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TREATMENT OF UNSTABLE INTERTROCHANTERIC FRACTURE OF FEMUR WITH DYNAMIC HIP SCREW VERSUS PROXIMAL FEMORAL NAIL: A COMPARATIVE STUDY

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ABSTRACT: BACKGROUND: Surgical treatment of intertrochanteric fractures of femur by Dynamic hip screw or by proximal femoral nail provides better results. However in cases of unstable intertrochanteric fractures, PFN, being an intramedullary fixation device, has shown much higher success rates, in comparison with DHS. Being intramedullary, it is a biomechanically stable device providing better fixation of unstable intertrochanteric fractures with lesser rates failure of fixation and also permitting early mobilization and faster rehabilitation in elderly patients. This study compares the functional outcome of unstable intertrochanteric fractures treated with PFN and DHS. **MATERIALS AND METHODS:** We evaluated 30 (PFN: 15;DHS: 15) cases of unstable intertrochanteric fractures of femur from June 2012 to June 2014 admitted to the Department of Orthopaedics, Chettinad Medical College and Research Institute, treated by PFN/DHS. In our study we included 30 cases of intertrochanteric fractures. Type II, III and IV of Boyd and Griffins classification were included. Of the 30 cases, 11 cases of type II (36.7%), 12 cases of type III (40%) and 7 cases of type IV (23.3) fractures. 30 cases were divided into two groups, 15 each and the fractures in one group were fixed with Dynamic Hip Screw, while fractures in the other group were fixed with Proximal Femoral Nail. We evaluated the functional outcome of both groups. **RESULTS:** Shortening of 2cms was noted in 2 patients treated with DHS. At the final follow up Richard screw cut through was noted in 1 patient treated with DHS for which implant exit was done. Implant Failure-"Z-effect" was noted in 1 patient treated with PFN. Functional outcome was compared between both the groups using Harris Hip Score. The average functional score at 1 month postop in DHS and PFN group is 65.7 and 71.3 respectively. Functional score at 3 months in DHS group is 71.7 and 75.4 in PFN group. At the final follow up, 6th month postop functional score in DHS group is 83 and 83.7 in PFN group. **DISCUSSION:** None of the parameters investigated revealed a significant difference between patients undergoing DHS and PFN procedures for internal fixation of intertrochanteric fractures. These results are supported by several other studies, which suggest that there is no statistical difference between patients undergoing PFN and DHS in terms of outcome measures, or complication rate. Previous studies have suggested that the PFN procedure has an advantage over DHS in reducing time to first mobilization. There was a slightly reduced time to first mobilization in PFN patients, but this was not found to be statistically significant.

KEYWORDS: Proximal femoral nail, Dynamic hip screw, Unstable intertrochanteric fracture.

INTRODUCTION: Intertrochanteric fractures are defined as "Fractures involving upper end of femur along inter- trochanteric line with or without extension into upper femoral shaft". An increasing incidence of inter-trochanteric fractures with advancing age is well known. The incidence of intertrochanteric fractures varies from country to country. Any metabolic condition associated with

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bone loss like Osteoporosis, Hyperparathyroidism, Hyperthyroidism, Cushing's Syndrome, Diabetes mellitus etc., is associated with rise in the risk for hip fractures.

Gulberget al¹ has predicted that the total no. of hip fractures will reach 2.6 million by 2025 and 4.5million by 2050. In 1990, 26% of all hip fractures occurred in Asia whereas this figure could rise to 37% in 2025 and 45% in 2050.^{2,3} Hagino et al reported a lifetime risk of hip fracture for individuals at 50 years of age as 5.6% for men and 20.0% for women. They are the most frequently operated fracture type, having the highest postoperative fatality rate among surgically treated fractures and have become a serious health resource issue, due to the high cost of treatment.

With advancing life expectancy and geriatric care, more patients who could have been conservatively treated in the past for hip fractures, have now become candidates for surgery. It is therefore imperative for a study, for better understanding of the inter-trochanteric fractures and to find the best possible means to stabilize them.

The treatment options for inter-trochanteric fractures are operative and non-operative. Non-operative treatment should only be considered in non-ambulatory or chronic dementia patients with pain that is controllable with analgesics and rest, terminal diseases with less than 6 weeks of life expectancy, unresolved medical comorbidities.

That preclude surgical treatment and incomplete intertrochanteric fractures.⁴ Non-operative approach include reduction via traction and early mobilization within the limits of pain tolerance. The conservative approach however has high complication rates. The common problems of prolonged immobilization like decubitus ulcers, U.T.I, joint contractures, pneumonia, and thromboembolism contribute to the high mortality rate. The increased incidence of varus deformity and shortening due to non-operative treatment often result in poor function.

Operative approach includes dynamic hip screw fixation, intramedullary nailing and prosthetic replacement, of which the dynamic hip screw and proximal femoral nail constitute the most widely and commonly used modality of treatment of inter-trochanteric fractures.

The aim of this study is to compare the clinical (Functional) and radiological outcome of unstable inter-trochanteric fractures treated with Dynamic Hip Screw (DHS) and Proximal Femoral Nail (PFN) and to evaluate the overall outcome (Union rate).

MATERIALS AND METHODS: Patients admitted with unstable inter-trochanteric fractures of Hip in the Department of Orthopaedics, Chettinad Hospital and Research Institute-Kelambakkam, Kancheepuram District are included in the study.

Study Design: This is a prospective comparative study. The duration of study period is 02 years. Cases admitted in Chettinad Hospital and Research institute during the period of May 2010 to May 2014 and satisfying the inclusion criteria alone were included in the study. Patients are followed up for a period of upto 6 months (1, 3 and 6 months) from the date of surgery and evaluated clinically with Harris Hip Score and the outcome will be used for comparison.

Inclusion Criteria:

- a. All patients above 18 years of age.
- b. All patients with isolated unstable inter-trochanteric fractures of hip-(Comminution of posteromedial cortex, subtrochanteric extension and reverse obliquity pattern – Boyd and Griffin's type II - IV)
- c. All patients, who were ambulatory before sustaining the injury.

Exclusion Criteria:

- a. Inter-trochanteric fractures of Boyd and Griffin's classification, Type I.
- b. Patients with Polytrauma.
- c. Fractures other than inter-trochanteric fracture of femur.
- d. Fractures associated with vascular injury.

Proximal Femoral Nail:

- The proximal femoral nail is a cephalo-medullary nail in which the larger diameter lag screw has been replaced with a 6.5mm dia Superior and and 11mm dia inferior screw.
- Material -steel or titanium.
- Proximal nail diameter-17mm.
- Distal nail diameter-10mm, 11mm, 12mm,
- Length-170 to 235mm.
- Lag screw insertion angle-125, 130, 135 degrees.
- MI angle-6 degrees.
- Distal screw diameter 4.9mm.

PROCEDURE AND POSTOPERATIVE PROTOCOL:^{4,5,6,7}

General Measures: All patients received in the emergency room were resuscitated for hypovolemia with fluids and blood. Major injuries were treated first. After the general condition of the patient improved, X-ray pelvis for both hips antero-posterior and lateral views are taken. Then, the fracture was immobilized in a bohrer brawn splint with upper tibial pin traction.

Once the patient is assessed by the anaesthetist for surgery, Type II, III & IV intertrochanteric fractures included in the study were fixed with both dynamic compression screw fixation and proximal femoral nailing according to the group they fall in. Most of the cases were taken up for elective surgery before the 5th day. Cases were taken up after 5th day, if there are associated injuries or factors delaying the assessment for surgery.

Fixation with Dynamic Hip Screw: Type II, III & IV inter-trochanteric fractures of group I were fixed with dynamic compression screw fixation. The preoperative lag screw size and length of plate were assessed using digital x-rays. Patient is positioned in supine position on a fracture table with traction in affected limb with 15 degrees of internal rotation. Uninjured limb is flexed abducted. Area of peroneal nerve is padded. Reduction of the inter-trochanteric fracture is done by standard reduction technique, i.e, Traction, abduction and internal rotation under the fluoroscopic guidance as described by the principles of AO/ASIF. Fracture reduction is checked in both anteroposterior and lateral views using C-arm.

Proximal femur is approached laterally from the greater trochanter and extended distally. Length of incision depends on length of implant used. Elevate the vastus lateralis off the intermuscular septum, coagulating the branches of profunda femoris artery. Entry point is mainly 2cm below the vastus lateralis ridge for the 135 degree angle plate. Guide pin is inserted in the femoral head and position of the pin is confirmed in both anteroposterior and lateral views. After confirming the pin position, the triple reamer is adjusted after measuring with the direct measuring device.

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Then gently reaming of the femoral head is done and stopped at 10mm below the subchondral bone. After tapping, the lag screw of proper length is introduced without piercing the subchondral bone. Short barrel or long barrel plate is selected according to the length of the lag screw. Length of the plate depends on the extension of the fracture line. Plate is fixed with cortical screws to the bone. Then traction is released and compression screw is applied on the lag screw. Wound is closed in layers with suction drain attached.

FIXATION WITH PROXIMAL FEMORAL NAILING: Type II, III & IV intertrochanteric fractures in group II are fixed with proximal femoral nail. Nail size and the size of the lag screws were measured preoperatively. Patient on fracture table in supine position with traction on injured limb. Other limb is flexed and abducted. Reduction of the inter-trochanteric fracture is done by standard reduction technique, i.e., Traction, abduction and internal rotation under the fluoroscopic guidance as described by the principles of AO/ASIF. Fragment position is checked in both anteroposterior and lateral views. Draping is done only after reduction of the fracture. Skin incision made 4 to 5cm above greater trochanter, adequate enough to make entry point. Entry point for this nail is the tip of greater trochanter. Bone awl is used for the entry point. Once confirmed in both views, guide wire is inserted. After checking the position of the guide wire in both the views, adequate length nail is inserted. Nail has proximally 2 holes for cancellous screws in the head and neck. Incision is made for the fixation of 2 cancellous screws. First the anti-rotation screw is inserted and then the larger lag screw. Length of both the screws is checked on both views. Proximal screw should be shorter than the distal lag screw. Always distal locking should be done with locking bolts designed for the nail.

Postoperative Protocol: Post-operative rehabilitation was decided by the stability of the fracture. In all types of trochanteric fractures with dynamic hip screw fixation and proximal femoral nail fixation, toe touch weight bearing was started on day two after drain removal. Partial weight bearing was allowed from third week. Full weight bearing was allowed only after radiological evidence of union.

Functional Outcome was assessed using Harris Hip Score.

Interpretation of Harris Hip Score:

<70 POOR	80-89 GOOD
70-79 FAIR	90-100 EXCELLENT

The following observations were made from this comparative study of:

Dynamic hip Screw and Proximal femoral nail in the treatment of 30 cases of Intertrochanteric fractures of femur in the Department of Orthopaedics, CHRI, between June 2012 and June 2014.

Age (Years)	No. of Patients in DHS	No. of Patients in PFN
<=50	2(13.3%)	4(26.7%)
51-65	7(46.7%)	4(26.7%)
66-75	3(20%)	5(33.3%)
>75	3(20%)	2(13.3%)
Total	15(100%)	15(100%)
Age Distribution of Cases		

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- In our series, majority of the cases i.e, 7(46.7%) were seen in the age group 51-65 years in DHS group and 5(33.3%) were seen in the age group 66-75 years in PFN group.
- Mean age in years of patients treated with DHS: 65.
- Mean age in years of patients treated with PFN: 61.9.

Sex	No. of Patients in DHS	No. of Patients in PFN
Male	8(53.3%)	9(60%)
Female	7(46.7%)	6(40%)
Total	15(100%)	15(100%)
Gender Distribution		

MODE OF TRAUMA	DHS	PFN
RTA	7(46.7%)	6(40%)
Fall from height	3(20%)	3(20%)
Slip and fall	5(33.3%)	6(40%)
Total	15(100%)	15(100%)
Mode of Trauma		

- In the DHS group, RTA is the most common mode of injury i.e, 7(46.7%) patients. Whereas in the PFN group, the most common mode of injury is RTA & Slip and fall i.e, 6(40%) each.
- In both the groups, fall from height was found to be the least common mode of injury i.e, 3(20%).

Boyd and Griffin classification	Group I (DHS)	Group II (PFN)
TYPE II	6(40%)	5(33.3%)
TYPE III	6(40%)	6(40%)
TYPE IV	3(20%)	4(26.7%)
According to Boyd & Griffin's Classification		

- In Group I (DHS), majority of the fractures were of Type II (40%) and Type III (40%) of Boyd and Griffin's Classification.
- In Group II, majority were of Type III (40%).
- Type III fractures of Boyd and Griffin's classification had the highest incidence in the population included in this study i.e., total-12 cases.

Age Group	TYPE II	TYPE III	TYPE IV
<=50	0(0%)	1(8.3%)	5
51-65	1(9.1%)	8(66.7%)	2
66-75	5(45.5%)	3(25%)	0(0%)
>75	5(45.5%)	0(0%)	0(0%)
Association Between type of Fracture and Age			

Majority of fractures in <=50 years of age was of Type IV, followed by Type III in age group 51-65 years and Type II in age group 66-75 years and over 75 years.

- Association between the fracture types and age is not statistically significant.

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RESULTS & DISCUSSION: With the modern method of treatment and awareness of healthy living, Average life expectancy of Indian population has increased almost double fold, from 35 years to 64 years, resulting in a tremendous increase in osteoporotic population and osteoporotic fractures. Increasing life expectancy, sedentary life style, increasing traffic on road, poor road sense etc., result in a remarkable increase in the incidence of such fractures.

The aim of this study is to compare the clinical (functional) outcome of:

Unstable inter-trochanteric fractures treated with Dynamic Hip Screw (DHS) and Proximal Femoral Nail (PFN) and to evaluate the radiological outcome (Union rate).

In our study, we included 30 cases of inter-trochanteric fractures. Type II, III and IV of Boyd and Griffins classification were included. Of the 30 cases, 11 cases of type II (36.7%), 12 cases of type III (40%) and 7 cases of type IV (23.3) fractures. 30 cases were divided into two groups, 15 each and the fractures in one group were fixed with Dynamic Hip Screw, while fractures in the other group were fixed with Proximal Femoral Nail.

There were 17 male cases and 13 female cases. Road Traffic Accidents being the most common mode of injury followed by slip and fall and fall from height, 43.3%, 36.7% and 20% respectively. The average age in the DHS group is 65 years whereas in PFN group it is 61.8 years.

All the patients included in our study were evaluated with x-ray pelvis with both hips, both anteroposterior and lateral views. In addition traction and internal rotation - special view of the affected side was also taken for better understanding of the fracture anatomy. Routine blood investigations, ECG and X-ray Chest were also taken for preoperative assessment.

Antibiotic prophylaxis was administered for all patients. Dynamic hip screw fixation is done by lateral approach. Proximal femoral nailing incision is much smaller, just for the entry point over the tip of the trochanter. In this study the average duration of surgery in the DHS group is more than that of the PFN group, former being 93.3minutes and latter 82.7minutes. In all types of trochanteric fractures with dynamic hip screw or proximal femoral nail fixation, the post-op protocol mentioned above was followed.

Functional outcome was compared between both the groups using Harris Hip Score at 1st, 3rd and 6th month postoperatively. The average functional score at 1 month postop in DHS and PFN group is 65.7 and 71.3 respectively. Functional score at 3 months in DHS group is 71.7 and 75.4 in PFN group. At the final follow up, 6th month postop functional score in DHS group is 83 and 83.7 in PFN group. Although the initial functional scores are better in PFN group, the final score at 6 months are almost similar in both DHS and PFN groups. The p-value of Harris hip score at 1,3 and 6 months is >0.05. Although the functional scores are favoring PFN group, the p-value is more than 0.05 and it is statistically not significant (Table: 8)

Follow up	Functional score Group I(DHS)	Functional score Group II (PFN)	p-value
1 Month	65.7±4.39*	71.3±1.91*	>0.05
3 Months	73.9±3.93*	75.4±2.41*	>0.05
6 Months	83±3.89*	83.7±3.71*	>0.05
Functional Outcome – Harris Hip Score			

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Radiological outcome (Union rate) at the final follow up, 6th month post op, was assessed for all the patients included in this study. Fracture was termed united if callus was seen in all the cortices in both the anteroposterior and lateral views. Fractures in all the patients in both the groups united at the final follow up, 6th month postoperatively.

Complications in DHS group were, shortening of 2cms in 2 patient's for which foot wear modification was prescribed. One patient had implant failure in the form of lag screw cutting through the femoral head. The fracture was united at the final follow-up after which implant exit was done. Complications in PFN group- one patient at final follow up had superior neck screw pull out, which was later removed. Range of movement in knee was decreased by 30 degrees in two patients.

None of the parameters investigated revealed a significant difference between patients undergoing DHS and PFN procedures for internal fixation of inter-trochanteric fractures. These results are supported by several other studies,^{8,9,10} which suggest that there is no statistical difference between patients undergoing PFN and DHS in terms of outcome measures, or complication rate. Previous studies have suggested that the PFN procedure has an advantage over DHS in terms of early mobilization of patient post-surgery.¹¹ there was a slightly reduced time for the initial mobilization in PFN patients, but this was not found to be statistically significant.

- Thus in this two years study, there is no statistical significance in the functional and Radiological outcome in patients undergoing DHS and PFN procedures for internal fixation of intertrochanteric fractures.

PFN has all advantages of an Intramedullary Device:

- Because of its central location, it provides more efficient load transfer.
- Possibility of insertion through closed technique.
- Decreased blood loss.
- Decreased infection rate.
- Minimal soft tissue dissection and wound complications.

The main Advantages of PFN over DHS are:

- PFN fixation requires small incision, less tissue handling, decreased blood loss, decreased chance of infection and increased mechanical stability.
- Allows early weight bearing.
- It can be used in elderly osteoporotic bones.
- PFN acts as a buttress to prevent mediatisation of the shaft (It can be used even in fracture of lateral cortex).
- It also temporarily compensates for the function of medial column.

STATISTICAL ANALYSIS: All the continuous variables were assessed for the normality using Shapiro Wilk's test. If the variables are normally distributed, they were expressed as Mean +/-SD. otherwise Median (Inter quartile range).

All the categorical variables were expressed either as percentage or proportion. Comparison of categorical variables are done by either chi-square test or Fisher's exact test, based on the number of observation. All the p values less than (<0.05) were considered as statistically significant. Data analysis is done by a statistical software SPSS version 11.0.

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