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ORIGINAL ARTICLE

OUTCOME ANALYSIS OF PROXIMAL FEMORAL NAIL IN STABLE INTERTROCHANTERIC FEMUR FRACTURES

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ABSTRACT: BACKGROUND: Proximal femoral nail is commonly recommended as treatment of choice for unstable and reverse oblique intertrochanteric fracture in view of superior biomechanics and prevention of varus collapse associated with Dynamic hip screw. Although in stable fracture types DHS is still being preferred as the treatment modality of choice. Proximal femoral nail owing to better biomechanics, less complications can still be used as the method of choice in stable fracture pattern as well. The aim of this study is to evaluate the results of PFN nail in stable intertrochanteric fracture and include evaluation of the mean operative time, amount of blood loss, complications and functional status of the patient. **MATERIALS AND METHODS**: In this study 30 patients presented to Orthopedics Department Hamidia Hospital Bhopal with stable intertrochanteric fracture were treated with proximal femoral nail. All patients were followed up for a period of 1 year and functional outcome assessment including amount of shortening, neck-shaft angle, Harris hip score was noted. **RESULTS**: At the time of final follow-up, all 30 patients showed union with average Harris hip score of 86.6 (range 62-94).14 patients had excellent score, 9 patients had good score, 5 patients had fair score and 2 patients had poor outcome. Mean neck shaft angle achieved post-reduction was 131.4 degrees and at final follow-up was 128.4 degrees. Limb length discrepancy was assessed in the final follow-up with average shortening of 5 mm and 4 patients had shortening above 1.5 cm. Average blood loss was 80 ml, the mean operative time was 65 minutes. Complications were seen in 3 cases with one case of local wound infection, one of screw cut-out and one of screw penetration. **CONCLUSION**: With proper technique PFN gives excellent results with less blood loss and shorter incision with less soft tissue trauma are added advantages which ultimately lead to less morbidity and early mobilisation of the patient and early return to normal routine activities. Most of the complications can be avoided by proper placement of the screw and maintaining proper neck-shaft angle.

KEYWORDS: Intertrochanteric fracture, Proximal femoral nail, Harris hip score.

INTRODUCTION: Intertrochanteric fractures are very common fractures in elderly patients and their incidence is on the rise in recent years due to increased life expectancy[1]. Achieving and maintaining stable fixation in elderly patients is very difficult due to poor bone quality[2]. Aim is to mobilise these patients as early as possible to prevent early comorbidities associated with long term immobilisation, by surgical stabilization.[3,4] Various implants for treatment of intertrochanteric fractures have been developed. Extra medullary fixation using Sliding hip screw may result in deterioration of pre-existing comorbidities in elderly patients owing to increased blood loss, soft tissue damage, and longer rehabilitation.[5] Other complications like varus collapse upon weight bearing, cutting out of screw, medialisation of the distal fragment (in unstable fracture pattern) are very common with SHS.[6,7]

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To overcome these difficulties, a biomechanically more stable, intramedullary device is being used recently very commonly. Theoretically, it has shorter lever arm which provides more load sharing and allows less collapse,[8] also with reduced surgical incision it also reduces blood loss, less soft tissue trauma and infection.[8] Proximal femoral nail provides stable fixation and early mobilisation in intertrochanteric fractures. Many authors have reported increased failure with the use of SHS in unstable fracture pattern and advocated the use of PFN in those fracture types,[9-13] but they consider SHS as gold standard treatment modality for stable fracture types.[14-17] Intramedullary fixation using PFN can reduce the complications and increased morbidity associated with SHS in stable fracture types and can be used as treatment modality of choice even in stable fracture types.

The aim of this study is to evaluate the results of PFN nail in stable intertrochanteric fracture and include evaluation of the mean operative time, amount of blood loss, complications and functional status of the patient.

MATERIALS AND METHODS: This study was conducted at Gandhi Medical College and Hamidia Hospital Bhopal during Jan 2011-Jan 2014 on 35 patients admitted with stable intertrochanteric fracture AO/ASIF 31A1.1, 31A1.2, 31A1.3. 35 patients were registered in this study with 5 patients lost to follow-up so a total of 30 patients were available for the outcome analysis. There were 18 males and 12 females with an average age of 68 years (Range 24-88 years). Fractures were classified as per AO/ASIF classification as 31A1 (Stable intertrochanteric), 31A2-31A3 (Unstable intertrochanteric). Inclusion criteria included all stable intertrochanteric fracture and exclusion criteria were unstable intertrochanteric fracture, inability to walk before the fracture, others fractures interfering with rehabilitation and pathological fractures.

Operative Technique: Closed reduction was achieved in all the cases. Skin incision is taken about 5 cm cranial to the tip of greater trochanter. After passing the fascia and muscles, a 2.8 mm threaded K-wire is inserted at the tip of the greater trochanter under C-arm control. The K-wire is advanced into the femoral shaft in such a way that it is located in the middle of the shaft in both directions. The proximal part of the femoral shaft is reamed manually with a 17 mm reamer. After mounting the nail on the radiolucent insertion device, the nail can be introduced manually into the femoral shaft. Via the aiming arm, which is attached to the insertion device, the guide wire for the neck screw is first introduced into the femoral neck in such a way that the screw will be placed into the lower half of the neck on the anteroposterior view and centrally on a lateral view.

Thereafter, the guide wire for the antirotational hip pin is introduced. The hip pin is introduced first with the tip just about 25 mm medial to the fracture line; then, the neck screw is inserted. Afterwards, depending on the type of fracture, distal interlocking is either statically or dynamically achieved via the same aiming arm. All patients received one dose of 3rd generation cephalosporin intraoperatively and 2 doses postoperatively. Suture removal was done on 11th postoperative day. Patients were mobilised from 2nd postoperative day and weight bearing as tolerated was started.

Outcome Analysis: Clinical and radiographic examination was done at 11th postoperative day, at 3 weeks, 6 weeks, 3rd month, 6th month and 12th month. Clinical evaluation was done using Harris Hip Score. The fracture was united when it has shown callus and the patient did not feel pain and tenderness at the facture site.

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RESULTS: The mean age of the patient was 68 years (24-88) and the sex distribution was 18 males and 12 females. Left side was fractured in 20 patients and right side in 10 patients. A fall at home was commonest mode of injury (76.7%), followed by RTA. The average time from injury to surgery was 6.7 days. The mean operative time was 65 minutes (range 45-120 minutes). Average intraoperative blood loss was estimated to be 80 ml. Distal locking was used in all patients with dynamic screws in 6 patients and static screws in 24 patients. Immediate full weight bearing was allowed in 9 patients and partial weight bearing in the rest depending upon the general condition of the patient and the intraoperative assessment of the stability.

All fractures were united at the time of final follow-up. Dynamisation of two static nail was done in 3 patients at 12, 13, 15 weeks due to delayed union. No case of non-union was seen. 25 patients were walking without the help of stick, 3 patients were using stick and 2 patients were using walker. Average follow up was 12.4 months. Functional assessment using Harris Hip score showed average score of 86.6 (Range 62-94).14 patients had excellent score, 9 patients had good score, 5 patients had fair score and 2 patients had poor outcome. Mean neck shaft angle achieved post-reduction was 131.4 degrees and at final follow-up was 128.4 degrees. Limb length discrepancy was assessed in the final follow-up with average shortening of 5 mm and 4 patients had shortening above 1.5 cm. Local infection was reported in one case which was managed with dressing and long term antibiotic therapy. Cutting out of the proximal screw was seen in 1 case and Z phenomenon with protrusion of the hip pin through the femoral head was seen in 1 case which was managed with implant removal.

DISCUSSION: Due to increased life expectancy of individuals, the prevalence of hip fracture has been increased dramatically over the past decade[1]. Early surgical stabilisation of the fractures is important to reduce complications associated with long term immobilisation and to decrease mortality risk[8, 9]. The outcome in intertrochanteric fracture depends on many factors, age of the patient, associated comorbidity, patient general health, stability of fixation and implant of choice. Implant of choice for treatment of intertrochanteric fracture is still a topic of debate with many studies claiming advances of one implant over the other. Many studies have demonstrated that Dynamic hip screws are accepted as the implant of choice for treatment of stable intertrochanteric femur fracture.[14-17]

Wolfrang[16] reported complication rates of 9% in stable fracture as compared to 19% in unstable fractures. Similarly Haidukewyeh[18] reported failure of fixation of DHS in unstable pattern specifically reverse oblique type to be as high as 56%.

Intramedullary device inserted by means of a minimal invasive method seems to be better in elderly patients.[19,20] Closed reduction preserves the fracture hematoma[21] and minimal surgical incision allows the surgeon to minimise soft tissue trauma, blood loss, infection rate, wound complications[8,22,23] and therefore reducing the morbidity associated with intertrochanteric fractures especially in elderly patients. Gamma nail as an intramedullary device had a failure rate of 10%[22-25] (Collapse, cut-out of the implant, fracture of the femur). AO therefore developed the proximal femoral nail with antirotational hip pin with small distal shaft diameter to avoid these complications associated with Gamma nail.

PFN has major biomechanical innovations to overcome the limitations of Gamma nail (i) the addition of 6.5 mm antirotation hip pin to reduce the incidence of implant cut-out and rotation of cervico-cephalic fragment (ii) the more proximal positioning of the distal locking screw (iii) smaller

diameter and fluting of the tip of the nail to reduce stress risers and thus reducing the incidence of femoral fracture at the tip of nail (iv) smaller valgus angle and greater implant length.

Various studies have been conducted to evaluate the results of PFN in intertrochanteric femur fractures. In the series of 295 patients with trochanteric fractures treated with PFN by Domingo et al[8] the authors emphasized that the surgical technique is not complex, the number of complications recorded were acceptable and the overall results were comparable with those of other fracture systems. Simmermacher et al[26] reported complication rate of just 4.6% in 191 patients and no complications of fracture below the tip or bending or breakage of the implant was reported. Al-Yassari et al[27] reported an 8% incidence of cut-out and one case of fracture around the tip of the nail after a secondary fall in a total of 76 patients. In an experimental study, Gotze[28] compared the load bearing capacity of implants in unstable per and subtrochanteric fractures and found that PFN could bear the highest amount of load.

In literature when analysing failures of PFN, we found that most of them were due to faulty techniques like failure to reduce properly, use of larger screw, failure to anticipate nail touching anterior cortex while hammering. J Pajarinen et al[4] in their study of comparison between DHS and PFN found that the use of PFN has a positive effect on the better functional outcome primarily due to restoration of near normal anatomy as compared to DHS in which there is greater impaction of fracture leading to shortening of femoral neck. M.S.G. Ballal et al[29] in their study found 5 % failure rate and advocated proper alignment between 2 main fragments and proper placement of the lag screw in the femoral head should be ensured.

In our study mean shortening was 5 mm which was definitely less than the shortening observed in DHS group (10.8 mm in Pajarinen et al). Although study comparing DHS with PFN in stable intertrochanteric fracture by Saudan et al[3] found no statistical difference between groups with reduced mobility in PFN group and higher screw failure rate in PFN group. However it was mentioned in that study the screw failure rate were due to higher screw placement. Looking at these studies we believe that most of the complications were due to technical failure rather than failure of the implant, if properly done PFN gives better results. Placement of the hip screw and maintaining the neck-shaft angle is critical to the final outcome of PFN patients.

In our series, average neck shaft angle at follow up was 128.4 degrees and mean shortening was 5 mm in stable intertrochanteric fractures treated with PFN fixation which shows excellent results compared to any of previous DHS study results. Also average operative time with less blood loss and shorter incision with less soft tissue trauma are added advantages which ultimately lead to less morbidity and early mobilisation of the patient and early return to normal routine activities. Most of the complications are not implant related but are due to technical faults and can be avoided by proper surgical technique with maintaining proper neck shaft angle and proper placement of the screw.

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Variables	Values
Mean Age	68 years
Sex (Male/female)	18/12
Side (Right/left)	10/20
Age distribution of cases	
21-40	2
41-60	4
61-80	21
81-90	3
Mechanism of Injury	
Simple fall at home	23
Road traffic accident	6
Fall from height	1
Fracture classification	
31A1.1	6
31A1.2	11
31A1.3	13

Table 1: Preoperative data of the patients

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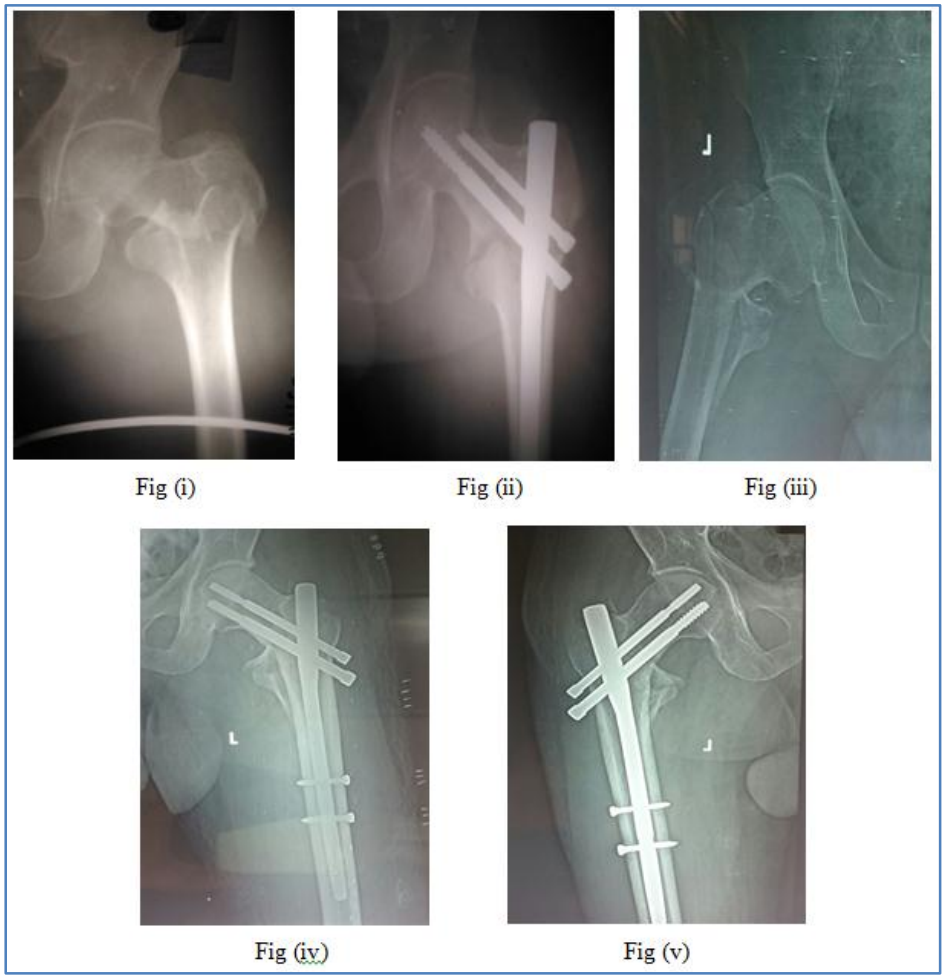
Score	Rating
90-100	Excellent
80-89	Good
70-79	Fair
<70	Poor

Table 2: Harris Hip Score

Author	Number of patients	Type of fracture	Technical Failures	Reoperation rate
Domigo(8)	295	A2 (59%)	12%	3%
Simmermacher(26)	191	A2 (67%)	4.7%	7%
Al-yassari(27)	76	A2(77%)	10.5%	7.1%
Werner(30)	70	A2(54%)	25.7%	19%
Boldin(5)	55	A3(62%)	18.7%	18%

Table 3: Technical and mechanical complications of the PFN system published in the literature



Radiographs of (i) Preoperative X- ray of 65 year old (ii) Postoperative X-ray of same patient (iii) Preoperative X-ray of 70 year old (iv) Post-operative X-ray (v) Follow-up X-ray at 6 months.

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