

Proximal Femoral Nailing in Subtrochanteric Fractures: An Experience at a Secondary Level Care

Nisar Ahmad Dar¹, Nissar Ahmad Shah², Muhammad Bin A Hamid³, Ilyas Ahmad Shah⁴

¹ Consultant, Department of Orthopaedics, District Hospital, Baramulla

² Orthopaedic Trauma Surgeon, Department of Orthopaedics, District Hospital, Baramulla

³ Resident, Department Of Orthopaedics, GMC Srinagar

⁴ Bangabandhu Memorial Hospital, Chittagong

Correspondence Author: Nissar Ahmad Shah, Orthopaedic Trauma Surgeon, Department of Orthopaedics, District Hospital, Baramulla, J&K, India

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Abstract

Background

Subtrochanteric fractures remain one of the most challenging fractures to be treated by orthopaedic surgeons. The most appropriate implant for internal fixation of subtrochanteric fractures remains a subject of debate, and many different intramedullary and extramedullary implants have been advocated for surgical fixation of these fractures. Due to better understanding of biology, reduction techniques and biomechanically improved implants like Gamma nail, Russell Taylor nail, Proximal femoral nail (PFN), results have shown consistent improvement in the post operative outcome. The purpose of this paper is to share our observations with intramedullary fixation of subtrochanteric fractures with proximal femoral nail at a secondary health care level.

Material and methods

The prospective study included 22 patients with fresh subtrochanteric fractures admitted to the department of orthopaedics, district hospital Baramulla, Kashmir who underwent an intramedullary fixation with PFN. Patients with pathologic fractures, multiple fractures, fractures in children, old neglected fractures were excluded from the study.

Results

In our study of 22 patients, there were 19 male and 3 female patients with mean age of 38.25 years (range 18-70 years). 68.2% of the patients (n=15) had fractures due to road traffic accidents, 22.8 % (n= 5) patients due to fall from height and 10% of the patients (n=2) due to trivial fall with right side being more common side affected. Time to radiological union ranged between 4 months to 9 months (mean 6.2month). Two patients got malunion, first patient had 15° varus and second patient had 10° retroversion. One patient developed breakage of superior 6mm screw being longer than the 8mm screw; but the fracture united uneventfully. Two patients got shortening of less than 1.5cm. One patient got superficial wound infection which responded to intravenous antibiotics.

Conclusion

PFN is a viable treatment option for subtrochanteric fractures with high rate of fracture union and minimal soft tissue damage. Intramedullary fixation has biological and biomechanical advantages, but the operation is technically demanding. Gradual learning and great patience is needed in order to make this method truly minimally invasive.

Keywords: subtrochantric fractures, proximal femoral nail, minimal invasive

Introduction

Subtrochanteric fractures are defined as the fractures of the proximal part of the femur in which a portion of the fracture line lies between the lesser trochanter and a horizontal line five centimeters below it.^{8,9,13,15}. Deforming muscle forces on both the proximal and distal fragments and substantial biomechanical stresses several multiples of the patient's weight make this area a challenge for the treating surgeon to achieve reduction and maintain it through the healing process. Nonoperative treatment has limited role in these fractures in view of deformity created, the instability of the fracture pattern and the poor outcomes with this treatment modality¹⁶. Both extramedullary and intramedullary devices have been used to fix these fractures with varied results. The purpose of this paper is to share our observations with intramedullary fixation of these fractures at a secondary healthcare.

Surgical Technique All the patients were operated upon within one week duration on a traction table in supine position under combined spinal and epidural anaesthesia. The unaffected limb was held on a limb-support in flexion and abduction to allow free access to the C arm image intensifier for anteroposterior and lateral views of hip and femur. A percutaneous Steinman pin was placed in anterior part of head and neck fragment as a joystick to assist correction of abduction and external rotation deformity (**Figure 1**). This also helped in better presentation of piriform fossa for entry point. Any persistent flexion deformity was corrected with the help of an anteriorly placed percutaneous ball spike.⁸ If by all these measures satisfactory closed reduction was not achieved, miniopen reduction with or without cerclage wiring was done before attempting reaming of the canal. A 5 cm incision was made just above the greater

trochanter and muscles were split to reach to the piriform fossa (**Figure 2**). Entry point for guide pin was chosen along the medial side of greater trochanter in piriform fossa in AP view and at the junction of anterior third and posterior two third of greater trochanter in lateral view. After passing the guide wire under C arm imaging control the canal was properly reamed and appropriate size nail negotiated without hammering till the hole for 8 mm screw corresponded with inferior margin of neck. Then two neck screws were placed over guide wires passed under C arm imaging control (**Figure 3**). Finally distal locking was done by free hand technique. All the wounds were closed and dressings were applied. On the first postoperative day patients were encouraged to do quadriceps static exercises and bedside range of movement exercises of knee and ankle. Within first week they were allowed to be ambulatory on walker with non weight bearing for initial 2-3 weeks followed by toe touch weight bearing for another 2-3 weeks. Patients were allowed for partial weight bearing using crutches at 6 weeks postoperatively with careful radiological monitoring of the healing status (**Figure 4 a-b**). When the patient restored the mobility and fullweight bearing without pain or visible radiological consolidation of the fracture, the fracture was considered to be healed. We recorded the surgical complications, union events and implant-related complications.

Results

All the fractures united uneventfully; there was no case of non-union in this series. Time to radiological union ranged between 4 months to 9 months (mean 6.2 month). Two patients got malunion, first patient had 15° varus with inability of passing the second Hip Screw and second patient had 10° retroversion (**Figure 5-6**). One patient developed breakage of superior 6mm screw being longer than the 8mm screw; but the fracture united uneventfully

(Figure7). We had no case of Z effect or reverse Z effect. Two patients got shortening of less than 1.5cm. One patient got superficial wound infection which responded to intravenous antibiotics.

Discussion

Subtrochantric fractures are one of the most challenging fractures for management. Muscular deforming forces on proximal fragment result into a characteristic deformity of flexion, abduction and external rotation due to iliopsoas, gluteus medius and short external rotators respectively; long adductors cause shortening and adduction of distal fragment¹². The subtrochanteric portion of femur contends with the highest compressive and tensile forces in the human skeleton during weight bearing which may be several multiples of the patient's weight¹². These forces render achievement and maintenance of reduction through the healing process very difficult. Consequently conservative treatment has only limited role in these fractures when surgical consent is refused, or the patient is deemed an unfit surgical candidate due to prohibitive medical co morbidity, or in nonambulators hemi and quadriplegics. Seinsheimer also cautioned against the disastrous complications of treating the elderly with prolonged bed rest¹³.

De Lee et al¹ used preliminary traction followed by an ambulatory cast-brace with a pelvic band to treat severely comminuted fractures in younger patients. They emphasized that this treatment regimen requires exacting attention to detail by the treating physician. The amount of time needed from the physician in this form of treatment is considerably greater than that after open reduction and internal fixation. Despite all this three of their 15 patients developed bed sores¹. Sarmiento¹¹ stated that the tendency of fractures of the proximal third of the femur toward varus angulation makes cast-brace treatment unsuitable.

Different fixation methods have been used to treat these fractures including both plating and nailing with varying results. In a cadaveric study to compare the biomechanical performance of a cephalomedullary nail (CMN), a proximal femoral locking plate, and a 95-angled blade plate in a comminuted subtrochanteric fracture model, Forward et al² found that CMN construct was biomechanically superior to either the locking plate or 95-blade plate constructs and withstood significantly more cycles, failed at a significantly higher force, and withstood a significantly greater load than either of the plate constructs. Varus collapse was significantly lower in the CMN construct. Although it was developed for the treatment of transtrochantric fractures, DHS (Dynamic Hip Screw) fixation has been widely used for the fixation of subtrochanteric fractures also. However, due to the characteristic biomechanics of the subtrochanteric fractures, several authors reported unsatisfactory results in nearly 70% of the cases in which this implant was used. As DHS is a dynamic system, progressive medialization of the diaphysis and fixation failure can occur⁶. The blade plate and the DCS (Dynamic Condylar Screw), developed by the AO group, are viable options for the treatment of subtrochanteric fractures, especially when techniques of indirect reduction and biological fixation are used.⁶ Halwai et al⁴ reported 73% good to excellent results with DCS in subtrochanteric fractures using biological reduction technique and bone grafting in settings devoid of C arm imaging. Wiss et al¹⁵ recommended closed interlocking nailing as the preferred treatment for subtrochanteric fractures of the femur resulting from trauma regardless of the fracture pattern or degree of comminution as favorable mechanical characteristics of interlocking nails have eliminated the requirement of surgically reconstituting the medial femoral cortex. Closed nailing constitutes a form of biological fixation avoiding

too much soft tissue dissection as needed in plating. PFN also has all the advantages of an intramedullary device such as decreasing the moment arm, having load sharing characteristics, can be inserted by closed technique which retains the fracture hematoma, decreases blood loss, minimizes soft tissue dissection and wound infections⁵. These may be credited for a shorter time to union. Timing of surgery has also been a subject of considerable debate. In our study patients were operated within one week. Khan et al⁷ reviewed 52 studies, with a total of 291,413 patients, and demonstrated that surgery conducted within the first 48h reduces hospital stay, complications and mortality. Lourenco et al⁸ also opted for early fixation of subtrochanteric fractures of the femur (within the first 48h after the trauma) whenever possible. Proper reduction of the fracture is mandatory to expect a good anatomical result and union. Non adherence to this dictum resulted in malunion in two patients in our series, one patient had varus and another had retroverted proximal fragment. Rucker and Rueger¹⁰ stressed that proximal reaming should start only after proper fracture reduction even if it require opening the fracture. Lourenco et al⁸ opined that regardless of the stability principle and of the method chosen for treatment of the subtrochanteric fracture, the key point to reduce the risk of complications is the quality of the reduction. Choosing the correct entry portal for nail is one of the crucial points of intramedullary nailing. We preferred an entry portal in piriform fossa just medial to greater trochanter. Rucker and Rueger¹⁰ recommended reaming of intact bone medial to comminuted greater trochanter to avert varus malposition after nail insertion. We had one case of breakage of superior screw due to the fact that it was longer than the inferior screw; however the fracture united uneventfully. There was no case of Z effect in which the inferior lag screw migrates laterally and the superior lag screw migrates medially during physiologic

loading. Reverse Z effect is also described where superior screw migrates laterally.^{3,14} We had no case of nonunion or reoperation which can mainly be attributed to small number of patients in this series. Our average time to union was 6.2 months which matches favourably with previous studies.¹⁵ Wiss et al¹⁵ reported three delayed unions, one nonunion, and six malunions in a series of 95 patients.

Conclusion

Intramedullary fixation is an important tool for surgeons to fix subtrochanteric fractures, having biological and biomechanical advantages. Although technically demanding, with patience and experience over time the procedure can be made truly minimally invasive.

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Figure 1: Closed Reduction using Steinmans pin



Figure 2: Skin Incision (straight Line) Proximal to Tip of the Greater Trochanter (Curved Line)



Figure 3: Two neck screws and Distal Locking Screw



Figure 4b: United Fracture (post-Operative) Antero Posterior View/Lateral View



Figure 4a: Subtrochanteric Fracture (pre-operative)



Figure 5: Varus Deformity with inability of placing one hip screw intra-operatively

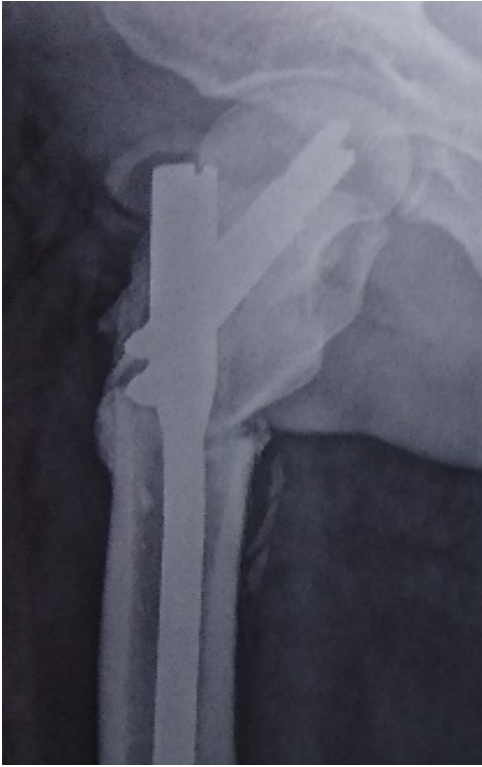


Figure6: Union of the Fracture in Retroversion



Figure 7: Implant Breakage In a united Fracture