

Original Research Article

Cemented Bipolar Hemiarthroplasty versus Proximal Femoral Nails: A Prospective Comparative Outcome Analysis in Unstable Elderly Intertrochanteric Fractures

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ABSTRACT

Introduction: Hip fractures always cause short-term pain, disability and a longer-term pain, disability or Deformity. Only a small number of reports on the incidence of hip fractures in the Asian population exist. Intertrochanteric fractures in osteoporotic bones with gross comminution are highly unstable and are associated with a high risk of morbidity and mortality.

Material and Methods: To compare the functional and clinical outcomes of cemented bipolar arthroplasty and proximal femoral nailing in unstable intertrochanteric fractures, this multicenter prospective study was initiated from Aug'12 to Dec'14 on 70 patients with unstable (Evans type III and IV) intertrochanteric fractures with minimum 2 years follow-up. Harris Hip Score was used to assess functional outcome.

Results: Out of 70 patients, independent full weight bearing and return to pre-fracture activity levels was early in arthroplasty group i.e. 1.2(p<0.001) and 5.4(p<0.01) weeks respectively as compared to PFN group i.e. 8.2 and 10.2 weeks respectively was significantly earlier in patients with bipolar arthroplasty group. Postoperative complications were lower in the arthroplasty group. Hip scores at 3 months in arthroplasty and PFN group was 80.55 and 68.89(p<0.001); at 24 months, 86.46 and 75.91(p<0.01) respectively.

Conclusion: Primary cemented hemiarthroplasty in unstable elderly hip fractures is reliable, technically simple and a safe procedure. It has a major advantage of allowing early mobilisation, immediate full weight bearing, rapid rehabilitation, shorter hospital stay and early return to work. Cemented arthroplasties are advantageous in non-union and high risk patients suffering from psychiatric illness in preventing peri-prosthetic dislocations and fractures.

Key words: Intertrochanteric, Fracture, Hemiarthroplasty, Bipolar, PFN, Elderly, Osteoporosis.

INTRODUCTION

Elderly patients with hip fractures constitute the Largest Group of Emergency

Orthopedics Admissions. [1] Hip fractures always cause short-term pain, disability and a longer-term pain, disability or Deformity.

[2] The incidence hip fractures is approximately 80 per 100,000 persons and is expected to double over the next 50 years as the population ages [3] and intertrochanteric fractures makes up 45% of these fractures.

Intertrochanteric fractures are extra-capsular associated with severely displacement, rotations or comminution. Management of elderly hip fractures have evolved over the years ranging from old conservative treatment of traction, boot plaster or spica to more recent intramedullary fixations with titanium elastic nails, proximal femoral nails, dynamic hip screws or hemi-arthroplasty and total hip replacement in gross comminution and loss of calcar femorale. The management is aimed to achieve a stable fixation and early full-weight-bearing mobilization [4] to prevent dreaded complications of dependency like pressure sores, pneumonia, muscle wasting, contractures and a lengthy hospital stay.

Unstable comminuted intertrochanteric fractures are associated with poor bone quality, osteoporosis, pose difficulty in obtaining anatomical reduction and high non-union, metal failure and femoral head perforation rates. [5,6] Whereas simple Intertrochanteric fractures can easily be treated by osteosynthesis with proximal femoral nails and dynamic hip screws [7-11] with good results. Protocol for management of unstable elderly intertrochanteric fractures is lacking despite of the publication of reports of randomized trials and comparative studies. [8,9] To allow early weight-bearing, mobilisation, rehabilitation and early return to home, surgeons recommend prosthetic replacement in unstable intertrochanteric fractures [12-14] but established literature from the subcontinent on hemi-arthroplasties for unstable intertrochanteric fractures is sparse.

Approximately 6.26 million hip fractures are predicted to occur worldwide in 2050, out of which 50% will occur in Asia.

[15] Whereas only a small number of reports on the incidence of hip fractures in the Asian population exist. [15] We performed a prospective study to compare the functional and clinical outcomes of cemented bipolar arthroplasty as a primary treatment for unstable intertrochanteric fracture in the elderly patients and compared it to proximal femoral nail osteosynthesis.

MATERIALS & METHODS

A multicenter Prospective therapeutic study was undertaken from August'2012 to December'2014 after approval from institutional ethical committee, 70 patients with unstable intertrochanteric fractures were included in the study group after obtaining consent to compare the outcomes of primary cemented hemi-arthroplasty versus intramedullary proximal femur nailing in treatment of elderly unstable hip fractures i.e. Evans type III or IV and AO/OTA type 31-A2.2 and 2.3)

Inclusion criteria:

Male/Female patients, Age>60years, fresh/old fractures, any etiology, unstable Intertrochanteric fracture of femur (Evans type III and type IV, AO/OTA type-(31-A 2.2 and 2.3)

Exclusion criteria:

Patients who were unfit for surgery, refused for surgery, treated conservatively, stable intertrochanteric fracture i.e. Evans type I and type II, AO/OTA type -(A2.1 and A 1.1,1.2,1.3), compound fractures, pathological fractures, fracture neck of femur and sub trochanteric fractures were excluded from the study.

Randomization Protocol:

The study population (n=70) were divided into 2 groups (n=35) based on a computer based random number sequence by a person uninvolved in the surgical procedure. Group-1(n=35) was operated with hemi-arthroplasty and Group-2 (n=35) with Proximal femoral nailing. All surgical

procedures were performed by the same surgical team which was blinded to the randomization procedure

Methodology:

Patient's demographic data was recorded. Other pre-operative data included: fracture type, and co-morbid medical problems. Postoperative data included duration of hospital stay, time to full weight bearing, postoperative complications such as pulmonary problems, urinary tract infection, deep vein thrombosis, cardiac problems, infection (superficial and deep), pressure sores, fixation failure, prosthetic dislocation, and mortality.

Patients were operated, as soon as their condition stabilized, usually within 48 hours following presentation. Same prophylactic antibiotics were the same in the two groups. IV cefuroxime given at the induction of anaesthesia and continued for 3 doses postoperatively. Prophylaxis against deep venous thrombosis using low molecular-weight heparin (enoxaparin) was started 12 hr prior to the operation and continued postoperatively.

All surgical procedures were performed under either spinal or epidural anesthesia.

Operative technique:

In the bipolar arthroplasty group (group 1): Pre-operative templating of radiographs was performed to determine the approximate size and position of the stem and femoral neck offset. Trans-gluteal lateral approach in a lateral decubitus position used. Femoral head and neck were osteotomized at a level determined by preoperative templating of the uninjured side and by the use of trial femoral components to help find the appropriate level. Meticulous care was taken to preserve the integrity of the greater trochanter, abductor muscles, and all the vascularised bone fragments. The femoral medullary canal was then reamed to appropriate stem size and diameter.

Trial reductions were performed to determine the exact length that will provide the desired tension and tissue balancing of the abductor muscles and equal leg length. Careful restoration of neck length, offset and version to maximize stability of the hip joint was also performed during trial. The definitive femoral stem was cemented by the use of a cement gun to deliver the cement in a doughy state. Small calcar bone fragments were reduced over the medial aspect of the femoral stem below the stem collar during insertion. Any protrusion of cement between reduced bone fragments was cleaned out. Hip reduction done and the gluteus medius muscle and vastus lateralis muscle were sutured to their anatomical locations using anchor sutures. Fascia Lata was tightly closed over a suction drain (see. fig.1).

In the Proximal femoral nail group (group 2): Operations were performed on an orthopaedic fracture table, with the patients lying supine. Biplane fluoroscopy was routinely used. Close or if required open reduction was done to obtain an optimum position, with a correct angle between the femoral neck and shaft or a slight valgus position. Distraction of the fragments, varus position, or lateral displacement of the shaft was avoided. The proximal part of the femur was exposed through a lateral approach with splitting of the vastus lateralis muscle, and PFN was inserted. The wound was closed in layers over a suction drain (see fig.2).

Post-operative protocol:

Patients in the bipolar arthroplasty group were ambulated full weight bearing on the 2nd postoperative day with the aid of a physiotherapist. Patients in the internal fixation group were ambulated non-weight bearing on the 2nd postoperative day and gradually progressed to partial then full weight bearing depending on the quality of bone fixation assessed intraoperatively and bone healing on follow up radiographs.

Clinical radiological evaluation: After discharge from hospital, patients in both

groups were followed at six weeks; at three, six, and twelve months; and yearly thereafter for radiological control and functional evaluation using the Harris Hip score at each visit. A stem was considered to be unstable when there was progressive subsidence exceeding 3 mm, any change in position, or a continuous radiolucent line wider than 2 mm at the bone-cement interface.

Statistical analysis:

Data were reported as mean, median (range) or number. t-test was used to assess significant difference among all numerical parameters of the study within the two surgical groups. P-values < 0.05 were considered statistically significant.

RESULTS

Out of the 70 patients, 100% patients had unstable elderly intertrochanteric fracture of. In group-1, average age- 73.6 years (range: 60-91 years) with 16 men and 19 women. 15 patients had Evans III and 20 had Evans IV fracture type. In group-2, average age- 72.4 years (range: 60-89 years) with 17 men and 18 women. 16 patients had Evans III and 19 had Evans IV fracture type. Patient characteristics are represented in Table.1. The mean follow-up (months) in Group-1 and 2, was 22 (range 18-26) and 21 (range 19-24) respectively.

Table 1. DEMOGRAPHIC AND PREOPERATIVE DATA (n=70):

Variables	Group-1 (Hemiarthroplasty)	Group-2 (ProximalFemoralNail)
No. of patients	35	35
Mean Age(range)	73.6 years (60-91 years)	72.4 years (60-89 years)
Sex(M/F)	16/19	17/18
Fracture type (no. of patients)		
Evans III	15	16
Evans IV	20	19

In Group-2, 8 patients had unsatisfactory results: 2 patients had limb shortening with range of motion limitation, 3 patients had screws back out, 2 patients were unable to walk due to generalized weakness and 1 patient had limping and pain. In Group-1, 4 patients had unsatisfactory results: 1 patient had restricted terminal movements, 2 patients had leg length discrepancy (more than 13mm), and 1 patient was unable to ambulate due to generalized weakness. There was no dislocation or femoral stem instability.

Postoperative complications were higher in Group-2; pressure sores (2 patients in group-1 and 7 in group-2, pulmonary complications (2 patients in group-1 and 6 in group-2), cardiac complications (1 patient in group-1 and 2 in group-2), superficial wound infection (3 patients in group-1 and 3 in group-2) which resolved completely after a course of antibiotics. No significant difference was noted between the 2 groups as regards the occurrence of urinary tract infection and deep vein thrombosis. For post-operative complications see Table-2.

Table 2. Postoperative complications in Group-1 and Group-2:

S.no	Complication	Hemiarthroplasty Group-1 (n=35)	PFN Group-2 (n=35)
1	Mortality rate (within 2 years)	2	1
2	Pulmonary Complications	2	6
3	Urinary Tract Infection	0	0
4	Deep Vein Thrombosis	0	0
5	Cardiovascular Complications	1	2
6	Prosthetic/Fixation related	3	6
7	Wound Infection	3	3
8	Pressure Sores	2	7

Mortality rate at 2 years was 2.8% and 5.6% in Group-1 and Group-2 respectively with no significant differences.

Harris Hip Score at 3rd month was significantly higher in patients who underwent bipolar arthroplasty (Group-1) 80.55(range: 68–86) compared to those who

were operated with PFN (Group-2) 68.89 (range: 58-75) ($p<0.001$); at 12th month was 83.25 (range: 72–89) and 72.47(range: 61-80) ($p<0.01$) and at 24th month, it was 86.46(range: 76–92) and 75.91 (range: 66-84) ($p<0.01$) respectively. Post-operative hip scores are represented in Table.3.

Table 3. Functional outcomes in Group-1 and Group-2:

	Hemiarthroplasty Group-1 (n=35)	PFN Group-2 (n=35)	p-value
Follow-up Period in months(range)	22 (18-26)	21 (19-24)	
Mean Time to full weight bearing (weeks)	1.2	8.2	$p<0.001$
Harris Hip Score (100)			
3 months	80.55 (68 – 86)	68.89 (58 - 75)	($p<0.001$)
12 months	83.25 (72 – 89)	72.47(61 - 80)	($p<0.01$)
24 months	86.46(76 – 92)	75.91 (66 - 84)	($p<0.01$)
Return to Normal daily activities (weeks)	5.4	10.2	$P<0.01$



Fig.1: Immediate pre/post-operative x-ray: Femoral Hemiarthroplasty.



Fig.2: Immediate pre/post-operative x-ray: Proximal Femoral nailing.

Mobilisation was started in Group-1 on 2nd day postoperatively whereas in Group-2 mobilisation was started at mean- 4.2 days,

the delay attributed to pain. Time to independent full weight bearing was mean- 1.2 weeks in group-1 and mean- 8.2 weeks in group 2 ($p<0.001$) and return to the pre-fracture level of daily activity (5.4 weeks in group-1 compared to 10.2 weeks in group-2 ($p<0.01$)) was significantly earlier in patients who underwent bipolar arthroplasty.

DISCUSSION

Displaced and Comminuted intertrochanteric fractures in elderly osteoporotic patients pose challenging problems, with an added risk of increased morbidity and mortality. Treatment of these fractures aim at achieving a stable fixation and early mobilization with early return to daily activities. [16] Internal fixation has drastically reduced the mortality associated with intertrochanteric fractures; however; early weight bearing is still avoided in cases with comminution, osteoporosis, or poor screw fixation and non-weight bearing walking is recommended. Early post-operative ambulation is necessary to prevent complications like pressure sores, pneumonia, osteoporosis, contractures and muscle wasting.

Surgical treatment facilitates early rehabilitation with improved quality of life and function.

Patients who regain their independence have significantly lower mortality rates. ^[17] In this elderly cohort of patients with various co morbidities, it is difficult to maintain compliance with partial weight bearing. This obviously prolongs the duration of hospital stay in these patients and potentially predisposes them to further falls. In addition, they need regular outpatient follow-up to assess fracture healing, osteonecrosis and implant position.

Although union rates as high as 100% have been reported in association with well-reduced, stable fractures that were treated with ideal implant placements, failure rates of as high as 56% have been noted in association with unstable fractures, comminutions, suboptimal fracture fixations, or poor bone qualities in elderly patients. ^[18,19] In patients with osteoporosis and unstable fracture patterns, dynamic hip screws and intramedullary devices are associated with higher rates of non-union, varus collapse, screw cut-out, rotational deformity and shortening. ^[20,21]

Post-operative infections, pain, hospital stay and independent full weight bearing were significantly lower in the Hemi-arthroplasty group ($p < 0.001$). Return to pre-fracture level of daily activity was achieved earlier in Hemi arthroplasty group i.e. 5.4 weeks as compared to 10.2 weeks in PFN group ($p < 0.01$), similar to other reported studies. ^[22] A concern with Joint replacements anywhere in the body is Peri-prosthetic Infections. Factors facilitate bacterial contamination around the prosthesis are septic operating conditions, diabetes, immunosuppressive and corticosteroid drug usage, long duration surgeries, large wound surfaces, extensive dissection ^[23-25] and revision surgeries. Proximal femoral nails were associated with more implant related complications attributed to a high learning curve and osteoporotic bone quality of the elderly population.

We had no instances of post-operative dislocations in patients treated with hemi-arthroplasty, attributed probably to large diameter of the head and self-centred cup that were used. Factors predisposing to dislocations following arthroplasty include abductor weakness, trochanteric non-union, ^[26-28] faulty cementing technique and faulty acetabular cup placements in total hip replacements. The Harris hip scores, at 3 months were significantly higher for bipolar arthroplasty group i.e. 80.55 (range: 68–86) as compared to 68.89 (range: 58-75) in the PFN group ($p < 0.001$); and at 24 months, 86.46 (range: 76–92) and 75.91 (range: 66-84) ($p < 0.01$) respectively, similar to other published studies. ^[29,30]

Various implant related factors like bone collapse, fixation loss, and cut-out of the lag screw are high when fixing unstable elderly hip fractures with intramedullary implants like dynamic hip screws or proximal femoral nails resulting in poor function. Treatment of unstable intertrochanteric fracture is still controversial, despite of the publication of reports of randomized trials and comparative studies ^[8,9] and their role in unstable osteoporotic and severely comminuted intertrochanteric fractures is still to be defined.

We compared and found better clinico-functional outcomes with cemented bipolar arthroplasty with early return to home and work. Thus, we recommend cemented hemi-arthroplasty for primary treatment of unstable osteoporotic intertrochanteric fractures in elderly patients especially in whom recumbency and lengthy hospital stay is unfavorable. Cemented arthroplasties are advantageous in non-union and high risk patients suffering from psychiatric illness in preventing peri-prosthetic dislocations and fractures.

CONCLUSION

Primary cemented hemiarthroplasty in unstable elderly hip fractures is reliable, technically simple and a safe procedure. It has a major advantage of allowing early mobilisation, immediate full weight bearing, rapid rehabilitation, shorter hospital stay and early return to work. Cemented arthroplasties are advantageous in non-union and high risk patients suffering from psychiatric illness in preventing peri-prosthetic dislocations and fractures.

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