

Functional and Radiological Outcome of Fracture Subtrochanteric Femur Treated by Proximal Femoral Nail Antirotation (PFNA)

Jagdish Kumar, Muhammad Soughat Katto, Mehtab Ahmed Pirwani, Nusrat Rasheed, Irfan Muhammad Rajput, Syed Salman Adil

ABSTRACT

Objective: To evaluate clinical and radiological outcome and morbidity of fracture Subtrochanteric femur treated by PFNA.

Methods: A prospective analytic cross-sectional study was conducted at Orthopaedic Surgery department, Dow Medical College & Dr. Ruth Pfau Civil Hospital Karachi during the period from January 2017 to May 2018. Thirty-three patients with Subtrochanteric femur fracture according to Russell and Taylor Classification Type IA & B were operated with Proximal femoral nail antirotation (PFNA). Patients were assessed clinically for functional outcome based on Harris hip score and radiologically for union. Typical post-surgical morbidity (i.e., Infection, delayed union, nonunion, mal-union and fixation failure) were noted.

Multiple fractures in polytrauma patients, pathological fractures, open fractures, poor ambulatory patients previous to the fracture and related neurovascular injuries were excluded from the study.

Results: A total of 33 patients (21 males, 12 females; mean age 49.5 years) were treated with PFNA. Based on Russell and Taylor classification: 18 had Type IA and 15 had Type IB fractures. The mean follow-up duration was 11 months (range, 9 to 16 months). All fractures were united in an average time of 18.4 weeks). Superficial stitch infection was seen in 5 cases. We had no instance of deep infection. Distal locking screw was broken in two patients. Implant failure and / or Nonunion were not observed whereas delayed union was noted in 5 patients. The functional outcome results were (as per Harris hip scoring system) excellent and good in 27(81.8%) and fair to poor in 6 (18%) cases.

Conclusions: The post-operative clinical and radiological outcome suggest that PFNA is an exceptional device for treatment of fracture subtrochanteric femur. Although technically demanding, it avoids extensive soft tissue dissection and iatrogenic bony devascularization thus decrease the incidence fracture nonunion and implant failure and at the same time provide much more axial stability due to its intramedullary placement thus it allows the patients to move relatively early following surgery.

Key words: Subtrochanteric femur fracture, intramedullary, Proximal femoral nail.

This article may be cited as:

INTRODUCTION

Fracture Subtrochanteric femur (SFF) accounted for 10% to 15% of all hip fractures [1-3]. These fractures are common between elderly osteoporotic people, resulting from low energy trauma. In young adults, these fractures are usually complex injuries and generally result from high energy trauma [1,4].

Currently, Fracture subtrochanteric femur is still a big global challenge, even to the experienced trauma Orthopaedic surgeons due to the powerful deforming muscles forces that surrounding the hip acting on the fracture fragments as well as *high* compressive and *tensile* stress in the fractured subtrochanteric region, placing significant demands on devices used for fixation, thus give rise to fracture nonunion and implant fatigue fracture [1,5 -7]. A multitude of different extra- and intra-medullary fixation devices for Subtrochanteric fracture fixation have been suggested [1,8 -10]. Traditional extramedullary osteosynthesis

D.U.H.S & Civil hospital Karachi
Correspondence: Jagdish Kumar
E-mail: Jagdish@doctor.com

with 95° dynamic condylar screws plate (DCSP) was used for more than a century but due to the mechanical load bearing effect lead to frequent implant failures. Despite the advent of locked plating and minimally invasive surgical techniques there is still a high complication rate of implant fatigue fracture and nonunion [1,3,5,11-14].

Considering these drawbacks, we are using recently introduced intramedullary devices; Proximal femoral nail antirotation (PFNA) at our institution for these Subtrochanteric femur fractures in adult. The advantages of proximal femoral nail antirotation (PFNA) are – minimal invasive biological fixation due to closed percutaneous insertion, it may reduce amount of additional surgical trauma, preserve the fracture hematoma and decrease blood loss. Being biomechanically, superior this implant shares the load and provide much more angular and rotational stability thus helps in early mobilization and weight bearing [1,5,11,15]. Recently several studies have reported its favorable outcome and reduced mechanical failure of implant in Subtrochanteric femur fracture in comparison with other methods of fixation [1,10,11].

However in our setup no specific scientific study has been done in our institute. Therefore, to strategize future guidelines a prospective analytic cross-sectional study of traumatic Subtrochanteric femur fracture was carried out. The objective of the study was to evaluate clinical and radiological outcome and morbidity of fracture Subtrochanteric femur treated by PFNA.

METHODS

This prospective analytic cross-sectional study was done Orthopaedic Surgery department, Dow Medical College & Dr. Ruth Pfau Civil Hospital Karachi during the period from January 2017 to May 2018. This study, analyzed 33 skeletally mature patients with fracture Subtrochanteric femur (*Russell and Taylor Classification [16] Type IA & B*) internally fixed with PFNA. Multiple fractures in polytrauma patients, pathological fractures, open fractures, poor ambulatory patients before getting the fracture and related neurovascular injuries were excluded from the study.

Initial trauma biplane radiographs were taken and *Russell and Taylor Classification* was used to describe fractures. The operative procedure and its risks and benefits and follow-up were explained in detail and informed written consent was obtained regarding treatment and photographic documentation.

The fracture was reduced closely by applying traction under C-arm control and the PFNA device was implanted in all cases by using previously presented standard surgical guidelines for nail and blade insertion [17].

Post-operative management and outcome assessment

Post-operative prophylactic antibiotics for 5 days to prevent infection and low molecular heparin as thromboembolic prophylaxis in elderly patients was also given. The rehabilitation protocol during hospitalization was identical for all patients; patients were allowed to sit on first post-operative day, permitting standing and toe touch walking with the aid of walker as tolerated was started on second and third day. Depending on fracture stability, partial weight bearing was allowed from 4 to 6 weeks and then full weight bearing from 3 months of achieving clinico-radiological union. Sutures removal were done on day 14. Follow up reviews of patients were done for every two weeks for first two months and thereby monthly for next four months to evaluate clinically for functional outcome based on Harris hip score [18]. and radiologically for union. Typical post-surgical morbidity (i.e., Infection, delayed union, nonunion, mal-union and fixation failure) was noted. The Fractures were considered healed if radiologically, showed a bridging callus in two orthogonal views and clinically, if the fracture was stable and non-tender at fracture site on manual stress and the patients were able to walk without pain.

Statistical analysis:

The data entered and analyzed in statistical program SPSS version 16.0.

Sample technique

Non-probability – purposive sampling technique was used to select 33 patients, who sustained Subtrochanteric femur fracture requiring surgery.

Sample size calculation

Determination of sample size was based on an epidemiological study, where hip fractures in adult comprise 20% of all fractures; Femoral neck fractures and intertrochanteric fractures together make up over 90% of the proximal femur fractures and the remaining 5-10% are subtrochanteric fracture [10,22,23,24],

Using Fishers' formula

$$n = Z^2 PQ / D^2$$

Where

n is the estimated sample size.

Z2 is the score of confidence interval at 95% and is 1.962.

P is expected true prevalence of hip fracture in this case at 20% and Q is 1 – P.

D2 is the degree of error, which is 0.052

Therefore

$$n = 1.962 \times 0.20 (1 - 0.20) / 0.052$$

n = 246 patients of hip fracture

Out of 246 patients of hip fracture, 10% of patients had subtrochanteric fracture

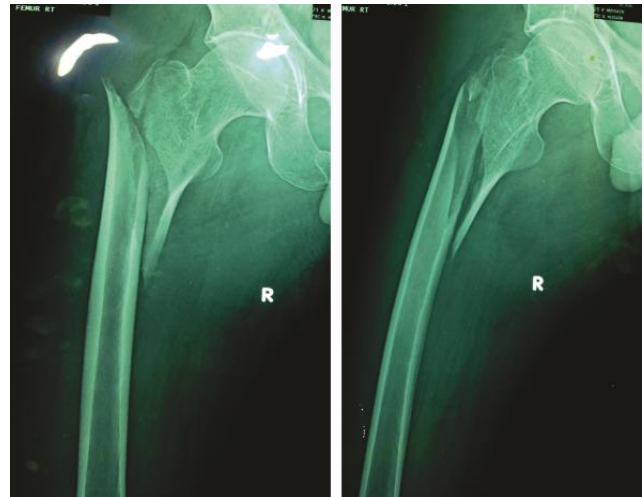
The 10% of 246 is 24.6

So n= 25 patients of subtrochanteric fracture

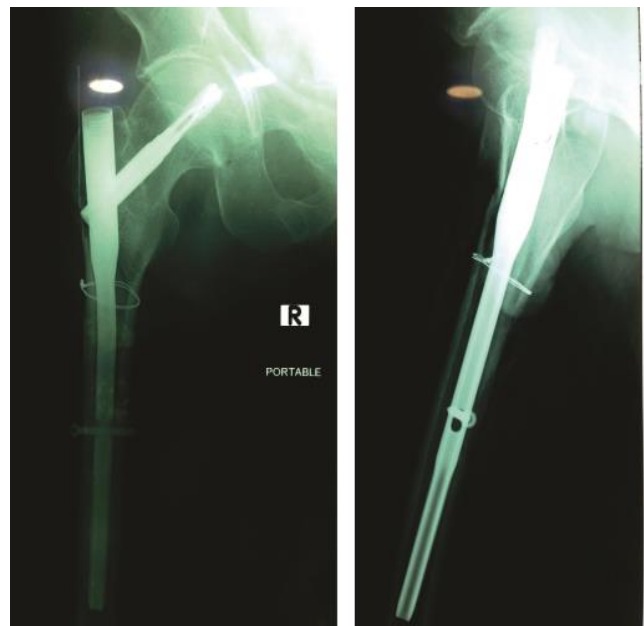
RESULTS

This study analyzed 33 patients (21 men and 12 women.) with Subtrochanteric femoral fractures fixed with PFNA. The mean age of the patients was 49.5 (21–68) years. Thirteen of the (39.3%) injuries involved the left hip and 20 (60.6%) involved the right hip. Of these, 19 (57.5%) had experienced ground level fall, followed by road traffic accident in 11 (33.3%) cases and fall from height in 3 (9%) cases. According to the Russell and Taylor classification, 18 fractures were graded as type 1A and 15 as type IIB. Mean delay between the fracture and operation was 8.79 ± 3.15 days. The reasons behind such surgical delay were mainly the late reporting of patients, older age with multiple co-morbid and in large proportion of patients delay in admission, due to overburden in our Government setup hospital.

Out of 33, 27 were reduced closely whereas in 6 cases limited Open reduction and fixation with cerclage wiring as needed were done. The mean follow-up duration was 11 months (range, 9 to 16 months). All fractures united in an average time of 18.4 weeks (range 12 - 36 weeks). Superficial stitch infection was seen in 5 cases; All of these resolved with daily dressing and oral antibiotics. We had no instance of deep infection. Distal locking screw was broken in two patients, within eight weeks of fixation. Implant failure and / or Nonunion were not observed whereas delayed union was noted in 5 patients, all progressed to union with additional minor surgical procedure; bone grafting in two cases and dynamization in three cases. The functional results were excellent and good in 27(81.8%), fair and poor in 6 (18%) cases.



Case No 1: Pre-operative x-ray: A- AP View B-Lateral view of right hip of a 55 year old male with fracture subtrochanteric femur after a ground level fall at home.



Case No 2: Post-operative x-ray: AP and Lateral view after limited open reduction and fixation with a PFNA

DISCUSSION

Surgical fixation of fracture Subtrochanteric femur is still a matter of discussion. Numerous altered implants were used for the internal fixation [3,8]. Conventional extramedullary plate osteosynthesis has the possible disadvantages of extensive soft tissue dissection and bony devascularization hence leading to high rates of infection and fracture nonunion. In addition, the laterally placed extramedullary plating is

prone to implant breakage due to their mechanical load-bearing effect [1,3,5,19,20]. However, intramedullary devices; PFNA has biological as well as biomechanical advantages. Biologically these devices allow the surgeons to treat these complex fractures less invasively. Indirect reduction without exposure of the fracture preserves the haematoma and bone viability, an essential element in fracture healing. Biomechanically, these devices act like an internal splint and can provide much more axial stability thus it allows the patients to move relatively early following surgery [3,5,12]. Along with this ability, the helical blade of the PFNA prevents rotation or compaction of the proximal fragment by locking with the nail rotationally.

Recently several authors have confirmed the PFNA a reliable implant for fixation of fracture Subtrochanteric femur [1,3,5,12]. Wang WY 2010 [5] analyzed 25 patients with fracture subtrochanteric femur, fixed with long PFNA. They achieved healing in all their cases. Implant failure and / or Nonunion were not observed whereas delayed union was noted in 1 patients. They reported 92% excellent to good functional results and concluded that PFNA is effective in treatment of subtrochanteric fractures. Umer 2014 [1] operated 33 patients with acute subtrochanteric fractures by femoral nail with spiral blade. They achieved uneventful healing except 3 cases of delayed union requiring dynamization in 2 cases and bone grafting in one. Implant failure noted in 2 cases requiring repeat surgery. They concluded that femoral nail with spiral blade is a suitable alternative for acute subtrochanteric fractures with favorable results. Mereddy P 2009 [11] evaluated 62 patients with unstable proximal femoral fractures treated with the PFNA. Except 4 cases of delayed healing, they achieved union in all their cases. Functionally 80% of patients reached to their pre-injury mobility. They suggested that PFNA blade provides additional anchoring in osteoporotic bone. Liu Y et al [17] analyzed 143 patients who had peritrochanteric femoral fractures and treated with PFNA. They achieved union in all their patients except one case of delayed union. Functionally 74% of patients restored to their pre-operative mobility and the suggested that PFNA is a very safe and effective treatment option in the treatment of peritrochanteric femoral fractures. Kristek D 2010 [21] did a study on 76 patients treated with PFNA. They observed delayed union in 3 cases. Implant breakage was not recorded. Functionally 60% of cases regained

to their pre-injury mobility. They concluded that The PFNA is an excellent implant as well as an exceptional device for reosteosynthesis of peritrochanteric fractures. Abraham VT 2016 [10] analyzed 26 patients of PFN-treated fracture subtrochanteric femur. In their study, all fractures went on to unite and there was no implant failure and functionally 82% of cases returned to their pre-injury mobility. They suggested that the PFN requires minimal soft tissue dissection and achieves biological fixation. Radaideh AM 2018 [9] did a study on 50 patients internally fixed with the PFNA. Solid union was achieved in all their cases without any implant related complications. They recommended PFNA owing to its easy insertion, reduced blood loss, stable fixation and satisfactory clinical and radiological results.

In our study, we also found similar findings; we evaluated 33 patients with fracture subtrochanteric femur fixed with PFNA. We achieved union in all cases at mean time of 18.4 weeks. Implant failure and / or Nonunion were not observed whereas delayed union was noted in 5 patients, all progressed to union with additional minor surgical procedure; bone grafting in two cases and dynamization in three cases. In our study, distal locking screws were broken in 2 cases, within 2 months of fixation due to early full weight bearing by the patients. There were 5 incidences of superficial stitch infection and subsided with dressing and oral antibiotics. In our study, functionally 81.8% of patients regained excellent to good Harris hip score. Limitations of this study, includes its small number of patients, lack of control group such as Dynamic condylar plate to serve as a comparison to the surgical technique and short follow-up period. Also, the exclusion of polytrauma patients with multiple fractures could lead to a selection bias, possibly omitting patients with more severe injuries. Hence, the results in this study were comparable to the results noted in most other studies.

CONCLUSION


The post-operative clinical and radiological outcome suggest that PFNA is a exceptional device for treatment of fracture subtrochanteric femur. Although technically demanding, it avoids extensive soft tissue dissection and iatrogenic bony devascularization thus decrease the incidence of fracture nonunion and implant failure and at the same time provide much more axial stability due to its intramedullary placement thus it allows the patients to move relatively early following surgery.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

No	Author Name	Contribution to paper	Signature
1	Dr. Jagdesh Kumar	Article Write up	
2	Mohammad Soughat Katto	Topic Selection	
3	Mehtab Ahmed Pirwani	Literature Search	
4	Dr. Nusrat Rasheed	Data Analysis	
5	Irfan Muhammad Rajput	Data collection	
6	Syed Salman Adil	Data Interpretation	