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CLINICAL STUDY OF TROCHANTERIC FRACTURES TREATED WITH PROXIMAL FEMORAL NAILING.

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ABSTRACT

Background- Trochanteric fractures constitute approximately half of all the hip fractures in elderly patients who have decreased bone strength and density. Proximal femoral nail [PFN] was introduced by AO/ASIF as a biomechanically stronger intramedullary device. Present study was aimed to study of trochanteric fractures treated with proximal femoral nailing at a tertiary hospital. **Material and Methods:** Present study was single-center, prospective, observational study, conducted in patients in the age group of more than 20 years of either sex, trochanteric fracture type 31-A1, 31-A2, 31-A3 (OTA classification) and 4 types of Boyd & Griffin classification. Patients were operated with PFN under fluoroscopic guidance. **Results:** In present study, 30 patients were studied. Majority patients were in the elderly group. 60% of patients in our study were females. In present study, type 31.A2 was the most commonly occurring pattern (47 %) while, type 31.A3 the reverse oblique unstable type was the least common (16%). The maximum patients have Singh's index of 3 and 4 (54 %). Intraoperatively closed reduction was achieved in 97% patients. Only 1 patient (3%) required open reduction due to the complex fracture pattern. Good and acceptable reduction was achieved in 70% and 27% respectively. Only 3% (1 patient) had poor reduction and had poor outcome in final analysis. 27 Patients had no complications. 1 had Z-effect and 2 had shortening. 20 Patients (66 %) were found to have radiological union before 15 weeks. The outcome of patients treated with PFN were analyzed with Harris hip score at the end of 6th month post operatively and were found to be excellent in 47% patients (14 patients). Good outcome in 9 (30%), fair in 5 (17%). 2 patients had poor outcome (6%). **Conclusion:** Proximal femur nailing offers a stable and reliable fixation with a promising functional outcome in patients with intertrochanteric fractures.

Keywords: Proximal femur nailing, intertrochanteric fractures, Harris hip score, functional outcome

INTRODUCTION

Trochanteric fractures constitute approximately half of all the hip fractures in elderly patients who have decreased bone strength and density. More than 50% of intertrochanteric fractures are unstable.^{1,2} The incidence increases as the age progresses. The goal of treatment of any fracture is to restore mobility, safely and efficiently while minimizing the risk of medical complications and restore the patient to pre-injury status. Treatment methods of unstable intertrochanteric fractures have always been challenging.

The dynamic hip / condylar screws which are used for decades as treatment option, has been shown to produce good results, but complications are frequent particularly in unstable inter-trochanteric fracture. They require longer incision, more soft tissue involvement, blood loss and higher operating time. Conservative management can be considered only in selected patients who are non-ambulant and the fracture has minimal impact on their daily routine.

Proximal femoral nail [PFN] was introduced in 1997 by AO/ASIF as a biomechanically stronger intramedullary device. The advantage of PFN fixation is that it provides a more biomechanically stable construct by reducing the distance between hip joint and implant.^{3,4} Present study was aimed to study of trochanteric fractures treated with proximal femoral nailing at a tertiary hospital.

MATERIAL AND METHODS

Present study was single-center, prospective, observational study, conducted in Department of Orthopaedics Saveetha Institute of Medical & Technical Sciences, India. Study duration was from May 2017 to September 2018. Study approval was obtained from institutional ethical committee.

Inclusion criteria

- Patients in the age group of more than 20 years of either sex, trochanteric fracture type 31-A1, 31-A2, 31-A3 (OTA classification) and 4 types of Boyd & Griffin classification, willing to participate in present study

Exclusion criteria

- Bilateral fractures, Pathological fractures, Compound fractures, Fractures associated with polytrauma
- Pre-existing femoral deformity preventing hip screw osteosynthesis or intra-medullary nailing
- Sub-trochanteric fractures or fractures extending 5 cm distal to the inferior border of the lesser trochanter
- Patients unfit for surgery
- Patients with psychiatric illness

Study was explained to patients in local language & written consent was taken for participation & study. After patient's admission to orthopedic ward, detailed history on mode of injury, mobility prior to trauma, medical co-morbidities were recorded. Patients were clinically evaluated. Management in Emergency Department was done for haemodynamic stability, monitoring of Vital parameters, Management of associated vital organ injuries (chest, abdomen, head injury etc.). & Pain management. All patients were started on oral or intravenous analgesics and skin traction applied. If surgery was delayed by more than 5 days, upper tibial pin traction was applied with BB splint. Blood investigations such as Haemoglobin, Total count, Differential count, ESR, Blood urea, Serum Creatinine, Blood sugar Level, Blood grouping and Rh type, Bleeding time and Clotting time, HIV, HbsAg, Urine routine, Electro cardiogram & Radiographs (Pelvis with both hips – AP, Injured Hip with femur-AP Traction and internal rotation view, Chest X ray PA view) were done in all patients. Specific investigations with respect to co-morbidities whenever required.

Pre-operatively, radiological measurement of Nail diameter (measurement at the level of isthmus) & Neck shaft angle (on unaffected limb with goniometer). With pre-operative preparation, as NPO from midnight, Informed and written consent patients were posted for proximal femoral nailing, under spinal or epidural anesthesia. Patients were operated with PFN under fluoroscopic guidance.

Post-Operatively, intravenous antibiotics were administered till 5th post op day, oral antibiotics from 6th day to suture removal. Static and dynamic quadriceps exercises started from day 2. Non weight bearing walking as tolerate was started from the 2nd postoperative day. Hip and knee mobilization from POD 2. Suture removal on POD-12. Patients were usually discharged after 5th POD with instructions of exercises and medications, partial weight bearing from 2nd week and full weight bearing later on. Patients were evaluated clinically and radiologically every 4 weeks for 2 months and every 6 weeks henceforth until signs of radiological union appear. Clinical union was observed as the absence of pain and tenderness with full weight bearing.

All patients were assessed with respect to pre-operative, intra operative and post-operative status. The clinical and radiological outcome of each group were analyzed and recorded at the intervals of 4 weeks, 8 weeks, 12 weeks, and 6 months. Outcome was assessed with Harris Hip Score (based on the parameters of pain, limp, distance covered, absence of deformity and range of motion) and radiological assessment for union and alignment of fractures.

The study was conducted to analyze the age incidence, sex distribution, side incidence, mode of injury, fracture anatomy, the operative technique itself and the results obtained and complications. Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Statistical analysis was done using descriptive statistics.

RESULTS

In present study, 30 patients were studied. The youngest patient in the study was 35 years and oldest 90 years. Mean age 63 years. Majority patients were in the elderly group. 60% of patients in our study were females. 57% of cases had right side fracture. Our study had a female predominance with most of them with domestic fall. 63% patients were operated in less than 5 days. The mean interval was 5 days with range from 2 to 15 days.

Table 1: General characteristics

	No. of patients	Percentage
Age groups (in years)		
31-40	2	6.67
41-50	4	13.33
51-60	8	26.67
61-70	8	26.67
71-80	5	16.67
Above 80	3	10
Mean age (mean \pm SD)	63	
Gender		
Female	18	60
Male	12	40
Mode Of Injury		
RTA	14	46.67
Domestic Trauma	16	53.33
Side		
Right	17	56.67
Left	13	43.33
Interval		
0-5 days	13	43.33
6-10 days	3	10
10-15 days	2	6.67

In present study, type 31.A2 was the most commonly occurring pattern (47 %) while, type 31.A3 the reverse oblique unstable type was the least common (16%). The maximum patients have Singh's index of 3 and 4 (54 %). 60% patients were osteoporotic showing that the intertrochanteric fractures are more common in the osteoporotic individuals.

Intraoperatively closed reduction was achieved in 97% patients. Only 1 patient (3%) required open reduction due to the complex fracture pattern. Good and acceptable reduction was achieved in 70% and 27% respectively. Only 3% (1 patient) had poor reduction and had poor outcome in final analysis. 27 Patients had no complications. 1 had Z-effect and 2 had shortening. Infection, cut out, Reverse z effect & Diaphyseal fracture noted in present study.

Table 2: Fracture & operative characteristics

	No. of patients	Percentage
Fracture classification		
31.A1	11	36.67

31.A2	14	46.67
31.A3	5	16.67
Singh's index		
1	0	0
2	2	6.67
3	8	26.67
4	8	26.67
5	6	20
6	6	20
Reduction		
Closed	29	96.67
Open	1	3.33
Result of Reduction		
Good	21	70
Acceptable	8	26.67
Poor	1	3.33
Complication		
Shortening	2	6.67
Z effect	1	3.33

22 patients (73%) had no limp. Slight limp was noted in 6 patients (20%). Severe limping in 2 patients (7%) 23 patients (77%) did not use any walking aid. 4 patients (13%) used cane only while taking long walks. Full time cane was used by 2 patients (7%). Only 1 patient (3%) used crutches to aid in walking.

87% patients had no difficulty in climbing stairs. 10% (3 patients) were able to use stairs with the support. Only 1 patient was unable to use and is bound to indoor mobility alone 23 Patients (77%) were able to squat with ease. 5 had difficulty and 2 were unable to. They were provided potty training to use western toilets.

Table 3: Follow-up characteristics

	No. of patients	Percentage
Quality of Limp		
None	22	73.33
Slight	6	20
Moderate	0	0
Severe	2	6.67
Walking Aid		
None	23	76.67
Cane for long walks	4	13.33
Cane for full walking	2	6.67
Crutches	1	3.33
Stairs		
Normal	26	86.67
Unable	1	3.33
With support	3	10
Squatting		
With ease	23	76.67
Unable	2	6.67
With difficulty	5	16.67

50 % patients had no pain and 44% slight pain. Severe pain in only 1 patient (3%).

Table 4: Quality of pain

Quality of pain	No. of patients	Percentage
None	15	50 %
Slight	13	44 %
Mild	1	3 %

Moderate	-	-
Marked / severe	1	3 %

20 Patients (66 %) were found to have radiological union before 15 weeks. 8 Patients (27%) obtained between 16-18 weeks. Union was delayed more than 18 weeks in 2 patients. Mean duration was 14 weeks.

Table 5: Radiological Union (Weeks)

Radiological Union (Weeks)	No. of patients	Percentage
Less than 10 weeks	7	23 %
11-15 week	13	43 %
16-18 weeks	8	27 %
More than 18 weeks	2	7 %

The outcome of patients treated with PFN were analyzed with Harris hip score at the end of 6th month post operatively and were found to be excellent in 47% patients (14 patients). Good outcome in 9 (30%), fair in 5 (17%). 2 patients had poor outcome (6%)

Table 6: Harris hip score (6th month)

Harris hip score (6 th month)	No. of patients	Percentage
Excellent	14	47 %
Good	9	30 %
Fair	5	17 %
Poor	2	6 %

DISCUSSION

The intertrochanteric fractures of femur are the most common fracture of hip occurring predominantly in the elderly population. Most patients suffer a domestic trauma, a trivial fall before the fracture. This is attributed to the osteoporotic bones of the elderly. The biomechanical forces acting on proximal femur, along with the deforming muscular forces and poor vascularity together pose a threat to fracture healing. Also, prolonged hospital stay and lack of mobility lead to various complications like pulmonary embolism, deep vein thrombosis, bed sores and urinary tract infection.

The operative management includes fracture reduction, stabilization and early mobilization. This reduces the complications arising from recumbence. Pajarinen *et al.*,⁵ stated that the primary goal is to stabilize the fracture and allow early mobilization and to restore the pre-injury functional state as early as possible.

Outcome of intertrochanteric fractures depends on patient's age, general health status, interval between trauma and treatment, co-morbidities and stability of fixation. The implant of choice is still in debate as the various intramedullary and extramedullary implants available for intertrochanteric fractures claim advantages over one another. Studies by Pelet *S et al.*,⁶ Adams *CI et al.*,⁷ & Liu *Y et al.*,⁸ established that intramedullary devices have a biomechanical advantage over the older extramedullary implants. Since they are minimally invasive procedures, they are preferred in elderly as it reduces the blood loss, operating time and infection rate. These advantages make it a better choice of fixation.

The PFN introduced by AO offers the advantage of combining the intramedullary devices and that of the sliding screws thereby achieving maximal compression at fracture site in a minimal incision. The stability offered by PFN is second-to-none which helps in early weight bearing of patients with intertrochanteric fractures. The biomechanical advantage of intramedullary device that reduces the bending forces of hip acting on the implant by shortening the lever arm of the hip forces.⁹

AO classification of intertrochanteric fractures was used. 31A2 was the most common type in our study (47 %), similar findings were noted by Herrera *et al.*,¹⁰ (59 %). In our study 29 patients out of 30 were operated by closed reduction technique. Only 1 patient required open reduction (3%). Similar findings were noted by Christian *boldin et al.*,¹¹ (9 %), Pavelka *et al.*,¹² (14 %), Minos *tylliankis et al.*,¹³ (0 %),

In some studies, intraoperative difficulties such as broken guide wires, broken drill bit, difficulty in positioning the derotation screws were mentioned. We had difficulty in placing the derotation screw in one patient. No other intra-op complications were encountered.

All the patients were put on early mobilization with partial weight bearing started within 2 weeks. At the observation at 6 months post operatively only 2 patients had marked walking difficulty and was only in indoor mobility. 23 patients were walking without need of aids. 25 patients were able to squat without any difficulty. No infection was noted in any patient. Although the derotation screw used in that case was 10mm less than that of lag screw (technique followed as recommended by earlier studies), there was one patient with z effect.

Radiological union was achieved in all patients with a mean duration of 14 weeks (10-20 weeks range). No cases of non-

union were reported. Malunion occurred in 1 patient with z effect. The outcome was analyzed with Harris Hip score at 6th month post operatively. Excellent outcome was achieved in 14 patients (47%). Good in 9 patients (30%) fair in 5 (17%) poor in 2 (6%) patients. The mean score was 86. This result is comparable to most international studies on PFN. Patients had a significant improvement in walking status post operatively. With weight bearing started in 2 weeks and 23 patients required no walking aid. 4 patients required canes only on long walking. Only 2 patients had a marked morbidity and were on indoor mobilization only with the help of crutches or walker support.

From the above results it can be seen that PFN is both biomechanically and economically advantageous to the patients as it has short duration of surgery, minimal incision, less blood loss and thereby no / less blood transfusion, reduced hospital stay, early return to work & lesser requirement of antibiotics.

The dynamic hip screw was the implant of choice for intertrochanteric fractures for a very long time. But its morbidity rate and failure rates have led to the invention of intramedullary devices. The first-generation nails, although easy to use, had numerous complications that they could not be used now. The current intramedullary device of PFN, offers a stable fixation with minimal invasion and much lesser blood loss. It has proven to be advantageous to both the surgeon and the patient by reducing the operating time and allowing the early weight bearing.

The intramedullary devices, being placed closer to the calcar, reduces the short arm lever of the bending forces of hip acting on the implant and reduced the failure rate compared to the plate and screw set up. PFN temporarily compensates for the medial column function and helps in fracture healing in medial column comminution also.

The PFN has a fluted tip that prevents the stress fracture on the shaft of femur. It also acts as buttress and prevents the medialisation of shaft. Since the entry point is on the greater trochanter, the abductor mechanism is unaffected. The derotation screw and hip lag screw use provides adequate compression at the fracture site. These entire points together make the Proximal Femoral Nail an ideal implant for use in intertrochanteric fractures.

Our study is a prospective study with a limited sample size of 30 patients with a mean follow up of only 6 months. An extensive study involving a larger volume of patients and longer follow up is required for a more accurate evaluation. Compound injuries were not included and all the surgeries were done by different surgeons which may yield different outcome. Further studies with extensive analysis are required for a better understanding.

CONCLUSION

Proximal femur nailing offers a stable and reliable fixation with a promising functional outcome in patients with intertrochanteric fractures irrespective of the fracture pattern with no incidence of chronic infection and minimum residual impairment. With a good surgical set up and an experienced surgeon, proximal femur nail is the ideal implant for treatment of intertrochanteric fractures.

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