# **Original Research**

# To Evaluate Functional Outcome Of Subtrochanteric Femur Fracture Treated By Proximal Femur Nail

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# ABSTRACT

Orthopaedic practitioners encounter the most usual fracture known as Subtrochanteric femoral fracturesoften are associated with intertrochanteric fractures within 5 centimeters distal to the lesser trochanter. It is difficult to treat due to strong deforming forces at the fracture site, tenuous blood supply, and the immense load-bearing forces exerted through the peritrochanteric region. Adequate reduction and stable fixation are paramount when treating these fractures to optimize patient outcomes. Hence, it is essential to evaluate functional outcome of subtrochanteric fracture treated by proximal femur nail. We included 30 patients with close subtrochanteric fracture were treated with proximal femur nail. All patients were followup in OPD on 15<sup>th</sup> day, then every month and progress of union seen in x-ray. Harris – hip score calculated at each visit. Data collected was subjected to statistical analysis. Majority of cases were males 70% and female were 30% and majority of cases N=14(46%) were found in the 18-40 years of age range. Mode of injury by road traffic accidents were higher 23(76.67%) and 17(56.67%) patients had left side injury. Radiological findings according to Seinsheimer Classification majorly patients fell under type II B (27.4%) fractures. Based on Harris Hip score, 4 (13.33%) patient's outcome was excellent, 22 (72.6%) patients showed 12 weeks of union, 6 (20%) patients were with other injury and 25 (83%) cases have fracture reduced by close reduction. 10 (33.33%) patients had normal BMI which lies between 18.5 kg/m<sup>2</sup>-24.9 kg/m<sup>2</sup> and 4 (13.33%) patients had Obesity class II 35.0 kg/m<sup>2</sup>-39.9 kg/m<sup>2</sup> of BMI. 9 cases had Union time 12 weeks and no case have 14 weeks of union time in which BMI was between  $25.0 \text{ kg/m}^2$  -  $29.9 \text{ kg/m}^2$ . 7 cases had Union time 12 weeks and 3 cases have 14 weeks of union time, in which BMI was between  $18.5 \text{ kg/m}^2 - 24.9 \text{ kg/m}^2$ . The correlation between BMI status and Union Time was found to be statistically significant (P<0.05), on applying Chi- square test. Fractures were reduced by Close reduction among 25/30 (83%) patients. The proximal femoral nail is an excellent implant for femoral subtrochanteric fracturesparticularly in the elders.

Key Words: Subtrochanteric fractures, proximal femur nail, Harris hip score

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# INTRODUCTION

Subtrochanteric fractures are femoral fractures that occur below lesser trochanter to 5 cm distally in the shaft of femur<sup>1</sup>. These fractures account for 10% to 34% of all hip fractures<sup>2</sup>. These fractures have a bimodal age distribution and are seen in two main population groups, older osteopenic patients following low energy falls and younger patients with high energy trauma<sup>2</sup>. Due to the insertion of muscles in this region, it is put through many distorting forces like flexion by the iliopsoas, abduction by the gluteus medius, and external rotation by the external rotators of the proximal femur fragment <sup>3</sup>.

The main goals of surgical treatment of subtrochanteric fractures are anatomic reduction, stable fixation and early mobilization and rehabilitation of the patient<sup>4</sup>. A better understanding of fracture biomechanics and development of new implants and surgical techniques have led to better treatment and better outcome<sup>5</sup>. Historically for proximal femur fractures various modalities like Jewett nails, side plates, angle blade plate, dynamic condylar screw and dynamic hip screw have been used<sup>6</sup>. Despite improved implants and better understanding of these fractures delayed union, malunion, infection and implant failure occur with disturbing frequency because of high stress in this region<sup>7</sup>.

In1996 the AO/ASIF developed the proximal femoral nail (PFN) as an intramedullary device for the treatment of unstable intertrochanteric and subtrochanteric femoral fractures in order to

overcome the deficiencies of the extramedullary fixation of these fractures. This nail has the following advantages compared to extramedullary implant such as decreasing the moment arm, can be inserted by closed technique, which retains the fracture hematoma an important consideration in fracture healing, decreases blood loss, infection, minimizes the soft tissue dissection and wound complications.<sup>8</sup> Hence proximal femur nail has proved as an excellent implant for treatment of subtrochanteric fracture and considered as standard care of treatment for subtrochanteric fracture femur.

### METHODOLOGY

Present study was a prospective, observational, hospital based study conducted at theDepartment of Orthopedics, Santokba Durlabhji Hospital, a tertiary care centre, Jaipur. 30 patients who came in Emergency and OPD of SDM Hospital between August 2022 to May 2023 with subtrochanteric fracture femur, close fracture and age above 18 years were included in this study. But, patients with pathological fracture, open fracture, fracture in patients below 18 years of age and old fractures were excluded from the study.

# **OPERATIVE TCHNIQUES**

After administering prophylactic antibiotic, in supine position patient's limb was held in slight adduction

and longitudinal traction for reduction of fracture. An incision was made upto 3-4 cm proximal to tip of the greater trochanter on the proximal extension of the anatomical femoral bow. The skin incision was aligned with the curved axis of the femoral canal and the fascia was opened and the gluteus muscle was split along its fibers. The entry was made just medial to tip of greater trochanter. A guide wire inserted and advanced in shaft of femur while maintaining reduction. Reaming was done with increasing size of reamer. Nail size measured. Appropriate size nail was advanced while maintaining reduction. The guide pin was inserted through zig for 8 mm screw and positioned in lower half of neck in AP view in C-arm and central in lateral view. Then second guide pin was inserted for 6.5 mm screw and checked under C-arm. Second guide pin was centre positioned both in AP and lateral view. Appropriate size screws were inserted and distal interlocking was done by free hand technique. Final reduction and implant position was checked under C-arm. Wound was closed in layers. Post-treatment follow-up were performed and patients were discharged from the hospital when independent walking was possible with walking aids and advise for follow up after 15 days for suture removalin OPD, then every month and progress of union seen in x-ray. Harris - hip score calculated at each visit.Data collected was subjected to statistical analysis.

#### RESULTS

Among the 30 participants, majority 21(70%) were males and 9(30%) were females. Majority of patients 14(46.67%) were between 18 to 40 years and equal number of 8 (26.67\%) patients were between 40-60 and 60-80 age groups.

Table 1: Gender Distribution of study participants				
Gender	No. of patients	%		
Female	09	30.0		
Male	21	70.0		
Total	30	100.0		

**Table 1: Gender Distribution of study participants** 

Wate	21 70:0				
Total	30	100.0			
Table 2: Age Distribution of study participants					
Age (Yrs)	No. of patients	%			
18-40	14	46.67			
40-60	08	26.67			

08

30

The mode of injury in patients with road traffic accidents were higher 23(76.67%) and 7(23.33%) patients had
sustained fall (slipped at home). The subtrochanteric femur fracture based on the radiological findings was
classified according to Seinsheimer classification. Based on this classification majority of 8 (26.67%) patients
fell under type II B fractures followed by type III B 5 (16.67%), IV 4 (13.33%), V 4 (13.33%) and only 3 (10%)
patients had type II A, II C, III A type of fractures each.

Table 3	3: Mode	of injury	among study	participants

Mode of Injury	No. of patients	%
Fall (Slip at home)	07	23.33
RTA	23	76.67
Total	30	100.0

60-80

Total

26.67

100.0

Tuble in Distribution bused on the duration for fracture union				
Time for Union	Frequency	Percentage %		
12 Weeks	22	73.33		
14 Weeks	06	20		
Delayed Union	1	3.33		
Non-union	1	3.33		
Total	30	100.0		

#### Table 4: Distribution based on the duration for fracture union



Based on Harris Hip score, we obtained that 4 (13.33%) patients' outcome was excellent, 20 (66.67%) patients were good, 4 (13.33%) patients had fair outcome and 2 (6.67%) had poor outcome. In this study, 22 (73.33%) patients showed 12 weeks of union, 6 (20%) patients had 14 weeks of union and only 2 (3.33%) patients had delayed / non-union. 10 (33.33%) patients had normal BMI which lies between 18.5 kg/m<sup>2</sup>-24.9 kg/m<sup>2</sup>. 30% (9/30 patients) had 25.0 kg/m<sup>2</sup> -29.9 kg/m<sup>2</sup> of BMI (pre-obesity). 23.33% (7/30 patients) had BMI in between 30.0 kg/m<sup>2</sup> -34.9 kg/m<sup>2</sup> (Obesity class I) and only 13.33% (4/30 patients) had 35.0 kg/m<sup>2</sup>-39.9 kg/m<sup>2</sup> of BMI (Obesity class II).



# Table 5: BMI wise distribution of recruited patients

<b>BMI</b> (kg/m <sup>2</sup> )	Patients (n)	Percentages %	Nutritional Status
< 18.5	0	0	Underweight
18.5-24.9	10	33.33	Normal
25.0-29.9	09	30.0	Pre-obesity
30.0-34.9	07	23.33	Obesity Class I

35.0-39.9	04	13.33	Obesity Class II
Total	30	100.0	

Out of total 30 cases, 6 (20%) patients showed to be having other injury. When correlation between BMI and Union time was considered, 7 patients had Union time 12 weeks and 3 patients have 14 weeks of union time, in which BMI was between 18.5 kg/m<sup>2</sup> – 24.9 kg/m<sup>2</sup>. 9 patients had Union time 12 weeks and no case have 14 weeks of union time in which BMI was between 25.0 kg/m<sup>2</sup> - 29.9 kg/m<sup>2</sup>. 4 patients had Union time 12 weeks, and 3 patients had 14 weeks of union time in which BMI was between 30.0 kg/m<sup>2</sup>-34.9 kg/m<sup>2</sup> of BMI. Only 2 patients had Union time 12 weeks and 2 patients had delayed union time in which BMI lies between 35.0 kg/m<sup>2</sup> - 39.9 kg/m<sup>2</sup>. The correlation between BMI status and Union Time was found to be statistically significant (P<0.05), on applying Chi- square test.

DMI status	Union Time (Weeks) in patients			Total
DIVIT Status	12 weeks	14 weeks	<b>Delayed / Non-union</b>	Total
18.5-24.9	7	3	0	10
25.0-29.9	9	0	0	9
30.0-34.9	4	3	0	7
35.0-39.9	2	0	2	4
Total	22	6	2	30
Chi-square=19.364 with 6 degrees of freedom: $\mathbf{P} = 0.004$ (Significant)				

# Table 6: Correlation between BMI and Union Time

Fractures were reduced by Close reductionamong 25/30 (83%) patients and among 5/30 (16%) patients showed reduced fractures by Open reduction.



# DISCUSSION

Proximal femur fracture is a common type of fracture that is regularly reported in the department of orthopedics. <sup>9</sup> The subtrochanteric region, which is located 5 cm below the lesser trochanter and is one of the most significant areas in the proximal part of the femur, normally encounters a high amount of stress and, if not treated effectively, results in a negative outcome. Previous research has revealed that the total incidence of this type of fracture is 15 - 20/100,000 people, with females over the age of 50 being the most usually affected. <sup>10, 11</sup> Diabetes, low bone mineral density, and individuals who had been taking bisphosphonates for osteoporosis for more than 5 years are also risk factors for subtrochanteric fractures. <sup>12, 13</sup>

High-energy trauma is the most common mode of injury in subtrochanteric femur fractures, and due to their complicated stress structure, these fractures commonly occurs in the area of least resistance in the proximal femur. <sup>14</sup> Furthermore, the unstable fractures that occur in this region represent a substantial challenge to the operating surgeon since repairing these fractures becomes technically challenging, and poor technique may lead to primary fixation failure. According to earlier studies, the optimum treatment for these fractures is to repair the fractures with dynamic hip screws (DHS), but failure rates of up to 20% have been reported. <sup>15, 16</sup> The most prevalent causes of fixation failure were found to be fracture instability, osteoporosis, a lack of anatomic reduction, implant failure, and inserting the lag screw in a wrong

position in the femoral head. <sup>17</sup> Intramedullary fixation is the most popular choice among orthopedicians due to its benefits such as minimal soft tissue injury and wound problems. Among the various procedures in intramedullary fixation, introducing a proximal femoral nail is a newer technique in which the nail tip is specially shaped to reduce stress and further prevent low energy fracture at the tip of the implant, as well as reduce the lever arm distance during reactionary forces generated in hip joint movements. <sup>18</sup> With these benefits in mind, the current study was conducted to evaluate the operational outcome of patients treated with proximal femoral nails for fractures in the subtrochanteric region of the femur.

In this study, the age of the patients operated for subtrochanteric fractures in the current study were found in the majority of cases N=14 (14/30; 46.67%) in the 18-40 years of age range, which is almost identical to the study done by Sandeep Sharma et al, where he quoted the mean age as 53 years, few other studies done by C.Bouldinetal, I.C.Schipper, et al, and T.Pavelka et al had mentioned the mean age as more than 70 years. In our study males outnumber females.<sup>19-21, 22</sup> The most prevalent method of injury in our study was road traffic accidents, followed by accidental falls, same observation was reported by all previous studies these two as the most common modes of injury, with modest differences in the percentage. 20, 21, 22 This indicates that, unlike other peritrochanteric femur fractures, these fractures are primarily caused by high-velocity injuries rather than osteoporosis.

The Seinsheimer classification was used in the current investigation to classify subtrochanteric fractures, and type II B was shown to be the most common form. Similar findings were observed in a study done by Sharma et al.<sup>23</sup> The imaging of those fractures revealed anterior flexion of the head-neck fragment with a distinct lesser trochanter beneath. The anterior flexion of the proximal fragment continued even after traction was applied. In these fractures, an underlying lesser trochanter fragment (typically big) effects an anterior displacement of the proximal fragment; with the lesser trochanter fragment itself pulled by the iliopsoas. A lateral incision was recommended, and the fracture was reduced by a close method, Steinmann, with a bone clamp or a bone lever. Other research found comparable cases, and the reduction strategies utilised were likewise similar. 24, 25 The anterior cortex was pushed downward using a Steinmann pin or periosteum elevator, while the thigh was lifted with a hammer.

In this study, only 6 (20%) cases were with other injury and 24 (80%) cases were without other injury. Most of the cases in the current study had a complete union of the fracture in 12 weeks, and few cases have a union time of about 14 weeks. Only 2 cases showed delayed or non-union. In line with our results, Vivek Pradhan et al's<sup>26</sup> study also reported that the mean time for the complete union was 13.88 weeks, and

most other studies likewise ranged between 13.5 and 14.5 weeks. <sup>26</sup> In our investigation, no major postoperative complications such as malunion or nonunion were recorded; only superficial wound infection was seen in 1 case, whereas Sandeep et al found non-union in 3.5% of patients and D.M.Rahme et al<sup>27</sup> found it in 12% and 13% of patients, respectively. <sup>27, 28</sup>

Most hip function evaluation scoring systems, as they are applied to the Western population, do not cover the Indian situation, where squatting and cross-legged sitting are required to carry out our daily duties. We added squatting and cross-legged sitting to the Harris hip score and awarded a fair or higher grade only if they could squat and sit cross-legged. And in the current series, we have the majority of patients achieving this basic need.

The Harris hip score <sup>29</sup> was used to measure the patient's functional status, which revealed that 13.33% were excellent, 66.67% were good, 13.33% were fair and 6.67% were poor. Zhou et al. <sup>30</sup> obtained 96.05% excellent-to-good results and 3.95% fair-to-poor results. Our findings are comparable to those of other series.

In our study, most of the patients (n=10) have normal BMI which lies between 18.5 kg/m<sup>2</sup> – 24.9 kg/m<sup>2</sup>. 9 patients lie in the 25.0 kg/m<sup>2</sup> -29.9 kg/m<sup>2</sup> of BMI (pre-obesity).7 patients lie in between 30.0 kg/m<sup>2</sup> - 34.9 kg/m<sup>2</sup> of BMI (Obesity class I) and only 4 patients lie in between 35.0 kg/m<sup>2</sup> -39.9 kg/m<sup>2</sup> of BMI (Obesity class II).

Numerous studies have found that being underweight is linked to reduced bone density and an increased risk of falling. <sup>31</sup> A BMI of less than 20 kg/m<sup>2</sup> is related to a considerably increased relative risk of proximal femur fractures. <sup>32, 33</sup> Overweight patients with proximal femur fractures are expected to have worse postoperative results; nevertheless, scientific evidence is still equivocal. While patients with a BMI of 26 and above appear to have a greater one-year survival rate following hip fracture, <sup>34</sup> the detrimental effects of increasing body weight are documented in terms of postoperative complications and length of stay in the early postoperative period. <sup>35</sup>

Some studies <sup>36, 37</sup> contradict these findings, finding no difference in hospitalisation or surgical complications in patients with a high BMI. Furthermore, certain studies show that an overweight body constitution (BMI 25-29.9 kg/m2) protects against postoperative problems after elective or trauma-related hip surgery when compared to underweight patients. <sup>38</sup>

Problems such as non-union, implant failure were observed in two cases, which is consistent with most other series. One patient has developed a superficial infection that responded to antibiotics.

According to the traditional view, the medial and posteromedial fracture fragments are the most critical factors in defining the severity of peritrochanteric hip fractures. Other publications, however, have recognised the relevance of the lateral trochanteric

wall in supporting peritrochanteric fractures.<sup>39-41</sup> The lateral wall, first described by Gotfried, is the proximal prolongation of the femoral shaft. <sup>39</sup> The lateral wall is a brittle bone component in an unstable three or four-part peritrochanteric fracture. An unbroken lateral wall is crucial in the stability and repair of unstable peritrochanteric fractures, even more so than implant placement such as TAD (tip apex distance). <sup>42</sup>

Christian Boldin et al. found three occurrences of Z effect and two cases of the reverse Z effect in their research of 55 patients with proximal femoral fractures with PFN. 2 patients had screw cut-outs that had nothing to do with the fracture pattern, and 10% had open reductions. <sup>43</sup> In our study, there were no case with Z effect and reverse Z-effect, and 25 (83%) cases have fractures reduced by close reduction and 5 (16%) fractures reduced by open reduction.

With the above results, we came an opinion that the proximal femoral nail is an implant with many advantages over traditional implants.

#### CONCLUSION

In conclusion, the proximal femoral nail is an excellent implant for femoral subtrochanteric fractures. The benefits include reduced exposure (closed approach), improved stability, and earlier mobilisation. In majority of the cases, the fractures fused, and the postoperative functional prognosis was acceptable. Because it allows for early and stable mobilisation, proximal femoral nails may be a preferred implant of choice in treating subtrochanteric fractures, particularly in the elderly. A larger investigation could be beneficial.

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