A Prospective Study of Clinicoradiological Outcome Assessment in Proximal Femoral Fractures Treated with Proximal Femoral Nail

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ABSTRACT

Introduction: Proximal femoral Fractures are a major source of morbidity and mortality in today's ageing population. The incidence of pertrochanteric femoral fractures has increased significantly during recent decades. The goal of the treatment of these fractures is stable fixation, which allows early mobilisation of the patient. Hence we conducted a prospective study to assess the clinical and radiological outcomes in pertrochanteric fractures treated with PFN.

Material and methods: 22 Patients aged >20yrs with proximal femoral fractures treated surgically with proximal femoral nail in our institution were included in the study from June 2013 to November 2014. Detailed clinical and radiological assessment of injured limb done and suitably classified according to seinsheimer. All fractures were managed surgically with PFN. Assessment of the end result was done by the kyle's[15] criteria.

Results: 22 patients are treated in study period. 16 cases were in the age group between 50-70 years. 17 patients were male and 5 were female. 86% patients were involved in motor vehicle accidents, 14% in fall from height. Right side was involved in 18 cases and left in 4 cases. Mean duration of radiological union was 4 months. Early complications include shortening in 2 cases, rotational deformity in 4 cases, superficial infection in 2 cases and late complications include Non union in 1, delayed union in 2, malunion in 3 cases, knee stifness in 2 cases. Kyle's criteria is used for assessment of outcome.

Conclusion: Unstable proximal femoral fractures tend to occur in the very elderly and debilitated, resulting in a relatively high rate of complications. PFN is a good minimally invasive implant for unstable proximal femoral fractures when closed reduction is possible. We believe that the PFN is the implant of choice for stabilising subtrochanteric fractures. We also believe that the use of the PFN for unstable trochanteric fractures is very encouraging.

Keywords: Clinicoradiological Outcome, Proximal Femoral Fractures, Proximal Femoral Nail

INTRODUCTION

Proximal femoral Fractures are important cause of morbidity and mortality these days in aged population.[1] More than ninety percent of hip fractures occur after the age of 65 years and they are frequently associated with age related diseases.[2] The incidence of pertrochanteric fractures are rising these days due to rise in population and it continues to rise till control of rise in population.[3,4] The goal of the treatment of these fractures is stable fixation, which allows early mobilisation of the patient. To return to preinjury function and activity levels, early operative interventions have become the preferred solution for the treatment of senile femoral intertrochanteric fracture.[5] The DHS and its variants had been considered the standard implant in the treatment of pertrochanteric hip fractures[6] with a high cost performance for stable intertrochanteric fracture.[7] However, for unstable intertrochanteric fractures, the failure rate is higher.[8-10] The load bearing in the proximal femur is mainly through posteriomedial cortex i.e. calcar femorale and fixation with sliding hip hip screw is definitely inferior to intramedullary devices due to load sharing property of intramedullary devices. (Fig 1). And hence sliding hip screw cannot be used in unstable and subtrochanteric fractures. For stable fractures, biomechanical failure of sliding hip screw does not appear to result in a significant difference in failure rate and so the DHS is preferred implant. For unstable fractures, the failure rate for a DHS is as high as 21%.[11]

The proximal femoral nail (PFN) was introduced to increase the efficiency of roational instability and it also has property of load bearing, sliding with a neck screw. Proximal femoral nail was introduced way back in 1997 and many clinical studies[12,13] have shown good results with few intra-operative problems and a low rate of complications.[14] We felt there was a need to investigate the clinical relevance of the presumed advantages and lower complication rates associated with use of a PFN for pertrochanteric fractures in our setup. We therefore initiated a prospective study to assess the clinicoradiological outcomes in pertrochanteric fractures treated with PFN.

MATERIAL AND METHODS

After obtaining ethical clearance from the institute (Bangalore medical college and research institute) and consent from the patients, study was conducted between June 2013 to November 2014, 22 patients with proximal femoral fractures treated surgically with proximal femoral nail in our institution were included in the study. Patients who fulfilled the inclusion criteria were included in the study. Inclusion criteria were 1.All proximal femoral fracture including intertrochantric and subtrochantric region. 2. Age of the patient > 20 years. Exclusion criteria were 1. Age of the patient < 20 yrs. 2. Compound fractures. 3. Pathological fractures. 4. Patients with associated injuries in the same limb or other limbs.

After hemodynamic stabilization of the patients, AP and

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lateral views of the involved extremity was obtained along with routine blood investigations. Age, gender, pre-fracture walking ability, ASA grade and mechanism of injury were recorded preoperatively. The operation was usually performed within two days of admission, in most cases. All fractures were reduced by closed means with a fracture table. The standard PFN (with a length of 240 mm) and diameter of 9 mm, 10 mm or 11 mm was used by using a 5-cm skin incision which extended from the cranial part to the tip of the greater trochanter. After penetrating the fascia and muscles, a 2.8 mm K-wire was inserted at the tip of the greater trochanter under fluoroscopic control in both planes. The proximal part of the femoral shaft was reamed with a 17-mm reamer. The nail was then introduced manually into the femoral shaft. Using C-arm control the first guide wire for the neck screw was placed in the femoral neck so that the screw could be placed in the lower half of the neck on the anteroposterior view and centrally/or slightly posterior on the lateral view. Then the guide wire for the antirotational hip screw was introduced. Depending on the type of fracture, distal static or dynamic interlocking was done using the distal aiming device. All patients received a prophylactic dose of an intravenous antibiotic, and were also treated with low-molecular-weight heparin during their stay in hospital. Patients were allowed to perform quadriceps-strengthening exercises the next day. Partial weight-bearing was allowed. Sutures were removed on post op day14. In case of stable fractures full weight bearing was allowed at 6 weeks and in unstable fractures weight bearing was delayed until patient is free of pain and bony union is seen in xrays. Post operatively patients were followed up at 6 weeks, 3 months, 6 months, and 12 months. At each follow up patients were assessed with xrays by AP and lateral views of the operated limb and functional assessment was done in terms of pain, ROM, return to work was carried out. The functional outcome was assessed by kyle's[15] criteria.

Data collection: The following data were collected: patient's demographic information, medical history, causes and classification of each fracture, fracture union, the time to union, osteosynthesis complications, wound infection, deep vein thrombosis, pulmonary embolism and cardiovascular events. Bone union was defined if AP and lateral X-ray showed bone formation across fracture site within 6 month after fixation. Delayed union was defined if bone union occurred 6 to 9 months after fixation. Non union was defined if patients had consistent pain and bone union failed to occur even after > 9 months after fixation.

RESULTS

Of the 22 cases included in the study, 16 (72.7%) cases were in the age group between 50-70 years. 17 (77.2%) male and 5 female patients were included in the study. In our study 86 % of the patients had injuries due to road traffic accident, remaining 14 % sustained injury by fall from height. 18 fractures (81.8%) were right sided fractures. The fractures were classified according to seinsheimer's classification and 8 (36.4%) cases were type 3 fractures involving the unstable variety of fractures. 16 (72.7%) cases were subtrochanteric fractures of which 4 (18.3%) fractures had extension into the intertrochanteric region i.e seinsheimer type 5 fractures. 6 (27.3%) cases were pure intertrochanteric fractures. The mean duration of surgery in 18 cases was about 90 min (35-110min) and in the rest it was more than 90min. The average duration of union in our subtrochanteric fractures was 4 months (3.7- 5.6months). Of the 16 subtrochanteric fractures 13 cases showed union (Fig 1,2,3), 2 cases showed delayed union which went on to unite within 9 months and 1 case of non union which had to be revised. In the intertrochanteric fracture group all the 6 cases went on to unite in an average span pf 3.8months (3.4- 4.2months). Excellent and good re-

Figure-1: Subtrochanteric fracture.

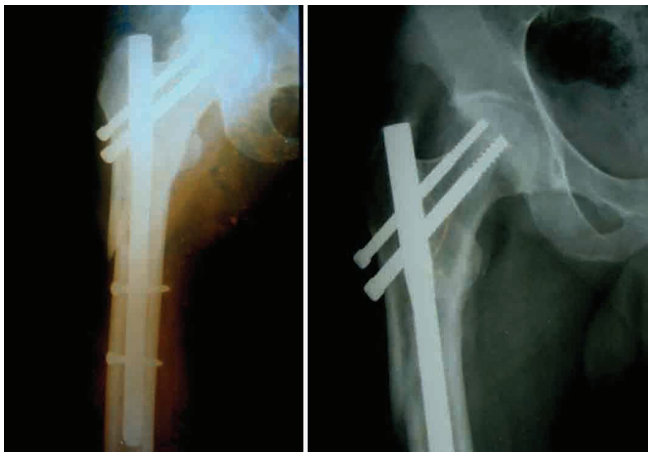

Figure-2: Immediate post OP X- ray; **Figure-3:** 4 Months post OP X-ray.

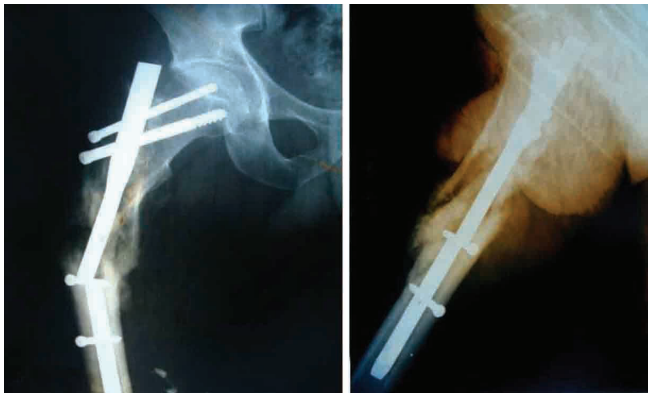

Figure-4: Non union and implant failure.

sults according to Kyle's criteria was considered satisfactory outcome and fair and poor results was considered unsatisfactory outcome. In our study 17 (77.2%) cases had satisfactory outcome.

Complications in our study were divided into early and late complications. The same is shown in table 1, 2.

In our study superficial infection was encountered in 2 patients which settled with wound debridement and IV antibiotics. Shortening and rotational deformity was seen in 4 patients with subtrochanteric fractures. 1 implant failure (Fig 4) occurred in subtrochanteric fracture patient. We did not encounter any intraoperative complications during our study period.

Sl. No.	Complications	No. of patients	
		Subtrochanteric	Intertrochanteric
1	Shortening	2	
2	Rotation deformity	2	2
3	Superficial infection	1	1
4	Deep infection	0	0
5	Bed sores	0	0
6	Mortality	0	0

Table-1: Early complications.

Sl. No.	Complications	No. of patients	
		Subtrochanteric	Intertrochanteric
1	Malunion	2	1
2	Non union and implant failure	1	0
3	Delayed union	2	0
4	Knee stiffness	2	0

Table-2: Delayed complications.

DISCUSSION

The treatment of pertrochanteric fracture is still associated with some failures. The reasons are attributed to biomechanics, overestimation of potentials of new surgical techniques and new implants, or poor adherence to established procedures. 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 elderly patients. Closed reduction of the fracture preserves the fracture hematoma, which is very crucial for fracture healing. The advantage of Intramedullary fixation is minimal soft tissue dissection which inturn reduces surgical trauma, blood loss, infection, and wound complications. Before proximal femoral nail, intramedullary device used for these fractures was the Gamma Nail, which was discontinued because of its high failure rate as high as 10 percent.[16] These failures are collapse of the fracture area, cut-out of the neck screw and fracture of the femur shaft at the tip of the implant. In order to eliminate these drawbacks a new device was developed by AO/ASIF: the proximal femoral nail (PFN), with as main differences an additional antirotational hip pin preventing rotation and collapse of the head and neck fragment and an especially shaped tip together with a smaller distal shaft diameter resulting in less stress concentration at the tip. Placement of the lag screw must be central in lateral view and inferior in AP view in order to provide space for the anti-rotation hip pin or else this screw might be placed in anterior or superior position risking a high rate of cut out or back out. In the literature, cut-out frequencies in proximal femoral fractures have been reported in up to 10%.[17] Among the patients in whom cut out of implant was occurred, 80 percent of them are associated with difficult reduction and non anatomical but acceptal position of neck screws. In our study there was no case of screw cut out as great care was taken in proper positioning of the screw and adequate length of the screw. Another complication is the lateral protrusion of the proximal screws, because of impaction of the fracture. Suboptimal reduction, malpositioning of the implant, or the combination of both may contribute to collapse of the fracture, irrespective of the implant used, and may facilitate the dynamisation and lateral protrusion of the hip screw(s). In our study there was no such compliacation encountered, we neither had any case of intraarticular penetration of the proximal screw so called 'Z' effect. There was one case of implant failure in our study. The fracture had failed to unite and the patient was walking independently, so the nail was taking all the patient's weight. The non union was due to the mechanical problem of distraction at the fracture site. The implant broke at the distal locking bolt level. The broken implant was removed, the fracture site was debrided and the bone was grafted, and another PFN was inserted. The fracture united at 3.5 months

CONCLUSION

Unstable proximal femoral fractures tend to occur in the very elderly and debilitated, resulting in a relatively high rate of complications. PFN is a good minimally invasive implant for unstable proximal femoral fractures when closed reduction is possible. The surgical technique involved is relatively straight forward, involves very minimal soft tissue handling. Post-operatively, we found a good union rate at 4 months, no cut-out for unstable fractures and no low energy fractures below the tip of the implant. We believe that the PFN is the implant of choice for stabilising subtrochanteric fractures. We also believe that the use of the PFN for unstable trochanteric fractures is very encouraging.

REFERENCE

1. Freeman, C. Todd, C. Camilleri-Ferrante et al.Quality improvement for patients with hip fracture: experience from a multi-site audit. Quality and Safety in Health Care. 2002;11:239–245.
2. H. H. Sherk, C. T. Vangsness, G.Thabit III, and R. W. Jackson. National consensus conference on improving the continuum of care for patients with hip fracture. Journal of Bone and Joint Surgery. 2002;84:670–674,.
3. Kannus P, Oarkkari J, Sievänen H, et al. Epidemiology of hip fractures. Bone. 1996;18:57-63.
4. Gullberg B, Duppe H, Nilsson B, et al. Incidence of hip fractures in Malmö. Bone. 1993;14:23-9.
5. P. A. Cole and M. Bhandari. What's new in orthopaedic trauma. Journal of Bone and Joint Surgery. 2005;87: 2823–2838.

6. T. Cheng, G. Zhang, and X. Zhang. Review: minimally invasive versus conventional dynamic hip screw fixation in elderly patients with intertrochanteric fractures: a systematic review and meta-analysis. Surgical Innovation. 2011;18:99– 105.
7. D. G. Lorich, D. S. Geller, and J. H. Nielson. Osteoporotic pertrochanteric hip fractures:management and current controversies. Journal of Bone and Joint Surgery. 2004;86:398–410.
8. W.-Y. Kim, C.-H. Han, J.-I. Park, and J.-Y. Kim. Failure of intertrochanteric fracture fixation with a dynamic hip screw in relation to pre-operative fracture stability and osteoporosis. International Orthopaedics. 2001;25:360–362,.
9. G. J. Haidukewych, T. A. Israel, and D. J. Berry. Reverse obliquity fractures of the intertrochanteric region of the femur,Journal of Bone and Joint Surgery. 2001;83:643–12.
10. Saarenp¨a¨a, T. Heikkinen, J. Ristiniemi, P. Hyv¨onen, J. Leppilahti, and P. Jalovaara. Functional comparison of the dynamic hip screw and the Gamma locking nail in trochanteric hip fractures: a matched-pair study of 268 patients. International Orthopaedics. 2009;33:255–260.
11. Wolfgang GL, Bryant MH, Oneil JP. Treatment of intertrochanteric fractures of the femur using sliding screw plate fixation. Clin Orthop. 1982;163:148–58.
12. Schwab E, Höntzsch K, Weise K. Die Versorgung instabiler perund subtrochantärer Femurfrakturen mit dem Proximalen Femurnagel (PFN). Akt Traumatol. 1998;28:56-60.
13. Simmermacher RK, Bosch AM, Van der Werken Ch. The AO/ASIFproximal femoral nail (PFN): a new device for the treatment of unstable proximal. Injury 1999;30:327-32.
14. Sadowski C, Lubbeke A, Saudan M, et al. Treatment of reverse oblique and transverse intertrochanteric fractures with use of an intramedullary nail or a 95 degrees screw-plate: a prospective, randomized study. J Bone Joint Surg [Am]. 2002;84-A:372-81.
15. Kyle R.F., Gustillo R.B. Analysis of six hundred and twenty two intertrochanteric hip fractures J.B.J.S (Am), 1979:61:216-21.
16. Friedl W. Vergleichende Untersuchung der Gammanagel(G)- und Gleitnagel (GN)-osteosynthese bei perund subtrochantaÈ - ren Femurfracturen. Hefte Unfallchir. 1996;262:4.
17. Euler E, Huber St, Heining S, Schweiberer L. Spannungsoptische Untersuchung unterschiedlicher Stabilisierungsverfahren bei pertrochantaÈ ren Femurfracturen. Hefte Unfallchir. 1996;262:2.
18. Wu CC, Shih WLT, Lee MY, Tai CL. Biomechanical analysis of location of lag screw of a dynamic hip screw in treatment of unstable intertrochanteric fracture. J Trauma 1996;41:699-702.

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