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ORIGINAL RESEARCH

Short VS long PFN for treating Intertrochanteric fracturesradiological and functional outcome - A prospective comparative study

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Abstract

Background: Hip fracture contributes to both morbidity and mortality in the elderly. Hence; the present study was undertaken for comparing the short versus long PFN for treating IT fracturesradiological and functional outcome.

Materials & methods: The material for the present study was obtained from the patients admitted in Bangalore medical college and research institute, department of Orthopaedics with diagnosis of intertrochanteric fractures Boyd & Griffin type 2 and type 3 from September 2017 to August 2019. 142 cases were taken and the patients were informed about the study in all respects and informed consent was obtained from each patient. After admission all the necessary clinical details were recorded in proforma prepared for this study. Final outcome was assessed with HARRIS HIP SCORING

Results: Long PFN took a longer operative time, mean of 91.9 minutes, statistically significant ($p<0.05$) as compared to a mean of 70.3 minutes for performing a Short PFN surgery as shown in table 1. No statistically significant difference was seen in terms of Harris hip score between the two groups of patients at 6 months of follow-up (p value= 0.881) as shown in Figure 1. The mean time to union in fractures treated with Short PFN was 16.6 weeks and for those treated with Long PFN was 17.1weeks as shown in Table 2. Among the short PFN group 3 % of the patients had complications, whereas the long PFN group contributed to 4 % of the complications which is not statistically significant ($p>0.05$) as shown in table 3.

Conclusion: Our study concludes that Long nails do not offer any advantage over the shorter variant in the treatment of type 2 and type 3 intertrochanteric fractures in terms of functional outcome p value >0.05. Short PFN operative time is less as compared to use of Long PFN.

Key words: Long Proximal femoral nail, Short proximal femoral nail

Introduction

Hip fracture contributes to both morbidity and mortality in the elderly. The demographics of world populations are set to change, with more elderly living in developing countries.[1] Proximal femoral Fractures account for a large proportion of hospitalization among trauma cases. An overwhelming majority of these patients (>90%) are aged above 50 years. Inter trochanteric fractures of femur occur in the area between the greater and lesser trochanter and may involve these two structures. Inter trochanteric fractures make up 45% of all hip

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fractures. This region consists of weight bearing trabeculaes and has a good amount of cancellous bone and vascularity thus minimizing the risk of avascular necrosis and non-union. Inter trochanteric (I/T) fractures can be classified in many ways viz. The goal of treatment of these fractures is stable fixation, which allows early mobilization of the patient. These fractures are associated with substantial morbidity and mortality. Generally, intramedullary fixation and extramedullary fixation are the 2 primary options for treatment of such fractures. Proximal femoral nail (PFN) and Gamma nail are 2 commonly used devices in the intramedullaryfixation. Previous studies showed that the Gamma nail did not perform as well as DHS because it led to a relatively higher incidence of post-operative femoral shaft fracture.[1-3]

PFN, introduced by the AO/ASIF group in 1997, has become prevalent in treatment of intertrochanteric fractures in recent years because it was improved by addition of an antirotation hip screw proximal to the main lag screw. However, both benefits and technical failures of PFN have been reported.[4-6] Hence; the present study was undertaken for comparing the short versus long PFN for treating IT fracturesradiological and functional outcome.

Materials & methods

The material for the present study was obtained from the patients admitted in Bangalore medical college and research institute, department of Orthopaedics with diagnosis of intertrochanteric fractures Boyd & Griffin type 2 and type 3 from September 2017 to August 2019. 142 cases were taken and the patients were informed about the study in all respects and informed consent was obtained from each patient. After admission all the necessary clinical details were recorded in proforma prepared for this study. After the completion of the hospital treatment patients were discharged and called for follow up at outpatient level, at regular intervals for serial clinical and radiological evaluation.

Inclusion criteria

1. Patients with unstable IT fractures according to Boyd and Griffin system of classification (types 2, 3).
2. Patients of either sex equal to or above 18 years of age.
3. Patients who were willing to be part of the study.
4. Patients who gave an informed written consent.

Exclusion criteria

1. Patients with any pathological cause for the fracture.
2. Patients with ipsilateral or contralateral lower limb associated fractures.
3. Loss to follow-up
4. Patients who died before the 6 month follow-up period

Pre op planning

1. Determination of nail diameter: Nail diameter was determined by measuring diameter of the femur at the level of isthmus on an AP X ray.
2. Determination of the neck shaft angle: Neck shaft angle was measured in unaffected side in AP X ray using goniometer.
3. Length of the nail: A short PFN and long PFN were randomly used to treat these fractures.

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Implant details

Proximal femoral nail consists of self tapping 6.5mm hip pin, self tapping 8mm femoral neck screw, 4.9 distal locking screw and an end cap. Proximal femoral nail is made up of either 316L stainless steel or titanium alloy which comes in following sizes.

1. Length: Standard PFN- 250 mm, Long PFN- 340, 380, 420 mm
2. Diameter: 9, 10, 11, 12 mm
3. Neck shaft angle range: 125, 130,135 degree.

The nail is having 14mm proximal diameter. This increases the stability of the implant. There is 6 degree mediolateralvalgus angle, which prevents varus collapse of the fracture even when there is medial comminution.

The distal diameter is tapered to 9 to 12mm which also has grooves to prevent stress concentration at the end of the nail. Proximally it has 2 holes the distal one is for the insertion of the 8mm neck screw which acts as a sliding screw, the proximal one is for 6.5mm hip pin which helps to prevent rotation. Distally nail has two holes for insertion of 4.9mm locking screws, of which one is static and the other one is dynamic which allows dynamization of 5mm.

In our study we used a standard short PFN of 250mm as well as a long PFN of variable length according to the length of the patients Femur with distal diameter of 10,11,12 mm, the proximal diameter of the nail is 14mm. The proximal derotation screw of 6.5 mm and distal lag screw of 8mm. Distal locking done with self tapping 4.9 mm cortical screws one in static mode and other in dynamic mode allowing 5mm dynamisation. The nail is universal with 6 degrees mediolateralangulation and with a neck shaft angle of 135 degrees.

Operative technique

Patient positioning and fracture reduction

The patient is placed in supine position on fracture table with adduction of the affected limb by 10-15 degrees and closed reduction of the fracture was done by the traction and internal rotation. The unaffected leg is flexed and abducted as far as possible or kept in wide abduction. The image intensifier was positioned so that anterior-posterior and lateral views of hip and femur could be taken. Open reduction is performed if closed reduction failed.

The patient is then prepared and draped as for any standard hip fracture fixation Prophylactic antibiotic is given in all patients 30mins before surgery.

Approach

The tip of greater trochanter was located by palpation in thin patients and in obese patients, we used image intensifier. 5cms longitudinal incision was taken proximal from the tip of the greater trochanter. A parallel incision was made in fascia lata and gluteus medius was split in line with the fibres. Tip of 46 greater trochanter is exposed. Determination of entry point and insertion of guide wire In AP view on c-arm, the entry point is on tip or slightly lateral to the tip of greater trochanter. However in intertrochanteric fractures fracture involves tip of trochanter with communition. If it is a simple fracture extending to tip of trochanter without communition, it is easy to put guide pin as fracture site itself provides the entry point. But in practice, there is always some communition at tip of trochanter or fracture line is not exactly through tip. Due to this even if an entry is made in tip of trochanter, due to narrow bone bridge lateral to tip of trochanter and medial to fracture line, guide wire and subsequent reamers fall into fracture line thus making the entry lateral to tip of trochanter. Some times there will be communition with an additional coronal split so that there is no lateral support at the entry region while reaming or putting nail. All these things lead to lateral entry of nail. However we believe these things will not affect the final outcome as communited fragments sit around the nail and mould and unite thus there will not be significant abductor weakness.

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Important technical aspect here is to start the entry from tip of trochanter and slightly anterior in the lateral plane and then aim to pass the guide wire into shaft of femur in the centre, once guide wire is passed into shaft we ignore the lateralization of guide wire at tip of trochanter.
Insertion of the guide wire for neck screw and hip pin
These are inserted with the help of aiming device lightly screwed to the insertion handle. A 2.8 mm guide wire is inserted through the drill sleeve after a stab incision. This guide wire is inserted 5mm deeper than the planned screw size. The guide wire is advanced in to the femoral head at least 4mm superior to the calcar to a level 5mm below the subchondral bone. The final position of the guide wire should be in the lower half of the neck in AP view and in the centre of the neck in lateral view.
A second 2.8 mm guide wire is inserted through the drill sleeve above the first one for hip pin. The tip of this guide wire should be approximately 25-20mm less deep than planned neck screw.

Insertion of the Neck Screw and Hip Pin
Drilling is done over 2.8mm guide wire until the drill is 8mm short of tip of the guide wire. Tapping is not done as neck screw is self-tapping. Neck screw is inserted using cannulated screw driver.

Distal locking
Distal locking is usually performed with two cortical screws. A drill sleeve system is inserted through a stab incision. A drill hole is made with 4mm drill bit through both cortices. Locking screw is inserted and position confirmed with image intensifier.

Closure
After fixation is over, lavage is given using normal saline and incision is closed in layers. Suction drain is used in case open reduction is performed. Sterile dressing applied over wound and compression bandage given.
Total time of the surgery was noted intra-operatively.

Post-operative protocol
a. Patients pulse, blood pressure, respiration, temperature was monitored
b. Limb elevation over pillow and patient kept under observation in recovery room until stable then shifted to ward.
c. IV antibiotics were continued for first 48hrs and then it was shifted to oral.
d. Blood transfusion was given depending on the requirement.
e. Suction drainage was removed after 48hours in case of open reduction.
f. Static quadriceps exercises were started on third postoperative day.
g. Active quadriceps and hip flexion exercises were started on 6th and 7th postoperative day.
h. Dressing was done at 3rd,6th and 10th postoperative day
i. Sutures were removed on 12th postoperative day.
j. Patients were advised to walk non weight bearing walking on axillary crutches as soon as tolerable.
k. Partial weight bearing started at about 6weeks postoperatively.
l. Full weight bearing walking was allowed after assessing for radiological and clinical union.

Discharge
Patients were discharged from the hospital when they were able to ambulate independently with or without walking aids.

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Follow up

Clinical follow up at 6 weeks, 3 months and 6 months regarding disability and functional outcome.

At every visit patient was assessed clinically regarding hip and knee function, walking ability, fracture union, deformity and shortening.

X-ray of the involved hip with femur was done to assess fracture union and implant bone interaction.

Final outcome

Final outcome was assessed with HARRIS HIP SCORING

Results

In our study, majority of the cases i.e. 67% were elderly (> 60 years), 33 % were below 60 years of age. The youngest patient was 30 years and eldest patient was 90 years. The mean age was 63.6 years. Majority of the patients were males 80 (63.3%) and 50 (36.6%) were females. 86 cases (66.20%) affected were due to trivial fall, 26 cases (20%) due to fall from height, and 18 cases (13.80%) were due to road trafficaccident. Out of 130 cases included in our study 80 cases(56.66%) involved on right side and remaining 50 cases on left side. Long PFN took a longer operative time, mean of 91.9 minutes, statistically significant ($p<0.05$) as compared to a mean of 70.3 minutes for performing a Short PFN surgery as shown in table 1. No statistically significant difference was seen in terms of Harris hip score between the two groups of patients at 6 months of follow-up (p value= 0.881) as shown in Figure 1. The mean time to union in fractures treated with Short PFN was 16.6 weeks and for those treated with Long PFN was 17.1weeks as shown in Table 2. Among the short PFN group 3 % of the patients had complications, whereas the long PFN group contributed to 4 % of the complications which is not statistically significant ($p>0.05$) as shown in table 3.

Table 1: Duration of surgery

Duration of surgery	Mean duration
Short PFN	70.3
Long PFN	91.9

Figure 1: Results of functional outcome

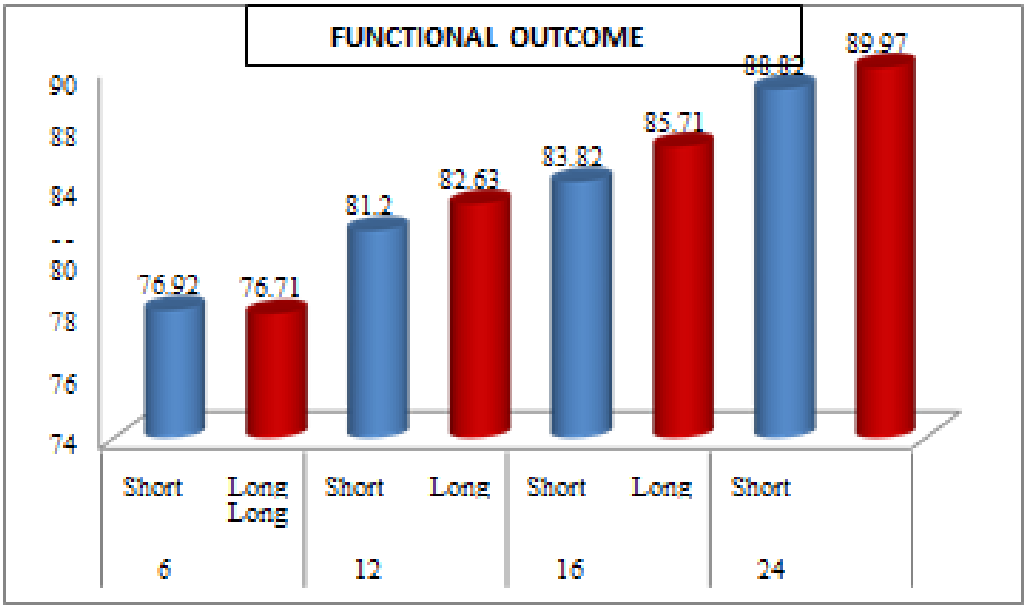

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Table 2: Mean radiological time to union

Type of fixation	Mean radiological time to union(in weeks)
Short PFN	16.6
Long PFN	17.1

Table 3: Complications

Uncomplicated	93%
Short PFN	3%
Long PFN	4%

Discussion

The advancement in modern medicine has enabled many to live long. However, as the age advances so do certain comorbidities. Osteoporosis is one such significant comorbidity. The increased prevalence of hip fractures in osteoporotic individuals is well known. Trivial trauma such as a fall from a standing height is the most common cause for sustaining a fragility fracture. The number of hip fractures has been estimated to rise over the next few years, leading to increasing costs and subsequent rising financial burden. Pertrochanteric fractures are those which are around the trochanteric region of femur. They are classified as 31-A1 pertrochanteric simple, pertrochantericmultifragmentary and 31-A3 intertrochanteric as per the Arbeitsgemeinschaft furOsteosynthesefragen (AO) classification.[6- 10]

There has been considerable debate over the method of treating pertrochanteric fractures. Meta analytical studies in literature have not been able to come to a consensus whether an extramedullary or an intramedullary implant is better in this regard.[9] The PFN-A is available in various sizes. The short version has 170mm, 200mm, 240mm as length and the long version if from 300-420mm with 20mm increments and a bending radius of 1500mm.[10]Hence; the present study was undertaken for comparing the short versus long PFN for treating IT fracturesradiological and functional outcome.

In our study, majority of the cases i.e. 67% were elderly (> 60 years), 33 % were below 60 years of age. The youngest patient was 30 years and eldest patient was 90 years. The mean age was 63.6 years. Majority of the patients were males 80 (63.3%) and 50 (36.6%) were females. 86 cases (66.20%) affected were due to trivial fall, 26 cases (20%) due to fall from height, and 18 cases (13.80%) were due to road trafficaccident. Out of 130 cases included in our study 80 cases(56.66%) involved on right side and remaining 50 cases on left side. Long PFN took a longer operative time, mean of 91.9 minutes, statistically significant ($p<0.05$) as compared to a mean of 70.3 minutes for performing a Short PFN surgery as shown in table 1. Li Z et al compared failure rates between short and long intramedullary nails used for the treatment of intertrochanteric hip fractures in patients over 65 years of age. A retrospective review of 156 patients aged more than 65 years with femoral intertrochanteric fractures from December 2010 to December 2012 was performed. The patients were allocated to two groups: those treated with long nail (n=59) and short nail (n=97). Relevant patient variables and medical comorbidities were collected.. The failure rate was defined as periprosthetic fracture or reoperation requiring removal or revision of nail. Variables were statistically compared between the two groups, with statistical significance at $P<0.05$. Patients treat with long nails and short nails were comparable for all assessed clinical variables ($P>0.05$). There were no statistically significant differences between these groups in intraoperative blood loss, time to fracture union and Harris Hip Score at 1 year postoperatively ($P>0.05$). The long nail group had significantly less failure rate (0/59) and hip pain rate (3/59) than those with short nail (3/97 and 13/97, respectively) ($P < 0.05$), but the operative time was significantly longer in the former (60.60 ± 11.43 minutes) than the latter (53.10 ± 8.51 minutes) group ($P < 0.05$). Both the long and short intramedullary nails are the optional internal fixation choices for

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femoral intertrochanteric fracture in the aged patients older than 65 years. But the long nail could avoid the refracture of femur and reduced postoperative hip pain.[6]

In the present study, no statistically significant difference was seen in terms of Harris hip score between the two groups of patients at 6 months of follow-up (p value= 0.881) as shown in Figure 1. The mean time to union in fractures treated with Short PFN was 16.6 weeks and for those treated with Long PFN was 17.1weeks as shown in Table 2. Among the short PFN group 3 % of the patients had complications , whereas the long PFN group contributed to 4 % of the complications which is not statistically significant (p>0.05) as shown in table 3. Raval P et al compared patients with pertrochanteric fractures treated between January 2011 and June 2012. In all 80 patients were enrolled in the study, of which 40 were treated with short PFNA and the remaining with long PFNA. Comparative analyses of demographic data, peri-operative outcome and complications were carried out. There was no significant difference noted in the two groups with regards to Arbeitsgemeinschaft fur Osteosynthesefragen (AO) fracture classification, time from injury to surgery, blood transfusion post surgery and hospital stay. The surgical duration for a short PFNA procedure was significantly less (58 minutes) when compared to that of a long PFNA (87 minutes). Similarly intra-operative blood loss was significantly higher in the long PFNA group as compared to the short PFNA. A relatively quicker surgical time of just under an hour , lesser blood loss and better learning curve with trainee surgeons make short PFNA a better implant choice in the treatment of pertrochanteric fractures.[11]

Conclusion

This Prospective comparative study between Long and short PFN was performed to assess the functional outcome in the treatment of comminutedintertrochanteric fractures. Our study concludes that Long nails do not offer any advantage over the shorter variant in the treatment of type 2 and type 3 intertrochanteric fractures in terms of functional outcome p value >0.05. Short PFN operative time is less as compared to use of Long PFN. Our study showed no difference in rate of peri-prosthetic fractures between the two , however our follow-up period was only 6 months and to infer on Long term follow-up we have no data. The outcomes of Short and Long PFNs are comparable in terms of function and complication rate. Short PFN does not cause an increased incidence of anterior thigh pain as hypothesized. The limitation of our study is the lack of a long term follow-up preferably 5 years or more and the heterogeneity of the cases in terms of age and associated co-morbidities.Also it is a single centre study.

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