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Comparative evaluation of clinico-radiological and functional outcome of proximal femoral locking compression plate and proximal femoral nail in unstable proximal femoral fractures

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Abstract
Intertrochanteric fractures are of the commonest fractures of the hip. They occur mainly in elderly people with osteoporotic bone usually due to low energy trauma like simple fall. Their incidence is increasing day by day because of population aging. 30 patients treated by proximal femoral locking compression plate and 30 patients treated by proximal femoral nailing was selected for study. Average operating time in PFN was 67(range 73.42-61.58 mins) and in PF-LCP is 81.5(range 90.71-72.29 mins). Out of 60 cases, radiological union was seen in 56(93.33%) cases and no radiological union was seen in 4 (6.67%) cases.

Keywords: Femoral Fractures, Femoral locking compression plate and Proximal Femoral Nail

Introduction
Fractures of proximal femur are presenting a big challenge to manage especially the unstable extra-capsular proximal femoral fractures. Such fractures requires proper planning and fixation method for recovery and good functional outcome. These fractures are inherently unstable and require prolonged immobilization even after surgical management. The fracture pattern has changed in recent times due to high energy trauma, unstable, complex and comminuted fractures are quite common nowadays.

Intertrochanteric fractures are of the commonest fractures of the hip. They occur mainly in elderly people with osteoporotic bone usually due to low energy trauma like simple fall. Their incidence is increasing day by day because of population aging [1, 2].

Sub-trochanteric fractures extend from the lower limit of lesser trochanter to the isthmus of diaphysis and have bimodal distribution. Older patients typically sustain low energy trauma whereas in young and healthy individuals the injury result from high energy trauma. These fractures occur at junction between trabecular and cortical bone where mechanical stress across the junction is highest in the femur.

Although these fractures are the very difficult to manage, the improved understanding of complex biology and biomechanics of the proximal femoral region as well as the rapid development of orthopaedic philosophy and implant design has led to consensus on the treatment of proximal femoral fractures [3].

Intra medullary implant like proximal femoral nail has theoretical advantage, they are biomechanically stable but technically difficult. Proper placement of the nail is compulsory otherwise it will lead to complications like Z-effect. Fractures having lateral wall burst, postero-medial fragment, comminuted and osteoporotic are very difficult to manage and one cannot the medialisation with such implant.

Stable extra-capsular proximal femur fractures can be treated successfully with conventional implants, such as sliding hip screws, cephalo medullary nails, and angular blade plates and rarely by a primary hip arthroplasty. However are comminuted and unstable proximal femoral fractures, fractures with extension into the pyriformis fossa and combined intracapsular and extra-capsular fractures prone to complications.

The proximal femoral locking compression plate introduced in the 21st century as a newer implant that allows angular stable plating for the treatment of unstable, extra-capsular proximal femoral fractures with comminuition [4].

The Proximal femur locking compression plate offers the surgeon a greater degree of adjustment in plate placement, medialisation and fixation in comminuted, unstable fractures and even in the presence of postero-medial fragment. The Proximal femur locking compression plate thus fulfills the role of a fixed angle device, achieves the greater degree of variability and stable fixation. There are very few studies available with this newer implant proximal femur locking compression plate.

Methodology

The study was conducted at central institute of orthopaedics (CIO); Safdarjung Hospital; New Delhi to compare the outcome of the fixation with proximal femoral locking compression plate and proximal femoral nail in unstable proximal femoral fractures. An informed consent was obtained from the patient in the study.

Sample size: 30 patients treated by proximal femoral locking compression plate and 30 patients treated by proximal femoral nailing was selected for study.

The study was prospective and patients were selected based on the following criteria.

Inclusion Criteria

1. Closed Proximal femoral unstable fractures involving Trochanteric and sub-trochanteric fractures.
2. Age>18 years (skeletal maturity)
3. Sex-patients of both sexes
4. Injury duration <3 weeks.

Exclusion Criteria

1. Pathological fractures.
2. Patients associated with life threatening injuries.
3. Associated co-morbidity that hampers the mobility of patient and medical contra-indications of surgery.
4. Patients having other injuries in ipsilateral limb
5. 5 Local site infection.
6. Psychiatric patients

Pre-operative care

All patients with proximal femoral fractures on admission to Central Institute of Orthopaedics were first managed by traction and other routine protocol for general care. All patients were attended in orthopaedic emergency room and detailed history followed by through general examination and local examination including neurovascular status of all the limbs was done.

Routine Investigations and Pre-anaesthetic check-up.

Surgical technique

Surgery is performed with the patient supine either on a radiolucent operating table or on a fracture table in traction. For the latter option closed reduction is obtained before surgery under fluoroscopic view in anterio-posterior (AP) and lateral and subsequently secured in traction. Care must be taken to achieve an adequate rotation of the femur with the patella in a horizontal position.in highly comminuted and unstable fractures that cannot be adequately reduced by traction on a fracture table we prefer free draping of the lower extremity in supine position on a radio lucent operating table.

A lateral approach typically is performed by a straight incision from the greater trochanter, extending approximately 10 cm distally. After a longitudinal incision of the iliotibial band, the fascia of the vastus lateralis is incised in a L shaped at its proximal insertion and the muscle is flipped anteriorly to visualize the lateral aspect of the proximal femur. Care should be taken not to dissect the comminution zone to preserve vascularity of the fracture.

Post-operative care

Patients were allowed to sit on second day. Physiotherapy was started. Continuous passive motion was initiated immediately after surgery. Gentle active and active assisted exercises were begun when swelling subsides. Ambulation with a walker or crutches was started on post-operative day 2 or day 3, all owing only touch-down weight bearing. Range of motion and quadriceps and hamstring exercises are increased gradually. If fracture is healing satisfactorily, partial weight bearing was allowed at 8 weeks. By 12-14 weeks, the patient is gradually allowed full weight bearing. The residual disability is usually minor, good range of

motion can be regained when reduction and fixation are satisfactory, and joint motion is begun early.

Results

Table 1: Fracture and gender

		Sex		Total	P value
		F	M		
Fracture Side	L	6 (50.00%)	21 (43.75%)	27 (45.00%)	0.697
	R	6 (50.00%)	27 (56.25%)	33 (55.00%)	
Total		12 (100.00%)	48 (100.00%)	60 (100.00%)	

Out of 48 males, 21 (43.75%) had Left sided fractures and 27 (56.25%) had right sided fractures.

Out of 12 females, 6 (50%) had left sided fractures and 6 (50%) had right sided fractures.

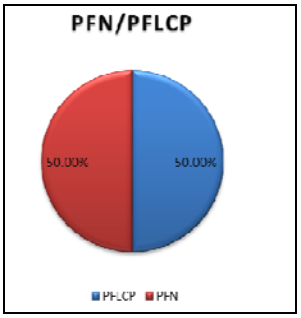

Fig 1: PFN and PFLCP

Out of 60 patients, 30(50%) were treated by PF-LCP and 30 (50%) were treated by PFN.

Table 2: Age and PFN/PFLCP

		PFLCP	PFN	Total
Age grouping	<=20	2 (6.67%)	0 (0.00%)	2 (3.33%)
	21-30	8 (26.67%)	7 (23.33%)	15 (25.00%)
	31-40	5 (16.67%)	8 (26.67%)	13 (21.67%)
	41-50	4 (13.33%)	7 (23.33%)	11 (18.33%)
	51-60	11 (36.67%)	8 (26.67%)	19 (31.67%)
Total		30 (100.00%)	30 (100.00%)	60 (100.00%)

Out of 30 patients treated by PF-LCP, 2 (6.67%) were <20 years of age, 8 (26.67%) were of 21-30 years of age, 5(16.67%) were of 31-40 years age, 4(13.33%) were of 41-50 years of age, 11(36.67%) were of 51-60 years age.

Out of 30 patients treated by PFN,0 (0%) were of <20 years of age,7(23.3%)were of 21-30 years of age,8 (26.67%)were of 31-40 years of age,7(23.3%)41-50 years of age,8(26.67%)were of 51-60 years of age.

Table 3: Age and PFN/PFLCP

		PFNPFLCP		Total	P value
		PFLCP	PFN		
Sex	F	7 (23.33%)	5 (16.67%)	12 (20.00%)	0.748
	M	23 (76.67%)	25 (83.33%)	48 (80.00%)	
Total		30 (100.00%)	30 (100.00%)	60 (100.00%)	

Out of 30 patients treated by PF-LCP, 7(23.33%) were female, 23 (76.67%) were male.

Out of 30 patients treated by PFN, 5 (16.67%) were female, 25 were male (83.33%).

Table 4: Fracture type and PFN/PFLCP

		PFNPFLCP		Total	P value
		PFLCP	PFN		
Fracture Type	I/T	22 (73.33%)	12 (40.00%)	34 (56.67%)	0.009
	S/T	8 (26.67%)	18 (60.00%)	26 (43.33%)	
Total		30 (100.00%)	30 (100.00%)	60 (100.00%)	

Out of 30 patients treated with PF-LCP, 22 (73.33%) had I/T, 8(26.67%) had S/T fractures.

Out of 30 patients treated with PFN, 12 (40%) had I/T, 18 (60%) had S/T fractures.

Table 5: Fracture side and PFN/PFLCP

		PFLCP	PFN		
Fracture Side	L	14 (46.67%)	13 (43.33%)	27 (45.00%)	0.795
	R	16 (53.33%)	17 (56.67%)	33 (55.00%)	
Total		30 (100.00%)	30 (100.00%)	60 (100.00%)	

Out of 30 patients treated with PF-LCP, 14 (46.67%) had left sided fracture, 16(53.33%) had right sided fracture.

Out of 30 patients treated with PFN, 13 (43.33%) had left sided fracture, 17 had (56.67%) had right sided fracture.

Table 6: Average operating time

AOT min	PFN		PFCLP		P value
	Frequency	%	Frequency	%	
56 - 60 min	9	30%	1	3.3%	<0.001
61 - 70 min	15	50%	4	13.3%	
71 - 80 min	6	20%	12	40.0%	
81 - 90 min	0	0%	11	36.7%	
90 - 100 min	0	0%	2	6.7%	
Total	30	100%	30	100%	
Mean ± SD	67.0 ± 6.42		81.50 ± 9.21		<0.001

Average operating time in PFN was 67 (range 73.42-61.58 mins) and in PF-LCP is 81.5(range 90.71-72.29 mins).p value is <0.001 which is statistically significant

Table 7: Median Hospital stay

MHS days	PFN		PFCLP		P value
	Frequency	%	Frequency	%	
3	23	76.7%	9	30.0%	<0.001
4	7	23.3%	12	40.0%	
5	0	0.0%	9	30.0%	
Total	30	100%	30	100%	
Mean ± SD	3.23 ± 0.43		4.00 ± 0.79		<0.001

Median hospital stay in PFN is 3.23 days (range 3.66- 2.8days) and in PF-LCP is 4.00 days (range 4.79-3.21 days). p value is <0.001 which is statistically significant.

Table 8: Average operating time

RU mon	PFN		PFCLP		P value
	Frequency	%	Frequency	%	
3	30	100%	26	86.7%	0.112
no	0	0.0%	4	13.3%	
Total	30	100%	30	100%	

Out of 60 cases, radiological union was seen in 56(93.33%) cases and no radiological union was seen in 4 (6.67%) cases.

Table 9: Complications

Complications	PFN		PFCLP		P value
	Frequency	%	Frequency	%	
Non-union	0	0%	4	13.3%	0.112
no	30	100%	26	86.7%	
Total	30	100%	30	100%	

Out of 30 cases treated with PFN, no complications occurred. Out of 30 cases treated with PF-LCP, 26 cases had no complications. Non-union occurred in 4 cases treated with PF-LCP. p value is 0.112 which is statistically significant

Table 10: Harris Hip Score

	PFN (n=30)	PFCLP (n=30)	P Value
	Mean ± SD	Mean ± SD	
HHS	88.67 ± 4.77	80 ± 7.10	<0.001

Average Harris hip score in patients treated with PFN is 88.67 (range 98.21-79.13) and in PF-LCP is 80 (87.1-72. 9).p value is < 0.001 which is statistically significant

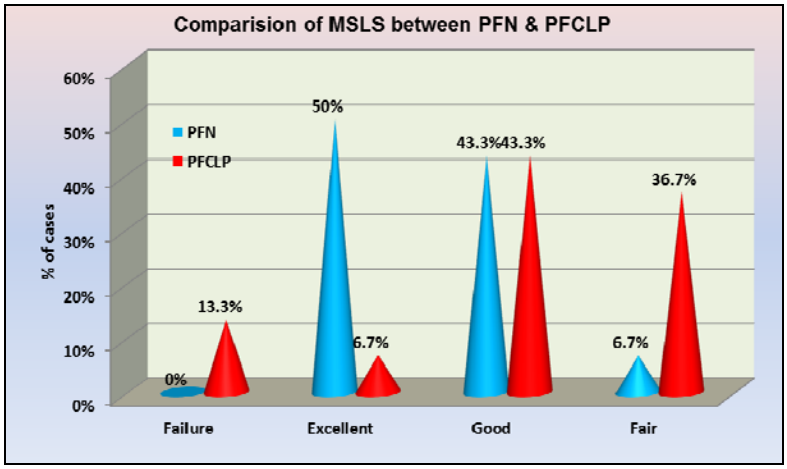

Fig 2: Comparison of MSLS

Comparing the outcome of PFN and PF-LCP with MSLS, PFN had 0% failure, 50% excellent, 43.3% good, 6.7% fair results.PF-LCP had 13.3% failure, 6.7% excellent, 43.3% good, 36.7% fair results. p value is< 0.001 which is statistically significant.

Discussion

Average operating time in PFN was 67 (range 73.42-61.58 mins) and in PF-LCP is 81.5(range 90.71-72.29 mins).p value is <0.001 which is statistically significant.

Median hospital stay in PFN is 3.23 days (range 3.66- 2.8days) and in PF-LCP is 4.00 days (range 4.79-3.21 days). p value is <0.001 which is statistically significant.

Average amount of blood loss in PFN was 325 ml (range 373.69-276.31) and in PF-LCP 413.33 ml (range 481.47-345.19 ml).p value is <0.001 which is statistically significant.

Partial weight bearing was allowed in all cases at 2 months and full weight bearing at 3 months.

Radiological union was seen all 30 cases treated with PFN and in 26 cases out of 30 cases treated with PF-LCP.4 cases with no radiological union was seen in PF-LCP. P value is 0.112 which is statistically significant.

Non-union occurred in 4 cases treated with PF-LCP. p value is 0.112 which is statistically significant.

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Conclusion

Radiological union was seen in all cases treated with PFN

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