# Cemented calcar replacement hemiarthroplasty for unstable intertrochanteric fracture femur in elderly patients

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**Background**
Unstable intertrochanteric fractures in elderly patients are associated with a high rate of complications and poses difficulty in fixation. Cemented calcar replacement hemiarthroplasty may be a suitable treatment in these patients. The aim of this study is to assess the clinical and functional results of the use of such a prosthesis in old patients with an unstable intertrochanteric fracture of the femur.

**Patients and methods**
Thirty patients were included in this prospective study, mean age 66 years. All the patients had unstable intertrochanteric fractures. Only patients with type III, IV, or type V fractures according to the Evans' classification were included in the study. Functional and radiological results were assessed after a mean follow-up period of 22 months.

**Results**
At the end of the study, only 24 patients were available for evaluation. The mean follow-up period was 22 months (range, 18–36 months). At the last follow-up, the mean Harris hip score was 85 points. Radiologically, all stems were stable, without significant changes in alignment or progressive subsidence. No infection or thromboembolic complications were encountered.

**Conclusion**
Cemented bipolar hemiarthroplasty with calcar replacement is a good option for unstable intertrochanteric fractures in the elderly. It allows early weight bearing and rapid return to prefracture activity and does not have the difficulty and complications of internal fixation of this complex fracture.

**Keywords:**
fracture femur, hemiarthroplasty, unstable intertrochanteric

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## Introduction

The management of unstable intertrochanteric fractures in the elderly is challenging because of difficult anatomical reduction, poor bone quality, and sometimes a need to protect the fracture from the stresses of weight bearing. Internal fixation in these cases usually involves prolonged bed rest or limited ambulation to prevent implant failure. This might result in higher chances of pulmonary complications and deep vein thrombosis (DVT) [1].

Although a relative consensus exists on the treatment of femoral neck fractures for elderly patients, the optimal treatment for pertrochanteric and intertrochanteric fractures is still under debate [2–4].

Patients with hip fractures are usually osteoporotic elderly patients with a high rate of mortality and morbidity. Therefore, such patients must immediately recover to their previous functional status [5].

As restoration of the preoperative ambulatory level is correlated with survival and elderly patients are often unable to cooperate with partial weight bearing, the primary stability of the device is crucial to allow early mobilization to prevent cardiopulmonary complications and thrombosis [4].

The aim of the study is to evaluate the functional results and complication rate after operative treatment of unstable intertrochanteric fractures with cemented calcar replacement hemiarthroplasty in elderly patients.

## Patients and methods

Thirty patients with intertrochanteric fractures were included in this prospective study. There were 20 women and 10 men. The inclusion criteria were as follows:

(1) Patient age older than 60 years (range, 60–77 years).
(2) Type III (three-fragment fracture without posterolateral support, owing to displacement of the greater trochanter fragment), type IV (three-fragment fracture without medial support, owing to displaced lesser trochanter or femoral arch fragment), or type V (four-fragment fracture without posterolateral and medial support) fractures according to the Evans' classification.
(3) Ambulatory patient before trauma.
(4) No hip arthritis.

The following patients were excluded from the study:

(1) Patients with associated fractures that might affect the final functional outcome.
(2) Nonambulatory patients before injury.
(3) Patients with fractures complicated by infection.
(4) Pathological fractures.

Radiological assessment of the fracture was performed before surgery using plain radiograph on the affected hip anteroposterior and lateral views. According to the Evans' classification, five patients were classified as having type III fractures, 20 patients as having type IV fractures, and five patients as having type V fractures.

Preoperative templating of radiographs of the fractured side and contralateral side was performed to determine the approximate size and position of the stem and the approximate femoral neck offset.

All operations were performed in the lateral position under regional anesthesia using a modified Harding's lateral approach. The fracture anatomy was assessed in terms of the number of fragments. Special care was exercised to leave the greater trochanteric fragment in place with its attachment to the abductor sleeve. The posteromedial fragment was kept attached with the shaft of the femur and was osteotomized from the head and neck fragment. After removing the femoral head, the hip was gently flexed, adducted, and externally rotated. The femoral canal was reamed with increasing sizes of the reamers. After securing the trochanteric fragments, cementation of the femur was performed with the cement mantle medially, and then the prosthesis was inserted (SmartHip CAL prosthesis).

This prosthesis has a metaphyseal part in three lengths of 38, 48, and 58 mm, and is offered to compensate for bone deficiencies in the proximal/medial portion of the femur. In addition, the stems are produced in three different diameters, 8, 10, and 12 mm. The 8 mm size component has a standard 140 mm stem length, whereas the 10 and 12 mm components have a 150 mm stem length.

After trial reduction, the proper head length that restored leg length and abductor tension was chosen, and finally, greater trochanter with abductors attached to it was secured to the proximal femur and to the special hole in the prosthesis using stainless-steel suture wires (Figs 1 and 2). Any protrusion of cement between reduced bone fragments was cleaned out. The wound was closed tightly in layers.

Prophylactic antibiotics were administered before skin incision and elastic stockings were used for 1 month postoperatively for DVT prophylaxis; low-molecular-weight heparin was also administered for DVT prophylaxis for 3 weeks postoperatively. Early walking on a walker was allowed as tolerated from the first postoperative day. Sutures were removed on day 14. Clinical and radiographic examinations were performed at 1, 3, and 6 months, and then yearly.

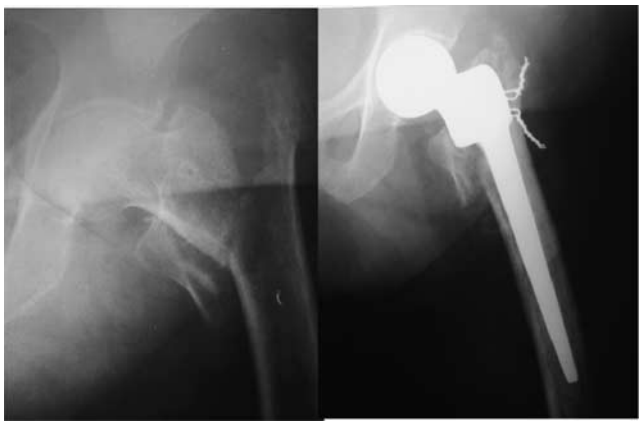
## Results

At the end of the study, only 24 patients were available for evaluation. Three patients died in the first year because of causes unrelated to surgery and three patients were lost to follow-up. The average age of the patients was 66 years (range, 60–77 years). All the remaining patients were followed up for a minimum of 18 months and evaluated using the modified Harris hip score.

**Figure 1**

Case 1: 65-year-old female patient with a left intertrochanteric fracture. Calcar replacement was performed. Follow-up radiograph after 24 months is shown. The Harris hip score is 85.

**Figure 2**



Case 2: 70-year-old male patient with a type IV fracture. Follow-up radiograph after 28 months. The Harris hip score is 80.

**Figure 3**

Case 3: 65-year-old female patient with a type V fracture. Follow-up radiograph shows avulsion of comminuted greater trochanter 12 months postoperatively.

The mean follow-up period was 22 months (range, 18–36 months). At the last follow-up, the mean Harris hip score was 85 points. At the last follow-up, 10 patients were walking without any aid, eight patients had a limp and used a stick for walking, and six patients used a walker. The average period of initiation of full weight bearing was 3 days (range, 2–5 days).

Radiologically, all stems were stable, without significant changes in alignment or progressive subside.

Dislocation of the prosthesis was not observed in any case. One patient experienced avulsion of a fragment from the comminuted greater trochanter and refused to undergo surgery again and was satisfied with the final results (Fig. 3). No infection or thromboembolic complications were encountered.

## Discussion

Hip fractures are the most frequent cause of morbidity in the elderly. Such fractures have a marked impact on the health, psychological, social, and economical status of the patients. Although patient care and surgical techniques have improved compared with the past, in recent years, treatment of patients with hip fractures may result in worse outcome than expected [6].

Management of intertrochanteric fractures in elderly osteoporotic patients continues to be a challenging problem for orthopedic surgeons. Cutting out of an implant from the femoral head and varus malpositioning of fragments are often found in such cases if early ambulation is allowed. Prolonged bed rest in elderly patients leads to a higher risk of complications such as bed sores, pneumonia, and DVT, not uncommonly leading to fatal pulmonary embolism [2].

The ideal treatment for intertrochanteric fractures is still under debate as none of the existing osteosynthetic devices have been proven to be superior in former studies [7,8]. The most frequent problem in elderly patients who are usually not able to walk without weight bearing was a cutting out of the hip screw, which occurred in 4–20% of the reported cases [9,10].

Although union rates as high as 100% have been reported in association with well-reduced, stable fractures that were treated with ideal implant placement, failure rates as high as 56% have been found in association with unstable fractures, comminution, suboptimal fracture fixation, or poor bone quality in elderly patients [11,12]. The poor mechanical properties of the weak and porotic bone in these elderly patients do not usually provide a firm purchase for the screws, leading to early biomechanical failure [13,14]. This will lead to collapse, with migration of the femoral head into varus and retroversion, resulting in limping because of shortening and decreased abductor muscle lever arm [15,16]. Another complication of internal fixation in porotic weak bone is cutting out of the implant from the femoral head, leading to severe functional disability and pain [17].

To date, a clear indication of arthroplasty in the treatment of intertrochanteric fractures does not exist. Although operation time and blood loss are higher, no significant difference in the mortality rate between primary arthroplasty and internal fixation could be found, but the revision rate with arthroplasty is significantly smaller, especially with the use of bipolar hemiarthroplasty instead of total hip replacement. If the cemented arthroplasty has been performed accurately, there is very little concern about weight bearing. Furthermore, primary arthroplasty eliminates the possibility for malunion, cut-out of the hip screw, and avascular necrosis of the femoral head [18].

Haentjens *et al.* [19] compared 37 patients who received a calcar replacement device with 42 patients of a retrospective group, who were treated by internal fixation, and found an advantage in functional outcome. Although the mortality rate did not decrease, early walking with full weight bearing reduced the incidence of pressure sores, pulmonary infection, and atelectasis. Kim *et al.* [20], who compared calcar replacement prosthesis with intramedullary fixation in a prospective

study in two small groups of 29 patients, could not find a significant difference in the functional outcomes, but the cut-out rate of the hip screw was 7% in their patients.

Unstable intertrochanteric fractures are historically associated with a high rate of complications. Immediate partial or full weight bearing in this patient group is crucial – although not always possible – after internal fixation with dynamic hip screws or proximal femoral nails. Cutting out of these hip screws has been reported in 4–20% of cases. Hip replacement has been considered a viable option in a select group of previously independent mobile patients and is reported to be associated with significantly lower complication rates [18].

Conflicting reports on postoperative mortality in cases with primary hemiarthroplasty in intertrochanteric fractures are cited in the literature. Kesmezacar *et al*. [16] reported postoperative mortality in 34.2% of patients after a mean of 13 months and in 48.8% of patients after a mean of 6 months in patients treated with internal fixation and endoprosthesis, respectively. Other studies have shown no differences in postoperative mortality in two groups [19,21]. In the present series, only three patients out of the 30 died (10%) within 12 months of surgery because of unrelated causes.

The increase in hip fractures among the elderly and the presence of intercurrent diseases make it necessary to institute treatments that help patients resume their activities as soon as possible; immediate full weight bearing irrespective of bone quality is an advantage of primary cemented arthroplasty. In our study, all patients are encouraged to stand up the day after surgery. The technique adopted in the current study allowed safe and early weight bearing on the injured hip and had a relatively low rate of complications. As most of the patients were out of bed on an average of 3 days postoperatively, there were neither chest complications nor thromboembolic complications.

Stability of the prosthesis depends on its geometry with its metaphyseal part fitted in the proximal femur. Reconstruction of the trochanteric fragments is crucial in maintaining a stable prosthesis; thus, we performed reconstruction of the trochanteric fragment using cerclage stainless-steel wires and nonabsorbable sutures. None of the patients developed instability or dislocation in the study group. Cementation also enables early recovery of the patients and allows painless early mobilization.

The functional results of treatment of unstable intertrochanteric fracture in elderly patients with primary cemented calcar replacement bipolar hemiarthroplasty rather than internal fixation could return these patients to their preinjury level of activity more quickly, thus reducing the postoperative complications caused by immobilization or failure of the implant.

## Conclusion

Cemented bipolar hemiarthroplasty with calcar replacement is a good option for unstable intertrochanteric fractures in the elderly. It allows early weight bearing and rapid return to prefracture activity and does not have the difficulty and complications of internal fixation of this complex fracture.

## Acknowledgements

### Conflicts of interest

There are no conflicts of interest.

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