

**Comparative Study of Bipolar Prosthetic Replacement and Proximal Femoral Nail (PFN) In Unstable Intertrochanteric Fracture of Femure: Interventional Prospective Randomized Study**

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**Conflicts of Interest:** Nil

**Abstract**

**Background:** The proposed study is aimed to compare cemented bipolar prosthetic replacement and Proximal Femoral Nail (PFN) in the management of unstable Intertrochanteric fracture of femur.

**Methods-** The present study was prospectively carried out in 60 consecutive patients of Fracture Intertrochanter Femur reported to Department of Orthopaedics, SMS Medical College, Jaipur, and treated with Hemiarthroplasty with Cemented Bipolar Prosthesis and Proximal Femoral Nail during year 2018-19.

**Results:** The average harris hip score is 89.44 and mobility score of Parker and Palmer is 8.15 in PFN group. In Bipolar group average harris hip score is 85.79 and mobility score of Parker and Palmer is 7.38. Final functional outcome were better in PFN group (P value 0.048) than bipolar group.

**Conclusion:** Hip arthroplasty is an effective salvage procedure after failed internal fixation of an intertrochanteric fracture of an older patient. Most patients report good pain relief and very few serious orthopaedic complications are associated with this procedure.

**Keywords:** Hip arthroplasty, PFN, Outcome.

**Introduction**

Hip fractures are among the most devastating injuries in the elderly patients. Hip fractures in young adults are often the result of high energy trauma while in contrast 90% of hip fractures in elderly result from trivial trauma – a simple fall, tripping over a rug, arising from chair, or some slight misstep. The main factor contributing to the injury lies in the elderly person's inherent instability while erect, and his slow reflex proprioceptive response.<sup>1</sup>

The need for internal fixation and early mobilization of patients with intertrochanteric fracture femur is now thus widely accepted. However, most patients with intertrochanteric fractures have severe osteopenia and this along with comminution in elderly osteoporotic patients renders internal fixation difficult. In addition comminution along calcar and posterior cortex leads to varus malpositioning of the fracture fragments.<sup>2</sup>

Rigid nail plate devices used initially for stabilization of these fractures caused mechanical complications like nail penetration and breakage of plate component, especially in unstable intertrochanteric fracture that collapsed into more stable position. This resulted in innovation of sliding fixation devices so as to allow controlled collapse during conversion of an unstable fracture into stable position.<sup>3</sup>

The DHS superceded earlier devices such as McLaughlin Plate, Angle Blade Plate and the Jewitt nail plate, but failure of fixation still occurs in up to 20 percent cases. Cutting out of implant from the femoral head continues to be an important cause of mechanical failure with these implants though its incidence is determined by factors like fracture subtype, quality of reduction, implant position and bone density.

An intramedullary device (Gamma nail) has some theoretical advantage over DHS and its predecessors. It is not dependent on screw fixation of a plate to the lateral cortex, which can be a problem in very osteoporotic bone. In addition, as the load is transmitted to the femur along a more medial axis, it has a shorter moment arm. However, these devices have also been associated with increased risk of intraoperative and postoperative femoral shaft fractures. Another long term complication has been the incidence of thigh pain possibly secondary to distal locking, lack of an anterior bow of the implant and nail length. To avoid this Long

PFN is used now. Simple intertrochanteric fractures can easily be treated by Osteosynthesis with proximal femoral nail (PFN) with good result.<sup>4</sup>

With unstable intertrochanteric fractures, internal fixation achieves satisfactory initial fracture site reduction but late fracture collapse into varus during weight bearing especially in osteopenic individuals can lead to high failure rates. When instability is a potential problem, the patient must remember and adhere to a prolonged postoperative regimen of limited weight bearing until union of the fracture. However, many elderly patients who sustain hip fractures are not capable of complying with weight bearing restrictions during postoperative ambulation.<sup>5</sup>

#### **Material and Methods**

**Type of study:** Randomised Prospective Interventional Comparative Study

**Sample size:** Sample size is calculated at 80% study power and 0.05 alpha errors assuming mean difference in operation time, in cemented bipolar hemiarthroplasty and proximal femoral nail in intertrochanteric fracture, to be 20 at expected SD of 26 as per seed article. thus, the minimum sample size found 30 patients in each group

**Study area:** Department of Orthopedics SMS Medical College, Jaipur

Follow-up - 6 months

#### **Method of Data Collection**

Cases were selected at random and age 60-80 years.

#### **Inclusion Criteria**

- Patients admitted in department of orthopedics at S.M.S. Hospital Jaipur with Unstable intertrochanteric fractures of femur (Evan's type third, fourth and fifth )
- Age 60-80 years

- Patients who have given informed and written consent

**Exclusion Criteria**

- Patient unfit for surgery as per A.S.A. (American Society of Anaesthesiologists) guidelines.
- Patient having previous hip surgery
- Patient having pathological fracture
- Patient having Associated fracture
- Patient having compound injury.

**Outcome Variable**

- Walks unaided full weight bearing weeks
- Mean VAS score for pain
- Mean shortening
- Able to do daily activities
- Post op mobility score of parker and palmer
- Harris Hip Score(HHS)
- Patient who regained their preoperative ability

**Outcome Analysis**

- The data would be compiled using MS- Excel worksheet (2007) and analysis done with the help of primer (Trial Version) and SPSS software.
- Data will be analyzed using relevant statistical methods.
- Qualitative data will be expressed in the form of proportions and percentages.
- Quantitative data will be expressed in mean ± SD (Complications).
- Qualitative data will be compared using chi square test
- Unpaired t-test will be used to infer the difference in means.
- For significance p value <0.05 will be accepted as significant.

**Observation**

The present study was prospectively carried out in 60 consecutive patients of Fracture Intertrochanter Femur

reported to Department of Orthopaedics, SMS Medical College, Jaipur, and treated with Hemiarthroplasty with Cemented Bipolar Prosthesis and Proximal Femoral Nail during year 2018-19. The following observations were made in present study.

The age of the patients in present study was in range of 60 - 80 years. There was a preponderance of female in present study in both groups.

Table 1: Duration of Surgery

	PFN		Bipolar	
	Mean	SD	Mean	SD
Duration of surgery (mins)	53.83	6.52	93.83	9.71
Range	40-65		75-110	
P value	P<0.001 (S)			

The mean duration of surgery in the Bipolar group (93.83 minutes) was much more than in PFN (53.83 minutes) group.

Table 2: Post Operative Hospital Stay

	PFN		Bipolar	
	Mean	SD	Mean	SD
Post operative stay	5.67	1.92	5.53	1.25
Range	4-14		4-8	
P value	0.750 (NS)			

All patients of Bipolar group was discharged between 4 to 8 days and in PFN group 4 to 14 days after surgery.

Table 3: Wound Infection

	PFN		Bipolar	
	No.	%	No.	%
Nil	28	93.33	30	100.00
Staphylococcus aureus Infection	2	6.67	0	0
Total	30	100.00	30	100.00
P value	0.472(NS)			

Out of the 30 patients, 2 patients infected with staphylococcus aureus in PFN group. No patient infected in Bipolar group

Table 4: Mortality

	PFN		Bipolar	
	No.	%	No.	%
Yes	3	10.00	1	3.33
No	27	90.00	29	96.67
Total	30	100.00	30	100.00
P value	0.605 (NS)			

Three patients died in PFN group and one patient died in Bipolar group out of 30 patients.

Table 5: Limb Length Discrepancy

	Bipolar		PFN	
	No.	%	No.	%
Shortening	21	70.00	0	0
Lengthening	9	30.00	0	0
Total	30	100.00	0	0

There is no LLD in PFN group in Bipolar group 21 patients have shortening and 9 patients have lengthening.

Table 6: Weight Bearing

	PFN		Bipolar	
	Mean	SD	Mean	SD
Full weight bearing	12.83	1.62	5.87	3.97
Range	10-15		3-15	
P value	P<0.001			

Most of the patients were allowed to bear weight with support of walker beginning from 3rd Post operative day in Bipolar group and 10th post operative day in PFN group. Average range of initiation of full weight bearing in present study in Bipolar group is 3 to 15 days and 10 to 15 days in PFN group.

Table 7: Final Harris Hip Score

	PFN		Bipolar	
	Mean	SD	Mean	SD
Final Hip Score	89.44	4.69	85.79	8.26
Range	80-97		64-95	
P value	0.048 (S)			

The average harris hip score in PFN group is 89.44 and range is 80-97 and in Bipolar group is 85.79 and range is 64-95. Final functional outcome were better in PFN group (P value 0.048) than by Bipolar group and significant.

Table 8: Final Mobility Score of Parker and Palmer

	PFN		Bipolar	
	Mean	SD	Mean	SD
Final Mobility score of parker and palmer	8.15	0.95	7.38	0.86
Range	6-9		6-9	
P value	0.002 (S)			

The average mobility score in PFN group is 8.15 and in Bipolar group is 7.38. Final mobility score is better in PFN group (P value 0.002) than by Bipolar group.

### Discussion

Intertrochanteric fractures in elderly osteopenic patients especially those who cannot follow limited weight bearing instructions, continue to vex orthopaedic surgeons. The best treatment for intertrochanteric fractures in such patients remains controversial. The discussion about ideal implant still continues and the variety of methods available attest to the difficulty encountered in the treatment of this fracture.

In an attempt to improve results and decrease the complications inherent in the postoperative period, Massey and then Holt developed more effective internal fixation. Holt reported walking his patients in 7 days with good results. Other orthopaedic surgeons though did not obtain results as good as these authors

and other answers to the treatment of this fracture were sought. Dimon and Hughston and then Sarmiento developed osteotomies to obtain valgus position and good bone apposition and reported good results. Ecker et al reported good results using compression screw. However, Laros reported that in his series of 244 patients neither medial displacement nor anatomic reduction improved his results. He further stated that treatment should be chosen, first as a means of stabilizing the fracture at minimum risk to patient, so as to allow early mobilization. Many surgeons have recommended that the hip be protected throughout the healing period in patients who have intertrochanteric or subtrochanteric fractures that have major comminution, osteoporosis, or poor fixation of screws. The poor mechanical properties of weak and porous bones in these elderly patients do not usually provide a firm purchase for the screws. Though fracture healing and functional restoration are important but are secondary to the overall welfare of the patient. This summarises our philosophy in the treatment of intertrochanteric fractures in elderly patients with arthroplasty and proximal femoral nail (PFN).

The average operative time in patients in whom standard hemiarthroplasty was done is 93.83 minutes and in PFN group is 53.83 minutes. The operative time was much more in Bipolar than the PFN group and result are significant. This is comparatively same as previous studies:

Authors	Operative time	Prosthesis
Chan, Gurdev <sup>6</sup>	69 mins	Modular endoprosthesis
Stern, Goldstein <sup>7</sup>	80.5 mins	Leinbach prosthesis
Present study	93.83mins	Cemented

Bipolar		Bipolar prosthesis
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Early mobilization is well known with Bipolar hemiarthroplasty. Average period of initiation of full weight bearing in present study in Bipolar group is 5.87 days and in PFN group is 12.83 days. Patients were trained to begin walking with walker earlier (average 5.87 days) in Bipolar group to reduce postoperative complications of prolonged recumbency like pneumonia, bed sore, DVT etc.

In Bipolar group patients were discharged after being trained to walk with Walker with full weight bearing. In PFN group patient were told exercises to strengthen muscle and increase range of motion and walk started after 10 to 15 days.

This is comparatively same as previous studies as Kayali c et al,<sup>8</sup> in their study showed that time to full weight bearing was significantly earlier in the hemiarthroplasty group as compare to the PFN group.

The patients who were ambulatory at discharge gradually improved over follow up period and were able to transition from walker to cane and few patients without support. Age, gender, prefracture health status and social dependency before fracture are important factors determining functional recovery after surgery. Other patient never followed any physiotherapy advices and showed up after one year with an attack of stroke and continue to remain bedridden. This indicates the importance of following of strict physiotherapy regime for good outcome of surgery in patients. Majority of patients gained good range of motion with physiotherapy.

Limb length discrepancy was absent in PFN group and in Bipolar group 70% of cases in present study had limb shortening >10 mm and 30% had limb lengthening >10 mm. Some may say that one set of

problems associated with internal fixation (loss of fixation, hardware cut out) are being traded with another set of problems in arthroplasty (limb length discrepancy), but if center of prosthesis is taken at level of greater trochanter tip then appropriate limb length can be maintained. In cases when greater trochanter is fractured, a surgeon can still make the length determination by repositioning the fractured greater trochanter anatomically and observing the tension of fascia over the gluteus medius. Anteversion and retroversion of the prosthesis can be determined with the use of posterior aspect of lateral femoral condyle as a guide.

Modified Harris Hip Score and mobility score of Parker and Palmer was used at our hospital for assessing the final functional outcome of patients in present study. This score takes into account pain, limp, support, distance walked, climbing of stairs, putting on shoes and socks, entering public transportation, limb length discrepancy, deformity and range of motion. The total score is 100, with outcome graded as excellent, good, poor and fair.

The average harris hip score in PFN group is 89.44 and in Bipolar group is 85.79. Both have good results. Stern and Goldstein reported good result in 94% of patients while Chan et al reported good result in 83% cases. Final functional outcome and mobility score of Parker and Palmer is better in PFN group than the Bipolar group after this study, we think that using standard arthroplasty is a reasonable alternative to osteosynthesis in intertrochanteric fractures. We would like to emphasize the careful selection of cases for this technique. The potential advantage of hemiarthroplasties for the treatment of intertrochanteric fractures warrants additional larger studies to be

compared with a matched control group treated with osteosynthesis.

### **Conclusions**

Although majority of patients with intertrochanteric fractures can be successfully managed with osteosynthesis, older patients with severe osteoporosis and associated comorbidity may benefit from prosthetic replacement. There are some definite advantages of prosthetic replacement over reduction and fixation in such patients. If the prosthetic replacement has been properly performed, there is very little concern over immediate ambulation and weight bearing. This decreases the incidence of pulmonary complications and pressure sores: In addition, bipolar arthroplasty eliminates the possibility of excessive collapse compromising walking function, malunion, as well as the uncommon problems of non union and avascular necrosis. However, the surgical procedure is technically demanding as anatomical landmarks are distorted in such cases. Besides calcar reconstruction is must in cases where it is deficient to prevent sinking of prosthesis. Likewise, hip arthroplasty is an effective salvage procedure after failed internal fixation of an intertrochanteric fracture of an older patient. Most patients report good pain relief and very few serious orthopaedic complications are associated with this procedure.

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