

## Original Research Article

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

Sivabalan T.<sup>1</sup>, Thirunarayanan V.<sup>2\*</sup>, Senthil Kumar S.<sup>1</sup>, Ramprasath D. R.<sup>3</sup>, Basheer Ahmed S.<sup>1</sup>

Department of Orthopaedic Surgery, <sup>1</sup>Govt. Royapettah Hospital, Chennai, <sup>2</sup>Govt. Dharmapuri Medical College Hospital, Dharmapuri, <sup>3</sup>Govt. Coimbatore Medical College Hospital, Coimbatore, Tamil Nadu, India

**Received:** 25 October 2017

**Revised:** 30 November 2017

**Accepted:** 01 December 2017

### \*Correspondence:

Dr. Thirunarayanan V.,

E-mail: [thiruorthokmc@gmail.com](mailto:thiruorthokmc@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## 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.<sup>1</sup> 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.<sup>2-4</sup> 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<sup>7</sup>.

Replacement arthroplasty for intertrochanteric fracture is a major advance in recent years aimed at reducing time in bed.<sup>5,6</sup> 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.<sup>1,7,8</sup> 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.

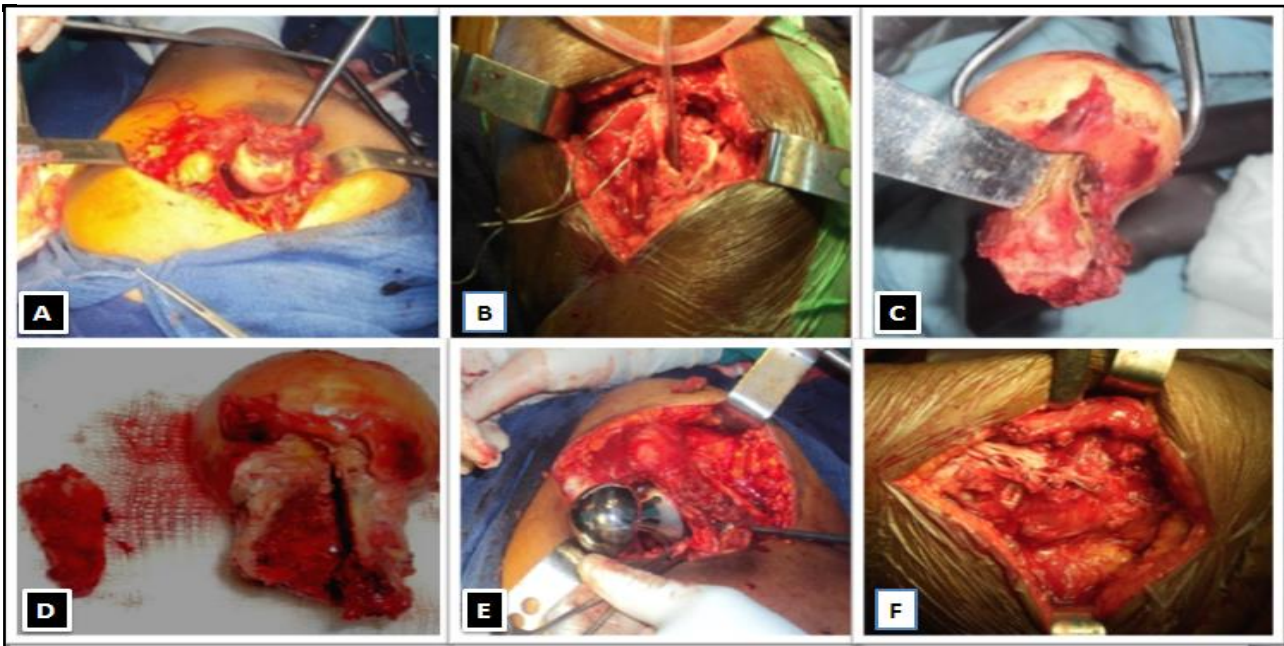
**METHODS**

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.<sup>9,10</sup> 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.<sup>9,10</sup>

**Operative procedure**

Surgery done though posterior approach in lateral position under spinal anesthesia. 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).<sup>11</sup>



**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 anteversion 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 1<sup>st</sup> 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 3<sup>rd</sup> post-operative day. DVT prophylaxis with 40 mg LMWH is given till 5<sup>th</sup> 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.

**Table 1: Demographic characteristics.**

Total number of patients	N=60 (Women-40 & Men-20 )			
1. Age wise distribution	70-80 years 27 patients (45%)	81-90 years 27 patients (45%)	91-100 years 6 patients (10%)	
2. Osteoporosis grading	Singh index I 3 patients (5%)	Singh Index II 12 patients (20%)	Singh index III 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 (Harris hip score)	Excellent 17 (28%)	Good 26 (43%)	Fair 14 (23%)	Poor 1 (2%)



**Figure 2: Pre-operative X-ray.**

Two case of deaths occurred in the 2<sup>nd</sup> 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 3: Post-operative X- ray.**





**Figure.4: A=3 years follow up, B=Adduction, C=Abduction, D=Flexion, E=External rotation, F= Internal rotation.**

**Case illustration**

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.<sup>12</sup> 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.<sup>13</sup> The prosthesis selected must replace the calcar, with provisions for greater trochanteric reattachment to restore abductor function.

Many patients with stable peritrochanteric fractures may have been successfully treated by internal fixation.

However, some elderly patients who sustain a comminuted unstable intertrochanteric fracture experience loss of reduction or fixation and require revision surgery. This population of patients would benefit most from primary prosthetic replacement. Chan KC et al. describes that judicious identification of these patients before surgery will definitely improve the clinical outcome. This group has an easier and faster rehabilitation, with a lower incidence of pressure sores, pulmonary infection, and atelectasis, which they attributed to earlier return to full weight bearing.<sup>14</sup>

But primary arthroplasty is a technically more demanding procedure in these patients because of difficulty in assessing version, maintaining length and preventing varus collapse in comminuted trochanteric 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.<sup>15</sup> 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 anteversion of about 15° with reference to medial femoral condyle with hip and knee in 90° of flexion.<sup>16</sup>

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.<sup>11</sup> 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 <sup>17</sup> (2002)	Not mentioned	54	57.4	8
2	Sancheti et al <sup>18</sup> (2010)	Ethibond & steel wires to reconstruct GT & LT	37	67.5	6
3.	Kiran Kumar et al <sup>19</sup> (2013)	Tension band wiring technique for GT & LT.	20	80	4
4	Kadam et al <sup>1</sup> ( 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.<sup>13</sup> Hence we took up this study to determine the functional outcome of cemented bipolar hemiarthroplasty using a standard femoral stem with medial calcar augmentation 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 comorbidities. 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.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the institutional ethics committee*

## REFERENCES

- Kadam R, Sawant R, Chhallani A. Functional outcome of intertrochanteric fractures treated with bipolar hemiarthroplasty. *Int J Res Orthop.* 2016;3(1):1-3.
- Geiger F, Zimmermann-Stenzel M, Heisel C, Lehner B, Daecke W. Trochanteric fractures in the elderly: the influence of primary hip arthroplasty on 1-year mortality. *Arch Orthop Trauma Surg.* 2007;127:959–66.
- 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;35:651–8.
- Cummings SR, Melton LJ III. Epidemiology and outcomes of osteoporotic fractures. *Lancet.* 2002;359:1761–7.
- Waddell JP, Morton J, Schemitsch EH. The role of total hip replacement in intertrochanteric fractures of the femur. *Clin Orthop Relat Res.* 2004;429:49–53.
- Waddell JP, Morton J, Schemitsch EH. The role of total hip replacement in intertrochanteric fractures of the femur. *Clin Orthop Relat Res.* 2004;429:49–53.
- Haentjens P, Casteleyn PP, De BH, 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.
- Haentjens P, Casteleyn PP, Opdecam P. Primary bipolar arthroplasty or total hip arthroplasty for the treatment of unstable intertrochanteric and subtrochanteric fractures in elderly patients. *Acta Orthop Belg.* 1994;60(1):124–8.
- Boyd HB, Griffin LL. Classification and treatment of trochanteric fractures. *Arch Surg.* 1949;58(6):853-66.
- Singh M, Nagrath A, Maini PS. Changes in trabecular pattern of the upper end of the femur as an index of osteoporosis. *J Bone Joint Surg.* 1970;52(3):457-67.
- Thakkar CJ, Thakkar S, Kathalgere RT, Kumar MN. Calcar femorale grafting in the hemiarthroplasty of the hip for unstable inter trochanteric fractures. *Indian J Orthop.* 2015;49(6):602.
- Macaulay W, Pagnotto MR, Iorio R, Mont MA, Saleh KJ. Displaced femoral neck fractures in the elderly: hemiarthroplasty versus total hip arthroplasty. *J Am Acad Orthop Surg.* 2006;14(5):287–93.
- Faldini C, Grandi G, Romagnoli M, Pagkrati S, Digennaro V, Faldini O, et al. Surgical treatment of unstable intertrochanteric fractures by bipolar hip replacement or total hip replacement in elderly osteoporotic patients. *J Orthop Traumatol.* 2006;7:117–21.
- Chan KC, Gill GS. Cemented Hemiarthroplasties for elderly patients with intertrochanteric fractures. *Clin Orthop Relat Res.* 2000;371:206-15.
- Grimrud C, Monzon RJ, Richman J, Ries MD. Cemented hip arthroplasty with a novel circlage cable technique for unstable intertrochanteric hip fractures. *J Arthroplasty.* 2005;20:337–43.
- Harwin SF, Stern RE, Kulick RG. Primary Bateman–Leinbach bipolar prosthetic replacement of the hip in the treatment of unstable intertrochanteric fractures in the elderly. *Orthopaedics.* 1990;13:1131–6.
- Rodop O, Kiral A, Kaplan H, Akmaz I. Primary bipolar hemiprosthesis for unstable intertrochanteric fractures. *Int Orthop.* 2002;26(4):233-7.
- 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 journal of orthopaedics.* 2010;44(4):428.
- Kiran Kumar GN, Meena S, Kumar V, Manjunath S, MK VR. Bipolar hemiarthroplasty in unstable intertrochanteric fractures in elderly: a prospective study. *J Clin Diagnos Res.* 2013;7(8):1669.

**Cite this article as:** Sivabalan T, Thirunaryanan V, Senthil KS, Ramprasath DR, Basheer AS. Functional analysis of cemented bipolar hemiarthroplasty with medial calcar augmentation for unstable intertrochanteric fractures in elderly. *Int J Res Orthop* 2018;4:141-5.