

## Original Research Article

# Functional outcome of intertrochanteric fractures in elderly patients with proximal femoral nail: retrospective study

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## ABSTRACT

**Background:** Intertrochanteric fractures are disabling injuries in elderly population and they are the most frequently operated fracture type which has the highest postoperative fatality rate of all surgically treated fractures. The objective of the study was to evaluate the functional outcomes of intertrochanteric fractures treated with proximal femoral nail (PFN) in elderly patients.

**Methods:** A retrospective study of 24 patients, all above 60 years treated with PFN between March 2016 to April 2018. Data collected include age, sex, mechanism of injury, type of fracture pattern according to Boyd and Griffin's classification. Patients were followed up at intervals of 6, 12, 18 and 24 weeks and final results were evaluated using Kyle's criteria at the end of 24<sup>th</sup> week. All patients had a minimum follow up of one year.

**Results:** The study included 24 patients, 10 males, 14 females with mean age of 75.77 years (range: 60-82 years). The fracture union rate was 96% and average union time was 14.2 weeks. Our results were excellent (80%), good (8%), fair (8%) and poor (4%). Our complications include thigh pain (20%) shortening (20%), varus displacement (8%), knee and hip stiffness (8%), z effect (4%) and non-union (4%).

**Conclusions:** PFN is a reliable fixation in intertrochanteric fractures only after good intraoperative reduction leading to high rate of bone union and with reduced rate of implant failure or complications.

**Keywords:** Proximal femoral fractures, Proximal femoral nail, Internal fixation, Complications

## INTRODUCTION

Trochanteric fractures are of interest globally as they are the most devastating injuries in all age groups and the incidence has increased significantly in recent years due to advancing age of population.<sup>1</sup> The estimated future incidence of hip fracture worldwide would double to 2.6 million by the year 2025, and 4.5 million by the year 2050.<sup>2</sup> In 1990, 26% of all hip fractures occurred in Asia, whereas this figure could rise to 37% in 2025 and 45% in 2050.<sup>2</sup>

The reported lifetime risk of hip fracture for individuals at 50 years of age is 5.6% for men and 20% for women.<sup>3</sup>

Elderly patients with minor fall can sustain this fracture due to osteoporosis and this accounts for 90% of this fracture type.<sup>4</sup> They have become a serious health resource issue due to high cost of care required after injury. These fractures readily unite with conservative treatment with prolonged bed rest for fracture healing coupled with problems of decubitus ulcer, urinary tract infection, pneumonia, joint contractures and thromboembolism ensuing with high mortality rate.<sup>5</sup> But the fracture union results in complications such as coxavara, malunion, medialization of shaft and external rotation deformity resulting in shortening of limb and limping.<sup>6</sup>

The trochanteric fractures favour surgical repair as it provides greater pain relief due to early mobility and reduces mortality rate. The pertrochanteric region of anatomy is quite variable in its combination of cortical and cancellous bone, due to poor bone quality in elderly it is difficult to achieve and maintain stable fixation.<sup>7</sup> Various operative procedures with different implants which include dynamic hip screw (DHS), gamma nail, proximal femoral nail (PFN) and proximal femoral nail anti rotation (PFNA) are available. The ideal implant for treatment of these fractures is still a matter of discussion.

The primary goal is to achieve good union with restoration of normal abductor lever- arm mechanism of hip joint.<sup>8</sup> Biomechanically intramedullary device is a better choice as it provides support to posteromedial cortex and prevents varus collapse.<sup>8</sup> Furthermore these devices can be inserted through small exposure, with less blood loss, preservation of hematoma, with minimal wound complications and infection.<sup>9</sup>

In this retrospective study carried out at our institution we evaluated the functional outcome of intertrochanteric fractures treated with PFN in elderly patients by Kyle's criteria.<sup>10</sup>

## METHODS

A retrospective study of 24 patients, all above 60 years treated with PFN between March 2016 to April 2018 at Nagai hospital, Nagapattanam. Data collected include

age, sex, mechanism of injury, type of fracture pattern according to Boyd and Griffin's classification. Data were statically evaluated with IBM SPSS statistics for windows, version 20, IBM corp, Chicago, Illinois. We had an inclusion and exclusion criteria.

### Inclusion criteria

Inclusion criteria were patients above 60 years of either sex; closed fractures; patient fit to undergo surgical procedure.

### Exclusion criteria

Exclusion criteria were pathological fracture; open fracture; subtrochanteric fractures.

All patients were operated within 10 days of the occurrence of the fracture after complete pre anaesthetic evaluation. Injection cefuroxime 1.5 gram was administered half an hour before surgery.

### Operative technique

The PFN we used had a standard configuration with a length of 36 to 42 cm, mediolateral angulation of 6° and neck shaft angle of 135°. The nail had a proximal diameter of 15 mm and distal diameter of 9 to 12 mm we used proximal derotation of 6.2 mm and distal lag screw of 8 mm distal locking was done with 4.9 mm cortical screws both in static and dynamic mode.



Figure 1 (a-f): Technique for inserting long PFN.

Patients were operated on a standard radiolucent fracture table under spinal or general anaesthesia according to the condition of the patient. Fractures were reduced by longitudinal traction and the limb was placed in slight adduction to facilitate nail insertion. The reduction was done.

The incision was made 5 cm cranial to the tip of greater trochanter. The entry point was made at the tip of the greater trochanter in its midpoint with a curved awl with image intensifier guidance. Then 2.8 mm guide wire was inserted. Serial reaming was done. The proximal 7 cm of femur was reamed up to 15 mm. After mounting the appropriate sized nail on the insertion device the nail was introduced manually. Two guide pins were then passed up to 5 mm below the subarticular surface for derotation and compression screw which were introduced after reaming in sequential manner. The distal locking was done with free hand technique (Figure 1 a-f).

Intravenous antibiotics were given for first 72 hours followed by oral antibiotics for next 5 days. In all cases antithrombotic prophylaxis was given using low molecular weight heparin.

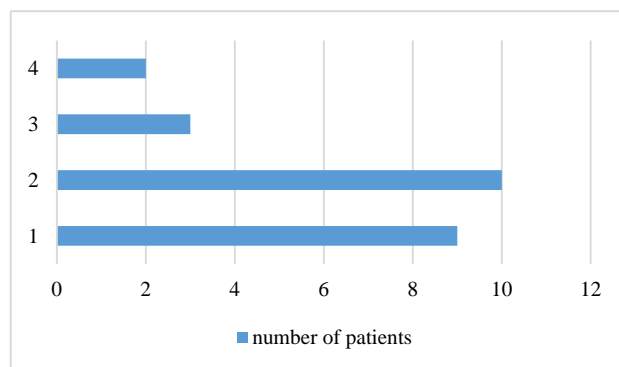
Static quadriceps mobilization exercises were started on 2<sup>nd</sup> day. Partial weight bearing with axillary crutches as soon as possible. Sutures were removed on 14<sup>th</sup> postoperative day. Protein and caloric nutrition, especially osteoporotic therapy with vitamin D supplementation, is important for successful recovery. Tablet risedronate 35 mg once weekly for 6 months was given at the end of 2<sup>nd</sup> week along with calcium and vitamin D supplementation of 60000 IU weekly for 12 weeks. Partial weight bearing was started at about 4<sup>th</sup> week. Patients were followed up at intervals of 6, 12, 18 and 24 weeks. Full weight bearing walking was allowed after assessing for radiological and clinical union. All patients had a minimum follow up of one year. The final results were evaluated using Kyle's criteria at the end of 24<sup>th</sup> week.

**RESULTS**

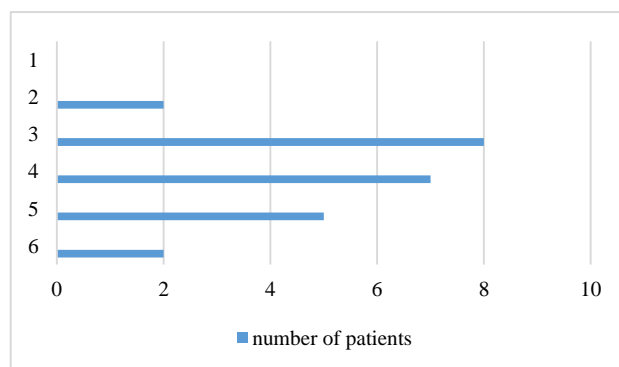
Our retrospective study we had 10 males and 14 females with mean age of 75.77 years (range: 60- 82 years). The mode of injury in 20 patients (83.34%) was due to trivial fall and in 4 (17.66%) due to road traffic accidents. The right hip was involved in 16 (66%) and left hip in 8 (34%) cases. According to Boyd and Griffin classification the fracture patterns were type 1 in 9 (37%), type 2 in 10 (42%), type 3 in 3 (13%) and type 4 in 2 cases (8%) (Figure 2). In most of the patients level of osteoporosis were either 3 or 4 according to Singh's index (Figure 3).

All cases were operated within 10 days of admission with an average of 5.25 days (range 0 to 10). 20 cases (83%) were operated with closed reduction and 4 (17%) needed minimal open reduction. No intraoperative complications

were noted during the surgical procedures. The average blood loss was 130 ml with mean duration of radiation exposure was 90 seconds and total duration of surgery ranged from 45 to 60 minutes. All cases were followed up with regular clinical and radiological examination as per our study protocol. The fracture union rate was 96% with an average union time of 14.2 weeks ranging from 13.3 to 15.4 weeks according to the fracture pattern. One case of type 4 trochanteric fracture showed signs of established non-union after 9 months of postsurgical procedure due to extensive lateral wall comminution and improper immobilization.



**Figure 2: Types of fracture.**

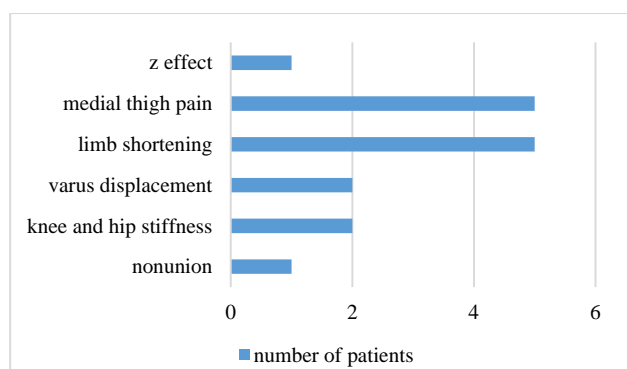


**Figure 2: Singh's index.**



**Figure 4: Results according to Kyle's criteria.**

Our results were analysed using Kyle's criteria at the end of 6 months. It was excellent in 19 (80%), good in 2(8%), fair in 2 (8%) and poor in 1 case (4%) (Figure 4).



**Figure 3: Complications.**

The most common complication encountered in our study was shortening and medial thigh pain in 5 cases (20%) each. The shortening was treated with heel rise and the thigh pain was due to anterior impingement of the long PFN which we used in all cases, we initially treated with oral analgesics and we advised metal exit at a later date. The other complications include varus displacement 2 (8%) due to improper reduction, knee and hip stiffness in 2 (8%), z effect in 1 (4%) and non-union in 1 case (4%) (Figure 5). We did not encounter any infection, screw cut out, nail breakage, reverse z effect and avascular necrosis of femoral head in our study. In 1 case of non-union we counselled for implant removal and to undergo revision procedure.

## DISCUSSION

Trochanteric fractures are on increasing incidence and these fractures are technically demanding injuries for an average orthopaedic surgeon. These fractures typically occur in frail patients with multiple medical comorbidities and often result in decreased patient's functional outcome. The effective management of these injuries should result in high union rate with less complications. Cooper stated that the consequences of hip fractures relate to (1) premature death, averaging a 20% rate at 1 year, (2) permanent disability of up to 30%, (3) an inability to ambulate independently in 40% of patients, and (4) loss of at least one activity of independent daily living in 80% of treated patients.<sup>11</sup>

In elderly patients the surgeon cannot control the quality of bone, patient compliance or comorbidities but he should be able to minimize the morbidity associated with fracture by performing an accurate reduction with an ideal implant while being conscious of implant cost.

The PFN is an effective intramedullary load-sharing device invented in 1996. It incorporates the principles and theoretical advantages of the zickel Nail, dynamic hip screw and locked intramedullary nail. Biomechanically PFN is more stiff, it has shorter moment arm i.e. tip of lag screw to the centre of femoral canal whereas the DHS has a longer moment arm which causes significant stress on weight bearing and hence higher

incidence of Lag screw cut out and varus malunion. The larger proximal diameter (15 mm) of PFN gives additional stiffness to the nail. Intramedullary devices have been shown to be biologically stronger and can withstand higher static and several fold higher cyclical loading.<sup>12</sup> PFN acts as a buttress in preventing medialization of shaft so the fracture heals without primary restoration of medial column as the implant compensates for it.<sup>13</sup>

The most common mode of injury in 20 patients (83.34%) was due to trivial fall as we included only patients above 60 years in our study. The common fracture patterns in our study were mostly type 1 and 2 according to Boyd and Griffin classification and were taken up for surgery. We used a standard long PFN in all our cases as we believe that it is wise to consider most fragility fractures in elderly patients to be pathologic fractures; in addition, this patient population has a propensity for falls, increasing their risk of subsequent fractures.<sup>14</sup> We did 4 open reductions in our study and was mainly due to complexity of fractures and not due delayed surgeries.

Anatomical reduction and secure fixation are essential for high union rate. In our study it was 96%. The most common complication encountered in study was medial thigh pain in 5 cases (20%) this may be due to using of long PFN in all cases as the person ages, the femoral diaphysis enlarges and the femoral bow increases leading to thigh pain.<sup>15</sup> We had Z effect in 1 case. This can be avoided by placing the derotation screw 10 mm shorter and parallel to the hip screw both in AP and lateral views. This ensues the derotation screw does not take the weight load but only fulfil the antirotation function. We did not encounter any infection, screw cut out, nail breakage, reverse Z effect and avascular necrosis of femoral head in our study.

In our study all patients were treated with both calcium and Vitamin D supplementation. As vitamin D has been reported as an independent risk factor for recovery. Due to the avoidance of sunlight for fear of skin cancer and the lack of vitamin D in the modern diet, vitamin D deficiency has re-emerged as a health problem.<sup>15</sup> Vitamin D deficiency causes muscle weakness. Skeletal muscles have a vitamin D receptor and may require vitamin D for maximum function.<sup>17</sup> A meta-analysis of five randomized clinical trials (with a total of 1,237 subjects) revealed that increased vitamin D intake reduced the risk of falls by 22% as compared with only calcium or placebo.<sup>18</sup>

In our study all patients were referred to physical therapy for fall preventive education and the family members were asked to perform a home safety check to prevent fall in elderly patients.

The main limitation of our study was small sample size, lack of control group, most patients belonged to type 1 and type 2 fracture patterns, no serum vitamin D level

estimation and no comparison with other forms of fixations.

## CONCLUSION

PFN is a reliable fixation device in all trochanteric fractures in elderly after adequate fracture reduction and it is efficient and minimally invasive surgical procedure. PFN also has few complications which can be avoided by continued innovative thinking during treating these injuries.

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