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Trochanteric fractures treated by proximal femoral nail - Our experience

Sreeranga Nagaraj [1], Varun R [2], K Shankara [3], Lakshmeesha T [4], SC Kiran [5], Poornachandra [6], Lokesh P [7]

Department of Orthopaedics, Hassan Institute of Medical Sciences, Hassan-573201. Karnataka. 1- Associate Professor, 2- Resident in Orthopaedics Department. 3&4- Assistant Professor. 5&6- Senior Resident. 7- Resident

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Corresponding Author:

Dr. Sreeranga Nagaraj, Associate Professor, Department of Orthopaedics, Hassan Institute of Medical Sciences, Hassan-573201. Karnataka, India. Email: sreerangadoc18@gmail.com

Abstract:

Background & Objectives: Intertrochanteric fractures pose a challenging problem for orthopaedic surgeons. Many implants have come in vogue. Use of Proximal femoral nail in treatment of trochanteric fractures gives an advantage of being intramedullary device along with the decrease in the number of complications**. Materials & Methods:** In our study 50 patients who presented to the orthopaedic unit of Hassan Institute of Medical Sciences between january 2010 to july 2013 with intertrochanteric fractures were included. All were followed upto 2 years & the final outcome was assessed for the type of fracture using evan's classification, position of the lag screws, time of union and functional assessment score using kyle 's criteria. **Results:** Forty five patients completed 2 years follow up. 2 patients died after 1year due to co-morbid conditions & 3 were lost to follow-up. Based on Evan's classification 80% fractures- unstable 20%- stable, 76% of the lag screws in AP view were in the inferior quadrant & 92% in central position in lateral view, with mean time of union of 12.8 weeks. Functional results according to kyle's criteria were Excellent 55.6%, Good 31.1%, Fair 8.9% and Poor 4.4%. There were 3 cases of superficial infection, 2 cases of proximal migration (Z effect) & 1 case of screw breakage. All were adequately treated. **Conclusions:** PFN is a technically demanding procedure. Closed anatomical reduction, small size of incision, less blood loss, rigid fixation & early weight bearing are its advantages in helping patient return to his functional capacity at earliest.

Key words: Evan's classification; Functional outcome; Intertrochanteric fractures; Kyle's criteria; Proximal femoral nailing.

Introduction

Intertochantric fractures are common fractures encountered in our OPD. These are potentially hazardous fractures noted in the elderly population. With the increase in the number of years of life in the elderly these fractures decrease the quality of their life. Common complications of these fractures are malunion. Also patients become dependent, neglected & economically burdened if not treated, R. Marks [1] & Guyton J.L [2]. Hence it is imperative to put them back on their feet at the earliest. AO/ASIF in 1996 designed a new intramedullary device – Proximal femoral nail over the other implants for the treatment of intertrochantric fractures, Simmermacher RK et al [3]. This implant has the advantage over other devices specially GAMMA nail in form of additional anti-rotation 6.5mm hip pin which decreases the cut out rate & the design of the tip of the nail which reduces stress forces. Also the associated complications of varus collapse, prolonged recumbency & malunion are avoided. Hence use of PFN in these fractures as a surgical option provides good surgical fixation with early mobilization & ambulation. We at our institute used this implant to note its efficacy in treating trochantric fractures.

Material and Methods

50 patients of the age between 52 to 85 with intertrochantric fractures were treated from january 2010 to july 2013 with proximal femoral nailing at our institute. Male to female ratio was 1.5:1. Patients with pathological fractures, polytrauma & compound fractures were excluded from this study. All the above patients were investigated thoroughly, physician & anesthetist opinion taken before subjecting them for the proposed surgery. Mandatory consent was taken from the patient & their relatives.

Patients were positioned supine on the fracture table with "heel to toe" relationship. The opposite limb with abducted away for the easy access of the C-arm. Adequate traction & counter traction was provided & closed reduction of the fracture was achieved.

Evan's stable fracture patterns [4] was noted in 10 patients where the posteromedial cortex was intact & hence with minimal manipulation on the fracture table reduction could be achieved. In 40 patient's posteromedial cortex was either displaced or comminuted & hence needed adequate manipulation for its reduction & they belonged to Evan's unstable pattern. However in 5 fractures open reduction was needed as they were operated late due to lack of surgical fitness. Lateral approach above the tip of trochanter of about 3-5 cms was used for all fractures. Using a cannulated curved bone awl portal of entry was made, guide wire was passed across the trochanter & fracture, reaming was done & nail of 9, 10 or 11 mm was passed connected to a jig. Nail length was always 250cm in length. Under the C-arm guidance nail was locked with 2 proximal screws. The cervicocephalic screw 8mm was always used first & it was provided with additional stability in form of anti-rotation hip pin of 6.5mm superior to it. Distally either one or two 4.5mm cortical screws were used to lock the nail. The stability of fracture was re-assessed under C-arm before wound closure. The patient was put on IV antibiotics for a minimum of 3 days. Post-operatively once his surgical pain reduced he was made to sit up & static quadriceps exercises started. Following check x-ray's & after patient's condition improved non-weight bearing ambulation started.

They were discharged on the 5^{th} -10^{th} post-operative day. Suture removal was done on 14^{th} post-operative day. They were advised strictly not to bear weight & walk on the affected leg along with oral analgesics & calcium tablets on discharge.

Patient was regularly followed up at an interval of 3 weeks initially, later at 6 weeks, 3 months, 6 months, 12 months, 18 months & 24 months. They were assessed clinically & radiologically and were rated according to Kyle's criteria [5]. Final outcome was analyzed as in discussion.

Results:

These fractures were commonly seen in the elderly population between 5^{th} – 8^{th} decade (52 -85). Male preponderance is high with 60% (30) as against females 40% (20).The mean age affected was **70.6 years**. Road traffic accidents accounted for 50% (25) of the cases, followed by H/o fall 44% (22) & Assault 6% (3).

As per Evan's classification stable fracture pattern was noted in 20% (10) while unstable was seen in 80% (40). In majority of the cases patients were operated within 4 days of injury while 5 cases were operated after 10 days. The delay was attributed to co-morbid problems of IHD & DM. The position of lag screw was noted in both AP & Lateral views. 76% (38) were in inferior quadrant in AP view while 24% (12) were in central position. 92% (46) of screws were in central position in lateral view while 6% (3) in posterior position & 2% (1) in anterior position. The average duration of surgery from skin to skin was about 66 minutes (35-128). The average

hospital stay was about 10 -12 days. 6 cases stayed for more than 15 days. Non weight bearing was started within 3 days of surgery in 78% (39) while in remaining it took more than 3 days 22% (11). Union was noted within 12 weeks in 90% (45) while rest took a longer time. 3 patients took 16.5 weeks for union 6% (3), 1 patient took 24 weeks (2%) while one patient 2% was lost for follow up before union. Mean union time noted was 12.8 weeks. Full weight bearing was allowed at 9 weeks post operatively in 88% (44). 94.2% (42) of cases attained pre-injury walking status with or without aid by 24 weeks. As per Kyle's criteria 86.7% had excellent to good results at 24 weeks follow up.

Complications like superficial infection occurred in 2 patients before suture removal & they resolved with appropriate antibiotics after culture & sensitivity. One patient had infection at 9 weeks as this patient had psoriatic skin infection which resolved after IV antibiotics & appropriate skin treatment. 2 cases of proximal migration of screw with one case of screw breakage was noted in patients in whom the surgery was delayed due to lack of fitness & also the reduction was difficult in them. Other complications noted were delay in union in 3 patients, 5 patients had knee stiffness & 2 patients had <2.5cm shortening which was not significant.

Discussion:

Trochantric fractures are common among the **elderly population especially between 60 – 80 years** owing to their weak co-ordination, poor general condition & co-morbid problems while the fractures between 40 -60 years are common as a result of their active life style outdoors & they are prone to road traffic accidents, falls, assaults etc., Several implants have come in vogue to treat these fractures. Use of DHS in the recent past was quite popular but the uncontrolled collapse in communited fractures resulted in varus union with short neck & a high rate of screw cut out which has made us to think of an intramedullary option. Minimal invasion & biomechanical advantage has helped use of intramedullary devices like GAMMA nailing & proximal femoral nailing gain importance as discussed by Pelet S et al [6] & Adams CI et al [7]. Aim of treating these fractures is to achieve good surgical fixation, promote faster healing, early mobilization, & restore prefracture functional state at the shortest possible time as described by Pajarienen J et al [8], Baumgaetner MR et al [9] & Madsen JE et al [10].

In our prospective study, male to female ratio was 1.5:1 as men were probably more aggressive in their lifestyle. The mean age affected was 70.6. Nuber S Schonweiss et al (2005) [11] observed the mean age of 81.5 years. The incidence of mean age affected was lower in our population probably due to poor general health conditions like osteoporosis, poor eyesight, fragile bones, co-morbid conditions along with damaged roads, poor light source and lack of awareness. Road traffic accidents were common cause of fracture in our history indicating poor road conditions & improper driving practices. Falls also accounted for a good percentage especially in elderly population as suggested by Sudan et al [12]. The onus on us was to prepare & motivate them for the proposed surgery in order to put them back on their feet as early as possible & prevent the morbidity & mortality.

Trochantric fractures are classified by a number of classifications, however in our study ***Evan's*** **classification** [4] was used. They are based on the stability pattern of the fracture depending on the posteormedial cortical contact. 80% were unstable in nature in our study owing to the velocity of trauma or poor bone condition. Evan's too noted high rate of unstable fractures in osteoporotic & elderly individuals even in low energy velocity injury.

Reduction of the fractures was done by indirect technique using C-arm on a fracture table, however in some patients open reduction was needed. It is very important to reduce the fracture to near anatomical approximation both in Anterior Posterior & Lateral views to help us 1). To put the screws in the proper position and 2). To get good posteomedial cortical contact before nailing. This gives adequate stability for the fracture Metin et al [13]. During nailing, placement of bone owl is important as it can slip into the fracture site, especially in the comminuted variety but none the less the outcome will not change as the fragments fall around the nail without variation in abductor power site as noted by Janardhan et al [14].

Placement of the lag screw must be central in lateral view & 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. T. Morihara [15] compared the position of lag screw immediately after surgery & at the final follow up & concluded that the free sliding of PFN provides better impaction especially in communited fractures. However he also noted that the hip pin should be 10-15mm shorter

than the lag screw or else the rate of cut out will be as high as 39%. We in our study have used hip pins 15mm shorter so as to prevent the load on the screw & prevent cut out. There was no case of screw cut out in our study.

The tip apex distance is also very important & it is the sum of the distances from the tip of the screw to the femoral head in both AP & lateral views. The ideal distance should be around <25mm as described by Baumgaertner MR et al [9]. We have tried to maintain the distance between 20-25mm of Tip apex distance. TAD also successfully predicts the outcome of the result. George J. Haidukewych [16] in his study has tipped PFN as an ideal implant especially when the lateral wall is communtied in comparison to 95^0 Condylar plates, DHS or locking plates which have poor results.

Also the hip screw is first placed & later the anti-rotation hip pin is put so as to get good compression across the fracture site following release of traction before tightening the screws. We also found difficulty in passing the screws across the nail & bending of the guide wires. So we generally drill over the guide wire till the large drill bit passes the nail & enters the neck, later the guide wire is withdrawn & reaming is continued. This prevents breakage of the guide wire & also adjusts reamer into the nail hole, Pajarienen J et al [8] & Janardhana Aithala P et al [14]. Fewer times it might be useful to adjust the traction & also the position of the leg in adduction to have easy passage of the screws.

Average operating time in our study was 52 minutes. The longest surgical time was 110minutes & the shortest was 35 minutes from skin incision to skin closure. Pajarinen et al [8] however opined mean operation time of 45 mins for DHS as against 55 minutes for PFN. Morihara et al [15] in his studies shows a mean operating time of 77 mins (31-281 range) compared to GAMMA nailing. We have taken longer time to finish the surgery in our initial cases however as expertise grew the average time of surgery became shorter & shorter. Our study clearly shows a statistical difference with respect to the time of surgery & is less than DHS or GAMMA nailing. Mean blood loss was significantly less in our study averaging around 350 ml comparable to Pajarinen et al study [8].

Post operatively we found good **reduction** in 41cases (82%) while it was acceptable in 09 cases (18%). Good reductions were noted in stable uncommunited & early fixations cases. However our acceptable reductions were due to unstable variety with communition, delay in surgery due to lack of fitness & also gross osteoporosis. Metin et al [13] also reported similar reduction percentages.

The mean union rate of the fracture noted was 12.8 weeks (10-17 weeks). However the time of union in DHS too is around the same 12-16 weeks. Statistically it was not significant in our study. (N. Muzaffar et al [17]).

Proximal migration of the screws in our study occurred as a result of its placement in superior & anterior quadrant in 2 patients but they did not penetrate the joint nor were cut out. This particularly results in poor outcome. Z effect occurs when the hip pin remains static while the screw slides down during collapse. This can result in the hip pin cutting out the cortex or penetrating the joint. The reverse can also occur when the hip pin slides down while the hip screw remains static & this is reverse Z-effect. Minos et al [18] noted in their "study of long term results in 45 patients treated with PFN", 5 had Z-effect & 1 with reverse Z-effect. They attributed it to the poor technical or mechanical error. We also noted that in our study 2 cases had proximal migration of screws with Z-effect which could be attributed to poor placement of screws. Nevertheless they went on to unite & the implant was removed in them at 16 & 20 weeks with <2.5mm shortening. In our case delay in surgery & reluctance in opening the fracture due to co-morbid conditions might have resulted in this complication. These cases were in the early part of our study.

Knee stiffness was seen in 8 patients to their lack of muscle bulk & strength which did not hinder their mobility. Shortening occurred in 2 patients due to communition of the fractures & early collapse which was negligible, A.S. Sidhu et al [19] Ballal M.S et al [20].

In our experience closed nailing using PFN had advantages over methods with respect to size of incision, time of surgery, amount of blood loss & return to functional recovery at the earliest. Use of anti-rotation hip screw prevents screw cut out rate. Limb length inequality is also minimal. In communited fractures though accurate reduction is a relative entity with loss of reduction & varus collapse as complications commonly seen in other implants was much less with use of PFN. Rate of union is also fast with fewer malunions & nonunions.

Conclusion:

In our experience use of PFN in the treatment of trochantric fractures produces better results. Although surgery is technically demanding with need of C-arm & fracture table the outcome was

good. It is more biological, aesthetic friendly & can be done in elderly patients with peritrochanteric fractures with co-morbidity. Good anatomical reduction with posteromedial cortical contact & placement of screws as discussed will prevent complications like varus collapse, Z-effect & shortening. Also the size of incision, time of surgery & blood loss is much less. Recovery is faster with return to functional ability at the earliest.

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Abbreviations:

DHS – Dynamic hip screw

PFN – Proximal femoral nail

AO – Arbeitsgemeinschaft fur Osteosynthesifragen

AP – Anteroposterior

ROM – Range of movement

RTA – Road traffic accidents

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Figure 1: Pre-OP x-ray

Figure 2: Immediate Post-OP x-ray

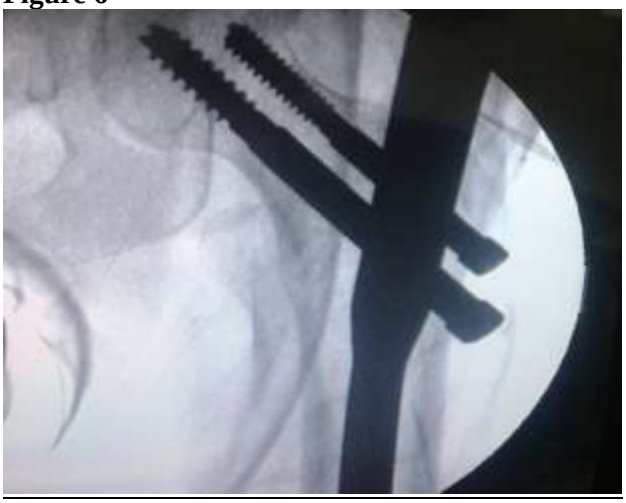
Figure 3

Figure 4

Figure 3 & 4: Six months follow-up showing good union both in AP & Lateral views

Figure 5

Figure 6



C-arm pictures showing [5] pre-operative reduction with good posteromedial contact & [6] immediate post fixation picture in OT.

Table 1- KYLE'S CRITERIA

Excellent:	1. No or minimal limp
	2. No pain in hip joint
	3. Full ROM
Good:	1. Mild limp
	2. Mild occasional pain
	3. Full ROM
Fair:	1. Moderate limp
	2. Moderate pain (Using sticks)
	3. Limited ROM
Poor:	1.Wheel Chair bound
	2. Pain in any position
	3. Non ambulatory

Chart No.1: Pie chart depicting our clinical outcome

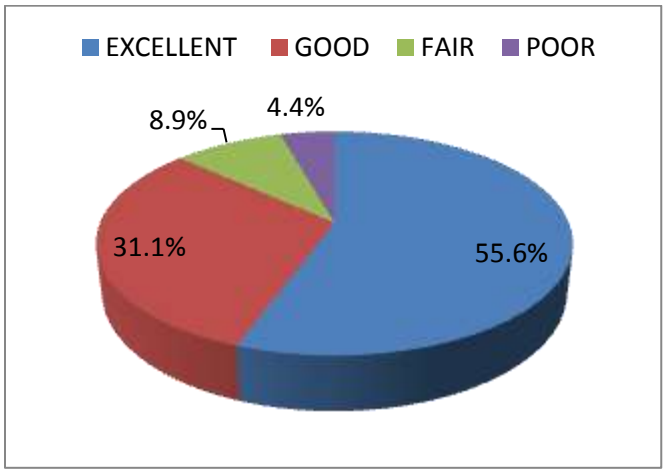


Table 2- Clinical outcome of our results

Variables	Value
Age	Mean 70.6 years
Gender	M:F=1.5:1
Mechanism of injury	RTA=25, Fall=22, Assault=3
Evans classification	Stable=10, Unstable=40
Follow up	Mean =24 months
Bone healing period	Mean =12.8weeks
Clinical outcome As per KYLE's criteria	Excellent =25 Good =14 Fair =4 Poor=2
Complications	1.Superficial infection=3 2.Z- effect=2 3.Delayed union=1 4.Breakage of screw =1 5.Knee stiffness=8 6.Shortening<2.5cms=2