Calcar Femorale Grafting In The Cemented Bipolar Hemiarthroplasty Of The Hip For Unstable Intertrochanteric Fractures Using Posterolateral Approach.

*Dr. Pranav Kulkarni, **Dr. Vishal Kharade, *** Dr. Deepak Naikwade

*Resident,** Assitant Professor ,***Professor and Head, Department Of Orthopaedics, Dr. Vithalrao Vikhe Patil Foundation's Medical college, Ahmednagar

Corresponding Author : Dr. Vishal Kharade

Mail id : drvishalkharade@gmail.com

Mobile No.: 9884631577

Address : Department of Orthopaedics, Dr. Vithalrao Vikhe Patil Foundation's Medical College, Ahmednagar.

Abstract

Background : Unstable intertrochanteric fractures are associated with a high rate of complications and poses difficulty in fixation. Calcar femorale cemented bipolar 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 :** We have presented a simple and effective technique of calcar grafting by harvesting cortical bone strut from the neck of the fractured femur. Fifty patients were included in this prospective study. 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 18 months. **Results :** At the end of the study, only 42 patients were available for evaluation. The mean follow-up period was 18 months (range, 16–24 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 :** Calcar femorale cemented bipolar hemiarthroplasty 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, calcar, hemiarthroplasty, unstable, intertrochanteric.

Introduction : It is a challenge to treat comminuted or unstable intertrochanteric fractures in the elderly because of difficult anatomic reduction, very poor bone quality, and most of the times a need to protect the fracture from the stresses of weight bearing. Internal fixation in such cases mainly involves prolonged bed rest and limited ambulation to avoid implant failure which might result in higher chances of pulmonary embolism and deep vein thrombosis (DVT).[1]

The gold standard treatment for intertrochanteric fractures is still controversial even though a relative consensus exists on the management of neck of femur fractures for elderly patients.[2,4]

Osteoporosis is the cause of high rate of mortality and morbidity in elderly patients with intertrochanteric fractures. Immediate recovery of such patients to their original functional status is vital in such cases.[5]

For stable fracture with good quality of bone, both sliding screw plate devices and cephalomedullary devices have been shown to be associated with good results.[6],[7],[8] However, in unstable, comminuted fractures in osteoporotic bones, shortening, external rotation deformity, implant cut-out, and re-operation are common occurrences with sliding nail plate devices.[9],[10],[11],[12],[13],[14]

Intramedullary nailing is currently preferred for these fractures, but the current versions of intramedullary devices are also associated with technical and mechanical complications like cut-out of screws from the head and fracture of the shaft of the femur at the site of distal screw.[15],[16],[17] These devices appear to be still under evolution with a series of modifications.[18],[19]

Prosthetic replacement using cemented implant is another viable alternative in the management of unstable, osteoporotic fractures, and it allows early mobilization.[14],[20],[21],[22],[23],[24],[25]

The primary stability of the device is consequential to start

early mobilization to prevent cardiopulmonary hazards and deep vein thrombosis because restoration of the preoperative ambulatory level is correlated with survival and most of the times it is difficult for the elderly patients to cooperate with partial weight bearing or toe touch weight bearing.[4]

In inter trochanteric fractures, medial calcar support is deficient. This necessitates the use of a calcar bearing prosthesis. However, they may not be readily available off the shelf and are expensive. The other option is to fill the void around the area of the calcar with bone cement but because cement has poor tolerance to bending and shear forces, it is not a good alternative. Besides, prosthetic replacement include achieving limb length equalization and maintaining adequate soft tissue tension in abductors to prevent dislocation. Loss of bone stock in the proximal femur due to the use of metallic prosthesis or bone cement is a disadvantage at the time of revision procedure (if required later).

To overcome these problems, a simple method of using bone graft from the head and neck portion of the femur. This graft fills the commonly occurring postero-medial void; prevents placement of the prosthesis in varus and retroversion and serves as a guide to limb length equalization.

The aim of the study is to evaluate the outcome of this novel technique of calcar femorale grafting in cemented bipolar hemiarthroplasty of the hip for unstable inter trochanteric fractures.

Patients and methods : Fifty patients with intertrochanteric fractures were included in this prospective study. There were 30 women and 20 men. The inclusion criteria were as follows:

(1) Patient age older than 65 years (range, 60–80 years).

(2) Type III (three-part fracture without postero-lateral support, owing to displacement of the greater trochanter fragment), type IV (three-part fracture without medial support, owing to displaced lesser trochanter or femoral arch fragment), or type V (four-part fracture without posterolateral and medial support) fractures according to the Evans' classification. [Figure 1]

(3) Patients who were able to walk before trauma.

(4) Non- arthritic hip

The following patients were excluded from the study :

(1) Patients with associated fractures that might affect the final functional outcome.

(2) Non-ambulatory patients before injury.

(3) Infected hip.

(4) Bleeding disorders

(5) Pathological fractures.

Digital X-rays of the affected hip in anteroposterior and lateral views were obtained to do radiological analysis of the fracture. According to the Evans' classification, seventeen patients were classified as having type III fractures, 20 patients as having type IV fractures, and thirteen patients as having type V fractures.

Approximate size and position of the stem and the femoral neck offset were calculated by preoperative templating of radiographs of the affected side and contralateral side

Figure 1: Preoperative radiograph of hip joint anteroposterior view showing comminuted intertrochanteric fracture of the left femur

Prophylactic antibiotics were administered 30 minutes before commencing the skin incision. A Southern posterolateral approach which is a modification of posterior approach by Gibson and Moore was taken to carry out all the surgeries in lateral position under spinal or epidural anaesthesia. The greater trochanteric break was

identified, and the trochanteric pieces were separated to reach the head neck fragment. Going through the trochanter is useful in retaining the attachment of abductors and short rotators. All the capsular attachments to the proximal head and neck fragment were meticulously released. The ligamentumteres was resected with sharp scissors. The femoral head was extracted, and the head size was measured using templates.

Graft with a length of 2-2.5 cm and width of 1.5 cm was harvested from the calcar region of the proximal fragment [Figure 3].

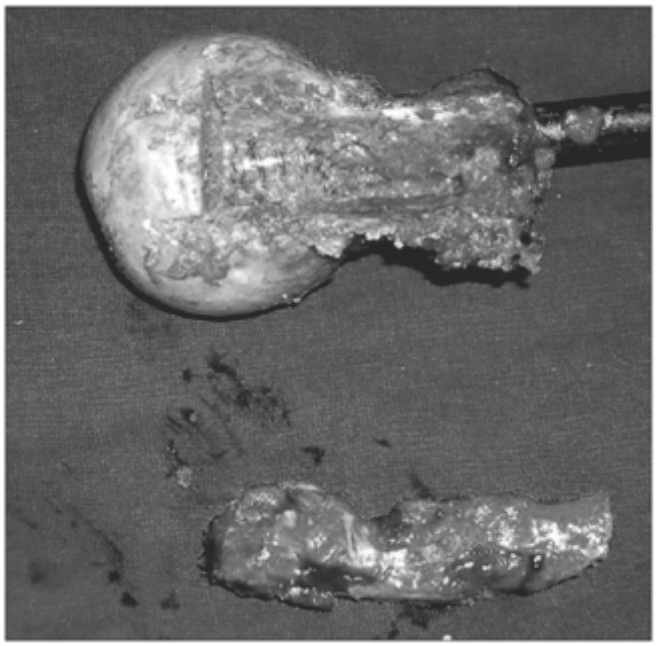

Figure 3: Peroperative photograph showing calcar femorale graft has been harvested from the head and neck fragment of the femur using a power saw

The proximal limit of the graft was the junction of calcar portion of the neck with the head. Oscillating saw was used to make the cuts through the strong calcar bone to avoid splintering.[Figure 3]

The femoral canal was prepared in the standard fashion. Since the greater and lesser trochanters were no longer attached to the femoral shaft, the correct anteversion was judged in relation to inter-epicondylar line of the distal femur (with knee flexed to 90°). If the lesser trochanter was separated from the proximal femur, it was brought back into its anatomical position and held with a cerclage wire around the femoral shaft. The graft was then trimmed if necessary and was inserted in the void, so that 50% of its length was in the medullary canal, and 50% was outside [Figure 4].

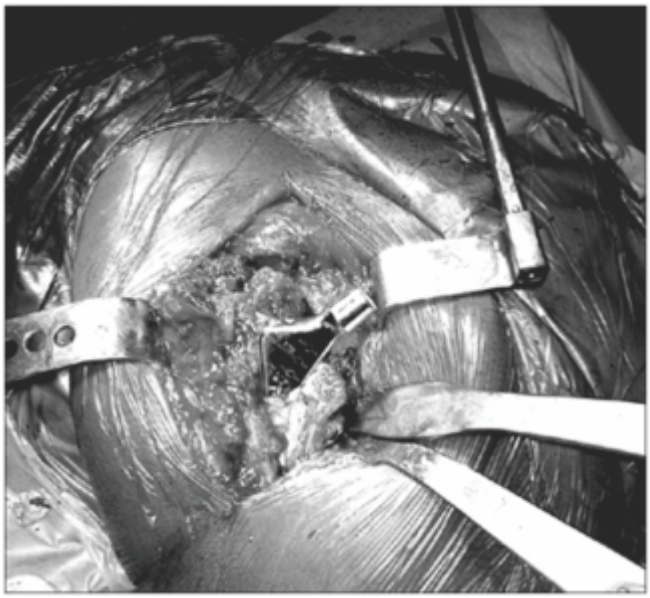

Figure 4: Peroperative photograph showing trial bipolar stem is being inserted with the calcar graft in situ

The broach or the trial prosthesis was now inserted to judge the fit of the graft. The graft was firmly wedged between the medial femoral cortex and medial edge of the prosthesis and thus was auto-stabilized [Figure 5].

Figure 5: Model bone showing the extent of graft insertion

The varus bending movement of the prosthesis pushes the upper edge of the graft towards the medial femoral cortex; this causes the lower edge of the graft to push against the medial edge of the prosthesis [Figure 6].

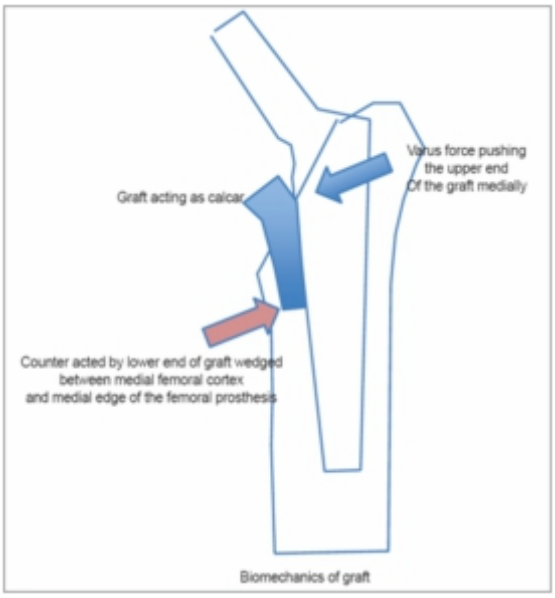

Figure 6: Schematic diagram showing graft is wedged between the medial femoral cortex and the medial edge of the prosthesis. Vaurs force (blue arrow) pushes the upper end of the graft medially, this is counter acted by the lower end of the graft and medial edge of the prosthesis (pink arrow)

In this way, opposing forces stabilize the graft obviating the need for any further fixation. The trochanteric pieces were sutured together by 18 g stainless steel wire (wiring of trochanter was planned in such a way that the trochanter was reattached to the shaft, hence appropriate holes were made in the shaft and wires passed before cementing). In some patients, No 5 Ethibond suture was used for reattaching the fragments. [Figure 6]

The medullary canal was washed using pulsed lavage. Second-generation cementing technique was used in all our patients. Cement restrictor was inserted till the appropriate depth, and the canal was packed with dry roller gauze pack. The cement was inserted using a cement gun and the area that was to receive a bone graft was cleaned off cement with a curette. The prosthesis was inserted and any cement that came into the area of the graft insertion was cleared once again. Time was allowed for the cement to reach doughy consistency. The graft was inserted at this stage such that half of its length was inside the canal, and half was out. This would be akin to the calcar cut at the proposed level while doing a hip replacement. The prosthesis was finally impacted in to the femoral canal maintaining the necessary ante-version, till the mark on the prosthesis was at the level of the proximal edge of the graft, and if a collared prosthesis was being used, till the collar made contact with the superior edge of the graft. This automatically ensured correct leg length in majority of cases. The joint was reduced after the cement had hardened. Two horizontal wire loops were tied to close the gap in the greater trochanter, and vertical loop was tied to bring the trochanter back to the shaft. The wound was closed in layers.

Crepe bandage was used for 1 month postoperatively for DVT prophylaxis. From the first post-operative day onwards the patient was mobilised aided with a walker and weight bearing given as tolerated. Sutures were removed on day 14. Clinical and radiographic examinations were performed at 1, 3, and 6 months, and then at the end of one year.[Figure 7]

Figure 7: Immediate postoperative anteroposterior radiograph showing the graft and the implant

Results : 42 patients were available for evaluation after the study. Four patients died in the first year because of causes unrelated to surgery and four patients were lost to follow-up. The average age of the patients was 68 years (range 65–80 years). All the remaining patients were followed up for a minimum of 12 months and analysed using the modified Harris hip score. The mean follow-up period was 18 months (range 16-24 months). Mean Harris hip score was 85 points at the last follow-up in which 20 patients were walking without any aid, 14 patients had a limp and used a stick for walking, and 8 patients used a walker. The average period of initiation of full weight bearing was 3 days (range, 2–5 days).

No significant changes in the alignment or progressive subsidence was present radiologically and all the implants were appearing stable.

Dislocation of the prosthesis was observed in one case one month postoperatively which was managed by close reduction.

Discussion : Unlike in fracture of the neck of femur, prosthetic replacement is still not considered as the gold standard of treatment for unstable inter-trochanteric fractures. Inter-trochanteric fractures have traditionally been treated with internal fixation using dynamic hip screw (DHS) or cephalo-medullary nailing devices like PFN. Union rates of close to 100% have been achieved in stable, well-fixed fractures in patients with good quality of bone. However, problems arise in unstable or comminuted osteoporotic fractures, where a high incidence of complications has been observed.

Sinno et al. reported 26% unsatisfactory results with DHS due to bio-mechanical failure.[14] Shortening of limb is another common problem with DHS fixation in unstable inter-trochanteric fractures.[10],[11]

Wolfgang et al. reported a complication rate of 38.6% during fixation of the inter-trochanteric fractures with sliding hip screws.[9] Studies with proximal femoral nail (PFN) in unstable inter-trochanteric fractures have shown a high incidence of complications.

According to a study by Tyllianakis et al., technical and mechanical complications were noted in 41.3% during operation and 30.4% during followup.[16] Overall re-operation rate was 28.8%. Only 30% of the patients recovered to the previous level of functional scores. After analyzing the cases of lateral and intra articular protrusion of screws, they suggested a possible explanation that screws were jammed or their sliding through PFN did not proportionately follow the fracture subsidence or impaction and PFN implant acted as a fixed device. Studies of the recent trochanteric femoral nail also show a high rate of complications and require a precise surgical technique.

The study by Crawford et al. reported 11% re-operation rate because of screw cut-out or fracture at the distal tip of the nail.[15]

Earlier authors have reported that prosthetic replacement for inter-trochanteric fractures is a technically difficult procedure associated with considerable blood loss.[21],[25] However, in our experience the morbidity as well as transfusion requirements were low. Hemiarthroplasty with a standard bipolar implant is a reasonable alternative to open reduction and internal fixation. Arthroplasty has the advantage of early weight bearing and avoids potential fixation failure and need for subsequent revisions.[22] Since there is posterior-medial defect, the use of long stem prosthesis and calcar replacement stem has been reported in the literature.[16] These implants are not readily available everywhere and are expensive. Calcar replacement or head and neck replacement prostheses require removal of a large amount of bone from the proximal femur.[22] Use of long stem calcar replacement prosthesis has been shown to be associated with higher cost, longer surgical time, higher blood loss and increased mortality rate in comparison with internal fixation using PFN.[23] The advantages of building posteromedial defect with strut graft include - near normal limb length; prevention of varus tilt/collapse of stem; preservation of the normal host bone, which may be useful in revision surgery.

Since it permits the use of standard endoprosthesis, it is less expensive than calcar replacement long stem prosthesis and entails less bone resection from the proximal femur. We used standard endoprosthesis in all our patients and implant subsidence was not a major problem in our series due to the presence of the intramedullary calcar graft.

There is a concern that the non vascularizedcalcar graft may undergo resorption with time. But our experience shows that the graft consolidates well without resorption in the majority of patients. Haentjens et al. showed that callus formation occurs following prosthetic replacement of the proximal femur and the callus occurs mainly in the posteromedial aspect of the proximal femur. Comminuted bone fragments united with the femoral shaft even in the absence of fixation due to this callus formation.[24] The same callus can be expected to stabilize the calcar graft also when it binds to the extra medullary portion of the graft.

Conclusion : It can be said that that prosthetic replacement is a suitable alternative to fixation in elderly individuals because it provides early full weight bearing and rapid rehabilitation.[21],[22] Considering our experience and review of the literature, replacement arthroplasty may be considered as a primary option in selected patients for comminuted unstable inter-trochanteric fractures. Calcar grafting as described here is useful in minimizing the subsidence of the implant and in maintaining the limb length.[33]

References:

1. Sancheti KH, Sancheti PK, Shyam AK, Patil S, Dhariwal Q, Joshi R. Primary hemiarthroplasty for unstable osteoporotic intertrochanteric fractures in the elderly: a retrospective case series. Indian J Orthop 2010; 44:428–434.

2. Siwach R, Jain H, Singh R, Sangwan K. Role of hemiarthroplasty in inter- trochanteric fractures in elderly osteoporotic patients: a case series. Eur J OrthopSurgTraumatol 2012; 22:467–472.

3. Blomfeldt R, To rnkvist H, Ponzer S, So derqvist A, Tidermark J. Comparison of internal fixation with total hip replacement for displaced femoral neck fractures: randomized, controlled trial performed at four years. J Bone Joint Surg Am 2005; 87:1680–1688.

4. Geiger F, Schreiner K, Schneider S, Pauschert R, Thomsen M. Proximal fracture of the femur in elderly patients. The influence of surgical care and patient characteristics on post-operative mortality. Orthopade 2006; 35:651–658.

5. Vatansever A, Ozic U, Okcu G. Assessment of quality of life of patients after hemiarthroplasty for proximal femoral fractures. ActaOrthopTraumatolTurc 2005; 39:237–242.

6. Adams CI, Robinson CM, Court-Brown CM, McQueen MM. Prospective randomized controlled trial of an intramedullary nail versus dynamic screw and plate for intertrochanteric fractures of the femur. J Orthop Trauma 2001;15:394-400.

7. Ahrengart L, Törnkvist H, Fornander P, Thorngren KG, Pasanen L, WahlströmP, et al. A randomized study of the compression hip screw and Gamma nail in 426 fractures. Clin OrthopRelat Res 2002;401 209-22.

8. Utrilla AL, Reig JS, Muñoz FM, Tufanisco CB. Trochanteric gamma nail and compression hip screw for trochanteric fractures: A randomized, prospective, comparative study in 210 elderly patients with a new design of the gamma nail. J Orthop Trauma 2005;19 (4):229-33.

9. Wolfgang GL, Bryant MH, O'Neill JP. Treatment of intertrochanteric fracture of the femur using sliding screw plate fixation. ClinOrthopRelat Res 1982;163:148-58.

10. Hsueh KK, Fang CK, Chen CM, Su YP, Wu HF, Chiu FY. Risk factors in cutout of sliding hip screw in intertrochanteric fractures: An evaluation of 937 patients. IntOrthop 2010;34:1273-6.

11. Palm H, Lysén C, Krasheninnikoff M, Holck K, Jacobsen S, Gebuhr P. Intramedullary nailing appears to be superior in pertrochanteric hip fractures with a detached greater trochanter: 311 consecutive patients followed for 1 year. ActaOrthop 2011;82:166-70.

12. Bendo JA, Weiner LS, Strauss E, Yang E. Collapse of intertrochanteric hip fractures fixed with sliding screws. Orthop Rev 1994;Suppl: 30-7.

13. Steinber GG, Desai SS, Kornwitz NA, Sullivan TJ. The intertrochanteric hip fracture. A retrospective analysis. Orthopedics 1988;11:265-73.

14. Sinno K, Sakr M, Girard J, Khatib H. The effectiveness of primary bipolar arthroplasty in treatment of unstable

intertrochanteric fractures in elderly patients. N Am J Med Sci 2010;2:561-8.

15. Crawford CH, Malkani AL, Cordray S, Roberts CS, Sligar W. The trochanteric nail versus the sliding hip screw for intertrochanteric hip fractures: A review of 93 cases. J Trauma 2006;60:325-8.

16. Tyllianakis M, Panagopoulos A, Papadopoulos A, Papasimos S, Mousafiris K. Treatment of extracapsular hip fractures with the proximal femoral nail (PFN): Long term results in 45 patients. ActaOrthopBelg 2004;70:444-54.

17. Norris R, Bhattacharjee D, Parker MJ. Occurrence of secondary fracture around intramedullary nails used for trochanteric hip fractures: A systematic review of 13,568 patients. Injury 2012;43:706-11.

18. Parker MJ, Handoll HH. Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults. Cochrane Database Syst Rev 2010; Sep 8;(9) CD000093; doi: 10.1002/14651858.CD000093.pub5

19. Parker MJ, Bowers TR, Pryor GA. Sliding hip screw versus the Targon PF nail in the treatment of trochanteric fractures of the hip: A randomised trial of 600 fractures. J Bone Joint Surg Br 2012;94:391-7.

20. Broos PL, Rommens PM, Deleyn PR, Geens VR, Stappaerts KH. Pertrochanteric fractures in the elderly: Are there indications for primary prosthetic replacement? J Orthop Trauma 1991;5:446-51.

21. Green S, Moore T, Proano F. Bipolar prosthetic replacement for the management of unstable intertrochanteric hip fractures in the elderly. ClinOrthopRelat Res 1987;224 169- 77.

22. Chan KC, Gill GS. Cemented hemiarthroplasties for elderly patients with intertrochanteric fractures. ClinOrthopRelat Res 2000;371 206-15.

23. Kim SY, Kim YG, Hwang JK. Cementlesscalcar-replacement hemiarthroplasty compared with intramedullary fixation of unstable intertrochanteric fractures. A prospective, randomized study. J Bone Joint Surg Am 2005;87:2186-92.

24. Haentjens P, Casteleyn PP, De Boeck H, Handelberg F, Opdecam P. Treatment of unstable intertrochanteric and subtrochanteric fractures in elderly patients. Primary bipolar arthroplasty compared with internal fixation. J Bone Joint Surg Am 1989;71:1214-25.

25. Zhang B, Chiu KY, Wang M. Hip arthroplasty for failed internal fixation of intertrochanteric fractures. J Arthroplasty 2004;19:329-33.

26. Singh M, Nagrath AR, Maini PS. Changes in trabecular pattern of the upper end of the femur as an index of osteoporosis. J Bone Joint Surg Am 1970;52:457-67.

27. Harris WH. Traumatic arthritis of the hip after dislocation and acetabular fracture treated by moldarthroplasty. An end result survey using a new method of result evaluation. J Bone Joint Surg Am 1969;51:737-55.

28. Gingras MB, Clarke J, Evarts MC. Prosthetic replacement in femoral neck fractures. ClinOrthopRelat Res 1980;152:147-57.

29. Haidukewych GJ, Berry JB. Hip arthroplasty for salvage of failed treatment of intertrochanteric hip fractures. J Bone Joint Surg Am 2003;85:899-903.

30. Stern MB, Angerman A. Comminuted intertrochanteric fractures treated with a Leinbach prosthesis. ClinOrthopRelat Res 1987;218 75-80.

31. Stappaerts KH, Deldycke J, Broos PL, Staes FF, Rommens PM, Claes P. Treatment of unstable peritrochanteric fractures in elderly patients with a compression hip screw or with the Vandeputte (VDP) endoprosthesis: A prospective randomized study. J Orthop Trauma 1995;9:292-7.

32. Stern MB, Goldstein TB. The use of the Leinbach prosthesis in intertrochanteric fractures of the hip. ClinOrthopRelat Res 1977;128 325-31.

33. Rodop O, Kiral A, Kaplan H, Akmaz I. Primary bipolar hemiprosthesis for unstable fractures of the hip. IntOrthop 2002;26:233-7.