International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2018; 4(1): 572-575

www.orthopaper.com
Received: 01-11-2017
Accepted: 02-12-2017

Dr. Daivesh P Shah
Assistant Professor, Dept of Orthopaedics, B J Medical College & Civil Hospital, Ahmedabad, Gujarat, India

Dr. Sandip R Rathod
Assistant Professor, Dept of Orthopaedics, B J Medical College & Civil Hospital, Ahmedabad, Gujarat, India

Correspondence
Dr. Daivesh P Shah
Assistant Professor, Dept of Orthopaedics, B J Medical College & Civil Hospital, Ahmedabad, Gujarat, India

Study of clinical and functional outcomes of unstable intertrochanteric femur fractures treated with long proximal femoral nail

Dr. Daivesh P Shah and Dr. Sandip R Rathod

DOI: https://doi.org/10.22271/ortho.2018.v4.i1i.81

Abstract
Introduction: The following study was conducted to examine the long term clinical, radiological and functional results of unstable intertrochanteric femur fractures treated with long Proximal Femoral Nail.
Materials and Methods: This was a prospective, non-randomized study of 50 cases of intertrochanteric fractures of unstable variety treated by long Proximal Femoral Nail at the Department of Orthopedics, B J Medical College and Civil Hospital, Ahmedabad, between 2014 to 2016. Patients were undergoing primary surgery, with unstable types of fracture pattern AO/OTA type 31A2.2 to 31A3.3. Pathological fractures and patients with previous surgery on proximal femur were excluded.
Results: The sample consisted fifty patients, 33 were males and 17 females. The patients' ages ranged from 18 - 90 years with mean of 68.2 years. Majority (86%) of the intertrochanteric fractures occurred following trivial trauma usually a domestic accident like fall in bathroom or fall from stairs. Associated bony injuries were present in 3 cases (6%). Most common associated injury was fracture lower end radius (in all 3 cases). 29(58%) patients had an osteoporosis Grade 5 while 17 (34%) had Grade 4. AO/OTA Type A2.3 type of fractures were most common in 31 (62%) patients, followed by A2.2, A3.1 and A3.3. Functional Outcome was assessed with modified Harris Hip Score in which 70% of the patients had good to excellent functional results on final follow up at 1 year.
Conclusion: The proximal femoral nail, is an optimum implant for the internal fixation of unstable intertrochanteric fractures with advantages of stable fixation, perfect reduction, early weight bearing and ambulation, shortened hospital stay and improved rate of union with early resumption of independent life style.

Keywords: Unstable intertrochanteric fracture, proximal femur fracture, proximal femoral nail, long PFN

Introduction
Femoral trochanteric fractures are one of the most frequently occurring fractures in the elderly, usually following trivial trauma. In the younger age group of people, in whom it is uncommon, it occurs almost always due to high velocity trauma. Trochanteric fractures are seen nowadays with increasing frequency and severity, as the life span of the population has increased. The morbidity and mortality both are quite high in this age group of the patients irrespective of the mode of treatment more so if ambulation is delayed [1].
Unlike fractures of the neck of the femur, fracture union is not a problem in case of fracture trochanter femur. It can be achieved by both conservative and operative methods. Non operative treatment has been found to have a high rate of malunion except in a few studies. Morbidity and mortality associated with conservative treatment, because of prolonged bed ridden state, has been quite high [2].
The last four decades has seen improvement in the management of this common injury, mainly by early surgical fixation and stability of the fracture site. The porotic nature of the bone in the elderly leads to severe comminution and results in the so called unstable fracture. While the proper understanding of the biomechanics of the fracture and fixation along with altered and deteriorating physiology has led to more satisfactory results, the oversight of some basic principles has led to unwarranted complications [3, 4].

This is an attempt to study the long term results of operative management of unstable intertrochanteric fractures by the Long Proximal Femoral Nail (PFN) in a standardized and objective manner. Factors affecting the quality of fixation and hence patients ambulation have been analyzed. A form of pre-operative assessment and final assessment has been used. The results have been studied in depth with a view to outline guidelines for better management of these fractures.

Materials and Methods

This was a prospective, non-randomized study of 50 cases of intertrochanteric fractures of unstable variety treated by Long Proximal Femoral Nail at the Department of Orthopedics, B J Medical College and Civil Hospital, Ahmedabad, between 2014 to 2016 with a view to analyze the fracture patterns, the mode of treatment employed, the difficulties encountered in its use and the final results.

Patients included 18 to 90 years of age, undergoing primary surgery, with unstable types of fracture pattern AO/OTA type 31A2.2 to 31A3.3. Pathological fractures and patients with previous surgery on proximal femur were excluded.

All the patients were admitted through the out patient department or through casualty. A complete history regarding the nature of trauma, the side of injury, the duration since trauma and history of associated injuries or any other medical or surgical ailments was taken. Thorough clinical evaluation of the injury was done. Radiological confirmation of the diagnosis was carried out by taking anterior-posterior x-rays of hip and the fractures were classified according to AO/OTA Classification.

Intertrochanteric fractures were treated by closed reduction on a fracture table and internal fixation using a long proximal femoral nail inserted under radiographic control. All cases were operated using long PFN from various companies all having basic design derived from standard PFN introduced by AO/Synthes. Reduction was considered good if the cortical congruence at the calcar region was restored, and if the displacement between the fragments did not exceed 2 mm in any projection.

Post-operatively patients were first followed up usually at stitch removal at 2 weeks. Clinical assessment of fracture union, range of movement of hip and knee and radiological assessment of fracture union was done on follow up.

If union was found satisfactory and radiological union was found to be in progress, partial weight bearing was started as tolerated, if not started previously. Patients were next called at 1 1/2 months and reassessment, both clinical as well as radiological, was done and if union was found to be progressing satisfactorily full weight bearing was started as tolerated. Patients were next called at 12 months and reassessment, both clinical as well as radiological was done.

Data collected was analyzed using simple statistical method of percentages and functional outcome was rated using modified Harris Hip Score [5].

Results

The commonest age group (Table 1) for intertrochanteric fractures is between 61-70 years (34%) followed by 71-80 years (30%). The youngest patient in the study, group was 44 years old and oldest 90 years. The average age was 68.2 years.

Table 1: Age distribution of the patients

Age in years	No. of patients	Percentage
21-30	0	0
31-40	0	0
41-50	6	12
51-60	8	16
61-70	17	34
71-80	15	30
>80	4	8
Total	50	100

Male: Female ratio is 1.9: 1.Majority (86%) of the intertrochanteric fractures occurred following trivial trauma usually a domestic accident like fall in bathroom or fall from stairs. Associated bony injuries were present in 3 cases (6%) while chest injury & head injury was present in 2 & 1 case respectively. Most common associated injury was fracture lower end radius (in all 3 cases). 37(74%) of the patients had hospital stay between 6-10 days while 20% needed longer hospital stay (>10 days), with average hospitalization being 8.7 days. 29(58%) patients had an Osteoporosis Grade 5 while 17 (34%) had Grade 4.

From this Table 2 it is obvious that A2.3 type of fractures were most common in 31 (62%) patients, followed by A2.2, A3.1 and A3.3.

Table 2: Distribution of patients according to fracture type (AO/ASIF)

Fracture Side	Number of Patients	Percentage
A2.2	15	30
A2.3	31	62
A3.1	2	4
A3.2	0	0
A3.3	2	4

In PFN fixation, the proximal fragment was fixed using the lag screw and the derotation screw in all but 2 cases. In 90% of cases, distal locking was done in long PFN. Medial cortex continuity was achieved in 72% of cases.

Incidence of complications related to implant cut-out, peri-implant fracture, implant migration correlated with patient specific factors, such as advanced age and presence of osteoporosis, irrespective of the type of implant used. Infection and non union occurred in the presence of treatment related complications. 33 patients were allowed to partial weight bear within 6 weeks of surgery while 30 patients were allowed full weight bearing within 12 weeks after surgery.

Implant was found in situ in 86% of PFN patients at final follow up. Implant failure was seen in 7 patients treated with PFN 14%. The functional outcome as per modified Harris Hip Score (Table 3) shows that 36% of the patients had excellent functional results on final follow up, 34% had good results, 20% had fair and 10% had a poor functional results on follow up.

Table 3: Functional Results In Present Study: Surgeon's Assesment (According To Harris Hip Score)

Clinical results	Total points	No. of Patients	Percentage
Excellent	81-100	18	36
Good	61-80	17	34
Fair	41-60	10	20
Poor	<40	5	10
Total		50	100

Discussion

Load bearing in the proximal femur is predominantly through calcarfemorale, the lever arm of laterally placed plate of DHS is increased so there is a higher risk of implant cutout. So biomechanically compared to a laterally fixed side plate as in DHS, an intramedullary device decreases the bending force of the hip joint on implant by 25-30%. This has advantages especially in elderly patients, in whom the primary goal is early weight bearing mobilization. So now the intramedullary screw devices are gaining popularity. A search of the review group of the Cochrane library for the ideal implant in intertrochanteric fractures still favours the use of sliding hip screw over intramedullary implants [6]. Traditionally it was the posteromedial comminution which was considered the most important factor in determining the severity of fracture. The importance of the integrity of the lateral femoral wall has been documented recently [7, 8]. The lateral wall is the proximal extension of the femoral shaft. This lateral wall is extremely thin in unstable 31A2 type fracture. The lateral wall in patients treated with dynamic hip screw' provides a lateral buttress for the controlled fracture impaction and preventing collapse. Palm *et al.* [9] found that there was an eight times higherrisk of re-operation due to technical failure with the gold standard technique of dynamic hip screw in patients with fracture of the lateral femoral wall. This has been attributed to the fact that when the lateral femoral wall is fractured, the fracture line is parallel to the sliding vector of the sliding hip screw, which, as in the reverse oblique intertrochanteric fracture, allows the trochanteric and femoral head and neck fragments to slide laterally and the shaft to slide medially. The fracture complex subsequently disintegrates with a high risk of failure including cut-out of the screw into the hip joint. Gotfried [7] in a retrospective analysis of 24 patients with documented postoperative fracture collapse and their findings showed unequivocally that in all patients, this complication followed fracture of the lateral wall and resulted in protracted period of disability until fracture healing. The importance of the integrity of the lateral wall for event-free fracture healingclearly is indicated, and fracture of the lateral wall should be avoided in any fixation procedure.

All cases were evaluated according to modified Harriship score on residual effects on clinical grounds at final examination. Pain and functional capacity are the two basic considerations for this scoring system. Points were given for pain, function, range of motion and absenceof deformity. In the study group, the walking capacity of majority of patients (52%) was unlimited or limited upto a maximum of 1000 meters. 76% of the patients used little or no support for walking. 78% of the patients in this series complained of none or only slight pain at the hip on final follow up. 46% of the patients were able to sit cross-legged and 32% were able to squat without difficulty on final follow up. Based on all the above criteria the functional result according to Harris Hip Score was found to be excellent in 36%, good in 34%, fair in 20% and poor in only 10% of patients.

Radio logically, 70% of the fractures were found to be clinically united by 12 weeks following surgery. In the minority in whom the clinical union was delayed beyond 12 weeks but within 16 weeks were occurred in 24% while 3 (6%) patients had non union at final follow up, 1 due to infection at the fracture site with screw migrated into joint which had to under go implant removal, one due to broken nail, and other due to backing out of the proximal hip screws. All of which considered as non-unions for the study purpose which subsequently united after relevant surgical procedures with scooping and debridement at the fracture site after opening the fracture and exchange nailing done in case of infection and backout implants and broken nail was operated with bone grafting and angled blade plate.

Intramedullary nails are associated with less shortening and less sliding of the lag screw. This is due to the fact that intramedullary nail stops the proximal part of the nail blocks the head-and-neck fragment, preventing its complete impaction. Leading to less limb shortening in the group treated with an intramedullary hip screw than in those treated with a dynamichip-screw, especially in unstable intertrochanteric fracture. If the hip pin is longer than the lag screw, vertical forces would increase on the hip pin and start to induce cutout, a knife effect or Z-effect. This might force the hip pin to migrate into the joint and the lag screw to slide laterally. The cut-out rate with a PFN is reportedly 0.6 to 8% [1, 10]. Although complication rates remain low, cut-out of either screw is a serious complication, which can lead to revision surgery and related morbidity. When the hip pin was 10mm shorter than lag screw, the percentage of the total load carried by the hip pin ranged from 8-39% (mean 21%) [11, 12]. Unstable A2 fractures should be initially reduced to a slightly valgus position during PFN surgery, because the neck-shaft angle would decrease during the first 6 postoperative weeks.

The lag screw should be inserted into the femoral head inferiorly in the AP view, and centrally in the lateral view. The tip of the lag screw should always be inferior to the centre of the femoral head. Anatomic and biomechanical studies have shown that the superomedial quadrant of' the femoral head is the weakest part for the implant, and therefore, proper positioning of the screw is emphasized. Cutout is usually resulted frompoor positioning of the proximal screw in the femoral head, particularly in the osteoporotic bone. In our study, the lag screw was inserted close to the subchondral bone, and the antirotational hip pin superior to the femoralhead. This resulted in 90% of the lag screws being inserted at the optimalsite inferior to the centre of the femoral head and to an optimal depth, thereby achieving rigid fixation [13].

The results of our study regarding fixation of intertrochanteric fractures with lateral cortical breech (31 A3 type fracture) and those with extremely thin lateral cortex (31, A2.2 and A2.3) are highly encouraging with shortening of less than 1 cm in (approximately 75%) patients and close to 95% return of pre-injury mobility.

The duration of hospital stay, operative time is less in PPFN. We cannot keep the patient admitted till rehabilitation in a busy trauma unit. So patients are usually discharged on 5th

post operative day if no complication was present.

Conclusion

Intertrochanteric fractures commonly occur in elderly persons, usually following minor trauma whereas in young patients a major trauma is needed to cause this fracture. In the study group average operative time taken for internal fixation with PFN was 1-2 hrs. Stable fixation with near perfect reduction could be achieved in majority of the patients which is the key determining factor in early ambulation. The need for internal fixation and early mobilization of patients with intertrochanteric fractures of the femur is generally accepted, not only to reduce the morbidity/ mortality rates associated with the prolonged immobilization, but also to improve the functional result. Partial weight bearing could be started as early as 2nd post operative day in suitable patients, but usually delayed for 3-6 weeks post operatively. The discussion about the ideal implant for treatment of proximal femoral fractures continues. From the mechanical point of view, a combined intramedullary device inserted by means of a minimally invasive procedure seems to be better in all patients. Closed reduction of the fracture preserves the fracture hematoma, an essential element in the consolidation process. Intramedullary fixation allows the surgeon to minimize soft tissue dissection thereby reducing surgical trauma, blood loss, infection, and wound complications. Patients had a significant shorter incision with much less dissection and lower rate of infection and thus shorter hospital stay (mean 8.7 days). Functional assessment according to modified Harris Hip Score was found to be excellent in 36% and good in 34%, a major percentage of patients at final follow up. Surgery/Implant related total 7 complications occurred in form of infection, screw backout, broken screw or nail, screw cut through etc. Prevention is always better than cure and patient education about post menopausal and anti-osteoporotic treatment regimens and patient education on fall preventive measures can decrease a substantial economic burden to the community.

In conclusion the PFN, is an optimum implant for the internal fixation of unstable intertrochanteric fractures with advantages of stable fixation, perfect reduction, early weight bearing and ambulation, shortened hospital stay and improved rate of union with early resumption of independent life style.

References

1. Al-yassari G, Langstaff RJ, Jones JM, Al-Lami M. The AO/ASIF proximal femoral nail (PFN) for the treatment of unstable trochanteric femoral fracture. Injury. 2002; 33:395-9.
2. Morihara T *et al*. Proximal femoral nail for treatment of trochanteric femoral fractures. J Orthop Surg. 2007; 15(3):273-7.
3. Gundle R. How to minimize failures of fixation of unstable intertrochanteric fractures – Injury. 1995; 26(9):611-4.
4. Menezes DFA, Gamulin A, Noesberger B. Is the proximal femoral nail a suitable implant for treatment of all trochanteric fractures. CIin Orthop. 2005; 439:221-7.
5. Harris Hip Score; J Bone Joint Surg Am. 1969; 51(A):737-755.
6. Parker MJ, Handoll HHG. Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults (review). The Cochrane Library, 2008, 3.
7. Gotfried Y. The lateral trochanteric wall: a key element in the reconstruction of unstable pertrochanteric hip fractures. Clin Orthop. 2004; 425:82-6.
8. Haidukewych GJ, Israel TA, Berry DJ. Reverse obliquity fractures of the intertrochanteric region of the femur, J Bone Joint Surg Am. 2001; 83:643-50.
9. Palm H, Jacobsen S, Sonne-Holm S, Gebuhr P. Integrity of the lateral femoral wall in intertrochanteric hip fractures: an important predictor of a re-operation. J Bone Joint Surg Am. 2007; 89:470-5.
10. Banan H, Al-Sabti A, Jimulia T, Hart Af. The treatment of unstable, extracapsular hip fractures with the AO/ASIF proximal femoral nail (PFN)-our first 60 cases. Injury. 2002; 33:401-5.
11. Herrera A, Domingo LJ, Calvo A, Martinez A, Cuenca J. A comparative study of trochanteric fractures treated with the Gamma nail or the proximal femoral nail. Int Orthop. 2002; 26:365-9.
12. Schipper IB, Bresina S, Wahl D, Linke B, Van Vugt AB, Schneider E. Biomechanical evaluation of the proximal femoral nail. Clin Orthop Relat Res. 2002; 405:277-86.
13. Brown TD, Ferguson AB Jr. Mechanical property distributions in the cancellous bone of the human proximal femur. Acta Orthop Scand. 1980; 51:429-37.