Functional outcome of cemented hemiarthroplasty in home-ambulant elderly patients with unstable pertrochanteric fractures

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Abstract
Background: Unstable pertrochanteric fractures pose a significant health problem in elderly home-ambulant patients with increased morbidity and mortality, and their attendant co-morbidities.

Objective: To study the functional outcome of cemented hemiarthroplasty in home ambulant elderly patients with unstable pertrochanteric fractures.

Methods: A hospital-based, prospective, non-randomized study between September 2013 and September 2019. All patients aged 65 years and above with unstable pertrochanteric fractures were included with the exception of those who were non-ambulant before injury and those with histologically confirmed tumors. Harris Hip Scoring (HHS) was done for all patients on both hips pre-operatively and postoperatively. Cemented bipolar hemiarthroplasty was done using cement mantle to reconstruct the calcar, and biopsy was taken for histology at surgery. Subperiosteal detachments of the ilioptosus muscle and adductor tenotomy were done when indicated. Full weight-bearing ambulation was commenced on the second postoperative day.

Results: Forty-eight hips in 47 patients were analyzed. The mean age was 83.4 +/- 5.0 years with a F: M ratio of 2.4:1. Average duration of presentation was 26.4 +/- 12.8 days as all the patients had had traditional bone setters’ treatment prior to their presentation. Hypertensive heart disease was the commonest co-morbid condition. The mean operation time was 77.9 +/- 9.5 minutes (range 60-98 minutes). The mean estimated blood loss (EBL) was 385.6 +/- 198.2 ml (range 150-850ml). Twenty-two (45.8%) patients were transfused. All patients ambulated at second postoperative day. Forty-seven (97.92%) hips had good and excellent functional outcomes at 12 weeks, and 46 (95.83% of total hips studied, but 100% of those still alive) had good to excellent functional outcomes at 2 years with p value < 0.0005. A patient had both hips recruited 2 years apart. A deep surgical site infection and two limb length discrepancies were associated complications. Two (4.26%) of the patients died of unrelated causes before the end of the first year of follow up.

Conclusion: Primary cemented bipolar hemiarthroplasty allows early weight bearing and produces good to excellent functional outcomes in home-ambulant elderly patients with unstable pertrochanteric fractures with minimal complications.

Keywords: functional outcome, cemented hemiarthroplasty, home-ambulant elderly patients, unstable pertrochanteric fractures

Introduction
Unstable pertrochanteric fracture in the elderly patient is a frequent problem and is becoming frequent as the proportion of elderly people in the population increases [1]. The treatment of such unstable intertrochanteric fracture remains controversial, despite the publication of reports of randomized trials and comparative studies [2]. Although the treatment of choice for unstable intertrochanteric fractures in elderly patients has been internal fixation for a long time, several studies have shown mechanical and technical failures [3]. Unstable intertrochanteric fracture is associated with poor bone quality, excessive collapse, loss of fixation, and cut-out of the lag screw as the common problems of attempts to fix the fractures [4]. The primary goals of treatment are stable fixation and early rehabilitation [5]. Management of these cases with cemented bipolar hemiarthroplasty eliminates most of the short-comings of other modes of internal fixation and permits early mobilization, thus avoiding most of the
complications related to prolonged immobilization [6, 7]. The purpose of this prospective cohort study (level II evidence) was to assess the functional outcome of cemented bipolar hemiarthroplasty as a primary treatment modality for unstable intertrochanteric fractures in home-ambulant elderly patients in a low resource community.

**Methodology**

Prospective cases of unstable pertrochanteric fractures using the Kyle classification scheme were treated with primary bipolar hemiarthroplasty between September 2013 to September 2019. All elderly independently home-ambulant patients with unstable pertrochanteric fractures were included. Patients with stable fractures, those who were community ambulant or non-ambulant prior to injury, those with histologically confirmed tumors, and those that did not consent were excluded. Ethical clearance was obtained from the hospitals’ research and ethics committees. The endoprostheses used were products from JS Medimax (P) limited and Sofia Surgicals PVT, limited, both based in Delhi, India. No conflict of interest to declare.

Preoperative Harris hip scores (HHS) were obtained. Preoperative planning was done using templates on the radiographs on both the fractured and contralateral hips, to determine the vertical and horizontal offsets, the approximate size of the head of femur and hence, the sizes of the bipolar to be made available for surgery (usually a range 2mm above and below the estimated size) (figure 1). Surgeries were done as soon as the patients were stabilized and adjudged fit by the anesthetists (usually within 48 hours of admission). Elective cases had to wait for the following elective list, usually not more than 4 days.

All cases were done under regional or general anesthesia and led by the same surgeon. Prophylactic antibiotics were given at induction. The surgeries were performed using the anterolateral approach in a supine position with the index hip elevated with a sandbag (figure 2a-c). The limb length discrepancy (LLD) is re-assessed and correlated with the preoperative record. This served as a reference to achieving the desired equal limb length. See foot note for the detailed description of the procedure [8]. The extracted head, neck, and the bone fragments were sent for histology. Operation time and blood loss were estimated and recorded.

All patients had postoperative radiographs, and commenced deep venous thrombosis prophylaxis (Subcutaneous Clexane injection at 40mg daily for 5 days, then Tab Rivaroxaban 10mg daily for 6 weeks), and isometrics exercises on the first postoperative day. All patient had injection morphine, pethidine or pentazocine, Paracetamol, and Nonsteroidal anti-inflammatory drugs (NSAIDs) for 48 to 72 hours before conversion to oral NSAIDs and Paracetamol. Drain is removed and full weight-bearing ambulation is commenced on the second postoperative day. Postoperative HHS was done for all patients at 3 months, 6 months, 12 months, and 24 months. Data regarding patient demographics, presentation, comorbidities, operation time, estimated blood loss, Limb length discrepancy (LLD), as well as pre- and postoperative HHS, were analyzed using SPSS version 23.

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**Fig 1:** A left unstable pertrochanteric fracture. Vertical offset and diameter of the head being determined.

**Fig 2:** (a) anterolateral incision, (b) exposure to periarticular pad of fat, (c) exposing the neck.

**Fig 3:** (a) removing a cylinder off the neck; (b) delivering the head; (c) broached marrow.
Results
Fifty-three hips in 52 patients were initially recruited but pruned down to 48 hips in 47 patients as 5 patients had histologic diagnosis of metastatic tumors. The mean age was 83.4 +/- 5.0 years (age range of 70 to 96 years) with a F: M ratio of 2.4:1. Age range 81-85 years were the most reviewed, representing 28 (59.57%) of the total patients (table 1 and 2). The mean operation time was 77.9 +/- 9.5 minutes (range 60-98 minutes). The mean estimated blood loss (EBL) was 385.6 +/- 198.2 ml (range 150-850ml). Twenty-two (45.8%) patients were transfused.

Table 1: Age distribution (years)

| Age Distribution (Years) | Frequency | Percent |
|--------------------------|-----------|---------|
| 70-75                    | 2         | 4.2     |
| 76-80                    | 8         | 16.7    |
| 81-85                    | 28        | 58.3    |
| 86-90                    | 6         | 12.5    |
| 91-96                    | 4         | 8.3     |
| Total                    | 48        | 100     |

Mean: 83.4 +/- 5.0 years

Table 2: Gender distribution

| Gender | Frequency | Percent |
|--------|-----------|---------|
| Female | 34        | 70.8    |
| Male   | 14        | 29.2    |
| Total  | 48        | 100     |

A sudden improvement in functional status was recorded in all the patients in the postoperative period as all the patients could ambulate full-weight bearing by second postoperative day with the aid of a walking frame. Postoperative radiographs were obtained at 2nd postoperative day (figure 4b-c). The average hospital stay was 6.5 +/- 2.2 days. Every patient had an adult relation giving supportive care both in the hospital and after discharge.

Table 3: Comparison of Mean Harris Hip Scores (HHS)

| Comparison of HHS | Pre-Op HHS | HHS (3 Months) | HHS (6 months) | HHS (1 YEAR) | HHS (2 Years) |
|-------------------|------------|----------------|----------------|--------------|---------------|
| Mean              | 25.88      | 90.96          | 91.94          | 92.59        | 93.17         |
| Standard Deviation| 3.54       | 6.99           | 4.05           | 2.89         | 2.91          |
| P-Value           |            | < 0.0005       | < 0.0005       | < 0.0005     | < 0.0005      |

Earlier recruited for the left hip sustained contralateral unstable pertrochanteric fracture of the right hip at about 2 years of follow up for the first injury. The right hip was also recruited, followed up, and reviewed separately (figure 6a-h).

Forty-seven (97.92%) hips had good and excellent functional outcomes at 12 weeks with p value < 0.0005 (Table 3). At 2 years, 46 (95.83% of total hips studied, but 100% of those still alive) had good to excellent functional outcomes with p value < 0.0005 (Table 3), (figure 5). A patient with cor pulmonale earlier recruited for the left hip sustained contralateral unstable pertrochanteric fracture of the right hip at about 2 years of follow up for the first injury. The right hip was also recruited, followed up, and reviewed separately (figure 6a-h).
Limb length discrepancy (LLD) of 1.0 and 1.5 cm were recorded in two patients. LLD in other patients were less than 1.0 cm and were considered insignificant (figure 7). A deep surgical site infection was recorded in one patient after she dislocated following her discharge from the hospital, and had open reduction. Debridement and implant retention (DAIR) was done but the infection could not be controlled. Thus, necessitating a conversion to Girdle Stone Excision Arthroplasty, GSEA. Hip function was poor at the end of 3 months, but fair at 6 months for the infected case. She was one of the two patients that died before 1 year of follow up. She died from an unknown cause at about 9 months of the postoperative period. The other patient was a 90-year-old man that died of the complication of an ischemic heart disease which he was being managed for before the hip injury. He was seen last at 3 months of follow up with a good functional outcome score. Total percentage death was 4.2% (affecting 2.9% of females, but 7.1% of the recruited males). Complications are summarized in figure 8.

Discussion

The mean age and F:M ratio of the patients in this study (Table 1&2) were similar to what were recorded in other studies [6, 7] Sancheti et al. and Gu et al. also recorded similar findings in their studies [8, 9]. The female preponderance in most of the reviewed articles may not be unconnected with the obvious presence of more elderly females than males in many cultures as the females live longer (may be due to the relatively lesser risk involved in their usual activities which is in contrast to the usual aggressive and adventurous lives of men). Physiologically, the females also develop osteoporosis earlier in life, hence more fragility fractures.

The primary cemented hemiarthroplasty by-passes the phase of fracture healing thereby providing an immediate stable, mobile, relatively pain-free joint which eliminates the need for prolonged immobilization and permits early ambulation [1, 7]. [10, 11]. It equally eliminates the fear of implant failure and not usually associated with peri-implant fractures as commonly seen in other modes of fixation [12, 13]. A systematic review by Yoo et al. revealed that the overall outcomes such as mortality, reoperation rate, and complication showed no significant difference between the arthroplasty and internal fixation groups but, the arthroplasty group achieved superior functional outcomes, especially earlier mobilization [14]. The results in this study affirms the early mobilization as all the patients ambulated at second postoperative day with good to
excellent HHIS in 47 (97.92%) hips at 12 weeks (Table 3) with p value < 0.0005. At 2 years, 46 (95.83%) of total hips studied, but 100% of those still alive) had good to excellent functional outcomes (figure 5). Pre-hospital delay in surgery for hip and proximal femoral fracture is the norm in our environment due to the persistent patronage of traditional bone setters despite their obvious failures. The average duration of patients’ presentation in this study was 26.4 +/- 12.8 days (range 3 to 150 days), mainly pre-hospital delay. This is contrary to the findings of Cha et al. in their study with a mean delay before surgery of 7.5 days (range 3–167 days) after hip fracture which was mainly hospital delay [10]. They concluded that delayed surgery was significantly related to 30-day and 1-year mortality [10]. Despite the significant delay in presentation in this study however, we had no mortality in 30 days and the overall mortality was low. The reason is unknown to us.

Jolly A et al. reported that cemented hip-replacement arthroplasty allows early pain-free mobilization and had a good short term outcome, over time it was associated with a variety of complications that significantly affects the quality of life of patients unlike patients treated with PFN that had delayed postoperative mobilization, but better results when followed up to 1-year post-surgery [10]. This finding is contrary to the findings in this study, and those of Thakur A and Lal M, Singh S, and Gashi YN et al. that found cemented hemiarthroplasty to be consistently superior [3, 4, 17]. A patient had cemented hemiarthroplasty on the contralateral hip after 2 years of follow up with excellent functional outcomes for both hips (figure 6a-h).

One case of dislocation leading to deep surgical site infection, and two LLD of 1.0 and 1.5cm were the complications recorded. These relatively less complications were reported by other researchers [4, 8, 18]. Chehade MJ et al. in their study found that older age, male gender, higher American Society of Anesthesiologists classification, in residential care, and in-patient reported medical complications were independent risk factors for early mortality [19]. Two patients died of unrelated causes in this study. This is similar to the findings of Sancheti et al. and Zha et al. [8, 20]. Advantages and limitations of cemented hemiarthroplasty for unstable per trochanteric fractures in home-ambulant patients are as listed in table 4.

**Table 4:** Shows the highlights of the advantages and disadvantages of primary cemented Hemiarthroplasty.

| Advantages                          | Disadvantages                      |
|-------------------------------------|------------------------------------|
| Early weight-bearing ambulation     | Cement related complications       |
| Shorter duration of surgery         | Make use of permanent exogenous materials |
| Shorter hospital stay               | Not suitable for community ambulant patients |
| Fluoroscopy not needed              |                                    |
| Relatively cheaper than internal fixation |                                  |
| Less failure rate and re-operation |                                    |
| Better functional outcome from first day postoperative period |                        |

**Conclusion**

Primary cemented bipolar hemiarthroplasty allows early weight bearing and produces good to excellent functional outcomes in home-ambulant elderly patients with unstable pertrochanteric fractures with minimal complications. Level of evidence is level II (Prospective cohort study).

**Limitations**

1. Prolonged hospital stays: Despite weight-bearing ambulation at second postoperative day, patients are kept in the hospital until they are confident ambulating using a walking frame because of paucity of nursing homes to discharge patients to in our environment. This is not unconnected with the fact that African cultures and religions encourage children to take care of their parents in old age.

2. Variable days of presentations due to various length of stay with the TBS also made some of the cares to the patient to be individualized.

**References**

1. Mansukhani SA. A Comparative study of the Dynamic Hip Screw, the Cemented Bipolar Hemiarthroplasty and the Proximal Femoral Nail for the Treatment of Unstable Intertrochanteric Fractures. J Clin Diagnostic Res. 2017.

2. 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(12):561-8.

3. Gashi YN, Elhadi AS, Elbushra IM. Outcome of Primary Cemented Bipolar Hemiarthroplasty compared with Dynamic Hip Screw in Elderly Patients with Unstable Intertrochanteric Fracture. Malaysian Orthop J [Internet]. [Cited 2020 May 29] 2018;12(1):36-41. Available from: http://www.ncbi.nlm.nih.gov/pubmed/29725511

4. Singh S, Shrivastava C, Kumar S. Hemi replacement arthroplasty for unstable inter-trochanteric fractures of femur. J Clin Diagnostic Res 2014.

5. Kadam R, Sawant R, Chhallani A. Functional outcome of intertrochanteric fractures treated with bipolar hemiarthroplasty. Int J Res Orthop 2016;3(1):1.

6. Rodop O, Kiral A, Kaplan H, Akmaz I. Primary bipolar hemiprosthesi for unstable intertrochanteric fractures. Int Orthop 2002;26(4):233-7.

7. Kiran Kumar GN, Meena S, Vijaya Kumar N, Manjunath S, Vinaya Raj MK. Bipolar hemiarthroplasty in unstable intertrochanteric fractures in elderly: A prospective study. J Clin Diagnostic Res 2013;7(8):1669-71.

8. 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(4):428-34.

9. Gu GS, Wang G, Sun DH, Qin DM, Zhang W. Cemented bipolar hemiarthroplasty with a novel cerclage cable technique for unstable intertrochanteric hip fractures in senile patients. Chinese J Traumatol - English Ed. 2008.

10. Cui Q, Liu YS, Li DF, Zhang P, Guo J, Liu C, et al. Cemented hip hemiarthroplasty clinical observations on unstable intertrochanteric fracture in elders. Eur J Trauma Emerg Surg 2016.

11. Grote S, Stegmeyer F, Bogner V, Biberthalpr P, Mutschler W. [Treatment results after cemented hemiprosthesi for care of unstable pertrochanteric femoral fractures in the elderly]. Unfallchirurg 2012.

12. Yli-Kyyyn T, Ojanperä J, Venesmaa P, Kettunen J, Miettinen H, Salo J, et al. Perioperative complications after cemented or uncemented hemiarthroplasty in hip fracture patients. Scand J Surg 2013.

13. Yin Q, Jiang Y, Xiao L, Tian Y, Fu J, Li X, et al. Treatment of intertrochanteric comminuted fracture in aged patients by replacement of artificial long-stem,
bipolar femoral head. Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi 2008;22(6):692-5.

14. Yoo Il J, Ha YC, Lim Young J, Kang H, Yoon BH, Kim H. Early rehabilitation in elderly after arthroplasty versus internal fixation for unstable intertrochanteric fractures of femur: A systematic review and meta-analysis. J Korean Med Sci. 2017;32(5):858-67.

15. Cha YH, Ha YC, Yoo J Il, Min YS, Lee YK, Koo KH. Effect of causes of surgical delay on early and late mortality in patients with proximal hip fracture. Arch Orthop Trauma Surg 2017.

16. Jolly A, Bansal R, More AR, Pagadala MB. Comparison of complications and functional results of unstable intertrochanteric fractures of femur treated with proximal femur nails and cemented hemiarthroplasty [Internet]. Vol. 10, Journal of Clinical Orthopaedics and Trauma. Elsevier B.V. [cited 2020 May 29]. 2019, 296-301. Available from: http://www.ncbi.nlm.nih.gov/pubmed/30828197

17. Thakur A, Lal M. Cemented hemiarthroplasty in elderly osteoporotic unstable trochanteric fractures using fracture window. Malaysian Orthop J 2016.

18. Yoo J-I, Cha Y-H, Kim K-J, Kim H-Y, Choy W-S, Hwang S-C. Comparison between Cementless and Cemented Bipolar Hemiarthroplasty for Treatment of Unstable Intertrochanteric Fractures: Systematic Review and Meta-analysis. Hip Pelvis [Internet]. [Cited 2020 May 29] 2018;30(4):241. Available from: http://www.ncbi.nlm.nih.gov/pubmed/30534543

19. Chehade MJ, Carbone T, Awward D, Taylor A, Wildenauer C, Ramasamy B, et al. Influence of Fracture Stability on Early Patient Mortality and Reoperation After Pertrochanteric and Intertrochanteric Hip Fractures. J Orthop Trauma 2015.

20. Zha GC, Liu J, Wang Y, Feng S, Chen XY, Guo KJ, et al. Cementless distal fixation modular stem without reconstruction of femoral calcar for unstable intertrochanteric fracture in patients aged 75 years or more. Orthop Traumatol Surg Res [Internet]. [Cited 2020 May 29] 2019;105(1):35-9. Available from: http://www.ncbi.nlm.nih.gov/pubmed/30639029