

Treatment of Stable and Unstable Intertrochanteric Fracture with Short Proximal Femoral Nail: Our Experience with 100 Patients

Kishore Raichandani¹, Raunak Surana^{2*}, Abhinav Bhardwaj³, Sanjay Garhwal², Hemant Jain⁴, Surbhi Raichandani⁵

¹Senior Professor and Head, ²PG Resident (Illrd Year), ³Senior Resident, ⁴Assistant Professor, Department of Orthopaedics, Dr. S.N. Medical College, Jodhpur, Rajasthan, India.

⁵MBBS Student, Dr. S.N. Medical College, Jodhpur, Rajasthan, India.

ABSTRACT

Introduction: Intertrochanteric fractures are very common fractures around hip in old age. About 50% of intertrochanteric fractures are unstable. With extramedullary implants like sliding hip screw giving dissatisfactory results in unstable fractures, intramedullary implants came into existence. In this prospective study, we evaluate benefits of Short Proximal Femoral Nail in the management of stable and unstable intertrochanteric fractures.

Methods: Between 2015 and 2016, we treated 100 patients of stable and unstable intertrochanteric fracture with Short Proximal Femoral Nail. All patients were followed up for a minimum period of 6 months and evaluated by Kyle's criteria.

Results: 90% cases achieved anatomical reduction. 16% cases had post-operative complications which included, two cases of screw back out, two cases of Z effect, two cases of varus malunion, five cases of limping while walking and eight cases of lateral thigh discomfort. Out of these only 4% cases needed re-operation. The average union time was 19.41 weeks. At end of 6 months, 92% cases had good or excellent result and 72% patients returned to their pre injury functional level.

Conclusion: Short Proximal Femoral Nail provides good

fixation for both stable and unstable intertrochanteric fractures, with less soft tissue trauma, early mobilisation and high union rates. It has several advantages over extramedullary implants like less operative time, less blood loss, lower chances of varus angulation even in unstable fractures, decreased rates of screw cut out and early weight bearing.

Key Words: Intertrochanteric Fracture; Short Proximal Femoral Nail; Kyle's Criteria.

*Correspondence to:

Dr. Raunak Surana,
19/617, Chopasani Housing Board,
Jodhpur, Rajasthan, India.

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INTRODUCTION

Amongst fractures around hip, intertrochanteric fractures are most common, especially in old age. These fractures usually occur after trivial trauma because of increased osteoporosis in old age and are more common in females than males.¹ About 50% of intertrochanteric fractures are unstable because of old age and low bone mineral density.² The presence of osteoporosis plays a crucial role because fixation of the proximal fragment depends entirely on the quality of cancellous bone present.

Management of unstable intertrochanteric fractures remains a persistent challenge. With extramedullary devices like the Sliding Hip Screw giving dissatisfactory results in unstable intertrochanteric fracture, intramedullary implants came into existence. In this prospective study, we evaluated the effectiveness and drawbacks of one such newer intramedullary device – Short Proximal Femoral Nail (PFN) in the management of intertrochanteric fractures.

MATERIALS AND METHODS

We evaluated 100 patients (60 female and 40 male) with intertrochanteric fractures out of which 15 cases had unstable fracture pattern classified according to Boyd and Griffin classification (Class I to Class IV)³. Patients with age less than 20 years and with pathological fractures were excluded from the study.

A Short PFN with length of 240 mm and a proximal diameter of 15 mm was used. The narrow proximal diameter enables easy insertion and reduces the risk of femoral fracture. Distally, it is available in 9, 10, 11 and 12 mm diameters. The nail has a 6° medio-lateral angle for easy insertion and a flexible distal tip to avoid stress generation and re-fracture. It has an 8mm compression screw and a 6.4mm anti-rotation screw proximal to it. Distally, it has 4.9mm both static and dynamic locking bolts. The patient was placed in supine position on a fracture table under

image intensifier. The affected limb is placed in 10-15° of adduction for easy insertion of nail. Reduction of unstable fracture is a persistent challenge. Closed reduction was achieved by traction and internal rotation primarily, and adduction or abduction as required. In cases where reduction becomes very difficult, as

seen in unstable fractures, Hohmann levers were used as joysticks to reduce the fracture. Radiographs were analysed for adequacy of reduction using Baumgaertner criteria modified by fogagnolo et al⁴ and classified as good, acceptable or poor. (Table 1)

Table 1: Postoperative Evaluation of Reduction. (According to Baumgaertner criteria modified by fogagnolo et al.⁴)

I. Alignment	Anteroposterior plane: Normal Cervico-diaphysial angle or slight valgus Lateral plane: Angulation less than 20° Degrees
II. Displacement of main fragments	More than 80% overlapping in both Planes Shortening less than 5 mm
RESULTS	
GOOD	Meets Both Criteria
ACCEPTABLE	Meets Only One Criteria
POOR	Meets None of the Criteria

Table 2: Clinical outcomes according to Kyle criteria⁵

Outcome	Criteria
Excellent	No or minimum limp Absence of pain Full range of motion Rarely using a cane
Good	Mild limp Mild occasional pain Full range of motion Using a cane
Fair	Moderate limp Moderate pain Limited range of motion Using 2 canes or walker
Poor	Wheelchair bound Pain on any position Non-ambulatory

Active isometric and isotonic quadriceps exercises were started from day 2. Partial weight bearing ambulation with support of walker was started from day 2, depending on quality of fracture reduction. Full weight bearing ambulation was started after radiological signs of union.

The minimum follow up period was 6 months. Regular follow up was done at 1.5, 3 and 6 months, for serial clinical and radiological evaluation.

All patients were clinically assessed by using the Kyle's criteria⁵ at the end of 6 months (Table 2). Radiological assessment for progression and time of union, fracture alignment and implant related complications were analysed.

RESULTS

Out of 100 patients, maximum were in age group of 71-80 years (35 cases), with mean age of 65.38 years. Most of the fractures occurred due to trivial fall (64 cases). 23 cases had associated medical illness like hypertension, ischemic heart disease, diabetes mellitus, bronchial asthma and chronic renal failure. Two cases had associated injuries, one being colle's fracture and other intercondylar fracture humerus. The mean interval between trauma and surgery was 9.5 days. The delay was due to delay in arrival to the hospital, medical condition of the patient and associated injuries. The mean operative time was 43.2 minutes (35-55 minutes) and mean blood loss was 87 ml (50-150 ml). Average incision length was 8.58 cm (8-11cm). In 10 cases out of

the 15 cases which had unstable fracture pattern, use of levers as joystick was needed to reduce the fracture. The average duration of hospital stay was 19.6 days (6-30 days). Post-operative reduction was assessed according to Baumgaertner criteria modified by fogagnolo et al.⁴

Good reduction was achieved in 90 cases. Acceptable reduction was achieved in 10 cases due to severe comminution and unstable fracture pattern. Five patients had intra-operative complications which included two cases of iatrogenic lateral wall fracture and three cases of greater trochanter splintering. Post-operative complications included two cases of Z-effect, for which anti-rotation screw and the compression screw were changed & tightened respectively and the fracture united.

Screw back out was seen in two cases, which lead to pain due to irritation of tensor fascia lata and they went for screw removal. Varus malunion occurred in three cases. Five cases had mild to moderate limp while walking and eight cases complained of lateral thigh pain.

For assessing radiological union, obliteration of fracture lines and trabecular continuity between the two fragments on anteroposterior and lateral x-rays in three cortices were seen. The average time of union was 19.41 weeks (16-30 weeks). Maximum number of fractures united between 16 to 20 weeks. At follow up of 6 months, 92% cases had good or excellent result according to Kyle's criteria⁵ and 72% patients returned to their pre injury functional level.

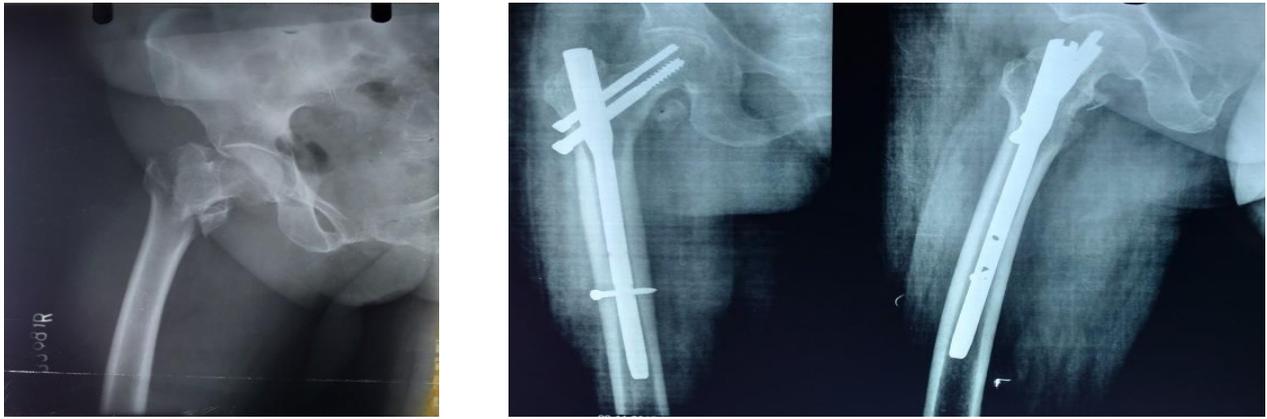


Figure 1: Pre and Post-operative Radiograph of Type II Fracture at 6 month follow up



Figure 2: Z-Effect

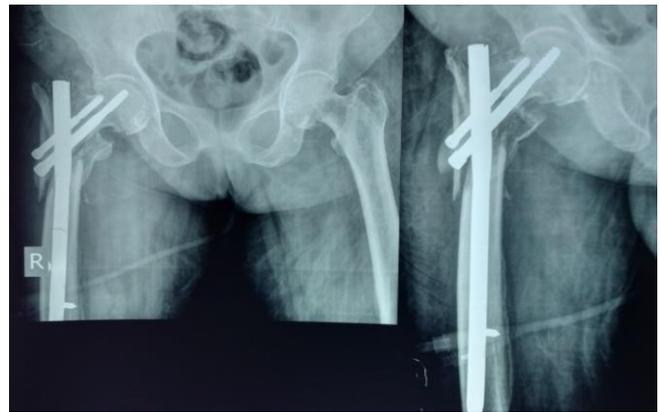


Figure 3: Iatrogenic Lateral Wall Fracture

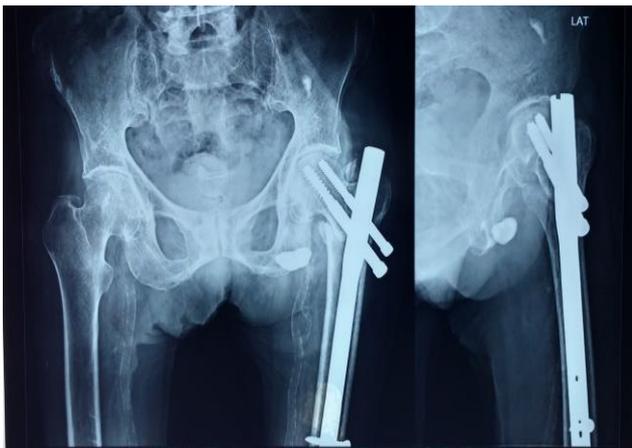


Figure 4: Varus Malunion with Screw Back Out

DISCUSSION

Intertrochanteric fractures are common in old age due to increased osteoporosis and occur even after trivial trauma. They need to be treated promptly as it has been seen that early surgical treatment reduces morbidity and mortality by allowing early mobilisation and reducing the risk of prolonged bed rest.⁶ For successful treatment of intertrochanteric fractures various factors like bone quality, patient age, general health, interval from fracture to treatment, comorbidities, and fixation stability come into play.⁷ In this study, we evaluated how intramedullary implant like Short PFN is better in surgical management of stable and unstable intertrochanteric fractures by overcoming the failures of extramedullary implants like dynamic hip screw.⁸

In dynamic hip screw (DHS), the fracture site is inadvertently opened, especially in unstable fractures which may result in deterioration of pre-existing comorbidities in elderly patients due to higher blood loss, more soft-tissue damage, and longer rehabilitation.⁹ In a study by Kim WY et al up to 28% of cases, complications like varus angulation, femoral head screw cut out have been reported and in unstable fractures with osteoporosis failure rate is more than 50%.¹⁰ The common causes due to which the fixation fails are instability of the fracture, osteoporosis, lack of anatomic reduction and incorrect placement of the lag screw in the femoral head.^{11,12} In other studies where unstable fractures were treated by DHS, failure rate is as high as 23%.^{13,14} In view of all these problems, intramedullary fixation for intertrochanteric fractures seems to be more appealing because they are inserted by minimally invasive technique which is better for elderly patients.¹⁵ Intramedullary nails have a trochanteric entry point and are biomechanically stronger than extramedullary implants. In unstable proximal femoral fractures, control of axial telescoping and rotational stability are essential.⁸ It allows surgeon to minimise soft tissue dissection which helps in reducing surgical trauma, blood loss, infection and wound complications.¹⁶ The initial intramedullary implant, Gamma nail failed to demonstrate these advantages and showed increased risk of femoral fractures at tip of nail and re-operation rate as high as 12.2%.¹⁷ In our study, we had a lower re-operation rate of 4% with no case of peri-implant fracture at tip of nail. A single-screw configuration of gamma nail in proximal femur is unstable as it doesn't provide rotational stability. Short proximal femoral nail uses a 2-screw configuration.¹⁸ These intramedullary

implants are subject to lower bending moments than extramedullary implants. It is a biomechanically stable construct that enables early weight bearing. Open reduction is usually not required in most of the cases as compared to DHS, thereby the fracture hematoma is not disturbed and even unstable fractures unite without need of primary or secondary bone grafting.^{8,19-21} In our study, even the unstable fractures and fractures with postero-medial comminution went on uniting without need of bone grafting and less cases of varus collapse were noted. Fixation with PFN is associated with technical and mechanical complications such as difficult reduction, problems with distal locking, greater trochanter splintering during nail insertion, lateral protrusion of screws, a Z effect or a reversed Z effect, pseudo arthrosis, and wound-healing impairment.^{16,22-28} These technical or mechanical complications, seen especially in unstable fracture pattern seems to be related to the fracture type, operating technique, and time to weight bearing rather than the implant itself.²⁹ Screw migration as seen in Z-effect and reverse Z-effect is mainly due to unstable fracture pattern, osteoporosis and impaction at the fracture site.^{23,29} In our study, the percentage of intra-operative and post-operative complications like iatrogenic lateral cortex fracture, greater trochanter splintering, operative time, blood loss during surgery, Z effect, screw back out, varus malunion, lateral thigh discomfort, limping while walking, shortening, mortality rate and the ability to return to pre-injury functional level were lower than those encountered by other investigators. We didn't experienced any case with superficial or deep infection and also no case of guide wire breakage as seen in other studies, as we used proper aseptic precautions per-operatively and post-operatively and also shows technical superiority as we went on doing more and more number of cases.^{4,22,24,29-32}

A newer system was developed by the AO/ASIF in 2004 as Proximal Femoral Nail Antirotation (PFNA). The main design characteristic of the implant is the use of a single blade which compacts the cancellous bone, providing optimal anchoring and stability when the implant is inserted into osteoporotic bone.³³

CONCLUSION

In our study, Good to excellent results were seen in 92 % of the elderly patients. It is a closed method thus having shorter operative time, less blood loss and also preserves fracture hematoma leading to early healing and early union even in unstable fractures without need of primary or secondary bone grafting. A shorter incision is needed to perform the surgery as compared to DHS, thus leading to less soft tissue trauma, faster rehabilitation and less infection rates. The implant being intramedullary has better control of axial telescoping, rotational stability and being a load-sharing device; provides stable fixation even in unstable fracture pattern, thus allowing early weight bearing, just a day after operation in most of the cases. Hence we conclude that Short PFN provides good fixation for unstable intertrochanteric fractures leading to high rate of bone union and minimal soft tissue damage.

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