Outcome Of Proximal Femoral Nail in Management of Pertrochanteric Fracture

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Abstract

Background: Fractures around the trochanteric region of femur are one of the commonest fractures encountered in orthopedics. Better understanding of the biomechanics and the development of better implants have led to radical changes in treatment modalities of pertrochanteric fracture femur. This study was undertaken for evaluating the results of Proximal Femoral Nail in the management of pertrochanteric fractures by analysing the factors which influence the post-operative mobility, associated complications and to evaluate the functional outcome.

Material and Method: This prospective study was done in 50 cases of pertrochanteric fracture treated with Proximal Femoral Nail of age more than 20 years. Open, pathological fractures and age less than 20 years were excluded from the study. Outcome was assessed by modified Harris Hip Score system and radiologically for union

Results: 50 Patients of pertrochanteric fracture with mean age 70.4 year (range 25 to 95 years) were included in study. The mean delay in surgery was 3.8 days (range 2 to 8 days). The mean Harris Hip Score at final follow up was 84.32 ± 5.55. 32 (68%) patients had good outcome, 7 (14%) reported with excellent outcome and 5 (10%) had a fair outcome. Only 4 (8%) patient had poor outcome. Union was achieved in all patients in mean 12.02 weeks (range 10 to 14 weeks). The mean surgical time was 71 min (range 63 to 110 min). The mean blood loss in surgery was 180 ml (range 150 to 300 ml). Most common complications was shortening seen in 4 (8% cases), whereas varus, superficial infection and screw cut out was seen in one patients respectively, while Z effect and abductor lurch was seen in two patients each.

Conclusion: The Proximal Femoral Nail, after proper training and technique is a safe and easy implant option for treatment of complex pertrochanteric fractures which has the unique advantages of closed procedure, minimal invasive, preservation of fracture hematoma, less tissue damage, early rehabilitation and early return to work and is biomechanical stable.

Keywords: Proximal femoral nail, pertrochanteric femur fractures, intertrochanteric fractures

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Introduction

Fractures around the trochanteric region of femur are one of the commonest fractures encountered in orthopaedics and also the most devastating injuries of the elderly. The incidence of this fracture increases with advancing age. These pertrochanteric femoral fractures especially in elderly have the high postoperative fatality rate and have become a serious health resource issue because of the high cost of care, prolonged morbidity and

extensive disability unless the treatment is appropriate [1].

Better understanding of the biomechanics and the development of better implants have led to radical changes in treatment modalities of pertrochanteric fracture femur which can be treated with either a sliding hip screw or a trochanteric nail. A problem with sliding hip screws is collapse of the femoral neck, leading to loss of hip offset and shortening of the leg. Although some such sliding is expected, too much shortening is detrimental to hip function. Therefore, Proximal Femoral Nail was designed in 1996 which gives a further advantage of minimally invasive surgery [1].

This study was therefore undertaken for evaluating the results of Proximal Femoral Nail in the management of pertrochanteric fractures by analysing the factors which influence the post-operative mobility, associated complications and functional outcome.

Material and Methods

This prospective study was done at our centre in 50 cases of pertrochanteric fracture treated with PFN between 2014 to 2016 after written informed consent and clearance from institutional ethical committee. Patients with pertrochanteric fractures, with age more than 20 years and fit for surgery were included in the study, whereas skeletally immature individual, open or pathological fractures were excluded from the study.

After obtained medical clearance, all patients were operated under the same spinal anesthesia on fracture table. Primarily closed reduction was obtained and under c arm reduction was checked in AP and lateral views on the fracture table. Proximal femoral nailing was done as prescribed by making entry with awl or thick pin at the priformis fossa after 3 cm incision above the tip of greater trochanter. Guide wire was passed from entry in to the canal and checked under C arm for its placement. Reaming of canal was done in patients having narrow medullary canal to fit largest possible diameter nail in the canal. The nail is passed over guide wire. The holes in PFN were aligned in the direction of neck properly just above the calcar. The guide wire sleeve is targeted through the jig into the corresponding holes of PFN and guide wire is passed in to neck and head of femur. The placement of guide wire was checked under c arm in AP and lateral views and later drilled and fixed with corresponding screws. Distal interlocking was done by free hand technique under c-arm control.

The patients were mobilized in-bed and encouraged to sit in bed and perform static exercises from the next day of operation. At around 14th day postoperatively, the stitches were removed. Touchdown weight bearing with the help of a walker or crutches began two weeks after the surgery. Slowly progressive weight bearing and full weight bearing was started as per pain tolerance of the patient. Functional outcome was assessed by modified harris hip score [2] and radiological X rays were assessed for union.

Results

50 Patients of pertrochanteric fracture with mean age 70.4 year (range 25 to 95 years) were included in study, with more than 60% patients were elderly having osteoporosis. There were 24 females and 26 males in the study. Domestic fall and road traffic accident were the mode of injury in all the patients. As per Boyd & Griffin classification, type 1 fracture was seen in 1 (2%) patient, type 2 in 32 patients (64%), type 3 in 11 (22%) and type 4 in 6 patient (12 %). Right to left side involvement was in 28 to 22 patients respectively. The mean delay in surgery was 3.8 days (range 2 to 8 days). In all patients closed reduction was successful to achieve anatomical reduction, except for 5 patients, in which manipulation / elevation or compression with help of the bone spike was done. The mean surgical time was 71 min (range 63 to 110 min). The mean blood loss in surgery was 180 ml (range 150 to 300 ml). Union was achieved in all patients in mean 12.02 weeks (range 10 to 14 weeks).

The mean Harris Hip Score at final follow up of 6 months in 47 patients was 84.32 ± 5.55. 32 (68%) patients had good outcome, 7 (14%)

reported with excellent outcome and 5 (10%) had a fair outcome. Only 4 (8%) patient had poor outcome (fig 1). There was an statistically significant improving trend in the Harris hip score from 1 month, 3 months to 6 months which was 37.68 ± 5.42, 70.83 ± 5.06 and 84.32 ± 5.55 respectively.

Majority of the patients (74.46%) had either no pain or slight pain which did not affect their activities. Only one patient had severe pain and 19.1% (9) of patients had mild to moderate pain which was relieved with analgesics. 41 patients (86 %) had no or slight limp that did not affect their activities. 6 patient (12.8%) had moderate limp which was mainly due to shortening. 51% patients did not require any support for walking and 25.5% of patients used cane for only long walks, whereas only 2 patients was mobilizing with the help of crutch. 87.2% patient was able to walk outdoor. Only 10.6 % patients walk in indoor area. One patient was not able to walk and stay in bed & chair. 38.29% of patients could climb stairs without any support but 46.8% required the support of railing. 3 patients were unable to climb the stairs. Squatting was possible in 29.8% with ease and with difficulty in 48.9%. 10 patients were not able to squat. Cross leg sitting was possible in 78.7% of the patients, but 48.9% of these patients had some difficulty while doing so. 10 elderly patients were unable to sit cross legged. This restriction of motion was primarily due to osteoarthritis.

Of the 47 patients in this series, 1 patient had shortening of more than 2 cm which required shoe raise. 3 patients had less than 2 cm of shortening and it did not require any treatment, whereas rest had no LLD.

3 patients had implant failure and treated by different surgical procedure after PFN implant removal. Most common complications was shortening seen in 4 (8% cases), whereas varus, superficial infection and screw cut out was seen in one patients respectively, while Z effect and abductor lurch was seen in two patients each (table 1).

Fig 1. Pre-operative AP view of pelvis (a) showing pertrochanteric fracture, which was treated by PFN showing good reduction in immediate AP (b) and lateral (c) X rays of hip with thigh. 6 months postoperative AP (d) and lateral (e) X rays of hip with thigh and clinical photographs (f to h) showing excellent outcome.

Table no.1. Complications after PFN

Complication	No. of Patient
Superficial Infection	1 (2%)
Deep Infection	0 (0%)
Screw Cut-out	1 (2%)
"z" Effect	2 (4%)
Reverse "z" Effect	0 (0%)
Varus Deformity	1 (2%)
Abductor Lurch	2 (4%)
Shortening	4 (8%)
Greater trochanteric splintering	3 (6%)
TOTAL	14 (28%)

Discussion

The successful treatment of Pertrochanteric fractures depends on many factors like age of the patient, patient's general health and comorbidities, time from fracture to treatment, adequacy of treatment and stability of the fixation. Current recommendations suggest that all pertrochanteric fractures should be internally fixed to reduce the morbidity and the mortality of the patient. But the appropriate method and the ideal implant

by which to fix the pertrochanteric fracture is still in debate [1].

Several fixation devices have been developed to overcome the difficulties encountered in the treatment of unstable trochanteric fractures. Until recently most of these fractures were treated by sliding hip screw. Since these devices performed less well in unstable trochanteric fractures with high rates of failure, intra medullary devices have become increasingly popular. The proximal femoral nail is an effective load sharing device that incorporates the principles and theoretical advantages of all the intra medullary devices [3]. Biomechanically, PFN is better as it is stiffer; it has a shorter lever arm (i.e. from the tip of the lag screw to the center of the femoral canal) whereas the DHS has a longer lever arm (i.e. from the tip of the lag screw to the lateral cortex). The DHS with a longer lever arm undergoes significant stress on weight bearing and hence higher incidence of lag screw cut out and varus malunion [4]. PFN can be done closed, which provided advantages of minimal blood loss, shorter operative time and early weight. PFN provides a dynamic femoral neck screw and splints whole of the femer [5].

We evaluated the outcome of PFN in 50 patients of pertrochanteric fracture and found excellent to good outcome in 39 (78%) cases, whereas poor outcome in 4 (8%) cases with mean Harris Hip Score at final follow up of 84.32 ± 5.55. The results are comparable with the studies done by Pajarinenet al, Saudanet al, Zhoa et al, kumar al, Bhakatet al and Huang et al [7-12]. Anatomic reduction before nailing is a prior requirement for the excellent outcome of surgery. We also achieved closed reduction in all patients except 10%, in comparison to 9% by Boldinet et al which required additional methods for reduction like elevation with spike [13].

The mean surgical time in our series was 71 min, which was comparable to other studies [6-12]. The surgical time was reduced greatly in the later part of the study, indicating that proximal femoral nailing requires learning curve. The average intra operative blood loss was 180 ml and only 22% of our patients required intra or post-operative transfusion, but this was because many of our patients were anaemic. The average union time was 12.02 weeks in our series. We did not found any case of non-union in our study.

We had "Screw Cut-out" in 2% and "z" effect in 4% of patients which was mostly due to suboptimal placement of the hip screw or cervical screw along with early mobilization of the patients who had severe osteoporosis. Hence these 3 patients required revision surgery. One patient with "z" effect treated with PFN implant removal and fixed was by DHS. Another two patients with "z" effect and screw cut-out required calcar replacing cemented bipolar prosthesis. Only one patient with shortening of more than 2 cms required shoe raise, while none other needed any treatment for shortening. Abductor lurch was seen in two patients in the post-operative period which, improved with progression of time. This has been attributed to Gluteus medius tendon injury in patients treated with IM devices [7]. 6% of our patients had greater trochanter splintering while inserting the nail but no other intervention was required and all the fractures healed well. Infection was present in 2% of the patients which was superficial and was treated with antibiotics and dressing only and none required debridement or revision and healed well.

Pajarinen et al on comparison of PFN with DHS, found that use of the proximal femoral nail may allow a faster postoperative restoration of walking ability [7], whereas Saudan et al concluded no advantage of intramedullary nail over sliding compression hip screw for low-energy pertrochanteric fractures [8].

Kumar et al and Bhakatet et al concluded that DHS was tolerated better by young patients with stable fracture while PFN had a better outcome with osteoporotic patients and weak bone mass and reverse oblique fractures. PFN group has less blood loss and less operating time compared to DHS group. In the long term both the implant had almost similar functional outcomes [10,11]. Whereas Huang et al in his

meta-analysis concluded that PFN fixation shows the same effectiveness as DHS fixation with respect to operation time, blood transfusion, hospital stay, wound complications, number of reoperation, and mortality rate [12].

We found proximal femoral nail to be more useful in unstable and reverse oblique patterns due to the fact that it has better axial telescoping and rotational stability. It has shown to be more biomechanically stronger because they can withstand higher static and several fold higher cyclical loading. So the fracture heals without the primary restoration of the medial support. The implant compensates for the function of the medial column. Intramedullary proximal femoral nail also acts as a buttress in preventing the medialization of the shaft. Also, proximal femoral nail is long and it has smaller diameter at the tip which reduces the stress concentration at the tip. Hip screw and the anti-rotation cervical screw of the Proximal femoral nail adequately compress the fracture, leaving between them adequate bone block for further revision, if need arise.

We in our study found success of Proximal femoral nail depends on good surgical technique, proper instrumentation and good C-arm visualization and it had advantages of easy reduction with traction, lesser assistance, easy patient manipulation and better C arm visibility. Proximal femoral nail is costly than the dynamic hip screw, but it provided advantages like less operative time, lower blood loss, lesser hospital stay and lesser medications as minimal invasive, thus reducing the overall cost and early return to daily activities.

Conclusion

Proximal femoral nail can be considered the most judicious and rational method of treating pertrochanteric fractures, especially the unstable and reverse oblique type as it is minimal invasive, with preserves the fracture hematoma, yields early healing and early union. Minimal invasive also confirms quick procedure, small incision, significantly less amount of blood loss, lesser hospital stay and early mobilization. But Proximal femoral nailing requires a higher surgical skill, good fracture table, good instrumentation and good C-arm control. It has a steep learning curve. Proximal Femoral Nail, after proper training and technique a safe and easy implant option for treatment of complex pertrochanteric fractures which has the unique advantages of closed reduction, preservation of fracture hematoma, less tissue damage, early rehabilitation and early return to work.

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