

# Study of outcomes of cemented hemiarthroplasty for comminuted intertrochanteric fractures in the elderly

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## ABSTRACT

**Aims & objectives:** To assess the functional outcomes of the unstable intertrochanteric fractures in the osteoporotic individuals treated by primary cemented hemiarthroplasty by early mobilization and immediate weight-bearing, restoration of limb length, and gait Assessment.

**Materials and methods:** It is a prospective study of 17 elderly patients with comminuted intertrochanteric fractures managed with cemented hemiarthroplasty attending to the Department of Orthopaedics, Government General Hospital, Rangaraya medical college, Kakinada.

**Results:** 17 cases of unstable intertrochanteric fractures were treated with cemented bipolar hemiarthroplasty. The average follow-up period was 12 months. The average age was 72.75 years with a standard deviation of 5.56. Most (82.3%) of the patients presented with Boyd and Griffin type 2 fracture. The functional assessment by HHS showed good to excellent outcomes in most of the patients (64.7%). 2 patients had abductor weakness, 1 patient had superficial surgical site infection, one had hypotension, and 1 patient had bedsore.

**Conclusions:** Primary cemented bipolar prosthetic replacement in comminuted intertrochanteric fractures in the elderly patients provide s painless, stable, and mobile hip joint so that we can institute early postoperative mobilization which can avoid the consequences of prolonged recumbency. Hemiarthroplasty also avoids a second procedure in such elderly patients with multiple comorbidities as there is a high risk of failure of internal fixation in patients with poor bone quality, subjecting them to a second surgery and anaesthesia being a risky proposition.

## 1. Introduction

**Background:** Intertrochanteric fractures with extensive displacement or comminution are prevalent among older individuals (age >65 years) because of decreased bone quality and are caused primarily by trivial trauma by slip and fall.<sup>1</sup> Intertrochanteric fractures account for 45% of fractures in osteoporotic individuals. Osteosynthesis of intertrochanteric fractures often needs prolonged immobilization which can lead to atelectasis, pressure sores, pneumonia, and deep vein thrombosis posing a significant morbidity and a 20% mortality risk following surgery.<sup>24</sup>

The poor bone quality predisposes to implant failure, non-union, and gross shortening.<sup>2,5,6</sup>

Osteosynthesis requires hardening of callus as well as trabecular strengthening with initial non weight bearing exercises, which only improves gradually with time. Hence, osteosynthesis cannot be relied upon to allow early complete weight-bearing in the presence of marked osteoporosis and significant fracture site comminution.<sup>4,6</sup> This can be addressed with a prosthesis that transfers axial load from the hip joint to the middle of the femur.<sup>7</sup>

Thus, fracture stability (comminution), quality of bone

(osteoporosis), and immediate postoperative mobilization of the patient are the factors that determine the functional outcome of intertrochanteric fractures in the elderly.<sup>4,7</sup> For the management of unstable intertrochanteric fractures in osteoporotic individuals, some surgeons favor cemented prosthetic replacement to allow early postoperative weight-bearing, quick rehabilitation, reduce post-operative mid-thigh pain, and avoid complications from osteosynthesis.<sup>7,8</sup>

Even now, many of the surgeons wouldn't agree about the ideal management for older patients with unstable intertrochanteric fractures,<sup>2,5,6</sup> and there is little data on the prosthetic replacement for these fractures. The goal of this study is to analyze the functional outcomes of cemented hemiarthroplasty as the primary management for unstable intertrochanteric fractures in osteoporotic patients by implementing early mobilization in the post-operative period.

## 2. Aims & objectives

To assess the functional outcomes of the unstable intertrochanteric fractures in the osteoporotic individuals treated by primary cemented hemiarthroplasty by.

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1. Early mobilization and immediate weight-bearing
2. Restoration of limb length
3. Gait Assessment

### 3. Methods

After getting approval from the ethics committee and informed consent from the participants, a prospective study was conducted on 17 inpatients admitted to Government General Hospital, Kakinada during a period of 2 years from December 2019 to November 2021.

### 4. Inclusion criteria

1. Comminuted unstable intertrochanteric fractures
2. Age above 65 years
3. Boyd and Griffin type 2,3 and 4
4. DORR type 3 proximal femur

### 5. Exclusion criteria

1. Stable intertrochanteric fractures
2. Boyd and Griffin type 1
3. DORR type 1 and 2 proximal femur
4. Patients with severe comorbidities

### 6. Surgical technique

Under spinal/epidural anaesthesia, patient was positioned in lateral decubitus. Padding was applied to all bony prominences. The Operative limb was allowed to be mobile to allow for checking stability during the procedure.

#### 6.1. Procedure – “coxo femoral bypass”

All surgeries were performed through the Hardinge direct lateral transgluteal approach. A posteriorly directed lazy-J incision was given centered over the greater trochanter.<sup>9</sup> Fascia lata was divided in line with the skin incision. The tensor fascia lata was retracted anteriorly and gluteus maximus posteriorly, and exposed the insertion of gluteus medius and the origin of the vastus lateralis. The tendon of the gluteus medius was released from the greater trochanter leaving posterior half of its insertion intact, and the muscle fibers of the gluteus medius at the junction of the middle and posterior third was split. Care was taken to restrict the split not more than 4–5 cm from the tip of the greater trochanter to avoid injury to the superior gluteal nerve and artery. Distally, the incision was carried along the fibers of the vastus lateralis down up to the femur. Anterior portion of gluteus minimus and vastus lateralis can be elevated subperiosteally if required according to surgeon's discretion. The hip was then abducted to expose the anterior capsule and capsulotomy was done. The fracture anatomy was assessed and a high neck cut was done (about 1–2 cm above lesser trochanter) depending upon the severity of comminution.

In most of the cases, the proximal neck with head of the femur were extracted with the help of corkscrew through dead lateral (Hardinge) approach taking advantage of the coronal split of the greater trochanter. Distal neck if available, was properly shaped with power saw for proper entry of the prosthesis. No other osteotomies for neck were required. [Fig. 1](#)

#### 6.2. “TROCHANTERIC RECONSTRUCTION”

Every attempt was made to reconstruct the medial wall and the lesser trochanter along with the medial calcar (if not comminuted). It was fixed with the help of cerclage SS- wire by making a drill hole in the lesser trochanter to prevent upward migration of cerclage wire while tightening. The neck was cut in such a way that its medial part becomes



**Fig. 1.** Trans trochanteric window (coronal split in GT).

useful in reconstruction of the calcar.

Provisional fixation on the lateral side with reconstruction of greater trochanter over lateral wall was done with the help of K-wires. The distance from the fracture on lateral wall to the tip of greater trochanter was measured to determine the depth to which the prosthesis needs to be inserted (as the tip of the greater trochanter corresponds to the center of the head of femur). [Fig. 2 and 3](#)

The SS- wires were passed through the holes made in the greater trochanter and were fashioned in a figure of 8 manner around the K-wires. The wires were kept aside and tightened only after the insertion of the prosthesis along with the cement and once the cement became hardened. [Fig. 4](#)

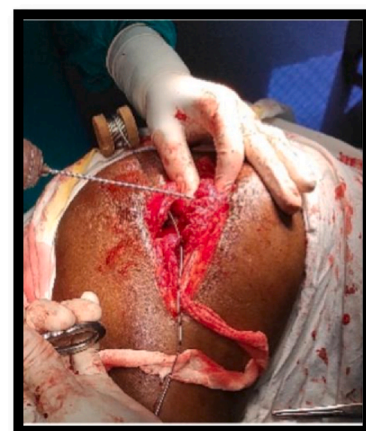
As the fracture fragments were provisionally fixed, care was taken to prevent the cement from entering fracture site by distal filling and avoiding proximal filling of the canal with the cement. The gluteus medius, greater trochanter, and the vastus lateralis were fashioned to be maintained as a stable and continuous lateral sleeve. [Fig. 5](#)

When both greater trochanter and lesser trochanter were heavily comminuted, they were reconstructed to form separate masses using ethibond and finally attached to the shaft using steel wires.

Then, femoral head was reduced into the acetabulum. The hip movements were assessed for stability. Finally, wound was closed over a suction drain.

#### 6.3. Postoperative protocol and follow up

A compression bandage to the lower limb and aspirin 75 mg once daily were given for 14 days to prevent deep vein thrombosis.<sup>26</sup> Blood transfusions were administered if hemoglobin was less than 10 in the post operative period. After 48 h wound was inspected for dressing and the vacuum drain was removed. Apart from the pre op dose, a 2nd dose



**Fig. 2.** Provisional fixation of GT



Fig. 3. Measurement of depth to which prosthesis need to be inserted.

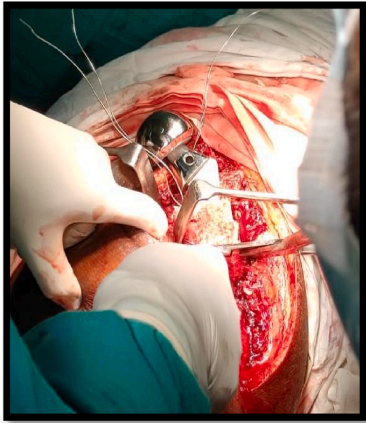


Fig. 4. Insertion of bone cement and prosthesis.



Fig. 5. Final reconstruction of GT

of antibiotic (intra-operative) was given if surgical time exceeded 2 h. Suture removal was done on the 14th postoperative day.

Post operative follow up was scheduled at 6 weeks, 3 months, and 6 months. As we wanted to give early mobilization, patients were mobilized from bed to chair on the second day itself. Touch toe gait with

walker was initiated on the 2nd day, followed by partial weight bearing with a cane on 5th or 6th day. Under supervised gait training full weight bearing was possible on 12th day for majority of the patients. Patients were analyzed clinically and radiologically at each follow-up visit. Radiologically the patients were assessed for the position of the stem, stem loosening or subsidence, and periprosthetic fractures. Clinical and functional assessments were done using the HHS at each visit. Fig. 6, 7, 8, 9, 10 and 11

## 7. Results

17 cases of unstable intertrochanteric fractures were treated with cemented bipolar hemiarthroplasty from December 2019 to November 2021. The follow-up period ranged from 6 months to 24 months with an average of 12 months.

The average age in the present study was 72.75 years with a standard deviation of 5.56 years, and 82.3% of patients belonged to the 65–79 years age group. There were 27.7% cases above 80 years of age.

70.5% of the subjects were females in the current study. All 17 cases were due to trivial falls. The right hip was more frequently (58.8%) involved. Hypertension was the most common comorbidity (4 cases), followed by diabetes mellitus (2 cases) and co-existing DM and HTN (2 cases). One case had Hypothyroidism and another case had epilepsy.

In the present study maximum patients (82.3%) had Boyd and Griffin type II fracture, 11.7% had type III, and 5.8% had type IV fractures. The mean time from injury to surgery was 6.06 days. The mean time taken for surgery was 90 min. The mean time for postoperative ambulation was 6.2 days with a standard deviation of 2.98 days. The mean hospital stay was 14.5 days.

The functional outcome was calculated using HHS (Harris Hip Score) at 6 months follow up period. The mean HHS was 81.41 with a standard deviation of 6.89 which indicates that it's a homogenous group. Out of 17 patients, 11 patients had excellent to good results, while 5 had fair results and 1 patient had poor result.

2 Patients had a LLD (limb length discrepancy) of 2 cm, 4 patients had 1–1.9 cm, and 7 patients had < 1 cm LLD. The mean LLD was 0.75 cm with a standard deviation of 0.69 cm. 4 Cases had no shortening at all. A total of 5 cases (29.4%) had postoperative complications. 2 Patients developed abductor weakness, 1 had hypotension and she died on the 2nd postoperative day, 1 had surgical site infection, and 1 had bed sore. Care was taken to restore the vertical as well as horizontal offsets as far as possible (as per the pre operative x-ray templating) to minimize the abductor inefficiency and limb length discrepancy.

Despite all the measures taken 2 patients developed abductor weakness clinically manifested as lurch. The weakness was measured by using MRC grading on clinical examination. Patients with weak abduction were trained to increase the power by routine physiotherapy.



Fig. 6. 72/M, type 2 boyd and griffin fracture left HIP.

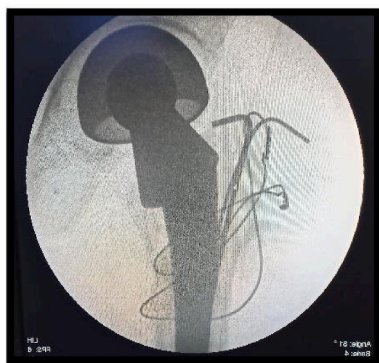


Fig. 7. Intra OP C - arm image

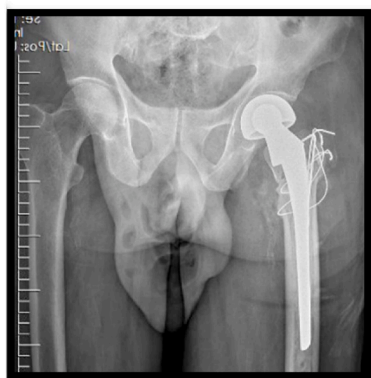


Fig. 8. Post OP follow UP at 1 year.



Fig. 9. 68/F, type 2 boyd and griffin fracture left HIP.



Fig. 10. Post OP follow UP at 6 months.



Fig. 11. Post OP follow UP at 1 year.

### 8. Discussion

Intertrochanteric fractures were associated with increased morbidity and mortality in elderly patients. Osteosynthesis of these fractures reduced the mortality rate. The intramedullary devices were considered biomechanically superior to extramedullary devices for unstable intertrochanteric fractures.<sup>20</sup> However, earlier mobilization is still not recommended in these cases to prevent implant failure. Hemiarthroplasty offers a modality of treatment option for intertrochanteric fractures that provides stable hip and early mobilization, thus reducing postoperative complications. Stern and Goldstein used the Leinbach prosthesis for the primary treatment of 22 intertrochanteric fractures and found early ambulation and early return to the pre-fracture status.<sup>21</sup> Grimsrud et al. treated 39 patients of unstable intertrochanteric fractures with a standard femoral stem and cerclage wiring of the trochanter and observed early weight bearing on the injured hip and had a relatively less complications.<sup>22</sup>

The use of prosthetic replacement eliminates much of the difficulties associated with osteosynthesis and the necessity for the union. Although the direct benefits of endoprosthesis might not be obvious at the outset, the patients returning to a better level of activity, close to pre-injury levels which is not always possible with internal fixation, has favored hemiarthroplasty.

Hemiarthroplasty was commonly used for neck of femur fractures and only in the management of failed osteosynthesis of IT fractures. The long-stem Matchett Brown endoprosthesis was used in 1974 by Tronzo,<sup>11</sup> for the first time, for the primary treatment of IT fractures and he demonstrated its benefits in its primary application itself. This encouraged further research in the use of endoprosthesis for IT fractures and soon other surgeons started reporting better outcomes by using various prostheses.

The present study was conducted among 17 elderly patients with comminuted IT fractures who presented to our tertiary care facility during a two-year period with an average 6 months to 1 year follow-up period, with the goal of furthering research in this area.

In this analysis, the average age for IT fractures was 72.7 years, which was similar to the age range found in other studies<sup>12–16</sup> like 72.4 in Kiran Kumar Gn et al, 75.6 in Rodop et al, 76 in Gashi et al, and 78 by Skender Ukaj et al. IT fractures occur more commonly in the elderly due to generalized osteoporosis, reduced soft tissue over bone, and decreased reflexes. The lower mean age in the current study can be attributed to the small sample size. 70.5% of the subjects were females in the present study. A study by Gashi et al had 62% females and 38%

males, 57% females and 43% males by **Skender Ukaj et al**, while **Rodop et al** included 63% women and 37% men in their study. A higher incidence in the female population is attributed to their decreased bone mass after menopause.

The mode of injury was a trivial fall for all 17 cases in our study. All these cases had varying amount of fracture comminution owing to their poor bone quality. This influenced us to choose cemented hemiarthroplasty over osteosynthesis; which allows early mobilization and avoids the possibility of a second surgery in case if osteosynthesis fails due to poor bone quality.<sup>12</sup>

58.8% of patients had associated comorbidities in the current study. Hypertension was the most common comorbidity (4 cases), followed by diabetes mellitus (2 cases) and co-existing DM and HTN (2 cases). One case had hypothyroidism and another case had epilepsy. In a study conducted by **Xiang Ping et al**,<sup>8</sup> 64% of patients had co-morbid conditions. In both studies, hypertension was the predominant co-morbid condition. The comorbidities led to a significant delay to prepare them fit for anaesthesia, but all the candidates were taken to surgery within 8 days. In cases of proximal femur fractures, the surgical delay is a significant predictor of death and postoperative morbidity.<sup>17</sup> However, due to the limited sample size, the current study was unable to remark on these aspects, which is one of the study's shortcomings.

Moreover, because of the dissimilarities in the accompanying comorbidities among patients, the effect of delay in surgery on overall functional outcome could not be commented. In the present study, the mean time from injury to surgery was 6.06 days. Whereas it was 5.61 days in a study by **Sancheti et al**,<sup>18</sup> and it was 7.1 days in a study conducted by **Rodop et al**. The delay in time taken from trauma to surgery was because of candidates presenting late & the associated co-morbid conditions which required stabilization before surgery.<sup>4,15</sup>

82.3% of the cases in this study have Boyd and Griffin type II fractures. All cases were done in Hardinge's approach. This *trans*-gluteal approach could address the intertrochanteric fracture better than the regularly done posterior approach. Whenever there was a coronal split in the GT, the head could be easily extracted through the *trans*-trochanteric window. This also helped in a more stable and better reconstruction of the trochanter within lesser time. The average time taken for surgery was 90 min which was similar to other studies. All procedures were done by senior surgeons in the current study to achieve a less than average operating time. The increasing experience with hemiarthroplasty procedures and better implant designs has brought down the surgical time associated with this procedure.<sup>8,13,14</sup>

In our series, after the surgery most of the patients began partial weight bearing by means of an aid at 6.2 days. It was 5.4 days in a study by **Kiran Kumar Gn et al**,<sup>16</sup> and 5.5 by **Green S, Moore T et al**.<sup>19</sup> Our technique allows safe and early weight bearing on the injured hip. Since most of the patients were out of the bed on the 2nd post operative day, we had relatively less complications related to recumbency. If osteosynthesis was done, weight bearing would have been delayed to allow enough time to achieve trabecular strengthening and consolidation of the callus at the comminuted fracture site. By this time, patient might have developed complications of prolonged recumbency as well. Hemiarthroplasty patients were allowed full weight bearing significantly earlier than the internal fixation patients.<sup>7,23</sup> Partial weight bearing creates a micromovement in the dynamic systems which increases union rate. However, cut-out is the main complication of internal fixation. Many surgeons prefer arthroplasty for the treatment of unstable trochanteric fractures in the elderly in order to decrease complications. They insisted that early weight bearing was the major factor responsible for decreasing postoperative complications.<sup>7,23</sup>

In the current study, 5 cases (29.4%) had postoperative complications. Two of them developed weakness of the abductor muscles, 1 had hypotension and she died on the 2nd POD due to myocardial infarction. 1 patient had SSI and 1 had bedsore. Two patients who developed abductor weakness had severe comminution of the GT which could not be reconstructed satisfactorily. They could not be mobilized until the 7th

POD. They were given gait training in the follow-up period and they walked with limp and lurch with an aid. At the end of the study, the lurch got improved and they were walking comfortably with a cane. 1 obese patient with DM and HTN developed superficial SSI that got over with a course of IV antimicrobials for 5 days. The patient who had bedsore due to non-compliance with physiotherapy received regular wound care and eventually healed before discharge with no progression in grade. In our research, there were no late infections, DVT, pneumonia, subsidence or loosening of the implant, dislocation, or periprosthetic fractures.

In the present study, 6 cases (35.2%) had a shortening of 1–2 cm, which on raising the shoe height got successfully compensated while the remaining subjects had no functional restrictions and did not need any assistance or intervention. In severely comminuted fractures, it was difficult to determine the prosthesis length (vertical offset) because of the loss of anatomical landmarks like trochanters. After broaching, the trial reduction was done to identify the correct length that would bring both knees to the same level. Then enough soft tissue tension was given and the prosthesis was held in place. The desired femoral stem was inserted into the medullary canal containing cement to the exact length and version as determined by the trial prosthesis. At the last follow-up, two patients had abductor muscle weakness, a positive Trendelenberg test, and Trendelenberg gait. The majority of our subjects, on the other hand, could walk comfortably with a cane. The mean HHS at 1-year follow-up in the present study was 81.41 with 64.70% of patients having excellent to good scores. Similar studies by **Sancheti et al** reported 71% of good to excellent results in their study. It was 65.8% by **Xiang Ping et al**, 45.2% by **Thakur et al** and 74.5% by **Rodop et al**.<sup>8,14–16</sup>

Increased blood loss, mechanical issues including dislocation, and infection were listed as potential drawbacks of the coxo-femoral bypass approach by its critics in comparison to internal fixation as a standard procedure. When hemiarthroplasty and internal fixation were first compared, **Haentjens et al**.<sup>23</sup> found that internal fixation significantly reduced the risk of pneumonia and pressure sores in patients receiving prosthetic replacement. In a comparison study of internal fixation vs cone hemiarthroplasty, **Kayali et al**.<sup>6</sup> concluded that the clinical outcomes of both groups were comparable. Patients who had hemiarthroplasty were allowed to fully weight bear far sooner than those who had internal fixation. According to **Broos et al**,<sup>24</sup> the two groups had identical operating times, blood losses, and fatality rates, with a slightly larger proportion of those getting prostheses reporting no pain (73% versus 63%). Both groups experienced a comparable functional outcome. A higher transfusion demand in the replacement group was the only difference **Stappaerts et al**.<sup>25</sup> could make out between the two groups.

The strengths of the current study include that, consequences of prolonged recumbency is well tackled by the early post-operative mobilization after achieving a stable and painless hip. If the patient had an osteosynthesis for an unstable IT fracture, there is a high risk of failure, subjecting them to a second surgery and anaesthesia being a risky proposition. As a result, there is a very good possibility of avoiding a second procedure in the current study. The weakness of this study is that the long-term complications of prosthetic replacement may overshadow its short-term benefits. It doesn't allow to comment on the effect of delay in surgery on overall functional outcomes due to the limited sample size and the dissimilarities in the accompanying comorbidities among patients.

## 9. Conclusion

Primary cemented bipolar prosthetic replacement in unstable intertrochanteric fractures in elderly patients allows quicker mobilization and faster recovery to pre-injury levels. It provides a long-term solution and avoids the need for a second surgery, thus enhancing the quality of life. However, a larger prospective RCT comparing the use of intramedullary devices against primary hemiarthroplasty for unstable

osteoporotic fractures will be needed.

### Declaration of competing interests

Jijulal.C.U, G. Jayaram, M.V.Sudhakar, and R. Ashok Kumar declare that they have no conflicts of interest.

### Author statement

Jijulal.C.U, Gude Jayaram and M.V.Sudhakar devised the idea for the study. Gude Jayaram and Ashok Kumar Rangiseti contributed to the literature search. Jijulal.C.U, Gude Jayaram and Ashok Kumar Rangiseti designed and drafted the figures. Jijulal.C.U and Gude Jayaram prepared the initial manuscript draft. All authors contributed to, reviewed and approved the final draft of the paper.

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