

## Management of Subtrochanteric Femur Fracture Using Proximal Femoral Nail

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**Introduction:** Injuries to the femur, the longest bone in the body presents a challenging situation to the orthopedic surgeon. The proximal femoral intramedullary devices are useful for the treatment of isolated pathological lesions in the subtrochanteric region. Biomechanically, the nail can withstand between 3 to 5 times body weight. Hence the present study was planned to study the management of these fractures with the proximal femoral nail. **Materials and Methods:** A total of 44 patients with proximal femoral fractures of the subtrochanteric region admitted in the department were included in the study. Patients age more than 25 years and diagnosed with subtrochanteric femur fracture were included in the study. **Results:** The age of the patients was more than 25 years. There were 34 males and 10 females included in the study. In the clinical evaluation as per the functional Grading of the patient as per Kyle's Criteria excellent and good results were considered satisfactory, whereas fair and poor results were considered unsatisfactory. In this series 92%, satisfactory results were obtained. **Conclusion:** Proximal femur nail (PFN) is an effective device in the management of complex femoral fractures. The use of PFN in such fractures provides various advantages: Closed procedure, Minimal soft tissue damage. It offers superior stabilization than other currently used methods of internal fixation. The use of PFN is technically demanding and needs expertise. Complications can be avoided by proper operative techniques. Early postoperative mobilization and physiotherapy improve the results of PFN.

**Keywords:** Femur fracture, Subtrochanteric fractures, Proximal Nail, Trauma

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## Introduction

Injuries to the femur, the longest bone in the body presents a challenging situation to the orthopedic surgeon. Femur fractures are commonly seen in polytrauma patients-mechanism of injury include automobile crashes, vehicle vs pedestrian injuries, gunshot wounds, fall from a height, and industrial accidents [1].

Subtrochanteric fractures are femoral fractures where the fractures occur below the lesser trochanter to 5 cm distally in the shaft of the femur. These fractures occur typically at the junction between trabecular bone and cortical bone where the mechanical stress across the junction is highest in the femur, which is responsible for their frequent comminution [2].

Axial loading forces through the hip joint create a large moment arm, with significant lateral tensile stresses and medial compressive loads. In addition to the bending forces, muscle forces at the hip also create torsional effects that lead to significant rotational shear forces. In the sub-trochanteric region thickness of cortical bone is more and vascularity is less which produces healing disturbances [3].

Now the proximal femoral fracture is best treated surgically in most cases as restoration of femoral length and rotation and correction of femoral head and neck angulation can be done [4].

There are two ways to treat fracture proximal femur by internal fixation i.e. sliding compression hip screw with side plate assembly and intramedullary fixation devices. The advantages of intramedullary devices include retained blood supply to bone fragments, less operative blood loss, and less disruption of the environment [5].

The goal was to find the most suitable treatment for a given fracture pattern in the available setup. The proximal femoral intramedullary devices are proposed to treat intertrochanteric fractures, high subtrochanteric fractures, and a combination of these fractures.

The proximal femoral intramedullary devices are useful for the treatment of isolated pathological lesions in the subtrochanteric region. Biomechanically, the nail can withstand between 3 to 5 times body weight. Hence the present study was planned to study the management of these fractures with the proximal femoral nail.

## Materials and Methods

The present study was done for 2 years in the department of orthopedics, associated with the medical college. The college ethical committee was informed about the study and the ethical clearance certificate was obtained from it. A total of 44 patients with proximal femoral fractures of the subtrochanteric region admitted in the department were included in the study.

Patients age more than 25 years and diagnosed with subtrochanteric femur fracture were included in the study. Those patients who were of less than 25 years, diagnosed with a compound fracture with subtrochanteric fracture and with a history of previous wound or bone infection and previously treated with fracture were excluded from the study.

The present cases were studied based on injury mechanism, treatment of proximal femur fracture with a nail, and assess the clinical and functional outcome. After stabilization of vitals, radiographs of affected extremities were carried out. The fracture pattern was grouped according to the classification/inclusion criteria.

### Preoperative management

Upon admission of the patients, all the routine investigations were done. Specific investigations of all associated medical illnesses were carried out. Pre-op anesthetic and physician fitness was assessed and done. Adequate blood reserved in the blood bank. Shaving of affected extremity was done.

All the patients were informed about the study and the written informed consent of patients and relatives for internal fixation was taken. All the patients were kept for fasting overnight. Clinical and radiological measurement of proper nail size was carried out. Indwelling urinary catheterization was done either pre-op or post-op.

### Operative procedure

All cases were done under spinal-epidural anesthesia. Prophylactic iv antibiotic usually a third-generation cephalosporin was given 15 minutes before surgery. All patients were given a supine position following anesthesia, on a radiolucent tabletop to facilitate the use of an image intensifier.

The reduction is carried out by either open or closed. Closed reduction is done by manipulation attempted initially after the patient is anesthetized.

Extremity has been secured in the traction foot piece; traction is exerted longitudinally on the abducted extremity. Traction is maintained; the limb is adducted and internally rotated at the same time. Regular follow up of every patient was carried out at 4 weeks interval initially and later at 6 weeks until union. Clinical and radiological evaluation was done.

#### Assessment of functional outcome as per the system used by Friedman and Wyman

**Good:** no limitation of activities of daily living, no pain, less than 20% loss of hip or knee function.

**Fair:** mild limitation of activities of daily living, mild to moderate pain, 20-50% loss of hip or knee function.

**Poor:** moderate limitation of activities of daily living, severe pain, more than 50% loss of hip or knee function.

## Results

A recent study was done to study the management of this fracture with a proximal femoral nail. A total of 44 patients were included in the study. All the patients satisfied the inclusion criteria. The age of the patients was more than 25 years. There were 34 males and 10 females included in the study (Table 1).

**Table 1: Incidence in the group divided by the age of the patients.**

Age division	No. of Patients
25 to 30 years	10
31 to 40 years	22
41 to 50 years	6
51 to 60 years	2
More than 60 years	4
Total	44

In the mechanism of the injury, the majority of the patients had a road traffic accident. About 86% percent had the reason for a road traffic incident, rest 14% got fracture due to fall from height. Thus, proximal fractures are commonly sustained due to high energy trauma. In our series, the right side is involved more frequently than the left. The delay in trauma to surgery was due to delayed referral from the primary center to our institute and in some cases, it is because of other system injuries. In the clinical evaluation as per the functional Grading of the patient as per Kyle's Criteria excellent and good results were considered satisfactory, whereas fair and poor results were considered unsatisfactory.

In this series 92%, satisfactory results were obtained.

**Table 2: Functional grading of the patient as per Kyle's criteria.**

Grading	No. of patients
Excellent	12
Good	22
Fair	8
Poor	2
Total	44

## Discussion

Fractures of the proximal femur are challenging injuries for the orthopedic surgeon. The subtrochanteric fracture of the proximal femur treatment is associated with some failures [6]. The reasons may be enlisted as follows: disregard for biomechanics, overestimation of the potentials of new surgical techniques or new implants, or poor adherence to established procedures. High-stress concentration is subject to multiple deforming forces, slow healing time because of the predominance of cortical bone, decreased vascularity, high incidence of complications after surgical treatment [7].

Also, the results of the treatment of this type of fracture in young and middle-aged adults are influenced by the amount of trauma suffered at the time of injury. The Subtrochanteric region is usually exposed to high stresses during activities of daily living [8]. Axial loading forces through the hip joint create a large moment arm, with significant lateral tensile stresses and medial compressive loads. In addition to the bending forces, muscle forces at the hip also create torsional effects that lead to significant rotational shear forces. During normal activities of daily living, up to 6 times the bodyweight is transmitted across the subtrochanteric region of the femur [3,9].

Unlike osteoporotic trochanteric fractures, subtrochanteric fractures are usually the result of high-energy trauma and are often subjected to significant displacement and great difficulty in close reduction through traction. The high incidence of delayed union, malunion, and non-union of fractures has left conservative treatment, as advocated by DeLee et al, abolished in modern trauma care [10]. In the present study majority of the patients were of the age group 31 to 40 years. The mean age was found to be 36 years.

The age incidence in our series and other series was almost the same and comparable. In our series, there were 82% males and 18% females, which indicate males are highly exposed to the risk factor, due to highly demanding physical work and vehicular accidents.

In closed reduction, it was carried out with the knowledge of the deforming forces acting on the proximal fragment i.e. the proximal fragment is externally rotated and flexed due to the insertion of the iliopsoas and it is also abducted due to short abductors of the hip muscles on the greater trochanter. The distal fragment was always displaced medially due to the pull from adductors.

## Conclusion

PFN is an effective device in the management of complex femoral fractures. The use of PFN in such fractures provides various advantages: Closed procedure, Minimal soft tissue damage. It offers superior stabilization than other currently used methods of internal fixation.

## What does the study add to the existing knowledge

The use of PFN is technically demanding and needs expertise. Complications can be avoided by proper operative techniques. Early postoperative mobilization and physiotherapy improve the results of PFN.

## Author's contributions

**Dr. Navin Gagal:** Concept, study design

**Dr. Anand Hirani:** Manuscript preparation

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