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Unstable intertrochanteric fractures in high risk elderly patients treated with primary bipolar hemiarthroplasty: Retrospective case series

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Abstract
Background: The management of unstable osteoporotic intertrochantric fractures in elderly is challenging because of difficult anatomical reduction, poor bone quality, and sometimes a need to protect the fracture from stresses of weight bearing. Internal fixation in these cases usually involves prolonged bed rest or limited ambulation, to prevent implant failure secondary to osteoporosis. The purpose of this study is to assess the mortality and morbidity and post-operative complication in high risk intertrochanteric fractures treated by cemented bipolar.
Material and Methods: We retrospectively studied, 28 elderly patients with preoperative ASA grade-III with unstable intertrochanteric fractures (AO/OTA type 31-A2.2 and 31-A2.3 and Evans type III or IV) by primary hemiarthroplasty using a cemented bipolar prosthesis. All patients were operated by the same surgical team. Bipolar implants were cemented (tapered design, 2nd generation cemented technique, standard length) and trochanteric comminution was circlage to restore abductor mechanism. The assessment was done with emphasis on perioperative mortality, morbidity and complications related to prolonged bed rest.
Results: Mean patient age was 75.6 (64-91) years and mean follow-up was 22.3 (5-48) months. 10 patients were able to walk with a walker in the first post-operative week. Rehabilitation was easier and faster and post op morbidity like pressure sore pulmonary complication was significantly low (P<0.05). The mortality (2/28) was significantly low. We obtained 15 excellent and 8 good results after 12 months according to the Harris hip-scoring system. The series thoroughly compared with standard international series like, Stern *et al*, Chris Grismud *et al*, Harwin *et al*, Haentgens *et al*, Chan *et al*, Green *et al*.
Conclusion: Primary Bipolar Hemiarthroplasty may be a better alternative treatment for unstable comminuted osteoporotic Intertrochanteric fractures in elderly moribund patients.

Keywords: Hemiarthroplasty, unstable intertrochanteric fractures, high risk elderly patients

1. Introduction
Intertrochanteric fractures are major cause of disability and death in elderly. The incidence of all hip fractures is approximately 80 per 100,000 persons and is expected to double over the next 50 years as the population ages [1]. Intertrochanteric fractures make up 45% of all hip fractures.
Stable fractures can be easily treated with osteosynthesis with predictable results. However, the management of unstable intertrochantric (Evans type III or IV and AO/OTA type 31-A2.2 and 2.3) [2, 3]. Fractures in elderly patients is a challenge because of difficulty in obtaining anatomical reduction and associated with high rates of morbidity and mortality, although the results have improved with the use of internal fixation. In these patients however, comminution, osteoporosis, and instability often preclude the early resumption of full weight bearing. Treatment with primary bipolar arthroplasty rather than internal fixation could perhaps return these patients to their preinjury level of activity more quickly, thus obviating the postoperative complications caused by immobilization or failure of the implant.
Intramedullary interlocking devices have shown reduced tendency for cut-outs in osteoporotic bones and also have better results in cases of unstable intertrochanteric fractures [4]**.** However, the role of the intramedullary devices in unstable osteoporotic and severely comminuted intertrochanteric fractures is still to be defined.

Endoprosthetic replacements have also been shown to achieve early rehabilitation of the patient and good long-term results [5, 6, 7, 8]. However, an ideal treatment method is still rather controversial because of the poor quality of bone mass, comorbid disorders, and difficulty in rehabilitation of these patients.

Recent publications indicate concern with excessive sliding of these fixation devices when used in unstable intertrochanteric fractures, the excessive sliding can result in unacceptable shortening and external rotation deformity of the limb. Bendo *et al* [9] reported that most of the patients with moderate or severe collapse had poor functional results. Elderly patients often are unable to cooperate with partial weight bearing, or if allowed full weight bearing, voluntarily limit loading of the injured limb. To allow immediate postoperative full weight bearing and to avoid excessive collapse at the fracture site, some surgeon recommended prosthetic replacements for unstable intertrochanteric fracture [7].

The purpose of this study was to determine whether cemented hemiarthroplasty using a standard femoral stem is a reasonable alternative method of treatment for elderly patients in unstable intertrochanteric fracture to reduce mortality and morbidity in term of day of full weight bearing and complications related to prolonged bed rest.

2. Material and methods

Between August 2016 and September 2018, 28 patients who were older than sixty five years, associated with preexisting systemic disease, who are high risk for anesthesia (ASA Grade III &IV), osteoporosis as asses by Singh's index, (All patients had confirmed osteoporosis on the preoperative bone mineral density scan confirming with the WHO criteria) [10] The fractures were classified according to AO/OTA and Evans classification. Only AO/OTA type 31-A2.2 and 31-A2.3 and Evans type III or IV fractures were included in this study and who had been independently mobile before sustaining an unstable intertrochanteric fracture were treated by the same surgical team at P.D.U. Medical college and hospital Rajkot.

Patients who were unable to walk before the fracture, who were younger than sixty five years old, not associated with any medical disease or who had stable fracture with intact lesser trochanter been not included in the study.

Operative technique

We used a posterolateral modified Gibbson's approach in lateral position. The fracture anatomy was assessed and a cut was taken high up in the neck (almost subcapital level) to facilitate removal of the femoral head. With the removal of the head, the fracture now had three main fragments namely the greater trochanter, the lesser trochanter, and the shaft with the retained portion of the neck of femur. Thus, the reconstruction was made between greater trochanter, the lesser trochanter, and the shaft were wired together using steel wires in 23 cases while only ethibond sutures were used in five cases which were severely comminuted. (Anteversion - retroversion of the prosthesis - was determined using the lesser trochanter as a guide after temporarily reducing the lesser trochanter anatomically.) The femoral canal was broached with appropriate anteversion. A fixed bipolar prosthesis was then inserted and trial reduction was done. With the trial prosthesis in situ traction was applied to the leg and compared with the opposite leg for limb length equality. We used the second-generation cementing technique and cement restrictor in all cases. Once the prosthesis was fixed, the broken trochanter and calcar were again retightened by tensioning the wire cables. The sleeve of gluteus medius, greater trochanter, and vastus medialis if reconstructed was now reattached to the shaft by additional wires. The short external rotators were then sutured back using bone tunnels in the greater trochanter with the closure of the superficial layers, as routine over a suction drain after achieving hemostasis.

Prophylactic first-generation cephalosporin and low-molecular-weight heparin (enoxaparin) was started 12 h before operation. Walking exercises were started on the second post-operative day. Patients were followed in 3-month intervals for the first year and 6-month intervals in the second year. During the follow-up patients were evaluated according to the Harris hip-scoring scale. (Patient was evaluated using the Harris hip score (HHS) and were graded as <70 poor, 70-79 Fair, 80-89 Good and 90-100 Excellent). We used the Gingras criteria in determining radiographic loosening[11]. For acetabular erosion the distance from the head of the prosthesis to the superior dome of the acetabulum was measured on the immediate post-operative and follow-up roentgenograms.

To determine movements of the bipolar head we measured the angle between a line parallel to the edge of the outer cup and a line parallel to the longitudinal axis of the femoral stem. We measured the angle between these two lines with the hip in neutral position and in 45° of abduction.

3. Results

There were 13 women and 15 men with an average age of 75.6 (64-91) years. The Singh index was grade 3 in 5 patients, grade 2 in 12, and grade 1 in 11. Average interval between occurrence of fracture and hospitalization was 1.4 days and average interval between hospitalization and operation was 5.7 days. Numerous medical problems were noted upon admission, including hypertension, diabetes mellitus, heart disease, neurological disease, haematological disease, lung disease and others.

The average surgery time was 71 min (range, 55-88 min) with an average intraoperative blood loss of 350 ml (range, 175-500 ml). Out of the 32, two patients expired due to unrelated causes (both due to myocardial infarction). The remaining 30 patients having a minimum one year follow up were evaluated and data was further analyzed for only these 28 patients. The minimum follow up was average of 24.5 months (range, 18-39 months).

The patients started full weight bearing at an average 4.2 days after surgery (range, 3-8 days). One patient refused to walk after surgery and had a poor result (HHS 58). The average stay in the hospital was 10.96 days (range, 5-21 days). One of the patients developed bed sore postoperatively, and required a week more of hospital stay, till the healing of the sore. This patient was operated on 5th day post injury and did not have a pre-operative bed sore.

A total of 11 patients were graded as excellent, 10 patients as good, 4 as fair, 3 as poor results. At latest follow-up (mean 24.5 months, range 18 months to 39 months), the mean HHS was 84.8□9.72 (range, 58-97).

At last follow-up, 16 patients were walking without any aid, 10 patients had a limp and used a stick for walking, 1 patient used a walker, and 1 was wheelchair bound. 5 patients had shortening of the operated limb with an average shortening of 1.1 cm (range, 5-15 mm) which was well compensated by giving a shoe raise. A total of 12 patients had an abductor lurch at 3-month follow-up; however, only 3 patients had abductor muscle weakness with a positive Trendelenberg test

at final follow-up. Most of these patients however could walk well with the use of a stick.

Among the patients with poor results, one patient had a superficial wound infection which settled down with a course of intravenous antibiotics for 2 weeks. However, the patient continued to have diffuse pain along the incision site and walked with a limp. The second patient of poor results also had pain and limp, but we could not find any obvious reason for the pain. The patient with the failed result was a case of Alzheimer's disease. The patient did not cooperate with the physiotherapy program and refused to walk postoperatively. Eventually, the patient developed a severe adduction contracture and was wheelchair bound.

Deep infection developed in one patient during the 13th month post-operatively, and the prosthesis was removed 1 year later. There was one case of acetabular erosion, 4 patients with non-union of the greater trochanter and 6 with leg-length discrepancy due to high seating of the prosthesis. In 2 patients we found the circlage wire used for the greater trochanter had broken. There was no dislocation or aseptic loosening. One patient developed pneumonia which settled down with intravenous antibiotics. One patient had a periprosthetic fracture 6 months after surgery which was treated with a locking compression plate. The fracture healed and the patient went on to have an excellent result.

4. Discussion

Displaced, unstable, severely comminuted intertrochanteric fractures are associated with notable morbidity and mortality in elderly patients. Internal fixation has drastically reduced the mortality associated with intertrochantric fractures [12]; however; early mobilization is still avoided in cases with comminution, osteoporosis, or poor screw fixation. Primary hemiarthroplasty offers a modality of treatment that provides adequate fixation and early mobilization in these patients thus preventing postoperative complications such as pressure sores, pneumonia, atelectasis, and pseudo arthrosis. The Indian perspective regarding the use of primary arthroplasty as a modality of treatment for severe comminuted unstable intertrochantric fractures is been commented on by few authors [13, 14]; however, our case series reporting the Indian experience (Mid Term Results) with this technique.

Hemiarthroplasty has been used for unstable intertrochanteric fractures since 1971, however less frequently as compared to femoral neck fractures. It is initial use was as a salvage procedure for failed pinning or other complications. Tronzo claimed to be the first to use long, straight-stemmed prosthesis for the primary treatment of intertrochanteric fractures [5]. Rosenfeld, Schwartz, and Alter reported good results with the use of the Leinbach prosthesis. Since then there are multiple studies showing good results using this technique. Stern and Goldstein reported on 29 patients with intertrochanteric fractures treated with the Leinbach prosthesis with excellent results in 88%. They reported a deep infection rate of 6.8% but no dislocations. Stern and Angerman [16] reported on 105 cases of unstable intertrochanteric femoral fractures treated with Leinbach prosthesis. They reported a deep infection rate of 2.8% but made no comments on dislocations. They obtained a 94% success rate in returning the patient to the pre-fracture ambulatory status.

The earliest comparison of internal fixation and hemiarthroplasty was done by Haentjens *et al*. [16] showing a significant reduction in the incidence of pneumonia and pressure sores in those undergoing prosthetic replacement. In a comparative study of cone hemiarthroplasty versus internal fixation, Kayali *et al.* reached the conclusion that clinical results of both groups were similar. Hemiarthroplasty patients were allowed full weight bearing significantly earlier than the internal fixation patients.

Broos *et al*. [7] concluded that the operative time, blood loss, and mortality rates were comparable between the two groups, with a slightly higher percentage (73% versus 63%) of those receiving a prosthesis considered to be pain free. The functional outcome was comparable between both groups. Stappaerts *et al*. found no difference between two groups except a higher transfusion need in the replacement group. In our series the average blood loss was 350 ml with only six patients requiring postoperative blood transfusion and there was no incidence of dislocation.

Rodop *et al*. [18] in a study of primary bipolar hemiprosthesis for unstable intertrochanteric fractures in 37 elderly patients obtained 17 excellent (45%) and 14 good (37%) results after 12 months according to the Harris hip-scoring system. A total of 18 out of 23 patients in our study had a good to excellent result (71%). If the patients with a fair result were also included, the percentage goes up to 91%. Thus the results of this modality of treatment are definitely promising.

Green [19] reported on 17 patients who had a primary head-neck bipolar prosthetic replacement for unstable intertrochanteric femoral fractures. Average patient age was 82.2 years, average time to ambulation was 5.5 days, and average follow-up time was 13.2 months. Two patients had non-union of the greater trochanter. Overall results were uniformly good with no infections or dislocations. The mortality rate was 20% at the end of the first year.

P. Florian Geiger; P. Monique Zimmermann-Stenzel [20] found that Mortality was significantly influenced by Age, Gender, Amount of Co-morbidities but not by fracture classification.[43]

Mortality rate of bipolar arthroplasty and internal fixation of different study compare with current study are shown in following table (Table 1). (Journal of arthroplasty- April2005, Chris Grimsud, Raul J. Monzon *et al* [15]).

Table 1: Comparison of mortality rate in various studies with present study

	Mortality at 1 yr
Stern *et al.* [17]	14%
Green *et al.* [19]	20%
Chris Grismud [15]	10.3%
Harwin *et al.* [6]	NR
Haentgens *et al.* [16]	35%
Chan *et al.* [8]	7.3%
Current study	14%

In the short term, unipolar or bipolar hemiarthroplasty seem to give better results than open reduction and internal fixation in the treatment of unstable intertrochanteric hip fractures in terms of mortality and morbidity rates, complications, early rehabilitation and returning to daily living activities. Long-term problems such as loosening, protrusio, stem failure, late infections and late dislocations have not been seen in these series. While these theoretically are potential problems they are seen usually years after the surgery. Although the average patient age in these series was between 74 and 82 years, shorter-term complications seem to be more important than long-term ones. Because life expectancy increases in all countries, long-term disadvantages of the hemiarthroplasty may outweigh its short-term advantages.

Delay in surgery is an important predictor for mortality in

patients with proximal femur fracture and also of the postoperative morbidity. We in our study, however, could not comment on these points because of small sample size and this is one of the limitations of our study. Further, inhomogeneous population in terms of existing co-morbidity and retrospective nature of our study are the other limitations.

5. Conclusion

Thus in conclusion, primary hemiarthroplasty does provide a stable, pain-free, and mobile joint with acceptable complication rate as seen in our study; however a larger prospective randomised study comparing the use of intramedullary devices against primary hemiarthroplasty for unstable osteoporotic fractures will be needed.

However, bipolar hemiarthroplasty for unstable intertrochanteric fractures was used as a salvage procedure after primary fixation failure, but primary bipolar hemiarthroplasty may be used as a better alternative treatment for unstable osteoporotic Intertrochanteric fractures in elderly moribund patients for early ambulation and good functional results.

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