

Management of intertrochanteric fractures with short proximal femoral nail

Rushikesh Lonikar^{1,*}, Shriniwas Yemul²

¹Assistant Professor, ²Associate Professor, Dept. of Orthopedics, Ashwini Rural Medical College, Hospital & Research Centre, Solapur

***Corresponding Author:**

Email: rushikeshlonikar1@gmail.com

Abstract

Background: Intertrochanteric fracture is one of the most common fractures of the hip especially in the elderly with porotic bones, usually due to low-energy trauma like simple falls. The present study was undertaken to assess outcome of 50 patients of intertrochanteric fractures treated with short proximal femoral nail.

Methods: 50 cases of intertrochanteric fractures in adults treated by short proximal femoral nail were studied. Results assessed by Modified Harris Hip Score at the end of 12 months. Maximum age was 84 years and minimum age was 26 years. 32 were male and 18 were female. 11 of type I, 19 of type II, 12 of type III, 8 of type IV Boyd and Griffin classification were reviewed.

Result: Most common type of intertrochanteric fracture was Boyd and Griffin type II. Average time for union was 15.56 weeks. Malunion with varus angulation was seen in 4 cases. Z effect was seen in two cases. Reverse Z effect was seen in two cases. There was one case having broken implant 4 month post operatively. Shortening of more than 1 cm was seen in five cases. 70% excellent and good results were obtained among all cases and 62% excellent and good results were obtained in unstable type 3 and type 4 fractures.

Conclusion: The rigid fixation, more efficient load transfer, shorter lever arm of SPFN improves stability of fracture. These features makes SPFN very suitable implant for unstable intertrochanteric fractures. Less operative time, less blood loss, decreased complications makes short PFN superior implant for stable and unstable intertrochanteric fractures.

Keywords: Intertrochanteric fracture, Hip, Short proximal femoral nail

Introduction

Intertrochanteric fracture is one of the most common fractures of the hip especially in the elderly with porotic bones, usually due to low-energy trauma like simple falls. Intertrochanteric and femoral neck fractures account for 90% of the proximal femoral fractures occurring in elderly patients.⁽¹⁾

It is universally agreed that the treatment of intertrochanteric fractures is stable internal fixation as early as possible. Stable fixation is the keystones of successful union of trochanteric fractures. Factors affecting successful treatment are: (i) Fracture geometry and stability (ii) Bone quality (iii) Comminution (iv) Good reduction, (v) Proper choice of implant (vi) Proper surgical technique, and (vii) Availability of modern operation rooms, entire set of implants, instrumentation and image intensifier.

The factors most significant for instability and fixation failure are: (i) Severe comminution (ii) Loss of posteromedial support, (iii) Poor bone quality (iv) Reverse oblique fracture. (v) Shattered lateral wall (vi) Extension into femoral neck area and (vii) Subtrochanteric extension of the fracture. Osteoporosis is particularly important in the fixation of proximal femoral fractures. This can be measured by Singh's index and bone densitometry.⁽²⁾

Various implants for treatment of intertrochanteric fractures have been reported. The open technique of sliding hip screw may result in deterioration of pre-existing co-morbidities in elderly patients owing to increased blood loss, soft-tissue damage, and longer

rehabilitation. Cutting out of the sliding hip screw, excessive medialisation of the distal fragment (in unstable fractures), and collapse upon weight bearing are major concerns. Such complications not only impede fracture healing, but also cause severe pain during walking and hamper rehabilitation.

A short proximal femoral nail with a length of 180 mm and a proximal diameter of 15 mm is therefore developed to enable easy insertion and reduce the risk of femoral fracture. The nail has a medio-lateral angle for easy insertion and a flexible distal tip to avoid stress generation and refracture.⁽³⁾

The incidence of intertrochanteric fracture is rising because of increasing number of senior citizens with osteoporosis. Therefore, present study was undertaken, to study management of intertrochanteric fracture by short proximal femoral nail (Traffon Nail) and outcome.

Material and Methods

The present study comprises of 50 cases of intertrochanteric fractures in adults treated by short proximal femoral nail. Cases were selected from the patients with intertrochanteric fractures admitted to hospital. Patient's history was taken and name, age, gender and place of residence were recorded. History of any other co-morbid disease was obtained. All the patients below age of 18 years were excluded from study. All the cases of 18 years and above were treated by closed nailing with short proximal femoral nail.

Mode and time of injury were noted. Thorough clinical examination of patient was done to rule associated injuries. The affected limb was thoroughly examined to rule out vascular or neurological injury.

Anteroposterior (AP) radiograph of pelvis and anteroposterior and cross table view of involved femur was obtained. True AP view obtained by internally rotating affected limb by 15 degrees to offset the anteversion of femoral neck. AP view of pelvis allowed comparison of involved side. Lateral view obtained to assess presence of any posterior comminution or sag. Radiograph of ipsilateral knee was taken.

To minimize discomfort of displaced fracture, affected limb was immobilized by giving skeletal traction of 5 Kg. Prior to surgery all the patients were evaluated medically for hypertension, heart disease, diabetes, chronic obstructive pulmonary disease, cerebral vascular disease and urinary tract infection to minimize any potential risk for surgery.

Statistical analysis: Descriptive statistics such as mean, SD and percentage was used. Data analysis was done by using Microsoft Excel.

Result

In this study, maximum age was 84 years and minimum age was 26 years. Most of the patients were between 60 to 80 years. Mean age was 65.42 years. There was male (64%) predominance in our study. Most common nature of violence was slip and fall (64%) followed by road traffic accidents (20%) and fall from height (16%).

Table 1: Type of fracture

| Type of fracture | Number of cases | Percentage |
|------------------|-----------------|------------|
| Type I | 11 | 22% |
| Type II | 28 | 56% |
| Type III | 6 | 12% |
| Type IV | 5 | 10% |
| Total | 50 | 100% |

Cases were classified according to fracture type based on Boyd and Griffin classification. Most common type of intertrochanteric fracture was Boyd and Griffin type two (56%). As per the Boyd and Griffin classification system there were 11 (22%) type I fractures, 28 (56%) type II, 6 (12%) type III, 5 (10%) type IV fracture.

Table 2: Nature of violence

| Nature of violence | Number of cases | % of cases |
|------------------------|-----------------|------------|
| Slip and fall | 32 | 64 |
| Road traffic accidents | 10 | 20 |
| Fall from height | 8 | 16 |
| Total | 50 | 100 |



Pre-operative X-ray



Immediate post-operative



4 months follow up



Using cane for walking



Squatting



Cross leg sitting

Time of Surgery

All the cases included in study group were fresh fractures that underwent surgery at the earliest possible in our set up. The delay was due to associated injuries and medical condition of the patient. All the patients were operated at an average interval of 8 days from the day of trauma. All cases were treated with closed short proximal femoral nail with 8 intraoperative complications. Average hospital stay was 10 days. Average time for union was 15.56 weeks.

In our study, we used the modified Harris hip score for evaluation of hip functions. Depending on the score, results were graded as excellent, good and poor. There were 70% excellent and good results were obtained among all cases and 62% excellent and good results were obtained in unstable type 3 and type 4 fractures by modified harris hip score. Mean modified Harris hip score was 80.62.

Modified Harris hip score

Table 3: Modified Harris hip score

| Modified Harris hip score | Number of cases | Percentage |
|---------------------------|-----------------|------------|
| Excellent | 14 | 28% |
| Good | 21 | 42% |
| Fair | 9 | 18% |
| Poor | 6 | 12% |

Most of intraoperative complications occurred in the first few cases. In 7 of the cases anatomic reduction

could not be achieved due to comminution, closed reduction was done by percutaneous k wires and Steinman pin in these cases. Derotation screw Guide wire breakage was seen in one case.

There was one case having broken implant 4 month post operatively due to non-union for which implant removal followed by dynamic hip screw was done. All the cases were locked distally with two locking bolts without any complication. Two cases of infection were seen in this study.

Postoperatively there was breakage of distal interlocking bolt in one case. Knee and hip stiffness with inability to squat and sit cross legged was seen in four cases. Malunion at fracture site with varus angulation was seen in four cases. Medial migration of proximal bolt which is called as Z effect was seen in two cases. Lateral migration of proximal bolts which is called the reverse Z effect was seen in two cases due to fracture impaction.



Immediate post-op



4 months follow up



After implant removal



Treated with DHS

Table 4: Delayed complications

| Complications | No. of cases | Percentage |
|--------------------|--------------|------------|
| Hip stiffness | 2 | 4% |
| Knee stiffness | 1 | 2% |
| Z effect | 2 | 4% |
| reverse z effect | 2 | 4% |
| Non union | 1 | 2% |
| Shortening of >1cm | 5 | 10% |
| Varus malunion | 4 | 8% |
| Screw cut out | 0 | 0% |
| Nail breakage | 1 | 2% |

Discussion

Before the introduction of suitable fixation devices in the 1960s, treatment of intertrochanteric fractures was mainly non-operative consisting of prolonged bed rest in traction. The study of 83 patients treated with proximal femoral nail concluded that, the introduction of a short reconstruction nail into practice has caused an evident qualitative shift in the therapy for fractures of the proximal femur.⁽⁴⁾

The dynamic hip screw is not suitable for reverse oblique and comminuted fractures, but for stable fractures it seems to be advantageous to short femoral nails regarding reoperation rate and fracture fixation failure in the literature. They further support the recommendation that the Dynamic Hip S crew should

be used for stable A1- and A2.1-type fractures while an intramedullary device is advantageous for unstable fractures.⁽⁵⁾

To complications of prolonged immobility in old age and for early mobilization & restoration of function, majority of fractures should be treated operatively. Restoration of mobility in-patients with unstable fractures ultimately depends on the strength of surgical construct. There are multiple factors and variables, which affect the biomechanical strength of repair. Surgeon independent variables are bone quality, fracture pattern and stability. Whereas surgeon dependent variables are quality of fracture reduction and choice and placement of implant.⁶ Varieties of implants have been used to fix these fractures. With better understanding of biomechanics of trochanteric fractures there has been development of better implants.

First successful implants used were fixed angle nail plate devices [Smith Peterson, Jewett nail, Holt nail] consisting of tri-flanged nail fixed to a plate at an angle of 130 degrees to 150 degrees. Because of their complications like penetration into the hip joint and cut out through superior portion of head and neck they were replaced by sliding nail plate devices [Massie nail, Ken-pugh nail] which consisted of a nail that provided proximal fragment fixation and a side plate that allowed the nail to telescope within barrel. This device gave rise to sliding hip screw, which is the most widely used implant for stabilization of proximal femoral fractures. But its use in unstable fractures was associated with resultant deformity and shortening because of excessive sliding. This dissatisfaction led to the development of intramedullary hip screw devices. Screw and side plates have been shown to have high rates of fracture union when used in fracture involving piriformis fossa.⁽⁷⁾ Saudan et al.⁽⁸⁾ showed that intramedullary screws have no advantages over dynamic hip screws in stable fractures.

In a comparative study between DHS and PFN in pertrochanteric fractures conducted by Pajarinen et al.,⁽⁹⁾ PFN group showed a significant difference with regard to restoring preoperative walking capacity but reduction loss was observed in similar number of subjects in each group. Crawford et al.⁽¹⁰⁾ reported rehabilitation rate of 94% without a complication for DHS and 89% for intramedullary screw. However, treatment choices for unstable fractures are still under debate. Biomechanical studies have shown that intramedullary (IM) hip screws distributed the load more evenly over the femur calcar with the medialization effect.⁽¹¹⁾ IM nails according to extramedullary system have a shorter load arm decreases the tension forces acting on the screw. Thus, implant failure is minimized.^(12,13,14,15) Initially developed IM nails were longer in size which were associated with anterior thigh pain so short PFN was introduced.

In the present study, patients of 26 to 84 years were treated. Average age was 65.42 yrs. W Gadegone et al reported average age of 67 years.⁽¹⁶⁾ T Morihara et al reported average age of 85 years.⁽¹⁷⁾ C Kayali et al found average age of 75 years.⁽¹⁸⁾

Sex Distribution: The present study report 32(64%) femoral fractures occurring in male patients as compared to only 18 (36%) in females, whereas Brian W. Su et al. reported out of 38 patients 5 were male and 33 were female.⁽⁶⁾

Type of Fracture: As per the Boyd and Griffin classification system there were 11 (22%) type I fractures, 28 (56%) type II, 6 (12%) type III, 5 (10%) type IV fracture for present study. As per the AO/ASIF classification there were 3 type A1.1 fractures, 8 type A1.2 fractures, 22 fractures of type A1.3 & 11 fractures of type A2.1 and 6 fractures of type A2.2 and 2 fractures of type A2.3. Whereas N Khan et al⁽¹⁹⁾ in his study, when classified by Boyd and Griffin classification of intertrochanteric fracture there were 39 (39.0%) cases of Type-I, 28 (28.0%) cases of Type-II and 19 (19.0%) cases of Type-III and 14 (14.0%) cases of Type IV fracture.

Harris hip score: In present study, mean harris hip score was 80.62. Harris hip score was excellent 14 cases, good in 21 cases, fair in 9 cases and poor in 6. Michael Wild et al found mean harris hip score of 83 in his study.⁽²⁰⁾ Peng-Han Ye et al reported, 26 patients reached an excellent result, 37 good, 18 poor and 9 bad according to harris hip score.⁽²¹⁾

Conclusion

The introduction of a short reconstruction nail into practice has caused an evident qualitative shift in the therapy for intertrochanteric fracture. Excellent results can be obtained with short proximal femoral nail (SPFN) in managing intertrochanteric fractures. Being a minimally invasive technique, the intraoperative blood loss and incidence of postoperative infection was less with SPFN. The mini-invasive surgical approach without exposing the fracture region causes a minimal trauma to soft tissue, and decreases the risks of infection; moreover, the advantages of primary haematoma are retained. This solution brings less post-operative pain to the patients and enables early rehabilitation. The minimal blood loss in the course of the operation has positive effects on the post-operative course without the necessity of blood transfusions, which is also reflected in the economical aspects of the treatment. Early mobilization achieved with this technique reduces the morbidity and mortality in patients as compared to other treatment modalities. The rigid fixation, more efficient load transfer, shorter lever arm of SPFN improves stability of fracture. These features makes SPFN very suitable implant for unstable intertrochanteric fractures.

But still it is not completely full proof. Shattered lateral wall, reverse obliquity, loss of posteromedial support, poor bone quality, marked comminution, severe angulations and displacements as well as faulty instrumentation can all lead to problems. So caution and experience is needed to avoid disasters on table in such fractures and other modalities of treatment like DHS should be kept as an alternative on table.

References

1. Zuckerman JD, "Hip fracture" *N Engl J Med* (1996)334, 1519–25.
2. James F Kellam, Richard S Goodman, William L Jaffe, 2016. Intertrochanteric hip fractures. Available <http://emedicine.medscape.com/article/1247210-overview>.
3. Frank Mabesooin. Classification of trochanteric fracture patterns *Maitrise Orthopédique* n° 65 Jun 1997. Available http://www.maitriseorthop.com/corpusmaitri/orthopaedic/mo65_trochanteric_fracture/index.shtml.
4. Reska M., Veverkova I., Divis P., Konecny J. "Proximal femoral nail (Pfn) – a new stage in the therapy of extracapsular femoral fractures" *SCRIPTA MEDICA (BRNO)* (2006)79 (2),115–122.
5. Florian Geiger, Monique Zimmermann-Stenzel, Christian Heisel, Burkhard Lehner, and Wolfgang Daecke "Trochanteric fractures in the elderly: the influence of primary hip arthroplasty on 1-year mortality" *Arch Orthop Trauma Surg* (2007) 127(10),959–966.
6. Brian W. Su et al "Basicervical Versus Intertrochanteric Fractures: An Analysis of Radiographic and Functional Outcomes" *ORTHOPEDECS* (2006), 29(10):919.
7. Velasco RV, Comfort TH "Analysis of treatment problems in subtrochanteric fractures of femur" *Jour Trauma* (1978)18,513.
8. Saudan M, Lübbecke A, Sadowski C, Riand N. "Pertrochanteric fractures: is there an advantage to an intramedullary nail?: a randomized, prospective study of 206 patients comparing the dynamic hip screw and proximal femoral nail" *J Orthop Trauma* (2002)16,386–93.
9. Pajarinen J, Lindahl J, Michelsson O. "Pertrochanteric femoral fractures treated with a dynamic hip screw or a proximal femoral nail. A randomised study comparing post-operative rehabilitation" *J Bone Joint Surg [Br]* (2005)87,76–81.
10. Adams CI, Robinson CM, Court-Brown CM, McQueen MM "Prospective randomized controlled trial of an intramedullary nail versus dynamic screw and plate for intertrochanteric fractures of the femur" *J Orthop Trauma* (2001)15, 394–400.
11. Baumgaertner MR, Curtin SL, Lindskog DM, Keggi JM "The value of the tip-apex distance in predicting failure of fixation of peritrochanteric fractures of the hip" *J Bone Joint Surg [Am]* (1995)77, 1058–64.
12. Simmermacher RK, Bosch AM, Van der Werken C. "The AO/ASIF-proximal femoral nail (PFN): a new device for the treatment of unstable proximal femoral fractures" *Injury* (1999)30, 327–32.
13. Madsen JE, Naess L, Aune AK, Alho A. "Dynamic hip screw with trochanteric stabilizing plate in the treatment of unstable proximal femoral fractures: a comparative study with the Gamma nail and compression hip screw". *J Orthop Trauma* (1998)12,241–8.
14. Seral B, García JM, Cegoñino J, Doblaré M "Finite element study of intramedullary osteosynthesis in the

- treatment of trochanteric fractures of the hip: Gamma and PFN" *Injury* (2004)35,130-5.
15. Banan H, Al-Sabti A, Jimulia T, Hart AJ. "The treatment of unstable, extracapsular hip fractures with the AO/ASIF proximal femoral nail (PFN)-our first 60 cases" *Injury* (2002)33,401-5.
 16. Erez O, Dougherty PJ. "Early Complications Associated With Cephalomedullary Nail for Intertrochanteric Hip Fractures" *J Trauma* (2011) Jul 15. [Epub ahead of print]
 17. T Morihara "Proximal femoral nail for treatment trochanteric femoral fractures" *Journal of Orthopaedic Surgery* (2007)15(3), 273-7.
 18. C Kayali, H Agus, S Ozluk "Treatment for unstable intertrochanteric fractures in elderly patients: internal fixation versus cone hemiarthroplasty". *Journal of Orthopaedic Surgery* (2006)14(3),240-4.
 19. Khan N, Askar Z, Ahmed I, Durrani Z, Khan MA "Intertrochanteric fracture of femur; outcome of dynamic hip screw elderly patients" *Professional Med J* (2010)17(2), 328-333.
 20. Michael Wild, Pascal Jungbluth et al. "The Dynamics of Proximal Femoral Nails: A clinical comparison between PFNA and Targon PF" *ORTHOPEDICS* (2010)33(8), 547.
 21. Peng-Han Ye, Lei Huang, Ng Feng Zha, et al "Proximal femoral nail for the treatment of unstable intertrochanteric femoral fractures" *China journal of orthopaedics and traumatology* (2011)24(8), 6457.