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## A prospective study to evaluate the radiological and functional outcome of unstable intertrochanteric fractures treated with proximal femoral nail

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### Abstract

**Background and Objectives:** Intertrochanteric fracture is one of the most common fractures of the hip especially in the elderly. These fractures are three to four times more common in women and the mechanism of injury is usually due to low-energy trauma like a simple fall. More than 50% of intertrochanteric fractures are unstable. The surgical stabilization of unstable intertrochanteric fractures remains a persistent challenge. The purpose of this dissertation is to study the effectiveness and drawbacks of one such newer intramedullary device, the Proximal Femoral Nail in the management of unstable intertrochanteric fractures

**Methodology:** This study is a prospective, time bound, hospital based study conducted at P.G.I of swasthiyog Pratishtan, Miraj, between March 2013 to Feb 2014. The study included 45 cases of unstable intertrochanteric fractures (AO classification 31A2 & 31A3) that were operated with the PFN which fitted into the inclusion criteria. All patients were informed about the study in all aspects and an informed consent was obtained. Follow up at 4, 8, 12, 18, 24 weeks for serial clinical and radiological evaluation was done and assessed clinically regarding pain, limp, hip movements, walking ability, deformity and shortening. Functional evaluation at end of 6 months was done by using Harris hip score.

**Results:** The study included 45 cases of unstable intertrochanteric fractures (36 cases of 31A2 & 9 cases of 31A3) that were operated with the PFN. The average age was 64 years. The most common mode of injury was trivial fall in 30 cases. Good reduction was achieved in 39 patients (86.66%). Acceptable reduction was achieved in 6 patients. 3 intraoperative complications and 9 post-operative complications observed. The average time of union was 18.44 weeks. Maximum number of fractures united between 16-20 weeks. Good to excellent results were seen in 88.8% of the cases according to Harris hip score at end of 6 months.

**Conclusion:** Hence we conclude that short Proximal Femoral Nail provides good fixation for unstable intertrochanteric fractures if proper preoperative planning, good reduction and surgical technique are followed, leading to high rate of bone union and minimal soft tissue damage especially for asian patients with relatively small femora.

**Keywords:** Osteoporosis, Harris hip score, Singh's Index, PFN, Intertrochanteric fractures, AO classification

### 1. Introduction

Intertrochanteric fracture is one of the most common fractures of the hip especially in the elderly. The incidence of intertrochanteric fracture is rising because of the increase in number of elderly population superadded with osteoporosis. These fractures are three to four times more common in women and the mechanism of injury is usually due to low-energy trauma like a simple fall. By 2040 the incidence is estimated to be doubled. In India the figures may be much more [1].

More than 50% of intertrochanteric fractures are unstable. Unstable patterns occur more commonly with increased age and with low bone mineral density [2]. The presence of osteoporosis in intertrochanteric fractures is important because fixation of the proximal fragment depends entirely on the quality of cancellous bone present [3].

The surgical stabilization of unstable intertrochanteric fractures remains a persistent challenge. Dissatisfaction with the use of the extramedullary devices like the Dynamic Hip Screw in unstable intertrochanteric fracture patterns led to the evolution of intramedullary devices [4].

The purpose of this dissertation is to study the effectiveness and drawbacks of one such newer intramedullary device, the Proximal Femoral Nail in the management of unstable intertrochanteric fractures.

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**2. Material and Methods**

This study is a prospective, time bound, hospital based study conducted at P.G.I of swasthiyog Pratishthan, Miraj, between March 2013 to Feb 2014. The study included 45 cases of unstable intertrochanteric fractures (AO classification 31A2 & 31A3) that were operated with the PFN which fitted into the inclusion criteria. All patients were informed about the study in all aspects and an informed consent was obtained.

Inclusion criteria included Unstable intertrochanteric fractures according to AO/OTA classification - AO31A2 & AO 31A3, Patients aged more than 18 years age who are medically fit for surgery and Patients who are willing to give consent. Exclusion criteria included Open hip fractures, Pathological fractures due to malignancy, Periprosthetic fractures and Paediatric fractures (before physal closure).

Preoperatively Neck shaft angle was measured on the unaffected side on an AP x-ray using a goniometer, Nail diameter was determined by measuring diameter of the proximal femur on an AP x-ray and Approximate sizes of the compression and anti-rotation screws were measured in the head neck region.

After the completion of the hospital treatment, patients were discharged and called for follow up at outpatient level, at regular intervals at 4, 8, 12, 18, 24 weeks, for serial clinical and radiological evaluation. If possible, further follow up was done.

All patients were clinically assessed by using the harris hip score at the end of 6 months. Radiological assessment for progression and time of union, fracture alignment and implant

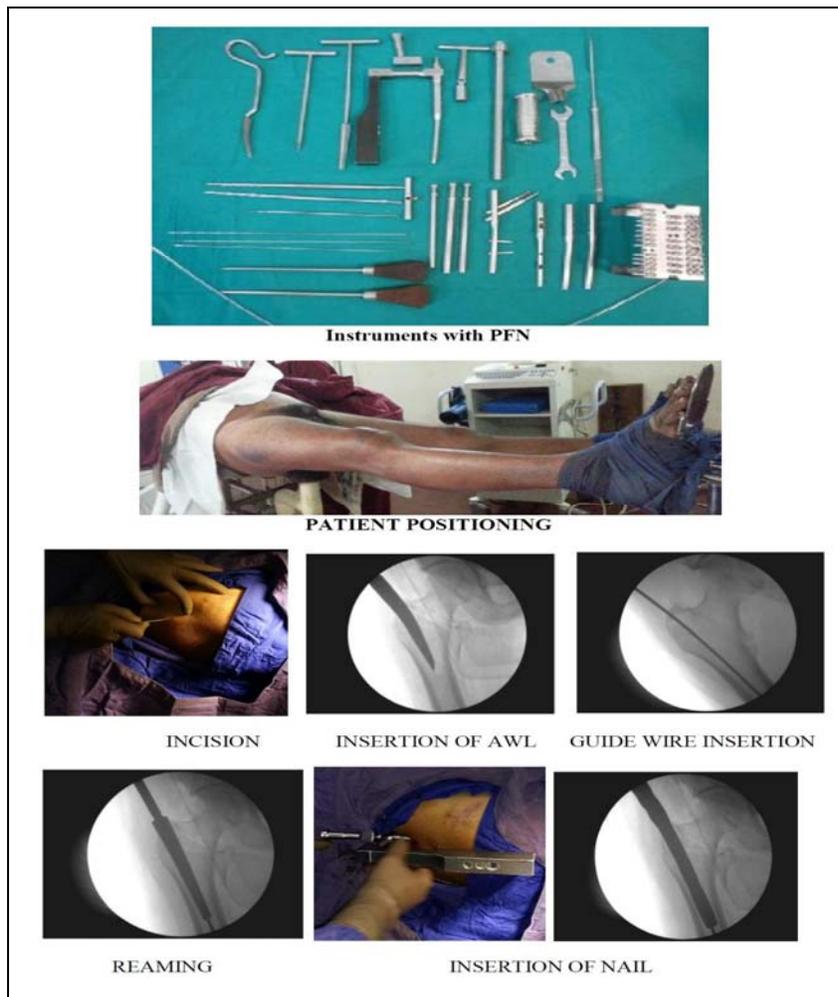
related complications were analysed. Data collected at the end of the study was statistically analyzed.

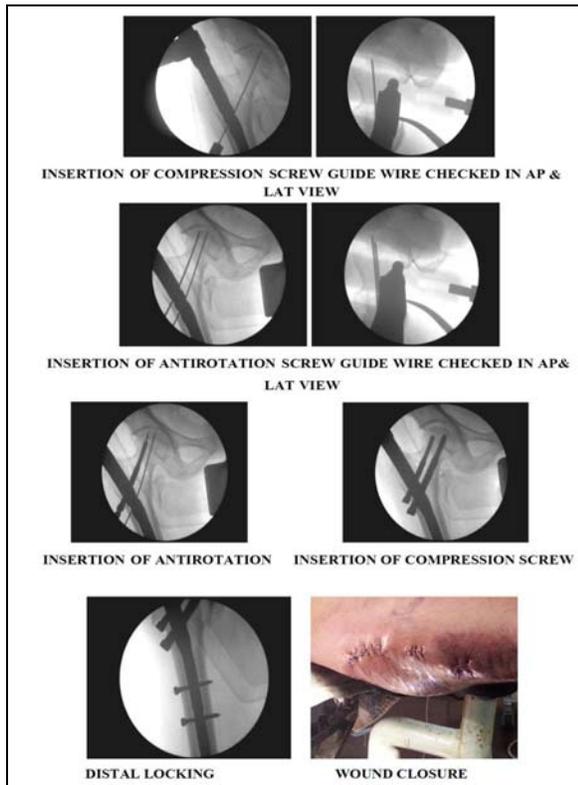
**2.1 Surgical approach:** Under Spinal or Epidural Anaesthesia all patients were placed in supine position on a fracture table with the unaffected leg, flexed and abducted as far as possible in order to accommodate the image intensifier. Operative leg was put on traction.

A reduction protocol was followed where posterior medial buttress was reduced by closed reduction or joystick method, flowed by limb was adducted. If fracture remained undisplaced nail was inserted, but if fracture got displaced, fracture was reduced again and transfixed with percutaneous k-wires through anterior cortex and then nail was inserted. Medullary canal was reamed by 15mm reamer before inserting nail. After nail insertion compression screw and derotation screws were inserted in the neck of femur under image intensifier. And last but not the least the distal screw was locked through jig after releasing the traction.

Postoperatively, Patients were encouraged to sit in the bed after 24 hours after surgery. Active isometric and isotonic quadriceps exercises were started from 2<sup>nd</sup> post-operative day. Non-weight bearing ambulation with the help of walker was started from 2<sup>nd</sup> post-operative day. Partial weight bearing ambulation was started from 6th week. Full weight bearing ambulation was started after radiological signs of union.

**2.2 Operative Photographs**





### 3. Results

The study included 45 cases of unstable intertrochanteric fractures (AO/OTA classification 31A2 & 31A3) that were operated with the PFN which fitted into the inclusion criteria. The mean age of the patients forming the study group was 64 years. Majority of patients were in the age range of 61-70 years. Majority of patients were males accounting for 28(62.2%) cases. In side distribution, 26(57.8%) cases occurred on the right side and 19(42.2%) on the left side. The leading cause for fracture was trivial fall in 30(66.7%) of cases whereas fall from a height was seen in 5(11.1%), road traffic accident 9(20%) and bull gore injury in 1(2.2%) patient.

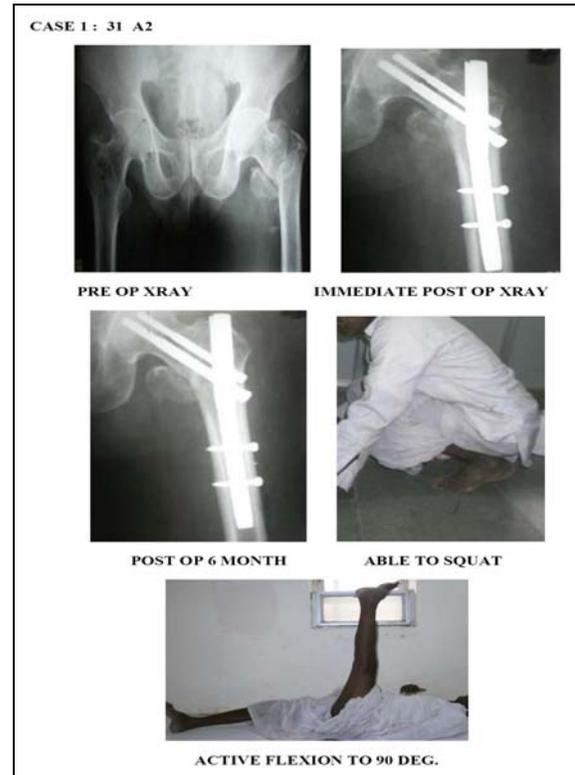
The study included 45 cases of unstable intertrochanteric fractures (AO/OTA classification 31A2 & 31A3). 36(80%) patients had 31A2 fractures and 9(20%) patients had type 31A3 fractures. Singh index was used to assess the osteoporosis radiologically. 13 patients had grade III, 19 patients had grade IV and 13 patients had grade V osteoporosis. 3 of the 45 patients had associated injuries/deformities, where 1 patient had left basicervical neck of femur fracture, right distal end radius fracture, right 5<sup>th</sup> metacarpal fracture which was treated with DHS, plating & pinning respectively. 1 patient had associated left frontal bone fracture which was managed conservatively. 1 patient had right elbow dislocation & distal end radius fracture, for which closed reduction & plating done respectively.

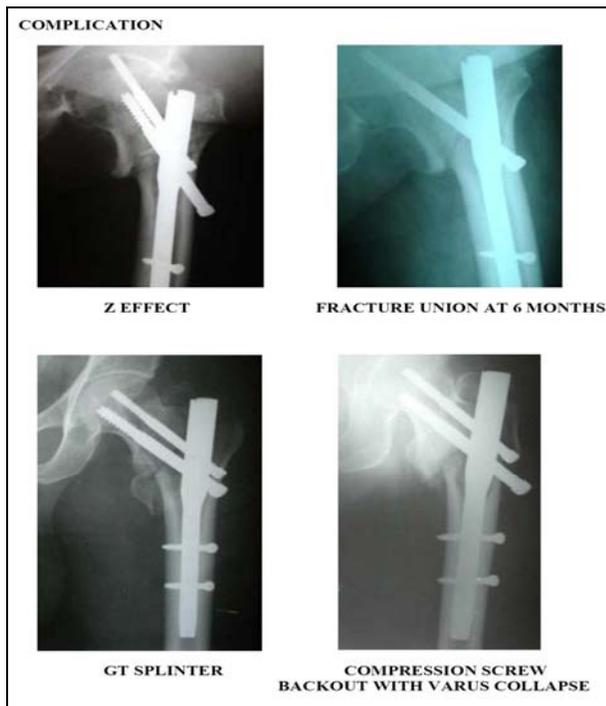
3 patients had Intra-operative complications where one had iatrogenic medial cortex fracture and two had greater trochanter split fracture. There were 15 cases of postoperative complications in present study which included 2(4.44%) mechanical failure, 3(6.66%) varus malunion, 2(4.44%) implant failure, 2(4.44%) lateral thigh discomfort and 5(9%) had shortening of affected lower limb as complication.

Radiological union was said to be achieved, on the evidence of obliteration of fracture lines and appearance of trabecular continuity between the two fragments on anteroposterior and lateral x rays in three cortices. The average time of union was

18.42 weeks, the range being from 15 to 24 weeks in 45 cases. Maximum number of fractures united between 16 to 20 weeks. All patients after 6 months of follow up (after fracture union) were assessed clinically and functionally as per the following criteria. Patients were followed up for a minimum of 6 months and maximum of 1 year. In our study of the 45 cases, there were 20 cases (44.4%) with excellent results, 20 cases (44.4%) with good results, 5 cases (11.11%) with fair results and no case with poor results.

### 3.1 Radiographs and clinical photos of results





#### 4. Discussion

Stable intertrochanteric fractures are those, in which posteromedial cortex remains intact and calcar femorale is not affected. Unstable intertrochanteric fractures are those, in which comminution of posteromedial buttress exceeds a simple lesser trochanteric fragment, those with subtrochanteric extension or those with reverse oblique fracture patterns. Surgical management is the preferred treatment for unstable fractures. Successful treatment of intertrochanteric fractures depends on surgeon independent variables like bone quality (osteoporosis), fracture pattern & fracture stability. Surgeon dependent variables like quality of fracture reduction, choice & placement of implant (63).

The Dynamic Hip Screw is accepted as the gold standard for stable trochanteric fractures. It provides controlled compression at the fracture site

In unstable proximal femoral fractures, control of axial telescoping and rotational stability are essential. Intramedullary implants inserted in a less-invasive manner are better tolerated by the elderly (90).

The main advantages of the Proximal Femoral Nail over its precursor-gamma nail, are that the 2 proximal screws are smaller in diameter. The 2 proximal screws provide better rotational control of proximal fracture fragment. Complications of proximal femoral nailing include lateral protrusion of screws, Z effect or reverse Z effect, fracture of the lateral wall of the trochanter, intra-operative femoral shaft fractures and anterior thigh pain.

Our study consisted of 45 patients. The mean age was 64 years and 40% of patients were in age group 61 to 70 years, this finding was similar to study done by GS Kulkarni 1984 and Kenzor *et al* 1984 where mean age was 62 and 73 respectively. There was a male preponderance in the present study with 28(62.2%) of the patients being males. This finding was similar to the observation of study done by Lin-chih hwang (2001) with 70% males.

The leading cause of the injuries in the present study was trivial fall in 30 patients accounting for 66.7%. This observation was similar to Gupta R.C *et al* [16]. (1974) 79.4%. 3 patients had Intra-operative complications where one had

iatrogenic medial cortex fracture and two had greater trochanter split fracture. A study by Gadegone WM *et al* [12]. (2010) had iatrogenic greater trochanter split in 12% patients and guide wire breakage in 1% patients. There were 15 cases of postoperative complications in present study which included 2(4.44%) mechanical failure, 3 (6.66%) varus malunion, 2 (4.44%) implant failure, 2 (4.44%) lateral thigh discomfort and 5 (9%) had shortening of affected lower limb as complication. In study by Gadegone WM *et al* [12]. (2010) faced postoperative complications like 4(4%) superficial wound infection, 1 (1%) AVN, 1(1%) non-union, 5(5%) mechanical failure, 6(6%) varus malunion, 7(7%) lateral thigh discomfort and 10(10%) shortening of affected lower limb.

The average time of union was 18.42 weeks, the range being from 15 to 24 weeks in present study. Maximum number of fractures united between 16 to 20 weeks. Where as in a study by Gadegone WM *et al* [12]. (2010) the average time for union was 19.5 weeks, the range being from 15-21 weeks. Our study had the following functional outcome which was assessed by harris hip score, 19 cases (42.2%) with excellent results, 19 cases (42.2%) with good results, 7 cases (15.56%) with fair results and no Case with poor results. Good to Excellent results were seen in 88.8% of the patients, of an average age of 64 yrs, with unstable (AO 31A2 & 31A3) intertrochanteric fracture, with grade V to III osteoporosis, according to Harris HIP score, at the end of 6 months. Gadegone WM *et al* [12]. (April 2010) at the end of one-year follow-up, reported 90% of the patients had good or excellent results in 100 stable and unstable intertrochanteric fractures. 50 patients (50%) had returned to their pre injury functional level.

#### 4. Conclusion

In our study, we conclude that short Proximal Femoral Nail provides good fixation for unstable intertrochanteric fractures if proper preoperative planning, good reduction and surgical technique are followed, leading to high rate of bone union and minimal soft tissue damage especially for asian patients with relatively small femora.

Intramedullary fixation has biological and biomechanical advantages over extramedullary fixation. It is a closed method thus preserves the fracture hematoma and yields early healing and early union. The procedure is less invasive, less time consuming, provides stable fixation and allows early weight bearing that in turn enhances the process of union, especially in unstable intertrochanteric fractures. Further, it can be used in all unstable configurations of trochanteric fractures with equally good results. However, functional outcome in fractures with severe osteoporosis varied.

Most of the complications of proximal femoral nailing are related to the operative technique, type of fracture, preoperative reduction, time to weight bearing, instruments and implant quality which can be brought down by proper preoperative planning.

Proximal femoral nailing requires a higher surgical skill, good fracture table, good instrumentation and good C-arm control. The implant is comparatively expensive and it has a steep learning curve and should be used after proper training.

#### 4.1 Limitations of our study

1. As this was a descriptive study, due to the absence of a control or comparator group, it is difficult to make a definitive conclusion whether PFN is the best treatment option for the unstable intertrochanteric fractures or not. To make a definitive conclusion, a randomized controlled trial would be needed.

2. Our sample size reflects the routine patient inflow in our hospital. A study with a larger sample size, would have made a better assessment of this surgical intervention.
3. As our study was time bound, the patients were followed up for a minimum of 6 months and a maximum of 1 year. Therefore, the long-term effects of this intervention remain unknown in our cohort. A longer follow up would have made a complete assessment of this surgical intervention.
4. Best quality instrument set and Implants were not available in our region. We used the instrument set which was readily available in our region. Complications like implant breakage and failure may be attributed to sub optimum quality of the implant.

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