



## Subtrochanteric Fracture of the Femur in the Elderly Osteoporotic Bone: Long Proximal Femoral Nail is the best Treatment Option: In Rural Population - Case Series

Authors

Neelakrishnan R<sup>1</sup>, Barathiselvan V<sup>2</sup>, Anush Rao P<sup>3</sup>, Akilan C<sup>4</sup>

<sup>1</sup>Professor and Head, Department of Orthopaedics, Rajah Muthiah Medical College, Annamalai University, Chidambaram, Tamilnadu

<sup>2</sup>Lecturer, Department of Orthopaedics, Rajah Muthiah Medical College, Annamalai University Chidambaram, Tamilnadu

<sup>3</sup>Senior Resident, Department of Orthopaedics, Rajah Muthiah Medical College, Annamalai University, Chidambaram, Tamilnadu

<sup>4</sup>Final Year Postgraduate, Department of Orthopaedics, Rajah Muthiah Medical College, Annamalai University, Chidambaram, Tamilnadu.

Corresponding Author

**Dr R. Neelakrishnan**

Professor and Head, Department of orthopaedics, Rajah Muthiah Medical college Hospitals, Annamalai University, Chidambaram, Tamil Nadu, India

Email: [orthokrishnan@gmail.com](mailto:orthokrishnan@gmail.com)

### Abstract

*Sub-trochanteric fractures involve the upper part of femur between the lesser trochanter and the isthmus region. Fractures in this area are complex and treatment is bothersome to both the patient and the orthopaedic surgeon. These fractures are common among elderly adults with coexisting low bone mineral density due to osteoporosis. Plates, dynamic hip screw, dynamic condylar screw, proximal femoral locking compression plate, intramedullary nail, cephalo medullary nail, proximal short and long femoral nail (PLFN) are the transformational procedures available in which the PLFN is being preferred due to stable fixation.<sup>1</sup> 10 patients were enrolled in the study.<sup>2</sup> The patients were assessed using modified Harris hip scoring postoperatively at one, three, six month and one year from the date of surgery. Descriptive statistics was done in the MS office excel 2010. The encountered complications are non union (n=1), postoperative delirium (n=0) and a case of varus deformity (n=1). The biomechanical properties and minimally invasive fixation technique in spite of good of reduction the PLFN takes lower mean duration of surgery, lower rate of reoperation has the least complications among the other fixation techniques.*

**Background:** Long proximal femoral nail has been the standard treatment for subtrochanteric fractures. However there are many fixation implants in the field of traumatology.<sup>1</sup> Especially in elderly osteoporotic bone fractures long proximal femoral nail achieved good functional outcome with least complications compared to other implants which led to high failure rates.

**Methods:** A Series of eleven cases of osteoporotic subtrochanteric fractures are operated with long proximal femoral nail. One patient lost follow up. The patients are followed (at one, three, six month and one year) at regular intervals. Results were assessed using modified harris hip scoring system.

**Results:** Total ten patients were taken for study were followed by minimum six months and maximum of one year. Clinical outcome was rated as per modified harris hip score. Excellent – 60 %, Good – 20 %, Fair –

10%, Poor – 10%.

**Conclusion:** The surgical management of subtrochanteric fracture with long proximal femoral nail provides stable fixation with moderate pain free early mobilization and good outcome in osteoporotic patients with limited complications.

**Keywords:** Long proximal femoral nail, osteoporosis, subtrochanteric fracture, modified harris hip scoring system.

## Introduction

Sub-trochanteric fractures involve the upper part of femur between the lesser trochanter and the isthmus region. Fractures in this area are complex and treatment is bothersome to both the patient and the orthopaedic surgeon. These fractures are common among elderly adults with coexisting low bone mineral density due to osteoporosis.<sup>2</sup> Since the bone is inherently weak, trivial trauma like self fall is the most common mode of injury. The complication in these fractures are increased mortality and morbidity, implant or fixation failure, screw pullout especially in osteoporosis, non-union, penetration of the screw in to hip and associated systemic diseases like diabetes, hypertension and other illness.<sup>3</sup>

## Unique Anatomy and Biomechanics

- Area of greater stress concentration – muscle insertion – Deforming force
- Classical deformity

Deformity	Provoking muscle
Flexion	Iliopsoas
External rotation	Short external rotators
Abduction	Gluteus medius, Gluteus minimus
Adductors	Thigh Adductors
Shortening	Quadriceps and Hamstring

- Predominant – Cortical bone – precarious vascularisation
- Complex fracture – medial support failure – fixation failure – reoperation.

## Classification System

- Boyd and Griffin (1949)<sup>1</sup>
- Fielding and Magleaito (1966)
- Russell Taylor
- AO classification
- Seinsheimer classification
- MCG classification

We followed Seinsheimer's classification. The most used and practical system which describes number of fracture fragments, involvement of medial and lateral cortex.

## Treatment Modalities

- Non Surgical: Recently non surgical management is exceptionally allowed in Patients with serious ill clinical comorbidities.
- Surgical: Evolution of implants

## Extra Medullary Implants

- 1) Dynamic hip screw – unsatisfactory results in 70% of patients
- 2) Blade plate
- 3) DCS } Causes local evascularisation, infection, pseudo arthrosis, osteosynthesis failure.
- 4) PF – LCP – causes shortening and viscous consolidation in external rotation.

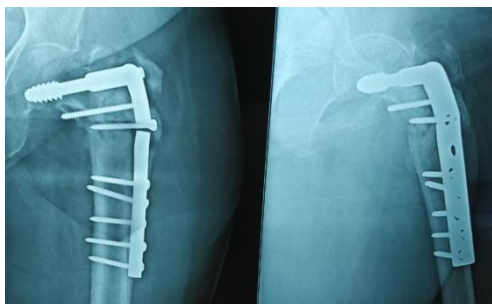
## Intra Medullary Implants

- 1) IM Nail } osteosynthesis failure
- 2) Gamma nail } due to varus reduction
- 3) Short PFN – causes refracture, post operative thigh pain
- 4) Long PFN- is the best implant of choice available for speedy recovery, low non union rate, limited complications, good outcome.

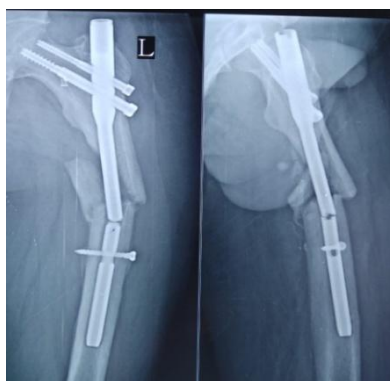
Blade Plates, dynamic hip screw, dynamic condylar screw, proximal femoral locking compression plate, intramedullary nail, gamma nail, proximal short and long femoral nail (PLFN) are the transformational procedures available in which the PLFN is being preferred due to stable fixation.<sup>4</sup> As the proximal segment is small, internal fixation is difficult and deformational forces disrupt alignment of the fragments. All the

operative procedures aims at maintaining the length and avoiding the varus deformity of the affected limb with abductor muscle power at

early.<sup>5</sup> However in osteoporotic elderly women, multidisciplinary approach is preferred.



**DCS Implant Breakage**



**Short PFN - Implant Breakage with Refracture**

### Materials and Methods

It is a prospective descriptive study conducted in the department of orthopaedics, RMMCH from May 2016 to August 2018 after obtaining ethical committee clearance and informed consent, 10 patients were enrolled in the study using simple random sampling. Patient with subtrochanteric fracture, osteoporosis and duration less than 14

days are included while those with other systemic comorbidities, medically unfit for surgery, any other fractures in the ipsilateral limb and the girdle, age less than 55 years are excluded. The patients were assessed using modified Harris hip scoring postoperatively at one, three, six month and one year. Descriptive statistics was done in the MS office excel 2010.

### Functional Outcome



**Pre op x ray**



1 month post op



3 month post op



6 month post op

### Range of Movements



Extension



Flexion



**Ext. Rotation****Int. Rotation****Sitting in cross legs****Squatting**

### Observation and Results

In our study of 10 cases majority of patients are male (n=6). The most common mode of injury is trivial fall (7) followed by fall from height (n=2) and RTA (n=1). The mean duration of hospital stay is  $13 \pm 2$  days. Out of 10 patients, one suffered from rheumatoid arthritis in which outcome is poor. The encountered complications are non union (n=1), postoperative delirium (n=0)

and a case of varus deformity (n=1). For the case of non-union, through old surgical in lateral position augmentation with locking plate and bone grafting was one for additional stability and weight bearing. For the case of delirium in the postoperative period, psychiatric management with de-rotational boot was done.

### Complications

**Case-1****Rotation of Proximal Fragment****Case -2****Screw Pull Out**

**Case -3**



**Pre-op x ray**



**1 month post op**



**3 month post op**



**5 month post op**



**6 months post op (Non-Union)**

**Augmentation Plating with Bone Grafting Done**



**Locking Plate Augmentation**



**Iliac Bone Grafting**



Post op X Ray

**Table-1**

Age (years)	Size (n)	Percentage (%)
55-59	0	0
60-64	2	20
65-69	4	40
70-74	1	10
75-79	2	20
>80	1	10
Total	10	100
Sex	Size (n)	Percentage (%)
Male	6	60
Female	4	40
Total	10	100
Complication	Size (n)	Percentage (%)
None	6	60
Non union	1	10
Varus deformity	1	10
Delirium	1	10
Screw pullout	1	10
Shortening	0	0
Z effect	0	0
Total	10	100

**Table-2**

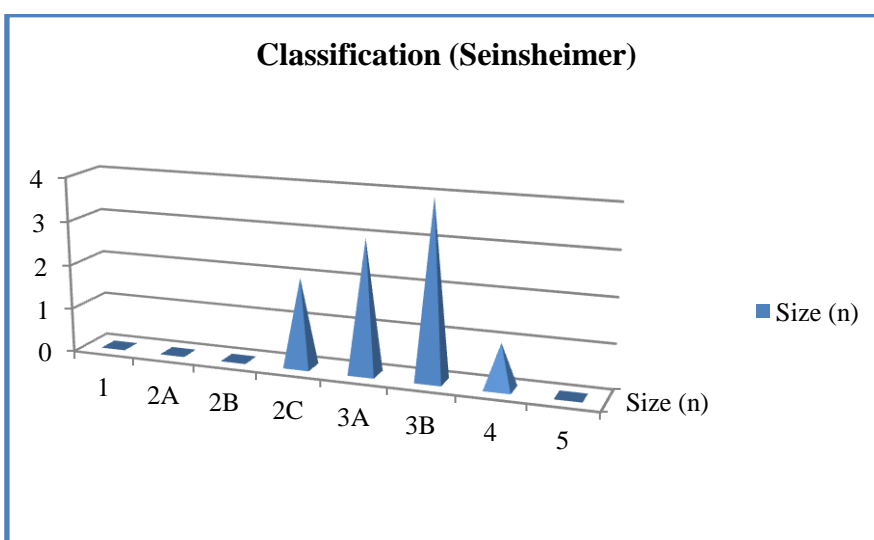
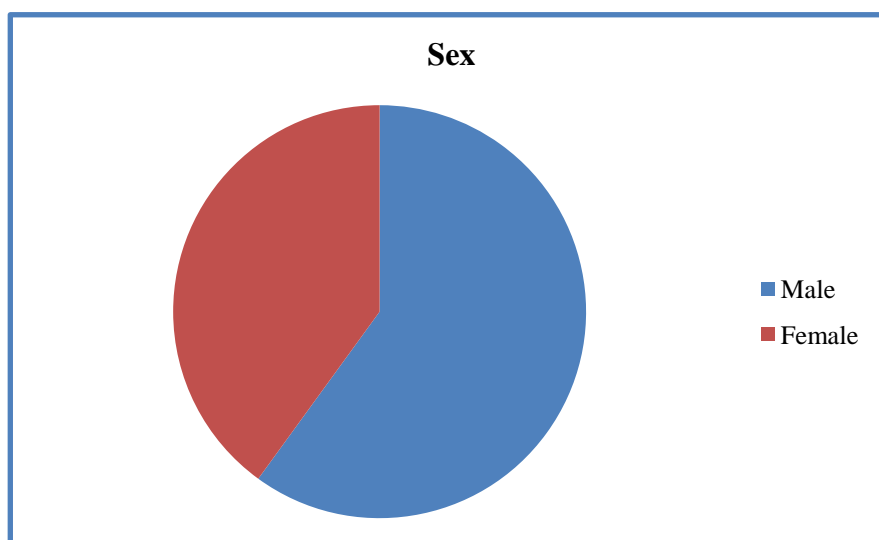
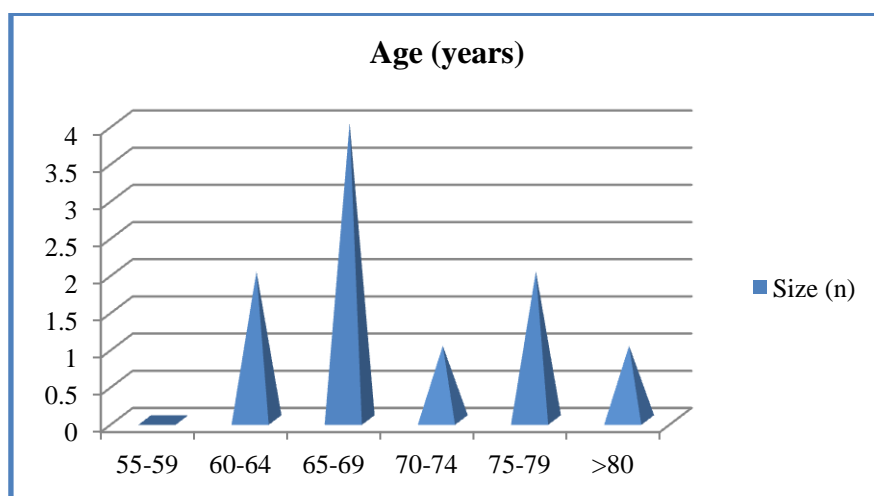
Classification (Seinsheimer)	Size (n)	Percentage (%)
1	0	0
2A	0	0
2B	0	0
2C	2	20
3A	3	30
3B	4	40
4	1	10
5	0	0
Total	10	100

**Table-3**

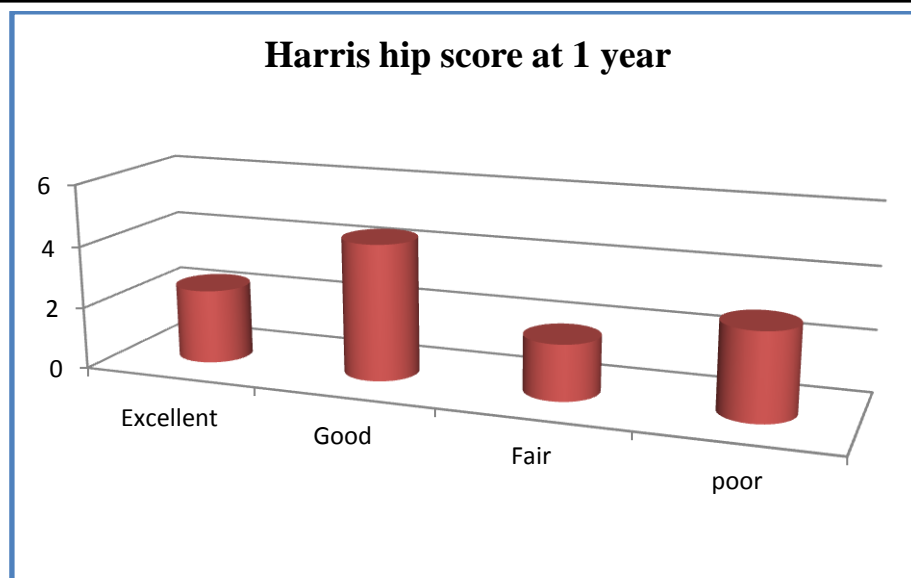
Harris hip score at 1 year	Size (n)	Percentage (%)
Excellent	6	60
Good	2	20
Fair	1	10
Poor	1	10
Total	10	100

**Table-4**

Reduction technique	Size (n)	Percentage (%)
Open (mini open)	6	60
Closed	4	40
Total	10	100







### Discussion

The osteoporotic sub-trochanteric fractures usually have a weak bone. So it is difficult to attain stable bone implant construct, thereby preventing the reduction of load on the affected extremity during the phase of healing.<sup>6</sup> The main idea of treating these osteoporotic fractures is early mobilization and restoring the pre-fracture normal state. The load sharing between the bone and the implant is considered as a key role.<sup>12</sup> The overall therapeutic concept of osteoporotic fractures is treatment of comorbidities, timing of operation, selection of implant and operative technique.<sup>13</sup> In osteoporotic bone the main cause of failure is of fracture fixation rather than implant failure itself.<sup>7</sup>

The higher incidence of non-union in sub-trochanteric fracture is the most common complication advocated by Delee et al is abolished in traumatology by fixation techniques.<sup>11</sup> Extramedullary fixation has more complications than the intramedullary leading to the fracture union, implant failure, soft tissue damage and blood loss.<sup>8</sup> In sub trochanteric fracture was first describe by Boyd and Griffin in 1949 as a variant of trochanteric fractures and noted unsuccessful fixation results. In 1966, Fielding and Magleaito simply classified subtrochanteric fractures by the lesser trochanter to the distance of the fracture. In the early 1997, proximal femoral nail as intramedullary device was introduced.<sup>9</sup> In 2003,

Christian Bolein et al concluded proximal femoral nail as a good minimally invasive method for the fractures, in 2007, Lei-sheing-jiang introduced the long PFN as a reliable implant for the subtrochanteric fractures.<sup>10</sup> In 2013, Calrderon et al did a study on subtranchantranteric fracture treated with a L-PFN have a better outcomes. The L-PFN has shorter lever arm on the proximal fixation, biologically friendly fixation resulted in high union rates than closed reduction.<sup>13</sup> Lei-sheing-jiang et al in his study had no complications like cut out, implant breakage, peri-prosthetic fractures. Werner et al was the first to introduce the term of “Z-effect” in the 5 of 70 cases.<sup>12</sup> Boldein et al escribe reverse z effect in two cases of 55 patients. In the most recent study to evaluate the use of L-PFN is from Fogagnolo et al reported two implant failures.<sup>11</sup> Simmermacher et al described technical failure after poor reduction malrotation or wrong choice of screws in 5% of the cases.<sup>4</sup>

### Conclusion

In the elderly osteoporotic subtrochanteric fractures with unfavourable anatomical peculiarities and origin of new implant techniques, the treatment of these fracture still remains challenging. The biomechanical properties and minimally invasive fixation technique inspite of good reduction the L-PFN takes lower duration of surgery, lower rate of reoperation, with least

complications among the other fixation techniques.

## References

1. Boyd HB, Griffin (1949) Classification and treatment of trochanteric fractures. Arch surgery 58(6): 853-866.
2. Fielding JW, Magliato HJ (1966) Subtrochanteric fractures. Surg Gynec Obstetric 122(3): 555-560.
3. Simmermacher RKJ, Bosch AM, Van der Werken C (1999) The AO/ ASIF-Proximal femoral nail: a new device for the treatment of unstable proximal femoral fractures. Injury 30(5): 327-332.
4. Boldin C, Seibert FJ, Fankhauser F, Peicha G, Grechenig W, et al. (2003) The proximal femoral nail (PFN)-a minimal invasive treatment of unstable proximal femoral fractures: a prospective study of 55 patients with a follow-up of 15 months. Acta Orthop Scand 74(1): 53-58.
5. Pajarinen J, Lindahl J, Michelsson O, Savolainen V, Hir-vensalo E (2005) Pertrochanteric femoral fractures treated with a dynamic hip screw or a proximal femoral nail. A ran-domised study comparing post-operative rehabilitation. J Bone Joint Surg Br 87(1): 76-81.
6. Lei-Sheng Jiang, Lei Shen, Li-Yang Dai (2007) Intra medullary Fixation of subtrochanteric fractures with Long proximal femoral nail or Long Gamma Nail; Technical Notes and Preliminary Results. Ann Acad Med Singapore 36(10): 821-826.
7. Brian Aros B, Tosteson AN, Gottlieb DJ, Koval KJ (2008) Is a sliding hip screw or im nail the preferred implant for intertrochanteric fracture fixation. Clin orthrop Relat Res 466(11): 2827-2832.
8. Calderon A, Ramos T, Vilchez F, Mendoza-Lemus O, Pena V, et al. (2013) Proximal femoral intramedullary nail versus DHS plate for the treatment of intertrochanteric fractures. A prospective analysis. Acta Ortop Mex 27(4): 236-239.
9. Ekstrom W, Karlsson Thur C, Larsson S, Ragnarsson B, Alberts KA (2007) Functional outcome in treatment of unstable trochanteric and subtrochanteric fractures with the proximal femoral nail and the Medoff sliding plate. J Orthop Trauma 21(1): 18-25.
10. Fogagnolo F, Kfuri M, Paccola CA (2004) Intramedullary fixation of per trochanteric hip fractures with short AO ASIF PFN. J Arch Orthop Trauma Surg 124(1): 31-37.
11. Simmermacher RKJ, Bosch AM, Van der Werken C (1999) The AO/ ASIF-Proximal femoral nail: a new device for the treatment of unstable proximal femoral fractures. Injury 30(5): 327-332.
12. De Lee JC, Clanton TO, Rockwood CA Jr (1981) Closed treatment of subtrochanteric fractures of the femur in a modified cast-brace. J Bone Joint Surg Am 63(5): 773-779.
13. Domingo LJ, Cecilia D, Herrera A, Resines C (2001) Trochanteric fractures treated with a proximal femoral nail. International Orthopaedics 25(5): 298-301.