Original Research Article

A prospective study of evaluation of various methods of trochanteric fracture fixation and their comparison in a tertiary care hospital

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Abstract

Background: Intertrochanteric fractures are one of the most common fracture of the hip especially in the elderly with osteoporotic bones, usually due to low-energy trauma like simple falls. The incidence of intertrochanteric fractures varies from country to country. **Materials and Methods:** This prospective study was conducted at Department of orthopaedics, Santhiram Medical College and General Hospital, Nandyal between period of August 2018 to September 2019 on 62 patients who attended in OPD and emergency. Patients were included in the study as decided by inclusion and exclusion criteria and operative intervention for each group was decided on the basis of radiological examination. Approval was taken from the college ethical committee. During the period the patients who attended the hospital were enrolled as sample size. **Results:** Comparison of Harris hip score at 12-month-follow-up period revealed that PFN group to be significantly more mobile (PFN- 94.8 vs. DHS- 90.8 vs. PFLCP- 89.3). p-Value for PFN vs. DHS group is 0.12, p value for PFN vs. PFLCP is 0.073 (>0.05) and p value for DHS vs. PFLCP is 1.00. All p values show insignificant difference in functional outcome of patients. It shows that most of patients achieved approximately same level of functional outcome at the end of one year. **Conclusion:** PFN had good to excellent outcomes. Only one patient developed non-union, but he still walks with slight limp. So PFN offers high rotational stability, compression at fracture site, create a shorter lever arm, so had decreased rate of mechanical failure, reduced hospital stay, less blood loss and less surgical time, early mobilization, early rehabilitation and faster union as compared to DHS and PFLCP.

Key Words: DHS, PFLCP, PFN, Harris hip score

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INTRODUCTION

Intertrochanteric fractures are one of the most common fracture of the hip especially in the elderly with osteoporotic bones, usually due to low-energy trauma like simple falls.[1] The incidence of intertrochanteric fractures varies from country to country. Gulberg *et al* has predicted that the total number of hip fractures will reach 2.6 million by 2025 and 4.5 million by 2050.[2] The treatment of choice in fracture intertrochanteric femur is internal fixation. There are various forms of internal fixation devices used for trochanteric fractures i.e. DHS, PFN, PFLCP

The most commonly used device is the dynamic hip screw with slide plate assemblies. Dynamic Hip Screw (DHS) is still considered the gold standard for treating intertrochanteric fractures by many.[3]The advantages and disadvantages of the DHS have been well established in several studies done in the past, this is a collapsible fixation device, which permits the proximal fragment to collapse or settle on the fixation device, seeking its own position of stability. Stable fractures can be very well treated with dynamic hip screw alone with good results proven by various studies.[4] It is the unstable fractures which are difficult to manage with dynamic hip screw

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alone. Rates of complications like screw cut out, shortening of limb, varus deformity of proximal femur, and even non-union are higher in unstable fractures as compared with stable fractures.[5]ArbeitsegmeninSchaftfur Osteo Synthes Fragen (AO/ASIF) in 1996 designed a new medullary device, the proximal femoral nail (PFN),[6] this is also a collapsible, centramedullary and biomechanically sounder device with added rotational stability.[7] Several studies show that PFN has its own limitations as in complex unstable intertrochanteric fractures (i.e. fracture of greater trochanter with or without comminution of lateral wall of proximal femur) implant failure is seen in form of non-union, secondary varus collapse, cut-out of proximal screw and reoperation.[8] Latest implant is proximal femoral locking compression plate (PFLCP) which is currently in clinical use.[9] Several studies show that it has several advantages over DHS and PFN specially in complex comminuted osteoporotic unstable fracture where the lateral wall support has been shattered. [10]

MATERIALS AND METHODS

This prospective study was conducted at Department of orthopaedics, Santhiram Medical College and General Hospital, Nandyal between period of August 2018 to September 2019 on 62 patients who attended in OPD and emergency. Patients were included in the study as decided by inclusion and exclusion criteria and operative intervention for each group was decided on the basis of radiological examination. Approval was taken from the college ethical committee. During the period the patients who attended the hospital were enrolled as sample size.

Statistical analysis is done by SPSS 16.0 version software. The following tests and tools were used for the statistical analysis of the observations and results. ANOVA Test is done to compare the means of three groups and POST HOC Analysis/Boneferroni Test is used to find out which group is significantly different from rest of the groups. P value <0.01 is considered significant.

Inclusion Criteria

- All Patients with close intertrochanteric fracture above 18 years.
- Fractures within 2 weeks.
- Patient who Ready to give informed consent for minimum 12 months of follow up.
- No medical contraindication to general anaesthesia or regional anaesthesia.

Exclusion Criteria

- Pathological fractures.
- Compound fractures.
- Polytrauma patients and patients with co-morbidities (i.e. politic and paralytic limb).
- Patient is on chemotherapy or radiotherapy.

History was taken from each patient regarding mode of injury, time since injury. All patients were examined clinically and investigated thoroughly. A day before surgery the patients were subjected to pre anaesthesia check-ups, surgical site of each patient was prepared, and informed consent were taken from each patient or his/her attendants. Each patient received a single dose antibiotic half an hour before induction of anaesthesia. I.V antibiotic was given to all patients for 5 days. All the patients were operated by single surgeon under spinal epidural anesthesia. Drain was not used in PFN Group Wound dressings were done at 3rd post-operative day in routine or anytime when needed for proper care. Stitches were removed on 10-12th post op day.All patients were followed at an interval of 4 weeks till 3 months and patents were assessed clinically, and radiologically, then at the interval of 3 months for period of 1 year. Analysis of results was done at 1 month, 3 month, 6 month and 12 month as per Harris hip scoring system.

Harris Hip Scoring System

Maximum Points 100.

1. Pain relief: (44)
2. Function (47)
3. Range of motion (5)
4. Absence of Deformity (4)

Table 1: Harris Hip Scoring System

S.No	Score	Rating
1	90-100	Excellent
2	80-89	Good
3	70-79	Fair
4	>70	Poor

RESULTS

Out of the 62 patients, 34 patients (54.83%) were male and 28 patients (45.16%) female. The age of patients recorded in our series ranged between 20-90 yrs. Mean age for PFN group is 56 years, mean age for DHS group is 58 years, and mean age for PFLCP group is 64 years.

Table 2: Mode of injury

Mode of Injury	PFN		DHS		PFLCP		Total	Total %
RTA	06	30%	12	37.5%	04	40%	22	35.8
Domestic fall	13	65%	18	56.2%	06	60%	37	60.4
Assault	01	5%	02	6.25%	0	0%	03	3.75

We found that intertrochanteric fracture due to domestic fall (60.4%) was most common mode of injury, followed by fracture due to road traffic injury (35.83%). 60 % fractures occurred on left side and 40% on the right side.

Table 3: Classification of fractures

AO Classification	PFN	DHS	PFLCP
A1	04	02	01
A2	05	12	01
A3	11	18	08

Table 4: Fracture Pattern

Type	PFN		DHS		PFLCP	
Stable (25)	09	45%	14	43.75%	02	20%
Unstable (37)	11	55%	18	56.25%	08	80%

According to AO classification 25 patients (40.3%) were stable and 37 patients (59.6 %) were unstable. In our study we got most of patients with A3 type unstable fractures. In PFN group 11 patients (55%), in DHS group 18 patients (56.26) and in PFLCP group 8 patients (80) were with A3 type fractures. While patients with A1 type fractures were least in numbers. In PFN group 4 patients (20%), in DHS group 2 patients (6.25%) and in PFLCP group 1 patient (10%) were with A1 type fractures. In our study shortest operation time was in PFN group with overall mean of 46.5 min followed by DHS (60 minutes) and PFLCP (75 minutes) shows significant difference in operation time PFN vs. DHS (P- value 0.001) PFN vs. PFLCP (P-value 0.000) and DHS vs. PFLCP (P-value 0.000).In our study patients with stable fracture mobilizes early as compare to unstable fracture. In PFN group overall mean for mobilization is about 9.75 days. While for DHS group it is about 12.7 days but in PFLCP group patients restrict to weight-bearing for about 19.6 days. Patient treated with PFN was having least duration of hospital stay average of about 3 days, ranging from 2-7 days while patients treated with DHS was having average stay of 5 days ranging from 2-9 days. After intervention in PFLCP group average duration of hospital stay was 5 days ranging from 2-7 days postoperatively.

Table 5: Evaluation of Harris Hip Score

Group and classification	No	1 month		3 month		6 month		12 month	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
PFN	20	44.3		72.0		88.3		94.8	
Stable	09	47.3	±8.5	74.5	±10.8	89.4	±4.9	85.4	±3.6
Unstable	11	41.9		69.5		69.5		93.6	
DHS (B)	32	37.9		60.4		81.7		91.8	
Stable	14	39.2	±5.9	62.8	±9.2	84	±6.6	93.2	±6.5
Unstable	18	36.9		58.8		80		88.2	
PFLCP (C)	10	35.8		52.9		76.1		89.3	
Stable	2	47.8	±5.9	55.4	±7.4	76.5	±8.3	89.6	±8.5
Unstable	8	35.3		50.4		76		89.0	

In present study at 01 month mean score for (PFN 44.3 vs. DHS 37.9) p=0.002, PFN 44.3 vs. PFLCP 37.8) p=0.002 shows significant improvement in PFN group. At 3 months mean score for (PFN 72 vs. DHS 60.4) p = 0.00, (PFN 72 vs. PFLCP 52.9) p = 0.000 shows significant improvement in PFN group. At 6 months, mean score for (PFN 88.3 vs. DHS 81.7) p=0.000, (PFN 88.3 vs. PFLCP 76.1) p=0.000 shows highly significant improvement in PFN group. But at 1 year of follow up Harris Hip score for PFN = 94.8 vs. DHS = 91 vs. PFLC = 89.1 shows insignificant difference in functional status of patients belong to either group.

Table 6: After one month Follow up

ANOVA Test		Sum of Squares	Degree of Freedom	Mean Square	F Stats	P Value
After 1 month	Between groups	681.0	2	340.5	6.9	.002
	Within groups	2911.0	59	49.3		
	Total	3592.2	61			

Comparison With in the Groups

ANOVA test gives p value of 0.02 indicating there is significant improvement in functional outcomes of patients in all 3 groups at 01 month of follow up.

Table 7: After 1 month of follow up: post Hoc analysis

Dependent variable	Group	Group	Mean difference	Std. error	P Value	95% Confidence Interval	
						Lower Bound	Upper Bound
After 1 month	Group A	Group B	8.49	2.72	.008	1.8	15.2
		Group C	6.43	2.00	.006	1.5	11.4
	Group B	Group A	-8.49	2.72	.008	-15.2	-1.80
		Group C	-2.06	2.54	1.000	-8.3	4.2
	Group C	Group A	-6.43	2.00	.006	-11.4	-1.5
		Group B	2.06	2.54	1.000	-4.2	8.3

Comparison Among the Groups

For comparison we applied Bonferroni/ post HOC analysis p value for PFN vs. DHS is 0.008 (<0.05) and p value for PFN vs. PFLCP is 0.006 (<0.05) indicating a significant improvement in functional score of patients in PFN group as compared to DHS and PFLCP group. While p-value for DHS vs. PFLCP is 1.00 (>0.05) shows insignificant difference in functional status of patients in these groups.

Table 8: After 3 months Follow Up

ANOVA test		Sum of squares	Degree of freedom	Mean square	F Stats	P Value
After 03 months	Between groups	2837.8	2	1418.9	14.7	0.000
	Within groups	5677.6	59	96.2		
	Total	8515.4	61			

Comparison With in the Groups

ANOVA test gives p value of 0.000 in all 3 groups indicating highly significant improvement in functional score of patients in all groups at 03 month of follow up.

Table 9: After 3 months of follow up: post Hoc analysis

Dependent variable	Group	Group	Mean difference	Std. error	P Value	95% Confidence Interval	
						Lower Bound	Upper Bound
After 3 months	Group A	Group B	19.05	3.80	.000	9.7	28.4
		Group C	11.55	2.80	.000	4.7	18.4
	Group B	Group A	-19.05	3.80	.000	-28.4	-9.7
		Group C	-7.50	3.55	.117	-16.3	1.3
	Group C	Group A	-11.55	2.80	.000	-18.4	-4.7
		Group B	7.50	3.55	-1.3	-1.3	16.3

Comparison Among the Groups

p value for PFN vs. DHS and PFN vs. PFLCP is 0.00 while for DHS vs. PFLCP p value is 0.117 (>0.05). Indicating PFN group patient had better functional score at 3 months than DHS and PFLCP group it is because of early mobilisation and weight bearing in this group. But there is insignificant difference in functional score of DHS and PFLCP group at 3 months of follow up.

Table 10: After 6 months of Follow Up

ANOVA test		Sum of squares	Degree of freedom	Mean square	F Stats	P Value
After 06 months	Between groups	1102.2	2	551.1	12.7	0.00
	Within groups	2568.2	59	43.5		
	Total	3670.4	61			

Comparison With in the Groups

p-value is 0.00 for all 3 group it inferences a highly significant improvement in functional score of patients at 6 months of follow up.

Table 11: After 6 Months of Follow Up: Post Hoc Analysis(Bonferroni Test)/ Multiple Comparison

Dependent variable	Group	Group	Mean Difference	Std. Error	P value	95% Confidence Interval	
						Lower bound	Upper Bound
After 6 months	Group A	Group B	12.28	2.56	.003	6.0	18.6
		Group C	6.60	1.88	.000	2.0	11.2
	Group B	Group A	-12.28	2.56	.000	-18.6	-6.0
		Group C	-5.67	2.39	.063	-11.6	.2
	Group C	Group A	-6.60	1.88	.003	-11.2	-2.0
		Group B	5.67	2.39	.063	-2	11.6

DISCUSSION

Most of patients in our study were from 5th to 7th decade, Mean age for PFN 56 years, Mean age for DHS 58 years while for PFLCP 64 years.[11] Cleveland *et al* pointed out higher incidence of intertrochanteric fractures in elderly people because of poor vision, senile osteoporosis, and low muscle mass to absorb energy of trauma. Ahrengart L, Tornkvist H, Fornander P *et al* reported average age 80

years for male and 78 year for female.[12]Tyllionksi M *et al* reported average age 71.3 years.[13] In our study overall average age is 58.32 years which is lower in comparison to above mentioned studies probably because of lower life expectancy, early osteoporosis and poor built in Asian population specially of developing countries like India.[14] Harrington and Johnton reported 42% male and 58% female, G.S.Kulkarni in 1984 concluded average age of 62 years. Kudema*et al* 36% male and 64% female, Poihgen first and Schnable 17% male and 83% female.[15]In our study, male and female ratio 1.2:1(34 male 28 female) which is in contrast to most of the reported literature. In this part of India, females are mostly confined to their houses in this age group. It is very difficult to classify the mode of injury accurately.[16] We divided the mode of injury into 3 broad categories as RTA, domestic fall and assault on the basis of this classification maximum cases were observed in domestic fall i.e. 37 patients (59.67%) out of 62.[17] According to Cummings and Nevit, there is inadequate protective reflexes to reduce energy of fall, inadequate local shock absorbers and none strength in elderly patient.[18]Keneth J. Koval and Joseph D. Zuckerman observed that 90% of hip fractures in the elderly result from a simple fall. In our study average hospital stay of patient in PFN group was about 3 days ranging from 2-5 days, in DHS group it was 5 days ranging from 2-9 days and in PFLCP group 5 days ranging from 2 to 7 days. Shishir Murugharaj*et al* reported average hospital stay of 7.9 days in patients treated with PFN and 12.04 days in patients treated with DHS.In present study we used AO classification to classify the fracture pattern. In PFN group 9 cases out of 20, in DHS 14 out of 32 cases and in PFLCP 2 out of 10 cases was having stable fracture configuration. In present study unstable fractures accounts for 37 (59.67%) out of 62 patients while stable fracture accounts for 40.3% cases of total 62 patients. Wolfgang *et al*[17] reported 79% stable and 21% unstable type fracture, Neilson, B.P. *et al* reported 28% stable and 72% unstable trochanteric fracture, Larsson S, Friberg S *et al* reported a series of 35% stable and 65% unstable trochanteric fracture. In the present study the patients were mobilized in bed to a sitting position the day after surgery to decrease the incidence of pulmonary thromboembolism and urinary tract complication. Gentle hip and knee exercise in the bed was promoted in all groups. A Frame/walker walking program with partial weight bearing was allowed after 1 postoperative week for PFN and DHS groups. The ability to resume ambulation after trochanteric fracture is related to several factors besides simple fracture healing. NJ. Little, V. Verma. *et al* suggested the reason for this to be post-operative factors: pain, muscle dysfunction and medical co-morbidities.[20]In our study mean operative time for DHS group is 60 minutes and for PFN in 46.5 minutes while for PFLCP group is 75 minutes. This is in accordance with previous studies Wie Ting lee *et al* reported mean operating time for PFLCP on 13 cases with multi-fragmentary unstable intertrochanteric fracture was 151.3 minutes while for stable fractures 116 minutes. Nayerasif*et al* reported average operating time in 27 patients operated with PFLCP was about 75 minutes. Mean blood loss in PFN was 100 to 300 ml, DHS 350 to 700 ml, PFLCP 350 to 600 ml.

CONCLUSION

PFN had good to excellent outcomes. Only one patient developed non-union, but he still walks with slight limping. So PFN offers high rotational stability, compression at fracture site, create a shorter lever arm, so had decreased rate of mechanical failure, reduced hospital stay, early mobilization, less blood loss and less surgery time, early rehabilitation and faster union as compared to DHS and PFLCP.DHS offers advantages over PFN and PFLCP in terms of lesser cost of implant, lesser radiation exposure and requiring least surgical expertise. But it should be used cautiously in unstable comminuted intertrochanteric fractures as it leads to varus collapse in 12.5% cases. Proximal femoral locking plate also seems to be a feasible alternative to PFN and DHS in certain complex comminuted unstable osteoporotic intertrochanteric fractures as it locks the fracture in reduced position achieved by surgeon without controlled collapse. There was varus collapsing in one patient. One of major draw backs of using PFLCP is that weight bearing has to be controlled and allowed only after radiological evidence of fracture union in unstable fractures.

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