

Role of Cemented Bipolar Hemiarthroplasty for Comminuted Inter-trochanteric Femur Fracture in elderly osteoporotic patients through a modified Transtrochanteric approach- “SION Hospital Modification”.

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Abstract: We operated 126 elderly osteoporotic patients with mean age of 65.5 years who sustained Comminuted Inter-trochanteric femur fracture treated with Cemented Bipolar hemiarthroplasty and Tension band wiring for Greater trochanter through transtrochanteric approach. Mean Harris hip score at the mean follow up of 2.92 years was 80.76 and showed a statistically significant improvement as compared to pre-operative scores. Mean blood loss during the mean operative time of 61.35 min was 321 ml.

In our case series we came across some serious complications like infection, dislocation, osteolysis, Non-union Greater trochanter, protusio and implant breakage but no fatalities were reported. 5 of our patient underwent repeat surgery in form of Total Hip Replacement and 1 Excision Arthroplasty. From our study we would like to suggest that Cemented Bipolar hemiarthroplasty is a viable technique for elderly osteoporotic patients with Comminuted inter-trochanteric femur fracture using “modified Sion hospital” technique with no trauma to abductors or external rotators of hip and sciatic nerve as we approach the hip through the fracture site itself and not posteriorly as in Southern Moore’s approach. It also helps in faster rehabilitation and recovery in elderly osteoporotic patients. Modified “SION HOSPITAL” technique needs further evaluation and level 1 & 2 study for its efficiency comparing it to other approaches and its usage for Total hip arthroplasty in comminuted inter-trochanteric fractures.

Keywords: Inter-trochanteric fractures, comminuted, unstable, Elderly osteoporotic, cemented Bipolar, Hemiarthroplasty.

I. Introduction.

Comminuted, unstable inter-trochanteric femur fractures are one of the most common fractures in elderly osteoporotic patients. Both Extracapsular and intracapsular neck femur fractures constitute one of the major cause of mortality in elderly population¹. The mortality rates after occurrence of these fractures is as high as 20 percent in the first post-operative year². These fractures are caused generally by trivial trauma like fall in bathroom or on floor, slipping while walking etc. Stable Inter-trochanteric fractures have been treated successfully with open reduction and internal fixation using Dynamic hip screw, Cephalomedullary nail or Jewett blade plate etc. But it has been a challenge, treating unstable comminuted inter-trochanteric femur fractures (Evan type III and IV, AO/OTA type 31- A2.2 and 2.3) as in elderly osteoporotic patients ,anatomical reduction and early rehabilitation both are essential^{3,4}. Cut-out, Excessive head collapse, Plate breakage , plate pullout, Z-effect, reverse Z effects are few of the implant related complications especially with unstable type of fractures^{5,6}. Intramedullary device has shown better results with less cut-out rates in osteoporotic comminuted inter-trochanteric femur fractures but on the other hand Endoprosthesis have proved good mid-long term survivorship and early rehabilitation^{7,8,9}. The main motive of performing surgery in a comminuted inter-trochanteric fracture femur was early ambulation and avoids complications associated with Open reduction and internal fixation in elderly osteoporotic patients¹⁰. This aim is fulfilled to some extent by Bipolar hemiarthroplasty.

The treatment of osteoporotic unstable comminuted inter-trochanteric femur fracture in elderly patients has still been a controversial debate. The aim of our study was to evaluate the efficiency of Bipolar hemiarthroplasty in such cases in terms of mid-term survivorship and functional outcome.

II. Material and Methods

126 patients underwent Cemented Bipolar hemiarthroplasty between 2007 and 2012 who had sustained inter-trochanteric fractures. All patients were operated by primary and corresponding authors by Transtrochanteric approach. We selected this approach as in all our cases greater trochanter and lateral wall was fractured so in all cases femoral head was approached through the fracture site. We had kept certain inclusion criteria for our study.

Inclusion Criteria –

- 1) Age- More than 55 years.
- 2) All Patients were osteoporotic, as confirmed on Bone mineral Density as per WHO guidelines.¹¹
- 3) All sustained Evans type III and IV, AO/OTA type 31- A2.2 and 2.3 of Inter-trochanteric Fractures. Unstable, Comminuted Fractures only.
- 4) No other fracture sustained only isolated Inter-trochanteric fracture
- 5) No head injury or other injury.
- 6) Fracture less than 3 weeks old

Exclusion Criteria-

- 1) Patients not willing to participate in the study.
- 2) Any Transcervical, subcapital, basicervical or subtrochanteric fractures.
- 3) Non comminuted IT fractures.

Anaesthesia –

Almost all the patients in our study were given Hypotensive epidural anaesthesia, Barring few who were give general anaesthesia.

Operative Technique –

With patient in lateral position, incision was taken on lateral aspect of hip, centered on proximal aspect of greater trochanter. Proximally incision was curved posteriorly towards Posterior superior iliac spine. Tensor Fascia Lata was cut in the direction of skin incision. Proximally fibres of gluteus maximus were dissected along skin incision to expose fracture site. Now we carefully dissected fracture site and retracted fracture fragments of greater trochanter, so as to reach base of femur neck. We extracted femur head and the attached neck through this “trans trochanteric window”. After extraction of femoral neck and head, acetabulum was inspected and cleared of any of remaining bone pieces. Then we started femoral canal preparation using reamer and serial broach’s. After preparing femoral canal we drilled two holes on lateral aspect of proximal femur 5cm below vastus ridge. 2 Holes were placed 2cm away from each other. A stainless steel wire was passed from outside through one hole in the medullary canal and then taken out from another hole. Now the two free ends of the wire are lying on lateral aspect of femur. The implant placement is now started with special emphasis on-

1. Ante version which is decided by using long axis of the leg as guide.
2. Length of the implant to be inserted in the femur is decided by carefully judging soft tissue tension. Also tension is checked with Help Of Shuck Test showing less than 2-3mm of displacement, no dislocation of the trial implant with , 10 degree of extension, 50 degree of abduction, 40 degree of adduction external rotation of 30 degrees and flexion 90 -100 degrees and internal rotation of 40-50 degrees. Also Limb length was aimed to maintained almost same as that of other limb and the amount of stem to be sinked in was carefully observed and marked both on trial and final implant before cementing and then cementing was done.
3. No excess cement should spread on fracture site as it interferes with union of the fracture.

We had reconstructed all the calcar with help of cement. Once the Final implant of adequate size is inserted, the hip is reduced. The fracture pieces of GT are now approximated to each other. A wire passer is passed above tip of the trochanter deep inside the abductors. Previously passed wire is now crossed over and passed through the wire passer, so as to complete figure of 8 which is now tightened. This achieves compression across the fracture site and restores the abductor mechanism of hip. Closure is done in layers carefully over a negative suction drain.

Post-operative and Rehabilitation Protocol-

All patients were kept under analgesic effect with help of epidural catheter till two days post-operative. All the patients operated, except for those who had landed with few immediate complications were started with

Physiotherapy . All patients were treated with Quadriceps strengthening exercises immediately post op and full weight bearing walk next day with help of walker for first 6 weeks post-operative. Thereafter patients started full weight bearing with support of a stick. Patients were instructed to use only Western style commode for Toilet activity, strictly avoid Indian style commode, avoid activities involving squatting and cross legged sitting for the rest of their life as a precautionary measure to avoid dislocation of the bipolar hemiarthroplasty. Patients were followed up regularly at 2 weeks, 4 weeks, 3 months post-operatively and then yearly once.

III. Results

Statistical Analysis was done by the statistician on Windows XP, Using Microsoft word, Microsoft excel and SPSS 13 by statistician.

Patients were evaluated serially pre-operatively, 3 months post-operatively and then at final follow up using Harris Hip score.

Variables-

We had 126 patients included in our study with 64 female and 62 male patients. 57.9 % patients had suffered the injury due to trivial trauma like fall from chair/bed, slip in bathroom or in house on floor. Rest 42.1% of patients had suffered from major trauma like fall from significant height, road traffic accident or fall from stairs. The data regarding all the variables are as given in Table 1.

Table No. 1 :
Statistics of various variables among the 126 cases

Variables	No.	All cases				Minimum	Maximum
		Mean	SD	Median	IQR		
Age (years)	126	65.75	7.85	66.00	12.00	55.00	88.00
Harris hip score:Pre-op	126	12.49	3.78	10.00	5.00	8.00	20.00
Harris hip Score:3 months post-op	126	69.60	5.92	70.00	6.00	40.00	78.00
Harris hip score:Final follow up	126	80.76	4.70	80.00	4.00	60.00	88.00
Follow-up (years)	126	2.92	1.30	2.50	2.00	1.00	6.00
Blood Loss (ml)	126	321.03	122.21	300.00	100.00	200.00	800.00
Operative time (min)	126	61.35	15.72	60.00	20.00	40.00	100.00
Time between injury & operation (days)	126	3.56	2.65	3.00	2.00	1.00	13.00
Stay in Hospital post-op(days)	126	4.83	1.22	5.00	2.00	3.00	7.00

Note: IQR= Interquartile Range (i.e. 75th Percentile-25th Percentile)

Above Table shows that we had total of 126 patients with mean age of 65 years and mean follow up of 2.9 years. Our mean operative time was 61.35 minutes with mean blood loss of 321 ml . We had operated all the patients within first two weeks of trauma with mean time between injury and operation being 3.5 days . The biggest advantage with this surgery was that all the patients were mobilized immediately on next day of surgery so the recovery and rehabilitation was quick with mean post-operative stay in hospital being 4.83 days. Mean Harris hip score at 3 months follow up and final follow –up showed significant improvement from pre-op mean of 12.49 to that of 69.60 and 80.76 respectively .This improvement was statistically significant. Of 126 patients we had 76.2% patients with good Harris hip score, 21.4% patients had fair and 2.4%patients had poor scores .Harris Hip score had no statistical significance or association with any of the variables used in our study.

Complications-

In our study we had certain significant complication but no mortalities. We divided the complication into immediate(within 3 months post-operative) and delayed. We had 11 patients with immediate complication and 8 with delayed complication. Details of the same are shown in table 2.

Table 2- Complications -

Complications	Immediate	Delayed	Measures Taken
Dislocation	1		Closed Relocated under Anesthesia
Implant Loosening/osteolysis		2	Both were converted to Total hip arthroplasty
Infection	1	1	Immediated infection – debridement and antibiotics

			given. It got cured. Delayed infection at 1.5 years post-op despite repeated debridements and antibiotics-did not heal so implant removal and conversion to excision arthroplasty done.
Implant breakage		1	Converted to Long stemmed total hip arthroplasty
Non-union Greater trochanter		2	Both patients were treated with ORIF with Tension band wiring and freshening of fracture edges of greater trochanter and bone grafting
Protrusion		2	One of the patient was symptomatic so it was converted to total hip arthroplasty and the other was left alone as patient was not symptomatic nor willing for revision surgery.
Recurrent Dislocation	1		Initially treated with closed reduction but despite repeat dislocation -Converted to Total Hip Arthroplasty
Shortening	8		Only shoe raise given that too if needed.
Total			5- Total Hip arthroplasty done 1- Excision arthroplasty Done

2 patients encountered with protrusion were at 4.5 years and 5.5 years of Follow-up. 2 patients encountered with anterior thigh pain and osteolysis were at the mean age of 3 and 4.5years. One patient at follow-up of 2 years had history of trivial trauma with implant breakage. The cause of loosening could not be ascertained and was considered to be aseptic . Non of the complication was directly attributable to surgery statistically. But the Harris hip score was found to have statistical significance in patients with complications with poor scores.

IV. Discussion.

It is beyond doubt that implants like Dynamic hip screw , gamma nail and other intra-medullary devices are the mainstay of treatment of Inter-trochanteric fractures^{12,13}. But complications like screw cut-out, Plate breakage, Z-effect, Reverse Z-effect are some of the implant related complication encountered in unstable comminuted inter-trochanteric femur fractures , mainly in osteoporotic and elderly patients.^{5,6} Maintenance of fracture reduction which should be anatomical or near anatomical, proper positioning of the implant and monitored weight bearing are the pre-requisites to achieve good functional outcomes. But In osteoporotic elderly patients with Inter-trochanteric comminuted fracture femur the bone quality is poor, cut-out rates of implant is high, loss of reduction is an known fact which leads to poor functional results. Also Ambulation is prevented in elderly patients with fear of such complications, which in elderly patients causes other complications like Aspiration Pnuemonitis, Bed sores , Deep vein thrombosis,atelectasis etc which gets further complicated with existing co-morbidities.¹⁴ Hip fractures hence are most serious health care problems affecting elderly patients. There were an estimated 1.66 million hip fractures world-wide in 1990, this worldwide annual number will rise to 6.26 million by the year 2050^{15,16}. Failure rates between 6% - 32% have been reported for internal fixation of both stable and unstable intertrochanteric hip^{17,18}. In our series we had very few implant related complication. Also we had no patients with complications like Bed sore, aspiration pnuemonitis or atelecasis as all the patients were immediately mobilized on next day of operation. Even care was taken that those patients with immediate or delayed complication were given priority and needful was done to see to it that in them early mobilization was started.

Several studies in literature have shown that results with Cemented bipolar hemiarthroplasty are good. It helps in early mobilization of patient with good and fast improvement in Harris Hip score. Complications like pressure sores, aspiration, Pneumonitis are very rare with this surgery. Cemented bipolar hemiarthroplasty has given constant good results in terms of early ambulation and good mid-term survival rates in comminuted unstable inter-trochanteric fractures and results are constant as compared to variable results given by osteosynthesis^{19,20,21}. Even our results were synchronous to the above studies in terms of early mobilization , less implant related complications and faster over-all rehabilitation.

There have been many case series and comparative studies which have compared results of osteosynthesis and cemented bipolar hemiarthroplasty for similar unstable inter-trochanteric fractures. They have proved that final outcome in both the groups were more or less comparable except for the fact that there was

early ambulation in hemiarthroplasty group. They have also stated that blood loss and need for transfusion was more in hemiarthroplasty group as compared to osteosynthesis^{22,23}. We do agree that Blood loss and need for blood transfusion is more in this surgery. We had mean blood loss of 321 ml with minimum of 200 ml and maximum of 800 ml.

The rate of repeat operation in case series with osteosynthesis in elderly patients has been reported to be as high as 8-16%. Repeat surgeries in elderly patients with other co-morbidities have shown more medical complications and implant related complications^{24,25}. Our series had revision surgery 4.8 % which is less than the osteosynthesis group.

We had used standard Tension band wiring technique for fixation of greater trochanter as shown in case series by Zhang Q et al²⁶. In our series we had encountered two delayed non-union of greater trochanter which were treated with repeat open reduction and fixation with circlage wire and bone grafting. Both patients presented clinically with pain at greater trochanter and decrease active abduction at follow-up of 4-5 months post-operatively.

Haentjens et al²⁷ and Geiger et al²⁸ in their case series showed dislocation rate in the patient group who underwent total hip arthroplasty was significantly higher (12% to 44.5%) than those who had bipolar arthroplasty (0 to 3.3%). We too had two (1.5%) patients who had got dislocated post-operatively. One of them were treated with closed relocation under anaesthesia and the other had to be treated with Revision surgery in form of total hip arthroplasty.

Study by George J et al²⁹ has shown Ten-year survivorship of cemented bipolar hemiarthroplasty in inter-trochanteric fracture femur free of reoperation for any reason was 93.6%. We in our series have shown a good early to mid-term survivorship at our mean follow up of 2.9 years with minimum of 1 year and maximum of 6 years.

The literature supports that all three approaches have comparable dislocation rates when using the posterior approach augmented with soft tissue repair and it is apparent an adequate soft tissue repair when performing the posterior approach greatly reduces the relative risk of dislocation. But certain studies have also shown that there are higher rates of dislocation with posterior approach when compared with transtrochanteric and antero-lateral approach. Studies have also shown that former has less rate of ectopic ossification as compared to the latter two. Also there is higher rate of non-union with trans-trochanteric approach thus affecting the abductor lever arm and can lead to Lurching gait³⁰. We in our case series had implemented a novel Trans-trochanteric approach. We had selected all patients with comminuted inter-trochanteric fracture femur which has Greater trochanter as a separate fragment. We had to repair Greater trochanter with tension band wiring irrespective of the approach used. So we did not use Southern Moore's approach. As the greater trochanter fragment was elevated supero-posteriorly we saw the fracture neck and the head through the fracture site. So there was no need to cut external rotators which causes bleeding, nor we had to split Gluteus maximum or any of the abductors. Since we were constantly on lateral aspect nerve was always safe posteriorly. Above mentioned were the advantages of this approach in Comminuted inter-trochanteric fractures. We would like to name this approach "SION HOSPITAL" modification of Transtrochanteric approach for Comminuted inter-trochanteric fractures. There were two cases of dislocation and two cases of non-union Greater trochanter. We postulated that dislocation may be most probably due to inadequate version and possible non union due to either cementing technique or inadequate fixation. But the exact cause could not be ascertained.

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, protrusion, stem failure, late infections and late dislocations have been prevalent. Because life expectancy increases in all countries, long-term disadvantages of the hemiarthroplasty may outweigh its short-term advantages.^{31,32} Our series too have shown such complications and long term survivorship of this implant would always be questionable despite its advantages.

Our results were comparable to study by Sancheti et al³³ and Elmorsy et al³⁴ which has shown that primary bipolar hemiarthroplasty in comminuted extra-capsular neck femur fracture five early mobilization, stable and painfree hip with early rehabilitation and return to daily routine life with less re-operation rate and is fairly economical especially for developing countries.

Our study is an Level 4 study, hence firm conclusions cannot be ascertained. Finally we agree with The Cochrane Database analysis has also quoted insufficient evidence to prove superiority of osteosynthesis or primary arthroplasty in inter-trochanteric fractures³⁵. So for the same a very well co-ordinated multicentric randomized double blinded trial is essential to prove efficacy, feasibility and long term survivorship. Also the use of this "SION HOSPITAL" Modification of transtrochanteric approach in comminuted inter-trochanteric fracture both for total hip arthroplasty and hemiarthroplasty is yet to be established. Its comparative study with other approaches too needs further evaluation.

V. Conclusion.

Although Bipolar Hemiarthroplasty has its set of long term complications questioning its long term survivorship, but it is an excellent and viable option for early ambulation and good early-mid term survivorship, with less implant related complication for elderly osteoporotic patients with comminuted inter-trochanteric fracture femur. Also 'SION HOSPITAL' modification of transtrochanteric approach needs further extensive study for its efficiency with respect to total hip arthroplasty and Level I/II studies comparing with other approaches. In our study this approach is a good technique without harming Sciatic nerve, External rotators of and abductors of hip. This is used for endoprosthetic replacement in comminuted inter-trochanteric fractures with Greater trochanter as separated fragment.

Acknowledgement – None

Figure Legends –

Figure 1-

A-Pre-operative pelvis with both hips antero-posterior view with comminuted unstable intertrochanteric fracture .

B- Pre-operative lateral view showing comminuted unstable intertrochanteric fracture .

C- Immediate Post-operative view showing cemented bipolar hemiarthroplasty with tension band wiring for Greater trochanter.

D- X-ray showing pelvis with both hips and antero-posterior view with cemented bipolar hemiarthroplasty with tension band wiring for Greater trochanter at 5 years post-op.

E- X-ray showing lateral view with cemented bipolar hemiarthroplasty with tension band wiring for Greater trochanter at 5 years post-op.

Fig 2.1- A –(magnified image)- Intra-operative image showing trans-trochanteric window with greater trochanter fragment retracted postero-supero-laterally and head visible through the window.

Figure 2.2-

A- Intra-operative image showing trans-trochanteric window with greater trochanter fragment retracted postero-supero-laterally and head visible through the window.

B and C- Intra-operative image showing head being extracted through with help of cork screw (head extractor).

D- Head extracted and acetabulum cleared and visualized.

E- Tension band wire passed through the lateral cortex of femur.

F- Cemented stem being inserted in the femoral canal .

Figure 3- Patient with cemented bipolar hemiarthroplasty in comminuted intertrochanteric fracture .

A-Standing full weight bearing .

B-Sitting on chair comfortably.

C- Demonstrating Hip and knee flexion.

D- Demonstrating active straight leg raising.

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Figure 1 -



Figure 2.1-

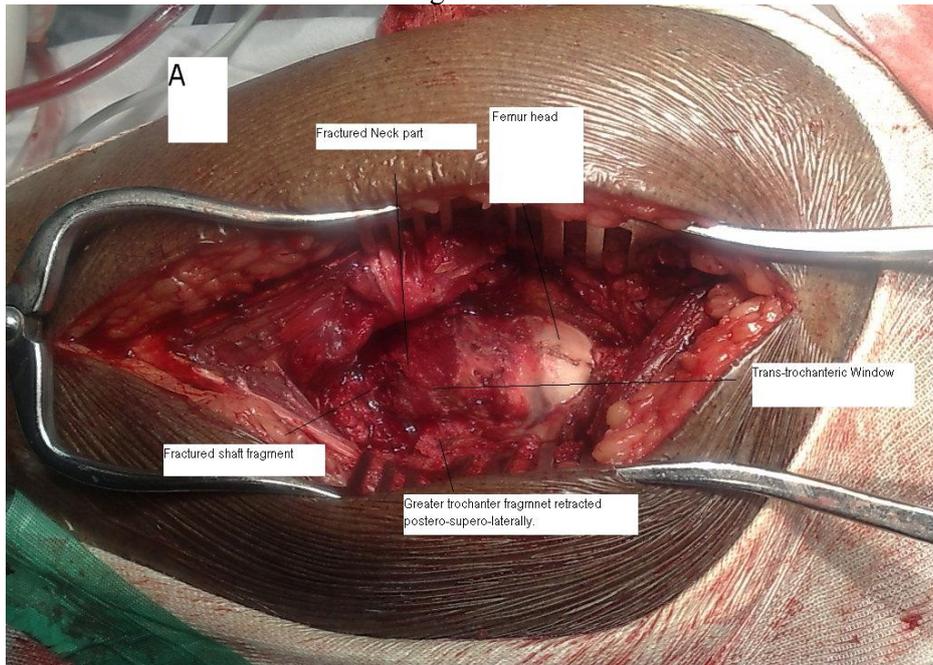


Figure 2.2 –



Figure 3-

