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Comparative prospective study between cemented hemiarthroplasty and dynamic hip screw or proximal femur nail in elderly unstable intertrochanteric fracture

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Abstract

Introduction: Intertrochanteric femur (IT) fracture is a common fracture in old age. The cause of morbidity and mortality in IT femur is malunion, non-union, respiratory tract infections and bed sores, etc. DHS and PFN are time-tested treatment modalities but with availability of better implants and hemiarthroplasty techniques, mortality and morbidity can be reduced.

Aims and objectives: To study and compare the advantages and disadvantages of hemiarthroplasty over dynamic hip screw and proximal femur nail for management of elderly unstable intertrochanteric fracture femur.

Method and Materials: 120 patients of age 60 years and above, who were admitted and operated between October 2017 and March 2019 and had fulfilled the inclusion criteria, were enrolled for this study. Case selection was random.

Bipolar Hemiarthroplasty: Total numbers of patients was 40, mean age 80.2 years, F: M ratio 14:26, follow-up period 1.1 years. **DHS:** Total numbers of patients was 40, mean age 70.1 years, F:M ratio 18:22, follow-up period 6 months.

PFN: Total no of patients was 40, mean age 68.3 years, F:M ratio 11:29, follow-up period 6 months. Harris hip Scoring System assessed post operatively.

Result: For result assessment and evaluation, we use Harris hip score, T-test, Chi-square test, and statistical analysis. P value < 0.05 is considered significant.

Bipolar group: 1 had superficial wound infection, 1 had bed sore, and none had deep infection or pulmonary infection. Over all minimum post-operative complication and early mobilization seen. DHS group had maximum complication, PFN group had mixed results. Minimum blood loss seen with PFN and maximum with bipolar group. Excellent result observed at the end of 1 year: all patients who came for follow-up had good-to-excellent results.

Conclusion: Functional recovery was delayed with internal fixation group. Early post-operative Harris hip score was better in patients treated with hemiarthroplasty as compared to internal fixation group but at the end of 1 year, score was comparable. Post-operative complications were more in internal fixation group than in hemiarthroplasty group and were comparable with other studies. 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 dynamic hip screw and proximal femur nail against primary hemiarthroplasty for unstable intertrochanteric fracture is needed.

Keywords: IT fracture in elderly, bipolar hemiarthroplasty, DHS dynamic hip screw, PFN proximal femur nail, morbidity

Introduction

There is a worldwide increase in the incidence of intertrochanteric fracture among elderly patients. This is due to the increased life expectancy of people and osteoporosis¹⁻³. Most of the fractures occur from trivial trauma. Intertrochanteric fracture is defined as the fracture extending from the extra-capsular basilar neck region to the region along the lesser trochanter before medullary canal development. Unstable fractures are those with comminution in the posteromedial cortex.

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Orthopaedic practice demands repetitive and complex decision making. All decisions are influenced by non-specific consideration such as limited facilities, financial constraints, and noncompliance from patients, etc. Despite these impediments, we strive towards accuracy in decision making. The goal of fracture treatment has shifted from just union of fracture to maximal functional recovery of the limb as early as possible. One of the most common fractures has been proximal femoral fracture as emphasized by this anecdote-"human beings come in the world through the pelvis and leave the world through the broken hips."

Various operative procedures with different implants have been described for the treatment of intertrochanteric fractures. Unstable intertrochanteric fractures are one of those enigmas which become increasingly mysterious with advancing knowledge and better imaging modalities. For decades, attempts were made to overcome the difficulties encountered by surgeons in the treatment of proximal femoral fractures. Questions were raised regarding the configuration of a fixation device. At our institute, we introduced hemi replacement to overcome problems of postoperative morbidity and to improve early post-operative ambulation in unstable intertrochanteric fracture of femur, especially in old age people. In this technologically advancing world, it is crucial that we upgrade our systems to cope with these fractures to serve the mankind better.

Material and Method

This is a prospective study of 40 cases of unstable intertrochanteric fractures, treated with primary hemi replacement between October 2017 and March 2019. Intertrochanteric femoral fracture (AO/OTA type 31A2.2, A2.3, A3.2, A3.3) patients were enrolled in the study, which was approved by the institutional review board. Written and informed consent of each patient was taken.

Inclusion criteria

1. More than 60 years of age.
2. All patients with unstable IT femur fracture type 31-A2.2 and 31-A2.3 (AO/OTA classification)/ Evan category type 3, 4 and 5.
3. Patient must be ambulatory before sustaining injury.

Exclusion criteria

1. Patient not in the defined age group.
2. Pathological fractures
3. Stable fractures
4. Patients with active infection
5. Patients with other systemic disorders or not fit for surgical intervention.
6. Patients who lost follow-up.

Surgical technique: The intertrochanteric fracture was temporarily given traction with below knee sponge or skeleton traction. Once the patient was selected for surgery, pre-operative planning and investigations were done and patient posted for surgical intervention.

a) Cemented Modular Bipolar

Patient placed in the lateral position, with affected hip drape-free. A curved incision was made at the posterolateral aspect of greater trochanter, then the superficial fat and gluteus maximus muscle was cut with the cautery, rotators were cut and capsule cut so that fracture neck was exposed. The limb was dislocated in internal rotation. Head and neck part was

removed and checked for implant head size, femoral canal was prepared and checked with trial stem and head washed with NS. Bone plug was inserted, a stem of appropriate size inserted with bone cement, head applied over stem and reduction done with external rotation of limb. ROM was checked, broken greater trochanter repaired with tension band wiring or Ethibond suture for strengthening, capsule and rotators sutured with greater trochanter, drain applied, closure done.



Fig 1: Position



Fig 2: Implant insertion



Fig 3: Broken GT



Fig 4: GT repair with TBW and Ethibond

b) Proximal Femur Nail

Patient put on traction table and maximum reduction achieved

with traction, manipulation and rotation of affected limb. After painting and draping, incision was given 3 cm above greater trochanter, entry made with fossa finder at greater trochanter tip, guide wire inserted, proximal reaming done, appropriate nail inserted, proximal lag screw inserted, reduction checked with c-Arm, distal locking done and then closed.



Fig 5: PFN entry



Fig 6: DHS incision

Dynamic Hip Screw

Same procedure followed as for PFN till incision, which is made on lateral aspect of thigh at the level of lesser trochanter, tensor fascia lata cut. Bone is exposed by lifting vastus lateralis muscle, guide wire inserted in neck femur with the help of angle guide, checked with C-arm, lag screw inserted, plate applied, coupling screw fixed and closure done with vacuum drain.

Post-operative care

Haemogram and serum electrolytes done immediate post-operative and 24 hour post-operative; static exercise started in bed, if pain permits, for glutei, hamstrings and quadriceps with regular ankle pumping exercise. Drain removed after 48 hours, sitting started on 2nd post-operative day with quadriceps in bed. Non-weight bearing walking on operated side after 2 days. ROM exercised actively. After 5 days, partial weight bearing started in hemiarthroplasty, if pain permits. In internal fixation groups, partial weight bearing depends upon stability of trochanteric fixation. Post-operative dressing done on 2nd, 5th and 8th day, sutures removed on or after 14th day, patient was discharged after rehabilitation. Prior to discharge, check done for late clinical sepsis and Deep Venous Thrombosis.

Follow up

Done at 6 weeks, 3, 6 and 12 months. Systemic grading of patients according to Harris hip Scoring system as formulated

by W.H. Harris. It incorporates all the important variables into a single reliable figure, which is both, reproducible and reasonably objective.

Statistical grading of patients: Data reported as mean, standard deviation (SD), median (range) or number (percentage). T-test used to assess significant differences between all numerical parameters of the study within two surgical groups. Chi-square test used for statistical analysis among all studied categorical variables such as gender, pre-morbid condition and post-operative complications. P-values <0.05 considered statistically significant.

Observation and Results

There were no significant differences between the 2 groups in terms of demographic data (age, sex), fracture type, hospital stay, operating time, metabolic diseases and associated diseases. Full weight bearing started significantly earlier in surgically treated patients. Patients who underwent fixation had more early complication than those with hemiarthroplasty. Mean follow up period for internal fixation is 1.2 years. Osteoporosis evaluation not done by tests like dexa scan etc. Only X-rays were done and as patients were selected randomly, no uniformity of osteoporosis was noted in selected group.



Fig 7: Pre-OP (Right)



Fig 8: Cemented modular bipolar with ethibond & TBW

Hemiarthroplasty (Bipolar group): Total number of patients in this group was 40 years, mean age 80.2 years and female to male ratio 26:14. 18 cases were type 3 fractures, 16 type 4, 5 type 5 and 1 type reverse oblique. Mean follow up period 1.1 years. Mechanism of injury in this group was mainly trivial trauma in the form of slip and fall; one patient had road traffic accident. All were ambulatory pre-fall, either in community or household. Average trauma admission time was 2.2 days with average stay of 15.53 days in hospital. All were operated with cemented bipolar prosthesis. Complete weight bearing was started after an average period of 7.46 days. 1 patient had superficial wound infection which was treated with meticulous wound care and antibiotics; no patient had deep infection or pulmonary infection; 1 had bed-sores which were treated with air-bed and wound dressing. 1 patient

had post-operative constipation and abdominal distention (known operated case of carcinoma stomach); GI scope was done and treated accordingly, this increased his stay in hospital. After 3 months of follow up, fair result found in 4 patients, good in 12 and excellent in 24. Eventually all had good-to-excellent result after 1 year. There was no dislocation, acetabular protrusion or aseptic loosening of the stem.

Internal fixation (dynamic hip screw): Total number of patients in the group was 40, mean age 70.1 years and female to male ratio 22:18. 19 cases were of type 3, 13 type 4 and 8 type 5. Mean follow-up period of 1.2 years. The mechanism of injury in this group was also mostly trivial trauma in the form of slip and fall; 3 had road traffic accident and 1 had fall from height. All patients were ambulatory pre-fall except one who had hemiplegia on same side. Average trauma admission time was 3.57 days and inpatient duration was 14.95 days. All fractures were fixed using DHS in this group; bone wires, k-wires and screws were used to provide additional stability in some fractures. Complete weight bearing was started after average period of 12.3 weeks. 3 patients had bed sores, treated with air-bed and wound dressing. 1 patient was admitted at 6th month in physiotherapy for gait training and muscle strengthening. 1 had palpable implant and pain in hip: implant was cut through and removed after 1 year; fracture was united after collapse. No patient had deep infection. After 3 months of follow-up, 8 had poor results, 16 fair, 14 good and 2 excellent. At the end of 1 year, all the patients who came for follow-up had fair-to-excellent results. One implant cut out was seen, and one revision surgery was done with bipolar.

Internal fixation group (proximal femur nail): Total number of patients in the group was 40, mean age 73.1 years and female to male ratio of 29:11. 21 were of type 3, 15 type 4 and 4 type 5. Mean follow up period 1.2 years. The mechanism of injury in this group was also trivial trauma in the form of slip and fall, 4 had road traffic accident and none had fall from height. All patients were ambulatory pre-fall. Average trauma admission time was 2.52 days and inpatient duration was days. All fractures were fixed using Proximal Femur Nail in this group. Complete weight bearing was started after average period of 11.1 weeks, 2 patients had bed sores, 1 had DVT. After 3 month follow up- 4 had poor results, 10 fair, 20 good and 6 excellent; at the end of one year, nearly all patients of this group has good-to-excellent result.

Discussion

Surgical outcome in elderly patients is unsatisfactory with associated co-morbid conditions like medical illness, osteoporosis and fracture instability. Elderly patients, even if they are in good general health, cannot be mobilized without some weight being borne on the involved limb. Early mobilization may decrease the risk of mortality and morbidity. In patients with osteoporotic fractures, and major comminution, maintenance of reduction can be a major problem, so many surgeons recommend hip to be protected throughout the healing period. To reduce the healing time, dynamic devices are replaced with the static ones. Dynamic implants have more weight bearing capacity than static implants. Partial weight bearing creates a micro movement in dynamic system which increases union rate. The weak and porotic bone tolerates screws poorly so cut out is the major

problem in internal fixation. Central position of the screw in the femoral neck is the recommended position. Use of internal fixation has decreased the mortality rate but rate of complications are high so many surgeons prefer arthroplasty for the treatment of unstable intertrochanteric fractures. The patient's rapid return to the prefecture level of activity has essentially prevented post-operative complications such as bed sores, pulmonary infections and atelectasis.

Stern and Angerman reported 94% good- to-excellent results after mean follow-up period of 8 months with 1% cases of pneumonia and 3% cases of deep infection. Haentj *et al.* 28 compared results of bipolar arthroplasty and internal fixation and reported 75% satisfactory results with less post-operative complications in arthroplasty group. Rosenfeld *et al.* 29 reported 86% satisfactory results in early period using arthroplasty. Failure rates as high as 56% have been noted in association with unstable fractures, comminution, suboptimal fracture fixation, or poor bone quality treated by DHS in elderly patients. No difference in post-operative mortality in the two groups. The Cochrane database analysis of relevant studies concluded that there is insufficient evidence to prove that primary arthroplasty has any advantage over internal fixation. However, they also mentioned that there were only two randomized trials studied and both had methodological limitations, including an inadequate assessment of the longer term outcome.

Harwin *et al.* reported on fifty-eight elderly patients with osteoporosis in whom a comminuted intertrochanteric femoral fracture had been treated with a bipolar Bateman Leinbach prosthesis and who were followed for an average of twenty-eight months. The average patient age was seventy-eight years, and 91% were ambulatory prior to discharge. Two patients had a nonunion of the greater trochanter. There were no deep infections, dislocations, acetabular erosions, or cases of stem loosening.

Broos *et al.* reported on ninety-four elderly patients treated with a bipolar Vandeputte prosthesis. They found that the average operating time was shorter, mortality rate lower, and functional results better in the group treated with bipolar hemiarthroplasty than in that treated with Ender nailing, angled blade-plate, or dynamic hip screw. Recently, Rodop *et al.* reported on fifty-four elderly patients who had been treated with a bipolar Leinbach hemiprosthesis (Protek; Sulzer Orthopedics, Baar, Switzerland). A good-to-excellent result, as assessed with the Harris hip-scoring system, was reported in 82% of the patients.

In the current study, there were no dislocations or cases of stem loosening. 90% patients had good-to-excellent results after follow-up period of 3 months in bipolar group, due to early mobilisation and rigid fixation of trochanter; after 1 year, fair-to-good results in DHS group and good-to-excellent results in PFN and Bipolar group were achieved. So the key point is early mobilisation and early recovery. Patients with internal fixation were advised to put minimal weight on the affected limb. Nevertheless, despite the advice, patients bore more weight. It is difficult to teach them to bear weight on normal limb only. The most serious complication in arthroplasty is deep infection, whose rate is reported to range from 0 to 3% in literature. In our study, rate of deep infection is 0% in arthroplasty. It should be remembered that even in the conventional total hip replacement, the rate of deep infection is higher in patients who have had a previous operation on the hip. Rate of post-operative complications are higher in internal fixation as compared to arthroplasty; full weight bearing is delayed in internal fixation. 0 to 7%

dislocations were seen in other studies but none in ours. The rate of dislocation is aggravated by improper prosthesis length, larger the femoral component greater the tendency to dislocate.

Conclusion

1. Patients treated with internal fixation (DHS+PFN) started full weight bearing (avg. 11.7 weeks) late as compared to hemiarthroplasty (avg. 7.46 days), hence the functional recovery was delayed with internal fixation group.
2. Early post-operative Harris hip score was good in patients treated with hemiarthroplasty as compared to internal fixation group but at the end of 1 year score was comparable.
3. Post-operative complications were more in internal fixation group than hemiarthroplasty group and were comparable with other studies.
4. Most of the fractures occur above 60 years were due to trivial trauma. As age advances, there is weakening of bones due to osteoporosis and decreased mineralization and deterioration of general condition due to which cancellous bones are prone to fracture with trivial trauma.
5. Early mobilization is always advisable since elderly patients with multiple medical problems are prone to hazards of immobilization.
6. Small sample size and inhomogeneous population in terms of existing co-morbidity are limitations of our study.
7. The last word from our study is that primary hemiarthroplasty provides a stable, pain-free, and mobile joint with acceptable complication rate; however a larger, prospective, randomised study comparing the use of dynamic hip screw devices against primary hemiarthroplasty for unstable intertrochanteric fractures is needed.

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