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A PROSPECTIVE STUDY OF INTERTROCHANTERIC FRACTURE MANAGEMENT IN ADULTS BY PROXIMAL FEMORAL NAIL (PFN)

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Abstract

Background: Intertrochanteric fracture in younger individuals are usually the result of high energy injury, such as motor vehicle accidents or fall from height. In elderly 90 % of intertrochanteric fracture results from simple falls. All treatment modalities are aimed at preventing malunion and deformity. Both the methods of non operative and operative managements have strong advocates. Now a days, conservative method of treatment of intertrochanteric fracture have been largely abandoned. Rigid internal fixation of the intertrochanteric fractures with early mobilization is considered as standard treatment.

Aims And Objectives: To analyze the results of proximal femoral nailing in the management of intertrochanteric fractures.

Methodology: A prospective interventional study was done at Vinayaka Missions Kirupananda Variyar Medical College, Salem between August 2013 to August 2015. 30 patients who were clinically and radiologically diagnosed as intertrochanteric fractures were included in the study. The fractures were classified based on Boyd and Griffin classification. The patient had undergone proximal femoral nailing under c-arm. All the patients were assessed by using Kyle's criteria during the follow up period. The patients were followed up for a period of 3 to 6 months.

Results: Majority of the patients had developed the intertrochanteric fractures mainly due to road traffic accidents (76.6%). Based on Boyd and Griffin classification majority of patients had type II fractures. Among the 30 patients 25 patient had undergone closed reduction and remaining 5 patients had open reduction. The mean time for the fracture union was 5.13 month for the patient who had undergone closed reduction type of surgery and it was 5.81 month among the patients undergone open reduction. Based on Kyle's criteria the functional outcome at end of 6 months was excellent for 10 patients and the outcome was good for 16 patients and outcome was fair for 3 patients and only one patient had a poor outcome at the end of 6 months due to delayed union of the fracture.

Conclusion: Proximal femoral nail is a better implant for unstable type of intertrochanteric fractures as our study show excellent and good functional results with no implant related complications.

Keywords: *Intertrochanteric fracture, proximal femoral nailing, hip fractures*

Introduction:

Hip fractures rank in the top of all impairments worldwide in terms of loss in disability-adjusted years of people 50+years old.[1] Ninety percent of hip fracture results from simple fall.[2] Although it might be argued that hip fracture incidence may change in the future due to recent drug intervention for osteoporosis,[3] effort to prevent hip fracture are unlikely to have a substantial impact on hip fracture incidence.[4-7]

The goal of treatment for hip fracture is to return patient to their pre –fracture level of function.[8] Incidence has increased primarily due to increasing life span and more sedentary lifestyle brought by urbanization. In younger population, IT fractures due to high velocity trauma. In elderly 90% of intertrochanteric fractures results from simple fall. Of these pathological fracture constitute 1.3% of total fractures. Fortunately for these fracture union is not a problem due to abundant blood supply, cancellous nature of the bone in a wide cross sectional area at the fracture site. All treatment modalities are aimed at preventing malunion and deformity. Both the method of non operative and operative managements have strong advocates. The advocates of the former method believes that the simplicity of conservative treatment minimizes the technical expertise and equipment which is needed for operative management, and also yields good results because of rich blood supply and wide cross sectional area. Whereas the advocates of the later believes that early ambulation and ability to work again following surgery overrules the results of conservative management. Nonunion is seen in less than 2% of the patients.

Now a days, conservative methods of treatment of intertrochanteric fracture have been largely abandoned. Rigid internal fixation of intertrochanteric fracture with early mobilization is considered as standard treatment. It is emphasized that a stable trochanteric fracture will unite with good result irrespective of type of implant used.

Materials and Methodology:

It is a prospective interventional study conducted in Vinayaka Missions Kirupananda Variyar Medical College and Hospital, salem, during the period between August 2013 to august 2015 after permission from Instituitional Ethical committee.

Criteria to include the patients in this series were, All proximal femoral fracture including unstable, reverse oblique, comminuted intertrochanteric and subtrochanteric fracture, Age >20years and patients who are fit for surgery. Exclusion Criteria were patients less than 20yrs, previous wound or bone infections, operatively treated fractures, or retained hardware in the same extremity, and pathological fractures. Preoperatively patient underwent routine blood investigation and cardiac fitness obtained. Patients taken up for surgery were put on fracture table in supine position with the affected side up. All Fractures were reduced and checked under c-arm guidance. If the reduction satisfactory, a small incision made over the greater trochanter area was made and tip of the greater trochanter was exposed and entry point was made using femoral awl. Proximal reaming was done and appropriate proximal femoral nail was introduced and fixed with two proximal lag screw of appropriate size. The distal interlocking screws was placed. The final position was checked by using the C-arm. Pre-operative and post operatively prophylactic antibiotic was given (inj.cefoperazone+sulbactam 1.5gm 12th hourly for 5 days), intravenous analgesic for 3 days and then oral analgesics for 7 days. Quadriceps strengthening exercise, static quadriceps exercise and ankle movements were started after the patient recovered from anaesthesia. Patients were advised to non weight bearing walking (NWBW) 24 hrs after surgery. Sutures were removed on 15th post-Operative day. Partial weight bearing walking (PWBW) was started around 6 weeks. Full weight bearing walking was allowed after assessing for radiological and clinical union.. At each follow up patient was assessed clinically as per kyle's criteria and x ray AP/LAT view of hip with femur is taken.

Results:

Table 1 shows that the minimum age and maximum age are 30yrs and 60yrs respectively and the mean age is 47.46 ±7.02years. The majority of our study population were males (70%) compared to females (30%) and the male: female ratio was 2.3:1. About 76.6% patient had the intertrochanteric fracture mainly due to road traffic accident and that was followed by an accidental fall (23.3%). Table 2 shows that about 66.6% were type II fracture based on Boyd and Griffin classification. There were almost equal distribution of left and right sided limb injury. Twenty five patients underwent closed reduction and 5 patients underwent open reduction. The mean interval between injury and surgery was 3.93±1.48. The mean total operating time was 99±8.84 minutes. Only 2 patient had post operative complication, one had infection which was controlled by giving i.v antibiotics

and another patient had delayed union of the fracture. Table 3 shows that the mean time for the fracture union was 5.13±0.86 months for the patient who underwent closed reduction surgery and it was 5.81±0.79 months among the patient undergone open reduction (p value 0.175).

The functional outcome had improved for all the patients from 3 month to 6 month period. The excellent outcome which was 20% at the end of 3 months had improved to 33.3% at the end of 6 months (Table 4). Only one patient had poor outcome at end of 6 months of follow up (Table 5). The patient had delayed union and the fracture union occurred in 8 months.

Discussion:

Intertrochanteric hip fractures account for approximately half of all hip fractures in the elderly population. Among these fractures,50 to 60 % are classified as unstable.[9] Unstable intertrochanteric fractures occurs more often with increased age and low bone mineral density and are associated with a high rate of complications.[10] Several methods of fixation have been proposed for the management of intertrochanteric fractures , such as compression hip screw and sliding plate, dynamic compression sliding plate, fixed angle blade plate, intramedullary sliding hip screw ,and lately external fixator.[11]

Scottl first described a method of treating intertrochanteric fracture by skeletal pinning and external fixation. Since then several author have proposed multiple type of external fixators, but results were not so encouraging.[12] The successful treatment of intertrochanteric fracture depends on many factors: the age of the patient, the patient's general health, the time from fracture to treatment, the adequacy of treatment, concurrent medical treatment, and the stability of fixation.[13] The appropriate method and the ideal implant to fix pertrochanteric fracture are topic still open to debate with proponents of the various approaches each claiming advantage over the other methods.

Many internal fixation device have been recommended for the treatment of pertrochanteric fractures, including extramedullary and intramedullary implants. The dynamic hip screw (DHS) initially introduced by Clawson in 1964, remains the implant of choice because its favourable results and low rate of non-union and failure. It provides controlled compression at the fracture site. The use of DHS has been supported by its biomechanical properities which have been assumed to improve the healing of fractures.[14] DHS require a relatively larger exposure, more tissue handling and anatomical reduction,all of which increase the morbidity, the probability of infection and significant blood loss, the possibility of varus collapse and inability of the implant to survive until fracture union.

The slide plate and screws weaken the bone mechanically. The common causes of fixation failure are instability of fractures, osteoporosis, lack of anatomical reduction, failure of fixation device and incorrect placement of lag screw in femoral head.[15] Control of axial telescoping and rotational stability are essential in unstable proximal femoral fractures. An intramedullary implant inserted in a minimally invasive manner is better tolerated in the elderly.[16] The cephallomedullary femoral reconstruction nails with a trochanteric entry point have gained popularity in recent years.[17] they have shown to be biomechanically stronger than extramedullary implants.

The Gamma nail is associated with specific complications, among which is anterior thigh pain and fracture of the femoral shaft. Intramedullary implants for internal fixation of proximal femur withstand higher static and a several fold higher cyclical loading than DHS type of implants. As a result the fracture heals without the primary restoration of the medial support the implant temporarily compensates for the function of the medial column.[18]

The arbeitsgemeinschaft fur osteosynthesefragen (AO ASIF) in 1996, therefore developed the proximal femoral nail with an antirotational hip pin together with a smaller distal shaft diameter which reduces stress concentration to avoid these failures. Proximal femoral nail has all advantage of an intramedullary device, such as decreasing the moment arm, can be inserted by closed technique, which retains the fracture haematoma an important consideration in fracture healing,decrease blood loss,infection,minimizes soft tissue dissection and wound complications. The lag screw should be inserted into the femoral head as deeply as noted in the AP view, and centrally in lateral view.[19] The tip of the lag screw should always be inferior to the centre of the femoral head.[20,21] Anatomic and biomechanical studies have shown that the superomedial quadrant of the femoral head is the weakest part for the implant, and therefore proper positioning of the screw is emphasized.[21] Cut out is usually resulted from poor positioning of the proximal screw in the femoral head, particularly in osteoporotic bone.[22]

In our study, the lag screw was inserted close to subchondral bone, and the hip pin superior to femoral head. This resulted in 90% of the lag

screw being inserted at the optimal site (inferior to the centre of the femoral head) and to the optimal depth, there by achieving rigid fixation. Good reduction of fracture, and optimal positioning and length of the hip pin and lag screw are the crucial for the pfn procedure and reported to yield excellent outcomes.[22]

Metin Uzun [23] et al, in 2009, in study of 35 patients reported long term radiographic complications following treatment of unstable intertrochanteric femoral fractures with proximal femoral nail and effects on functional results. Reduction was assessed as good or acceptable in all the patients. Complete union was achieved in all but two patients. The mean Harris hip score was 82.1. The results were excellent in 11 patients (31.4%), good in 15 patients (42.9%), fair in 7 patients (20%),and poor in 2 patients (5.7%). Radiographic complication mainly included secondary varus displacement in 9 patients (25.7%). Secondary varus displacement was due to cut-out of the proximal screws(n=2), screw loosening due to collapse of the fracture site (n=2), and reverse z effect (n=5). In our study at the end of 6 month follow up of the patients we had 33.3% of the patients with excellent functional outcome, 53.3% of the patients with good outcome and 10% with fair outcome and we had no implant failure or Z-effect.

W. M. Gadegone &Y.S. Salphale[24], in 2007, reported a study on PFN-an analysis of 100 cases of proximal femoral fractures with an average follow up of 1 year. Postoperative radiographs showed a near –anatomical fracture reduction in 88% of patients. The fracture consolidated in 4.5 months. No perceptible shortening was noted. 7% of the patients had superficial infections which were controlled with antibiotics, 82% had a full range of hip motion. In our study we had 100% near normal anatomical fracture reduction and # consolidated in 5 months. All patients had full range of hip motion .we encountered no non union only one delayed union case was reported in our study.

Conclusion:

New implants must undergo critical evaluation as they are introduced into the orthopaedic surgeon's practice .The proximal femoral nail used in our series to treat intertrochanteric fracture performed well both functionally and radiographically .The union rates and the mobility score seen in our series were comparable with the studies in literature. In our study the PFN showed excellent and good functional results without any implant related complications.

Table 1: Age wise distribution of study population.

Age in Group (in years)	Frequency	Percentage	Mean ±SD
30-35	1	3%	47.46±7.02
36-40	4	13.3%	
41-45	7	23.3%	
46-50	6	20%	
51-55	8	26.6%	
56-60	4	13.3%	
Total	30	100%	

Table 2: Boyd and Griffin type of fracture classification among the study population.

Type of fracture	Frequency	Percentage
Type I	1	3.3%
Type II	20	66.6%
Type III	2	6.6%
Type IV	7	23.3%
Total	30	100%

Table 3: Mean and SD of the time of union of fractures

Type of surgery	Time of union		P value
	Mean(In months)	SD	
Closed reduction	5.13	0.86	0.175
Open reduction	5.81	0.79	

Table 4: Functional outcome based on kyle's criteria at the end of 3 months

Functional outcome	Frequency	Percentage
Excellent	6	20%
Good	19	63.3%
Fair	4	13.3%
Poor	1	3.3%
Total	30	100%

Table 5 :Functional outcome based on kyle's criteria at the end of 6 months

Functional outcome	Frequency	Percentage
Excellent	10	33.3%
Good	16	53.3%
Fair	3	10%
Poor	1	3.3%
Total	30	100%

References:

1. Johnell O, Kanis JA. An estimate of the world wide prevalence,mortality and disability associated with hip fractures. Osteoporosis International 2004 Nov:15(11):897-902.
2. Chang KP,Centre JR,Nyugen TV,et al. Incidence of hip and other osteoporotic fractures in elderly men and women:Dubbo Osteoporosis epidemiology study. Journal of Bone & Mineral Research 2004APR;19(4):532-6.
3. Aschkenasy MT, Rothenhaus TC. Trauma and falls in the elderly. Emergency Medicine clinics of North America 2006 May;24(2):413-32
4. Marks R, Allegrante JP, Ronald Mackenzie C, et al. Hip fractures among the elderly: causes,consequences and control. Ageing Research Reviews 2003 Jan; 2 (1)57-93.
5. Melton L J, 3rd. Epidemiology of hip fractures: implication of the exponential increase with age. Bone 1996 Mar;18 (3 Suppl): 121S-5S
6. Zucker JD. Hip fracture. [see comment]. New England Journal of Medicine 1996 Jun 6;334 (23): 1519-25.
7. Cummings SR, Melton LJ. Epidemiology and outcomes of osteoporotic fractures[see comment]. Lancet 2002 May 18; 359 (9319): 1761-7
8. Lorich DG, Geller DS, Nielson JH. Osteoporotic petrochantric hip fractures: management and current controversies. Instructional course lectures 2004;53:441-54
9. Baumgaetner MR, Curtin SL, Lindskog DM, Keggi JM: The value of tipapex distance in predicting failure of fixation of peritrochantric fractures of the hip. J Bone Joint surg Am1995,77: 1058-64.
10. Cole P, Bhandari M:What's new in orthopaedic trauma. J Bone Joint surg Am 2006, 88:2545-61.
11. Lindskog DM, Baumgaetner MR: Unstable intertrochanteric hip fractures in the elderly. J Am Acad Orthop surg 2004, 12:179-90.
12. Gotfried Y, Frish E, Mendes DG, Roffman M: Intertrochanteric fractures in high risk geriatric patients treated by external fixation. Orthopaedics 1985, geriatric patients treated by external fixation. Orthopaedics 1985, 8: 769-74.
13. Dean GL, David S, Jason HN (2004) Osteoporotic pertrochanteric fractures; management and concurrent controversies. J Bone Jt Surg (Am) 72-B:737-752.
14. Pajarinen J, Lindahl J, Michaelsson O, Savolainen V, HirvensaloE(1992) pertrochanteric fractures femoral fractures treated with a dynamic hipscrew or a proximal femoral nail. J Bone Jt Surg (Br)74-B:352-357
15. Kim WY, Han CH, Park JI, Kim FJY(2001) Failure of intertrochanteric fracture fixation with a dynamic hip screw in relation to preoperative fracture stability and osteoporosis. Int Orthop 25:360-362.
16. Valverde JA, Alonso MG, Porro JG et al (1998) Use of gamma nail in treatment of fractures of the proximal femur. Clin Orthop 350:56-61
17. Windoff J, Hollander DA, Hakimi M, Linhart W(2005) Pitfalls and the complications in the use of proximal femoral nail. Langenbecks Arch Surg 390(1):59-65,Feb Epub 2004 Apr 15.
18. Pavelka T,Matejka J, Cervenkova H(2005) Complications of internal fixation by a short proximal femoral nail. Acta Chir Orthop Traumatol Cech72:344-354.
19. Kawaguchi S, Sawada K, Nabeta Y.Cutting – out of the lag screw after internal fixation with the Asiatic gamma nail. Injury 1998;29:47-53
20. Haynes RC, Poll RG,Miles AW, Weston RB. Failure of femoral headfixation:a cadaveric analysis of lag screw cut-out with gamma locking nail and AO dynamic hipscrew. Injury 1997;28:337-41
21. Brown TD, Ferguson AB Jr. Mechanical property distributions in the cancellous bone of the human proximal femur. Acta Orthop Scand 1980;51:429-37.
22. Schipper IB, Steyerberg EW, Castelein RM, Van der Heijden FH, Den Hoed PT, Kerver AJ,et al.Treatment of unstable trochanteric fractures. Randomised comparison of the gamma nail and the proximal femoral nail. J Bone joint Surg Br 2004;86:86-94.
23. Metin Uzun, Erden Erturer, Irfan Ozturk, Senol Akman, Faik Seckin and Ismail Bulent Ozcelik. Long-term radiographic complications following treatment of unstable intertrochanteric femoral fractures with the proximal femoral nail and effects on functional results. Acta Orthop Traumatol Turc.2009;43(6):457-463
24. Gadegone WM and Salphale YS. Proximal Femoral nail- an analysis of 100cases of proximal femoral fractures with an average follow up of 1 year. International Orthopaedics (SICOT).2007;31:403-408.