal fixation in terms of lower complication rates and better functional outcome.

Level of evidence: Level 4

Key words: unstable intertrochanteric fracture, osteosynthesis, hemiarthroplasty, internal fixation

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Introduction

The intertrochanteric fracture is one of the most common fractures of the hip in the elderly, and usually is a result of low-energy trauma;[1] it accounts for up to 48% of all hip fractures.[2] These fractures are associated with substantial morbidity and mortality, mechanical complications, and great financial burden to patients and their families.[3,4] Stable fractures can be easily treated with osteosynthesis with predictable results. However, the management of unstable intertrochanteric (Evans type II and AO/OTA type 31-A2.2 and 2.3)[5,6] fractures in elderly patients is a challenge because of the difficulty in obtaining anatomical reduction and the increased rates of morbidity and mortality.

In the literature, a variety of methods have been used to manage intertrochanteric fractures; however, each method has its own limitations.[7,8] Hemiarthroplasty replacements have been shown to achieve early rehabilitation of the patient and good long-term results.[9-12] However, the ideal treatment method for intertrochanteric fractures is still unclear because of the poor quality of bone mass, comorbid disorders, and difficulty in rehabilitating patients.

The aim of this study was to compare the outcome of primary cemented bipolar (PCB) hemiarthroplasty with internal fixation in the management of comminuted intertrochanteric hip fractures in elderly patients.

Methods

This was a prospective cohort hospital-based study conducted at three main tertiary hospitals. The study was conducted over a period of two years (January 2014 to February 2016). A total of 117 patients were enrolled in the study, all 65 years of age and above, with unstable intertrochanteric fracture. Those with stable fractures, age less than 65 years and with pathological fractures were excluded from the study. The study patients were treated by orthopaedic surgeons with a minimum of three years' experience in hip trauma.

Fifty-seven patients were treated with internal fixation (dynamic hip screw and proximal femoral nail) and 60 patients were treated with PCB hemiarthroplasty; the method of treatment was selected according to hospital policy. Personal data, mode of trauma and comorbidity were reported using a structured questionnaire. Fractures were classified according to AO/OTA classification.[6] Details about intra-operative events (e.g. duration of surgery and blood loss) were reported. Partial weight bearing, hospital stay, full weight bearing, infection, and other complications were used as predictors of post-operative improvement and complications. All patients received pre-operative prophylactic antibiotics (1.5 mg of cefuroxime with induction of anaesthesia) and post-operative anticoagulant treatment (4 000 IU of low-molecular-weight heparin). All patients were seen at 2 weeks, 6 weeks, and 12 weeks post-operatively, and at the final follow-up, which was one-year post surgery in both groups. All patients were evaluated using the Harris Hip Score[13] at 3 months and at the final follow-up to assess functional outcomes. Peri-operative mortality, complications and functional outcome were used as main outcome measures.

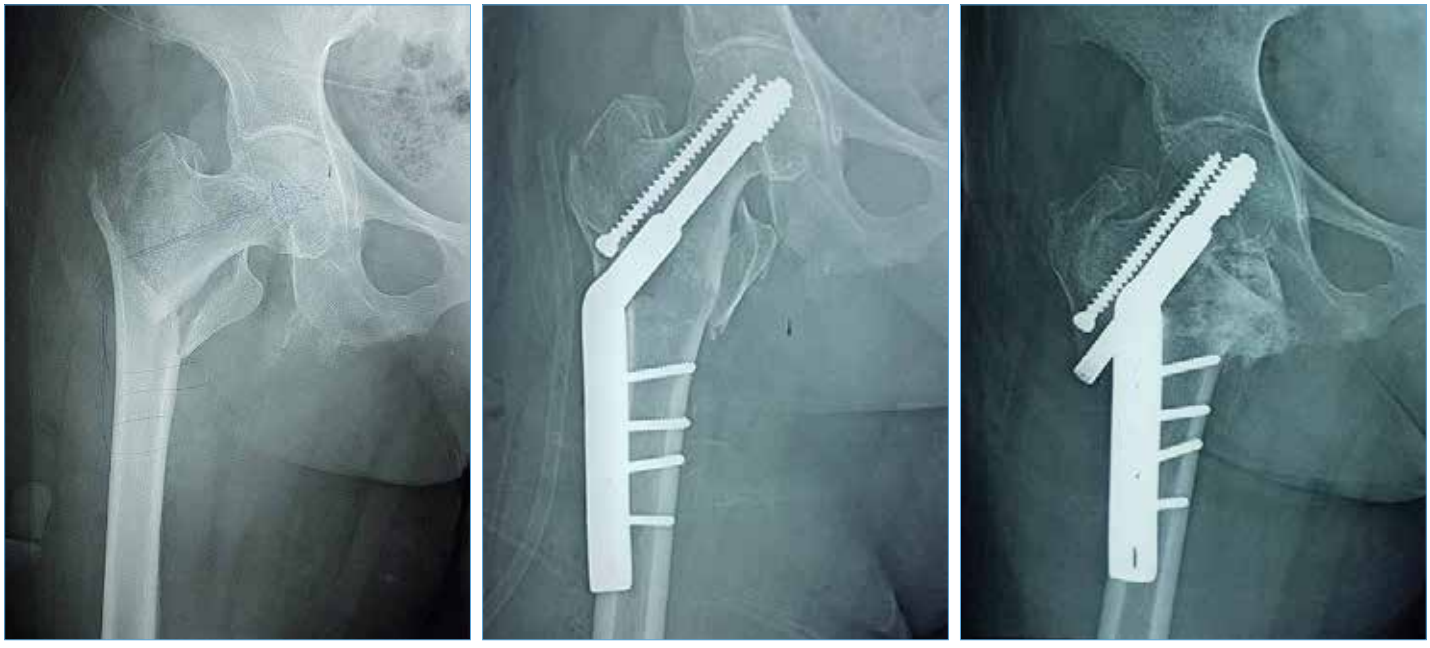
Surgical procedure

Dynamic hip screw (DHS)

On the traction table, through a direct lateral femoral approach with vastus lateralis reflection in the majority of cases (94.7%), the lag screw was applied after reduction, and its position checked with a C-arm. Tip apex distance (TAD) was taken into consideration and within accepted limits. Thereafter, a side plate was fixed to the femoral shaft with cortical screws. The device used was SH Pitkar Orthotools Pvt Ltd, Pimpri-Chinchwad, India (*Figure 1*).

Proximal femoral nail (PFN)

On the traction table, a minimal incision was made above the greater trochanter, under C-arm viewing, through the trochanteric entrance. Canal opening and serial reaming were performed and the size and length of the proximal femoral nail (PFN) was chosen. Intramedullary nailing (IMN) was introduced with two proximal lag screws through handle (jig), then two distal locking screws applied. The outcome was assessed with the C-arm. The device used was produced by MJ surgical, Ahmedabad, Gujarat, India (*Figure 2*).



(a) Pre-operative (b) Immediately post-operative (c) At 3-months follow-up

Figure 1. Anteroposterior radiographs of 73-year-old male showing unstable intertrochanteric fracture fixed with DHS

(a) Immediately post-operative (b) At 3-months follow-up (c) At 6-months follow-up

Figure 2. Anteroposterior radiographs of 69-year-old female showing unstable intertrochanteric fracture fixed with PFN

(a) Intra-operative image

(b) AP fluoroscopic radiograph

Figure 3. Unstable intertrochanteric fracture in elderly female treated with cemented bipolar hemiarthroplasty showing removed part of comminuted calcar, built up with cement and the greater and lesser trochanter reconstructed with cerclage wire

PCB hemiarthroplasty

All arthroplasties were performed through the lateral Hardinge approach in the decubitus position. The head and bony fragments were removed except for the greater trochanter. The greatly fragmented calcar was removed and remodelled with cement in three cases (*Figure 3*); the lesser trochanter was not removed. Thereafter, the greater trochanter was reattached with cerclage wire and a cemented bipolar prosthesis was applied. The implant used was the LINK SP II hip prosthesis produced by Waldemar Link- Hamburg, Germany (*Figure 4*).

Data analysis

The collected data were analysed with the Statistical Package for Social Sciences version 21 (IBM, Armonk, NY, USA). The level of significance was set as $p \leq 0.05$. Variables were analysed using the chi square and Fisher's exact tests.

Results

There were no significant differences between the two groups in terms of demographic data (age, sex), fracture type (classification), mode of trauma, comorbidities and mean follow-up duration (*Table I*). Allocation of patients to either of the two groups depended on the protocol used in the hospital where the treatment was performed.

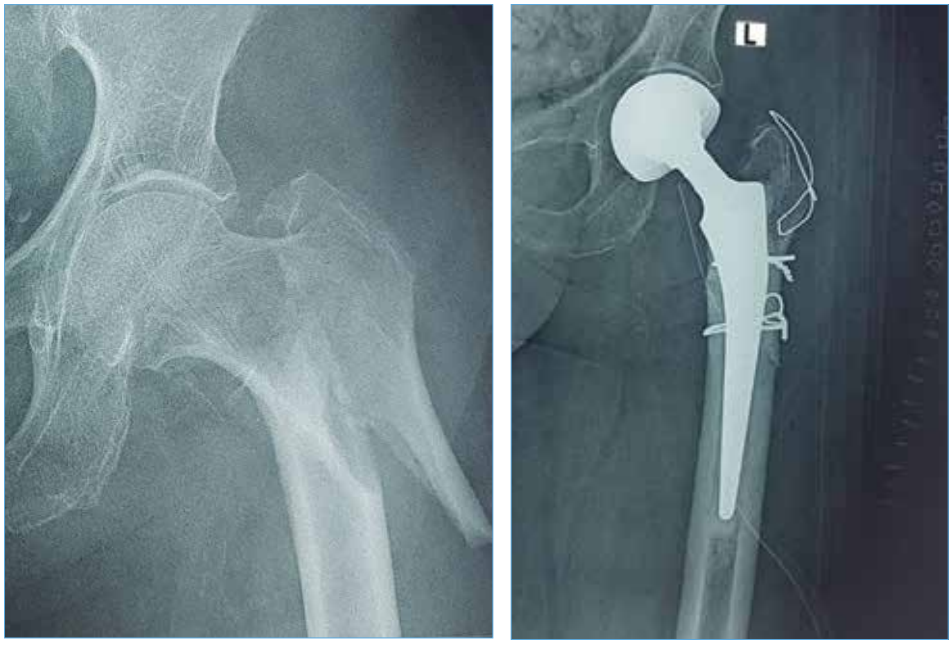
The duration of surgical operation with hemiarthroplasty was less compared to fixation. This difference was significant as only four patients in the hemiarthroplasty group, compared to 12 patients in the fixation group, needed more than 2 hours of surgery (p=0.044).

Regarding intra-operative complications, the need for blood transfusion was less in the fixation group (28 patients) than in the hemiarthroplasty group (37 patients); however, this difference was statistically non-significant (p=0.209).

Considering post-operative outcome parameters, patients who underwent hemiarthroplasty had a shorter post-operative hospital stay compared to patients that underwent fixation; 56 patients in the hemiarthroplasty group, compared to 30 patients in the fixation group, needed hospital admission for less than 1 week, and the difference between both groups was significant (p=0.002).

Most patients in the hemiarthroplasty group (56 patients) were able to start partial weight bearing on the first post-operative day. This contrasted with the observation in the fixation group where 43 patients were able to start partial weight bearing after 15 days (p<0.001).

Most patients who underwent hemiarthroplasty (52 patients) started full weight bearing at the end of the first week post-operatively, while patients who underwent fixation started full weight bearing at 6 to 12 weeks post-operatively (p<0.001).



(a) Pre-operative (b) Post-operative

Figure 4. AP radiograph of 74-year-old male showing unstable reverse oblique fracture treated with cemented bipolar

Table I: Main demographic and clinical data

	Hemiarthroplasty (n=60)	Internal fixation (n=57)
Mean age (range) years	76.15 (65–91)	77.21 (65–105)
Male:Female	23:37	26:31
Fracture type:		
31 A 2.2	23	25
31 A 2.3	37	32
Mode of trauma:		
Domestic fall	58	52
Mean follow-up (range) month	13.66 (10–18)	12 (10–15)
Comorbidities:		
DM	17	11
Asthma	0	2
None	41	44

DM = diabetes mellitus

Table II: Clinical and mechanical complications in the two groups

Complication	Hemiarthroplasty	Internal fixation
Infection:	5%	17.5%
Deep	3.3%	10.5%
Superficial	1.7%	7%
DVT	3.3%	7%
Bedsore	8.3%	7%
Cut-out	0	12.3%
Periprosthetic fracture	0	1.8%
Dislocation	1.7%	0
Non-union	0	1.8%
Malunion:		
Varus malunion	0	7%
Medialisation	0	3.5%

The mean Harris Hip Score at 12 weeks post-operatively was 77.85 (49–93) for the hemiarthroplasty group and 53.9 (32–81) for the fixation group (p=0.001).

At the final-follow up, which was 13.66 (10–18) months in the hemiarthroplasty group and 12 (10–15) months in the internal fixation group, nine out of the 57 patients who underwent internal fixation had died and seven patients were lost to follow-up. Ten patients developed infection, of whom six had superficial infection, which was managed with debridement and intravenous antibiotics. Four patients had deep infection that necessitated the removal of implants and revision with external fixation. Eight patients had general complications, four had deep venous thrombosis (DVT), and four had bedsores. Seven patients had cut-out and penetration into the acetabulum, and all were later revised with arthroplasty. One patient with PFN had periprosthetic fracture, one had non-union revised with hemiarthroplasty, one had delayed union, four had varus malunion, and two patients ended with medialisation (dynamic hip screw – DHS) (*Table II*).

At the final follow-up, ten out of the 60 patients who underwent hemiarthroplasty had died and two were lost to follow-up. Three patients had infections: two had deep infections that necessitated removal of the implants; one was left as a girdle stone and the other revised later after exclusion of the infection; one patient had superficial infection. Two patients had DVT. Five patients had bedsores, three of whom had the bedsores before surgery. Only one patient had dislocation of the hip, which was reduced surgically (*Table II*).

The mean Harris Hip Score at time of final follow-up was 74.33 (42–96) for the internal fixation group and 91.14 (73–99) for the hemiarthroplasty group (p<0.001).

The re-operation rate was significantly less (p=0.012) in the hemiarthroplasty group; 12 patients in the fixation group, compared to three patients in the hemiarthroplasty group, needed re-operation.

Discussion

For several decades, the treatment of choice for unstable intertrochanteric fractures in elderly patients has been internal fixation, although several studies have shown mechanical and technical failures.[14-16] Surgeons use different fixation modalities, both extramedullary and intramedullary, with the aim of reducing these complications taking into account different biomechanics. However, Reindl *et al.*[17] reported no differences in functional outcome between extra- and intramedullary fixation. Other surgeons have recommended prosthetic replacement for the treatment of unstable intertrochanteric fractures because of the improved outcomes noted.[9-12,18-23]

The present study showed better results with hemiarthroplasty than with internal fixation for the treatment of unstable hip fracture in elderly patients, in terms of clinical and functional outcomes. In this study, the duration of surgery was less in hemiarthroplasty. Huang and Yee[24] reported a similar result in their study that compared DHS, proximal femoral nail anti-rotation (PFNA), and hemiarthroplasty. Partial and full weight bearing started earlier in the hemiarthroplasty group and this was also observed in other studies by Huang and Yee[24] and Kayali *et al.*[25] The latter[25] reported full weight bearing at four weeks, while in our series, full weight bearing commenced at the end of the first week. This may be explained by the fact that they used a cone medullary prosthesis, while we used a cemented stem. The hospital stay was also less in the hemiarthroplasty group due to the earlier weight bearing.

In the present study, there was no significant difference in mortality rate and the occurrence of deep venous thrombosis between the hemiarthroplasty and fixation groups. Similar results were noted in other studies.[25-27] Kayali *et al.*[25] reported a one-year mortality rate of 24% in the hemiarthroplasty group versus 16% in the fixation group. Parker *et al.*[26] in their systematic review reported 18 versus 14 cases of mortality in arthroplasty versus fixation respectively; Bonnevialle *et al.*[27] reported three-month mortality to be 21% versus 21.2% in both groups. Blood loss was higher in the hemiarthroplasty group, but the difference was non-significant.

The re-operation rate was higher in the internal fixation group, and a study by Bonnevialle *et al.*[27] reported similar outcomes. In the fixation group, the cut-out was 12% and was similar to the findings of Kayali *et al.*[25] The mean final Harris Hip Score was significantly higher in the hemiarthroplasty group both at 3 months and at the final follow-up.

The main limitation of this study is the short duration of follow-up. In addition, the cost of the implant and the exposure to radiation, which are important parameters in the overall evaluation of each method, were not included in this study.

In conclusion, the clinical results of hemiarthroplasty seemed superior to those of internal fixation in terms of duration of surgery, early mobilisation, re-operation rate, infection rate, and mechanical complications, although similar outcomes were noted in the one-year mortality rate and DVT.

Ethics statement

Ethical approval (SMCT 006/11/14) from the Sudan Medical Specialisation Board research ethics committee was granted before starting this research and informed consent was obtained from all participants.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

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For commentary and more information on this article, please refer to the **Letter to the Editor** on **page 57**.