Original Research Article

Functional analysis of cemented bipolar hemiarthroplasty with medial calcar augmentation for unstable intertrochanteric fractures in elderly

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ABSTRACT

Background: Intertrochanteric fracture is one of the most common fractures among the elderly osteoporotic population, constituting about 50% of hip fractures. These fractures are managed either by fixation using dynamic hip screw (DHS), proximal femur nail (PFN) or by replacement, based on the stability of fracture pattern, age of the patient, quality of bone and associated co-morbid conditions. Prosthetic replacement which is routinely done for femoral neck fractures requires modification when done for trochanteric fractures to improve stability. This study aims to analyse the short term functional outcome of cemented bipolar hemiarthroplasty with medial calcar augmentation for unstable intertrochanteric fractures in elderly.

Methods: Our study includes 60 patients of age more than 70 years admitted in our institution during June 2012 to September 2016 with unstable intertrochanteric fractures. All patients operated through posterior approach to hip and cemented hemiarthroplasty with medial calcar augmentation with bone graft was done. Patients were followed up for an average of period of 2 years. Functional outcome was evaluated with Harris Hip score.

Results: 28% of cases had excellent outcome. 43% of cases had good and 23% of cases had fair outcome. 2% of cases ended with poor outcome. The in-hospital mortality rate was 3.3%. The survival rate of the patients in this study at the end of one year is 85%.

Conclusions: Cemented bipolar hemiarthroplasty with medial calcar augmentation can be considered as a good primary option for elderly unstable intertrochanteric fracture patients with osteoporotic bones and associated co-morbidities.

Keywords: Unstable intertrochanteric fracture, Cemented hemiarthroplasty, Calcar augmentation

INTRODUCTION

Intertrochanteric fracture is one of the most common fractures among the elderly osteoporotic population and associated with slightly higher mortality than patients with femoral neck fractures.¹ According to Campbell, “the mortality rates associated with these fractures varies from 10% to 30% within the first year of injury. Most of the intertrochanteric fractures in the elderly occur due to a simple fall. The chances of fall increase with patient age.²-⁴ Management options are wide with conservative and surgical management. Conservative management have largely been given up due to significantly poor results. Only comfortable non ambulatory patients or patients with brief life expectancies should be treated non-operatively. Surgical treatment includes dynamic hip screw (DHS), proximal femur nail (PFN) and prosthetic replacement. DHS permits the proximal fragment to collapse or settle onto the fixation device. Use of intramedullary devices gives stable fixation, but both nail
and DHS might fail due to loss of hold in elderly osteoporotic people leading to failure of implant, where cemented hemiarthroplasty is a viable option”.

Replacement arthroplasty for intertrochanteric fracture is a major advance in recent years aimed at reducing time in bed. Kadam et al study gave good to excellent results in 95% of cases and Haentjens et al study gave good to excellent results in 78% with cemented hemiarthroplasty for unstable trochanteric fractures in 100 patients, all above 75 years of age. Some authors suggested the use of polymethyl methacrylate (PMMA) to augment the fixation thereby improving stability and allowing for early mobilization in these patients. In trochanteric fractures, the fracture in the medial calcar may cause instability for prosthesis placement and so medial calcar augmentation with bone graft improves stability, prevents varus collapse, achieves near limb length equalization thereby providing easier & faster rehabilitation with good functional outcome.

**Aim and objective**

To perform a functional analysis of cemented bipolar hemiarthroplasty with medial calcar augmentation for unstable intertrochanteric fractures in elderly.

**METHODS**

This is a prospective study conducted in Government Royapettah hospital, Chennai over a period of 4 years from June 2012 to September 2016. After institutional ethical committee approval, totally 60 patients with age more than 70 years with fracture less than 3 weeks of duration, unstable Intertrochanteric fractures (Boyd and Griffin types 2, 3, 4), osteoporotic bone quality (Singhs index– grade I to III) are included in the study. Patients with good bone quality (Singhs index– grade IV to VI), stable Intertrochanteric fractures (Boyd and Griffin type 1), pathological fractures, and previous hip disorders are excluded from the study.

**Operative procedure**

Surgery done though posterior approach in lateral position under spinal anestheisa. After incising Skin, subcutaneous tissue, fascia lata and gluteus maximus split, charnley’s retractor applied. Trochanteric bursa split and short external rotators cut. (In most cases, the normal anatomy of proximal femur muscles will be altered due to fractured greater and lesser trochanter. In those cases the cleavage plane in the torn muscles is taken as the plane of dissection). Then capsule is split. Head and neck is delivered (Figure 1A). Head size is measured using regular measuring gauge. Torn trochanteric fracture fragments are temporarily fixed with SS wire (Figure 1B). Graft of size 1.5 to 2 cm width is harvested from the delivered neck and head (Figure 1C) is trimmed (Figure 1D) and the graft is firmly wedged between the medial femoral cortex and medial edge of the prosthesis. So it is autostabilised. According to Thakkar et al, calcar grafting as a wedge incorporates the graft well in the situation of comminuted intertrochanteric fractures and provides stability to the implant (normally cement is used to fix the prosthesis in femoral neck fractures. But when cement is used to build up medial calcar in intertrochanteric fractures, cement may fail due to poor shear stress. So, autograft was preferred).

![Figure 1](image1.png)

**Figure 1:** A= Head and neck delivered, B= Securing greater trochanter with SS wire, C= Harvesting of graft from delivered proximal fragment, D= Harvested graft, E= Trial with the graft and prosthesis, F= SS wire for greater trochanter tightened.
As there is no lesser trochanter, the guide to version will be the posterior surface of femur, medial femoral condyle. The prosthesis is kept parallel to the posterior surface of femur or in the anteverision of about 15° with reference to medial femoral condyle with hip and knee in 90° of flexion. Reconstructed GT gives approximate assessment of limb length (also maintains the abductor mechanism preventing postoperative abductor lurch). Trial reduction (Figure 1E) done before proceeding with cementation. Cementation done and bipolar prosthesis is placed with the assistant securing the graft and maintaining the version kept by the surgeon. Once the cement is completely set, reduction is done. Movements checked in all possible range of motion. SS wire which were initially placed are tightened (Figure 1F). Meticulous closure of capsule, muscle, fascia lata, subcutaneous tissue and skin done after securing drain.

Post-op protocol

Mobilization started on the 1st post-op day. Drain removed and full weight bearing standing and walking as tolerated with the help of walker started on 2nd post-op day. Intravenous antibiotics continued upto 3rd post-operative day. DVT prophylaxis with 40 mg LMWH is given till 5th post-operative day. Walker is continued till the abductor power IV and hip abduction pillow maintained till abductor power IV.

Follow up protocol

Patients were followed up at monthly intervals for first three months, then at two month intervals till one year and at three month interval then on. In each follow up X-ray evaluation, range of motion and Harris Hip score documentation was done.

RESULTS

Demographic characteristics, various observations including osteoporotic grading, average surgery duration and blood loss, functional outcome based on Harris hip score are given in (Table 1). The in-hospital mortality rate is 3.3%. The survival rate of the patients in this study at the end of one year is 85%. There were no non-union of the greater trochanter.

| Total number of patients | N=60 (Women-40 & Men-20) |
|--------------------------|---------------------------|
| 1. Age wise distribution | 70-80 years 81-90 years 91-100 years |
|                         | 27 patients (45%) 27 patients (45%) 6 patients (10%) |
| 2. Osteoporosis grading | Singh index I Singh Index II Singh index III |
|                         | 3 patients (5%) 12 patients (20%) 45 patients (75%) |
| 3. Follow up period     | 6 months to 4 years |
| 4. Average blood loss   | 200 ml |
| 5. Average surgery time | 59 mins (range, 35-130 minutes) |
| 6. Functional outcome   | Excellent Good Fair Poor |
| (Harris hip score)      | 17 (28%) 26 (43%) 14 (23%) 1 (2%) |

Two case of deaths occurred in the 2nd post-op day. First patient was a 77 year old female, a known case of CVA, DM and HT and the cause of death being aspiration pneumonia. Second patient is 78 years old female patient who died of MI. In both the cases cause of death were confirmed by autopsy findings. There were 6 cases of limb length shortening less than 1 inch managed with appropriate shoe rise. Among them 2 patients had good outcome and 4 had a fair outcome. Two patients had dislocation, which was managed by closed reduction followed by abduction pillow for period of 4 weeks. They did not have any further dislocation. One patient had superficial skin infection which was managed with dressing and antibiotics. One patient had heterotopic ossification but he had fair range of movements in Harris hip score evaluation. So the mass was left as such with regular follow up.

Figure 2: Pre-operative X-ray.

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A case of 78 years female with left sided unstable intertrochanteric fracture with Grade II osteoporosis operated with cemented hemiarthroplasty with medial calcar augmentation. 3 years follow up showed excellent functional outcome (Figures 2-4).

DISCUSSION

Prosthetic replacement is an accepted treatment modality for femoral neck fractures. Faldini et al in their study stated that the anatomic location of femoral neck fractures makes prosthetic replacement a reasonable option because the distal portion of the femoral neck remains intact, providing excellent prosthetic support; in addition, the greater trochanter-abductor mechanism remains undisturbed. Neither condition applies when endoprosthetic replacement is used for comminuted intertrochanteric fractures. Grimsrud et al described that, applying circlage wires for those fragments including the greater and the lesser trochanter before cementing the stem prevents extrusion thereby having good hold of prosthesis. Achieving limb length and proper version of prosthesis can be demanding especially in utterly comminuted fractures, which can be managed by reconstructing the greater trochanter and keeping the prosthesis parallel to the posterior surface of femur or in the anteverision of about 15° with reference to medial femoral condyle with hip and knee in 90° of flexion.

Using bone from the calcar as a graft serves
- Filling posteromedial gap.
- Prevents placement of prosthesis in varus and retroversion.
- Near limb length equalization.
- Restores abductor tension.
- Overcomes the poor shear stress of cement.

In the study by Thakkar et al with similar calcar grafting technique involving 34 patients with average follow up of 54 months, calcar graft healed well without any dislodgement or resorption in 94% of patients. In our study, graft healed well in all the cases.

Table 2: Comparison with similar other studies.

| S. No | Study | Method for improving stability of prosthesis | Total no. of cases | Outcome (excellent and good result) (%) | No. of complications |
|-------|-------|---------------------------------------------|-------------------|----------------------------------------|---------------------|
| 1.    | Rodop et al (2002) | Not mentioned | 54 | 57.4 | 8 |
| 2.    | Sancheti et al (2010) | Ethibond & steel wires to reconstruct GT & LT | 37 | 67.5 | 6 |
| 3.    | Kiran Kumar et al (2013) | Tension band wiring technique for GT & LT | 20 | 80 | 4 |
| 4.    | Kadam et al (2017) | Cementation with bipolar prosthesis | 22 | 95 | Not mentioned |
| 5.    | Our study | Medial calcar augmentation with bone graft | 60 | 71 | 12 |
To date, calcar replacement prostheses generally have not been greatly used. Obstacle to use of this class of prosthesis for intertrochanteric fractures are due to the limited availability of the prosthesis, the limited surgeons familiarity of the prosthesis and the more extensive nature of surgery involved. Hence we took up this study to determine the functional outcome of cemented bipolar hemiarthroplasty as a good procedure in elderly osteoporotic patients with associated co-morbid illness focusing on postoperative complications, survival, and functional status. Comparison of results with various other studies shown in (Table 2).

CONCLUSION

Cemented bipolar hemiarthroplasty with medial calcar augmentation can be considered as a good primary option for elderly unstable intertrochanteric fracture patients with osteoporotic bones and associated co-morbidities. Early ambulation provided by this procedure in elderly patients reduces the problems of prolonged immobilization and provides them immense psychological support to get back to their activities of daily living. Our study gave an outcome of 71% good to excellent results in Harris hip score evaluation.

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