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A STUDY ON FUNCTIONAL OUTCOME OF SURGICAL MANAGEMENT OF PROXIMAL FEMUR FRACTURES WITH PROXIMAL FEMUR NAIL A2 (PFNA2)

Orthopaedics

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ABSTRACT

OBJECTIVE: To evaluate the functional outcome of surgical management of proximal femur fractures treated with proximal femur nail A2.
BACKGROUND: Fractures of the proximal femur of the hip are relatively common injuries in adults. Dissatisfaction with use of a sliding hip screw in unstable fracture patterns lead to the development of intra medullary devices like PFN. This design offers potential advantages like more efficient load transfer, decrease tensile strength on the implant, controlled fracture impaction, reduces amount of sliding and therefore limits limb shortening and deformity, shorter operative time and less soft tissue dissection potentially resulting in decreased overall morbidity. Proximal femoral nail antirotation (PFNA) devices have been introduced as an intramedullary option in recent years. These devices were developed to obtain better fixation strength in the presence of osteoporotic bone.The blade has a significantly higher cut-out resistance than other commonly used screw systems, thus be a more biomechanically suitable implant for unstable pertrochanteric fractures in osteoporotic bones.
METHODS: This is a prospective study of 31 cases of fresh intertrochanteric and sub trochanteric fractures admitted to Vydehi Institute of Medical Sciences & Research Centre, Whitefield Bangalore between January 2018 to June 2019. Cases were taken according to inclusion and exclusion criteria. Results were evaluated by fracture union on X-ray and Modified Harris hip score.
RESULTS: In our series of 31 cases there were 20 males and 11 females, maximum age of 80 years and minimum age of 18 years, most of the patients were between 40 to 65 years. Mean age of 57.7years, of cases were admitted due to slip and fall. Functional outcome was evaluated by Modified Harris hip score at 6 months and 1 year follow up. 3 patient lost follow up (2 died/1 did not come for follow up).Excellent to good results were seen in 23 patients (88%) with intertrochanteric # and 4 patients (80%) with sub trochanteric .**CONCLUSIONS:** From this study, we consider that PFNA2 is an excellent implant for the treatment of unstable inter trochanteric and sub trochanteric fractures of femur especially in the elderly with osteoporosis. The terms of successful outcome include a good understanding of fracture biomechanics, proper patient selection, good preoperative planning and accurate instrumentation.

KEYWORDS

PFNA2, Intertrochanteric, Sub trochanteric.

INTRODUCTION

Proximal femoral fractures are commonly seen in patients over 60years of age. In younger population, proximal femoral fracture occurs due to high velocity trauma, whereas in elderly population, it is most often due to trivial trauma. Pertrochanteric fractures of femur possess clinical, structural, anatomical and biomechanical characteristics that distinguish them from intra capsular fractures. Inter trochanteric fractures comprises about 10 to 34% of hip fractures.[1]

The incidence of pertrochanteric fractures is gender and race dependent and varies from country to country. In the United States, the annual rate of per trochanteric fractures in elderly females is about 63 per 100,000, in males 34 per 100,000.[2]

Per trochanteric fractures can be managed by conservative or operative methods. Conservative methods were the treatment of choice until 1960 before the introduction of new fixation devices. If suitable precautions are not taken the fracture under goes malunion leading to Varus and external rotation deformity at the fracture site with shortening and limitation of hip movements. As conservative methods resulted in higher mortality rates and complications like decubitus ulcer, urinary tract infections, pneumonia, thromboembolic complications these methods have been abandoned.[2,3]

Subtrochanteric fractures are complicated by malunion and delayed union and nonunion. The factors responsible for these complications in subtrochanteric fractures are high stress concentration, predominance of cortical bone and difficulties in getting biomechanically sound reduction because of communition and intense concentration of deforming forces.

Rigid Internal fixation and early mobilization has been the standard method of treatment.[3]

DHS with side plate assembly is most commonly used device for fixation of intertrochanteric fractures. It is a non-collapsible fixation device, which permits the proximal fragment to collapse or settle on the fixation device seeking its own position of stability.[4]

The sliding hip screw had been considered the choice because fracture union predictably occurs. A problem with sliding hip screws is collapse of the femoral neck, leading to loss of hip offset and shortening of leg.[4]

Therefore a new intramedullary device Proximal Femoral Nail was designed in 1996 which gives an advantage of minimally invasive surgery. Being intra medullary, load transfer is more efficient. Shorter lever arm results in less transfer of the stress and hence less chance of implant failures .Advantage of controlled impaction is maintained. Amount of sliding is limited by intramedullary location, therefore less chance of shortening and deformity. Shorter operative time, less soft tissue dissection and less blood loss.[5]

Proximal femoral nail antirotation (PFNA) devices have been introduced as an intramedullary option in recent years. These devices were developed to obtain better fixation strength in the presence of osteoporotic bone and consist of an intramedullary nail with a proximal angulation of 6 degree that is available in short and long versions. Compaction of cancellous bone by the helical blade into the femoral head increases rotational stability of cervicocephalic fragments and decreases load on the femoral head. Biomechanical testing has demonstrated that the blade has a significantly higher cut-out resistance than other commonly used screw systems. The PFNA blade may thus be a more biomechanically suitable implant for unstable pertrochanteric fractures associated with osteoporotic bone.[6,7]

The PFNA2 device was recently introduced and appears to be better suited to the typical Asian patient who has smaller femurs. Here is an effort to carry out a prospective study on evaluation of clinical & functional outcome in extracapsular proximal femur fractures surgically treated with proximal nail Antirotation 2 (PFNA2).

METHODOLOGY

The material for the present study was obtained from the patients admitted in Vydehi Institute of Medical Sciences and Research Centre, Department of Orthopedics, Whitefield, Bangalore with diagnosis of intertrochanteric fractures and subtrochanteric fractures from January 2018 to June 2019 .A minimum of 31 cases were taken and the patients were informed about the study in all respects and informed consent was obtained from each patient.

After the patient with pertrochanteric fracture was admitted to hospital all the necessary clinical details were recording proforma prepared for this study. After the completion of the hospital treatment patients were discharged and called for follow up at out patient level, at regular intervals for serial clinical and radiological evaluation.

Inclusion Criteria:

Patients between 18-80 years both sex with Per trochanteric, intertrochanteric, sub trochanteric & pathological fractures who are considered for surgery.

Exclusion Criteria: -

Isolated or combined medial femoral neck fractures.

- Proximal femur fracture treated with other modalities.
- open Proximal femur fractures.
- Associated fractures of the ipsilateral or contralateral limb.
- Patients who **are medically unfit for surgery.**

RESULTS

The following observation were made from the data collected during this study of PFNA2 in the treatment of 31 cases of Inter trochanteric and Subtrochanteric fractures of proximal femur in the Department of Orthopaedics, Vydehi Institute of Medical Sciences & Research Centre from January 2018 to June 2019.

Majority of the cases i.e. 15 (48%) were in the age group of 41-60years, followed by 11 cases in the age group 61-80years.The youngest patient was 31years and eldest patient was 80years.The mean age was 57.9years. Right side is involved in 11 cases, left in 20 cases. Intertrochanteric fracture accounted for 83.8%(26) while Subtroch anteric fracture accounted for 16.1%(5). 25% (7) showed union at 12 weeks, 67% (19) showed union at 16 weeks, 7% (2) showed union at 20 weeks. 6.4% (2) had superficial infection , lateral hip pain in 12.9% (4), bed sore in 6.4%(2) and helical blade back out in 3%(1).

DISCUSSION

The successful treatment of proximal femur fractures depends on many factors like: Age of the patient, Patient's general health, Time from fracture to treatment, The adequacy of treatment ,Concurrent medical illness, Stability of fixation. At present it is generally believed 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 a debate. Because each method having its own advantages and the disadvantages. High stress concentration that is subjected to multiple deforming forces,slow healing time because of predominance of cortical bone, decreased vascularity , high incidence of complications reported compels the surgeon to give a second thought regarding selection of proper implant. The most common current modes of fixation are blade plate system, sliding screw systems and intra medullary devices. Intra-medullary nail systems inserted by means of minimally invasive procedure offer many biomechanical advantages over extra-medullary systems in the treatment of unstable pertrochanteric fractures in elderly patients with osteoporosis. The mechanical axis of the intra-medullary system is close to the centre of the body, decreasing the lever arm of the implant and hence offering better mechanical properties. The implant also acts as a buttress against medialisation of the shaft. They also offer biological advantages like decreased periosteal stripping and decreased blood loss as compared to extra medullary implants. Closed reduction preserves the fracture hematoma, an essential element in the consolidation process. The use of intra-medullary nails for intertrochanteric fractures gained popularity in the 1980s. The earliest nails used were the Gamma nailsand the Russell-Taylor Reconstruction nail. However, they were associated with complications like cut out and medial penetration of the hip screw. To overcome these problems, the AO/ ASIF group introduced the Proximal Femoral Nail (PFN) in 1998. Despite having advantages over the previous versions, the PFN was associated with complications like proximal screw cutting, Z effect and iliotibial tract irritation. The design of the PFN was improved and the Proximal Femoral Nail Antirotation (PFNA) was introduced in 2003. The main change made was the replacement of the lag screws with a helical blade, which has a gradually increasing diameter, to allow for compression of the bone around the femoral head, thereby allowing antirotation. The use of PFNA in Asian patients, with relatively shorter stature than western population, was found to have complications like nail tip impingement over anterior femoral cortex, femoral fractures at the nail tip and soft tissue irritation at the proximal part. To overcome these problems, the PFNA was further modified to suit the Asian population and the PFNA-II was introduced in 2008. The proximal nail diameter was reduced from 17mm to 16.5mm, the medio-lateral angle was reduced from 6 to 5 degree and the proximal lateral surface was made more flat. Xie H et al[8] performed a comparative study of results of Dynamic Hip Locking Plates (DHLP) and PFNA-II for unstable intertrochanteric fractures. They recommend the use of PFNA-II for such fractures because of its shorter operation time, faster full weight bearing, faster recovery and lower failure rate. They also had excellent to good results, as assessed by the Harris Hip Score, in 80% of their patients at 6 months follow up. Macheras et al[9] performed a retrospective comparative study of unstable peritrochanteric fractures treated by PFNA and PFNA-II. They concluded that the PFNA-II avoids lateral cortex impingement and provides fast and stable fixation for such fractures. The mean Harris Hip Score of their patients at 12 month follow up was 81.42. Yaozeng et al.[10] reported 6 (5.6%) intra operative femoral shaft fractures in their series of 107 intertrochanteric fractures No cases of intra operative femoral shaft fractures were noted in our study. Adequate reaming of the femoral canal especially when using longer nails can decrease the incidence of this complication. In the present study 31 patients of either sex with pertrochanteric fractures were studied. Average age was 58 years which was slightly higher but was comparable to Indian as well as western authors with similar study.We had a male predominance when compare to females. The most common mode of injury in our study was domestic fail 83.9%, which is comparable to most of the Indian studies.

This was also affected by the age as the older the patient more likely he/she getting the fracture by domestic falls .Osteoporosis was measured by the singh's index. More osteoporosis was present in the older patient and post menopausal females. The average intra operative blood loss was very minimal and was more in patients who required a limited open reduction.The average operating time was 55 mins from the incision to closure. We had a greater operating time in the beginning which reduced greatly in the later part of the study. This signifies the learning curve of the Proximal femoral nailing.No intra operative femur fracture compare to Yaozeng et al[10]. where they reported 6 cases . The average hospital stay was 13.4 days. It was more in patients with co-morbid conditions. Infection was present in 6% of the patient it was superficial which was treated with antibiotics and dressing in the ward, none required debridement or revision and healed well. A major complication of Helical blade back out was reported in 1 of our case who was adviced hemi Arthroplasty and patient lost follow up. Keshav Shenoy et al[11] reported 1 of case of Helical blade back out . In our study 2(7%) patients died before 3 month follow up because of comorbid conditions which is compared with the study of Hebattu-allah et al who showed 15% mortality at 3-6 month follow up.58 In our study, the functional outcome was evaluated by the Harris Hip Score at 6months & 1 year follow up. Excellent to good results were seen in 24(85%) patients compare to Macheras et al (81%) , Xie H et al (80%). 26 (92%) patients were ambulatory, with or without support at 1 year follow up. The 2 patients who remained bed ridden were so because of advanced age, and multiple medical co-morbid conditions. Hence PFN A2 is a better implant with specific design superior to conventional PFN and with distinct advantages over other implants to treat pertrochanteric fractures. With adequate surgical technique, the advantages of the PFNA2 increases and the complication rate decreases.

CONCLUSION

Operating with PFN A2 has distinct advantages over conventional PFN or DHS like shorter operating time and lesser blood loss in elderly, osteoporotic unstable trochanteric fractures. The operative time is less compared with other procedures. Early mobilization and weight bearing is allowed in patients treated with PFNA2 thereby decreasing the incidence of bedsores, lung infections, DVT. The incidence of postoperative femoral shaft fractures, helical blade cut off can be reduced by good preoperative planning and correct surgical technique, adequate reaming of the femoral canal, insertion of implant

and meticulous placement of distal locking screws and post operative rehabilitation. PFN A2 is a significant advancement in the treatment of proximal femur fractures which has the unique advantage of closed reduction, preservation of fracture hematoma, minimal soft tissue damage during surgery, early rehabilitation . Hence we conclude, that the PFNA-II is an effective treatment modality for intertrochanteric and subtrochanteric fractures especially in the elderly with osteoporosis, providing excellent functional outcome and regaining the pre-fall ambulatory status with minimal complications. However, proper operative technique is important for achieving fracture stability and to avoid major complications.

Table 1: Patient Demographics.

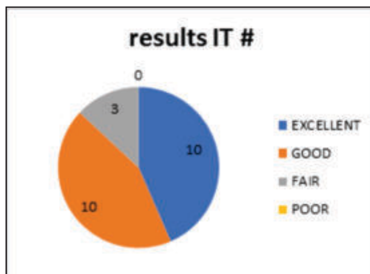
TABLE 1. PATIENT DEMOGRAPHICS		
MEAN AGE (YEARS)		57.9
TOTAL NUMBER OF PATIENTS		31
	MALE	20
	FEMALE	11
SIDE OF INJURY		
	RIGHT	11 (35.4%)
	LEFT	20 (64.5%)
TYPE OF FRACTURE		31
	INTERTROCHANTERIC FRACTURE	26
	SUBTROCHANTERIC FRACTURE	5

Table shows summary of mean age of patients, number of male and female patients, side of Injury And type of fracture.

Intertrochanteric Fractures
Table 2: Clinical Outcomes.

VARIABLE	FREQUENCY	PERCENTAGE
EXCELLENT	10	43.5
GOOD	10	43.5
FAIR	3	14
POOR	0	0

Table shows summary of clinical outcome intertrochantric fractures treated with PFN A2. Outcome assessed based on harris hip score.



Subtrochanteric Fractures
Table 3: Clinical Outcomes.

VARIABLE	FREQUENCY	PERCENTAGE
EXCELLENT	2	40
GOOD	2	40
FAIR	1	20
POOR	0	0

Table shows summary of clinical outcome subtrochantric fractures treated with PFN A2. Outcome assessed based on harris hip score.

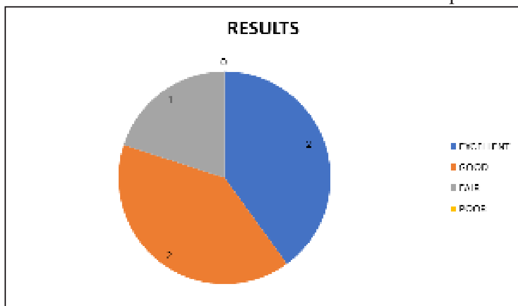


Illustration 1

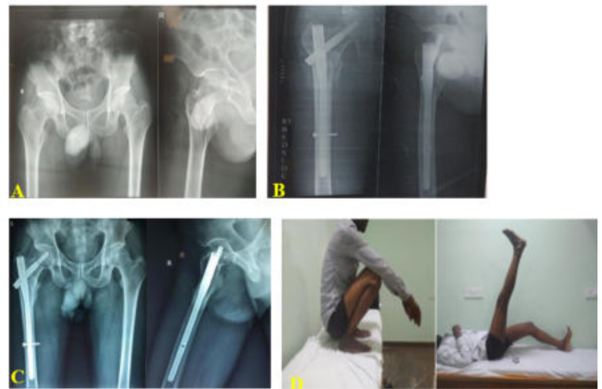
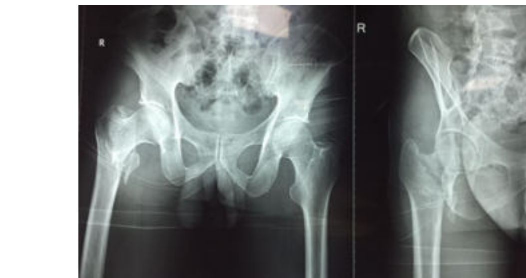
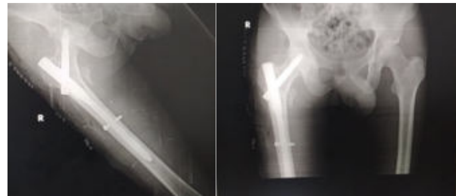


Figure 1 : Functional And Radiological Outcome Of Intertro chantric Fracture Treated With Pfn A2. A. Preop Xray B. Immediate Post Op Xray. C. 1year Follow Up Xray. D. Clinical Outcome Images.

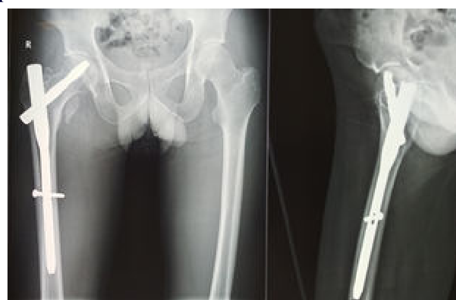
Illustration 2



Pre Operative



Post Operative



1 Year Follow Up

Clinical Photos

Figure 2: Functional And Radiological Outcome Of Intertro chantric Fracture Treated With Pfn A2. A. Preop Xray B. Immediate Post Op Xray. C. 1year Follow Up Xray. D. Clinical Outcome Images.

Illustration 3

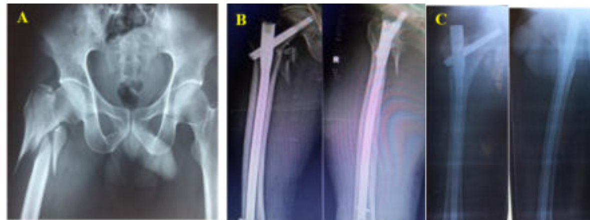


Figure 3 : Radiological Outcome Of Subtrochantric Fracture Treated With Pfn A2. A. Preop Xray B. Immediate Post Op Xray. C. 9month Follow Up Xray

REFERENCES

1. S.TerryCanale's "Campbell's operative orthopaedics" Vol3,(13) :3239-3261, 3237-3308.
2. Micheal.W.Chapman's"Chapman'sorthopaedicsurgery",volumeLipincott Williams and wilkins company,(3):618-665.
3. KennethJ.KovalandJosephD.Zuckerman:"Rockwoodandgreen'sfracture in adults" Chapter 49,50,51, 7th edition, 2001-edited by Robert W. Bucholz and JamesD.Heckman,J.B.LippincottCompany, page-2039-2147
4. M J X Hange "Management of per-subtrochantcric femoral fractures" Aklulle traumatolgy 1994 Feb 24(l)1-5.
5. PavelkaT ,Kortus J, Linhart M. Osteosynthesis of proximal femoral fractures using short proximal femoral nails.
6. Mereddy P., Kamath S., Ramakrishnan M., Malik H., Donnachie N. The AO/ASIF proximalfemoral nail antirotation (PFNA): a new design for the treatment of unstable proximal femoral fractures. Injury. 2009;40(4):428–432. doi: 10.1016/j.injury. 2008. 10.014
7. Brunner A., Jöckel J.A., Babst R. The PFNA proximal femur nail in treatment of unstable Proximal femur fractures--3 cases of postoperative perforation of the helical blade into the hipjoint. J. Orthop. Trauma. 2008;22(10):731–736. D 10.1097/ BOT. 0b0 13e3181893b1b
8. Xie H, Wang Z, Zhang J, Xu L, Chen B. Clinical outcome of dynamic hip locking plates and proximal femoral nails anti-rotation-Asia for treating intertrochanteric femur fracture with lateral wall fractures in the elder patients. Oncotarget. 2017 Jul 31; 8(47): 82700-4.
9. Macheras GA, Koutsostathis SD, Galanakos S, Kateros K, Papadakis SA. Does PFNA II avoidlateral cortex impingement for unstable peritrochanteric fractures? Clin Orthop Relat Res. 2012Nov;470(11):3067–3076
10. Yaozeng X., Dechun G., Huilin Y., Guangming Z., Xianbin W. Comparative study of trochantericfracture treated with the proximal femoral nail anti-rotation and the third generation of gamma nail.Injury. 2010;41(12):1234–1238. doi: 10.1016/j. injury. 2010. 03.005
11. unstable intertrochanteric fractures treated with proximal femoral nail antirotationii: an evaluation of functional outcome in the elderly keshavshenoy s1 , santosh s jeevannavar2 , prasannabaindoor1 , ranjan .
12. Results of the proximal femoral nail anti-rotation (PFNA) in elderly Chinese patients.Pu JS1, Liu L, Wang GL, Fang Y, Yang TF.
13. Review of Proximal Nail Antirotation (PFNA) and PFNA-2 – Our Local Experience WL Loo, M Med Orth, SYJ Loh, FRCS (Edin), HC Lee, FRCS (Edin) Department of Orthopaedic Surgery, Changi General Hospital, Singapore
14. PFNA-II protrusion over the greater trochanter in the Asian population used in proximal femoral fractures- Chao li ang et al in 2011
15. Results of proximal femur nail antirotation for low velocity trochanteric fractures in elderly Ashok Sunil Gavaskar,1 Muthukumar Subramanian,2 and Naveen Chowdary Tummala.
16. Proximal Femoral Nail Antirotation in Treatment of Fractures of Proximal Femur Sahmir Sadic,1 Svemir Custovic,1 Mahir Jasarevic,1 Mirsad Fazlic,1 Nedim Smajic,1 Asmir Hrustic,1 Aleksandar Vujadinovic,1 and Ferid Krupic2
17. Treatment of Unstable Intertrochanteric Fractureswith Proximal Femoral Nail Antirotation II: Our Experience in Indian Patients§G.N. Kiran Kumar,1 Gaurav Sharma,1 Kavin Khatri,2 Kamran Farooque,1 Devendra Lakhotia,*,3 Vijay Sharma,1 and Sanjay Meen
18. A Comparison of the Clinico-Radiological Outcomes with Proximal Femoral Nail (PFN) and Proximal Femoral Nail Antirotation (PFNA) in Fixation of Unstable Intertrochanteric Fractures Anirudh Sharma, 1 Anupam Mahajan,2 and Bobby John
19. unstable intertrochanteric fractures treated with proximal femoral nail antirotationii: an evaluation of functional outcome in the elderly keshavshenoy s1 , santosh s jeevannavar2 , prasannabaindoor1 , ranjan .
20. Comparison of radiological and functional outcome of unstable intertrochanteric femur fractures treated using PFN and PFNA-2 in patients with osteoporosis. Mallya S1, Kamath SU2, Madegowda A1, Krishnamurthy SL1, Jain MK1, Holla R3.
21. Comparative study of PFNA vs PFNA 2 in unstable intertrochanteric fractures: A randomised control study of 50 cases Dr. Shashikant S Gadhe, Dr. Pramod Bhor, Dr. Ibad Patel, Dr. Arvind J Vatkar, Dr. Sachin Kale and Dr. Gaurav Kanade