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Evaluation of Outcomes of Bipolar Hemiarthroplasty in Unstable Intertrochanteric Fractures in among Elder Patients

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ABSTRACT

Background: Early postoperative ambulation following hemiarthroplasty for elderly patients with unstable intertrochanteric femur fractures is possible with the use of bipolar prosthesis.

Objective: to evaluate the safety and efficacy of a new surgical treatment for unstable intertrochanteric fractures in elderly patients treated with bipolar hemiarthroplasty.

Patients and Methods: Our study was done on 18 patients that experienced primary cemented bipolar hemiarthroplasty for fixation of unstable intertrochanteric fractures at Zagazig University Hospital. Patients were followed up clinically and radiologically for 6 months. Clinical evaluation was done using Harris hip score.

Results: The standard cemented bipolar hemiarthroplasty represented (61.1%) and cemented bipolar hemiarthroplasty with calcar replacement (38.9%) of line of treatment. Most of the studied group (41.2%) had excellent Harris hip score (HHS) followed by (35.3%) had good score then fair (17.6%) and lastly poor score (5.9%), with mean HHS of 83.23.

Conclusion: When treating older patients with unstable intertrochanteric fractures, primary bipolar hemiarthroplasty is a better option than open reduction and internal fixation.

Keywords: Bipolar Hemiarthroplasty, Elderly, Unstable Intertrochanteric Fractures.

INTRODUCTION

Intertrochanteric fractures (IT) are among the most common types of fractures seen by orthopedics. These fractures are becoming more common as life expectancy rises [(1)]. By 2040, the prevalence of hip fractures is predicted to have doubled because of a decrease in muscle mass surrounding the hip and osteoporosis, which is growing more common as the elderly population grows. IT fractures account for roughly 45 to 50 percent of all hip fractures in the elderly, and of these, 50 to 60 percent are considered unstable. For dynamic hip screw (**DHS**); the cut-out rate can be as high as 8%, and the likelihood of failure with unstable IT fractures can be as high as 50 percent [(2)].

When treating older patients with unstable intertrochanteric fractures, it might be difficult to achieve anatomical reduction because of the high rates of morbidity and death that are associated with these fractures. There have been numerous studies showing mechanical and technological failures in the treatment of choice for many decades for older individuals with unstable intertrochanteric fractures. Intertrochanteric hip fractures, both stable and unstable, are commonly treated with a dynamic hip screw (DHS), which has a number of drawbacks, particularly in unstable fractures [(3)]. Extramedullary implants were previously blamed for these failures; however a recent study found no difference in unstable intertrochanteric fracture fixation between intra- and extramedullary types of implants [(4)].

Restoring mobility safely and quickly, while limiting the risk of medical consequences and technological failure, is the primary goal of treatment. A patient's ability to walk again depends on the quality of bone and the type of implant that was used. These patients may be able to return to their pre-injury level of activity more soon with primary bipolar arthroplasty treatment, therefore avoiding the postoperative problems that arise from immobilization or implant failure [(5)].

In the elderly, unstable intertrochanteric fractures are one of the leading causes of morbidity. Diabetic and cardiovascular conditions like diabetes are common in this age range. If these patients are confined to a hospital bed, their health rapidly deteriorates as a result of these conditions. Restoring pre-fracture activity levels, allowing for early return to full weight bearing, and avoiding the need for a second surgery are the most important considerations when treating these fractures in the elderly. In some cases, as many as 10% of patients are described as having a failure of fixation. In older patients with unstable intertrochanteric fractures of the femur, hemiarthroplasty employing bipolar prostheses results in good clinical outcomes, including early postoperative ambulation. This will have a significant impact on the patient's overall health and ability to recover after surgery [(6)].

For treatment of intertrochanteric fractures, the gamma nail is a traditional intramedullary fixation device created using the sliding hip screw and intramedullary nail systems [(7)]. A surgeon can easily and quickly use the standardized surgical approach for inserting gamma nails, resulting in tiny incisions after surgery. If the medullary cavities are thin or obstructed or the femur shafts have wide anterior arches and the patient has apparent osteoporosis, this procedure is not recommended. Complications of the Gamma Nail include stress fractures of the distal femoral shaft, worsened intertrochanteric fractures, and the rupture of the major nails, in addition to malunion of fractures. The lag screw lengths and positions are also a problem [(8)].

In the case of unstable or osteoporotic intertrochanteric fractures, conventional DHS may be able to provide useful stability, although this is not the

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case when using conventional DHS. In osteoporotic fractures, DHS fixing has a failure rate of between 3% and 26%. Single DHS fixation cannot provide secure fixation of the lesser trochanter fragment in an unstable intertrochanteric fracture because the posteromedial buttress is the most important supportive point in load bearing [(9)].

A novel surgical treatment for unstable intertrochanteric fractures in the elderly was the purpose of this study. Bipolar hemiarthroplasty was used to evaluate the safety and efficacy of the treatment in this study.

PATIENTS AND METHODS

This study was undertaken in the Orthopedic Surgery Department of Zagazig University Hospitals, it was conducted on 18 patients that experienced primary cemented bipolar hemiarthroplasty for fixation of unstable intertrochanteric fractures.

Ethical consent:

Zagazig University's Research Ethics Council approved the study as long as all participants signed informed consent forms and submitted them to ZU-IRB#7051. We adhered to the Helsinki Declaration, which is the ethical norm for human testing established by the World Medical Association.

Inclusion criteria: Patients with unstable intertrochanteric fractures, age: above 65 years old, and gender: both male and female.

Exclusion criteria: Patients with stable intertrochanteric fractures, patients with pathological fractures, infected wounds, and unfit for surgery due to uncontrolled co-morbidities.

All Patients were subjected to:

Full history: Name, age, sex, residence, medical history of chronic and metabolic diseases, date of examination and/or admission, previous surgical interventions, any medical comorbidity and medications.

Clinical examination: General examination, local examination and neurovascular examination were done.

Laboratory investigations: Random blood sugar, complete blood picture as well as renal function tests**.**

Radiological investigations: Preoperative plain X ray, CT if indicated, and postoperative plain X ray.

Operative technique:

Anesthesia: Thirty minutes before the procedure, a broad-spectrum intravenous antibiotic was administered. All patients were operated upon under general anesthesia (GA) with muscle relaxants.

Anatomical considerations in surgical planning and preparation: All patients with the lateral decubitus were treated with a lateral (modified Harding) approach. The limb was draped separately from the pelvis.

Skin incision: The greater trochanter began around 5 centimetres above the tip. To finish the procedure, a longitudinal incision was made along the femoral shaft, starting at the greater trochanter and lasting approximately 8 cm.

Dissection:

The greater trochanter and the muscles that adhere to it were exposed through iliotibial band splitting and blunt gluteus maximus fibre splitting during deep dissection.

A split was made in the abductor component of the gluteus medius anteriorly along its fibres, which left a large piece of this muscle linked to the greater trochanter. No more than 3-4 cm of the greater trochanter were cut to prevent causing harm to the superior gluteal nerve, which exites the lower back and travels through the greater sciatic notch to pass under the gluteus medius muscle. A transverse path running 1 to 5 centimetres in height above the muscle's greater trochanter was made. Electrocautery release of the gluteus medius' distal end from the greater trochanter's anterior border was done. Pealing the upper part of the vastus lateralis muscle off the proximal femur was done for better exposure of proximal femur for reconstruction. Anterior flap that consists of the anterior part of the gluteus medius was developed and the gluteus minimus was cut off the greater trochanter using electrocautery. The anterior capsule was exposed then capsule was split by longitudinal T shaped incision. It was necessary to remove the head and neck when proper femur exposure was achieved with the corkscrew **(Figure 1)**.

Figure (1): The standard corkscrew can be used to remove the head and neck.

Femoral canal preparation, cementation and reconstruction technique:

The goal in femoral canal preparation is to optimize the cement-bone interface.

1) Canal preparation: After the intramedullary reamer prepares the femoral canal, a series of broaches created an envelope around the implant. In order to

accommodate enough cement, the broaches were designed to be larger than the implanted component. In order to ensure that the hip was stable, and the leg was properly lengthened, a trial reduction was performed utilising a trial head. It was then tightened prior to broach removal in cases where a reconstructed lesser trochanter was to be completed. The broach was subsequently removed, and the curette was used to remove the loose cancellous bone. Cement penetration into the residual cancellous bone was improved as a result of this.

2) Plastic plugs were employed in most of our cases. Better filling and higher incursion pressure were both made possible by plugging. 1 to 2 cm distally from the femoral component's tip, the plug was inserted.
3) Pressurized lavage was then used to clear the femoral canal. This accomplished two things: By eliminating fat and blood from the marrow. Cement penetration into the bone improved as a result of this.
4) Suction dried the channel. When the cement was inserted, a dry femoral canal aided in the optimization of this contact even further.
5) A standard and low-viscosity bone cement was used in this research work.
6) Each and every time, the bone cement was placed by hand.
7) When placing the stem in the femoral canal, care was taken to ensure that it is in the canal's centre region and that the anteverion angle was between 10-15 degrees. Using a trial head, a reduction was performed to ensure that the neck and head were the correct sizes. After that, the definitive head was used to complete the reduction, and the process was completed **(Figure 2)**.

Figure (2): The definite head is applied.

8) Using the tension band approach, two wires were tied anteroposterior above the greater trochanter, and subsequently wires were tied anteroposteriorly and laterally below the lesser trochanter. Over the trochanteric region, these wires were attached.
9) Cervical or bone grafts were used to rebuild the calcar and lesser trochanter during the placement of a prosthesis, using the head and neck or cement collar that was removed during the procedure.
10) Trochanters could be attached to the calcar stem prosthesis by putting wires or sutures via perforations in the calcar area **(Figure 3)**.

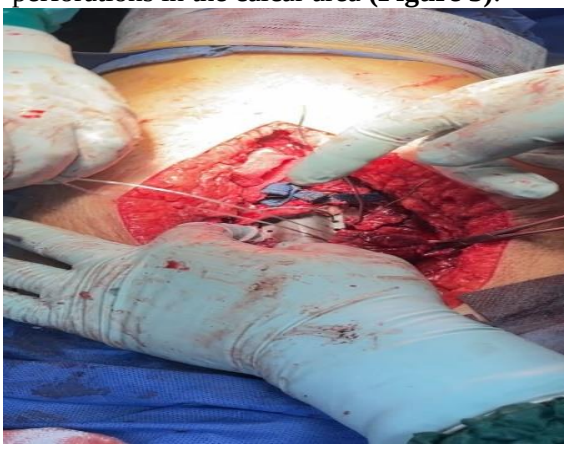

Figure (3): Passing wires to fix trochanters.

Finally:
Suction draining the wound followed by layering the wound's closure **(Figure 4)**.

Figure (4): After emptying the incision, the wound is closed in layers.

Postoperative positioning: Patients transfer from the operation theater to the recovery room and from the recovery room to bed was supervised by the surgeon himself, holding the operated limb in the position of abduction and neutral position. Abduction frame was applied after putting the patient in bed; this wedge maintains the limb in abduction and neutral position or slight internal rotation.

Follow up: After 2 weeks, 3 months, and 6 months of follow-up, clinical and radiological evaluations were conducted.

Clinical follow up: In this clinical trial, the Harris hip score was employed. Results rated as excellent (91-100 points), good (81-90 points), fair (71-80 points) and poor (= or < 70 points).

Statistical Analysis

The collected data were coded, processed and analyzed using the SPSS (Statistical Package for the Social Sciences) version 22 for Windows® (IBM SPSS Inc, Chicago, IL, USA). Quantitative data were represented as mean, standard deviation (SD), median, and range. Qualitative data were represented as frequencies and relative percentages and were compared using a chi-square test (X^2). P value < 0.05 was considered significant.

RESULTS

Demographic characteristics: Our study showed that the average age of the studied group was (74.6±39). Two thirds of the patients were females (**Table 1).**

Table (1): Demographic characteristics of the studied group

Demographic data	The studied group	
	No=(18)	%
Age (years) Mean ± SD Median (Range)	74.6±39 75.5 (66-84)	
Age (years)		
65-70 years	8	44.4%
70-80 years	8	44.4%
>80 years	2	11.2%
Sex		
Male	6	33.3%
Female	12	66.7%

AO classification among the studied group: In our study 31A2.2 was the commonest AO classification (50.0%) among the studied group **(Table 2)**.

Table (2): AO classification among the studied group

AO classification	The studied group	
	No=(18)	%
31A2.1	6	33.3%
31A2.2	9	50.0%
31A2.3	3	16.7%

Line of treatment: Our study showed that the standard cemented bipolar hemi-arthroplasty were 11 patient **(Table 3).**

Table (3): Line of treatment among the studied group

Treatment	The studied group	
	No=(18)	%
Standard cemented bipolar hemiarthroplasty	11	61.1%
Cemented bipolar hemiarthroplasty with calcar replacement	7	38.9%

Postoperative outcomes among the studied group: Our study showed that most of the studied group 17 patient (94.4%) had discharged from the hospital after time ranged from 3 to10 days and one case died (5.6 %) after admission to ICU Department for 7 days postoperatively, this patient aged 78 years with DM, HTN and ischemic heart disease (IHD) and died from cardiac cause (**Table 4).**

Table (4): Postoperative outcome among the studied group

Outcome	The studied group	
	No=(18)	%
Discharged	17	94.4%
Died	1	5.6%

Postoperative complications among the studied group: Our study showed that most of the studied group 14 patient (77.8%) didn't have any postoperative complications, while 4 patients (22.2 %) of them had postoperative complications. Two of them had surgical site infection (SSI), both treated by oral antibiotics and serial debridement. One case had postoperative dislocation treated by close reduction under GA and skin traction for two week, also she had hematoma formation. While the other case has been died due to cardiac causes as it had history of IHD (**Table 5).**

Table (5): Postoperative complications among the studied group

Postoperative complications	The studied group	
	No=(18)	%
Yes	4	22.2%
No	14	77.8%

Relation between Harris Hip Score and demographic characteristics of the studied group: Our study showed that there was statistically significant older age among poor and fair outcome than excellent and good outcome, also all patients with poor and fair outcome were females (**Table 6).**

Table (6): Relation between Harris Hip Score and demographic characteristics of the studied group

Demographic data	Harris Hip Score				p-value
	Excellent & Good (N=13)		Fair, Poor & Death (N=4)		
	No.	%	No.	%	
Age (years)					
65-70 years	8	61.5%	0	0.0%	**0.02***
70-80 years	5	38.5%	2	50.0%	
>80 years	0	0.0%	2	50.0%	
Male	6	46.2%	0	0.0%	**0.04***
Female	7	53.8%	4	100.0%	

Relation between Harris Hip Score and AO classification: Our study showed that there was statistically significant higher AO classification among poor and fair outcome than excellent and good outcome (**Table 7).**

Table (7): Relation between Harris Hip Score and AO classification of the studied group

AO classification	Harris Hip Score				p-value
	Excellent & Good (N=13)		Fair, Poor & Death (N=4)		
	No.	%	No.	%	
31A2.1	6	46.2%	0	0.0%	**0.01***
31A2.2	7	53.8%	1	25.0%	
31A2.3	0	0.0%	3	75.0%	

Relation between Harris Hip Score with postoperative complications: Our study showed that there were statistically significant more postoperative complications among poor and fair outcome than excellent and good outcome **(Figure 5).**

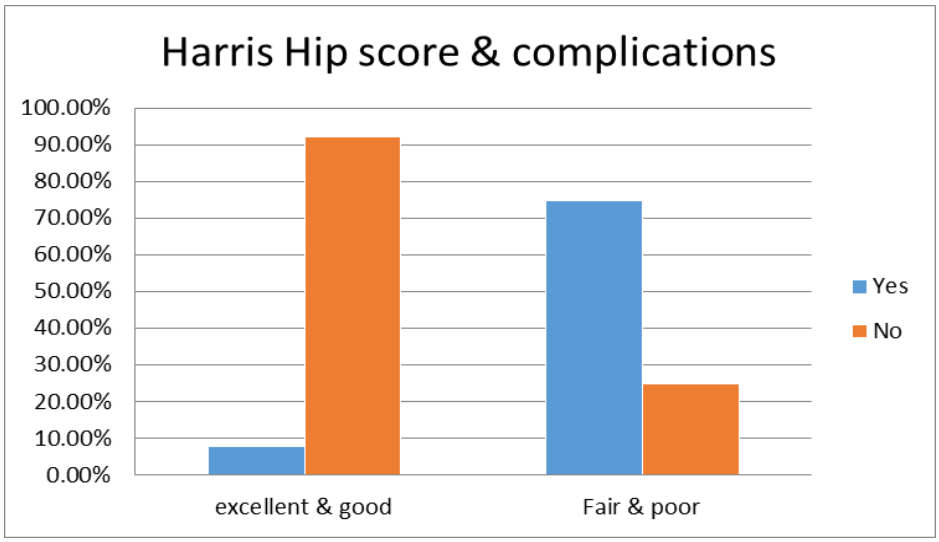

Figure (5): Bar chart for Harris Hip score with pre- and postoperative complications among the studied group

Figure 6 shows X-rays before, immediately after, and 6 months after the operation of one of the studied patients.

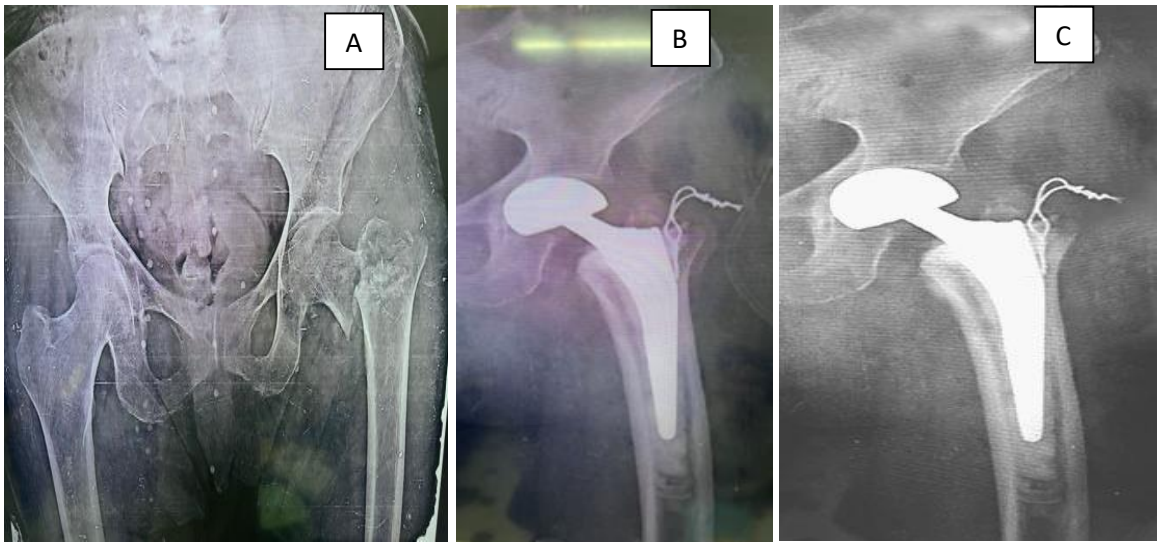

Figure (6): A: Preoperative X-ray AP and lateral view. **B**: Immediate postoperative X-ray AP view **C:** 6 months postoperative X-ray AP view. Female patient, 72 years old, she had Alzheimer, injured due to road traffic accident. Admitted to the hospital as a case of right intertrochanteric fracture classified as 31-A2.3 according to Association of Osteosynthesis Foundation/Orthopaedic Trauma Association (AO/OTA) classification, treated by cemented bipolar hemiarthroplasty. At final follow-up the patient had no complications, and she had good functional outcome according to Harris Hip Score.

DISCUSSION

One of the most common causes of disability among the elderly is unstable intertrochanteric fractures. Diabetes, hypertension, and other systemic disorders are common in this age range. The impact of these diseases cause rapid deterioration of the general condition of those patients especially in the bed ridden condition [(10)].

Osteoporosis, proximal migration of the prosthesis, instability, and a reduced range of motion are common side effects of hemiarthroplasty in the long term. There is a theory that the femoral head's friction against the acetabular cartilage is causing the erosion, and previous studies have found that erosion of the acetabulum occurs between 5 and 64 percent of the time. Another issue with hemiarthroplasty is the possibility of the femoral stem becoming loose or sinking [(11)].

In this prospective study 18 patients were included, the age ranged from 66 to 84 years with mean age of (74.6±39 years), 12 of them were females (66.7%) and 6 were males (33.3%), and the affection side was right in 8 patients and left in10 patients with, most of them injured due to fibrous dysplasia (FD) (14 patients 77.8%) while the rest were injured due to road traffic accident (RTA). According to AO/OTA classification half of patients were classified as 31A2.2, while 33.33% were 31A2.1 and only 16.7% were

31A2.3. 61.11% of the unstable intertrochanteric fractures were treated by the standard cemented bipolar hemiarthroplasty while 38.9% were treated by cemented bipolar hemiarthroplasty with calcar replacement. This was comparable with **Saoudy and Salama** [6] who documented that the range of ages was from 55 to 70 years, with the average being 60, most of them were males (73.3%) while 26.7% were females, most of patients 83.3% were injured due to FD while the rest were injured by RTA. According to AO/OTA classification 66.67% was A2 and 33.33% was A3**.**

In this study regarding HHS which, was done at the final follow-up (six months postoperatively) most of the studied group 77.78% were satisfied (either excellent or good functional outcome) while the rest 22.22% were unsatisfied (3 fair and 1 patient was poor according to HHS). With mean HHS 83.23. This was comparable with **Esen *et al.*** [12] who treated 58 patients with intertrochanteric fractures by cemented bipolar hemiarthroplasty with calcar replacement and documented that the mean HHS was 78.34. Also, **Gashi *et al.*** [13]**,** who treated 60 patients complaining from unstable intertrochanteric fractures by primary cemented bipolar hemiarthroplasty, found that the mean HHS was 91.14**.**

As regard factors affecting functional outcome, it had been noticed that age, sex, AO/OTA classifications and postoperative complications had statistically significant effect on HHS. All patients older than 80 years had unsatisfactory results, while no case below age of 70 years had unsatisfactory functional outcome. Also, sex had statistically significant effect on HHS. All the unsatisfactory results were females, this could be due to decrease of bone density in this elderly post-menopausal female. This was comparable with **Xie *et al.*** [14] who had 80.9% female patients in his study, and the mean HHS was 83.7 ranged from 63 to 90 at 6 months of follow-up. Also **Gashi *et al.*** [13] reported that 61.7% of the patients treated with cemented bipolar were female and the mean HHS was 91.14±5.7.

On the same way the AO/OTA classification had significant P value as about three quarters of unsatisfactory patients were classified as A2.3 while all cases with A2.1 had satisfactory results. **Saoudy and Salama** [6] reported that according to the Association for Osteosynthesis/Association for the Study of Internal Fixation (AO/ASIF) classification, there were 20 cases with type A2 and 10 cases with type A3, with Harris hip score at the last follow-up ranged from 93 to 54, with a mean value of 79.5. Also, **Kayali *et al.*** [15] reported that half of patients were classified as A2.2 while 41.67% were A2.1. 58.33% and as regard the HHS 58.4% of cases were satisfactory and 33.3% were unsatisfactory and the rest of patients died.

Regarding postoperative complications our results showed that five complications occurred in four patients (22.2%), as two patients had SSI, while one patient had dislocation along with haematoma formation and only one patient died from cardiac causes. While the majority of patients (77.8%) had no complications. This was superior to **Hwang *et al.*** [16]. After 2 years of follow up on a greater number of patients who had a longer follow-up time, they documented postoperative complications that included 1 pneumonia, 1 deep venous thrombosis (DVT), 1 pulmonary thromboembolism (PTE), 3 stress ulcers, and 1 superficial infection. They also found that 1 patient experienced pulmonary edema. Postoperative delirium and a partial bladder rupture occurred in one case each, as well as a superficial pressure sore in one case.

In this study about 72.2% of the patients could walk about 600-meter distance. A postoperative infection, blood clot, or embolism did not occur. This was comparable with **Grimsrud *et al.*** [17], for the two patients who were unable to walk after surgery, there was only one occurrence of DVT and two cases of pressure sores. Postoperative mobility is a primary goal in treating this type of injury**.**

Finally, the usage of cemented bipolar hemiarthroplasty in treatment of unstable intertrochanteric fractures had good results as HHS in these results was with mean HHS 83.23. While **Saoudy and Salama** [6] reported mean value of 79.5 and the complication rate was 22.2%**.**

CONCLUSION

Primary bipolar hemiarthroplasty is an effective treatment option for the unstable intertrochanteric fractures in the elderly when compared to open reduction and internal fixation. Cemented fixation is recommended in the elderly patients with osteopenic bone. Results of hemiarthroplasty in the treatment of unstable intertrochanteric fractures are affected by the age and sex of the patients, and medical comorbidities. Long term evaluation of the results of hemiarthroplasty in the treatment of unstable intertrochanteric fractures in elderly is recommended to assess the survivorship of the prosthesis and to evaluate the patient response to the hemiarthroplasty.

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