

## Research Article

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# Outcome of subtrochanteric fracture of the femur managed with proximal femoral nail

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## ABSTRACT

**Background:** Subtrochanteric fractures of the femur remain some of the most challenging fractures facing Orthopaedic surgeons. Internal fixation of these fractures has gained widespread acceptance but the problems i.e. malunion, nonunion, implant failure, refracture and infection encountered after surgical treatment of these fractures have prompted continued development of new devices and treatment programs. We study the outcome of these fractures treated with long proximal femoral nail.

**Methods:** All patients above 16 years of age who presented to our emergency department with subtrochanteric fracture of the femur were included in the study. Radiographs were taken and all the fractures were classified according to the Seinsheimers classification. All patients underwent fixation with the proximal femoral nail. The functional outcomes of the patients were assessed using the Harris hip score.

**Results:** There were 20 males and 6 females in our study. According to the Seinsheimers classification we had 10 patients with type II fracture, 11 patients with type III fracture, 3 patients with type IV fracture and 2 with type V fracture. The average Harris hip score at the end of 1 year follow up was 82. There were 10 patients with an excellent Harris hip score, 9 patients with a good score, 4 with fair score and 3 had poor scores. We had 8 minor complications in our study, all fractures went on to unite and there was no implant failure.

**Conclusions:** In our study we had good results with the proximal femoral nail, it requires minimal exposure and achieves biological fixation. It allows early weight bearing which is beneficial and has fewer implant related complications. Proximal femoral nail is a good choice of implant for fixation of subtrochanteric fractures.

**Keywords:** Subtrochanteric fracture, Proximal femoral nail, Early weight bearing

## INTRODUCTION

Subtrochanteric fractures of the femur remains some of the most challenging fractures facing orthopaedic surgeons. They account for 10 to 15 % of all hip fractures.<sup>1</sup> Osteoporosis, severe comminution and high stresses in this region of the skeleton can lead to failure of fixation, shortening, malrotation and non-union. Furthermore the involved bone is cortico-diaphyseal, rather than the more rapidly healing cancellous bone that predominates in the intertrochanteric region. There is a

bimodal distribution with 1/3 of these fractures occurring in young patients with high energy injury and 2/3 in the elderly population with low energy injuries and osteoporotic bone.<sup>2</sup>

Subtrochanteric fractures have been variously defined but most authors' limit the term to fractures occurring between the lesser trochanter and isthmus of the diaphysis of the femoral shaft. Fielding and Magliato have defined it as fractures occurring between a line

extending from the superior border of the lesser trochanter to a line 7.5 cm distal to it.<sup>3</sup>

The mechanism of injury varies with age. In younger patients, the fracture is more commonly caused by high energy trauma. In older age groups, the fractures occur with low energy trauma as in a simple fall. Bergman and colleagues noted an average age of 40.6 years in high energy trauma group and an average age of 76.2 years in the low energy group.<sup>4</sup>

Closed management of these injuries poses difficulty in obtaining and maintaining a reduction making operative management the preferred treatment.

Internal fixation of these fractures has gained widespread acceptance but the problems i.e. malunion, nonunion, implant failure, refracture and infection encountered after surgical treatment of these fractures have prompted continued development of new devices and treatment programs. The theoretical and biomechanical advantages of cephalomedullary implants over plate fixation are attributed to a reduced distance between the hip joint and the implant. These further results in a reduced bending movement across the implant and fracture site and allow the load to be transferred directly to the femoral shaft, bypassing the calcar femorale. Despite these advantages cephalomedullary nails have been associated with a number of complications including perimplant fracture and thigh pain.<sup>5</sup>

The objective was to study the outcome of these fractures treated with proximal femoral nail.

## METHODS

All patients who presented to our emergency department from January 2012 to April 2015 with subtrochanteric fracture of the femur were included in the study. All patients who were above 16 years of age with fracture of non-pathological origin and who were able to walk prior to the fracture were included in the study.

Patients with pathological fractures, patients with associated neurological problems and polytrauma patients were excluded from the study.

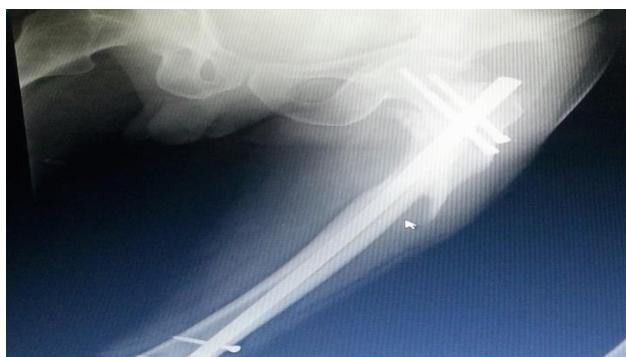
Radiographs were taken and all the fractures were classified according to the Seinsheimer's classification. Patients were worked up and pre anesthetic checkup was done. Preoperatively antibiotics were given according to the hospital protocol. All patients underwent fixation with the proximal femoral nail (Figure 1-9). Post operatively the patients were started on weight bearing mobilization from the 2<sup>nd</sup> post-operative day (POD). Patients were regularly followed up at 6 weeks, 3 months, 6 months and 1 year and patients were assessed using radiographs. The functional outcome of the patients was assessed using the Harris hip score. All patients who had a minimum follow up of at least one year, were included in the study.



**Figure 1: Case 1; pre-operative radiograph.**



**Figure 2: Case 1; immediate post-operative radiograph.**



**Figure 3: Case 1; 12 months post-operative AP radiograph showing fracture union.**



**Figure 4: Case 1; 12 months post-operative Lat radiograph.**



**Figure 5: Case 2; pre-operative radiograph.**



**Figure 6: Case 2; immediate post-operative AP radiograph.**



**Figure 7: Case 2; immediate post-operative Lat radiograph.**



**Figure 8: Case 2; 13 months post-operative AP radiograph showing union.**



**Figure 9: Case 2; 13 months post-operative lateral radiograph showing union.**

## RESULTS

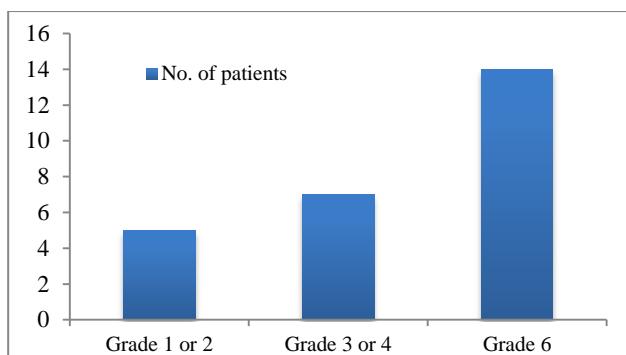
30 patients with subtrochanteric fractures were included in the study out of which 4 patients were lost to follow up. Therefore the final outcome analysis was done in 26 patients. The average age of the patients was 50 years. There were 20 males and 6 females in the study.

Road traffic accident (RTA) was the most common mode of injury in 15 (58%) patients, trivial fall was the next common cause in 8 (31%) cases and fall from height was seen in 3 patients (11%). According to the Seinsheimer's classification we had 10 patients with type II fracture, 11 patients with type III fracture, 3 patients with type IV fracture and 2 with type V fracture (Table 1).

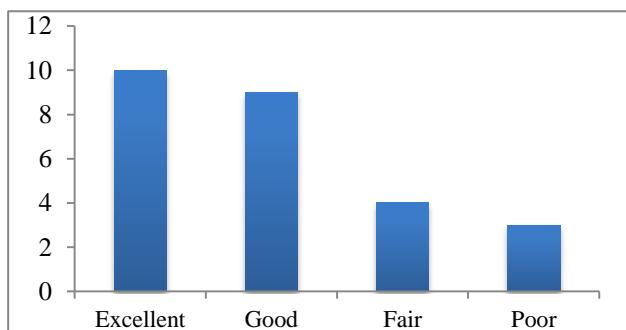
**Table 1: Number of patients according to Seinsheimer's classification.**

	Type II	Type III	Type IV	Type V
No of patients	10	11	3	2

5 (19%) patients had frank osteoporosis Singh's index of grade 1 or grade 2. 7 (27%) patients had borderline osteoporosis of grade 3 or 4. No radiological evidence of osteoporosis was seen in the 14 (54%) patients with a Singh's index of 6 (Figure 10). The average Harris hip score at the end of 1 year follow up was 82. There were 10 patients with an excellent Harris hip score, 9 patients with a good score, 4 with fair score and 3 patients had poor scores (Figure 11). The complications which we saw in our series of patients include superficial infection in 2 patients, lateral migration or backout of the screws in 2 patients, 1 case of delayed union, 1 case only a single cephalic lag screw was put because of problems of the jig and open reduction was done and fracture was further supported with stainless steel wire but fracture went on to unite, Urinary tract infection was seen in 2 patients (Table 2). There were no cases of implant failure.



**Figure 10: Grade of osteoporosis in patients according to Singh's index.**



**Figure 11: Number of patients with various grades of Harris hip score.**

**Table 2: Complications.**

Complications	Number of patients
Superficial infection	2
Lat migration of screws	2
Delayed union	1
Single cephalic screw	1
Urinary tract infection	2

## DISCUSSION

Subtrochanteric fractures of the femur are usually the result of high energy trauma, the fracture fragments are significantly displaced, because of which there is difficulty in closed reduction and maintenance of reduction. Because of the high incidence of malunion, non-union and delayed union, there is no role of conservative treatment as previously advocated by Lee et al.<sup>7</sup> Extramedullary fixation of these fractures with implants like the dynamic hip screw or the dynamic condylar screw has potential disadvantages of extensive exposure, more blood loss which then leads on to problems in fracture union and also implant failure. Intramedullary fixation is a more biological fixation and has mechanical benefits over extramedullary fixation.<sup>8</sup>

The proximal femoral nail acts like an internal splint and can bear a large axial load, this allows the patient early weight bearing. It is performed through a small surgical

incision, so it is minimally invasive and reduces blood loss. Some disadvantages of the proximal femoral nail which have been reported include cutout of implant, lateral migration of proximal screws and femoral medialization.<sup>9,10</sup>

Our study shows a good outcome of subtrochanteric fractures treated with the proximal femoral nail (PFN). We had good to excellent results in 19 (73%) of our patients. Below 60 years patients had a better average harris hip score (93) compared to the above 60 years patients (average 75). Majority of our patients were either type 2 or 3 Seinsheimer's subtrochanteric fractures. We had 8 complications in our series of patients, the 2 superficial infections settled with antibiotics, 2 patients with lateral migration of screws had mild pain but the fracture went on to unite. 1 patient had delayed union and in 1 patient only a single cephalomedullary screw was put but fracture went on to unite. The 2 patients with urinary tract infection improved with antibiotics.

Kish et al did a study on 46 patients with unstable pertrochanteric and subtrochanteric fractures.<sup>11</sup> The average age of the patients was 78 years. All the patients in their series were allowed immediate full weight bearing. There was 1 case of shortening more than 1 cm, 1 case of cutting out was observed. They concluded that the use of a PFN appears to be advantageous and a beneficial alternative to DHS in elderly patient's unstable pertrochanteric fractures and subtrochanteric fractures as it allows the patient immediate full weight bearing thus decreasing the post-operative morbidity. We also allowed our patients immediate weight bearing as tolerated in our patients and had good results.

Menezes et al reviewed 155 consecutive patients who were treated with a proximal femoral nail.<sup>12</sup> Failure of fixation occurred in three patients (2%), and a femoral shaft fracture occurred in one patient (0.7%). Fixation failures included one cutout, one delayed fracture healing, and one lateral displacement of the antirotation screw. The low rates of femoral shaft fractures and failure of fixation suggest the proximal femoral nail is useful for treatment of unstable trochanteric and subtrochanteric fractures.

Harris et al did a comparative study of the subtrochanteric fractures treated with the 95 degree blade plate and the proximal femoral nail.<sup>13</sup> A total of 41 patients were studied. There was a failure rate of 6 (29%) patients in the patients treated with the 95 degree blade plate whereas there was no failure in the patients treated with the PFN. They concluded that internal fixation of subtrochanteric femur fractures with a 95-degree angled blade plate is associated with increased implant failure and revision compared to closed intra-medullary nailing using a proximal femoral nail. We also had no failures in our study.

Jiang LS et al did a study on 49 patients with subtrochanteric fractures treated with the long proximal femoral nail.<sup>5</sup> They achieved union in all their cases but one case had delayed union. They had no complications like cut out or breakage of the implant. They concluded that long proximal femoral nail or long gamma nail is a reliable implant in treatment of subtrochanteric fractures and leads to a high rate of bone union with minimal soft tissue damage. We also had similar results in our study.

Sahin EK et al did a comparison of proximal femoral nail antirotation with dynamic condylar screw in the elderly in the treatment of peritrochanteric fracture of the femur.<sup>14</sup> They found that the mean salvati-wilson hip score was 31 in the PFNA group and 26 in the DCS group. They had good results in 73.9% of the patients in the PFNA group and 70% in the DCS group. They concluded that PFNA is a better choice as it has minimal exposure, reduce blood loss and achieves biological fixation.

We had some limitations in our retrospective study. First, we had no control group such as patients treated with dynamic condylar screw or other types of internal fixation methods to serve as a comparison to the surgical technique, secondly the number of patients were less.

## CONCLUSION

In our study we had good results with the proximal femoral nail, it requires minimal exposure and achieves biological fixation. It allows early weight bearing which is beneficial and has fewer implant related complications. Proximal femoral nail is a good choice of implant for fixation of subtrochanteric fractures.

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